

2-line IPAD™, EMI filter including ESD protection

Features

- 2-line, low-pass filter + 2-line ESD protection
- High efficiency in EMI filtering
- Lead-free package
- Very low PCB space occupation: $< 2.80 \text{ mm}^2$
- Very thin package: 0.65 mm
- High efficiency in ESD suppression (IEC 61000-4-2 level 4)
- High reliability offered by monolithic integration
- High reduction of parasitic elements through integration and wafer level packaging

Complies with the following standards

- IEC 61000-4-2 level 4 on external pins:
 - 15 kV (air discharge)
 - 8 kV (contact discharge)
- IEC 61000-4-2 level 1 on internal pins:
 - 2 kV (air discharge)
 - 2 kV (contact discharge)

Application

ESD protection and EMI filtering for:

- USB OTG port

Description

The EMIF02-USB03F2 is a highly integrated array designed to suppress EMI / RFI noise for USB OTG (on-the-go) ports.

The EMIF02-USB03F2 Flip-Chip packaging means the package size is equal to the die size.

Additionally, this filter includes ESD protection circuitry which prevents damage to the protected device when subjected to ESD surges up to 15 kV on external contacts.

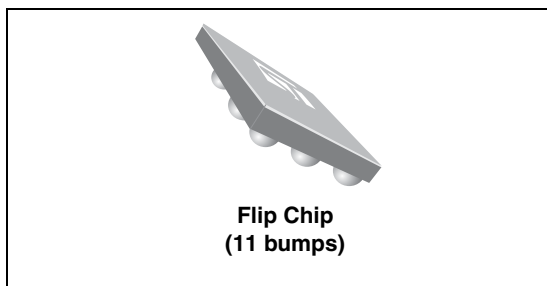


Figure 1. Pin layout (bump side)

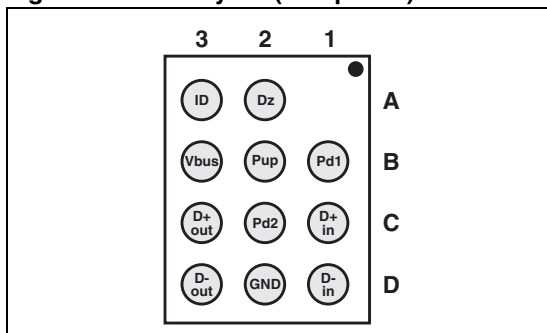
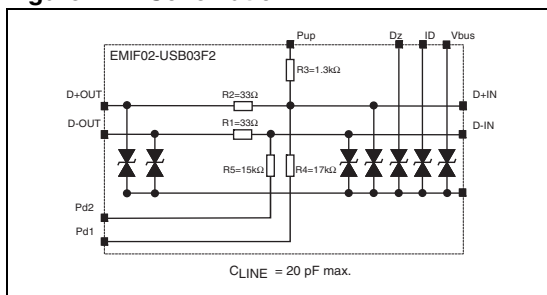


Figure 2. Schematic



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1 Characteristics

Table 1. Absolute ratings ($T_{amb} = 25\text{ }^{\circ}\text{C}$)

| Symbol | Parameter and test conditions | Value | Unit |
|-----------|-----------------------------------------------|------------|--------------------|
| V_{PP} | Internal pins (D3, C3, C2, B2, B1): | | |
| | ESD discharge IEC61000-4-2, air discharge | 2 | |
| | ESD discharge IEC61000-4-2, contact discharge | 2 | |
| | External pins (D1, C1, A2, A3, B3): | | |
| | ESD discharge IEC61000-4-2, air discharge | 15 | |
| | ESD discharge IEC61000-4-2, contact discharge | 8 | |
| T_j | Maximum junction temperature | 125 | $^{\circ}\text{C}$ |
| T_{op} | Operating temperature range | -40 to +85 | $^{\circ}\text{C}$ |
| T_{stg} | Storage temperature range | -55 to 150 | $^{\circ}\text{C}$ |

