

## 2-line IPAD™, EMI filter including ESD protection

### Features

- 2-line low-pass filter + ESD protection
- High efficiency in EMI filtering
- Lead-free package
- Very low PCB space occupation: <math>< 2.5 \text{ mm}^2</math>
- 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
  - $\pm 15 \text{ kV}$  (air discharge)
  - $\pm 8 \text{ kV}$  (contact discharge)

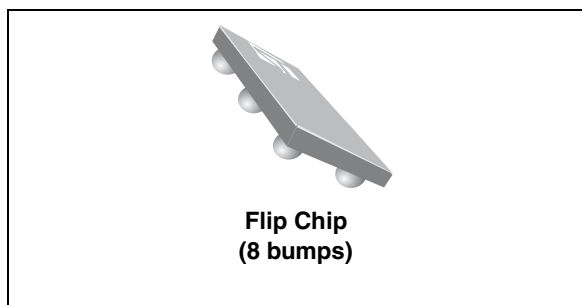
### Application

- ESD protection and EMI filtering for USB port

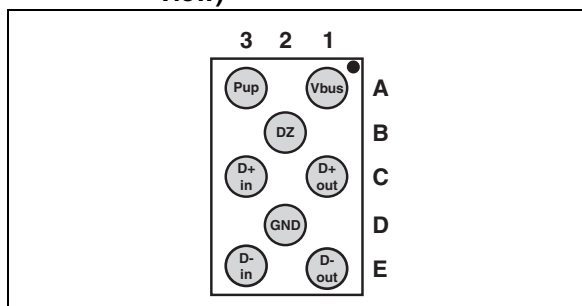
### Description

The EMIF02-USB01F2 is a highly integrated array designed to suppress EMI / RFI noise for USB port filtering. The EMIF02-USB01F2 Flip-Chip packaging means the package size is equal to the die size.

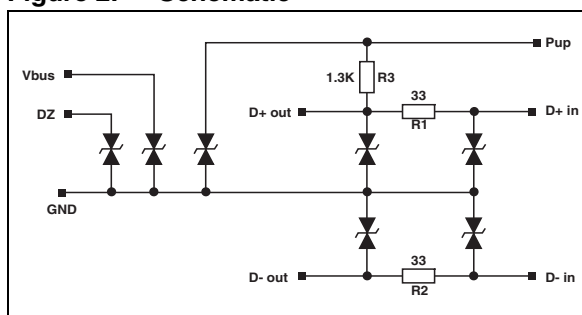
Additionally, this filter includes ESD protection circuitry which prevents damage to the protected device when subjected to ESD surges up to 15 kV.



**Figure 1. Pin configuration (bump side view)**



**Figure 2. Schematic**



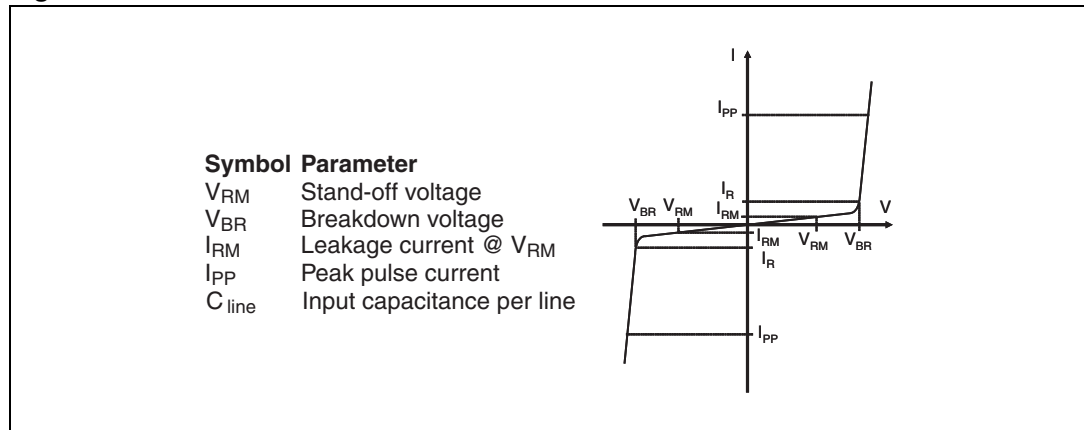
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# 1 Characteristics

