

Thyristors

The Protection Products Group of World Products Inc., specializing in protection components for telecommunication and AC and DC circuits, is proud to feature World Products complete line of Thyristors.

At World Products Inc. we keep our promises. It's just that simple. You will see for yourself when you buy a World Products Thyristor that you have not only purchased a fine component, but that we will also provide the finest customer service in today's marketplace.

The main features of these Thyristors are:

- Bidirectional transient voltage protection.
- Nanosecond clamping response.
- No performance degradation under service life.
- Glass passivated junction.

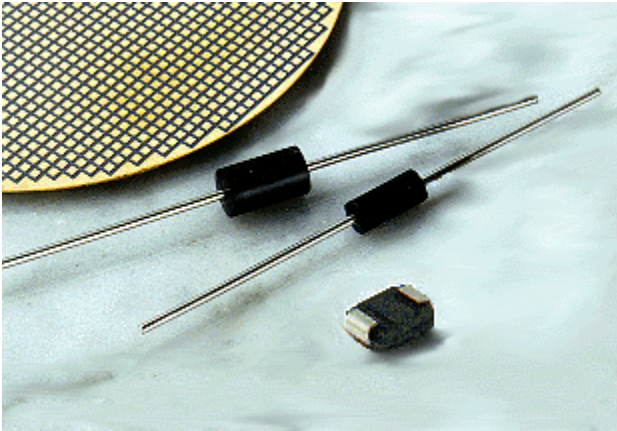
Providing the following benefits:

- Excellent voltage protection levels.
- Primary or secondary protection levels.
- Never needs replacement (no maintenance cost).
- Highest level of quality and reliability.
- Low cost auto-assembly.

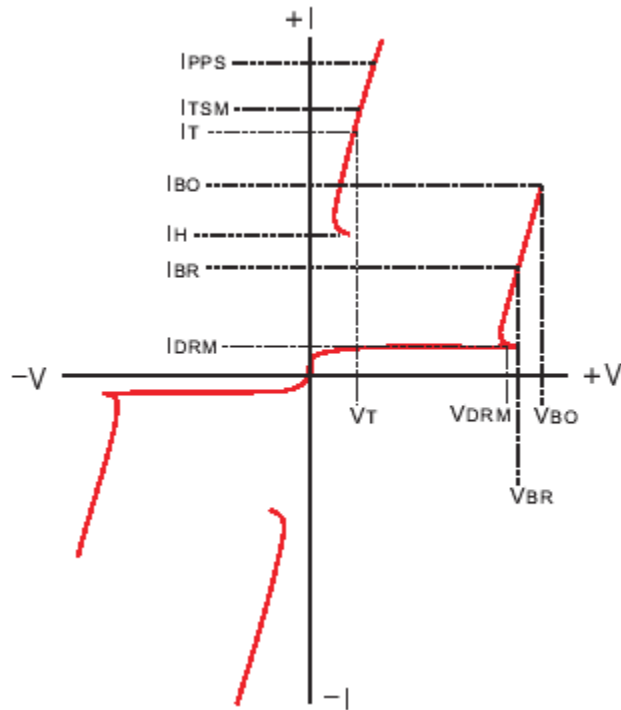
Discover why the first choice in Thyristors is World Products.

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Thyristors - Definitions



SYMBOL	CHARACTERISTIC	VALUE
V_{BO}	Max Breakover Voltage	The maximum voltage across the device in or at breakdown measured under a specified voltage and current rate of rise.
V_{BR}	Min Breakover Voltage	The minimum voltage at which the device switch-on begins and significant current flows.
I_{BO}	Breakover Current	The instantaneous current flowing at the breakover voltage. (V_{BO})
I_H	Holding Current	The minimum current required to maintain the device in the on-state.
I_T	On-state Current	The current through the device in the on-state condition.
V_T	On-state Voltage	The voltage across the device in the on-state condition at a specified current. (I_T)
V_{DRM}	Rated Repetitive Peak Off-state Voltage	Rated maximum (peak) continuous voltage that may be applied in the off-state condition.
I_{DRM}	Repetitive Peak Off-state Current	The maximum (peak) value of the current that results from the application of (V_{DRM})
I_{PPS}	Non-Repetitive Peak Pulse Current	Rated maximum value of peak impulse current of specified amplitude and waveshape that may be applied without damage to the device under test.
I_{TSM}	Non-Repetitive Surge Peak On-state Current	Rated maximum value of AC current, at a given frequency, which may be applied for specified time or number of cycles.
di/dt	Critical Rate of Rise of On-state Current.	Rated value of the rate of rise of current that the device can withstand without damage.
dv/dt	Critical Rate of Rise of Off-state Voltage.	The maximum rate of rise of voltage (below V_{DRM}) that will not cause switching from the off-state to the on-state

