

# SPO30A(B)(C) THRU SP345A(B)(C)

## SIDAC PROTECTOR

### SOLID STATE OVERVOLTAGE PROTECTOR)

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#### GENERAL DESCRIPTION

SIDAC PROTECTORS (SP) are devices used to protect sensitive IC's from electrical disturbances caused by lightning and AC power cross conditions. The structure and characteristics of the thyristor are used to create an over-voltage protection device with precise and repeatable characteristics. SP have been chosen firstly in modern communication systems to avoid lightning. The SP operates much like a switch. In off-state, the device presents a leakage current ( $I_{DRM}$ ) less than 2uA making it invisible to the circuit it is protecting. As a transient voltage exceeds the SP  $V_{DRM}$ . The device will begin to enter its protective mode with characteristics similar to an avalanche diode. Then, once the current exceeds its switching current, its voltage decreases to turn-on voltage ( $V_T$ ) with most transient current passing through this parallel circuit so the sensitive circuit is protected. After the transient, the current decreases to  $I_H$  or below, the SP will reset and return to high off-state impedance. The SP turn-on voltage  $V_T$  is very smaller compared with other clipping protection devices. SP can be used repeatedly and can not degenerate because of no consumption.

#### FEATURE

The SP is the predominant choice for today's telecom needs because it offers absolute surge suppression regardless of the surge current level and rate of applied voltage ( $dv/dt$ ) unlike other devices, the SP:

- Can not be damaged voltage
- Eliminates the hysteresis and heat dissipation typically found with a clamping device
- Eliminates voltage overshoot caused by fast rising transients
- Is non-degenerative
- Will not fatigue
- Has negligible capacitance making it ideal for high speed transmission equipment

#### APPLICATION

When protecting telecommunication circuits the SP is connected across the TIP-Ring interface for metallic protection and the TIP-Ring-Ground interface for longitudinal protection, typically behind some type of current limiting device such as fuse. Common

applications are:

- Can not be damaged voltage
- T-1/E-1, ISDN, and DSL transmission equipment
- Customer Premise Equipment (CPE) such as phones, modems, and caller ID adjunct boxes
- PBX's, KSUs and other switches.
- Primary protection including main distribution frames, 5-pins modules entrance equipment
- and station protection modules

Other applications that use SP are data lines, security systems, CATV line amplifiers & power inserter. The SP is also used to protect solenoids in sprinkler systems and thyristors such as SCR's and triacs in motor speed controls. It should be noted though that when used in these applications, the short circuit AC current of the circuit being protected can not exceed the AC current rating of the SP, and the short circuit DC current must be below the minimum holding current ( $I_H$ ) of the SP (in order to reset)

SP030A  
SP030B  
SP030C

THRU  
THRU  
THRU

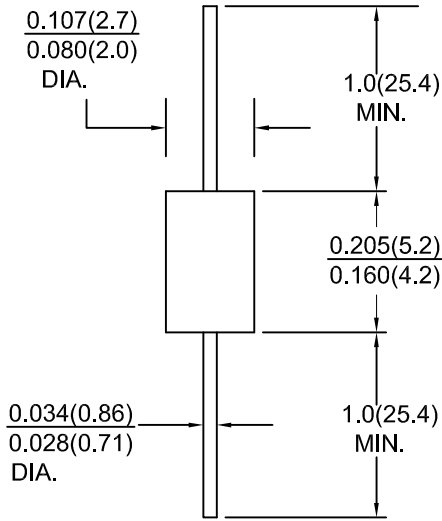
SP345A  
SP345B  
SP345C

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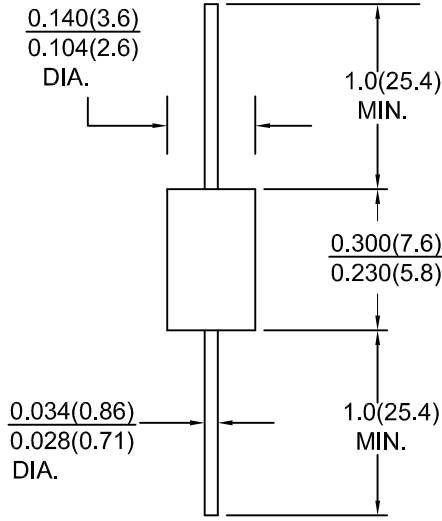
DO-41

