Current regulating diode

CRD

Current regulating diodes (CRD hereunder) are diodes that maintain a constant current flow despite voltage fluctuations. CRDs supply constant current over a wide range of voltage from less than 1V to 100V. Constant current is supplied regardless of fluctuations in voltage applied, load resistance changes and ripple voltage. Creating a constant current circuit generally involves multiple components, but with SEMITEC CRDs only one part is required to accomplish the same function.

Product number explanation

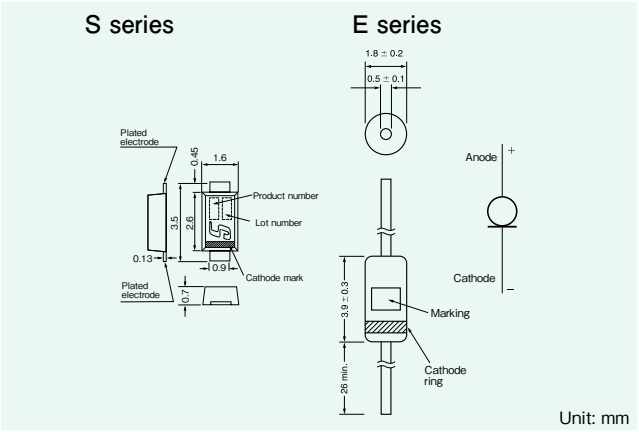
□ 102 □

Packing method
No marking: Untaped bulk products
26Z: 26 mm width; axial taping; Z folding
26R: 26 mm width; axial taping; reel
52Z: 52 mm width; axial taping; Z folding
T: S series only; SMD reel taping

Pinch-off current
E.g.: 301: 30 x 10^1 µA = 0.3 mA
102: 10 x 10^2 µA = 1.0 mA
452: 45 x 10^2 µA = 4.5 mA

E: Leaded type
S: SMD type

Dimensions



Unit: mm

Applications

- Constant current source for LED brightness stabilization
- LED street lights, LED fluorescent lamps, LED light bulbs, LED downlights
- Constant voltage circuit for supplying constant current to Zener diodes
- Constant current source for proximity sensors and other sensors
- Battery charge / discharge circuits
- Electrolytic capacitor aging equipment
- Constant current test equipment for various semiconductor devices
- Telecommunications line interface
- Earth leakage circuit breakers
- Current source for piezoelectric actuators
- Stabilized power supply circuits

Specifications

General

	E series	S series
Rated power	300 mW	500 mW
Rated voltage (pulse wave)	100 V (E-101 to E-562)	100 V (S-101 to S-562)
	50 V (E-822 to E183)	50 V (S-822 to S-223)
Allowable reverse current	50 mA	
Junction temperature	150 ℃	
Operating temperature range	– 30 to 150 ℃	– 40 to 150 ℃

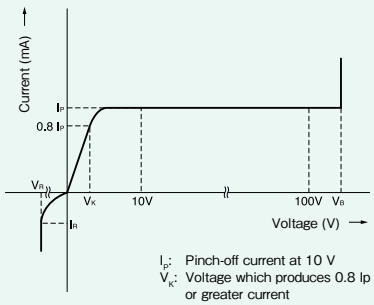
Recommended maximum voltage

Product number	Voltage	Product number	Voltage
E-101 to E-562	100	S-101 to S-562	100
E-822	30	S-822T to S-223T	50
E-103			
E-123			
E-153	25		
E-183			

Product number		Pinch-off current (10 V)[1]		Limiting current[1]		Limiting current ratio $I_{100V}/Ip*I_{30V}/Ip$	Temperature coefficient (% / ℃)[2]
SMD	Leaded	Ip (mA) typical	Min - max	V_k (V)	I_k (mA)		
S-101T	E-101	0.10	0.05 – 0.21	0.5	0.8 Ipmin.	1.1 max	+ 2.10 to + 0.10
S-301T	E-301	0.30	0.20 – 0.4	0.8			+ 0.40 to – 0.20
S-501T	E-501	0.50	0.40 – 0.6	1.1			+ 0.15 to – 0.25
S-701T	E-701	0.70	0.60 – 0.9	1.4			0.00 to – 0.32
S-102T	E-102	1.00	0.88 – 1.3	1.7			– 0.10 to – 0.37
S-152T	E-152	1.50	1.28 – 1.7	2.0			– 0.13 to – 0.40
S-202T	E-202	2.00	1.68 – 2.3	2.3			– 0.15 to – 0.42
S-272T	E-272	2.70	2.28 – 3.1	2.7			– 0.18 to – 0.45
S-352T	E-352	3.50	3.00 – 4.1	3.2			– 0.20 to – 0.47
S-452T	E-452	4.50	3.90 – 5.1	3.7			– 0.22 to – 0.50
S-562T	E-562	5.60	5.00 – 6.5	4.5			– 0.25 to – 0.53
S-822T	E-822	8.20	6.56 – 9.8	3.1		1.0 max (I_{30}/Ip)	– 0.25 to – 0.45
S-103T	E-103	10.0	8.00 – 12.4	3.5			– 0.25 to – 0.45
S-123T	E-123	12.0	9.60 – 14.4	3.8			– 0.25 to – 0.45
S-153T	E-153	15.0	12.0 – 18.0	4.3			– 0.25 to – 0.45
S-183T	E-183	18.0	16.0 – 20.0	4.6			– 0.25 to – 0.45
New S-223T		22.5	20.0 – 25.0	5.3			– 0.25 to – 0.45

