VISHAY INTERTECHNOLOGY, INC.

INTERACTIVE data book

SINTERGLASS AVALANCHE DIODES

VISHAY SEMICONDUCTORS

VSE-DB0112-1009

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1. To navigate:
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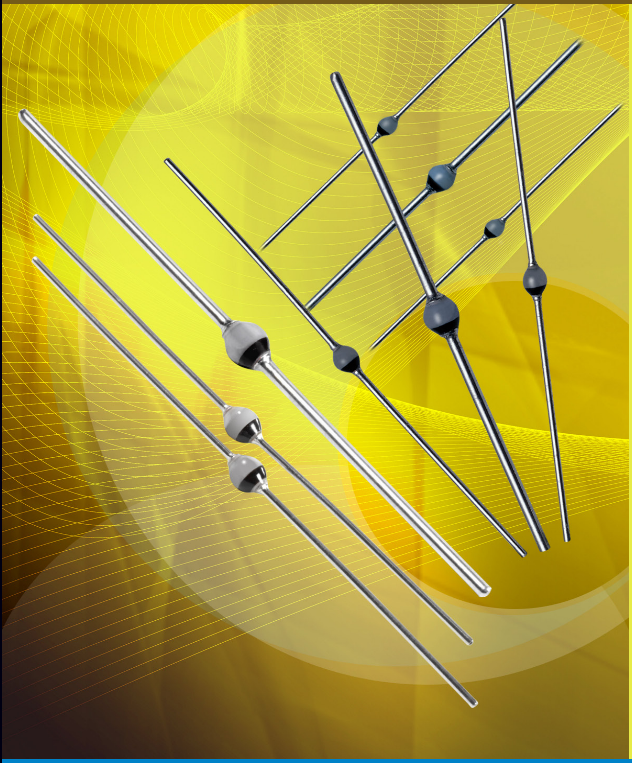
VISHAY INTERTECHNOLOGY, INC.



DATA BOOK

SINTERGLASS AVALANCHE DIODES

VISHAY SEMICONDUCTORS

www.vishay.com

SEMICONDUCTORS

RECTIFIERS
- Schottky (single, dual)
- Standard, Fast and Ultra-Fast Recovery (single, dual)
- Bridge
- Superectifier®
- Sinterglass Avalanche Diodes

HIGH-POWER DIODES AND THYRISTORS
- High-Power Fast-Recovery Diodes
- Phase-Control Thyristors
- Fast Thyristors

SMALL-SIGNAL DIODES
- Schottky and Switching (single, dual)
- Tuner/Capacitance (single, dual)
- Bandswitching
- PIN

ZENER AND SUPPRESSOR DIODES
- Zener (single, dual)
- TVS (TRANSZORB®, Automotive, ESD, Arrays)

FETs
- Low-Voltage TrenchFET® Power MOSFETs
- High-Voltage TrenchFET® Power MOSFETs
- High-Voltage Planar MOSFETs
- JFETs

OPTOELECTRONICS
- IR Emitters and Detectors, and IR Receiver Modules
- Optocouplers and Solid-State Relays
- Optical Sensors
- LEDs and 7-Segment Displays
- Infrared Data Transceiver Modules
- Custom Products

ICs
- Power ICs
- Analog Switches

MODULES
- Power Modules (contain power diodes, thyristors, MOSFETs, IGBTs)

PASSIVE COMPONENTS

RESISTIVE PRODUCTS
- Film Resistors
  - Metal Film Resistors
  - Thin Film Resistors
  - Thick Film Resistors
  - Metal Oxide Film Resistors
  - Carbon Film Resistors
- Wirewound Resistors
- Power Metal Strip® Resistors
- Chip Fuses
- Variable Resistors
  - Cermet Variable Resistors
  - Wirewound Variable Resistors
  - Conductive Plastic Variable Resistors
- Networks/Arrays
- Non-Linear Resistors
  - NTC Thermistors
  - PTC Thermistors
  - Varistors

MAGNETICS
- Inductors
- Transformers

CAPACITORS
- Tantalum Capacitors
  - Molded Chip Tantalum Capacitors
  - Coated Chip Tantalum Capacitors
  - Solid Through-Hole Tantalum Capacitors
  - Wet Tantalum Capacitors
- Ceramic Capacitors
  - Multilayer Chip Capacitors
  - Disc Capacitors
- Film Capacitors
- Power Capacitors
- Heavy-Current Capacitors
- Aluminum Capacitors

Sinterglass Avalanche Diodes

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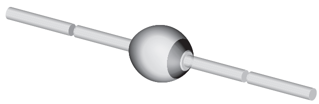
Sinterglass Avalanche Diodes

ULTRA-FAST AVALANCHE SINTERGLASS DIODES

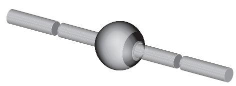


SOD-57 PACKAGE
ULTRA-FAST AVALANCHE SINTERGLASS DIODES (t_{rr} < 100 ns)

PART NUMBER	V_R V_{RRM} V_{RWM} (V)	I_{FAV} (A)	I_{FSM} AT t_p = 10 ms (A)	V_F 25 °C (V)	AT I_F (A)	I_R AT T_j 25 °C (µA)	I_R HIGH TEMP. (µA)	AT T_j (°C)	T_j, T_{stg} MIN. (°C)	T_j, T_{stg} MAX. (°C)	t_{rr} MAX. (ns)	E_R (mJ)	AT I_R (A)	PAGE
BYT53A	50	1.9	50	1.1	1	5	200	150	- 55	175	50	20	1	60
BYT53B	100	1.9	50	1.1	1	5	200	150	- 55	175	50	20	1	60
BYT53C	150	1.9	50	1.1	1	5	200	150	- 55	175	50	20	1	60
BYT53D	200	1.9	50	1.1	1	5	200	150	- 55	175	50	20	1	60
BYT53F	300	1.9	50	1.1	1	5	200	150	- 55	175	50	20	1	60
BYT53G	400	1.9	50	1.1	1	5	200	150	- 55	175	50	20	1	60
BYV26A	200	1	30	2.5	1	5	100	150	- 55	175	30	10	1	63
BYV26B	400	1	30	2.5	1	5	100	150	- 55	175	30	10	1	63
BYV26C	600	1	30	2.5	1	5	100	150	- 55	175	30	10	1	63
BYV26D	800	1	30	2.5	1	5	100	150	- 55	175	75	10	1	63
BYV26E	1000	1	30	2.5	1	5	100	150	- 55	175	75	10	1	63
BYV27-50	50	2	50	1.07	3	1	150	165	- 55	175	25	20	1	66
BYV27-100	100	2	50	1.07	3	1	150	165	- 55	175	25	20	1	66
BYV27-150	150	2	50	1.07	3	1	150	165	- 55	175	25	20	1	66
BYV27-200	200	2	50	1.07	3	1	150	165	- 55	175	25	20	1	66
BYV27-600	600	2	50	1.35	3	5	150	150	- 55	175	40	10	0.4	69
SF1200	1200	1	30	3.4	1	5	50	125	- 55	175	75	10	0.4	84
SF1600	1600	1	30	3.4	1	5	50	125	- 55	175	75	10	0.4	84
SF4001	50	1	30	1	1	5	50	125	- 55	175	50	10	0.4	87
SF4002	100	1	30	1	1	5	50	125	- 55	175	50	10	0.4	87
SF4003	200	1	30	1	1	5	50	125	- 55	175	50	10	0.4	87
SF4004	400	1	30	1	1	5	50	125	- 55	175	50	10	0.4	87
SF4005	600	1	30	1.7	1	5	50	125	- 55	175	75	10	0.4	87
SF4006	800	1	30	1.7	1	5	50	125	- 55	175	75	10	0.4	87
SF4007	1000	1	30	1.7	1	5	50	125	- 55	175	75	10	0.4	87

Note

- E_R = pulse energy in avalanche mode



SOD-64 PACKAGE
ULTRA-FAST AVALANCHE SINTERGLASS DIODES (t_{rr} < 100 ns)

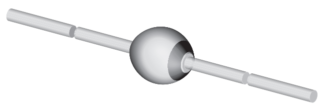
PART NUMBER	V_R V_{RRM} V_{RWM} (V)	I_{FAV} (A)	I_{FSM} AT t_p = 10 ms (A)	V_F 25 °C (V)	AT I_F (A)	I_R AT T_j 25 °C (µA)	I_R HIGH TEMP. (µA)	AT T_j (°C)	T_j, T_{stg} MIN. (°C)	T_j, T_{stg} MAX. (°C)	t_{rr} MAX. (ns)	E_R (mJ)	AT I_R (A)	PAGE
BYV28-50	50	3.5	90	1.1	5	1	150	165	- 55	175	30	20	1	72
BYV28-100	100	3.5	90	1.1	5	1	150	165	- 55	175	30	20	1	72
BYV28-150	150	3.5	90	1.1	5	1	150	165	- 55	175	30	20	1	72
BYV28-200	200	3.5	90	1.1	5	1	150	165	- 55	175	30	20	1	72
BYV28-600	600	3.5	90	1.35	5	5	150	150	- 55	175	50	20	1	75
BYV98-50	50	4	70	1.1	5	10	200	150	- 55	175	35	20	1	78
BYV98-100	100	4	70	1.1	5	10	200	150	- 55	175	35	20	1	78
BYV98-150	150	4	70	1.1	5	10	200	150	- 55	175	35	20	1	78
BYV98-200	200	4	70	1.1	5	10	200	150	- 55	175	35	20	1	78
BYW178	800	3	80	1.9	3	1	20	100	- 55	175	60	20	1	81
SF5400	50	3	150	1.1	3	5	50	125	- 55	175	50	10	0.4	91
SF5401	100	3	150	1.1	3	5	50	125	- 55	175	50	10	0.4	91
SF5402	200	3	150	1.1	3	5	50	125	- 55	175	50	10	0.4	91
SF5403	300	3	150	1.1	3	5	50	125	- 55	175	50	10	0.4	91
SF5404	400	3	150	1.1	3	5	50	125	- 55	175	50	10	0.4	91
SF5405	500	3	150	1.7	3	5	50	125	- 55	175	75	10	0.4	91
SF5406	600	3	150	1.7	3	5	50	125	- 55	175	75	10	0.4	91
SF5407	800	3	150	1.7	3	5	50	125	- 55	175	75	10	0.4	91
SF5408	1000	3	150	1.7	3	5	50	125	- 55	175	75	10	0.4	91

Note

- E_R = pulse energy in avalanche mode

For technical questions within your region, please contact one of the following:
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com

FAST AVALANCHE SINTERGLASS DIODES



SOD-57 PACKAGE
FAST AVALANCHE SINTERGLASS DIODES (t_{rr} < 500 ns)

PART NUMBER	V_R V_{RRM} V_{RWM} (V)	I_{FAV} (A)	I_{FSM} AT t_p = 10 ms (A)	V_F 25 °C (V)	AT I_F (A)	I_R AT T_j 25 °C (µA)	I_R HIGH TEMP. (µA)	AT T_j (°C)	T_j, T_{stg} MIN. (°C)	T_j, T_{stg} MAX. (°C)	t_{rr} MAX. (ns)	E_R (mJ)	AT I_R (A)	PAGE
BY203-12S	1200	0.25	20	2.4	0.2	2	-	-	- 55	175 (1)	300	10	0.4	102
BY203-16S	1600	0.25	20	2.4	0.2	2	-	-	- 55	175 (1)	300	10	0.4	102
BY203-20S	2000	0.25	20	2.4	0.2	2	-	-	- 55	175 (1)	300	10	0.4	102
BY268	1400	0.8	20	1.25	0.4	2	15	100	- 55	175	400	10	0.4	105
BY269	1600	0.8	20	1.25	0.4	2	15	100	- 55	175	400	10	0.4	105
BYT52A	50	1.4	50	1.3	1	5	150	150	- 55	175	200	10	0.4	112
BYT52B	100	1.4	50	1.3	1	5	150	150	- 55	175	200	10	0.4	112
BYT52D	200	1.4	50	1.3	1	5	150	150	- 55	175	200	10	0.4	112
BYT52G	400	1.4	50	1.3	1	5	150	150	- 55	175	200	10	0.4	112
BYT52J	600	1.4	50	1.3	1	5	150	150	- 55	175	200	10	0.4	112
BYT52K	800	1.4	50	1.3	1	5	150	150	- 55	175	200	10	0.4	112
BYT52M	1000	1.4	50	1.3	1	5	150	150	- 55	175	200	10	0.4	112
BYT54A	50	1.25	30	1.5	1	5	150	150	- 55	175	100	10	0.4	115
BYT54B	100	1.25	30	1.5	1	5	150	150	- 55	175	100	10	0.4	115
BYT54D	200	1.25	30	1.5	1	5	150	150	- 55	175	100	10	0.4	115
BYT54G	400	1.25	30	1.5	1	5	150	150	- 55	175	100	10	0.4	115
BYT54J	600	1.25	30	1.5	1	5	150	150	- 55	175	100	10	0.4	115
BYT54K	800	1.25	30	1.5	1	5	150	150	- 55	175	100	10	0.4	115
BYT54M	1000	1.25	30	1.5	1	5	150	150	- 55	175	100	10	0.4	115
BYV12	100	1.5	40	1.5	1	5	150	150	- 55	175	300	10	0.4	124
BYV13	400	1.5	40	1.5	1	5	150	150	- 55	175	300	10	0.4	124
BYV14	600	1.5	40	1.5	1	5	150	150	- 55	175	300	10	0.4	124
BYV15	800	1.5	40	1.5	1	5	150	150	- 55	175	300	10	0.4	124
BYV16	1000	1.5	40	1.5	1	5	150	150	- 55	175	300	10	0.4	124
BYV37	800	2	50	1.1	1	5	150	150	- 55	175	300	10	0.4	128
BYV38	1000	2	50	1.1	1	5	150	150	- 55	175	300	10	0.4	128
BYW32	200	2	50	1.1	1	5	150	150	- 55	175	200	10	0.4	131
BYW33	300	2	50	1.1	1	5	150	150	- 55	175	200	10	0.4	131
BYW34	400	2	50	1.1	1	5	150	150	- 55	175	200	10	0.4	131
BYW35	500	2	50	1.1	1	5	150	150	- 55	175	200	10	0.4	131
BYW36	600	2	50	1.1	1	5	150	150	- 55	175	200	10	0.4	131

Notes

- E_R = pulse energy in avalanche mode

(1) T_j = 150 °C

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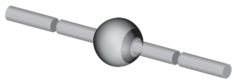
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com



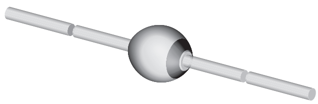
SOD-64 PACKAGE
FAST AVALANCHE SINTERGLASS DIODES (t_{rr} < 500 ns)

PART NUMBER	V_R V_{RRM} V_{RWM} (V)	I_{FAV} (A)	I_{FSM} AT t_p = 10 ms (A)	V_F 25 °C (V)	AT I_F (A)	I_R AT T_j 25 °C (µA)	I_R HIGH TEMP. (µA)	AT T_j (°C)	T_j, T_{stg} MIN. (°C)	T_j, T_{stg} MAX. (°C)	t_{rr} MAX. (ns)	E_R (mJ)	AT I_R (A)	PAGE
1N5417	200	3	100	1.1	3	1	20	100	- 55	175	100	20	1	96
1N5418	400	3	100	1.1	3	1	20	100	- 55	175	100	20	1	96
BYW172D	200	3	100	1.1	3	1	20	100	- 55	175	100	20	1	99
BYW172F	300	3	100	1.1	3	1	20	100	- 55	175	100	20	1	99
BYW172G	400	3	100	1.1	3	1	20	100	- 55	175	100	20	1	99
BYM36A	200	3	65	1.6	3	5	100	150	- 55	175	100	20	1	108
BYM36B	400	3	65	1.6	3	5	100	150	- 55	175	100	20	1	108
BYM36C	600	3	65	1.6	3	5	100	150	- 55	175	100	20	1	108
BYM36D	800	2.9	65	1.78	3	5	100	150	- 55	175	150	20	1	108
BYM36E	1000	2.9	65	1.78	3	5	100	150	- 55	175	150	20	1	108
BYT56A	50	3	80	1.4	3	5	150	150	- 55	175	100	10	0.4	118
BYT56B	100	3	80	1.4	3	5	150	150	- 55	175	100	10	0.4	118
BYT56D	200	3	80	1.4	3	5	150	150	- 55	175	100	10	0.4	118
BYT56G	400	3	80	1.4	3	5	150	150	- 55	175	100	10	0.4	118
BYT56J	600	3	80	1.4	3	5	150	150	- 55	175	100	10	0.4	118
BYT56K	800	3	80	1.4	3	5	150	150	- 55	175	100	10	0.4	118
BYT56M	1000	3	80	1.4	3	5	150	150	- 55	175	100	10	0.4	118
BYT77	800	3	100	1.2	3	5	150	150	- 55	175	250	10	0.4	121
BYT78	1000	3	100	1.2	3	5	150	150	- 55	175	250	10	0.4	121
BYW72	200	3	100	1.1	3	5	150	150	- 55	175	200	10	0.4	134
BYW73	300	3	100	1.1	3	5	150	150	- 55	175	200	10	0.4	134
BYW74	400	3	100	1.1	3	5	150	150	- 55	175	200	10	0.4	134
BYW75	500	3	100	1.1	3	5	150	150	- 55	175	200	10	0.4	134
BYW76	600	3	100	1.1	3	5	150	150	- 55	175	200	10	0.4	134

Note

- E_R = pulse energy in avalanche mode

STANDARD AVALANCHE SINTERGLASS DIODES

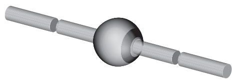


SOD-57 PACKAGE
STANDARD AVALANCHE SINTERGLASS DIODES (t_{rr} > 500 ns)

PART NUMBER	V_R V_{RRM} V_{RWM} (V)	I_{FAV} (A)	I_{FSM} AT t_p = 10 ms (A)	V_F 25 °C (V)	AT I_F (A)	I_R AT T_j 25 °C (µA)	I_R HIGH TEMP. (µA)	AT T_j (°C)	T_j, T_{stg} MIN. (°C)	T_j, T_{stg} MAX. (°C)	t_{rr} MAX. (µs)	E_R (mJ)	AT I_R (A)	PAGE
1N5059	200	2	50	1	1	1	100	150	- 55	175	4	20	1	138
1N5060	400	2	50	1	1	1	100	150	- 55	175	4	20	1	138
1N5061	600	2	50	1	1	1	100	150	- 55	175	4	20	1	138
1N5062	800	2	50	1	1	1	100	150	- 55	175	4	20	1	138
BY448	1500	2	30	1.6	3	3	140	140	- 55	175 (1)	2	10	0.4	147
BY458	1200	2	30	1.6	3	3	140	140	- 55	175 (1)	2	10	0.4	147
BY527	800	2	50	1	1	1	10	100	- 55	175	4	20	1	153
BYT51A	50	1.5	50	1.1	1	1	100	150	- 55	175	4	20	1	153
BYT51B	100	1.5	50	1.1	1	1	100	150	- 55	175	4	20	1	153
BYT51D	200	1.5	50	1.1	1	1	100	150	- 55	175	4	20	1	153
BYT51G	400	1.5	50	1.1	1	1	100	150	- 55	175	4	20	1	153
BYT51J	600	1.5	50	1.1	1	1	100	150	- 55	175	4	20	1	153
BYT51K	800	1.5	50	1.1	1	1	100	150	- 55	175	4	20	1	153
BYT51M	1000	1.5	50	1.1	1	1	100	150	- 55	175	4	20	1	153
BYT62	2400	0.35	10	3	0.2	5	250	175	- 55	190 (2)	5	60	1	156
BYW52	200	2	50	1	1	1	10	100	- 55	175	4	20	1	158
BYW53	400	2	50	1	1	1	10	100	- 55	175	4	20	1	158
BYW54	600	2	50	1	1	1	10	100	- 55	175	4	20	1	158
BYW55	800	2	50	1	1	1	10	100	- 55	175	4	20	1	158
BYW56	1000	2	50	1	1	1	10	100	- 55	175	4	20	1	158
BYX82	200	2	50	1	1	1	25	100	- 55	175	4	-	-	164
BYX83	400	2	50	1	1	1	25	100	- 55	175	4	-	-	164
BYX84	600	2	50	1	1	1	25	100	- 55	175	4	-	-	164
BYX85	800	2	50	1	1	1	25	100	- 55	175	4	-	-	164
BYX86	1000	2	50	1	1	1	25	100	- 55	175	4	-	-	164
S330D	1000	2	50	1.65	10	5	50	100	- 55	175	4	20	1	168

Notes
- E_R = pulse energy in avalanche mode

(1) T_j = 140 °C
(2) T_j = 175 °C



SOD-64 PACKAGE
STANDARD AVALANCHE SINTERGLASS DIODES (t_{rr} > 500 ns)

PART NUMBER	V_R V_{RRM} V_{RWM} (V)	I_{FAV} (A)	I_{FSM} AT t_p = 10 ms (A)	V_F 25 °C (V)	AT I_F (A)	I_R AT T_j 25 °C (µA)	I_R HIGH TEMP. (µA)	AT T_j (°C)	T_j, T_{stg} MIN. (°C)	T_j, T_{stg} MAX. (°C)	t_{rr} MAX. (µs)	E_R (mJ)	AT I_R (A)	PAGE
BY228	1500	3	50	1.5	5	5	140	140	- 55	175 [1]	2	10	0.4	141
BY228-13	1000	3	50	1.5	5	5	140	140	- 55	175 [1]	2	10	0.4	144
BY228-15	1200	3	50	1.5	5	5	140	140	- 55	175 [1]	2	10	0.4	144
BYW82	200	3	100	1	3	1	10	100	- 55	175	5	20	1	161
BYW83	400	3	100	1	3	1	10	100	- 55	175	5	20	1	161
BYW84	600	3	100	1	3	1	10	100	- 55	175	5	20	1	161
BYW85	800	3	100	1	3	1	10	100	- 55	175	5	20	1	161
BYW86	1000	3	100	1	3	1	10	100	- 55	175	5	20	1	161

Notes
- E_R = pulse energy in avalanche mode

(1) T_j = 140 °C

About Sinterglass Avalanche Diodes

Vishay's Sinterglass avalanche diodes are specially designed for applications requiring high reliability and are suitable for storage and operating temperatures higher than any plastic package.

The combination of high reliability, reverse avalanche energy rating and soft recovery switching behaviour provides unique features for dedicated applications.

No other 1.0 A to 3.5 A diode of any kind - plastic or metal - can match Vishay's Sinterglass avalanche diodes combination of the following features a result of Vishay's unique Sinterglass construction:

Cross Section of Sinterglass Diodes Construction

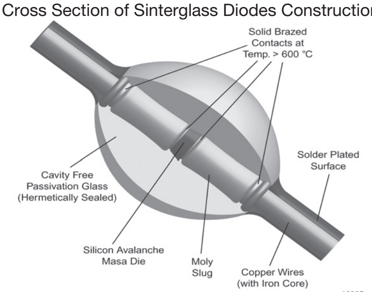


Fig. 1 - Cross Section of Sinterglass Diodes Construction

- Brazed at greater than 600 °C at both leads and die; eliminates all soft solders
- Hermetically-sealed package
- 100 % plastic-free construction
- Reverse avalanche energy rated
- Proven reliability to meet automotive requirements
- Very high reverse avalanche energy capability and therefore suited for series connection
- High reverse voltage up to 2400 V
- Low forward losses
- Low reverse losses
- Excellent reverse current stability at highest temperatures
- Low switching losses, due to fast/ultra fast reverse and forward recovery characteristics

Most other diodes rated up to 3.5 A are soft soldered with silicon rubber passivation or pressure contacted. Sinterglass avalanche diodes use a brazed construction and glass passivation to hermetically seal its junction. To withstand the 600 °C, required to melt and fuse the glass, only high temperature brazing operations are used. This technique tremendously enhances mechanical strength and temperature cycling capability, increasing operating and storage temperature range while reducing thermal resistance. The Sinterglass avalanche diode will not go up in flames.

Sinterglass avalanche diodes are the world's only diodes with totally brazed construction together with glass passivated junction and meets the most stringent reliability requirements.

These devices lend themselves to a wide variety of applications. They can withstand the harsh environment of the automotive world, meeting the long term reliability and specialized electrical performance requirements of the computer, consumer and telecommunication markets. The small size of the Sinterglass avalanche diode with its capability up to 3.5 A enables high density board layout in electronic assemblies and equipment, while increasing reliability.

We offer the Sinterglass avalanche diode as standard recovery, fast recovery and ultrafast recovery types in leaded packages up to 2400 V reverse voltage.

Fundamentals of Sinterglass Diodes

Sinterglass diodes are primarily used for conducting in one direction and blocking in the other.

Within Sinterglass diodes there are several groups depending on the reverse recovery characteristic (reverse recovery time t_{rr}):

- Standard Sinterglass diodes with $t_{rr} > 500$ ns (e.g. BYT51, BYW56, BYW86)
- Fast Sinterglass diodes with 100 ns $< t_{rr} <$ 500 ns (e.g. BYT52, BYW36, BYW76)
- Ultra fast Sinterglass diodes with $t_{rr} < 100$ ns (e.g. BYV26, BYV27, BYV28, SF5408)

Sinterglass diodes are of p-n junction technology with different processes to optimize the characteristics for different applications. They are placed in different packages, leaded like the Sinterglass (SOD-57, SOD-64, G1, G3, G4) which fulfill different power requirements.

Because of their predominant rectifying qualities, Sinterglass diodes are primarily used for power or signal conditioning in a variety of applications. This can range from high power output diode applications (e.g. power plants, railways,...) to low power switching diode requirements (e.g. mobile phone chargers, energy saving lamps,...). They are also used in several other specialized ways like clamping networks for SMPs (e.g. BYT52), damper and modulator diodes for the deflection circuits in CRTs (e.g. BY228), freewheeling diodes for inductive loads etc.

The fig. 1. shows the basic rectifier characteristics with the two regions, the forward conducting region, in which the forward current I_F is flowing and the reverse blocking region, in which the reverse leakage current I_R is flowing.

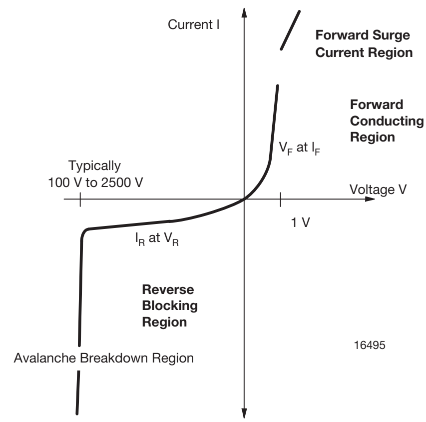
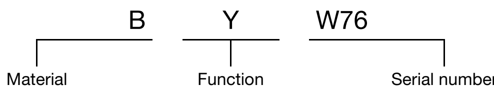


Fig. 1 - Basic Recitfier Characteristics

Conventions Used in Presenting Technical Data

NOMENCLATURE FOR SEMICONDUCTOR DEVICES ACCORDING TO PRO ELECTRON

The part number of a semiconductor device consists of two letters followed by a serial number.
For example:



The **first letter** indicates the material used for the active part of the device.

A Germanium
(Materials with a bandgap 0.6 to 1.0 eV) [(1)]

B Silicon
(Materials with a bandgap 1.0 to 1.3 eV) [(1)]

C Gallium-arsenide
(Materials with a bandgap > 1.3 eV) [(1)]

D Compound materials
(For example cadmium-sulphide)

The **second letter** indicates the circuit function.

A Diode: detection, switching or mixer
B Diode: variable capacitance
C Transistor: low power, audio frequency
D Transistor: power, audio frequency
E Diode: tunnel
F Transistor: low power, high frequency
G Diode: oscillator and miscellaneous
H Diode: magnetic sensitive
K Hall effect device:
in an open magnetic circuit
L Transistor: power, high frequency
M Hall effect device: in a closed magnetic circuit
N Photo coupler
P Diode: radiation sensitive
Q Diode: radiation generating
R Thyristor: low power
S Transistor: low power, switching
T Thyristor: power
U Transistor: power, switching
X Diode: multiplier, e.g. varactor, step recovery
Y Diode: rectifying, booster
Z Diode: voltage reference or voltage regulator transient suppressor diode

Note
(1) The materials mentioned are examples

The **serial number** consists of:

- A four digit number from 100 to 9999 for devices primarily intended for consumer equipment.
- One letter (P, Q, R, etc.) and a three-digit number from 10 to 999 for devices primarily intended for professional equipment.

A version letter can be used to indicate a deviation of a single characteristic, either electrical or mechanical. This letter does not have a fixed meaning. The only exceptions are the use of the letter R, indicating reversed pinning or bending and W indicating SOT-323 or SOT-343 package.

Basic Definitions

BASIC SINTERGLASS DIODE PARAMETERS

The major parameters for the selection of the appropriate Sinterglass diodes are the maximum reverse voltage (V_{RRM}), the average forward current (I_{FAV}) and for switching application the reverse recovery characteristic (t_{rr}), too.

Additional parameters may be for example the reverse avalanche energy capability (E_R) and forward surge capability (I_{FSM}) etc.

V_R	Reverse voltage
V_{RRM}	Repetitive peak reverse voltage, including all repeated reverse transient voltages
$V_{(BR)R}$	Reverse breakdown voltage
I_R	Reverse (leakage) current, at a specified reverse voltage V_R and temperature T_J
I_F	Forward current
V_F	Forward voltage drop, at a specified forward current I_F and temperature T_J
I_{FAV}	Average forward output current, at a specified current waveform (normally 10 ms/50 Hz half-sinewave, sometimes 8.3 ms/60 Hz half-sine-wave), a specified reverse voltage and a specified mounting condition (e.g. lead-length = 10 mm or PCB mounted with certain pads and distance)
I_{FSM}	Peak forward surge current, with a specified current waveform (normally 10 ms/50 Hz half-sine-wave, sometimes 8.3 ms/60 Hz half-sine-wave),
t_{rr}	Reverse recovery time, at a specified forward current (normally 0.5 A), a specified reverse current (normally 1.0 A) and specified measurement conditions (normally from 0 A to 0.25 A)
E_R	Reverse avalanche energy, non-repetitive

POLARITY CONVENTIONS

The voltage direction is given

- by an arrow which points from the measuring point to the reference point
  or
- by a two letter subscript, where the first letter is the measuring point and the second letter is the reference point.

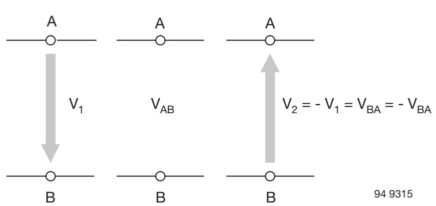


Fig. 1

The numerical value of the voltage is positive if the potential at the arrow tail is higher than at the arrow head; i.e., the potential difference from the measuring point (A) to the reference point (B) is positive.

The numerical value of the voltage is negative if the potential at the arrow head is higher than the tail; i.e., the potential difference from the measuring point to the reference point is negative.

In the case of alternating voltages, once the voltage direction is selected it is maintained throughout. The alternating character of the quantity is given with the time dependent change in sign of its numerical values.

Fig. 2

The numerical value of the current is positive if the charge of the carriers moving in the direction of the arrow is positive (conventional current direction), or if the charge of the carriers moving against this direction is negative. The numerical value of the current is negative if the charge of the carriers moving in the direction of the arrow is negative, or if the charge of the carriers moving against this direction is positive.

The general rules stated above are also valid for alternating quantities. Once the direction is selected, it is maintained throughout. The alternating character of the quantity is given with the time-dependent change in sign of its numerical values.

Polarity Conventions for Diodes

Here, the direction of arrows is selected in such a way that the numerical values of currents and voltages are positive both for forward (F or f) and reverse (R or r) directions.

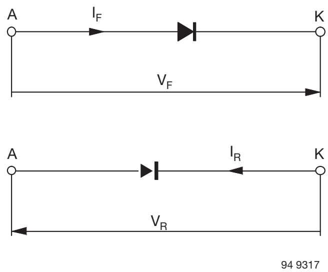


Fig. 3

ARRANGEMENT OF SYMBOLS

Letter Symbols for Current, Voltage and Power

(according to DIN 41 785, sheet 1)
To represent current, voltage and power, a system of basic letter symbols is used. Capital letters are used for the representation of peak, mean, DC or root-mean-square values. Lower case letters are used for the representation of instantaneous values which vary with time.

Capital letters are used as subscripts to represent continuous or total values, while lower case letters are used to represent varying values.

The following table summarizes the rules given above.

BASIC LETTER	
UPPERCASE	UPPERCASE
Instantaneous values which vary with time	Maximum (peak) average (mean) continuous (DC) or root-mean-square (RMS) values

SUBSCRIPT(S)	
UPPER-CASE	UPPER-CASE
Varying component alone, i.e., instantaneous, root-mean-square, maximum or average values	Continuous (without signal) or total (instantaneous, average or maximum) values

Letter Symbols for Impedance, Admittances, Twoport Parameters etc.

For impedance, admittance, two-port parameters, etc. capital letters are used for the representation of external circuits of which the device is only a part.

Lower case letters are used for the representation of electrical parameters inherent in the device.

Capital letters are used as subscripts for the designation of static (DC) values, while lower case letters are used for the designation of small-signal values.

If more than one subscript is used (h_{FE}, h_{fe}), the letter symbols are either all capital or all lower case.
If the subscript has numeric (single, double, etc.) as well as letter symbol(s) (such as h_{21E} or h_{21e}), the differentiation between static and small-signal value is made only by a subscript letter symbol.

Other quantities (values) which deviate from the above rules are given in the list of letter symbols.

The following table summarizes the rules given above.

BASIC LETTER	
UPPER-CASE	UPPER-CASE
Electrical parameters inherent in the semiconductor devices except inductances and capacitances	Electrical parameters of external circuits and of circuits in which the semiconductor device forms only a part; all inductances and capacitances

SUBSCRIPT(S)	
UPPER-CASE	UPPER-CASE
Small-signal values	Static (dc) values

Examples:

G_P Power gain

Z_S Source impedance

f_T Transition frequency

I_F Forward current

Example for the Use of Symbols

According to 41785 and IEC 148

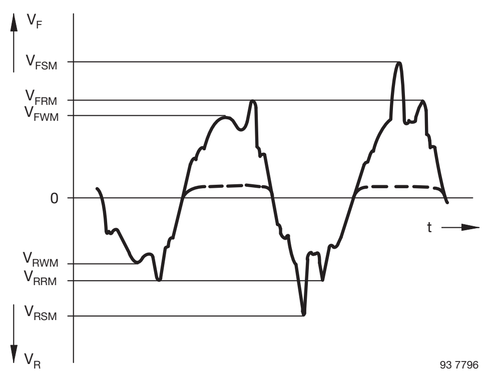


Fig. 4

V_F Forward voltage

V_R Reverse voltage

V_{FSM} Surge forward voltage (non-repetitive)

V_{RSM} Surge reverse voltage (non-repetitive)

V_{FRM} Repetitive peak forward voltage

V_{RRM} Repetitive peak reverse voltage

V_{FWM} Crest working forward voltage

V_{RWM} Crest working reverse voltage

LIST OF SYMBOLS

A	Anode
a	Distance (in mm)
b	Normalized power factor
C	Capacitance, general
C_{case}	Case capacitance
C_D	Diode capacitance
C_j	Junction capacitance
C_L	Load capacitance
C_P	Parallel capacitance
E_R	Reverse avalanche energy, non-repetitive
F	Noise figure
f	Frequency
f_g	Cut-off-frequency
g	Conductance
K	Kelvin, absolute temperature
I_F	Forward current
i_F	Forward current, instantaneous total value
I_{FAV}	Average forward current, rectified current
I_{FRM}	Repetitive peak forward current
I_{FSM}	Surge forward current, non-repetitive
I_{FWM}	Crest working forward current
I_R	Reverse current
I_{RM}	Maximum reverse current
i_R	Reverse current, instantaneous total value
I_{RAV}	Average reverse current
I_{RRM}	Repetitive peak reverse current
I_{RSM}	Non-repetitive peak reverse current
I_{RWM}	Crest working reverse current
I_S	Supply current
I_Z	Z-operating current
I_{ZM}	Z-maximum current
l	Length (in mm), (case-holder/soldering point)
LOCEP	(local epitaxy) A registrated trade mark of TEMIC for a process of epitaxial deposition on silicon. Applications occur in planer Z-diodes. It has an advantage compared to the normal process, with improved reverse current.
P	Power
P_R	Reverse power
P_{tot}	Total power dissipation
P_V	Power dissipation, general
Pvp	Pulse-power dissipation
Q	Quality
Q_{rr}	Reverse recovery charge
R_F	Forward resistance
r_f	Differential forward resistance
R_L	Load resistor
r_P	Parallel resistance, damping resistance
R_R	Reverse resistance
r_r	Differential reverse resistance
r_s	Series resistance
R_{thJA}	Thermal resistance between junction and ambient
R_{thJC}	Thermal resistance between junction and case
R_{thJL}	Thermal resistance junction lead
r_z	Differential Z-resistance in breakdown region (range) $r_z = r_{zj} + r_{zth}$
r_{zj}	Z-resistance at constant junction temperature, inherent Z-resistance
r_{zth}	Thermal part of the Z-resistance
T	Temperature, measured in centigrade
T	Absolute temperature, Kelvin temperature
T	Period duration
T_{amb}	Ambient temperature (range)
t_{av}	Integration time
T_{case}	Case temperature
t_{fr}	Forward recovery time
T_j	Junction temperature
T_K	Temperature coefficient
T_L	Connecting lead temperature in the holder (soldering point) at the distance/(mm) from case
t_p	Pulse duration (time)
t_p/T	Duty cycle
t_r	Rise time
t_{rr}	Reverse recovery time
t_s	Storage time
T_{sd}	Soldering temperature
T_{stg}	Storage temperature (range)
$V_{(BR)}$	Breakdown voltage
VF	Forward voltage
V_F	Forward voltage, instantaneous total value
V_{FAV}	Average forward voltage
V_o	Rectified voltage
V_{FP}	Turn on transient peak voltage
V_{FSM}	Surge forward voltage, non-repetitive
V_{FRM}	Repetitive peak forward voltage
V_{FWM}	Crest working forward voltage
V_{HF}	RF voltage, RMS value
V_{HF}	RF voltage, peak value
V_R	Reverse voltage

V_R	Reverse voltage, instantaneous total value
V_{RSM}	Surge reverse voltage, non-repetitive
V_{RRM}	Repetitive peak reverse voltage
V_{RWM}	Crest working reverse voltage
V_S	Supply voltage
V_T	Temperature voltage
V_Z	Z-operating voltage
Z_{thp}	Thermal resistance - pulse operation
φ	Angle of current flow
η_ρ	Rectification efficiency
T_o	Time constant
C_D	Capacitance deviation

DATASHEET CONSTRUCTION

Datasheet information is generally presented in the following sequence:

- Device description
- Absolute maximum ratings
- Thermal data - thermal resistances
- Characteristics, switching characteristics
- Electrical characteristics
- Dimensions (mechanical data)

Additional information on device performance is provided where necessary.

Device Description

The following information is provided: part number, semiconductor materials used, sequence of zones, technology used, device type and, if necessary construction.

Also, information on the typical applications and special features is given.

Absolute Maximum Ratings

The absolute maximum ratings indicate the maximum permissible operational and environmental conditions. Exceeding any one of these conditions could result in the destruction of the device. Unless otherwise specified, an ambient temperature of 25 °C ± 3 °C is assumed for all absolute maximum ratings. Most absolute ratings are static characteristics; if they are measured by a pulse method, the associated measurement conditions are stated.

Maximum Ratings are Absolute

(i.e., not interdependent).
Any equipment incorporating semiconductor devices must be designed so that even under the most unfavorable operating conditions the specified maximum ratings of the devices used are never exceeded. These ratings could be exceeded because of changes in:

- Supply voltage
- The properties of other components used in the equipment
- Control settings
- Load conditions
- Drive level
- Environmental conditions
- The properties of the devices themselves (aging)

Thermal Data - Thermal Resistances

Some thermal data (e.g., junction temperature, storage temperature range, total power dissipation), impose a limit on the application range of the device, and are given under the heading “Absolute Maximum Ratings”.
A special section is provided for thermal resistances. Temperature coefficients, on the other hand, are listed together with the associated parameters under “Characteristics, Switching Characteristics”.

Characteristics, Switching Characteristics

Under this heading, the most important operational electrical characteristics (minimum, typical and maximum values) are grouped together with associated test conditions supplemented with graphs.

Dimensions (Mechanical Data)

Important dimensions and the sequence of connections supplemented by a circuit diagram are included in the mechanical data. Case outline drawings carry DIN, JEDEC or commercial designations. Information on weight complete is also included.

Note

- If the dimension information does not include any tolerances, then lead length and mounting hole dimensions are minimum values. All other dimensions are maximum.

Additional Information

Not for new developments: This heading indicates that the device concerned should not be used in equipment under development. It is, however, available for devices presently in production.

Physical Explanation

GENERAL TERMINOLOGY

Semiconductor diodes are used as rectifiers, switches, varactors and voltage stabilizers (see Zener data book).

Semiconductor diodes are two-terminal solid-state devices having asymmetrical voltage-current characteristics. Unless otherwise stated, this means a device has single pn-junction corresponding to the characteristics shown in figure 1.

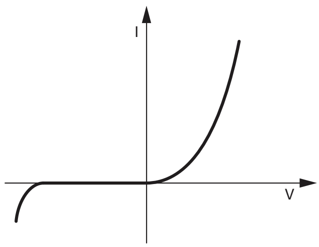


Fig. 1

An application of the voltage current curve is given by

$$I = I_S\left(\exp\frac{V}{V_T} - 1\right)$$

where

I_S = saturation current

$V_T = \frac{k \times T}{q}$ = temperature potential

If the diode is forward-biased (anode positive with respect to cathode), its forward current ($I = I_F$) increases rapidly with increasing voltage. That is, its resistance becomes very low.

If the diode is reverse-biased (anode negative with respect to cathode), its reverse current ($-I = I_R$) is extremely low. This is only valid until the breakdown voltage V_{BR} has been reached. When the reverse voltage is slightly higher than the breakdown voltage, a sharp rise in reverse current results.

Bulk resistance

Resistance of the bulk material between junction and the diode terminals.

Parallel resistance, r_P

Diode resistance resulting from HF rectification which acts as a damping resistance to the pre-tuned demodulation circuit.

Differential resistance

See forward resistance, differential

Diode capacitance, C_D

Total capacitance between the diode terminals due to case, junction and parasitic capacitances.

Breakdown voltage, V_{BR}

Reverse voltage at which a small increase in voltage results in a sharp rise of reverse current. It is given in the technical data sheet for a specified current.

Forward voltage, V_F

The voltage across the diode terminals which results from the flow of current in the forward direction.

Forward current, I_F

The current flowing through the diode in the direction of lower resistance.

Forward resistance, r_F

The quotient of DC forward voltage across the diode and the corresponding DC forward current.

Forward resistance, differential r_f

The differential resistance measured between the terminals of a diode under specified conditions of measurement, i.e., for small-signal AC voltages or currents at a point of forward direction V-I characteristic.

Case capacitance, C_{case}

Capacitance of a case without a semiconductor crystal.

Integration time, t_{av}

With certain limitations, absolute maximum ratings given in technical data sheets may be exceeded for a short time. The mean value of current or voltage is decisive over a specified time interval termed integration time. These mean values over time interval, t_{av}, should not exceed the absolute maximum ratings.

Average rectified output current, I_{FAV}

The average value of the forward current when using the diode as a rectifier. The maximum allowable average rectified output current depends on the peak value of the applied reverse voltage during the time interval at which no current is flowing. In the absolute maximum ratings, one or both of the following are given:

- The maximum permissible average rectified output current for zero diode voltage (reverse).
- The maximum permissible average rectified output current for the maximum value of V_{RRM} during the time interval at which no current is flowing.

Note

- I_{FAV} decreases with an increasing value of the reverse voltage during the interval of no current flow.

Physical Explanation

Rectification efficiency, η_r

The ratio of the DC load voltage to the peak input voltage of an RF rectifier.

Series resistance, r_s

The total value of resistance representing the bulk, contact and lead resistance of a diode given in the equivalent circuit diagram of variable capacitance diodes.

Junction capacitance, C_J

Capacitance due to a pn junction of a diode which decreases with increasing reverse voltage.

Reverse voltage, V_R

The voltage drop which results from the flow of reverse current (through the semiconductor diode).

Reverse current, I_R (leakage current)

The current which flows when reverse bias is applied to a semiconductor junction.

Reverse resistance, R_R

The quotient of the DC reverse voltage across a diode and the corresponding DC reverse current.

Reverse resistance, differential, r_r

The differential resistance measured between the terminals of a diode under specified condition of measurement i.e., for small-signal (AC) voltage or currents at a point of reverse-voltage direction V-I characteristic.

Peak forward current, I_{FRM}

The maximum forward current with sine-wave operation, $f \geq 25$ Hz, or pulse operation, $f \geq 25$ Hz, having a duty cycle $t_p/T \leq 0.5$.

Peak reverse voltage, V_{RRM}

The maximum reverse voltage having an operating frequency $f \geq 25$ Hz for sine-wave as well as pulse operation.

Peak surge forward current, I_{FSM}

The maximum permissible surge current in a forward direction having a specified waveform with a short specified time interval (i.e., 10 ms) unless otherwise specified. It is not an operating value. During frequent repetitions, there is a possibility of change in the device's characteristic.

Peak surge reverse voltage, V_{RSM}

The maximum permissible surge voltage applied in a reverse direction. It is not an operating value. During frequent repetitions, there is a possibility of change in the device's characteristic.

Power dissipation, P_V

An electrical power converted into heat. Unless otherwise specified, this value is given in the data sheets under absolute maximum ratings, with $T_A = 25$ °C at a specified distance from the case (both ends).

Switching on Characteristic

Forward recovery time, t_{fr}

The time required for the voltage to reach a specified value (normally 110 % of the steady state forward voltage drop), after instantaneous switching from zero or a specified reverse voltage to a specified forward biased condition (forward current).

This recovery time is especially noticeable when higher currents are to be switched within a short time. The reason is that the forward resistance during the turn-on time could be higher than the DC current (inductive behavior). This can result in the destruction of a diode because of high instantaneous power loss if constant current control is used.

Turn on transient peak voltage, V_{fp}

The voltage peak (overshoot) after instantaneous switching from zero or a specified reverse voltage to a specified forward biased condition (forward current). The forward recovery is very important especially when higher forward currents must be switched on within a very short time (switching on losses).

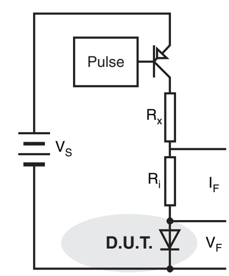


Fig. 2

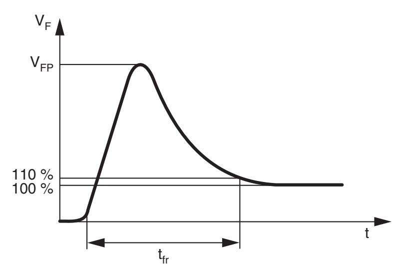


Fig. 3

Switching off Characteristic, Inductive Load

Reverse recovery time, t_{rr}

The time required for the current to reach a specified reverse current, i_R (normally 0.25 % of I_{RM}), after switching from a specified forward current I_F to a specified reverse biased condition (reverse voltage V_{Batt}) with a specified slope dI_F/dt.

Physical Explanation

Peak reverse recovery current, I_{RM}

The peak reverse current after switching from a specified forward current I_F to a specified reverse biased condition (reverse voltage V_R) with a specified switching slope dI_F/dt.

The reverse recovery is very important especially when switching from higher currents to high reverse voltage within a very short time (switching off losses).

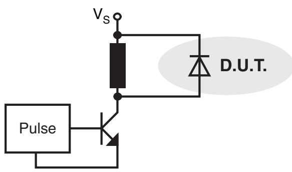


Fig. 4

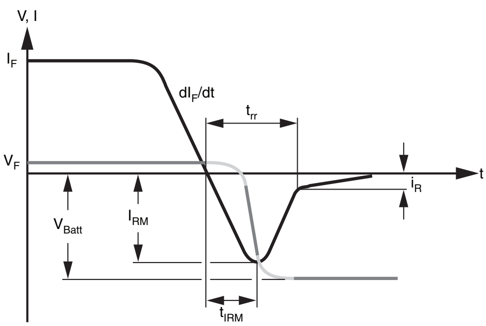


Fig. 5

Reverse avalanche energy, E_R

The reverse avalanche energy when using the rectifier as a freewheeling diode with an indicutive load. When the inductance is switched off, the current through the inductance will keep on flowing through the D.U.T. until the stored energy,

$$E_R = \frac{1}{2} \times L \times I^2$$

is dissipated within the rectifier. Under this condition the diode is in a reverse avalanche mode with a reverse current at the beginning which is equal to the current that was flowing through the inductance just before it was switched off.

The reverse energy capability depends on the reverse current and the junction temperature prior to the avalanche mode.

