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# LIFE CYCLE ASSESSMENT OF THE FAIRPHONE 3

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# Abbreviations

| | |
|---|---|
| ADP | Abiotic resource depletion |
| AUO | AU Optronics Corporation, Taiwanese display manufacturer |
| BOD | Biological oxygen demand |
| BoM | Bill of materials |
| $CO_2e$ | Carbon dioxide equivalents |
| COD | Chemical oxygen demand |
| DRAM | Dynamic random access memory |
| ecoinvent | Life cycle inventory data base |
| EoL | End of life |
| FP2 | Fairphone 2 |
| FP3 | Fairphone 3 |
| GaBi | LCA software by thinkstep |
| GWP | Global warming potential |
| IC | Integrated circuit |
| LCA | Life cycle assessment |
| LCD | Liquid crystal display |
| LCI | Life cycle inventory |
| LCIA | Life cycle impact assessment |
| LCO | Lithium cobalt oxide |
| LED | Light emitting diode |
| LPG | Liquefied petroleum gas |
| NOx | Generic term for the mono-nitrogen oxides nitric oxide (NO) and nitrogen dioxide ($NO_2$) |
| PC | Polycarbonate |
| PCB | Printed circuit board |
| PFC | Perfluorocarbons |
| SB-e | Antimony equivalents |
| SOx | Sulfur oxide |
| TPU | Thermoplastic polyurethane |
| TSS | Total suspended solids |
| VOCs | Volatile organic compounds |

# 1
# Executive Summary

Fairphone 3 is the new iteration of Fairphone's modular smartphone. The present LCA study aims to assess the environmental impact of the Fairphone 3 and identifies main drivers and hotspots in the life cycle. A special focus is put in the modular design of the device, which allows for easier repair. For that matter, a scenario-based approach is used, accounting for different lengths of the use phase and involving various repair strategies. The functional unit is set to be three years of intensive use of the Fairphone 3 as it is delivered to the customer.

The following impact categories are analysed in the study:

- Climate change (GWP)
- Abiotic resource depletion – elements (ADP elements)
- Abiotic resource depletion – fossil resources (ADP fossil)
- Human toxicity (Human tox)
- Ecotoxicity (Eco tox)

The data for this study is based on the bill of materials provided by Fairphone B.V., as well as on the material declarations provided by its suppliers. Those have been cross-checked with a teardown of a Fairphone 3 performed by Fraunhofer IZM.

### Results

The total GWP for the Fairphone 3 is estimated to be 39.5 kg CO2e. The relative values for five impact categories are shown in Figure 1-1.

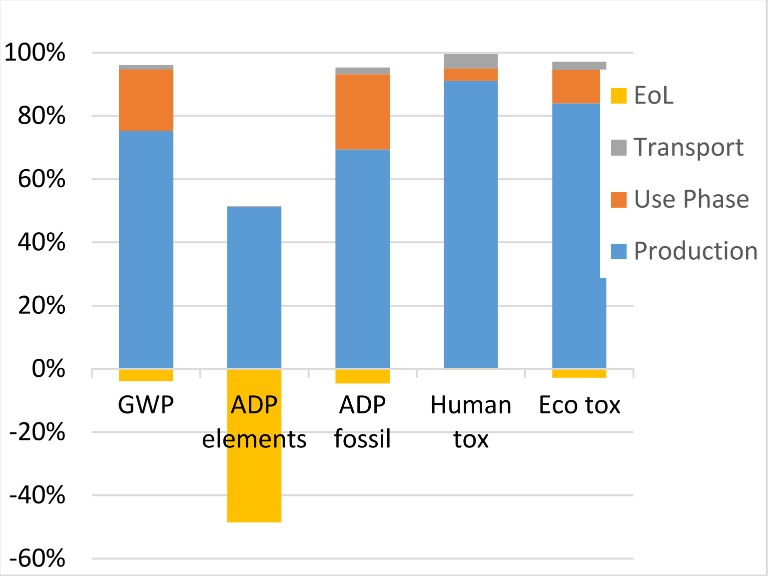

**Figure 1-1: Relative impact per life cycle phase**

Production is the main driver for all impact categories. A breakdown of the contributions of the different parts is shown in Figure 1-2 below. The second main contribution to the impact categories is the use phase while the role of transport is rather minor. The end-of-life (EoL) phase shows negative impacts, which means environmental benefits, most distinctly in the impact category ADP elements due to the recovery of gold.

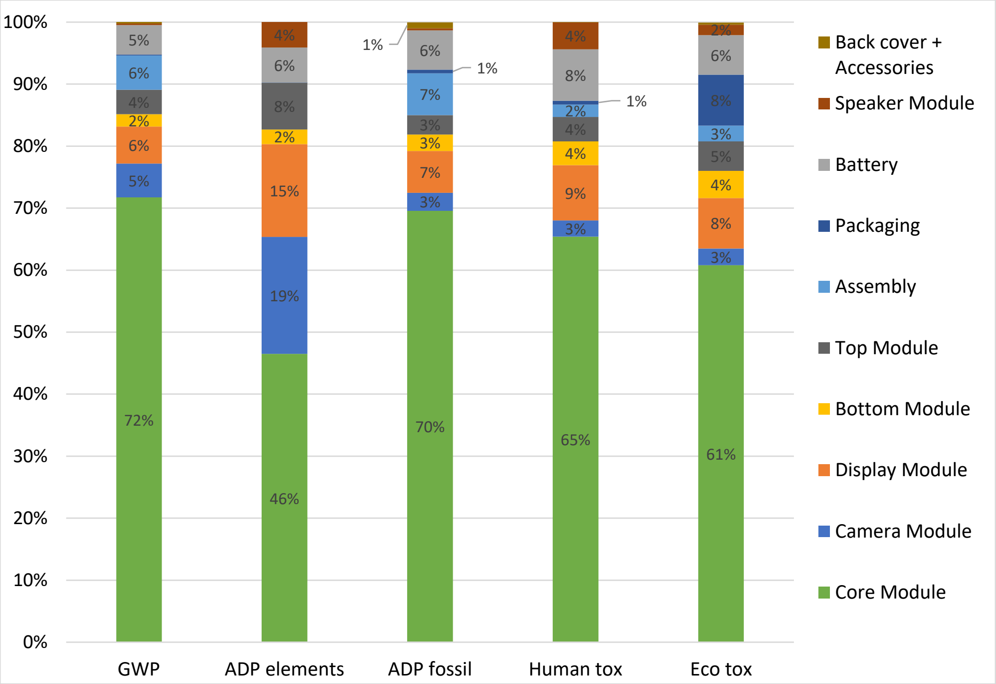

**Figure 1-2: Relative impacts of the production phase per impact category**

Within production, the core module is associated with the greatest contribution across all impact categories as it includes most of the PCB area, the main ICs and electronics.

## Modularity and repair

Modularity has been modelled as being mainly related to extra housing and module connections. Those are made through flex cables and press-fit connectors. For GWP the modularity overhead is calculated to be 0.744 kg CO2e, which represents 2.3 % of all production impacts. For ADP elements the share is bigger at around 17.2 %, due to the gold plating of the connector contacts. Figure 1-3 expands on that.

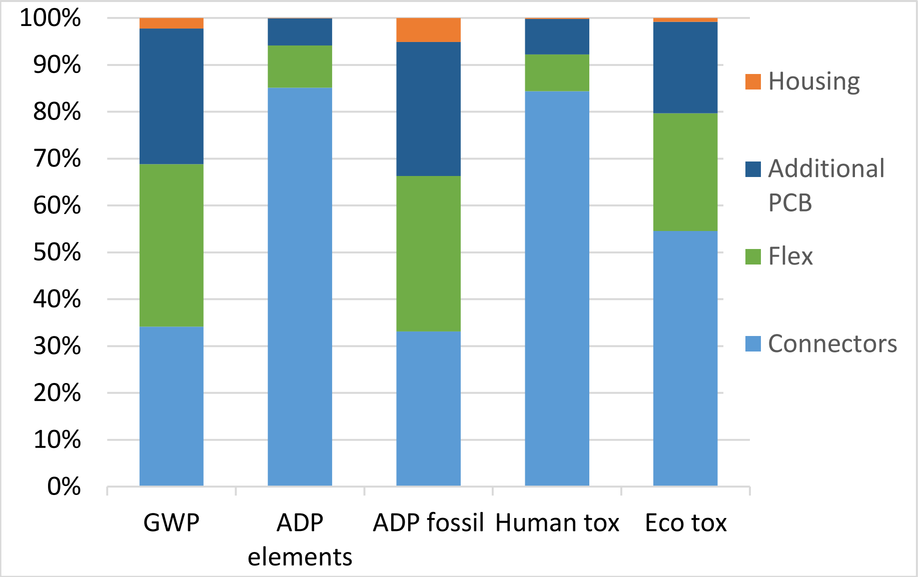

**Figure 1-3: Relative impacts connected to modularity**

As for repair, two main repair scenarios have been assumed. In repair scenario A, faulty modules are assumed to be replaced by new ones, taking advantage of Fairphone's modular design. In repair scenario B, it is assumed that part of the faulty modules are actually repaired at board-level, allowing for replacement of specific components. A per-year comparison of the results are shown in Figure 1-4. It is clear that the benefits from both repair scenarios are highly dependent on the related use phase extension.

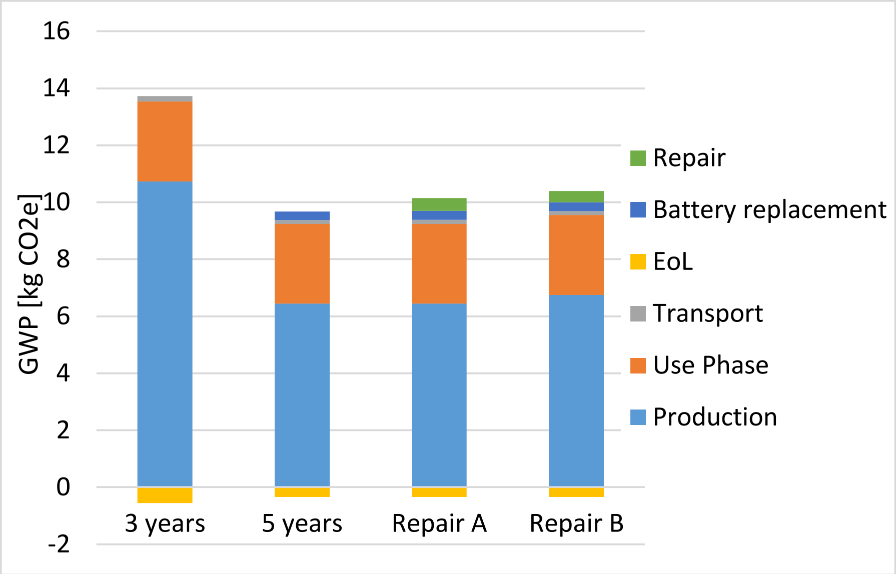

**Figure 1-4: Relative impact per year use for the impact category GWP**

Figure 1-5 provides a more detailed look at the differences between both repair scenarios which are too small to be seen in the per-year results. The benefits of on-board repair are tightly connected to the burden that transport poses and the components that can be effectively replaced. The study considered a conservative scenario in which only 37 % of modules are effectively repaired (75 % used modules are collected and only 50 % of those can be repaired).

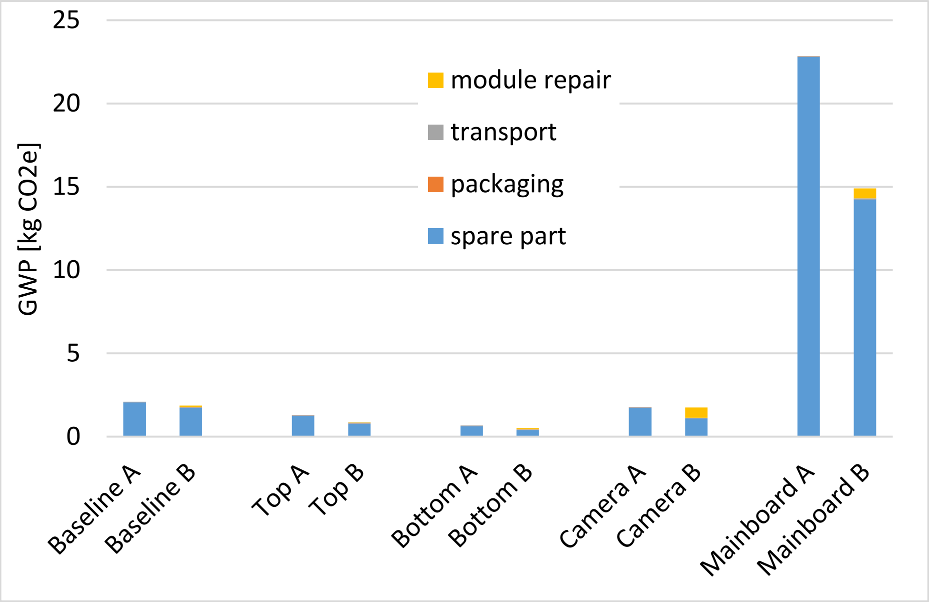

**Figure 1-5: Variation between different repairs**

## Conclusions

The results of the Fairphone 3 LCA show that environmental impacts are largely production driven, with the electronic components causing the main impact. Housing and structural parts play a minor role in the overall impact. Design aspects, such as form factor, indirectly influence the entire LCA of the device, mainly through the display and battery size, but not through the impact of housing material itself.

As the main impact is caused by production, prolonging the use phase is still a strong measure to influence the overall environmental impact for all impact categories except ADP elements, which can be reduced through efficient precious metal recycling. The comparison of 3, 5 and 7 years of use shows that the impact per year of use drops significantly with longer lifetime (up to 42 % GWP drop per year for a 7 years use phase). This is still the case if repair is needed, as shown in the repair scenarios. This is, however, dependent on the effective lifetime extension that is achieved in reality.

The impact of the additional hardware required to enable modularity has been reduced in comparison with Fairphone 2. This is due to the new connectors which, unlike the previous pogo pin connectors, use less gold in their contacts. Furthermore, the small press-fit connectors are not a unique feature of the Fairphone, as they can also be found in more conventionally designed smartphones. Therefore, the "modularity overhead" is now much smaller when compared to the previous model.

The change in transport to the distribution hub, which now takes place by train rather than by air, is translated into a notable reduction on transport-related impacts of around 87 % reduction in GWP. The use phase, on the contrary, results in an increased environmental impact in all categories when compared to the Fairphone 2, mainly due to the bigger battery of the Fairphone 3 and the assumption of one full charge/ discharge cycle per day.

# 2
# Goal and Scope Definition

## 2.1
## Goal

The goal of this life cycle assessment is threefold:

- Assess the environmental impact of the Fairphone 3 and identify main drivers and hotspots in its life cycle.
- Compare different use phase assumptions, especially regarding repair.
- Assess the potential impact of using more recycled material for 8 focus materials (section 5).

To assess the environmental impact of the phone, a baseline scenario is assessed based on the product as sold to the users.

For the impact of repair and different use-times, additional scenarios with varying use-time (active years of use) and replacements of parts are being calculated.

The potential impact of a possible use of secondary materials for eight focus materials is assessed separately in section 5. Those are a selection of materials in which Fairphone is focusing efforts to tackle some environmental and social hotspots.

The intended applications of the study are:

- Use lessons-learned for possible future product designs,
- evaluate the effect of using more recycled materials in the production of the phone, and
- stakeholder communication

## 2.2
## Scope

The scope of this study covers the entire life cycle of the Fairphone 3: raw material acquisition, manufacturing, transport, use and end-of-life.

The functional unit for the baseline scenario is an intensive smartphone use over three years. The corresponding reference flow is the Fairphone 3 as delivered to the customer including sales packaging, manual, screwdriver and protection bumper, but without charger, which is not part of the standard delivery. No parts' failures are assumed for the baseline scenario. The additional scenarios cover:

- Varying years of use:
  - 5 years of use with one additional replacement battery
  - 7 years of use with two additional replacement batteries
- Different repair scenarios:
  - Repair scenario A: 5 years use with replacement of several modules (see section 3.5.1)
  - Repair scenario B: similar to repair scenario A, but with additional repair of module (see section 3.5.2)

The data inventory is based on the bill-of-materials (BoM), a product tear-down, and material declarations for subparts from suppliers. The final assembly process is based on primary data from Arima comms in China (see section 3.1.13).

The following impact categories are covered for the life cycle assessment:

- Climate change (GWP)
- Abiotic resource depletion – elements (ADP elements)

- Abiotic resource depletion – fossil resources (ADP fossil)
- Human toxicity (Human tox)
- Ecotoxicity (Eco tox)

However, not all processes used in the assessment could cover all the listed impact categories. The effect will be described in the sensitivity analysis and interpretation of results (section 4.5). Additionally, the analysis of recycled materials covers mainly GWP and only partially other impact categories due to limited data availability (see section 5).

Transport processes cover the transport of parts to the final assembly, transport of the final product from final assembly in China to the distribution hub in Europe, and product delivery to the final customer within Europe.

Use phase impacts are related to electricity consumption of the phone and the charger, which is not delivered with the product. Impact of the mobile network (availability and data transfer) are not within the scope of this study. Consumables are considered for the scenarios with longer use (replacement batteries) and spare parts for the repair scenarios.

Processes are modelled with the LCA software GaBi and the corresponding data base, including the "Electronics" extension data base. This is supplemented with the ecoinvent data base v3.6 for processes where no suitable GaBi data set is available.

# 3
# Life Cycle Inventory

The life cycle inventory covers the following sections:

- Raw material acquisition and manufacturing
- Use phase
- Transport
- End-of-life (EoL)

The raw material acquisition is indirectly covered using cradle-to-gate data sets for the manufacturing.

For the assessment, the life cycle assessment software GaBi with its own data base, the electronics extension as well as the ecoinvent 3.6 data base was used. If data is used from additional sources, this is specifically mentioned in the description. In many aspects, the modelling follows the same assumptions as the Fairphone 2 LCA [Proske et. al. 2016], which was also carried out by Fraunhofer IZM.

## 3.1
## Raw material acquisition and manufacturing

The manufacturing phase was modelled according to the bill of materials (BoM) of the Fairphone 3 and the material compositions of several components provided by the suppliers. The analysis was supplemented with a teardown of the phone at Fraunhofer IZM.

Life cycle data sets were allocated to all parts based on weight (mechanical parts), number of pieces (electronic components) or size/area (e.g. printed circuit boards). The individual approach for each module and component group is described in the following. The modules of the phone with its main parts are shown in Table 3-1.

**Table 3-1: Main parts per module**

| Module | Main parts | Weight [g] |
|---|---|---|
| Fairphone 3 | | 190.4 |
| Core module | | |
| | Mainboard with<br>• Main electronic components<br>• Connectors to modules<br>• Connectors to battery and display assembly | 18.5 |
| | Button assembly | |
| | Flex boards to module connectors | |
| | Fingerprint sensor | |
| | Frame and mid frame | |
| Top module | | 5.1 |
| | Top module board | |
| | Front camera | |
| | Receiver (speaker) | |
| | Earphone jack | |
| Camera module | | 2.9 |
| | Camera | |
| | Camera board | |
| Bottom module | | 4.3 |
| | Bottom module board | |
| | Vibration motor | |
| | USB-C connector | |

| Module | Main parts | Weight [g] |
|---|---|---|
| Speaker module | | 3.1 |
| | Speaker, microphone | |
| Display module | | 63.4 |
| | Display frame | |
| | LCD display | |
| | Display board | |
| | Cover glass | |
| Battery module | | 50.4 |
| | Battery | |
| Back cover | | 12.6 |

### 3.1.1
### Core Module

The core module consists of the following parts:

- Mainboard with the majority of integrated circuits (ICs) of the phone, including the CPU, memory and storage, and other electronic components
- Metallic shielding on the board
- Connectors to the different modules, based on flexible printed circuit boards (flex boards)
- SIM card and MicroSD card connectors
- Mid-frame and screws
- Fingerprint sensor
- Buttons and printed circuit boards

The detailed modelling of the PCBs, ICs, passive components and connectors is described in subsection 3.1.9. The detailed BoM with the assigned weight and life cycle inventory data set for the core module can be found in the annex in Table 8-5.

### 3.1.2
### Battery

The battery in the Fairphone 3 contains a lithium-ion cell with the following specifications:

- Capacity: 11.55 Wh / 3040 mAh
- Mass: 52 g

The following Table 3-2 lists the material composition ranges provided by the manufacturer. The median values are used for modelling, which results in the mass of individual materials provided in the last column. A range of additional materials is included in the category "other".

**Table 3-2: Material composition of the battery**

| Material | Mass percentage range | Mass percentage median | Mass per cell [g] |
|---|---|---|---|
| Cobalt Oxide | 25 - 30 % | 27.5 % | 14.3 |
| Graphite | 23 - 35 % | 29 % | 15.1 |
| $LiPF_6$ | 12 - 15 % | 13.5 % | 7 |
| Aluminium foil | 7 – 10 % | 8.5 % | 4.4 |
| Copper | 5 – 10 % | 7.5 % | 3.9 |
| Nickel | 2 – 3 % | 2.5 % | 1.3 |

| Material | Mass percentage range | Mass percentage median | Mass per cell [g] |
|---|---|---|---|
| Polyvinylidene fluoride (PVDF) | 0.5 – 2 % | 1.25 % | 0.7 |
| Polypropylene | 2 – 5 % | 3.5 % | 1.82 |
| Polyethylene | 0.5 – 1 % | 0.75 % | 0.39 |
| PVC | 0.2 – 0.5 % | 0.35 % | 0.18 |
| Other | | 5.65 | 2.94 |

The battery management system PCB and the cell packaging are assumed to be the same as in the FP2.

For replacement batteries (depending on the years of use, see section 3.2) additional packaging and transport is assumed.

### 3.1.3
### Top module

The top module consists of the following parts:

- Module housing
- Module board with electronic components
- Front camera
- Receiver
- Connectors
- Earphone jack

The detailed modelling of the PCBs, ICs, passive components and connectors is described in subsection 3.1.9. The detailed BoM with the assigned weight and life cycle inventory data set for the top module can be found in the annex in Table 8-7.

### 3.1.4
### Bottom module

The bottom module consists of the following parts.

- Module housing
- Module board with electronic components
- Connectors
- USB-C connector
- Vibration motor

The vibration motor is modelled based on the material composition. For the tungsten, no data set was available in GaBi or ecoinvent. Therefore, a data set from the German life cycle data base Probas was used [Probas 2020].

The detailed modelling of the PCBs, ICs, passive components and connectors is described in subsection 3.1.9. The detailed BoM with the assigned weight and life cycle inventory data set for the bottom module can be found in the annex in Table 8-7.

### 3.1.5
### Speaker module

The speaker module consists of the following parts:

- Module housing
- Speaker
- Connectors

The detailed modelling of the connectors is described in subsection 3.1.9. The detailed BoM with the assigned weight and life cycle inventory data set for the speaker module can be found in the annex in Table 8-8.

### 3.1.6
### Display Module

GaBi does not contain an LCD data set. The data set from Ecoinvent for a display is from 2001 and therefore out-dated and has only limited applicability for a smartphone display. Therefore, the display is modelled according to the CSR report from the Taiwanese display manufacturer AUO [AUO 2019]. The same approach was used for the Fairphone 2 LCA, but with older data from 2015.

The data is scaled by panel size, which in the case of Fairphone 3 is of 81.9 cm$^2$.

AUO data covers scope 1 (direct emissions) and scope 2 (purchased energy). Scope 3 covers product use, business travel, and commuting but not the impact of upstream suppliers and is therefore not taken into account. Production of input materials is not covered. The data covers the panel manufacturing without backlight and electronics (display board).

The following data presented in Table 3-3 is given by the AUO CSR report and the data marked in blue is transferred to the LCA model.

The given values from AUO for scope 2 greenhouse gas (GHG) emissions (from purchased energy) are not directly transferred, but the energy consumption is included via the corresponding processes (electricity production, gas, diesel) to also address other impact categories. Purchased electricity for the production process is included as electricity from Taiwan.

**Table 3-3: Panel production data by AUO [2019]**

| **Input** | **Total** | | **per m$^2$** | |
|---|---|---|---|---|
| **Material** | | | | |
| Glass substrate | 97,865.90 | tonnes | 1.42E+00 | kg/m$^2$ |
| liquid crystal | 90.00 | tonnes | 1.31E-03 | kg/m$^2$ |
| Photoresist | 31,290.00 | kiloliters | 4.55E-01 | l/m$^2$ |
| Array stripper Usage | 80,862.30 | tonnes | 1.18E+00 | kg/m$^2$ |
| CF Thinner | 1,774.00 | tonnes | 2.58E-02 | kg/m$^2$ |
| Developer | 49,188.00 | tonnes | 7.15E-01 | kg/m$^2$ |
| Aluminium Etchant | 10,493.00 | kiloliters | 1.53E-01 | l/m$^2$ |
| PFC Usage | 900.40 | tonnes | 1.31E-02 | kg/m$^2$ |
| **Energy** | | | | |
| total consumed | 19,746,407.09 | GJ | 2.87E-01 | GJ/m$^2$ |
| Purchased Electricity | 18,921,349.28 | GJ | 2.75E-01 | GJ/m$^2$ |
| Natural Gas | 716,182.93 | GJ | 1.04E-02 | GJ/m$^2$ |
| LPG | 12,511.37 | GJ | 1.82E-04 | GJ/m$^2$ |
| Diesel | 96,363.50 | GJ | 1.40E-03 | GJ/m$^2$ |
| self-generated solar power | 299.87 | GJ | 4.36E-06 | GJ/m$^2$ |
| Wind power | 0.00 | GJ | 0.00E+00 | GJ/m$^2$ |
| **Water** | | | | |
| total | 33,735.21 | megaliters | 4.90E+02 | l/m$^2$ |
| **Emissions** | | | | |
| scope 1 | 320,000.00 | tonnes CO$_2$ | 4.65E+00 | kg CO$_2$/m$^2$ |
| scope 2 | 3,250,000.00 | tonnes CO$_2$ | 4.73E+01 | kg CO$_2$/m$^2$ |
| scope 3 | 8,250,000.00 | tonnes CO$_2$ | 1.20E+02 | kg CO$_2$/m$^2$ |
| ODS emissions | 0.08 | tonnes | 1.16E-06 | kg/m$^2$ |

| Input | Total | | per $m^2$ | |
|---|---|---|---|---|
| $SO_x$ | 53.80 | tonnes | 7.82E-04 | kg/$m^2$ |
| $NO_x$ | 75.00 | tonnes | 1.09E-03 | kg/$m^2$ |
| Fluorides | 3.60 | tonnes | 5.23E-05 | kg/$m^2$ |
| $HCl_4$ | 2.20 | tonnes | 3.20E-05 | kg/$m^2$ |
| Volatile organic compounds (VOC) | 144.90 | tonnes | 2.11E-03 | kg/$m^2$ |
| Wastewater | 25,995.10 | megaliters | 3.78E+02 | l/$m^2$ |
| COD | 874.80 | tonnes | 1.27E-02 | kg/$m^2$ |
| Biochemical oxygen demand (BOD) | 121.70 | tonnes | 1.77E-03 | kg/$m^2$ |
| total suspended solids | 179.40 | tonnes | 2.61E-03 | kg/$m^2$ |
| hazardous waste | 30,623.40 | tonnes | 4.45E-01 | kg/$m^2$ |
| non-hazardous waste | 79,349.50 | tonnes | 1.15E+00 | kg/$m^2$ |
| **Panel output** | | | | |
| large size | 114.80 | Mio pieces | | |
| small/medium size (<10inch) | 166.60 | Mio pieces | | |
| Total produced display area | 68.78 | Mio. $m^2$ | | |

**Backlight assembly:**

Die size of LEDs per screen area is modelled (as for the FP2 LCA) based on Deubzer [2012] for a comparable tablet display (see Table 3-4). This results in a die area of 0.0077 $cm^2$ for the Fairphone 3 display. The LEDs are modelled per die area as CMOS logic according to Boyd [2012] as it is also described by Zgola [2011].

**Table 3-4: Die area per display area [Deubzer 2012]**

| Backlight design (typical product) | Display diagonal | Brightness [cd/m²] | Total die area per display area [mm²/cm²] |
|---|---|---|---|
| Edge lit (tablet) | 7 " | 350 | 0.0094 |

### 3.1.7
### Camera Module

The camera module consists of

- Camera with camera sensor Sony IMX363
- Camera board
- Connector.

The sensor ICs are modelled according to the die size as described in section 3.1.9.3 and was determined via CT images.

The detailed modelling of the connectors is described in subsection 3.1.9. The detailed BoM with the assigned weight and life cycle inventory data set for the camera module can be found in the annex in Table 8-10.

### 3.1.8
### Back cover

The back cover consists of 12.5 g polycarbonate.

### 3.1.9
### Cross-module approaches

#### 3.1.9.1 Connectors

Connectors are modelled according to their material composition provided by the manufacturers. The impacts of possible production overheads are analysed in the sensitivity analysis (see section 4.5.2).

The board-to-board connectors changed from pogo pin connectors in the Fairphone 2 to press-fit connectors in the FP3 and they mainly consist of the following materials:

- Copper, nickel and gold for the contacts
- Steel or bronze for metal fittings
- Glass fibre-supported plastic for the housing

A flex cable is used per module to connect it to the core, with a pair of male/female press-fit connectors on each end. The connectors are modelled based on the material composition from the manufacturer, while the flex cables are modelled as one-layer PCBs.

The detailed material breakdown can be found in the corresponding module table in the annex.

The connector between mainboard (core module) and display board is the only pogo pin connector with 32 pins on the mainboard and has contact areas on the PCB on the display side. The pogo pins are modelled as the press-fit connectors based on the material composition given by the supplier.

The contact area is modelled similarly to the Fairphone 2 LCA based on the additional amount of nickel and gold on the PCB. The amount of gold deposited on all module boards together is 2 mg (see also Figure 3-1). 80% of that gold is assumed to be connected to the contact area, resulting in 1.6 mg.

#### 3.1.9.2 PCBs:

The conventional method to model printed circuit boards is according to the number of layers and outer dimension (smallest rectangular). This might over- or underestimate offcuts, depending on the specific form and production layout. For the Fairphone 3, the production layouts were available and therefore directly used for the modelling of the rigid PCBs.

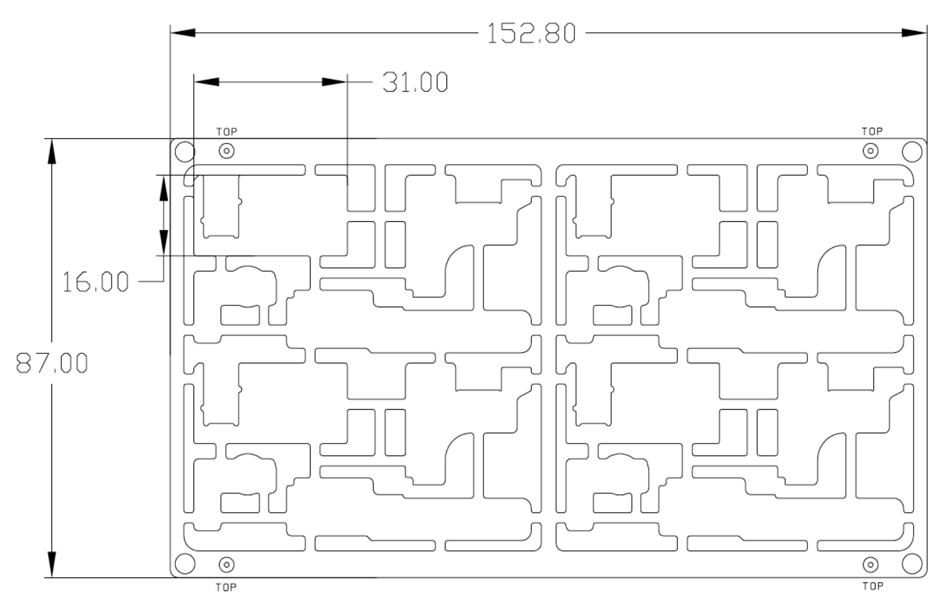

**Figure 3-1: Module board production layout**

The module PCBs are produced all on the same panel (Figure 3-1), with four module boards are arranged in each. The mainboard is modelled with two mainboards per panel. Table 3-5 shows the allocated area for the boards and the area based on the outer dimensions. The results show that the offcuts would have been underestimated for the module boards (in total by 13.5 cm$^2$) and overestimated for the mainboard (in total by 17.8 cm$^2$).

**Table 3-5: Printed circuit board area modelled**

| **Module** | **Boards per panel** | **Length** | **Width** | **Area** | **Allocated area** |
|---|---|---|---|---|---|
| | | **mm** | **mm** | **cm²** | **cm²** |
| Module panel | 4 per module | 152.8 | 87 | 132.94 | |
| Bottom | | 25 | 24 | 6.00 | 10.11 |
| Camera | | 15 | 16 | 2.40 | 4.04 |
| Display | | 49 | 13 | 6.37 | 10.73 |
| Top | | 31 | 16 | 4.96 | 8.35 |
| Mainboard panel | 2 | 166.0 | 86.0 | 142.76 | 71.38 |
| Mainboard | | 136.1 | 65.51 | 89.16 | |

Flexible printed circuit boards are modelled as one-layer PCBs according to the outer dimensions as no data set for flex boards was available.

### 3.1.9.3 Integrated circuits

The environmental impact of ICs is determined mainly by the processed die area. For the Fairphone 3, die area was determined using CT images of the individual boards (Figure 3-2) and grinding of the ICs.

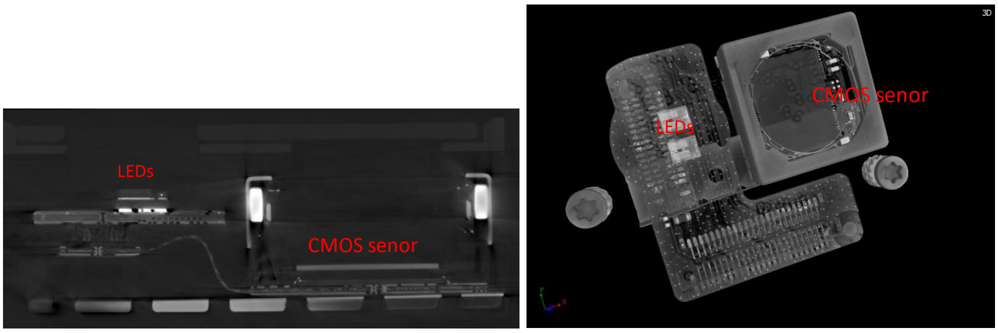

**Figure 3-2: Exemplary pictures of CT images – camera module**

For the main board, CT images were not enough to determine the die size. Therefore, additional x-rays from various dimensions and vertical grinding of the ICs was used.

Table 3-6 shows the identified and modelled die sizes per module. Additional ICs from the mainboard are modelled with existing data sets from GaBi.

**Table 3-6: Die sizes**

| Module | IC description | Die area [mm$^2$] |
|---|---|---:|
| Bottom module | I.C analogue switch | 0.847 |
| Camera module | LED Flash | 1.208 |
| Camera module | LED Flash | 1.222 |
| Camera module | CMOS image sensor | 35.714 |
| Top module | Light sensor | 0.8933 |
| Top module | Light sensor | 0.0814 |
| Top module | LED Full Colour | 0.2556 |
| Top module | CMOS image sensor | 18.0093 |
| Mainboard (WLAN) | I.C WLAN | 11.6 |
| Mainboard (WLAN) | I.C WLAN | 1.44 |
| Mainboard | I.C audio power amplifier | 12.96 |
| Mainboard | I.C analogue switch | 1.61 |
| Mainboard (power management) | I.C power amplifier modules | 6.28 |
| Mainboard (power management) | I.C PMU | 26.88 |
| Mainboard (power management) | I.C PMU | 0.77 |
| Mainboard (power management) | I.C PMU | 11.36 |
| Mainboard | Sensor | 7.2 |
| Mainboard | NFC Microcontroller | 8.69 |
| Mainboard | I.C transceiver | 11.44 |
| Mainboard | I.C audio power amplifier | 9.58 |

| Module | IC description | Die area [mm²] |
|---|---|---|
| Mainboard (CPU) | Baseband processor | 46.4 |
| Mainboard (Flash/RAM) | Stacked memory | 507.74 |

The integrated circuits with greater die size are the power management ICs, CPU and Flash/RAM stacked package. The latter having a higher die size than all other ICs together. Flash storage and RAM are contained within one stacked memory with 9 stacked dies. It was not possible to assign all of them to either RAM or Flash, so die area and results are presented for the whole package.

The impact of the ICs is modelled according to figures from Boyd [2012] and Prakash et al. 2013. Boyd [2012] refers to CMOS logic, the numbers from Prakash et al. [2013] are based on a DRAM chip by Samsung. Therefore, the DRAM and storage of the Fairphone 3 are modelled according to Prakash et al. [2013] (see Table 3-9), all other ICs listed in Table 3-4: Die area per display area [Deubzer 2012] and Table 3-6 are based on the figures for logic chips (see Table 3-8). As the wafer manufacturing is similar for all ICs, the more detailed wafer data set from Prakash et al. [2013] was used also for the wafer manufacturing of the CMOS logic ICs.

The impact category ADP elements is not covered by the data by Boyd [2012]. This impact category is driven by material use, specifically gold and other precious metals have a high impact. To reflect this, the ADP elements impact of gold, silver and palladium in the package is added to the individual ICs which are modelled with the CMOS logic based on the material composition given by the supplier (see Table 3-7).

**Table 3-7: Gold, silver and palladium in IC packages per module board**

| | Gold | Silver | Palladium |
|---|---|---|---|
| | [g] | [g] | [g] |
| Mainboard | 2,45E-04 | 1,83E-03 | 6,95E-06 |
| Top module | 8,55E-04 | 5,99E-05 | 3,10E-06 |
| Camera module | 0,00E+00 | 2,00E-07 | 0,00E+00 |
| Bottom module | 0,00E+00 | 1,70E-05 | 0,00E+00 |

The DRAM figures already include gold as an individual flow in the model. The material composition of the Samsung storage chip used by Prakash et al. [2013] therefore fits the amount of gold stated by the material composition of the Fairphone 3 storage IC very well when scaled by die size.

**Table 3-8: Environmental impacts according to Boyd [2012] per $cm^2$ die for the technology 32 nm logic chips**

| Process | Energy | GWP | Photo-chemical smog | Acidification | Eco-toxicity | Human Health Cancer | Human Health non cancer |
|---|---|---|---|---|---|---|---|
| | [MJ] | [kg $CO_2$e] | [kg NOx] | [mol H+] | [kg 2,4-D] | [kg C6H6] | [kg C6H6] |
| Fab | 33.6 | 0.9 | 0.006 | 0.356 | 0.030 | | 2.444 |
| Infrastructure (fab construction and equipment) | 17.9 | 1.5 | 7.43E-03 | 3.86E-01 | 4.96E-05 | 7.36E-05 | 3.07E+00 |
| Silicon | 5.9 | 0.5 | 5.25E-03 | 3.03E-01 | 2.60E-02 | | 2.08E+00 |
| Chemicals | 2.9 | 0.4 | | | | | |
| Fab direct emissions and EoL | | | 2.51E-04 | 2.00E-01 | 4.70E-04 | 1.89E-05 | 1.00E+00 |

**Table 3-9: Environmental impacts according to Prakash et al. [2013] of storage chips**

| Process | | Wafer | Good die out | | Packaged die | | GaBi process |
|---|---|---|---|---|---|---|---|
| Reference | $cm^2$ | 1 | 1 | | 1 | | |
| Inputs | | | process | incl. upstream | process | incl. upstream | |
| Wafer | | | 1,38 | | | | |
| good die | | | | | 1 | | |
| Electricity | kWh | 3,85E-01 | 1,27 | 1,80E+00 | 5,72E-01 | 2,37E+00 | CN: Electricity grid mix ts |
| Natural gas | kWh | | 1,60E-01 | 1,60E-01 | 7,09E-02 | 2,31E-01 | US: Natural gas mix ts |
| Silicon dioxide | kg | 4,87E-03 | | 6,72E-03 | 1,10E-04 | 6,83E-03 | GLO: Silicon mix (99%) ts |
| Wood pellets (as energy material) | kg | 1,83E-03 | | 2,53E-03 | | 2,53E-03 | EU-28: Wood pellets (6.2% moisture; 5.8% H2O content) (EN15804 B6) ts |
| Lignite | kg | 3,98E-03 | | 5,49E-03 | | 5,49E-03 | EU-28: Lignite mix ts |
| Petroleum coke | kg | 5,97E-04 | | 8,24E-04 | | 8,24E-04 | EU-28: Petroleum coke at refinery ts |
| Electrode material | kg | 1,63E-04 | | 2,25E-04 | | 2,25E-04 | |
| HCl | kg | 6,75E-03 | | 9,32E-03 | | 9,32E-03 | RER: Hydrogen chloride ELCD/PlasticsEurope <t-agg> |

| Process | | Wafer | Good die out | Packaged die | GaBi process |
|---|---|---|---|---|---|
| Water | kg | 7,88E+00 | 7,88E+00 | 7,88E+00 | EU-28: Water (deionised) ts |
| N2 (high purity)[1] | kg | 6,06E-01 | 6,06E-01 | 6,06E-01 | EU-28: Nitrogen (gaseous) ts |
| O2 (high purity) | kg | 4,13E-03 | 4,13E-03 | 4,13E-03 | EU-28: Oxygen (gaseous) ts |
| Ar (high purity) | kg | 2,34E-03 | 2,34E-03 | 2,34E-03 | DE: Argon (gaseous) ts |
| H2 (high purity) | kg | 6,34E-05 | 6,34E-05 | 6,34E-05 | RER: Hydrogen (electrolysis) PlasticsEurope |
| Sulphuric acid (high purity) | kg | 7,33E-03 | 7,33E-03 | 7,33E-03 | EU-28: Sulphuric acid (96%) ts |
| Hydrogen peroxide (high purity) | kg | 2,04E-03 | 2,04E-03 | 2,04E-03 | DE: Hydrogen peroxide (100%; H2O2) (Hydrogen from steam cracker) ts |
| hydrofluoric acid (high purity) | kg | 5,53E-04 | 5,53E-04 | 5,53E-04 | |
| Phosphoric acid (high purity) | kg | 3,32E-03 | 3,32E-03 | 3,32E-03 | EU-28: Phosphoric acid (H3PO4, 54% P2O5) Fertilizers Europe |
| 2-Propanol (C3H8O)/ isopropyl alcohol (IPA) (high purity) | kg | 2,78E-03 | 2,78E-03 | 2,78E-03 | DE: Isopropanol ts |
| Ammonium hydroxide (high purity) | kg | 1,09E-03 | 1,09E-03 | 1,09E-03 | |
| CF4 | kg | 5,94E-05 | 5,94E-05 | 5,94E-05 | |
| CHF3 | kg | 5,66E-06 | 5,66E-06 | 5,66E-06 | GLO: trifluoromethane production ecoinvent 3.5 |
| NF3 | kg | 3,02E-04 | 3,02E-04 | 3,02E-04 | |
| C2F6 | kg | 6,89E-05 | 6,89E-05 | 6,89E-05 | GLO: hexafluoroethane production, from fluorination of tetrafluoroethane ecoinvent 3.5 |
| SF6 | kg | 8,96E-06 | 8,96E-06 | 8,96E-06 | RER: sulphur hexafluoride production, liquid ecoinvent 3.5 |

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[1] For high-purity materials, adjustments factors according to Prakash et al. [2013] were applied.

| Process | | Wafer | Good die out | | Packaged die | | GaBi process |
|---|---|---|---|---|---|---|---|
| NaOH (for wastewater treatment) | kg | | 2,04E-03 | 2,04E-03 | | 2,04E-03 | EU-28: Sodium hydroxyde (caustic soda) mix (100%) ts |
| Polymer | kg | | | | 2,47E-05 | 2,47E-05 | |
| Au | kg | | | | 4,65E-07 | 4,65E-07 | GLO: Gold (primary) ts |
| Carbon Black | kg | | | | 4,65E-07 | 4,65E-07 | DE: Carbon black (furnace black; general purpose) ts |
| Ag | kg | | | | 1,62E-06 | 1,62E-06 | GLO: Silver mix ts |
| Cu | kg | | | | 2,33E-07 | 2,33E-07 | GLO: Copper mix (99,999% from electrolysis) ts |
| Sn | kg | | | | 5,49E-05 | 5,49E-05 | GLO: Tin ts |
| BT-Core (Bismaleimidetriazine)+ Cu+Au+Ni | kg | | | | 1,22E-04 | 1,22E-04 | |
| Emissions | | | | | | | |
| CO2 | kg | 8,33E-03 | | 1,15E-02 | | 1,15E-02 | |
| CO | kg | 1,67E-04 | | 2,30E-04 | | 2,30E-04 | |
| Nox | kg | 1,38E-05 | | 1,90E-05 | | 1,90E-05 | |
| Methanol | kg | 8,51E-05 | | 1,17E-04 | | 1,17E-04 | |
| Methane | kg | 8,50E-05 | | 1,17E-04 | | 1,17E-04 | |
| Ethan | kg | 2,90E-05 | | 4,00E-05 | | 4,00E-05 | |
| Particles | kg | 2,01E-04 | | 2,77E-04 | | 2,77E-04 | |
| H2O | kg | 1,88E-03 | | 2,59E-03 | | 2,59E-03 | |
| SO2 | kg | 3,44E-05 | | 4,75E-05 | | 4,75E-05 | |
| Hydrogen | kg | 1,25E-04 | | 1,73E-04 | | 1,73E-04 | |
| HFC-23 (Trifluormethane) | kg | | 2,26E-06 | 2,26E-06 | | 2,26E-06 | modelled directly as CO2-emissions |
| Perfluorethane (C2F6) | kg | | 3,84E-06 | 3,84E-06 | | 3,84E-06 | |
| Tetrafluormethane (CF4) | kg | | 3,25E-06 | 3,25E-06 | | 3,25E-06 | |
| Perfluorpropane (C3F8) | kg | | 2,26E-06 | 2,26E-06 | | 2,26E-06 | |
| SF6 | kg | | 2,26E-06 | 2,26E-06 | | 2,26E-06 | |
| NF3 | kg | | 1,56E-05 | 1,56E-05 | | 1,56E-05 | |

#### 3.1.9.4 Passive components

Passive components were modelled with corresponding data sets from the GaBi electronics extension, scaled by number of pieces. If no corresponding data set was available in GaBi, an ecoinvent data set for unspecific passive components was used and scaled by weight.

### 3.1.10 Protection bumper

The Fairphone 3 is delivered with a protection bumper, therefore it is included in the reference flow. It consists of 13.7 g TPU from bio-based oil. As no life cycle data is available for this specific material it is modelled as conventional TPU.

