



IPAD™

# EMIF02-USB05F2

## 2 LINES EMI FILTER INCLUDING ESD PROTECTION

### MAIN APPLICATION

When EMI filtering is ESD sensitive equipment is required:

- Mobile phones and communication systems
- Computers, printers and MCU boards

### DESCRIPTION

The EMIF02-USB05F2 is a highly integrated array designed to suppress EMI / RFI noise for USB port filtering.

The EMIF02-05USBF2 Flip-Chip packaging means the package size is equal to the die size. Additionally, this filter includes an ESD protection circuitry which prevents the protected device from destruction when subjected to ESD surges up to 15kV. This device is designed to be fully compatible with all USB standards.

### BENEFITS

- 2 x EMI low-pass filter + 2 lines ESD protected
- 1.5kΩ pull-up included
- High efficiency in EMI filtering
- Lead free package
- Very low PCB space consuming:  
1.92mm x 0.92mm
- Very thin package: 0.650mm
- High reliability offered by monolithic integration
- High reducing of parasitic elements through integration and wafer level packaging
- USB 2.0 full speed (12Mbps), OTG compliant

### COMPLIES WITH THE FOLLOWING STANDARDS:

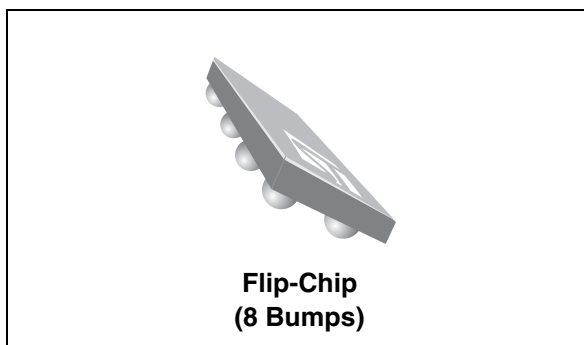
IEC61000-4-2

Level 4

15kV (air discharge)

8kV (contact discharge)

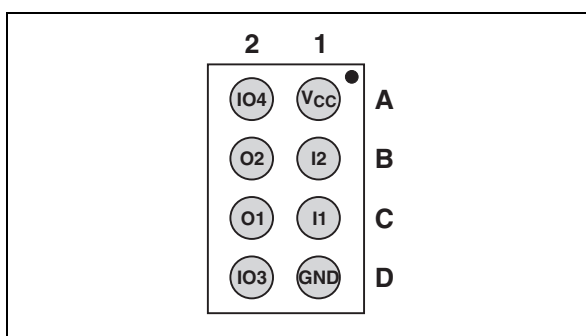
MIL STD 883E - Method 3015-6 Class 3



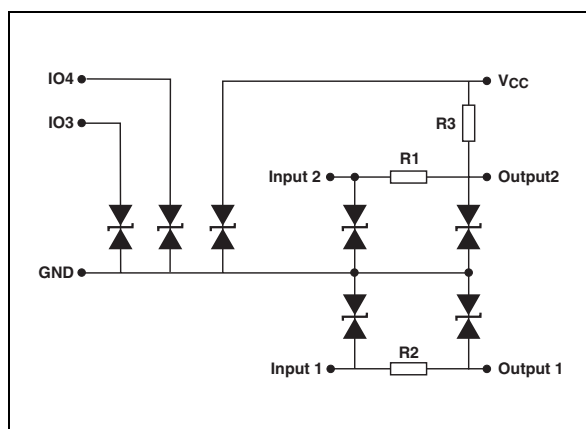
**Table 1: Order Code**

| Part Number    | Marking |
|----------------|---------|
| EMIF02-USB05F2 | GV      |

**Figure 1: Pin Configuration (ball side)**



**Figure 2: Configuration**



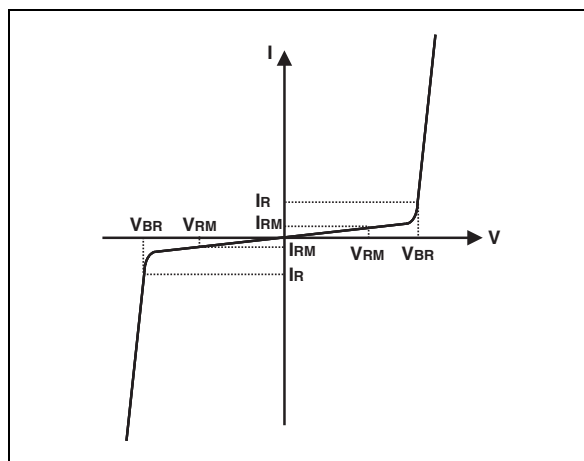
TM: IPAD is a trademark of STMicroelectronics.

