

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

### Features

- EMI symmetrical (I/O) low-pass filter
- High efficiency in EMI filtering
- Very low PCB space consuming:  
1.07 mm x 1.47 mm
- Very thin package: 0.65 mm
- High efficiency in ESD suppression
- High reliability offered by monolithic integration
- High reducing of parasitic elements through integration and wafer level packaging

### Complies with the following standards:

- IEC 61000-4-2 level 4, on output pins:
  - 15 kV (air discharge)
  - 8 kV (contact discharge)
- IEC 61000-4-2 Level 1, on input pins:
  - 2 kV (air discharge)
  - 2 kV (contact discharge)
- MIL STD 883E - Method 3015-6 Class 3

### Applications

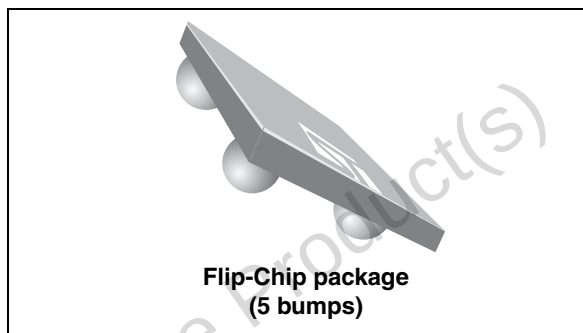
Where EMI filtering in ESD sensitive equipment is required:

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

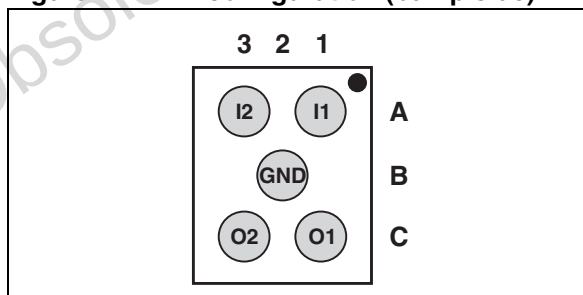
### Description

The EMIF02-SPK01 is a highly integrated device designed to suppress EMI/RFI noise in all systems subjected to electromagnetic interferences. The EMIF02 Flip-Chip packaging means the package size is equal to the die size.

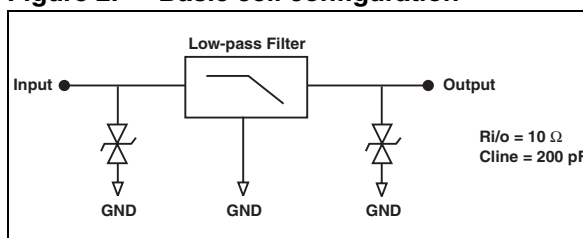
This filter includes an ESD protection circuitry which prevents damage to the application when subjected to ESD surges up 15 kV.



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



**Figure 2. Basic cell configuration**



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# 1 Electrical characteristics

Table 1. Absolute maximum ratings (T<sub>amb</sub> = 25 °C)

| Symbol           | Parameter                    | Value       | Unit |
|------------------|------------------------------|-------------|------|
| T <sub>j</sub>   | Maximum junction temperature | 125         | °C   |
| T <sub>op</sub>  | Operating temperature range  | -40 to +85  | °C   |
| T <sub>stg</sub> | Storage temperature range    | -55 to +150 | °C   |

Figure 3. Electrical characteristics (definitions)