Thyristors - Application Notes

FEATURES

- Protects by Limiting voltages and shunting surge currents away from sensitive circuits.
- Designed for telecommunications applications such as line cards, modems, PBX, FAX, LAN, VHDSL.
- Helps meet standards such as GR1089, ITU K.20, IEC950, UL1459&50, FCC part 68.
- Low capacitance, High surge (A, B, C rating available), precise voltage limiting, Long life.

SELECTION GUIDE

Follow these steps to select the proper Thyristor surge protector for your application:

1. Define the operating parameters for the circuit:

- Ambient operating temperature range
- Maximum telephone line operating current (highest battery and shortest copper loop)
- Maximum operating voltage: (Maximum DC bias + peak ringing voltage)
- Maximum surge current
- System voltage damage threshold

2. Select device with an off-state voltage rating (VDRM) above the maximum operating voltage at the minimum operating temperature

3. Select surge current ratings (I_{PPS} and I_{TSM}) \geq those which the application must withstand

4. Verify that the minimum holding current of the device at the maximum ambient temperature is above the maximum dc current of the system

5. Verify that the maximum breakover voltage of the device is below the system damage threshold.

6. Verify that the circuit's ambient operating temperatures are within the device's operating temperature range.

7. Verify that the device's dimensions fit the application's space considerations.

8. Independently evaluate and test the suitability and performance of the device in the application

MAXIMUM THERMAL RATINGS

Rating	Symbol	Value	Unit
Storage Junction Temperature Range	T _{STG}	-50 to 150	°C
Operating Junction Temperature Range	T _J	-40 to 150	°C
Operating Ambient Temperature Range	T _A	-40 to 65	°C

Notes:

PCB board mounted on minimum foot print.

THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance Junction to leads TL on tab adjacent to plastic. Both leads soldered to identical pad sizes.	R _{ØJL}	Max. 20	°C / W

Notes:

The junction to lead thermal resistance represents a minimum limiting value with both leads soldered to a large near-infinite heatsink. The junction to ambient thermal resistance depends strongly on board mounting conditions and typically is 3 to 6 times higher than the junction to lead resistance. The data shown is to be used as guideline values for preliminary engineering.

Thyristors - Application Notes - (Continued)

ELECTRICAL CHARACTERISTICS (T_c = 25 °C UNLESS OTHERWISE NOTED)

Parameters	Test Conditions	Symbol	Min.	Max.	Unit
Repetitive Peak Off-State Current	V _D = rated V _{DRM}	I _{DRM}		5	μA
Breakover Current	f = 60 Hz, I _{sc} = 1Arms, V _{ac} = 1 KVrms, R _L = 1Kohm, 1/2 AC cycle	I _{BO}		800	mA
Holding Current	10/1000μs waveform, I _{sc} = 10A, V _{oc} = 62 V, R _L = 400 ohms	I _H	150		mA
On-State Voltage	I _T = 1 A, T _w = 300μs, 1 pulse	V _T		5	V

