



# EMIF02-USB02F2

IPAD™

## EMI FILTER INCLUDING ESD PROTECTION

### MAIN PRODUCT CHARACTERISTICS

EMI filtering and ESD protection for USB port.

### DESCRIPTION

The EMIF02-USB02F2 is a highly integrated array designed to suppress EMI / RFI noise for USB port.

The EMIF02-USB02F2 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 15 kV.

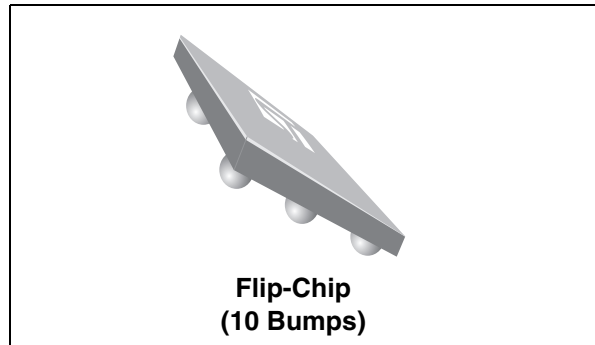
### BENEFITS

- 2 lines low-pass-filter + 2 ESD protection
- High efficiency in EMI filtering
- Lead Free Package
- Very low PCB space consuming < 3.2 mm<sup>2</sup>
- Very thin package: 0.65 mm
- High efficiency in ESD suppression
- High reliability offered by monolithic integration
- High reducing of parasitic elements through integration & wafer level packaging

### COMPLIES WITH THE FOLLOWING STANDARDS:

**IEC61000-4-2** 15kV (air discharge)  
8kV (contact discharge)

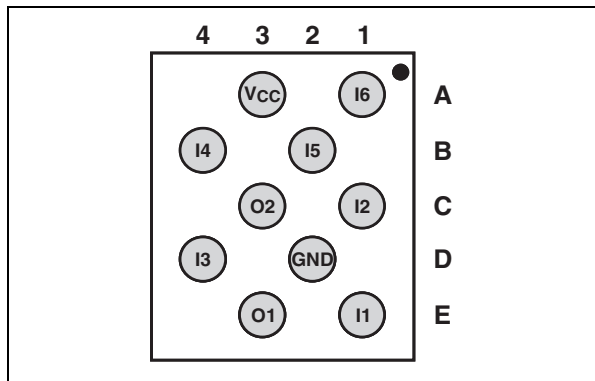
**MIL STD 883E - Method 3015-6 Class 3**



