SP245-03

Solid State Initiator Firing Switch, TO-247(5L)
Data Sheet, Initial Production (CAO20180326)

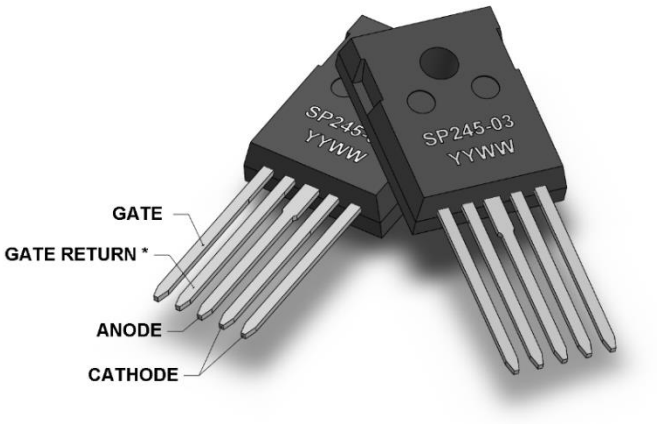
***NOTICE:* This product is export controlled**

The **SP245-03** is an advanced high-voltage current-controlled thyristor packaged in a **JEDEC TO-247 (5L)** package.

Like all Solidtron products, the internal semiconductor employs high cell density and an advanced high voltage termination design to achieve high peak current capability, low conduction loss, low off-state leakage, negligible turn-on delay jitter, and high turn-on dI/dt capability. It is ideally suited for a wide variety of capacitor discharge applications requiring precise timing and rapid energy transfer capability.

The **JEDEC TO-247 (5L)** package is an industry standard package in which the semiconductor is attached to a copper header utilizing 92.5Pb/5Sn/2.5Ag solder. The top of the chip is joined to the appropriate leads using a combination of 0.005" and 0.010" aluminum wire bonds. It is then molded with Hysol MG15F-0140 compound and its leads are tinned with 63Sn/10Pb solder.

The **SP245-03** replaces the SMCTAA32N14A10. Like its predecessor, it is intended to replace triggered spark gaps of similar voltage and current ratings.



The **Gate Return lead provides a dedicated connection directly to the cathode of the semiconductor die. Internally, this connection consists of a single 0.005" aluminum bond wire.*

*Although it is not mandatory with CCS Devices that the Gate return lead be used as an independent gate driver return path, its use in this fashion may reduce V=L*dI/dt induced stress on other gate driver components.*

Due to the small diameter of its internal wire bond connection, using this pin (pin2) as an additional cathode connection is highly discouraged.

Key Product Features

- 1400V Repetitive Off-State Voltage
- V_{GK} = 0V = OFF
- 100 kA/µs dI/dt capability
- Low Turn-on and Conduction Losses
- < 100nSec Turn-on Delay Time
- 3.5kA Repetitive Surge Current

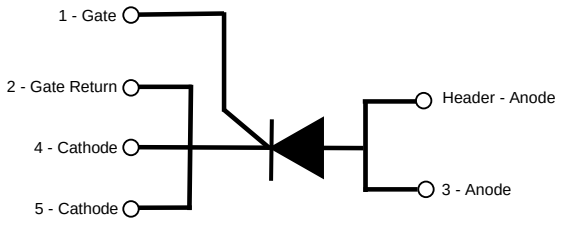


Table 1. Maximum Ratings	Symbol	Value	Units
Repetitive Peak Off-State Voltage (Note 1.)	V_{DRM}	1400	V
Repetitive Peak Reverse Voltage	V_{RRM}	-10	V
Off-State Rate of Change of Voltage Immunity (V_D=1400V)	dv/dt	1000	V/µSec
Peak Non-Repetitive Surge Current (1/2 Sinusoid Pulse Duration =/<300nSec)	I_{TSM}	4000	A
Peak Repetitive Surge Current (1/2 Sinusoid Pulse Duration =/<300nSec)	I_{TRM}	3500	A
Rate of Change of Current	dI/dt	100	kA/µSec
Repetitive Capacitor Discharge Event Integral (Underdamped LCR Circuit) (Note 2.)	$I^2t_{REPETITIVE}$	2.0	A^2sec
Critical Capacitor Discharge Event Integral (Underdamped LCR Circuit) (Note 2.)	$I^2t_{CRITICAL}$	TBD	A^2sec
Continuous Gate-Cathode Reverse Voltage	V_{GKS}	-9	V
Forward Peak Gate Current (10µSec Duration)	I_{GM}	10	A
Required Off-State Gate-Cathode Voltage	V_{GDM}	0	V
Operating Junction Temperature Range	T_J	-55 to +125	°C
Maximum Soldering Installation Temperature		220	°C
Storage Temperature Range *(See Moisture Sensitivity & Solderability Cautions)*		-55 to +150	°C

