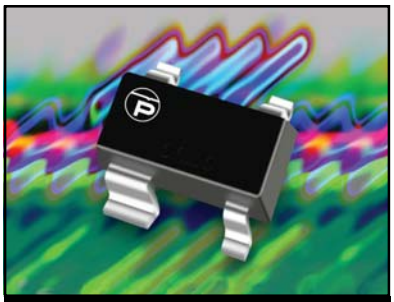
PROTEK DEVICES

USB0403 thru USB0424C

LOW CAPACITANCE TVS ARRAY



SOT-143

APPLICATIONS

✔ Ethernet - 10/100 Base T
✔ Cellular Phones
✔ Audio & Video Inputs
✔ FireWire, SCSI & USB Interfaces

IEC COMPATIBILITY (EN61000-4)

✔ 61000-4-2 (ESD): Air - 15kV, Contact - 8kV
✔ 61000-4-4 (EFT): 40A - 5/50ns
✔ 61000-4-5 (Surge): 12A, 8/20µs - Level 1(Line-Gnd) & Level 2(Line-Line)

FEATURES

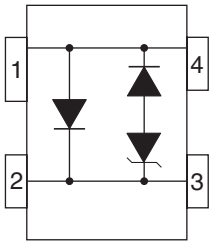
✔ 500 Watts Peak Pulse Power per Line (tp=8/20µs)
✔ Unidirectional & Bidirectional Configurations
✔ Available in Multiple Voltage Types Ranging From 3V to 24V
✔ Protects One Line
✔ ESD Protection > 40 kilovolts
✔ Low Leakage
✔ Low Capacitance: 5pF per Line Pair
✔ RoHS Compliant in Lead-Free Versions

MECHANICAL CHARACTERISTICS

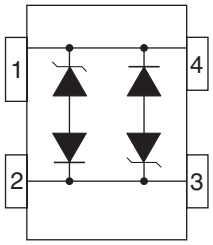
✔ Molded JEDEC SOT-143 Package
✔ Weight 9 milligrams (Approximate)
✔ Available in Tin-Lead or Lead-Free Pure-Tin Plating(Annealed)
✔ Solder Reflow Temperature:
Tin-Lead - Sn/Pb, 85/15: 240-245°C
Pure-Tin - Sn, 100: 260-270°C
✔ Flammability Rating UL 94V-0
✔ 8mm Tape and Reel Per EIA Standard 481
✔ Marking: Marking Code

PIN CONFIGURATIONS

UNIDIRECTIONAL



BIDIRECTIONAL



DEVICE CHARACTERISTICS

MAXIMUM RATINGS @ 25°C Unless Otherwise Specified			
PARAMETER	**SYMBOL**	**VALUE**	**UNITS**
Peak Pulse Power (t_p = 8/20µs) - See Figure 1	P_{PP}	500	Watts
Operating Temperature	T_J	-55°C to 150°C	℃
Storage Temperature	T_{STG}	-55°C to 150°C	℃

ELECTRICAL CHARACTERISTICS PER LINE @ 25°C Unless Otherwise Specified

PART NUMBER (See Notes 1-2)	DEVICE MARKING	RATED STAND-OFF VOLTAGE V_{WM} VOLTS	MINIMUM BREAKDOWN VOLTAGE @ 1mA $V_{(BR)}$ VOLTS	MAXIMUM CLAMPING VOLTAGE (See Fig. 2) @ I_P = 5A V_C VOLTS	MAXIMUM CLAMPING VOLTAGE (See Fig. 2) @8/20µs V_C @ I_{PP}	MAXIMUM LEAKAGE CURRENT @V_{WM} I_D µA	MAXIMUM CAPACITANCE 0V @ 1 MHz C pF
USB0403	3U	3.3	4.0	9.0	19.0V @ 20.0A	125	5
USB0403C	3B	3.3	4.0	9.0	19.0V @ 20.0A	125	5
USB0405	5U	5.0	6.0	11.0	18.3V @ 17.0A	20	5
USB0405C	5B	5.0	6.0	11.0	18.3V @ 17.0A	20	5
USB0408	8U	8.0	8.5	16.6	18.5V @ 17.0A	10	5
USB0408C	8B	8.0	8.5	16.6	18.5V @ 17.0A	10	5
USB0412	12U	12.0	13.3	24.0	28.6V @ 11.0A	1	5
USB0412C	12B	12.0	13.3	24.0	28.6V @ 11.0A	1	5
USB0415	15U	15.0	16.6	30.0	31.8V @ 10.0A	1	5
USB0415C	15B	15.0	16.6	30.0	31.8V @ 10.0A	1	5
USB0424	24U	24.0	26.7	N/A	56.0V @ 6.0A	1	5
USB0424C	24B	24.0	26.7	N/A	56.0V @ 6.0A	1	5

