Voidless-Hermetically-Sealed Unidirectional Low-Capacitance Transient Voltage Suppressors Data Sheet

1N8147–1N8182

Product Overview

This series of voidless-hermetically-sealed unidirectional low-capacitance Transient Voltage Suppressor (TVS) designs are ideal for protecting higher frequency applications in high-reliability applications where a failure cannot be tolerated. They include a unique rectifier diode in series and opposite direction from the TVS to achieve a very low capacitance of 4 pF. This product series provides a working peak "standoff" voltage selection from 5.0V to 170V with 150-watt ratings. They are very robust in hard-glass construction and use an internal metallurgical bond identified as Category 1 for high reliability applications. These devices are also available in axial leaded packages for surface mounting.

Features

- High surge current and peak pulse power unidirectional protection for sensitive circuits
- Very low capacitance for high frequency or high baud rate applications
- Bidirectional capability with two devices in anti-parallel (see Figure 4-5)
- Triple-layer passivation
- Internal "Category 1" metallurgical bonds
- Voidless hermetically sealed glass package
- RoHS compliant versions are available

Applications/Benefits

- High reliability transient protection
- Extremely robust construction
- Working peak "standoff" voltage (V_{WM}) from 5.0 to 170 volts
- Available as 150W peak pulse power (P_{PP}) at 10/1000 µs
- Lowest available capacitance for 150W rated TVS
- ESD and EFT protection per IEC61000-4-2 and IEC61000-4-4 respectively
- Secondary lightning protection per select levels in IEC61000-4-5
- Flexible axial-leaded mounting terminals
- Nonsensitive to ESD per MIL-STD-750 method 1020
- Inherently radiation hard as described in Microchip MicroNote 050

Figure 1. "A Package"

Also available in:

"A" MELF package

(surface mount)

1N8147US – 1N8182US

Table of Contents

1. Maximum Ratings

Table 1-1. Maximum Ratings

Parameter	Symbol	Ratings	Unit
Capacitance at zero volts	C	4	pF
Impulse repetition rate (duty factor)	d_F	0.01	%
Junction and storage temperature	T_J and T_{STG}	–55 to 175	°C
Peak pulse power at 25 °C (10/1000 µs)	P_{PP}	150	W
Solder temperature (10 seconds maximum)	T_{SP}	260	°C
Steady state (average) power at T_A = 25 °C	$P_{M(AV)}$	1.0	W
Thermal resistance junction to ambient	$R_{\Theta JA}$	150	°C/W

Note:

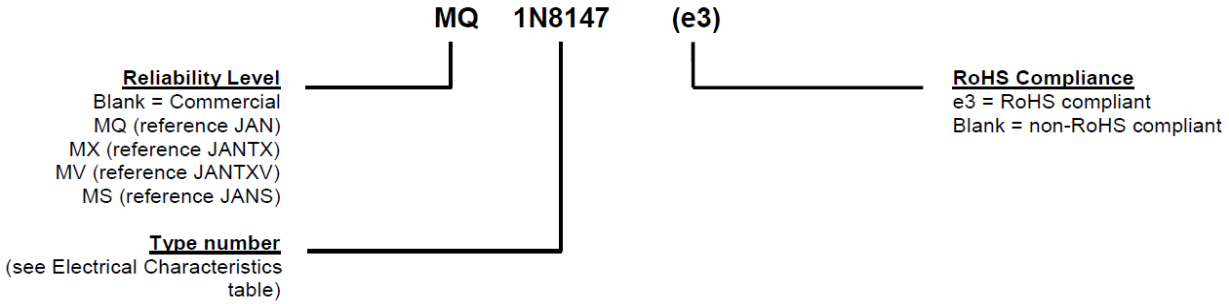
1. Steady-state power ratings with reference to ambient are for PC boards where thermal resistance from mounting point to ambient is sufficiently controlled where $T_{J(MAX)}$ is not exceeded.

