3 line IPAD™, EMI filter for SIM card applications

Features

- SIM card EMI low-pass filter
- High efficiency in EMI filtering
- Very low PCB space consumption: 1.7 mm x 1.5 mm
- Very thin package: 0.6 mm max
- High efficiency in ESD suppression on external pins (IEC 61000-4-2 level 4).
- High reliability offered by monolithic integration
- High reduction of parasitic elements through integration and wafer level packaging.
- Lead free package
- Easy layout and flexibility thanks to I/O topology
- Low clamping voltage

Complies with following standards

- IEC 61000-4-2 level 4 external pins
  - 15 kV (air discharge)
  - 8 kV (contact discharge)
- IEC 61000-4-2 level 2 internal pins
  - 2 kV (air discharge)
  - 2 kV (contact discharge)
- MIL STD 883G - Method 3015-7 Class 3A (all pins)

Applications

Where EMI filtering in ESD sensitive equipment is required:

- Keyboard for mobile phones
- Computers and printers
- Communication systems
- MCU boards

Description

The EMIF03-SIM02M8 is a 3 line highly integrated device designed to suppress EMI/RFI noise in all systems exposed to electromagnetic interference.

This filter includes ESD protection circuitry, which prevents damage to the application when subjected to ESD surges up to 15 kV on the external pins.
## Characteristics

### Table 1. Absolute ratings (limiting values at $T_{\text{amb}} = 25$ °C unless otherwise specified)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{PP}$</td>
<td>Internal pins</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ESD discharge IEC 61000-4-2 air discharge</td>
<td>2</td>
<td>kV</td>
</tr>
<tr>
<td></td>
<td>ESD discharge IEC 61000-4-2 contact discharge</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>External pins and $V_{CC}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ESD discharge IEC 61000-4-2 air discharge</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ESD discharge IEC 61000-4-2 contact discharge</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>All pins</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MIL STD 883G - Method 3015-7 Class 3A (human body model)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>$T_{j}$</td>
<td>Junction temperature</td>
<td>125</td>
<td>°C</td>
</tr>
<tr>
<td>$T_{\text{op}}$</td>
<td>Operating temperature range</td>
<td>-40 to + 85</td>
<td>°C</td>
</tr>
<tr>
<td>$T_{\text{stg}}$</td>
<td>Storage temperature range</td>
<td>-55 to +150</td>
<td>°C</td>
</tr>
</tbody>
</table>

### Table 2. Electrical characteristics ($T_{\text{amb}} = 25$ °C)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{BR}$</td>
<td>Breakdown voltage</td>
<td>$I_R = 1$ mA</td>
<td>6</td>
<td></td>
<td>7.9</td>
<td>V</td>
</tr>
<tr>
<td>$I_{RM}$</td>
<td>Leakage current @ $V_{RM}$</td>
<td>$V_{RM} = 3$ V</td>
<td></td>
<td>0.2</td>
<td></td>
<td>μA</td>
</tr>
<tr>
<td>$V_{CL}$</td>
<td>Clamping voltage</td>
<td>$R_1, R_3$ Tolerance ± 20%</td>
<td>100</td>
<td></td>
<td></td>
<td>Ω</td>
</tr>
<tr>
<td>$I_{PP}$</td>
<td>Peak pulse current</td>
<td>$R_2$ Tolerance ± 20%</td>
<td>47</td>
<td></td>
<td></td>
<td>Ω</td>
</tr>
<tr>
<td>$C_{\text{line}}$</td>
<td>Input capacitance per line</td>
<td>$V_R = 0$ V, $F = 1$ MHz, $V_{OSC} = 30$ mV</td>
<td>17</td>
<td>20</td>
<td></td>
<td>pF</td>
</tr>
</tbody>
</table>
Figure 3. S21(db) attenuation (RST line)

Figure 4. S21(db) attenuation (CLK line)

Figure 5. S21(db) attenuation (DATA line)

Figure 6. Analog cross talk measurements

Figure 7. ESD response to IEC 61000-4-2 (+15 kV air discharge) applied to external pin

Figure 8. ESD response to IEC 61000-4-2 (-15 kV air discharge) applied to external pin
2 Application schematic

Figure 11. Application schematic

3 Ordering information scheme

Figure 12. Ordering information scheme

<table>
<thead>
<tr>
<th>EMI Filter</th>
<th>EMIF yy - xxx zz Mx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of lines</td>
<td></td>
</tr>
</tbody>
</table>
| Information | xxx = application  
z = version |
| Package | Mx = Micro QFN x leads |
4 Package information

- Epoxy meets UL94, V0

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a lead-free second level interconnect. The category of second level interconnect is marked on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com.