DO-15

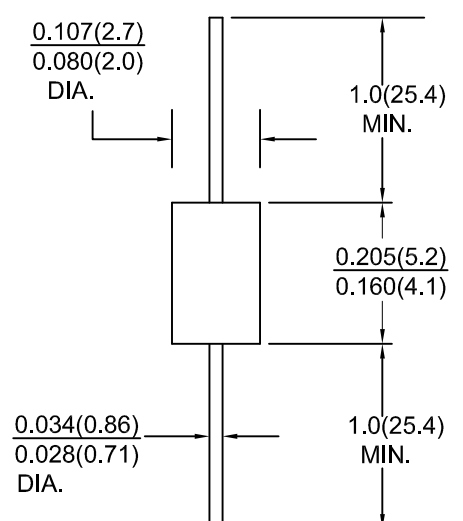
DO-204AL(DO-41)



Suffix"A" for DO-41



Suffix"B" for DO-15



Suffix"C" for DO-201AD

Dimensions in inches and (millimeters)

MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

Rating at 25°C ambient temp. unless otherwise specified.

Single phase, half sine wave, 60 Hz, resistive or inductive load.

For capacitive load, derate current by 20 %.

Characteristic	Symbol	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	Units	
		030A	064A	100A	120A	120A	150A	220A	240A	270A	320A		
		SP	SP	SP	SP	SP	SP	SP	SP	SP	SP		
Breakover Voltage ( Instantaneous Clamping Voltage)	Max.	V <sub>BO</sub>	27	58	90	120	135	170	190	220	275	300	Volts
	Minl.	V <sub>BO</sub>	36	70	125	145	165	225	265	300	350	400	
Minimum Blocking Voltage		V <sub>DRM</sub>	20	50	75	95	110	140	160	180	200	240	Volts
Maximum Peak off - stat Current at V <sub>DRM</sub>		I <sub>DRM</sub>	2.0									mAmps	
Maximum Continue off - stat DC or RMS Current		I <sub>r</sub>	0.1									Amps	
Minimum Holding Current		I <sub>H</sub>	150									mAmps	
Peak on - stat Current at I <sub>r</sub> =1A		V <sub>TM</sub>	5.0									Volts	
Typical Switching Current		I <sub>s</sub>	250									mAmps	
Typical Junction Capacitance		C <sub>o</sub>	100	60	30			40				PF	
Maximum Peak Pulse Current ( T <sub>J</sub> ≤ 150 °C )	10x160ms 10x560ms 10x1000ms	I <sub>PP</sub>	100(SPXXXXA) 50(SPXXXXA) 50(SPXXXXA)			150(SPXXXXA) 100(SPXXXXA) 60(SPXXXXA)			200(SPXXXXA) 150(SPXXXXA) 90(SPXXXXA)			Amps	
Peak one Cycle Sin Surge Current 50Hz/60Hz		I <sub>TSM</sub>	16.7/20(SPXXXXA) 25/30(SPXXXXB) 50/60(SPXXXXC)									Amps	
Maximum Critical Rate of Rise of on-state Current A /mA		DI/dt	100										
Operating Junction temperature range		T <sub>J</sub>	-40 to +150									°C	
Storage temperature range		T <sub>stg</sub>	-65 to +150									°C	

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Notes:

1. All measurements are at 60Hz with resistive load at ambient temperature of +25°C unless otherwise specified.
2. All SP's are bidirectional and electrical parameters apply to both the forward and reverse polarities
3. All SP's meet the surge requirements of the following standards.
4. Lead solder temperature is a maximum of the +230°C for 10 seconds, 0.375"(9.5mm) lead length

CCITK17-20	10/700mA	1.5KV
	5/310mA	38A
VDE0433	10/700mA	2KV
	5/200mA	50A
	0.5/700mA	1.5KV
	0.2/310mA	38A