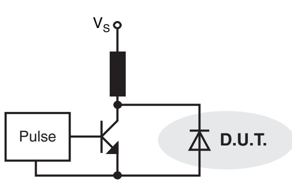


Fig. 6

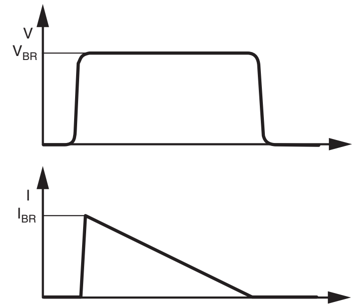


Fig. 7

Switching off Characteristic, Instantaneous Switching

Reverse recovery time, t_{rr}

The time required for the current to reach a specified reverse current, i_R (normally 0.25 A), after instantaneous switching from a specified forward current I_F (normally 0.5 A) to a specified reverse current I_R (normally 1.0 A).

Reverse recovery charge, Q_{rr}

The charged stored within the diode when instantaneous switched from a specified forward current I_F (normally 0.5 A) to a specified reverse current I_R (normally 1.0 A).

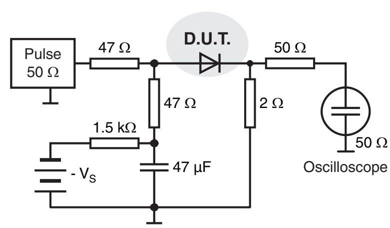


Fig. 8

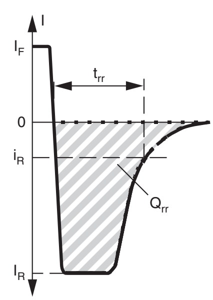


Fig. 9

Tape and Reel Standards

PACKAGE	AVAILABLE PACKAGING			
	10" TAPE AND REEL	13" TAPE AND REEL	AMMO PACK #1	AMMO PACK #2
	QUANTITY/REEL	QUANTITY/REEL	QUANTITY/BOX	QUANTITY/BOX
SOD-57	5000	-	5000	-
SOD-64	2500	-	2500	-

TAPING SPECIFICATIONS SOD-57 AND SOD-64		
DESCRIPTION	SYMBOL	SPECIFICATION (mm)
Component pitch	A	5 ± 0.5
Inside tape spacing	B	52 + 2 mm - 1 mm
Lead to lead eccentricity	ID1-D2I	1.4 max.
Lead extension	K	0
Lead bending	M	1.2 max.
Cumulative pitch	P	2 per 10 pitch
Exposed adhesive	S	0.8 max.
Tape width	T	6 ± 0.4
Tape leader	Beginning and end of reel or ammo pack	300 min.
Empty spaces	Consecutive missing components not allowed	< 0.1 %
Polarity marking	All polarized components shall be oriented in the same direction. The cathode tape shall be colored, and anode tape shall be white or light beige	

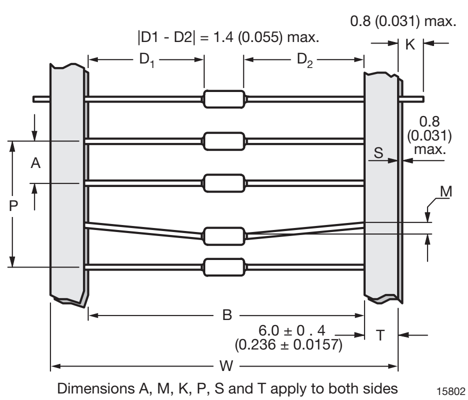


Fig. 1

10" REEL SPECIFICATION (SOD-57 AND SOD-64 PACKAGES)		
DESCRIPTION	**SYMBOL**	**REEL SIZE 10"**
Arbor hole diameter	D_0	30 mm ± 1 mm
Core diameter	D_1	71 mm ± 1 mm
Reel diameter	D_2	250 mm ± 2 mm
Drive hole diameter	D_3	10 mm ± 1 mm
Reel width	W_1	68 mm ± 1 mm
Drive/arbor hole spacing	W_2	27.5 mm ± 1 mm
Core material		Plastic
Reel material		Plastic

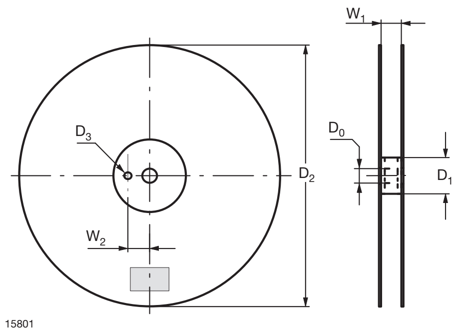


Fig. 2

AMMO PACK # 1 SPECIFICATION (SOD-57 AND SOD-64 PACKAGES) (figure 3)			
DESCRIPTION	**SYMBOL**	**SPECIFICATION**	
		INCHES	**MILLIMETERS**
Length	A	10.25 ± 0.2	260 ± 5
Width	B	2.75 ± 0.2	70 ± 5
Height	C	5.75 ± 0.65	146 ± 16

Note

- Material: corrugated board (neutral)

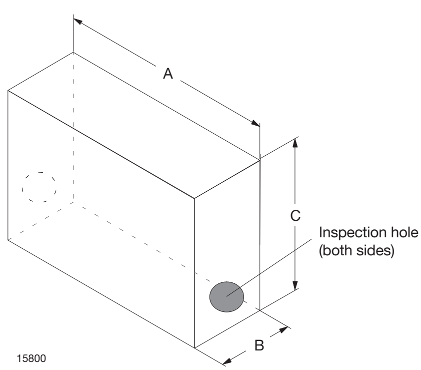


Fig. 3

PREFORMED LEADS (SOD-64 PACKAGES)

Some types of automatic insertion machines have problems in bending the relatively thick leads of SOD-64 Sinterglass diodes. To overcome this, our diodes can be ordered with preformed leads as follows. Preformed Sinterglass diodes are shipped in bulk.

SUFFIX RA

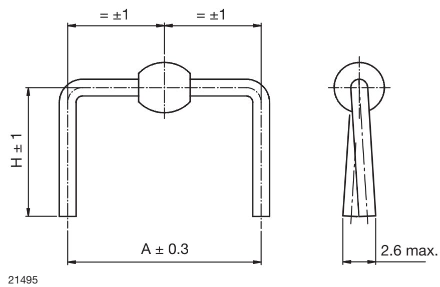


Fig. 4

SUFFIX RAP

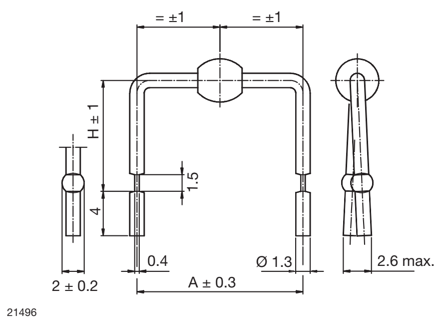


Fig. 5

SUFFIX RAS

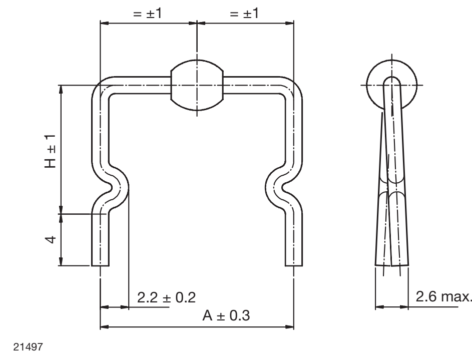


Fig. 6

COMMON BENDING VERSION				
SUFFIX			A (mm)	H (mm)
RA 15/10	RAS 15/10	RAP 15/10	15	10
RA 17.5/10	RAS 17.5/10	RAP 17.5/10	17.5	10

Note

- Other bending versions are available on request.

Standard Avalanche Sinterglass Diode

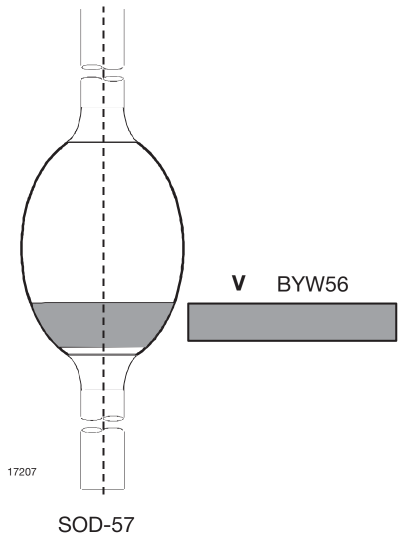


Fig. 1

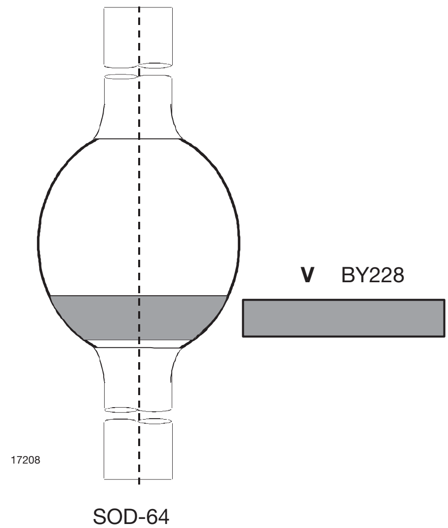


Fig. 2

Packing Information

PACKING ORDERING CODE		
SUFFIX TO PART NUMBER	PACKAGE	PACKING VERSION
- TR	SOD-57, SOD-64	10" plastic reel antistatic
- TAP	SOD-57, SOD-64	Ammobox # 1
- RAxx	SOD-64	Bulk packing for preformed leads

WEIGHT OF COMPONENTS	
PACKAGE	WEIGHT
SOD-57	370 mg
SOD-64	860 mg

DIMENSIONS AND WEIGHT					
PACKAGE	INNER BOX DIMENSIONS AND QUANTITY L x W x H (mm)	INNER BOX WEIGHT (kg)	OUTER BOX DIMENSIONS AND QUANTITY L x W x H (mm)	OUTER BOX WEIGHT (kg)	NUMBER OF INNER BOXES IN OUTER BOXES
SOD-57-TR	260 x 260 x 75 5000 pcs	2.3	Equal to inner box	Equal to inner box	
SOD-64-TR	260 x 265 x 75 2500 pcs	2.5	Equal to inner box	Equal to inner box	
SOD-57-TAP	260 x 150 x 75 5000 pcs	2	380 x 270 x 160 25 000 pcs	10.3	5
SOD-64-TAP	260 x 150 x 75 2500 pcs	2.3	380 x 270 x 160 12 500 pcs	11.7	5

For technical questions within your region, please contact one of the following:
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
Document Number: 86103
Rev. 1.9, 23-Aug-10

Assembly Instructions

GENERAL

Semiconductor devices can be mounted in any position. The terminal length may be bent at a distance greater than 1.5 mm from the case provided no mechanical force has an effect on the case.

If the device is to be mounted near heat generating components, consideration must be given to the resultant increase in ambient temperature.

SOLDERING INSTRUCTIONS

Leaded Devices

Protection against overheating is essential when a device is being soldered. It is recommended, therefore, that connection terminals are left as long as possible, are soldered at the tip only, and that any heat generated is quickly conducted away. The time during which the specified maximum permissible device junction temperature is exceeded during the soldering operation should be as short as possible, (i.e. for silicon, 260 °C for 5 s).

Avoid any force on the body or leads during or just after soldering.

Do not correct the position of an already soldered device by pushing, pulling or twisting the body. Prevent fast cooling after soldering. The maximum soldering temperatures are shown in table 1.

TABLE 1 - MAXIMUM SOLDERING TEMPERATURES

IRON SOLDERING				DIP OR FLOW SOLDERING			
	Iron temperature	Soldering distance from the case	Maximum allowable soldering time	Soldering temperature	Soldering distance from the case		Maximum allowable soldering Time
					Vertical	Horizontal	
Glass case	≤ 260 °C ≤ 260 °C 260 °C to 400	1.5 mm to 5 mm > 5 mm > 5 mm	5 s 10 s 5 s	≤ 260 °C	> 1.5 mm	> 5 mm	5 s

Important Layout Notes

If components are to be arranged in rows, then separate soldering surfaces must be provided for each component. If this is not carried out, a block of solder forms between the components during soldering, and a rigid connection results. This can cause breakage or cracks in the component as the result of the slightest bending of the board, and thus lead to failure. If it is necessary to solder a wire (standard conductor, etc.) to the board, a separate soldering surface must be provided in order to avoid excessive heating of the components during soldering with a soldering iron.

HEAT REMOVAL

To keep the thermal equilibrium, the heat generated in the semiconductor junction(s) must be removed.

In the case of low-power devices, the natural heatconductive path between the case and surrounding air is usually adequate for this purpose. However, in the case of medium-power devices, heat radiation may have to be improved by the use of star or flagshaped heat dissipators, which increase the heat radiating surface.

Finally, in the case of high-power devices, special heat sinks must be provided, the cooling effect of which can be increased further by the use of special coolants or air blowers.

The heat generated in the junction is conveyed to the case or header by conduction rather than convection. A measure of the effectiveness of heat conduction is the inner thermal resistance or thermal resistance junction case, R_{thJC}, the value of which is governed by the construction of the device. Any heat transfer from the case to the surrounding air involves radiation convection and conduction. The effectiveness of transfer is expressed in terms of an R_{thCA}-value, i.e. the external or case-ambient thermal resistance. The total thermal resistance between junction and ambient is consequently

$R_{thJA} = R_{thJC} + R_{thCA}$.

The total maximum power, $P_{tot\ max}$, of a semiconductor device can be expressed as follows

$$P_{totmax.} = \frac{T_{jamb} - T_{amb}}{R_{thJA}} = \frac{T_{max.} - T_{amb}}{R_{thJC} + R_{thCA}}$$

where

$T_{jmax.}$ is the maximum junction temperature,

T_{amb} is the highest ambient temperature likely to be reached under the most unfavorable conditions,

R_{thJA} is the thermal resistance between junction and ambient.

For diodes with axial leads, it is measured with a heat sink at a specified distance from the case,

R_{thJC} is the thermal resistance between junction and case,

R_{thCA} is the thermal resistance between case and ambient.

Its value is cooling dependent. When using a heat sink, it can be influenced through thermal contact between the case and heat sink, thermal distribution in the heat sink and heat transfer to the surroundings. Therefore, the maximum permissible total power dissipation for a given semiconductor device can be influenced only by changing T_{amb} and R_{thCA}. The value of R_{thCA} can be obtained either from the data of heat sink suppliers or through direct measurements. Heat due to energy losses is mainly conducted with power diodes without cooling pins through the connecting leads and hence the PC board.

Figure 1. shows the thermal resistance plotted as a function of edge length. The values are valid with a heat source in the middle of the plate, resting air and vertical position. In a horizontal position, thermal resistance increases approximately by 15 % to 20 %.

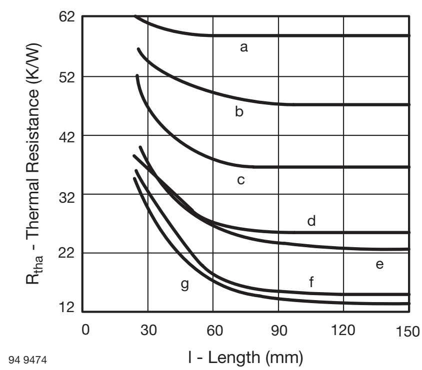


Fig. 1

Pertinax boards 1.5 mm thick

a: Pertinax non-metallized

b: Pertinax with 35 mm copper metallization on one side; heat source fitted to non-metallized side

c: Pertinax with 70 mm copper metallization on one side; heat source fitted to non-metallized side

d: Pertinax with 35 mm copper metallization on one side; heat source fitted to metallized side

e: Pertinax with 35 mm copper metallization on both sides

f: Pertinax with 70 mm copper metallization on one side; heat source fitted to metallized side

g: Pertinax with 70 mm copper metallization on both sides

R_{tha}: Thermal resistance of boards

l: Edge length

When using cooling plates as heat sink without optimum performance, the following approach is acceptable.

The curves shown in fig. 2 and fig. 3 are given for thermal resistance, R_{thCA}, by using square plates of aluminium with edge length **a** but with different thick- nesses. The device case should be mounted directly on the cooling plate.

The edge length **a** derived from fig. 2 and fig. 3 for a given R_{thCA} value must be multiplied with α and β:

$a' = a \times \beta \times \alpha$

where

α = 1.00 for vertical arrangement

α = 1.15 for horizontal arrangement

β = 1.00 for bright surface

β = 0.85 for dull black surface

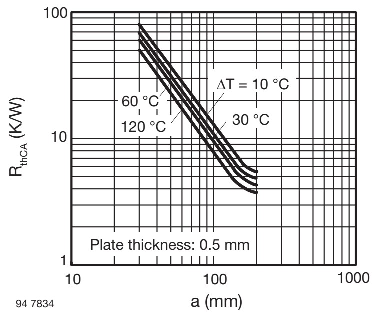


Fig. 2

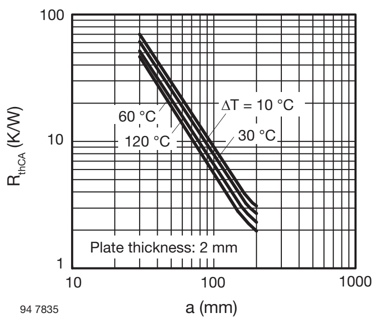


Fig. 3

Example

For a silicon power rectifier with $T_{jmax.}$ = 150 °C and R_{thJC} = 5 K/W, a 2 mm aluminum square sheet is used in a horizontal arrangement. The maximum ambient temperature is 50 °C and the maximum power dissipation is $P_{totmax.}$ = 8 W.
With R_{thCA} = 7.5 K/W and ΔT = 60 °C, plate thickness = 2 mm. Therefore, the edge length a = 90 mm. This value should be multiplied with a = 1.15 due to the horizontal arrangement. Hence, the actual edge length = 105 mm.

$$P_{totmax.} = \frac{T_{jmax.} - T_{amb}}{R_{thJC} + R_{thCA}}$$

$$R_{thCA} = \frac{T_{jmax.} - T_{amb}}{P_{tot}} - R_{thJC} = \frac{150\ °C - 50\ °C}{8\ W} - 5\ °K/W = 7.5\ K/W$$

$\Delta T = T_{case} - T_{amb}$ can be calculated from

$$P_{totmax} = \frac{T_{jmax.} - T_{amb}}{R_{thJC} + R_{thCA}} = \frac{T_{case} - T_{amb}}{R_{thCA}}$$

$$T_{case} - T_{amb} = \frac{R_{thCA}(T_{jmax.} - T_{amb})}{R_{thJC} + R_{thCA}} = \frac{7.5\ °C \times (150\ °C - 50\ °C)}{5\ K/W + 7.5\ K/W} = 60\ °C$$

For a given plate sheet length, the allowable power dissipation should be first calculated with a supposed ΔT. The result should be corrected then with the actual ΔT.

BOARDS FOR R_{thJA} DEFINITION

Epoxy glass hard tissue, board thickness 1.5 mm, copper overlay 35 mm

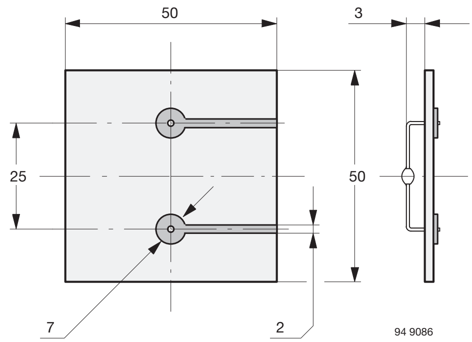


Fig. 1 - Leaded Diodes

Quality Information

VISHAY SEMICONDUCTORS' CONTINUOUS IMPROVEMENT

- Quality training for ALL personnel including production, development, marketing and sales departments
- Zero defect mindset
- Permanent quality improvement process
- Total Quality Management (TQM)
- Vishay Semiconductors' Quality Policy established by the management board
- Quality system certified per ISO 9001 2008
- Quality system certified per ISO/TS 16949:2009
- Environmental system certified per ISO 14001:2004

VISHAY SEMICONDUCTORS' TOOLS FOR CONTINUOUS IMPROVEMENT

- Vishay Semiconductors follows the rules of the EFQM - Quality - Management system
- Vishay Semiconductors qualifies materials, processes and process changes
- Vishay Semiconductors uses process FMEA (failure mode and effects analysis) for all processes. Process and machine capability as well as Gauge R & R (Repeatability & Reproducibility) are proven
- Vishay Semiconductors' internal qualifications correspond to IEC 68-2 and MIL-STD 883 and AEC-Q101
- Vishay Semiconductors periodically requalifies device types (long term monitoring)
- Vishay Semiconductors uses SPC for significant production parameters. SPC is performed by trained operators
- Vishay Semiconductors' 2 x 100 % testing of final products
- Vishay Semiconductors' lot release is carried out via sampling. Sampling acceptance criterion is always c = 0

Fig. 1

CREATE FIRST-CLASS QUALITY, ON-TIME DELIVERY, AND SATISFY CUSTOMERS' REQUIREMENTS

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

Management Service

CERTIFICATE

The Certification Body
of TÜV SÜD Management Service GmbH
certifies that

VISHAY Semiconductor Ges.m.b.H
Telefunkenstrasse 5, A-4840 Vöcklabruck / AUSTRIA

has established and applies
a Quality Management System for

Design, Manufacture and Sales
of Small Signal Products

An audit was performed, Report No. 70004203
Proof has been furnished that the requirements
according to

ISO 9001:2008

are fulfilled. The certificate is valid until 2012-08-24
Certificate Registration No. 12 100 12741 TMS

Munich, 2009-09-15
Page 1 of 1

QMS-TGA-ZM-07-92

TÜV SÜD Management Service GmbH • Zertifizierstelle • Ridlerstraße 65 • 80339 München • Germany

Fig. 2 - Vishay Semiconductor, A-Voecklabruck,
ISO 9001:2008

Within a certification audit, the
Vishay Semiconductor (Austria) Ges.m.b.H

at the location A-4840 Vöcklabruck, Telefunkenstraße 5 has proven that, meeting the requirements of the international standard EN ISO 14001, an environmental policy was published, an environmental management system is maintained and management system audits are performed regularly.

Certificate

No. u-12402-3

of an
Environmental Management System
according to

Berlin, June 12th 2007

ISO 14001

Issued November 2004

For the Business Activities:
Development and manufacture of electronic devices

This certificate is held since 1998 and is valid until June 12th 2010.

Dr.-Ing. Jan Uwe Lieback
Environmental verifier DE-V-0026

Dipl.-Ing. Dirk Horstmann
Environmental verifier DE-V-0262

GUT

DAU DE-V-0213

Dipl.-Phys. Andreas Lemke
Certification office

Fig. 4 - Vishay Semiconductor, A-Voecklabruck,
ISO 14001

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certifies that

VISHAY Semiconductor Ges.m.b.H
Telefunkenstrasse 5, A-4840 Vöcklabruck / AUSTRIA

has established and applies
a Quality Management System for

Design and Manufacture of Small Signal Products
(with Product Design as per Chapter 7.3)

An audit was performed, Report No. 70004203
Proof has been furnished that the requirements
according to

ISO/TS 16949:2009
Third Edition 2009-06-15

are fulfilled. The certificate is valid from 2009-08-25 until 2012-08-24
Certificate Registration No.: 12 111 12741 TMS
IATF Certificate No.: 0087574

Munich, 2009-09-15
Page 1 of 1

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Fig. 3 - Vishay Semiconductor, A-Voecklabruck,
ISO/TS 16949:2009

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The Certification Body
of TÜV SÜD Management Service GmbH
certifies that

Vishay Semiconductor GmbH
Theresienstraße 2 • D-74072 Heilbronn
Division Opto • Division SSP

has established and applies
a Quality Management System for

Design, Manufacture and Sales of
Optoelectronic Components and Small Signal Products
with Design ant Vishay Infrared Components Inc.,
Santa Clara California 95054, 2201 Laurelwood Road, USA
and Sales at Vishay Elektronik GmbH in D-95100 Selb

An audit was performed, Report No. 70007368
Proof has been furnished that the requirements
according to

ISO 9001: 2000

are fulfilled. The certificate is valid until 2010-04-29
Certificate Registration No. 12 100 21690 TMS

Munich, 2007-05-07

QMS-TGA-ZM-07-92

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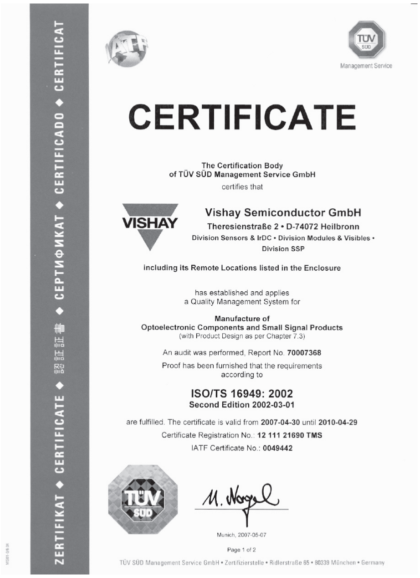
Fig. 5 - Vishay Semiconductor, D-Heilbronn,
ISO 9001:2000



ZERTIFIKAT ◆ CERTIFICATE ◆ 認證證書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

Management Service

CERTIFICATE

The Certification Body
of TÜV SÜD Management Service GmbH
certifies that

Vishay Semiconductor GmbH
Theresienstraße 2 • D-74072 Heilbronn
Division Sensors & IrDC • Division Modules & Visibles •
Division SSP

including its Remote Locations listed in the Enclosure

has established and applies
a Quality Management System for

Manufacture of
Optoelectronic Components and Small Signal Products
(with Product Design as per Chapter 7.3)

An audit was performed, Report No. **70007368**
Proof has been furnished that the requirements
according to

ISO/TS 16949: 2002
Second Edition 2002-03-01

are fulfilled. The certificate is valid from **2007-04-30** until **2010-04-29**
Certificate Registration No.: **12 111 21690 TMS**
IATF Certificate No.: **0049442**

Munich, 2007-06-07

Page 1 of 2

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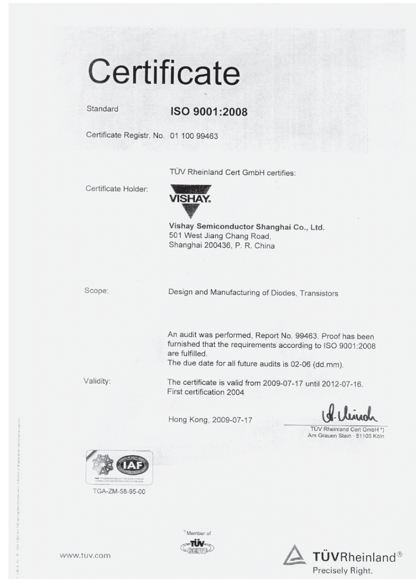
Fig. 6 - Vishay Semiconductor, D-Heilbronn,
ISO/TS 16949:2002



Certificate

Standard **ISO 9001:2008**

Certificate Registr. No. 01 100 99463

TÜV Rheinland Cert GmbH certifies:

Certificate Holder: **Vishay Semiconductor Shanghai Co., Ltd.**
501 West Jiang Chang Road,
Shanghai 200436, P. R. China

Scope: Design and Manufacturing of Diodes, Transistors

An audit was performed, Report No. 99463. Proof has been furnished that the requirements according to ISO 9001:2008 are fulfilled.
The due date for all future audits is 02-06 (dd.mm).

Validity: The certificate is valid from 2009-07-17 until 2012-07-16.
First certification 2004

Hong Kong, 2009-07-17

TÜV Rheinland Cert GmbH
Am Grauen Stein · 51105 Köln

TGA-ZM-58-95-00

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Precisely Right.

Fig. 8 - Vishay Semiconductor Shanghai,
ISO 9001:2008

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Management Service

CERTIFICATE

The Certification Body
of TÜV SÜD Management Service GmbH
certifies that

Vishay Semiconductor GmbH
Theresienstraße 2
D-74072 Heilbronn

has established and applies
an Environmental Management System for

Design, Manufacture and Sales
of Optoelectronic Components
and Small Signal Products.

An audit was performed, Report No. **70007368**
Proof has been furnished that the requirements
according to

ISO 14001: 2004

are fulfilled. The certificate is valid until **2011-02-11**
Certificate Registration No. **12 104 21690 TMS**

Munich, 2008-02-14

EMS-TGA-ZM-07-92

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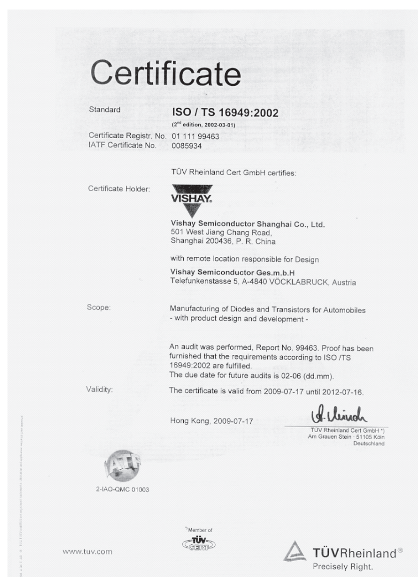
Fig. 7 - Vishay Semiconductor, D-Heilbronn,
ISO 14001:2004



Certificate

Standard **ISO / TS 16949:2002**
(2nd edition, 2002-03-01)

Certificate Registr. No. 01 111 99463
IATF Certificate No. 0085934

TÜV Rheinland Cert GmbH certifies:

Certificate Holder: **Vishay Semiconductor Shanghai Co., Ltd.**
501 West Jiang Chang Road,
Shanghai 200436, P. R. China

with remote location responsible for Design
Vishay Semiconductor Ges.m.b.H
Telefunkenstasse 5, A-4840 VÖCKLABRUCK, Austria

Scope: Manufacturing of Diodes and Transistors for Automobiles
- with product design and development -

An audit was performed, Report No. 99463. Proof has been furnished that the requirements according to ISO /TS 16949:2002 are fulfilled.
The due date for future audits is 02-06 (dd.mm).

Validity: The certificate is valid from 2009-07-17 until 2012-07-16.

Hong Kong, 2009-07-17

TÜV Rheinland Cert GmbH
Am Grauen Stein · 51105 Köln
Deutschland

2-IAO-QMC 01003

www.tuv.com

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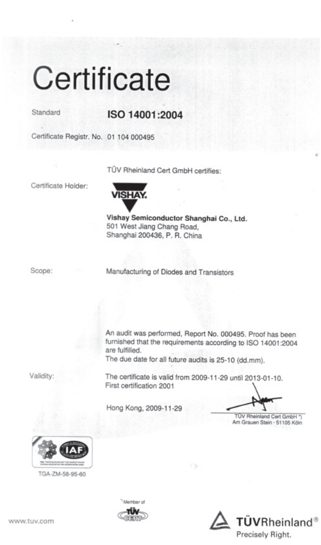
Fig. 9 - Vishay Semiconductor Shanghai,
ISO/TS 16949:2002



Certificate

Standard ISO 14001:2004

Certificate Registr. No. 01 104 000495

TÜV Rheinland Cert GmbH certifies:

Certificate Holder: Vishay Semiconductor Shanghai Co., Ltd.
501 West Jiang Chang Road,
Shanghai 200436, P. R. China

Scope: Manufacturing of Diodes and Transistors

An audit was performed, Report No. 000495. Proof has been furnished that the requirements according to ISO 14001:2004 are fulfilled.
The due date for all future audits is 25-10 (dd.mm).

Validity: The certificate is valid from 2009-11-29 until 2013-01-10.
First certification 2001

Hong Kong, 2009-11-29

TÜV Rheinland Cert GmbH
Am Grauen Stein · 51105 Köln

TGA-ZM-58-95-60

www.tuv.com

TÜVRheinland®
Precisely Right.

Fig. 10 - Vishay Semiconductor Shanghai, ISO 14001:2004

EUROCERT

Certificate of Approval

Based on it's procedure
EUROCERT Qualifying and Certifying Ltd. certifies, that

VISHAY HUNGARY Ltd.,
Budapest, Hungary.

has implemented and operates an environmental management system, which complies with the

ISO 14001: 2004

standard.

Scope of activity/service: Production of microelectronic devices and systems.

Sites: 1047 Budapest, Fóti út 56.

This certificate is valid 13. 05. 2011.

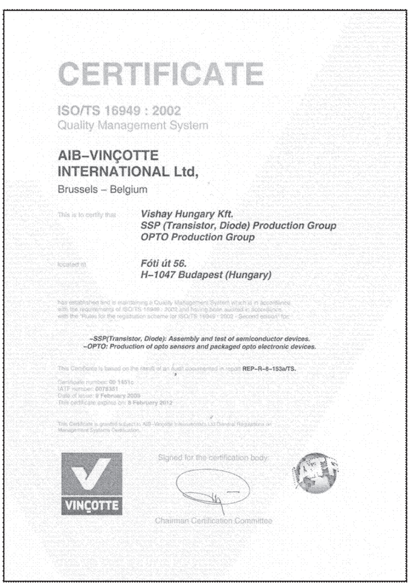
Certificate registration number: KMR 035

Budapest, 13th of May, 2008

Reg No. 187/R-026

Péter Oláh
managing director

Fig. 12 - Vishay Semiconductor Hungary, ISO 14001:2004



CERTIFICATE

ISO/TS 16949 : 2002
Quality Management System

AIB–VINÇOTTE INTERNATIONAL Ltd,
Brussels – Belgium

This is to certify that *Vishay Hungary Kft.*
SSP (Transistor, Diode) Production Group
OPTO Production Group

located at *Fóti út 56.*
H–1047 Budapest (Hungary)

has established and is maintaining a Quality Management System which is in accordance with the requirements of ISO/TS 16949 : 2002 and having been audited in accordance with the "Rules for the registration scheme for ISO/TS 16949 : 2002 - Second edition" for:

–SSP(Transistor, Diode): Assembly and test of semiconductor devices.
–OPTO: Production of opto sensors and packaged opto electronic devices.

This Certificate is based on the result of an audit documented in report REP–R–6–153a/TS.

Certificate number: 00 1451c
IATF number: 0078351
Date of issue: 9 February 2009
This certificate expires on: 8 February 2012

This Certificate is granted subject to AIB–Vinçotte International's Ltd General Regulations on Management Systems Certification.

Signed for the certification body

Chairman Certification Committee

VINÇOTTE

Fig. 11 - Vishay Semiconductor Hungary, ISO/TS 16949:2002

GENERAL QUALITY FLOW CHART

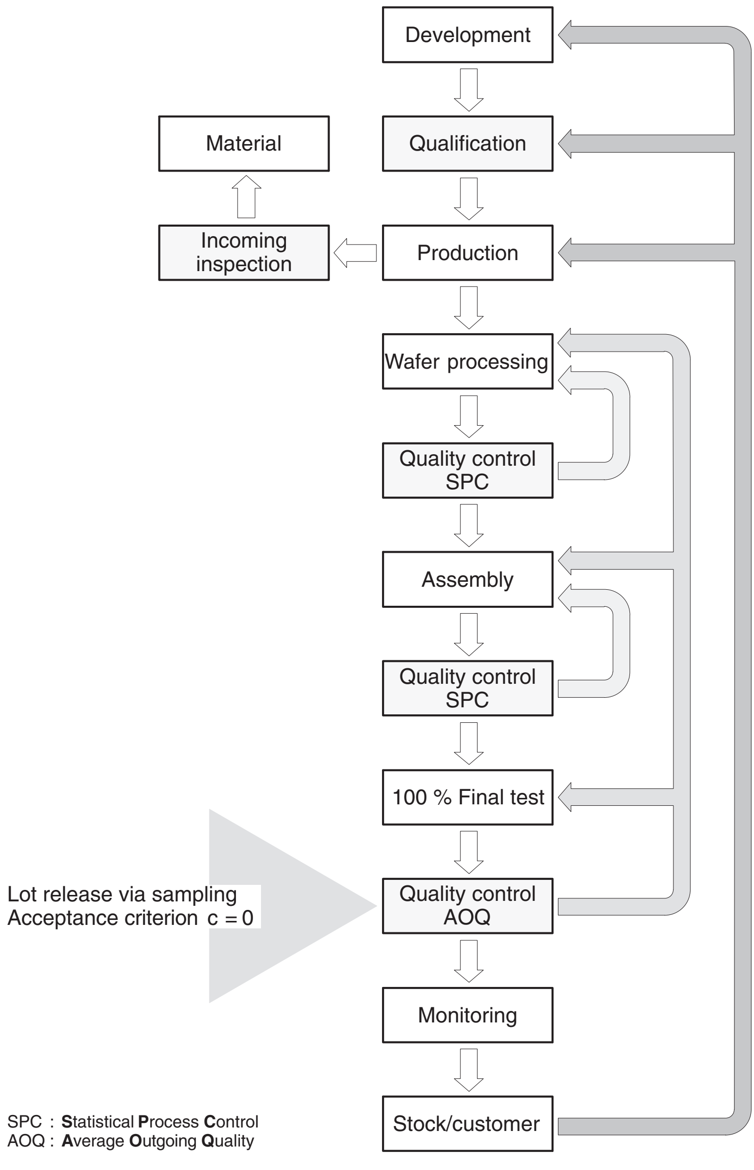


Fig. 13

VISHAY QUALITY ROAD MAP

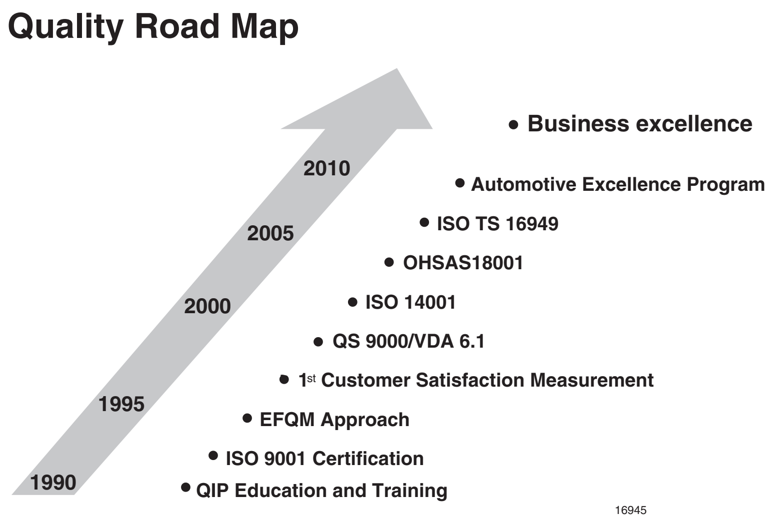


Fig. 14

QUALIFICATION AND RELEASE

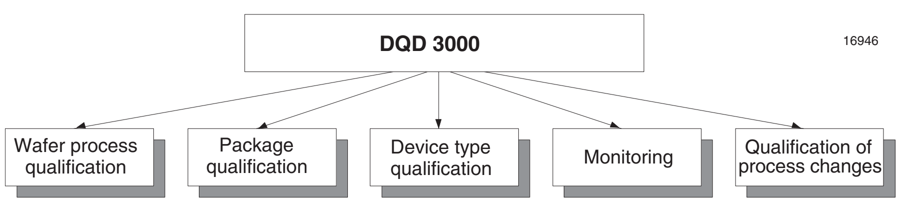


Fig. 15

New wafer processes, packages and device types are qualified according to the internal Vishay Semiconductors specification DQD 3000.

DQD 3000 consists of five parts (see figure 18.).

Wafer process release

The wafer process release is the fundamental release qualification for the various technologies used by Vishay Semiconductors. Leading device types are defined for various technologies. Three wafer lots of these types are subjected to an extensive qualification procedure and are used to represent this technology. A positive result will lead to release of the technology.

Package release

The package release is the fundamental release qualification for the different packages used. Package groups are defined.

Critical packages are selected: two assembly lots are subjected to the qualification procedure represented. A positive result will release all similar packages.

Device type release

The device type released is the release of individual designs.

Monitoring

Monitoring serves both as the continuous monitoring of the production and as a source of data for calculation of early failures (early failure rate: EFR).

Product or process changes are released via ECN (Engineering Change Note). This includes proving process capability and meeting the quality requirements.

Test procedures utilized are IEC 68-2-... and MIL-STD-750 respectively.

STATISTICAL METHODS FOR PREVENTION

To manufacture high-quality products, it is not sufficient to inspect the product at the end of the production process. Quality has to be "designed-in" during process and product development. In addition to that, the "designing-in" must also be ensured during production flow. Both will be achieved by means of appropriate measurements and tools.

- Statistical Process Control (SPC)
- R & R - (Repeatability and Reproducibility) tests
- Up-Time Control (UTC)
- Failure Mode and Effect Analysis (FMEA)
- Design Of Experiments (DOE)
- Quality Function Deployment (QFD)

Vishay has been using SPC as a tool in production since 1990/91.

By using SPC, deviations from the process control goals are quickly established. This allows control of the processes before the process parameters run out of specified limits. To assure control of the processes, each process step is observed and supervised by trained personnel. Results are documented.

Process capabilities are measured and expressed by the process capability index (C_{pk}).

Validation of the process capability is required for new processes before they are released for production.

Before using new equipment and new gauges in production, machine capability (C_{mk} = machine capability index) or R & R (Repeatability & Reproducibility) is used to validate the equipment's fitness for use.

Up-Time is recorded by an Up-Time Control (UTC) system. This data determines the intervals for preventive maintenance, which is the basis for the maintenance plan.

A process-FMEA is performed for all processes (FMEA = Failure Mode and Effect Analysis). In addition, a design- or product-FMEA is used for critical products or to meet agreed customer requirements.

Design of Experiments (DOE) is a tool for the statistical design of experiments and is used for optimization of processes. Systems (processes, products and procedures) are analyzed and optimized by using designed experiments. A significant advantage compared to conventional methods is the efficient performance of experiments with minimum effort by determining the most important inputs for optimizing the system.

As a part of the continuous improvement process, all Vishay employees are trained in TQM thinking and in using new statistical methods and procedures.

RELIABILITY

The requirements concerning quality and reliability of products are always increasing. It is not sufficient to only deliver fault-free parts. In addition, it must be ensured that the delivered goods serve their purpose safely and failure of free, i.e. reliably. From the delivery of the device and up to its use in a final product, there are some occasions where the device or the final product may fail despite testing and outgoing inspection.

In principle, this sequence is valid for all components of a product.

For these reasons, the negative consequences of a failure, which become more serious and expensive the later they occur, are obvious. The manufacturer is therefore interested in supplying products with the lowest possible

- AOQ (Average Outgoing Quality) value
- EFR (Early Failure Rate) value
- LFR (Long-term Failure Rate) value

AVERAGE OUTGOING QUALITY (AOQ)

All outgoing products are sampled after 2 x 100 % testing. This is known as "Average Outgoing Quality" (AOQ). The results of this inspection are recorded in ppm (parts per million) using the method defined in JEDEC 16.

EARLY FAILURE RATE (EFR)

EFR is an estimate (in ppm) of the number of early failures related to the number of devices used. Early failures are normally those which occur within the first 300 h to 1000 h. Essentially, this period of time covers the guarantee period of the finished unit.

Low EFR values are therefore very important to the device user. The early life failure rate is heavily influenced by complexity. Consequently, "designing-in" of better quality during the development and design phase, as well as optimized process control during manufacturing, significantly reduces the EFR value. Normally, the early failure rate should not be significantly higher than the random failure rate. EFR is given in ppm (parts per million).

LONG-TERM FAILURE RATE (LFR)

LFR shows the failure rate during the operational period of the devices. This period is of particular interest to the manufacturer of the final product. Based on the LFR value, estimations concerning long-term failure rate, reliability and a device's or module's operational life may be derived. The usage life time is normally the period of constant failure rate. All failures occuring during this period are random.
Within this period the failure rate is:

$$\lambda = \frac{\text{Sum of failures}}{\Sigma\ (\text{Quantity} \times \text{Time to failure})} \times \frac{1}{\text{h}}$$

The measure of λ is FIT (Failures In Time = number of failures in 10^9 device hours).

Example

A sample of 500 semiconductor devices is tested in a operating life test (dynamic electric operation). The devices operate for a period of 10 000 h.

Failures:

1 failure after 1000 h
1 failure after 2000 h

The failure rate may be calculated from this sample by

$$\lambda = \frac{2}{1 \times 1000 + 1 \times 2000 + 498 \times 10\,000} \times \frac{1}{h}$$

$$\lambda = \frac{2}{4\,983\,000} \times \frac{1}{h} = 4.01 \times 10^{-7} \frac{1}{h}$$

This is a λ-value of 400 FIT, or this sample has a failure rate of 0.04 %/1000 h on average.

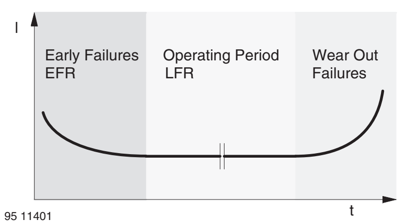


Fig. 16 - Bath Tub Curve

CONFIDENCE LEVEL

The failure rate λ calculated from the sample is an estimate of the unknown failure rate of the lot.

The interval of the failure rate (confidence interval) may be calculated, depending on the confidence level and sample size.

The following is valid:

- The larger the sample size, the narrower the confidence interval.
- The lower the confidence level of the statement, the narrower the confidence interval.

The confidence level applicable to the failure rate of the whole lot when using the estimated value of λ is derived from the x^2-distribution. In practice, only the upper limit of the confidence interval (the maximum average failure rate) is used.

Therefore:

$$\lambda_{max.} = \frac{x^2/2(r;P_A)}{n \times t} \text{ in } \frac{1}{h}$$

$$LFR = \frac{x^2/2(r;P_A)}{n \times t} \times 1 \times 10^9 \text{ in (FIT)}$$

r: Number of failures
PA: Confidence level
n: Sample size
t: Time in hours
n x t: Device hours

The $x^2/2$ for λ are taken from table 1.

For the above example from table 1:
$x^2/2$ (r = 2; PA = 60 %) = 3.08
n x t = 4 983 000 h

$$\lambda = \frac{3.08}{4\,983\,000} = 6.8 \times 10^{-7} \frac{1}{h}$$

This means that the failure rate of the lot does not exceed 0.0618 %/1000 h (618 FIT) with a probability of 60 %.
If a confidence level of 90 % is chosen from table 1:
$x^2/2$ (r = 2; PA = 90 %) = 5.3

$$\lambda_{max.} = \frac{5.3}{4\,983\,000} = 1.06 \times 10^{-6} \frac{1}{h}$$

This means that the failure rate of the lot does not exceed 0.106 %/1000 h (1060 FIT) with a probability of 90 %.

TABLE 1

NUMBER OF FAILURES	CONFIDENCE LEVEL			
	50 %	60 %	90 %	95 %
0	0.60	0.93	2.31	2.96
1	1.68	2.00	3.89	4.67
2	2.67	3.08	5.30	6.21
3	3.67	4.17	6.70	7.69
4	4.67	5.24	8.00	9.90
5	5.67	6.25	9.25	10.42
6	6.67	7.27	10.55	11.76
7	7.67	8.33	11.75	13.16
8	8.67	9.35	13.00	14.30
9	9.67	10.42	14.20	15.63
10	10.67	11.42	15.40	16.95

OPERATING LIFE TESTS

Number of devices tested: $n = 50$
Number of failures:
(positive qualification): $c = 0$
Test time: $t = 2000$ h
Confidence level: PA = 60 %
$x^2/2$ (0; 60 %) = 0.93

$$\lambda_{max.} = \frac{0.93}{50 \times 2000} = 9.3 \times 10^{-6} \frac{1}{h}$$

This means, that the failure rate of the lot does not exceed 0.9 %/1000 h (9300 FIT) with a probability of 60 %.

This example demonstrates that it is only possible to verify LFR values of 9300 FIT with a confidence level of 60 % in a normal qualification test (50 devices, 2000 h).

To obtain LFR values which meet today’s requirements (< 50 FIT), the following conditions have to be fulfilled:

- Very long test periods
- Large quantities of devices
- Accelerated testing (e.g. higher temperature)

MEAN TIME TO FAILURE (MTTF)

For systems which can not be repaired and whose devices must be changed, e.g. semiconductors, the following is valid:

$$MTTF = \frac{1}{\lambda}$$

MTTF is the average fault-free operating period per a monitored (time) unit.

ACCELERATING STRESS TESTS

Innovation cycles in the field of semiconductors are becoming shorter and shorter. This means that products must be brought to the market quicker. At the same time, expectations concerning the quality and reliability of the products have become higher.

Manufacturers of semiconductors must therefore assure long operating periods with high reliability but in a short time. Sample stress testing is the most commonly used way of assuring this.