Table 3. QFN 1.7 x 1.5 package dimensions

<table>
<thead>
<tr>
<th>Ref</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.50 0.55 0.60</td>
</tr>
<tr>
<td>A1</td>
<td>0.00 0.02 0.05</td>
</tr>
<tr>
<td>b</td>
<td>0.15 0.18 0.25</td>
</tr>
<tr>
<td>D</td>
<td>1.70</td>
</tr>
<tr>
<td>D2</td>
<td>0.90 1.00 1.10</td>
</tr>
<tr>
<td>E</td>
<td>1.50</td>
</tr>
<tr>
<td>E2</td>
<td>0.30 0.40 0.50</td>
</tr>
<tr>
<td>e</td>
<td>0.40</td>
</tr>
<tr>
<td>k</td>
<td>0.20</td>
</tr>
<tr>
<td>L</td>
<td>0.25 0.30 0.35</td>
</tr>
</tbody>
</table>

Figure 13. Footprint (dimensions in mm) Figure 14. Marking
Figure 15. Tape and reel specification

Note: Product marking may be rotated by 90° for assembly plant differentiation. In no case should this product marking be used to orient the component for its placement on a PCB. Only pin 1 mark is to be used for this purpose.
5 Recommendation on PCB assembly

5.1 Stencil opening design

1. General recommendation on stencil opening design
   a) Stencil opening dimensions: L (Length), W (Width), T (Thickness).

![Stencil opening dimensions](image)

b) General Design Rule
   - Stencil thickness \( T \) = 75 ~ 125 µm
   - Aspect Ratio \( \frac{W}{T} \geq 1.5 \)
   - Aspect Area \( \frac{L \times W}{2T(L + W)} \geq 0.66 \)

2. Reference design
   a) Stencil opening thickness: 100 µm
   b) Stencil opening for central exposed pad: Opening to footprint ratio is 50%.
      Example: Stencil opening \( L = 680 \, \mu m, \, W = 300 \, \mu m \)
      Footprint (see Figure 13) \( L = 1000 \, \mu m, \, W = 400 \, \mu m \)
   c) Stencil opening for leads: Opening to footprint ratio is 90%.
      Example: Stencil opening \( L = 570 \, \mu m, \, W = 190 \, \mu m \)
      Footprint (see Figure 13) \( L = 600 \, \mu m, \, W = 200 \, \mu m \)

5.2 Solder paste

1. Halide-free flux qualification ROL0 according to ANSI/J-STD-004.
2. “No clean” solder paste is recommended.
3. Offers a high tack force to resist component movement during high speed
4. Solder paste with fine particles: powder particle size is 20-45 µm.
5.3 Placement

1. Manual positioning is not recommended.
2. It is recommended to use the lead recognition capabilities of the placement system, not the outline centering.
3. Standard tolerance of ± 0.05 mm is recommended.
4. 3.5 N placement force is recommended. Too much placement force can lead to squeezed out solder paste and cause solder joints to short. Too low placement force can lead to insufficient contact between package and solder paste that could cause open solder joints or badly centered packages.
5. To improve the package placement accuracy, a bottom side optical control should be performed with a high resolution tool.
6. For assembly, a perfect supporting of the PCB (all the more on flexible PCB) is recommended during solder paste printing, pick and place and reflow soldering by using optimized tools.

5.4 PCB design preference

1. To control the solder paste amount, the closed via is recommended instead of open vias.
2. The position of tracks and open vias in the solder area should be well balanced. The symmetrical layout is recommended, in case any tilt phenomena caused by asymmetrical solder paste amount due to the solder flow away.

5.5 Reflow profile

Figure 17. ST ECOPACK® recommended soldering reflow profile for PCB mounting

![Reflow profile diagram]

Note: Minimize air convection currents in the reflow oven to avoid component movement.
6 Ordering information

Table 4. Ordering information

<table>
<thead>
<tr>
<th>Part number</th>
<th>Marking</th>
<th>Package</th>
<th>Weight</th>
<th>Base qty</th>
<th>Delivery mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMIF03-SIM02M8</td>
<td>HA</td>
<td>Micro QFN</td>
<td>4 mg</td>
<td>3000</td>
<td>Tape and reel (7&quot;)</td>
</tr>
</tbody>
</table>

7 Revision history

Table 5. Document revision history

<table>
<thead>
<tr>
<th>Date</th>
<th>Revision</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>07-Oct-2007</td>
<td>1</td>
<td>Initial release.</td>
</tr>
</tbody>
</table>
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