## QUALITY ASSURANCE

TEST DESCRIPTION	CONDITIONS	
Surge(I <sub>PP</sub> )	Rated Current	Repeated 2 times in the normal sequence of testing
Breakover Voltage(V <sub>BO</sub> )	V <sub>BO</sub> in forward and reverse directions	All devices fully characterized on voltage to ensure proper operation and reliability
Holding Current(I <sub>BH</sub> )	Measured for the rated minimum value	Measured for the rated minimum value
Peak On-state Voltage(V <sub>I</sub> )	Measured with 1Amp RMS or DC Current	Measured with 1Amp RMS or DC Current
Leakage Current(I <sub>DRM</sub> )	Measured at 80% of Rated V <sub>BO</sub>	Measured at 80% of Rated V <sub>BO</sub>

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FIG. 1A-Pulse WaveForm (10x1000ms)

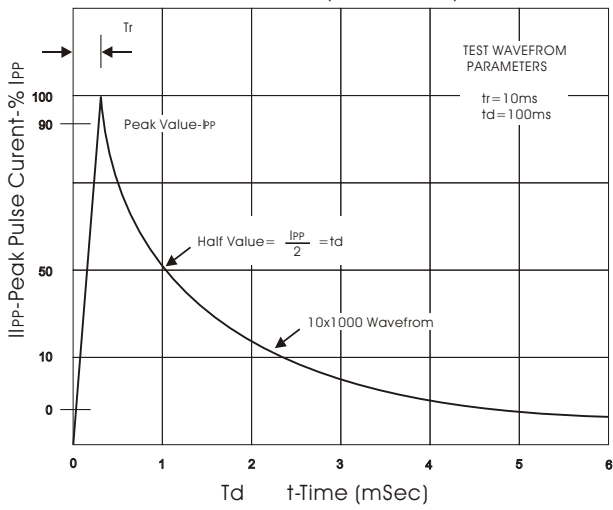


FIG. 1B-Pulse WaveForm (10x560ms)

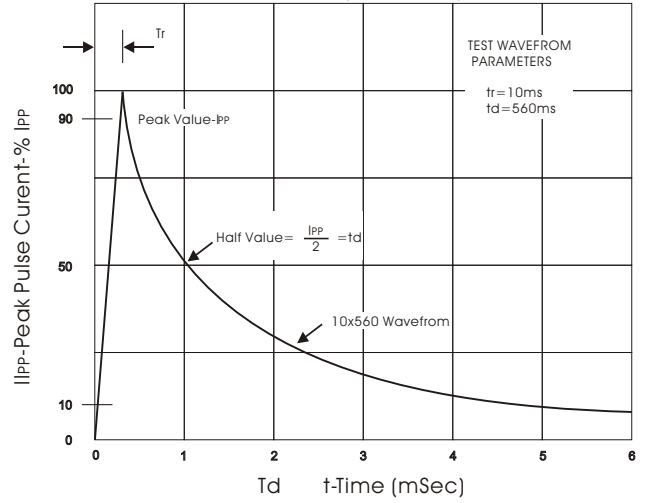


FIG. 1C-Pulse WaveForm (10x160ms)