**Table 2: Absolute Ratings** (limiting values)

| Symbol    | Parameter and test conditions | Value         | Unit |
|-----------|-------------------------------|---------------|------|
| $T_j$     | Maximum junction temperature  | 125           | °C   |
| $T_{op}$  | Operating temperature range   | - 40 to + 85  | °C   |
| $T_{stg}$ | Storage temperature range     | - 55 to + 150 | °C   |

**Table 3: Electrical Characteristics** ( $T_{amb} = 25^{\circ}\text{C}$ )

| Symbol     | Parameter                  |
|------------|----------------------------|
| $V_{BR}$   | Breakdown voltage          |
| $I_{RM}$   | Leakage current @ $V_{RM}$ |
| $V_{RM}$   | Stand-off voltage          |
| $C_{line}$ | Input capacitance per line |



| Symbol     | Test conditions                 | Tolerance | Min. | Typ. | Max. | Unit             |
|------------|---------------------------------|-----------|------|------|------|------------------|
| $V_{BR}$   | $I_R = 1 \text{ mA}$            |           | 6    |      | 9    | V                |
| $I_{RM}$   | $V_{RM} = 5 \text{ V per line}$ |           |      |      | 1    | $\mu\text{A}$    |
| $R_1, R_2$ | $I = 10 \text{ mA}$             | $\pm 5\%$ |      | 33   |      | $\Omega$         |
| $R_3$      | $I = 1 \text{ mA}$              | $\pm 5\%$ |      | 1.5  |      | $\text{k}\Omega$ |
| $C_{line}$ | @ 0V                            |           |      | 30   |      | pF               |
| Matching   | Serial resistance matching      |           |      | 1    |      | %                |

