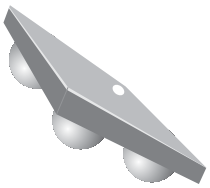
USBULC6-2F3

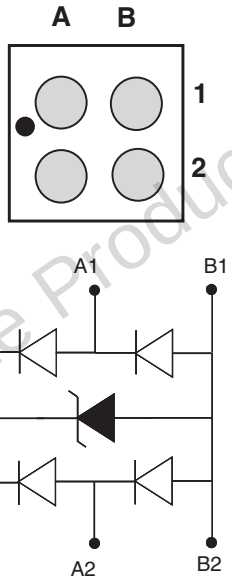
2-line Transil™, transient surge voltage suppressor (TVS) ultralow capacitance protection for high speed USB

Datasheet - production data



Flip Chip
USBULC6-2F3
(4 bumps)

Figure 1. Pin layout (bump side) and Device configuration



Note: B1 and B2 bumps must be grounded on the PCB together

Features

- Ultralow diode capacitance (1.5 pF max)
- Two data lines (D+ and D-) protected against ESD
- Breakdown voltage V_{BR} = 6.0 V min.
- Flip Chip, 400 µm pitch, lead-free
- Very low leakage current
- Very small PCB area
- RoHS compliant

Benefits

- Minimized impact on rise and fall times for maximum data integrity
- Low PCB space occupation
- Higher reliability offered by monolithic integration

Complies with the following standards

- IEC 61000-4-2 level 4 on external pins:
  - 8 kV (contact discharge)
- **MIL STD 883G - Method 3015.7**
  - 25 kV (Human body model)

Application

This device is designed to protect a high speed USB port in wireless handsets (up to 480 Mb/s according to USB 2.0 high speed specification).

Description

The USBULC6-2F3 is a monolithic, application specific discrete device dedicated to ESD protection of high speed interfaces.

Its ultralow line capacitance secures a high level of signal integrity without compromising the protection of downstream sensitive chips against the most stringently characterized ESD strikes.

TM: Transil is a trademark of STMicroelectronics.

1 Characteristics

Table 1. Absolute maximum ratings (T_{amb} = 25 °C)

Symbol	Parameter	Value	Unit
V_{PP}	ESD discharge IEC 61000-4-2: Contact discharge	10	kV
P_{PP}	Peak pulse power dissipation (8/20 µs)	90	W
T_j	Maximum junction temperature	125	°C
T_{op}	Operating temperature range	-30 to + 85	°C
T_{stg}	Storage temperature range	-55 to +150	°C

Figure 2. Electrical characteristics - definitions

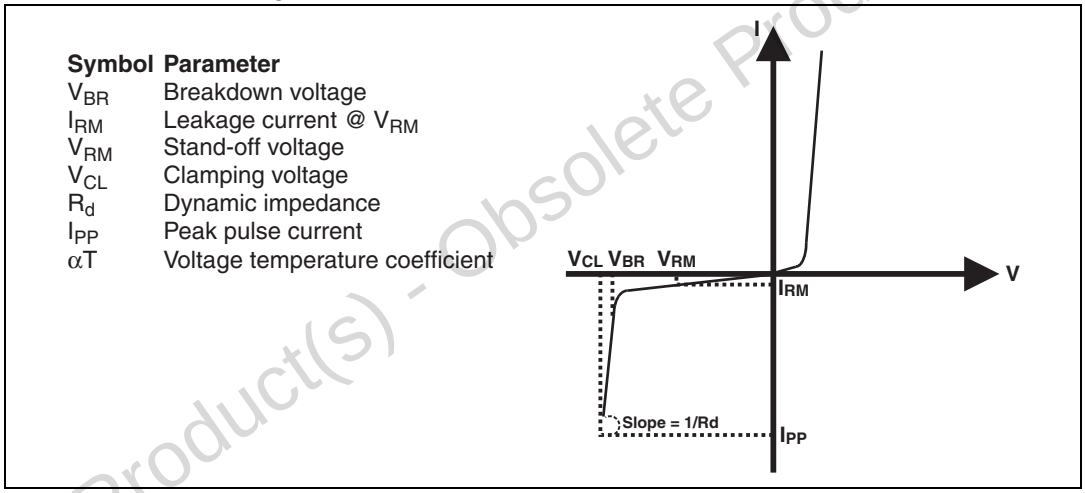


Table 2. Electrical characteristics - values (T_{amb} = 25 °C)