The rule of Arrhenius describes this temperature dependent change of the failure rate.

$$\lambda (T_2) = \lambda (T_1) \times e^{\left[\frac{E_A}{k} \times \left(\frac{1}{T_1} - \frac{1}{T_2}\right)\right]}$$

Boltzmann's constant
$k = 8.63 \times 10^{-5}$ eV/K
Activation energy
E_A in eV
Junction temperature real operation
T_1 in Kelvin
Junction temperature stress test
T_2 in Kelvin
Failure rate real operation
$\lambda (T_1)$
Failure rate stress test
$\lambda (T_2)$

The acceleration factor is described by the exponential function as being:

$$AF = \frac{\lambda (T_2)}{\lambda (T_1)} = e^{\left[\frac{E_A}{k} \times \left(\frac{1}{T_1} - \frac{1}{T_2}\right)\right]}$$

Example

The following conditions apply to an operating life stress test:
Environmental temperature during stress test
$T_A = 70$ °C
Power dissipation of the device
$P_V = 100$ mW
Thermal resistance junction/environment
$R_{thJA} = 300$ K/W
The system temperature/junction temperature results from:
$T_J = T_A + R_{thJA} \times P_V$
$T_J = 70$ °C + 300 K/W 100 mW
$T_J = 100$ °C

Operation in the field at an ambient temperature of 50 °C and at an average power dissipation of 80 mW is utilized. This results in a junction temperature in operation of $T_J = 74$ °C. The activation energy used for opto components is $E_A = 0.8$ eV.

The resulting acceleration factor is:

$$AF = \frac{\lambda (373\ K)}{\lambda (347\ K)} = e^{\left[\frac{E_A}{k} \times \left(\frac{1}{347\ K} - \frac{1}{373\ K}\right)\right]}$$

$AF \approx 6.5$

This signifies that, in this example, the failure rate is lower by a factor of 6.5 compared to the stress test.
Other accelerating stress tests may be:

- Humidity (except displays type TDS.)
  $T_A = 85$ °C
  RH = 85 %
- Temperature cycling
  Temperature interval as specified

The tests are carried out according to the requirements of appropriate IEC-standards (see also chapter “Qualification and Release”).

ACTIVATION ENERGY

There are some conditions which need to be fulfilled in order to use Arrhenius' method:

- The validity of Arrhenius' rule has to be verified
- "Failure-specific" activation energies must be determined

These conditions may be verified by a series of tests. Today, this procedure is generally accepted and used as a basis for estimating operating life. The values of activation energies can be determined by experiments for different failure mechanisms.

Values often used for different device groups are:

Opto components	0.8 eV
Bipolar ICs	0.7 eV
MOS ICs	0.6 eV
Transistors	0.7 eV
Diodes	0.7 eV
Sinterglass diodes	0.7 eV

By using this method, it is possible to provide longterm predictions for the actual operation of semiconductors even with relatively short test periods.

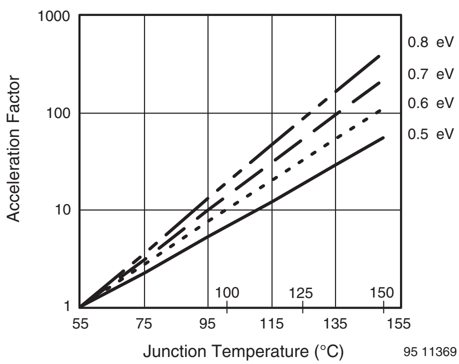


Fig. 17 - Acceleration Factor for Different Activation Energies Normalized to T_J = 55 °C

The Constituents of Semiconductor Components

Responsible electronic component and equipment manufacturers are already preparing for the time when the lifespan of their products comes to an end by scrutinizing the materials incorporated and their future recyclability. Recycling laws have already come into force in Germany ("Kreislauf-Wirtschaftsgesetz") and guidelines for electronic scrap are in preparation.

The aim is a suitable waste disposal program and, as a preventative measure, a reduction in the content of hazardous damaging materials in such components. In order to conform to this procedure, detailed information about the materials and their quantities is needed.

This present overview answers questions put forward by customers as to the constituents and their function in the most important of Vishay Semiconductors semiconductor products. Special significance is given to so-called "Hazardous Substances". It demonstrates that Vishay Semiconductors' products under normal operating conditions do not expose the applier or environment to any hazard. However, most products nevertheless contain small but necessary quantities of "Hazardous Substances" which can, if not treated correctly or through accidents, be released on a small scale into the environment.

The present information was produced with the greatest possible care. Any suggestions for improvement of this brochure are welcome.

DEFINITIONS

Vishay Semiconductors offers a wide range of semiconductor components including transistors, diodes and optoelectronic components. These have been manufactured in various standard packages.

On the following pages, these packages are listed together with their materials shown in weight percentages. In order to limit the number of tables, all components whose structure and composition are the same have been compiled in families. In many cases, different lead frames together with chips of different sizes may be used for the one package. This usually means that there may be slight differences in the quantities of the declared material. The weight percent is, however, valid for a representative sample of the relevant family. In order to sensibly reduce the number and quantities of materials contained in the respective components, quantities smaller than 0.1 % by weight have been stated in the following list as **traces**. This is the case unless lower limits are forced by law, e.g. cadmium < 75 ppm and PCDD as well as PCDF (known as dioxin) < 2 ppb. In the lists themselves, details of content and composition are separated into the individual parts of the semiconductor component. The most important of these are:

Active element: the active element is either a silicon chip or, for optoelectronic components, a chip containing combinations of Ga (Al) (As, P). These are doped with very small amounts of boron, arsenic, phosphorus, zinc and germanium etc. The metallisation consists of thin layers of aluminium, gold or titanium. The chips are generally bonded to the lead frame with a silver epoxy and have gold or aluminium wires bonded to the lead frame.

Lead frame: for electrical connection, a metal lead frame made from alloys such as FeNi (42) or CuFe (2) and partly or totally plated with silver is commonly used. The metal alloys contain traces of silver, zinc and phosphorus. Part of the lead frame is also coated with tin/lead.

Case: the semiconductor chip is protected from the environment by a case of glass, plastic or metal.

The glass is composed of oxides of silicon and lead together with boron and aluminum.

Plastic cases are composed of an epoxy resin filled with up to 70 % by weight of quartz particles. Antimony trioxide and brominated epoxy resin (no TBA) are added as flame retardents. Antimony and bromine amount to about 1.6 % and 1.0 % respectively.

In use: in use, it is the content of hazardous substances which is of importance. In Germany, there are a number of lists which give the materials which are potentially hazardous to people and the environment, for example:

appendix II and IV of the "Hazardous Materials Regulations", the TRGS 900 ("MAK-Wert-Liste") and the "Catalog of Materials Hazardous to the Water Supply". These lists, however, are only partially consistent.

The names used are often different for materials with the same chemical composition. Furthermore, the use of trivial and trade names often adds to the confusion.

Therefore, Vishay Semiconductors use for their descriptions that proposed by the Zentralverband Elektrotechnik und Elektronikindustrie e.V. (ZVEI; Central Association of Electrical Engineering and Electronic Industry) for the harmonization of the nomenclature of hazardous substances.

Instructions are given on the safety precautions to be used during storage and disposal by mechanical, chemical and thermal means of the more important chemicals (so-called "Leitchemikalien"). These are listed in the tables in the order of their potential risk. Their effect upon people and the environment are also listed and any special precautions emphasized.

Notes

- The following information has been prepared to be as exact and reliable as possible.
- The manufacture of semiconductor components is, however, subject to regular change without special notification.
- The publication of this brochure excludes any responsibility resulting from its use.

EXPLANATION OF ABBREVIATIONS

While the information on weight percent is believed correct, discrepancies depending upon component type may be possible.

1) Material information etc. material listed as "Material Hazardous in Production"

2) S: Trace material < 0.1 % by weight; Cd < 75 ppm; concerning Cd see ***) PCDD and PCDF < 2 ppb

*) Dioxin content - lies below agreed limits

**) No. 85 "Rules for Hazardous Materials", to be replaced as soon as a technically suitable alternative material is available

***) Traces of cadmium can only be found in lead frames made of copper

CTM Material containing carcinogens, mutagens or terratogens

Tox Material is toxic or very toxic

S Material with allergy producing characteristics

HAL Halogen containing material

WKG Material hazardous to the water supply

L Storage, suitable for disposal

D Disposable

M Mechanical disposal

N Chemical disposal

T Thermal disposal

H Handling

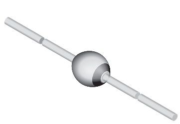
OZONE DEPLETING SUBSTANCES

The use of ozone depleting substances has been totally eliminated by Vishay Semiconductors and by doing so meets the legal requirements as defined in the following documents.

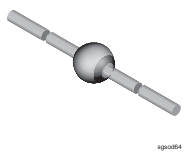
1. The "Montreal Protocol" together with the "London Amendments" appendix A, B, and the "List of Transitional Substances"
2. "Clean Air Act", amendments 1990, "Environmental Protection Agency" (EPA), USA, class I and II - ozone depleting substances
3. "European Council Resolution" number 88/540/EEC and 91/690/EEC appendix A, B and C (transitional substances)

Vishay Semiconductors guarantees that its components do not contain, and are manufactured without, the use of ozone depleting substances.

CONTENTS OF A DIODE IN SINTERED GLASS PACKAGE SOD-57

				mg	ppm
 sgsod57 Total weight 370 mg	Leads, tinned		85,9 %		
	Copper	Cu	58.3 %	185.29	500.797
	Iron	Fe	22.15 %	70.4	190.269
	Molybdenum	Mo	18.55 %	58.96	159.345
	Tin	Sn	0.5 %	1.59	4.295
	Lead	Pb	0.2 %	0.64	1.718
	Silver	Ag	0.1 %	0.32	0.859
	Carbon	C	0.1 %	0.32	0.859
	Oxygen	O_2	0.1 %	0.32	0.859
	Traces of Mn, P, S				
	Package, glass		13.8 %		
		PbO	42 %	21.45	57.960
		SiO_2	38 %	19.4	52.440
		B_2O_3	15 %	7.66	20.700
		Al_2O_3	5 %	2.55	6.900
	Silicon chip		0.3 %		
	Silicon	Si	90 %	1	2.700
	Aluminum	Al	10 %	0.11	0.300
	Traces of P, GA, Pt (dopant)				

CONTENTS OF A DIODE IN SINTERED GLASS PACKAGE SOD-64

				mg	ppm
	Leads, tinned		85.9 %		
	Copper	Cu	58.3 %	430.69	500.797
	Iron	Fe	22.15 %	163.63	190.269
	Molybdenum	Mo	18.55 %	137.04	159.345
	Tin	Sn	0.5 %	3.69	4.295
	Lead	Pb	0.2 %	1.48	1.718
	Silver	Ag	0.1 %	0.74	0.859
	Carbon	C	0.1 %	0.74	0.859
	Oxygen	O_2	0.1 %	0.74	0.859
	Traces of Mn, P, S				
	Package, glass		13.8 %		
		PbO	42 %	49.85	57.960
		SiO_2	38 %	45.1	52.440
Total weight 860 mg		B_2O_3	15 %	17.8	20.700
		Al_2O_3	5 %	5.93	6.900
	Silicon chip		0.3 %		
	Silicon	Si	90 %	2.32	2.700
	Aluminum	Al	10 %	0.26	0.300
	Traces of P, GA, Pt (dopant)				

SIGNIFICANT MATERIALS FOR DISPOSAL

NO.	MATERIAL AND/OR GROUP (1)	CMT	T	S	HAL	WGK	AVAILABLE IN THE COMPOUND USED FOR	PART IN (2) WEIGHT PERCENT	L	D	M	N	T	H
1	Lead and compounds		(2)			(2)	Package glass, lead	6			(2)	(2)	(2)	
2	Molybdenum and compounds		(2)				Lead	15.9				(2)		

Note

*), **), ***), (1), (2), CMT, T

Sinterglass Diodes Connected in Series for Increased Reverse Voltage

The use of several Sinterglass diodes connected in series is necessary where the voltage rating of a single Sinterglass diode is too low, or where special requirements such as very low switching losses requires the implementation of several low-loss ultra fast Sinterglass diodes. In these cases Sinterglass diodes connected in series are used for high voltage applications, e.g. TV monitor or automotive and in switching applications such as PFC-boost-converters, SMPS or other applications where low losses and high voltages are necessary.

According to the text book it is usually necessary to ensure symmetrical conditions for each Sinterglass diode. This is normally done with resistors for static conditions and with capacitors for dynamic conditions, see figure 1 (circuit diagram), which illustrates the situation for two Sinterglass diodes.

These configurations cause an increase in power dissipation and increase costs because of the larger number of parts. If you want to avoid this by simply connecting Sinterglass diodes in series without resistors and capacitors for symmetrical conditions then the following applies.

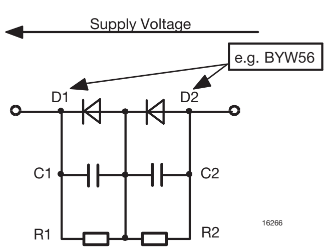


Fig. 1 - Circuit Diagram

STATIC CONDITIONS WITHOUT RESISTORS FOR SYMMETRY

For static conditions the important parameters are the reverse characteristics, especially the reverse breakdown-voltage. Applying a certain supply voltage will result in a certain reverse current, I_{Rsum}, through both Sinterglass diodes, at which the sum of the reverse voltage across each Sinterglass diode is equal to the applied supply voltage. In principle there are three different cases (the folowing drawings are exaggerated for better understanding).

Similar Sinterglass Diodes with Sufficient Reverse Breakdown-Voltage

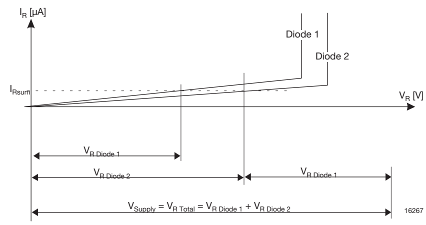


Fig. 2 - Static Conditions for similar Sinterglass Diodes with Sufficient V_R

For Sinterglass diodes with similar and sufficient reverse characteristics the resulting reverse voltage across Sinterglass diode 1 and Sinterglass diode 2, $V_{R\ Diode\ 1}$ and $V_{R\ Diode\ 2}$ is well below the breakdownvoltage. Therefore the resulting leakage current of this configuration will be very low and no problems willoccur, even if there are small overvoltage spikes on the supply. This is a practicable solution, but one needs Sinterglass diodes with a breakdown-voltage which is much higher than half of the supply voltage (for 2 Sinterglass diodes) if the Sinterglass diodes are not avalanche safe!

Similar Sinterglass Diodes with Insufficient Reverse Breakdown-Voltage

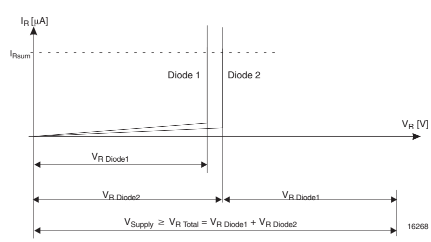


Fig. 3 - Static Conditions for similar Sinterglass Diodes with Insufficient V_R

For Sinterglass diodes with similar and insufficient reverse characteristics the resulting reverse voltage across Sinterglass diode 1 and Sinterglass diode 2, $V_{R\ Diode\ 1}$ and $V_{R\ Diode\ 2}$ is the breakdown-voltage. Both Sinterglass diodes will be in the reverse avalanche mode - and they must be able to withstand it!

Sinterglass Diodes Connected in Series for Increased Reverse Voltage

Normally the whole configuration will behave like a Zener-diode because the sum of the breakdown-voltages of both Sinterglass diodes is less than the applied supply voltage, with a very high reverse current mainly limited by the power supply and not the Sinterglass diode. If by chance the sum of the breakdown-voltages is exactly the supply voltage, the reverse leakage current will be mainly limited by the Sinterglass diode reverse characteristics. Because the reverse characteristics depend on the junction temperature the sum of the breakdown-voltages will change with the temperature too and the configuration will behave like a Zener-diode again.

So this is not really a practicable solution.

Sinterglass Diode with Different Reverse Breakdown-Voltages

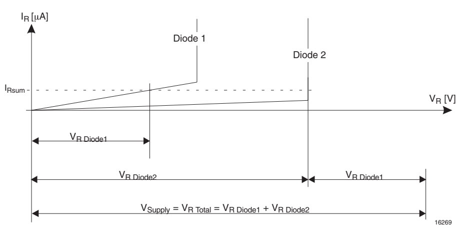


Fig. 4 - Static Conditions for different Sinterglass Diodes

For Sinterglass diodes with different reverse characteristics, the resulting reverse voltage for one Sinterglass diode, the better one, Sinterglass diode 2 in figure 4. Static conditions for different Sinterglass diodes, is in the area of the breakdown-voltage ($V_{R\ Diode\ 2}$) and for the other, Sinterglass diode 1, below the breakdown-voltage ($V_{R\ Diode\ 1}$). Because of the variations in the manufacturing processes for semiconductors it can always happen that within one certain type there will be Sinterglass diodes with different reverse characteristics as mentioned above.

Dynamic Conditions without Capacitors for Symmetry

Switching Sinterglass diodes, which are connected in series without capacitors, from a certain forward condition, e.g. 1 A forward current, to a certain reverse condition, e.g. 1000 V reverse voltage, will generate an avalanche pulse in the faster Sinterglass diode. It is similar to a chain, there the weak part will break first, here the faster Sinterglass diode will be off first. The reverse recovery characteristics are the important parameters for dynamic conditions, not only for Sinterglass diodes in switch mode power supply with frequencies of kHz to MHz, but also for Sinterglass diodes used for the rectification of the mains with 50 Hz or 60 Hz.

As already noted, due to variations in the manufacturing process there will be differences in the characteristics of the semiconductors. For better understanding of what is happening with each Sinterglass diode, we carried out measurements with two different ultrafast Sinterglass diodes connected in series without other components in parallel. The difference between the reverse recovery times is the same as can happen within one type due to the variations of the processes. For slower Sinterglass diodes it will be similar.

Sinterglass diode 1: (e.g. BYT53G)
reverse recovery time t_{rr} = 45 ns
(I_F = 0.5 A/I_R = 1 A/i_r = 0.25 A)
reverse breakdown-voltage
$V_{(BR)R}$ = 500 V

Sinterglass diode 2: (e.g. SF4007)
reverse recovery time t_{rr} = 60 ns
(I_F = 0.5A/I_R = 1A/i_r = 0.25 A)
reverse breakdown-voltage
$V_{(BR)R}$ = 1200 V

Dynamic Conditions with Low Reverse Voltage

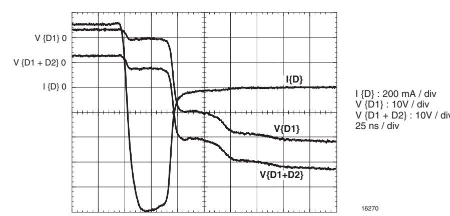


Fig. 5 - Dynamic Conditions with Low V_R

Figure 5. dynamic conditions with low V_R shows the dynamic characteristics with low reverse voltage, approx. 50 V, and constant current, using the test circuit for measuring the reverse recovery time trr according to JEDEC with a forward current I_F = 500 mA , a reverse current I_R = 1 A and measuring at 250 mA (for further explanations see the application note “Test Circuit for the Reverse Recovery Time t_{rr}“).

One can see the current through both Sinterglass diodes I{D}, the voltage across Sinterglass diode 1, V{D1} and the total voltage across both Sinterglass diodes, V{D1 + D2}.

As expected, the switching time of the series connection is the same as the switching time of the faster Sinterglass diode, D1, with t_{rr} = 45 ns. At the beginning the total reverse voltage is applied to the faster one (D1), V{D1} 9 V{D1+D2}, see figure 5. dynamic conditions with low V_R. The stored charge of Sinterglass diode 1 is less than the charge stored in Sinterglass diode 2, the slower one. Because the same current is passing through both Sinterglass diodes, the charge stored in Sinterglass diode 1 is reduced faster and Sinterglass diode 1 will be in the reverse mode with a small reverse current before all the charge stored in Sinterglass diode 2 is reduced. The reduction of the remaining charge in Sinterglass diode 2 is achieved by the low leakage current

Sinterglass Diodes Connected in Series for Increased Reverse Voltage

of Sinterglass diode 1, which will take a long time depending on the difference between the charges in the Sinterglass diodes.

Although the above explanations are more or less of theoretical interest because of the low applied reverse voltage, it is important to understand the mechanism. In real life situations, with high reverse voltage, the reason for switching the Sinterglass diodes in series becomes apparent when we consider the next step.

Dynamic Conditions with High Supply Voltage

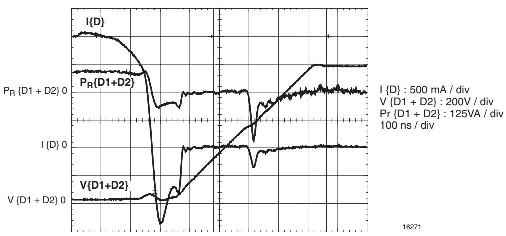


Fig. 6 - Dynamic Conditions with high V_R

Figure 6. dynamic conditions with high V_R shows the dynamic characteristics with high reverse voltage, approx. 1000 V, and constant current (forward current I_F = 2 A and a reverse current I_R = 1 A).

Again one can see the current through both Sinterglass diodes I{D}, the total voltage across both Sinterglass diodes connected in series, V{D1 + D2} and the total energy of both Sinterglass diodes P_R{D1 + D2}.

Understanding the mechanism, as explained in 2.1, we know that the stored charge is reduced faster in the faster Sinterglass diode, Sinterglass diode 1, therefore this Sinterglass diode is in the reverse mode first, Sinterglass diode 2 is still not in the reverse mode.

The total reverse voltage increases with a certain slope due to the inductive load. After approx. 250 ns the voltage across the Sinterglass diodes is the breakdown-voltage of Sinterglass diode 1. At this moment Sinterglass diode 1 goes into the reverse avalanche mode with a short current peak, approx. 350 mA for 40 ns and a breakdown-voltage of approx. 550 V (at 350 mA). But this means an avalanche pulse of approx. 8 µWs, which the Sinterglass diode must be able to survive!

Due to the avalanche current peak of Sinterglass diode 1 the stored charge in Sinterglass diode 2 is reduced and this Sinterglass diode will be in the reverse mode too. After this the total reverse voltage across both Sinterglass diodes can rise further, up to the maximum supply voltage of approx. 1000 V. When the final reverse voltage of both Sinterglass diodes is reached, the static conditions as described above apply.

Depending on the difference of the reverse recovery characteristics (stored charge) the current peak and the duration of the avalanche pulse will be different. It is very important to the losses generated consider by the short avalanche pulse in the example mentioned above, see figure 6. dynamic conditions with high V_R. Each time switching from forward to reverse takes place, this will result in an avalanche energy of approx. 8 µWs. If the frequency of this application is 100 kHz, the power loss due to the avalanche pulse is 800 mW! This can result in a temperature increase of approx. 80 °C for a Sinterglass diode in the SOD-57 package such as the BYV26 or BYV27. The real reverse loss due to the avalanche of the better Sinterglass diode is given through the circuit and must definitely be taken into account when calculating the total loss of the parts!

Summary

For static conditions the important parameter is the reverse characteristic. A certain supply voltage results in a certain reverse current at which the sum of the reverse voltages of all the Sinterglass diodes is equal to the applied supply voltage. If the safety factor for the reverse breakdown-voltage for each Sinterglass diode is low (e.g. 10 %), it can happen that the best Sinterglass diode (best reverse characteristics, high breakdown-voltage and low leakage current) will be in the avalanche mode all the time.

For dynamic conditions the important parameter is the switching characteristic. Switching from forward to reverse conditions will result in a short avalanche pulse in the fastest Sinterglass diode, because this Sinterglass diode is already in the reverse mode with reverse voltage and the other not, i.e. there is still some charge stored in the slower one.

Sinterglass diodes can be connected in series without external components for symmetrical conditions if these Sinterglass diodes are able to withstand the avalanche energy and the resulting junction temperature is below the maximum guaranteed temperature. Vishay offers a wide range of Sinterglass diodes with a special construction of the junction to be avalanche safe. In addition, they are 100 % tested with the guaranteed avalanche energy. For more details please refer to the datasheets.

Sinterglass Avalanche Diodes for Power-Factor-Correction (PFC)

HISTORICAL BACKGROUND

Why PFC is Important for all Future Electronic Equipment

The new european standard EN 61000-3-2 along with amendments A1 and A2 became mandatory on 01.01.2001. Amendment has also been published with a 3 year transition period.

It says that every power-supply with an input power of more than 75 W has to be equipped with so-called power-factor correction and it says that it is not allowed to bring power-supplies into the market that are not equipped with PFC or the user has to provide an additional electronic ballast with PFC.

TECHNICAL BACKGROUND

What are the Effects of Non-PFC-equipped Circuits

Non-PFC power supplies use a capacitive input filter, as shown in fig. 1, when powered from AC power line. This results in rectification of the AC line, which in turn causes peak currents at the crest of the AC voltage, as shown in fig. 2. These peak currents lead to excessive voltage drops in the wiring and imbalance problems in the three-phase power delivery system. This means that the full energy potential of the AC line is not utilized.

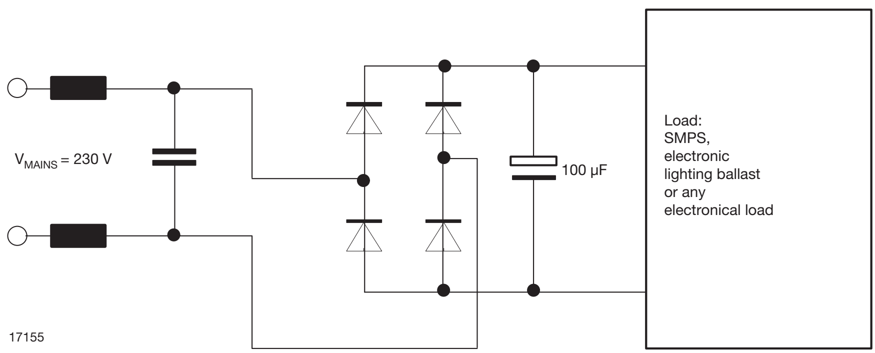


Fig. 1 - Standard Bridge Rectification of Line Voltage

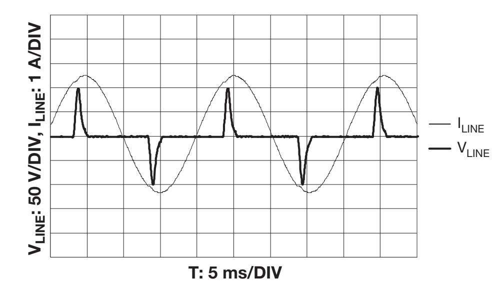


Fig. 2 - 20 W Resistive Load Powered by a Circuit like Fig. 3

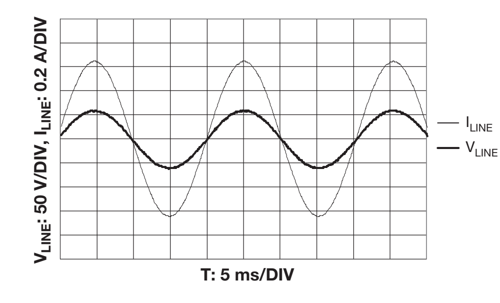


Fig. 3 - Same Load like Fig. 2, but Unity Powerfactor

Power Factor Correction (PFC) can be defined as the reduction of the harmonic content. By making the current waveform look as sinusoidal as possible, as shown in fig. 3., the power drawn by the power supply from the line is then maximized to real power.
Assuming that the voltage is almost sinusoidal, power factor depends first of all on the current waveform.
Thus real power can be defined as:

$$P = V_{RMS} \times I_1 \times \sin(\omega_1 t)$$

$$S = \sqrt{P^2 + Q^2}$$

$$S = V_{RMS} \times \sqrt{I_1{}^2 \times \sin(\omega_1 t)^2 + I_2{}^2 \times \sin(\omega_2 t)^2 + \ldots I_n^2 \times \sin(\omega_n t)^2}$$

That means that real power only is carried by the fundamental harmonic, all the higher harmonics are carrying only reactive power. Eliminating the higher harmonics means increasing power factor to unity.
The definition of power factor is:

$$\text{Power Factor} = \frac{\text{Real Power}}{\text{Apparent Power}}$$

For the circuit in fig. 1 - Standard bridge rectification of line voltage, the power factor is typically about 40 % to 50 %.

For example (related to fig. 1 and fig. 2):
The following measurements can be done with the circuit in fig. 1:

C = 100 µF	R = 680 W
I_{TRMS} = 495 mA	P = 20 W
S = 43 VA	Q = 38 var

Power Factor = 0.464

With the same resistor directly connected to the line terminals or using power factor correction the follow
I_{TRMS} = 172 mAP = 20 W
S = 20 WQ = 0
Power Factor = 1

This simple example gives a good impression what happens if all electronic equipment is powered without PFC. Obviously we see in this example the same real power, but big differences in RMS current.

DESCRIPTION OF STANDARD EN 60000-3-2

The standard has 2 parts that are important for the manufacturer of electronic devices:

- Classification of electrical loads
- Limitation of line current harmonics depending on the effective class of the load

Classification of Electrical Loads

This standard will be effective for all electrical loads supplied by the low voltage power line with line input currents up to 16 A.

- In general all 3-phase line-loads and all loads that can not be classified to be class B, C or D loads are class A loads.
- All portable electrical tools are class B loads.
- All lighting devices or lighting regulators are class C loads.
- All electrical loads with a power consumption below 600 W and line input current waveform that for a half period of the line voltage is 95 % or more inside the hatched area of the diagram shown in

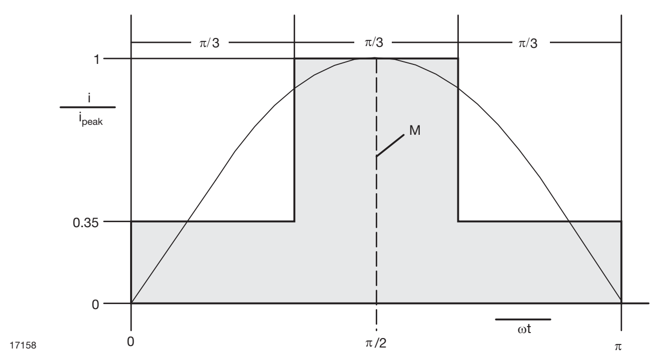


Fig. 4 - Definiton Criterim for Class D Load

Sinterglass Avalanche Diodes for Power-Factor-Correction (PFC)

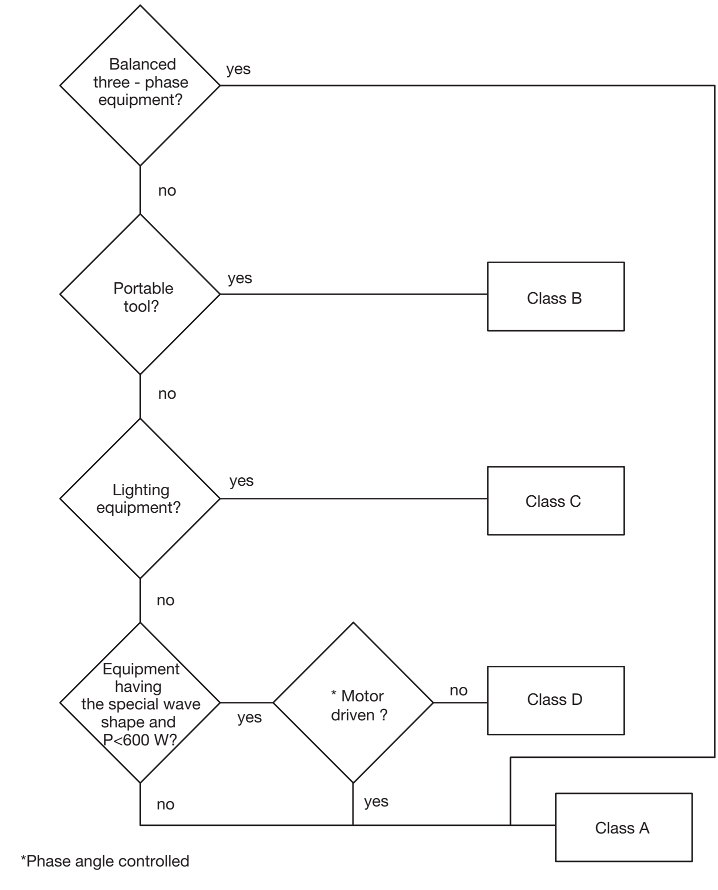


Fig. 5 - Flow Chart for the Classification of Equipment

CLASS RELATED LIMITATIONS OF HARMONICS

TABLE 1 - LIMITS OF CLASS A: ODD HARMONICS	
NR. of HARMONIC (n)	RMS CURRENT LIMIT (A)
3	2.3
5	1.14
7	0.77
9	0.40
11	0.33
13	0.21
15 < n < 39	0.15 x 15/n

TABLE 2 - LIMITS OF CLASS A: EVEN HARMONICS	
NR. of HARMONIC (n)	RMS CURRENT LIMIT (A)
2	1.08
4	0.43
6	0.30
8 < n < 40	0.23 x 8/n

Electrical loads in class B show 1.5 times higher limit currents compared to class A limits

TABLE 3 - LIMITS OF CLASS C	
NR. of HARMONIC (n)	RMS CURRENT LIMIT (% of THE FUNDAMENTAL HARMONIC)
2	2
3	30 x λ [1]
5	10
7	7
9	5
11 < n < 39	3

Note

[1] λ = Powerfactor of the circuit

Because usually the third harmonic has the highest amplitude using the power factor as a factor for the limit becomes of greater importance. Smaller power factor means tougher limit and vice versa.

TABLE 4 - LIMITS OF CLASS D HARMONICS		
NR. of HARMONIC (n)	RMS CURRENT LIMIT PER W (mA/W)	RMS CURRENT LIMIT (A)
3	3.4	2.3
5	1.9	1.14
7	1	0.77
9	0.5	0.40
n > 13	3.85/n	0.15 x 15/n

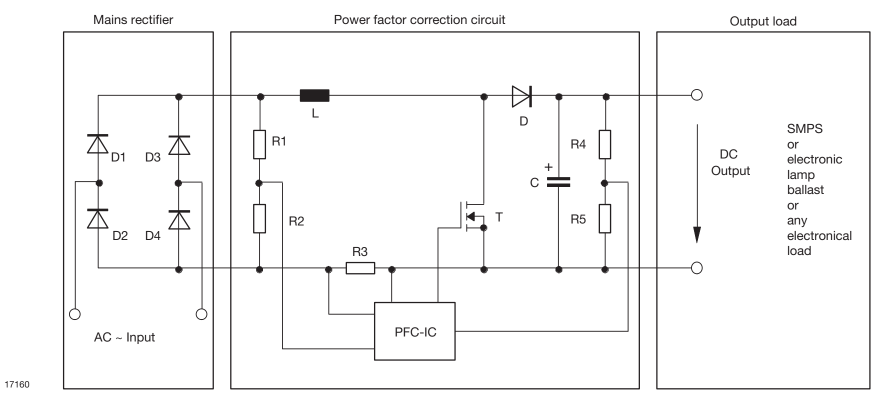


Fig. 6 - Typical Boost Converter Topology for active PFC

Because it is the most cost saving solution the continuous current mode boost converter as shown in fig. 6 is today the most used topology for active power factor correction.

The bridge rectifier BR1 converts the AC input current into DC current. The MOSFET T is used as an electronic switch, and is cycled "on" and "off" driven by the PFC-IC. While the MOSFET is "on" the inductor current through L increases. While the MOSFET is "off", the inductor delivers current to the capacitor C through the forward biased output rectifier diode D. The inductor current does not fall to zero during the entire switching cycle, because this operation is called "continuous current mode". This mode is suitable for almost all load current variations. If a constant load current is expected the so-called "discontinuous current mode", where currents falls at the end of each cycle to zero, should be preferred. The MOSFET anyway is pulse-width-modulated so that the input impedance of the circuit appears purely resistive, and the ratio of peak to average current is kept low.

The most cost-effective way of reducing losses in the circuit is by choosing a suitable diode D for the application. Diodes for use in PFC circuits typically have higher forward voltages than conventional fast epitaxial diodes, but much shorter (faster) reverse recovery times.

How a Standard PFC Circuit Works

Fig. 6 shows the typical topology of a PFC prestage that is built of a standard boost converter driven by a control IC. It is important that at the output of the Rectifier BR1 there will be no "large" smoothing capacitor with several mF connected, because that would eliminate all efforts of the PFC circuit, although it would operate sufficiently. The input voltage of the PFC is a rectified DC voltage pulsed with double line frequency. The shown switch is usually implemented by an IGBT or Power-MOS transistor.

Operation principle:
The instantaneous value of the current through the boost inductor has to be adapted as well as possible to the instantaneous value of the line voltage through suitable pulse-width modulation of the transistor switch T. The actual inductor current can be won by the voltage drop at R3.

The input voltage can be found at the voltage divider R1, R2. The current amplitude will be regulated on the value of the output voltage, R4, R5.

To be able to control the current through the boost inductor, the output voltage of the PFC has to be higher at every moment of operation than the crest of the line input voltage. For 230 V mains the DC output should be about 400 V. A large capacitor at the ouput does not affect the power factor, but is good for smoothing the DC voltage.

An additional advantage of PFC circuit is the regulated DC voltage that gives the opportunity of having a following SMPS to be wide range operated (e.g. 110 V to 230 V input voltage).

Advantages of Circuits with PFC

- The use of PFC allows the manufacturer of electrical load to use smaller, more cost-effective mains rectifiers because of smaller RMS current with PFC.
- Offers a stable regulated output voltage which is the input voltage for the following electrical load. Indeed the PFC makes it a system based widerange power supply itself.
- The following electrical load (SMPS, Electronic ballast unit or other electrical load) can be much simpler, which is also a cost saving factor.

Vishay Semiconductor recommends the use of their ultra-fast Sinterglass avalanche diode series of PFC Sinterglass avalanche diodes.

TABLE 5 - RECOMMENDED REVERSE VOLTAGES FOR MOST USED LINE VOLTAGE LEVELS

V_{LINE} RMS [V]	V_{RRM} [V]
110	400
120	400
230	600
277	600

Preferred types for the mains Sinterglass avalanche diodes and the boost Sinterglass avalanche diodes are listed in table 6 and table 7.

MAINS SINTERGLASS AVALANCHE DIODES (4 DEVICES EACH)

TABLE 6 - SELECTION GUIDE FOR THE MAINS SINTERGLASS AVALANCHE DIODES

INPUT POWER	MAINS VOLTAGE		
	120 V	230 V	277 V
≤ 75 W	BYT51G	BYW54	
≤ 100 W	BYT51G BYW53		
≤ 150 W	BYW83		
≤ 200 W		BYT51K BYW55	BYT51M
≤ 250 W		BYW 85	BYT51M BYW56
≤ 400 W			BYW86

Note
- Conditions: T_{amb} = 40 °C
  Leaded Sinterglass avalanche diodes PCB mounted

Because of large variations in the applications the table above shows a rough selection only. The appropriate diode must be selected depending on the application! For wide range power supplies the lowest mains voltage will result in the highest forward losses of the diode. For these applications the selection of the reverse voltage must be at the highest voltage, the power selection at the lowest.

BOOST-DIODES

TABLE 7 - SELECTION GUIDE FOR THE BOOST DIODES

<table>
<tr><th rowspan="2">INPUT POWER</th><th colspan="3">MAINS VOLTAGE</th></tr>
<tr><th>120 V</th><th>230 V</th><th>277 V</th></tr>
<tr><td>≤ 75 W</td><td>BYT53G
BYV26B</td><td rowspan="2"></td><td rowspan="3">BYW36
BYV26C</td></tr>
<tr><td>≤ 100 W</td><td>BYV27-600
SF4004</td></tr>
<tr><td>≤ 150 W</td><td>BYV28-600
2* BYV27-200</td><td>BYV26C
SF4005</td></tr>
<tr><td>≤ 200 W</td><td>BYW178
SF5404
2* BYV98-200</td><td>3* BYV27-200</td><td>SF4005</td></tr>
<tr><td>≤ 250 W</td><td>2* BYV28-200</td><td>BYV27-600</td><td>3* BYV27-200</td></tr>
<tr><td>≤ 300 W</td><td rowspan="4">BYW178</td><td>SF5406
3* BYV98-200</td><td>BYV27-600</td></tr>
<tr><td>≤ 350 W</td><td>BYV28-600
BYW178
2* BYV27-200</td><td>SF5406</td></tr>
<tr><td>≤ 400 W</td><td rowspan="2">3* BYV28-200</td><td>BYV28-600
BYW178
3* BYV27-200</td></tr>
<tr><td>≤ 500 W</td><td>3* BYV98-200</td></tr>
</table>

Note

- Conditions: T_{amb} = 40 °C,
  Leaded diodes PCB mounted

Because of large variations in the switching conditions (frequency....) the table above shows a rough selection only, the data are calculated with ≈ 25 % switching losses. The appropriate diode with the right characteristics (especially switching characteristic/reverse recovery time t_{rr}) must be selected depending on the application! Depending on these requirements the series connection of 2 or 3 diodes (e.g. 3*BYV98-200) can be the better solution.

Cross Reference

This guide includes a code letter system which designates the compatibility between Vishay Semiconductors devices and those of other manufacturers.

CODE DEFINITIONS

1 = equivalent

2 = minor electrical difference

2 = minor mechanical difference

Although every effort has been made to assure accurate and reliable substitutions, Vishay Semiconductors assumes no responsibility for the consequences of such substitutions in actual designs. In every case Vishay Semiconductors detailed device documentation should be used as a final technical reference for substitution. Vishay Semiconductors technical representatives will be glad to assist you in choosing the most suitable device for your design.

IND. PART NUMBER	VISHAY TYPE	CODE
11ES2	BYT51D	3
11ES4	BYW54	2 +, 3
1A2	BYT51B	3
1A3	BYT51D	3
1A4	BYT51G	3
1A5	BYT51J	3
1A6	BYT51K	3
1A7	BYT51M	3
1G2	BYT51D	1
1G4	BYT51G	1
1G6	BYT51J	1
1G8	BYT51K	1
1N4383GP	BYT51D	3
1N4384GP	BYT51G	3
1N4385GP	BYT51J	3
1N4585GP	BYT51K	2, 3
1N4586GP	BYT51M	2, 3
1N4933GP	BYW32	2, 3
1N4934GP	BYW32	2, 3
1N4935GP	BYW32	2, 3
1N4936GP	BYW34	2, 3
1N4937GP	BYW36	2, 3
1N4946GP	BYW36	2, 3
1N5059GP	BYT51D	3
1N5060	1N5060	1
1N5060GP	1N5060	3
1N5061	1N5061	1
1N5061GP	1N5061	3
1N5062	1N5062	1
1N5062GP	1N5062	3

IND. PART NUMBER	VISHAY TYPE	CODE
1N5185GP	BYW72	2, 3
1N5186GP	BYW72	2, 3
1N5187GP	BYW72	3
1N5188GP	BYW74	3
1N5190GP	BYW76	3
1N5211	BYT51D	3
1N5212	BYT51G	3
1N5213	BYT51J	3
1N5320	BYW32	2, 3
1N5397GP	BYW54	2, 3
1N5399GP	BYW56	2, 3
1N5619GP	BYW36	3
1N5621GP	BYV37	3
1N5623GP	BYV38	3
1N5624	1N5624	1
1N5624GP	BYW82	3
1N5625	1N5625	1
1N5625GP	BYW83	3
1N5626	1N5626	1
1N5626GP	BYW84	3
1N5627GP	BYW85	3
1N5811	BYV28-150	2, 3
1N6626	BYV27-200	2, 3
1R5DL41A	BYV27-200	2, 3
1R5GH45	BYT53G	2, 3
1R5GU41	BYT53G	2, 3
1R5NH45	BYT54M	2, 3
1S1888	BYT51J	2, 3
1S2392	BYT51D	1
1S2394	BYT51G	1
1S2396	BYT51J	1
1S2398	BYT51K	1
1S2762	BYW82	1
1S2764	BYW83	1
1S2766	BYW84	1
1S2766A	BYW84	1
1S2768	BYW85	1
1S2768A	BYW85	1
2G10	BYW56	2, 3
2G2	BYW52	2, 3
2G4	BYW53	2, 3
2G6	BYW54	2, 3
2G8	BYW55	2, 3
2G8	BYW55	2, 3
2NH45	SF5404	2, 3
2PFF0	BYV38	2, 3
2PFF2	BYV27-200	2, 3

IND. PART NUMBER	VISHAY TYPE	CODE
2PFF8	BYV37	2, 3
31DF6	BYV28-600	2, 3
3BZ61	BYW82	2, 3
3DL41A	BYV28-200	2, 3
3DZ61	BYW82	1
3GH45	SF5404	2, 3
3GU41	SF5404	2, 3
3GZ61	BYW83	1
3JU41	SF5406	2, 3
3JZ61	BYW84	1
3LZ61	BYW85	1
3TH41	BY228	2, 3
BY133	BY448	2, 3
BY203-16S	BY203-16S	2, 3
BY203-20S	BY203-20S	2, 3
BY228	BY228	1
BY299	BYT77	2, 3
BY396GP	BYT56B	2, 3
BY397GP	BYT56D	2, 3
BY398	BYT56G	2, 3
BY398	BYW74	2, 3
BY398GP	BYT56G	2, 3
BY399GP	BYT77	2, 3
BY448	BY448	1
BY505	BY203-20S	2, 3
BY527	BY527	1
BY584	BY203-20S	2, 3
BYD14D	BYW52	2, 3
BYD14G	BYW53	2, 3
BYD14J	BYW54	2, 3
BYD14K	BYW55	2, 3
BYD14M	BYW56	2, 3
BYD73F	SF4004	2, 3
BYD73G	SF4004	2, 3
BYM26A	SF5402	3
BYM26B	SF5404	3
BYM26C	BYV28-600	3
BYM26D	BYT56K	3
BYM26E	SF5408	3
BYM36C	BYM36C	1
BYM36D	BYM36D	1
BYM36E	BYM36E	1
BYM56B	BYW83	2
BYM56C	BYW84	2
BYM56D	BYW85	2
BYM56E	BYW86	2
BYT01-400	SF4004	2, 3
BYT11-1000RL	BYT54M	2, 3
BYT11-600	BYV26C	2, 3

IND. PART NUMBER	VISHAY TYPE	CODE
BYT77	BYT77	2, 3
BYT78	BYT78	2, 3
BYV16	BYV16	1
BYV160	BYV27-600	2
BYV2100	BYV27-100	2
BYV26A	BYV26A	1
BYV26B	BYV26B	1
BYV26C	BYV26C	1
BYV26D	BYV26D	1
BYV26E	BYV26E	1
BYV27-100	BYV27-100	1
BYV27-150	BYV27-150	1
BYV27-200	BYV27-200	1
BYV27-50	BYV27-50	1
BYV27-600	BYV27-600	1
BYV28-100	BYV28-100	1
BYV28-150	BYV28-150	1
BYV28-200	BYV28-200	1
BYV28-50	BYV28-50	1
BYV28-600	BYV28-600	1
BYV36C	BYT54J	2
BYV36E	BYT54M	2
BYV37	BYV37	1
BYV38	BYV38	1
BYV95A	BYW32	2
BYV95B	BYW34	2
BYV95C	BYW36	2
BYV95D	BYT52K	2
BYV95E	BYT52J	2
BYV96D	BYT52K	2
BYV96E	BYT52M	2
BYV96E	BYV38	2, 3
BYV97G	BY268	2
BYV98	BY203-20S	2
BYV99	BYV26C	2, 3
BYW98-200	BYV98-200	2, 3
BYW27-1000	BYT51M	2, 3
BYW32	BYW32	1
BYW34	BYW34	1
BYW35	BYW35	1
BYW36	BYW36	1
BYW53	BYW53	1
BYW54	BYW54	1
BYW55	BYW55	1
BYW56	BYW56	1
BYW72	BYW72	1
BYW73	BYW73	1
BYW74	BYW74	1
BYW75	BYW75	1

IND. PART NUMBER	VISHAY TYPE	CODE
BYW76	BYW76	1
BYW83	BYW83	1
BYW86	BYW86	1
BYW95A	BYW72	2
BYW95B	BYW74	2
BYW95C	BYW76	2
BYW95D	BYT77	2
BYW95E	BYT78	2
BYW96D	BYT77	2
BYW96E	BYT78	2, 3
BYW98-100	BYV98-100	2, 3
BYW98-150	BYV98-150	2, 3
BYW98-200	BYV98-200	2, 3
BYW98-50	BYV98-50	2, 3
BYX10G	BY448	2
BYX132G	BYT62	2, 3
BYX132GL	BYT62	2, 3
BYX132GPL	BYT62	2, 3
BYX82	BYX82	1
BYX83	BYX83	1
BYX86	BYX86	1
CPR1F010	BYW32	2, 3
CPR1F020	BYW32	1
CPR1F040	BYW34	1
CPR1F080	BYV37	1
CPR1F100	BYV38	1
CPR2F010	BYW32	2, 3
CPR2F020	BYW32	2, 3
CPR2F040	BYW34	2, 3
CPR2F060	BYW36	2, 3
CPR2F080	BYV37	2, 3
CPR2F100	BYV38	2, 3
CPR3F010	BYW72	2, 3
CPR3F020	BYW72	1
CPR3F040	BYW74	1
CPR3F060	BYW76	1
CPR3F080	BYT77	1
CPR3F100	BYT78	1
CR1-005	BYT51A	3
CR1-010	BYT51B	3
CR1-020	BYT51D	3
CR1-040	BYT51G	3
CR1-060	BYT51J	3
CR1-080	BYT51K	3
CR1-100	BYT51M	3
CR2-005	BYW52	2, 3
CR2-010	BYW52	2, 3
CR2-020	BYW52	2, 3
CR2-040	BYW53	2, 3