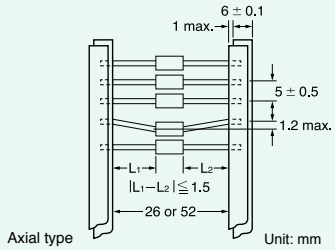
[1]: Pinch-off current and limiting current are measured by pulse wave at 25 ℃ environment temperature
[2]: Temperature coefficient is calculated from measurements at 25 and 50 ℃.

Voltage - current characteristics



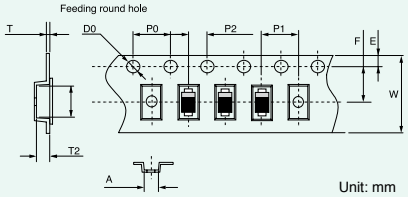
I_p: Pinch-off current at 10 V
V_K: Voltage which produces 0.8 Ip or greater current
V_B: Breakdown voltage
I_R: Permitted reverse current

Taping options
SEMITEC offers both axial and SMD taping.



Axial type

Unit: mm



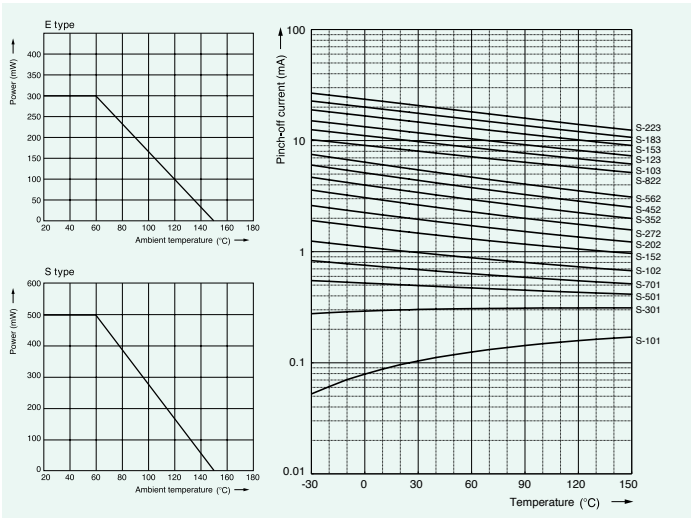
Unit: mm

A	B	W	F	E	P0	P1	P2	D0	T	T2
1.8	3.74	8.0	3.50	1.75	4.0	4.0	2.00	ϕ1.5	0.2	0.9
± 0.1	± 0.10	± 0.1	± 0.05	± 0.10	± 0.1	± 0.1	± 0.05	+ 0.1/-1	± 0.05	± 0.1

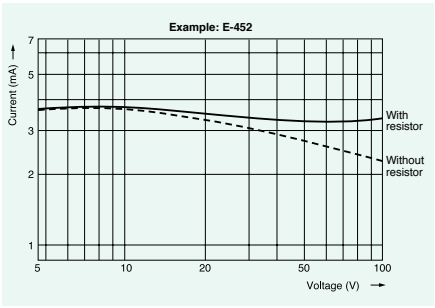
SMD element is set with the cathode side on the side with holes.

Minimum taping quantities
Axial type Reel: 5000 pcs
Box: 2500 pcs
SMD type 3000 pcs

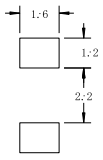
Influence of environment temperature on power and pinch-off current rating



Current - voltage characteristics with and without resistor (example)

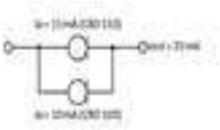


Recommended mounting pad dimensions (S series only)



CRD for higher currents

CRDs can be used in row to amplify permissable current.



CRD for higher voltages

Using CRDs in row with Zener diodes allows the use of stable currents at higher voltage values.

How to compensate current reduction due to heat up of the CRD

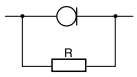
For currents of 1 mA or more resistors can be used together with CRDs to compensate for current decreases and fluctuations.
The following values are typical for compensation resistors.