Note 1: Part numbers with an additional "C" suffix are bidirectional devices, i.e., USB0405C.
Note 2: *Unidirectional Only:* Positive potential is applied from pin 2 to 1 or pin 3 to 4.

FIGURE 1
PEAK PULSE POWER VS PULSE TIME

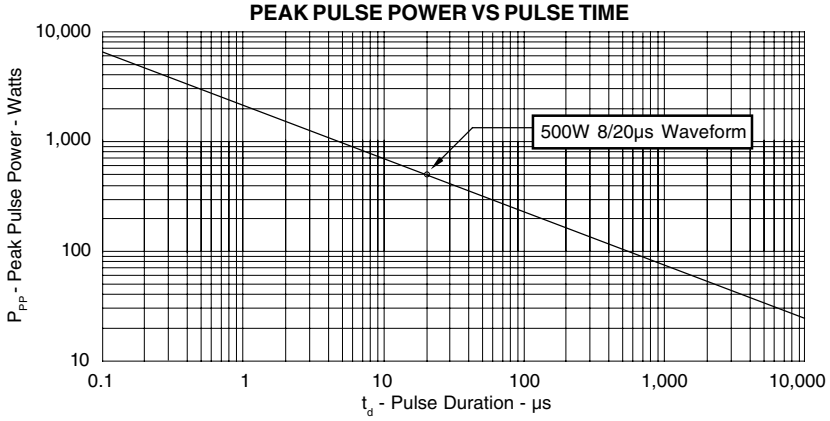
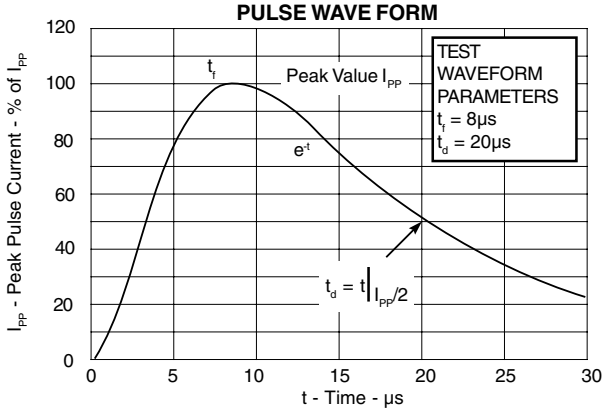