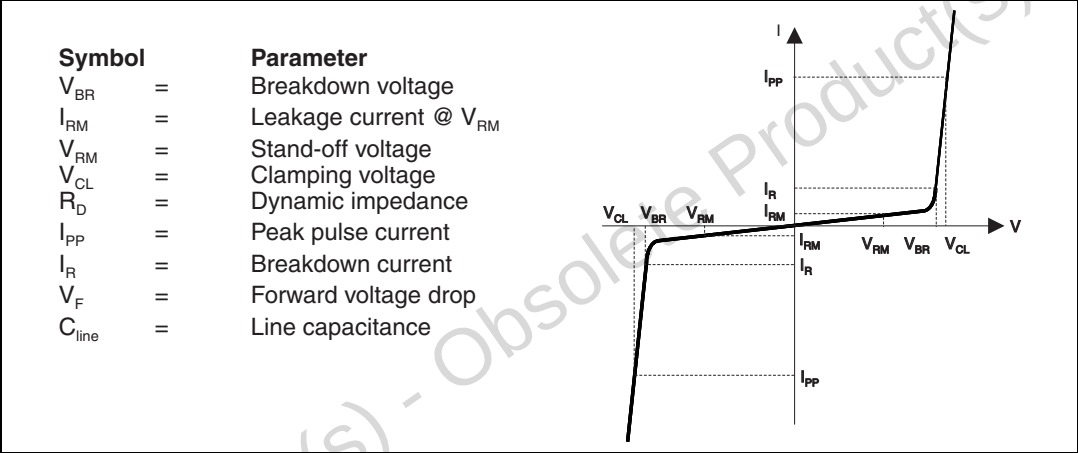
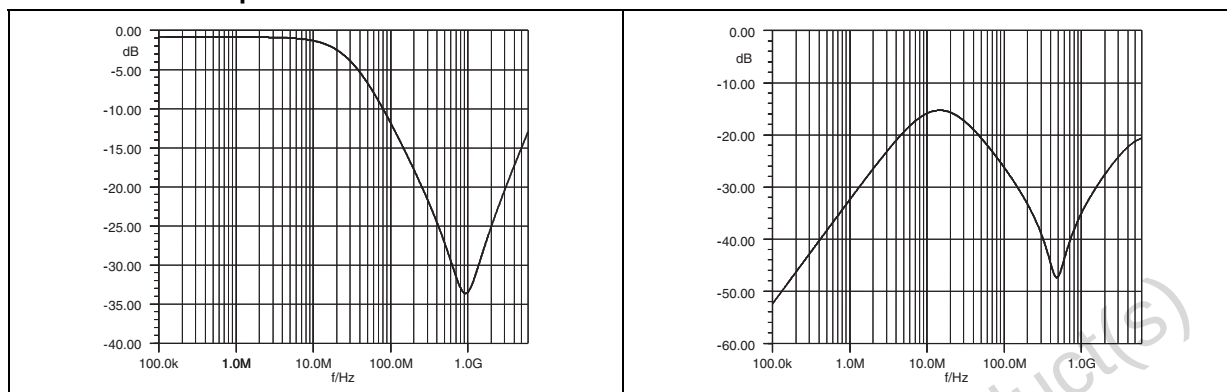


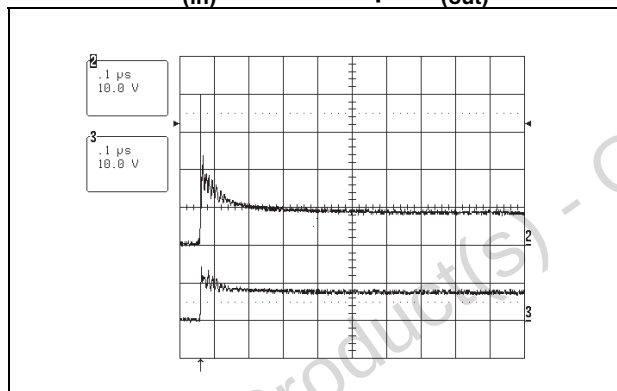
Table 2. Electrical characteristics (T<sub>amb</sub> = 25 °C)

| Symbol     | Test condition                 | Min. | Typ. | Max. | Unit     |
|------------|--------------------------------|------|------|------|----------|
| $V_{BR}$   | $I_R = 1\text{ mA}$            | 6    | 8    |      | V        |
| $I_{RM}$   | $V_{RM} = 3\text{ V per line}$ |      |      | 500  | nA       |
| $R_{I/O}$  | Tolerance $\pm 20\%$           |      | 10   |      | $\Omega$ |
| $C_{line}$ | $V_R = 0\text{ V}$             |      | 200  |      | pF       |