### 3.1.11
### Screwdriver

The screwdriver consists of a metal (~1.1 g stainless steel) and a plastic part (2.9 g polyamide) and was modelled by weight.

### 3.1.12
### Packaging

The packaging consists of a sales and a distribution packaging. The distribution packaging is proportionality reflected in the modelling. The detailed parts and assigned GaBi data sets are listed in the annex in Table 8-11.

### 3.1.13
### Final assembly

For the final assembly, electricity consumption of the final assembly process was considered using the Chinese energy grid mix. Additionally, the consumption of ethyl alcohol and cloths from cleaning processes in the packaging process and nitrogen gas used in the reflow oven are considered. This is based on primary data from the manufacturer Arima comms in China as shown in Table 3-10.

**Table 3-10: Final assembly**

| **Energy use** | | **GaBi dataset** |
|---|---|---|
| Electricity, from grid | 2.186 kWh | CN: Electricity grid mix ts |
| **Process material** | | |
| Ethyl alcohol (95% purity) | 0.39 g | RoW: benzyl alcohol production ecoinvent 3.5 |
| Nitrogen (gas, >95% purity) | 0,50 g | EU 28 Nitrogen (gaseous) |
| Cloth (lint free) | 0.15 g | GLO: Cotton fibre (bales after ginning) CottonInc |

## 3.2
## Use Phase

The following use pattern is assumed for the Fairphone 3 baseline scenario:

- Daily charging
- One charging cycle consumes 19.21 Wh, which results in 7.01 kWh/a

The energy per charging cycle is based on measurements carried out at Fraunhofer IZM with new and aged (state of health: 80 % capacity) batteries. As expected, aged batteries showed a lower efficiency. The average energy consumption was used to calculate the use phase consumption.

No repairs except battery replacements were assumed for the baseline scenario, but three different use-times were calculated:

- 3 years with one replacement battery
- 5 years with 2 replacement batteries

- 7 years with 3 replacement batteries

For the number of replacement batteries considered, laboratory cycle life testing of the battery was carried out. This resulted in the following insights: charging with the provided Quick Charge 3.0 enabled charger resulted in a charging rate of 0.67C (2A). The charging efficiency (power drawn from the grid relative to the battery capacity) with the above-mentioned charger was 60 %.

Battery cycle life testing at 0.67C in accordance with IEC 61960 showed that the batteries could, on average, withstand more than 850 cycles while retaining a capacity (SOH) of 80 %, and two out of three tested cells could even endure up to 1000 cycles.

Previous LCA studies of smartphones have worked with the conservative assumption that the battery is fully charged and discharged once every day, resulting in 365 charge/discharge cycles per year. Empirical data suggests that the actual number may be closer to 230 cycles on average annually [Clemm et al. 2016]. This study therefore works with the following assumptions: The battery durability is enough to last for 3 years of use, after which it needs to be replaced with a new battery. To calculate the use phase energy consumption, the study adopts the conservative assumption that the battery is fully charged once every day as explained above.

The electricity is assigned according to the distribution of sales within Europe (see Table 8-1 in the annex) assigning national electricity grid mixes.

## 3.3
## Transport

The transport is separated in three main parts:

- Transport of parts from tier 2 suppliers to final assembly in China
- Transport of the final product to the distribution hub in Europe
- Transport to customer from distribution hub within Europe

The transportation is modelled as so-called tonne kilometres (tkm), considering transported weight and distance.

### 3.3.1
### Transport to final assembly

For the transport to final assembly, the following modes of transportation are assumed:

- Truck delivery within China
- Air freight for international transportation

The transportation is scaled by distance and weight. For the components, a weight overhead is calculated to represent packaging. Therefore, the following factors are used (as for the Fairphone 2 LCA):

- 0.1 for components > 0.5 g
- 0.94 for components < 0.5 g

This results in the following distances:

- Air freight: 0.199 tkm
- Truck: 0.253 tkm

### 3.3.2
### Transport to distribution hub

The phone is transported from the final assembly in China to the distribution hub in the Netherlands by train freight for regular orders, for which a distance of 1.632 tkm was modelled.

### 3.3.3
### Transport to consumer

The phone is transported by truck within Europe. An average distance from the distribution hub to the different countries is assumed for this (Table 8-2 in the annex). These transport distances are weighted according to the distribution of sales.

## 3.4
## End-of-Life

For the reference case scenario, a conservative approach has been taken i.e. that the Fairphone 3 device is assumed to be discarded as a regular phone and join the wider WEEE recycling stream. This approach relies on the assumption that this is the most usual route for smartphones to follow in their end of life. Additionally, this was also the modelling approach for the Fairphone 2 LCA and using alternative modelling options could therefore hinder comparability.

Due to a lack of specific data on smartphone recycling, several assumptions needed to be made, which will be explained in this section. To begin with, the device is assumed to be disposed of in its entirety, meaning that no mass losses take place between the disposal and the recycling plant. On the lines of the EoL scenario of Fairphone 2 [Proske et al. 2016], no specific point of disposal was assumed and instead a general transport to the plant was modelled as follows, in accordance with [Hischier, 2007].

- Total transportation distance from user to recycling plant: 1500 km
- Mode of transportation is by lorry (75 % of distance) and by train (25 % of distance).

Following the Umicore recycling process [Hagelüken 2006], the device is set to have the battery removed first (depollution) and then the rest is sent to the material recovery streamline as scrap. The main processes included in the model are:

- Copper smelting
- Electrowinning
- Precious metal recovery

In the depollution step, 95% of the batteries are assumed to be separated correctly [Sommer 2013] and a recovery rate of 95% for the copper and cobalt contained is estimated. In the electrowinning step copper is recovered with a rate of 95%. Finally, in the precious metal recovery step, three elements are yielded: gold, silver and palladium, all with a rate of 95%. All recovery rates are based on Chancerel et al. [2016]. The absolute amounts recovered are in turn based on the cross comparison of the bill of materials provided by Fairphone and the material declarations of the suppliers themselves. Additionally, a disassembly of a Fairphone 3 device carried out at Fraunhofer IZM has been used as backup for completing weights and material data. Table 3-11 below shows a summary of the materials considered in the EOL modelling, their recovery rates and the mass in the device.

**Table 3-11: Recycling relevant material content in the device and recovery rate**

| Material | Recovery rate | Mass in device |
|---|---|---|
| Copper | 95% | 10,28 g |
| Cobalt | 95% | 11,25 g |
| Gold | 95% | 28,17 mg |
| Silver | 95% | 44,19 mg |
| Palladium | 95% | 7,5 mg |

All burdens as well as credits of the material recovery have been allocated to the Fairphone 3 under study. This has been decided in order not to hinder comparability with the Fairphone 2 LCA study. For the credits' estimation, direct correspondence has been assumed between recovered secondary material and avoided primary material production.

## 3.5
## Scenarios

In addition to the baseline scenario with different years of use, two repair scenarios are calculated, which are described in the following.

### 3.5.1
### Repair scenario A

Repair scenario A addresses the repair through module replacement:

- 5 years use
- 1 replacement battery
- And the repair of one module per phone based on repair and insurance statistics:
  - 63% display
  - 16% connectors resulting in
    - 9% top module (earphone jack)
    - 7% bottom module (USB-C connector)
  - 10% camera module
  - 5% speaker
  - 3% back cover and protection bumper
  - 3% mainboard

It is assumed that over the course of 5 years each phone is repaired once. The numbers are roughly based on numbers published by Clickrepair[1] with the following figures:

- 67.4% Display
  - 50.0% housings
  - 33.9% battery
  - 16.1% connectors
  - 7.9% camera

An older study from Clickrepair [click repair 2016] states a share of water damages of 5%. It is assumed that roughly half of these water damages lead to defects on the mainboard.

The battery is not included in the assumption of damages and replacement is based on degradation assumptions (see section 3.2). Additionally, it is assumed that broken housings are more frequent for phones with more fragile (glass) housings. Therefore, the number of replacement back covers is reduced compared to the statistics. The protection bumper is assumed to be replaced together with the back cover.

For the replacement batteries and spare part modules, additional transport and packaging is assumed. The changes in end-of-life are not assessed for the repair scenarios.

### 3.5.2
### Repair scenario B

The repair scenario considers the same use phase and replacement rates of modules as repair scenario A. However, repair scenario B considers additional repair of the modules itself on board-level:

- Top module: earphone jack replaced
- Bottom module: new microphone

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[1] https://www.clickrepair.de/images/presse/downloads/pdf/clickrepair-smartphone-repair-study-2019-en.pdf

- Camera module: new camera
- Mainboard: new power supply unit

For transport distances, a board-level repair in France is assumed. For the repair services, it is assumed that only the broken module and not the whole phone is transported.

It is assumed that 75% of broken modules (with the potential of repair, so no re-transport of e.g. displays) are sent back to Fairphone B.V. and 50% of these could be repaired. This results in 63% new modules still needed for top, bottom, camera module and mainboard plus individual components.

For the board-level repairs, energy consumption of de-soldering and re-soldering processes were measured at a rework station at Fraunhofer IZM to approximate board-level repair in professional environment.

### Materials and methods

Standard activities involved in rework are as follows:

[1]Desoldering: Application of heat to the PCB and BGA up until the melting point of the solder balls, then picking up the component, commonly with a vacuum nozzle

[2]Residual solder removal: Application of heat to melt the residual solder on the PCB, and removal with a vacuum nozzle

[3]Soldering in: The new or repaired (and re-balled) component is placed on the PCB and soldered in using heat (application of heat to the PCB and the BGA component)

Professional board-level repair in practice may be performed using industrial rework stations offering precise pre-programmable temperature and air flow profiles, high placement accuracy and bottom heating of the PCB. This process is approximated in this project using a manual rework station. The power consumption of the rework station in different operational modes was measured using a laboratory power meter.

- Weller Multi-Digital Rework Station WMD 3 (with In-Built Pump)
  - Power Input: 310W
  - Temperature control soldering/desoldering 50-450°C; hot air pencil 50-550°C
  - Pump: max. low pressure 0.7 bar; max. conveyance 20 l/min; hot air max. 10 l/min
- Hameg Programmable Power Meter HM8115-2

Generic profiles were derived from rework training material and referring to standard IPC/JEDEC J-STD-020E. The air flow on the rework station can be set between 10 % and 100 %. The temperature indicates the settings of the machine, not the temperature of the PCB or sample component. The power consumption of each operational mode was measured for at least 30 seconds to obtain average values.

### Results

The energy consumptions shown in Table 3-12 were measured, leading to simplified profile shown in Table 3-13.

**Table 3-12: Desoldering/reflow (hot air flow from nozzle) – measurements from Fraunhofer IZM**

| Phase/device status | Air flow [%] | Temperature [°C] | Measured average power consumption [W] |
|---|---:|---:|---:|
| Standby | n/a | n/a | 3,38 |
| Heating up | n/a | 300 | 19,46 |
| Operation | 50 | 300 | 49,04 |
| | 50 | 350 | 49,39 |

| Phase/device status | Air flow [%] | Temperature [°C] | Measured average power consumption [W] |
|---|---|---|---|
| | 75 | 300 | 70,39 |
| | 75 | 350 | 70,39 |
| | 100 | 300 | 99,17 |
| | 100 | 350 | 109,43 |

**Table 3-13: Simplified profile for desoldering/reflow energy consumption**

| Phase / device status | Time [s] | Power consumption [W] | Energy consumption [Ws] |
|---|---|---|---|
| Standby | 180 | 3,4 | 612 |
| Heating up / 300°C | 30 | 19,5 | 585 |
| Pre-heat / 300°C; 50% | 60 | 49,0 | 2.940 |
| Soak / 300°C; 75% | 120 | 70,4 | 8.448 |
| Reflow / 350°C; 100% | 45 | 109,4 | 4.923 |
| **Total [Ws]** | | | **17.508** |
| **Total [Wh]** | | | **4,86** |

In a simplified scenario, the above process flow is assumed for both desoldering and soldering in, in addition to residual solder removal described below in Table 3-14.

**Table 3-14: Residual solder removal**

| Phase / device status | Air flow [%] | Temperature [°C] | Measured average power consumption [W] |
|---|---|---|---|
| Standby | n/a | n/a | 3,40 |
| Heat up | n/a | 300 | 89,12 |
| Operation | 10 | 300 | 56,86 |
| | 50 | 300 | 102,33 |
| | 75 | 300 | 143,95 |

The following simplified profile for residual solder removal energy consumption is considered, assuming this process takes place right after desoldering, therefore no standby or heating up is accounted for.

**Table 3-15: Simplified profile for residual solder removal**

| Phase / device status | Time [s] | Power consumption [W] | Energy consumption [Ws] |
|---|---|---|---|
| Operation / 300°C; 75% | 30 | 145 | 4.350 |
| **Total [Wh]** | | | **1,21** |

The energy consumption of the entire process is therefore:

$$4{,}86\ Wh + 1{,}21\ Wh + 4{,}86\ Wh = 10{,}93\ Wh$$

# 4
# Impact Assessment

Based on material flows defined in the LCI, the life cycle impact assessment (LCIA) will be carried out according to the recognized CML methodology [CML 2001] using LCA software GaBi. For the following impact categories, the results will be displayed and discussed in detail:

- Climate change:
  - Global Warming Potential (GWP) 100 years in kg $CO_2$ equivalents
- Resource depletion:
  - Abiotic resource depletion (ADP) elements in kg Sb equivalents
  - ADP fossil in MJ
- Human toxicity:
  - Human Toxicity Potential in kg DCB equivalents
- Ecotoxicity:
  - Terrestrial Ecotoxicity Potential in kg DCB equivalents

Normalization, grouping, and weighting of the results (optional steps in the impact assessment of an LCA) will not be applied.

## 4.1
## Definition of impact categories

For the impact categories covered in this LCA study, the following definitions from CML are used:

- Global Warming Potential (GWP) 100 years: "Global warming is considered as a global effect. Global warming - or the "greenhouse effect" - is the effect of increasing temperature in the lower atmosphere. The lower atmosphere is normally heated by incoming radiation from the outer atmosphere (from the sun). A part of the radiation is normally reflected from the surface of the earth (land or oceans). The content of carbon dioxide (CO2) and other "greenhouse" gasses (e.g. methane (CH4), nitrogen dioxide (NO2), chlorofluorocarbons etc.) in the atmosphere reflect the infrared (IR)-radiation, resulting in the greenhouse effect i.e. an increase of temperature in the lower atmosphere to a level above normal. […] The GWP for greenhouse gases is expressed as CO2-equivalents, i.e. the effects are expressed relatively to the effect of CO2." [Stranddorf 2005]
- Resource depletion: "The model of abiotic resource depletion […] is a function of the annual extraction rate and geological reserve of a resource. In the model as presently defined, the ultimate reserve is considered the best estimate of the ultimately extractable reserve and also the most stable parameter for the reserve parameter. However, data for this parameter will by definition never be available. As a proxy, we suggest the ultimate reserve (crustal content)." [Oers 2016]
  - Abiotic resource depletion (ADP) elements: "The impact category for elements is a heterogeneous group, consisting of elements and compounds with a variety of functions (all functions being considered of equal importance)." [Oers 2016]
  - ADP fossil: "The resources in the impact category of fossil fuels are fuels like oil, natural gas, and coal, which are all energy carriers and assumed to be mutually substitutable. As a consequence, the stock of the fossil fuels is formed by the total amount of fossil fuels, expressed in Megajoules (MJ)." [Oers 2016]

- Human Toxicity Potential: "The normalisation references for human toxicity via the environment should reflect the total human toxic load in the reference area caused by human activity, i.e. the potential risk connected to exposure from the environment (via air, soil, provisions and drinking water) as a result of emissions to the environment from industrial production, traffic, power plants etc. Ideally, all emissions of substances potentially affecting human health should be quantified and assessed. However, the multitude of known substances (>100.000) and an even larger number of emission sources logically makes that approach unfeasible. The inventory used for calculating the normalisation references is therefore based on available emission registrations for substances, which are believed to contribute significantly to the overall load." [Stranddorf 2005]
- Terrestrial Ecotoxicity Potential: "The impact category ecotoxicity covers the possible effects of toxic substances released during the life cycle of a product to the environment. The sources of toxicants are quite different depending on the type of environment as well as the methods used in the assessment of the impact. Consequently, the impact on aquatic and terrestrial systems are usually considered separately. In principle, the normalisation reference for ecotoxicology includes all toxic substances emitted to the environment due to human activities, and it requires extensive data on all types of emissions. In general, however, only few data on environmental releases of toxic substances are available, and the normalisation there-fore relies on extrapolations from a relatively limited set of data.
  The normalisation reference includes the following emission types: […] Terrestrial environment: Pesticide use, Agricultural use of sewage sludge, Atmospheric deposition of metals and dioxins" [Stranddorf 2005]

## 4.2
## Results

The assessment results in a GWP of 39.5 kg CO2e (see Table 4-1). The main impact for all impact categories is caused by the production phase. Transport and use phase have a smaller impact. EoL has a negative impact value, meaning a positive potential for the environment. This is especially relevant for the impact category ADP elements. Most of this impact could potentially be recovered through recycling (see Figure 4-1.)

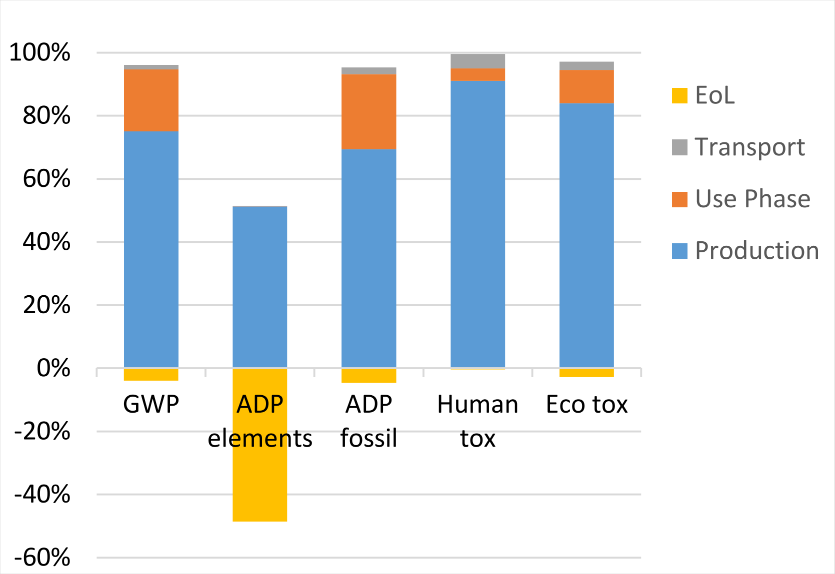

**Figure 4-1: Relative impact per life cycle phase (3-year scenario)**

**Table 4-1: Absolute impacts of the whole life cycle (3-year scenario)**

| | **GWP** | **ADP elements** | **ADP fossil** | **Human tox** | **Eco tox** |
|---|---|---|---|---|---|
| | kg CO2e | kg Sb eq. | MJ | kg DCB eq. | kg DCB eq. |
| Totals | 3,95E+01 | 8,40E-05 | 3,44E+02 | 8,63E+00 | 7,60E-02 |
| Production | 3,22E+01 | 1,51E-03 | 2,63E+02 | 7,92E+00 | 6,76E-02 |
| Use Phase | 8,40E+00 | 3,39E-06 | 9,03E+01 | 3,42E-01 | 8,49E-03 |
| Transport | 5,94E-01 | 5,79E-07 | 8,36E+00 | 3,98E-01 | 2,16E-03 |
| EoL | -1,67E+00 | -1,43E-03 | -1,76E+01 | -3,46E-02 | -2,29E-03 |

The difference between the three baseline scenarios is the varying length of the phone's use-time. The use phase impacts therefore scale directly with number of years in use. Within the production phase, only the impact of the battery changes and, connected to it, a small increase of package and transport impact is caused by the additional transport of the replacement battery to the customer (see Table 8-3 in the annex).

The absolute impact increases with the length of the use phase. However, the impact per year of use decreases with longer use as the main product impact is distributed across a longer useful life (see Figure 4-2). The figure shows a decrease of 29% for the yearly GWP impact category when extending lifetime to 5 years and one of 42% when extended to 7 years.

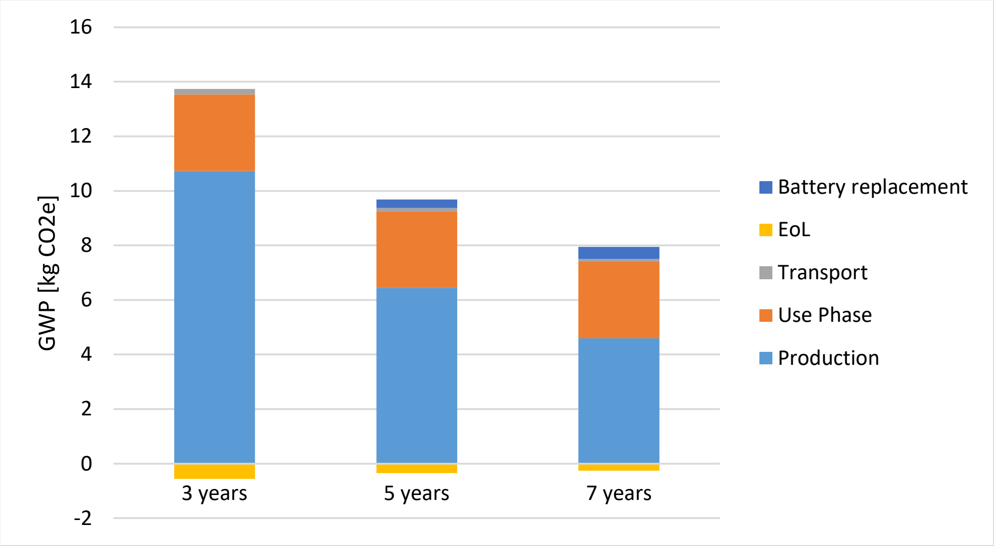

**Figure 4-2: Impact per year of use (baseline scenarios)**

## 4.3
## Contribution Analysis

The following contribution analysis is focussed on the baseline scenario with 3 years of use. Additional numbers for packaging, transport and production of the replacement battery can be found in the annex in Table 8-3.

### 4.3.1
### Production

Within the production phase, the production of the core module and therein specifically the mainboard causes the highest impact for all impact categories (see Figure 4-3 and Table 4-2). For the 5 and 7 years scenario, the impact of 1, respectively 2, batteries needs to be added accordingly, changing the relative impact of the modules only slightly.

The final assembly has an impact between 0.01 % (ADP elements) and 6.8% (GWP) of the total production impact, the display module between 7% (GWP) and 15% (ADP elements). Back cover, protection bumper and screwdriver cause a combined impact of less than 1%. Packaging is only relevant for the impact category eco toxicity (8.2%) due to paper and cardboard production.

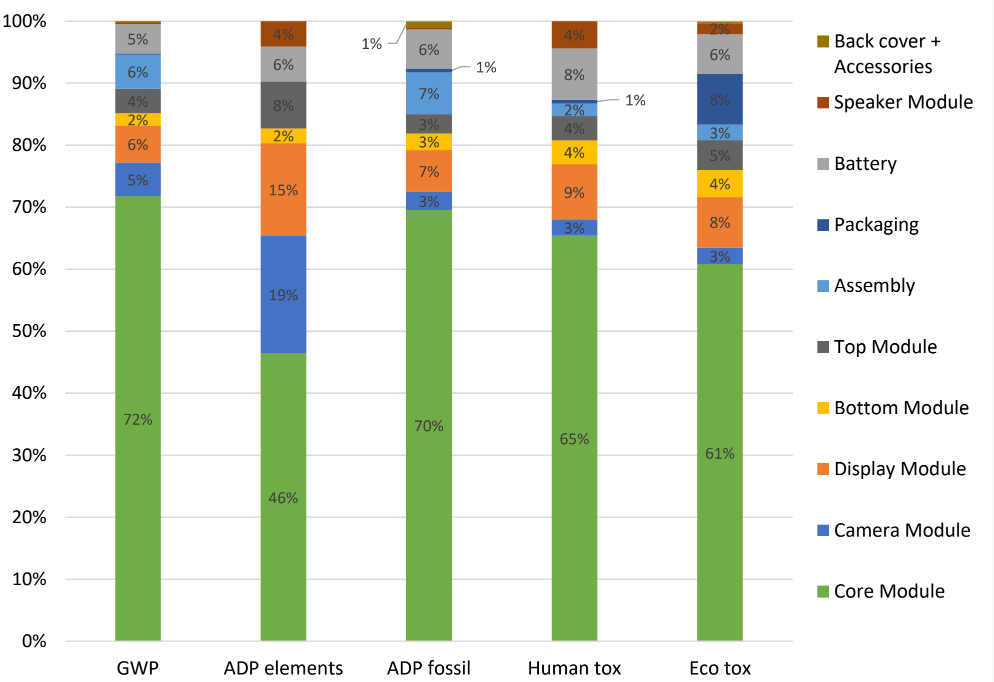

**Figure 4-3: Relative impacts of the production phase per impact category (3-year scenario)**

**Table 4-2: Absolute impacts of the production phase (3-year scenario)**

| | **GWP** | **ADP elements** | **ADP fossil** | **Human tox** | **Eco tox** |
|---|---|---|---|---|---|
| | kg $CO_2$e | kg Sb-e | MJ | kg DCB-e | kg DCB-e |
| Production | 3,22E+01 | 1,51E-03 | 2,63E+02 | 7,92E+00 | 6,76E-02 |
| Assembly | 1,78E+00 | 1,48E-07 | 1,78E+01 | 1,59E-01 | 1,70E-03 |
| Back cover | 4,24E-02 | 1,12E-07 | 1,08E+00 | 2,36E-03 | 7,39E-05 |
| Battery | 1,54E+00 | 8,55E-05 | 1,66E+01 | 6,57E-01 | 4,32E-03 |
| Bottom Module | 6,35E-01 | 3,55E-05 | 7,03E+00 | 3,06E-01 | 2,95E-03 |
| Camera Module | 1,76E+00 | 2,85E-04 | 7,61E+00 | 2,06E-01 | 1,83E-03 |
| Core Module | 2,31E+01 | 7,02E-04 | 1,83E+02 | 5,18E+00 | 4,11E-02 |
| Display Module | 1,92E+00 | 2,26E-04 | 1,77E+01 | 7,06E-01 | 5,50E-03 |
| Packaging | 4,55E-02 | 1,07E-07 | 1,56E+00 | 4,91E-02 | 5,55E-03 |
| Speaker Module | 7,84E-02 | 6,23E-05 | 8,58E-01 | 3,45E-01 | 1,14E-03 |
| Top Module | 1,27E+00 | 1,14E-04 | 8,19E+00 | 3,10E-01 | 3,23E-03 |
| Screwdriver | 1,26E-02 | 2,73E-08 | 2,81E-01 | 9,25E-04 | 1,89E-05 |
| Protection bumper | 5,58E-02 | 1,70E-07 | 1,23E+00 | 1,76E-03 | 1,48E-04 |

Broken down per type of component, the major share is caused by the production impact of the ICs, followed by the PCBs. Connectors have the highest relative impact in the category ADP elements (14.7%) due to the amount of gold used (see Figure 4-4 and Table 4-3).

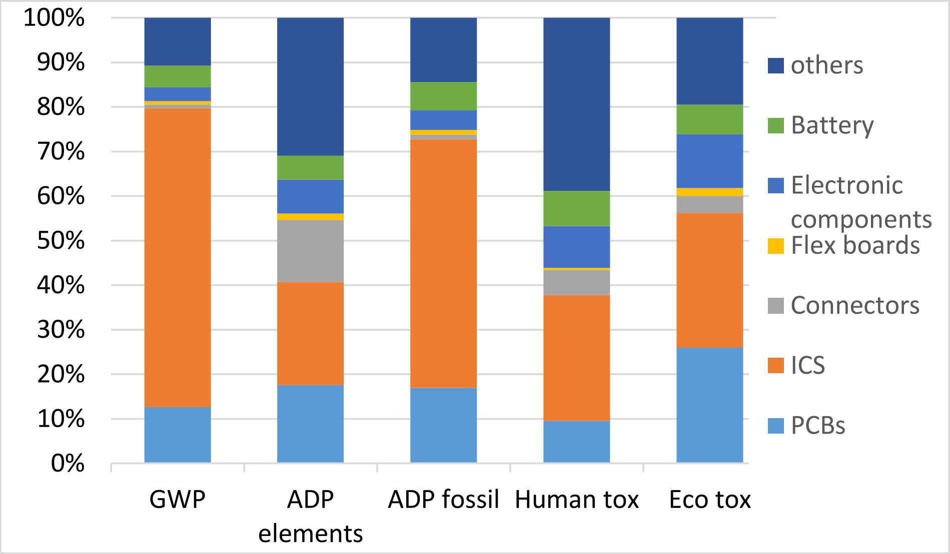

**Figure 4-4: Relative impact per component type of the phone (without packaging, assembly, accessories)**

**Table 4-3: Absolute impact of components**

| | GWP | ADP elements | ADP fossil | Human tox | Eco tox |
|---|---|---|---|---|---|
| | kg $CO_2$e | kg Sb e | MJ | kg DCB e | kg DCB e |
| ICS | 2,14E+01 | 3,70E-04 | 1,44E+02 | 2,37E+00 | 1,95E-02 |
| Connectors | 2,54E-01 | 2,21E-04 | 2,71E+00 | 4,68E-01 | 2,47E-03 |
| Flex boards | 2,58E-01 | 2,34E-05 | 2,72E+00 | 4,35E-02 | 1,14E-03 |
| PCBs | 4,03E+00 | 2,81E-04 | 4,38E+01 | 7,98E-01 | 1,67E-02 |
| Electronic components | 9,88E-01 | 1,21E-04 | 1,13E+01 | 7,86E-01 | 7,75E-03 |
| others | 3,43E+00 | 4,94E-04 | 3,71E+01 | 3,25E+00 | 1,25E-02 |

The core module causes more than half of the total production impact and is therefore analysed in detail in the following. The mainboard's ICs cause more than 80% of the related GWP impact. Within them, the combined RAM/Flash package causes the major share. The 8-layer rigid PCB has a share between 12% and 31%, whereas the flex boards of the connectors only have a share of 0.3% to 1.1% (see Figure 4-5).

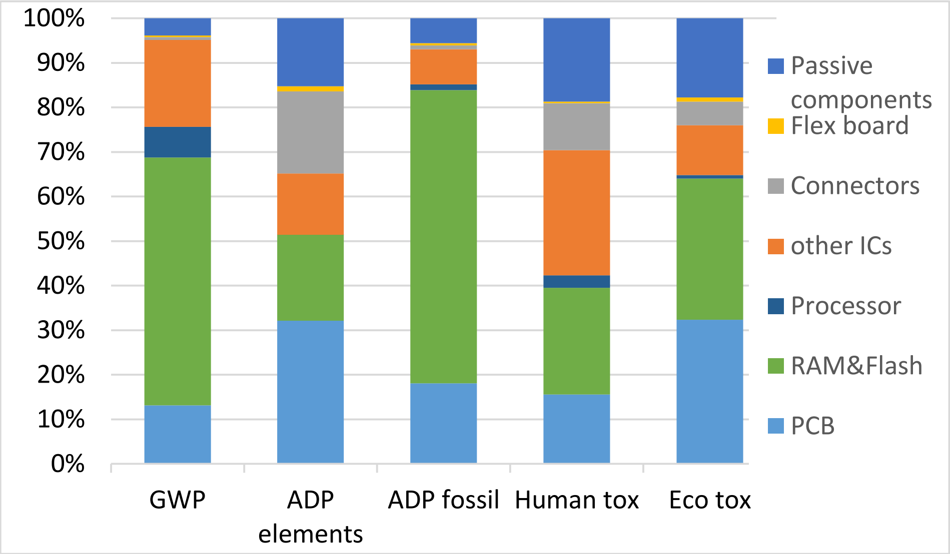

Figure 4-5: Relative impact of the core module per component type

### 4.3.2
### Use phase

The use phase emissions cause a smaller share of the life cycle emissions of the Fairphone 3. Within the use phase, emissions caused by Germany's electricity mix have a share of 50 to 60% while making up 44 % of the sales (see Figure 8-1 in the annex).

The effect that the relative environmental impact differs from the share of sales is caused by the different energy grid mixes which exist in the countries across Europe. For instance, the German energy mix causes more emissions than the European average. Therefore, the relative environmental impact is higher than the share of sales. In contrast, the French energy grid mix has low GHG emissions leading to a significantly lower share in the environmental impact than the share of sales.

There are no major differences regarding the impact per country between the different impact categories (see Figure 4-6 and Table 8-4 in the annex).

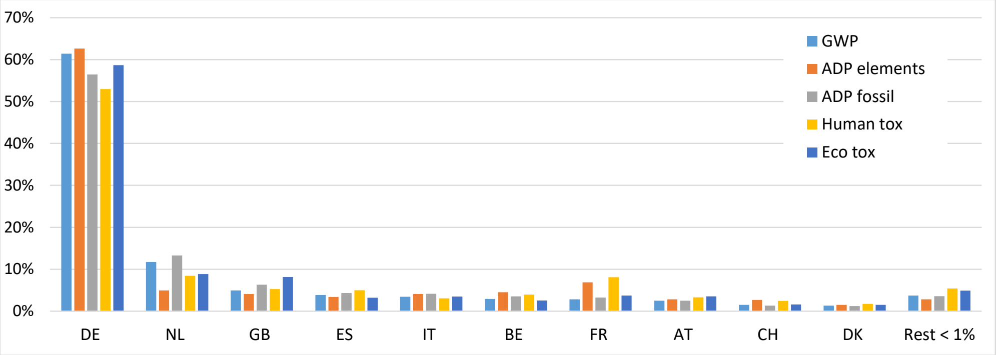

Figure 4-6: Relative impacts of the use phase per country and impact category

### 4.3.3
### Transport

The transportation phase emissions cause a smaller share of the overall life cycle impact. The highest influence of the transportation phase can be seen for the impact category human toxicity.

The main influence from the transport processes is caused by the air freight transport which is mainly located in the transport to some pieces to final assembly (see Figure 4-7).

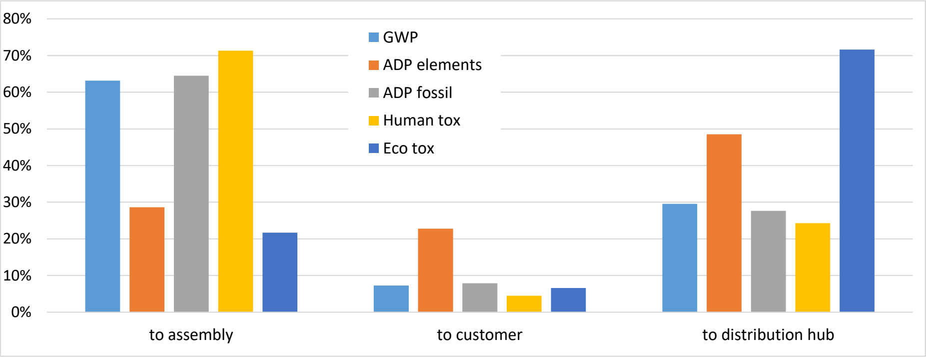

**Figure 4-7: Relative impact of transportation phases "to assembly", "to distribution", and "to customer" (3-year scenario)**

There are no major differences between the impact categories, except for the impact category Ecotoxicity, which is more influenced by train transport (see Figure 4-8).

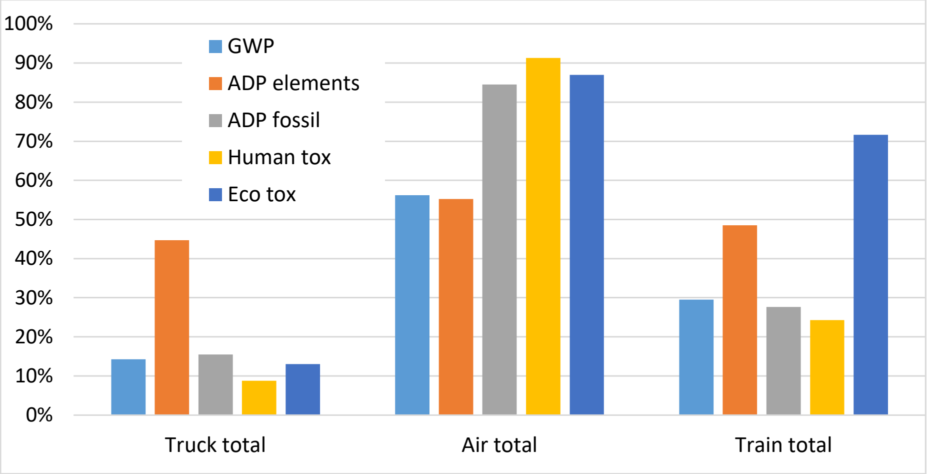

**Figure 4-8: Relative impact of transportation phase between modes of transportation "air", "train" and "truck" (3 year scenario)**

The absolute values for the 3-year use scenario can be found in Table 4-4. For the 5-year and 7-year scenario additional transport for one/two batteries is added to this according to Table 8-3 in the annex. The transport to the distribution hub by train is a recent change implemented by Fairphone, which previously took place by air freight. This reduces drastically its related impacts (around 87% lower GWP).

**Table 4-4: Results of the transport phase (3 years scenario)**

| Impact category | | to assembly | to customer | to distribution hub |
|---|---|---|---|---|
| GWP | kg $CO_2e$ | 3,75E-01 | 4,31E-02 | 1,75E-01 |
| ADP elements | kg Sb-e | 1,66E-07 | 1,32E-07 | 2,81E-07 |
| ADP fossil | MJ | 5,39E+00 | 6,58E-01 | 2,31E+00 |
| Human tox | kg DCB-e | 2,84E-01 | 1,78E-02 | 9,66E-02 |
| Eco tox | kg DCB-e | 4,69E-04 | 1,43E-04 | 1,55E-03 |

### 4.3.4
### End-of-Life

The impact values for the end-of-life phase are negative for all impact categories, meaning that they have a positive impact for the environment. The positive effect stems from the precious metal recycling (see Figure 4-9) and thereby mainly from the gold recycling. Battery recycling and copper smelter have a positive value for the toxicity impact categories, but this is outweighed by the impact of precious metal recycling. Human toxicity shows the strongest differences between the processes. The absolute values compared to whole life cycle small are still small for all impact categories except ADP elements (Table 4-5: Results of the EoL phase (3-year scenario).

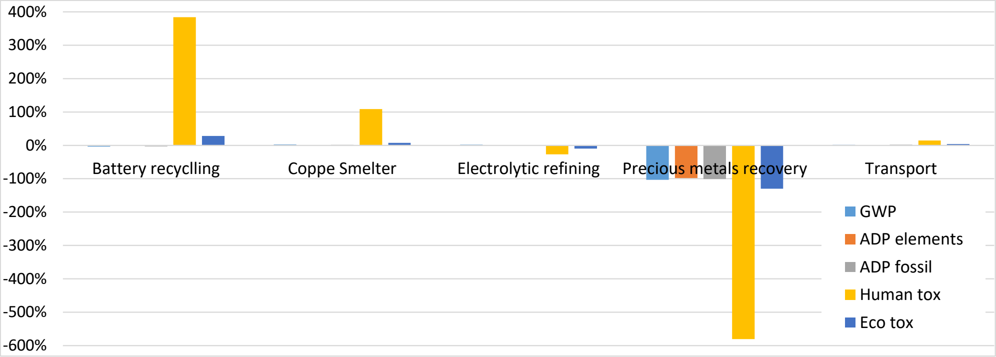

**Figure 4-9: Relative impact of EoL phase between battery recycling, copper smelter, electrolytic refining, precious metals recovery and transport (3-year scenario)**

**Table 4-5: Results of the EoL phase (3-year scenario)**

| **Impact category** | | **Battery recycling** | **Copper Smelter** | **Electrolytic refining** | **Precious metals recovery** | **Transport** |
|---|---|---|---|---|---|---|
| GWP | kg $CO_2$e | -6,06E-02 | 4,84E-02 | 3,64E-02 | -1,72E+00 | 2,67E-02 |
| ADP elements | kg Sb-e | -7,59E-06 | 6,40E-09 | -2,04E-05 | -1,40E-03 | 6,28E-08 |
| ADP fossil | MJ | -5,53E-01 | 3,09E-01 | 9,90E-02 | -1,78E+01 | 4,05E-01 |
| Human tox | kg DCB-e | 1,33E-01 | 3,76E-02 | -9,27E-03 | -2,01E-01 | 5,07E-03 |
| Eco tox | kg DCB-e | 6,51E-04 | 1,69E-04 | -2,19E-04 | -2,98E-03 | 8,38E-05 |

### 4.3.5
### Modularity

The impact of the modularity overhead (as it was shown also for the Fairphone 2) is connected to additional module housing, module connectors and the connecting flex boards as well as the additional PCB area for the board-to-board connector between Display and mainboard. The impact is shown in Table 4-6 and Figure 4-10.

**Table 4-6: Impacts connected to the modularity**

| | **GWP** | **ADP elements** | **ADP fossil** | **Human tox** | **Eco tox** |
|---|---|---|---|---|---|
| | kg $CO_2$e | kg Sb eq. | MJ | kg DCB eq. | kg DCB eq. |
| Totals | 7,44E-01 | 2,60E-04 | 8,19E+00 | 5,54E-01 | 4,53E-03 |
| Connectors | 2,54E-01 | 2,21E-04 | 2,71E+00 | 4,68E-01 | 2,47E-03 |
| Flex | 2,58E-01 | 2,34E-05 | 2,72E+00 | 4,35E-02 | 1,14E-03 |
| Additional PCB | 2,16E-01 | 1,51E-05 | 2,34E+00 | 4,21E-02 | 8,84E-04 |
| Housing | 1,64E-02 | 4,43E-08 | 4,17E-01 | 9,18E-04 | 3,59E-05 |

For GWP, ADP fossil and Eco tox, additional PCB area, flex cables and connectors cause each about one third of the modularity overhead. ADP elements and Human tox are driven more strongly by gold, leading to the connectors causing a stronger impact. Module housing causes a minor relative impact.

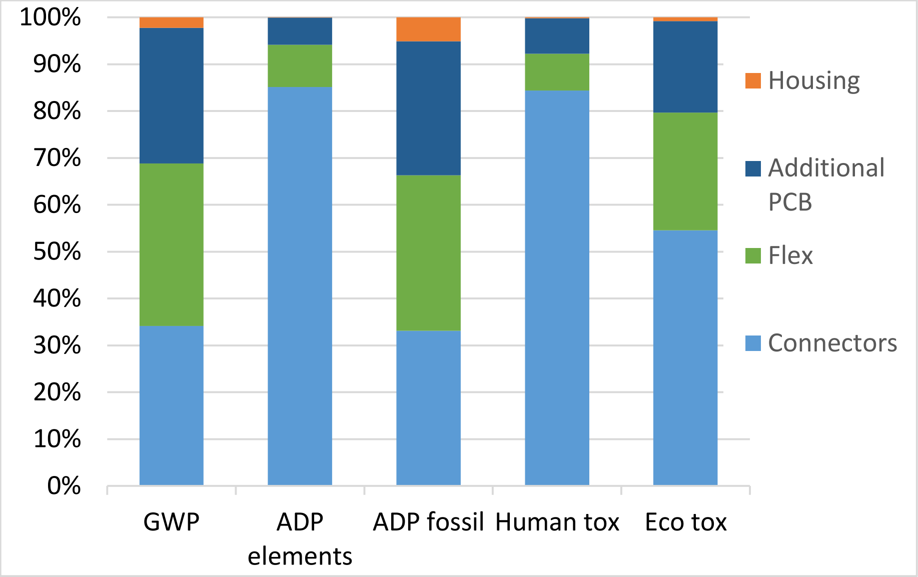

**Figure 4-10: Relative impacts connected to modularity**

The modularity overhead causes between 2.3 % (GWP) and 17.2% (ADP elements) of the total production impact.

## 4.4
## Repair Scenarios

The results of the two different repair scenarios are presented in the following.

### 4.4.1
### Repair Scenario A

Table 4-7 shows the additional impact through repair for repair scenario A without battery replacement.

**Table 4-7: Additional impact through repair (scenario A), without battery replacement**

| Impact category | Total repair | Spare part | Packaging | Transport |
|---|---|---|---|---|
| GWP | 2,33E+00 | 2,23E+00 | 2,28E-02 | 7,11E-02 |
| ADP elements | 2,05E-04 | 2,05E-04 | 1,06E-08 | 1,33E-07 |
| ADP fossil | 2,04E+01 | 1,86E+01 | 8,49E-01 | 9,66E-01 |
| Human tox | 7,12E-01 | 6,45E-01 | 2,99E-02 | 3,73E-02 |
| Eco tox | 8,88E-03 | 5,45E-03 | 2,87E-03 | 5,55E-04 |

Figure 4-11 shows the results per year of use for the 3-year and 5-year use scenario with and without repair. The impact of the repair itself is rather small and pays off when it leads to longer use. The difference between module replacement (scenario A) and module repair (scenario B) is too small to be visible per year of use. This is mainly caused by the very conservative assumptions of scenario b. Furthermore, the additional benefit of module repair differs significantly between the repaired modules (see discussion in the sensitivity analysis section 4.5).

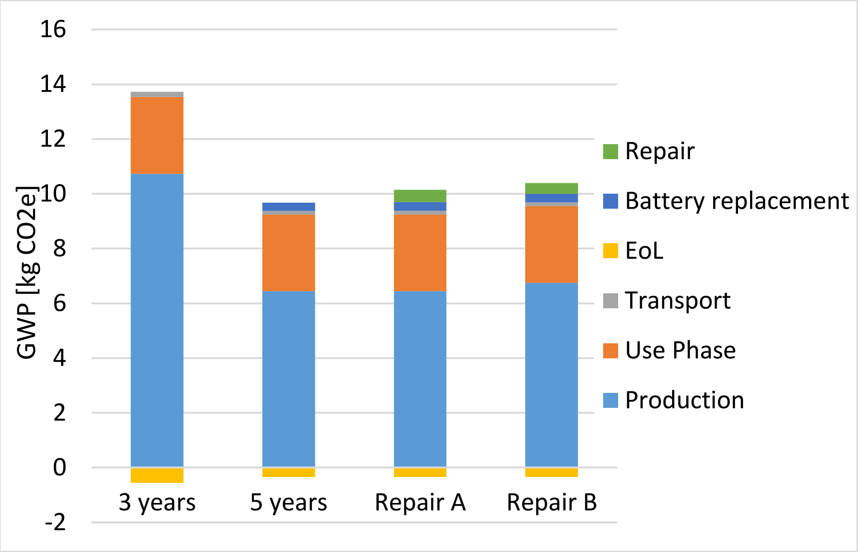

**Figure 4-11: Relative impact per year use for the impact category GWP**

The recent change in transport done by Fairphone removes a part of the burden associated with repair, namely the air freight emissions. This can be seen in Figure 4-12, where the main drivers in the repair overhead impacts are the spare parts themselves.