Note 1. Repetitive Peak Off-State Voltage rating is limited by the external lead clearance of this package
Note 2. See Application Notes

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Table 2. Electrical Characteristics

Parameter	Symbol	Test Conditions		Measurements Min	Typ	Max	Units
Anode to Cathode Breakdown Voltage	V_{BR}	V_{GK}= 0V, I_D=100µA, $T_C \leq 125°C$		1400			V
Anode-Cathode Forward Off-State Current *See Figure 2.*	I_{DRM}	V_{GK}= 0V, V_D=1400V	T_C=-55°C			60	nA
			T_C=25°C		11	100	nA
			T_C=85°C		180	1000	nA
			T_C=125°C		5	10	µA
Reverse Bias Gate-Cathode Breakdown Voltage	V_{GRRM}	I_{GM}=150µA, $T_C \leq 125°C$		9	10		V
Nine Volt Reverse Bias Gate-Cathode Leakage Current *See Figure 1.*	I_{GM}	V_{GK}= -9V	T_C=25°C		28		µA
			T_C=85°C		57		µA
			T_C=125°C		80		µA
Two Volt Reverse Bias Gate-Cathode Leakage Current *See Figure 1.*	I_{GM}	V_{GK}= -2V	T_C=25°C		0.8	2	µA
			T_C=85°C		1.9	4	µA
			T_C=125°C		2.4	6	µA
Gate Trigger Voltage	V_{GT}	V_D= 12V, I_D=1mA	T_C=25°C	450	500		mV
			T_C=85°C	250	350		mV
			T_C=125°C	200	250		mV
Gate Trigger Current	I_{GT}	V_D= 12V, I_D=1mA, $T_C \leq 125°C$				100	µA
Turn-on Delay Time	$t_{d(ON)}$	0.15µF Capacitor Discharge, T_C=25°C, I_{GT}= 500mA, V_{DD}=1200V, L_S=15nH, R_S=0.010Ω=CVR			30	60	nSec
Rate of Change of Current	dI/dt				65		kA/µsec
Capacitor Discharge Event Integral	I^2t				1.38		A^2sec
Peak Anode Current	I_{DM}				3.2		kA