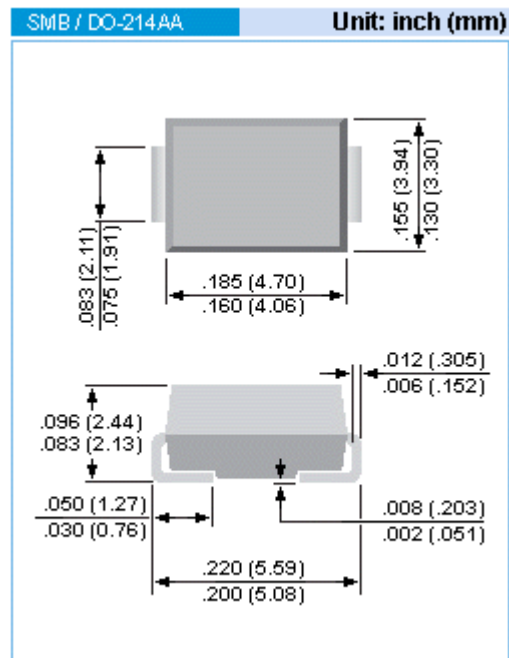
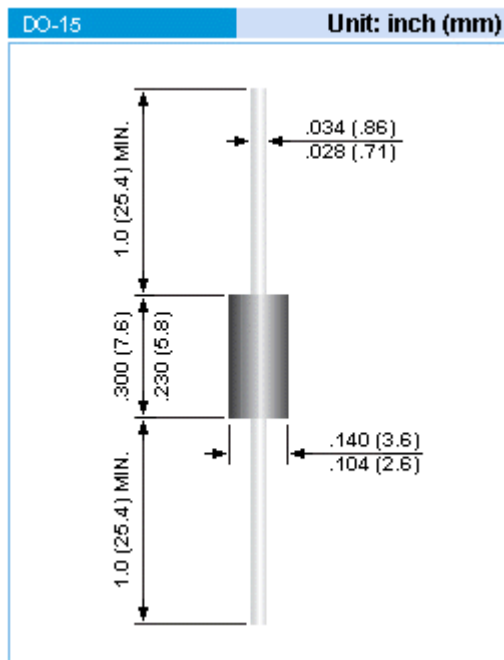
Notes:

Specific I_H values are available by request.

MECHANICAL DATA

- Case: JEDEC DO-15 molded plastic
- Terminals: Plated Axial leads, Solder per MIL-STD-750, Method 2026
- Polarity: Bi-directional
- Weight: 0.015 ounce, 0.4 gram

- Case: JEDEC DO-214AA molded plastic
- Terminals: Solder plated, Solderable per MIL-STD-750, Method 2026
- Polarity: Bi-directional Standard packaging: 12mm tape (EIA-481)
- Weight: 0.003 ounce, 0.093 gram



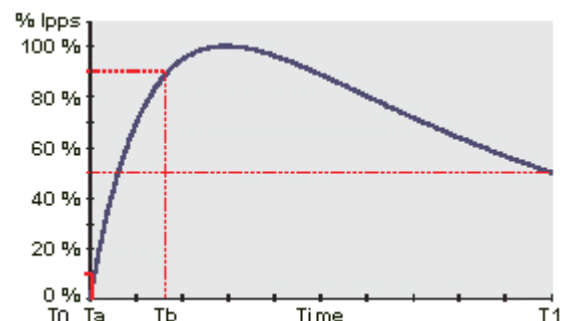
Thyristors - Maximum Surge Ratings

($T_j = 25\text{ }^\circ\text{C}$ UNLESS OTHERWISE NOTED)

Rating	Non-Repetitive Peak Pulse Current						Non-Repetitive Peak On-State Surge Current
	I_{PPS}						I_{TSM}
Symbol							
Short-Circuit Current Wave	2/10 μs	8/20 μs	10/160 μs	5/310 μs	10/560 μs	10/1000 μs	
Open-Circuit Voltage Wave	2/10 μs	1.2/50 μs	10/160 μs	10/700 μs	10/560 μs	10/1000 μs	
Value A and SA Series	175 A	150 A	100 A	85 A	70 A	50 A	20 A
Value B and SB Series	300 A	225 A	150 A	115 A	100 A	80 A	30 A
Value C and SC Series	500 A	350 A	200 A	150 A	125 A	100 A	60 A
Notes	(1,2,4,5,6)						(1,2,3,4)

Notes:

1. Thermal accumulation between successive surge tests is not allowed.
2. The device under test initially must be in thermal equilibrium with $T_j = 25\text{ }^\circ\text{C}$.
3. Test at 1 cycle, 60 Hz.
4. Surge ratings are non-repetitive because instantaneous junction temperatures may exceed the maximum rated T_j . Nevertheless, devices will survive many surge applications without degradation. Surge capability will not degrade over a device's typical operating life.
5. Adjust the surge generator for optimum current-wave accuracy when both voltage and current wave specifications cannot be exactly met. The current wave is more important than the voltage wave for accurate surge evaluation.
6. The waveform is defined as A/B ms where:
 A: (Virtual front time) = $1.25 \times \text{Rise time} = 1.25 \times (T_b - T_a)$
 B: (Duration time to 50% level of I_{PPS}) = $T_1 - T_0$



Thyristors - Electrical Characteristics

Part Number	Rated Repetitive Peak Off-State Voltage	Breakover Voltage	On-state Voltage	Repetitive Peak Off-State Current	Breakover Current	Holding Current	Off-State Capacitance ($f = 1\text{MHz}$, $V_{ac} = 15\text{mV}_{rms}$)		
	Max.	Max.	Max.	Max.	Max.	Min.	Typ.		
	V_{DRM}	$V_{BO@I_{BO}}$	$V_T@1A$	I_{DRM}	I_{BO}	I_H	$C_O @ 2V_{dc}$		
	V	V	V	μA	mA	mA	pF		
Series	A and SA, B and SB, C and SC						A SA	B SB	C SC
TSP058	58	77	5.0	5.0	800	150	36	53	69
TSP065	65	88	5.0	5.0	800	150	31	52	65
TSP075	75	98	5.0	5.0	800	150	29	49	59
TSP090	90	130	5.0	5.0	800	150	26	42	52
TSP120	120	160	5.0	5.0	800	150	24	38	47
TSP140	140	180	5.0	5.0	800	150	21	36	45
TSP160	160	220	5.0	5.0	800	150	21	34	43
TSP190	190	260	5.0	5.0	800	150	20	33	42
TSP220	220	300	5.0	5.0	800	150	19	32	42
TSP275	275	350	5.0	5.0	800	150	19	32	42
TSP320	320	400	5.0	5.0	800	150	19	32	41
Notes	(1,3)	(3,5,6)	(3)	(3)	(3)	(2,3)	(3)	(3)	(3)

Part Number Suffix:

Suffix - A,B,C
Axial Lead Type



DO-15

Suffix - SA,SB,SC
Surface Mount Type



SMB/DO-214AA

Notes:

1. Specific V_{DRM} values are available by request.
2. Specific I_H values are available by request.
3. All ratings and characteristics are at $25\text{ }^\circ\text{C}$ unless otherwise specified.
4. V_{DRM} applies for the life of the device. I_{DRM} will be in spec during and following operation of the device.
5. V_{BO1} is at 100V/msec , $I_{SC} = 10\text{A}_{pk}$, $V_{OC} = 1\text{KV}_{pk}$, 10/1000 Waveform.
6. V_{BO2} is at $f = 60\text{ Hz}$, $I_{SC} = 1\text{ A}_{(RMS)}$, $V_{ac} = 1\text{KV}_{(RMS)}$, $R_L = 1\text{ Kohm}$, 1/2 AC cycle.

Thyristors - Device Part Marking and Packing

Device Marking Codes

Axial Lead Type			Surface Mount Type		
Part Number	Marking Code		Part Number	Marking Code	*
TSP058ꝰ	TSP058ꝰ		TSP058ꝰꝰ	058*	SA = A
TSP065ꝰ	TSP065ꝰ		TSP065ꝰꝰ	065*	SB = B
TSP075ꝰ	TSP075ꝰ		TSP075ꝰꝰ	075*	SC = C
TSP090ꝰ	TSP090ꝰ		TSP090ꝰꝰ	090*	
TSP120ꝰ	TSP120ꝰ		TSP120ꝰꝰ	120*	
TSP140ꝰ	TSP140ꝰ		TSP140ꝰꝰ	140*	
TSP160ꝰ	TSP160ꝰ		TSP160ꝰꝰ	160*	
TSP190ꝰ	TSP190ꝰ		TSP190ꝰꝰ	190*	
TSP220ꝰ	TSP220ꝰ		TSP220ꝰꝰ	220*	
TSP275ꝰ	TSP275ꝰ		TSP275ꝰꝰ	275*	
TSP320ꝰ	TSP320ꝰ		TSP320ꝰꝰ	320*	