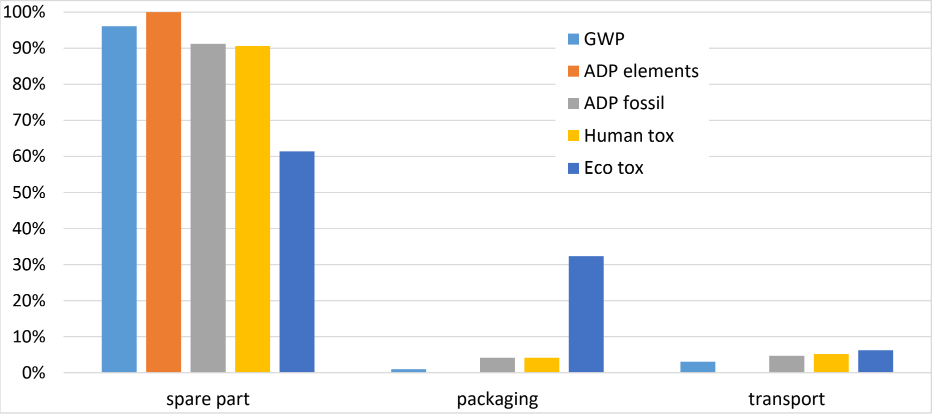

**Figure 4-12: Relative impact of repair (scenario A) due to spare part, additional packaging and additional transport**

### 4.4.2
### Repair Scenario B

The absolute impact overhead of repairing is reduced due to module-level repair in scenario B. However, the effect is rather low for the assumed share of repairs (see Table 4-8 and Figure 4-13).

**Table 4-8: Additional impact through repair (scenario B), without battery replacement**

| Impact category | Total repair | Spare part | Packaging | Transport | Module repair |
|---|---|---|---|---|---|
| GWP | 2,03E+00 | 1,85E+00 | 2,62E-02 | 7,02E-02 | 8,57E-02 |
| ADP elements | 1,97E-04 | 1,83E-04 | 1,15E-08 | 1,33E-07 | 1,39E-05 |
| ADP fossil | 1,81E+01 | 1,59E+01 | 9,82E-01 | 9,57E-01 | 3,73E-01 |
| Human tox | 6,59E-01 | 5,77E-01 | 3,48E-02 | 3,66E-02 | 1,09E-02 |
| Eco tox | 8,73E-03 | 4,77E-03 | 3,33E-03 | 5,40E-04 | 8,54E-05 |

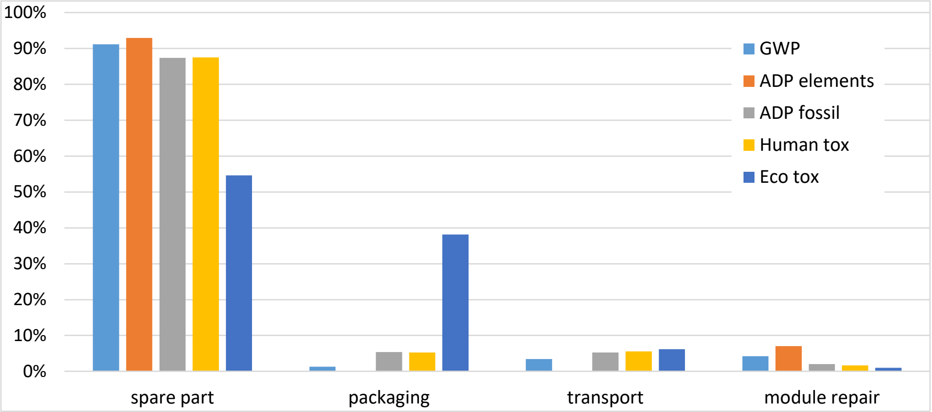

**Figure 4-13: Relative impact of repair (scenario B) due to spare part, additional packaging and additional transport**

## 4.5
## Sensitivity Analysis and Interpretation

The absolute impact of 39.5 kg CO2e as well as the distribution across life cycles are comparable with other smartphone LCAs, which differ in detail but have several similarities as shown by Clément et al.[2020]. Other impact categories are harder to compare as they are not addressed in most of the other studies.

The results and contribution analysis show that the main environmental impact is caused by the mainboard, which includes the ICs and more specifically, the RAM/Flash package. This is in line with other smartphone LCAs, although the relative impact of the RAM/Flash package are higher, which might be caused by the very high die size identified in the IC analysis.

### 4.5.1
### Display

The FP3 display was – similar to the FP2 display – modelled based on AUO environmental data as no data set was available in GaBi. The 2018 AUO material and energy consumption per produced panel area was smaller than in 2016 leading to lower relative emissions. Additionally, the IC data set used to model the ICs for the backlight had lower impacts. Although the display size increased from FP2 to FP3, the calculated impact decreased due to the new IC data set. This reduces the impact of the backlight LCDs as well as the display controller ICs. The FP3 has one display controller IC compared to two of the FP2. The overall impact of the display unit is influenced more strongly by the IC data set than by the display panel.

Compared with other smartphone LCAs, the result for the display is quite low. Ercan et al. (2016) state a value for 3.6 kg $CO_2e$ for a 74 $cm^2$ display compared to 1.9 kg $CO_2e$ for 81.9 $cm^2$ for the FP3 display. Ercan et al. (2016) state a higher electricity consumption for display manufacturing at about 0.1 $kWh/cm^2$, compared to 0.008 $kWh/cm^2$ from AUO (2019). However, the electricity value from AUO does not include the production of upstream materials or display electronics.

### 4.5.2
### Connectors

Connectors in the Fairphone 3 are modelled based on the material declaration provided by Fairphone B.V. and their suppliers, therefore neglecting possible losses in the manufacturing processes. For sensitivity reasons, a further analysis was done to assess the possible overhead.

To model the connector manufacturing processes, the following choices were made:

- The functional unit was set to be a female BtB connector and in terms of weight and materials, all connectors are assumed as equal.
- The processes include housing fabrication through injection moulding, the contact fabrication (modelled as sheet rolling of copper) and the contact plating.
- For the process modelling, pre-existing databases from Ecoinvent and Thinkstep were used.

The final individual GWP impact related to the production of a connector was then calculated to be 7.11E-05 kg of $CO_2e$. For the sensitivity analysis the focus will be in the board to board connectors, from which Fairphone 3 has 6 in total. A pair each for connecting the top, bottom and camera modules to the mainboard. The overhead modelling does not apply to the pogo pins connector attaching the display and core modules. The total process related overhead would then be 4,266e-4 kg of $CO_2e$. Table 4-9 shows that the total share of the connector production alongside the material related impacts is low for the connectors themselves and negligible on a broader scope. It should be borne in mind that the process modelling has a limited scope (not all steps involved in the actual process could be included in the model due to lack of data availability) and that a number of assumptions were done.

**Table 4-9: Connectors manufacturing overhead**

| **Process impacts** | **Material impacts** | **Connectors totals (materials + processes)** | **Share** |
|---|---|---|---|
| [kg $CO_2e$] | [kg $CO_2e$] | [kg $CO_2e$] | |
| 4,266E-4 | 2,54E-01 | 2,544E-01 | 0,17 % |

### 4.5.3
### Integrated Circuits

ICs have a very strong impact on the overall result. At the same time, it is a topic where up-to-date life cycle data is scarce and technology advances fast. Therefore, these results are connected with higher uncertainties than other aspects of the phone.

All ICs are modelled based on silicon die data, although at least one chip (WiFi) in the Fairphone three contains a Gallium-Arsenide die. However, no life cycle data is available for that material.

Data is scaled by the die size as the area is linked to the production processes more strongly than to the weight of the dies or total chip packages. External data sources were used as described in section 3.1.9.3 as GaBi data on ICs can only be scaled per piece of packaged chip without detailed information on the die size. Thereby the die to package ratio can vary significantly. Ecoinvent data on the other hand is scaled per weight, which is not deemed a reliable factor as especially stacked dies are thinned leading to lower silicon mass but increased production impact. The FP2 LCA contains a comparison with ecoinvent IC data [Proske et al. 2016].

The impact of 3.4 kg $CO_2e/cm^2$ for logic chips and 2.5 for DRAM/Flash used in the study are within the range of 2.2 to 4.3 k $CO_2e/cm^2$ as used by Andrae et al [214] and Ercan et al. [2016] according to Clément et al. [2020]. The absolute results for the ICs of the Fairphone 3 as well as the resulting share are within the range as reported by Clément et al. [2020] for other smartphone LCAs.

### 4.5.4
### Final assembly

Final assembly causes an impact of 1.7 kg $CO_2e$ per device or a share of 5.5 % of the GWP impact. This is caused mainly by the electricity consumption of 2.2 kWh per phone. There is not much data on energy consumption of assembly processes of smartphones available, but the number is considerably lower than for the Fairphone 2, for which the manufacturer stated an electricity consumption of 4.7 kWh per phone.

Huawei publishes carbon footprints for their smartphones [Huawei 2018]. The short reports do not state the energy consumption of the final assembly, but the corresponding GWP impact. They range between 2.1 and 3.2 kg $CO_2e$ per Huawei smartphone, thereby being a little higher but in the same range as the Fairphone assembly.

### 4.5.5
### Phone and module repair scenario

The results for the repair scenarios A and B showed little difference between simple module replacement and module repair. This is due to the assumed share of repairs with more than 63% being display replacements, where the display modules themselves cannot be repaired. For the repairable modules, the variations between scenario A and B differ as shown in Figure 4-14). The absolute benefit of module repair is significant for the repair of the mainboard, which also causes the major share of the initial production impact. Keeping as many parts of the ICs in use as possible is therefore beneficial from an environmental perspective. For the camera module, the repair of the module only leads to a reduction of 10% as the submodule with the highest environmental impact (the camera itself) has to be replaced during the process.

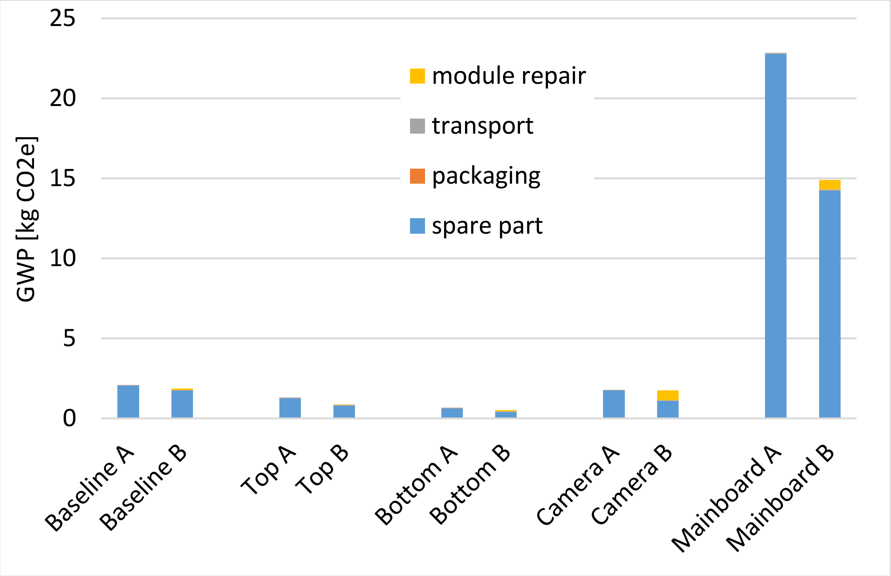

**Figure 4-14: Variation between different repairs**

Looking at the whole life cycle and the pay-off of smartphone repair, the results show that the environmental impact strongly depends on the module which is replaced. As shown in Figure 4-15, repair leads to reduced emissions per year of use for all parts except the main board. As the main board causes the major share of the absolute impact, replacing it to extend the time of active use by 2 years is not beneficial. However, if this is connected to on-board repair, it is beneficial – even if this still needs a share of 62.5 % new mainboards (as only 37.5% modules can be re-used based on the assumed return and repair rates).

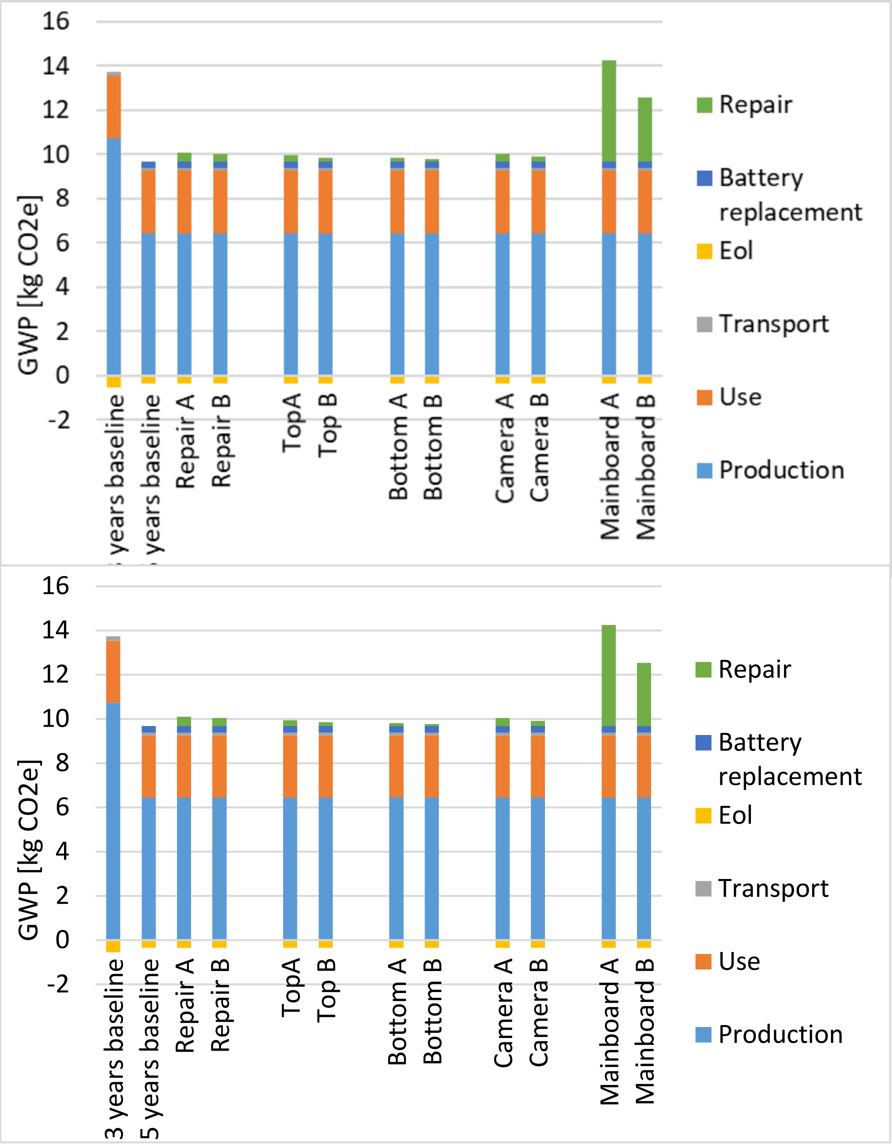

**Figure 4-15: Variation of different repairs – per year of use compared to baseline scenarios**

It is nonetheless important to point out that those results are heavily influenced by the assumptions made in terms of the share of effectively repaired modules. For instance, as seen above the main driver in repair overhead is the production of new modules or parts, which under the assumptions of this study goes from replacing an entire module to replacing 63% (see 3.5.2). Figures below show the potential benefits of module level repair itself, accounting only for the new parts in the production of the B scenario. Module repair in those diagrams refers to the energy use of the reworking machine modelled as explained in 3.5.2.

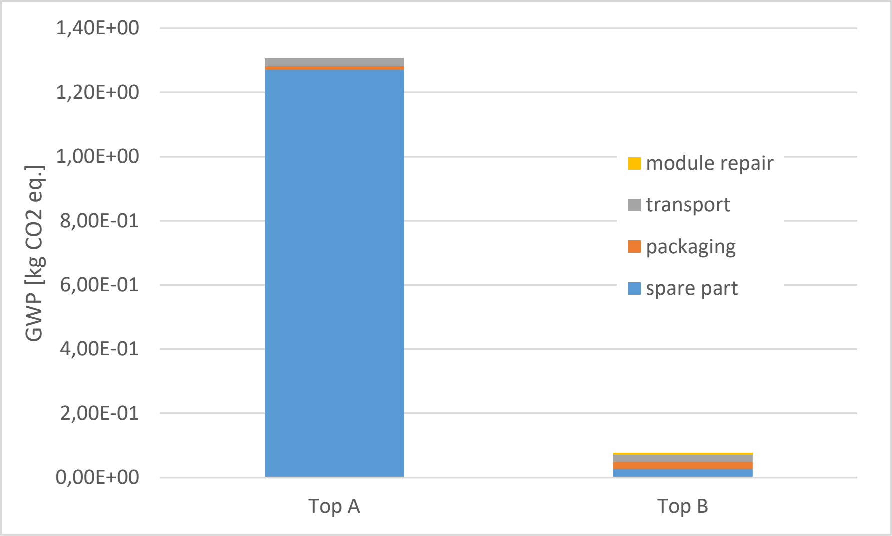

Figure 4-16: Module level repair overhead comparison for top module

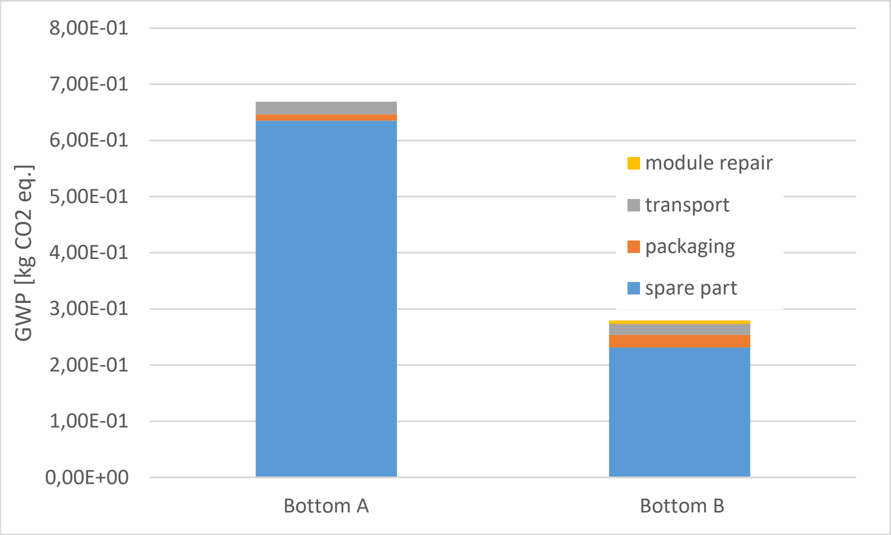

Figure 4-17: Module level repair overhead comparison for bottom module

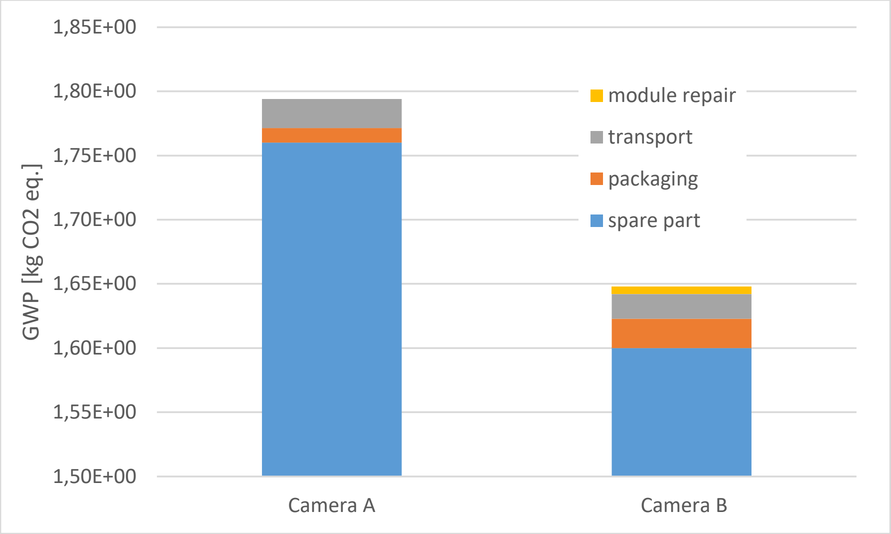

Figure 4-18: Module level repair overhead comparison for camera module

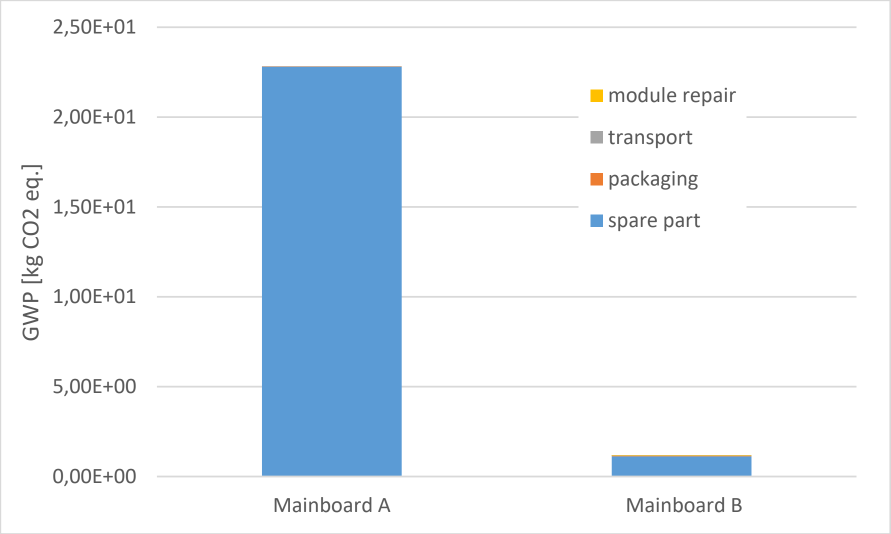

**Figure 4-19: Module level repair overhead comparison for mainboard module**

As seen here, the top and mainboard modules show the highest benefit opportunities since they have the largest production related impacts. The camera module shows the smallest benefit due to the fact that the camera itself it's being replaced within the module, which is the main driver for its production impacts. It is therefore seen that, while the potential benefits of enabling module level repair are noticeable, they are also highly dependent on the replaced pieces and parts as well as the means of transport used for the modules (as commented earlier).

### 4.5.6
### Modularity

The "impact of modularity" is calculated in section 4.3.5 to make a comparison with the Fairphone 2 and show the effect of the new connectors. However, to assign these connectors to the module boards solely to the feature "modularity" is not truly correct, as it neglects that conventional smartphones have more and more connectors on the mainboard, as well, leading flex cables to sub-parts and sub-boards (see Schischke et al. 2019). So, the real hardware differences to achieve modularity are lower than the impact shown there. The only parts really differing from conventional smartphones are the display connector (but even this became smaller compared to the Fairphone 2) and the module housing which have no significant impact on the overall phone.

It can be discussed whether the modular design leads to higher PCB area (not due to the connectors which is calculated in section 4.3.5). The individual module boards do not exist in many other smartphone designs. The impact of the module boards together makes up one third of the mainboard PCB (Table 4-10) due to lower PCB area and less PCB layers.

**Table 4-10: Impact of PCBs**

| | GWP | ADP elements | ADP fossil | Human tox | Eco tox |
|---|---|---|---|---|---|
| | kg $CO_2e$ | kg Sb eq. | MJ | kg DCB eq. | kg DCB eq. |
| PCB totals | 4,03E+00 | 2,81E-04 | 4,38E+01 | 7,98E-01 | 1,67E-02 |
| Mainboard | 3,01E+00 | 2,15E-04 | 3,27E+01 | 6,10E-01 | 1,28E-02 |
| Top module | 2,54E-01 | 1,44E-05 | 2,76E+00 | 4,72E-02 | 9,96E-04 |
| Camera module | 1,25E-01 | 8,47E-06 | 1,35E+00 | 2,30E-02 | 4,84E-04 |
| Bottom module | 3,12E-01 | 2,12E-05 | 3,38E+00 | 5,75E-02 | 1,21E-03 |
| Display module | 3,31E-01 | 2,25E-05 | 3,59E+00 | 6,10E-02 | 1,29E-03 |

However, the manufactured PCB areas differ across smartphone designs and the total Fairphone 3 PCB area is within the range of conventional smartphone designs and depends strongly on the shape of the PCB. L- and especially U-shaped PCBs lead to more produced PCB area compared to rectangular PCBs. PCB layout placing on the production panel by the PCB manufacturer also has an impact as the comparison of Fairphone 2 and Fairphone 3 PCB production shows. FP2 PCBs were more strongly nested and closer arranged on the production panel leading to less cut-off area.

### 4.5.7
### Comparison with Fairphone 2

In this section, a comparison with the prior Fairphone model will be carried out in order to identify environmental trends with the new design. The Fairphone 2 results were re-calculated using the newest life cycle inventory database updates in order to foster comparability between the two models (see Figure 4-20 and Figure 4-21).

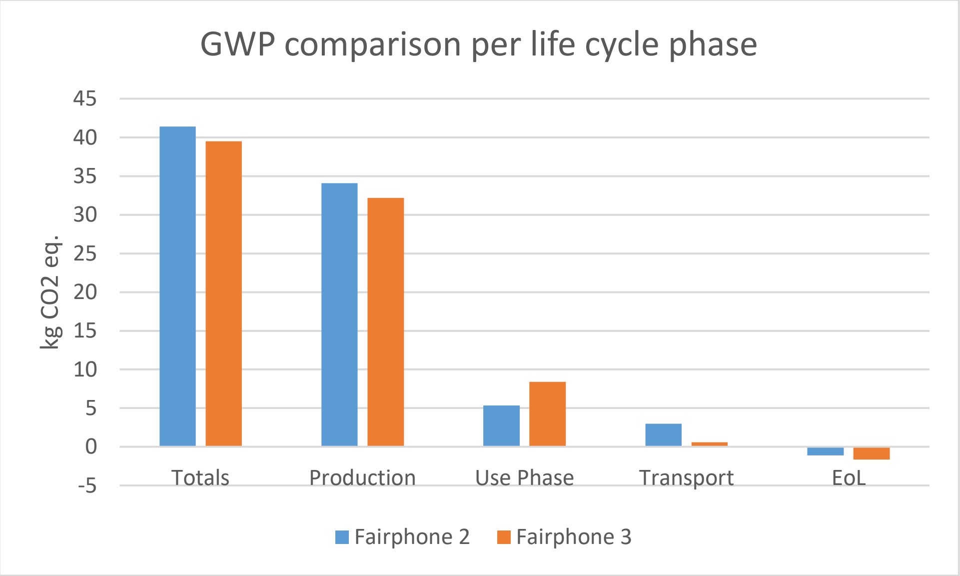

**Figure 4-20: GWP comparison per life cycle phase**

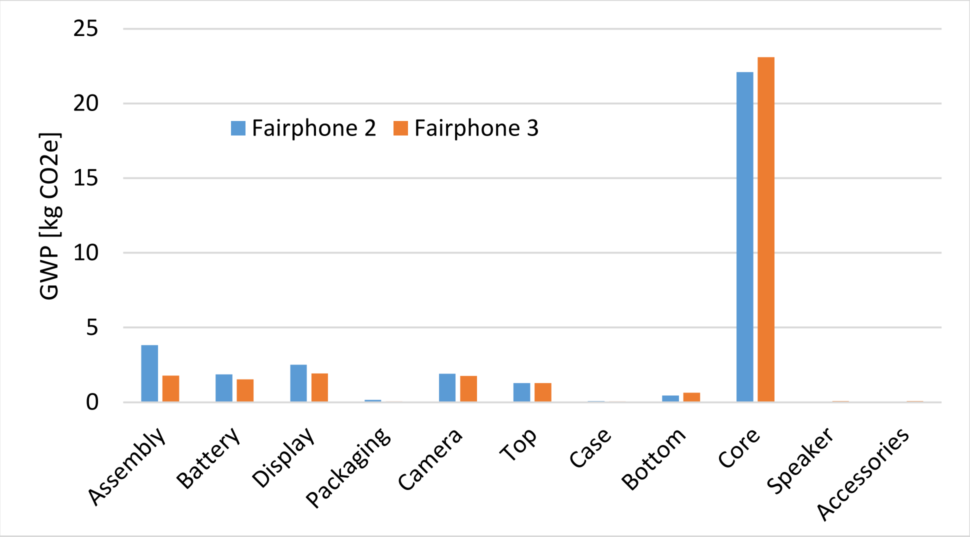

**Figure 4-21: GWP comparison at production level**

The overall values are quite similar, as seen in Figure 4-20, although the overall relative impacts of the Fairphone 3 are a bit lower. Transport shows the greatest decrease due to the replacing of air freight by train transport from final assembly to the distribution hub. Use phase-related impact has, on the contrary, increased for the newer model due to the higher battery capacity. End of life and production phases seem to be in the same range as the previous model, although production shows to have a smaller impact in comparison.

In Figure 4-21 the decomposition of the production phase into its constituents can be seen. While the core module shows higher impacts the assembly related impacts and the display ones are lower.

The end-of-Life results show a slight relative increase on environmental benefits, which are tied to a higher amount of recovered gold. This can be attributed mainly due to the improed data availability for the Fairphone 3, where for the majority of components a full material declaration was available.

### Use phase

The base case use phase results show a noticeable divergence between Fairphone 2 and Fairphone 3. Table 4-11 below shows a summary of the main aspects of the use phase modelling for both devices.

**Table 4-11: Use phase comparison**

| Characteristic | Fairphone 2 | Fairphone 3 |
|---|---|---|
| Use period (yr.) | 3 | 3 |
| Charging frequency assumed | Daily | Daily |
| Battery size (Wh) | 9,196 | 11,628 |
| Capacity and efficiency | Constant | Average (with ageing) |
| GWP (kg CO2 eq.) | 5,6 | 8,4 |

The two main differences are the following: battery size and charging efficiency. The Fairphone 3 has a bigger battery (3060 mAh compared to 2420 mAh) which, based on the assumption of one complete charging cycle per day increases consequently the amount of energy used by the phone. The other main cause of the difference is the chosen efficiency. The batteries tested in-house at Fraunhofer IZM (see section 3.2) showed a drop on capacity and efficiency. This has in turn been reflected and an average value has been chosen as a proxy. Additionally, in order to estimate the energy use of the phone for one charging cycle in-house testing has been carried out, giving away a higher value as compared to the estimation done based on the charger nominal efficiency and the battery size, which was the approach in the previous model's LCA (Proske et al. 2016).

### Integrated circuits

Integrated circuits are a component where modelling differs between Fairphone 2 and Fairphone 3. Figure 4-22 shows the difference in the impact category of GWP in the ICs of both models, distributed by parts.

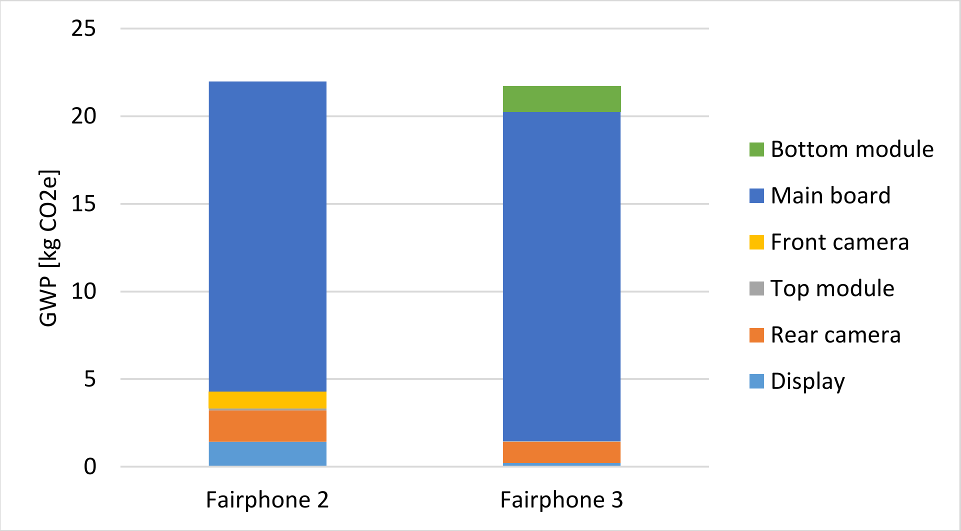

**Figure 4-22: GWP impact of IC per module**

CT imaging, x-rays and grinding have been used in order to measure the die size of the main ICs of the main board, due to their central role in the most relevant impact categories related to electronics (namely GWP and ADP). Figure 4-23 below shows the difference in the measured areas. Although for the Fairphone 2 LCA, grinding and x-rays were used as well, FP2 ICs were grinded horizontally and FP3 ICs vertically, leading to a better differentiation of stacked dies, which proved to be specially relevant in the Flash memory IC. The rest of the differences in die areas are most likely due to differences in the IC technology of the phone.

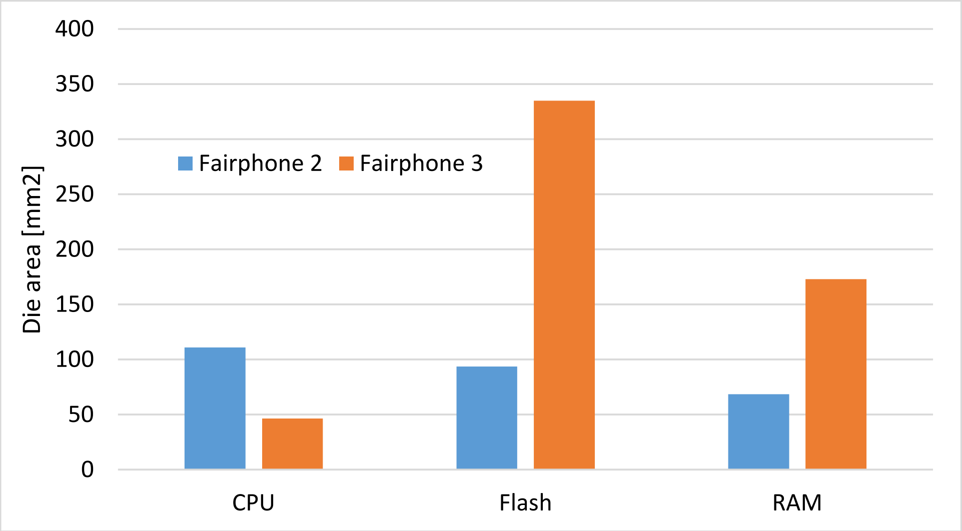

**Figure 4-23: Measured die area for the main ICs**

When comparing the figure above with Figure 4-22 it can be seen that the main differences in die area for the main ICs in Fairphone 3 and Fairphone 2 models are not directly correspondent in their GHG emissions impact, which are only slightly higher for the FP3 model in the main board and actually a bit smaller as a whole due to a different data source used for the storage and memory chip as explained in section 3.1.9.3.

## Connectors

One of the main design changes following Fairphone 2 were the connectors. Table 4-12 shows the comparison between the GWP and ADP elements impact for Fairphone 2 and Fairphone 3.

**Table 4-12: Connectors comparative impact summary**

| Model | Impact | Unit | BtB connectors | Flex cables | Sub-housing | Extra PCB (connector related) |
|---|---|---|---|---|---|---|
| Fairphone 2 | GWP | kg $CO_2$ e | 0,94 | - | 4,21E-02 | 0,66 |
| | ADP elements | kg Sb e. | 7,92E-04 | - | 9,72E-07 | 4,02E-05 |
| Fairphone 3 | GWP | kg $CO_2$ e | 0,25 | 0,26 | 1,64E-02 | 0,22 |
| | ADP elements | kg Sb e | 2,21E-04 | 2,34E-05 | 4,43E-08 | 1,51E-05 |

As the numbers point out, a noticeable reduction has been achieved in this regard, that is central to the modularity overhead. The main reason for this reduction is a change in the connectors used to bring the modules and the main board together. In the FP2 case pogo pin connectors were used, which are bigger and contain more gold. They were identified as a hotspot regarding the modularity in the FP2 LCA [Proske et al. 2016] and were substituted by flex cables and press-point male female connector pairs in the Fairphone 3. Since those connectors are smaller than the previous pogo pins, the additional PCB area is also reduced and thus the related impacts.

Table 4-12 shows that although Fairphone 3 ends up having more connectors (two pairs of male/female connectors per each flex cable) and a higher flex board use (which was not present in the FP2), the overall impacts are still favourable to the Fairphone 3 design since the pogo pins had more gold and the rigid PCB has greater impacts than flex cable.

### Display

Table 4-13 below shows the comparison between the GWP impact of the display for both FP2 and FP3 as well as their size.

**Table 4-13: Display comparison**

| Characteristic | Fairphone 2 | Fairphone 3 |
|---|---|---|
| Size (inch) | 5 | 5,65 |
| GWP (kg CO2 eq.) | 2.67 | 1.92 |

Despite the screen being now bigger for the Fairphone 3 the related impact is nonetheless lower. This is due to two main reasons: firstly, as commented above, the corrected IC modelling amounts to a lower impact compared to the modelling used for FP2. On the other hand, the GHG emissions reported by the AUO Environmental Report [AUO 2016, 2019] used as reference show a decrease of around 30 % on the impact per produced area from 2015 to the latest data in 2018. Those therefore outweigh the added impact due to the larger display. Additionally, the FP3 display unit has only one display control IC compared to two display control ICs for the FP2.

### Extra module

Another main difference between the Fairphone 3 and Fairphone 2 models is the extra module: the separate speaker module in the FP3. The impact on the total results is rather low. The speaker module only includes the speaker itself, the housing and the connector and represents only 0.24 % of the GWP impact for production. Table 4-14 below shows the comparison for the relative contribution in GWP for each module in both models.

**Table 4-14: Module GWP contribution comparison**

| Module | Fairphone 2 | Fairphone 3 |
|---|---|---|
| | % | % |
| Core | 62.5 | 71.6 |
| Battery | 5.4 | 4.8 |

| | | |
|---|---|---|
| Display | 7.5 | 6.0 |
| Camera | 5.4 | 5.5 |
| Top | 3.6 | 4.0 |
| Bottom | 1.5 | 2.0 |
| Speaker | | 0.2 |
| Back cover | 0.2 | 0.1 |
| Assembly | 13.4 | 5.5 |
| Packaging | 0.6 | 0.1 |
| Accessories | | 0.2 |

# 5
# Potential impact of recycled content as input material

Fairphone B.V. developed a list of focus materials in order to invest effort in tackling some environmental and social hotspots:

- Gold
- Copper
- Tin
- Tungsten
- Lithium
- Cobalt
- Neodymium
- Plastics

A separate analysis was carried out to assess the environmental impact of these materials within the phone and to determine a potential reduction of such impact through using recycled materials instead. The analysis is performed for each material individually and may vary between the materials due to different technical possibilities of material retraction and recycling, life cycle data for primary and secondary material and market forces (is the recycling market already established, are there differences in cost and quality, etc.). Due to limited data availability, the environmental impact is limited to global warming potential (GWP) for most materials and also differences in the GWP between different sources will be shown. It should therefore be kept in mind that the presented values for GWP might differ from the values used in the aforementioned LCA. The LCA is mainly calculated with datasets from GaBi whose terms of use do not allow to cite individual impacts of data sets.

The amount of material within the phone is determined in a similar way for all focus materials. The BoM was combined with the material composition as stated by the supplier to calculate the total amount per material, taking into account not only homogenous materials (e.g. copper foils for copper or gold-plated connector pins for gold), but also material within electronic components. If a component is supplied by different suppliers, only the first supplier in the material list is considered.

## 5.1
## Gold

| **Gold** | **0,143 g** |
|---|---|
| Main contributor | Battery, PCBs |
| Estimated benefit | Increase of 3,146 kg CO2 eq. in GWP (decrease in all other relevant impact categories) |

### Impact of primary production

The GWP impact of primary gold production varies between 11,500 and 55,000 kg $CO_2$e/kg gold according to different studies [Giegrich et al. 2012, Nuss & Eckelman 2014, Mudd 2007, Norgate & Haque 2012, Hagelüken & Meskers 2010, Chen et al. 2018, Dell 2017]. The differences stem mainly from different electricity production (e.g. coal or hydro power) and declining ore grade (Mudd 2007). The majority of sources state values around 15,000 kg $CO_2$e/kg gold.

### Impact for secondary production

The data on the environmental impact of recycled gold is much more limited than on primary gold. According to Dell [2017], the impact is significantly lower for most environmental impact categories. However, for GWP the environmental impact is about 2.5 times higher – about 37,000 kg $CO_2$e/kg gold – due to higher energy consumption in hydrometallurgical processes [Dell 2017]. Calculations with the software GaBi present benefits through recycling, however the numerical results cannot be presented in the public report.

Potential impact of recycled content as input material

### Recycling processes and qualities

The processes for gold recycling are well established and available on a large scale. The environmental impact and technology used depend on the sources of the gold scrap (e.g. jewellery or electronic scrap).

### Market

Markets for gold recycling are well established. Recycled gold accounted for approximately a third of the total gold supply from 1995 through 2014. Most of this, roughly 90%, is high-value recycled gold, mostly jewellery, gold bars and coins. The other 10% are industrial recycled gold, for example from e-waste. This value has doubled from 2004 to 2014. However, gold content in WEEE is decreasing, meaning that recyclers will have to process larger amounts of scrap to extract the same amount of gold. Gold made up 90% of bonding wires in 2008, for example, a value which had fallen to 50% in 2015 already [Hewitt 2015].

As is the case with many other recycling industries, gold recycling fluctuates in accordance to fluctuations in gold price and economic conditions. Interestingly, economic crisis boost gold recycling as gold is often used as a liquid asset to raise cash. An increase in gold price leads to an increase in gold recycling, as well [Hewitt 2015].

### Conclusion

Based on the well-established market and technologies for gold recycling even from WEEE and no quality differences between primary and secondary material, recycled gold is widely available on the market. Recycling methods are so well established, in fact, that buyers might not even be able to distinguish, whether they purchased primary or secondary gold.  So, there is no additional market stimulation achieved through purchasing recycled gold specifically and rates are mainly influenced by the gold price. Therefore, it is recommended to calculate with a market average for the input material within environmental assessments and focus efforts on good EoL collection and treatment to increase the amounts of devices which enter the correct recycling stream.

## 5.2
## Copper

| **Copper** | **8,145 g** |
|---|---|
| Main contributor | PCBs |
| Estimated benefits | Decrease of between 41,38 g and 19,22 g CO2 eq. in GWP |

### Impact of primary production

The impact of primary copper production varies between 2.8 and 5.4 kg $CO_2$e/kg copper [Giegrich et al. 2007/2012, Farjana et al. 2019, Nuss & Eckman 2014, BIR 2008].

### Impact for secondary production

Values given for life cycle data and GWP of recycled Copper vary. Jingjing et al. conducted an LCA on secondary copper production in China and calculated a GWP value of 0.32 kg $CO_2$e/kg recycled copper. In comparison, their LCA yields a GWP value of 3.4 kg $CO_2$e/kg copper for virgin copper. The GWP of recycled Copper is, in this case, therefore 90% smaller than that of virgin copper [Jingjing, 2019]. Similarly, the BIR cites 0.44 kg $CO_2$e/kg copper recycled from copper scrap [BIR, 2008]. Giegrich et al. conducted an LCA for copper recycling based on industry data and concluded that the recycling of copper scrap containing 60% copper has a GWP of 1.24kg$CO_2$/kg recycled copper product [Giegrich, 2007].

Potential impact of recycled content as input material

### Recycling processes and qualities

Copper is fully recyclable without any loss in quality or quantity [Bonnin 2015 and van Beers 2007]. It was estimated in 2012 that 85% of copper in use could be recovered through recycling [SCF, 2012]. Additionally, recycling methods for copper are well established. Pyrometallurgical recycling is the prevalent method, but an established hydrometallurgical process also exists [Bonnin, 2015].

PCB scrap presents a high concentration of copper, but its recycling suffers from low collection rates, just like other e-waste recycling methods [Veit, 2005].

### Market

Markets for the recycling of copper are well established. In 2008, approximately 37% of copper used worldwide was recycled copper [Bonnin, 2015] while figures for Europe today are up to 50% [ECI, 2018]. Because of its high economic value and comparably large availability in e-waste, recycling copper is economically feasible [Hagelüken, 2006].

### Conclusion

Similarly to gold, recycling technologies and markets for copper recycling are well established. Margins are a lot lower for copper, nickel, and tin than for precious metals. If WEEE recycling is considered, gold, copper and tin will be recycled from the same stream. Therefore, the same approach for considering environmental impact is considered: calculate LCA impacts with a market average for the input material and focus efforts on good EoL collection and treatment to increase the amount of devices which enter the correct recycling stream.

## 5.3
## Tin

| **Tin** | **2,48 g** |
|---|---|
| Main contributor | Solder paste |
| Estimated benefit | Decrease of 42,1 g CO2 eq. in GWP |

### Impact of primary production

The stated impact of primary tin production varies between 2.18 and 17.1 kg $CO_2$e/kg tin with two of the three sources citing values around 17 kg $CO_2$e/kg tin [BIR 2008, Giegrich et al. 2007, Nuss & Eckman 2014].

### Impact for secondary production

Life cycle data on the recycling of tin could only be found in a report from the Bureau of International Recycling [BIR, 2008]. Here, they state the GWP of recycled tin to be 0.024 kg$CO_2$e/kg recovered tin. Seeing as their initial values for primary tin were much lower than the ones from other sources, however, this number should be considered in comparison to the BIR GWP value for primary tin rather than in comparison to the other sources' values. But even when comparing the value to the BIR GWP value for virgin tin the recycled material's GWP is 99% smaller.

Potential impact of recycled content as input material

### Recycling processes and qualities

Tin can be recovered through pyro- and hydrometallurgical processes [BIR, 2008]. Metals such as tin are highly recyclable due to their intrinsic properties and relatively high economic value [ITA, 2020]. Approximately 44% of refined tin is being used in PCBs. Recycling of electronic waste is therefore an important factor in securing the tin supply for the upcoming years. One of the main problems of recovering tin from e-waste is, as mentioned above for other materials already, the low collection rate for recycling, with take-back numbers being as low as 12% in some developed countries. As there are also more valuable metals in e-waste, tin has not been a priority in the recovery [Yang, 2017].