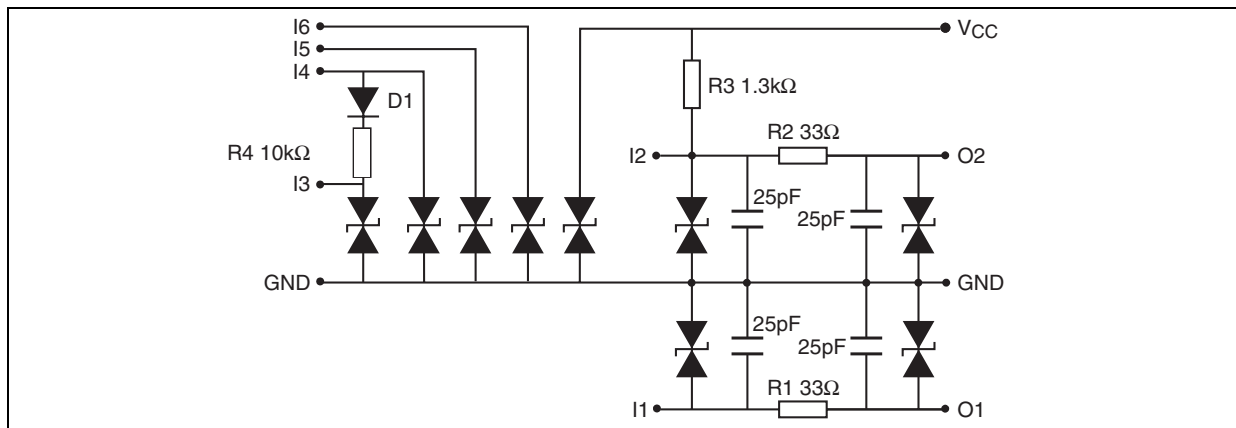
**Table 1: Order Code**

Part Number	Marking
EMIF02-USB02F2	FG

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



**Figure 2: Basic cell configuration**



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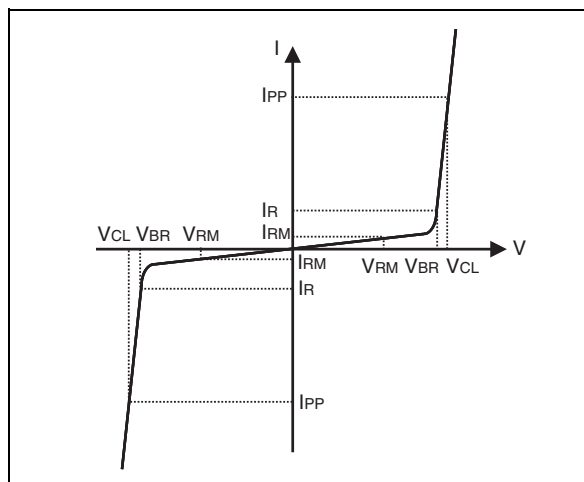
## EMIF02-USB02F2

**Table 2: Absolute Ratings** ( $T_{amb} = 25^{\circ}\text{C}$ )

Symbol	Parameter and test conditions	Value	Unit
$V_{PP}$	ESD discharge IEC61000-4-2, air discharge ESD discharge IEC61000-4-2, contact discharge	15 8	kV
$T_j$	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	$^{\circ}\text{C}$

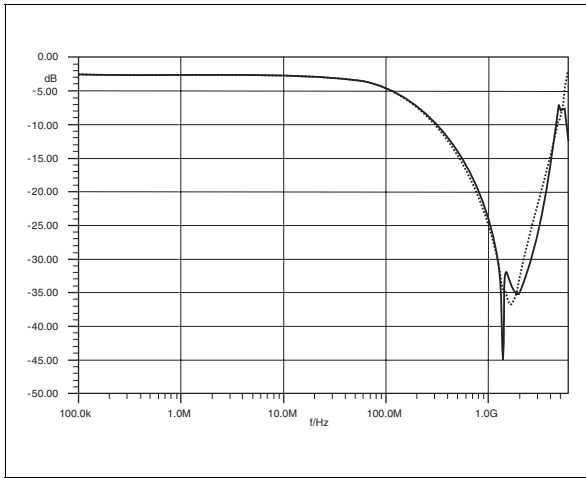
**Table 3: Electrical Characteristics** ( $T_{amb} = 25^{\circ}\text{C}$ )

Symbol	Parameter
$V_{BR}$	Breakdown voltage
$I_{RM}$	Leakage current @ $V_{RM}$
$V_{RM}$	Stand-off voltage
$V_{CL}$	Clamping voltage
$R_d$	Dynamic impedance
$I_{PP}$	Peak pulse current
$R_{I/O}$	Series resistance between Input & Output
$C_{line}$	Input capacitance per line