Symbol	Test conditions	Min.	Typ.	Max.	Unit
V_{BR}	I_R = 1 mA	6	-	9	V
I_{RM}	V_{RM} = 3 V	-	-	70	nA
R_d	Exponential wave form 8/20 µs, I_{pp} = 1 to 5 A	-	1.2	-	Ω
αT	I_R = 1 mA	-	-	5	10^{-4}/ °C
C_{line}	V_{LINE} = 0 V, V_{OSC} = 30 mV, F = 1 MHz	-	-	1.5	pF

Figure 3. Eye diagram, board only (according to USB high speed specification)

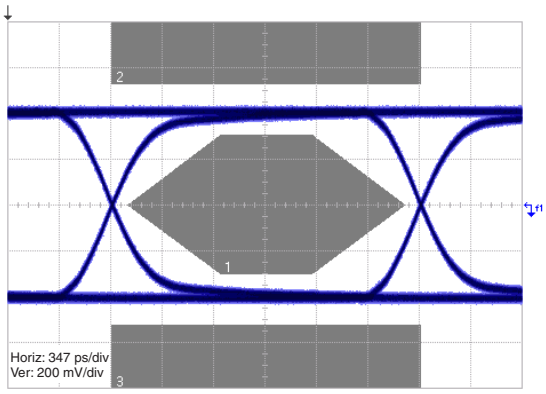


Figure 4. Eye diagram, board with USBULC6-2F3 (according to USB 2.0 high speed specification)

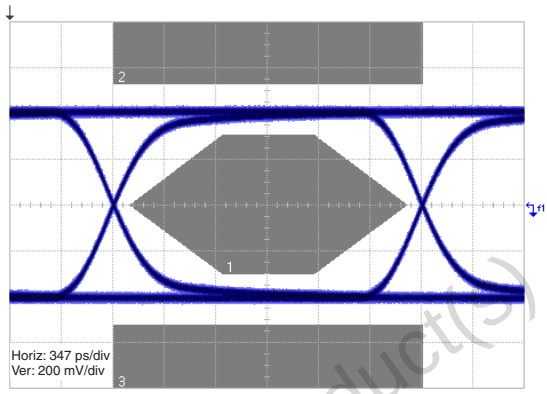


Figure 5. ESD response to IEC 61000-4-2 (+8 kV contact discharge)(1)

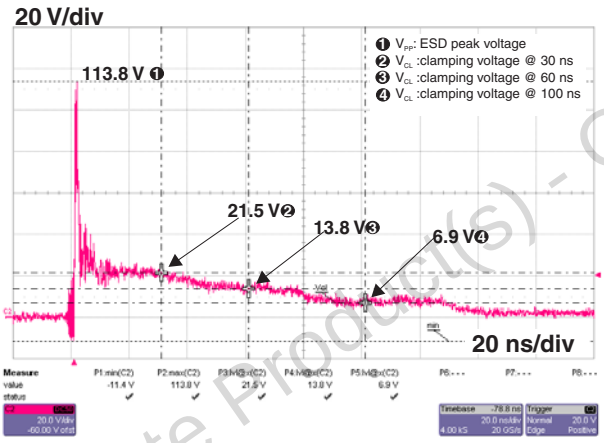
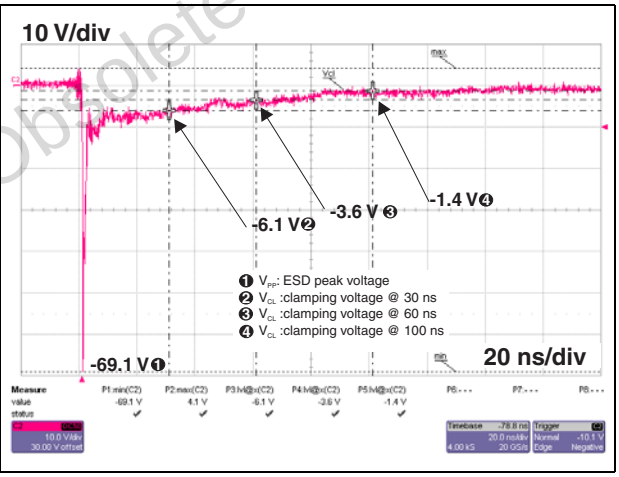


Figure 6. ESD response to IEC 61000-4-2 (-8 kV contact discharge)(1)



1. Test board connected to oscilloscope through 50 Ω cable and 20 dB + 6 dB attenuator. ESD generator return path connected to PCB ground plane.