### Market

According to the International Tin Association (ITA), the contribution of secondary tin towards the total tin consumption was 31% in 2018. 13% of this was re-refined tin with the remainder being reused or reformulated alloys. According to the ITA the contribution of recycled tin towards the total tin use was steady around 30-35% over the last decade, with dips roughly corresponding to periods of low tin prices [ITA, 2020]. In general, tin is highly used in the electronics industry. Yang et al. assumed in 2017 that at this rate, tin reserves would be depleted 16 years from then – in 2033. Improving the waste collection and recycling processes and increasing the amount of recycled materials is therefore very important. In 2014, for example, the amount of tin in e-waste reached 35% of the mined material in the same year, thus making it a great option to slow down tin depletion [Yang, 2017].

### Conclusion

Tin is highly recyclable. Large amounts of tin mined annually are used within the electronics industry. However, collection and recycling rates of electronic waste leave much to be desired. It is crucial to further stimulate the collection and recycling of electronic waste with a focus on tin, amongst other materials, to secure the tin supply for the upcoming decades.

## 5.4
## Tungsten

| **Tungsten** | **0,013 g** |
|---|---|
| Main contributor | Vibration motor |
| Estimated benefit | Not enough data |

### Impact of primary production

The life cycle data for tungsten is very scarce. According to Giegrich et al. [2012] the GWP of tungsten is about 2.9 kg $CO_2$e/kg tungsten. Nuss & Eckman [2014], on the other hand, state a value of 12.6 kg $CO_2$e/kg tungsten. For the LCA of the Fairphone 3, figures from Giegrich et al. [2012] for tungsten are used, as even the commercial data bases of GaBi and ecoinvent do not contain life cycle data on tungsten.

### Impact for secondary production

No figures on the environmental impact of recycled tungsten are available in literature or commercial data bases, even though significant parts of the world's tungsten supply are covered through recycled tungsten, as suggested by the International Tungsten Industry Association (ITIA) [ITIA, 2016].

### Recycling processes and qualities

Potential impact of recycled content as input material

Methods for the recycling of tungsten are well established and there are a variety of such available. The level of quality of recovered tungsten differs depending on the process used and input scrap material, but many of the processes are well established and tested [ITIA, 2016].

### Market

The ITIA suggests that 35% of tungsten used for producing intermediate products in 2016 was recycled [ITIA, 2018]. Tungsten is therefore in the top third of metals when it comes to recycling [UNEP, 2013].

### Conclusion

Tungsten recycling is well established with recycled tungsten making up a significant amount of total tungsten used for production. However, life cycle data is not readily available, thereby making it difficult to estimate the effects of using recycled tungsten. Tungsten is one of the materials with a comparatively high recycling rate, yet there is still room for improvement [ITIA, 2018].

## 5.5
## Lithium

| **Lithium** | **5,2 g** |
|---|---|
| Main contributor | Battery |
| Estimated benefit | Not enough data |

### Impact of primary production

Life cycle data for lithium is very scarce. Nuss & Eckman [2014], the only publicly available source found, state a value of 7.1 kg $CO_2$e/kg lithium as GWP.

### Impact for secondary production

No lifecycle data on secondary lithium was found, probably because lithium recycling has not been of great interest in the past.

### Recycling processes and qualities

Different types of lithium batteries, such as li-Ion batteries, have been recycled for several decades now. Up until a few years ago, however, the focus was the recovery of scarce metals such as cobalt and nickel [Georgi-Maschler, 2012]. It was not economic to recover lithium, as there was an abundance of natural lithium and demand and prices were comparatively low [Buchert, 2018]. With the increase in demand and in price for lithium, however, mainly due to the increasing production of electronic vehicles, the recovery of lithium from scrap materials is becoming a topic of interest [Buchert, 2018].

It has been stated by some sources, though, that the most prominent recycling technologies for lithium are not yet cost-effective on a large scale [Kushnir, 2015].

Many new research projects on the topic of lithium battery recycling have emerged in the last few years. Most of them, however, heavily focusing on electric vehicle batteries, many proposing a closed-loop approach, thereby not creating secondary lithium for other market segments. Batteries for electric vehicles are much larger than smartphone batteries and their disposal is easier to control, which makes research into the field of recycling them more appealing.

### Market

Potential impact of recycled content as input material

At the moment, there is no real market for secondary lithium for smartphone batteries with only few companies recovering lithium from scrap materials.

### Conclusion

Recovery methods for lithium are not well established. Much research is conducted and funded in this area mainly focusing, however, on lithium batteries for electric vehicles. It is therefore unlikely to be possible to substitute primary lithium with secondary lithium in smartphone batteries any time soon. An alternative might be using batteries that substitute other materials and combine them with primary lithium (see section on cobalt).

## 5.6
## Cobalt

| **Cobalt** | **11,24 g** |
|---|---|
| Main contributor | Battery |
| Estimated benefits | Not enough data |

### Impact of primary production

Few sources are available on the GWP of cobalt mining and production. Determined GWP values for cobalt vary between 8.3 and 11.73 kg $CO_2$e/kg cobalt, depending on the source [Nuss & Eckman 2014, Farjana 2019]. The variation in values cited by the sources is much smaller than for some of the other materials.

### Impact for secondary production

No lifecycle data on secondary cobalt was found. It was, however, possible to find data on recycled lithium-cobalt-oxide (LiCoO2). The only part of the FP3 that contains larger amounts of cobalt is the phone's battery. Recycling information on LiCoO2 is therefore also valuable [Umicore, 2011].

Umicore lists the GWP value of primary LiCoO2 as 10.1 kg $Co_2$e/kg LiCoO2. In comparison, the GWP value of secondary LiCoO2 is stated to be 2.8 kg $CO_2$e/kg LiCoO2, leading to a significant reduction in CO2-emission. Umicore combines secondary cobalt with newly sourced lithium to produce LiCoO2, any reduction in the LiCoO2's GWP value is therefore due to a reduction in the GWP value of cobalt [Georgi-Maschler, 2012].

### Recycling processes and qualities

Methods for recycling cobalt from a range of applications, such as li-Ion batteries or catalytic converters, exist [Buchert, 2012]. Recovery quotes for cobalt in professional recycling plants are already very good, with some plants recovering up to 95% of materials [Buchert, 2018]. Pyro-metallurgical recovery processes to recover cobalt from smartphone and notebook batteries are also already established. Because of their high cobalt content, li-ion batteries are an attractive end-of-life product [Buchert, 2012]

### Market

The end-of-life recycling rate for cobalt in the EU was estimated to be around 35% in 2016. The old scrap ratio is calculated at 50% [UNEP, 2011]. Recycling cobalt is currently not profitable on a big scale. The number of recycling plants is therefore limited and recycling mainly occurs together with primary production [Kotnis, 2018]. The market for cobalt recycling is not well developed.

Potential impact of recycled content as input material

Umicore is the biggest recycling company for cobalt from li-ion batteries with an input capacity of 7 000 tons of li-ion and nickel metal hydride batteries in 2011 [Umicore, 2011]. Demand for cobalt is likely going to increase further with an increase in electric vehicles, thus probably also increasing the demand for recycled cobalt. It is, however, likely that most research into this field will concentrate on batteries of electric vehicles.

### Conclusion

Because demand for cobalt is likely going to increase further in the upcoming years, recycling will gain further importance and methods for recycling cobalt from different applications are already established. It is also already possible to recover cobalt from li-ion batteries on an industrial level. One of the biggest challenges, as with many recycling products, is once again the comprehensive collection and thorough separation of the batteries in preparation for shredding [Buchert, 2012].

## 5.7
## Rare earth (neodymium)

| **Neodymium** | **0,17 g** |
|---|---|
| Main contributor | Vibration motor (magnet) |
| Estimated benefits | Not enough data |

### Impact of primary production

Nuss & Eckman [2014] were, again, the only publicly available source found on life cycle data of neodymium. They state the GWP value of neodymium to be 17.6 kg $CO_2$e/kg neodymium.

### Impact for secondary production

No life cycle data on the recycling of neodymium could be found, which is likely due to neodymium recycling being an absolute niche market.

It was, however, possible to find life cycle data on the recycling of neodymium-iron-boron magnets (NdFeB), which is a common type of neodymium magnet. Jin et al. conducted an LCA for a closed-loop-approach to NdFeB-magnet-recycling and concluded that the GWP value for recycled NdFeB magnets was 12.5 kg $Co_2$e/kg produced NdFeB-magnet, while it was 27.6 kg $Co_2$e/kg for virgin NdFeB magnets. Recycling thereby halves the GWP of NdFeB magnets [Jin, 2016]. These values should, however, be taken with caution as the recycling process used in this study is only effective if the magnet is already separated from other parts. Due to the nature of the application this would not be the case for the FP3, requiring further pre-processing steps and thereby probably increasing the GWP.

### Recycling processes and qualities

Ciacci, as well as others, states that the recycling rate for neodymium is below 1%. The often very small amount of neodymium in products makes recovery difficult and not economically feasible. For this reason, recycling processes are not well developed [Ciacci, 2019]. Schebek even goes as far as considering none of the currently available recycling methods for neodymium to be on an industrial scale level [Schebek, 2019]. Currently used recycling methods are very energy-intensive and use large amounts of acid to recover the rare earth materials, but less environmentally impactful recycling methods are already being researched [Schebek, 2019.]

### Market

The market for neodymium recycling is small and not well developed [Ciacci, 2019]. With an increase in electronic vehicles, research into recycling possibilities for neodymium and rare earth elements in general might become more prominent [Schebek, 2019].

### Conclusion

The market of neodymium recycling is not well developed. Recycling methods are lacking and often not economically feasible. As of right now, it does not seem possible to substitute the neodymium in the FP3's magnets with recycled neodymium.

## 5.8
## Plastics

Plastic is different from the other "focus materials" as it does not describe a specific material, but rather a material group, which is present in many different parts of the phone. One way to differentiate between the different types of plastic could be to separate them into plastics for structural parts (midframe, housings, etc.) and functional parts (e.g. plastics within PCBs, connectors, etc.) In this analysis on recycled content, we chose to focus on structural plastics used for mechanical parts.

For the Fairphone 3, the module housing, midframe and back cover are made of polycarbonate (PC). Additionally, the protection bumper is made from a single material: TPU.

### Impact of primary production

*TPU*

Data on TPU is very limited in literature as well as in LCA data bases (incl. GaBi and ecoinvent). According to Biron 2018, primary TPU has a GWP of 4.1 kg $CO_2$e/kg TPU. This is in line with the value given for rigid PU according to PlasticsEurope [2005] with 4.2 kg $CO_2$e/kg PU. However, the production process of TPU can also be compared to other thermoplastics. ABS has – in comparison – a fusion temperature similar to TPU and a GWP of 3.1 kg $CO_2$e/kg ABS according to PlasticsEurope [2015]. PA with a higher fusion temperature than TPU has a GWP of 6.4 kg $CO_2$e/kg PA [PlasticsEurope 2014 -b].

There are also new material inventions being launched by companies trying to lessen the carbon footprint of TPU. One attempt is, for example, to use $CO_{2,}$ which was already created in the production phase, thereby lessening the impact of the virgin TPU produced [Covestro, 2020]. However, these methods are rather new and there is next to no life cycle data publicly available.

*PC*

Life cycle data on polycarbonate is widely unavailable. PlasticsEurope [2019], the only source found, cites the GWP value for PC to be 3.4 kg $CO_2$e/kg PC.

### Impact for secondary production

No life cycle data was found on the impact of secondary production of TPU and PC.

Wäger and Hischier performed a life cycle analysis on the recycling of mixed plastics-rich WEEE and found the GWP for the production of post-consumer-recycled plastics to be only a fifth of that for the production of virgin plastics [Wäger & Hischier, 2015]. They consider a mix of plastics (ABS, PP and HIPS) and do not give absolute numbers, but the tendency is clear.

Garraín et al. conducted an LCA on HDPE recycling with data from the Italian recycling industry and compared it to other sources [2007]. Reversing their normalisation of values, the secondary HDPE has a GWP value of 0.86 kg $CO_2$e/kg HDPE. The values they cite from econinvent, Buwal and Plasticseurope for the GWP value of virgin HDPE are around 5.8 to 6.63 kg $CO_2e$/kg HDPE, thus reducing the GWP of HDPE by almost 90% through using secondary HDPE. Newer data from Plasticseurope, however, lists the GWP of virgin HDPE at 1.8 kg $CO_2e$/kg material [Plasticseurope, 2014 -a]. Unfortunately, no newer data on the GWP for secondary HDPE was found.

Potential impact of recycled content as input material

While these types of plastics are not used within the FP3 they clearly indicate a tendency: using secondary plastics reduces the GWP of the parts in question significantly when compared to using virgin plastics.

### Recycling processes and qualities

Plastics are, in difference to metals, not recyclable without quality losses. The number of recycling cycles, which are possible, depend on the plastic type and the needed quality. Each cycle leads to down-cycling.

Additionally, certain additives and especially glass fibres used to enhance strengthening of materials such as PC lead to materials, which are not recyclable.

Coherent information on TPU recycling is hard to find. Only few companies seem to be recycling TPU with often highly individualized methods, depending on the type of input [sikoplast, 2015]. Some companies mix secondary and primary TPU granulate to compensate for potential losses in quality during the recycling process [malz-polytec, n.d.]. According to BASF a maximum of 30% of TPU regenerate can be mixed into primary TPU [BASF, n.d.].

As for PC, the typical recycling process is to shred the parts and turn them into PC granulate. There are, however, also other recycling methods available [plastic expert, n.d.]. Little information on the quality of recycled PC was found. Recycled PC may show a reduced impact resistance and resilience in general. It is possible to reduce this effect through additives [AZoM, 2012].

### Market

There is a market for recycled plastics. However, currently the market is under-utilized, and potential production volumes exceed purchase volumes. Problems are varying quality and colour variations. Therefore, design for recycling and design from recycling should be considered. To enable the use of recycled content, it should be analysed which material qualities are really necessary from a design perspective and which are requested just out of routine.

### Conclusion

As the market is still growing and needs stimulation, the use of recycled input material does actually enhance the market. Therefore, it is also arguable that LCAs calculated with recycled input materials and using recycled plastics should be a focus strategy in design for environment.

# 6
# Conclusions and Recommendations

The results of the Fairphone 3 LCA show that environmental impacts are production driven, with the electronic components causing the main impact. Housing and structural parts play a minor role on the overall impact. Design aspects such as form factor influence the whole LCA of the device, mainly through impacts on the display and battery size, but not through the impact of housing material.

As the main impact is caused by production, prolonging the use phase is still a strong measure to influence the overall environmental impact for all impact categories except ADP elements, which can be reduced through efficient precious metal recycling. The comparison of 3, 5 and 7 years of use shows that the impact per year of use drops significantly with longer lifetime. This is still the case if repair is needed, as shown by the repair scenarios. However, as analysed in the sensitivity analysis, replacing the core module/mainboard with new modules is only beneficial if the additional time of use is as long as the use-time before the repair, because the mainboard causes the major share of environmental impact. With board-level repair, repair again becomes beneficial in case of mainboard replacement, being nonetheless dependent on the replaced parts and pieces and the extent to which said reparations can actually take place.

The "modularity overhead", which is caused by the design features allowing for repair, causes a lower impact than for the Fairphone 2 due to smaller connectors with less material usage. Additionally, comparison with conventional smartphones shows that small press-point connectors with flex cables are no stand-alone feature of the Fairphone anymore, so the additional impact through the feature of modularity would be even lower.

As described in the inventory and in the interpretation, the availability of specific and up-to-date life cycle data on electronics is still not sufficient and discrepancies between different data bases and sources is high. Nevertheless, the overall results are deemed reliable.

### ICs

ICs cause the major share of environmental impact and are at the same time directly enabling the functional spectrum of the device. Limiting or reducing ICs is therefore not a sensible option to improve the impact of the device as it would be done for material-driven parts. ICs production impact decreases over time when technology advances as it is shown by e.g. Boyd [2012].

Nevertheless, balance between designing an up-to-date product which can keep up with on-going trends and avoiding over-dimensioning is needed at the same time.

### PCBs

PCB area is directly connected to environmental impact. Area and number of layers should therefore be reduced where possible, including efficient production and reduced cut-offs. Reducing the needed area through different connector design was already a good development from Fairphone 2 to Fairphone 3.

### Connectors

The new Fairphone 3 connectors are a progress from environmental perspective as they need less material and less PCB area. Possible further reduction of material should be carefully aligned with reliability considerations as the main the active years of use of the phone as an important parameter for the overall impact. Material reduction should therefore not limit reliability. However, in that context, the new connectors are expected to be more reliable despite their lower material footprint.

### Display

Display size is directly connected to the environmental impact of the display panel and the housing. However, both of them have only a small overall impact. Display impact is more strongly electronics- than panel-driven. Nevertheless, the display size also impacts the energy consumption of the phone leading to a need for a bigger battery and/or more charging cycles. Reducing the display size would therefore be favourable from environmental perspective but has to be considered carefully with market trends as it is directly linked to purchasing decisions.

### Mode of transportation

Fairphone has recently changed the transportation from the production sites to its distribution hub via train for most of its shipments. This has shown to reduce notably the transport related environmental impacts as well as reducing the repair overhead, although delays compared to air shipping are also to be expected.

Additionally, reduced packaging for spare modules has the potential to reduce associated transport emissions as these parts have a high relative weight of packaging.

### Data availability/acquisition

Up-to-date and specific life cycle data for electronics is scarce. Collecting primary data from component manufacturers is time consuming and difficult, as e.g. confidentially problems occur. Therefore, it was not possible to derive primary data on production processes from component suppliers within this study. Nevertheless, data on the final assembly, PCB production layouts as well as the majority of full material declarations were available for the LCA. Fairphone B.V. should pursue this good work to derive primary data. Focus on the primary data collection should be on parts and components with a high production impact:

- ICs, especially CPU and memory
- Display
- PCBs
- Battery

Such primary data has the potential to improve the quality of the LCA and enhance accurate fitting to the specific Fairphone characteristics. It also builds the foundation for an individual hotspot analysis in the Fairphone manufacturing process.

The effect of an increased share of primary data on the numeric LCA results is difficult to predict. More detailed analyses often result in higher estimated environmental impacts as more processes and materials are covered. This should, however, not be seen as a drawback, as it still helps to improve the overall quality of the assessment and increase the knowledge about the product’s manufacturing processes.

# 7
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# 8
# Annex

## 8.1 Distribution of sales and transport

**Table 8-1: Distribution of sales**

| Country | Share |
|---|---:|
| Germany | 44.136% |
| France | 14.363% |
| Netherlands | 8.838% |
| United Kingdom | 5.896% |
| Belgium | 5.771% |
| Spain | 4.481% |
| Switzerland | 3.520% |
| Austria | 3.338% |
| Italy | 3.308% |
| Sweden | 2.437% |
| Denmark | 1.712% |
| Norway | 1.117% |
| Luxembourg | 0.492% |
| Ireland | 0.466% |
| Finland | 0.315% |
| Czech Republic | 0.298% |
| Portugal | 0.250% |
| Poland | 0.129% |
| Hungary | 0.112% |
| Estonia | 0.056% |
| Slovakia | 0.056% |
| Croatia | 0.052% |
| Slovenia | 0.047% |
| Greece | 0.043% |
| Romania | 0.043% |
| Latvia | 0.022% |
| Liechtenstein | 0.022% |
| Cyprus | 0.022% |
| San Marino | 0.013% |
| Lithuania | 0.013% |
| Monaco | 0.013% |
| Malta | 0.009% |
| Bulgaria | 0.0043% |

**Table 8-2: Transport to customer**

| Share of sales | Country | Distance | Weighted tkm |
|---:|---|---:|---:|
| 44.136% | Germany | 442.77 | 7.55E-02 |
| 14.363% | France | 814.08 | 4.51E-02 |
| 8.838% | Netherlands | 97.66 | 3.33E-03 |
| 5.896% | United Kingdom | 1028.4 | 2.34E-02 |
| 5.771% | Belgium | 183.75 | 4.09E-03 |
| 4.481% | Spain | 1702.38 | 2.95E-02 |
| 3.520% | Switzerland | 758.87 | 1.03E-02 |
| 3.338% | Austria | 979.41 | 1.26E-02 |
| 3.308% | Italy | 1550.72 | 1.98E-02 |

| Share of sales | Country | Distance | Weighted tkm |
|---:|---|---:|---:|
| 2.437% | Sweden | 1551.77 | 1.46E-02 |
| 1.712% | Denmark | 808.31 | 5.34E-03 |
| 1.117% | Norway | 1374.12 | 5.93E-03 |
| 0.492% | Luxembourg | 254.21 | 4.83E-04 |
| 0.466% | Ireland | 1237.63 | 2.23E-03 |
| 0.315% | Finland | 2500.37 | 3.04E-03 |
| 0.298% | Czech Republic | 910.92 | 1.05E-03 |
| 0.250% | Portugal | 2041.42 | 1.97E-03 |
| 0.129% | Poland | 1062.45 | 5.31E-04 |
| 0.112% | Hungary | 1365.7 | 5.91E-04 |
| 0.056% | Estonia | 2094.64 | 4.54E-04 |
| 0.056% | Slovakia | 1419.83 | 3.08E-04 |
| 0.052% | Croatia | 1350.95 | 2.70E-04 |
| 0.047% | Slovenia | 1210.66 | 2.22E-04 |
| 0.043% | Greece | 2541.71 | 4.23E-04 |
| 0.043% | Romania | 1955.13 | 3.25E-04 |
| 0.022% | Latvia | 1881.52 | 1.57E-04 |
| 0.022% | Liechtenstein | 776.58 | 6.48E-05 |
| 0.022% | Cyprus | 3771.74 | 3.15E-04 |
| 0.013% | San Marino | 1313.81 | 6.54E-05 |
| 0.013% | Lithuania | 1648.11 | 8.21E-05 |
| 0.013% | Monaco | 1303.3 | 6.49E-05 |
| 0.009% | Malta | 2577.61 | 8.56E-05 |
| 0.004% | Bulgaria | 2363.06 | 3.92E-05 |

## 8.2
## Results

### 8.2.1
### Battery replacement

**Table 8-3: Results for the replacement of one battery**

| Impact category | Unit | Battery production | Battery packaging | Battery transport |
|---|---|---:|---:|---:|
| GWP | kg $CO_2$e | 1,54E+00 | 1,61E-02 | 4,40E-02 |
| ADP elements | kg Sb eq. | 8,55E-05 | 4,32E-09 | 8,21E-08 |
| ADP fossil | MJ | 1,66E+01 | 6,10E-01 | 5,95E-01 |
| Human tox | kg DCB eq. | 6,57E-01 | 2,52E-02 | 2,31E-02 |
| Eco tox | kg DCB eq. | 4,32E-03 | 2,41E-03 | 3,42E-04 |

### 8.2.2
### Use phase

**Table 8-4: Absolute impact of the use phase per country (3 year scenario)**

| | GWP | ADP elements | ADP fossil | Human tox | Eco tox |
|---|---:|---:|---:|---:|---:|
| | kg $CO_2$e | kg Sb-e | MJ | Kk DCB-e | kg DCB-e |
| Use Phase | 2,80E+00 | 1,13E-06 | 3,01E+01 | 1,14E-01 | 2,83E-03 |
| DE | 1,72E+00 | 7,08E-07 | 1,70E+01 | 6,04E-02 | 1,66E-03 |
| NL | 3,28E-01 | 5,56E-08 | 4,00E+00 | 9,63E-03 | 2,50E-04 |
| GB | 1,38E-01 | 4,61E-08 | 1,90E+00 | 6,03E-03 | 2,30E-04 |
| ES | 1,08E-01 | 3,82E-08 | 1,30E+00 | 5,67E-03 | 9,12E-05 |

| | **GWP** | **ADP elements** | **ADP fossil** | **Human tox** | **Eco tox** |
|---|---|---|---|---|---|
| | kg $CO_2$e | kg Sb-e | MJ | Kk DCB-e | kg DCB-e |
| IT | 9,67E-02 | 4,61E-08 | 1,24E+00 | 3,49E-03 | 9,88E-05 |
| BE | 8,17E-02 | 5,11E-08 | 1,06E+00 | 4,49E-03 | 7,17E-05 |
| FR | 7,85E-02 | 7,79E-08 | 9,73E-01 | 9,22E-03 | 1,05E-04 |
| AT | 6,97E-02 | 3,17E-08 | 7,48E-01 | 3,74E-03 | 1,00E-04 |
| CH | 4,16E-02 | 3,01E-08 | 3,95E-01 | 2,79E-03 | 4,49E-05 |
| DK | 3,66E-02 | 1,71E-08 | 3,62E-01 | 2,00E-03 | 4,21E-05 |
| IE | 1,79E-02 | 1,86E-09 | 2,10E-01 | 5,06E-04 | 1,04E-05 |
| LU | 1,58E-02 | 6,96E-09 | 1,58E-01 | 6,00E-04 | 1,54E-05 |
| CZ | 1,41E-02 | 2,28E-09 | 1,42E-01 | 3,78E-04 | 1,25E-05 |
| LV (Rest) | 1,27E-02 | 1,94E-09 | 1,52E-01 | 6,19E-04 | 2,40E-05 |
| PL | 8,36E-03 | 4,57E-10 | 8,15E-02 | 2,88E-04 | 6,89E-06 |
| SE | 7,85E-03 | 1,03E-08 | 5,51E-02 | 1,83E-03 | 3,46E-05 |
| PT | 6,73E-03 | 1,66E-09 | 7,96E-02 | 3,59E-04 | 7,08E-06 |
| FI | 4,55E-03 | 9,72E-10 | 4,60E-02 | 4,16E-04 | 7,59E-06 |
| EE | 3,96E-03 | 1,29E-10 | 3,73E-02 | 1,25E-04 | 4,31E-06 |
| HU | 3,31E-03 | 5,94E-10 | 3,53E-02 | 2,73E-04 | 6,00E-06 |
| NO | 2,42E-03 | 3,39E-09 | 1,75E-02 | 5,06E-04 | 2,22E-06 |
| GR | 2,23E-03 | 4,54E-10 | 2,27E-02 | 9,94E-05 | 3,30E-06 |
| SK | 1,64E-03 | 3,66E-10 | 1,66E-02 | 7,15E-05 | 1,86E-06 |
| RO | 1,31E-03 | 3,55E-10 | 1,46E-02 | 6,81E-05 | 1,73E-06 |
| SI | 1,23E-03 | 2,80E-10 | 1,21E-02 | 5,24E-05 | 1,29E-06 |

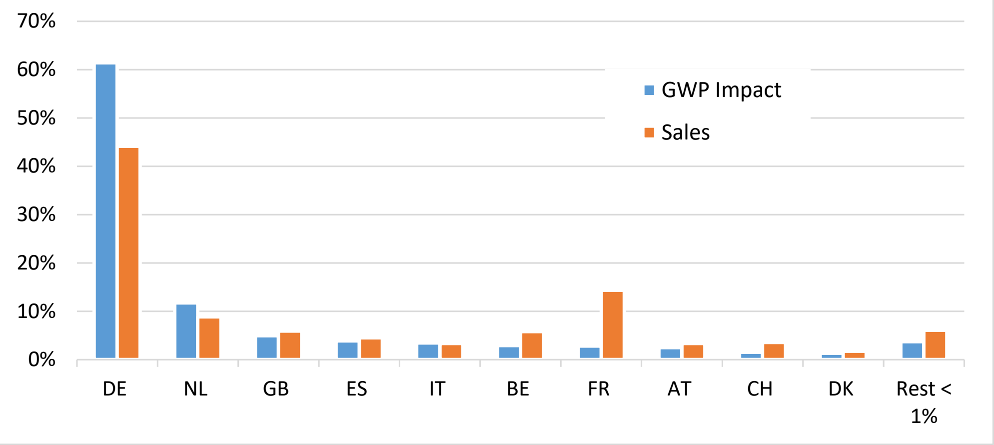

**Figure 8-1: Environmental impact GWP in relation to share of sales**

## 8.3
## Inventory lists

The following tables describe the inventory lists how the BOM is reflected in the GaBi model.

Level refers to the model in GaBi whether this is a baseline process (process), a process with further inputs (further inputs) or a plan. Scale in Gabi refers to the amount, weight or area that is entered as reference flow in GaBi.

### 8.3.1
### Core Module

**Table 8-5: Inventory list core module**

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 8-8902-00-0001 | Main Board Ass'y_8902_NATURAL_Main board | | #NV | 1 | | see below | | |
| 8PCB-8902-0001 | PCB_8902_QUAD-BAND_Main board | Electronics, PCBA, | 1,85E+01 | 1 | | Mainboard PCBA - Core Module FP3 | plan | |
| 301-1000-00402 | Chip NTC_100 Kohm_± 1%_1/10 W_0402_2.0mm_MURATA_N/A | Electronics, Resistor, MLCR thick film | 1,15E-03 | 2 | 0402 | GLO: Resistor thick film flat chip 0402 (0.75mg) ts | process | 6 |
| 301-1000-00969 | Chip NTC_100 Kohm_± 1%_1/10 W_0201_2.0mm_MURATA_N/A | Electronics, Resistor, MLCR thick film | 2,47E-04 | 1 | 0201 | GLO: Resistor thick film flat chip 0201 (0.15mg) ts | process | 120 |
| 301-1000-01087 | Chip resistor_0.01 Ohm_± 1%_1/2 W_0805_4.0mm_TA-I_N/A | Electronics, Resistor, no datasheet found | 3,69E-03 | 1 | 0805 | GLO: Resistor thick film flat chip 0603 (2.1mg) ts | process | 1 |
| 301-1000-01010 | Chip resistor_1.40 Kohm_± 1%_1/20 W_0201_2.0mm_RALEC_N/A | Electronics, Resistor, no datasheet found | 2,24E-04 | 1 | 0201 | covered with 301-1000-00969 | | |
| 301-G000-00001 | Chip resistor_1.00 Kohm_± 1%_1/20 W_0201_N/A | Electronics, Resistor, MLCR thick film | 2,07E-04 | 4 | 0201 | covered with 301-1000-00969 | | |
| 301-G000-00002 | Chip resistor_1.00 Kohm_± 5%_1/20 W_0201_2.0mm_N/A | Electronics, Resistor, MLCR thick film | 2,07E-04 | 4 | 0201 | covered with 301-1000-00969 | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 301-G000-00072 | Chip resistor_10.0 Kohm_± 1%_1/20 W_0201_2.0mm_N/A | Electronics, Resistor, MLCR thick film | 2,07E-04 | 4 | 0201 | covered with 301-1000-00969 | | |
| 301-G000-00082 | Chip resistor_100 Kohm_± 1%_1/20 W_0201_2.0mm_N/A | Electronics, Resistor, MLCR thick film | 2,07E-04 | 3 | 0201 | covered with 301-1000-00969 | | |
| 301-G000-00083 | Chip resistor_100 Kohm_± 5%_1/20 W_0201_2.0mm_N/A | Electronics, Resistor, MLCR thick film | 2,07E-04 | 15 | 0201 | covered with 301-1000-00969 | | |
| 301-G000-00085 | Chip resistor_100 Kohm_± 5%_1/16 W_0402_2.0mm_N/A | Electronics, Resistor, MLCR thick film | 5,97E-04 | 1 | 0402 | covered with 301-1000-00402 | | |
| 301-G000-00159 | Chip resistor_15.0 Kohm_± 1%_1/20 W_0201_N/A | Electronics, Resistor, MLCR thick film | 2,07E-04 | 2 | 0201 | covered with 301-1000-00969 | | |
| 301-G000-00233 | Chip resistor_2.20 Kohm_± 1%_1/20 W_0201_N/A | Electronics, Resistor, MLCR thick film | 2,07E-04 | 14 | 0201 | covered with 301-1000-00969 | | |
| 301-G000-00296 | Chip resistor_220 Kohm_± 1%_1/16 W_0402_N/A | Electronics, Resistor, MLCR thick film | 5,97E-04 | 1 | 0402 | covered with 301-1000-00402 | | |
| 301-G000-00380 | Chip resistor_3.90 Kohm_± 1%_1/20 W_0201_N/A | Electronics, Resistor, MLCR thick film | 2,07E-04 | 1 | 0201 | covered with 301-1000-00969 | | |
| 301-G000-00390 | Chip resistor_30.0 Kohm_± 1%_1/20 W_0201_N/A | Electronics, Resistor, MLCR thick film | 2,07E-04 | 1 | 0201 | covered with 301-1000-00969 | | |
| 301-G000-00400 | Chip resistor_300 Kohm_± 1%_1/20 W_0201_N/A | Electronics, Resistor, MLCR thick film | 2,07E-04 | 1 | 0201 | covered with 301-1000-00969 | | |
| 301-G000-00532 | Chip resistor_470 Kohm_± 1%_1/20 W_0201_N/A | Electronics, Resistor, MLCR thick film | 2,07E-04 | 1 | 0201 | covered with 301-1000-00969 | | |
| 301-G000-00554 | Chip resistor_5.60 Kohm_± 1%_1/20 W_0201_N/A | Electronics, Resistor, MLCR thick film | 2,07E-04 | 1 | 0201 | covered with 301-1000-00969 | | |
| 301-G000-00609 | Chip resistor_6.04 Kohm_± 1%_1/20 W_0201_2.0mm_N/A | Electronics, Resistor, MLCR thick film | 2,07E-04 | 1 | 0201 | covered with 301-1000-00969 | | |
| 301-G000-00765 | Chip resistor_1.0 Mohm_± 1%_1/20 W_0201_N/A | Electronics, Resistor, MLCR thick film | 2,07E-04 | 3 | 0201 | covered with 301-1000-00969 | | |
| 301-G000-01047 | Chip resistor_0.00 Ohm_+50 mohm_1/20 W_0201_2.0mm_N/A | Electronics, Resistor, MLCR thick film | 2,07E-04 | 52 | 0201 | covered with 301-1000-00969 | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 301-G000-01048 | Chip resistor_0.00 Ohm_+50 mohm_1/16 W_0402_2.0mm_N/A | Electronics, Resistor, MLCR thick film | 5,97E-04 | 2 | 0402 | covered with 301-1000-00402 | | |
| 301-G000-01136 | Chip resistor_10.0 Ohm_± 1%_1/20 W_0201_N/A | Electronics, Resistor, MLCR thick film | 2,07E-04 | 2 | 0201 | covered with 301-1000-00969 | | |
| 301-G000-01370 | Chip resistor_240 Ohm_± 1%_1/20 W_0201_2.0mm_N/A | Electronics, Resistor, MLCR thick film | 2,07E-04 | 3 | 0201 | covered with 301-1000-00969 | | |
| 301-G000-01382 | Chip resistor_27.0 Ohm_± 5%_1/20 W_0201_N/A | Electronics, Resistor, MLCR thick film | 2,07E-04 | 5 | 0201 | covered with 301-1000-00969 | | |
| 301-G000-01800 | Chip resistor_4.02 Kohm_± 1%_1/20 W_0201_2.0mm_N/A | Electronics, Resistor, MLCR thick film | 2,07E-04 | 1 | 0201 | covered with 301-1000-00969 | | |
| 302-0214-41043 | Chip Capacitor_15.0 pF_± 5%_NPO (COG)_25 V_0201_0.3 mm_MURATA_GRM0335C1E150J_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | GLO: Capacitor ceramic MLCC 0201 (0.17mg) D 0.6x0.3x0.3 ts | process | 294 |
| 302-0214-41051 | Chip Capacitor_33.0 pF_± 5%_NPO (COG)_25 V_0201_0.3 mm_MURATA_GRM0335C1E330J_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 26 | 0201 | covered with 302-0214-41043 | | |
| 302-0215-11006 | Chip Capacitor_0.50 pF_± 0.25 pF_NPO (COG)_50 V_0201_0.3 mm_MURATA_GRM0335C1HR50C_T=0.3±0.03 | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-01607 | Chip Capacitor_0.8 pF_± 0.05 pF_NPO (COG)_50 V_0201_0.3 mm_2.0mm_MURATA_GRM0335C1HR80W_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 2 | 0201 | covered with 302-0214-41043 | | |
| 302-0215-11017 | Chip Capacitor_1.50 pF_± 0.25 pF_NPO (COG)_50 V_0201_0.3 mm_MURATA_GRM0335C1H1R5C_T=0.3±0.03 | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-0215-41039 | Chip Capacitor_10.0 pF_± 5%_NPO (COG)_50 V_0201_0.3 mm_MURATA_GRM0335C1H100J_T=0.3±0.03 | Electronics, Capacitor, MLCC | 3,30E-04 | 2 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-00317 | Chip Capacitor_10.0 uF_± 20%_X5R_6.3 V_0402_N/A_MURATA_GRM155R60J106M_N/A | Electronics, Capacitor, MLCC | 3,10E-03 | 7 | 0402 | GLO: Capacitor ceramic MLCC 0603 (6mg) D 1.6x0.8x0.8 ts | process | 55 |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 302-1000-00394 | Chip Capacitor_2.20 pF_± 0.25 pF_NPO (COG)_50 V_0201_0.3 mm_MURATA_GRM0335C1H2R2C_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-01425 | Chip Capacitor_10.0 uF_± 10%_X5R_10 V_0603_0.8 mm_MURATA_GRM188R61A106K_N/A | Electronics, Capacitor, MLCC | 8,10E-03 | 1 | 0603 | GLO: Capacitor ceramic MLCC 0603 (6mg) D 1.6x0.8x0.8 ts | process | 42 |
| 302-1000-01454 | Chip Capacitor_3.30 pF_± 0.10 pF_NPO (COG)_50 V_0201_0.3 mm_MURATA_GRM0335C1H3R3B_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 3 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-01476 | Chip Capacitor_2.20 uF_± 10%_X5R_10 V_0402_0.5 mm_MURATA_GRM155R61A225K_N/A | Electronics, Capacitor, MLCC | 1,60E-03 | 6 | '0402 | covered with 302-1000-00317 | | |
| 302-1000-01487 | Chip Capacitor_22.0 uF_± 20%_X5R_10 V_0603_0.8 mm_MURATA_GRM188R61A226M_N/A | Electronics, Capacitor, MLCC | 9,10E-03 | 3 | 0603 | covered with 302-1000-01425 | | |
| 302-1000-01533 | Chip Capacitor_4.70 uF_± 20%_X5R_10 V_0402_0.5 mm_2.0mm_TAIYOYUDEN_LDK105BBJ475MVLF_N/A | Electronics, Capacitor, no datasheet found | 1,42E-03 | 7 | 0402 | covered with 302-1000-00317 | | |
| 302-1000-01549 | Chip Capacitor_56.0 pF_± 2.0%_NPO (COG)_50 V_0201_0.3 mm_MURATA_GRM0335C1H560G_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-01556 | Chip Capacitor_4.70 pF_± 0.10 pF_NPO (COG)_25 V_0201_0.3 mm_MURATA_GRM0335C1E4R7B_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-01603 | Chip Capacitor_22.0 uF_± 20%_X5R_16 V_1206_0.85 mm_4.0mm_MURATA_GRM319R61C226M_N/A | Electronics, Capacitor, MLCC | 2,40E-02 | 1 | 1206 | GLO: Capacitor ceramic MLCC 1210 (50mg) D 3.2x3.2x1.6 ts | process | 1 |
| 302-1000-01609 | Chip Capacitor_0.50 pF_± 0.10 pF_NPO (COG)_50 V_0201_0.3 mm_2.0mm_EYANG_C0201C0G0R5B500NTA_N/A | Electronics, Capacitor, MLCC | 2,50E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-01617 | Chip Capacitor_1.20 pF_± 0.10 pF_NPO (COG)_50 V_0201_0.3 mm_2.0mm_EYANG_C0201C0G1R2B500NTA_N/A | Electronics, Capacitor, MLCC | 2,50E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-01635 | Chip Capacitor_3.00 pF_± 0.25 pF_NPO (COG)_50 V_0201_0.3 mm_2.0mm_EYANG_C0201C0G3R0C500NTA_N/A | Electronics, Capacitor, MLCC | 2,50E-04 | 1 | 0201 | covered with 302-0214-41043 | | |