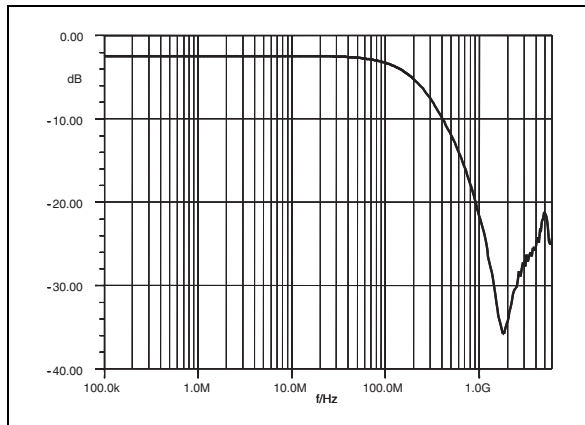
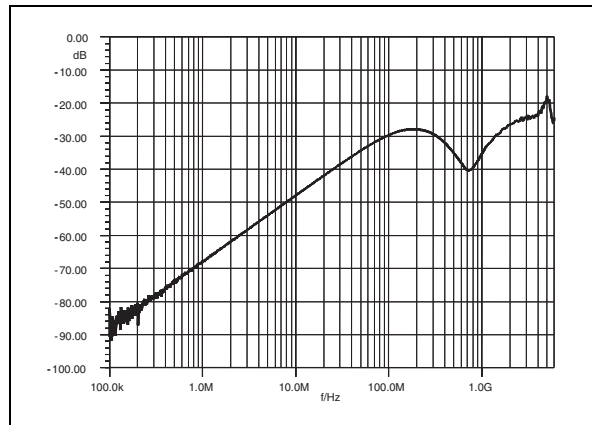
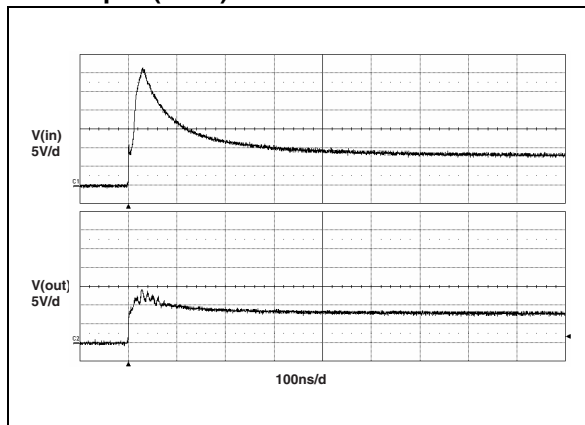
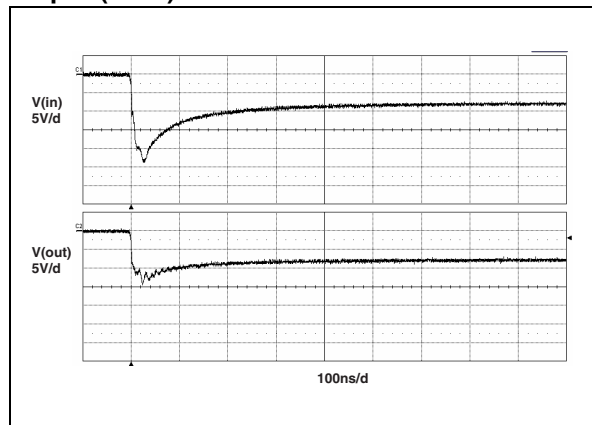
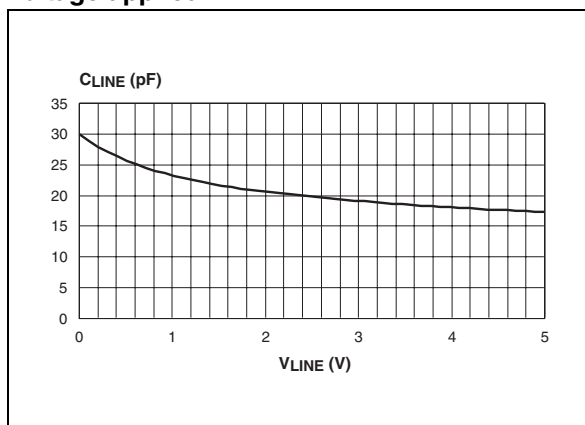
**Figure 3: S21 (dB) attenuation measurement****Figure 4: Analog crosstalk measurements****Figure 5: ESD response to IEC61000-4-2 (+15kV air discharge) on one input V(in) and on one output (Vout)****Figure 6: ESD response to IEC61000-4-2 (-15kV air discharge) on one input V(in) and on one output (Vout)****Figure 7: Junction capacitance versus reverse voltage applied**