Figure 7. Junction capacitance versus frequency (typical values)

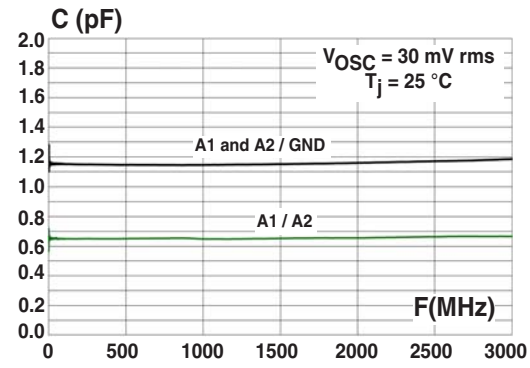


Figure 8. Analog crosstalk measurement

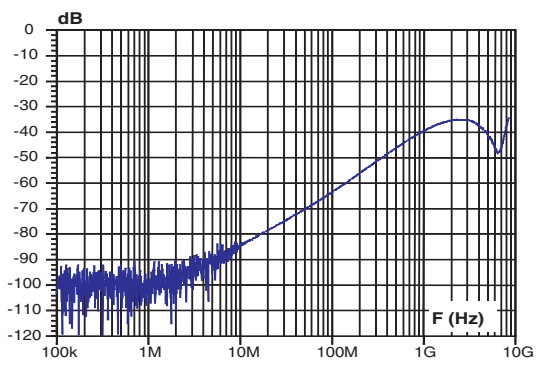


Figure 9. S21 (dB) attenuation measurement

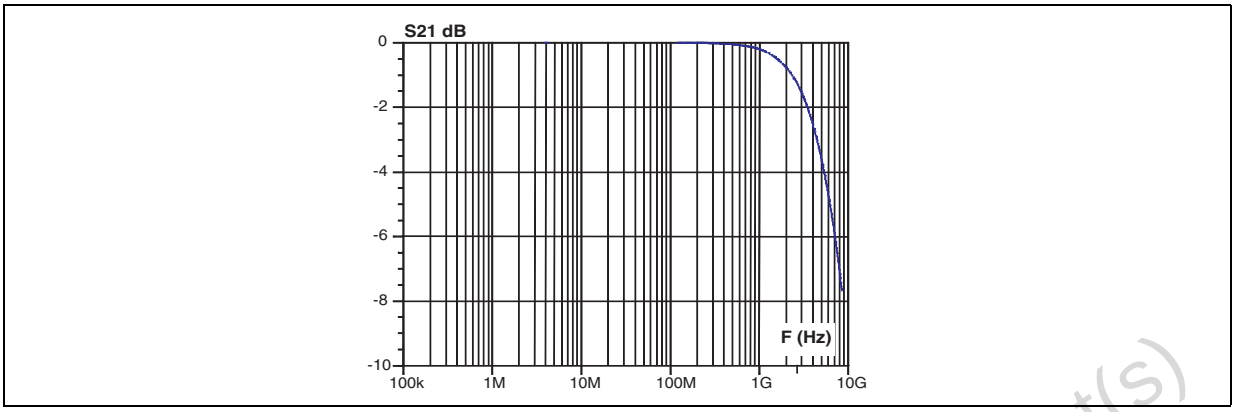


Figure 10. Peak pulse power versus initial junction temperature (maximum values, pulse 8/20 µs)

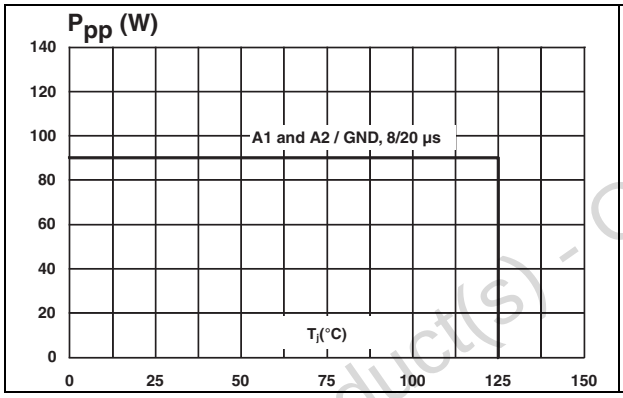


Figure 11. Peak pulse power versus exponential pulse duration (maximum values)