| **Item No** | **Description** | **Category, Type, Material** | **weight [g]** | **Quantity** | **size [cm2]** | **GaBi Process** | **Level** | **Scale in GaBi** |
|---|---|---|---|---|---|---|---|---|
| 302-1000-01640 | Chip Capacitor_3.90 pF_± 0.25 pF_NPO (COG)_50 V_0201_0.3 mm_2.0mm_EYANG_C0201C0G3R9C500NTA_N/A | Electronics, Capacitor, MLCC | 2,50E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-01564 | Chip Capacitor_27.0 pF_± 2.0%_NPO (COG)_50 V_0201_0.3 mm_MURATA_GRM0335C1H270G_N/A | Electronics, Capacitor, MLCC | 0,00E+00 | 2 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-02709 | Chip Capacitor_18.0 pF_± 2.0%_NPO (COG)_50 V_0201_0.3 mm_2.0mm_MURATA_GRM0335C1H180GA01D_N/A | Electronics, Capacitor, MLCC | 0,00E+00 | 2 | 0201 | covered with 302-0214-41043 | | |
| 302-0215-21036 | Chip Capacitor_8.00 pF_± 0.50 pF_NPO (COG)_50 V_0201_0.3 mm_MURATA_GRM0335C1H8R0D_T=0.3±0.03 | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-0215-21037 | Chip Capacitor_8.20 pF_± 0.50 pF_NPO (COG)_50 V_0201_0.3 mm_MURATA_GRM0335C1H8R2D_T=0.3±0.03 | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-0215-41041 | Chip Capacitor_12.0 pF_± 5%_NPO (COG)_50 V_0201_0.3 mm_MURATA_GRM0335C1H120J_T=0.3±0.03 | Electronics, Capacitor, MLCC | 3,30E-04 | 3 | 0201 | covered with 302-0214-41043 | | |
| 302-0215-21038 | Chip Capacitor_9.00 pF_± 0.50 pF_NPO (COG)_50 V_0201_0.3 mm_MURATA_GRM0335C1H9R0D_T=0.3±0.03 | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-0215-41043 | Chip Capacitor_15.0 pF_± 5%_NPO (COG)_50 V_0201_0.3 mm_MURATA_GRM0335C1H150J_T=0.3±0.03 | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-01692 | Chip Capacitor_33.0 pF_± 5%_NPO (COG)_50 V_0201_0.3 mm_2.0mm_EYANG_C0201C0G330J500NTA_N/A | Electronics, Capacitor, MLCC | 2,50E-04 | 2 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-01604 | Chip Capacitor_39.0 pF_± 2.0%_NPO (COG)_50 V_0201_0.3 mm_2.0mm_MURATA_GRM0335C1H390G_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 3 | 0201 | covered with 302-0214-41043 | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 302-1000-01598 | Chip Capacitor_100 pF_± 2.0%_NPO (COG)_50 V_0201_0.3 mm_2.0mm_MURATA_GRM0335C1H101GA01D_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 2 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-02707 | Chip Capacitor_270 pF_± 10%_X7R_50 V_0201_0.3 mm_2.0mm_MURATA_GRM033R71H271KA12D_N/A | Electronics, Capacitor, MLCC | 0,00E+00 | 2 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-01553 | Chip Capacitor_22.0 pF_± 2.0%_NPO (COG)_50 V_0201_0.3 mm_2.0mm_MURATA_GRM0332C1H220G_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 2 | 0201 | covered with 302-0214-41043 | | |
| 302-0215-41063 | Chip Capacitor_100 pF_± 5%_NPO (COG)_50 V_0201_0.3 mm_MURATA_GRM0335C1H101J_T=0.3±0.03 | Electronics, Capacitor, MLCC | 3,30E-04 | 16 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-02522 | Chip Capacitor_4.70 uF_± 10%_X5R_35 V_0603_0.8 mm_4.0mm_EYANG_C0603X5R475K350NTK_N/A | Electronics, Capacitor, no datasheet found | 5,60E-03 | 2 | 0603 | covered with 302-1000-01425 | | |
| 302-1000-01108 | Chip Capacitor_470 nF_± 10%_X5R_6.3 V_0201_0.3 mm_2.0mm_MURATA_GRM033R60J474K_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 7 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-02552 | Chip Capacitor_2.20 uF_± 20%_X5R_6.3 V_0201_0.3 mm_2.0mm_MURATA_GRM033R60J225ME47D_T=0.39 MAX | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-02527 | Chip Capacitor_3.60 pF_± 0.05 pF_NPO (COG)_25 V_0201_0.3 mm_1.0mm_MURATA_GRM0335C1E3R6W_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-02597 | Chip Capacitor_0.8 pF_± 0.05 pF_NPO (COG)_50 V_0201_0.3 mm_2.0mm_EYANG_C0201C0G0R8A500NTA_N/A | Electronics, Capacitor, MLCC | 2,50E-04 | 1 | '0201 | covered with 302-0214-41043 | | |
| 302-1000-02708 | Chip Capacitor_560 pF_± 10%_X7R_50 V_0201_0.3 mm_2.0mm_MURATA_GRM033R71H561KA12D_N/A | Electronics, Capacitor, MLCC | 0,00E+00 | 2 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-02530 | Chip Capacitor_0.50 pF_± 0.05 pF_NPO (COG)_25 V_0201_0.3 mm_1.0mm_MURATA_GRM0335C1ER50W_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 3 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-02617 | Chip Capacitor_22.0 nF_± 20%_X5R_16 V_0201_0.3 mm_2.0mm_EYANG_C0201X5R223M160NTA_N/A | Electronics, Capacitor, MLCC | 2,50E-04 | 1 | 0201 | covered with 302-0214-41043 | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 302-1000-01453 | Chip Capacitor_3.90 pF_± 0.10 pF_NPO (COG)_50 V_0201_0.3 mm_2.0mm_MURATA_GRM0335C1H3R9B_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-02640 | Chip Capacitor_1.00 pF_± 0.10 pF_NPO (COG)_50 V_0201_0.3 mm_2.0mm_EYANG_C0201C0G1R0B500NTA_N/A | Electronics, Capacitor, MLCC | 2,50E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-02645 | Chip Capacitor_4.30 pF_± 0.10 pF_NPO (COG)_50 V_0201_0.3 mm_2.0mm_EYANG_C0201C0G4R3B500NTA_N/A | Electronics, Capacitor, MLCC | 2,50E-04 | 2 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-02667 | Chip Capacitor_3.00 pF_± 0.25 pF_NPO (COG)_25 V_0201_0.3 mm_2.0mm_MURATA_GJM0335C1E3R0CB01D_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-G000-00023 | Chip Capacitor_1.00 nF_± 10%_X7R_25 V_0201_0.3 mm_2.0mm_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 6 | 0201 | covered with 302-0214-41043 | | |
| 302-G000-00143 | Chip Capacitor_10.0 nF_± 10%_X5R_16 V_0201_0.3 mm_2.0mm_N/A | Electronics, Capacitor, MLCC | 3,20E-04 | 11 | 0201 | covered with 302-0214-41043 | | |
| 302-G000-00182 | Chip Capacitor_100 nF_± 10%_X5R_10 V_0201_0.3 mm_2.0mm_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 100 | 0201 | covered with 302-0214-41043 | | |
| 302-G000-00191 | Chip Capacitor_100 nF_± 10%_X5R_6.3 V_0201_0.3 mm_2.0mm_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 3 | '0201 | covered with 302-0214-41043 | | |
| 302-G000-00196 | Chip Capacitor_100 nF_± 10%_X7R_16 V_0402_N/A_N/A_N/A | Electronics, Capacitor, MLCC | 1,60E-03 | 8 | 0402 | covered with 302-1000-00317 | | |
| 302-G000-00488 | Chip Capacitor_220 nF_± 20%_X5R_6.3 V_0201_0.3 mm_2.0mm_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-G000-00516 | Chip Capacitor_27.0 nF_± 10%_X7R_16 V_0402_0.5 mm_2.0mm_N/A | Electronics, Capacitor, MLCC | 1,60E-03 | 1 | 0402 | covered with 302-1000-00317 | | |
| 302-G000-00807 | Chip Capacitor_470 nF_± 10%_X5R_10 V_0402_N/A_N/A_N/A | Electronics, Capacitor, MLCC | 1,60E-03 | 2 | 0402 | covered with 302-1000-00317 | | |
| 302-G000-00826 | Chip Capacitor_470 nF_± 20%_X5R_6.3 V_0402_N/A_N/A_N/A | Electronics, Capacitor, MLCC | 1,60E-03 | 3 | 0402 | covered with 302-1000-00317 | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 302-G000-01475 | Chip Capacitor_220 pF_± 10%_X7R_25 V_0201_0.3 mm_2.0mm_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 2 | 0201 | covered with 302-0214-41043 | | |
| 302-G000-01629 | Chip Capacitor_330 pF_± 10%_X7R_50 V_0201_0.3 mm_N/A_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-G000-02041 | Chip Capacitor_1.00 uF_± 10%_X5R_35 V_0603_0.8 mm_4.0mm_N/A | Electronics, Capacitor, MLCC | 6,30E-03 | 4 | 0603 | covered with 302-1000-01425 | | |
| 302-G000-02058 | Chip Capacitor_1.00 uF_± 20%_X5R_10 V_0402_N/A_N/A_N/A | Electronics, Capacitor, MLCC | 1,60E-03 | 8 | 0402 | covered with 302-1000-00317 | | |
| 302-G000-02068 | Chip Capacitor_1.00 uF_± 20%_X5R_6.3 V_0201_0.3 mm_2.0mm_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 67 | 0201 | covered with 302-0214-41043 | | |
| 302-G000-02113 | Chip Capacitor_10.0 uF_± 20%_X5R_10 V_0603_N/A_N/A_N/A | Electronics, Capacitor, MLCC | 5,12E-03 | 5 | 0603 | covered with 302-1000-01425 | | |
| 302-G000-02163 | Chip Capacitor_2.20 uF_± 20%_X5R_6.3 V_0402_0.5 mm_2.0mm_N/A | Electronics, Capacitor, MLCC | 1,60E-03 | 8 | 0402 | covered with 302-1000-00317 | | |
| 302-G000-02197 | Chip Capacitor_22.0 uF_± 20%_X5R_6.3 V_0603_0.8 mm_4.0mm_N/A | Electronics, Capacitor, MLCC | 9,10E-03 | 24 | 0603 | covered with 302-1000-01425 | | |
| 302-G000-02232 | Chip Capacitor_4.70 uF_± 10%_X5R_10 V_0603_N/A_N/A_N/A | Electronics, Capacitor, MLCC | 6,30E-03 | 2 | 0603 | covered with 302-1000-01425 | | |
| 302-G000-02234 | Chip Capacitor_4.70 uF_± 10%_X5R_16 V_0603_0.8 mm_4.0mm_N/A | Electronics, Capacitor, MLCC | 8,10E-03 | 1 | 0603 | covered with 302-1000-01425 | | |
| 302-G000-02258 | Chip Capacitor_4.70 uF_± 20%_X5R_6.3 V_0402_0.5 mm_2.0mm_N/A | Electronics, Capacitor, MLCC | 2,50E-03 | 13 | 0402 | covered with 302-1000-00317 | | |
| 302-1000-02666 | Chip Capacitor_1.10 pF_± 0.25 pF_NPO (COG)_25 V_0201_0.3 mm_2.0mm_MURATA_GJM0335C1E1R1CB01D_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | '0201 | covered with 302-0214-41043 | | |
| 303-1000-01295 | Chip Inductor_7.50 nH_± 3%_0201_500 Mhz_0.4 mm_2.0mm_MURATA_LQP03HQ7N5H02D_N/A | Electronics, Inductor, Ceramic Chip Inductor Film Type (High Q Type) | 2,20E-04 | 1 | 0201 | GLO: inductor production, low value multilayer chip ecoinvent 3.5 | process | 1.05e-1 g |
| 303-1000-00040 | Chip Ferrite bead_120 ohm_± 25%_0603_100 Mhz_MURATA_BLM18PG121SN1D_DCR=0.05 Ohm | Electronics, Inductor, Ferrite Bead | 4,63E-03 | 2 | 0603 | covered with 303-1000-01295 | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 303-1000-00819 | Chip Inductor_1.60 nH_± 0.1 nH_0201_500 Mhz_0.3 mm_MURATA_LQP03TG1N6B02D_DCR<0.15,Idc:0.6A | Electronics, Inductor, Ceramic Chip Inductor Film Type (Standard Type) | 1,75E-04 | 1 | 0201 | covered with 303-1000-01295 | | |
| 302-1000-01494 | Chip Capacitor_1.50 pF_± 0.10 pF_NPO (COG)_25 V_0201_0.3 mm_MURATA_GRM0335C1E1R5B_N/A | Electronics, Inductor, ??? GRM is used for Capacitors at Murata's (see Datasheet). This is probably a Ceramic Chip Inductor. | 3,30E-04 | 1 | 0201 | GLO: electronic component production, passive, unspecified ecoinvent 3.5 | process | 2.05e-1g |
| 303-1000-00830 | Chip Inductor_5.60 nH_± 3%_0201_500 Mhz_0.3 mm_MURATA_LQP03TG5N6H02D_DCR<0.88,Idc:0.25 A | Electronics, Inductor, Ceramic Chip Inductor Film Type (Standard Type) | 1,75E-04 | 3 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-00445 | Chip Ferrite bead_1000 ohm_± 25%_0402_100 Mhz_MURATA_BLM15HD102SN1D_N/A | Electronics, Inductor, Ferrite Bead | 1,21E-03 | 6 | 0402 | covered with 302-1000-01494 | | |
| 303-1000-00825 | Chip Inductor_3.00 nH_± 0.1 nH_0201_500 Mhz_0.3 mm_2.0mm_MURATA_LQP03TG3N0B02D_DCR<0.25,Idc:0.45A | Electronics, Inductor, Ceramic Chip Inductor Film Type (Standard Type) | 1,75E-04 | 1 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-00709 | Chip Inductor_3.30 nH_± 0.1 nH_0201_500 Mhz_0.3 mm_2.0mm_MURATA_LQP03TN3N3B02D_DCR<0.25, Idc:450mA | Electronics, Inductor, Ceramic Chip Inductor Film Type (Standard Type) | 1,75E-04 | 1 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-00798 | Chip Ferrite bead_240 ohm_± 25%_0201_100 Mhz_0.3 mm_MURATA_BLM03AX241SN1D_DCR<0.38,Idc=350 mA | Electronics, Inductor, Ferrite Bead | 3,00E-04 | 1 | 0201 | covered with 302-1000-01494 | | |
| 303-1000-00800 | Chip Ferrite bead_1000 ohm_± 25%_0603_100 Mhz_0.8 mm_TDK_MPZ1608S102A_DCR<0.3 OHM,Idc<0.8A | Electronics, Inductor, Ferrite Bead | | 3 | 0603 | covered with 302-1000-01494 | | |
| 303-1000-00881 | Chip Inductor_1.00 nH_± 0.1 nH_0201_500 Mhz_0.3 mm_2.0mm_MURATA_LQP03TG1N0B02D_DCR<0.15,Idc:600mA | Electronics, Inductor, Ceramic Chip Inductor Film Type (Standard Type) | 1,75E-04 | 2 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-00818 | Chip Inductor_1.50 nH_± 0.1 nH_0201_500 Mhz_0.3 mm_2.0mm_MURATA_LQP03TG1N5B02D_DCR<0.15,Idc:0.6A | Electronics, Inductor, Ceramic Chip Inductor Film Type (Standard Type) | 1,75E-04 | 1 | 0201 | covered with 303-1000-01295 | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 303-1000-00821 | Chip Inductor_2.00 nH_± 0.1 nH_0201_500 Mhz_0.3 mm_2.0mm_MURATA_LQP03TG2N0B02D_DCR<0.25,Idc:0.45A | Electronics, Inductor, Ceramic Chip Inductor Film Type (Standard Type) | 1,75E-04 | 2 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-00931 | Chip Inductor_7.50 nH_± 3%_0201_500 Mhz_0.3 mm_2.0mm_MURATA_LQP03TG7N5H02D_DCR<1.22,Idc:200mA | Electronics, Inductor, Ceramic Chip Inductor Film Type (Standard Type) | 1,75E-04 | 1 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-00980 | Chip Inductor_0.7 nH_± 0.1 nH_0201_500 Mhz_0.3 mm_MURATA_LQP03TG0N7B02D_DCR<0.1Ohm,Idc:750mA | Electronics, Inductor, Ceramic Chip Inductor Film Type (Standard Type) | 1,75E-04 | 1 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-00999 | Chip Inductor_15.0 nH_± 3%_0201_500 Mhz_0.3 mm_2.0mm_MURATA_LQP03TG15NH02D_DCR<1.90,Idc:0.17A | Electronics, Inductor, Ceramic Chip Inductor Film Type (Standard Type) | 1,75E-04 | 1 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-01002 | Chip Wire Wound Inductor_0.47 uH_± 20%_0806_1.0 Mhz_1.0 mm_4.0mm_INPAQ_WIP201610P-R47ML_Rdc<0.04ohm,Irms<3.3A | Electronics, Inductor, Metal Molding Power Induction (Material Code: Iron Powder) | 1,79E-02 | 2 | | covered with 302-1000-01494 | | |
| 303-1000-01044 | Chip Ferrite bead_120 ohm_± 25%_0402_100 Mhz_0.5 mm_2.0mm_TDK_MMZ1005Y121CT_DCR<0.2.1 OHM,<400mA | Electronics, Inductor, Ferrite Bead | | 2 | 0402 | covered with 302-1000-01494 | | |
| 303-1000-01297 | Chip Inductor_6.80 nH_± 3%_0201_500 Mhz_0.4 mm_2.0mm_MURATA_LQP03HQ6N8H02D_N/A | Electronics, Inductor, Ceramic Chip Inductor Film Type (Standard Type) | 2,20E-04 | 1 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-01066 | Chip Inductor power_1.00 uH_± 20%_1008_1.0 Mhz_0.9 mm_4.0mm_MODA-INNOCHIPS_MP252010S1R0MFR_DCR:40mohm IDC:4.2A | Electronics, Inductor, no datasheet found | 2,48E-02 | 1 | | covered with 302-1000-01494 | | |
| 303-1000-01070 | Chip Ferrite bead_50 ohm_± 25%_0201_100 Mhz_0.3 mm_2.0mm_MURATA_BLM03EB500SN1D_DCR<0.58ohm,Idc=0.4A | Electronics, Inductor, Ferrite Bead | 3,00E-04 | 2 | 0201 | covered with 302-1000-01494 | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 303-1000-01100 | Chip Inductor power_1.00 uH_± 20%_0603_1.0 Mhz_0.8 mm_4.0mm_SHENZHEN SUNLORD_MPH160809S1R0MT_DCR<0.25Ohm,Idc:0.8 A | Electronics, Inductor, no data sheet found | 6,40E-03 | 1 | 0603 | covered with 302-1000-01494 | | |
| 303-1000-01136 | Chip Inductor power_10.0 uH_± 20%_2520_1.0 Mhz_0.9 mm_4.0mm_TDK_VLS252010HBU-100M_RDC<0.696ohm,Idc=1.3A | Electronics, Inductor, Typ: Wound Metal (?) | 2,60E-02 | 1 | | covered with 302-1000-01494 | | |
| 303-1000-01145 | Chip Inductor_1.00 uH_± 20%_0603_2.0 Mhz_0.75 mm_4.0mm_CHILISIN_HEI160808B-1R0M-Q8DG_RDC<0.115ohm,Idc<1.7A | Electronics, Inductor, Ferrite (Molding Power Inductor) | 6,90E-03 | 1 | 0603 | covered with 302-1000-01494 | | |
| 303-1000-01152 | Chip Inductor_160 nH_± 5%_0603_25 Mhz_0.8 mm_4.0mm_TDK_MLJ1608WR16JT_DCR<0.16 Ohm,Idc:600mA | Electronics, Inductor, Inductor Power Shielded Multi-Layer, 15Q-Factor Ferrite | | 2 | 0603 | covered with 302-1000-01494 | | |
| 303-1000-01158 | Chip Inductor power_4.70 uH_± 20%_1008_1.0 Mhz_0.9 mm_4.0mm_MURATA_DFE2520MFT-4R7M=P2_DCR<0.024 Ohm, Idc: 1.9A | Electronics, Inductor, Wound Metal Alloy (further specification not possible from Datasheet (Murata Product Line Up)) | 2,82E-02 | 1 | 1008 | covered with 302-1000-01494 | | |
| 303-1000-01162 | Chip Inductor power_1.00 uH_± 20%_1008_1.0 Mhz_0.95 mm_4.0mm_MODA-INNOCHIPS_MP252010H1R0MFR_N/A | Electronics, Inductor, no datasheet found | 2,48E-02 | 1 | 1008 | covered with 302-1000-01494 | | |
| 303-1000-01167 | Chip Inductor_1.50 nH_± 0.1 nH_0201_500 Mhz_0.3 mm_2.0mm_SHENZHEN SUNLORD_SDCL0603Q1N5BT02B02_N/A | Electronics, Inductor, Multilayer Chip Ceramic Conductor | 3,00E-04 | 4 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-01168 | Chip Inductor_1.80 nH_± 0.1 nH_0201_500 Mhz_0.3 mm_2.0mm_SHENZHEN SUNLORD_SDCL0603Q1N8BT02B02_N/A | Electronics, Inductor, Multilayer Chip Ceramic Conductor | 3,00E-04 | 2 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-01169 | Chip Inductor_2.00 nH_± 0.1 nH_0201_500 Mhz_0.3 mm_2.0mm_SHENZHEN SUNLORD_SDCL0603Q2N0BT02B02_N/A | Electronics, Inductor, Multilayer Chip Ceramic Conductor | 3,00E-04 | 2 | 0201 | covered with 303-1000-01295 | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 303-1000-00823 | Chip Inductor_2.40 nH_± 0.1 nH_0201_500 Mhz_0.3 mm_2.0mm_MURATA_LQP03TG2N4B02D_DCR<0.25,Idc:0.45A | Electronics, Inductor, Ceramic Chip Inductor Film Type (Standard Type) | 1,75E-04 | 1 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-01170 | Chip Inductor_2.70 nH_± 0.1 nH_0201_500 Mhz_0.3 mm_2.0mm_SHENZHEN SUNLORD_SDCL0603Q2N7BT02B02_N/A | Electronics, Inductor, Multilayer Chip Ceramic Conductor | 3,00E-04 | 1 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-01171 | Chip Inductor_5.60 nH_± 0.2 nH_0201_500 Mhz_0.3 mm_2.0mm_SHENZHEN SUNLORD_SDCL0603Q5N6CT02B02_N/A | Electronics, Inductor, Multilayer Chip Ceramic Conductor | 3,00E-04 | 2 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-01172 | Chip Inductor_6.80 nH_± 3%_0201_500 Mhz_0.3 mm_2.0mm_SHENZHEN SUNLORD_SDCL0603Q6N8HT02B02_N/A | Electronics, Inductor, Multilayer Chip Ceramic Conductor | 3,00E-04 | 1 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-01173 | Chip Inductor_2.20 nH_± 0.1 nH_0201_500 Mhz_0.3 mm_2.0mm_SHENZHEN SUNLORD_SDCL0603Q2N2BT02B02_N/A | Electronics, Inductor, Multilayer Chip Ceramic Conductor | 3,00E-04 | 1 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-01174 | Chip Inductor_1.00 nH_± 0.1 nH_0201_500 Mhz_0.3 mm_2.0mm_SHENZHEN SUNLORD_SDCL0603Q1N0BT02B02_N/A | Electronics, Inductor, Multilayer Chip Ceramic Conductor | 3,00E-04 | 3 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-01175 | Chip Inductor_10.0 nH_± 3%_0201_500 Mhz_0.3 mm_2.0mm_SHENZHEN SUNLORD_SDCL0603Q10NHT02B02_N/A | Electronics, Inductor, Multilayer Chip Ceramic Conductor | 3,00E-04 | 1 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-01176 | Chip Inductor_6.20 nH_± 0.2 nH_0201_500 Mhz_0.3 mm_2.0mm_SHENZHEN SUNLORD_SDCL0603Q6N2CT02B02_N/A | Electronics, Inductor, Multilayer Chip Ceramic Conductor | 3,00E-04 | 3 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-00982 | Chip Inductor_9.10 nH_± 3%_0201_500 Mhz_0.3 mm_2.0mm_MURATA_LQP03TG9N1H02D_DCR<1.4,Idc:0.2A | Electronics, Inductor, Ceramic Chip Inductor Film Type (Standard Type) | 1,75E-04 | 1 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-01179 | Chip Inductor_3.30 nH_± 0.1 nH_0201_500 Mhz_0.3 mm_2.0mm_SHENZHEN SUNLORD_SDCL0603Q3N3BT02B02_N/A | Electronics, Inductor, Multilayer Chip Ceramic Conductor | 3,00E-04 | 1 | 0201 | covered with 303-1000-01295 | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 303-1000-01180 | Chip Inductor_4.30 nH_± 0.1 nH_0201_500 Mhz_0.3 mm_2.0mm_SHENZHEN SUNLORD_SDCL0603Q4N3BT02B02_N/A | Electronics, Inductor, Multilayer Chip Ceramic Conductor | 3,00E-04 | 1 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-01181 | Chip Inductor_5.10 nH_± 0.2 nH_0201_500 Mhz_0.3 mm_2.0mm_SHENZHEN SUNLORD_SDCL0603Q5N1CT02B02_N/A | Electronics, Inductor, Multilayer Chip Ceramic Conductor | 3,00E-04 | 1 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-01182 | Chip Inductor_2.40 nH_± 0.1 nH_0201_500 Mhz_0.3 mm_2.0mm_SHENZHEN SUNLORD_SDCL0603Q2N4BT02B02_N/A | Electronics, Inductor, Multilayer Chip Ceramic Conductor | 3,00E-04 | 4 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-00828 | Chip Inductor_4.70 nH_± 3%_0201_500 Mhz_0.3 mm_2.0mm_MURATA_LQP03TG4N7H02D_DCR<0.72,Idc:0.25A | Electronics, Inductor, Ceramic Chip Inductor Film Type (Standard Type) | 1,75E-04 | 1 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-01184 | Chip Inductor_8.20 nH_± 3%_0201_500 Mhz_0.3 mm_2.0mm_SHENZHEN SUNLORD_SDCL0603Q8N2HT02B02_N/A | Electronics, Inductor, Multilayer Chip Ceramic Conductor | 3,00E-04 | 1 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-01204 | Chip Inductor power_2.20 uH_± 20%_0806_1.0 Mhz_0.9 mm_4.0mm_MODA-INNOCHIPS_MP201610H2R2MFR_N/A | Electronics, Inductor, no datasheet found | 1,79E-02 | 3 | 0806 | covered with 303-1000-01295 | | |
| 303-1000-01212 | Chip Inductor power_1.00 uH_± 20%_0806_1.0 Mhz_0.9 mm_4.0mm_MODA-INNOCHIPS_MP201610H1R0MFR_N/A | Electronics, Inductor, no datasheet found | 1,79E-02 | 2 | 0806 | covered with 303-1000-01295 | | |
| 303-1000-01218 | Chip Inductor_12.0 nH_± 5%_0201_500 Mhz_0.3 mm_2.0mm_SHENZHEN SUNLORD_SDCL0603Q12NJT02B02_N/A | Electronics, Inductor, Multilayer Chip Ceramic Conductor | 3,00E-04 | 2 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-01220 | Chip Inductor_27.0 nH_± 5%_0201_500 Mhz_0.3 mm_2.0mm_SHENZHEN SUNLORD_SDCL0603Q27NJT02B02_N/A | Electronics, Inductor, Multilayer Chip Ceramic Conductor | 3,00E-04 | 2 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-01224 | Chip Inductor_9.10 nH_± 3%_0201_500 Mhz_0.3 mm_2.0mm_SHENZHEN SUNLORD_SDCL0603Q9N1HT02B02_N/A | Electronics, Inductor, Multilayer Chip Ceramic Conductor | 3,00E-04 | 2 | 0201 | covered with 303-1000-01295 | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 303-1000-01241 | Chip Inductor_1.60 nH_± 0.1 nH_0201_500 Mhz_0.3 mm_2.0mm_SHENZHEN SUNLORD_SDCL0603Q1N6BT02B02_N/A | Electronics, Inductor, Multilayer Chip Ceramic Conductor | 3,00E-04 | 2 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-01243 | Chip Inductor_0.80 nH_± 0.1 nH_0201_500 Mhz_0.3 mm_2.0mm_SHENZHEN SUNLORD_SDCL0603Q0N8BT02B02_N/A | Electronics, Inductor, Multilayer Chip Ceramic Conductor | 3,00E-04 | 1 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-01285 | Chip Inductor_1.7 nH_± 0.1 nH_0201_500 Mhz_0.3 mm_2.0mm_MURATA_LQP03TG1N7B02D_N/A | Electronics, Inductor, Ceramic Chip Inductor Film Type (Standard Type) | 1,75E-04 | 1 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-01299 | Chip Inductor_20.0 nH_± 3%_0201_500 Mhz_0.4 mm_2.0mm_MURATA_LQP03HQ20NH02D_N/A | Electronics, Inductor, Ceramic Chip Inductor Film Type (High Q Type) | 2,20E-04 | 1 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-01298 | Chip Inductor_0.80 nH_± 0.1 nH_0201_500 Mhz_0.4 mm_2.0mm_MURATA_LQP03HQ0N8B02D_N/A | Electronics, Inductor, Ceramic Chip Inductor Film Type (High Q Type) | 2,20E-04 | 1 | 0201 | covered with 303-1000-01295 | | |
| 303-1000-01296 | Chip Inductor_3.40 nH_± 0.1 nH_0201_500 Mhz_0.4 mm_2.0mm_MURATA_LQP03HQ3N4B02D_N/A | Electronics, Inductor, Ceramic Chip Inductor Film Type (High Q Type) | 2,20E-04 | 1 | 0201 | covered with 303-1000-01295 | | |
| 305-0000-00176 | Crystal Resonator_X2R019200BZ1H-CHZ_19.2 MHZ_±10.0ppm_SMD-2.5*2mm-4Pin_4.0mm_HARMONY.ELE_Built-In Thermistor | Electronics, Oscillator, Quartz Crystal | 1,58E-02 | 1 | | GLO: Oscillator crystal (500mg) 11.05x4.65x2.5 ts | 1 | process |
| 305-0000-00241 | Crystal Resonator_1ZZHAE48000ZZ0A_48.0 MHZ_±20ppm_SMD-2.05*1.65mm-4Pin_4.0mm_KDS_N/A | Electronics, Oscillator, no datasheet found | 5,81E-03 | 1 | | covered with 302-1000-01494 | | |
| 308-0000-00281 | ESD protection_5.0V_IMG0505350FR_0402_2.0mm_MODA-INNOCHIPS_Cp=35 pF | Electronics, no datasheet found | 1,40E-03 | 12 | 0402 | covered with 302-1000-01494 | | |
| 308-0000-00321 | CHIP BIPOLARTVS_5.0V_ESD5311N-2/TR_DFN_2.0mm_WILLSEMI_Cj<0.4pF | Electronics, 1-Line, Bi-directional, Ultra-low Capacitance, transient voltage surpressor diode | 1,49E-03 | 7 | DFN1006-2L | GLO: Diode signal SOD123/323/523 (1.59mg) 0.8x0.75x1.6 with Au-Bondwire ts | process | 36 |
| 308-0000-00325 | CHIP BIPOLARTVS_5.0V_ESD73031N-2/TR_DFN_2.0mm_WILLSEMI_N/A | Electronics, 1-Line, Bi-directional, Ultra-low Capacitance, Transient Voltage Suppressors, transient voltage surpressor diode | 1,73E-03 | 23 | DFN1006-2L | covered with 308-0000-00321 | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 308-0000-00328 | CHIP BIPOLARTVS_5.0V_ESD5451R-2/TR_0402_2.0mm_WILLSEMI_Packing:DFP1006-2L | Electronics, 1-Line, Bi-directional, Transient Voltage Suppressors, transient voltage surpressor diode | 0,00E+00 | 5 | DFP1006-2L | covered with 308-0000-00321 | | |
| 309-0000-00274 | Diode Schottky_RB520S-30G_N/A_2pin_SOD-523_200mA/0.6V_LISION_1.7*0.7*0.77mm | Electronics, Diode, Schottky barrier diode, Construction: Silicon epitaxial planar | 0,00E+00 | 2 | SOD-523 | GLO: Diode signal SOD123/323/523 (9.26mg) 2.4x1.6x1 with Au-Bondwire ts | process | 4 |
| 309-0000-00309 | Diode Schottky_WSB5503W-2/TR_N/A_2pin_SOD-323_1A/＜0.57V_4.0mm_WILLSEMI_N/A | Electronics, Diode, Middle Power Schottky Barrier Diode | 4,60E-03 | 1 | SOD-323 | covered with 309-0000-00274 | | |
| 311-0000-01713 | I.C POWER AMP MODULE(RF)_BGA824N6E6327_TSLP-6-2_6 PINS_NoMemory_INFINEON_GNSS LNA | Electronics, IC, | 9,16E-04 | 1 | | IC modelling explained in section 3.1.9.3 | | |
| 311-0000-01957 | I.C WLAN MODULE_WCN-3680B-0-79BWLNSP-TR-05-1_WLNSP_79 Balls_NoMemory_8.0mm_QUALCOMM_3.805×3.82×0.36mm | Electronics, IC, | 1,90E-02 | 1 | | IC modelling explained in section 3.1.9.3 | | |
| 311-0000-02100 | I.C LDO_AP7341D-12FS4-7_DFN_4 PINS_NoMemory_4.0mm_DIODES_1.2V | Electronics, IC, | 1,33E-03 | 1 | | IC modelling explained in section 3.1.9.3 | | |
| 311-0000-02104 | I.C AUDIO POWER AMPLIFIER_WCD-9326-0-113FOWPSP-TR-03-0_FOWPSP_113 Balls_NoMemory_8.0mm_QUALCOMM_N/A | Electronics, IC, | 2,44E-02 | 1 | | IC modelling explained in section 3.1.9.3 | | |
| 311-0000-02114 | I.C ANALOG SWITCH_RF1683TR13-5K_MODULE_22BALLS_NoMemory_4.0mm_QORVO_N/A | Electronics, IC, | | 1 | | IC modelling explained in section 3.1.9.3 | | |
| 311-0000-02380 | I.C POWER AMP MODULE(RF)_QM56022TR13-5K_SMT_42 balls_NoMemory_8.0mm_QORVO_N/A | Electronics, IC, | | 1 | | IC modelling explained in section 3.1.9.3 | | |
| 311-0000-02136 | I.C WLAN MODULE_RFFM8516TR7-5K_QFN_16BALLS_NoMemory_4.0mm_QORVO_N/A | Electronics, IC, | | 1 | | IC modelling explained in section 3.1.9.3 | | |
| 311-0000-02250 | I.C POWER MANAGEMENT UNIT(PMU)_PM-8953-0-187FOWNSP-TR-01-0-VV_FOWNSP_187BALLS_NoMemory_8.0mm_QUALCOMM_N/A | Electronics, IC, | 4,46E-02 | 1 | | IC modelling explained in section 3.1.9.3 | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 311-0000-02263 | I.C DC-DC CONVERT_QET4101-0-12-WLNSP-TR-00-0-VV_WLNSP_12 Balls_NoMemory_4.0mm_QUALCOMM_N/A | Electronics, IC, | 2,26E-02 | 1 | | IC modelling explained in section 3.1.9.3 | | |
| 311-0000-02298 | I.C Front End Module_QM57508TR13-5K_SMT_44 BALLS_NoMemory_8.0mm_QORVO_N/A | Electronics, IC, | | 1 | | IC modelling explained in section 3.1.9.3 | | |
| 311-0000-02689 | I.C STACKED MEMORY_KMRH60014A-B614_FBGA_221 balls_64G+4G_16.0mm_SAMSUNG_N/A | Electronics, IC, | 3,01E-01 | 1 | | Memory (311-0000-02689) - FP3 <LZ> (IC modelling explained in section 3.1.9.3) | plan | |
| 311-0000-02383 | I.C DC-DC CONVERT_KTD3111EAA-20-1-TR_WLCSP_9 Balls_NoMemory_4.0mm_KINETIC_2P8S LED Driver | Electronics, IC, | 2,03E-03 | 1 | | IC modelling explained in section 3.1.9.3 | | |
| 311-0000-02411 | I.C DC-DC CONVERT_TPS612564CYFFR_DSBGA_9 BALLS_NoMemory_2.0mm_TI_NFC | Electronics, IC, | 1,90E-03 | 1 | | IC modelling explained in section 3.1.9.3 | | |
| 311-0000-02413 | I.C ANALOG SWITCH_BGSA14RN10_TSNP_10 Pins_NoMemory_4.0mm_INFINEON_N/A | Electronics, IC, | 1,89E-03 | 1 | | IC modelling explained in section 3.1.9.3 | | |
| 311-0000-02600 | I.C SENSOR_ICM-20602-Z_LGA_16Pins_NoMemory_8.0mm_INVENSENSE_3x3x0.75mm | Electronics, IC, | | 1 | | IC modelling explained in section 3.1.9.3 | | |
| 311-0000-02447 | I.C LDO_ET51518YB_DFN_4Pins_NoMemory_2.0mm_ETEK_N/A | Electronics, IC, | 2,24E-03 | 1 | | IC modelling explained in section 3.1.9.3 | | |
| 311-0000-02460 | NFC Microcontroller_NQ310A1EV/C101_VFBGA_64 BALLS_NoMemory_8.0mm_NXP_NFC controller designed for Qualcomm | Electronics, IC, | 2,68E-02 | 1 | | IC modelling explained in section 3.1.9.3 | | |
| 311-0000-02494 | I.C LDO_RP114K331D-TRB_DFN_4 PIN_NoMemory_2.0mm_RICOH_N/A | Electronics, IC, | 1,35E-03 | 1 | | IC modelling explained in section 3.1.9.3 | | |
| 311-0000-02495 | I.C CHARGE_KTS1680AEUZ-TR_WLCSP_12 Balls_NoMemory_4.0mm_KINETIC_N/A | Electronics, IC, | 2,85E-03 | 1 | | IC modelling explained in section 3.1.9.3 | | |
| 311-0000-02513 | I.C LDO_RP115L181D-E2_DFN_8Pins_NoMemory_4.0mm_RICOH_N/A | Electronics, IC, | 2,35E-03 | 1 | | IC modelling explained in section 3.1.9.3 | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 311-0000-02574 | I.C TRANSCEIVER_WTR-3925-2-106BWLPSP-TR-03-0-VV_WLPSP_106BALLS_NoMemory_8.0mm_QUALCOMM_N/A | Electronics, IC, | 2,04E-02 | 1 | | IC modelling explained in section 3.1.9.3 | | |
| 311-0000-02599 | I.C AUDIO POWER AMPLIFIER_AW8898QNR_QFN_24 Pins_NoMemory_8.0mm_AWINIC_N/A | Electronics, IC, | 3,35E-02 | 1 | | IC modelling explained in section 3.1.9.3 | | |
| 311-0000-02690 | I.C BASEBAND PROCESSOR_SDM-632-0-792NSP-TR-00-0-AA_NSP_792Balls_NoMemory_16.0mm_QUALCOMM_N/A | Electronics, IC, | 2,30E-01 | 1 | | CPU (311-0000-02690) - FP3 <LZ><br>IC modelling explained in section 3.1.9.3 | plan | |
| 311-0000-02617 | I.C SENSOR_AK09918C_WLCSP_4 balls_NoMemory_2.0mm_ASAHI KASEI_N/A | Electronics, IC, | 8,04E-04 | 1 | | IC modelling explained in section 3.1.9.3 | | |
| 311-0000-02618 | I.C POWER MANAGEMENT UNIT(PMU)_PMI-632-9-WLNSP81B-TR-02_WLNSP_81Balls_NoMemory_8.0mm_QUALCOMM_N/A | Electronics, IC, | 1,53E-02 | 1 | | IC modelling explained in section 3.1.9.3 | | |
| 311-0000-02629 | I.C LDO_RP114K281D-TRB_DFN_4 balls_NoMemory_2.0mm_RICOH_2.8V,300mA | Electronics, IC, | 1,35E-03 | 1 | | IC modelling explained in section 3.1.9.3 | | |
| 314-0000-00808 | CON. RF CONNECTOR WITH SWITCH_C90P106-00004-H_0.500 mm_4 pin_4.0mm_SPEED_AC250V/50 Ohm,12GHz,2x2x0.9 mm | Electronics, Connector, | 2,55E-02 | 3 | | Connector RF switch (314-0000-00808) - Core Module FP3 | plan | |
| 314-0000-01119 | CON. SPRING CONNECTOR_J9Y802K02308_NA_1 pin_4.0mm_KUNZHON_H=2.0mm | Electronics, Connector, | 4,00E-03 | 13 | | Spring connectors FP3 (314-0000-01119) | plan | |
| 314-0000-00982 | CON. SPRING CONNECTOR_J9Y802K00001_1.500 mm_1 pin_4.0mm_KUNZHON_H=1.1mm | Electronics, Connector, | 3,50E-03 | 3 | | Spring connector small FP3 (314-0000-00982) | plan | 3,5e-3 g |
| | | Nickel compounds | 8,00E-05 | | | GLO: Nickel mix ts | process | 8e-5 g |
| | | Gold | 2,00E-05 | | | GLO: Gold mix (primary, copper and recycling route) ts <t-agg> | process | 2e-5 g |
| | | Tin | 1,80E-04 | | | GLO: Copper mix (99,999% from electrolysis) ts | process | 1,8e-4 g |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | Copper | 3,20E-03 | | | GLO: Tin ts | process | 3,2e-3 g |
| 314-0000-00947 | CON. PCB FEMALE CONNECTOR_BM20B(0.8)-50DS-0.4V(51)_0.400 mm_50 pin_4.0mm_HIROSE_H=0.8mm | Electronics, Connector, | 3,36E-02 | 3 | | Connector 50 pin (314-0000-00947) - Core Module FP3 | plan | 3*3.36 e-2 g |
| | | SV CONTACT(2), Copper | 1,16E-02 | | | GLO: Copper mix (99,999% from electrolysis) ts | process | 1.2e-2 g |
| | | SV CONTACT(2), Nickel (metallic) | 1,25E-03 | | | GLO: Nickel mix ts | process | 1.28e-3 g |
| | | SV CONTACT(2), Red phosphorous | 2,41E-05 | | | neglected | | |
| | | SV CONTACT(2), Lead | 2,54E-06 | | | EU-28: Lead primary and secondary mix ILA <t-agg> | process | 2.8e-6 g |
| | | SV CONTACT(2), Cadmium | 1,27E-07 | | | GLO: Cadmium ts | process | 3.92e-5g |
| | | SV CONTACT(2), Cobalt metal powder | 2,50E-07 | | | GLO: Cobalt, refined (metal) CDI | process | 2.03e-5 g |
| | | SV CONTACT(2), Tin | 1,02E-03 | | | GLO: Tin ts | process | 1.02e-3 g |
| | | SV CONTACT(2), Gold | 4,98E-05 | | | GLO: Gold mix (primary, copper and recycling route) ts <t-agg> | process | 5.37e-5 g |
| | | SV CONTACT(2), Iron | 1,27E-05 | | | DE: Stainless Steel slab (X6CrNi17) ts <t-agg> | process | 1.3e-5 g |
| | | SV CONTACT(2), Zinc | 2,54E-05 | | | GLO: Special high grade zinc ELCD/IZA | process | 2.04e-4 g |
| | | SV REINFORCED METAL FITTINGS, Cobalt metal powder | 2,00E-05 | | | covered with cobalt above | | |
| | | SV REINFORCED METAL FITTINGS, Iron | 2,64E-07 | | | covered with iron above | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | SV REINFORCED METAL FITTINGS, Copper | 3,48E-04 | | | covered with copper above | | |
| | | SV REINFORCED METAL FITTINGS, Nickel (metallic) | 2,80E-05 | | | covered with nickel above | | |
| | | SV REINFORCED METAL FITTINGS, Zinc | 1,79E-04 | | | covered with zinc above | | |
| | | SV REINFORCED METAL FITTINGS, Gold | 3,98E-06 | | | covered with gold above | | |
| | | SV REINFORCED METAL FITTINGS, Cadmium | 3,91E-05 | | | covered with cadmium above | | |
| | | SV REINFORCED METAL FITTINGS, Lead | 2,63E-07 | | | covered with lead above | | |
| | | HOUSING, Talc containing asbestiform fibers | 5,70E-03 | | | EU-28: Talcum powder (filler) ts | process | 5.7e-3 g |
| | | HOUSING, Wholly aromatic liquid crystal polyester(LCP) | 1,11E-02 | | | DE: Polyester Resin unsaturated (UP) ts | process | 1.11e-2 g |
| | | HOUSING, Carbon black (airborne, unbound particles of respirable size) | 2,85E-04 | | | DE: Carbon black (furnace black; general purpose) ts | process | 2.85e-4 g |
| | | HOUSING, Fatty acids, montan-wax, ethylene esters | 9,50E-06 | | | neglected | | |
| | | HOUSING, Calcium Stearate | 1,90E-05 | | | neglected | | |
| | | HOUSING, Misc., not to declare | 9,48E-06 | | | neglected | | |
| | | HOUSING, Glass wool fibers (inhalable and biopersistent) | 1,90E-03 | | | EU-28: Glass wool ts | process | 1.9e-3 g |
| 314-0000-01120 | CON. RF CONNECTOR WITH SWITCH_C87P101-N0003-H_NA_4 pin_4.0mm_SPEED TECH CORP(BEIJING)_H=0.6mm | Electronics, Connector, | 5,20E-03 | 2 | | Connector RF switch (314-0000-01120) - Core Module FP3 | plan | 2*5.2e-3 g |
| | | Au plating, Aurate(1-), bis(cyano-.kappa.C)-, potassium (1:1) | 9,90E-05 | | | GLO: Gold mix (primary, copper and recycling route) ts <t-agg> | process | 1e-4 g |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | C2680, Lead | 8,00E-07 | | | EU-28: Red brass ts <t-agg> | process | 1,60E-03 |
| | | C2680, Copper | 1,09E-03 | | | covered with brass above | | |
| | | C2680, Zinc | 5,10E-04 | | | covered with brass above | | |
| | | C2680, Iron | 8,00E-07 | | | covered with brass above | | |
| | | Ni plating, nickel bis(sulfamidate); nickel sulfamate | 7,00E-05 | | | GLO: Nickel mix ts | process | 1e-4 g |
| | | Ni plating, Water | 3,00E-05 | | | covered above | | |
| | | C5191, Copper | 1,85E-03 | | | RoW: bronze production ecoinvent 3.5 | process | 2e-3 g |
| | | C5191, Red phosphorous | 7,00E-06 | | | covered with bronze above | | |
| | | C5191, Tin | 1,40E-04 | | | covered with bronze above | | |
| | | MG-350 BPRL, Talc containing asbestiform fibers | 4,06E-04 | | | EU-28: Talcum powder (filler) ts | process | 4.06e-4 g |
| | | MG-350 BPRL, Glass wool fibers (inhalable and biopersistent) | 3,50E-04 | | | EU-28: Glass wool ts | process | 3.5e-4 g |
| | | MG-350 BPRL, Carbon black (airborne, unbound particles of respirable size) | 1,40E-05 | | | DE: Carbon black (furnace black; general purpose) ts | process | 1.4e-5 g |
| | | MG-350 BPRL, 1,3-Benzenedicarboxylic acid, polymer with 1,4-benzenedicarboxylic acid, [1,1'-biphenyl]-4,4'-diol and 4-hydroxybenzoic acid | 6,30E-04 | | | neglected | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 314-0000-01138 | CON. SPRING CONNECTOR_818010053_NA_1 pin_4.0mm_ECT_H=1.75mm | Electronics, Connector, | 4,55E-03 | 4 | | Spring connector 4mm (314-0000-01138) - Core Module FP3 | plan | 4*4.55 e-3 g |
| | | SUS 301, Iron | 3,38E-03 | | | DE: Stainless Steel slab (X6CrNi17) ts <t-agg> | process | 4.53e-3 g |
| | | SUS 301, Red phosphorous | 1,81E-06 | | | covered with stainless steel above | | |
| | | SUS 301, Nickel (metallic) | 3,08E-04 | | | covered with stainless steel above | | |
| | | SUS 301, Silicon | 1,36E-05 | | | covered with stainless steel above | | |
| | | SUS 301, Carbon | 2,27E-06 | | | covered with stainless steel above | | |
| | | SUS 301, manganese | 5,44E-05 | | | covered with stainless steel above | | |
| | | SUS 301, chromium | 7,70E-04 | | | covered with stainless steel above | | |
| | | SUS 301, Sulfur | 1,36E-06 | | | covered with stainless steel above | | |
| | | Plate with nickel, Nickel (metallic) | 1,00E-05 | | | GLO: Nickel mix ts | process | 1e-5 g |
| | | Gold-plated, Gold | 1,00E-05 | | | GLO: Gold mix (primary, copper and recycling route) ts <t-agg> | process | 1e-5 g |
| 314-0000-01198 | CON. PIN STICK (POGO) CONTACT_LHHPG006-CS-R_2.000 mm_32 pin_16.0mm_SPEED TECH CORP_N/A | Electronics, Connector, | 1,18E+00 | 1 | | Connector 32 pin (314-0000-01198) - Core module FP3 | plan | 1.18 g |
| | | Plating Au, Gold | 1,00E-03 | | | GLO: Gold mix (primary, copper and recycling route) ts <t-agg> | process | 1e-3 g |
| | | Housing LCP E130i BK210P, LCP | 2,80E-01 | | | DE: Polyester Resin unsaturated (UP) ts | process | 5.39e-1 g |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | Housing LCP E130i BK210P, Glass wool fibers (inhalable and biopersistent) | 1,20E-01 | | | EU-28: Glass wool ts | process | 2.31e-1 g |
| | | Spring SUS304, Nickel (metallic) | 1,05E-03 | | | EU-28: Stainless steel cold rolled coil (304) Eurofer <t-agg> | process | 1e-2 g |
| | | Spring SUS304, Disodium tetraborate, anhydrous | 2,50E-06 | | | covered with stainless steel above | | |
| | | Spring SUS304, Antimony oxide (Antimony trioxide) | 2,50E-06 | | | covered with stainless steel above | | |
| | | Spring SUS304, Boric acid | 2,50E-06 | | | covered with stainless steel above | | |
| | | Spring SUS304, Alkanes, chloro | 1,00E-06 | | | covered with stainless steel above | | |
| | | Spring SUS304, Cobalt metal powder | 1,00E-04 | | | covered with stainless steel above | | |
| | | Spring SUS304, Copper | 1,00E-04 | | | covered with stainless steel above | | |
| | | Spring SUS304, Iron | 8,74E-03 | | | covered with stainless steel above | | |
| | | CAP LCP E130i BK211P, LCP | 2,59E-01 | | | covered with polyester resin above | | |
| | | CAP LCP E130i BK211P, Glass wool fibers (inhalable and biopersistent) | 1,11E-01 | | | covered with glass wool above | | |
| | | Plunger/Borrel C6801, Zinc | 9,99E-02 | | | GLO: Special high grade zinc ELCD/IZA | process | 9.99e-2 g |
| | | Plunger/Borrel C6801, Copper | 1,70E-01 | | | GLO: Copper mix (99,999% from electrolysis) ts | process | 1.7e-1 g |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | Shell 锌锡镍合金, Carbon | 1,63E-02 | | | DE: Carbon black (furnace black; general purpose) ts | process | 1.63e-2 g |
| | | Shell 锌锡镍合金, manganese | 8,45E-02 | | | ZA: Manganese ts | process | 8.45e-2 g |
| | | Shell 锌锡镍合金, Sulfur | 6,50E-03 | | | neglected | | |
| | | Shell 锌锡镍合金, Silicon | 5,07E-03 | | | DE: Silicone rubber (RTV-2, condensation) ts | process | 5.07e-3 g |
| | | Shell 锌锡镍合金, Nickel (metallic) | 1,44E-02 | | | GLO: Nickel mix ts | process | 1.64e-2 g |
| | | Shell 锌锡镍合金, Red phosphorous | 3,25E-03 | | | neglected | | |
| | | Plating Ni , Nickel (metallic) | 2,00E-03 | | | covered with nickel above | | |
| 314-0000-01201 | CON. SPRING CONNECTOR_788640001_1.6 mm_4 pin_8.0mm_MOLEX_N/A | Electronics, Connector, | 2,56E-02 | 3 | | Spring Connector 8mm (314-0000-01201) - Core Module FP3 | plan | 3*2.56 e-2 g |
| | | Nickel Plating, Nickel (metallic) | 4,39E-04 | | | GLO: Nickel mix ts | process | 4.39e-4 g |
| | | Tin Plating, Tin | 1,20E-05 | | | GLO: Tin ts | process | 1.2e-5 g |
| | | Gold Plating, Gold | 5,00E-06 | | | GLO: Gold mix (primary, copper and recycling route) ts <t-agg> | process | 5e-6 g |
| | | High Performance Copper Alloy Unplated, Copper | 1,12E-02 | | | GLO: Copper mix (99,999% from electrolysis) ts | process | 1.12e-2 g |
| | | High Performance Copper Alloy Unplated, Titanium | 3,65E-04 | | | GLO: Titanium ts | process | 3.65e-4 g |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | High Performance Copper Alloy Unplated, Iron | 2,30E-05 | | | DE: Stainless Steel slab (X6CrNi17) ts <t-agg> | process | 2.3e-5 g |
| | | LCP GF BLACK, LCP | 9,18E-03 | | | DE: Polyester Resin unsaturated (UP) ts | process | 9.18e-3 g |
| | | LCP GF BLACK, Carbon black (airborne, unbound particles of respirable size) | 6,80E-05 | | | DE: Carbon black (furnace black; general purpose) ts | process | 6.8e-5 g |
| | | LCP GF BLACK, Further Additives | 2,02E-04 | | | neglected | | |
| | | LCP GF BLACK, GF-Fibre | 4,05E-03 | | | EU-28: Glass wool ts | process | 4.05e-3 g |
| 314-0000-01202 | CON. BATTERY CONNECTOR_02-0024-01_2.000 mm_4 pin_12.0mm_YU LIANG_N/A | Electronics, Connector, | 4,40E-01 | 1 | | Connector Battery (314-0000-01202) - Core Module FP3 | plan | 4.4e-1 g |
| | | PA9T, Polychlorinated naphthalene | 9,40E-02 | | | RoW: glass fibre reinforced plastic production, polyamide, injection moulded ecoinvent 3.5 | process | 2e-1 g |
| | | PA9T, Additives | 2,00E-02 | | | covered above | | |
| | | PA9T, Glass wool fibers (inhalable and biopersistent) | 8,60E-02 | | | covered above | | |
| | | C2680, Iron | 9,70E-05 | | | EU-28: Brass (CuZn39Pb3) ts <t-agg> | process | 9.7e-2 g |
| | | C2680, Nickel (metallic) | 4,85E-04 | | | covered with brass above | | |
| | | C2680, Copper | 6,31E-02 | | | covered with brass above | | |
| | | C2680, Zinc | 3,33E-02 | | | covered with brass above | | |
| | | C2680, / | 4,85E-05 | | | covered with brass above | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | PLATING Ni, 3,7-diamino-2,8-dimethyl-5-phenylphenazinium chloride | 2,50E-02 | | | GLO: Nickel mix ts | process | 4.17e-2 g |
| | | PLATING Ni, nickel bis(sulfamidate); nickel sulfamate | 1,67E-02 | | | covered above | | |
| | | PLATING Au, 1,2,3-Propanetricarboxylic acid, 2-hydroxy- | 9,92E-03 | | | neglected | | |
| | | PLATING Au, citric acid, potassium salt | 2,67E-02 | | | neglected | | |
| | | PLATING Au, Gold | 1,53E-03 | | | GLO: Gold mix (primary, copper and recycling route) ts <t-agg> | process | 1.53e-3 g |
| | | PLATING MATTE, tin(II) methanesulphonate | 1,90E-02 | | | GLO: Tin ts | process | 6.32e-2 g |
| | | PLATING MATTE, methanesulphonic acid | 4,42E-02 | | | covered above | | |
| 321-0000-00790 | PCB_8901_FR4-HF_136.1*65.52mm_1.000 mm_12 Layer_Selective Gold+O.S.P_GOLD CIRCUIT_8901MB-008,3-6-3 | Electronics, PCB, FR4 HF 12 Layers | 3,00E+00 | 1 | 89.16 cm2 | GLO: Printed Wiring Board 12-layer rigid FR4 with chem-elec AuNi finish (Subtractive method) ts | process | 7.14e-3 m2 |
| 326-0000-00320 | Filter Dual Mode_ICMF062P900MFR_100MHz_2.0mm_MODA-INNOCHIPS_Common Mode,4pin,90 Ohm,100mA,0.87x0.67x0.47mm | Electronics, Filter, Ceramic multilayer type SMD component | 1,38E-03 | 10 | 603 | covered with 302-1000-01494 | | |
| 326-0000-00349 | Filter SAW_SAFFB1G56KB0F0AR15_1561.10/1575.42/1602 MHz_4.0mm_MURATA_50/50 OHM-SMD 5PIN | Electronics, Filter, SAW Filter | 1,71E-03 | 2 | 5 Pin, 1.1x0.9x0.5 | GLO: Filter SAW (25mg) 3x7x1 ts | process | 19 |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 326-0000-00352 | Filter SAW_SAFFB942MAN0F0AR15_942.5MHz_MURATA_GSM900/BAND8 Rx-SMD 5 pin | Electronics, Filter, SAW Filter | 1,71E-03 | 1 | 5 Pin, 1.1x0.9x0.5 | covered with 326-0000-00349 | | |
| 326-0000-00354 | Filter SAW_SAFFB1G84AB0F0AR15_1842.5 ± 35.1MHz_MURATA_Band3 Rx 50/50 Ohm-SMD 5 PIN | Electronics, Filter, SAW Filter | 1,71E-03 | 1 | 5 Pin, 1.1x0.9x0.5 | covered with 326-0000-00349 | | |
| 326-0000-00363 | Filter SAW_SAFFB2G14AA0F0AR15_2140MHz±30MMZ_MURATA_Band1/Band4 Rx 50/50 Ohm 5PIN | Electronics, Filter, SAW Filter | 1,71E-03 | 1 | 5 Pin, 1.1x0.9x0.5 | covered with 326-0000-00349 | | |
| 326-0000-00364 | Filter SAW_SAFFB1G96AB0F0AR15_1960MHz±30MHZ_MURATA_Band2,50/50 Ohm,SMD 5PIN | Electronics, Filter, SAW Filter | 1,71E-03 | 1 | 5 Pin, 1.1x0.9x0.5 | covered with 326-0000-00349 | | |
| 326-0000-00473 | Filter Bandpass_RFLPF1608060F18Q1C_673~2690 MHz_4.0mm_WALSIN_LTE Application,SMD 0603 3PIN | Electronics, Filter, Multilayer Ceramic (low pass filter) | 2,57E-03 | 1 | 0603 | covered with 302-1000-01494 | | |
| 326-0000-00482 | Filter SAW_SAFFB876MAA0F0AR15_876.5±17.5MHZ_2.0mm_MURATA_Band26 Unbalanced 50/50 ohm 5PIN | Electronics, Filter, SAW Filter | 1,71E-03 | 1 | 5 Pin, 1.1x0.9x0.5 | covered with 326-0000-00349 | | |
| 326-0000-00537 | Filter Bandpass_RFLPF1005040YM1T76_766.5±20.5MHz,_2.0mm_WALSIN_LOW PASS FILTER6 PIN | Electronics, Filter, Multilayer Ceramic (low pass filter) | 9,90E-04 | 1 | 402 | covered with 302-1000-01494 | | |
| 326-0000-00539 | Filter SAW_SAFFB742MAA0F0AR15_737.5MHz±8.5MHZ_2.0mm_MURATA_Band12+13/Unbalanced,50/50Ohm SMD 5 PIN | Electronics, Filter, SAW Filter | 1,71E-03 | 1 | 5 Pin, 1.1x0.9x0.5 | covered with 326-0000-00349 | | |
| 326-0000-00634 | Filter SAW_SAFFB806MAB0F0AR1X_806±15 MHz_2.0mm_MURATA_For B20 DRx,50/50 Ohm, 5PIN | Electronics, Filter, SAW Filter | 1,70E-03 | 1 | 5 Pin, 1.1x0.9x0.5 | covered with 326-0000-00349 | | |
| 326-0000-00635 | Filter SAW_SAFFB2G65AC0F0AR1X_2655±35 MHz_2.0mm_MURATA_Band7, 50/50 Ohm, 5PIN | Electronics, Filter, SAW Filter | 1,71E-03 | 1 | 5 Pin, 1.1x0.9x0.5 | covered with 326-0000-00349 | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 326-0000-00646 | Filter Bandpass_QM22545TR13-15K_2.4GHz_4.0mm_QORVO_N/A | Electronics, Filter, no datasheet found | 0,00E+00 | 1 | | covered with 302-1000-01494 | | |
| 326-0000-00650 | Filter Balance_RFBLN1608070F48Q1C_673 ~ 2700 MHz_4.0mm_WALSIN_Filter+Balun, 50Ohm, 0603, 6Pins | Electronics, Filter, | 2,94E-03 | 1 | 0603, 6 Pins | covered with 302-1000-01494 | | |
| 329-0000-00169 | SAW Duplexer_B39781B8620P810_EPCOS_LTE Band 13, 782/751MHz,8PIN | Electronics, Duplexer (Filter?), Ni, Au-plated terminals | 4,00E-03 | 1 | 1.8 x 1.4 mm2 | covered with 302-1000-01494 | | |
| 329-0000-00170 | SAW Duplexer_B39851B8622P810_EPCOS_LTE Band 20, 847/806 MHz,9PIN | Electronics, Duplexer (Filter?), SAW Duplexer, no datasheet found | 3,51E-03 | 1 | | covered with 326-0000-00349 | | |
| 329-0000-00188 | SAW Duplexer_4.0mm_SAYEY1G73BA0F0AR05_MURATA_1732.5/2132.5MHZ,Band4,50/50 8PIN | Electronics, Duplexer (Filter?), SAW Duplexer | 5,20E-03 | 1 | 8 Pin, 1.8x1.4x0.6(max) | covered with 326-0000-00349 | | |
| 329-0000-00189 | SAW Duplexer_4.0mm_SAYEY1G95GA0F0AR05_MURATA_1950/2140MHZ,Band1,50/50 8PIN | Electronics, Duplexer (Filter?), SAW Duplexer | 5,20E-03 | 1 | 8 Pin, 1.8x1.4.0.6 | covered with 326-0000-00349 | | |
| 329-0000-00198 | SAW Duplexer_4.0mm_SAYEY831MBA0B0AR05_MURATA_831.5/876.5MHz,Band26, 50/50 ohm 8PIN | Electronics, Duplexer (Filter?), SAW Duplexer | 5,20E-03 | 1 | 8 Pin, 1.8x1.4.0.6 | covered with 326-0000-00349 | | |
| 329-0000-00202 | SAW Duplexer_4.0mm_SAYEY897MBG0F0AR05_MURATA_Band8 Unbalanced LR 1814 | Electronics, Duplexer (Filter?), SAW Duplexer | 5,20E-03 | 1 | 8 Pin, 1.8x1.4.0.6 | covered with 326-0000-00349 | | |
| 329-0000-00259 | SAW Diplexer_4.0mm_RFDIP160806ALM6T30_WALSIN_2.4 GHz&5 GHz ISM Band,2450/5425MHz,6PIN | Electronics, Duplexer (Filter?), SAW Diplexer, multilayer ceramic | 2,63E-03 | 1 | 1.6x0.8x0.6 | covered with 326-0000-00349 | | |
| 329-0000-00283 | SAW Duplexer_4.0mm_B39272B8674P810_EPCOS_N/A | Electronics, Duplexer (Filter?), SAW Duplexer | 4,02E-03 | 1 | 8 Pin, 1.8x1.4.0.6 | covered with 326-0000-00349 | | |
| 329-0000-00285 | SAW Duplexer_4.0mm_QM23003_QORVO_N/A | Electronics, Duplexer (Filter?), SAW Duplexer | 0,00E+00 | 1 | 1814 | covered with 326-0000-00349 | | |
| 329-0000-00286 | SAW Duplexer_4.0mm_QM23002TR13_QORVO_N/A | Electronics, Duplexer (Filter?), SAW Duplexer | 0,00E+00 | 1 | 1814 | covered with 326-0000-00349 | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 415-59290-0024 | HOLDER_5929_SILVER_STAINLESS STEEL_Plating Ni-Sn_Coaxial cable holder_PLIGHT(JIANGSU)_h=1.34mm | Mechanical, Shielding, Stainless steel, Plating Ni-Sn | 4,10E-03 | 5 | 5,11E+00 | EU-28: Stainless steel sheet (EN15804 A1-A3) ts <t-agg> | process | 5.11 g |
| 415-89010-0002 | CASE_8901_SILVER_COPPER-NICKEL-ZINC ALLOY_N/A_BT/WIFI Shielding COVER_CJR_N/A | Mechanical, Shielding, Copper-Nickel-Zinc alloy | 4,42E-01 | 1 | 3,14E+00 | Nickel-Silver sheet - FP3 | further inputs | 3.14 g |
| 415-89010-0003 | CASE_8901_SILVER_COPPER-NICKEL-ZINC ALLOY_N/A_GPS Shielding COVER_CJR_N/A | Mechanical, Shielding, Copper-Nickel-Zinc alloy | 9,10E-02 | 1 | | covered with 415-89010-0002 | | |
| 415-89010-0018 | CASE_8901_SILVER_COPPER-NICKEL-ZINC ALLOY_N/A_Audio shielding cover_CJR_N/A | Mechanical, Shielding, Copper-Nickel-Zinc alloy | 3,00E-01 | 1 | | covered with 415-89010-0002 | | |
| 415-89010-0017 | SHEET_8901_SILVER_COPPER ALLOY_N/A_NFC SHD Frame_CJR_N/A | Mechanical, Shielding, Copper-Nickel-Zinc alloy | 3,10E-01 | 1 | | covered with 415-89010-0002 | | |
| 415-89010-0004 | CASE_8901_SILVER_STAINLESS STEEL_N/A_NFC Shielding COVER_CJR_N/A | Mechanical, Shielding, Stainless steeel | | 1 | | covered with 415-59290-0024 | | |
| 415-89010-0005 | CASE_8901_SILVER_COPPER-NICKEL-ZINC ALLOY_N/A_CPU Shielding FRAME_CJR_N/A | Mechanical, Shielding, Copper-Nickel-Zinc alloy | 4,95E-01 | 1 | | covered with 415-89010-0002 | | |
| 415-89010-0006 | CASE_8901_SILVER_STAINLESS STEEL_N/A_CPU Shielding COVER_CJR_N/A | Mechanical, Shielding, stainless steel | 1,86E+00 | 1 | | covered with 415-59290-0024 | | |
| 415-89010-0007 | CASE_8901_SILVER_COPPER-NICKEL-ZINC ALLOY_N/A_RF BACK Shielding FRAME_CJR_N/A | Mechanical, Shielding, Copper-Nickel-Zinc alloy | 4,55E-01 | 1 | | covered with 415-89010-0002 | | |
| 415-89010-0008 | CASE_8901_SILVER_STAINLESS STEEL_N/A_RF BACK Shielding COVER_CJR_N/A | Mechanical, Shielding, stainless steel | 1,26E+00 | 1 | | covered with 415-59290-0024 | | |
| 415-89010-0009 | CASE_8901_SILVER_COPPER-NICKEL-ZINC ALLOY_N/A_BB Shielding FRAME_CJR_N/A | Mechanical, Shielding, Copper-Nickel-Zinc alloy | 8,35E-01 | 1 | | covered with 415-89010-0002 | | |
| 415-89010-0010 | CASE_8901_SILVER_STAINLESS STEEL_N/A_BB Shielding COVER_CJR_N/A | Mechanical, Shielding, stainless steel | 1,80E+00 | 1 | | covered with 415-59290-0024 | | |
| 415-89010-0011 | CASE_8901_SILVER_COPPER-NICKEL-ZINC ALLOY_N/A_RF FRONT Shielding FRAME_CJR_N/A | Mechanical, Shielding, Copper-Nickel-Zinc alloy | 2,11E-01 | 1 | | covered with 415-89010-0002 | | |
| 415-89010-0012 | CASE_8901_SILVER_STAINLESS STEEL_N/A_RF FRONT Shielding COVER_CJR_N/A | Mechanical, Shielding, stainless steel | 1,80E-01 | 1 | | covered with 415-59290-0024 | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 314-0000-00971 | CON. NANO SIM CARD CONNECTOR_SM051-12116A01D_2.540 mm_6 pin_16.0mm_JTCONN_H=1.25mm | Electronics, Connector, | 2,76E-01 | 2 | | Connector nano SIM (314-0000-00971) - Core Module FP3 | 2*2.76e-1 g | |
| | | Au PLATING, others | 1,50E-06 | | | neglected | | |
| | | Au PLATING, Gold | 2,99E-06 | | | GLO: Gold mix (primary, copper and recycling route) ts <t-agg> | process | 2.99e-6 g |
| | | Au PLATING, Cobalt metal powder | 4,50E-06 | | | GLO: Cobalt, refined (metal) CDI | process | 4.5e-6 g |
| | | SHELL SUS301, manganese | 2,57E-03 | | | DE: Stainless Steel slab (X6CrNi17) ts <t-agg> | process | 1.37e-1 g |
| | | SHELL SUS301, Nickel (metallic) | 1,03E-02 | | | covered by stainless steel above | | |
| | | SHELL SUS301, Carbon | 1,93E-04 | | | covered by stainless steel above | | |
| | | SHELL SUS301, Iron | 9,26E-02 | | | covered by stainless steel above | | |
| | | SHELL SUS301, Silicon | 9,65E-04 | | | covered by stainless steel above | | |
| | | SHELL SUS301, Sulfur | 3,86E-05 | | | covered by stainless steel above | | |
| | | SHELL SUS301, chromium | 2,19E-02 | | | covered by stainless steel above | | |
| | | SHELL SUS301, Red phosphorous | 5,79E-05 | | | covered by stainless steel above | | |
| | | TERMINAL C5240, Lead | 8,64E-06 | | | RoW: bronze production ecoinvent 3.5 | process | 8.64e-2 g |
| | | TERMINAL C5240, Zinc | 5,18E-05 | | | covered by bronze above | | |
| | | TERMINAL C5240, Tin | 7,78E-03 | | | covered by bronze above | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | TERMINAL C5240, Iron | 2,59E-05 | | | covered by bronze above | | |
| | | TERMINAL C5240, Copper | 7,85E-02 | | | covered by bronze above | | |
| | | TERMINAL C5240, Red phosphorous | 6,91E-05 | | | covered by bronze above | | |
| | | SPRING SUS301, Iron | 5,97E-03 | | | covered by stainless steel above | | |
| | | SPRING SUS301, Sulfur | 2,49E-06 | | | covered by stainless steel above | | |
| | | SPRING SUS301, Carbon | 1,24E-05 | | | covered by stainless steel above | | |
| | | SPRING SUS301, manganese | 1,66E-04 | | | covered by stainless steel above | | |
| | | SPRING SUS301, Nickel (metallic) | 6,61E-04 | | | covered by stainless steel above | | |
| | | SPRING SUS301, Silicon | 6,22E-05 | | | covered by stainless steel above | | |
| | | SPRING SUS301, chromium | 1,41E-03 | | | covered by stainless steel above | | |
| | | SPRING SUS301, Red phosphorous | 3,73E-06 | | | covered by stainless steel above | | |
| | | HOUSING LCP BL3135, LIQUID CRYSTAL POLYMER | 2,63E-02 | | | DE: Polyester Resin unsaturated (UP) ts | process | 2.63e-2 g |
| | | HOUSING LCP BL3135, Glass wool fibers (inhalable and biopersistent) | 1,37E-02 | | | EU-28: Glass wool ts | process | 1.37e-2 g |
| | | HOUSING LCP BL3135, PROCESSING ADDITIVES | 4,04E-04 | | | neglected | | |
| | | Ni PLATING, Nickel (metallic) | 6,99E-06 | | | GLO: Nickel mix ts | process | 6.99e-6 g |
| | | Ni PLATING, others | 1,40E-05 | | | neglected | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | SLIDE PA46/HF4540, Polyamide 46 | 8,70E-03 | | | DE: Polyamide 6.6 Granulate (PA 6.6) ts | process | 8.7e-3 g |
| | | SLIDE PA46/HF4540, Carbon black (airborne, unbound particles of respirable size) | 4,37E-05 | | | DE: Carbon black (furnace black; general purpose) ts | process | 4,37E-05 |
| | | PULL BAR SUS304, manganese | 3,15E-05 | | | EU-28: Stainless steel cold rolled coil (304) Eurofer <t-agg> | process | 3,15E-03 |
| | | PULL BAR SUS304, Carbon | 1,89E-06 | | | covered by stainless steel above | | |
| | | PULL BAR SUS304, Nickel (metallic) | 2,64E-04 | | | covered by stainless steel above | | |
| | | PULL BAR SUS304, chromium | 5,99E-04 | | | covered by stainless steel above | | |
| | | PULL BAR SUS304, Red phosphorous | 1,26E-06 | | | covered by stainless steel above | | |
| | | PULL BAR SUS304, Silicon | 1,58E-05 | | | covered by stainless steel above | | |
| | | PULL BAR SUS304, Sulfur | 6,30E-07 | | | covered by stainless steel above | | |
| | | PULL BAR SUS304, Iron | 2,24E-03 | | | covered by stainless steel above | | |
| 314-0000-01148 | CON. MICRO SD CONNECTOR_1MSD010D09R1R_00_0.800 mm_8 pin_20.0mm_GOLDENCONN_H=1.28mm | Electronics, Connector, no datasheet found | 3,45E-01 | 1 | | Micro SD card connector - FP3 | plan | |
| 600-0000-00038 | Consumable_Solder Paste_SAC305 M8_AIMSOLDER_SAC305 M8 | Solder, SAC305, | 1,50E+00 | 1,5 | | GLO: Solder paste SnAg3Cu0.5 (SAC-Lot) ts | process | 1.5 g |
| 415-89010-0019 | CABLE_8901_BLACK_COPPER ALLOY_N/A_RF CONN_ECT_75.00 mm | Mechanical, Cable, Cable, Copper Alloy | 4,17E-01 | 1 | 75 mm | GLO: Cable 1-core signal 24AWG mPPE (3.0 g/m) D1.1 ts | process | 0,075 |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 478-581500-031 | WATER DISSOLVE LABEL _Mech. Label_5815_Global_WATER DISSOLVE LABEL_3*3mm_Reel packing_HSIN YI DE | | #NV | 2 | 3*3mm | neglected | | |
| 402-89010-0005 | Rear Cabinet_8901_BLACK_PC_N/A_Rear Cover Ass'y for Lotte SC-110R_CREATOR_N/A | Plastic, Midframe, PC | 1,48E+01 | 1 | | DE: Polycarbonate Granulate (PC) ts | process | 14.8 g |
| 402-89010-0009 | Rear Cabinet_8901_BLACK_PC_N/A_8901 REAR COVER SC-1100R FOR ARIMA_CREATOR_N/A | Plastic, PC | | 1 | | covered above | | |
| 415-89010-0041 | GASKET_8901_BLACK_PORON_N/A_MIC sponge_HUALONG_N/A | PORON Foam | | 2 | | neglected | | |
| 415-89010-0042 | GASKET_8901_BLACK_PORON_N/A_speaker sponge_HUALONG_N/A | PORON Foam | | 1 | | neglected | | |
| 404-89010-0001 | Key_8901_BLACK_ALUMINUM_NCVM_N/A_8901 side key assy_CJR_N/A | Aluminium + coating (?) | | 1 | | neglected | | |
| 415-89010-0046 | GASKET_8901_BLACK_PORON_N/A_coaxial sponge_HUALONG_N/A | PORON Foam | | 1 | | neglected | | |
| 336-0000-00275 | Fingerprint module_5246B_NA_Φ10 mm_DOLFA_N/A | | 3,22E+00 | 1 | | Fingerprint sensor - FP3 <t-agg> | further inputs | |
| | | Flex board | | | | GLO: Printed Wiring Board 1-layer rigid FR4 with chem-elec AuNi finish (Subtractive method) ts | process | 1,1129 cm2 |
| 321-M000-00244 | MODULE_8901_PI-RoHS_46.85*14.95mm_0.120 mm_2 Layer_Selective Gold+O.S.P_ALL-WINNER_8901SKB-004,Side Key | Electronics, PCB, 2 layers | 4,21E-01 | 1 | 1.36cm2 | GLO: Printed Wiring Board 2-layer rigid FR4 with chem-elec AuNi finish (Subtractive method) ts | process | 1.36e-4 m2 |
| 409-00000-0276 | Machine Screw_Flat_Cross(JCIS)_2.5mm_3.5_SILVER_Steel_Plating_H.N.M_N/A | Mechanical, Screw, Steel | 4,61E-02 | 9 | 22 | Screw 2,5 mm silver (409-00000-0276) - FP3 | plan | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm2] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 415-89010-0015 | SLEEVE_8901_SILVER_ALUMINUM_N/A_Pogo pin protective frame_CJR_AL metal + Gasket | Mechanical, Aluminium | 5,00E-01 | 1 | | EU-28: Aluminium extrusion profile ts | process | 0.5 g |
| 321-M000-00245 | MODULE_8901_PI-RoHS_13.5*14.18mm_0.200 mm_3 Layer_Selective Gold+O.S.P_ALL-WINNER_8901CB2-003,Rear Camera | Electronics, PCB, 3 layers (?), Flex PCB Camera | 1,22E+00 | 1 | 1.82cm2 | GLO: Printed Wiring Board 1-layer rigid FR4 with chem-elec AuNi finish (Subtractive method) ts<br>+ connector on both sides | process | 7.06e-4 m2 |
| 321-M000-00243 | MODULE_8901_PI-RoHS_18.27*14.0mm_0.200 mm_3 Layer_Selective Gold+O.S.P_ALL-WINNER_8901BTBS-004,South FPC | Electronics, PCB, 3 layers (?), Flex PCB Camera | 1,28E+00 | 1 | 2.25cm2 | covered above | | |
| 321-M000-00242 | MODULE_8901_PI-RoHS_23.8*21.3mm_0.18 mm_2 Layer_Selective Gold+O.S.P_ALL-WINNER_8901BTBN-004,North FPC | Electronics, PCB, 2 layers, Flex PCB | 4,30E-01 | 1 | 2.99cm2 | covered above | | |
| 415-89010-0014 | HOLDER_8901_SILVER_STAINLESS STEEL_N/A_Metal Cover MIDDLE_CJR_N/A | Mechanical, Stainless steel | 9,00E+00 | 1 | | EU-28: Stainless steel sheet (EN15804 A1-A3) ts <t-agg> | process | 6.773 g |
| 409-00000-0275 | Machine Screw_Flat_TORX_2.5mm_3.0_BLACK_Steel_Plating_H.N.M_N/A | Mechanical, Screw, Steel | 4,20E-02 | 2 | | Screw 2,5 mm (409-00000-0275) - FP3 <LZ> | plan | |
| 409-00000-0276 | Machine Screw_Flat_Cross(JCIS)_2.5mm_3.5_SILVER_Steel_Plating_H.N.M_N/A | Mechanical, Screw, Steel | 4,61E-02 | 13 | | covered with 409-00000-0276 above | | |