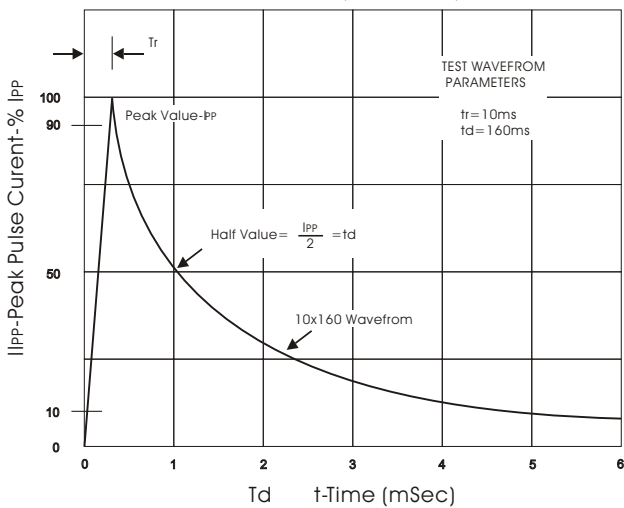


FIG. 3B-V-I Normalized DC Holding Current vs Case Temperature

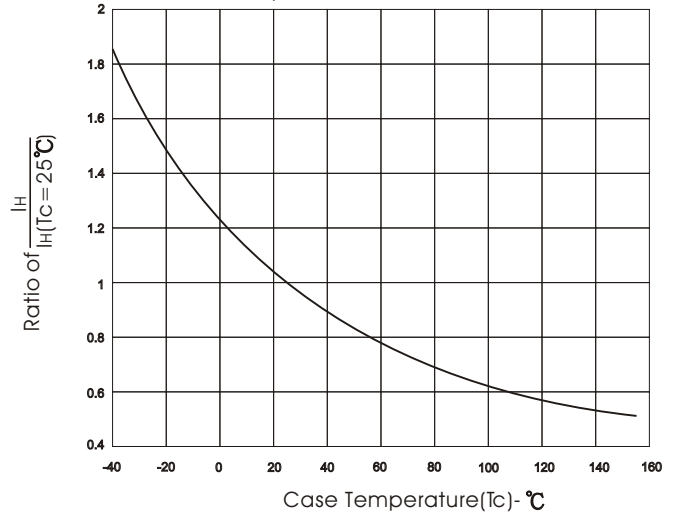


FIG. 3A-V-I Characteristics of Deviccs with Negative Resistance

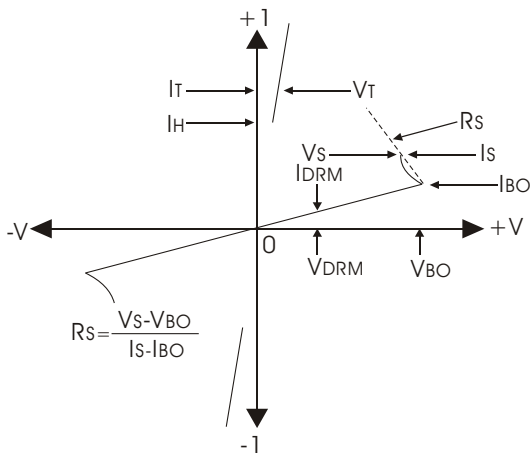
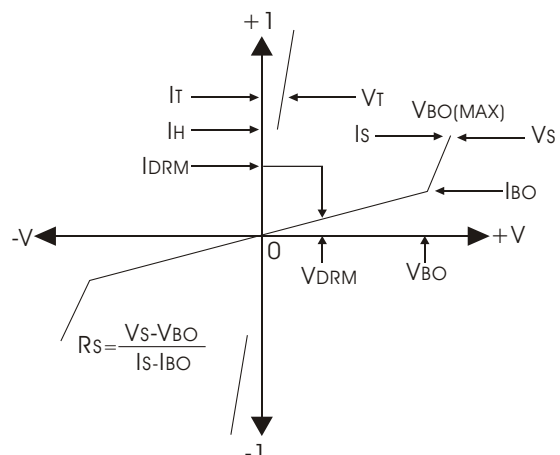


FIG. 3B-V-I Characteristics of Deviccs with Positive Resistance



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FIG. 4-Normalized VBO Change Junction Temperature

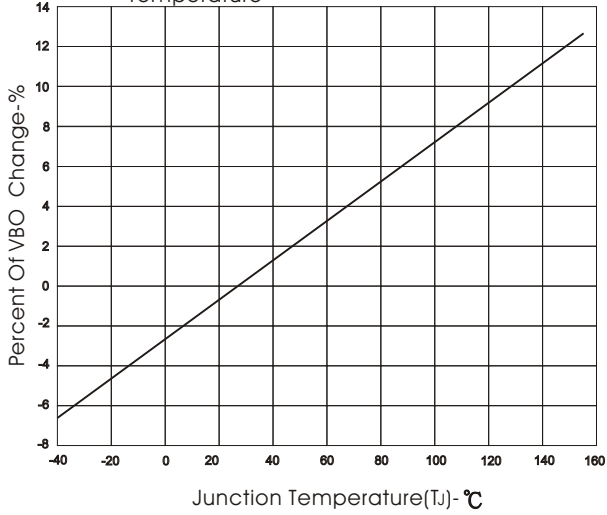


FIG. 5-Normalized Repetitive Peak Off-State (Leakage) Current Vs Junction Temperature