1.1. Mechanical and Packaging

- Case: Hermetically sealed voidless hard glass with tungsten slugs
- Terminals: Axial-leads are tin/lead or RoHS compliant matte/tin plating over copper
- Marking: Body paint and part number
- Polarity: Cathode band
- Mounting: Any position
- Tape and Reel Option: Standard per EIA-296
- Weight: Approximately 340 milligrams
- See Package Dimensions

2. Part Nomenclature

Figure 2-1. Part Nomenclature



2.1. Symbols and Definitions

Table 2-1. Symbols and Definitions

Symbol	Definition
C	Capacitance: The capacitance between the two terminals of the device.
I_D	Maximum Standoff Current: The maximum current that will flow at the specified voltage and temperature.
I_{IB}	Blocking Leakage Current: The current through the device at the rated inverse blocking voltage (V_{WIB}).
P_{PP}	Peak Pulse Power: The peak power dissipation resulting from the peak pulse current I_{PP}.
$V_{(BR)}$	Breakdown Voltage: The voltage the device will exhibit at a specified current (I_{BR}).
V_C	Maximum clamping voltage at specified I_{PP} (peak pulse current) at the specified pulse conditions.
V_{WIB}	Inverse Blocking Voltage: The maximum-rated value of dc or peak blocking voltage in the inverse direction.
V_{WM}	Working Peak Voltage: The maximum peak voltage that can be applied over the operating temperature range. This is also referred to as standoff voltage.

3. Electrical Characteristics

Table 3-1. Electrical Characteristics at T_A = 25 °C Unless Otherwise Noted

Part Number	Min. Breakdown Voltage ($V_{(BR)}$)	Breakdown Current ($I_{(BR)}$)	Working Standoff Voltage (V_{WM})	Max. Standby Current (I_D)	Max. Peak Clamping Voltage (V_C)	Max. Surge Current (I_{PPSM})	Max. $V_{(BR)}$ Temp-Co ($\alpha V_{(BR)}$)	Capacitance (C)	Rated Inverse Blocking Voltage (V_{WIB})	Blocking Leakage Current (I_{IB})
	V	mA	V	µA	V	A	%/°C	pF	V	µA
1N8147	6.46	10	5.0	500	11.5	13.0	0.057	4	300	1
1N8148	7.13	10	6.0	100	12.1	12.4	0.061	4	300	1
1N8149	7.79	10	6.8	20	12.8	11.7	0.065	4	300	1
1N8150	8.65	1	7.5	10	13.5	11.1	0.068	4	300	1
1N8151	9.5	1	8.5	10	14.5	10.3	0.073	4	300	1
1N8152	10.4	1	9	5	15.6	9.62	0.075	4	300	1
1N8153	11.4	1	10	1	16.9	8.88	0.078	4	300	1
1N8154	12.4	1	11	1	18.2	8.24	0.081	4	300	1
1N8155	13.8	1	12	1	20.2	7.42	0.084	4	300	1
1N8156	15.2	1	13	1	22.3	6.73	0.086	4	300	1
1N8157	17.1	1	15	1	25.1	5.98	0.088	4	300	1
1N8158	19	1	17	0.5	27.7	5.42	0.09	4	300	1
1N8159	20.9	1	18	0.5	30.5	4.92	0.092	4	300	1
1N8160	22.8	1	20	0.5	33.3	4.5	0.094	4	300	1
1N8161	25.7	1	22	0.5	37.4	4.01	0.096	4	300	1
1N8162	28.5	1	25	0.5	41.6	3.6	0.097	4	300	1
1N8163	31.4	1	28	0.5	45.7	3.28	0.098	4	300	1
1N8164	34.2	1	30	0.5	49.9	3.01	0.099	4	300	1
1N8165	37.1	1	33	0.5	53.6	2.8	0.1	4	300	1
1N8166	40.9	1	36	0.5	59.1	2.54	0.101	4	300	1
1N8167	44.7	1	40	0.5	64.6	2.32	0.101	4	300	1
1N8168	48.5	1	43	0.5	70.1	2.14	0.102	4	300	1
1N8169	53.2	1	47	0.5	77	1.95	0.103	4	300	1
1N8170	58.9	1	53	0.5	85.3	1.76	0.104	4	300	1
1N8171	64.6	1	58	0.5	93.7	1.6	0.104	4	300	1
1N8172	71.3	1	64	0.5	103	1.45	0.105	4	300	1
1N8173	77.9	1	70	0.5	113	1.32	0.105	4	300	1
1N8174	86.5	1	75	0.5	125	1.2	0.105	4	300	1
1N8175	95	1	82	0.5	137	1.09	0.106	4	300	1
1N8176	104	1	94	0.5	152	0.98	0.107	4	300	1
1N8177	114	1	100	0.5	168	0.89	0.107	4	300	1
1N8178	124	1	110	0.5	183	0.82	0.107	4	300	1
1N8179	138	1	120	0.5	208	0.72	0.108	4	300	1
1N8180	152	1	130	0.5	225	0.67	0.108	4	300	1
1N8181	171	1	150	0.5	261	0.57	0.108	4	300	1
1N8182	190	1	170	0.5	294	0.51	0.108	4	300	1