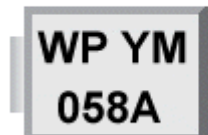
1st Line
Marking Code



2nd Line

WPI Logo
Y : Last Digit of
Calendar Year
WW : Weekly
P : Production Line

1st Line
WPI Logo
Y - Last digit of calendar year
M - Month



2nd Line
Marking Code

ꝰꝰ - Part Number Suffix:

Suffix - A,B,C - Axial Lead Type

Suffix - SA,SB,SC - Surface Mount Type



DO-15



SMB/DO-214AA

Order and Packing Information

Axial Lead Type

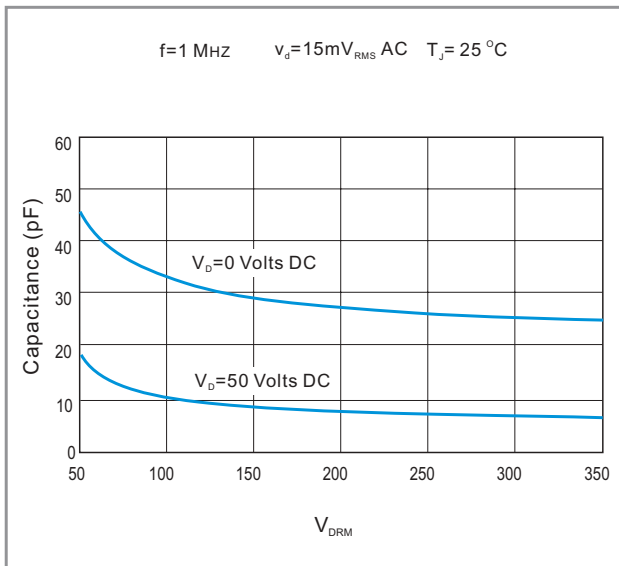
Device	Packing	Min. Order Qty.	Order As	Remark
TSPxxxꝰ	13" Tape & Reel	4,000 pcs	TSPxxxꝰ	Standard Packing
	Bulk	1,000 pcs	TSPxxxꝰ-B	
	Ammunition	3,000 pcs	TSPxxxꝰ-T/B	

Surface Mount Type

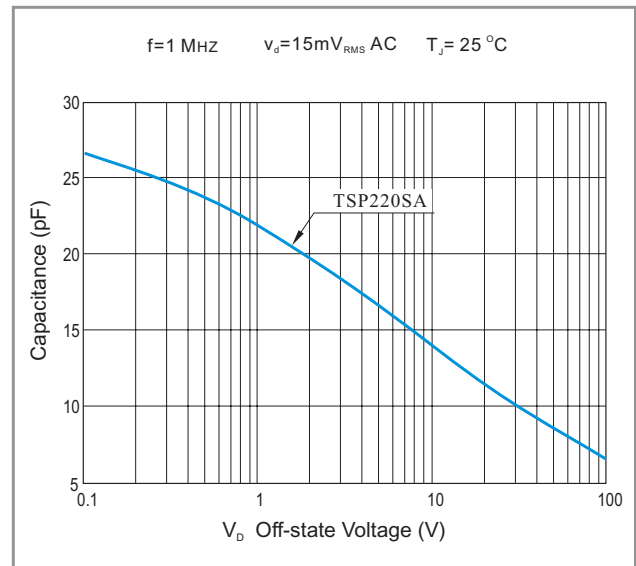
Device	Packing	Min. Order Qty.	Order As	Remark
TSPxxxꝰꝰ	13" Tape & Reel	3,000 pcs	TSPxxxꝰꝰ	Standard Packing
	7" Tape & Reel	500 pcs	TSPxxxꝰꝰ-7	