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

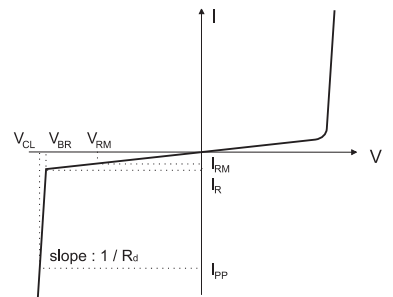
| Symbol | Parameters |  | | | |
|------------|---------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------|-----|---------------|
| V_{BR} | Breakdown voltage | | | | |
| I_{RM} | Leakage current @ V_{RM} | | | | |
| V_{RM} | Stand-off voltage | | | | |
| V_{CL} | Clamping voltage | | | | |
| R_d | Dynamic impedance | | | | |
| I_{PP} | Peak pulse current | | | | |
| C_{LINE} | Input capacitance per line | | | | |
| Symbol | Test conditions | Min | Typ | Max | Unit |
| V_{BR} | $I_R = 1\text{ mA}$ | 14 | | | V |
| I_{RM} | $V_{RM} = 3\text{ V}$ | | | 0.2 | μA |
| C_{LINE} | $V_{LINE} = 0\text{ V}$, $V_{OSC} = 30\text{ mV}$, $F = 1\text{ MHz}$, measured in zero light condition | | | 20 | pF |