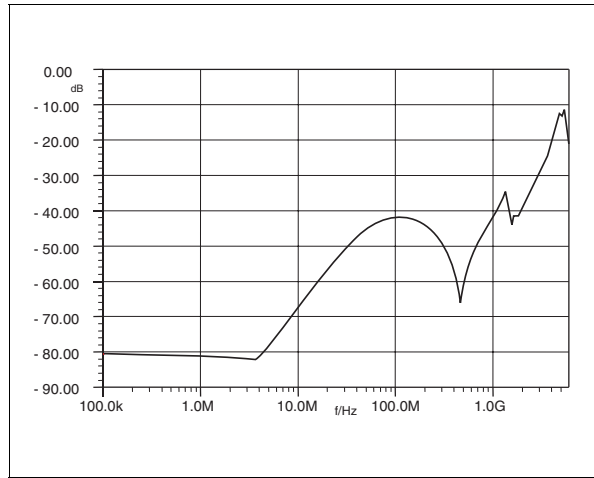


Symbol	Test conditions	Min.	Typ.	Max.	Unit
$V_{BR}$	$I_R = 1 \text{ mA}$	6			V
$I_{RM}$	$V_{RM} = 3\text{V}$		0.1	0.5	$\mu\text{A}$
$C_{line}$	@ 0V			50	pF
$R_1, R_2$	Tolerance $\pm 5\%$		33		$\Omega$
$R_3$	Tolerance $\pm 5\%$		1.3		k $\Omega$
$R_4$	Tolerance $\pm 5\%$		10		k $\Omega$
$V_F$	@ 1 mA (D1 diode)		1		V