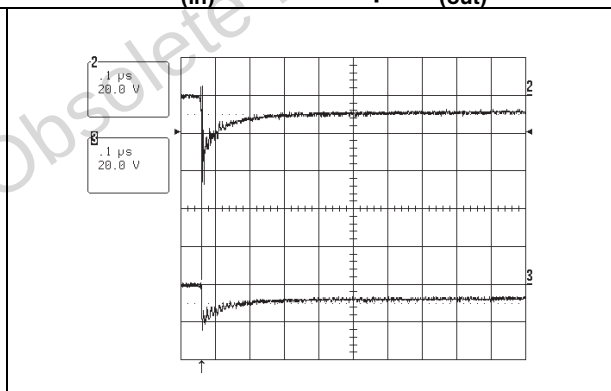
**Figure 4. S21 (dB) attenuation measurements** **Figure 5. Analog crosstalk measurements and Aplac simulation**



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



**Figure 7. ESD response to IEC 61000-4-2 (-15kV air discharge) on one input  $V_{(in)}$  and one output  $V_{(out)}$**



**Figure 8. Line capacitance versus applied voltage**

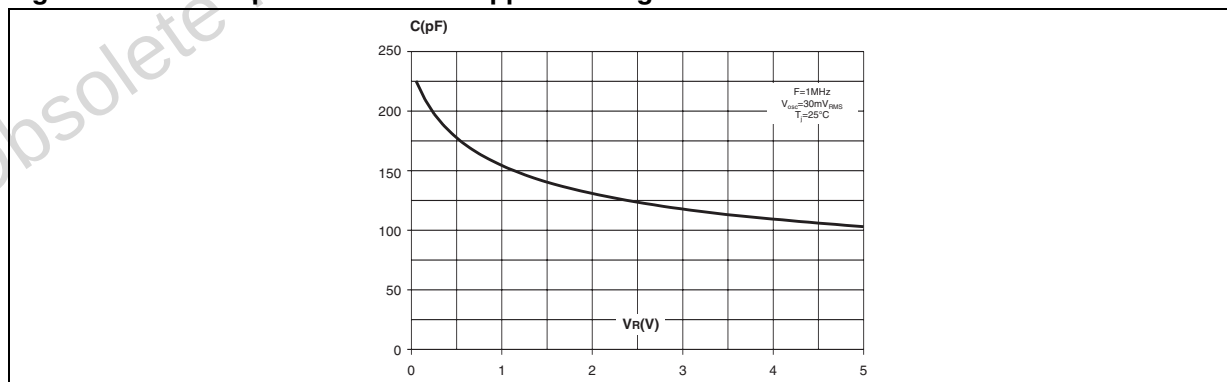


Figure 9. Aplac mode

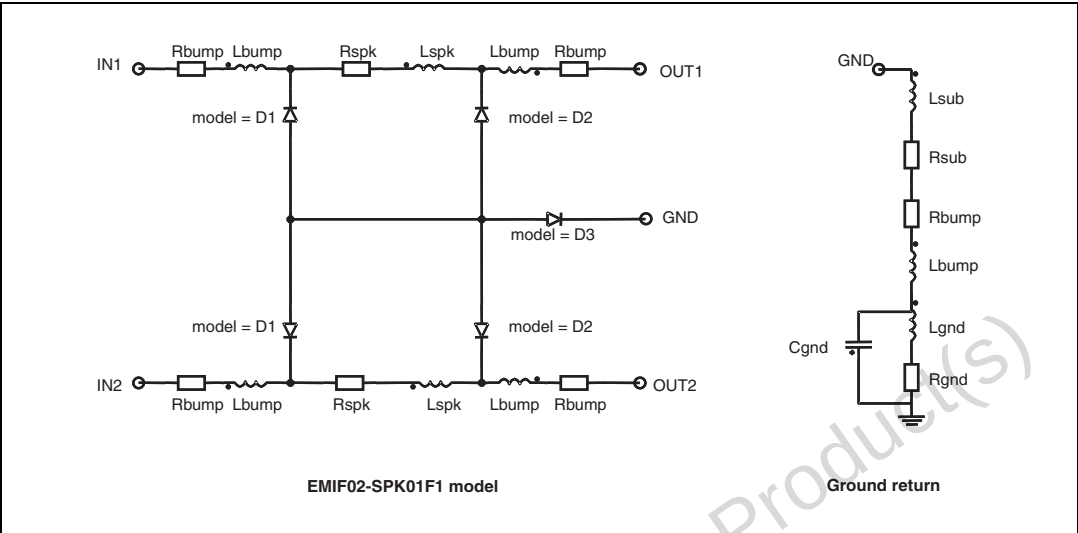
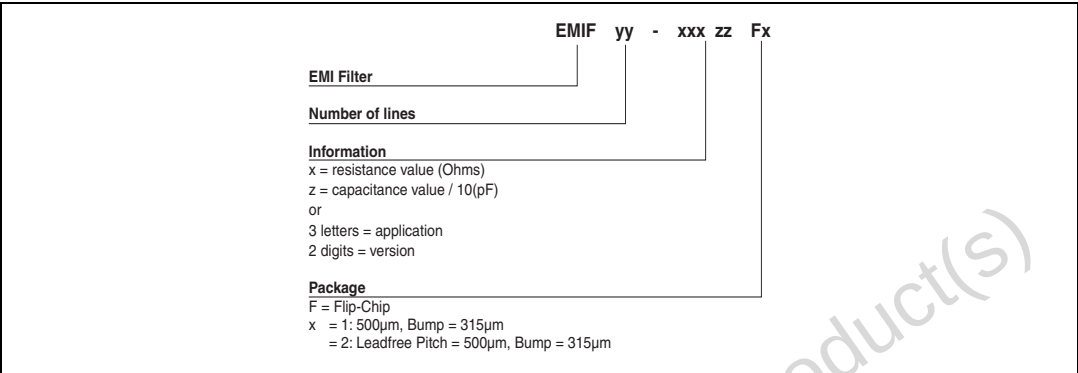


Figure 10. Aplac parameters

|             |             |             |                         |
|-------------|-------------|-------------|-------------------------|
| Model D1    | Model D3    | Model D2    | aplacvar Ls 1nH         |
| CJO=Cdiode1 | CJO=Cdiode3 | CJO=Cdiode2 | aplacvar Rs 150m        |
| BV=7        | BV=7        | BV=7        | aplacvar Rspk 10        |
| IBV=1u      | IBV=1u      | IBV=1u      | aplacvar Lspk 10p       |
| IKF=1000    | IKF=1000    | IKF=1000    | aplacvar Cdiode1 234pF  |
| IS=10f      | IS=10f      | IS=10f      | aplacvar Cdiode2 3.5ppF |
| ISR=100p    | ISR=100p    | ISR=100p    | aplacvar Cdiode3 1nF    |
| N=1         | N=1         | N=1         | aplacvar Lbump 50pH     |
| M=0.3333    | M=0.3333    | M=0.3333    | aplacvar Rbump 10m      |
| RS=0.7      | RS=0.12     | RS=0.3      | aplacvar Rsub 0.5m      |
| VJ=0.6      | VJ=0.6      | VJ=0.6      | aplacvar Lsub 10pH      |
| TT=50n      | TT=50n      | TT=50n      | aplacvar Rgnd 1m        |
|             |             |             | aplacvar Lgnd 50pH      |
|             |             |             | aplacvar Cgnd 0.15pF    |