| R_1, R_2 | Tolerance $\pm 5\%$ | | 33 | | Ω |
| R_3 | Tolerance $\pm 5\%$ | | 1.30 | | k Ω |
| R_4 | Tolerance $\pm 5\%$ | | 17 | | k Ω |
| R_5 | Tolerance $\pm 5\%$ | | 15 | | k Ω |

Figure 3. Filtering measurement

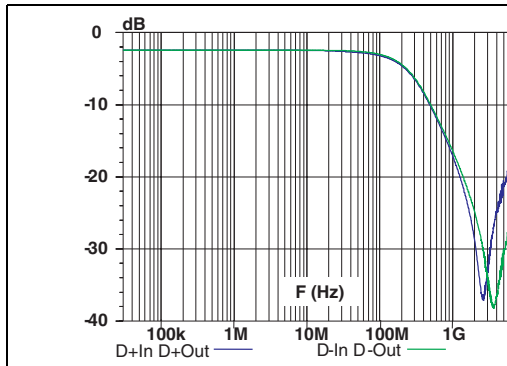


Figure 4. Analog crosstalk measurement

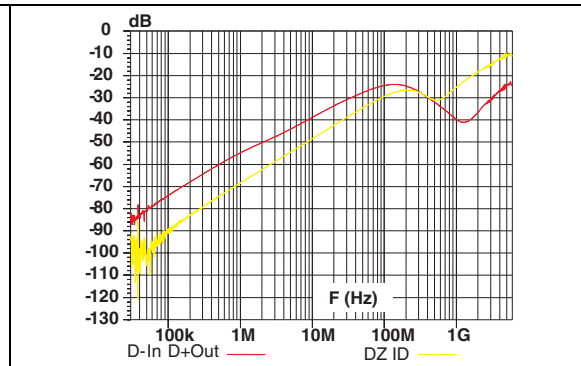
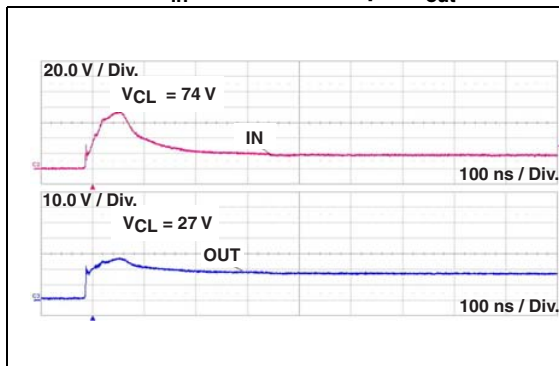
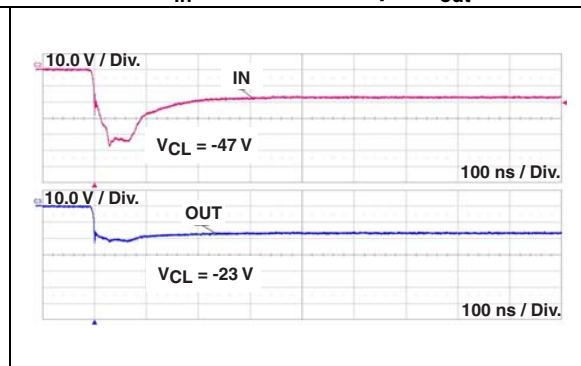
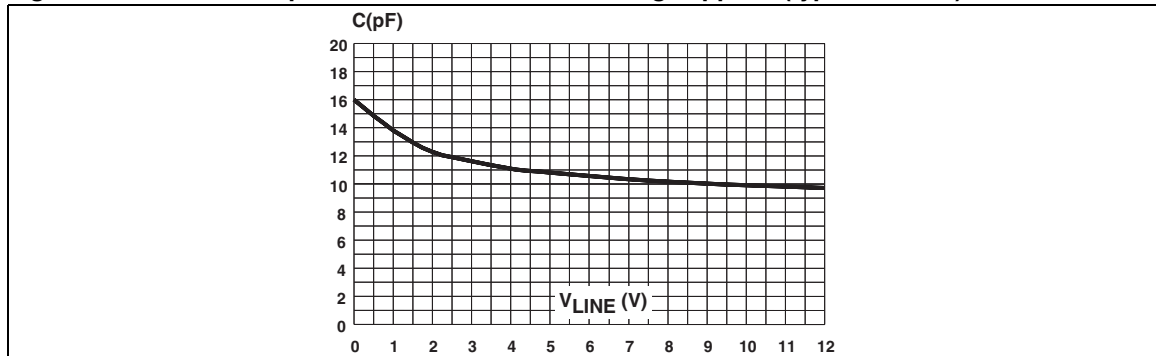
Figure 5. ESD response to IEC 61000-4-2 (+15 kV air discharge) on one input V_{in} and on one output V_{out} Figure 6. ESD response to IEC 61000-4-2 (-15 kV air discharge) on one input V_{in} and on one output V_{out} 