4. Graphs

Figure 4-1. Peak Pulse Power vs. Pulse Time

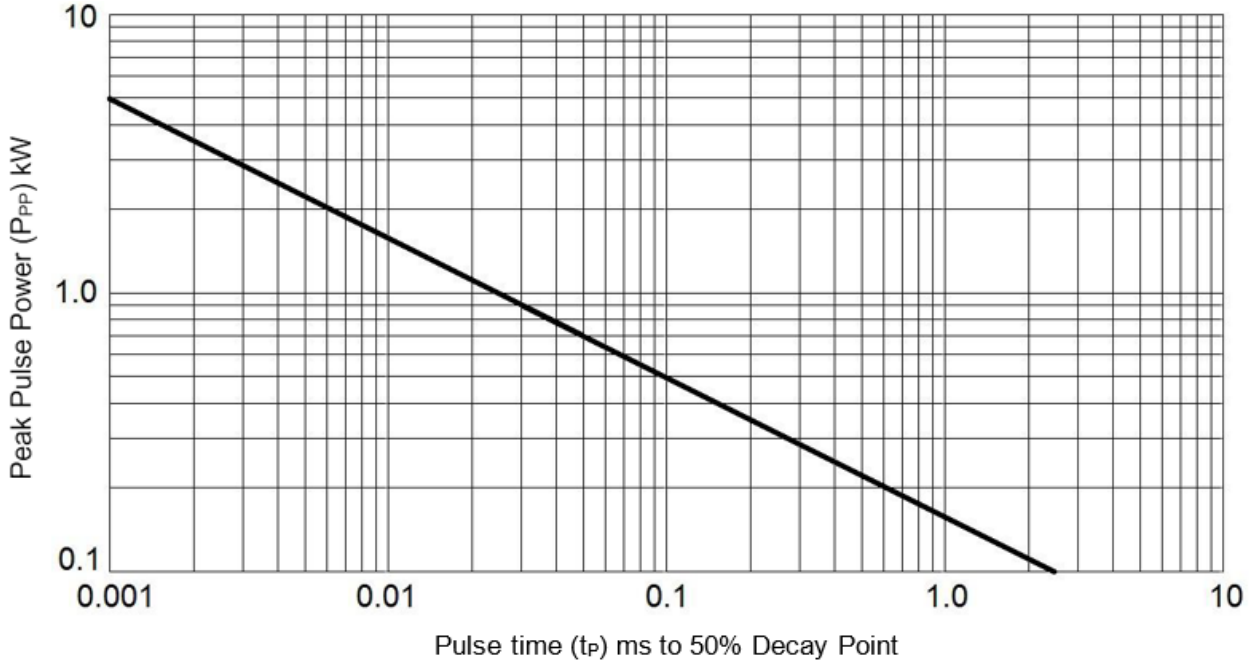


Figure 4-2. 10/1000 µs Current Impulse Waveform

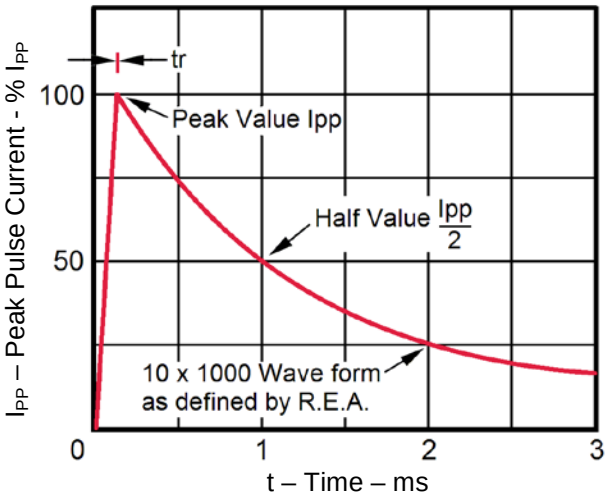
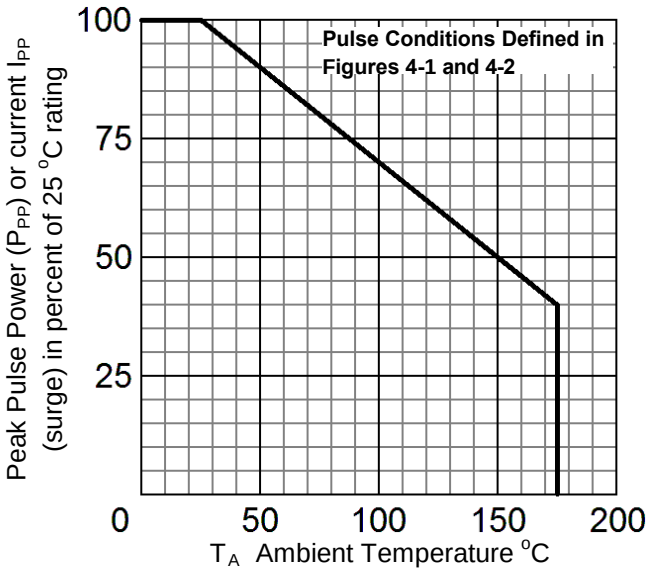