## 8.3.2
## Top module

**Table 8-6: Inventory list top module**

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 8-8902-00-0009 | PCBA Ass'y_8902_BLACK_North Module sub-assy | Module | 5,10E+00 | 1 | | FP3 Top Module | Plan | 5.1 g |
| 401-89010-0008 | Front Cabinet_8901_BLACK_PC_N/A_North Module Front Cover_CREATOR_N/A | Plastic, PC? | 1,04E+00 | 1 | 1,89E+00 | EU-28: Polycarbonate PlasticsEurope | process | 1.89 g |
| 313-0000-00352 | RECEIVER_SD1206-S-3_12.0 * 6.0mm_32 Ohm_117dB_CHANG ZHOU YU CHENG_N/A | | 3,87E-01 | 1 | | Receiver FP3 Top Module (313-0000-00352) | further inputs | |
| | | Stainless steel2, Nickel (metallic) | 7,07E-04 | | | EU-28: Stainless steel sheet (EN15804 A1-A3) ts <t-agg> | process | 0.0797 g |
| | | Stainless steel2, Carbon | 3,80E-06 | | | see above | | |
| | | Stainless steel2, Sulfur | 2,28E-06 | | | see above | | |
| | | Stainless steel2, chromium | 1,49E-03 | | | see above | | |
| | | Stainless steel2, Iron | 5,32E-03 | | | see above | | |
| | | Stainless steel2, Silicon | 6,48E-05 | | | see above | | |
| | | Stainless steel2, manganese | 1,25E-05 | | | see above | | |
| | | Stainless steel2, Red phosphorous | 2,89E-06 | | | see above | | |
| | | NdFeP, other | 2,19E-03 | | | neglected | | |
| | | NdFeP, Iron | 5,98E-02 | | | neglected | | |
| | | NdFeP, Praseodymium | 1,32E-02 | | | CN: Praseodymium ts | process | 1.32e-2 g |
| | | NdFeP, dysprosium | 9,12E-04 | | | neglected | | |
| | | NdFeP, boron | 1,00E-03 | | | GLO: boric oxide production ecoinvent | process | 1e-3 g |
| | | NdFeP, Neodymium | 1,40E-02 | | | GLO: neodymium oxide to generic market for mischmetal ecoinvent | process | 1.4e-2 g |
| | | PPA, Glass wool fibers (inhalable and biopersistent) | 1,54E-02 | | | EU-28: Glass wool ts | process | 1.54e-2 g |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm²] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | PPA, Impact Modifier | 2,57E-03 | | | neglected | | |
| | | PPA, Anti Oxidant | 1,17E-03 | | | neglected | | |
| | | PPA, Other additives | 9,36E-04 | | | neglected | | |
| | | PPA, Polyphthalamide | 2,67E-02 | | | EU-28: Polyamide 6.6 fibres (PA 6.6) ts | process | 2.74e-2 g |
| | | Cold rolled plate, Red phosphorous | 3,54E-05 | | | DE: Steel cold rolled coil <1,5mm ts <t-agg> | process | 0,151 g |
| | | Cold rolled plate, Carbon | 1,06E-04 | | | covered with colled rolled steel above | | |
| | | Cold rolled plate, Sulfur | 3,54E-05 | | | covered with colled rolled steel above | | |
| | | Cold rolled plate, Iron | 7,00E-02 | | | covered with colled rolled steel above | | |
| | | Cold rolled plate, manganese | 5,66E-04 | | | covered with colled rolled steel above | | |
| | | PEEK, Polyetheretherketone | 1,80E-03 | | | DE: Polyetherether ketone granulate (PEEK) ts | process | 1.8e-3 g |
| | | Super high line, Polyamide | 7,30E-04 | | | covered with polyamide above | | |
| | | Super high line, Copper | 1,33E-02 | | | GLO: Copper mix (99,999% from electrolysis) ts | process | 1.33e-2 g |
| | | Super high line, Silver | 5,84E-04 | | | GLO: Silver mix ts | process | 5.84e-4 g |
| | | Stainless steel, Sulfur | 2,16E-05 | | | covered with stainless steel above | | |
| | | Stainless steel, manganese | 1,19E-04 | | | covered with stainless steel above | | |
| | | Stainless steel, Red phosphorous | 2,74E-05 | | | covered with stainless steel above | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm²] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | Stainless steel, Iron | 5,05E-02 | | | covered with stainless steel above | | |
| | | Stainless steel, Carbon | 3,61E-05 | | | covered with stainless steel above | | |
| | | Stainless steel, Nickel (metallic) | 6,71E-03 | | | covered with stainless steel above | | |
| | | Stainless steel, Silicon | 6,14E-04 | | | covered with stainless steel above | | |
| | | Stainless steel, chromium | 1,41E-02 | | | covered with stainless steel above | | |
| | | PEN, Poly ethylene naphthalate | 1,60E-03 | | | neglected | | |
| | | PEN, Silicon dioxide | 3,20E-06 | | | neglected | | |
| | | Cold rolled plate2, Red phosphorous | 4,02E-05 | | | covered with colled rolled steel above | | |
| | | Cold rolled plate2, Sulfur | 4,02E-05 | | | covered with colled rolled steel above | | |
| | | Cold rolled plate2, manganese | 6,42E-04 | | | covered with colled rolled steel above | | |
| | | Cold rolled plate2, Iron | 7,95E-02 | | | covered with colled rolled steel above | | |
| | | Cold rolled plate2, Carbon | 1,20E-04 | | | covered with colled rolled steel above | | |
| 335-0000-00280 | CAMERA MODULE CMOS_HTE1006_8MP_HOLITECH_N/A | | 2,29E-01 | 1 | | Camera Module CMOS (335-0000-00280) - Top Module FP3 <t-agg> | plan | |
| | | 12X5BT, Silicon dioxide | 4,50E-06 | | | neglected | | 0,0001445 g |
| | | 12X5BT, Acrylic resin | 2,25E-05 | | | neglected | | |
| | | 12X5BT, Carbon black (airborne, unbound particles of respirable size) | 2,25E-05 | | | DE: Carbon black (furnace black; general purpose) ts | process | 0,0009265 g |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | 12X5BT, Polyethylene Terephthalate (PET) | 9,00E-05 | | | EU-28: Polyethylene terephthalate fibres (PET) ts | process | 0,000389 g |
| | | 12X5BT, Wax | 1,05E-05 | | | EU-28: Wax / Paraffins at refinery ts | process | 0,0000105 g |
| | | LCP E525T, LCP | 2,13E-02 | | | DE: Polyester Resin unsaturated (UP) ts | process | 0,02128 g |
| | | LCP E525T, Carbon black (airborne, unbound particles of respirable size) | 8,00E-04 | | | covered in cabron black above | | |
| | | LCP E525T, Inorganic filler | 9,92E-03 | | | neglected | | |
| | | Copper Foil, chromium | 1,40E-06 | | | RER: chromium production ecoinvent 3.5 | process | 0,0000014 g |
| | | Copper Foil, Zinc | 5,60E-06 | | | DE: Zinc redistilled mix ts | process | 0,0000056 g |
| | | Copper Foil, Copper | 1,40E-02 | | | GLO: Copper mix (99,999% from electrolysis) ts | process | 0,0173159 g |
| | | Copper Foil, Nickel (metallic) | 7,00E-06 | | | GLO: Nickel mix ts | process | 0,001585 g |
| | | FH8633, Hardener | 3,00E-05 | | | neglected | | |
| | | FH8633, Formaldehyde, polymer with 2-(chloromethyl)oxirane and phenol | 7,50E-05 | | | DE: Formaldehyde (HCHO; 100%) ts | process | 0,000075 g |
| | | FH8633, Calcium carbonate | 4,50E-05 | | | EU-28: Calcium carbonate > 63 microns IMA-Europe/ELCD | process | 0,000045 g |
| | | TAM-LCM-75, Oxycarboxylic acid | 1,35E-03 | | | neglected | | |
| | | TAM-LCM-75, Oxycarboxylic acid salt | 5,80E-04 | | | neglected | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | TAM-LCM-75, Oxalic acid salt | 2,30E-04 | | | neglected | | |
| | | TAM-LCM-75, ammonia ….% | 1,50E-04 | | | neglected | | |
| | | TAM-LCM-75, Amino-carboxylic acid salt | 6,90E-04 | | | neglected | | |
| | | TAM-LCM-75, Water | 7,00E-03 | | | EU-28: Process water ts | process | 0,01712 g |
| | | C5191R, Copper | 1,31E-03 | | | covered in copper above | | |
| | | C5191R, Tin | 8,40E-05 | | | GLO: Tin ts | process | 0,001157 g |
| | | C5191R, Red phosphorous | 2,10E-06 | | | neglected | | |
| | | Ti305, Ti305 | 1,20E-05 | | | neglected | | 0,000147 g |
| | | Ti3O5, Ti3O5 | 1,35E-04 | | | neglected | | |
| | | Conductive cloth, Copper | 3,60E-05 | | | covered in copper above | | |
| | | Conductive cloth, Polyethylene Terephthalate (PET) | 1,80E-05 | | | covered in PET above | | |
| | | Conductive cloth, Nickel (metallic) | 1,80E-05 | | | covered in nickel above | | |
| | | Conductive cloth, Viscose | 4,80E-05 | | | neglected | | |
| | | C5191, Copper | 1,86E-03 | | | covered in copper above | | |
| | | C5191, Tin | 1,33E-04 | | | covered in tin above | | |
| | | C5191, Red phosphorous | 7,00E-06 | | | neglected | | |
| | | SP168GN, Glass wool fibers (inhalable and biopersistent) | 4,50E-03 | | | EU-28: Glass wool ts | process | 0,005176 g |
| | | SP168GN, Inorganic Filler | 2,50E-03 | | | neglected | | |
| | | SP168GN, Halogen-free Epoxy Resin Blend | 3,00E-03 | | | neglected | | |
| | | Gold wire, Gold | 3,00E-04 | | | GLO: Gold (primary) ts | process | 0,0003 g |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm²] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | BRASS, Zinc | 7,11E-03 | | | EU-28: Brass (CuZn39Pb3) ts <t-agg> | process | 2.19e-2 g |
| | | BRASS, Copper | 1,38E-02 | | | covered with brass above | | |
| | | BRASS, Tin | 1,10E-04 | | | covered with brass above | | |
| | | BRASS, Iron | 1,10E-04 | | | covered with brass above | | |
| | | BRASS, Cadmium | 2,19E-07 | | | covered with brass above | | |
| | | BRASS, Lead | 1,97E-05 | | | covered with brass above | | |
| | | BRASS, Bismuth | 7,68E-04 | | | covered with brass above | | |
| | | X5R ceramics powder , Yttrium oxide | 1,00E-05 | | | neglected | | |
| | | X5R ceramics powder , Barium oxide (BaO) | 4,40E-04 | | | GLO: barium oxide production ecoinvent 3.5 | process | 0,00044 g |
| | | X5R ceramics powder , Calcium oxide (CaO) | 8,00E-05 | | | neglected | | |
| | | X5R ceramics powder , Titanium dioxide (airborne, unbound particles of respirable size) | 4,10E-04 | | | RER: titanium dioxide production, chloride process ecoinvent 3.5 | process | 0,00041 g |
| | | NI, Nickel (metallic) | 1,25E-03 | | | covered in nickel above | | |
| | | S-380W, Sulfuric acid, barium salt (1:1) | 2,40E-03 | | | neglected | | |
| | | S-380W, epoxy resin | 3,60E-03 | | | DE: Epoxy Resin (EP) Mix ts | process | 0,003675 g |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | S-380W, Ethanol, 2-(2-ethoxyethoxy)-, 1-acetate | 6,00E-04 | | | neglected | | |
| | | S-380W, Talc containing asbestiform fibers | 6,00E-04 | | | covered in talcum poweder above | process | 0,00665 g |
| | | S-380W, Defoaming agent | 1,20E-04 | | | neglected | | |
| | | S-380W, SiO2 | 6,00E-04 | | | neglected | | |
| | | S-380W, (2-methoxymethylethoxy)propanol | 6,00E-04 | | | neglected | | |
| | | S-380W, Inorganic pigment | 3,48E-03 | | | neglected | | |
| | | Nickel, Nickel (metallic) | 2,00E-05 | | | covered in nickel above | | |
| | | LCP, Talc containing asbestiform fibers | 1,04E-03 | | | covered in talcum poweder above | | |
| | | LCP, Glass wool fibers (inhalable and biopersistent) | 6,76E-04 | | | covered in glass wool above | | |
| | | LCP, Carbon black (airborne, unbound particles of respirable size) | 1,04E-04 | | | covered in carbon black above | | |
| | | LCP, Aromatic Polyester | 3,38E-03 | | | neglected | | |
| | | M705-S101ZH, Silver | 2,70E-06 | | | GLO: Solder paste SnAg3Cu0.5 (SAC-Lot) ts | process | 9.5e-5 g |
| | | M705-S101ZH, Copper | 3,00E-06 | | | covered with solder paste above | | |
| | | M705-S101ZH, solvent | 9,30E-06 | | | covered with solder paste above | | |
| | | M705-S101ZH, Tin | 8,00E-05 | | | covered with solder paste above | | |
| | | M705-S101ZH, Rosin | 5,00E-06 | | | covered with solder paste above | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | SF305C, 1H,3H-Benzo[1,2-c:4,5-c']difuran-1,3,5,7-tetrone, polymer with 4,4'-oxybis[benzenamine] | 7,80E-03 | | | neglected | | |
| | | SF305C, Halogen-free adhesive of epoxy resin | 4,20E-03 | | | neglected | | |
| | | A-11D, 1,3,5-Triazine-2,4,6(1H,3H,5H)-trione, compd. with 6-[2-(2-methyl-1H-imidazol-1-yl)ethyl]-1,3,5-triazine-2,4-diamine (1:1) | 2,20E-04 | | | neglected | | |
| | | A-11D, Epichlorohydrin-bisphenol A resin | 5,85E-04 | | | neglected | | |
| | | A-11D, Others | 5,50E-05 | | | neglected | | |
| | | A-11D, Silicon dioxide | 1,40E-04 | | | neglected | | |
| | | SF202, Copper | 3,06E-02 | | | covered in copper above | | |
| | | SF202, 1H,3H-Benzo[1,2-c:4,5-c']difuran-1,3,5,7-tetrone, polymer with 4,4'-oxybis[benzenamine] | 5,40E-03 | | | neglected | | |
| | | 7972, Silicones, monoorgano | 3,50E-06 | | | neglected | | |
| | | 7972, 2-Ethylhexyl acrylate | 6,55E-05 | | | neglected | | |
| | | 7972, Pulp, cellulose | 3,07E-04 | | | neglected | | |
| | | 7972, Polyethylene Terephthalate (PET) | 1,31E-04 | | | covered in PET above | | |
| | | Tin, Tin | 4,00E-05 | | | covered in tin above | | |
| | | Copper Termiation, Copper | 1,20E-04 | | | covered in copper above | | |
| | | SV-55, aluminium oxide | 4,05E-05 | | | GLO: aluminium oxide production ecoinvent | process | 0,0000405 g |
| | | SV-55, Quartz (SiO2) | 9,45E-05 | | | neglected | | |
| | | OKP1, Fluorene based polyester copolymer | 8,54E-03 | | | neglected | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | Sn, Tin | 9,00E-04 | | | covered in tin above | | |
| | | UV HQ210, acrylate | 4,60E-04 | | | neglected | | |
| | | Nickel Paste for X5R, Nickel (metallic) | 2,90E-04 | | | covered in nickel above | | |
| | | FH8808, Modified epoxy resin | 3,00E-05 | | 0.78cm2 | GLO: Printed Wiring Board 1-layer rigid FR4 with chem-elec AuNi finish (Subtractive method) ts | process | 7.8e-5 m2 |
| | | FH8808, curing agent | 4,50E-05 | | | covered above | | |
| | | FH8808, epoxy resin | 7,50E-05 | | | covered above | | |
| | | 12inch-Cls, Silicon | 5,80E-04 | | 0,180093 | IC-Front-End - FP2 | process | 1.80093 e-5 m2 |
| | | NPG-1-AS, Water | 6,15E-03 | | | covered in water above | | |
| | | NPG-1-AS, Nickel(II) sulfate hexahydrate (1:1:6) | 3,56E-03 | | | neglected | | |
| | | NPG-1-AS, Carboxylic acid salt | 2,90E-04 | | | neglected | | |
| | | ZEONEX K26R, Polycycloolefin Resin | 5,61E-03 | | | neglected | | |
| | | ZEONEX K26R, Polymer Stabilizer | 1,14E-04 | | | neglected | | |
| | | PET, Polyethylene Terephthalate (PET) | 1,50E-04 | | | covered in PET above | | |
| | | AU, Aurate(1-), bis(cyano-.kappa.C)-, potassium (1:1) | 1,25E-03 | | | neglected | | |
| | | SF-PC6000-U1, Silver | 2,04E-04 | | | | | |
| | | SF-PC6000-U1, Copper | 8,04E-04 | | | covered in copper above | | |
| | | SF-PC6000-U1, Polyethylene Terephthalate (PET) | 1,01E-02 | | | covered in PET above | | |
| | | SF-PC6000-U1, Eopoxy Resin Formulation | 9,24E-04 | | | covered in epoxy resin above | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | PC DN-5615B, Talc containing asbestiform fibers | 5,01E-03 | | | covered in talcum powder above | | |
| | | PC DN-5615B, Carbonic dichloride, polymer with 4,4'-(1-methylethylidene)bis[phenol] | 2,84E-02 | | | neglected | | |
| | | Si2O, Quartz (SiO2) | 8,00E-06 | | | neglected | | |
| | | TPD-35-B, Phosphinic acid, sodium salt (1:1) | 1,03E-03 | | | neglected | | |
| | | TPD-35-B, Water | 3,97E-03 | | | covered in water above | | |
| | | PSR4000MEH, Heavy aromatic solvent naphtha | 1,32E-03 | | | neglected | | |
| | | PSR4000MEH, Silica | 2,16E-03 | | | DE: Silica sand (flour) ts | process | 0,00216 g |
| | | PSR4000MEH, Other | 8,40E-03 | | | neglected | | |
| | | PSR4000MEH, Fluorides | 1,20E-04 | | | neglected | | |
| 402-89010-0004 | Rear Cabinet_8901_BLACK_PLASTIC+METAL_N/A_North Module-Rear Cover ASSY_CREATOR_N/A | | 1,61E+00 | 1 | | see below | | |
| 409-00000-0275 | Machine Screw_Flat_TORX_2.5mm_3.0_BLACK_Steel_Plating_H.N.M_N/A | Mechanical, Screw, Steel | 4,20E-02 | 3 | | Screw 2,5 mm (409-00000-0275) - FP3 <LZ> | plan | |
| 8-8902-00-0002 | Daughter Board_8902_NATURAL_North board | | #NV | 1 | | see below | | |
| 8PCB-8901-0002 | PCB_8901_NON_North board | Electronics, PCB, | 1,38E+00 | 1 | | PCBA Top Module FP3 | plan | 1.384 g |
| 301-G000-00235 | Chip resistor_2.20 Kohm_± 1%_1/16 W_0402_N/A_N/A | Electronics, Resistor, Chip Resistor: Ceramic Substrate, SN Plating, Ni Plating | 5,97E-04 | 1 | 0402 | GLO: resistor production, surface-mounted ecoinvent 3.5 | process | 8.21e-4 g |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 301-G000-01340 | Chip resistor_22.0 Ohm_± 1%_1/20 W_0201_N/A | Electronics, Resistor, Chip Resistor: Ceramic Substrate, SN Plating, Ni Plating | 2,24E-04 | 1 | 0201 | covered with 301-G000-00235 | | |
| 302-0214-41051 | Chip Capacitor_33.0 pF_± 5%_NPO (COG)_25 V_0201_0.3 mm_MURATA_GRM0335C1E330J_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 6 | 0201 | GLO: Capacitor ceramic MLCC 0201 (0.17mg) D 0.6x0.3x0.3 ts | process | 4 |
| 302-0222-52104 | Chip Capacitor_47.0 nF_± 10%_X5R_10 V_0402_N/A_N/A_MURATA_GRM155R61A473K_N/A | Electronics, Capacitor, MLCC | 1,60E-03 | 1 | 0402 | GLO: Capacitor ceramic MLCC 0603 (6mg) D 1.6x0.8x0.8 ts | process | 2 |
| 302-1000-01476 | Chip Capacitor_2.20 uF_± 10%_X5R_10 V_0402_0.5 mm_MURATA_GRM155R61A225K_N/A | Electronics, Capacitor, MLCC | 1,60E-03 | 1 | 0402 | covered with 302-0222-52104 | | |
| 302-1000-02552 | Chip Capacitor_2.20 uF_± 20%_X5R_6.3 V_0201_0.3 mm_2.0mm_MURATA_GRM033R60J225ME47D_T=0.39 MAX | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41051 | | |
| 302-G000-00182 | Chip Capacitor_100 nF_± 10%_X5R_10 V_0201_0.3 mm_2.0mm_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41051 | | |
| 302-G000-02068 | Chip Capacitor_1.00 uF_± 20%_X5R_6.3 V_0201_0.3 mm_2.0mm_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 2 | 0201 | covered with 302-0214-41051 | | |
| 303-0321-86076 | Chip Inductor_100 nH_± 5%_0402_100 Mhz_0.55 mm_MURATA_LQG15HNR10J02D_N/A | Electronics, Inductor, Multilayer Ceramic Chip Inductor (RF Inductor) | 1,07E-03 | 1 | 0402 | GLO: inductor production, low value multilayer chip ecoinvent 3.5 | process | 1.45e-2 g |
| 303-1000-00099 | Chip Ferrite bead_1800 ohm _± 25%_0402_100 Mhz_0.5 mm_MURATA_BLM15HD182SN1D_DCR<2.2 ohm | Electronics, Inductor, Ferrite Bead | 1,21E-03 | 4 | 0402 | covered with 303-0321-86076 | | |
| 303-1000-00799 | Chip Ferrite bead_220 ohm_± 25%_0603_100 Mhz_0.6 mm_MURATA_BLM18KG221SN1D_DCR<0.05,Idc=2200 mA | Electronics, Inductor, Ferrite Bead | 4,63E-03 | 1 | 0603 | covered with 303-0321-86076 | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 303-1000-01079 | Chip Ferrite bead_1000 ohm_± 25%_0402_100 Mhz_0.5 mm_2.0mm_MURATA_BLM15BX102SN1D_DCR=0.65ohm,Idc=300mA | Electronics, Inductor, Ferrite Bead | 1,16E-03 | 1 | 0402 | covered with 303-0321-86076 | | |
| 303-1000-01080 | Chip Ferrite bead_1000 ohm_± 25%_0402_100 Mhz_0.5 mm_2.0mm_CHILISIN_SBJ100505T-102Y-N_DCR<0.95ohm,Idc<200mA | Electronics, Inductor, Ferrite Bead | 1,40E-03 | 2 | 0402 | covered with 303-0321-86076 | | |
| 308-0000-00227 | CHIP BIPOLARTVS_12V_AIES12U020R2_0402_AMOTECH_Cp<0.3pF | Electronics, , transient voltage surpressor diode | 4,77E-04 | 1 | 0402 | GLO: Diode signal SOD123/323/523 (1.59mg) 0.8x0.75x1.6 with Au-Bondwire ts | process | 9 |
| 308-0000-00281 | ESD protection_5.0V_IMG0505350FR_0402_2.0mm_MODA-INNOCHIPS_Cp=35  pF | Electronics, , no datasheet found | 1,40E-03 | 6 | 0402 | covered with 308-0000-00227 | | |
| 308-0000-00328 | CHIP BIPOLARTVS_5.0V_ESD5451R-2/TR_0402_2.0mm_WILLSEMI_Packing:DFP1006-2L | Electronics, , transient voltage surpressor diode, 1-Line, Bi-directional, Transient Voltage Suppressors | 0,00E+00 | 2 | 0402 | covered with 308-0000-00227 | | |
| 309-0000-00204 | LED Full Color_19-337/R6GHBHC-A01/2T_RED/GREEN/BLUE_6pin_SMD6_20mA/R=100,G=180,B=50mcd_4.0mm_EVERLIGHT_N/A | Electronics, LED, AlInGaN / InGaN / InGaN | 1,80E-03 | 1 | 1.6x1.6x0.35 | GLO: LED SMD low-efficiency max 50mA (35mg) without Au 3.2x2.8x1.9 ts | process | 1 piece |
| 311-0000-02639 | I.C SENSOR_MN25733DKDSJD_DFN_8pins_NoMemory_8.0mm_EMINENT_Light Sensor w/ Built-in IR LED | Electronics, IC, | 7,77E-02 | 1 | 9,75E-03 | CMOS logic - FP3 <LZ> | process | 9.75e-7 m2 |
| 312-0000-00094 | MEMS MIC_MSM261D4030Z1CM_64 'dB_- 26dB_± 1.0dB_4*3*1mm_DIGT_BOTTOM_8.0mm_MEMSENSING_N/A | Electronics, Microphone, metal can LGA package | 3,77E-04 | 1 | 4mm x 3mm x 1mm | GLO: IC WLP CSP 49 (10.2mg) 3.17x3.17x0.55mm CMOS logic (22 nm node) ts | process | 1 piece |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 314-0000-00982 | CON. SPRING CONNECTOR_J9Y802K00001_1.500 mm_1 pin_4.0mm_KUNZHON_H=1.1mm | Electronics, Connector, | 3,50E-03 | 1 | | Spring connector small FP3 (314-0000-00982) | plan | |
| | | Nickel compounds | 8,00E-05 | | | | | |
| | | Gold | 2,00E-05 | | | | | |
| | | Tin | 1,80E-04 | | | | | |
| | | Copper | 3,20E-03 | | | | | |
| 314-0000-00989 | CON. PCB FEMALE CONNECTOR_BM20B(0.8)-24DS-0.4V(51)_0.400 mm_24 pin_4.0mm_HIROSE_H=0.8mm | Electronics, Connector, | 1,73E-02 | 1 | | Connector 24 pin (314-0000-00989) - Top Module FP3 | plan | 1.73e-2 g |
| | | SV CONTACT(2), Tin | 4,88E-04 | | | GLO: Tin ts | process | 4.88e-4 g |
| | | SV CONTACT(2), Zinc | 1,22E-05 | | | GLO: Special high grade zinc ELCD/IZA | process | 1.91e-4 g |
| | | SV CONTACT(2), Cadmium | 6,10E-07 | | | GLO: Cadmium ts | process | 3.79e-5 g |
| | | SV CONTACT(2), Gold | 2,39E-05 | | | GLO: Gold mix (primary, copper and recycling route) ts <t-agg> | process | 2.79e-5 g |
| | | SV CONTACT(2), Copper | 5,58E-03 | | | GLO: Copper mix (99,999% from electrolysis) ts | process | 5.93e-3 g |
| | | SV CONTACT(2), Red phosphorous | 1,16E-05 | | | neglected | | |
| | | SV CONTACT(2), Cobalt metal powder | 1,20E-07 | | | GLO: Cobalt, refined (metal) CDI | process | 2.01e-5 g |
| | | SV CONTACT(2), Iron | 6,10E-06 | | | DE: Stainless Steel slab (X6CrNi17) ts <t-agg> | process | 6,36E-06 |
| | | SV CONTACT(2), Nickel (metallic) | 6,00E-04 | | | GLO: Nickel mix ts | process | 6.28e-4 g |
| | | SV CONTACT(2), Lead | 1,22E-06 | | | EU-28: Lead primary and secondary mix ILA <t-agg> | process | 1,48E-06 |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | HOUSING, Talc containing asbestiform fibers | 3,00E-03 | | | EU-28: Talcum powder (filler) ts | process | 3e-3 g |
| | | HOUSING, Wholly aromatic liquid crystal polyester(LCP) | 5,84E-03 | | | DE: Polyester Resin unsaturated (UP) ts | process | 5,84E-03 |
| | | HOUSING, Glass wool fibers (inhalable and biopersistent) | 1,00E-03 | | | EU-28: Glass wool ts | process | 1e-3 g |
| | | HOUSING, Carbon black (airborne, unbound particles of respirable size) | 1,50E-04 | | | DE: Carbon black (furnace black; general purpose) ts | process | 1,50E-04 |
| | | HOUSING, Calcium Stearate | 1,00E-05 | | | neglected | | |
| | | HOUSING, Fatty acids, montan-wax, ethylene esters | 5,00E-06 | | | neglected | | |
| | | SV REINFORCED METAL FITTINGS, Cobalt metal powder | 2,00E-05 | | | covered by cobalt above | | |
| | | SV REINFORCED METAL FITTINGS, Gold | 3,98E-06 | | | covered by gold above | | |
| | | SV REINFORCED METAL FITTINGS, Nickel (metallic) | 2,80E-05 | | | covered by nickel above | | |
| | | SV REINFORCED METAL FITTINGS, Zinc | 1,79E-04 | | | covered by zinc above | | |
| | | SV REINFORCED METAL FITTINGS, Copper | 3,48E-04 | | | covered by copper above | | |
| | | SV REINFORCED METAL FITTINGS, Lead | 2,64E-07 | | | covered by lead above | | |
| | | SV REINFORCED METAL FITTINGS, Iron | 2,64E-07 | | | covered by iron above | | |
| | | SV REINFORCED METAL FITTINGS, Cadmium | 3,91E-05 | | | covered by cadmium above | | |
| 314-0000-01200 | CON. PCB FEMALE CONNECTOR_DF40GB(1.5)-48DS-0.4V(51)_0.400 mm_48 pin_8.0mm_HIROSE_N/A | Electronics, Connector, | 8,36E-02 | 1 | | FP3 Board-to-board Connector | plan | |
| | | HOUSING, Talc containing asbestiform fibers | 1,20E-02 | | | | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | HOUSING, Carbon black (airborne, unbound particles of respirable size) | 6,00E-04 | | | | | |
| | | HOUSING, Fatty acids, montan-wax, ethylene esters | 2,00E-05 | | | | | |
| | | HOUSING, Wholly aromatic liquid crystal polyester(LCP) | 2,34E-02 | | | | | |
| | | HOUSING, Calcium Stearate | 4,00E-05 | | | | | |
| | | HOUSING, Misc., not to declare | 2,00E-05 | | | | | |
| | | HOUSING, Glass wool fibers (inhalable and biopersistent) | 4,00E-03 | | | | | |
| | | SHIELD BOARD, Gold | 2,99E-06 | | | | | |
| | | SHIELD BOARD, Cobalt metal powder | 1,50E-05 | | | | | |
| | | SHIELD BOARD, Iron | 1,99E-05 | | | | | |
| | | SHIELD BOARD, Copper | 1,82E-02 | | | | | |
| | | SHIELD BOARD, Nickel (metallic) | 1,12E-03 | | | | | |
| | | SHIELD BOARD, Zinc | 3,98E-05 | | | | | |
| | | SHIELD BOARD, Lead | 3,98E-06 | | | | | |
| | | SHIELD BOARD, Tin | 1,59E-03 | | | | | |
| | | SHIELD BOARD, Red phosphorous | 3,78E-05 | | | | | |
| | | SHIELD BOARD, Cadmium | 1,99E-07 | | | | | |
| | | SV(B)CONTACT, Cobalt metal powder | 2,40E-07 | | | | | |
| | | SV(B)CONTACT, Zinc | 4,28E-05 | | | | | |
| | | SV(B)CONTACT, Tin | 1,71E-03 | | | | | |
| | | SV(B)CONTACT, Cadmium | 2,14E-07 | | | | | |
| | | SV(B)CONTACT, Gold | 4,78E-05 | | | | | |
| | | SV(B)CONTACT, Iron | 2,14E-05 | | | | | |
| | | SV(B)CONTACT, Copper | 1,96E-02 | | | | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | SV(B)CONTACT, Lead | 4,28E-06 | | | | | |
| | | SV(B)CONTACT, Red phosphorous | 4,07E-05 | | | | | |
| | | SV(B)CONTACT, Nickel (metallic) | 1,10E-03 | | | | | |
| 314-0000-01203 | CON. EAR PHONE JACK CONNECTOR_CJE105D21DC-Y-NH_Φ3.50 mm for Phone jack_5 pin_16.0mm_CVILUX_Audio jack 3.5mm | Electronics, Connector, | 3,53E-01 | 1 | | Ear Phone Jack FP3 | further inputs | 3,53e-1 g |
| | | Contact2, Red phosphorous | 9,70E-05 | | | neglected | | |
| | | Contact2, Tin | 5,82E-03 | | | GLO: Tin ts | process | 7,17e-3 g |
| | | Contact2, Copper | 9,11E-02 | | | GLO: Copper mix (99,999% from electrolysis) ts | process | 1,12e-1 g |
| | | Au Plating, Gold | 7,00E-04 | | | GLO: Gold mix (primary, copper and recycling route) ts <t-agg> | process | 7e-4 g |
| | | Contact1, Copper | 2,11E-02 | | | covered by copper above | | |
| | | Contact1, Tin | 1,35E-03 | | | covered by tin above | | |
| | | Contact1, Red phosphorous | 2,25E-05 | | | neglected | | |
| | | BASE, Triphenyl phosphate (TPP) | 1,33E-01 | | | GLO: triphenyl phosphate production ecoinvent 3.5 | process | 1,33e-1 g |
| | | BASE, Carbon black (airborne, unbound particles of respirable size) | 4,60E-03 | | | DE: Carbon black (furnace black; general purpose) ts | process | 4,6e-3 g |
| | | BASE, Glass wool fibers (inhalable and biopersistent) | 9,20E-02 | | | EU-28: Glass wool ts | process | 9,2e-2 g |
| | | Nickel Plating, Nickel (metallic) | 2,30E-03 | | | GLO: Nickel mix ts | process | 2,3e-3 g |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 321-0000-00787 | PCB_8901_FR4-HF_16*31mm_0.500 mm_6 Layer_Selective Gold+O.S.P_GOLD CIRCUIT_8901SUBN-007,North,4in1,1-4-1 | Electronics, PCB, FR4-HF 6 layers | 1,75E+01 | 1 | 4.96cm2 | GLO: Printed Wiring Board 8-layer rigid FR4 with chemSn elecAuNi finish (Subtractive method) ts | process | 8.35e-4 m2 |
| 314-0000-01119 | CON. SPRING CONNECTOR_J9Y802K02308_NA_1 pin_4.0mm_KUNZHON_H=2.0mm | Electronics, Connector, | 4,00E-03 | 1 | | Spring connectors FP3 (314-0000-01119) <LZ> | plan | |
| 600-0000-00038 | Consumable_Solder Paste_SAC305 M8_AIMSOLDER_SAC305 M8 | Solder, SAC305, | 2,00E-01 | 0.2 | | GLO: Solder paste SnAg3Cu0.5 (SAC-Lot) ts | process | 0.2 g |
| 478-890200-006 | STICKER LABEL _Packing Label_8902_Global_PET_10*4mm Black_E-LIN(KUNSHAN) | Label, PET | #NV | 1 | | neglected | | |
| 415-89020-0002 | GASKET_8902_BLACK_PORON_N/A_front camera sponge on holder_HUALONG_with adhesive | PORON Foam + adhesive | #NV | 1 | | neglected | | |
| 415-89010-0028 | FILTER_8901_BLACK_FELT MESH_N/A_8901 mic mesh_HUALONG_N/A | Felt (Mesh) | 7,00E-03 | 1 | 1,78E-01 | DE: Silicone rubber (RTV-2, condensation) ts | process | 1.78e-1 g |
| 415-89010-0029 | HOLDER_8901_BLACK_RUBBER、SILICON RUBBER_N/A_8901 psensor rubber_JUSHUO_N/A | Silicon rubber | 1,71E-01 | 1 | | covered with 415-89010-0028 | | |
| 415-89010-0030 | FILTER_8901_BLACK_FELT MESH_N/A_8901 receiver mesh_HUALONG_N/A | Felt (Mesh) | | 1 | | neglected | | |
| 403-89010-0003 | Lens_8901_BLACK_GLASS_AR Coating_Front camera lens_MINGYONG_N/A | Glass | | 1 | | neglected | | |
| 415-89010-0045 | SHEET_8901_GOLD_COPPER_N/A_north module copper_HUALONG_N/A | Copper (+Gold?) | 1,19E-01 | 1 | | EU-28: Copper sheet (A1-A3) ts | | 0.119 g |