IND. PART NUMBER	VISHAY TYPE	CODE
CR2-060	BYW54	2, 3
CR2-080	BYW55	2, 3
CR2-100	BYW56	2, 3
CR3F005	BYT56A	2, 3
CR3F010	BYT56B	2, 3
CR3F020	BYT56D	2, 3
CR3F040	BYT56G	2, 3
CR3F060	BYT56J	2, 3
CR3F080	BYT77	2, 3
CR3F100	BYT78	2, 3
D1NL40	SF4004	3
D3L60	BYT53G	2, 3
DSR3051	BYT53A	3
DSR3101	BYT53B	3
DSR3201	BYT53D	3
EG1	BYW34	2, 3
EGP20A	BYV27-50	2, 3
EGP20B	BYV27-100	2, 3
EGP20D	BYV27-200	2, 3
EGP20G	BYV27-600	2, 3
EGP50B	SF5401	3
EGP50D	SF5402	3
EGP50F	SF5403	3
EGP50G	SF5404	3
EL1Z	BYV27-200	1
EM01Z	BYW52	2, 3
EM1	BYT51B	2, 3
EM1A	BYW54	2, 3
EM2A	BYW54	2, 3
EM513	BY448	2, 3
ERA15-02	BYW52	3
ERA32-01	SF4002	2, 3
ERA32-02	SF4003	2, 3
ERA32-02	SF4003	2, 3
ERB06-13	BY228	2, 3
ERB06-13	BY448	2, 3
ERB06-13	BY458	2, 3
ERB06-15	BY448	2, 3
ERB12-01	BYT51B	2, 3
ERB12-02	BYT51D	2, 3
ERB12-04	BYT51G	2, 3
ERB12-06	BYT51J	2, 3
ERB12-06	BYW54	3
ERB12-10	BYT51M	2, 3
ERB32-01	BYT53B	2, 3
ERB35-02	SF4003	2, 3
ERB37-08	BYV26D	2, 3
ERB37-10	BYV26E	2, 3
ERB38-04	BYV26B	2, 3

IND. PART NUMBER	VISHAY TYPE	CODE
ERB38-05	BYV26C	2, 3
ERB38-06	BYV26C	2, 3
ERB44-02	BYT54D	2, 3
ERB44-02	BYW32	3
ERB44-04	BYT54G	2, 3
ERB44-04	BYW34	3
ERB44-06	BYT54J	2, 3
ERB44-06	BYW36	3
ERB44-08	BYT54K	2, 3
ERB44-10	BYT54M	2, 3
ERC01-02	BYW82	2, 3
ERC01-04	BYW83	2, 3
ERC01-06	BYW84	2, 3
ERC01-10	BYW86	2, 3
ERC04-06S	BYW84	2, 3
ERC05-10B	BYW86	2, 3
ERC06-13	BY228-15	2, 3
ERC06-15	BY228	2, 3
ERC06-15S	BY448	2, 3
ERC06-15SL	BY228	2 -
ERC13-08	BYW85	2, 3
ERC24-06	BYV27-600	2, 3
ERC25-04	BYT53G	2, 3
ERC35-02	SF5402	2, 3
ERC38-06	BYV26C	1
ERC91-02	BYV28-200	2, 3
ERD07-13	BY228-15	2, 3
ERD07-15	BY228	2, 3
ERD28-04	BYT56G	2, 3
ERD28-06	BYT56J	2, 3
ERD28-06S	BYW36	2, 3
ERD28-06S	BYW76	1
ERD29-08	BYT56K	2 -
ERD32-01	SF5401	2, 3
ERD32-02	BYV98	3
ERD32-02	SF5402	2, 3
ERD32-02	SF5402	2, 3
ERD38-04	SF5404	2, 3
ERD38-05	SF5405	2, 3
ERD38-06	SF5406	2, 3
F14B	BYT51D	1
F14D	BYT51G	1
F14H	BYT51K	1
F1N5420	BYW76	1
F1N5617	BYW34	1
F1N5621	BYV37	1
F1N5623	BYV38	1
FE2A	BYV27-50	3
FE2B	BYV27-100	3

IND. PART NUMBER	VISHAY TYPE	CODE
FE2C	BYV27-150	3
FE2D	BYV27-200	2, 3
FE3A	BYV28-50	2, 3
FE3B	BYV28-100	2, 3
FE3C	BYV28-150	2, 3
FE3D	BYV28-200	2, 3
FGP207	BYV38	2, 3
FGP4937	BYW36	3
FGP4947	BYV37	3
FGP4948	BYV38	3
FP200	BYT53A	2, 3
FP201	BYT53B	2, 3
FP202	BYT53D	2, 3
FP203	BYT53G	2, 3
FP204	BYT53G	2, 3
FP206	BYW36	2, 3
FP306	SF5406	2, 3
FR107GP	BYV38	2, 3
FR201GP	BYT53A	2, 3
FR202GP	BYT53B	2, 3
FR203GP	BYT53D	2, 3
FR204GP	BYT53G	2, 3
FR205GP	BYW36	2, 3
FR206GP	BYV37	2, 3
FR207GP	BYV38	2, 3
FR301GP	BYT56A	2, 3
FR302GP	BAT56B	2, 3
FR303GP	BYT56D	2, 3
FR304GP	BYT56G	2, 3
FR305GP	BYW76	2, 3
FR306GP	BYT77	2, 3
FR307GP	BYT78	2, 3
FUF4005	SF4005	1
FX1N5420	BYW76	2, 3
FX1N5615	BYW32	2, 3
FX1N5617	BYW34	2, 3
FX1N5619	BYW36	2, 3
FX1N5621	BYV37	2, 3
FX1N5623	BYV38	2, 3
GP110	BYT51M	3
GP15D	BYT51D	3
GP15G	BYT51G	2, 3
GP15J	BYT51J	3
GP20G	BYW53	2, 3
GP20J	BYW54	2, 3
GP20K	BYW55	2, 3
GP20M	BYW56	2, 3
GP30G	BYW83	2, 3
GP30M	BYW86	2, 3

IND. PART NUMBER	VISHAY TYPE	CODE
GP4001	BYT51A	3
GP4002	BYT51B	3
GP4003	BYT51D	3
GP4004	BYT51G	3
GP4005	BYT51J	3
GP4006	BYT51K	3
GP4007	BYT51M	3
GU41	BYT53G	2, 3
GUF15A-20A	BYT53A	2, 3
GUF15B-20A	BYT53B	2, 3
GUF15D-20A	BYT53D	2, 3
GUF15F-20A	BYT53F	2, 3
GUF15G-20A	BYT53G	2, 3
HER107	BYT51K	3
HER108	BYT51M	3
HER206	BYV27-600	2 +
HER303	SF5402	2, 3
HER307	BYT56K	2, 3
HR103N	BYW82	2, 3
HR103P	BYW82	2, 3
ICR1003	BYW32	2, 3
ICR1004	BYW34	2, 3
ICR1005	BYW36	2, 3
ICR3001	BYT56A	3
ICR3002	BYT56B	3
ICR3003	BYT56D	3
ICR3004	BYT56G	3
ICR3005	BYW76	3
ICR3006	BYT77	3
ICR3007	BYT78	3
IP643	BYW32	2, 3
IP644	BYW32	2, 3
IP647	BYW34	2, 3
LL4933	BYW32	2, 3
MB201	BYV27-100	2, 3
MB202	BYV27-100	2, 3
MB204	BYV27-150	2, 3
MB206	BYV27-200	2, 3
MB208	BYV27-100	2, 3
MB209	BYV27-100	2, 3
MB211	BYV27-150	2, 3
MB213	BYV27-200	2, 3
MR850GP	BYW72	2, 3
MR851GP	BYW72	2, 3
MR852	SF5402	2, 3
MR852GP	BYW72	3
MR854GP	BYW74	3
MR856	SF5406	2, 3
MR856GP	BYW76	3

IND. PART NUMBER	VISHAY TYPE	CODE
MUR1100	SF4007	3
MUR120	BYT53D	3
MUR140	BYT53G	3
MUR180E	SF4006	3
MUR405	BYV28-50	2, 3
MUR410	BYV28-100	2, 3
MUR4100	SF5408	2, 3
MUR415	BYV28-150	2, 3
MUR415	BYV28-150	2, 3
MUR420	BYV28-200	2, 3
MUR420	SF5402	2, 3
MUR430	SF5403	2, 3
MUR430	SF5403	2, 3
MUR440	SF5404	2, 3
MUR450	SF5405	2, 3
MUR460	BYV28-600	2, 3
MUR460	SF5406	2, 3
MUR470	SF5407	2, 3
MUR480	SF5407	2, 3
MUR490	SF5408	2, 3
PR1006GL	BYV37	2, 3
PR1007GL	BYV38	2, 3
PR3001G	BYT56A	2, 3
PR3002G	BYT56B	2, 3
PR3003G	BYT56D	2, 3
PR3004G	BAT56G	2, 3
PR3005G	BYW76	2, 3
PR3006G	BYT77	2, 3
PR3007G	BYT78	2, 3
RBP02-20E	BY203-20S	2, 3
RC2	BY203-20S	2, 3
RG10	BYT53G	2, 3
RG2	BYV27-600	2, 3
RG2	SF5404	2, 3
RG3A	BYT56A	1
RG3B	BYT56B	1
RG3D	BYT56D	1
RG3G	BYT56G	1
RG3J	BYW76	1
RG3K	BYT77	1
RG3M	BYT78	1
RG4	SF5404	2, 3
RG4A	BYT56A	1
RG4A	BYV28-600	2, 3
RG4A	BYW178	2, 3
RG4B	BYT56B	1
RG4C	SF5408	2, 3
RG4D	BYT56D	1
RG4G	BYT56G	1

IND. PART NUMBER	VISHAY TYPE	CODE
RG4J	BYW76	1
RG4Y	SF5401	2, 3
RGP02-12	BY268	2, 3
RGP02-16	BY203-16S	2, 3
RGP02-17E	BY203-20S	2
RGP02-20	BY203-20	2, 3
RGP02-20E	BY203-20S	1
RGP106	BYW36	3
RGP108	BYV37	2, 3
RGP15A	BYW32	2, 3
RGP15B	BYW32	2, 3
RGP15D	BYT52D	3
RGP15D	BYW32	2, 3
RGP15G	BYT52G	3
RGP15G	BYW34	2, 3
RGP15J	BYT52J	3
RGP15J	BYW36	2, 3
RGP15K	BYT52K	3
RGP15K	BYT52K	2, 3
RGP15M	BYT52M	2, 3
RGP20A	BYT53A	3
RGP20B	BYT53B	3
RGP20D	BYT53D	3
RGP20G	BYT53G	3
RGP20J	BYW36	3
RGP300	BYT56A	3
RGP301	BYT56B	3
RGP302	BYT56D	3
RGP304	BYT56G	3
RGP306	BYW76	3
RGP308	BYT77	3
RGP30A	BYW72	3
RGP30B	BYW72	3
RGP30D	BYW72	3
RGP30G	BYW74	3
RGP30J	BYW76	3
RGP30K	BYT77	3
RGP30M	BYT78	2, 3
RGP310	BYT78	3
RH10F	BY228	2, 3
RH10F	BY448	2, 3
RH1A	BYT51J	2, 3
RH4F	BY228	2, 3
RL101G	BYT51A	3
RL102G	BYT51B	3
RL103G	BYT51D	3
RL104G	BYT51G	3
RL105G	BYT51J	3
RL106F	BYV37	3

IND. PART NUMBER	VISHAY TYPE	CODE
RL106FG	BYV37	3
RL106G	BYT51K	3
RL107F	BYV38	3
RL107FG	BYV38	3
RL107G	BYT51M	3
RL3A	BYV28-600	2, 3
RL4Z	BYV28-200	3
RL850	BYW72	2, 3
RL851	BYW72	2, 3
RL852	BYW72	3
RL854	BYW74	3
RL856	BYW76	3
RM10A	BYW84	2, 3
RM11C	BYW56	2, 3
RM4933	BYW32	2, 3
RM4934	BYW32	2, 3
RM4935	BYW32	2, 3
RM4936	BYW34	2, 3
RN1Z	BYV27-200	1
RN3Z	BYV98-200	1
RP106G	BYW36	3
RP108G	BYV37	2, 3
RP110G	BYV38	2, 3
RP1A	BYW32	2, 3
RP1B	BYW32	2, 3
RP1H	BY203-20	2, 3
RP1H	SF1600	2, 3
RP200GP	BYW32	2, 3
RP201GP	BYW32	2, 3
RP202GP	BYW32	2, 3
RP204GP	BYW34	2, 3
RP206GP	BYW36	2, 3
RP300G	BYT56A	1
RP300GP	BYT56A	1
RP301G	BYT56B	1
RP301GP	BYT56B	1
RP302G	BYT56D	1
RP302GP	BYT56D	1
RP304G	BYT56G	1
RP304GP	BYT56G	1
RP306G	BYW76	1
RP306GP	BYW76	1
RP308G	BYT77	1
RS3FS	BY228	1
RS3FS-LFU1	BY228	2, 3
RU20A	BYV27-600	2, 3
RU20A	BYW36	2, 3
RU2AM	BYW36	2, 3
RU3AM	BYV27-600	2, 3

IND. PART NUMBER	VISHAY TYPE	CODE
RU3AM	BYW36	2, 3
RU3YX	BYV27-100	2, 3
RU4AM	BYT56J	2, 3
RU4AM	BYW76	2, 3
RU4B	BYT56K	2, 3
RU4Y	SF5402	2, 3
S0F	BYV38	3
S2F	BYW32	3
S2L40	BYT53G	2 +
S2L60	BYV27-600	2 +
S320S7	SF5402	1
S340S7	SF5404	1
S360S7	SF5406	1
S3L20U	BYV27-200	3
S3V60	BYW84	2, 3
S4F	BYW34	3
S5277B	BYT51B	3
S6F	BYW36	3
S8F	BYV37	3
SDR1305	SF5404	2, 3
SDR1306	SF5406	1
SDR1308	SF5407	1
SDR2G	BYT53G	1
SDR3A	SF5400	1
SDR3B	SF5401	1
SDR3D	SF5402	1
SDR3G	SF5404	1
SDR3J	SF5406	1
SDR3K	SF5407	1
SDR3M	SF5408	1
SDR4G	SF5404	1
SDR4J	SF5406	1
SDR4K	SF5407	1
SDR4M	SF5408	1
SF24	BYV27-200	2, 3
SF36	SF5404	2, 3
SF4	BYW36	2, 3
SFR106G	BYV37	2, 3
SFR107G	BYV38	2, 3
SFR201G	BYT53A	2, 3
SFR202G	BYT53B	2, 3
SFR203G	BYT53D	2, 3
SFR204G	BYT53G	2, 3
SFR205G	BYW36	2, 3
SFR206G	BYV37	2, 3
SFR207G	BYV38	2, 3
SFR301G	BYT56A	3
SFR302G	BYT56B	3
SFR303G	BYT56D	3

IND. PART NUMBER	VISHAY TYPE	CODE
SFR304G	BYT56G	3
SFR305G	BYW76	3
SFR306G	BYT77	3
SFR307G	BYT78	3
SHER101	BYT53A	2, 3
SHER102	BYT53B	2, 3
SHER103	BYT53D	2, 3
SHER105	BYT53G	2, 3
SHER301	SF5400	3
SHER302	SF5401	3
SHER303	SF5402	3
SHER305	SF5404	3
SHF1302	SF5402	1
SHF1304	SF5404	1
SHF1306	SF5406	1
SM-1XH02	BYT53D	2, 3
SM-1XP2TP	BYV27-200	2, 3
SPD205	BYV27-50	2, 3
SPD210	BYV27-100	2, 3
SPD220	BYV27-200	2, 3
SPD6F	BYW36	3
SRS110	BYT51B	1
SRS120	BYT51D	1
SRS140	BYT51G	1
SSF21	BYV27-50	2, 3
SSF22	BYV27-100	2, 3
SSF23	BYV27-150	2, 3
SSF24	BYV27-200	2, 3
SSF31	BYV28-50	2, 3
SSF32	BYV28-100	2, 3
SSF33	BYV28-150	2, 3
SSF34	BYV28-200	2, 3
STPR320	BYV28-200	2, 3
STSR220	BYV27-200	2, 3
SUF30J	BYV28-600	2, 3
SVD100-2	BYV27-100	3
SVD100-3	BYV28-100	2, 3
SVD150-2	BYV27-150	3
SVD150-3	BYV28-150	2, 3
SVD200-2	BYV27-200	1
SVD200-3	BYV28-200	2, 3
SVD50-2	BYV27-50	3
SVD50-3	BYV28-50	2, 3
TVR1G	BYT53G	2, 3
UF4005	SF4005	2, 3
UF140	SF4004, BYT53G	2, 3
UF305	BYV28-50	2, 3
UF310	BYV28-100	2, 3
UF315	BYV28-150	2, 3

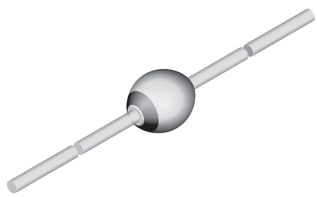
IND. PART NUMBER	VISHAY TYPE	CODE
UF320	BYV28-200	2,3
UF340	SF5404	2, 3
UF360	SF5406	2, 3
UF380	SF5407	2, 3
UF4001	SF4001	3
UF4002	SF4002	3
UF4003	SF4003	3
UF4004	SF4004	3
UF4005	SF4005	3
UF4006	SF4006	3
UF4007	SF4007	3
UF5400	SF5400	3
UF5401	SF5401	3
UF5402	SF5402	3
UF5403	SF5403	3
UF5404	SF5404	3
UF5405	SF5405	3
UF5406	SF5406	3
UF5407	SF5407	3
UF5408	SF5408	3
UFR150	BYT53A	2, 3
UFR151	BYT53B	2, 3
UFR152	BYT53D	2, 3
UFR154	BYT53G	2, 3
UP200	BYV27-50	2, 3
UP201	BYV27-100	2, 3
UP202	BYV27-200	2, 3
UP300	BVY28-50	2, 3
UP301	BYV28-100	2, 3
UP302	BYV28-200	2, 3
UT3005	BYW82	2, 3
UT3010	BYW82	2, 3
UT3020	BYW82	3
UT3040	BYW83	3
UT3060	BYW84	3
UTR01	BYW32	2, 3
UTR02	BYW32	2, 3
UTR11	BYW32	2, 3
UTR12	BYW32	2, 3
UTR21	BYW32	2, 3
UTR22	BYW32	2, 3
UTR2305	BYW32	2, 3
UTR2310	BYW32	2, 3
UTR2320	BYW32	2, 3
UTR2340	BYW34	2, 3
UTR3305	BYW72	2, 3
UTR3310	BYW72	2, 3
UTR3320	BYW72	3
UTR3340	BYW74	3

IND. PART NUMBER	VISHAY TYPE	CODE
UTR3360	BYW76	3
UTR41	BYW34	2, 3
UTR42	BYW34	2, 3
UTR61	BYW36	2, 3
UTX105	BYT53A	2, 3
UTX110	BYT53B	2, 3
UTX120	BYT53D	2, 3
UTX205	BYT53A	2, 3
UTX210	BYT53B	2, 3
UTX220	BYT53D	2, 3
UTX3105	BYT56A	3
UTX3110	BYT56B	3
UTX3115	BYT56D	2, 3
UTX3120	BYT56D	3
V19E-T52	BYW34	1

Ultra-Fast Avalanche Sinterglass Diodes

Contents

Ultra-Fast Avalanche Sinterglass Diode



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FEATURES

- Glass passivated junction
- Hermetically sealed package
- Low reverse current
- Soft recovery characteristics
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

RoHS COMPLIANT
HALOGEN FREE

MECHANICAL DATA

Case: SOD-57

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 369 mg

APPLICATIONS

- Very fast rectification and switches
- Switched mode power supplies
- High-frequency inverter circuits

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BYT53A	V_R = 50 V; I_{FAV} = 1.9 A	SOD-57
BYT53B	V_R = 100 V; I_{FAV} = 1.9 A	SOD-57
BYT53C	V_R = 150 V; I_{FAV} = 1.9 A	SOD-57
BYT53D	V_R = 200 V; I_{FAV} = 1.9 A	SOD-57
BYT53F	V_R = 300 V; I_{FAV} = 1.9 A	SOD-57
BYT53G	V_R = 400 V; I_{FAV} = 1.9 A	SOD-57

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	BYT53A	$V_R = V_{RRM}$	50	V
		BYT53B	$V_R = V_{RRM}$	100	V
		BYT53C	$V_R = V_{RRM}$	150	V
		BYT53D	$V_R = V_{RRM}$	200	V
		BYT53F	$V_R = V_{RRM}$	300	V
		BYT53G	$V_R = V_{RRM}$	400	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	50	A
Average forward current	l = 10 mm, T_L = 25 °C		I_{FAV}	1.9	A
Non repetitive reverse avalanche energy	$I_{(BR)R}$ = 1 A		E_R	20	mJ
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	45	K/W
	On PC board with spacing 25 mm	R_{thJA}	100	K/W

For technical questions within your region, please contact one of the following:
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
Document Number: 86030
Rev. 1.9, 04-Aug-10

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Forward voltage	I_F = 1 A		V_F	-	-	1.1	V
	I_F = 1 A, T_j = 175 °C		V_F	-	-	0.9	V
Reverse current	$V_R = V_{RRM}$		I_R	-	-	5	µA
	$V_R = V_{RRM}$, T_j = 150 °C		I_R	-	-	200	µA
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A		t_{rr}	-	-	50	ns

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

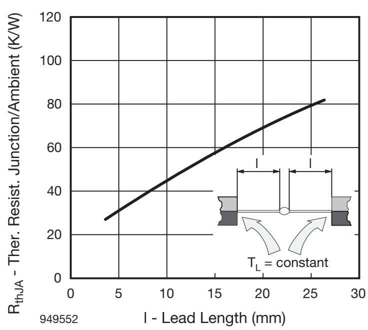


Fig. 1 - Max. Thermal Resistance vs. Lead Length

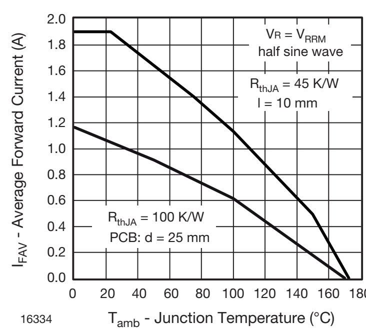


Fig. 3 - Max. Average Forward Current vs. Ambient Temperature

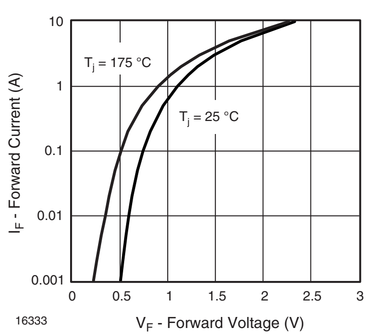


Fig. 2 - Max. Forward Current vs. Forward Voltage

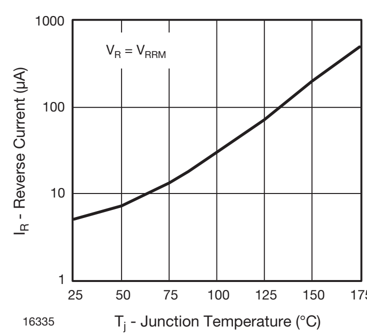


Fig. 4 - Max. Reverse Current vs. Junction Temperature

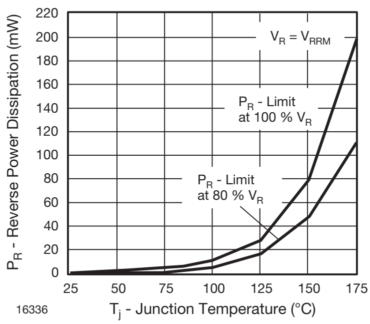


Fig. 5 - Max. Reverse Power Dissipation vs. Junction Temperature

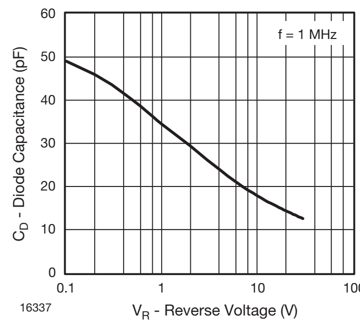
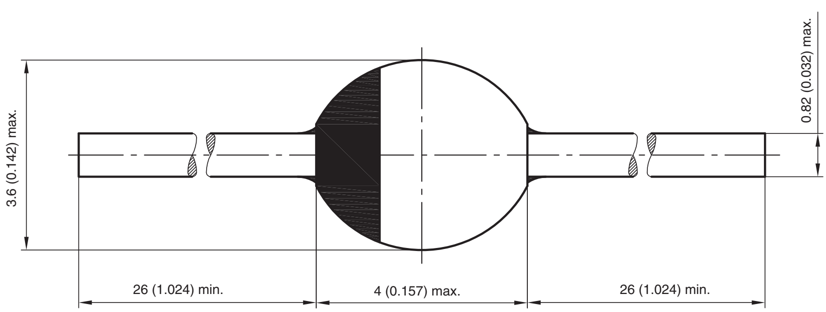


Fig. 6 - Diode Capacitance vs. Reverse Voltage

PACKAGE DIMENSIONS in millimeters (inches): **SOD-57**



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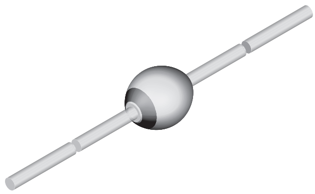
Ultra-Fast Avalanche Sinterglass Diode



949539

FEATURES

- Glass passivated junction
- Hermetically sealed package
- Very low switching losses
- Low reverse current
- High reverse voltage
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

RoHS COMPLIANT
HALOGEN FREE

APPLICATIONS

- Switched mode power supplies
- High-frequency inverter circuits

MECHANICAL DATA

Case: SOD-57

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 369 mg

PARTS TABLE		
PART	TYPE DIFFERENTIATION	PACKAGE
BYV26A	V_R = 200 V; I_{FAV} = 1 A	SOD-57
BYV26B	V_R = 400 V; I_{FAV} = 1 A	SOD-57
BYV26C	V_R = 600 V; I_{FAV} = 1 A	SOD-57
BYV26D	V_R = 800 V; I_{FAV} = 1 A	SOD-57
BYV26E	V_R = 1000 V; I_{FAV} = 1 A	SOD-57

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	BYV26A	$V_R = V_{RRM}$	200	V
		BYV26B	$V_R = V_{RRM}$	400	V
		BYV26C	$V_R = V_{RRM}$	600	V
		BYV26D	$V_R = V_{RRM}$	800	V
		BYV26E	$V_R = V_{RRM}$	1000	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	30	A
Average forward current			I_{FAV}	1	A
Non repetitive reverse avalanche energy	$I_{(BR)R}$ = 1 A, inductive load		E_R	10	mJ
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	l = 10 mm, T_L = constant	R_{thJA}	45	K/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Forward voltage	I_F = 1 A		V_F	-	-	2.5	V
	I_F = 1 A, T_j = 175 °C		V_F	-	-	1.3	V
Reverse current	$V_R = V_{RRM}$		I_R	-	-	5	μA
	$V_R = V_{RRM}$, T_j = 150 °C		I_R	-	-	100	μA
Reverse breakdown voltage	I_R = 100 μA	BYV26A	$V_{(BR)R}$	300	-	-	V
		BYV26B	$V_{(BR)R}$	500	-	-	V
		BYV26C	$V_{(BR)R}$	700	-	-	V
		BYV26D	$V_{(BR)R}$	900	-	-	V
		BYV26E	$V_{(BR)R}$	1100	-	-	V
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A	BYV26A	t_{rr}	-	-	30	ns
		BYV26B	t_{rr}	-	-	30	ns
		BYV26C	t_{rr}	-	-	30	ns
		BYV26D	t_{rr}	-	-	75	ns
		BYV26E	t_{rr}	-	-	75	ns

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

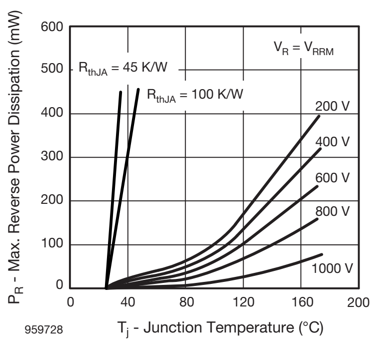


Fig. 1 - Max. Reverse Power Dissipation vs. Junction Temperature

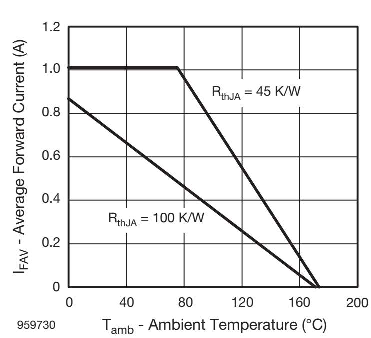


Fig. 3 - Max. Average Forward Current vs. Ambient Temperature

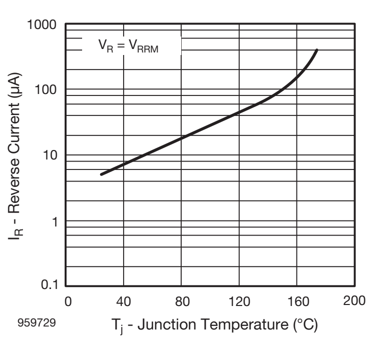


Fig. 2 - Max. Reverse Current vs. Junction Temperature

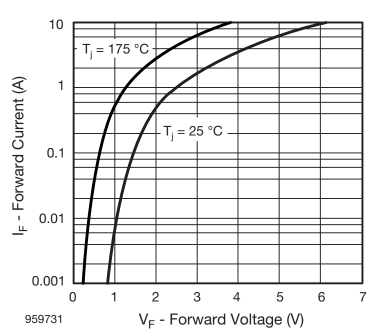


Fig. 4 - Max. Reverse Current vs. Junction Temperature

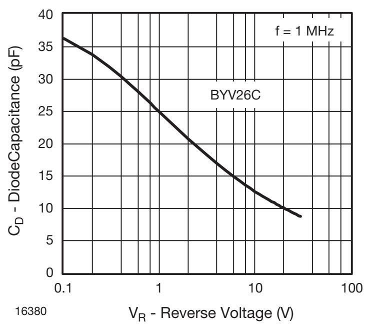


Fig. 5 - Diode Capacitance vs. Reverse Voltage

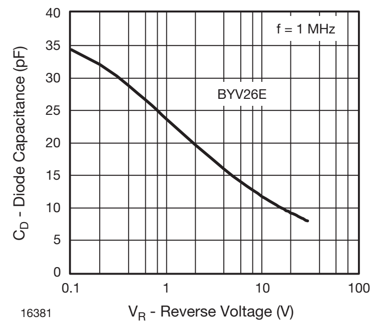
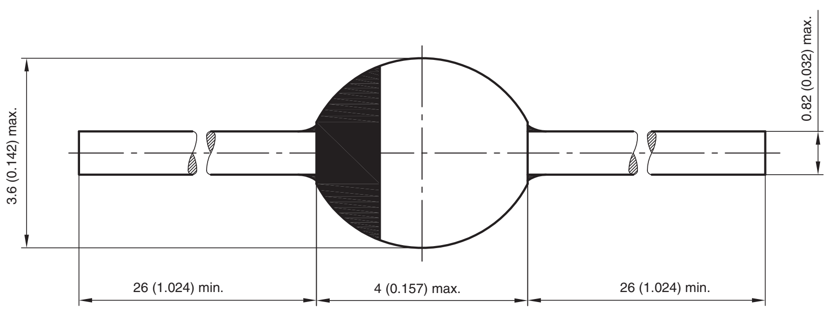


Fig. 6 - Diode Capacitance vs. Reverse Voltage

PACKAGE DIMENSIONS in millimeters (inches): **SOD-57**



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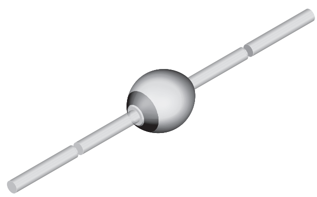
Ultra-Fast Avalanche Sinterglass Diode



949539

MECHANICAL DATA

Case: SOD-57

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 369 mg

FEATURES

- Controlled avalanche characteristic
- Low forward voltage
- Ultra fast recovery time
- Glass passivated junction
- Hermetically sealed package
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

RoHS COMPLIANT

HALOGEN FREE

APPLICATIONS

- Very fast rectification diode e.g. for switch mode power supply

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BYV27-50	V_R = 50 V; I_{FAV} = 2 A	SOD-57
BYV27-100	V_R = 100 V; I_{FAV} = 2 A	SOD-57
BYV27-150	V_R = 150 V; I_{FAV} = 2 A	SOD-57
BYV27-200	V_R = 200 V; I_{FAV} = 2 A	SOD-57

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Peak reverse voltage, non repetitive	See electrical characteristics	BYV27-50	V_{RSM}	55	V
		BYV27-100	V_{RSM}	110	V
		BYV27-150	V_{RSM}	165	V
		BYV27-200	V_{RSM}	220	V
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	BYV27-50	$V_R = V_{RRM}$	50	V
		BYV27-100	$V_R = V_{RRM}$	100	V
		BYV27-150	$V_R = V_{RRM}$	150	V
		BYV27-200	$V_R = V_{RRM}$	200	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	50	A
Repetitive peak forward current			I_{FRM}	15	A
Average forward current			I_{FAV}	2	A
Pulse energy in avalanche mode, non repetitive (inductive load switch off)	$I_{(BR)R}$ = 1 A, T_j = 175 °C		E_R	20	mJ
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Junction ambient	l = 10 mm, T_L = constant	R_{thJA}	45	K/W
	On PC board with spacing 25 mm	R_{thJA}	100	K/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Forward voltage	I_F = 3A		V_F	-	-	1.07	V
	I_F = 3 A, T_j = 175 °C		V_F	-	-	0.88	V
Reverse current	$V_R = V_{RRM}$		I_R	-	-	1	µA
	V_{RSM}		I_R	-	-	100	µA
	$V_R = V_{RRM}$, T_j = 165 °C		I_R	-	-	150	µA
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A		t_{rr}	-	-	25	ns

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

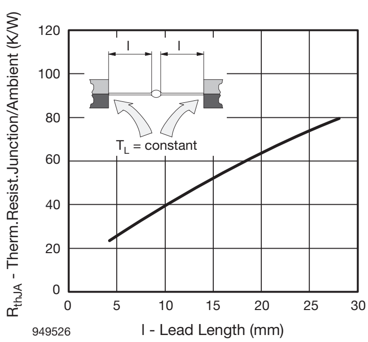


Fig. 1 - Typ. Thermal Resistance vs. Lead Length

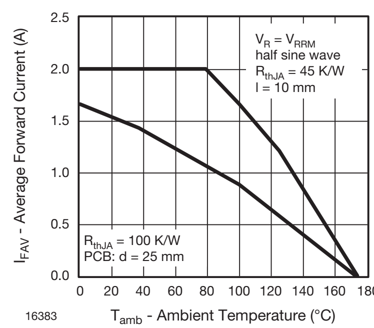


Fig. 3 - Max. Average Forward Current vs. Ambient Temperature

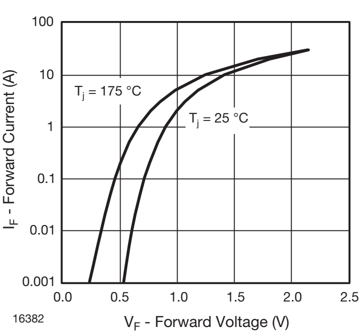


Fig. 2 - Forward Current vs. Forward Voltage

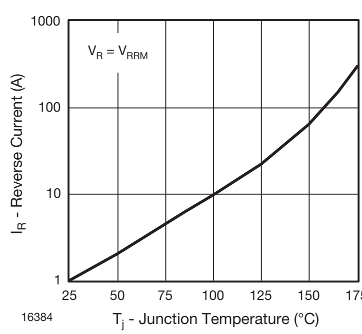


Fig. 4 - Reverse Current vs. Junction Temperature

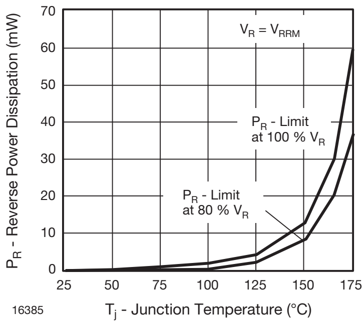


Fig. 5 - Max. Reverse Power Dissipation vs. Junction Temperature

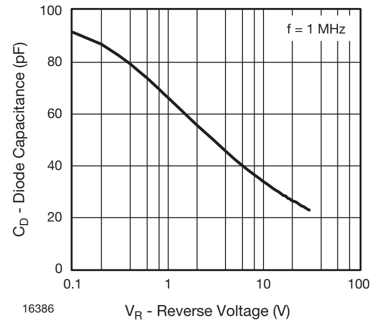
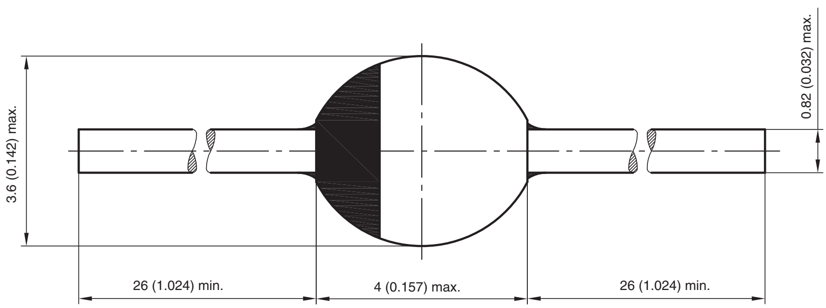


Fig. 6 - Diode Capacitance vs. Reverse Voltage

PACKAGE DIMENSIONS in millimeters (inches): **SOD-57**



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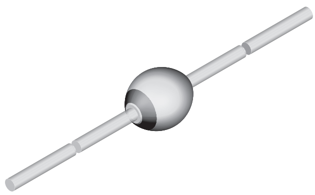
Ultra-Fast Avalanche Sinterglass Diode


949539

FEATURES

- Glass passivated junction
- Hermetically sealed axial-leaded glass envelope
- Low reverse current
- Ultra fast soft recovery switching
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

RoHS COMPLIANT HALOGEN FREE

MECHANICAL DATA

Case: SOD-57

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 369 mg

APPLICATIONS

- Electronic ballast
- SMPS

PARTS TABLE		
PART	**TYPE DIFFERENTIATION**	**PACKAGE**
BYV27-600	V_R = 600 V; I_{FAV} = 2 A	SOD-57

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	BYV27-600	$V_R = V_{RRM}$	600	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	50	A
Average forward current	T_{amb} = 50 °C, l = 10 mm		I_{FAV}	2	A
Non repetitive reverse avalanche energy	Inductive load, $I_{(BR)R}$ = 400 mA		E_R	10	mJ
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	45	K/W
	On PC board with spacing 25 mm	R_{thJA}	100	K/W

For technical questions within your region, please contact one of the following:
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com

Ultra-Fast Avalanche Sinterglass Diode

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Forward voltage	I_F = 1 A		V_F	-	-	1.15	V
	I_F = 3 A		V_F	-	-	1.35	V
	I_F = 1 A, T_j = 175 °C		V_F	-	-	0.85	V
	I_F = 3 A, T_j = 175 °C		V_F	-	-	1.15	V
Reverse current	$V_R = V_{RRM}$		I_R	-	-	5	μA
	$V_R = V_{RRM}$, T_j = 150 °C		I_R	-	-	150	μA
Reverse breakdown voltage	I_R = 100 μA	BYV27-600	$V_{(BR)R}$	600	-	-	V
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A		t_{rr}	-	-	40	ns
Forward recovery	I_F = 1 A		V_{FP}	-	3.4	-	V
Forward recovery time	I_F = 1 A		t_{fr}	-	250	-	ns

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

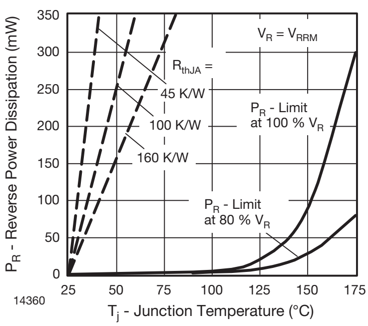


Fig. 1 - Max. Reverse Power Dissipation vs. Junction Temperature

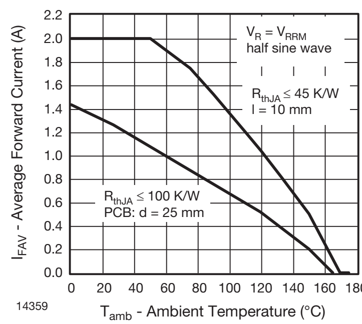


Fig. 3 - Max. Average Forward Current vs. Ambient Temperature

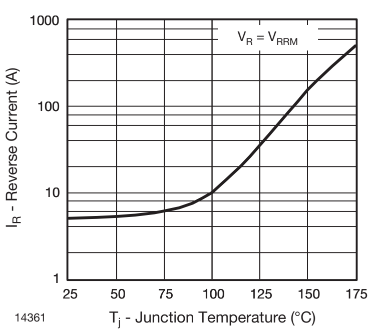


Fig. 2 - Max. Reverse Current vs. Junction Temperature

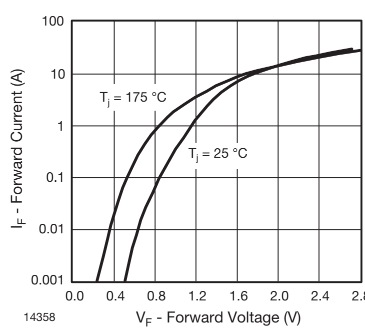


Fig. 4 - Max. Forward Current vs. Forward Voltage

For technical questions within your region, please contact one of the following:
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com

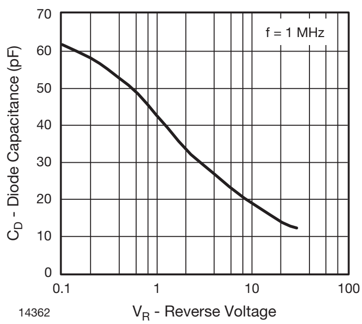
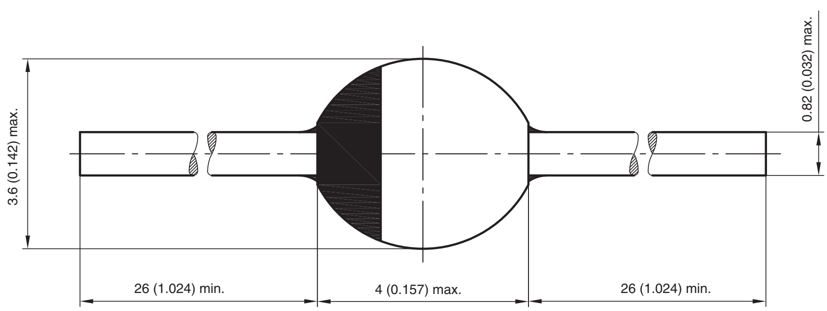


Fig. 5 - Typ. Diode Capacitance vs. Reverse Voltage

PACKAGE DIMENSIONS in millimeters (inches): **SOD-57**



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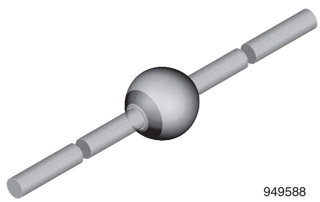
Rev. 3 - Date: 09.February 2005
Document no.:6.563-5006.3-4

Ultra-Fast Avalanche Sinterglass Diode



949588

FEATURES

- Controlled avalanche characteristic
- Low forward voltage
- Ultra fast recovery time
- Glass passivated junction
- Hermetically sealed package
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

RoHS COMPLIANT
HALOGEN FREE

APPLICATIONS

- Very fast rectification e.g. for switch mode power supply

MECHANICAL DATA

Case: SOD-64

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 858 mg

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BYV28-50	V_R = 50 V; I_{FAV} = 3.5 A	SOD-64
BYV28-100	V_R = 100 V; I_{FAV} = 3.5 A	SOD-64
BYV28-150	V_R = 150 V; I_{FAV} = 3.5 A	SOD-64
BYV28-200	V_R = 200 V; I_{FAV} = 3.5 A	SOD-64

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Peak reverse voltage, non repetitive	See electrical characteristics	BYV28-50	V_{RSM}	55	V
		BYV28-100	V_{RSM}	110	V
		BYV28-150	V_{RSM}	165	V
		BYV28-200	V_{RSM}	220	V
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	BYV28-50	$V_R = V_{RRM}$	50	V
		BYV28-100	$V_R = V_{RRM}$	100	V
		BYV28-150	$V_R = V_{RRM}$	150	V
		BYV28-200	$V_R = V_{RRM}$	200	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	90	A
Repetitive peak forward current			I_{FRM}	25	A
Average forward current			I_{FAV}	3.5	A
Pulse energy in avalanche mode, non repetitive (inductive load switch off)	$I_{(BR)R}$ = 1 A, Tj = 175 °C		E_R	20	mJ
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C

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Document Number: 86044
Rev. 1.7, 25-Aug-10

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	25	K/W
	On PC board with spacing 25 mm	R_{thJA}	70	K/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Forward voltage	I_F = 5 A		V_F	-	-	1.1	V
	I_F = 5 A, T_j = 175 °C		V_F	-	-	0.89	V
Reverse current	$V_R = V_{RRM}$		I_R	-	-	1	µA
	V_{RSM}		I_R	-	-	100	µA
	$V_R = V_{RRM}$, T_j = 165 °C		I_R	-	-	150	µA
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A		t_{rr}	-	-	30	ns

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

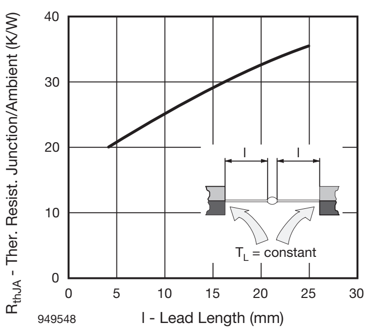


Fig. 1 - Max. Thermal Resistance vs. Lead Length

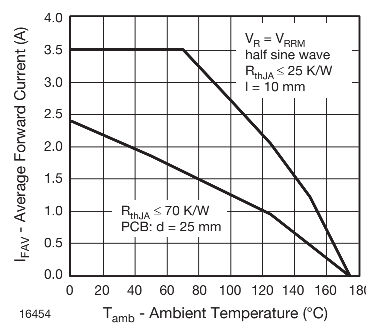


Fig. 3 - Max. Average Forward Current vs. Ambient Temperature

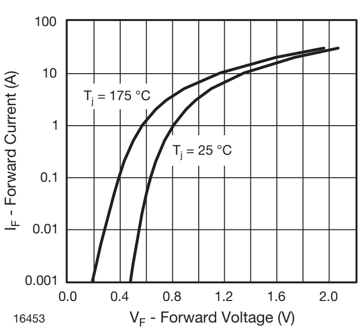


Fig. 2 - Forward Current vs. Forward Voltage

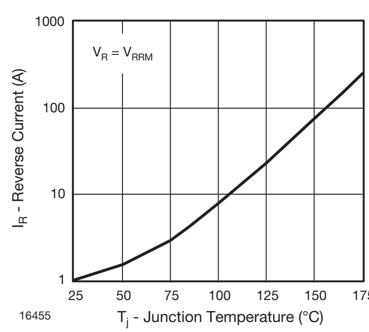


Fig. 4 - Reverse Current vs. Junction Temperature

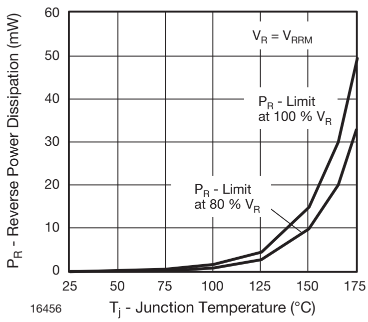


Fig. 5 - Max. Reverse Power Dissipation vs. Junction Temperature

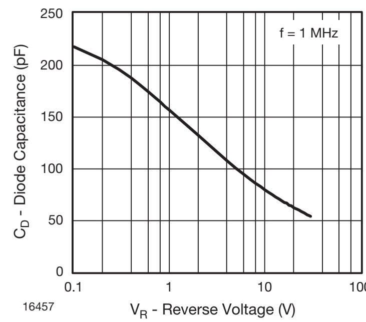
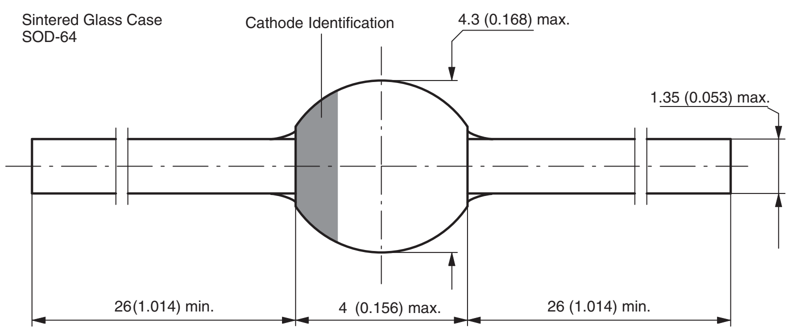