FIGURE 2
PULSE WAVE FORM



GRAPHS

FIGURE 3
POWER DERATING CURVE

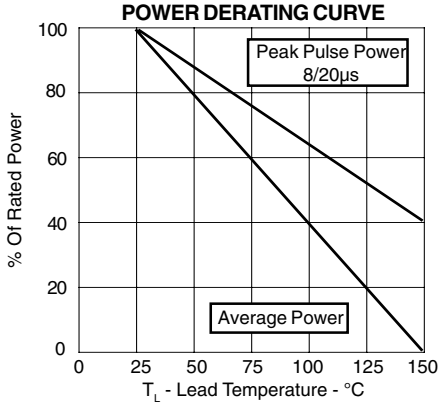
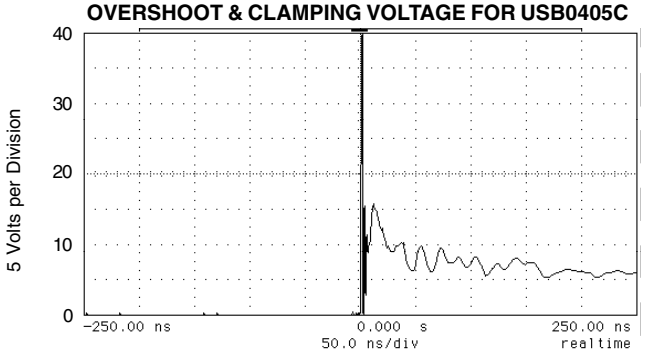


FIGURE 4
OVERSHOOT & CLAMPING VOLTAGE FOR USB0405C



ESD Test Pulse: 5 kilovolt, 1/30ns (waveform)

FIGURE 5
INSERTION LOSS - USB0405C

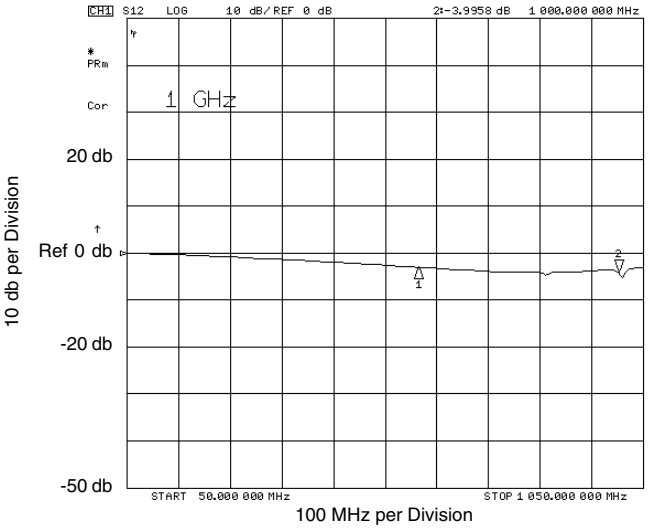
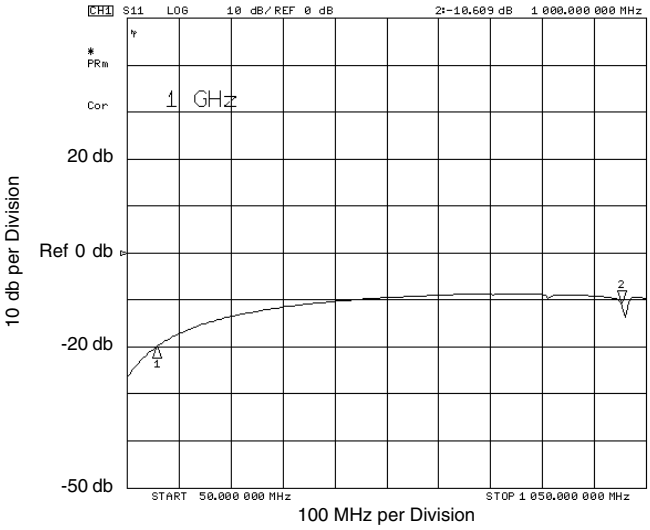