## 8.3.3
## Bottom module

**Table 8-7: Inventory list bottom module**

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 8-8902-00-0012 | PCBA Ass'y_8902_black_South module sub-assy | Module | 1,08E+00 | 1 | | FP3 Bottom Module | Plan | 42.8 g |
| 401-89010-0003 | Front Cabinet_8901_BLACK_PLASTIC+METAL_N/A_South Module Front Cover ASSY_CREATOR_N/A | | 0,00E+00 | 1 | | see processes below | | |
| | Front Cabinet: Plastic part | Plastic, PC | 8,29E-01 | | | covered with 402-89010-0002 | | |
| | Front cabinet: metal shielding | Metal, Steel | 3,84E-01 | | | DE: Stainless Steel slab (X6CrNi17) ts <t-agg> | | 0.384 g |
| 8-8902-00-0003 | Daughter Board_8902_NATURAL_South board | Electronics, PCBA | 1,05E+00 | 1 | | PCBA Bottom Module FP3 | further inputs | |
| 8PCB-8901-0003 | PCB_8901_NON_South board | Electronics, PCB | #NV | 1 | 4.3cm2 | covered with 321-0000-00786 | | |
| 301-G000-01047 | Chip resistor_0.00 Ohm_+50 mohm_1/20 W_0201_2.0mm_N/A | Electronics, Resistor, MLCR thick film | 2,07E-04 | 2 | 0201 | GLO: Resistor thick film flat chip 0201 (0.15mg) ts | process | |
| 302-0214-41043 | Chip Capacitor_15.0 pF_± 5%_NPO (COG)_25 V_0201_0.3 mm_MURATA_GRM0335C1E150J_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | GLO: Capacitor ceramic MLCC 0201 (0.17mg) D 0.6x0.3x0.3 ts | process | |
| 302-0214-41063 | Chip Capacitor_100 pF_± 5%_NPO (COG)_25 V_0201_0.3 mm_2.0mm_MURATA_GRM0335C1E101J_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-01445 | Chip Capacitor_8.00 pF_± 0.10 pF_NPO (COG)_50 V_0201_0.3 mm_MURATA_GRM0335C1H8R0B_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-01579 | Chip Capacitor_3.60 pF_± 0.10 pF_NPO (COG)_50 V_0201_0.3 mm_2.0mm_MURATA_GRM0335C1H3R6B_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-01604 | Chip Capacitor_39.0 pF_± 2.0%_NPO (COG)_50 V_0201_0.3 mm_2.0mm_MURATA_GRM0335C1H390G_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41043 | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 302-1000-01605 | Chip Capacitor_13.0 pF_± 2.0%_NPO (COG)_50 V_0201_0.3 mm_2.0mm_MURATA_GRM0335C1H130G_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-01606 | Chip Capacitor_8.20 pF_± 0.25 pF_NPO (COG)_50 V_0201_0.3 mm_2.0mm_MURATA_GRM0335C1H8R2C_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-1000-01608 | Chip Capacitor_100 nF_± 10%_X5R_35 V_0201_0.3 mm_2.0mm_MURATA_GRM033R6YA104K_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-G000-00023 | Chip Capacitor_1.00 nF_± 10%_X7R_25 V_0201_0.3 mm_2.0mm_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 2 | 0201 | covered with 302-0214-41043 | | |
| 302-G000-00182 | Chip Capacitor_100 nF_± 10%_X5R_10 V_0201_0.3 mm_2.0mm_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 1 | 0201 | covered with 302-0214-41043 | | |
| 302-G000-01475 | Chip Capacitor_220 pF_± 10%_X7R_25 V_0201_0.3 mm_2.0mm_N/A | Electronics, Capacitor, MLCC | 3,30E-04 | 2 | 0201 | covered with 302-0214-41043 | | |
| 302-G000-02041 | Chip Capacitor_1.00 uF_± 10%_X5R_35 V_0603_0.8 mm_4.0mm_N/A | Electronics, Capacitor, MLCC | 6,30E-03 | 1 | 0603 | covered with 302-0214-41043 | | |
| 303-0321-86076 | Chip Inductor_100 nH_± 5%_0402_100 Mhz_0.55 mm_MURATA_LQG15HNR10J02D_N/A | Electronics, Inductor, Multilayer Ceramic Chip Inductor (RF Inductor) | 1,07E-03 | 2 | 0402 | GLO: inductor production, low value multilayer chip ecoinvent 3.5 | process | 1,07E-02 |
| 303-0323-84054 | Chip Wire Wound Inductor_19.0 nH_± 2%_0402_100 Mhz_MURATA_LQW15AN Series | Electronics, Inductor, Ceramic Chip Inductor (RF Inductor) - Wire-Wound Ferrite Core Type | 7,60E-04 | 1 | 0402 | covered with 303-0321-86076 | | |
| 303-1000-01294 | Chip Wire Wound Inductor_160 nH_± 5%_0603_10 Mhz_0.8 mm_4.0mm_MURATA_LQW18CNR16J00D_N/A | Electronics, Inductor, Ceramic Chip Inductor (RF Inductor) - Wire-Wound Non-Magnetic Core Type | 3,80E-03 | 2 | 0603 | covered with 303-0321-86076 | | |
| 303-1000-00091 | Chip Ferrite bead_220 ohm_± 25%_0603_100 Mhz_0.6 mm_4.0mm_TDK_MPZ1608S221AT_DCR<0.05 Ohm,Idc<2A | Electronics, Inductor, Ferrite Bead | 4,63E-03 | 2 | 0603 | covered with 303-0321-86076 | | |
| 303-1000-00928 | Chip Inductor_0.60 nH_± 0.1 nH_0201_500 Mhz_0.3 mm_MURATA_LQP03TG0N6B02D_DCR<0.08,Idc:850 mA | Electronics, Inductor, Ceramic Chip Inductor (RF Inductor) - Film Type | 1,75E-04 | 1 | 0201 | covered with 303-0321-86076 | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size $[cm^2]$ | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 308-0000-00201 | ESD protection_5.0V_IECS0505C040FR_0402_ICT_C=0.4pF | Electronics, transient voltage surpressor diode | 7,80E-04 | 2 | | covered with 308-0000-00321 | | |
| 308-0000-00321 | CHIP BIPOLARTVS_5.0V_ESD5311N-2/TR_DFN_2.0mm_WILLSEMI_Cj<0.4pF | Electronics, transient voltage surpressor diode, 1-Line, Bi-directional, Ultra-low Capacitance | 1,49E-03 | 2 | | GLO: Diode signal SOD123/323/523 (1.59mg) 0.8x0.75x1.6 with Au-Bondwire ts | process | 9 |
| 308-0000-00323 | CHIP BIPOLARTVS_12V_ESD9N12BA-2/TR_DFN_2.0mm_WILLSEMI_Cj<20pF | Electronics, transient voltage surpressor diode | 1,64E-03 | 2 | | covered with 308-0000-00321 | | |
| 308-0000-00328 | CHIP BIPOLARTVS_5.0V_ESD5451R-2/TR_0402_2.0mm_WILLSEMI_Packing:DFP1006-2L | Electronics, transient voltage surpressor diode, 1-Line, Bi-directional, Transient Voltage Suppressors | 0,00E+00 | 2 | | covered with 308-0000-00321 | | |
| 308-0000-00298 | CHIP TVS_26V_PTVS26VZ1USK_SOD-964_2.0mm_NXP_N/A | Electronics, transient voltage surpressor diode | 9,23E-04 | 1 | | covered with 308-0000-00321 | | |
| 311-0000-02413 | I.C ANALOG SWITCH_BGSA14RN10_TSNP_10 Pins_NoMemory_4.0mm_INFINEON_N/A | Electronics, IC | 1,89E-03 | 1 | 8,47E-03 | IC Front-End - FP2<br>IC Back-End - FP2 | process | |
| 312-0000-00094 | MEMS MIC_MSM261D4030Z1CM_64 'dB_- 26dB_± 1.0dB_4*3*1mm_DIGT_BOTTOM_8.0mm_MEMSENSING_N/A | Electronics, metal can LGA package | 3,77E-04 | 1 | 4mm x 3mm x 1mm | GLO: IC WLP CSP 49 (10.2mg) 3.17x3.17x0.55mm CMOS logic (22 nm node) ts | process | 1 piece |
| 314-0000-01119 | CON. SPRING CONNECTOR_J9Y802K02308_NA_1 pin_4.0mm_KUNZHON_H=2.0mm | Electronics, Connector | 4,00E-03 | 1 | | Spring connectors FP3 (314-0000-01119) | plan | 4*0.004 g |
| | | Plating, Gold | 2,00E-05 | | | GLO: Gold mix (primary, copper and recycling route) ts <t-agg> | process | 4*2e-5 g |
| | | Plating, nickel bis(sulfamidate); nickel sulfamate | 8,00E-05 | | | GLO: Nickel mix ts | process | 4*8e-5 |
| | | Spring, Red phosphorous | 4,00E-05 | | | neglected | | |
| | | Spring, Copper | 3,47E-03 | | | GLO: Copper mix (99,999% from electrolysis) ts | process | 4*3.47e-3 |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | Spring, Tin | 3,90E-04 | | | GLO: Tin ts | process | 4*3.9e-4 |
| 314-0000-01025 | CON. SPRING CONNECTOR_J9Y802K00203_NA_1 pin_4.0mm_KUNZHON_C5210,H=1.25mm | Electronics, Connector | 4,00E-03 | 2 | | covered with 314-0000-01119 | | |
| | | Spring, Tin | 3,90E-04 | | | covered with 314-0000-01119 | | |
| | | Spring, Copper | 3,47E-03 | | | covered with 314-0000-01119 | | |
| | | Spring, Red phosphorous | 4,00E-05 | | | covered with 314-0000-01119 | | |
| | | Plating, Gold | 2,00E-05 | | | covered with 314-0000-01119 | | |
| | | Plating, nickel bis(sulfamidate); nickel sulfamate | 8,00E-05 | | | covered with 314-0000-01119 | | |
| 314-0000-01111 | CON. SPRING CONNECTOR_J9Y802K06308_NA_1 pin_4.0mm_KUNZHON_H=2.0mm | Electronics, Connector | 4,00E-03 | 1 | | covered with 314-0000-01119 | | |
| | | Plating, Gold | 2,00E-05 | | | covered with 314-0000-01119 | | |
| | | Plating, nickel bis(sulfamidate); nickel sulfamate | 8,00E-05 | | | covered with 314-0000-01119 | | |
| | | Spring, Tin | 3,90E-04 | | | covered with 314-0000-01119 | | |
| | | Spring, Red phosphorous | 4,00E-05 | | | covered with 314-0000-01119 | | |
| | | Spring, Copper | 3,47E-03 | | | covered with 314-0000-01119 | | |
| 314-0000-01196 | TYPE C CONNECTOR_UC16SM115_0.400 mm_16 pin_12.0mm_ASSEM_N/A | Electronics, Connector | 3,53E-01 | 1 | | USB-C connector | further inputs | 0.353 g |
| | | Shell, Sulfur | 5,70E-05 | | | DE: Stainless Steel slab (X6CrNi17) ts <t-agg> | process | 2e-1 g |
| | | Shell, chromium | 3,42E-02 | | | covered with stainless steel above | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | Shell, manganese | 3,80E-03 | | | covered with stainless steel above | | |
| | | Shell, Iron | 1,35E-01 | | | covered with stainless steel above | | |
| | | Shell, Red phosphorous | 8,55E-05 | | | covered with stainless steel above | | |
| | | Shell, Silicon | 1,90E-03 | | | covered with stainless steel above | | |
| | | Shell, Carbon | 1,52E-04 | | | covered with stainless steel above | | |
| | | Shell, Nickel (metallic) | 1,52E-02 | | | covered with stainless steel above | | |
| | | Mid-Plate, Sulfur | 3,00E-06 | | | covered with stainless steel above | | |
| | | Mid-Plate, Nickel (metallic) | 8,00E-04 | | | covered with stainless steel above | | |
| | | Mid-Plate, Silicon | 1,00E-04 | | | covered with stainless steel above | | |
| | | Mid-Plate, Red phosphorous | 4,50E-06 | | | covered with stainless steel above | | |
| | | Mid-Plate, Iron | 7,08E-03 | | | covered with stainless steel above | | |
| | | Mid-Plate, manganese | 2,00E-04 | | | covered with stainless steel above | | |
| | | Mid-Plate, Carbon | 8,00E-06 | | | covered with stainless steel above | | |
| | | Mid-Plate, chromium | 1,80E-03 | | | covered with stainless steel above | | |
| | | Contact, Copper | 2,27E-02 | | | GLO: Copper mix (99,999% from electrolysis) ts | process | 2.27e-2 g |
| | | Contact, Tin | 6,84E-05 | | | GLO: Tin ts | process | 6.84e-5 g |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm²] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | Contact, Nickel (metallic) | 1,14E-05 | | | GLO: Nickel mix ts | process | 1.14e-5 g |
| | | Contact, Zinc | 2,28E-05 | | | GLO: Special high grade zinc ELCD/IZA | process | 2.28e-5 g |
| | | Contact, Red phosphorous | 1,14E-05 | | | neglected | | |
| | | Shell Plating, Aurate(1-), bis(cyano-.kappa.C)-, potassium (1:1) | 1,00E-03 | | | neglected | | |
| | | Housing, 1,10-decanediamine polymer with 1,4-Benzenedicarboxylic acid | 3,38E-02 | | | covered with glass wool | | |
| | | Housing, Glass wool fibers (inhalable and biopersistent) | 4,13E-02 | | | EU-28: Glass wool ts | process | 1.3e-1 g |
| | | Housing, Additives - Proprietary Data | 3,75E-03 | | | covered with glass wool | | |
| | | Housing, Poly[imino(1,6-dioxo-1,6-hexanediyl)imino-1,6-hexanediyl] | 1,88E-02 | | | covered with glass wool | | |
| | | Housing, Frame retardant - Proprietary Data | 2,75E-02 | | | covered with glass wool | | |
| | | Contact Plating, Aurate(1-), bis(cyano-.kappa.C)-, potassium (1:1) | 4,60E-03 | | | neglected | | |
| 314-0000-01200 | CON. PCB FEMALE CONNECTOR_DF40GB(1.5)-48DS-0.4V(51)_0.400 mm_48 pin_8.0mm_HIROSE_N/A | Electronics, Connector | 8,36E-02 | 1 | | Board-to-board connector FP3 | Plan | 8.36e-2 g |
| | | HOUSING, Talc containing asbestiform fibers | 1,20E-02 | | | EU-28: Talcum powder (filler) ts | process | 1,20E-02 |
| | | HOUSING, Carbon black (airborne, unbound particles of respirable size) | 6,00E-04 | | | DE: Carbon black (furnace black; general purpose) ts | process | 6e-4 g |
| | | HOUSING, Fatty acids, montan-wax, ethylene esters | 2,00E-05 | | | neglected | | |
| | | HOUSING, Wholly aromatic liquid crystal polyester(LCP) | 2,34E-02 | | | DE: Polyester Resin unsaturated (UP) ts | process | 2,34E-02 |
| | | HOUSING, Calcium Stearate | 4,00E-05 | | | neglected | | |
| | | HOUSING, Misc., not to declare | 2,00E-05 | | | neglected | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | HOUSING, Glass wool fibers (inhalable and biopersistent) | 4,00E-03 | | | EU-28: Glass wool ts | process | 4e-3 g |
| | | SHIELD BOARD, Gold | 2,99E-06 | | | GLO: Gold mix (primary, copper and recycling route) ts <t-agg> | process | 5.07e-5 g |
| | | SHIELD BOARD, Cobalt metal powder | 1,50E-05 | | | GLO: Cobalt, refined (metal) CDI | process | 1.52e-5 g |
| | | SHIELD BOARD, Iron | 1,99E-05 | | | DE: Stainless Steel slab (X6CrNi17) ts <t-agg> | process | 4,13E-05 |
| | | SHIELD BOARD, Copper | 1,82E-02 | | | GLO: Copper mix (99,999% from electrolysis) ts | process | 3,78E-02 |
| | | SHIELD BOARD, Nickel (metallic) | 1,12E-03 | | | GLO: Nickel mix ts | process | 2.22e-3 g |
| | | SHIELD BOARD, Zinc | 3,98E-05 | | | GLO: Special high grade zinc ELCD/IZA | process | 8.26e-5 g |
| | | SHIELD BOARD, Lead | 3,98E-06 | | | EU-28: Lead primary and secondary mix ILA <t-agg> | process | 8.26e-5 g |
| | | SHIELD BOARD, Tin | 1,59E-03 | | | GLO: Tin ts | process | 3.3e-3 g |
| | | SHIELD BOARD, Red phosphorous | 3,78E-05 | | | neglected | | |
| | | SHIELD BOARD, Cadmium | 1,99E-07 | | | GLO: Cadmium ts | process | 4.13e-7 g |
| | | SV(B)CONTACT, Cobalt metal powder | 2,40E-07 | | | covered with cobalt above | | |
| | | SV(B)CONTACT, Zinc | 4,28E-05 | | | covered with zinc above | | |
| | | SV(B)CONTACT, Tin | 1,71E-03 | | | covered with tin above | | |
| | | SV(B)CONTACT, Cadmium | 2,14E-07 | | | covered with cadmium above | | |
| | | SV(B)CONTACT, Gold | 4,78E-05 | | | covered with gold above | | |
| | | SV(B)CONTACT, Iron | 2,14E-05 | | | covered with iron above | | |
| | | SV(B)CONTACT, Copper | 1,96E-02 | | | covered with copper above | | |
| | | SV(B)CONTACT, Lead | 4,28E-06 | | | covered with lead above | | |
| | | SV(B)CONTACT, Red phosphorous | 4,07E-05 | | | neglected | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | SV(B)CONTACT, Nickel (metallic) | 1,10E-03 | | | covered with nickel above | | |
| 321-0000-00786 | PCB_8901_FR4-HF_24.2*25.4mm_0.500 mm_6 Layer_Selective Gold+O.S.P_GOLD CIRCUIT_8901SUBS-007,South,4in1,1-4-1 | Electronics, PCB, FR4 HF 6 layers | 1,75E+01 | 1 | 6 cm2 | GLO: Printed Wiring Board 8-layer rigid FR4 with chem-elec AuNi finish (Subtractive method) ts | process | 1.01e-3 m3 |
| 326-0000-00320 | Filter Dual Mode_ICMF062P900MFR_100MHz_2.0mm_MODA-INNOCHIPS_Common Mode,4pin,90 Ohm,100mA,0.87x0.67x0.47mm | Electronics, Filter, Ceramic multilayer type SMD component | 1,38E-03 | 1 | | GLO: electronic component production, passive, unspecified ecoinvent 3.5 | process | 0,001376264 |
| 303-1000-01297 | Chip Inductor_6.80 nH_± 3%_0201_500 Mhz_0.4 mm_2.0mm_MURATA_LQP03HQ6N8H02D_N/A | Electronics, Inductor, Ceramic Chip Inductor Film Type (Standard Type) | 2,20E-04 | 1 | 0201 | covered with 303-0321-86076 | | |
| 600-0000-00038 | Consumable_Solder Paste_SAC305 M8_AIMSOLDER_SAC305 M8 | Solder, SAC305 | 2,00E-01 | | | GLO: Solder paste SnAg3Cu0.5 (SAC-Lot) ts | process | 0.2 g |
| 402-89010-0002 | Rear Cabinet_8901_BLACK_PC_N/A_South Module Rear Cover ASSY_CREATOR_N/A | Plastic, PC | 8,88E-01 | 1 | 1,72E+00 | EU-28: Polycarbonate PlasticsEurope | process | 1.72 g |
| 409-00000-0275 | Machine Screw_Flat_TORX_2.5mm_3.0_BLACK_Steel_Plating_H.N.M_N/A | Mechanical, Screw, Steel | 4,20E-02 | 2 | | Asia: Steel Hot Rolled Coil worldsteel | plan/process | 4.2e-2 g per screw |
| 320-0000-00113 | Vibrator Coin Type With Spring Contact_BVM1030H-TH02-U_Φ10.0*3.00mm_Tray_BAOLONG_N/A | Vibration motor | 1,14E+00 | 1 | | Vibration Motor FP3 | plan | 1.14 g |
| | | UPPER MAGNET, dysprosium | 5,60E-03 | | | neglected | process | |
| | | UPPER MAGNET, Copper | 1,92E-03 | | | GLO: Copper mix (99,999% from electrolysis) ts | process | 1.11e-1g |
| | | UPPER MAGNET, boron | 1,96E-03 | | | GLO: boric oxide production ecoinvent | process | 3,56E-03 |
| | | UPPER MAGNET, Neodymium | 5,79E-02 | | | GLO: neodymium oxide to generic market for mischmetal ecoinvent | process | 1.06e-1 g |
| | | UPPER MAGNET, Nickel (metallic) | 2,48E-03 | | | GLO: Nickel mix ts | process | 2,53E-02 |
| | | UPPER MAGNET, Iron | 1,28E-01 | | | GLO: Steel hot rolled coil (ILCD) worldsteel/ELCD | process | 5.45e-1 g |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm²] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | UPPER MAGNET, Aluminium powder | 1,80E-04 | | | EU-28: Aluminium ingot mix ts | process | 3.8e-4 g |
| | | UPPER MAGNET, Gallium | 1,60E-04 | | | GLO: gallium, in Bayer liquor from aluminium production ecoinvent 3.5 | process | 2.6e-4 g |
| | | UPPER MAGNET, Cobalt metal powder | 1,80E-03 | | | GLO: Cobalt, refined (metal) CDI | process | 3.3e-3 g |
| | | SHAFT, Copper | 2,00E-04 | | | covered by copper above | | |
| | | SHAFT, Iron | 2,70E-03 | | | covered by iron above | | |
| | | SHAFT, manganese | 6,00E-04 | | | ZA: Manganese ts | process | 1.2e-3 g |
| | | SHAFT, Nickel (metallic) | 9,00E-04 | | | covered by nickel above | | |
| | | SHAFT, molybdenum | 3,00E-04 | | | RER: molybdenum production ecoinvent 3.5 | process | 3e-4 g |
| | | SHAFT, chromium | 1,30E-03 | | | ZA: Ferro chrome ts | process | 1,30E-03 |
| | | PLASTIC HOLDER, Glass wool fibers (inhalable and biopersistent) | 5,00E-04 | | | EU-28: Glass wool ts | process | 7.5e-3 g |
| | | PLASTIC HOLDER, POLYBUTYRENE TEREPHTHALATE (PBT) | 1,50E-03 | | | DE: Polybutylene Terephthalate Granulate (PBT) ts | process | 2,25E-02 |
| | | CASE UPPER, Nickel (metallic) | 5,81E-03 | | | covered by nickel above | | |
| | | CASE UPPER, manganese | 1,88E-04 | | | covered by manganese above | | |
| | | CASE UPPER, Silicon | 3,13E-05 | | | neglected | | |
| | | CASE UPPER, Sulfur | 1,57E-05 | | | neglected | | |
| | | CASE UPPER, Carbon | 1,57E-05 | | | neglected | | |
| | | CASE UPPER, Iron | 1,56E-01 | | | covered by iron above | | |
| | | CASE UPPER, Copper | 2,49E-03 | | | covered by copper above | | |
| | | CASE UPPER, Red phosphorous | 1,57E-05 | | | neglected | | |
| | | SPRING, Sulfur | 1,00E-06 | | | neglected | | |
| | | SPRING, Red phosphorous | 1,00E-06 | | | neglected | | |
| | | SPRING, Glycine, N-(carboxymethyl)- | 2,00E-06 | | | neglected | | |
| | | SPRING, Silicon | 4,00E-06 | | | neglected | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | SPRING, Copper | 4,00E-06 | | | covered by copper above | | |
| | | SPRING, Carbon | 1,60E-05 | | | neglected | | |
| | | SPRING, confidential | 9,00E-06 | | | neglected | | |
| | | SPRING, Iron | 1,87E-03 | | | covered by iron above | | |
| | | SPRING, manganese | 9,00E-06 | | | covered by manganese above | | |
| | | SPRING, Phosphonic acid, P,P',P''-[nitrilotris(methylene)]tris- | 8,70E-05 | | | neglected | | |
| | | BRUSH, Copper | 6,97E-04 | | | covered by copper above | | |
| | | BRUSH, manganese | 3,00E-06 | | | covered by manganese above | | |
| | | BRUSH, Nickel (metallic) | 2,00E-04 | | | covered by nickel above | | |
| | | BRUSH, Tin | 1,00E-04 | | | GLO: Tin ts | process | 1,53E-03 |
| | | H-PCB, Talc containing asbestiform fibers | 4,00E-05 | | | RER: Epoxy resin PlasticsEurope | process | 4.4e-3 g |
| | | H-PCB, 2,2-bis(acryloyloxymethyl)butyl acrylate\|trimethylolpropane triacrylate | 6,00E-05 | | | covered above | | |
| | | H-PCB, confidential | 4,00E-03 | | | covered above | | |
| | | H-PCB, Solvent naphtha (petroleum), heavy arom.; Kerosine - unspecified | 1,60E-05 | | | covered above | | |
| | | H-PCB, Copper | 3,60E-03 | | | covered with copper above | | |
| | | H-PCB, 2-methyl-1-(4-methylthiophenyl)-2-morpholinopropan-1-one | 1,20E-04 | | | covered above | | |
| | | H-PCB, Pigment Green 7 | 1,60E-04 | | | covered above | | |
| | | H-PCB, Phenol, polymer with formaldehyde, glycidyl ether, acrylate | 4,00E-06 | | | covered above | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | BEARING, confidential | 1,50E-03 | | | neglected | | |
| | | BEARING, Carbon | 2,85E-04 | | | neglected | | |
| | | BEARING, Tin | 1,43E-03 | | | covered by tin above | | |
| | | BEARING, Copper | 1,54E-02 | | | covered by copper above | | |
| | | BEARING, Iron | 1,14E-02 | | | covered by iron above | | |
| | | Ink, butanone\|ethyl methyl ketone | 1,00E-03 | | | neglected | | |
| | | PBT, Glass wool fibers (inhalable and biopersistent) | 7,00E-03 | | | covered by glass wool above | | |
| | | POLYBUTYRENE TEREPHTHALATE (PBT) | 2,10E-02 | | | covered by PBT above | | |
| | | UV GLUE, Alkyl ester | 1,00E-04 | | | EU-28: UV-curing laminating adhesives (estimation) ts | process | 1,10E-02 |
| | | UV GLUE, acrylic acid\|prop-2-enoic acid | 1,00E-04 | | | covered above | | |
| | | UV GLUE, 2-Propenoic acid, 2-methyl-, (1R,2R,4R)-1,7,7-trimethylbicyclo[2.2.1]hept-2-yl ester, rel- | 2,00E-04 | | | covered above | | |
| | | UV GLUE, Photoinitiator | 1,00E-04 | | | covered above | | |
| | | UV GLUE, 2-hydroxyethyl methacrylate | 5,00E-04 | | | covered above | | |
| | | Slide, ACRYLIC ADHESIVE | 4,00E-03 | | | covered above | | |
| | | Slide, Ethene, homopolymer | 6,00E-03 | | | covered above | | |
| | | COIL, Copper | 8,27E-02 | | | covered by copper above | | |
| | | COIL, Polyurethane | 2,13E-03 | | | EU-28: Crystallising Polyurethane adhesive (estimation) ts | process | 2,13E-03 |
| | | COIL, 9,12-Octadecadienoic acid (9Z,12Z)-, dimer, reaction products with triethylenetetramine | 2,13E-03 | | | neglected | | |
| | | CASE LOWER, Sulfur | 6,20E-05 | | | neglected | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | CASE LOWER, Copper | 2,20E-03 | | | covered by copper above | | |
| | | CASE LOWER, Red phosphorous | 5,60E-05 | | | neglected | | |
| | | CASE LOWER, manganese | 4,00E-04 | | | covered by manganese above | | |
| | | CASE LOWER, Carbon | 2,00E-04 | | | neglected | | |
| | | CASE LOWER, Iron | 1,38E-01 | | | covered by iron above | | |
| | | CASE LOWER, Silicon | 2,80E-05 | | | DE: Silicone rubber (RTV-2, condensation) ts | process | 2.8e-5 g |
| | | CASE LOWER, Nickel (metallic) | 5,20E-03 | | | covered by nickel above | | |
| | | Lower Magnet, Iron | 1,07E-01 | | | covered by iron above | | |
| | | Lower Magnet, Nickel (metallic) | 2,10E-03 | | | covered by nickel above | | |
| | | Lower Magnet, Neodymium | 4,83E-02 | | | covered by neodymium above | | |
| | | Lower Magnet, boron | 1,60E-03 | | | covered by boron above | | |
| | | Lower Magnet, Aluminium powder | 2,00E-04 | | | covered by alumium above | | |
| | | Lower Magnet, dysprosium | 4,70E-03 | | | neglected | | |
| | | Lower Magnet, Gallium | 1,00E-04 | | | covered by gallium above | | |
| | | Lower Magnet, Copper | 1,60E-03 | | | covered by copper above | | |
| | | Lower Magnet, Cobalt metal powder | 1,50E-03 | | | covered by cobalt above | | |
| | | F-PCB, 2-Propenenitrile, polymer with 1,3-butadiene, 3-carboxy-1-cyano-1-methylpropyl-terminated | 5,00E-05 | | 0,6 | GLO: Printed Wiring Board 1-layer rigid FR4 with chem-elec AuNi finish (Subtractive method) ts | process | 6e-5 m2 |
| | | F-PCB, Nickel (metallic) | 4,70E-05 | | | covered above | | |
| | | F-PCB, confidential | 1,18E-04 | | | covered above | | |
| | | F-PCB, 1H,3H-Benzo[1,2-c:4,5-c']difuran-1,3,5,7-tetrone, polymer with 4,4'-oxybis[benzenamine] | 6,60E-05 | | | covered above | | |
| | | F-PCB, 3-aminophenol | 1,00E-05 | | | covered above | | |
| | | F-PCB, Gold potassium cyanide (KAu(CN)2) | 3,00E-06 | | | covered above | | |

| Item No | Description | Category, Type, Material | weight [g] | Quantity | size [cm²] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | F-PCB, 4-phenyl-5-tetradecylthiazol-2-amine | 1,00E-05 | | | covered above | | |
| | | F-PCB, Copper | 6,56E-04 | | | covered above | | |
| | | F-PCB, Epichlorohydrin-bisphenol A resin | 4,00E-05 | | | covered above | | |
| | | WEIGHT, Nickel (metallic) | 8,63E-03 | | | covered by nickel above | | |
| | | WEIGHT, Tungsten | 2,79E-01 | | | Tungsten (ProBas) <e-ep> | process | 2.79e-1 g |
| 478-890200-006 | STICKER LABEL _Packing Label_8902_Global_PET_10*4mm Black_E-LIN(KUNSHAN) | Label, PET(?) | #NV | 1 | | neglected | | |
| 415-89010-0048 | GASKET_8901_BLACK_PORON_N/A_vibrator sponge_HUALONG_N/A | PORON Foam | 1,10E-02 | 1 | | DE: Silicone rubber (RTV-2, condensation) ts | process | 1.1e-2 g |
| 415-89010-0047 | HOLDER_8901_BLACK_RUBBER、SILICON RUBBER_N/A_mic rubber_JUSHUO_N/A | Silicon rubber | #NV | 1 | | neglected | | |
| 415-89010-0044 | SHEET_8901_NoColor_ADHESIVE_N/A_vibrator adhesive_HUALONG_N/A | Adhesive | #NV | 1 | | neglected | | |
| 415-89010-0028 | FILTER_8901_BLACK_FELT MESH_N/A_8901 mic mesh_HUALONG_N/A | Felt (Mesh) | #NV | 1 | | neglected | | |