Figure 8: Aplac model device structure

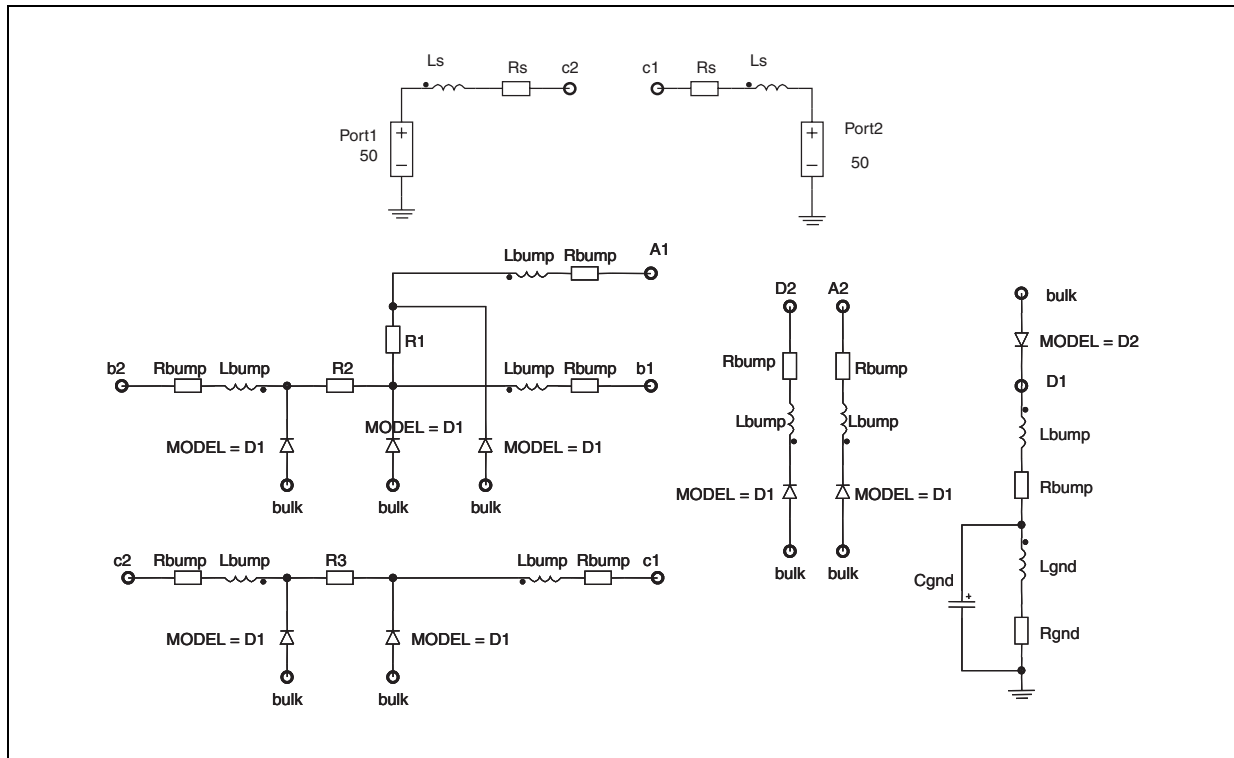


Figure 9: Aplac model parameters

**Variables**

aplacvar Ls 600pH  
 aplacvar Rs 200m  
 aplacvar R2 33  
 aplacvar R3 33  
 aplacvar R1 1.5k  
 aplacvar Cz\_D1 15pF  
 aplacvar Rs\_D1 1  
 aplacvar Cz\_D2 300pF  
 aplacvar Rs\_D2 0.3  
 aplacvar Lgnd 100pH  
 aplacvar Rgnd 100m  
 aplacvar Cgnd 0.4pF  
 aplacvar Lbump 50pH  
 aplacvar Rbump 20m