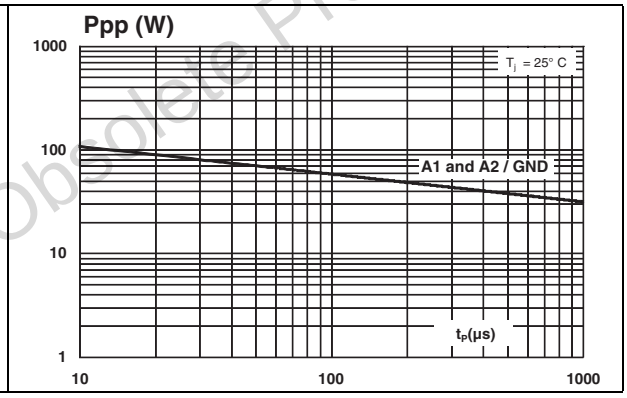


Figure 12. Clamping voltage versus peak pulse current (typical values, pulse 8/20 µs)

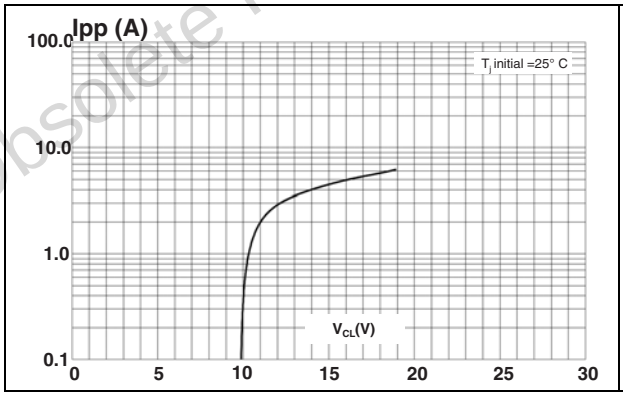
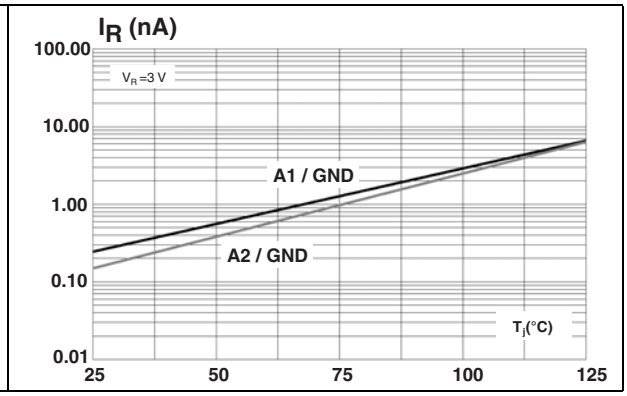
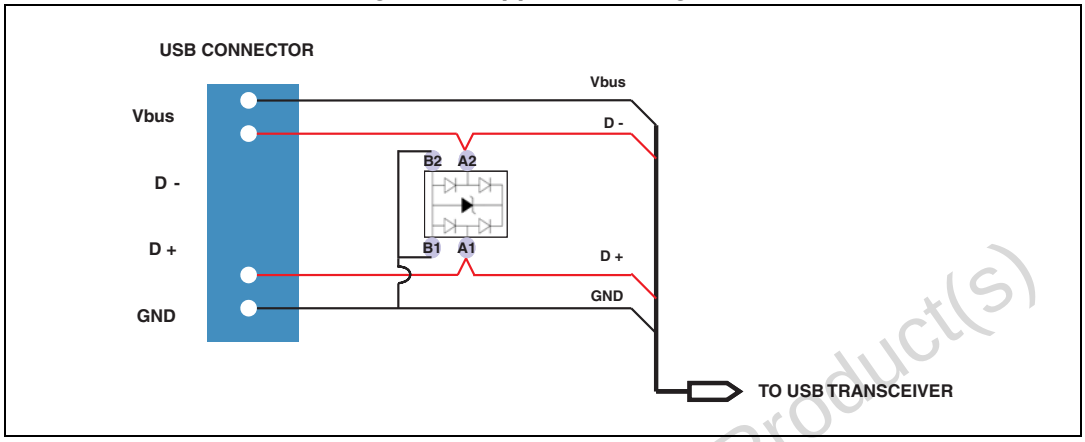