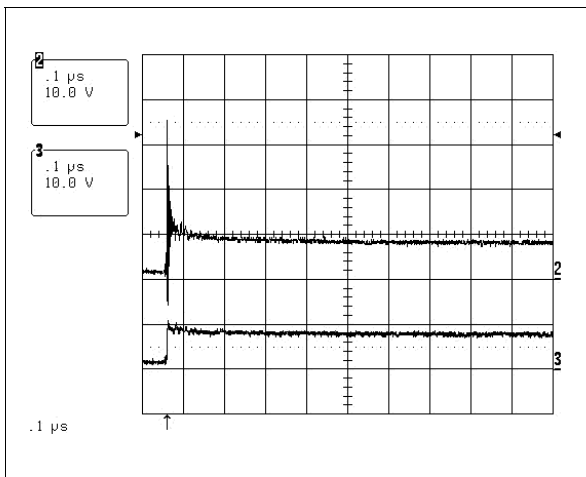
**Figure 3: Attenuation measurement**



**Figure 4: Analog crosstalk measurements (I1- O2)**



**Figure 5: ESD response to IEC61000-4-2 (+15kV contact discharge)**



**Figure 6: Line capacitance versus reverse applied voltage**

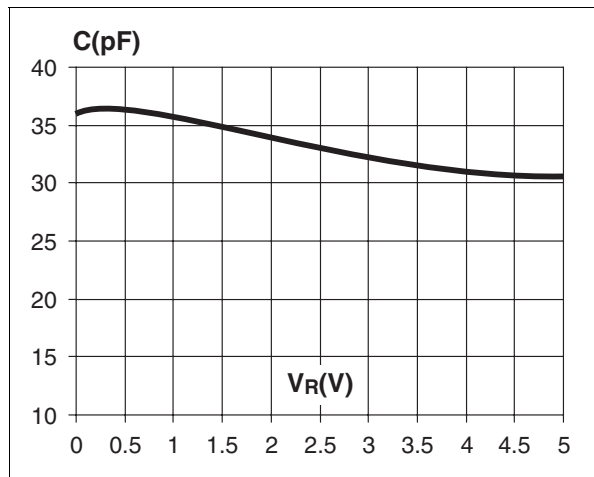


Figure 7: Aplac model of D+ & D- cells

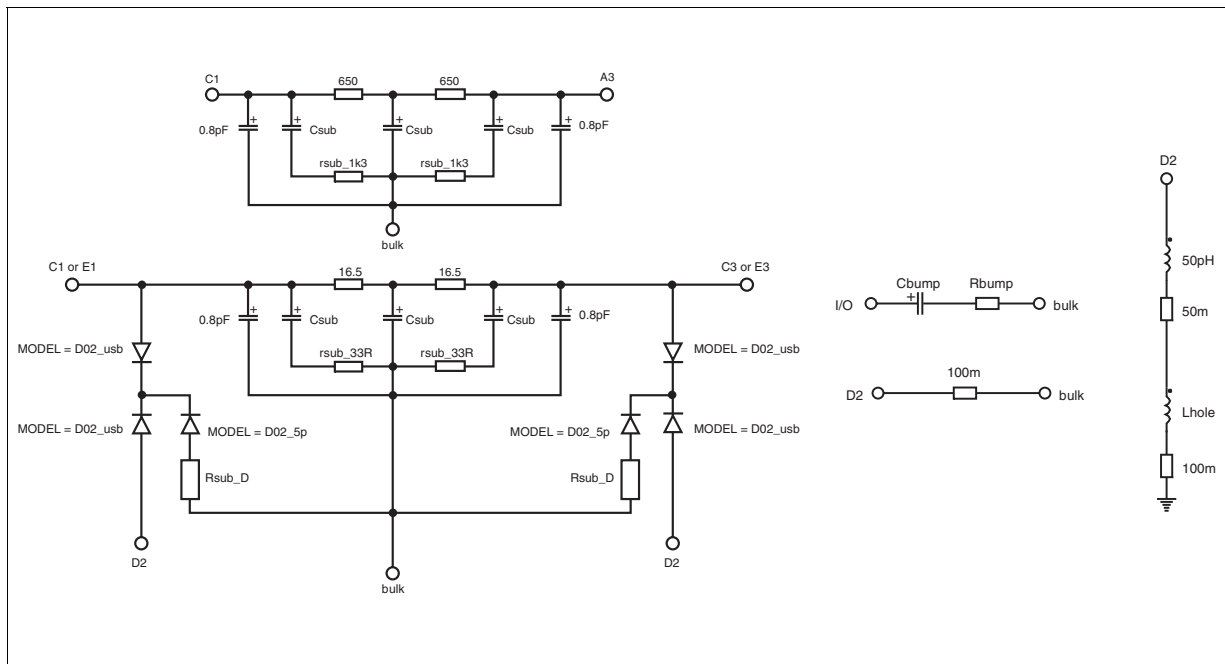


Figure 8: Aplac model parameters

Cz 17pF opt	D02_usb diodes model	D02_5p diodes model
Ls 0.4nH	+ BV = 7	+ BV = 100
Rs 0.1	+ IBV = 1m	+ IBV = 1m
Rsub_D 10	+ CJO = Cz	+ CJO = 5p
Csub 0.3pF	+ M = 0.3333	+ M = 0.3333
Rsub_33R 16	+ RS = 2	+ RS = 2
Rsub_1k3 18	+ VJ = 0.6	+ VJ = 0.6
lhole 170pH opt	+ TT = 100n	+ TT = 100n
Cbump 1.2pF opt		
Rbump 350		