Thyristors - Rating and Characteristic Curves

A and SA Series

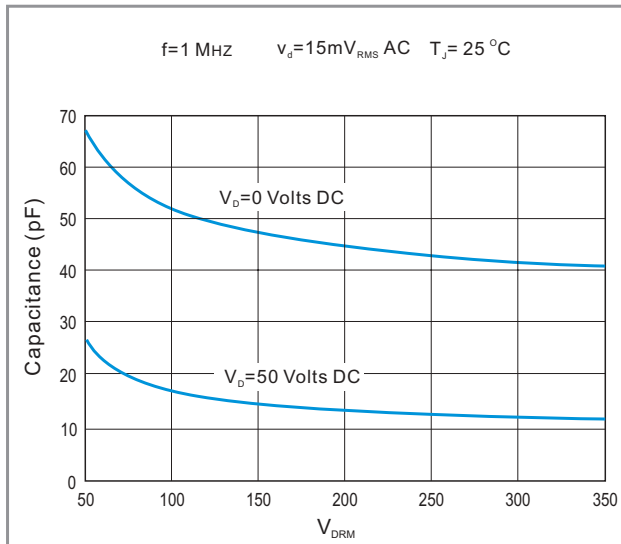


Typical Capacitance v.s. Rated Repetitive Off-state Voltage

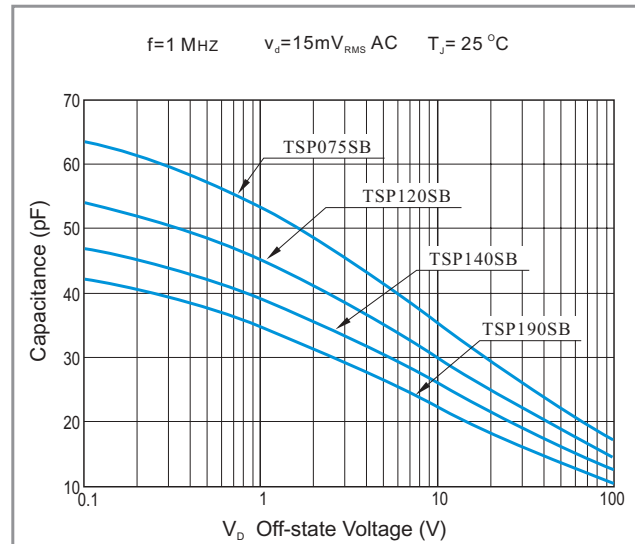


Typical Capacitance v.s. Off-state Voltage

B and SB Series

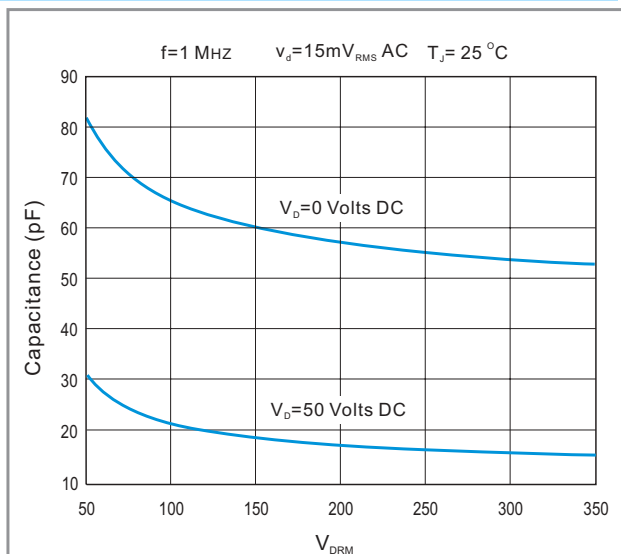


Typical Capacitance v.s. Rated Repetitive Off-state Voltage