FIGURE 6
RETURN LOSS - USB0405C



APPLICATIONS

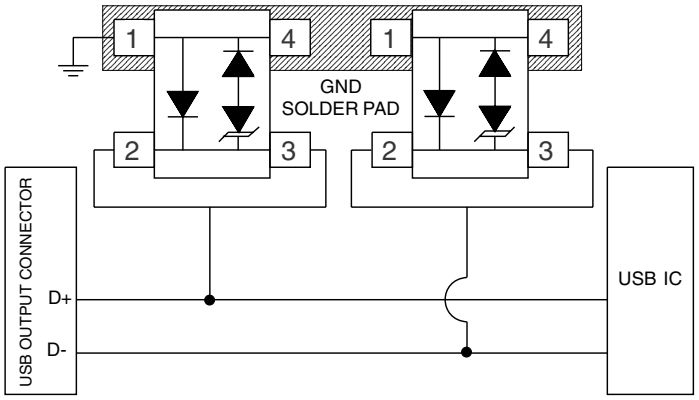
The USB04 Series are TVS arrays designed to protect I/O or data lines from the damaging effects of ESD and EFT. This product series provides both unidirectional and bidirectional protection, with a surge capability of 500 Watts P_{PP} per line for an 8/20µs waveform and ESD protection > 40kV.

UNIDIRECTIONAL
COMMON-MODE CONFIGURATION (Figure 1)

The two USB04 Series devices provide protection in a common-mode configuration as depicted in Figure 1.

Circuit connectivity is as follows:
- ✔ TVS Device 1: Line 1(D+) is connected to Pins 2 & 3.
- ✔ TVS Device 2: Line 2(D-) is connected to Pins 2 & 3.
- ✔ Both TVS Devices: Pins 1 & 4 connected to ground.

Figure 1 - Unidirectional Configuration (Two TVS Devices)
Common-Mode USB Protection

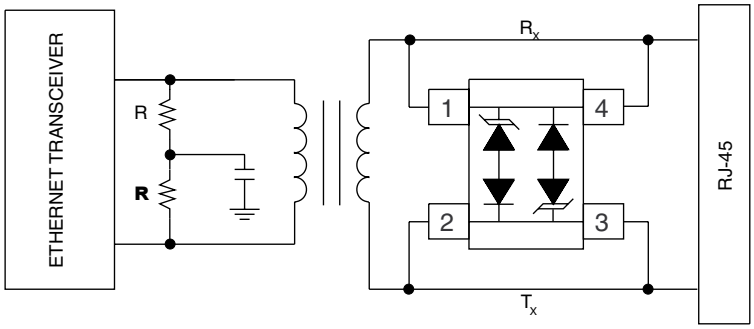


BIDIRECTIONAL
DIFFERENTIAL-MODE CONFIGURATION (Figure 2)

The USB04xxC Series provides protection in a differential-mode configuration as depicted in Figure 2.

Circuit connectivity is as follows:
- ✔ Line 1(R_x) is connected to Pins 1 & 4.
- ✔ Line 2(T_x) is connected to Pins 2 & 3.

Figure 2 - Bidirectional Configuration
Differential-Mode Ethernet Protection



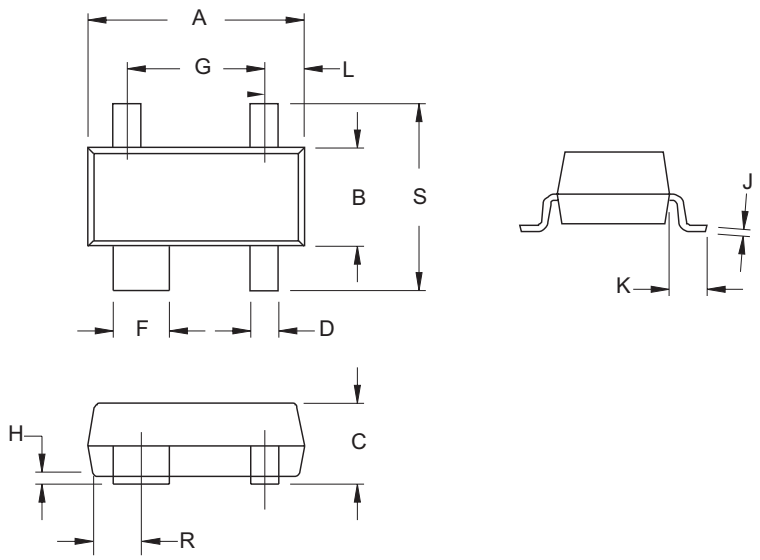
CIRCUIT BOARD LAYOUT RECOMMENDATIONS

Circuit board layout is critical for Electromagnetic Compatibility (EMC) protection. The following guidelines are recommended:

- ✔ The protection device should be placed near the input terminals or connectors, the device will divert the transient current immediately before it can be coupled into the nearby traces.
- ✔ The path length between the TVS device and the protected line should be minimized.
- ✔ All conductive loops including power and ground loops should be minimized.
- ✔ The transient current return path to ground should be kept as short as possible to reduce parasitic inductance.
- ✔ Ground planes should be used whenever possible. For multilayer PCBs, use ground vias.