Fig. 6 - Diode Capacitance vs. Reverse Voltage

PACKAGE DIMENSIONS in millimeters (inches): **SOD-64**



Document-No.: 6.563-5006.4-4
Rev. 3 - Date: 09.February.2005
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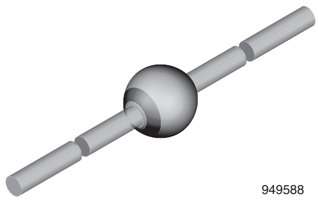
Ultra-Fast Avalanche Sinterglass Diode


949588

FEATURES

- Glass passivated
- Hermetically sealed axial-leaded glass envelope
- Low reverse current
- Ultra fast soft recovery switching
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

RoHS COMPLIANT
HALOGEN FREE

MECHANICAL DATA

Case: SOD-64

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 858 mg

APPLICATIONS

- TV
- SMPS
- Power feedback systems

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BYV28-600	V_R = 600 V; I_{FAV} = 3.5 A	SOD-64

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	BYV28-600	$V_R = V_{RRM}$	600	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	90	A
Average forward current	l = 10 mm		I_{FAV}	3.5	A
Non repetitive reverse avalanche energy	Inductive load, $I_{(BR)R}$ = 1 A		E_R	20	mJ
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	25	K/W
	On PC board with spacing 25 mm	R_{thJA}	70	K/W

Ultra-Fast Avalanche Sinterglass Diode

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Forward voltage	I_F = 3.5 A	V_F	-	-	1.25	V
	I_F = 5 A	V_F	-	-	1.35	V
	I_F = 3.5, T_j = 175 °C	V_F	-	-	0.95	V
	I_F = 5 A, T_j = 175 °C	V_F	-	-	1.06	V
Reverse current	V_R = V_{RRM}	I_R	-	-	5	μA
	V_R = V_{RRM}, T_j = 150 °C	I_R	-	-	150	μA
Reverse breakdown voltage	I_R = 100 μA	$V_{(BR)R}$	600	-	-	V
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A	t_{rr}	-	-	50	ns
Forward recovery	I_F = 5 A	V_{FP}	-	6.2	-	V
Forward recovery time	I_F = 5 A	t_{fr}	-	210	-	ns

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

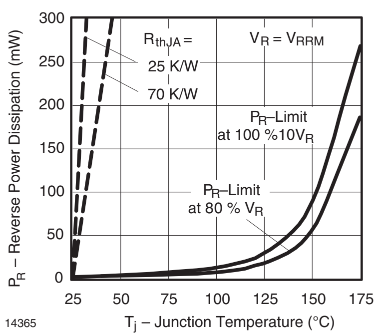


Fig. 1 - Max. Reverse Power Dissipation vs. Junction Temperature

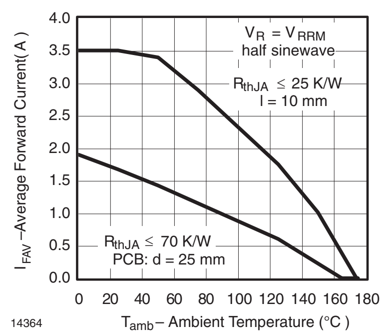


Fig. 3 - Max. Average Forward Current vs. Ambient Temperature

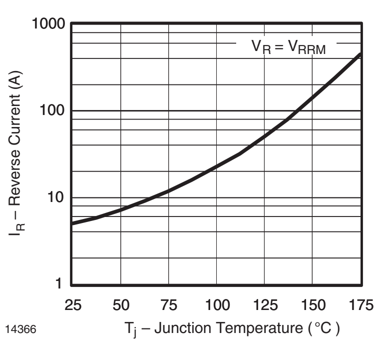


Fig. 2 - Max. Reverse Current vs. Junction Temperature

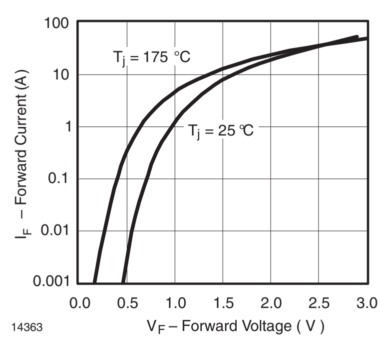


Fig. 4 - Max. Forward Current vs. Forward Voltage

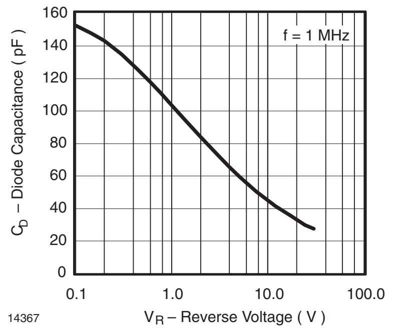
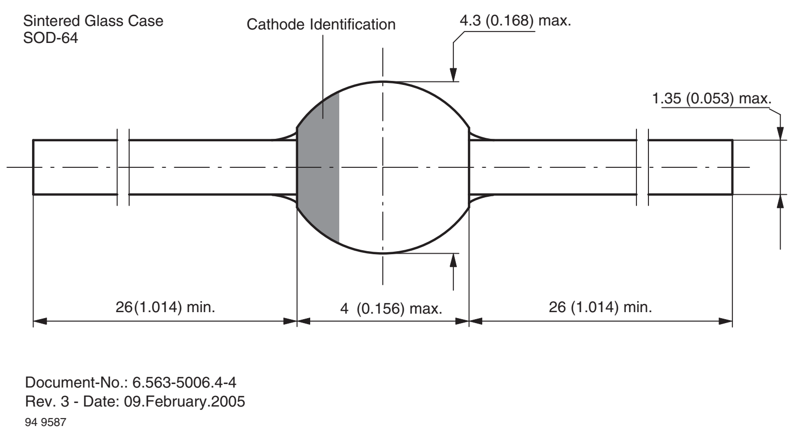
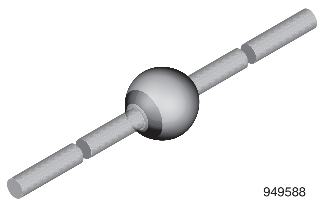


Fig. 5 - Typ. Diode Capacitance vs. Reverse Voltage

PACKAGE DIMENSIONS in millimeters (inches): **SOD-64**



Ultra-Fast Avalanche Sinterglass Diode



FEATURES

- High reverse voltage
- Glass passivated
- Low reverse current
- Low forward voltage drop
- Hermetically sealed axial-leaded glass envelope
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

RoHS COMPLIANT
HALOGEN FREE

APPLICATIONS

- Switched mode power supplies
- High-frequency inverter circuits

MECHANICAL DATA

Case: SOD-64

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 858 mg

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BYV98-50	V_R = 50 V; I_{FAV} = 4 A	SOD-64
BYV98-100	V_R = 100 V; I_{FAV} = 4 A	SOD-64
BYV98-150	V_R = 150 V; I_{FAV} = 4 A	SOD-64
BYV98-200	V_R = 200 V; I_{FAV} = 4 A	SOD-64

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	BYV98-50	$V_R = V_{RRM}$	50	V
		BYV98-100	$V_R = V_{RRM}$	100	V
		BYV98-150	$V_R = V_{RRM}$	150	V
		BYV98-200	$V_R = V_{RRM}$	200	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	70	A
Average forward current	T_{amb} = 30 °C, l = 10 mm		I_{FAV}	4	A
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C
Non repetitive reverse avalanche energy	$I_{(BR)R}$ = 1 A		E_R	20	mJ

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	25	K/W

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ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Forward voltage	I_F = 5 A		V_F	-	-	1.1	V
Reverse current	$V_R = V_{RRM}$		I_R	-	-	10	μA
	$V_R = V_{RRM}$, T_j = 150 °C		I_R	-	-	200	μA
Reverse breakdown voltage	I_R = 100 μA	BYV98-50	$V_{(BR)R}$	60	-	-	V
		BYV98-100	$V_{(BR)R}$	120	-	-	V
		BYV98-150	$V_{(BR)R}$	170	-	-	V
		BYV98-200	$V_{(BR)R}$	220	-	-	V
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A		t_{rr}	-	-	35	ns

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

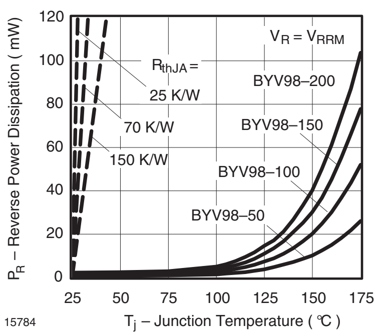


Fig. 1 - Max. Reverse Power Dissipation vs. Junction Temperature

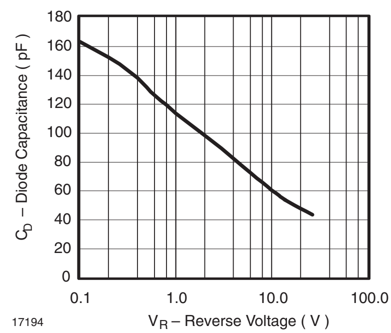


Fig. 3 - Diode Capacitance vs. Reverse Voltage

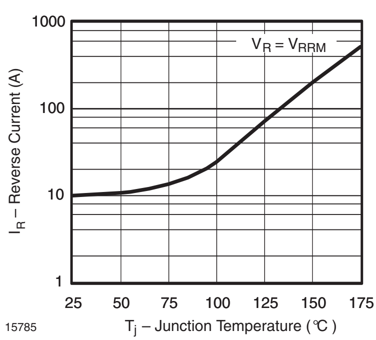


Fig. 2 - Max. Reverse Current vs. Junction Temperature

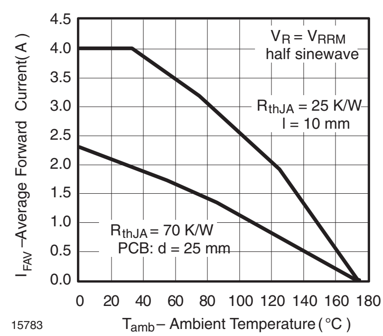


Fig. 4 - Max. Average Forward Current vs. Ambient Temperature

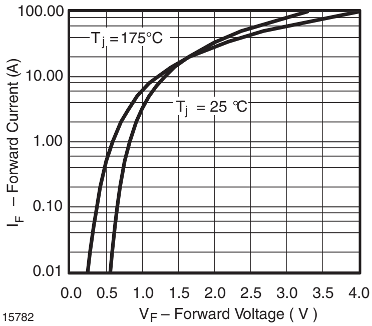
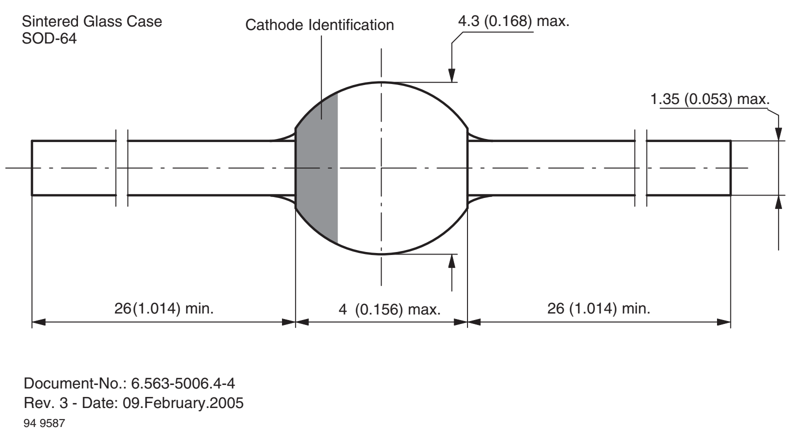
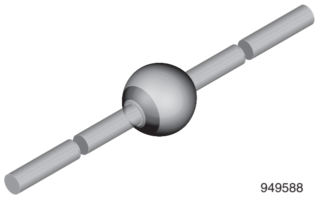


Fig. 5 - Max. Forward Current vs. Forward Voltage

PACKAGE DIMENSIONS in millimeters (inches): **SOD-64**



Ultra-Fast Avalanche Sinterglass Diode



949588

FEATURES

- Glass passivated junction
- Hermetically sealed package
- Low reverse current
- Soft recovery characteristics
- Very fast reverse recovery time
- Very fast reverse recovery time
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

RoHS COMPLIANT
HALOGEN FREE

MECHANICAL DATA

Case: SOD-64

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 858 mg

APPLICATIONS

- Ultra fast rectification diode for switching mode power supplies

PARTS TABLE		
PART	**TYPE DIFFERENTIATION**	**PACKAGE**
BYW178	V_R = 800 V; I_{FAV} = 3 A	SOD-64

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	BYW178	$V_R = V_{RRM}$	800	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	80	A
Repetitive peak forward current			I_{FRM}	15	A
Average forward current			I_{FAV}	3	A
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C
Non repetitive reverse	$I_{(BR)R}$ = 0.4 A		E_R	20	mJ

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction lead	Lead length l = 10 mm, T_L = constant	R_{thJL}	25	K/W
Junction ambient	On PC board with spacing 37.5 mm	R_{thJA}	70	K/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Forward voltage	I_F = 3 A	V_F	-	-	1.9	V
Reverse current	$V_R = V_{RRM}$	I_R	-	-	1	µA
	$V_R = V_{RRM}$, T_j = 100 °C	I_R	-	-	20	µA
Reverse recovery current	I_F = 1 A, $dI_F/dt \leq$ - 50 A/µs, V_{Batt} = 200 V	I_{RM}	-	2.2	-	A
Reverse recovery time	I_F = 1 A, $dI_F/dt \leq$ - 50 A/µs, V_{Batt} = 200 V, i_R = 0.25 x I_{RM}	t_{rr}	-	50	-	ns
Reverse recovery time (JEDEC)	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A	t_{rr}	-	-	60	ns

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DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

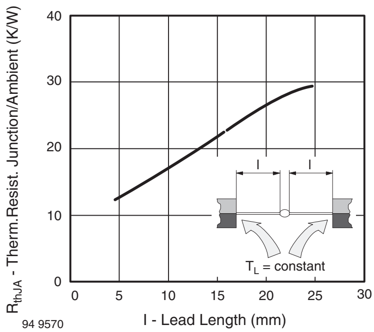


Fig. 1 - Typ. Thermal Resistance vs. Lead Length

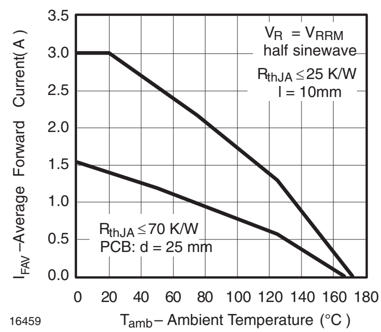


Fig. 4 - Max. Average Forward Current vs. Ambient Temperature

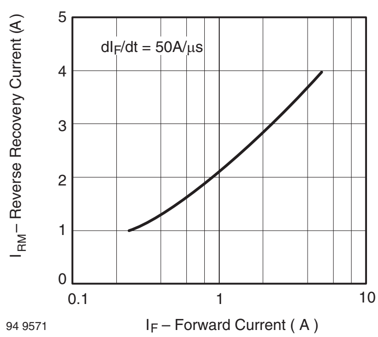


Fig. 2 - Typ. Reverse Recovery Current vs. Forward Current

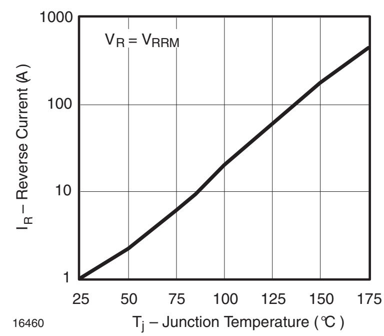


Fig. 5 - Reverse Current vs. Junction Temperature

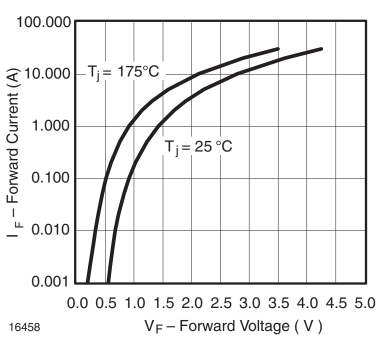


Fig. 3 - Forward Current vs. Forward Voltage

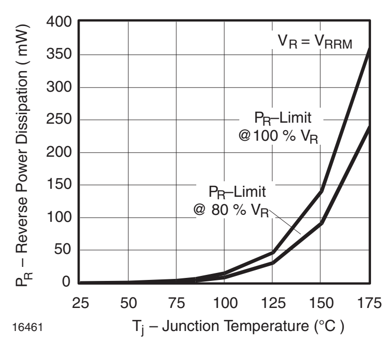


Fig. 6 - Max Reverse Power Dissipation vs. Junction Temperature

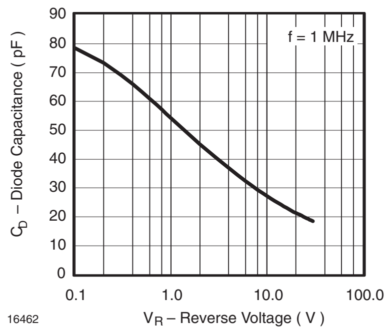


Fig. 7 - Diode Capacitance vs. Reverse Voltage

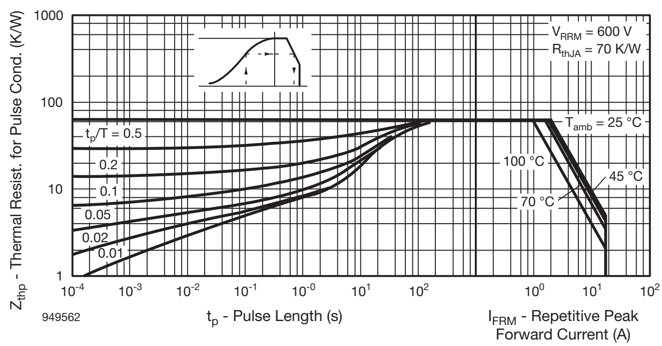
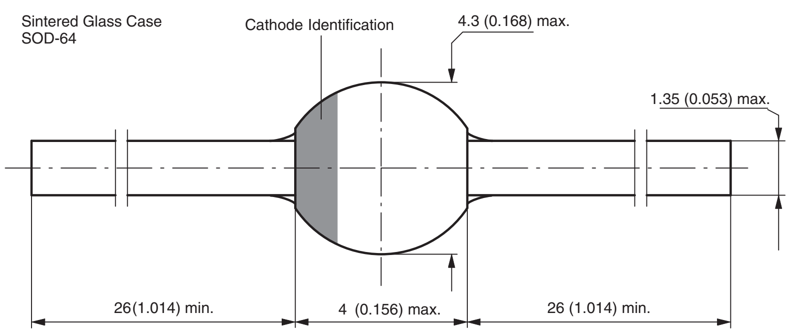


Fig. 8 - Thermal Response

PACKAGE DIMENSIONS in millimeters (inches): **SOD-64**



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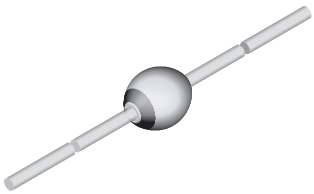
94 9587

Ultra-Fast Avalanche Sinterglass Diode



949539

FEATURES

- Very low switching losses
- Glass passivated
- High reverse voltage
- Hermetically sealed axial-leaded glass envelope
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

RoHS COMPLIANT
HALOGEN FREE

MECHANICAL DATA

Case: SOD-57

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 369 mg

APPLICATIONS

- Switched mode power supplies
- High-frequency inverter circuits

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
SF1200	V_R = 1200 V; I_{FAV} = 1 A	SOD-57
SF1600	V_R = 1600 V; I_{FAV} = 1 A	SOD-57

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	SF1200	$V_R = V_{RRM}$	1200	V
		SF1600	$V_R = V_{RRM}$	1600	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	30	A
Average forward current	Half sine wave, $V_R = V_{RRM}$, R_{thJA} = 45 k/W		I_{FAV}	1	A
Max. pulse energy in avalanche mode, non repetitive (inductive load switch off	$I_{(BR)R}$ = 400 mA, inductive load		E_R	10	mJ
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	45	K/W

For technical questions within your region, please contact one of the following:
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
Document Number: 86059
Rev. 1.7, 04-Aug-10

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Forward voltage	I_F = 1 A		V_F	-	-	3.4	V
Reverse current	$V_R = V_{RRM}$		I_R	-	-	5	μA
	$V_R = V_{RRM}$, T_j = 125 °C		I_R	-	-	50	μA
Reverse breakdown voltage	I_R = 100 μA	SF1200	$V_{(BR)R}$	1250	-	-	V
		SF1600	$V_{(BR)R}$	1650	-	-	V
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A		t_{rr}	-	-	75	ns

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

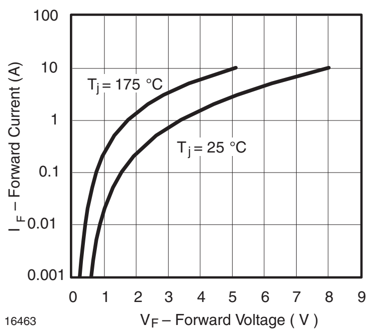


Fig. 1 - Forward Current vs. Forward Voltage

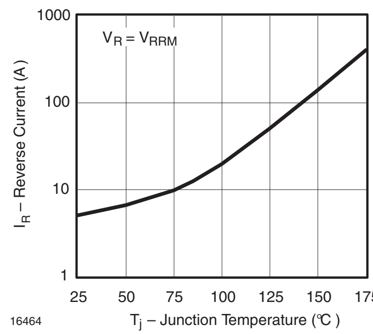


Fig. 3 - Reverse Current vs. Junction Temperature

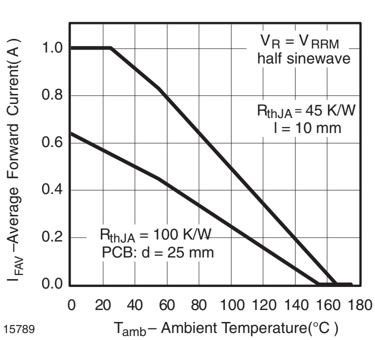


Fig. 2 - Max. Average Forward Current vs. Ambient Temperature

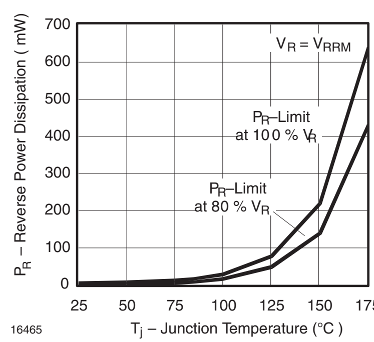


Fig. 4 - Max. Reverse Power Dissipation vs. Junction Temperature

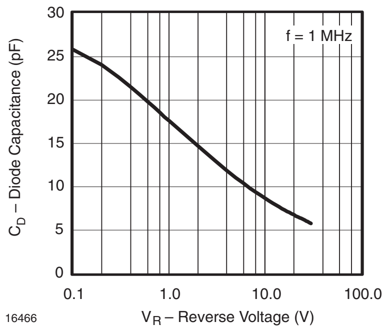
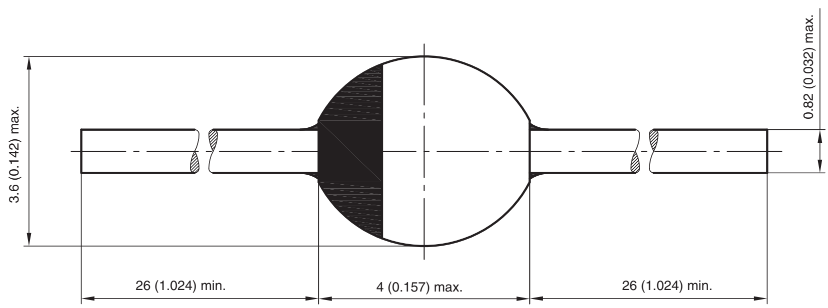


Fig. 5 - Diode Capacitance vs. Reverse Voltage

PACKAGE DIMENSIONS in millimeters (inches): **SOD-57**



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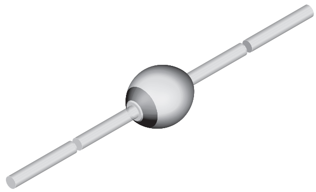
Ultra-Fast Avalanche Sinterglass Diode



949539

FEATURES

- Glass passivated
- Hermetically sealed axial leaded glass envelope
- Low reverse current
- High reverse voltage
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

e2
RoHS
COMPLIANT
HALOGEN
FREE

MECHANICAL DATA

Case: SOD-57

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 369 mg

APPLICATIONS

- Switched mode power supplies
- High-frequency inverter circuits

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
SF4001	V_R = 50 V; I_{FAV} = 1 A	SOD-57
SF4002	V_R = 100 V; I_{FAV} = 1 A	SOD-57
SF4003	V_R = 200 V; I_{FAV} = 1 A	SOD-57
SF4004	V_R = 400 V; I_{FAV} = 1 A	SOD-57
SF4005	V_R = 600 V; I_{FAV} = 1 A	SOD-57
SF4006	V_R = 800 V; I_{FAV} = 1 A	SOD-57
SF4007	V_R = 1000 V; I_{FAV} = 1 A	SOD-57

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	SF4001	$V_R = V_{RRM}$	50	V
		SF4002	$V_R = V_{RRM}$	100	V
		SF4003	$V_R = V_{RRM}$	200	V
		SF4004	$V_R = V_{RRM}$	400	V
		SF4005	$V_R = V_{RRM}$	600	V
		SF4006	$V_R = V_{RRM}$	800	V
		SF4007	$V_R = V_{RRM}$	1000	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	30	A
Average forward current	Lead length l = 10 mm		I_{FAV}	1	A
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C
Non repetitive reverse avalanche energy	$I_{(BR)R}$ = 0.4 A		E_R	10	mJ

For technical questions within your region, please contact one of the following:
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	45	K/W
	On PC board with spacing 25 mm	R_{thJA}	100	K/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Forward voltage	I_F = 1 A	SF4001	V_F	-	-	1	V
		SF4002	V_F	-	-	1	V
		SF4003	V_F	-	-	1	V
		SF4004	V_F	-	-	1	V
		SF4005	V_F	-	-	1.7	V
		SF4006	V_F	-	-	1.7	V
		SF4007	V_F	-	-	1.7	V
Reverse current	$V_R = V_{RRM}$		I_R	-	-	5	μA
	$V_R = V_{RRM}$, T_j = 125 °C		I_R	-	-	50	μA
Reverse breakdown voltage	I_R = 100 μA	SF4001	$V_{(BR)R}$	50	-	-	V
		SF4002	$V_{(BR)R}$	100	-	-	V
		SF4003	$V_{(BR)R}$	200	-	-	V
		SF4004	$V_{(BR)R}$	400	-	-	V
		SF4005	$V_{(BR)R}$	600	-	-	V
		SF4006	$V_{(BR)R}$	800	-	-	V
		SF4007	$V_{(BR)R}$	1000	-	-	V
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A	SF4001	t_{rr}	-	-	50	ns
		SF4002	t_{rr}	-	-	50	ns
		SF4003	t_{rr}	-	-	50	ns
		SF4004	t_{rr}	-	-	50	ns
		SF4005	t_{rr}	-	-	75	ns
		SF4006	t_{rr}	-	-	75	ns
		SF4007	t_{rr}	-	-	75	ns

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

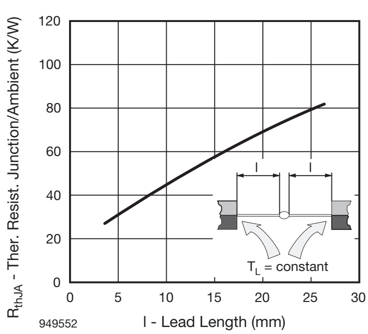


Fig. 1 - Max. Thermal Resistance vs. Lead Length

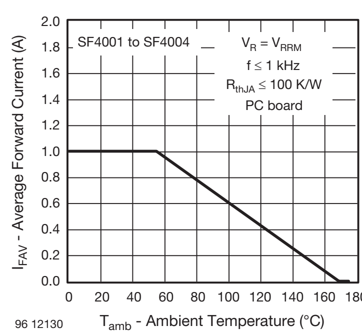


Fig. 2 - Max. Average Forward Current vs. Ambient Temperature

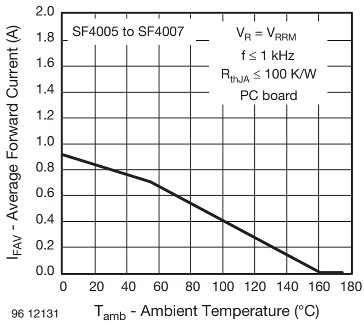


Fig. 3 - Max. Average Forward Current vs. Ambient Temperature

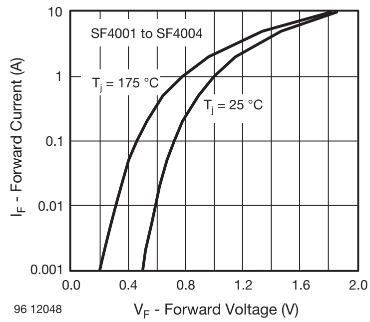


Fig. 6 - Max. Forward Current vs. Forward Voltage

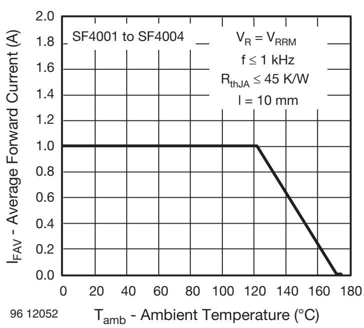


Fig. 4 - Max. Average Forward Current vs. Ambient Temperature

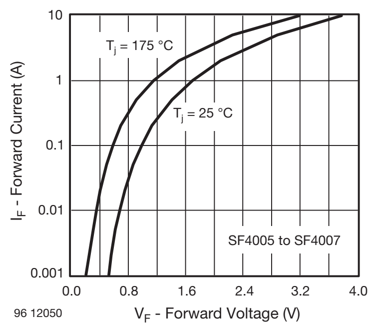


Fig. 7 - Max. Forward Current vs. Forward Voltage

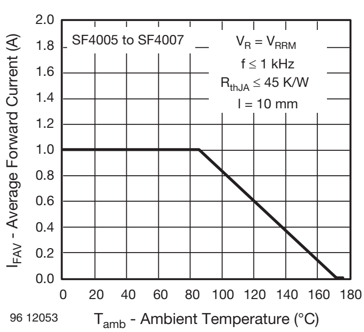


Fig. 5 - Max. Average Forward Current vs. Ambient Temperature

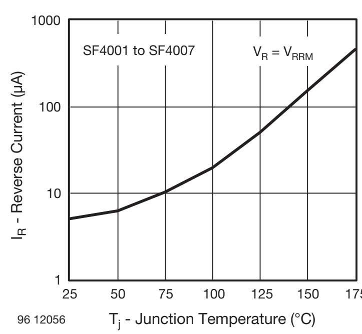


Fig. 8 - Max. Reverse Current vs. Junction Temperature

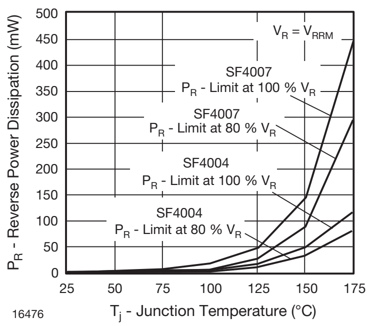


Fig. 9 - Max. Reverse Power Dissipation vs. Junction Temperature

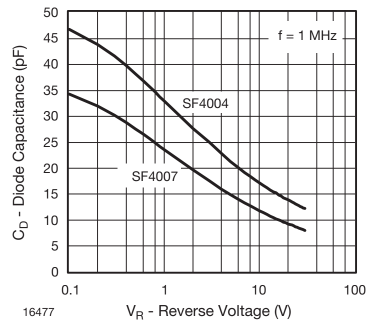
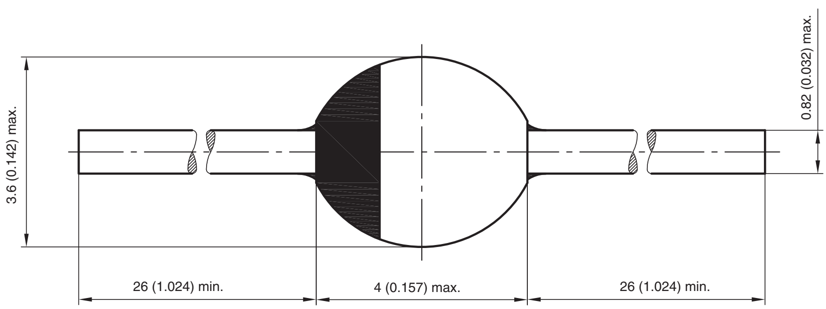


Fig. 10 - Diode Capacitance vs. Reverse Voltage

PACKAGE DIMENSIONS in millimeters (inches): **SOD-57**



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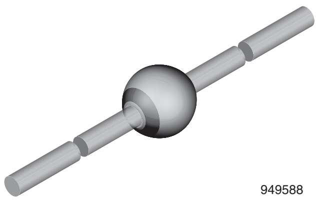
Ultra-Fast Avalanche Sinterglass Diode


949588

FEATURES

- Glass passivated
- Hermetically sealed axial leaded glass envelope
- Low reverse current
- High reverse voltage
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

RoHS COMPLIANT
HALOGEN FREE

MECHANICAL DATA

Case: SOD-64

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 858 mg

APPLICATIONS

- Switched mode power supplies
- High-frequency inverter circuits

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
SF5400	V_R = 50 V; I_{FAV} = 3 A	SOD-64
SF5401	V_R = 100 V; I_{FAV} = 3 A	SOD-64
SF5402	V_R = 200 V; I_{FAV} = 3 A	SOD-64
SF5403	V_R = 300 V; I_{FAV} = 3 A	SOD-64
SF5404	V_R = 400 V; I_{FAV} = 3 A	SOD-64
SF5405	V_R = 500 V; I_{FAV} = 3 A	SOD-64
SF5406	V_R = 600 V; I_{FAV} = 3 A	SOD-64
SF5407	V_R = 800 V; I_{FAV} = 3 A	SOD-64
SF5408	V_R = 1000 V; I_{FAV} = 3 A	SOD-64

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	SF5400	$V_R = V_{RRM}$	50	V
		SF5401	$V_R = V_{RRM}$	100	V
		SF5402	$V_R = V_{RRM}$	200	V
		SF5403	$V_R = V_{RRM}$	300	V
		SF5404	$V_R = V_{RRM}$	400	V
		SF5405	$V_R = V_{RRM}$	500	V
		SF5406	$V_R = V_{RRM}$	600	V
		SF5407	$V_R = V_{RRM}$	800	V
		SF5408	$V_R = V_{RRM}$	1000	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	150	A
Average forward current			I_{FAV}	3	A
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C
Non repetitive reverse avalanche energy	$I_{(BR)R}$ = 0.4 A		E_R	10	mJ

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	25	K/W
	On PC board with spacing 25 mm	R_{thJA}	70	K/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Forward voltage	I_F = 3 A	SF5400	V_F	-	-	1.1	V
		SF5401	V_F	-	-	1.1	V
		SF5402	V_F	-	-	1.1	V
		SF5403	V_F	-	-	1.1	V
		SF5404	V_F	-	-	1.1	V
		SF5405	V_F	-	-	1.7	V
		SF5406	V_F	-	-	1.7	V
		SF5407	V_F	-	-	1.7	V
Reverse current	$V_R = V_{RRM}$		I_R	-	-	5	µA
	$V_R = V_{RRM}$, T_j = 125 °C		I_R	-	-	50	µA
Reverse breakdown voltage	I_R = 100 µA	SF5400	V(BR)R	60	-	-	V
		SF5401	V(BR)R	110	-	-	V
		SF5402	V(BR)R	220	-	-	V
		SF5403	V(BR)R	330	-	-	V
		SF5404	V(BR)R	440	-	-	V
		SF5405	V(BR)R	550	-	-	V
		SF5406	V(BR)R	660	-	-	V
		SF5407	V(BR)R	880	-	-	V
		SF5408	V(BR)R	1100	-	-	V
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A	SF5400	t_{rr}	-	-	50	ns
		SF5401	t_{rr}	-	-	50	ns
		SF5402	t_{rr}	-	-	50	ns
		SF5403	t_{rr}	-	-	50	ns
		SF5404	t_{rr}	-	-	50	ns
		SF5405	t_{rr}	-	-	75	ns
		SF5406	t_{rr}	-	-	75	ns
		SF5407	t_{rr}	-	-	75	ns

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

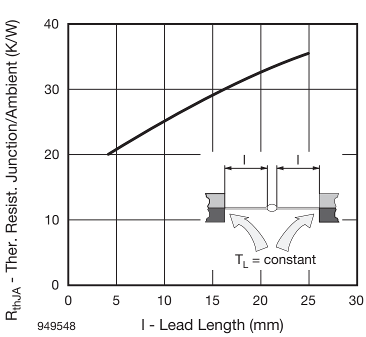


Fig. 1 - Max. Thermal Resistance vs. Lead Length

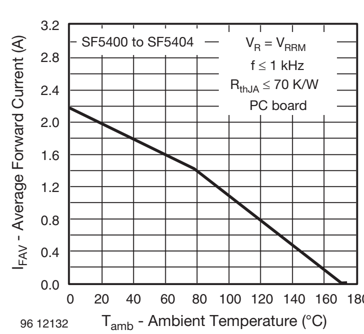


Fig. 2 - Max. Average Forward Current vs. Ambient Temperature

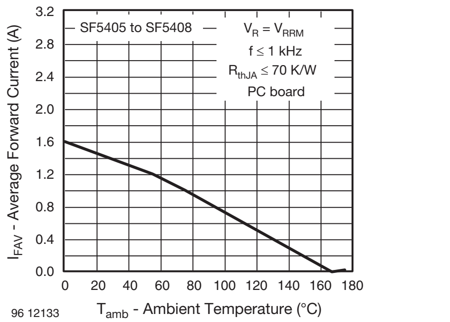


Fig. 3 - Max. Average Forward Current vs. Ambient Temperature

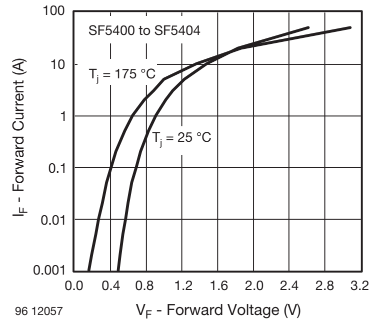


Fig. 6 - Max. Forward Current vs. Forward Voltage

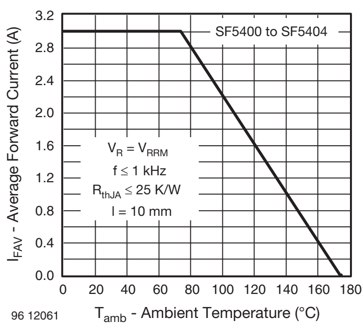


Fig. 4 - Max. Average Forward Current vs. Ambient Temperature

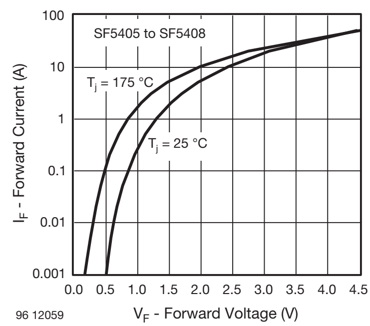


Fig. 7 - Max. Forward Current vs. Forward Voltage

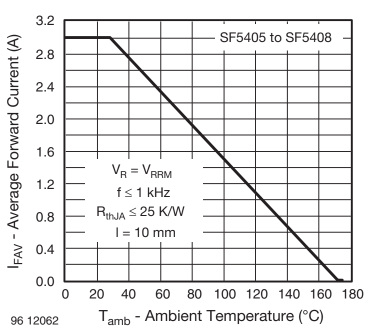


Fig. 5 - Max. Average Forward Current vs. Ambient Temperature

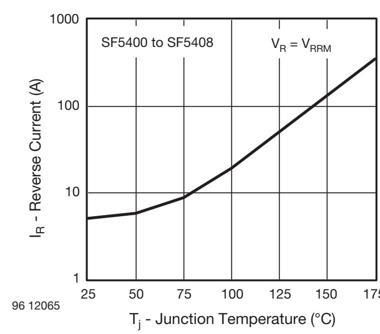


Fig. 8 - Max. Reverse Current vs. Junction Temperature

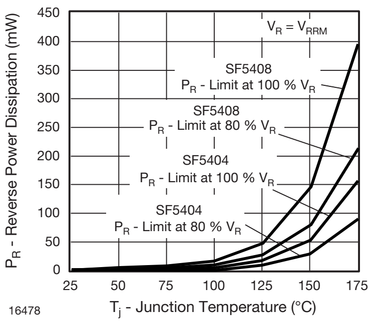


Fig. 9 - Max. Reverse Power Dissipation vs. Junction Temperature

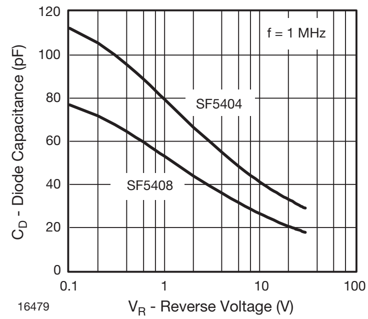
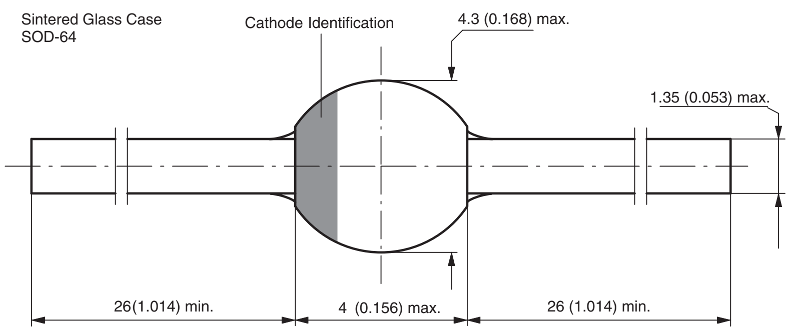


Fig. 10 - Diode Capacitance vs. Reverse Voltage

PACKAGE DIMENSIONS in millimeters (inches): **SOD-64**



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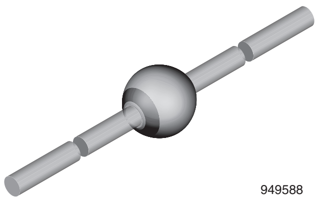
Fast Avalanche Sinterglass Diodes

Contents

Fast Avalanche Sinterglass Diode



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MECHANICAL DATA

Case: SOD-64

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 858 mg

FEATURES

- Glass passivated junction
- Hermetically sealed package
- Low reverse current
- Soft recovery characteristics
- Low forward voltage drop
- High pulse current capability
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

APPLICATIONS

- Fast rectification diode

PARTS TABLE		
PART	**TYPE DIFFERENTIATION**	**PACKAGE**
1N5417	V_R = 200 V; I_{FAV} = 3 A	SOD-64
1N5418	V_R = 400 V; I_{FAV} = 3 A	SOD-64

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)					
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**VALUE**	**UNIT**
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	1N5417	$V_R = V_{RRM}$	200	V
		1N5418	$V_R = V_{RRM}$	400	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	100	A
Average forward current	l = 10 mm, T_L = 25 °C		I_{FAV}	3	A
Non repetitive reverse avalanche energy	$I_{(BR)R}$ = 1 A		E_R	20	mJ
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	25	K/W
	On PC board with spacing 25 mm	R_{thJA}	70	K/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Forward voltage	I_F = 3 A		V_F	-	-	1.1	V
	I_F = 9 A		V_F	-	-	1.5	V
Reverse current	$V_R = V_{RRM}$		I_R	-	-	1	µA
	$V_R = V_{RRM}$, T_j = 100 °C		I_R	-	-	20	µA
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A		t_{rr}	-	75	100	ns

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

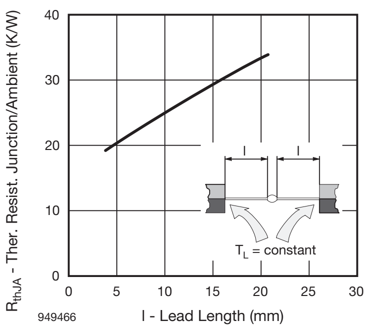


Fig. 1 - Max. Thermal Resistance vs. Lead Length

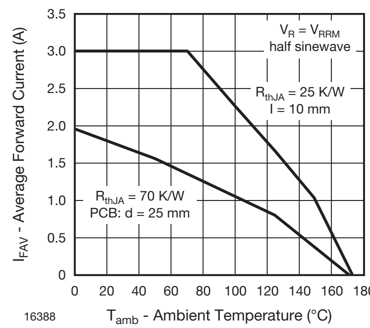


Fig. 3 - Max. Average Forward Current vs. Ambient Temperature

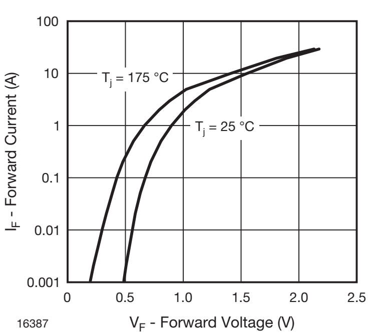


Fig. 2 - Max. Forward Current vs. Forward Voltage

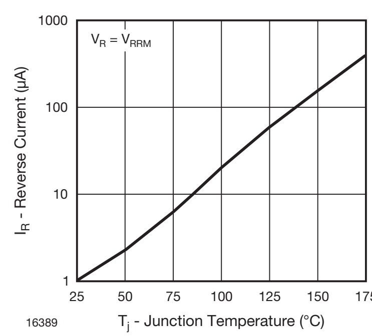


Fig. 4 - Max. Reverse Current vs. Junction Temperature

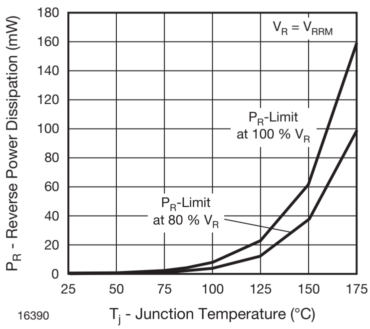


Fig. 5 - Max. Reverse Power Dissipation vs. Junction Temperature

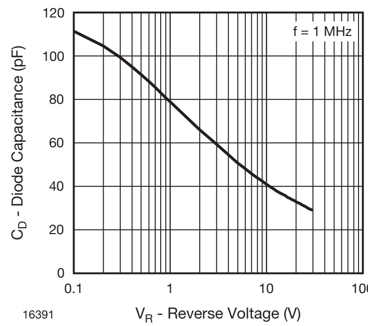


Fig. 6 - Diode Capacitance vs. Reverse Voltage

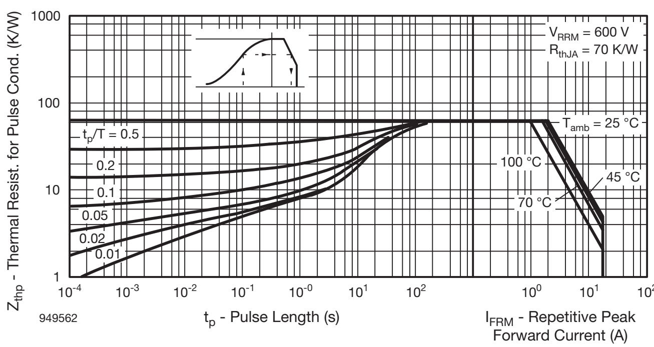
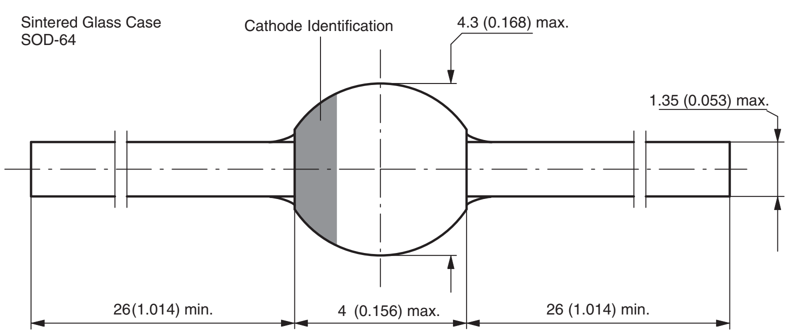


Fig. 7 - Thermal Response

PACKAGE DIMENSIONS in millimeters (inches): **SOD-64**



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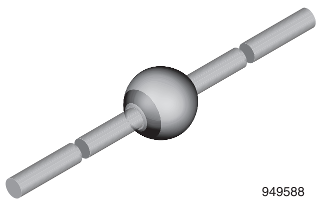
Fast Avalanche Sinterglass Diode