### 8.3.4
### Speaker module

**Table 8-8: Inventory list speaker module**

| Item Number | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi ) |
|---|---|---|---|---|---|---|---|---|
| 313-0000-00353 | SPEAKER MODULE_QT2723-F-1_26.65 * 26.6 mm_7.5 Ohm_91.5dB_CHANG ZHOU YU CHENG_N/A | | 3,03E+00 | 1 | | FP3 Speaker Module | plan | |
| | | FPC-Nickel Gold Plating, Gold | 1,88E-03 | | | GLO: Gold mix (primary, copper and recycling route) ts <t-agg> | process | 1.88e-3 g |
| | | FPC-Nickel Gold Plating, Nickel (metallic) | 7,52E-03 | | | GLO: Nickel mix ts | process | 7.52e-3 g |
| | | Sound film-PMI, 2-Propenamide, N,N'-methylenebis[2-methyl- | 1,60E-03 | | | neglected | | |
| | | Sound film-Peek, Polyetheretherketone | 6,80E-03 | | | neglected | | |
| | | Sound absorbent cotton, Sulfurous acid, sodium salt (1:1), polymer with formaldehyde and 1,3,5-triazine-2,4,6-triamine | 3,00E-04 | | | neglected | | |
| | | Voice coil, Silver | 1,92E-03 | | | GLO: Silver mix ts | process | 1.92e-3 g |
| | | Voice coil, [Name confidential or not available] | 2,41E-03 | | | neglected | | |
| | | Voice coil, Copper | 4,38E-02 | | | GLO: Copper mix (99,999% from electrolysis) ts | process | 5.28e-2 g |
| | | Magnetic Bowl, Sulfur | 3,82E-04 | | | EU-28: Stainless steel sheet (EN15804 A1-A3) ts <t-agg> | process | 1.56g |
| | | Magnetic Bowl, manganese | 6,11E-03 | | | covered by stainless steel above | | |
| | | Magnetic Bowl, Red phosphorous | 3,82E-04 | | | covered by stainless steel above | | |
| | | Magnetic Bowl, Iron | 7,55E-01 | | | covered by stainless steel above | | |
| | | Magnetic Bowl, Carbon | 1,14E-03 | | | covered by stainless steel above | | |
| | | damping-White, Terylene | 3,00E-04 | | | neglected | | |

| Item Number | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi ) |
|---|---|---|---|---|---|---|---|---|
| | | Iron sheet, chromium | 6,34E-02 | | | covered by stainless steel above | | |
| | | Iron sheet, manganese | 5,35E-04 | | | covered by stainless steel above | | |
| | | Iron sheet, Carbon | 1,62E-04 | | | covered by stainless steel above | | |
| | | Iron sheet, Sulfur | 9,73E-05 | | | covered by stainless steel above | | |
| | | Iron sheet, Red phosphorous | 1,23E-04 | | | covered by stainless steel above | | |
| | | Iron sheet, Nickel (metallic) | 3,02E-02 | | | covered by stainless steel above | | |
| | | Iron sheet, Iron | 2,27E-01 | | | covered by stainless steel above | | |
| | | Iron sheet, Silicon | 2,76E-03 | | | covered by stainless steel above | | |
| | | Front /Back cover, Carbonic acid, diphenyl ester, polymer with 4,4'-(1-methylethylidene)bis[phenol] | 9,66E-01 | | | neglected | | |
| | | FPC-copper foil, Copper | 9,03E-03 | | | covered with copper above | | |
| | | FPC-copper foil, 1H,3H-Benzo[1,2-c:4,5-c']difuran-1,3,5,7-tetrone, polymer with 4,4'-oxybis[benzenamine] | 4,37E-03 | | | neglected | | |
| | | Gasket, Aliphatic Hydrocarbon Resin | 1,40E-04 | | | DE: Silicone rubber (RTV-2, condensation) ts | process | 1.61e-2 g |
| | | Gasket, Polyethylene Terephthalate (PET) | 1,24E-02 | | | covered above | | |
| | | Gasket, Cellulose | 2,46E-03 | | | covered above | | |
| | | Gasket, 2-Propenoic acid, 2-methyl-, methyl ester, polymer with butyl 2-propenoate | 1,08E-03 | | | covered above | | |
| | | Frame, Polyphthalamide | 2,87E-02 | | | neglected | | |

| Item Number | Description | Category, Type, Material | weight [g] | Quantity | size [cm²] | GaBi Process | Level | Scale in GaBi ) |
|---|---|---|---|---|---|---|---|---|
| | | Frame, 1,3,5-Triazine-2,4,6(1H,3H,5H)-trione, 1,3,5-tris[[4-(1,1-dimethylethyl)-3-hydroxy-2,6-dimethylphenyl]methyl]- | 1,26E-03 | | | neglected | | |
| | | Frame, 1-Dodecanesulfonyl chloride | 1,01E-03 | | | neglected | | |
| | | Frame, Glass wool fibers (inhalable and biopersistent) | 1,66E-02 | | | EU-28: Glass wool ts | process | 1.66e-2 g |
| | | Frame, Impact Modifier | 2,77E-03 | | | neglected | | |
| | | Plate, Sulfur | 2,34E-04 | | | covered by stainless steel above | | |
| | | Plate, Iron | 4,64E-01 | | | covered with stainless steel above | | |
| | | Plate, Red phosphorous | 2,34E-04 | | | covered with stainless steel above | | |
| | | Plate, manganese | 3,75E-03 | | | covered with stainless steel above | | |
| | | Plate, Carbon | 7,03E-04 | | | covered with stainless steel above | | |
| | | Magnetic steel, Neodymium | 5,24E-02 | | | GLO: neodymium oxide to generic market for mischmetal ecoinvent | process | 5.24e-2 g |
| | | Magnetic steel, Praseodymium | 4,93E-02 | | | CN: Praseodymium ts | process | 4.93e-2 g |
| | | Magnetic steel, dysprosium | 3,40E-03 | | | neglected | | |
| | | Magnetic steel, boron | 3,74E-03 | | | GLO: boric oxide production ecoinvent | process | 3.74e-3 g |
| | | Magnetic steel, Other | 8,16E-03 | | | neglected | | |
| | | Magnetic steel, Iron | 2,23E-01 | | | GLO: Steel hot rolled coil (ILCD) worldsteel/ELCD | process | 2.23e-1 g |
| | | FPC-Tin Ingot, Tin | 1,90E-03 | | | GLO: Tin ts | process | 1.9e-3 g |
| | | Reed, Nickel (metallic) | 6,83E-04 | | | covered by stainless steel above | | |
| | | Reed, manganese | 7,30E-05 | | | covered by stainless steel above | | |

| Item Number | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi ) |
|---|---|---|---|---|---|---|---|---|
| | | Reed, Silicon | 3,65E-05 | | | covered by stainless steel above | | |
| | | Reed, Iron | 5,11E-03 | | | covered by stainless steel above | | |
| | | Reed, Carbon | 5,84E-06 | | | covered by stainless steel above | | |
| | | Reed, Sulfur | 2,19E-06 | | | covered by stainless steel above | | |
| | | Reed, Red phosphorous | 2,92E-06 | | | covered by stainless steel above | | |
| | | Reed, chromium | 1,39E-03 | | | covered by stainless steel above | | |
| | | Sound film-Aluminum foil, Other | 1,08E-02 | | | EU-28: Aluminium foil (2010) European Aluminium <t-agg> | process | 1.08e-2 g |
| | | Sound film-Aluminum foil, Cadmium | 1,08E-06 | | | covered by aluminium foil above | | |
| | | Sound film-Aluminum foil, Arsenic | 1,08E-06 | | | covered by aluminium foil above | | |
| | | Sound film-Aluminum foil, Lead | 1,08E-06 | | | covered by aluminium foil above | | |
| | | FPC-Covering film, Type paper | 1,12E-03 | | | neglected | | |
| | | FPC-Covering film, Oxirane, 2-(chloromethyl)-, homopolymer | 1,60E-04 | | | neglected | | |
| | | FPC-Covering film, 1H,3H-Benzo[1,2-c:4,5-c']difuran-1,3,5,7-tetrone, polymer with 4,4'-oxybis[benzenamine] | 3,20E-04 | | | neglected | | |
| | | damping-Black, DPP(Polyester Fibre) | 3,00E-04 | | | DE: Polyester Resin unsaturated (UP) ts | process | 3e-4 g |

## 8.3.5
## Display Module

Table 8-9: Inventory list display module

| Item Number | Description | Category, Type, Material | weight [g] | Quantity | size [cm²] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 8-8902-00-0014 | LCM Ass'y_8902_BLACK_DISPLAY MODULE SUB-ASS'Y | | 57,162 | 1 | | FP3 Display Module | plan | |
| 401-89010-0001 | Front Cabinet_8901_BLACK_PA+GF_N/A_Display Module housing ASSY_CREATOR_MG+AL+PLASTIC | fiber-reinforced PA | 13,65 | 1 | | EU-28: Polyamide 6.6 fibres (PA 6.6) ts | process | 3,63 |
| 336-0000-00281 | Touch Panel Capacitor Type_98-03057-6598B-I_36*18 channel_5.65 inch_DJN_CG thickness 0.9mm | LCD panel | 42,653 | 1 | | LCD Display - FP3 | plan | 8.19e-3 m2 display area |
| | cover glass | gorilla glass | 28,45 | 1 | | GLO: glass production, for liquid crystal display ecoinvent <e-ep> | process | 28.45 g |
| | flexible board | FPCB | | 1 | 14.94 | GLO: Printed Wiring Board 1-layer rigid FR4 with chem-elec AuNi finish (Subtractive method) ts | process | 1.494e-3 m2 |
| | | IC on flex board (display control chip?) | | | | IC modelling as described in section 3.1.9.3 | | 6mm2 |
| | electrical components on flex board | further components on flex board, MLCC, Diode, Resistor | | | | GLO: Capacitor ceramic MLCC 0603 (6mg) D 1.6x0.8x0.8 ts<br>GLO: Diode signal SOD123/323/523 (9.26mg) 2.4x1.6x1 with Au-Bondwire ts<br>GLO: Resistor flat chip 0603 (1.9mg) ts | process | 1 each |
| | connector on flex board | connector | | 1 | | Connector 40 pin (314-0000-01031) - Display Module FP3 <LZ> | process | 1 piece |
| 415-89010-0013 | CASE_8901_SILVER_STAINLESS STEEL_N/A_LCM Board Shielding_CJR_N/A | Mechanical, Shielding, stainless steel | 2,80E-01 | 1 | | DE: Stainless Steel slab (X6CrNi17) ts <t-agg> | process | 2.8e-1 g |
| 8-8902-00-0005 | Daughter Board_8902_NATURAL_LCM board | Electronics, PCBA | 8,73E-01 | 1 | | PCBA Display Module FP3 | plan | 8.73e-1 g |

| Item Number | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 8PCB-8901-0005 | PCB_8901_NON_LCM board | Electronics, PCB | | 1 | | covered with 321-0000-00789 | | |
| 301-G000-00002 | Chip resistor_1.00 Kohm_± 5%_1/20 W_0201_2.0mm_N/A | Electronics, Resistor, MLCR thick film | 2,07E-04 | 1 | 0201 | GLO: Resistor thick film flat chip 0201 (0.15mg) ts | process | 1 piece |
| 302-0215-41055 | Chip Capacitor_47.0 pF_± 5%_NPO (COG)_50 V_0201_0.3 mm_MURATA_GRM0335C1H470J_T=0.3±0.03 | Electronics, Capacitor, MLCC | 3,30E-04 | 3 | 0201 | GLO: Capacitor ceramic MLCC 0201 (0.17mg) D 0.6x0.3x0.3 ts | process | 5 pieces |
| 302-0225-41055 | Chip Capacitor_47.0 pF_± 5%_NPO (COG)_50 V_0402_0.5 mm_MURATA_GRM1555C1H470J_N/A | Electronics, Capacitor, MLCC | 1,60E-03 | 3 | 0402 | GLO: Capacitor ceramic MLCC 0603 (6mg) D 1.6x0.8x0.8 (Base Metals) ts | process | 6 pieces |
| 302-1000-01696 | Chip Capacitor_68.0 pF_± 5%_NPO (COG)_50 V_0201_0.3 mm_2.0mm_EYANG_C0201C0G680J500NTA_N/A | Electronics, Capacitor, MLCC | 2,50E-04 | 2 | 0201 | covered with 302-0215-41055 | | |
| 302-G000-02034 | Chip Capacitor_1.00 uF_± 10%_X5R_10 V_0402_0.5 mm_2.0mm_N/A | Electronics, Capacitor, MLCC | 1,60E-03 | 3 | 0402 | covered with 302-0225-41055 | | |
| 314-0000-01031 | CON. PCB FEMALE CONNECTOR_BM20B(0.8)-40DS-0.4V(51)_0.400 mm_40 pin_4.0mm_HIROSE_H=0.8mm | Electronics, Connector | 2,68E-02 | 1 | | Connector 40 pin (314-0000-01031) - Display Module FP3 | plan | 2.68e-2 g |
| | | SV REINFORCED METAL FITTINGS, Gold | 3,98E-06 | | | GLO: Gold mix (primary, copper and recycling route) ts <t-agg> | process | 4.38e-5 g |
| | | SV REINFORCED METAL FITTINGS, Iron | 2,64E-07 | | | DE: Stainless Steel slab (X6CrNi17) ts <t-agg> | process | 1.04e-5 g |
| | | SV REINFORCED METAL FITTINGS, Cadmium | 3,91E-05 | | | GLO: Cadmium ts | process | 3.92e-5 g |
| | | SV REINFORCED METAL FITTINGS, Copper | 3,48E-04 | | | GLO: Copper mix (99,999% from electrolysis) ts | process | 9.64e-3 g |
| | | SV REINFORCED METAL FITTINGS, Cobalt metal powder | 2,00E-05 | | | GLO: Cobalt, refined (metal) CDI | process | 2.02e-5 g |
| | | SV REINFORCED METAL FITTINGS, Nickel (metallic) | 2,80E-05 | | | GLO: Nickel mix ts | process | 1.03e-3 g |
| | | SV REINFORCED METAL FITTINGS, Lead | 2,64E-07 | | | EU-28: Lead primary and secondary mix ILA <t-agg> | process | 2.3e-6 g |

| Item Number | Description | Category, Type, Material | weight [g] | Quantity | size [cm²] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | SV REINFORCED METAL FITTINGS, Zinc | 1,79E-04 | | | GLO: Special high grade zinc ELCD/IZA | process | 1.99e-4 g |
| | | SV CONTACT(2), Gold | 3,98E-05 | | | covered by gold above | | |
| | | SV CONTACT(2), Cadmium | 1,02E-07 | | | covered by cadmium above | | |
| | | SV CONTACT(2), Red phosphorous | 1,93E-05 | | | neglected | | |
| | | SV CONTACT(2), Copper | 9,30E-03 | | | covered by copper above | | |
| | | SV CONTACT(2), Zinc | 2,03E-05 | | | covered by zinc above | | |
| | | SV CONTACT(2), Tin | 8,13E-04 | | | GLO: Tin ts | process | 8.13e-4 g |
| | | SV CONTACT(2), Cobalt metal powder | 2,00E-07 | | | covered by cobalt above | | |
| | | SV CONTACT(2), Nickel (metallic) | 1,00E-03 | | | covered by nickel above | | |
| | | SV CONTACT(2), Lead | 2,03E-06 | | | covered by lead above | | |
| | | SV CONTACT(2), Iron | 1,02E-05 | | | covered by iron above | | |
| | | HOUSING, Calcium Stearate | 1,50E-05 | | | neglected | | |
| | | HOUSING, Wholly aromatic liquid crystal polyester(LCP) | 8,77E-03 | | | DE: Polyester Resin unsaturated (UP) ts | process | 8.77e-3 g |
| | | HOUSING, Glass wool fibers (inhalable and biopersistent) | 1,50E-03 | | | EU-28: Glass wool ts | process | 1.5e-3 g |
| | | HOUSING, Carbon black (airborne, unbound particles of respirable size) | 2,25E-04 | | | DE: Carbon black (furnace black; general purpose) ts | process | 2.25e-4 g |
| | | HOUSING, Fatty acids, montan-wax, ethylene esters | 7,50E-06 | | | neglected | | |
| | | HOUSING, Talc containing asbestiform fibers | 4,50E-03 | | | EU-28: Talcum powder (filler) ts | process | 4.5e-3 g |
| 321-0000-00789 | PCB_8901_FR4-HF_49.4*12.4mm_0.500 mm_6 Layer_Selective Gold+O.S.P_GOLD CIRCUIT_8901LB-007,LCM,4in1,1-4-1 | Electronics, PCB, FR4 HF 6 layers | 1,75E+01 | 1 | 6.37cm2 | GLO: Printed Wiring Board 8-layer rigid FR4 with chem-elec AuNi finish (Subtractive method) ts | process | 1.073e-3 m2 |

| Item Number | Description | Category, Type, Material | weight [g] | Quantity | size [cm²] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 326-0000-00320 | Filter Dual Mode_ICMF062P900MFR_100MHz_2.0mm_MODA-INNOCHIPS_Common Mode,4pin,90 Ohm,100mA,0.87x0.67x0.47mm | Electronics, Filter, Ceramic multilayer type SMD component | 1,38E-03 | 5 | | GLO: Filter SAW (25mg) 3x7x1 ts | process | 0,276 pieces |
| 415-89010-0001 | SPRING_8901_SILVER_STAINLESS STEEL_Plating Sn_Shielding Clip 818004173_ECT_N/A | Mechanical, Spring, Stainless steel | 1,41E-02 | 3 | | DE: Stainless Steel slab (X6CrNi17) ts <t-agg> | process | 0.0423 g |
| 600-0000-00038 | Consumable_Solder Paste_SAC305 M8_AIMSOLDER_SAC305 M8 | Solder, SAC305 | 2,00E-01 | | | GLO: Solder paste SnAg3Cu0.5 (SAC-Lot) ts | process | 0.2 g |
| 600-0000-00040 | Consumable_Under Fill Glue_HHD 3605BK_HENKEL LOCTITE_BLACK | PU adhesive | 0,15 | | | DE: Thermoplastic polyurethane (TPU, TPE-U) adhesive ts | process | 0.15 g |
| 478-890200-006 | STICKER LABEL _Packing Label_8902_Global_PET_10*4mm Black_E-LIN(KUNSHAN) | Label, PET (?) | | 1 | | neglected | | |
| 415-89010-0022 | SHEET_8901_BLUE_PET_N/A_Front camera protection film_HUALONG_N/A | PET(?) | | 1 | | neglected | | |

### 8.3.6
### Camera Module

**Table 8-10: Inventory list camera module**

| Item Number | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 8-8902-00-0008 | PCBA Ass'y_8902_BLACK_Rear Camera Module sub-assy | Module | 2,89 | 1 | | FP3 Camera Module | plan | |
| 401-89010-0009 | Front Cabinet_8901_BLACK_PC_N/A_Main cameras module FC_CREATOR_N/A | Plastic, PC | 6,26E-01 | 1 | 1,187 | EU-28: Polycarbonate PlasticsEurope | process | 1.187 g |
| 402-89010-0003 | Rear Cabinet_8901_BLACK_PLASTIC+METAL_N/A_Rear Camera Module Rear Cover ASSY_CREATOR_N/A | PC + steel | 0,693 | 1 | | see below | | |
| | Rear Cabinet plastic part | PC | 0,561 | | | covered with 401-89010-0009 | | |
| | Rear Cabinet Metal shielding | steel | 5,70E-02 | | | DE: Stainless Steel slab (X6CrNi17) ts <t-agg> | process | 5.7e-2 g |
| 335-0000-00289 | CAMERA MODULE CMOS_OGP1722_12M_O-FILM_N/A | Sensor? Camera itself | 8,12E-01 | 1 | | Camera module CMOS (335-0000-00289) - Camera Module FP3 | plan | |
| | | VCM-F-SPRING C19900R, Copper | 6,66E-02 | | | Connectors - Camera module FP3 | plan | |
| | | VCM-F-SPRING C19900R, Titanium | 2,22E-03 | | | Connectors - Camera module FP3 | plan | |
| | | P4-M-121, Polycarbonate resin | 9,40E-03 | | | DE: Polycarbonate Granulate (PC) ts | process | 0,07453 g |
| | | 镜座组件-**支架**, Carbon black (airborne, unbound particles of respirable size) | 7,00E-04 | | | DE: Carbon black (furnace black; general purpose) ts | process | 0,00233 g |
| | | 镜座组件-**支架**, ponlyamide | 3,08E-02 | | | DE: Polyamide 6 Granulate (PA 6) Mix ts | process | 0,0308 g |
| | | 镜座组件-**支架**, Potassium titanium oxide (K2Ti8O17) | 3,50E-03 | | | neglected | | |
| | | LCP 6130GM, Carbon black (airborne, unbound particles of respirable size) | 4,00E-04 | | | covered in carbon black above | | |

| Item Number | Description | Category, Type, Material | weight [g] | Quantity | size [cm²] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | LCP 6130GM, Glass wool fibers (inhalable and biopersistent) | 4,50E-03 | | | EU-28: Glass wool ts | process | 0,0045 g |
| | | LCP 6130GM, Talc containing asbestiform fibers | 4,40E-03 | | | EU-28: Talcum powder (filler) ts | process | 0,02907 g |
| | | LCP 6130GM, LCP resin | 1,99E-02 | | | DE: Polyester Resin unsaturated (UP) ts | process | 0,07593 g |
| | | FPC-化学镍钯金, Palladium | 1,92E-03 | | | GLO: Palladium mix ts | process | 1,92e-3 g |
| | | FPC-化学镍钯金, Nickel (metallic) | 6,72E-03 | | | covered with nickel below | | |
| | | FPC-化学镍钯金, Gold | 9,60E-04 | | | covered with gold below | | |
| | | C5210R, Tin | 3,00E-03 | | | GLO: Tin ts | process | 0,0030199 g |
| | | C5210R, Red phosphorous | 1,00E-04 | | | neglected | | |
| | | C5210R, Copper | 3,54E-02 | | | GLO: Copper mix (99,999% from electrolysis) ts | process | 0,0509084 g |
| | | P4-P5 SPACER-S-030, Acrylic Resin | 1,30E-04 | | | neglected | | |
| | | P4-P5 SPACER-S-030, Polyethylene Terephthalate (PET) | 3,20E-04 | | | EU-28: Polyethylene terephthalate fibres (PET) ts | process | 6,76e-3 g |
| | | P5-M-148, Polycycloolefin Resin | 1,02E-02 | | | neglected | | |
| | | Au, Gold | 4,10E-03 | | | GLO: Gold (primary) ts | process | 5,06e-3 g |
| | | Au, Cobalt metal powder | 1,00E-04 | | | GLO: Cobalt, refined (metal) CDI | process | 0,0001 g |
| | | IC-HD8820, 2(3H)-Furanone, dihydro- | 3,40E-06 | | | neglected | | |
| | | IC-HD8820, Non regulated ingredients | 2,60E-06 | | | neglected | | |
| | | IC-HD8820, 2-methoxy-1-methylethyl acetate | 6,00E-07 | | | neglected | | |
| | | FPC-2UP, Copper | 2,04E-02 | | | covered in copper above | | |
| | | FPC-2UP, 1H,3H-Benzo[1,2-c:4,5-c']difuran-1,3,5,7-tetrone, polymer with 4,4'-oxybis[benzenamine] | 3,60E-03 | | | neglected | | |
| | | BARREL-B-115, Polycarbonate resin | 5,41E-02 | | | covered in PC above | | |

| Item Number | Description | Category, Type, Material | weight [g] | Quantity | size [$cm^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | P1-M-175, Ethylene-tetracyclododecene Copolymer | 1,20E-03 | | | RER: ethylene vinyl acetate copolymer production ecoinvent 3.5 | process | 0,0304 g |
| | | IC-SC40 MU, copper sulphate | 1,30E-06 | | | neglected | | |
| | | IC-SC40 MU, Sulphuric acid | 1,30E-06 | | | neglected | | |
| | | IC-SC40 MU, Water | 6,10E-06 | | | neglected | | |
| | | FPC-S-411W, Flexible board | 3,50E-03 | | 1.8cm2 | GLO: Printed Wiring Board 1-layer rigid FR4 with chem-elec AuNi finish (Subtractive method) ts | process | 1.8e-4 m2 |
| | | P1-M-148, Polycycloolefin Resin | 3,00E-03 | | | neglected | | |
| | | Electrode ZG, Copper | 6,84E-05 | | | covered in copper above | | |
| | | Electrode ZG, Silicon dioxide | 6,08E-06 | | | neglected | | |
| | | Electrode ZG, Diboron trioxide | 1,52E-06 | | | neglected | | |
| | | P2-M-156, Polycarbonate resin | 5,70E-03 | | | covered in PC above | | |
| | | Electrode ZD, Nickel (metallic) | 8,00E-06 | | | GLO: Nickel mix ts | process | 9,84e-3 g |
| | | 镜座组件-油墨, 2-Butoxyethanol | 7,00E-06 | | | neglected | | |
| | | 镜座组件-油墨, Coloring agent | 2,00E-05 | | | neglected | | |
| | | 镜座组件-油墨, 3,5,5-trimethylcyclohex-2-enone\|isophorone | 5,00E-06 | | | neglected | | |
| | | 镜座组件-油墨, Bisphenol A diglycidyl ether (BADGE) | 4,00E-06 | | | neglected | | |
| | | IC-target materials, Copper | 8,00E-07 | | | IC covered with CMOS logic - FP3 | | |
| | | IC-target materials, Titanium | 1,00E-07 | | | IC covered with CMOS logic - FP3 | | |
| | | IC-BS25, Silicon dioxide | 1,47E-05 | | | IC covered with CMOS logic - FP3 | | |
| | | IC-BS25, Acrylic Ester | 5,20E-06 | | | IC covered with CMOS logic - FP3 | | |

| Item Number | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | IC-BS25, Synthetic resign | 1,80E-06 | | | IC covered with CMOS logic - FP3 | | |
| | | Tin plating, Tin | 1,90E-05 | | | covered in tin above | | |
| | | Ni, Nickel (metallic) | 3,10E-03 | | | covered in nickel above | | |
| | | FPC-FH, 1H,3H-Benzo[1,2-c:4,5-c']difuran-1,3,5,7-tetrone, polymer with 4,4'-oxybis[benzenamine] | 4,90E-03 | | | neglected | | |
| | | FPC-FH, Release paper | 1,31E-02 | | | neglected | | |
| | | 镜座组件-膜材, Quartz (SiO2) | 2,00E-05 | | | neglected | | |
| | | 镜座组件-膜材, trititanium pentoxide | 1,00E-05 | | | neglected | | |
| | | VCM-Lens Holder Bobbin E525T LSLOCKY1, Liquid crystal polymers/LCP | 2,40E-02 | | | covered in polyester resin UP above | | |
| | | VCM-Lens Holder Bobbin E525T LSLOCKY1, Copper | 1,54E-02 | | | covered in copper above | | |
| | | VCM-Lens Holder Bobbin E525T LSLOCKY1, Talc containing asbestiform fibers | 9,52E-03 | | | covered in talc above | | |
| | | P5-P6 SPACER1-B-154, Polycarbonate resin | 3,35E-03 | | | covered in PC above | | |
| | | RETAINER-B-101, Polycarbonate resin | 1,98E-03 | | | covered in PC above | | |
| | | Nickel plating, Nickel (metallic) | 7,00E-06 | | | covered in nickel above | | |
| | | 镜座组件-玻璃, aluminium oxide | 5,00E-04 | | | GLO: aluminium oxide production ecoinvent | process | 0,0005 g |
| | | 镜座组件-玻璃, Magnesium fluoride (MgF2) | 1,00E-03 | | | neglected | | |
| | | 镜座组件-玻璃, Aluminium fluoride | 1,00E-03 | | | RER: aluminium fluoride production ecoinvent 3.5 | process | 0,001 g |
| | | 镜座组件-玻璃, Calcium fluoride | 1,00E-03 | | | neglected | | |
| | | 镜座组件-玻璃, Zinc Oxide (Nano) | 5,00E-04 | | | RER: zinc oxide production ecoinvent 3.5 | process | 0,0005 g |

| Item Number | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | 镜座组件-玻璃, barium fluoride | 1,50E-03 | | | neglected | | |
| | | 镜座组件-玻璃, Copper (II) oxide | 1,00E-03 | | | RER: copper oxide production ecoinvent 3.5 | process | 0,001 g |
| | | 镜座组件-玻璃, phosphorus pentoxide | 3,60E-03 | | | neglected | | |
| | | IC-Nickel sulfamate, Water | 4,00E-07 | | | IC covered with CMOS logic - FP3 | | |
| | | IC-Nickel sulfamate, Nickel (metallic) | 1,40E-06 | | | IC covered with CMOS logic - FP3 | | |
| | | P6-M-097, Ethylene-tetracyclododecene Copolymer | 2,19E-02 | | | covered in copolymer above | | |
| | | VCMMAGNET 48H, Misch metal, cerium | 1,73E-02 | | | CN: Cerium ts | process | 0,017348 g |
| | | VCMMAGNET 48H, Iron | 3,93E-02 | | | neglected | | |
| | | VCM-YOKE SPB, Iron | 1,60E-04 | | | neglected | | |
| | | VCM-YOKE SPB, manganese | 1,58E-01 | | | RER: manganese production ecoinvent 3.5 | | 0,15843 g |
| | | VCM-YOKE SPB, Carbon | 2,00E-05 | | | covered in carbon black above | | |
| | | FPC-PP, Flexible board | 4,40E-02 | | | covered with 1 layer PCB above | | |
| | | Ceramics, Barium oxide (BaO) | 1,32E-04 | | | GLO: barium oxide production ecoinvent 3.5 | process | 0,000132 g |
| | | Ceramics, Titanium dioxide (airborne, unbound particles of respirable size) | 6,60E-05 | | | RER: titanium dioxide production, chloride process ecoinvent | process | 0,000066 g |
| | | Ceramics, Misc | 2,20E-05 | | | neglected | | |
| | | P3-M-175, Ethylene-tetracyclododecene Copolymer | 5,80E-03 | | | covered in copolymer above | | |
| | | P5-P6 SPACER2-S-030, Polyethylene Terephthalate (PET) | 2,00E-04 | | | covered in PET above | | |
| | | P5-P6 SPACER2-S-030, Acrylic Resin | 8,00E-05 | | | neglected | | |

| Item Number | Description | Category, Type, Material | weight [g] | Quantity | size [cm²] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | VCM-BOTTOM E525T, Carbon black (airborne, unbound particles of respirable size) | 1,20E-03 | | | covered in carbon black above | | |
| | | VCM-BOTTOM E525T, Liquid crystal polymers/LCP | 3,20E-02 | | | covered in polyester resin UP above | | |
| | | VCM-BOTTOM E525T, Talc containing asbestiform fibers | 1,49E-02 | | | covered in talc above | | |
| | | VCM-B-SPRING C19900R, Copper | 6,71E-02 | | | Connectors - Camera module FP3 | plan | |
| | | VCM-B-SPRING C19900R, Titanium | 2,24E-03 | | | Connectors - Camera module FP3 | plan | |
| | | P3-P4 SPACER-S-030, Polyethylene Terephthalate (PET) | 1,00E-04 | | | covered in PET above | | |
| | | P3-P4 SPACER-S-030, Acrylic Resin | 4,00E-05 | | | neglected | | |
| | | 镜座组件-胶水, Substituted propane derivative | 1,50E-03 | | | neglected | | |
| | | 镜座组件-胶水, 2,2'-[(octahydro-4,7-methano-1H-indenediyl)bis(methyleneoxymethylene)]dioxirane | 7,50E-04 | | | neglected | | |
| | | 镜座组件-胶水, Carbon black (airborne, unbound particles of respirable size) | 1,00E-05 | | | covered in carbon black above | | |
| | | 镜座组件-胶水, Talc containing asbestiform fibers | 2,40E-04 | | | covered in talc above | | |
| | | 镜座组件-胶水, Calcium carbonate | 7,50E-04 | | | EU-28: Calcium carbonate > 63 microns IMA-Europe/ELCD | process | 0,00075 g |
| | | 镜座组件-胶水, Amine adduct | 7,50E-04 | | | neglected | | |
| | | 镜座组件-胶水, Substituted silane | 1,00E-05 | | | neglected | | |

| Item Number | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | 镜座组件-**胶水**, Epoxy resin | 7,50E-04 | | | DE: Epoxy Resin (EP) Mix ts | process | 0,00075 g |
| | | 镜座组件-**胶水**, Siloxanes and Silicones, di-Me, reaction products with silica | 2,40E-04 | | | neglected | | |
| | | FPC-SF-PC6000-U1, Silver | 1,16E-03 | | | GLO: Silver mix ts | process | 1,16e-3 g |
| | | FPC-SF-PC6000-U1, Polyethylene Terephthalate (PET) | 6,04E-03 | | | covered with PET above | | |
| | | P2-P3 SPACER-S-030, Acrylic Resin | 3,00E-05 | | | neglected | | |
| | | P2-P3 SPACER-S-030, Polyethylene Terephthalate (PET) | 1,00E-04 | | | covered in PET above | | |
| | | IC-Silicon, Silicon | 9,00E-04 | | | covered with IC above | | |
| | | IC-Silicon, Aluminium powder | 1,00E-04 | | | covered with IC above | | |
| | | Die, Arsenic | 1,00E-04 | | 0,35714 | CMOS logic - FP3 <LZ> | process | 3.5714e-5 m2 |
| | | Die, Silicon | 9,90E-03 | | | covered with IC above | | |
| | | P1-M-097, Ethylene-tetracyclododecene Copolymer | 1,50E-03 | | | covered in copolymer above | | |
| | | IC-Silver tin plating solution, Organic compound | 1,30E-06 | | | covered with IC above | | |
| | | IC-Silver tin plating solution, Tin | 9,00E-07 | | | covered with IC above | | |
| | | IC-Silver tin plating solution, Alkylsulphonic Acid | 2,20E-06 | | | covered with IC above | | |
| | | IC-Silver tin plating solution, Water | 1,72E-05 | | | covered with IC above | | |
| | | IC-Silver tin plating solution, Silver | 2,00E-07 | | | covered with IC above | | |
| 8-8902-00-0004 | Daughter Board_8902_NATURAL_Camera board | Electronics, PCBA | 3,88E-01 | 1 | | PCBA Camera Module FP3 | plan | 3.88e1 g |
| 8PCB-8901-0004 | PCB_8901_NON_Camera board | Electronics, PCB | #NV | 1 | | covered with 321-0000-00788 | | |
| 301-1000-00402 | Chip NTC_100 Kohm_± 1%_1/10 W_0402_2.0mm_MURATA_N/A | Electronics, Resistor, MLCR thick film | 1,15E-03 | 1 | 0402 | GLO: Resistor thick film flat chip 0402 (0.75mg) ts | process | 1 piece |

| Item Number | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 309-0000-00326 | LED Flash type_ELCH09-NB5060J8K2283910-FDX_WHITE_2pin_SMD2_1000 mA/350 lm_4.0mm_EVERLIGHT_N/A | Electronics, Diode, Flash LED (White) [Zener Diode, LED] | 7,00E-03 | 1 | 2.04x1.64x0.75 (mm) | GLO: LED SMD high-efficiency with lens max 1A (60mg) Au bondwire 3.5x3.5x2.0 ts | process | 1 piece |
| 309-0000-00327 | LED Flash type_ELCH08-NB2025J6J8283910-FDH(ARI)_WHITE_2pin_SMD2_1000mA/250 lm_4.0mm_EVERLIGHT_N/A | Electronics, Diode, Flash LED (White) [Zener Diode, LED] | 7,59E-03 | 1 | 2.04x1.64x0.75 | GLO: LED SMD high-efficiency with lens max 1A (60mg) Au bondwire 3.5x3.5x2.0 ts | process | 1 piece |
| 314-0000-00878 | CON. PCB FEMALE CONNECTOR_BM20B(0.8)-30DS-0.4V(51)_0.400 mm_30 pin_8.0mm_HIROSE_8.48*2.3*0.8mm | Electronics, Connector | 2,10E-02 | 1 | | Connector 30 pin (314-0000-00878) - Camera Module FP3 | plan | 2.1e-2 g |
| | | Ni Plating of SV CONTACT(2), Nickel (metallic) | 4,70E-04 | | | GLO: Nickel mix ts | process | 0.00052 g |
| | | SV REINFORCED METAL FITTINGS, Zinc | 3,36E-04 | | | GLO: Special high grade zinc ELCD/IZA | process | 0.000345 g |
| | | SV REINFORCED METAL FITTINGS, Copper | 6,53E-04 | | | GLO: Copper mix (99,999% from electrolysis) ts | process | 5.02e-3 g |
| | | SV REINFORCED METAL FITTINGS, Lead | 4,94E-07 | | | EU-28: Lead primary and secondary mix ILA <t-agg> | process | ###### |
| | | SV REINFORCED METAL FITTINGS, Cadmium | 7,33E-08 | | | GLO: Cadmium ts | process | 1.21e-7 g |
| | | SV REINFORCED METAL FITTINGS, Iron | 4,95E-07 | | | DE: Stainless Steel slab (X6CrNi17) ts <t-agg> | process | 0.00000527 g |
| | | SV CONTACT(2), Lead | 9,54E-07 | | | covered by lead above | | |
| | | SV CONTACT(2), Tin | 3,82E-04 | | | GLO: Tin ts | process | 0.000382 g |
| | | SV CONTACT(2), Iron | 4,77E-06 | | | covered by iron above | | |
| | | SV CONTACT(2), Red phosphorous | 9,06E-06 | | | neglected | | |
| | | SV CONTACT(2), Zinc | 9,54E-06 | | | covered by zinc above | | |
| | | SV CONTACT(2), Copper | 4,36E-03 | | | covered by copper above | | |
| | | SV CONTACT(2), Cadmium | 4,77E-08 | | | covered by cadmium above | | |

| Item Number | Description | Category, Type, Material | weight [g] | Quantity | size [$cm^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | | Au Plating of SV REINFORCED METAL FITTINGS, Gold | 9,95E-06 | | | GLO: Gold mix (primary, copper and recycling route) ts <t-agg> | process | 2.99e-5 g |
| | | Au Plating of SV REINFORCED METAL FITTINGS, Cobalt metal powder | 5,00E-08 | | | GLO: Cobalt, refined (metal) CDI | process | ###### |
| | | Au Plating of SV CONTACT(2), Cobalt metal powder | 1,00E-07 | | | covered by cobalt above | | |
| | | Au Plating of SV CONTACT(2), Gold | 1,99E-05 | | | covered by gold above | | |
| | | HOUSING, Wholly aromatic liquid crystal polyester(LCP) | 8,57E-03 | | | DE: Polyester Resin unsaturated (UP) ts | process | 8.57e-3 g |
| | | HOUSING, Calcium Stearate | 1,50E-08 | | | neglected | | |
| | | HOUSING, Talc containing asbestiform fibers | 4,40E-03 | | | EU-28: Talcum powder (filler) ts | process | 4.4e-3 g |
| | | HOUSING, Glass wool fibers (inhalable and biopersistent) | 1,47E-03 | | | EU-28: Glass wool ts | process | 1.47e-3 g |
| | | HOUSING, Carbon black (airborne, unbound particles of respirable size) | 2,20E-04 | | | DE: Carbon black (furnace black; general purpose) ts | process | 2.2e-4 g |
| | | Ni Plating of SV REINFORCED METAL FITTINGS, Nickel (metallic) | 5,00E-05 | | | covered by nickel above | | |
| 314-0000-01200 | CON. PCB FEMALE CONNECTOR_DF40GB(1.5)-48DS-0.4V(51)_0.400 mm_48 pin_8.0mm_HIROSE_N/A | Electronics, Connector | 8,36E-02 | 1 | | FP3 Board-to-board connector (as modelled in the bottom module) | plan | |
| 321-0000-00788 | PCB_8901_FR4-HF_16.7*15.3mm_0.500 mm_6 Layer_Selective Gold+O.S.P_GOLD CIRCUIT_8901CB1-007,camera,4in1,1-4-1 | Electronics, PCB, FR4 HF 6 layers | 1,75E+01 | 1 | 2.4 cm2 | GLO: Printed Wiring Board 8-layer rigid FR4 with chem-elec AuNi finish (Subtractive method) ts | process | 4.04e-4 m2 |
| 600-0000-00038 | Consumable_Solder Paste_SAC305 M8_AIMSOLDER_SAC305 M8 | Solder, SAC305 | 2,00E-01 | | | GLO: Solder paste SnAg3Cu0.5 (SAC-Lot) ts | process | 0.2 g |
| 409-00000-0275 | Machine Screw_Flat_TORX_2.5mm_3.0_BLACK_Steel_Plating_H.N.M_N/A | Mechanical, Screw, Steel | 4,20E-02 | 2 | | Screw 2.5mm (409-00000-0275) - FP3 | plan | |

| Item Number | Description | Category, Type, Material | weight [g] | Quantity | size [cm²] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| 478-890200-006 | STICKER LABEL _Packing Label_8902_Global_PET_10*4mm Black_E-LIN(KUNSHAN) | Label, PET(?) | | 1 | | neglected | | |
| 415-89010-0023 | ADHESIVE_8901_NoColor_ADHESIVE_N/A_8901 flash lens adhesive_HUALONG_N/A | Adhesive | | 1 | | neglected | | |
| 415-89010-0024 | GASKET_8901_BLACK_PORON_N/A_Flash lens sponge_HUALONG_N/A | PORON Foam | | 1 | | neglected | | |
| 415-89010-0025 | GASKET_8901_BLACK_PORON_N/A_Main camera sponge_HUALONG_N/A | PORON Foam | | 1 | | neglected | | |
| 415-89010-0026 | DECORATION_8901_BLACK_ALUMINUM_ANODIZING_Camera module deco_RUNER_N/A | Aluminium | 4,07E-01 | 1 | | DE: Aluminium sheet mix ts | process | |
| 403-89010-0002 | Lens_8901_BLACK_GLASS_AR Coating_Main camera lens_KAYMAO_N/A | Glass | | 1 | | | | |
| 415-89020-0001 | LIGHT GUIDE_8902_TRANSPARENT_PMMA_Painting_8902 flash lens_CRERATE_N/A | PMMA | 1,15E-01 | 1 | | DE: Polymethylmethacrylate granulate (PMMA) mix ts | process | 0.115 g |
| 415-89010-0040 | GASKET_8901_BLACK_PORON_N/A_main camera conn spong_HUALONG_N/A | PORON Foam | | 1 | | neglected | | |
| 415-89010-0021 | SHEET_8901_YELLOW_KAPTON_N/A_PCB Kapton_HUALONG_N/A | PCB (Kapton Film) | | 2 | | neglected | | |
| 415-89010-0020 | SHEET_8901_YELLOW_KAPTON_N/A_North Kapton_HUALONG_N/A | Kapton Film | | 1 | | neglected | | |
| 330-0000-00476 | ANTENNA EMBEDDED_8901_NFC Band ( 13.56 MHz)_BLACK_NF-C-F9-R0-006_INPAQ(SUZHOU)_N/A | | | 1 | | neglected | | |

### 8.3.7

### Packaging

**Table 8-11: Inventory list packaging**

| Item Number | Description | Category, Type, Material | weight [g] | Quantity | size [cm$^2$] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
| | Packaging | | | | | FP3 Packaging | Plan | |
| | | | 24,85 | | | Bulk packaging | further input | 24.85 g |
| 481-89010-0007 | Carton_8901_N/A_AB FLUTE_MASTER CARTON_RUN HAO(SUZHOU)_N/A_340*267*190(Inner) | | 474,00 | 0,034 | | see processes below | | |
| | | red ink | 5,00 | | | neglected | | |
| | | paper | 454,00 | | | EU-25: Graphic Paper Euro-graph/ELCD | process | 15.8 g |
| | | black ink | 5,00 | | | neglected | | |
| | | glue | 10,00 | | | neglected | | |
| 481-60110-0002 | Carton_6011_N/A_B FLUTE_PAPER SPACER_RUN HAO(SUZHOU)_N/A_336x263mm | paper | 5,00E+00 | 6,80E-02 | | covered with paper from 481-89010-0007 | | |
| 481-89010-0008 | Carton_8901_N/A_B FLUTE_HONEYCOMB BOARD_RUN HAO(SUZHOU)_N/A_336*263*175mm(85*30) | Cardboard | 2,47E+02 | 0,034 | | EU-28: Corrugated board excl. paper production 2015, open paper input, average composition ts/FEFCO <t-agg> | process | 8.4 g |
| | | | 204,39 | | | Sales Packaging | further input | 204.39 g |
| 479-00000-0148 | Bubble Wrap_3.00mm_PE_CHANGHONG(SUZHOU)_479-00000-0148_1271-2824.2 | Plastic, PE | 6,80 | 1 | | RER: Polyethylene film (PE-LD) PlasticsEurope | process | 6.8 g |
| 478-890100-001 | HANDSET LABEL _Packing Label_8901_Global_ART PAPER LABEL_N/A_E-LIN(KUNSHAN) | | | 1 | | neglected | | |
| 7L-890100-0001 | Label info HANDSET LABEL_8901_Global_LABEL | | | 1 | | neglected | | |
| 478-890100-002 | PROTECTIVE FILM LABEL_Packing Label_8901_Global_PET_N/A_E-LIN(KUNSHAN) | Plastic, PET | 2,292 | 1 | | EU-28: Polyethylene terephthalate fibres (PET) ts | process | 2.292 g |
| | Slide-On Sleeve Packaging | Paper/Cardboard, Cardboard | 15,330 | 1 | | EU-28: Corrugated board excl. paper production 2015, open paper input, average composition ts/FEFCO <t-agg> | process | 174.808 g |
| | Bottom Part Packaging | Paper/Cardboard, Cardboard | 67,315 | 1 | | covered with Slide-On Sleeve Packaging | | |

| Item Number | Description | Category, Type, Material | weight [g] | Quantity | size [cm²] | GaBi Process | Level | Scale in GaBi |
|---|---|---|---|---|---|---|---|---|
|  | Top Part packaging | Paper/Cardboard, Cardboard | 62,893 | 1 |  | covered with Slide-On Sleeve Packaging |  |  |
|  | Packaging inlay | Paper/Cardboard, Cardboard | 14,756 | 1 |  | covered with Slide-On Sleeve Packaging |  |  |
|  | Packaging of manuals | Paper/Cardboard, Cardboard | 14,514 | 1 |  | covered with Slide-On Sleeve Packaging |  |  |
|  | Manuals | Paper/Cardboard, Paper | 20,494 | 2 |  | EU-25: Graphic Paper Euro-graph/ELCD | process | 20,494 g |