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

Symbol	Parameter	Value	Unit
$T_j$	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	$^{\circ}\text{C}$

**Figure 3. Electrical characteristics - definitions**



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

Symbol	Test conditions	Min.	Typ.	Max.	Unit
$V_{BR}$	$I_R = 1\text{ mA}$	6	-	-	V
$I_{RM}$	$V_{RM} = 3\text{ V}$	-	-	0.5	$\mu\text{A}$
$C_{line}$	@ 0 V	-	40	45	pF
$R_1, R_2$	Tolerance $\pm 5\%$	-	33	-	$\Omega$
$R_3$	Tolerance $\pm 5\%$	-	1.30	-	k $\Omega$

Figure 4. S21 (dB) attenuation measurement

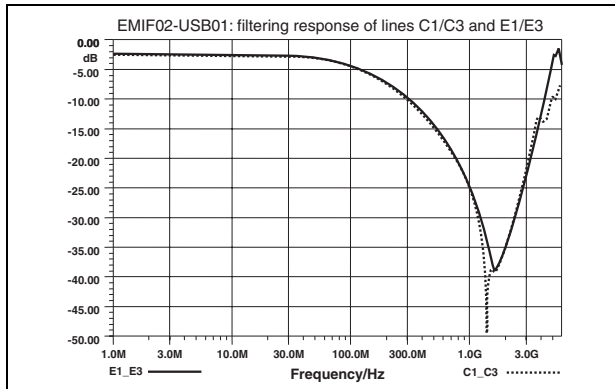


Figure 5. Analog crosstalk measurements

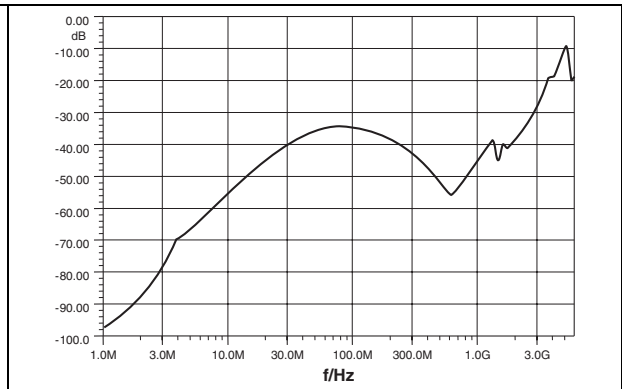


Figure 6. ESD response to IEC 61000-4-2 (+15 kV air discharge) on one input (Vin) and one output (Vout)

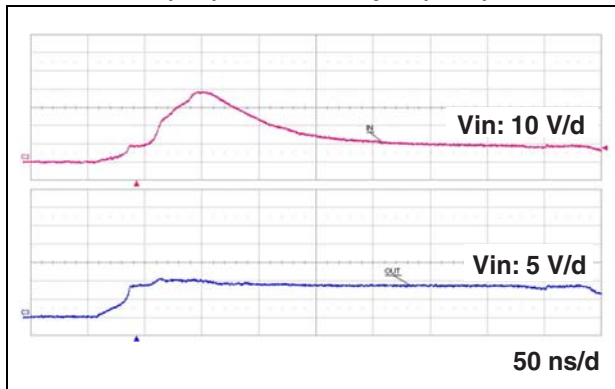


Figure 7. ESD response to IEC 61000-4-2 (-15 kV air discharge) on one input (Vin) and on one output (Vout)