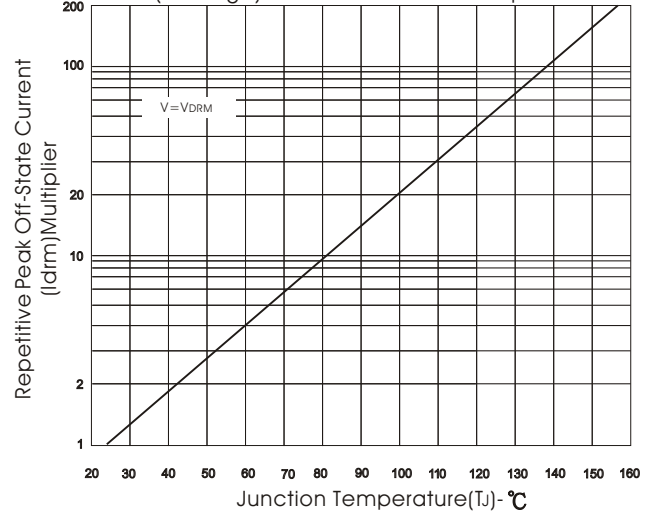


FIG. 6-Peak On-State Voltage Vs Peak On-State Current

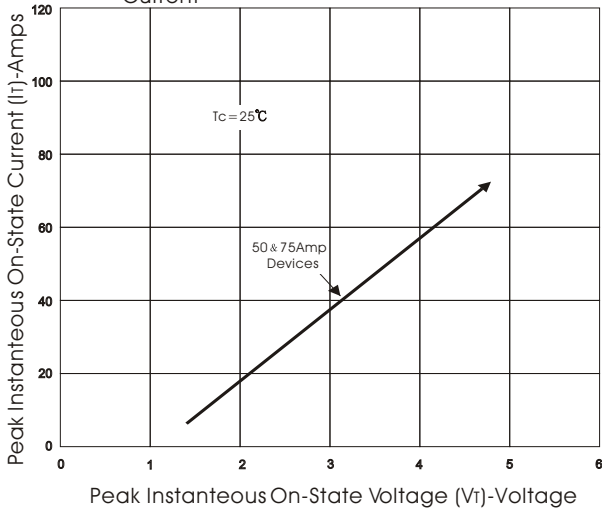
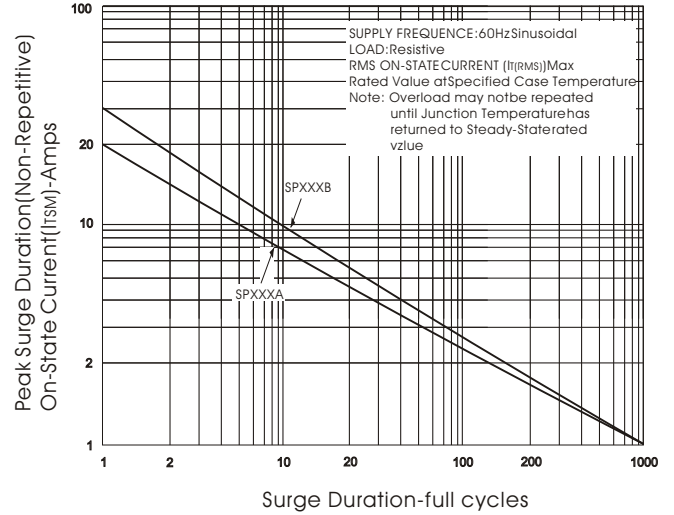


FIG. 7-Peak Surge On-State Current Vs Surge Current Duration



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## APPLICATIONS NOTS:

### 1.HOW TO CHOICE A SIDAC PROTECTOR

When selecting a SIDAC protectoe, The following criteria should be used:

(1) Off-state voltage ( $V_{DRM}$ )

The  $V_{DRM}$  of the SP must be greater than maximum operating voltage of circuit that SP is protecting.