Rated power: 500 mW

Product number	S-102	S-152	S-202	S-272	S-352	S-452	S-562	S-822	S-103	S-123	S-153	S-183	S-223
Recommended resistance value	1.1 MΩ	430 kΩ	300 kΩ	200 kΩ	130 kΩ	91 kΩ	62 kΩ	27 kΩ	18 kΩ	15 kΩ	12 kΩ	9 kΩ	5.6 kΩ

Rated power: 300 mW

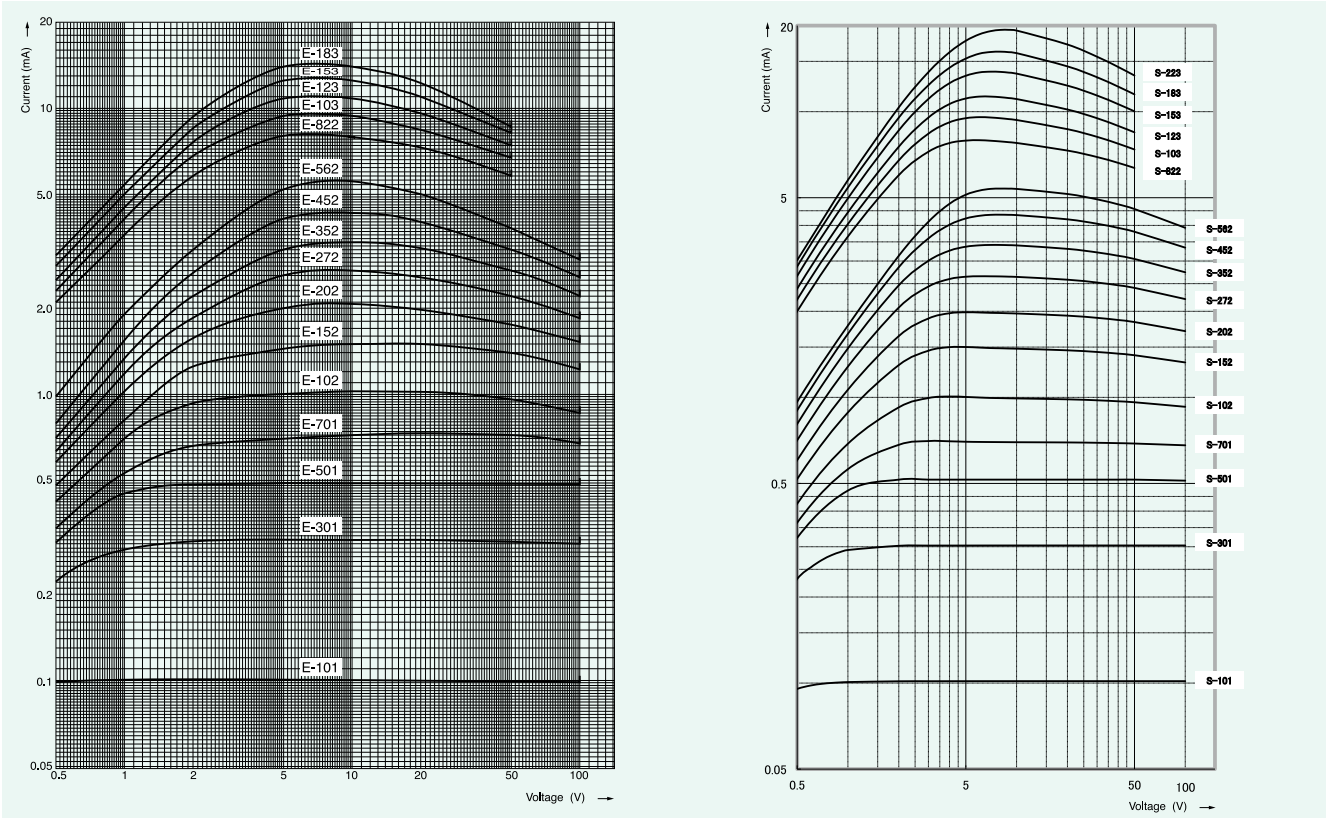
Product number	E-102	E-152	E-202	E-272	E-352	E-452	E-562	E-822	E-103	E-123	E-153	E-183
Recommended resistance value	1 MΩ	390 kΩ	240 kΩ	120 kΩ	82 kΩ	56 kΩ	39 kΩ	20 kΩ	15 kΩ	11 kΩ	9.1 kΩ	7.5 kΩ



Reliability data

Item	Test conditions	Criteria
Resistance to soldering heat	10 s at 260 °C (wave soldering)	Δ Ip ± 5%
Solderability	3 s at 245 °C Flux material: Rosin 25%, propanol 75%	More than 90% soldered
Dry heat	1000 hours at 150 °C	Δ Ip ± 5%
Damp heat (CRD S)	1000 hours at 85 °C and 85% humidity	
Damp heat (CRD E)	1000 hours at 70 °C and 90% humidity	
Temperature cycle / thermal shock (CRD S)	10 cycles as below: 1. - 55 °C for 15 minutes 2. Room temperature for 15 minutes 3. 150 °C for 15 minutes 4. Room temperature for 15 minutes	
Temperature cycle / thermal shock (CRD E)	5 cycles as below: 1. - 25 °C for 30 minutes 2. Room temperature for 15 minutes 3. 150 °C for 30 minutes 4. Room temperature for 15 minutes	

Dynamic characteristics (voltage - current)



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