Figure 4-3. Derating Curve



4.1. Schematic Applications

The TVS low capacitance device configuration described in this data sheet is shown in the following left figure involving a TVS and a unique diode in series and opposite direction. For bidirectional low capacitance TVS applications, use two low capacitance TVS devices as described in this data sheet in anti-parallel as shown in the following right figure. This will result in twice the capacitance of the left figure specified in this data sheet.

Figure 4-4. Low Capacitance TVS

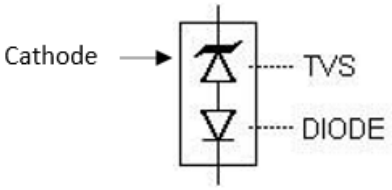
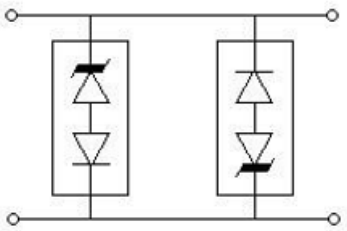
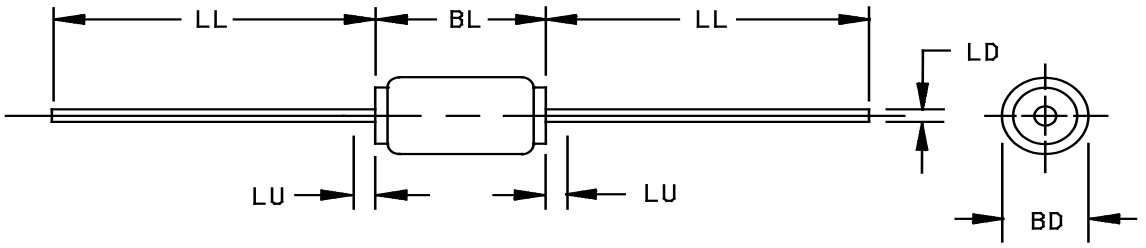


Figure 4-5. Bidirectional Configuration (Two Low Capacitance TVS Devices in Anti-Parallel Configuration)



5. Package Dimensions

Figure 5-1. Package Dimensions



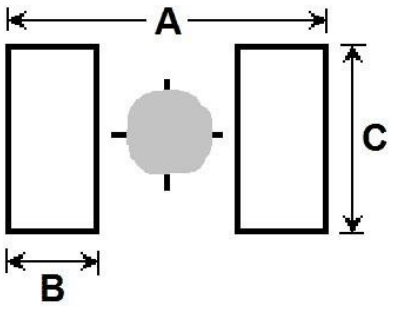
Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min.	Max.	Min.	Max.	
BD	0.060	0.085	1.52	2.16	3
BL	0.106	0.175	2.69	4.45	—
LD	0.028	0.032	0.71	0.81	—
LL	0.800	1.300	20.32	33.02	—
LU	—	0.050	—	1.27	4

Notes:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Dimension BD shall be measured at the largest diameter.
4. Dimension LU lead diameter uncontrolled in this area.
5. In accordance with ASME Y14.5M, diameters are equivalent to Φx symbology.

5.1. Pad Layout

Figure 5-2. Pad Layout



Symbol	Dimensions	
	Inch	Millimeters
A	0.288	7.32
B	0.070	1.78
C	0.155	3.94

Note:

1. If mounting requires adhesive separate from the solder, an additional 0.080 inch diameter contact may be placed in the center between the pads as an optional spot for cement.

6. Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

Revision	Date	Description
A	05/2025	Initial revision.

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