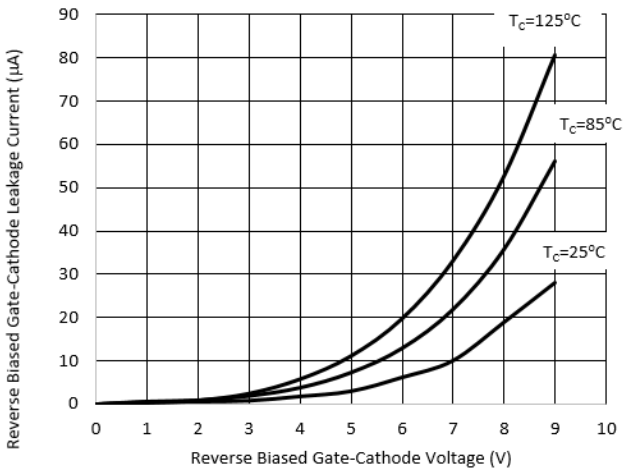


Figure 1. Typical Reverse Biased Gate-Cathode Leakage Characteristic

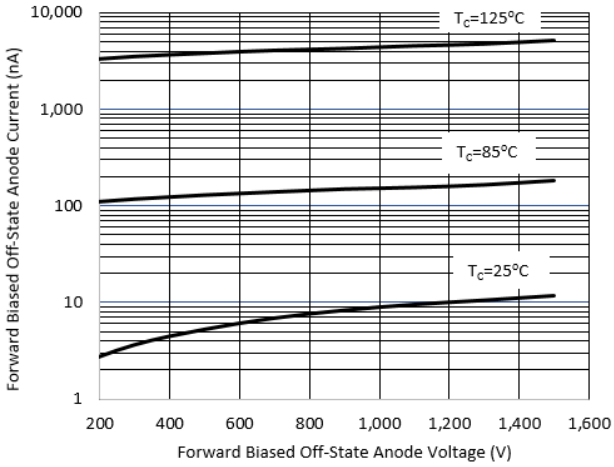
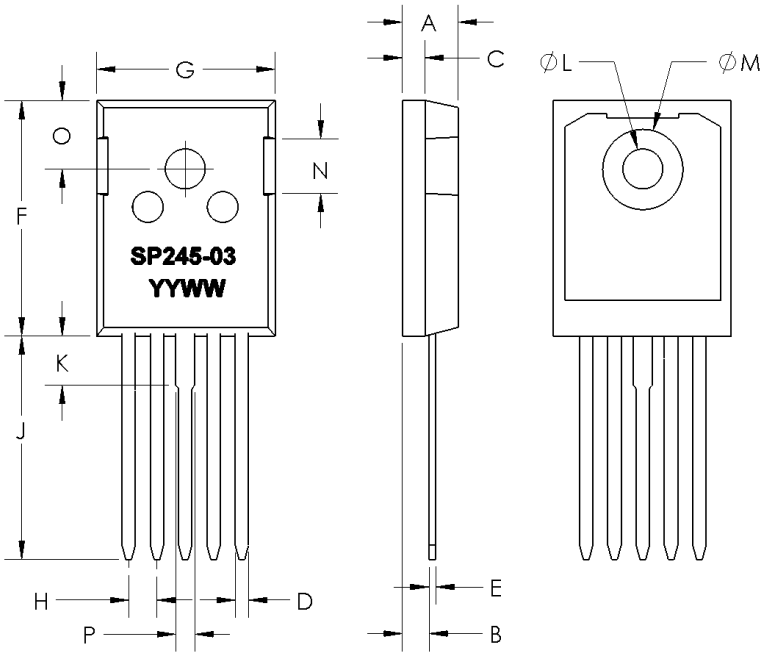


Figure 2. Typical Forward Biased Off-State Anode-Cathode Leakage Characteristic

Markings and Dimensions



DIMENSIONS ARE IN INCHES

DIMENSION	MIN.	MAX.
A	0.185	0.209
B	0.087	0.102
C	0.059	0.098
D	0.04	0.055
E	0.016	0.031
F	0.819	0.845
G	0.62	0.64
H	0.096	0.104
J	0.78	0.8
K	0.167	0.177
L	0.138	0.144
M		0.291
N	0.17	0.216
O	0.242	
P	0.065	0.07

PART NUMBER
SP = SILICON POWER
245 = CHIP TYPE
-03 = PACKAGE TYPE

DATE CODE
YY = LAST 2 DIGITS OF CALENDAR YEAR
WW = WORK WEEK

ESD Sensitivity

THIS PRODUCT SHOULD BE HANDLED AS AN ESD SENSITIVE DEVICE. OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC DISCHARGE SENSITIVE DEVICES IN ALL ASSEMBLY AND TEST AREAS (REF. JESD625).

IMPROPER HANDLING OF THIS DEVICE MAY PERMANENTLY DAMAGE THE DEVICE AND RENDER IT UNUSABLE.

Product Qualifications/Certifications/Classifications

Planned or Underway

- Solderability per IPC J-STD-002
- ESD-HBM (Human Body Model) classification per Mil-STD-883
- ESD-CDM (Charged Device Model) classification per ANSI/ESDA/JEDEC/JS-002-2014

Application Notes

Topics Under Development

- Capacitor Discharge Event Integral (I^2t)
- Triggering a CCS Device - Theory of Operation
- Gate Driver design for the CCS Device
  - Circuits & Critical Layout Considerations

Table 3. Typical Application Parameters	Value	Units
Off-State Anode Voltage (<1 hour)	1250	V
Repetitive Peak Forward Anode Current (**1/2 Cycle Pulse Width = 160nSec**)	2700	A
Repetitive Peak Reverse Anode Current (**1/2 Cycle Pulse Width = 160nSec**)	2200	A
Off-State Rate of Change of Voltage (dv/dt) immunity	≤200	V/mSec
Operational Case Temperature	-55 to 85	°C
Rate of Change of Anode Current (dI/dt)	65	kA/µSec
Peak Forward Gate Current (=/<20uSec pulse)	500	mA
Event Repetition Rate	≤1	Hz