Figure 9: Ordering Information Scheme

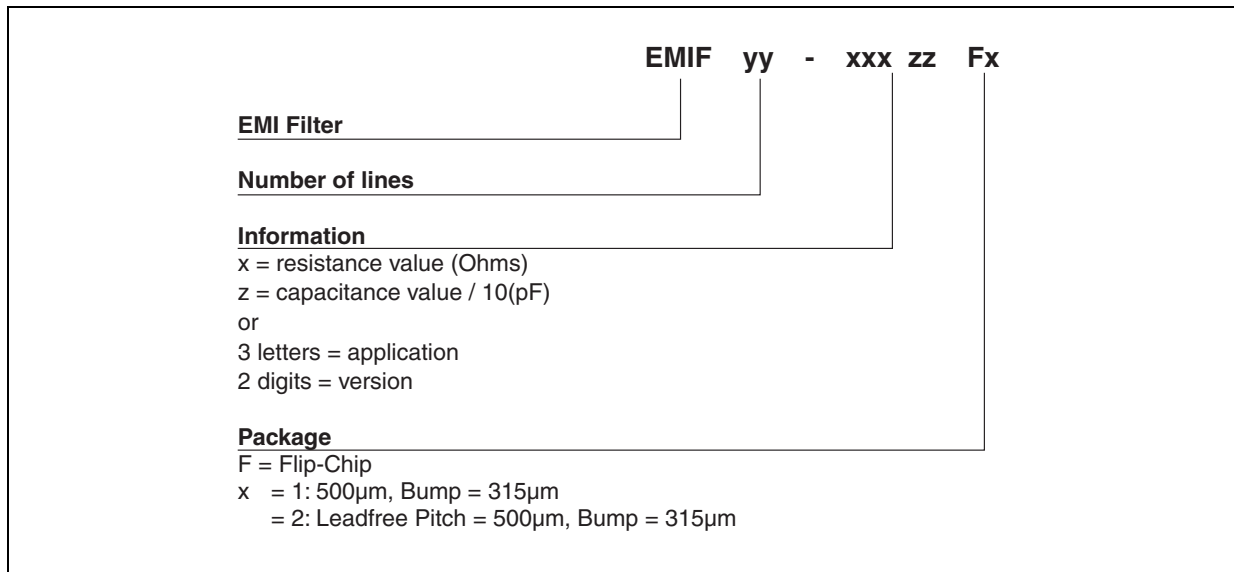


Figure 10: FLIP-CHIP Package Mechanical Data

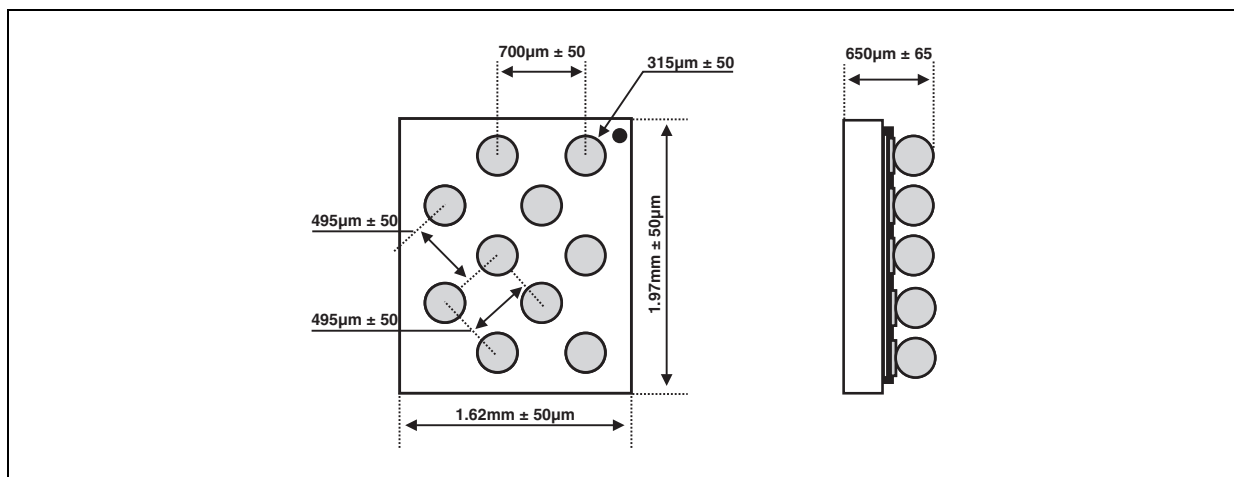


Figure 11: Foot print recommendations

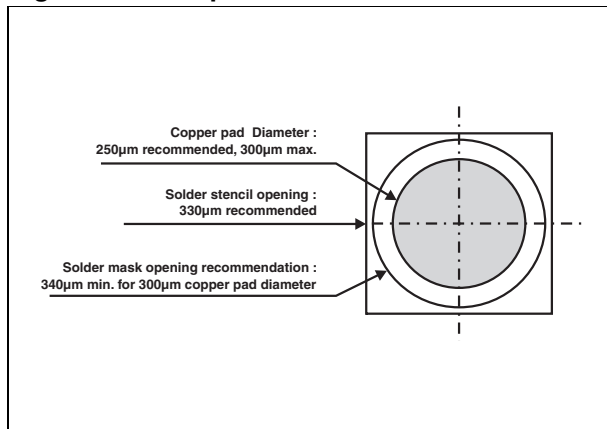


Figure 12: Marking

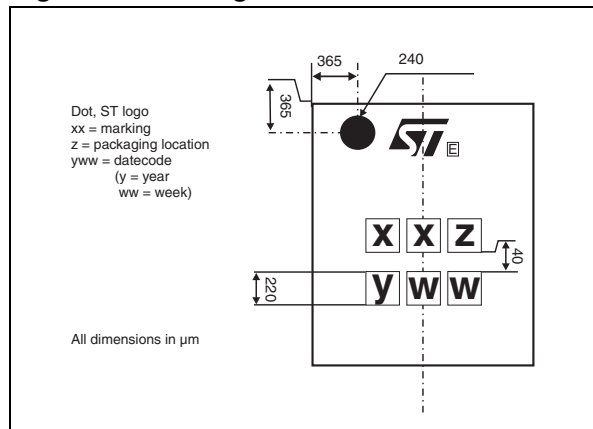


Figure 13: FLIP-CHIP Tape and Reel Specification