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MECHANICAL DATA

Case: SOD-64

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 858 mg

FEATURES

- Glass passivated junction
- Hermetically sealed package
- Low reverse current
- Soft recovery characteristics
- Low forward voltage drop
- High pulse current capability
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

e2
RoHS COMPLIANT
HALOGEN FREE

APPLICATIONS

- Fast rectification diode in S.M.P.S

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BYW172D	V_R = 200 V; I_{FAV} = 3 A	SOD-64
BYW172F	V_R = 300 V; I_{FAV} = 3 A	SOD-64
BYW172G	V_R = 400 V; I_{FAV} = 3 A	SOD-64

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	BYW172D	$V_R = V_{RRM}$	200	V
		BYW172F	$V_R = V_{RRM}$	300	V
		BYW172G	$V_R = V_{RRM}$	400	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	100	A
Average forward current			I_{FAV}	3	A
Non repetitive reverse avalanche energy	$I_{(BR)R}$ = 1 A		E_R	20	mJ
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	25	K/W
	On PC board with spacing 25 mm	R_{thJA}	70	K/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Forward voltage	I_F = 3 A		V_F	-	-	1.1	V
	I_F = 9 A		V_F	-	-	1.5	V
Reverse current	$V_R = V_{RRM}$		I_R	-	-	1	μA
	$V_R = V_{RRM}$, T_j = 100 °C		I_R	-	-	20	μA
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A		t_{rr}	-	75	100	ns

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

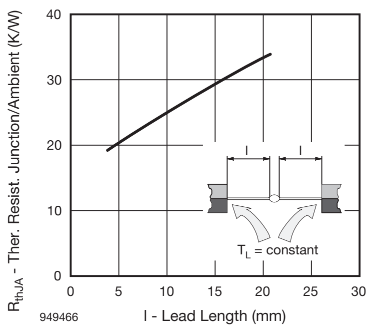


Fig. 1 - Max. Thermal Resistance vs. Lead Length

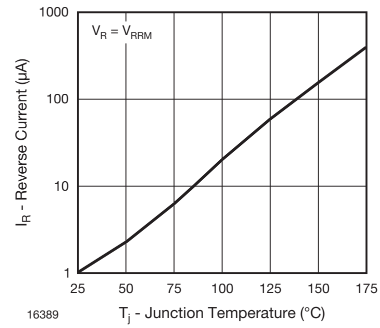


Fig. 4 - Max. Reverse Current vs. Junction Temperature

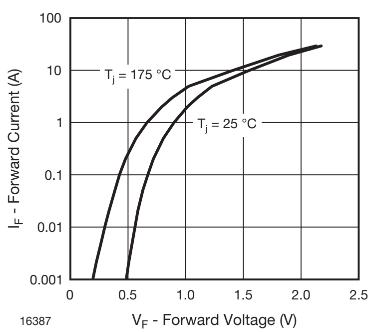


Fig. 2 - Max. Forward Current vs. Forward Voltage

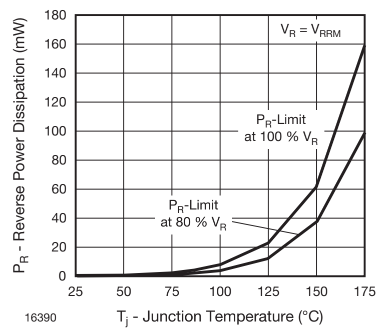


Fig. 5 - Max. Reverse Power Dissipation vs. Junction Temperature

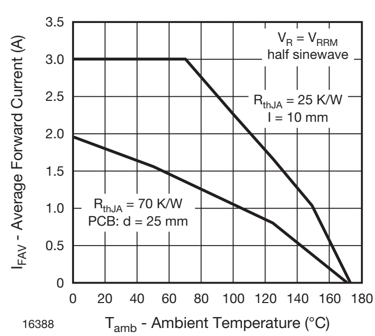


Fig. 3 - Max. Average Forward Current vs. Ambient Temperature

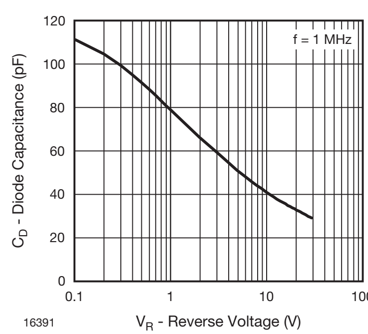


Fig. 6 - Diode Capacitance vs. Reverse Voltage

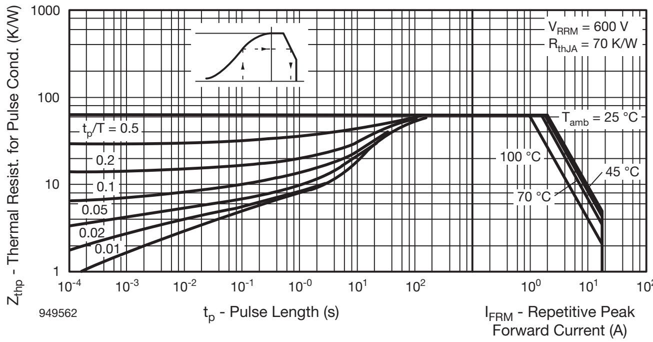
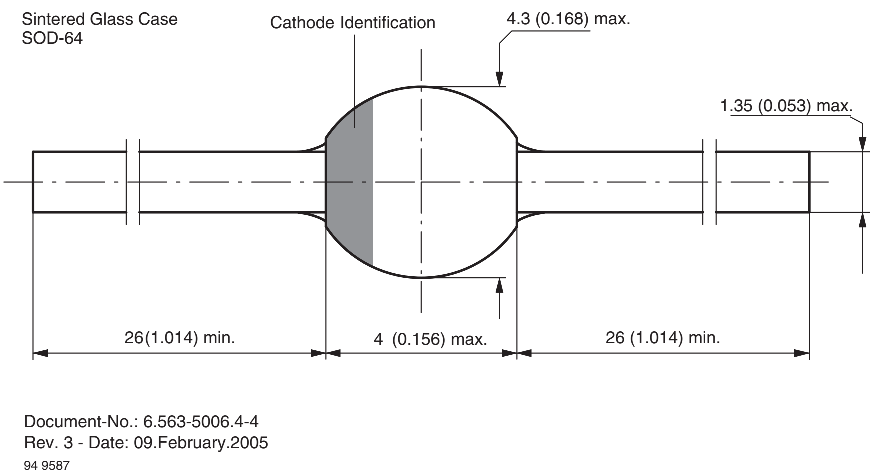
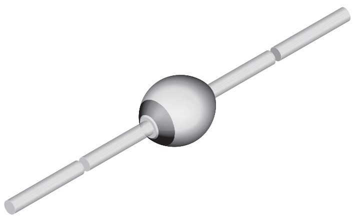


Fig. 7 - Thermal Response

PACKAGE DIMENSIONS in millimeters (inches): **SOD-64**



Fast Avalanche Sinterglass Diode



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FEATURES

- Glass passivated junction
- Hermetically sealed package
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

APPLICATIONS

- Fast rectification and switching avalanche sinterglass diode for TV-line output circuits an switch mode power supply

MECHANICAL DATA

Case: SOD-57 sintered glass case

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 369 mg

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BY203-12S	V_R = 1200 V; I_{FAV} = 250 mA	SOD-57
BY203-16S	V_R = 1600 V; I_{FAV} = 250 mA	SOD-57
BY203-20S	V_R = 2000 V; I_{FAV} = 250 mA	SOD-57

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	I_R = 100 µA	BY203-12S	$V_R = V_{RRM}$	1200	V
		BY203-16S	$V_R = V_{RRM}$	1600	V
		BY203-20S	$V_R = V_{RRM}$	2000	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	20	A
Average forward current			I_{FAV}	250	mA
Non repetitive reverse avalanche energy	$I_{(BR)R}$ = 0.4 A		E_R	10	mJ
Junction temperature range			T_j	- 55 to + 150	°C
Storage temperature range			T_{stg}	- 55 to + 175	°C

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	45	K/W
	Maximum lead length	R_{thJA}	100	K/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Forward voltage	I_F = 200 mA, t_p/T = 0.01, t_p = 0.3ms		V_F	-	-	2.4	V
Reverse current	V_R = 700 V	BY203-12S	I_R	-	-	2	μA
	V_R = 1000 V	BY203-16S	I_R	-	-	2	μA
	V_R = 1200 V	BY203-20S	I_R	-	-	2	μA
Breakdown voltage	I_R = 100 μA, t_p/T = 0.01, t_p = 0.3 ms	BY203-12S	$V_{(BR)}$	1200	-	-	V
		BY203-16S	$V_{(BR)}$	1600	-	-	V
		BY203-20S	$V_{(BR)}$	2000	-	-	V
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A		t_{rr}	-	-	300	ns

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

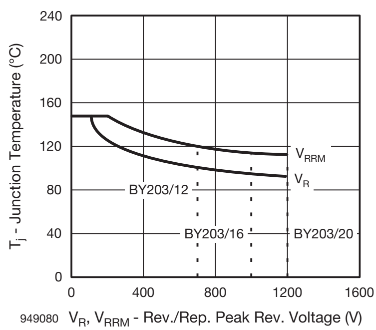


Fig. 1 - Junction Temperature vs.
Reverse/Repetitive Peak Reverse Voltage

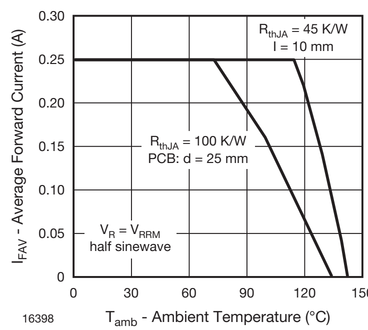


Fig. 3 - Max. Average Forward Current vs.
Ambient Temperature

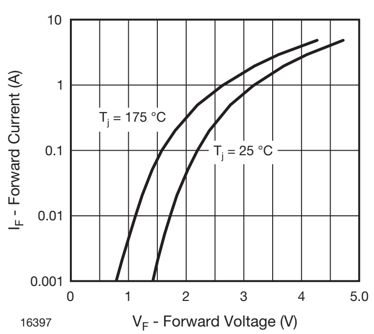


Fig. 2 - Max. Forward Current vs. Forward Voltage

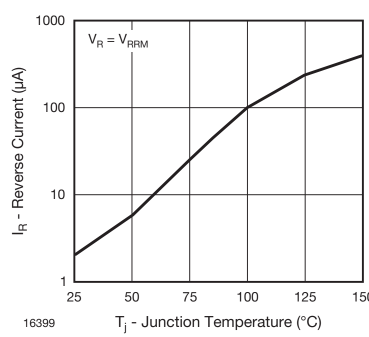


Fig. 4 - Max. Reverse Current vs. Junction Temperature

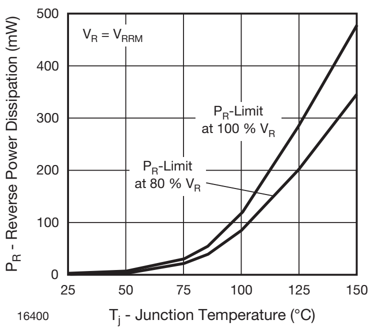


Fig. 5 - Max. Reverse Power Dissipation vs. Junction Temperature

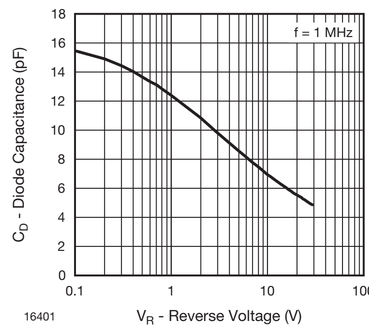
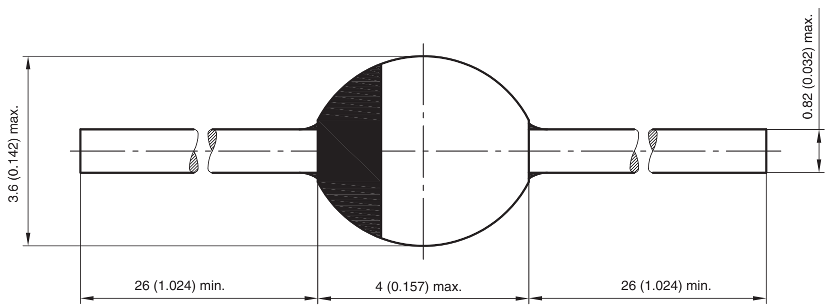


Fig. 6 - Diode Capacitance vs. Reverse Voltage

PACKAGE DIMENSIONS in millimeters (inches): **SOD-57**



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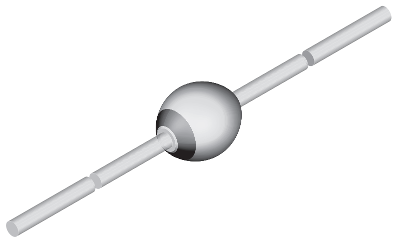
Fast Avalanche Sinterglass Diode



949539

FEATURES

- Glass passivated junction
- Hermetically sealed package
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

RoHS COMPLIANT
HALOGEN FREE

APPLICATIONS

- High voltage fast rectification diode

MECHANICAL DATA

Case: SOD-57

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 369 mg

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BY268	V_R = 1400 V; I_{FAV} = 0.8 A	SOD-57
BY269	V_R = 1600 V; I_{FAV} = 0.8 A	SOD-57

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Peak reverse voltage, non repetitive		BY268	V_{RSM}	1600	V
		BY269	V_{RSM}	1800	V
Reverse voltage	See electrical characteristics	BY268	V_R	1400	V
		BY269	V_R	1600	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	20	A
Average forward current			I_{FAV}	0.8	A
Non repetitive reverse avalanche energy	$I_{(BR)R}$ = 0.4 A		E_R	10	mJ
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	45	K/W
	On PC board with spacing 25 mm	R_{thJA}	100	K/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Forward voltage	I_F = 0.4 A		V_F	-	-	1.25	V
Reverse current	V_R = 1400 V	BY268	I_R	-	1	2	μA
	V_R = 1600 V	BY269	I_R	-	1	2	μA
	V_R= 1400 V, T_j = 100 °C	BY268	I_R	-	-	15	μA
	V_R= 1600 V, T_j = 100 °C	BY269	I_R	-	-	15	μA
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A		t_{rr}	-	-	400	ns

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

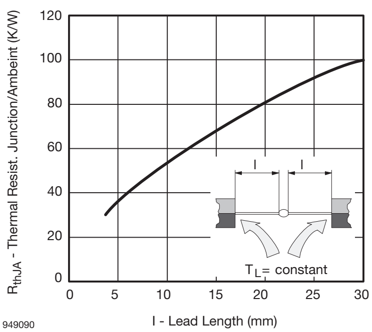


Fig. 1 - Max. Thermal Resistance vs. Lead Length

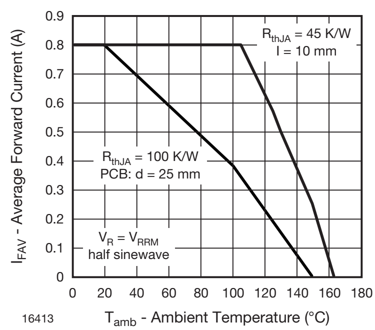


Fig. 3 - Max. Average Forward Current vs. Ambient Temperature

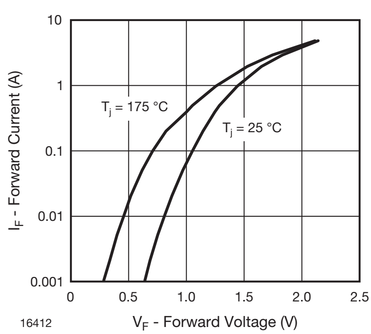


Fig. 2 - Max. Forward Current vs. Forward Voltage

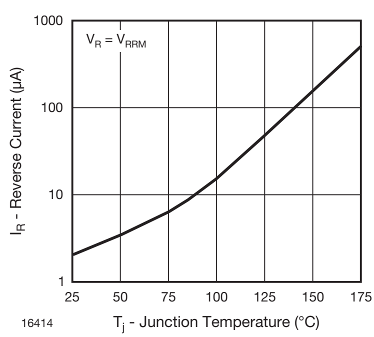


Fig. 4 - Max. Reverse Current vs. Junction Temperature

For technical questions within your region, please contact one of the following:
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com

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Rev. 1.7, 25-Aug-10

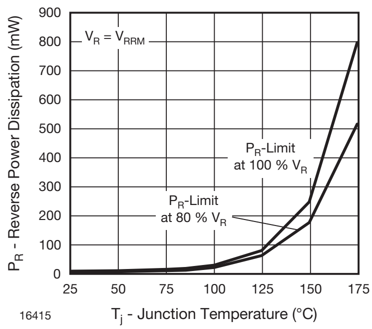


Fig. 5 - Max. Reverse Power Dissipation vs. Junction Temperature

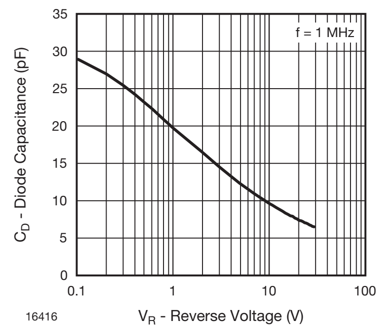
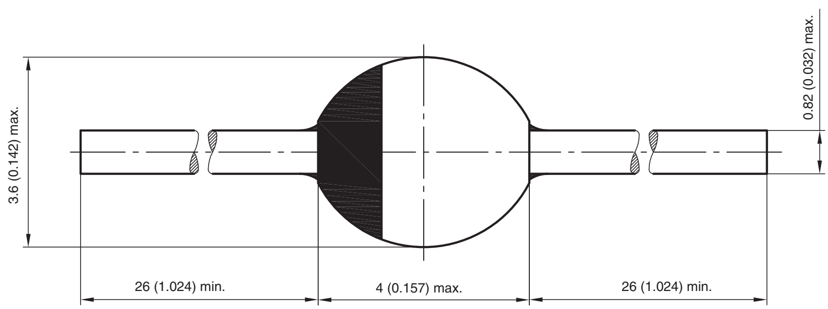


Fig. 6 - Diode Capacitance vs. Reverse Voltage

PACKAGE DIMENSIONS in millimeters (inches): **SOD-57**



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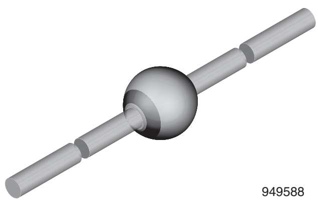
Document no.:6.563-5006.3-4

Fast Avalanche Sinterglass Diode



949588

MECHANICAL DATA

Case: SOD-64

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 858 mg

FEATURES

- Glass passivated
- Hermetically sealed package
- Very low switching losses
- Low reverse current
- High reverse voltage
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

e2
RoHS COMPLIANT
HALOGEN FREE

APPLICATIONS

- Switched mode power supplies
- High-frequency inverter circuits

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BYM36A	V_R = 200 V; I_{FAV} = 3 A	SOD-64
BYM36B	V_R = 400 V; I_{FAV} = 3 A	SOD-64
BYM36C	V_R = 600 V; I_{FAV} = 3 A	SOD-64
BYM36D	V_R = 800 V; I_{FAV} = 2.9 A	SOD-64
BYM36E	V_R = 1000 V; I_{FAV} = 2.9 A	SOD-64

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	BYM36A	$V_R = V_{RRM}$	200	V
		BYM36B	$V_R = V_{RRM}$	400	V
		BYM36C	$V_R = V_{RRM}$	600	V
		BYM36D	$V_R = V_{RRM}$	800	V
		BYM36E	$V_R = V_{RRM}$	1000	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	65	A
Average forward current		BYM36A	I_{FAV}	3	A
		BYM36B	I_{FAV}	3	A
		BYM36C	I_{FAV}	3	A
		BYM36D	I_{FAV}	2.9	A
		BYM36E	I_{FAV}	2.9	A
Non repetitive reverse avalanche energy	$I_{(BR)R}$ = 1 A, inductive load		E_R	20	mJ
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	25	K/W
	On PC board with spacing 25 mm	R_{thJA}	70	K/W

For technical questions within your region, please contact one of the following:
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
Document Number: 86012
Rev. 1.7, 25-Aug-10

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Forward voltage	I_F = 3 A	BYM36A	V_F	-	-	1.6	V
		BYM36B	V_F	-	-	1.6	V
		BYM36C	V_F	-	-	1.6	V
		BYM36D	V_F	-	-	1.78	V
		BYM36E	V_F	-	-	1.78	V
	I_F = 3 A, T_j= 175 °C	BYM36A	V_F	-	-	1.22	V
		BYM36B	V_F	-	-	1.22	V
		BYM36C	V_F	-	-	1.22	V
		BYM36D	V_F	-	-	1.28	V
		BYM36E	V_F	-	-	1.28	V
Reverse current	$V_R = V_{RRM}$		I_R	-	-	5	μA
	$V_R = V_{RRM}$, T_j = 150 °C		I_R	-	-	100	μA
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A	BYM36A	t_{rr}	-	-	100	ns
		BYM36B	t_{rr}	-	-	100	ns
		BYM36C	t_{rr}	-	-	100	ns
		BYM36D	t_{rr}	-	-	150	ns
		BYM36E	t_{rr}	-	-	150	ns
Reverse breakdown voltage	I_R = 100 μA	BYM36A	$V_{(BR)R}$	300	-	-	V
		BYM36B	$V_{(BR)R}$	500	-	-	V
		BYM36C	$V_{(BR)R}$	700	-	-	V
		BYM36D	$V_{(BR)R}$	900	-	-	V
		BYM36E	$V_{(BR)R}$	1100	-	-	V

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

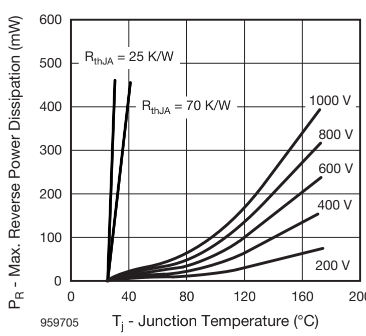


Fig. 1 - Max. Reverse Power Dissipation vs. Junction Temperature

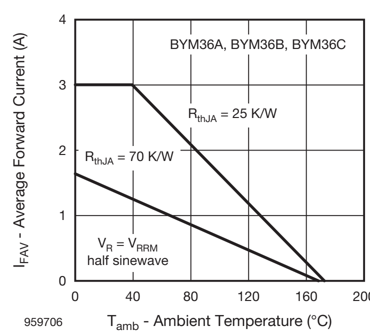


Fig. 2 - Max. Average Forward Current vs. Ambient Temperature

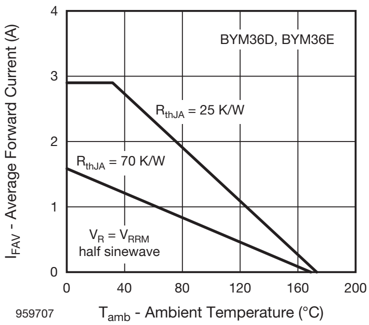


Fig. 3 - Max. Average Forward Current vs. Ambient Temperature

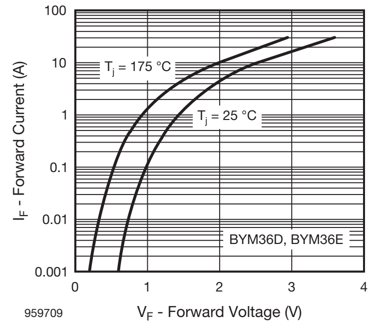


Fig. 6 - Max. Forward Current vs. Forward Voltage

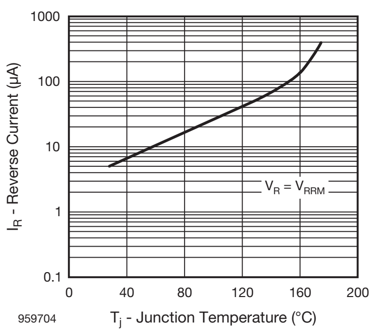


Fig. 4 - Max. Reverse Current vs. Junction Temperature

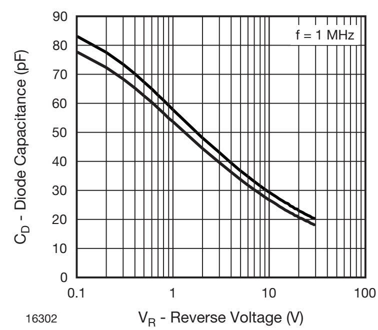


Fig. 7 - Diode Capacitance vs. Reverse Voltage

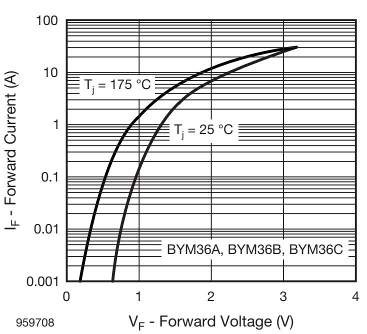
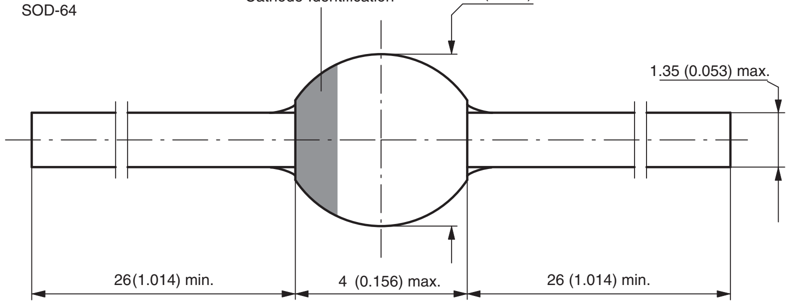


Fig. 5 - Max. Forward Current vs. Forward Voltage

For technical questions within your region, please contact one of the following:
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com

PACKAGE DIMENSIONS in millimeters (inches): **SOD-64**



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Rev. 3 - Date: 09.February.2005
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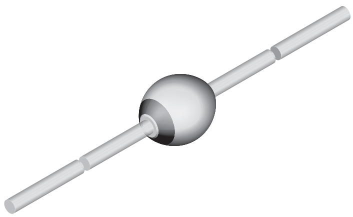
Fast Avalanche Sinterglass Diode



949539

FEATURES

- Glass passivated junction
- Hermetically sealed package
- Low reverse current
- Soft recovery characteristics
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

RoHS COMPLIANT
HALOGEN FREE

MECHANICAL DATA

Case: SOD-57

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 369 mg

APPLICATIONS

- Fast rectification and switching diode

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BYT52A	V_R = 50 V; I_{FAV} = 1.4 A	SOD-57
BYT52B	V_R = 100 V; I_{FAV} = 1.4 A	SOD-57
BYT52D	V_R = 200 V; I_{FAV} = 1.4 A	SOD-57
BYT52G	V_R = 400 V; I_{FAV} = 1.4 A	SOD-57
BYT52J	V_R = 600 V; I_{FAV} = 1.4 A	SOD-57
BYT52K	V_R = 800 V; I_{FAV} = 1.4 A	SOD-57
BYT52M	V_R = 1000 V; I_{FAV} = 1.4 A	SOD-57

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	BYT52A	$V_R = V_{RRM}$	50	V
		BYT52B	$V_R = V_{RRM}$	100	V
		BYT52D	$V_R = V_{RRM}$	200	V
		BYT52G	$V_R = V_{RRM}$	400	V
		BYT52J	$V_R = V_{RRM}$	600	V
		BYT52K	$V_R = V_{RRM}$	800	V
		BYT52M	$V_R = V_{RRM}$	1000	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	50	A
Average forward current	On PC board		I_{FAV}	0.85	A
	l = 10mm		I_{FAV}	1.4	A
Non repetitive reverse avalanche energy	$I_{(BR)R}$ = 0.4 A	BYT52J	E_R	10	mJ
		BYT52K	E_R	10	mJ
		BYT52M	E_R	10	mJ
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C

For technical questions within your region, please contact one of the following:
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
Document Number: 86029
Rev. 1.7, 30-Jul-10

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	45	K/W
	On PC board with spacing 25 mm	R_{thJA}	100	K/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Forward voltage	I_F = 1 A		V_F	-	-	1.3	V
Reverse current	$V_R = V_{RRM}$		I_R	-	-	5	μA
	$V_R = V_{RRM}$, T_j = 150 °C		I_R	-	-	150	μA
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A		t_{rr}	-	-	200	ns

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

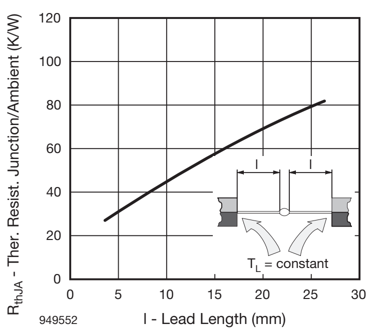


Fig. 1 - Max. Thermal Resistance vs. Lead Length

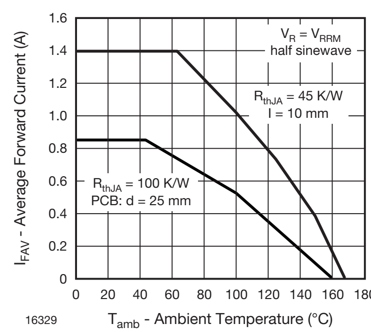


Fig. 3 - Max. Average Forward Current vs. Ambient Temperature

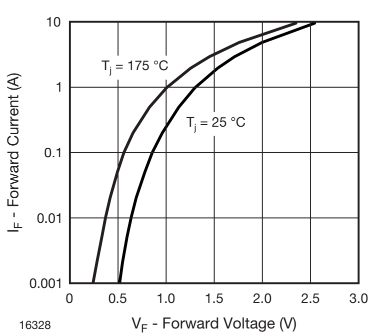


Fig. 2 - Max. Forward Current vs. Forward Voltage

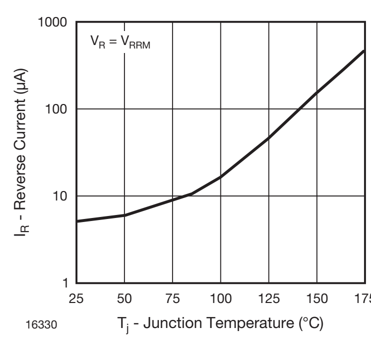


Fig. 4 - Max. Reverse Current vs. Junction Temperature

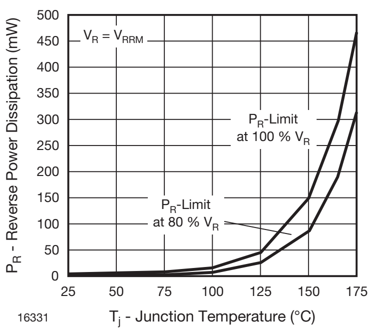


Fig. 5 - Max. Reverse Power Dissipation vs. Junction Temperature

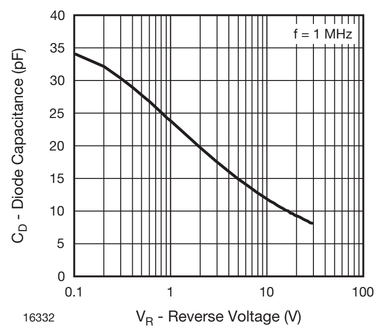
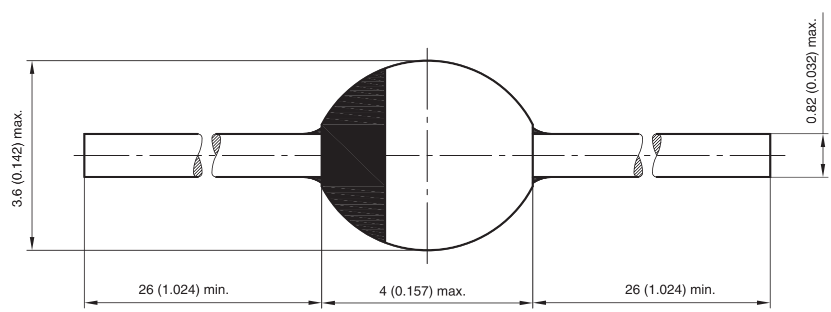


Fig. 6 - Diode Capacitance vs. Reverse Voltage

PACKAGE DIMENSIONS in millimeters (inches): **SOD-57**



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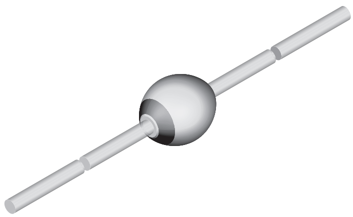
Fast Avalanche Sinterglass Diode



949539

FEATURES

- Glass passivated junction
- Hermetically sealed package
- Low reverse current
- Soft recovery characteristics
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

RoHS COMPLIANT

HALOGEN FREE

APPLICATIONS

- Very fast rectification and switching diodes

MECHANICAL DATA

Case: SOD-57

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 369 mg

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BYT54A	V_R = 50 V; I_{FAV} = 1.25 A	SOD-57
BYT54B	V_R = 100 V; I_{FAV} = 1.25 A	SOD-57
BYT54D	V_R = 200 V; I_{FAV} = 1.25 A	SOD-57
BYT54G	V_R = 400 V; I_{FAV} = 1.25 A	SOD-57
BYT54J	V_R = 600 V; I_{FAV} = 1.25 A	SOD-57
BYT54K	V_R = 800 V; I_{FAV} = 1.25 A	SOD-57
BYT54M	V_R = 1000 V; I_{FAV} = 1.25 A	SOD-57

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	BYT54A	$V_R = V_{RRM}$	50	V
		BYT54B	$V_R = V_{RRM}$	100	V
		BYT54D	$V_R = V_{RRM}$	200	V
		BYT54G	$V_R = V_{RRM}$	400	V
		BYT54J	$V_R = V_{RRM}$	600	V
		BYT54K	$V_R = V_{RRM}$	800	V
		BYT54M	$V_R = V_{RRM}$	1000	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	30	A
Average forward current	On PC board		I_{FAV}	0.75	A
	l = 10mm		I_{FAV}	1.25	A
Non repetitive reverse avalanche energy	$I_{(BR)R}$ = 0.4 A	BYT54J	E_R	10	mJ
		BYT54K	E_R	10	mJ
		BYT54M	E_R	10	mJ
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	45	K/W
	On PC board with spacing 25 mm	R_{thJA}	100	K/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Forward voltage	I_F = 1 A		V_F	-	-	1.5	V
Reverse current	$V_R = V_{RRM}$		I_R	-	-	5	μA
	$V_R = V_{RRM}$, T_j = 150 °C		I_R	-	-	150	μA
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A		t_{rr}	-	-	100	ns

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

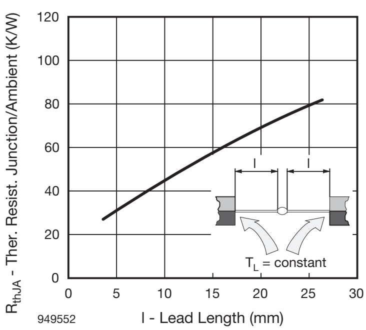


Fig. 1 - Max. Thermal Resistance vs. Lead Length

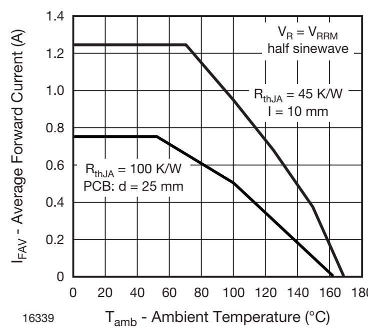


Fig. 3 - Max. Average Forward Current vs. Ambient Temperature

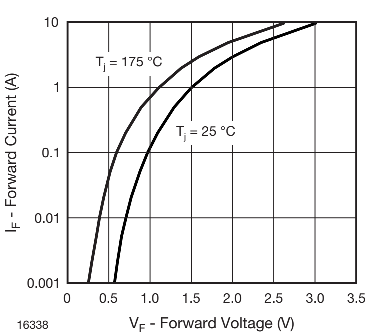


Fig. 2 - Forward Current vs. Forward Voltage

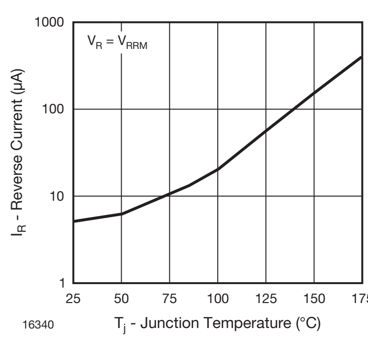


Fig. 4 - Max. Reverse Current vs. Junction Temperature

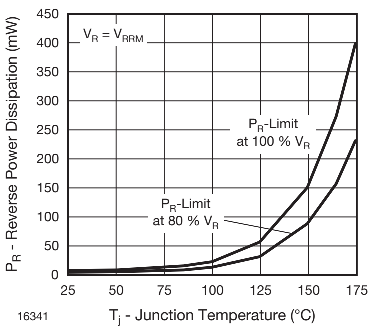


Fig. 5 - Max. Reverse Power Dissipation vs. Junction Temperature

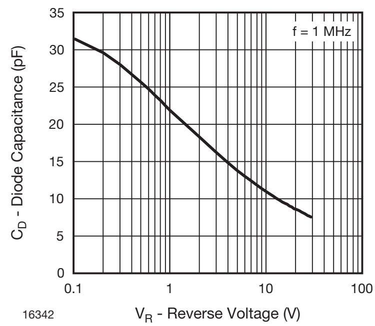
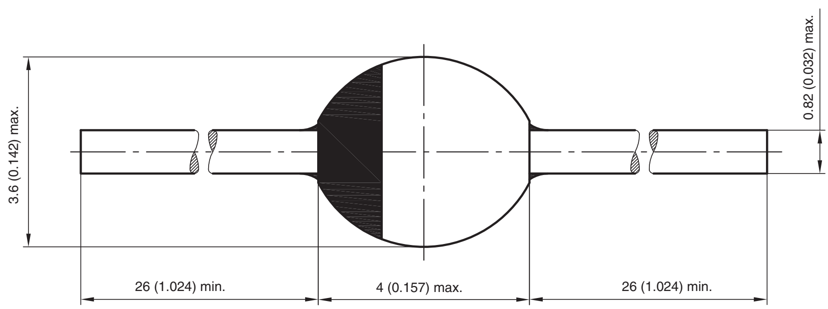


Fig. 6 - Diode Capacitance vs. Reverse Voltage

PACKAGE DIMENSIONS in millimeters (inches): **SOD-57**



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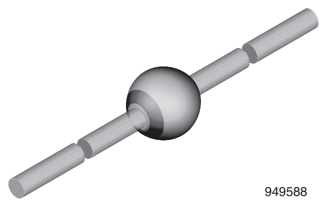
Fast Avalanche Sinterglass Diode


949588

FEATURES

- Glass passivated junction
- Hermetically sealed package
- Low reverse current
- Soft recovery characteristics
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

RoHS COMPLIANT
HALOGEN FREE

MECHANICAL DATA

Case: SOD-64

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 858 mg

APPLICATIONS

- Very fast rectification and switching diode

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BYT56A	V_R = 50 V; I_{FAV} = 3 A	SOD-64
BYT56B	V_R = 100 V; I_{FAV} = 3 A	SOD-64
BYT56D	V_R = 200 V; I_{FAV} = 3 A	SOD-64
BYT56G	V_R = 400 V; I_{FAV} = 3 A	SOD-64
BYT56J	V_R = 600 V; I_{FAV} = 3 A	SOD-64
BYT56K	V_R = 800 V; I_{FAV} = 3 A	SOD-64
BYT56M	V_R = 1000 V; I_{FAV} = 3 A	SOD-64

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	BYT56A	$V_R = V_{RRM}$	50	V
		BYT56B	$V_R = V_{RRM}$	100	V
		BYT56D	$V_R = V_{RRM}$	200	V
		BYT56G	$V_R = V_{RRM}$	400	V
		BYT56J	$V_R = V_{RRM}$	600	V
		BYT56K	$V_R = V_{RRM}$	800	V
		BYT56M	$V_R = V_{RRM}$	1000	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	80	A
Average forward current	On PC board		I_{FAV}	1.5	A
	l = 10mm		I_{FAV}	3	A
Non repetitive reverse avalanche energy	$I_{(BR)R}$ = 0.4 A		E_R	10	mJ
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C

For technical questions within your region, please contact one of the following:
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MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	25	K/W
	On PC board with spacing 25 mm	R_{thJA}	70	K/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Forward voltage	I_F = 3 A		V_F	-	-	1.4	V
Reverse current	$V_R = V_{RRM}$		I_R	-	-	5	μA
	$V_R = V_{RRM}$, T_j = 150 °C		I_R	-	-	150	μA
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A		t_{rr}	-	-	100	ns

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

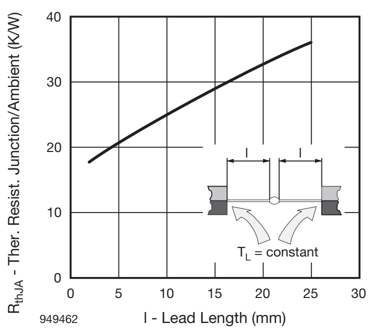


Fig. 1 - Max. Thermal Resistance vs. Lead Length

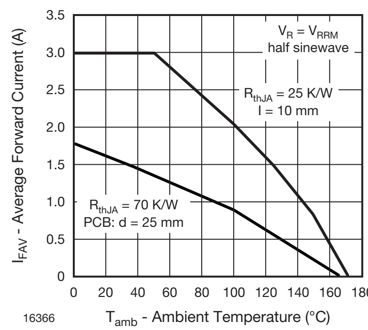


Fig. 3 - Max. Average Forward Current vs. Ambient Temperature

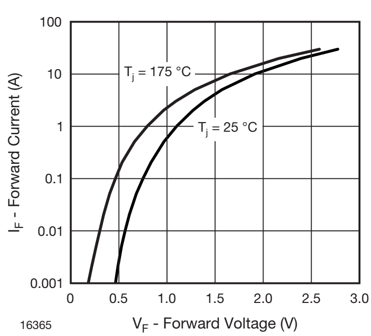


Fig. 2 - Max. Forward Current vs. Forward Voltage

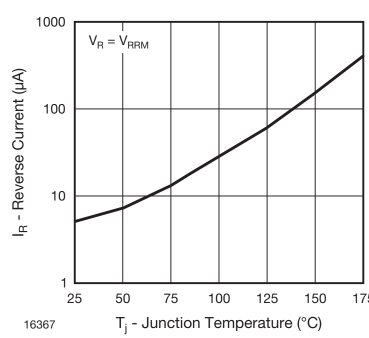


Fig. 4 - Max. Reverse Current vs. Junction Temperature

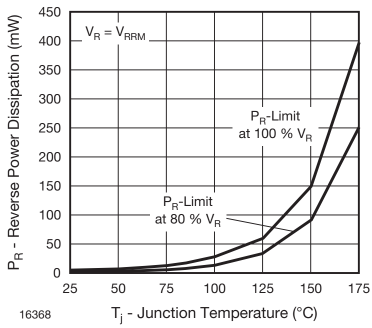


Fig. 5 - Max. Reverse Power Dissipation vs. Junction Temperature

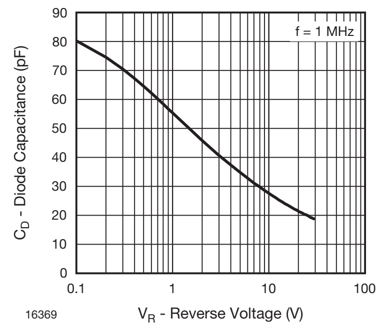
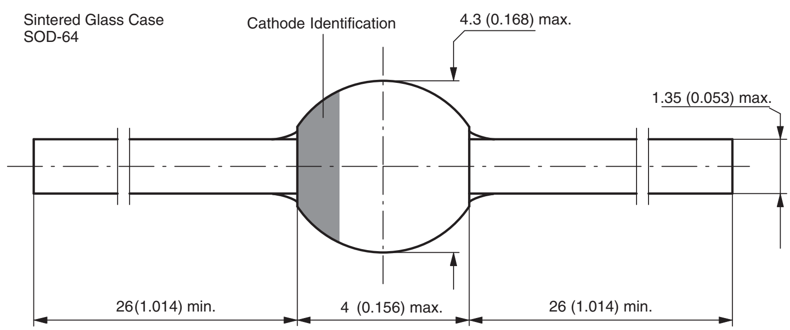


Fig. 6 - Diode Capacitance vs. Reverse Voltage

PACKAGE DIMENSIONS in millimeters (inches): **SOD-64**



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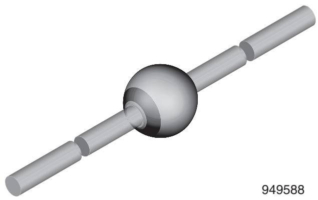
Fast Avalanche Sinterglass Diode



949588

MECHANICAL DATA

Case: SOD-64

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 858 mg

FEATURES

- Glass passivated junction
- Hermetically sealed package
- Low reverse current
- Soft recovery characteristics
- Controlled avalanche characteristics
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

Pb

e2

RoHS COMPLIANT

HALOGEN FREE

APPLICATIONS

- Fast “soft recovery” rectification diode

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BYT77	V_R = 800 V; I_{FAV} = 3 A	SOD-64
BYT78	V_R = 1000 V; I_{FAV} = 3 A	SOD-64

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	BYT77	$V_R = V_{RRM}$	800	V
		BYT78	$V_R = V_{RRM}$	1000	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	100	A
Average forward current	$T_{amb} \leq 45$ °C		I_{FAV}	3	A
Non repetitive reverse avalanche energy	$I_{(BR)R}$ = 0.4 A		E_R	10	mJ
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	25	K/W
	On PC board with spacing 25 mm	R_{thJA}	70	K/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Forward voltage	I_F = 3 A		V_F	-	1	1.2	V
Reverse current	$V_R = V_{RRM}$		I_R	-	1	5	µA
	$V_R = V_{RRM}$, T_j = 150 °C		I_R	-	60	150	µA
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A		t_{rr}	-	-	250	ns

For technical questions within your region, please contact one of the following:
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

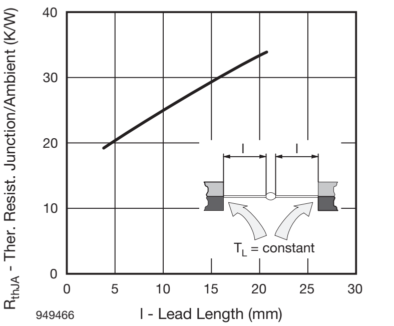


Fig. 1 - Max. Thermal Resistance vs. Lead Length

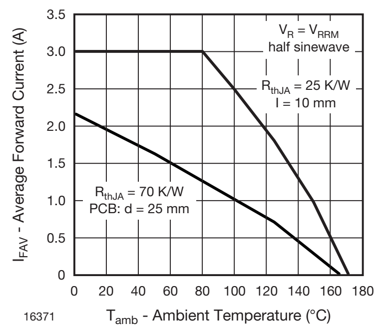


Fig. 4 - Max. Average Forward Current vs. Ambient Temperature

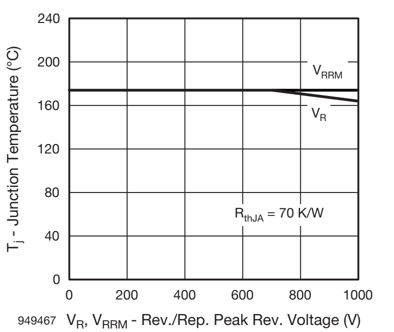


Fig. 2 - Junction Temperature vs. Reverse/Repetitive Peak Reverse Voltage

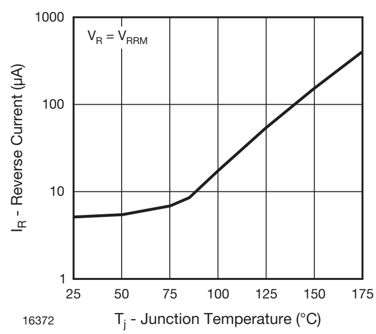


Fig. 5 - Reverse Current vs. Junction Temperature

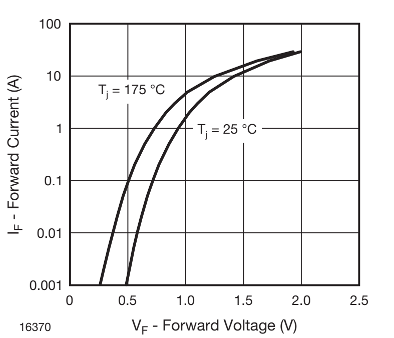


Fig. 3 - Forward Current vs. Forward Voltage

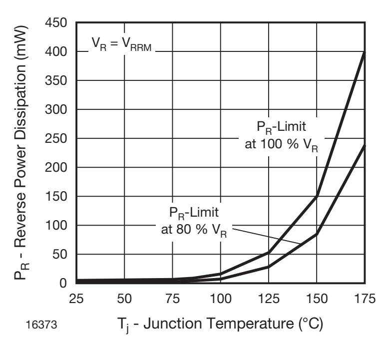


Fig. 6 - Max Reverse Power Dissipation vs. Junction Temperature

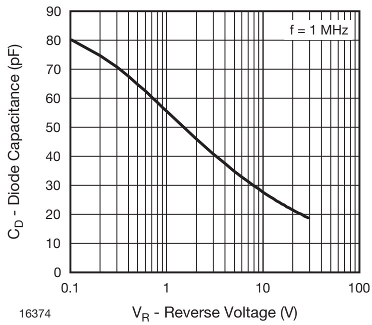
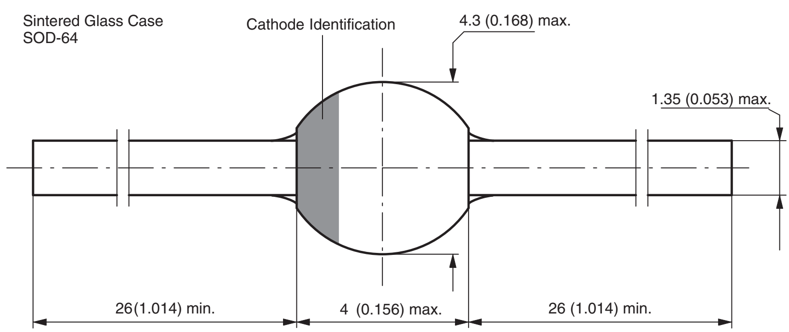