Figure 7. Junction capacitance versus reverse voltage applied (typical values)



2 Application information

Figure 8. Application schematic

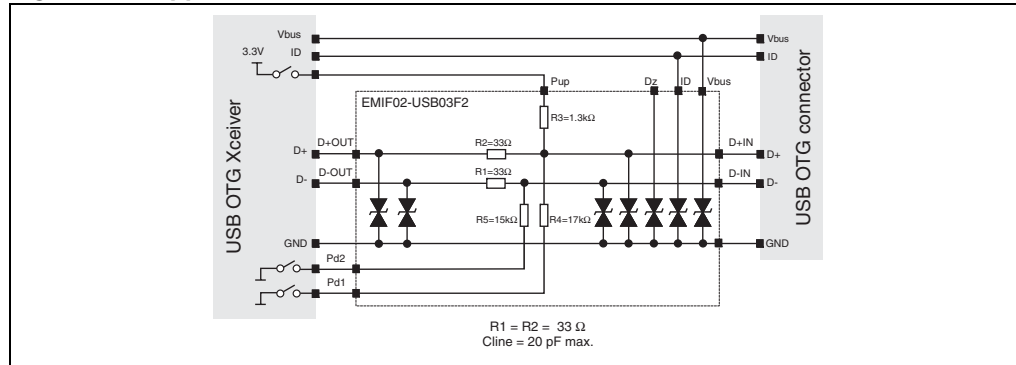


Figure 9. APlac model

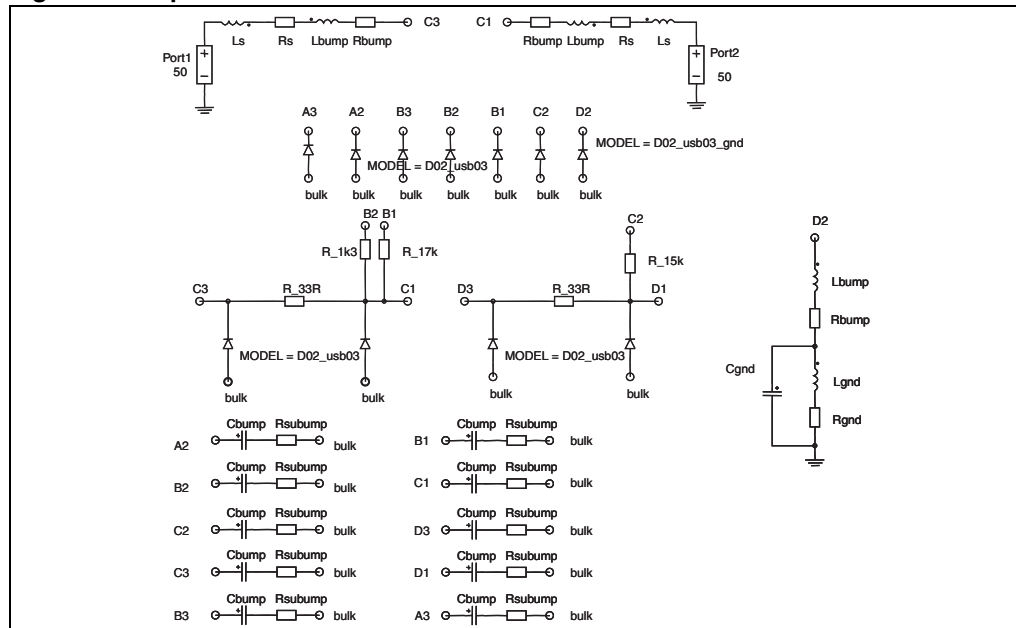
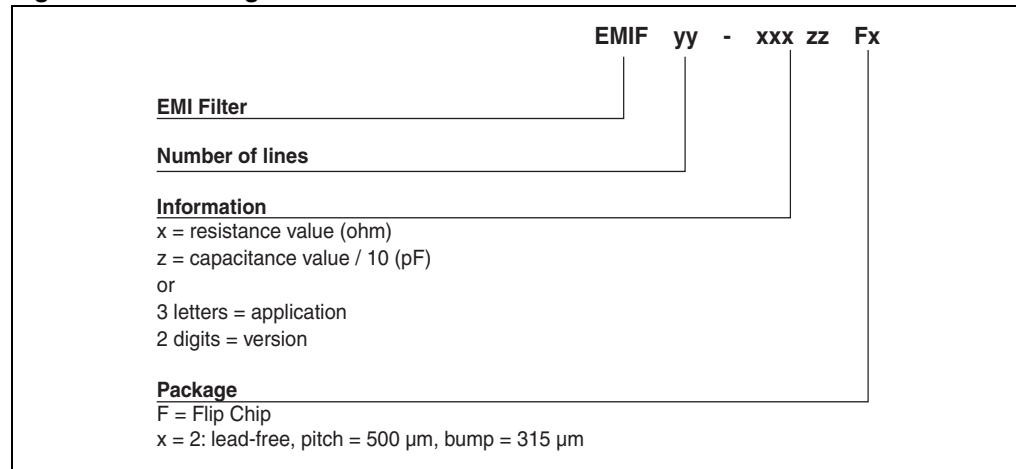


Figure 10. APlac parameters

| | |
|--------------------|------------------|
| Ls 950pH | Rs_usb03_gnd 0.9 |
| Rs 150m | Lgnd 50pH |
| R_33R 33 | Rgnd 100m |
| R_1k3 1.3k | Cgnd 0.15pF |
| R_15k 15k | Lbump 50pH |
| R_17k 17k | Rbump 20m |
| Cz_usb03 11pF | Cbump 2.4pF |
| Rs_usb03 1 | Rsubump 100m |
| Cz_usb03_gnd 220pF | |