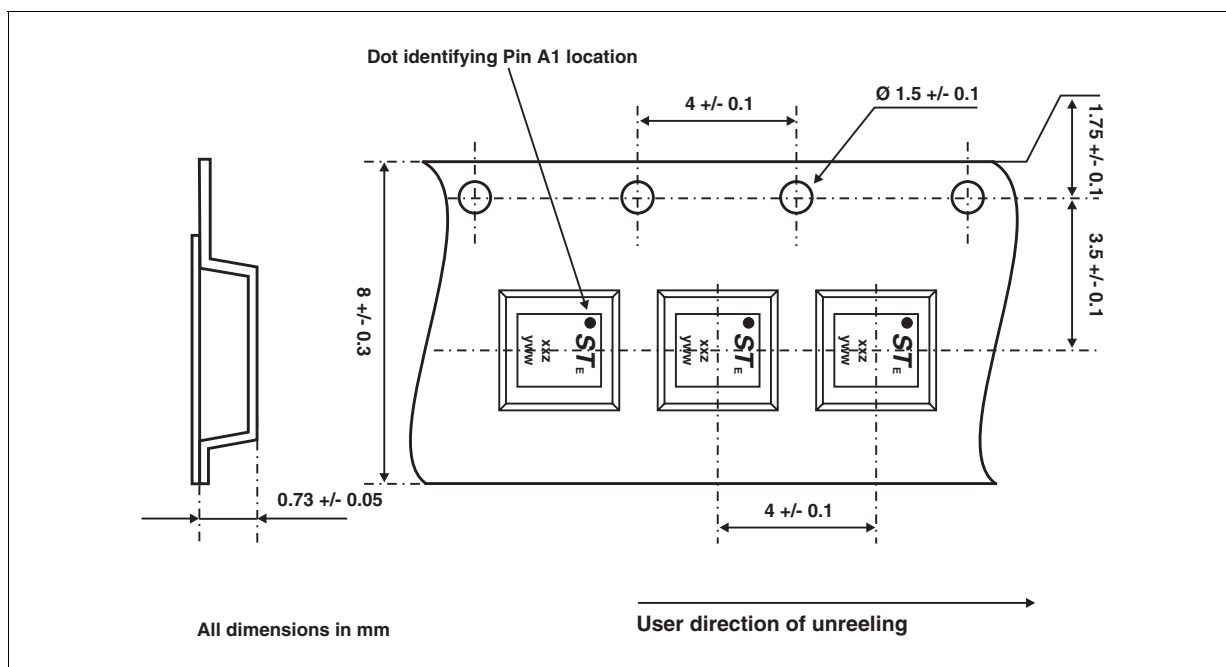


Table 4: Ordering Information

Ordering code	Marking	Package	Weight	Base qty	Delivery mode
EMIF02-USB02F2	FG	Flip-Chip	4.25 mg	5000	Tape & reel 7"

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

Table 5: Revision History

Date	Revision	Description of Changes
14-Dec-2004	1	First issue

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