Figure 13. Leakage current versus junction temperature (typical values)



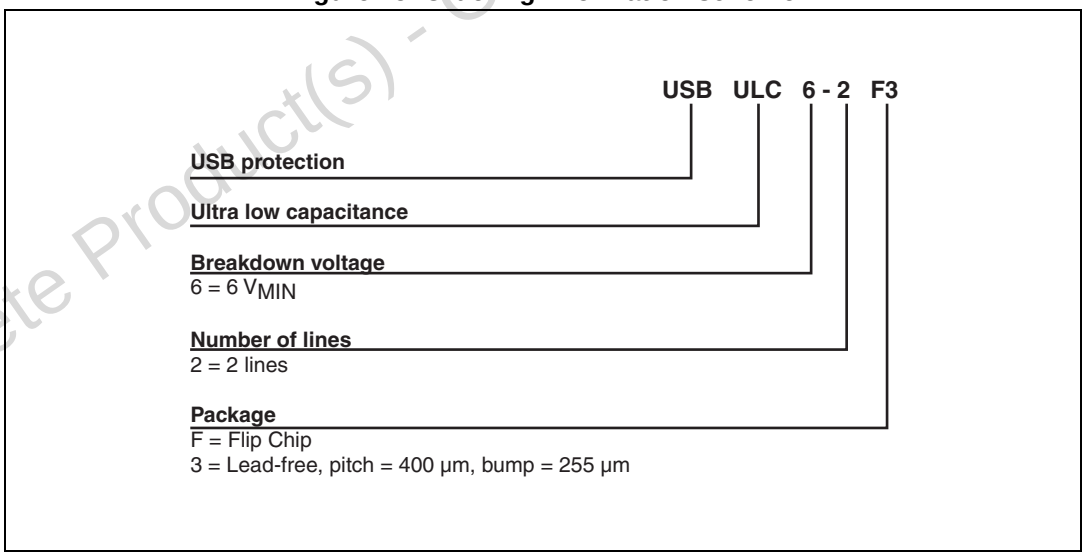
2 Application information

Figure 14. Application diagram



3 Ordering information scheme

Figure 15. 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 16. Package dimensions