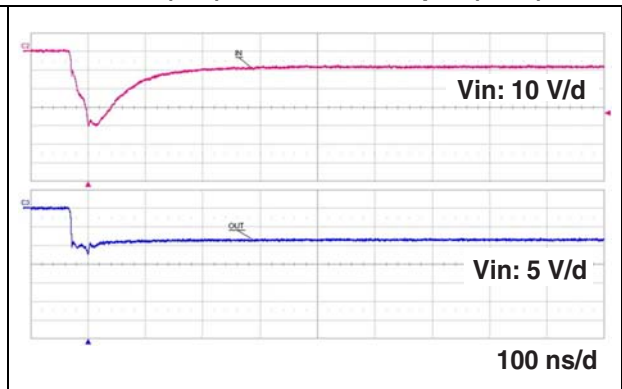
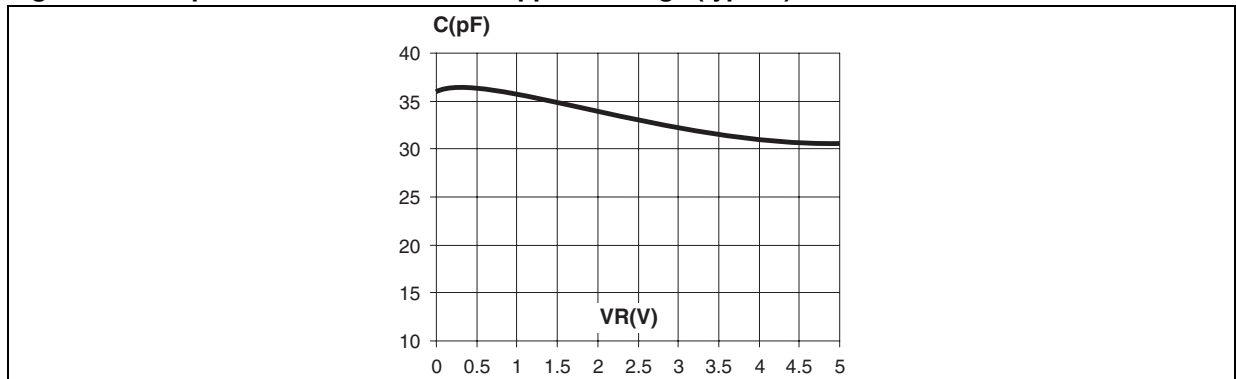
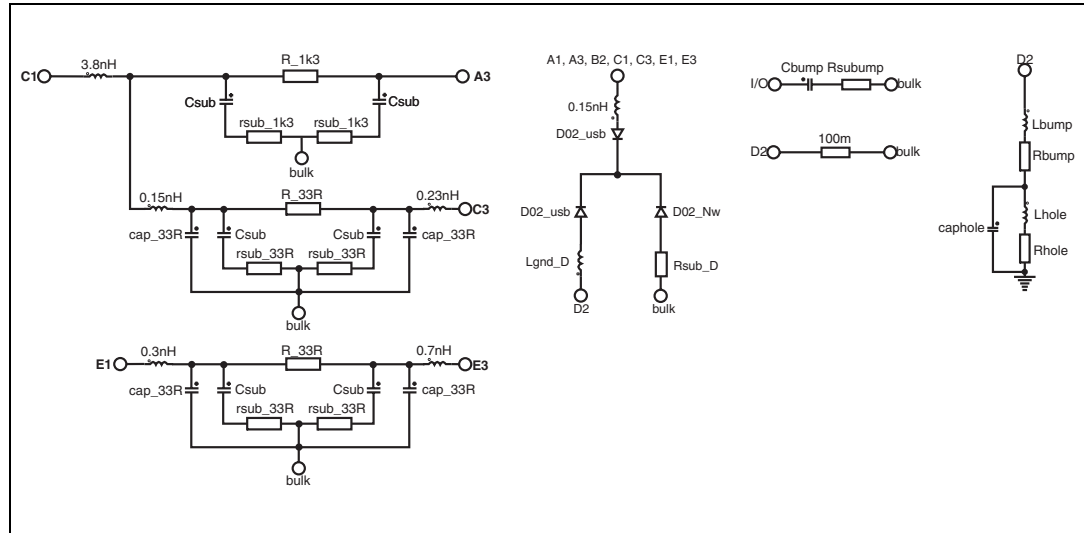


Figure 8. Capacitance versus reverse applied voltage (typical)