3 Ordering information scheme

Figure 11. Ordering information scheme



4 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

Figure 12. Package dimensions

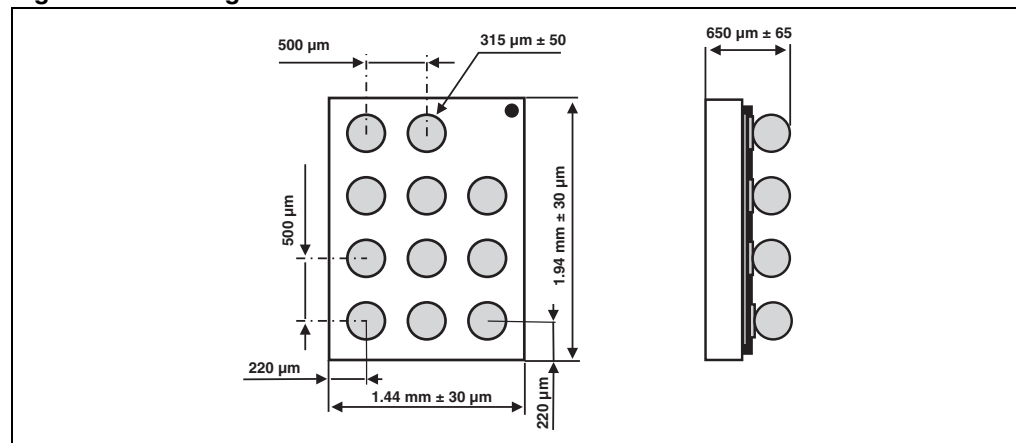


Figure 13. Footprint

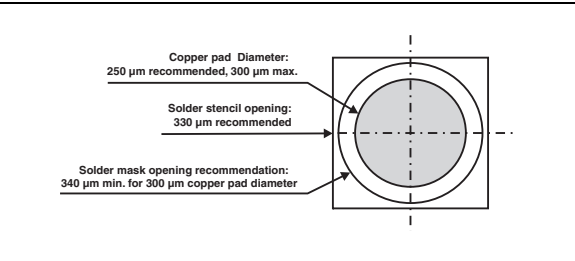


Figure 14. Marking

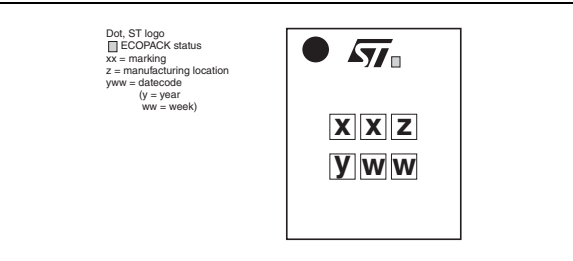
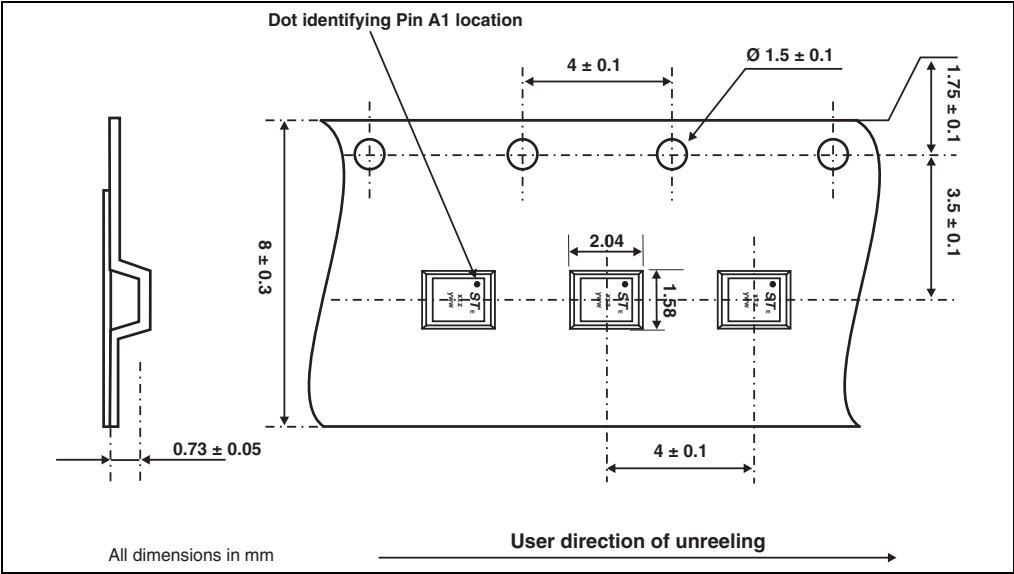


Figure 15. Flip Chip tape and reel specification



Note: More information is available in the application notes:
AN1235: "Flip Chip: Package description and recommendations for use"
AN1751: "EMI filters: Recommendations and measurements"

5 Ordering information

Table 3. Ordering information

| Order code | Marking | Package | Weight | Base qty | Delivery mode |
|----------------|---------|-----------|--------|----------|------------------|
| EMIF02-USB03F2 | FU | Flip Chip | 4 mg | 5000 | Tape and reel 7" |

6 Revision history

Table 4. Document revision history

| Date | Revision | Changes |
|-------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 14-Oct-2004 | 1 | Initial release. |
| 25-Oct-2004 | 2 | Figure 14 .: Flip Chip marking dimensions updated. |
| 27-Oct-2004 | 3 | Minor layout update. No content change. |
| 28-Apr-2008 | 4 | Updated ECOPACK statement. Updated Figure 11 , Figure 12 , Figure 13 , Figure 14 and Figure 15 . Reformatted to current standards. |
| 08-Feb-2010 | 5 | Updated the maximum value of I_{RM} in Table 2 . Updated Figure 12 and Figure 15 for die dimension reductions. |

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