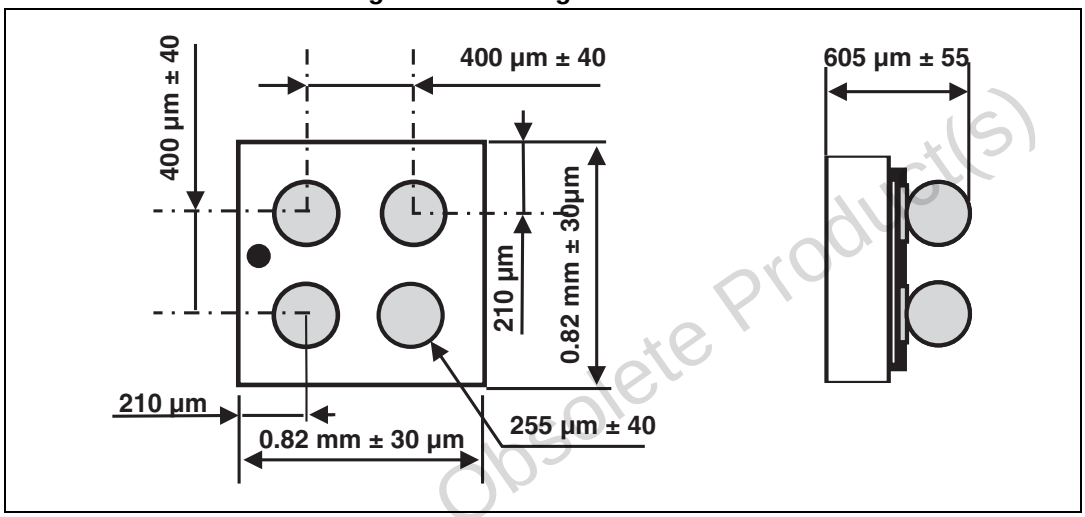


Figure 17. Footprint recommendations

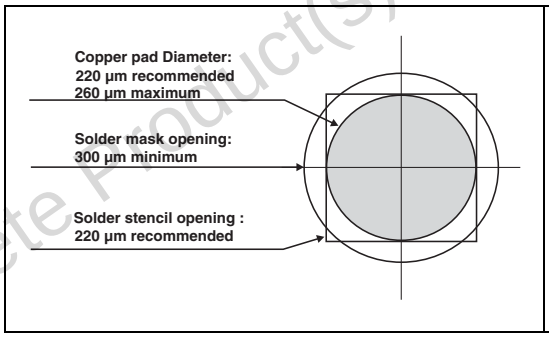


Figure 18. Marking

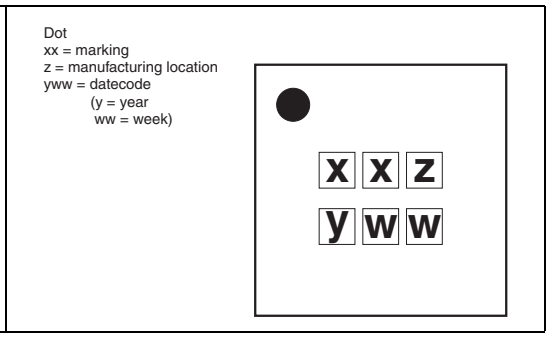
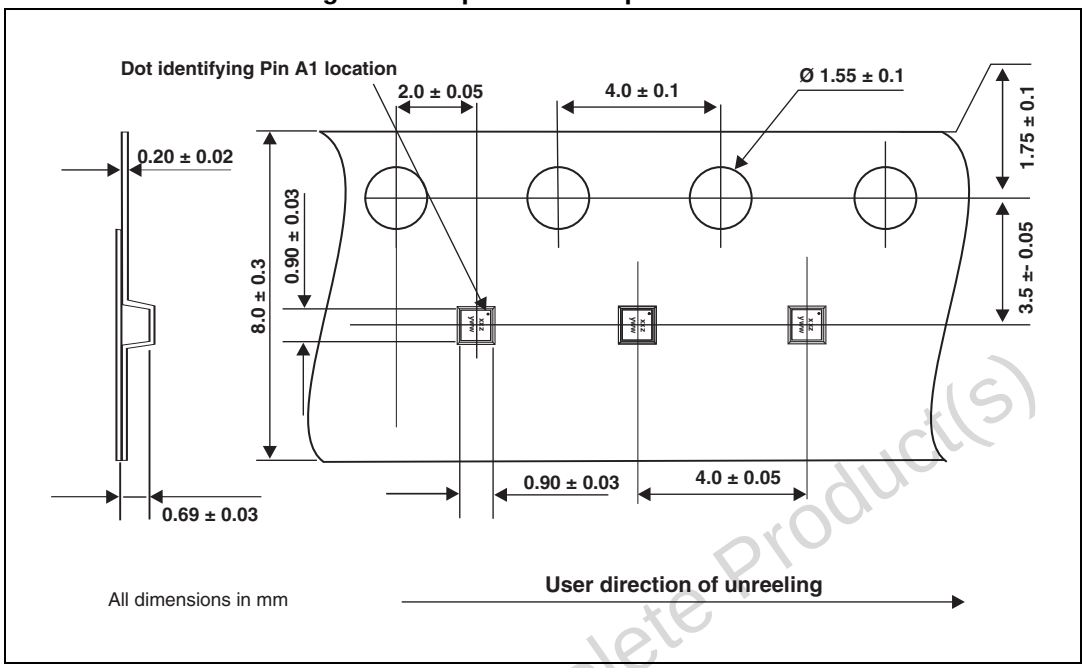


Figure 19. Tape and reel specifications



Note: More information is available in the STMicroelectronics Application notes:
AN2348: "400 µm 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
USBULC6-2F3	EH	Flip Chip	0.91 mg	5000	Tape and reel (7")

6 Revision history

Table 4. Document revision history

Date	Revision	Changes
15-Dec-2006	1	Initial release.
29-Apr-2008	2	Updated ECOPACK statement. Updated *Figure 16*, *Figure 17* and *Figure 19.* Reformatted to current standards.
27-Jun-2011	3	Added *Figure 5* and *Figure 6*. Updated die dimensions in *Figure 16* and pocket dimensions in *Figure 19*.
31-Mar-2014	4	Updated bump-side Pin 1 dot in *Figure* and *Figure 16*. Updated value of C_{line} in*Table 2*. Removed graphics on 15 kV ESD responses and digital crosstalk. Updated Figures *3* through *13*. Corrected graphical error in *Figure 19*