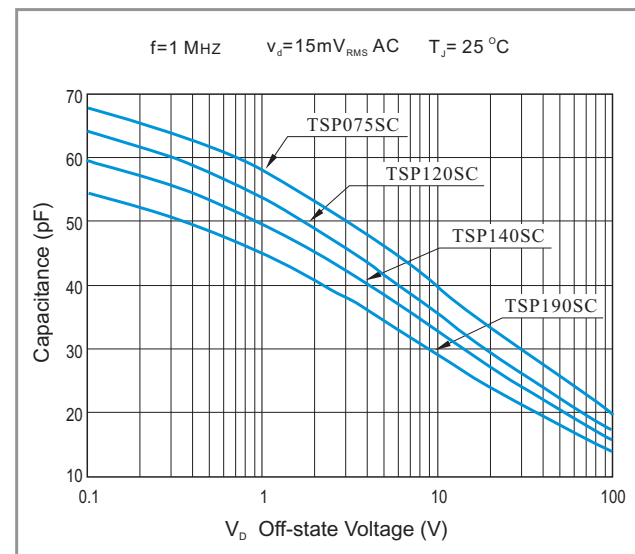


Typical Capacitance v.s. Off-state Voltage

C and SC Series



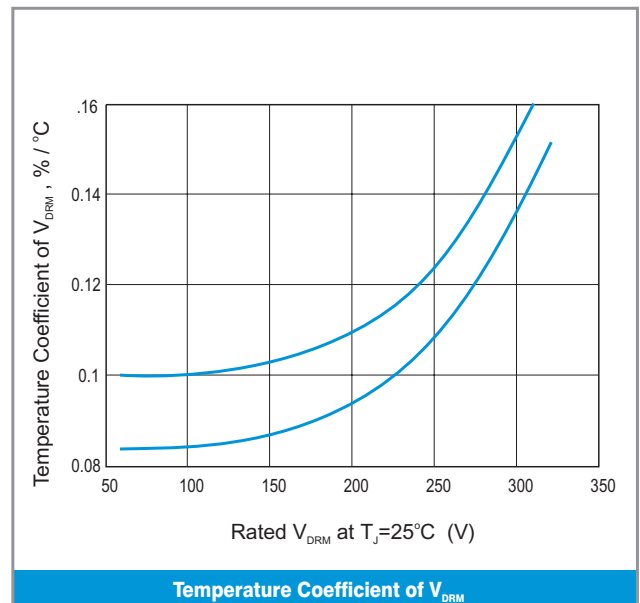
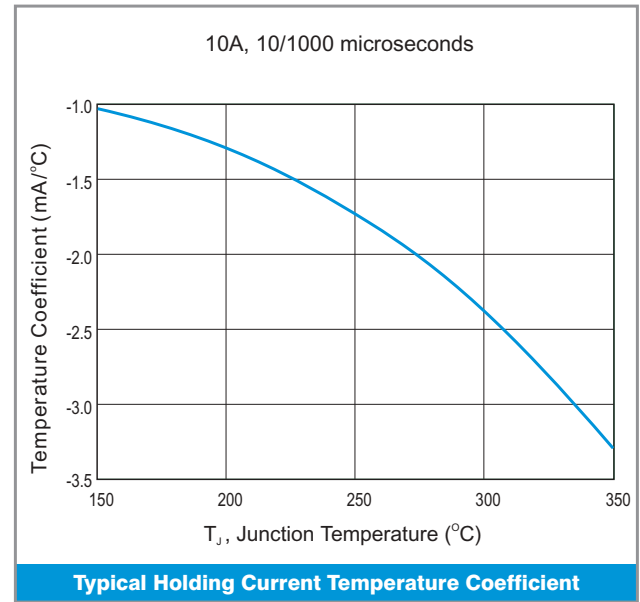
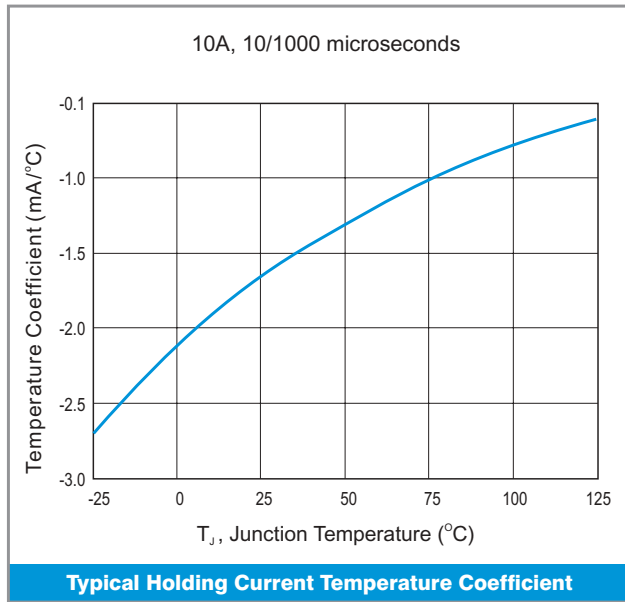
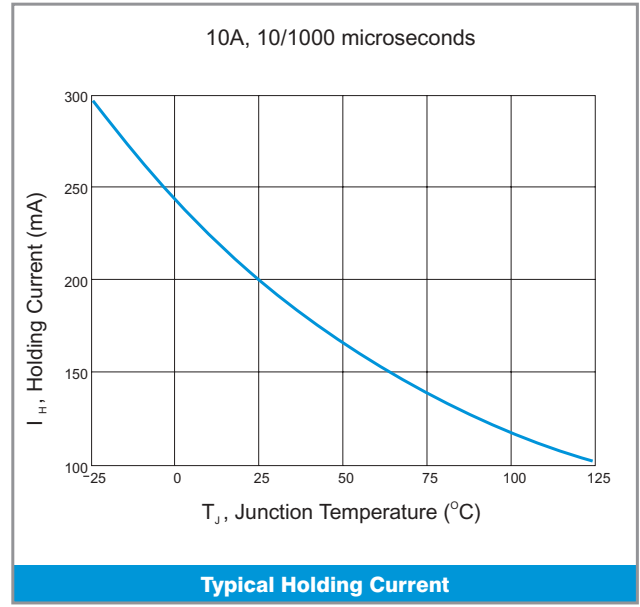
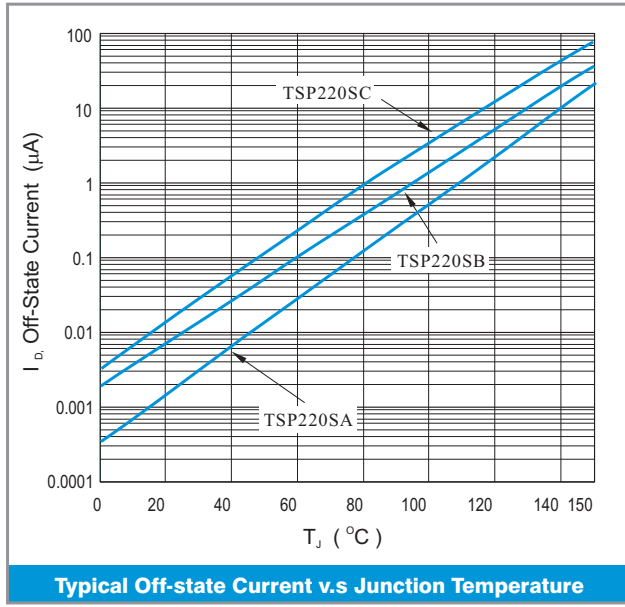
Typical Capacitance v.s. Rated Repetitive Off-state Voltage