## 2 Application information

**Figure 9. Aplac model (resistors, diodes and bumps and ground connections)**

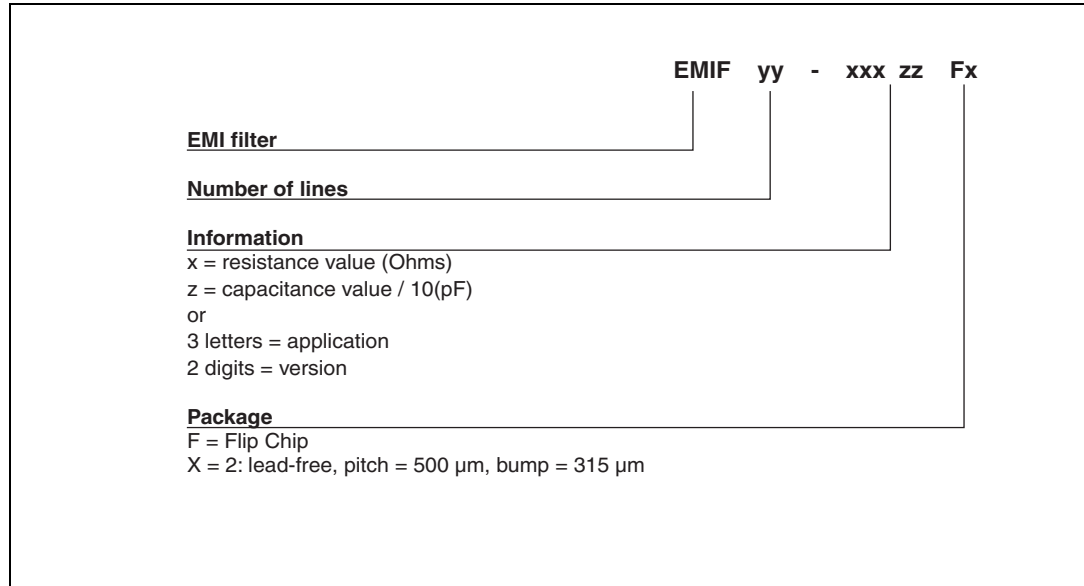


**Figure 10. Aplac model parameters**

R_33R 33.9	Model D02_Nw	Model D02_usb
cap_33R 1.2pF	BV=100	BV=16
	IBV=1m	IBV=1m
R_1k3 1.3k	CJO=6.8p	CJO=Cz
	M=0.3333	M=0.3333
Cz29pF	RS=2	RS=2
Rsub_D 100	VJ=0.6	VJ=0.6
	TT=100n	TT=100n
Csub0.3pF		
Rsub_33R 15		
Rsub_1k3 50		
lhole10pH		
Rhole400m		
Caphole0.4pF		
Lgnd_D 150pH		
Lbump50pH		
Rbump50m		
Cbump1.5pF		
Rsubump150		