**Diode D2**

BV=7  
 IBV=1m  
 CJO=Cz\_d2  
 M=0.3333  
 RS=Rs\_d2  
 VJ=0.6  
 TT=100n

**Diode D1**

BV=7  
 IBV=1m  
 CJO=Cz\_d1  
 M=0.3333  
 RS=Rs\_d1  
 VJ=0.6  
 TT=100n

Figure 10: Ordering Information Scheme

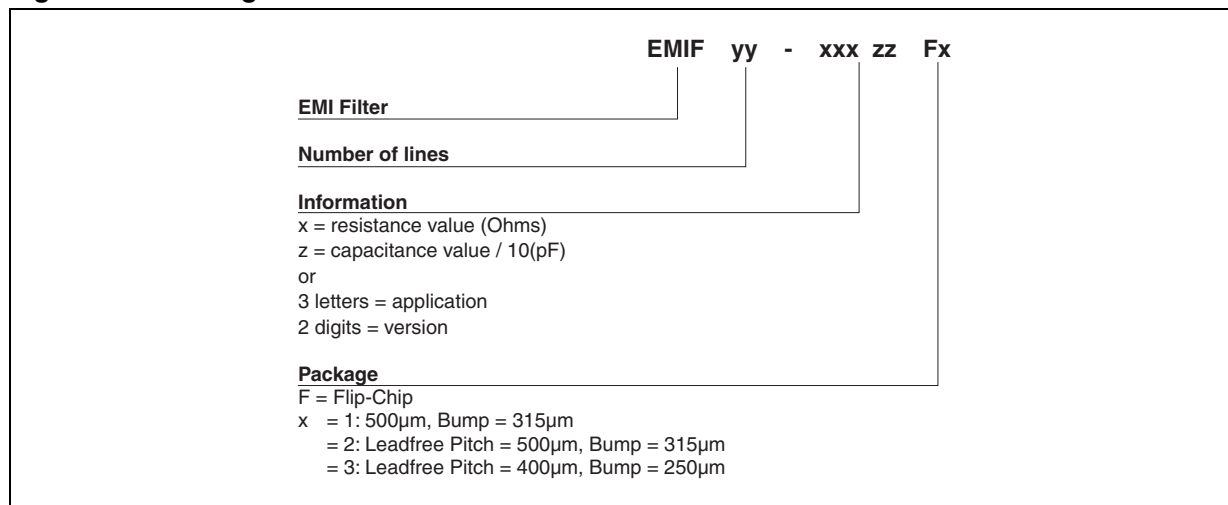


Figure 11: FLIP-CHIP Package Mechanical Data

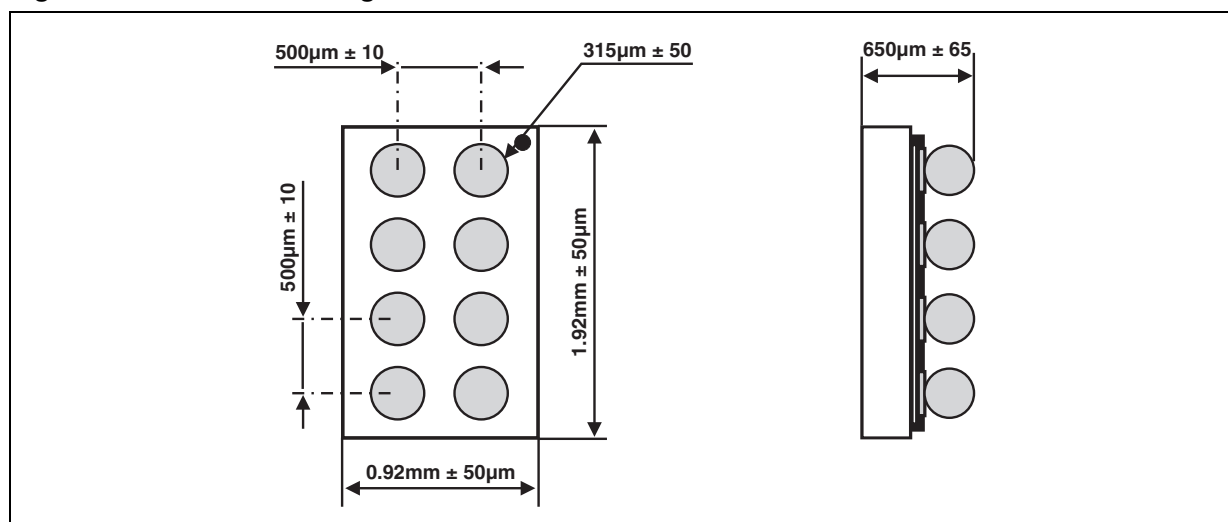


Figure 12: Foot Print Recommendations

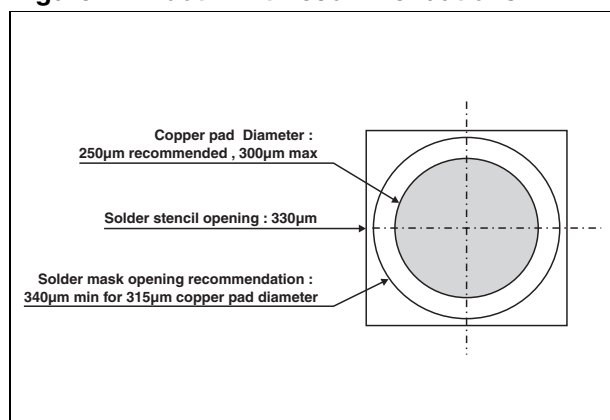


Figure 13: Marking

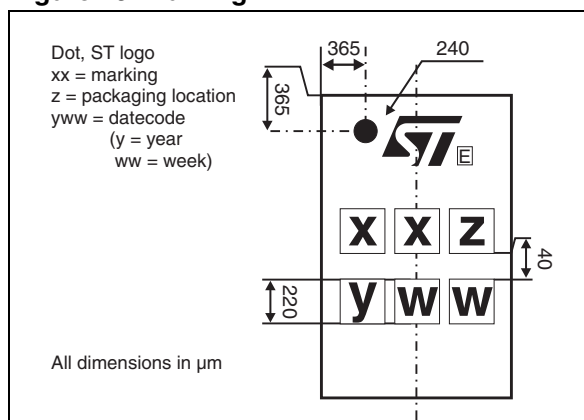


Figure 14: FLIP-CHIP Tape and Reel Specification

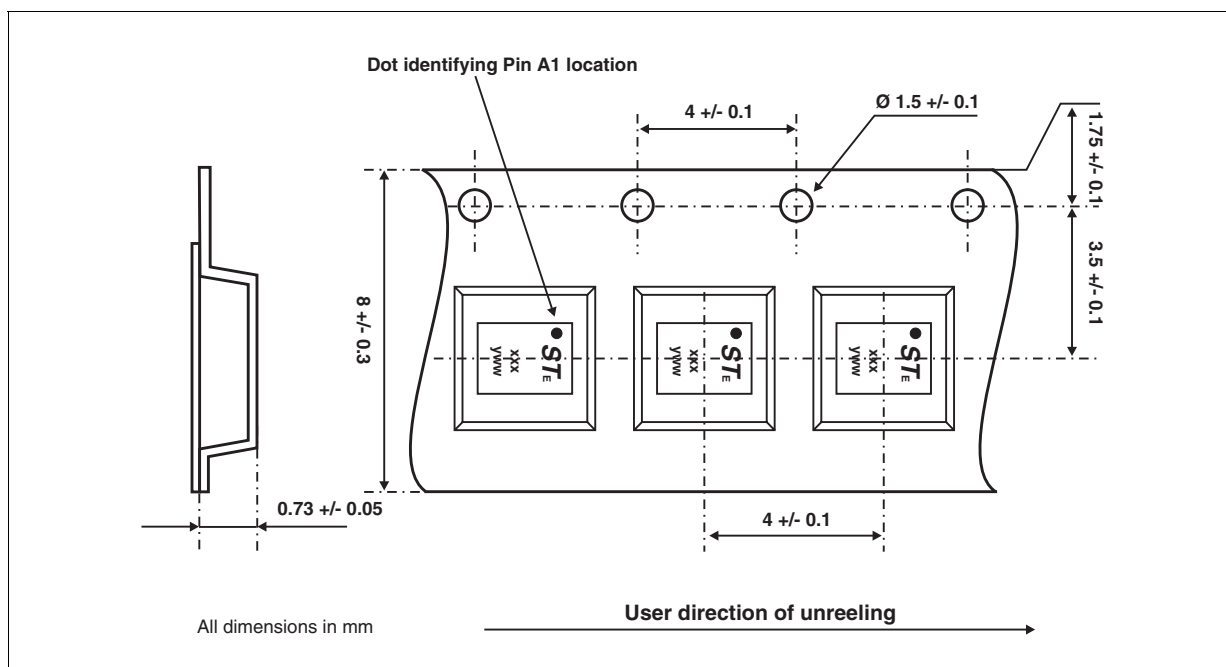


Table 4: Ordering Information

| Ordering code  | Marking | Package   | Weight | Base qty | Delivery mode  |
|----------------|---------|-----------|--------|----------|----------------|
| EMIF02-USB05F2 | GV      | Flip-Chip | 2.3 mg | 5000     | Tape & reel 7" |

**Note:** More packing informations are available in the application note  
 AN1235: "Flip-Chip: Package description and recommendations for use"  
 AN1751: "EMI Filters: Recommendations and measurements"

Table 5: Revision History

| Date        | Revision | Description of Changes |
|-------------|----------|------------------------|
| 07-Feb-2005 | 0C       | First issue.           |

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