Typical Capacitance v.s. Off-state Voltage

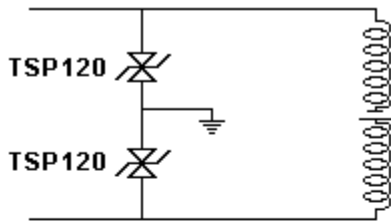
Thyristors - Rating and Characteristic Curves

A and SA Series - B and SB Series - C and SC Series

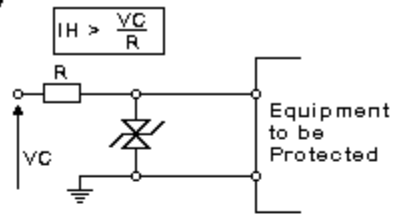


Thyristors - Circuit Examples

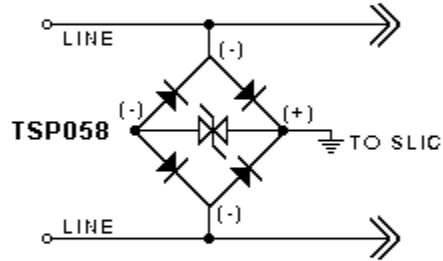
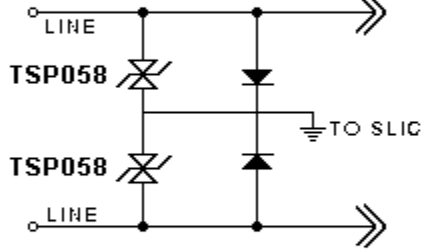
PABX Protection



DC Supply



SLIC Protection



Complete PC Board Operation Protection