### 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](http://www.st.com). ECOPACK® is an ST trademark.

Figure 12. Package dimensions

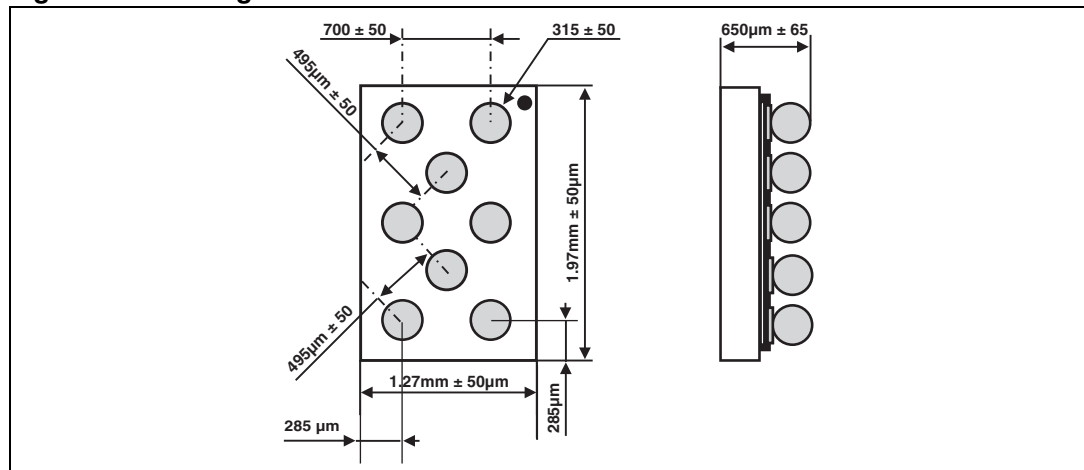


Figure 13. Footprint

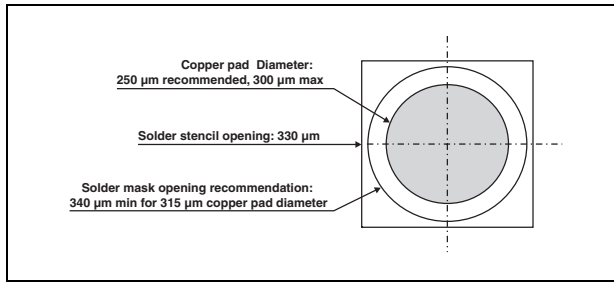


Figure 14. Marking

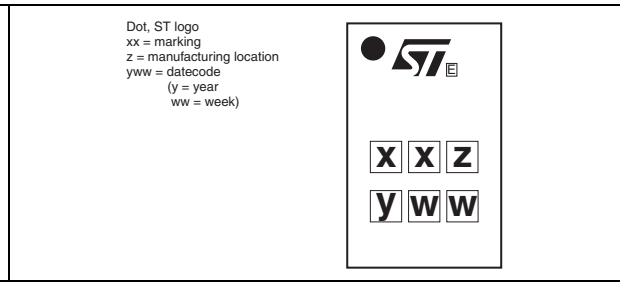
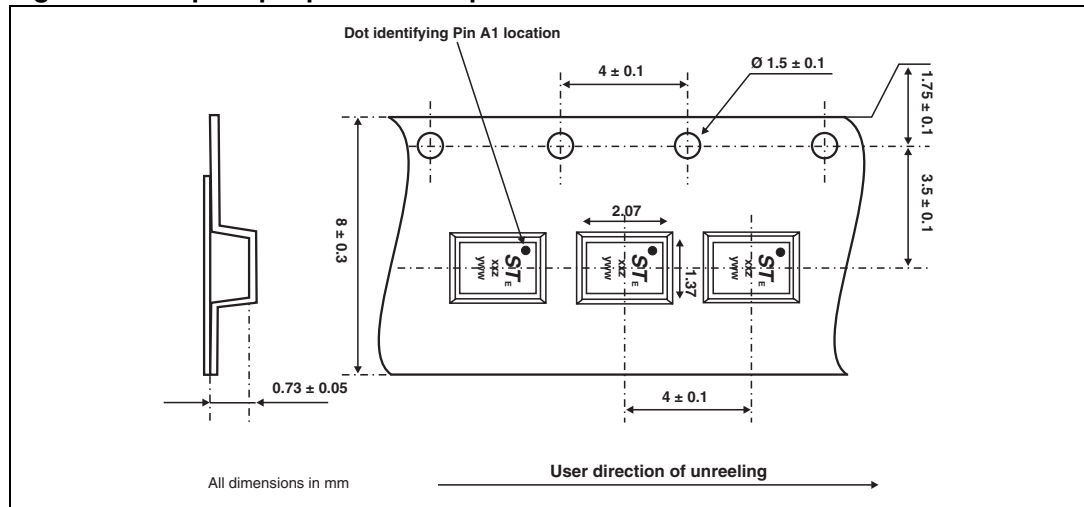


Figure 15. Flip Chip tape and reel specification



## 5 Ordering information

Table 3. Ordering information

Order code	Marking	Package	Weight	Base qty	Delivery mode
EMIF02-USB01F2	FF	Flip Chip	3.35 mg	5000	Tape and reel 7"

Note:

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

## 6 Revision history

**Table 4. Document revision history**

Date	Revision	Changes
26-Oct-2004	1	Initial release.
16-Apr-2007	2	Updated ECOPACK statement. Updated <a href="#">Figure 11</a> , <a href="#">Figure 12</a> and <a href="#">Figure 15</a> . Reformatted to current standards.
29-Apr-2008	3	Typographical errors corrected.
18-Sep-2009	4	Updated ESD graphic in <a href="#">Figure 6</a> and <a href="#">Figure 7</a> .

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