Fig. 7 - Diode Capacitance vs. Reverse Voltage

PACKAGE DIMENSIONS in millimeters (inches): **SOD-64**



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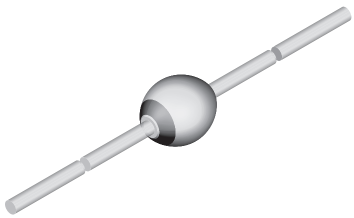
Fast Avalanche Sinterglass Diode



949539

FEATURES

- Glass passivated junction
- Hermetically sealed package
- Low reverse current
- Soft recovery characteristics
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

RoHS COMPLIANT
HALOGEN FREE

MECHANICAL DATA

Case: SOD-57

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 369 mg

APPLICATIONS

- Fast rectification and switching diode for example for TV-line output circuits and switch mode power supply

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BYV12	V_R = 100 V; I_{FAV} = 1.5 A	SOD-57
BYV13	V_R = 400 V; I_{FAV} = 1.5 A	SOD-57
BYV14	V_R = 600 V; I_{FAV} = 1.5 A	SOD-57
BYV15	V_R = 800 V; I_{FAV} = 1.5 A	SOD-57
BYV16	V_R = 1000 V; I_{FAV} = 1.5 A	SOD-57

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	BYV12	$V_R = V_{RRM}$	100	V
		BYV13	$V_R = V_{RRM}$	400	V
		BYV14	$V_R = V_{RRM}$	600	V
		BYV15	$V_R = V_{RRM}$	800	V
		BYV16	$V_R = V_{RRM}$	1000	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	40	A
Repetitive peak forward current			I_{FRM}	9	A
Average forward current	φ = 180°		I_{FAV}	1.5	A
Non repetitive reverse avalanche energy	$I_{(BR)R}$ = 0.4 A		E_R	10	mJ
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	45	K/W
	On PC board with spacing 25 mm	R_{thJA}	100	K/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Forward voltage	I_F = 1 A		V_F	-	-	1.5	V
Reverse current	$V_R = V_{RRM}$		I_R	-	1	5	µA
	$V_R = V_{RRM}$, T_j = 150 °C		I_R	-	60	150	µA
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A		t_{rr}	-	-	300	ns
Reverse recovery charge	I_F = 1 A, dI/dt = 5 A/µs		Q_{rr}	-	-	200	nC

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

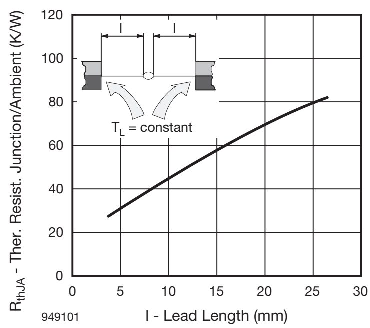


Fig. 1 - Typ. Thermal Resistance vs. Lead Length

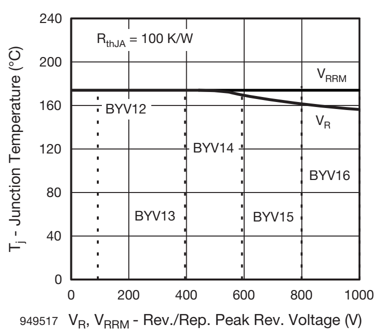


Fig. 2 - Junction Temperature vs. Reverse/Repetitive Peak Reverse Voltage

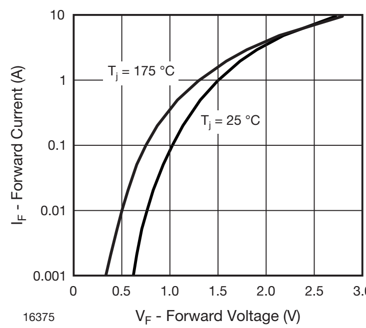


Fig. 3 - Forward Current vs. Forward Voltage

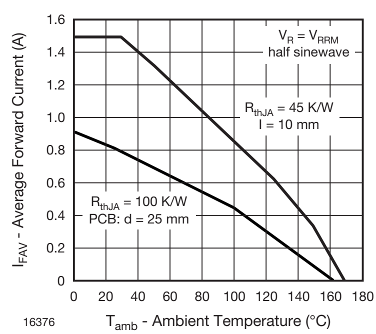


Fig. 4 - Max. Average Forward Current vs. Ambient Temperature

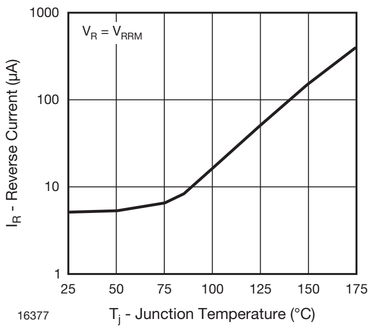


Fig. 5 - Reverse Current vs. Junction Temperature

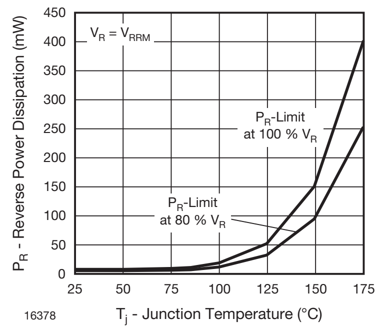


Fig. 6 - Max. Reverse Power Dissipation vs. Junction Temperature

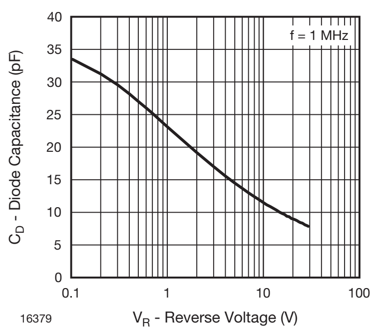


Fig. 7 - Diode Capacitance vs. Reverse Voltage

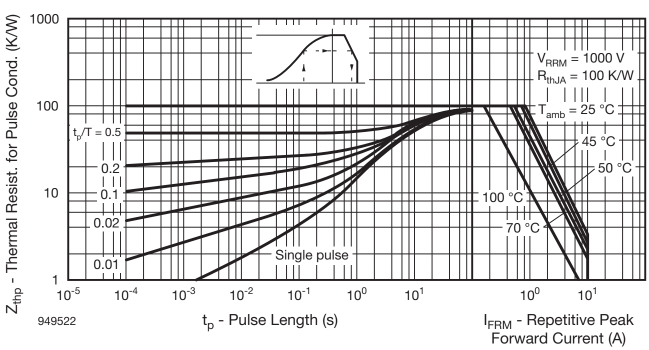
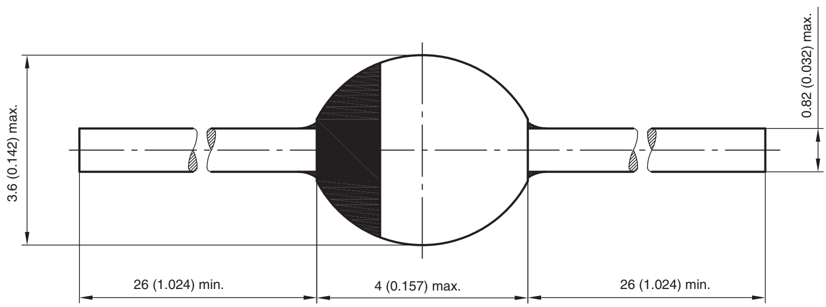


Fig. 8 - Thermal Response

PACKAGE DIMENSIONS in millimeters (inches): **SOD-57**



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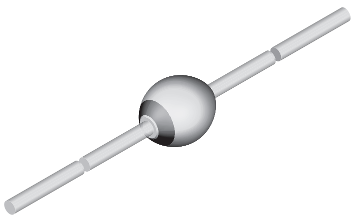
Fast Avalanche Sinterglass Diode



949539

FEATURES

- Glass passivated junction
- Hermetically sealed package
- Low reverse current
- Soft recovery characteristics
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

MECHANICAL DATA

Case: SOD-57

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 369 mg

APPLICATIONS

- Fast “soft recovery” rectification diode

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BYV37	V_R = 800 V; I_{FAV} = 2 A	SOD-57
BYV38	V_R = 1000 V; I_{FAV} = 2 A	SOD-57

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage	See electrical characteristics	BYV37	$V_R = V_{RRM}$	800	V
		BYV38	$V_R = V_{RRM}$	1000	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	50	A
Average forward current			I_{FAV}	2	A
Non repetitive reverse avalanche energy	$I_{(BR)R}$ = 0.4 A		E_R	10	mJ
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	45	K/W
	On PC board with spacing 25 mm	R_{thJA}	100	K/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Forward voltage	I_F = 1 A		V_F	-	1	1.1	V
Reverse current	$V_R = V_{RRM}$		I_R	-	-	5	µA
	$V_R = V_{RRM}$, T_j = 150 °C		I_R	-	-	150	µA
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A		t_{rr}	-	-	300	ns
Diode capacitance	V_R = 4 V, f = 1 MHz		C_D	-	15	-	pF

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

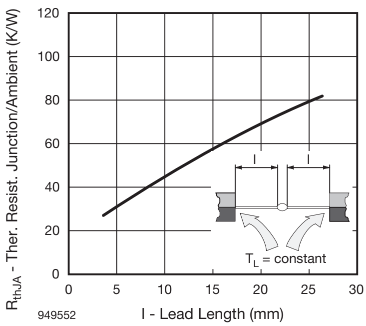


Fig. 1 - Max. Thermal Resistance vs. Lead Length

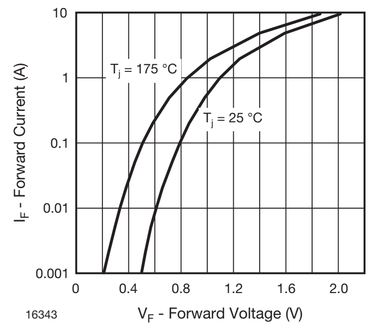


Fig. 4 - Forward Current vs. Forward Voltage

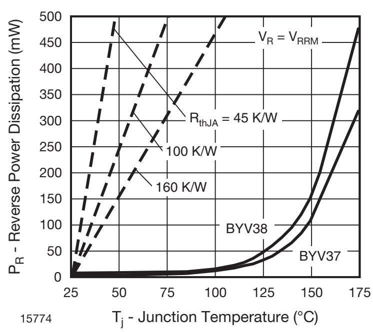


Fig. 2 - Max. Reverse Power Dissipation vs. Junction Temperature

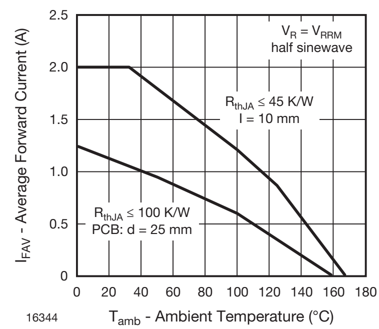


Fig. 5 - Max. Average Forward Current vs. Ambient Temperature

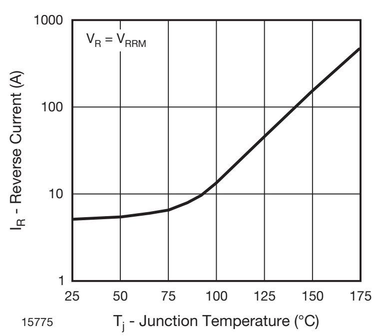


Fig. 3 - Max. Reverse Current vs. Junction Temperature

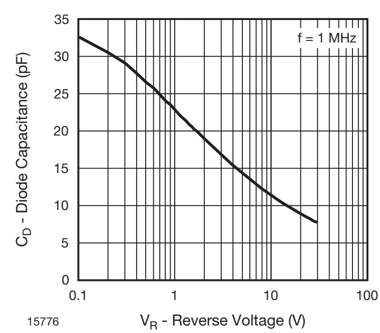
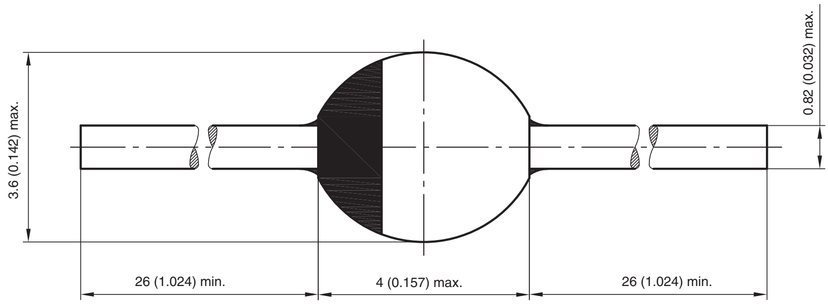


Fig. 6 - Typ. Diode Capacitance vs. Reverse Voltage

PACKAGE DIMENSIONS in millimeters (inches): **SOD-57**



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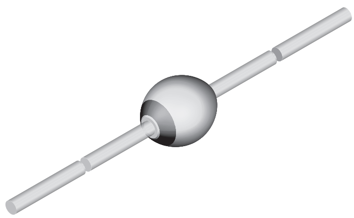
Document no.:6.563-5006.3-4

Fast Avalanche Sinterglass Diode



949539

FEATURES

- Glass passivated junction
- Hermetically sealed package
- Low reverse current
- Soft recovery characteristics
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

Pb

e2

RoHS COMPLIANT

HALOGEN FREE

MECHANICAL DATA

Case: SOD-57

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 369 mg

APPLICATIONS

- Fast rectification an switching diode for example for TV-line output circuits and switch mode power supply

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BYW32	V_R = 200 V; I_{FAV} = 2 A	SOD-57
BYW33	V_R = 300 V; I_{FAV} = 2 A	SOD-57
BYW34	V_R = 400 V; I_{FAV} = 2 A	SOD-57
BYW35	V_R = 500 V; I_{FAV} = 2 A	SOD-57
BYW36	V_R = 600 V; I_{FAV} = 2 A	SOD-57

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	BYW32	$V_R = V_{RRM}$	200	V
		BYW33	$V_R = V_{RRM}$	300	V
		BYW34	$V_R = V_{RRM}$	400	V
		BYW35	$V_R = V_{RRM}$	500	V
		BYW36	$V_R = V_{RRM}$	600	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	50	A
Repetitive peak forward current			I_{FRM}	12	A
Average forward current	φ = 180°		I_{FAV}	2	A
Non repetitive reverse avalanche energy	$I_{(BR)R}$ = 0.4 A		E_R	10	mJ
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	45	K/W
	On PC board with spacing 25 mm	R_{thJA}	100	K/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Forward voltage	I_F = 1 A		V_F	-	0.95	1.1	V
Reverse current	$V_R = V_{RRM}$		I_R	-	1	5	µA
	$V_R = V_{RRM}$, T_j = 150 °C		I_R	-	60	150	µA
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A		t_{rr}	-	-	200	ns

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

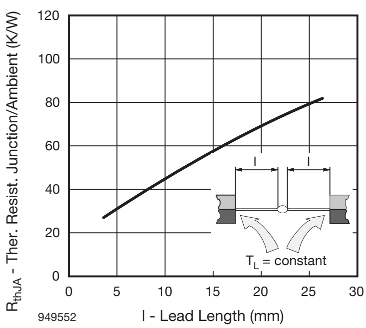


Fig. 1 - Max. Thermal Resistance vs. Lead Length

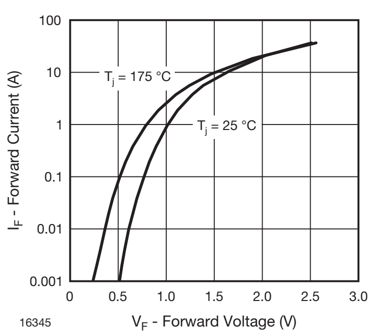


Fig. 2 - Forward Current vs. Forward Voltage

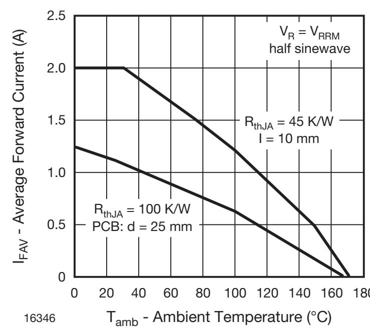


Fig. 3 - Max. Average Forward Current vs. Ambient Temperature

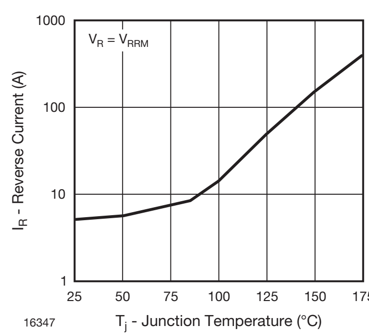


Fig. 4 - Reverse Current vs. Junction Temperature (°C)

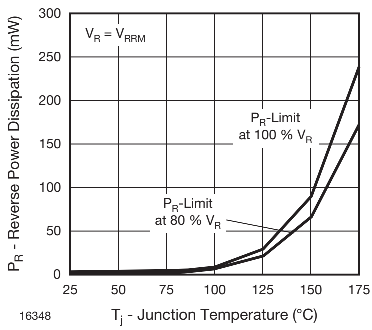


Fig. 5 - Max. Reverse Power Dissipation vs. Junction Temperature

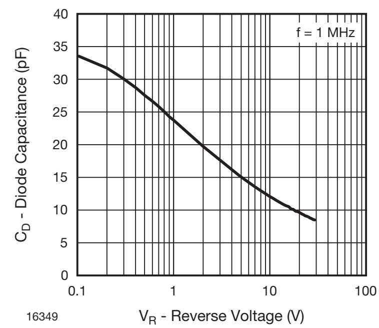


Fig. 6 - Diode Capacitance vs. Reverse Voltage

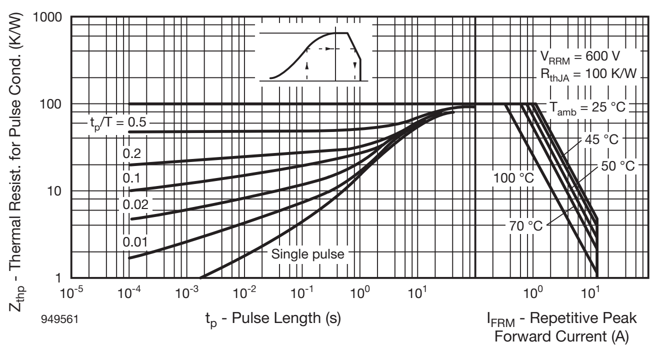
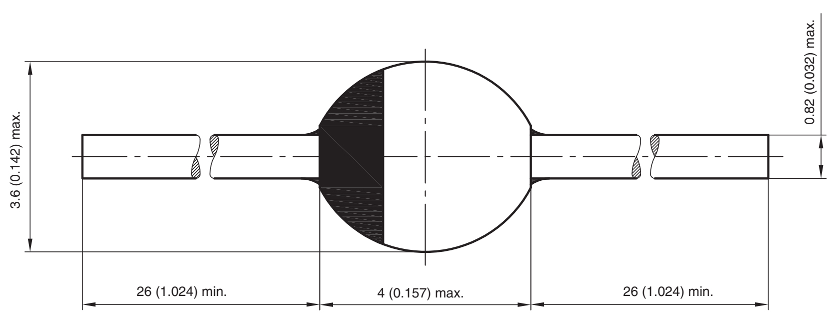


Fig. 7 - Thermal Response

PACKAGE DIMENSIONS in millimeters (inches): SOD-57



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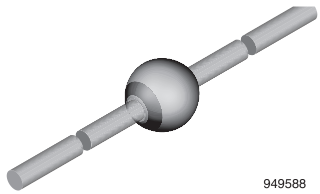
Fast Avalanche Sinterglass Diode



949588

MECHANICAL DATA

Case: SOD-64

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 858 mg

FEATURES

- Glass passivated junction
- Hermetically sealed package
- Low reverse current
- Soft recovery characteristics
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

APPLICATIONS

- Fast rectification and switching diode for example for TV-line output circuits and switch mode power supply

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BYW72	V_R = 200 V; I_{FAV} = 3 A	SOD-64
BYW73	V_R = 300 V; I_{FAV} = 3 A	SOD-64
BYW74	V_R = 400 V; I_{FAV} = 3 A	SOD-64
BYW75	V_R = 500 V; I_{FAV} = 3 A	SOD-64
BYW76	V_R = 600 V; I_{FAV} = 3 A	SOD-64

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	BYW72	$V_R = V_{RRM}$	200	V
		BYW73	$V_R = V_{RRM}$	300	V
		BYW74	$V_R = V_{RRM}$	400	V
		BYW75	$V_R = V_{RRM}$	500	V
		BYW76	$V_R = V_{RRM}$	600	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	100	A
Repetitive peak forward current			I_{FRM}	15	A
Average forward current			I_{FAV}	3	A
Non repetitive reverse avalanche energy	$I_{(BR)R}$ = 0.4 A		E_R	10	mJ
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	25	K/W
	On PC board with spacing 25 mm	R_{thJA}	70	K/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Forward voltage	I_F = 3 A		V_F	-	0.95	1.1	V
Reverse current	$V_R = V_{RRM}$		I_R	-	1	5	µA
	$V_R = V_{RRM}$, T_j = 150 °C		I_R	-	60	150	µA
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A		t_{rr}	-	-	200	ns

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

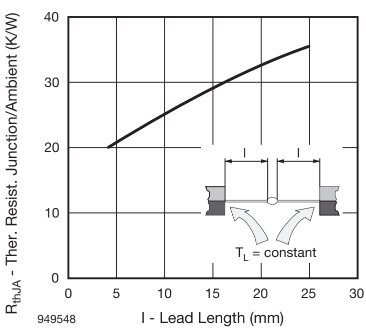


Fig. 1 - Max. Thermal Resistance vs. Lead Length

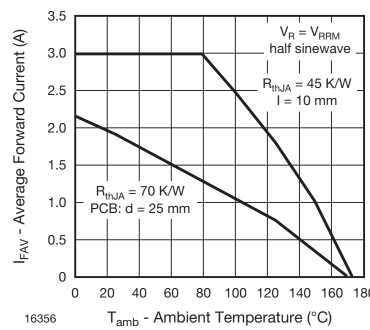


Fig. 3 - Max. Average Forward Current vs. Ambient Temperature

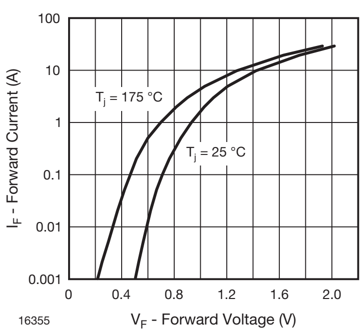


Fig. 2 - Max. Forward Current vs. Forward Voltage

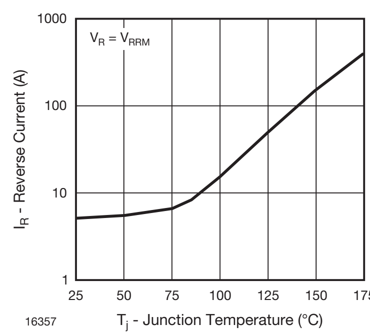


Fig. 4 - Max. Reverse Current vs. Junction Temperature

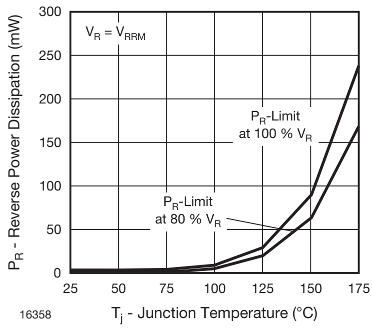


Fig. 5 - Max. Reverse Power Dissipation vs. Junction Temperature

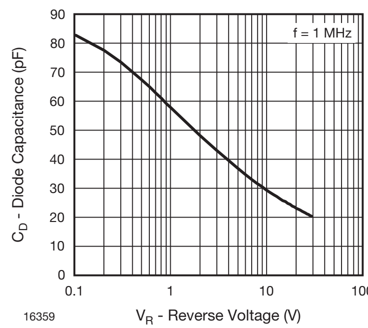


Fig. 6 - Diode Capacitance vs. Reverse Voltage

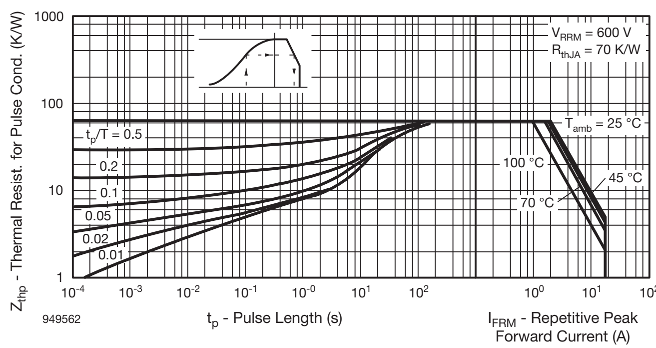
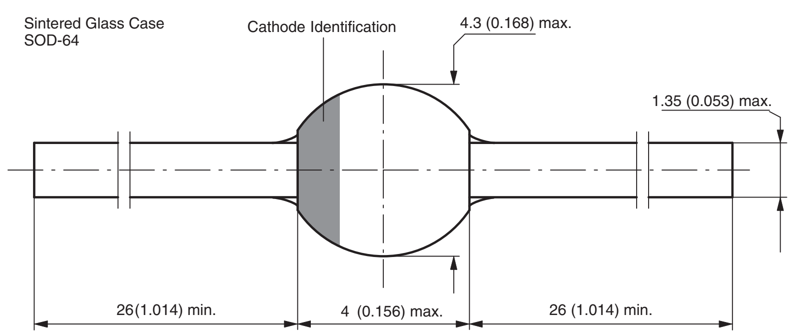


Fig. 7 - Thermal Response

PACKAGE DIMENSIONS in millimeters (inches): **SOD-64**



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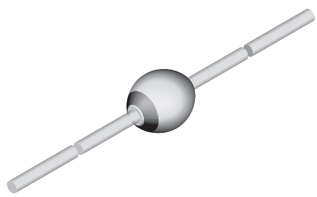
Standard Avalanche Sinterglass Diodes

Contents

1N5059, 1N5060, 1N5061,1N5062

Vishay Semiconductors

Standard Avalanche Sinterglass Diode



949539

MECHANICAL DATA

Case: SOD-57

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 369 mg

FEATURES

- Glass passivated junction
- Hermetically sealed axial-leaded glass envelope
- Controlled avalanche characteristics
- Low reverse current
- High surge current loading
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

APPLICATIONS

- Rectification diode, general purpose

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
1N5059	V_R = 200 V; I_{FAV} = 2 A	SOD-57
1N5060	V_R = 400 V; I_{FAV} = 2 A	SOD-57
1N5061	V_R = 600 V; I_{FAV} = 2 A	SOD-57
1N5062	V_R = 800 V; I_{FAV} = 2 A	SOD-57

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	1N5059	$V_R = V_{RRM}$	200	V
		1N5060	$V_R = V_{RRM}$	400	V
		1N5061	$V_R = V_{RRM}$	600	V
		1N5062	$V_R = V_{RRM}$	800	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	50	A
Average forward current	T_{thJA} = 45 K/W, T_{amb} = 50 °C		I_{FAV}	2	A
	T_{thJA} = 100 K/W, T_{amb} = 75 °C		I_{FAV}	0.8	A
Pulse energy in avalanche mode, non repetitive (inductive load switch off)	$I_{(BR)R}$ = 1 A, inductive load		E_R	20	mJ
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	45	K/W
	On PC board with spacing 25 mm	R_{thJA}	100	K/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX	UNIT
Forward voltage	I_F = 1 A		V_F	-	-	1	V
	I_F = 2.5 A		V_F	-	-	1.15	V
Reverse current	$V_R = V_{RRM}$		I_R	-	-	1	µA
	$V_R = V_{RRM}$, T_j = 100 °C		I_R	-	-	10	µA
	$V_R = V_{RRM}$, T_j = 150 °C		I_R	-	-	100	µA
Breakdown voltage	I_R = 100 µA	1N5059	$V_{(BR)R}$	225	-	1600	V
		1N5060	$V_{(BR)R}$	450	-	1600	V
		1N5061	$V_{(BR)R}$	650	-	1600	V
		1N5062	$V_{(BR)R}$	900	-	1600	V
Diode capacitance	V_R = 0 V, f = 1 MHz		C_D	-	40	-	pF
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A		t_{rr}	-	-	4	µs

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

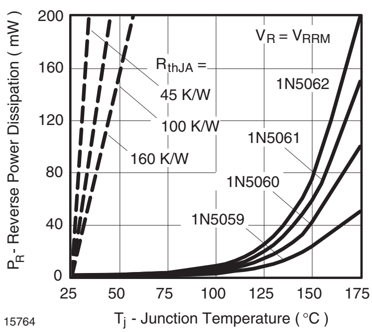


Fig. 1 - Max. Reverse Power Dissipation vs. Junction Temperature

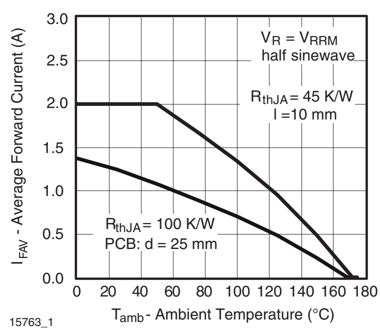


Fig. 3 - Max. Average Forward Current vs. Ambient Temperature

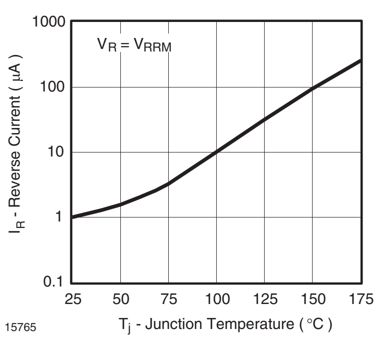


Fig. 2 - Max. Reverse Current vs. Junction Temperature

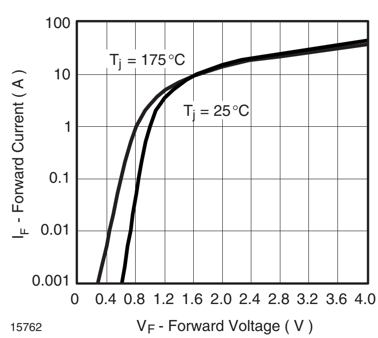


Fig. 4 - Max. Forward Current vs. Forward Voltage

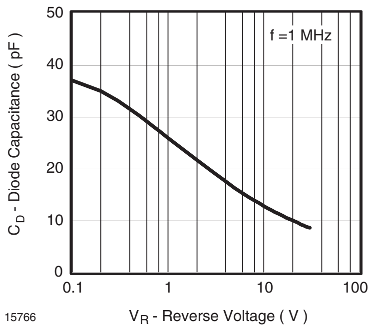
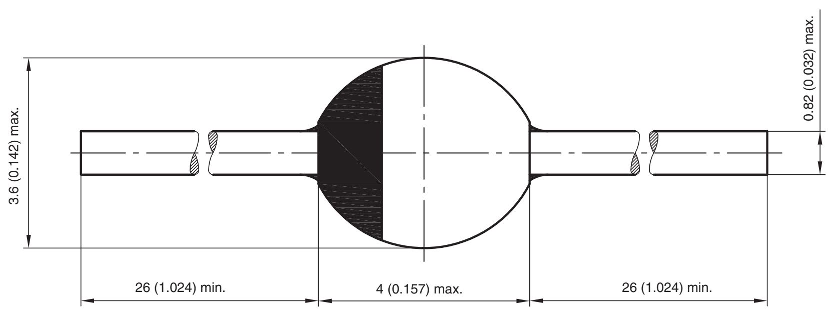


Fig. 5 - Diode Capacitance vs. Reverse Voltage

PACKAGE DIMENSIONS in millimeters (inches): **SOD-57**



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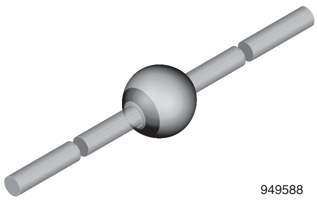
Document no.:6.563-5006.3-4

Standard Avalanche Sinterglass Diode


949588

FEATURES

- Glass passivated junction
- Hermetically sealed package
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

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RoHS COMPLIANT
HALOGEN FREE

APPLICATIONS

- High voltage rectification
- Efficiency diode in horizontal deflection circuit

MECHANICAL DATA

Case: SOD-64

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 858 mg

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BY228	V_R = 1500 V; I_{FAV} = 3 A	SOD-64

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Reverse voltage	See electrical characteristics	V_R	1500	V
Repetitive peak reverse voltage	I_R = 100 µA	V_{RRM}	1650	V
Peak forward surge current	t_p = 10 ms, half sine wave	I_{FSM}	50	A
Average forward current		I_{FAV}	3	A
Junction temperature		T_j	140	°C
Storage temperature range		T_{stg}	- 55 to + 175	°C
Non repetitive reverse avalanche energy	$I_{(BR)R}$ = 0.4 A	E_R	10	mJ

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	On PC board with spacing 25 mm	R_{thJA}	70	K/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX	UNIT
Forward voltage	I_F = 5 A	V_F	-	-	1.5	V
Reverse current	V_R = 1500 V	I_R	-	2	5	µA
	V_R = 1500 V, T_j = 140 °C	I_R	-	-	140	µA
Total reverse recovery time	I_F = 1 A, - dI_F/dt = 0.05 A/µs	t_{rr}	-	-	20	µs
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A	t_{rr}	-	-	2	µs

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

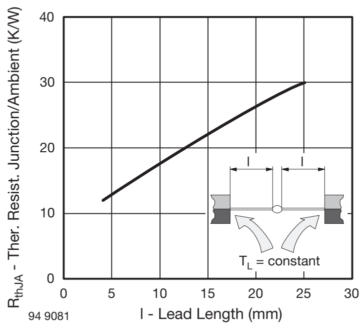


Fig. 1 - Typ. Thermal Resistance vs. Lead Length

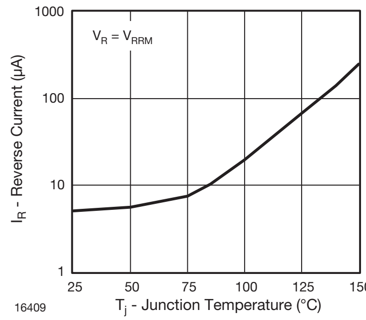


Fig. 4 - Reverse Current vs. Junction Temperature

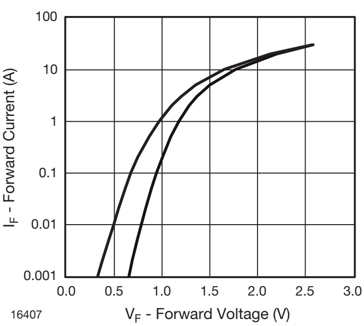


Fig. 2 - Forward Current vs. Forward Voltage

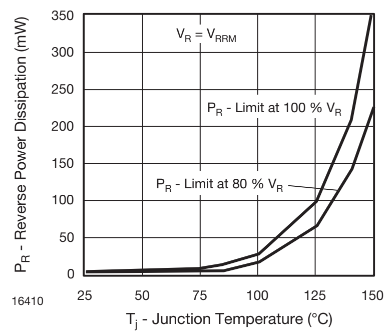


Fig. 5 - Max. Reverse Power Dissipation vs. Junction Temperature

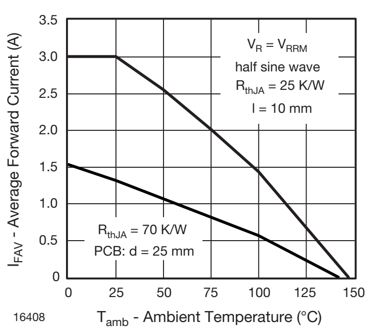


Fig. 3 - Max. Average Forward Current vs. Ambient Temperature

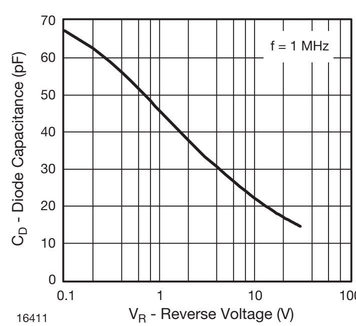
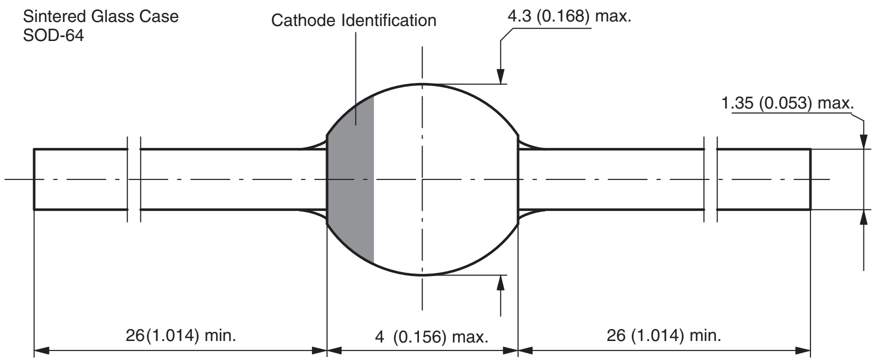


Fig. 6 - Diode Capacitance vs. Reverse Voltage

PACKAGE DIMENSIONS in millimeters (inches): **SOD-64**



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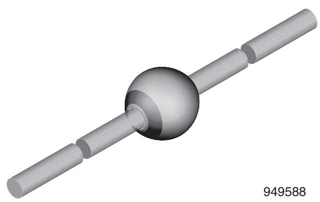
Standard Avalanche Sinterglass Diode



949588

FEATURES

- Glass passivated junction
- Hermetically sealed package
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

RoHS COMPLIANT
HALOGEN FREE

APPLICATIONS

- High voltage rectification
- Effficiency diode in horizontal deflection circuits

MECHANICAL DATA

Case: SOD-64

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 858 mg

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BY228-13	V_R = 1000 V; I_{FAV} = 3 A	SOD-64
BY228-15	V_R = 1200 V; I_{FAV} = 3 A	SOD-64

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Peak reverse voltage, non repetitive	I_R = 100 µA	BY228-13	V_{RSM}	1300	V
		BY228-15	V_{RSM}	1500	V
Reverse voltage	See electrical characteristics	BY228-13	V_R	1000	V
		BY228-15	V_R	1200	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	50	A
Average forward current			I_{FAV}	3	A
Junction temperature			T_j	140	°C
Storage temperature range			T_{stg}	- 55 to + 175	°C
Non repetitive reverse avalanche energy	$I_{(BR)R}$ = 0.4 A		E_R	10	mJ

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	On PC board with spacing 25 mm	R_{thJA}	70	K/W

For technical questions within your region, please contact one of the following:
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
Document Number: 86004
Rev. 1.7, 09-Aug-10

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX**	**UNIT**
Forward voltage	I_F = 5 A		V_F	-	-	1.5	V
Reverse current	V_R = 1000 V	BY228-13	I_R	-	2	5	μA
	V_R = 1200 V	BY228-15	I_R	-	2	5	μA
	V_R = 1000 V, T_j = 140 °C	BY228-13	I_R	-	-	140	μA
	V_R = 1200 V, T_j = 140 °C	BY228-15	I_R	-	-	140	μA
Total reverse recovery time	I_F = 1 A, - dI_F/dt = 0.05 A/μs		t_{rr}	-	-	20	μs
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A		t_{rr}	-	-	2	μs

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

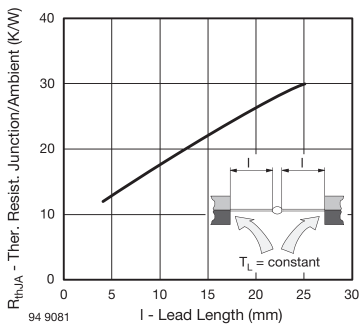


Fig. 1 - Typ. Thermal Resistance vs. Lead Length

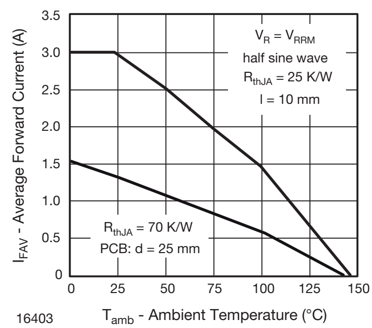


Fig. 3 - Max. Average Forward Current vs. Ambient Temperature

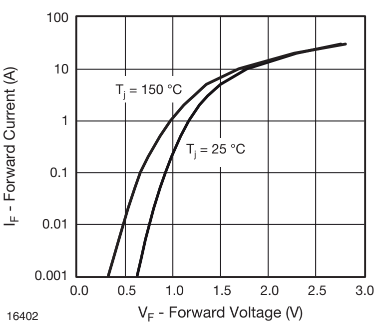


Fig. 2 - Forward Current vs. Forward Voltage

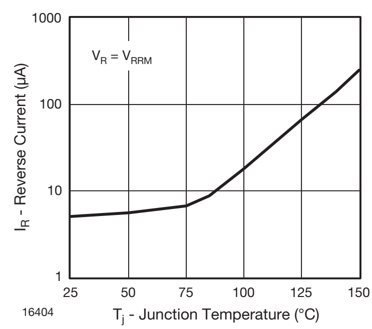


Fig. 4 - Reverse Current vs. Junction Temperature

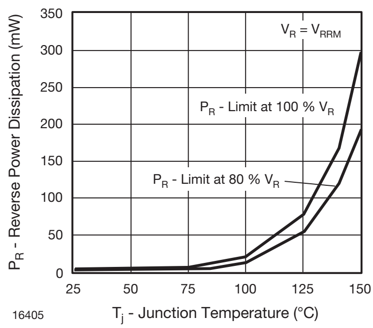


Fig. 5 - Diode Capacitance vs. Reverse Voltage

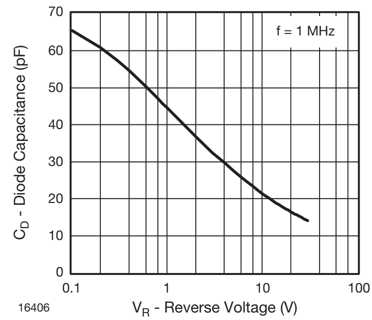
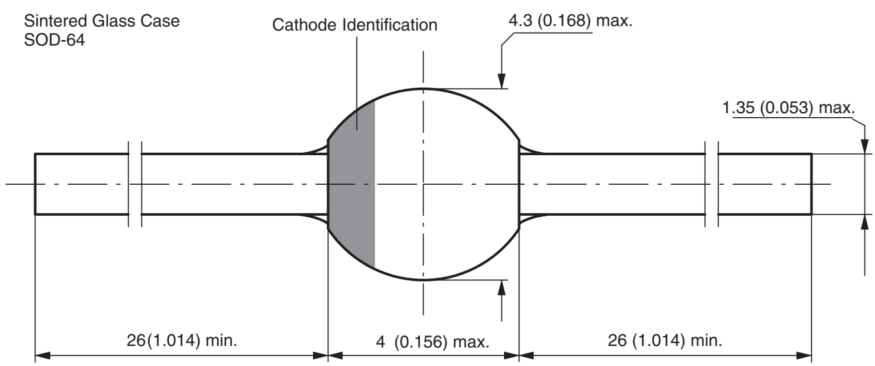


Fig. 6 - Diode Capacitance vs. Reverse Voltage

PACKAGE DIMENSIONS in millimeters (inches): **SOD-64**



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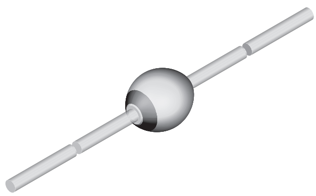
Standard Avalanche Sinterglass Diode



949539

FEATURES

- Glass passivated junction
- Hermetically sealed package
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

RoHS COMPLIANT
HALOGEN FREE

APPLICATIONS

- High voltage rectification
- Efficiency diode in horizontal deflection circuits

MECHANICAL DATA

Case: SOD-57

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 369 mg

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BY448	V_R = 1500 V; I_{FAV} = 2 A	SOD-57
BY458	V_R = 1200 V; I_{FAV} = 2 A	SOD-57

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage	See electrical characteristics	BY448	$V_R = V_{RRM}$	1500	V
		BY458	$V_R = V_{RRM}$	1200	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	30	A
Average forward current			I_{FAV}	2	A
Junction temperature			T_j	140	°C
Storage temperature range			T_{stg}	- 55 to + 175	°C
Non repetitive reverse avalanche energy	$I_{(BR)R}$ = 0.4 A		E_R	10	mJ

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	l = 10 mm, T_L = constant	R_{thJA}	45	K/W
	On PC board with spacing 25 mm	R_{thJA}	100	K/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX	UNIT
Forward voltage	I_F = 3 A	V_F	-	-	1.6	V
Reverse current	$V_R = V_{RRM}$	I_R	-	-	3	µA
	$V_R = V_{RRM}$, T_j = 140 °C	I_R	-	-	140	µA
Total reverse recovery time	I_F = 1 A, - dI_F/dt = 0.05 A/µs	t_{rr}	-	-	20	µs
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A	t_{rr}	-	-	2	µs

For technical questions within your region, please contact one of the following:
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

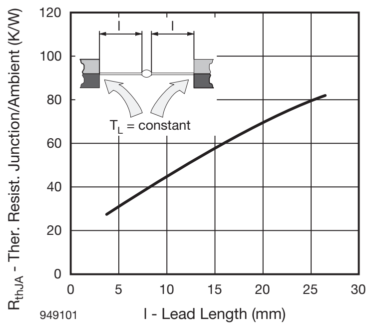


Fig. 1 - Typ. Thermal Resistance vs. Lead Length

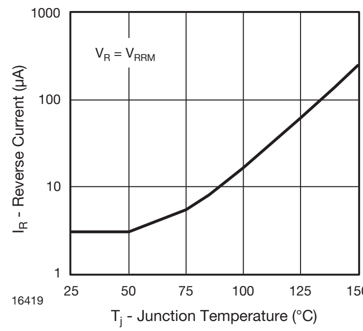


Fig. 4 - Reverse Current vs. Junction Temperature

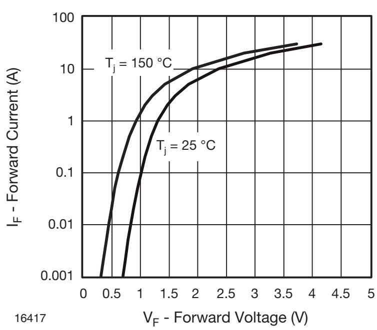


Fig. 2 - Forward Current vs. Forward Voltage

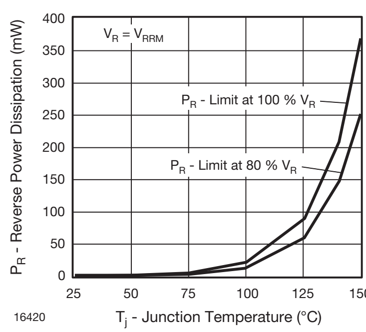


Fig. 5 - Max. Reverse Power Dissipation vs. Junction Temperature

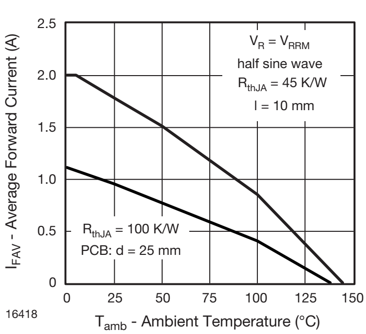


Fig. 3 - Max. Average Forward Current vs. Ambient Temperature

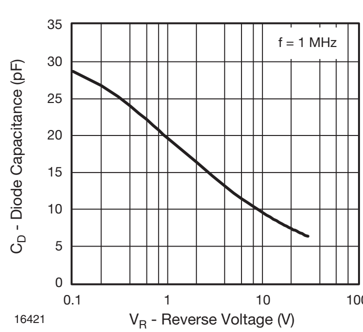
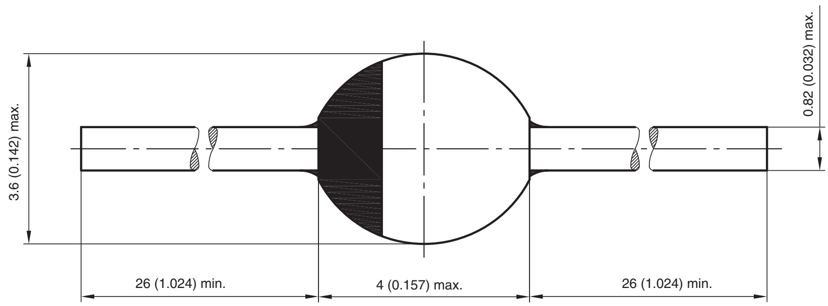