2 Ordering information

Figure 11. Ordering information scheme



3 Packaging 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. Flip-Chip dimensions

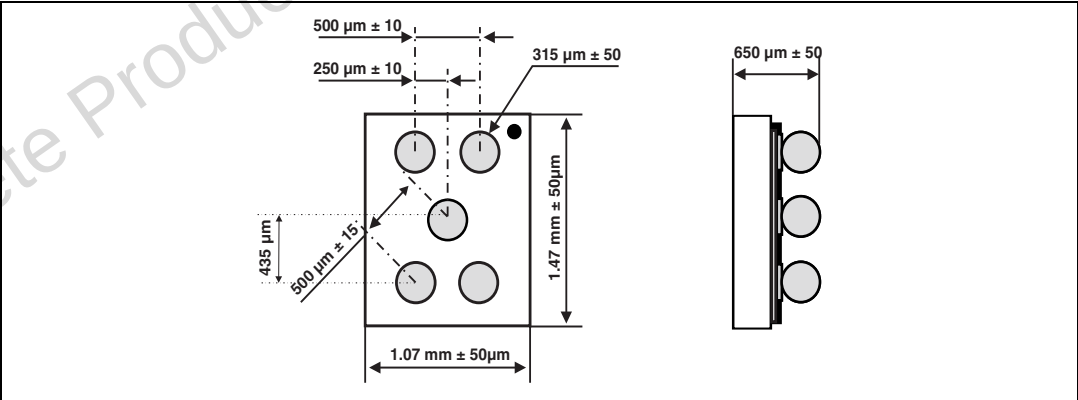


Figure 13. Footprint

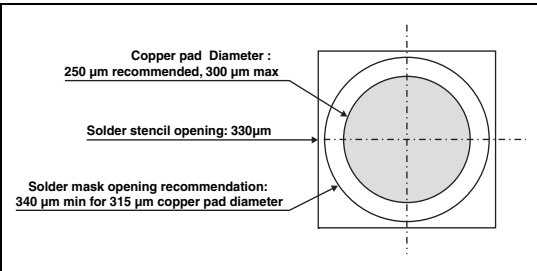


Figure 14. Marking

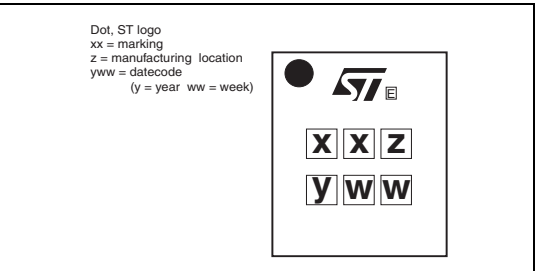
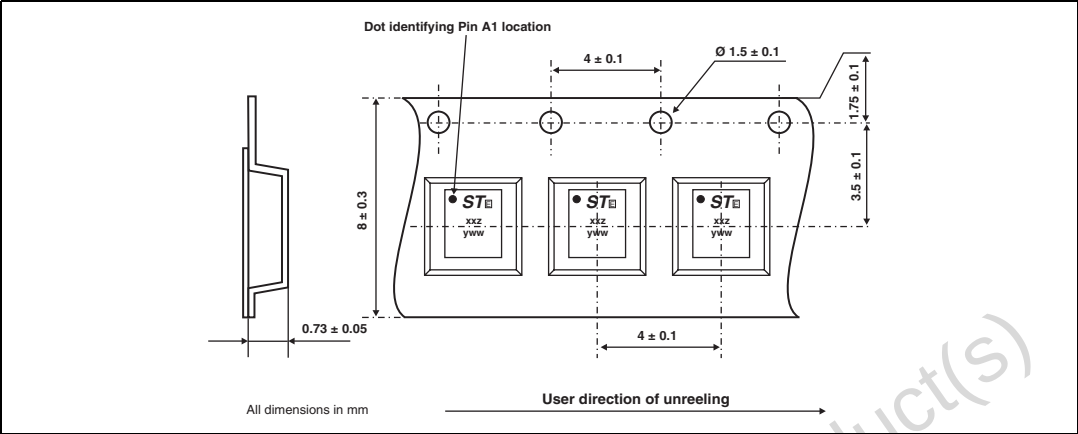


Figure 15. Packing



## 4 Ordering information

Table 3. Ordering information

| Order code     | Marking | Package   | Weight | Base qty | Delivery mode      |
|----------------|---------|-----------|--------|----------|--------------------|
| EMIF02-SPK01F2 | FX      | Flip Chip | 2.1 mg | 5000     | Tape and reel (7") |

Note: More packing information is available in the applications note:  
AN1235: "Flip-Chip: package description and recommendations for use"  
AN 1751: "EMI filters: Recommendations and measurements"

## 5 Revision history

Table 4. Document revision history

| Date        | Revision | Changes                                                           |
|-------------|----------|-------------------------------------------------------------------|
| 14-Oct-2006 | 1        | Initial release.                                                  |
| 08-Sep-2011 | 2        | Updated <a href="#">Figure 12</a> and <a href="#">Figure 13</a> . |

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