SOT-143 PACKAGE OUTLINE & DIMENSIONS

PACKAGE OUTLINE



SOT-143

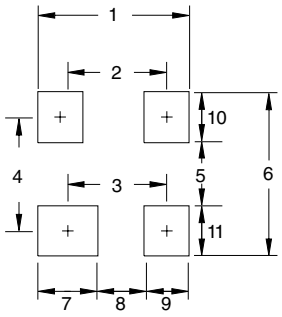


PACKAGE DIMENSIONS

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	2.80	3.04	0.110	0.120
B	1.20	1.39	0.047	0.055
C	0.84	1.14	0.033	0.045
D	0.39	0.50	0.015	0.020
F	0.79	0.93	0.031	0.037
G	1.78	2.03	0.070	0.080
H	0.013	0.10	0.0005	0.004
J	0.08	0.15	0.003	0.006
K	0.46	0.60	0.018	0.024
L	0.445	0.60	0.0175	0.024
R	0.72	0.83	0.028	0.033
S	2.11	2.48	0.083	0.098

MOUNTING PAD

TYPICAL DIM	Millimeters	Inches
1	2.85	0.112
2	2.00	0.079
3	1.80	0.071
4	1.90	0.075
5	1.05	0.041
6	2.75	0.108
7	1.20	0.047
8	0.80	0.031
9	0.85	0.033
10	0.85	0.033
11	0.85	0.033



NOTES

1. Dimensioning and tolerances per ANSI Y14.5M, 1985.
2. Controlling Dimension: Inches
3. Dimensions are exclusive of mold flash and metal burrs.

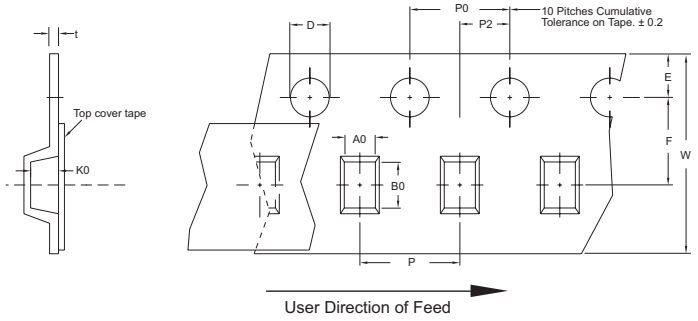
TAPE & REEL ORDERING NOMENCLATURE

1. Surface mount product is taped and reeled in accordance with EIA-481.
2. Suffix-T7 = 7 Inch Reel - 3,000 pieces per 8mm tape, i.e., *USB0405C-T7.*
3. Suffix-T13 = 13 Inch Reel - 10,000 pieces per 8mm tape, i.e., *USB0405C-T13.*
4. Suffix - LF = Lead-Free, Pure-Tin Plating, i.e., *USB0405C-LF-T7.*

Outline & Dimensions: Rev 2 - 6/06, 06011

Tape & Reel Specifications (Dimensions in millimeters)

Reel Dia.	Tape Width	A0	B0	K0	D	E	F	W	P0	P2	P	tmax
178mm (7")	8mm	3.10 ± 0.10	2.70 ± 0.10	1.35 ± 0.10	1.50 ± 0.10	1.75 ± 0.10	3.50 ± 0.05	8.00 ±0.30	4.00 ±0.10	2.00 ±0.05	4.00 ±0.10	0.25



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