Fig. 6 - Diode Capacitance vs. Reverse Voltage

PACKAGE DIMENSIONS in millimeters (inches): **SOD-57**



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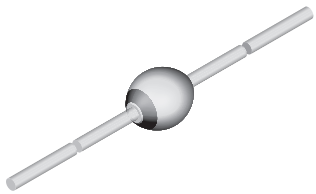
Rev. 3 - Date: 09.February 2005
Document no.:6.563-5006.3-4

Standard Avalanche Sinterglass Diode


949539

MECHANICAL DATA

Case: SOD-57

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 369 mg

FEATURES

- Controlled avalanche characteristics
- Glass passivated junction
- Hermetically sealed package
- Low reverse current
- High surge current capability
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

RoHS COMPLIANT HALOGEN FREE

APPLICATIONS

- General purpose

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BY527	V_R = 800 V; I_{FAV} = 2 A	SOD-57

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Reverse voltage, non repetitive	I_R = 100 µA	V_{RSM}	1250	V
Reverse voltage	See electrical characteristics	V_R	800	V
Peak forward surge current	t_p = 10 ms, half sine wave	I_{FSM}	50	A
Repetitive peak forward current		I_{FRM}	12	A
Average forward current	φ = 180°	I_{FAV}	2	A
Pulse avalanche peak power	T_j = 175 °C, t_p = 20 µs, half sinus wave	P_R	1000	W
Pulse energy in avalanche mode, non repetitive (inductive load switch off)	$I_{(BR)R}$ = 1 A, T_j = 175 °C	E_R	20	mJ
i^2t rating		i^2 t	8	A^2 s
Junction and storage temperature range		$T_j = T_{stg}$	-55 to + 175	°C

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	45	K/W
	On PC board with spacing 25 mm	R_{thJA}	100	K/W

Standard Avalanche Sinterglass Diode

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX**	**UNIT**
Forward voltage	I_F = 1 A	V_F	-	0.9	1	V
	I_F = 10 A	V_F	-	-	1.65	V
Reverse current	V_R = 800 V	I_R	-	0.1	1	µA
	V_R = 800 V, T_j = 100 °C	I_R	-	5	10	µA
Breakdown voltage	I_R = 100 µA, t_p/T = 0.01, t_p = 0.3 ms	$V_{(BR)}$	1250	-	-	V
Diode capacitance	V_R = 4 V, f = 1 MHz	C_D	-	16	-	pF
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A	t_{rr}	-	-	4	µs
	I_F = 1 A, dI/dt = 5 A/µs, V_R = 50 V	t_{rr}	-	-	4	µs
Reverse recovery charge	I_F = 1 A, dI/dt = 5 A/µs	Q_{rr}	-	-	3	µC

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

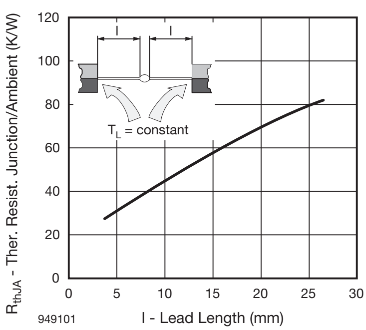


Fig. 1 - Typ. Thermal Resistance vs. Lead Length

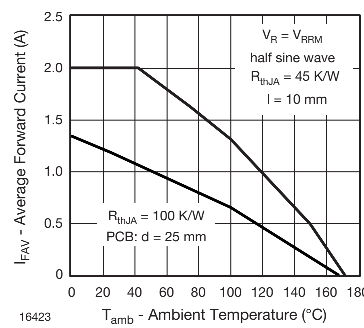


Fig. 3 - Max. Average Forward Current vs. Ambient Temperature

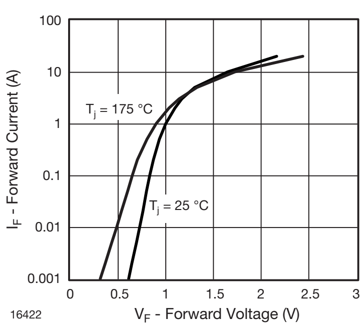


Fig. 2 - Forward Current vs. Forward Voltage

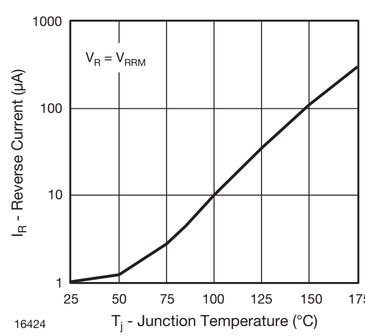


Fig. 4 - Reverse Current vs. Junction Temperature

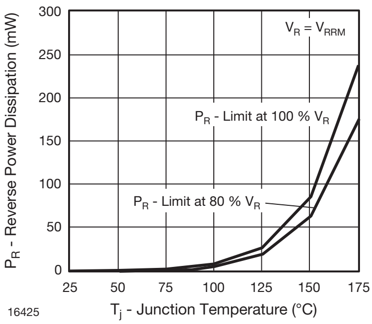


Fig. 5 - Max. Reverse Power Dissipation vs. Junction Temperature

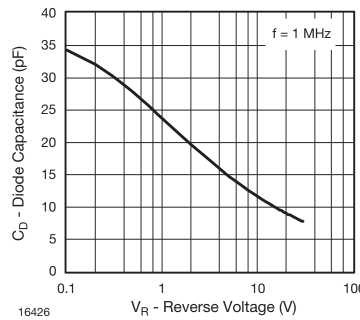


Fig. 6 - Diode Capacitance vs. Reverse Voltage

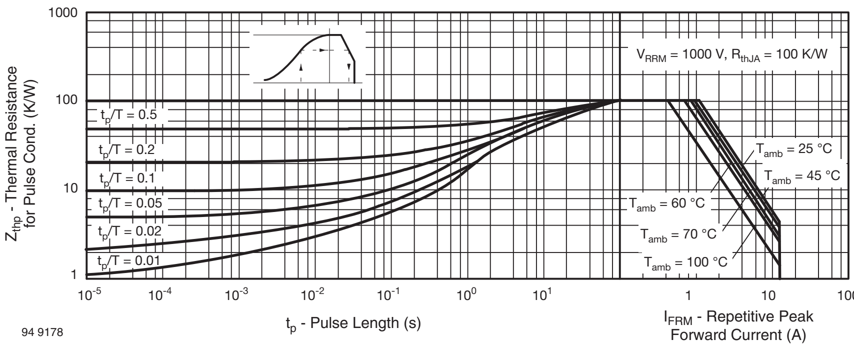
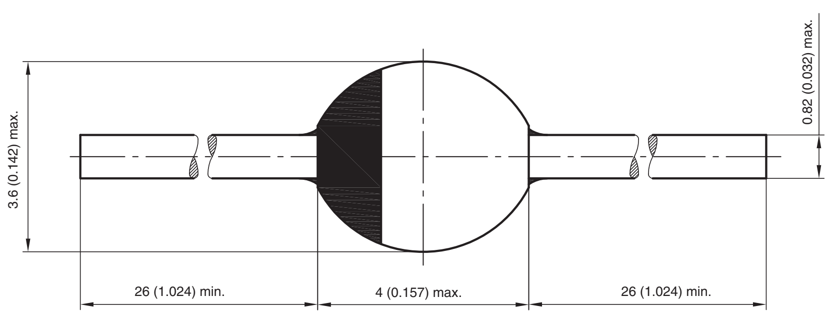


Fig. 7 - Thermal Response

PACKAGE DIMENSIONS in millimeters (inches): **SOD-57**



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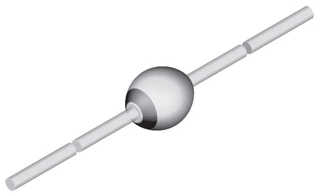
Standard Avalanche Sinterglass Diode



FEATURES

- Glass passivated junction
- Hermetically sealed package
- Low reverse current
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

Pb e2 RoHS COMPLIANT HALOGEN FREE

APPLICATIONS

- Rectification diode

MECHANICAL DATA

Case: SOD-57

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 369 mg

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BYT51A	V_R = 50 V; I_{FAV} = 1.5 A	SOD-57
BYT51B	V_R = 100 V; I_{FAV} = 1.5 A	SOD-57
BYT51D	V_R = 200 V; I_{FAV} = 1.5 A	SOD-57
BYT51G	V_R = 400 V; I_{FAV} = 1.5 A	SOD-57
BYT51J	V_R = 600 V; I_{FAV} = 1.5 A	SOD-57
BYT51K	V_R = 800 V; I_{FAV} = 1.5 A	SOD-57
BYT51M	V_R = 1000 V; I_{FAV} = 1.5 A	SOD-57

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	BYT51A	$V_R = V_{RRM}$	50	V
		BYT51B	$V_R = V_{RRM}$	100	V
		BYT51D	$V_R = V_{RRM}$	200	V
		BYT51G	$V_R = V_{RRM}$	400	V
		BYT51J	$V_R = V_{RRM}$	600	V
		BYT51K	$V_R = V_{RRM}$	800	V
		BYT51M	$V_R = V_{RRM}$	1000	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	50	A
Repetitive peak forward current			I_{FRM}	9	A
Average forward current	On PC board		I_{FAV}	1	A
	l = 10mm		I_{FAV}	1.5	A
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C
Non repetitive reverse avalanche energy	$I_{(BR)R}$ = 1 A		E_R	20	mJ

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	45	K/W
	On PC board with spacing 25 mm	R_{thJA}	100	K/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX**	**UNIT**
Forward voltage	I_F = 1 A		V_F	-	0.95	1.1	V
	I_F = 1 A, T_j = 175 °C		V_F	-	-	1	V
Reverse current	$V_R = V_{RRM}$		I_R	-	-	1	µA
	$V_R = V_{RRM}$, T_j = 150 °C		I_R	-	-	100	µA
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A		t_{rr}	-	-	4	µs

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

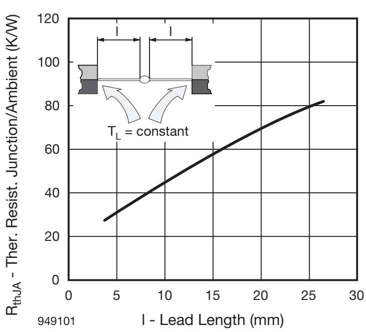


Fig. 1 - Typ. Thermal Resistance vs. Lead Length

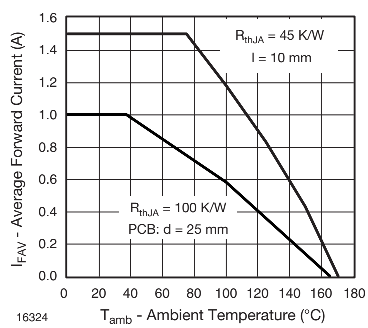


Fig. 3 - Max. Average Forward Current vs. Ambient Temperature

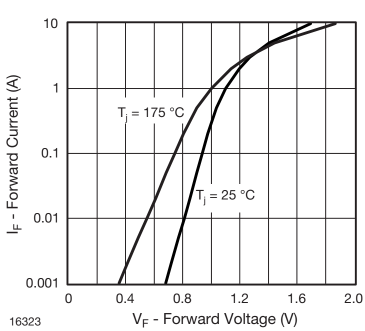


Fig. 2 - Forward Current vs. Forward Voltage

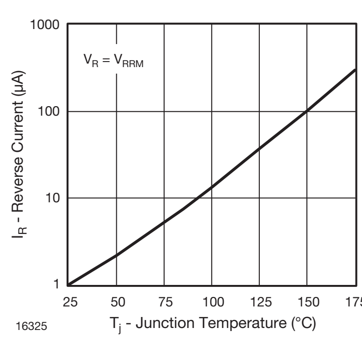


Fig. 4 - Reverse Current vs. Junction Temperature

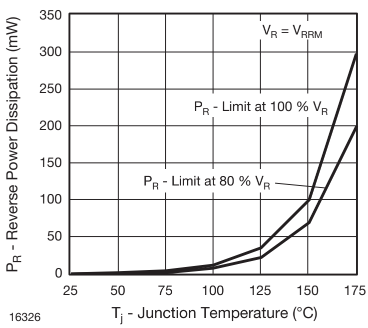


Fig. 5 - Max. Reverse Power Dissipation vs. Junction Temperature

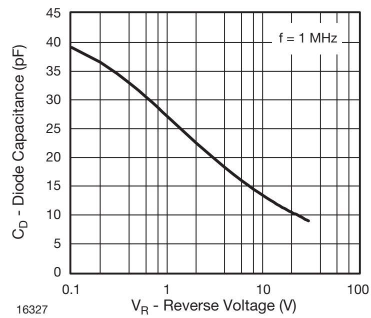
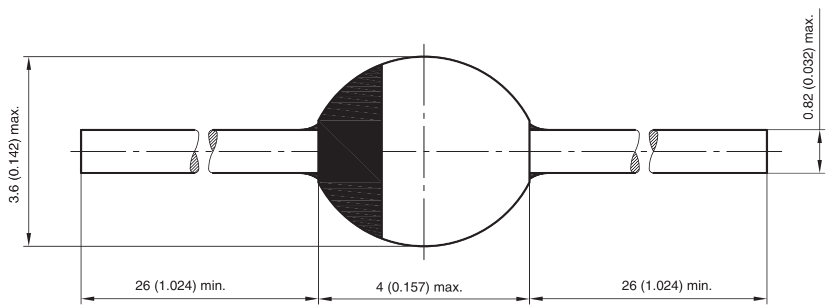


Fig. 6 - Diode Capacitance vs. Reverse Voltage

PACKAGE DIMENSIONS in millimeters (inches): **SOD-57**



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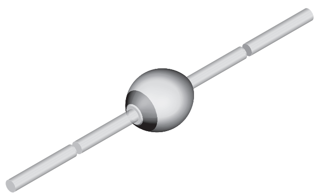
Standard Avalanche Sinterglass Diode



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FEATURES

- Glass passivated junction
- Hermetically sealed package
- Controlled avalanche characteristics
- Low reverse current
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

RoHS COMPLIANT
HALOGEN FREE

MECHANICAL DATA

Case: SOD-57

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 369 mg

APPLICATIONS

- High voltage rectification diode

PARTS TABLE		
PART	**TYPE DIFFERENTIATION**	**PACKAGE**
BYT62	V_R = 2400 V; I_{FAV} = 350 mA	SOD-57

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	$V_R = V_{RRM}$	2400	V
Peak forward surge current	t_p = 10 ms, half sine wave	I_{FSM}	10	A
Average forward current	$R_{thJA} \leq$ 60 K/W	I_{FAV}	350	mA
Non repetitive reverse avalanche energy	$I_{(BR)R}$ = 1 A, inductive load	E_R	60	mJ
Junction temperature		T_j	175	°C
Storage temperature range		T_{stg}	- 55 to + 190	°C

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	60	K/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX**	**UNIT**
Forward voltage	I_F = 200 mA	V_F	-	-	3	V
	I_F = 1 A	V_F	-	-	3.6	V
	I_F = 1 A, T_j = 175 °C	V_F	-	-	2.9	V
	I_F = 1 A, T_j = - 40 °C	V_F	-	-	4	V
Reverse current	$V_R = V_{RRM}$	I_R	-	-	5	µA
	$V_R = V_{RRM}$, T_j = 175 °C	I_R	-	-	250	µA
	$V_R = V_{RRM}$, T_j = - 40 °C	I_R	-	-	400	nA
Reverse breakdown voltage	I_R = 100 µA	$V_{(BR)R}$	2500	-	-	V
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A	t_{rr}	-	-	5	µs

For technical questions within your region, please contact one of the following:
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

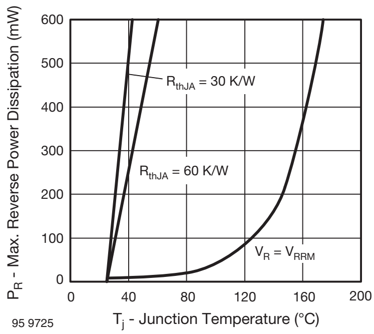


Fig. 1 - Max. Reverse Power Dissipation vs. Junction Temperature

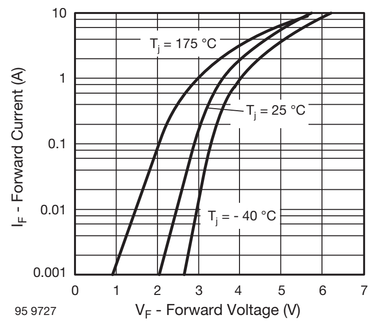


Fig. 3 - Max. Forward Current vs. Forward Voltage

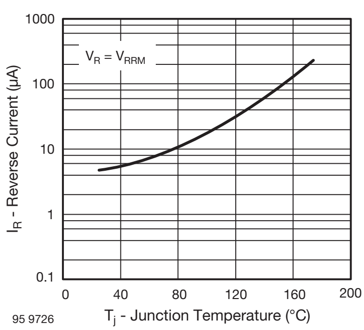
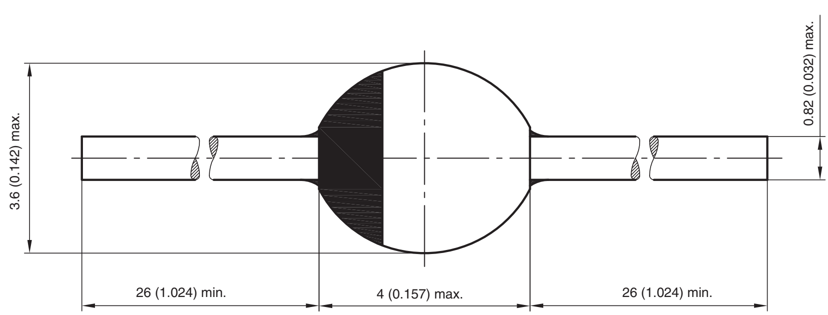


Fig. 2 - Max. Reverse Current vs. Junction Temperature

PACKAGE DIMENSIONS in millimeters (inches): **SOD-57**



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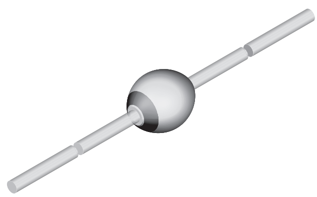
Standard Avalanche Sinterglass Diode



949539

MECHANICAL DATA

Case: SOD-57

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 369 mg

FEATURES

- Controlled avalanche characteristics
- Glass passivated junction
- Hermetically sealed package
- Low reverse current
- High surge current loading
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

e2 RoHS COMPLIANT HALOGEN FREE

APPLICATIONS

- Rectification, general purpose

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BYW52	V_R = 200 V; I_{FAV} = 2 A	SOD-57
BYW53	V_R = 400 V; I_{FAV} = 2 A	SOD-57
BYW54	V_R = 600 V; I_{FAV} = 2 A	SOD-57
BYW55	V_R = 800 V; I_{FAV} = 2 A	SOD-57
BYW56	V_R = 1000 V; I_{FAV} = 2 A	SOD-57

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	BYW52	$V_R = V_{RRM}$	200	V
		BYW53	$V_R = V_{RRM}$	400	V
		BYW54	$V_R = V_{RRM}$	600	V
		BYW55	$V_R = V_{RRM}$	800	V
		BYW56	$V_R = V_{RRM}$	1000	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	50	A
Repetitive peak forward current			I_{FRM}	12	A
Average forward current	φ = 180 °		I_{FAV}	2	A
Pulse avalanche peak power	t_p = 20 μs half sine wave, T_j = 175 °C		P_R	1000	W
Pulse energy in avalanche mode, non repetitive (inductive load switch off)	$I_{(BR)R}$ = 1 A, T_j = 175 °C		E_R	20	mJ
i^2t-rating			i^2t	8	A^2s
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	45	K/W
	On PC board with spacing 25 mm	R_{thJA}	100	K/W

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Document Number: 86049
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ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX**	**UNIT**
Forward voltage	I_F = 1 A	V_F	-	0.9	1	V
Reverse current	$V_R = V_{RRM}$	I_R	-	0.1	1	µA
	$V_R = V_{RRM}$, T_j = 100 °C	I_R	-	5	10	µA
Breakdown voltage	I_R = 100 µA, t_p/T = 0.01, t_p = 0.3 ms	$V_{(BR)}$	-	-	1600	V
Diode capacitance	V_R = 4 V, f = 1 MHz	C_D	-	18	-	pF
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A	t_{rr}	-	-	4	µs
	I_F = 1 A, dI/dt = 5 A/µs, V_R = 50 V	t_{rr}	-	-	4	µs
Reverse recovery charge	I_F = 1 A, dI/dt = 5 A/µs	Q_{rr}	-	-	200	nC

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

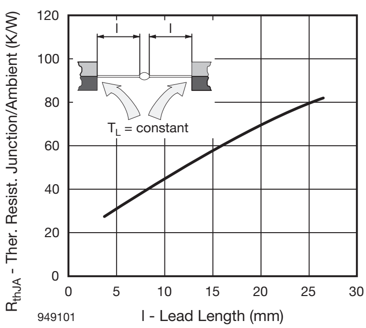

Fig. 1 - Typ. Thermal Resistance vs. Lead Length

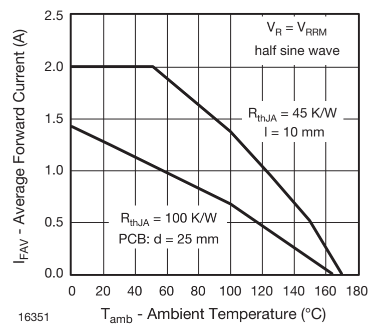

Fig. 3 - Max. Average Forward Current vs. Ambient Temperature

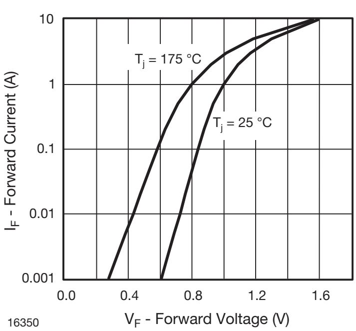

Fig. 2 - Forward Current vs. Forward Voltage

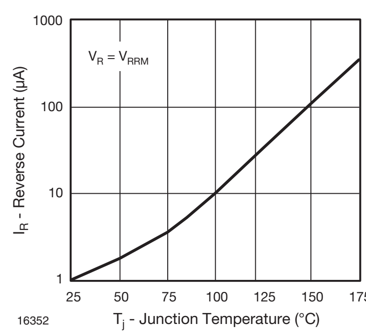

Fig. 4 - Reverse Current vs. Junction Temperature

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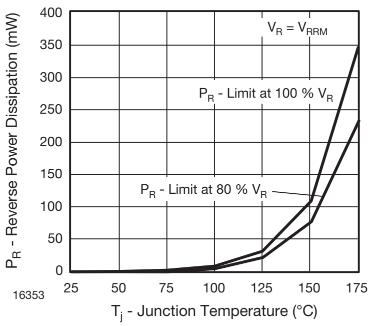


Fig. 5 - Max. Reverse Power Dissipation vs. Junction Temperature

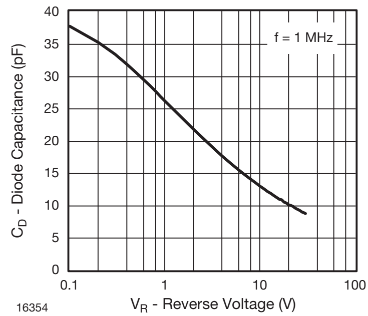


Fig. 6 - Diode Capacitance vs. Reverse Voltage

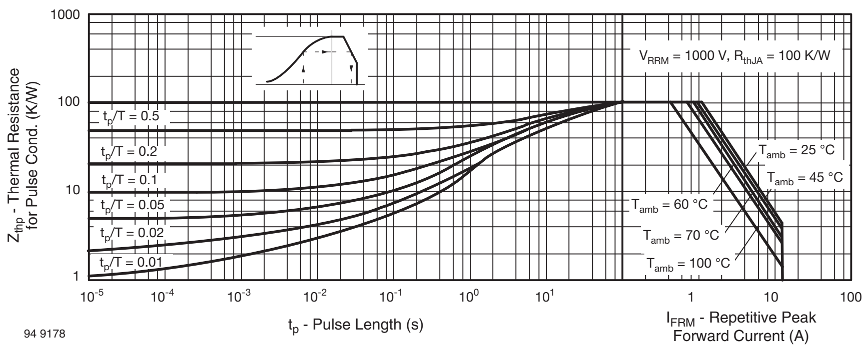
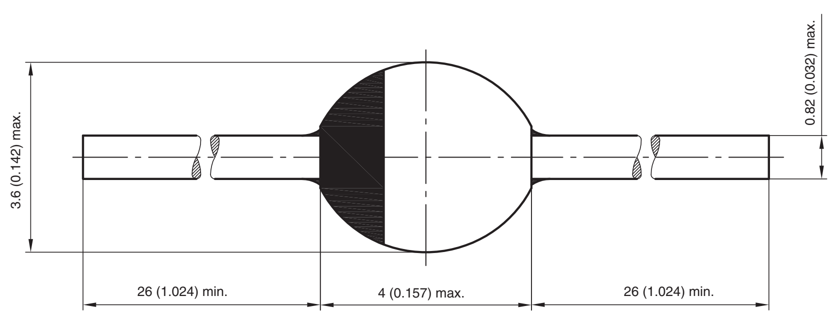


Fig. 7 - Thermal Response

PACKAGE DIMENSIONS in millimeters (inches): **SOD-57**



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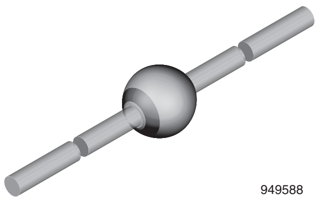
Document no.:6.563-5006.3-4

Standard Avalanche Sinterglass Diode


949588

FEATURES

- Glass passivated junction
- Hermetically sealed package
- Controlled avalanche characteristics
- Low reverse current
- High surge current loading
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

RoHS COMPLIANT
HALOGEN FREE

MECHANICAL DATA

Case: SOD-64

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 858 mg

APPLICATIONS

- Rectification, general purpose

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BYW82	V_R = 200 V; I_{FAV} = 3 A	SOD-64
BYW83	V_R = 400 V; I_{FAV} = 3 A	SOD-64
BYW84	V_R = 600 V; I_{FAV} = 3 A	SOD-64
BYW85	V_R = 800 V; I_{FAV} = 3 A	SOD-64
BYW86	V_R = 1000 V; I_{FAV} = 3 A	SOD-64

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	BYW82	$V_R = V_{RRM}$	200	V
		BYW83	$V_R = V_{RRM}$	400	V
		BYW84	$V_R = V_{RRM}$	600	V
		BYW85	$V_R = V_{RRM}$	800	V
		BYW86	$V_R = V_{RRM}$	1000	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	100	A
Repetitive peak forward current			I_{FRM}	18	A
Average forward current			I_{FAV}	3	A
Pulse avalanche peak power	t_p = 20 µs, half sine wave, T_j = 175 °C		P_R	1000	W
Pulse energy in avalanche mode, non repetitive (inductive load switch off)	$I_{(BR)R}$ = 1 A, T_j = 175 °C		E_R	20	mJ
i^2t-rating			i^2t	40	A^2s
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	25	K/W
	On PC board with spacing 25 mm	R_{thJA}	70	K/W

Standard Avalanche Sinterglass Diode

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX**	**UNIT**
Forward voltage	I_F = 3 A	V_F	-	-	1	V
Reverse current	$V_R = V_{RRM}$	I_R	-	0.1	1	μA
	$V_R = V_{RRM}$, T_j = 100 °C	I_R	-	5	10	μA
Breakdown voltage	I_R = 100 μA, t_p/T = 0.01, t_p = 0.3 ms	$V_{(BR)}$	-	-	1600	V
Diode capacitance	V_R = 4 V, f = 1 MHz	C_D	-	40	60	pF
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A	t_{rr}	-	3.5	5	μs
	I_F = 1 A, dI/dt = 5 A/μs, V_R = 50 V	t_{rr}	-	4.5	7.5	μs
Reverse recovery charge	I_F = 1 A, dI/dt = 5 A/μs	Q_{rr}	-	8	12	μC

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

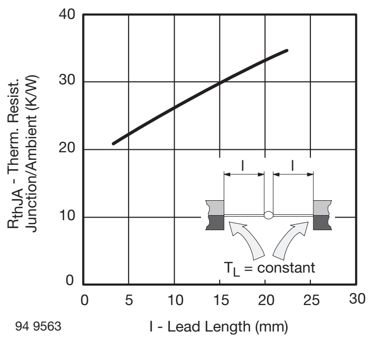


Fig. 1 - Max. Thermal Resistance vs. Lead Length

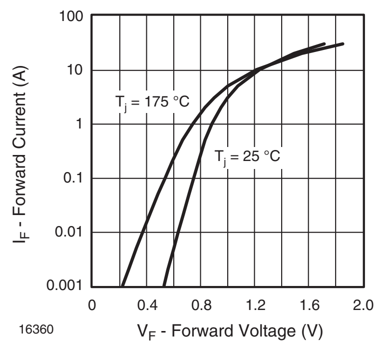


Fig. 3 - Forward Current vs. Forward Voltage

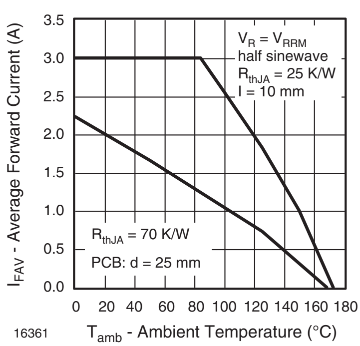


Fig. 2 - Max. Average Forward Current vs. Ambient Temperature

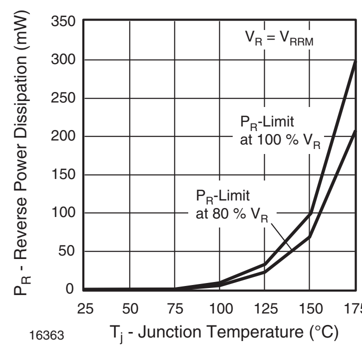


Fig. 4 - Max. Reverse Power Dissipation vs. Junction Temperature

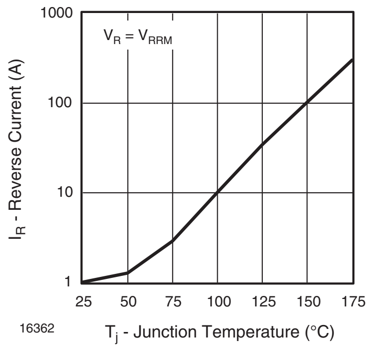


Fig. 5 - Reverse Current vs. Junction Temperature

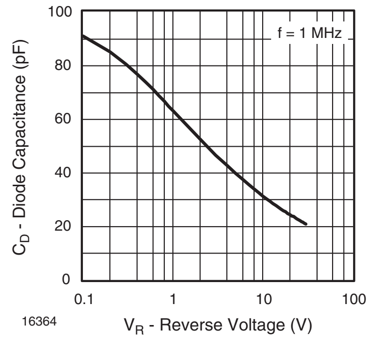


Fig. 6 - Diode Capacitance vs. Reverse Voltage

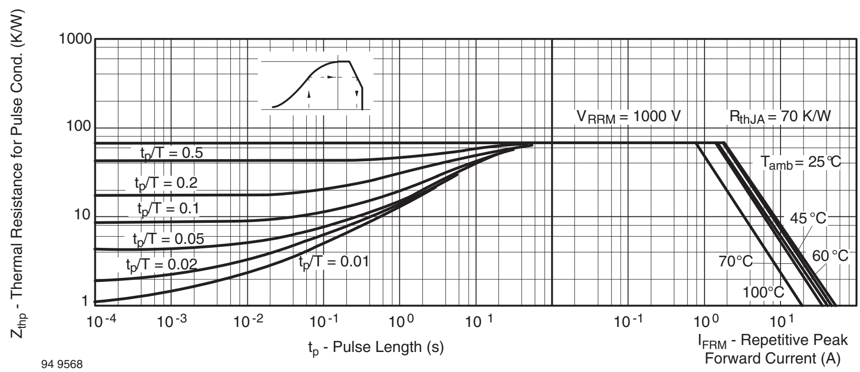
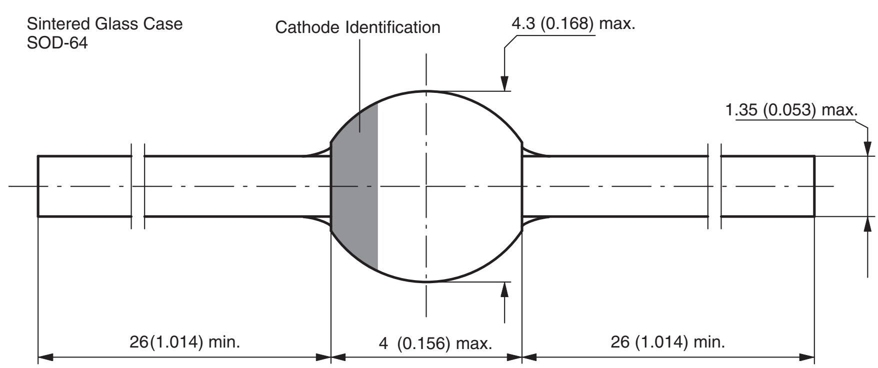


Fig. 7 - Thermal Response

PACKAGE DIMENSIONS in millimeters (inches): **SOD-64**



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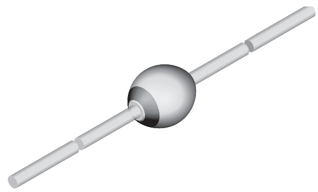
Rev. 3 - Date: 09.February.2005
94 9587

Standard Avalanche Sinterglass Diode



949539

MECHANICAL DATA

Case: SOD-57

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 369 mg

FEATURES

- Glass passivated junction
- Hermetically sealed package
- Low reverse current
- High surge current loading
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

e2
RoHS COMPLIANT
HALOGEN FREE

APPLICATIONS

- Rectification, general purpose

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
BYX82	V_R = 200 V; I_{FAV} = 2 A	SOD-57
BYX83	V_R = 400 V; I_{FAV} = 2 A	SOD-57
BYX84	V_R = 600 V; I_{FAV} = 2 A	SOD-57
BYX85	V_R = 800 V; I_{FAV} = 2 A	SOD-57
BYX86	V_R = 1000 V; I_{FAV} = 2 A	SOD-57

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	BYX82	$V_R = V_{RRM}$	200	V
		BYX83	$V_R = V_{RRM}$	400	V
		BYX84	$V_R = V_{RRM}$	600	V
		BYX85	$V_R = V_{RRM}$	800	V
		BYX86	$V_R = V_{RRM}$	1000	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	50	A
Repetitive peak forward current			I_{FRM}	10	A
Average forward current	$T_{amb} \leq 45$ °C		I_{FAV}	2	A
i^2t-rating			$i^2 t$	8	A^2s
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	45	K/W
	On PC board with spacing 25 mm	R_{thJA}	100	K/W

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Document Number: 86052
Rev. 1.6, 09-Aug-10

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX**	**UNIT**
Forward voltage	I_F = 1 A	V_F	-	0.9	1	V
Reverse current	$V_R = V_{RRM}$	I_R	-	0.1	1	µA
	$V_R = V_{RRM}$, T_j = 100 °C	I_R	-	10	25	µA
Diode capacitance	V_R = 4 V, f = 1 MHz	C_D	-	20	-	pF
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A	t_{rr}	-	2	4	µs
Reverse recovery charge	$I_F = I_R$ = 1 A, dI/dt = 5 A/µs	Q_{rr}	-	3	6	µC

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

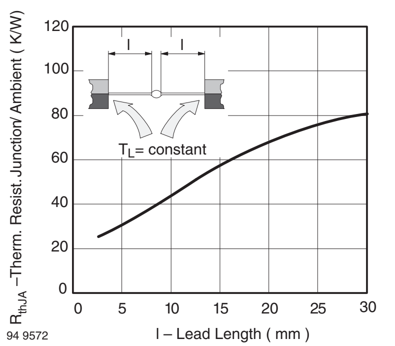


Fig. 1 - Max. Thermal Resistance vs. Lead Length

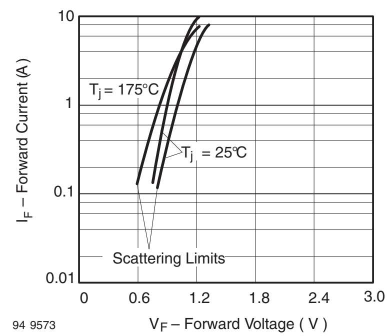


Fig. 3 - Forward Current vs. Forward Voltage

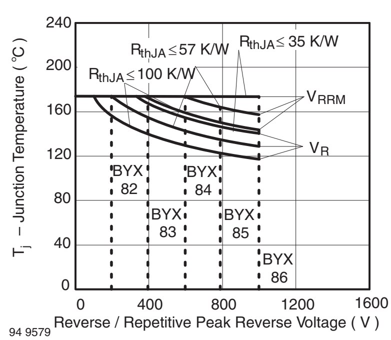


Fig. 2 - Junction Temperature vs. Reverse/Repetitive Peak Reverse Voltage

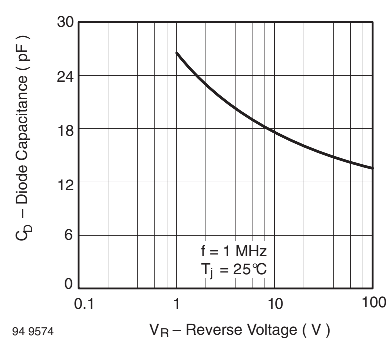


Fig. 4 - Typ. Diode Capacitance vs. Reverse Voltage

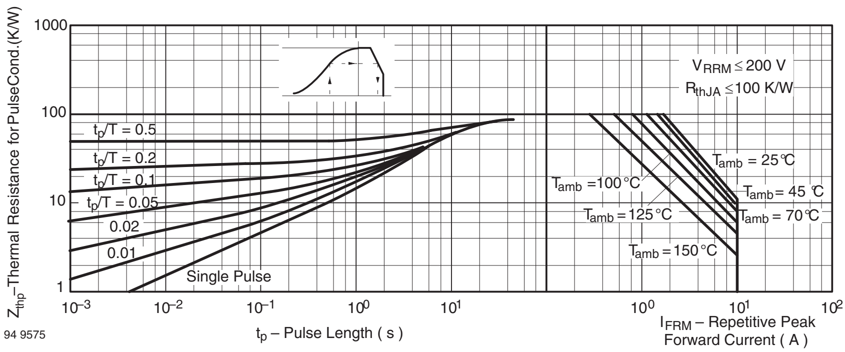


Fig. 5 - Thermal Response

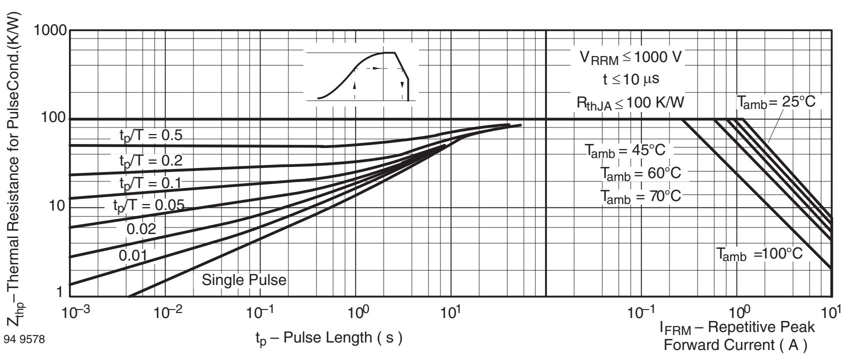


Fig. 6 - Thermal Response

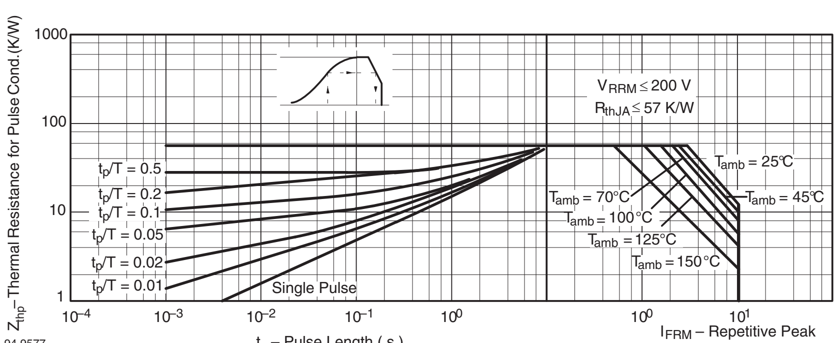


Fig. 7 - Thermal Response

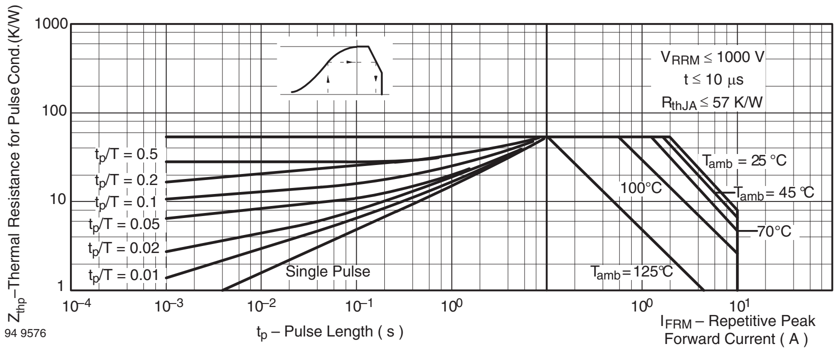
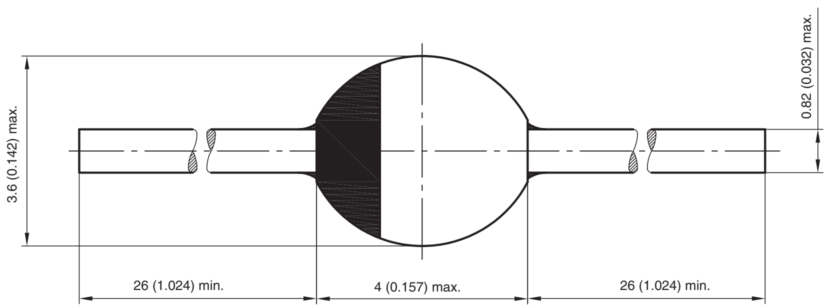


Fig. 8 - Thermal Response

PACKAGE DIMENSIONS in millimeters (inches): **SOD-57**



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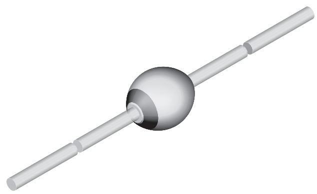
Standard Avalanche Sinterglass Diode



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FEATURES

- Glass passivated junction
- Hermetically sealed package
- Controlled avalanche characteristics
- Low reverse current
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21 definition

RoHS COMPLIANT
HALOGEN FREE

MECHANICAL DATA

Case: SOD-57

Terminals: plated axial leads, solderable per MIL-STD-750, method 2026

Polarity: color band denotes cathode end

Mounting position: any

Weight: approx. 369 mg

APPLICATIONS

- High voltage
- Power supplies

PARTS TABLE

PART	TYPE DIFFERENTIATION	PACKAGE
S330D	V_R = 1000 V; I_{FAV} = 2 A	SOD-57

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
Reverse voltage = repetitive peak reverse voltage	See electrical characteristics	S330D	$V_R = V_{RRM}$	1000	V
Peak forward surge current	t_p = 10 ms, half sine wave		I_{FSM}	50	A
Average forward current	T_{amb} = 50 °C, l = 10 mm		I_{FAV}	2	A
Pulse energy in avalanche mode, non repetitive (inductive load switch off)	$I_{(BR)R}$ = 1 A, inductive load		E_R	20	mJ
Junction and storage temperature range			$T_j = T_{stg}$	- 55 to + 175	°C

MAXIMUM THERMAL RESISTANCE (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Junction ambient	Lead length l = 10 mm, T_L = constant	R_{thJA}	45	K/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX	UNIT
Forward voltage	I_F = 1 A		V_F	-	-	1	V
	I_F = 10 A		V_F	-	-	1.65	V
Reverse current	$V_R = V_{RRM}$		I_R	-	-	5	μA
	$V_R = V_{RRM}$, T_j = 100 °C		I_R	-	-	50	μA
Breakdown voltage	I_R = 100 μA		$V_{(BR)R}$	1300	-	-	V
Reverse recovery time	I_F = 0.5 A, I_R = 1 A, i_R = 0.25 A		t_{rr}	-	-	4	μs

For technical questions within your region, please contact one of the following:
DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
Document Number: 86053
Rev. 1.6, 25-Aug-10

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

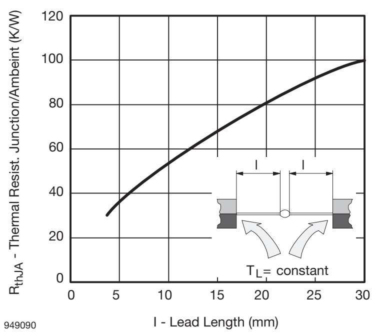


Fig. 1 - Typ. Thermal Resistance vs. Lead Length

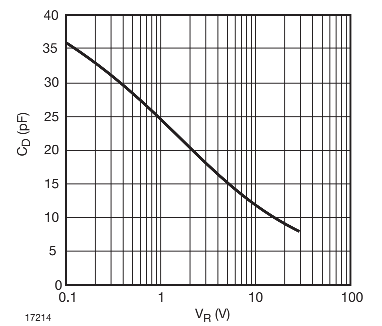


Fig. 4 - Diode Capacitance vs. Reverse Voltage

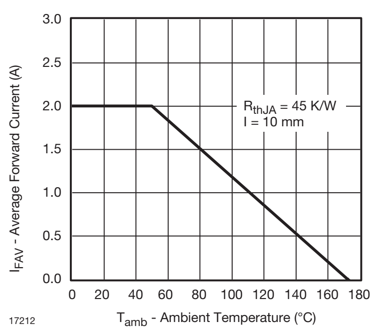


Fig. 2 - Max. Average Forward Current vs. Ambient Temperature

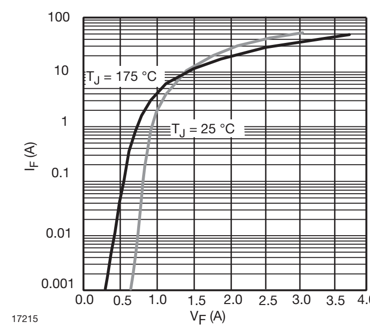


Fig. 5 - Diode Capacitance vs. Reverse Voltage

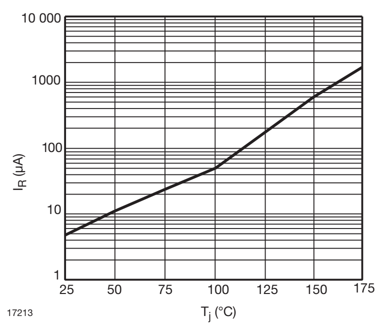


Fig. 3 - Reverse Current vs. Junction Temperature

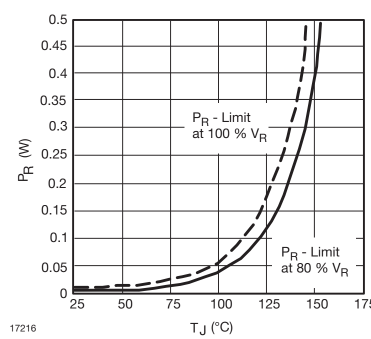
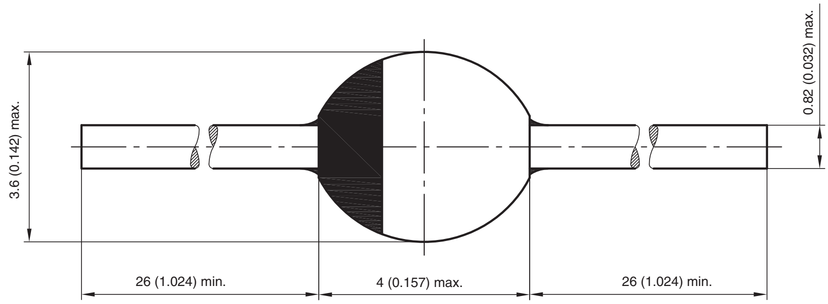


Fig. 6 - Max. Reverse Power Dissipation vs. Junction Temperature

PACKAGE DIMENSIONS in millimeters (inches): **SOD-57**



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