For exmple: a POTS (Plain Old Telephone Service) application, convert the maximum operating ring (150VEMS) to a peak voltage and add the maximum DC bias of the central office battery,

$$V_{DRM} > 268.8V$$

(2) Switching voltage ( $V_s$ )

The  $V_s$  of the SP should be equal to or less than the instantaneous peak voltage rating of the component it protecting.

For example:  $V_s \leq V_{\text{relay breakdown}}$

(3) Peak Pules Current ( $I_{PP}$ )

For circuits that do not require additional serues the surge current rating ( $I_{PP}$ ) of the SP should be greater than or equal to the surge current associated with the lightning tests of applicable Regulatory requirement ( $I_{PK}$ )

$$I_{PP} \geq I_{PK}$$

FOR CIRCUITS that utilize additional series resistance, the surge current ratings ( $I_{PP}$ ) of the SP should be grater than or equal to the available surge currents associated with the lightning immunity tests of the applicable Regulatory requirement ( $I_{PK(AVAILABLE)}$ )

$$I_{PP} \geq I_{PK(\text{available})}$$

The maximum available surge current is calculated by dividing the peak surge voltage ( $V_{PK}$ ) By the total circuit impedance ( $R_{TOTAL}$ )

$$I_{PK(\text{available})} = V_{PK} / R_{TOTAL}$$

For longitudinal surges (TIP-GUD, RING-GUD),  $R_{TOTAL}$  is calculated for both TIP and RING

$$\begin{aligned} R_{\text{aource}} &= V_{PK} / I_{PK} \\ R_{TOTAL} &= R_{TIP} + R_{\text{source}} \\ R_{TOTAL} &= R_{RING} + R_{\text{source}} \end{aligned}$$

For metallic surges (TIP-RING):

$$\begin{aligned} R_{\text{source}} &= V_{PK} / I_{PK} \\ R_{TOTAL} &= R_{TIP} + R_{\text{source}} + R_{RING} \end{aligned}$$

For example 1: The type A surge requirement of bellcore 1089 with 30 W onring,

$$I_{PK} = 100A, \quad 10 \times 1000ms$$

For examp:e 2: The surge requirment of bellcore 1089 with 30W on Tip an 30W ring,

$$\begin{aligned} I_{PK} &= 100A, \quad 10 \times 1000ms \\ V_{PK} &= 1000V \end{aligned}$$

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$$R_{source} = V_{PK} / I_{PK} = 10 \Omega$$

$$R_{TOTAL} = R_{TIP} + R_{source} = 40 \Omega$$

$$I_{PK(available)} = V_{PK} / R_{TOTAL} = 1000V / 40 = 25A$$

$$I_{PP} > 25A$$

(4) Holding Current(I<sub>H</sub>)

Because FCC Part 68.306.A.8.iii specifies that registered terminal equipment not exceed 140mA of DC current per conductor under short circuit conditions. The holding current of the SP is set at 150mA.

For special design criteria, The holding current(I<sub>H</sub>) of the SP must be greater than DC current be supplied during an operational and short circuit condition.

(5) Off-state Capacitance(C<sub>o</sub>)

Assuming that the criteria point of insertion loss is 70% of the original signal level value, The SP can be used in most applications with transmission speed of up 30MHz. If transmission speeds greater than 30MHz, a compensation circuit may be required.

## 2.The response speed comparison between Gas Discharge(GDTs),MOV's TVS diodes and SIDAC PROTECTOR(SP)

The axial represents the dv/dt(rise in voltage with respect to time) applied to each protector, and the Y axial represents the maximum voltage drop across each protector(A nominal state-off voltage ratings of 230V is supposed)

