SOLID STATE OPTRONICS

SMC1309

1 Form C
100V / 500mΩ
MOSFET Output Solid State Relay

Description

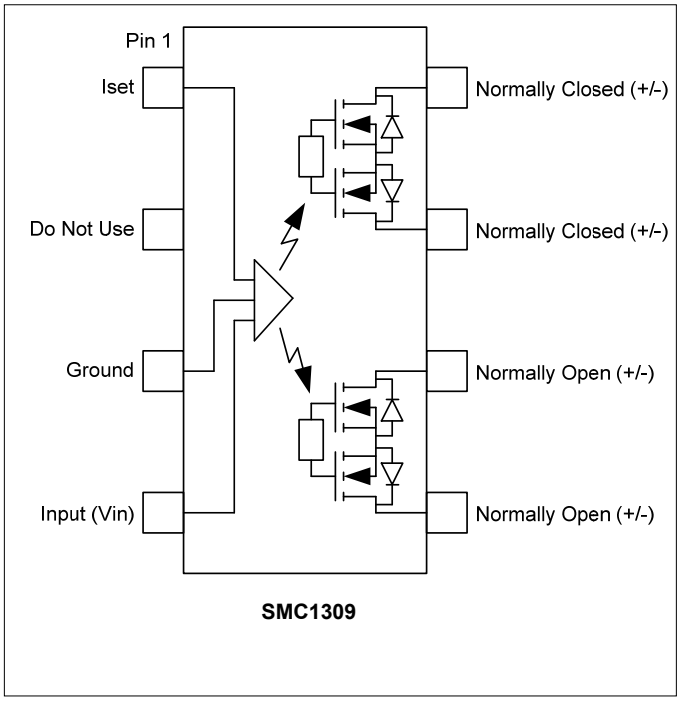
The SMC1309 is a 1 Form C solid state relay in a compact 8-pin small outline package. It is designed to be a cost-effective replacement of electro-mechanical relays in automotive component testing equipment. Input control is configured for 1 Form C functionality and provides true "break before make" switching. The output structures have low resistance (500mW TYP) and high blocking voltage (100V). The device has very low leakage currents, with typical values under 1nA @ 80V.

The SMC1309 comes standard in an 8 pin SOP package making it ideal for high-density board applications.

Applications

- EMR Replacement
- Automatic Test Equipment
- Data Acquisition
- Medical Equipment
- Battery Monitoring
- Safety Systems

Schematic Diagram



SMC1309

Features

- Low On Resistance (500mΩ TYP)
- Low Output Capacitance (18pF TYP @ 25V)
- Low Output Leakage (1nA MAX @ 80V)
- 750mA Maximum Continuous Load Current
- 2A Pulsed Current (100mS Period @ 10% DC)
- Isolation Voltage ($500V_{RMS}$)
- 1 Form C with Break Before Make Switching
- Long Life / High Reliability
- RoHS / Pb-Free / REACH Compliant

Absolute Maximum Ratings

The values indicated are absolute stress ratings. Functional operation of the device is not implied at these or any conditions in excess of those defined in electrical characteristics section of this document. Exposure to absolute Maximum Ratings may cause permanent damage to the device and may adversely affect reliability.

Storage Temperature .....-55 to +125°C
Operating Temperature .....-40 to +85°C
Continuous Input Current.....50mA
Transient Input Current.....500mA
Reverse Input Control Voltage 5V
Input Power Dissipation.....40mW
Total Power Dissipation 600mW
Solder Temperature – Wave (10sec).....260°C
Solder Temperature – IR Reflow (10sec).....260°C

Ordering Information

Part Number	Description
SMC1309	8 pin SOP, (50/Tube)
SMC1309-TR	4 pin SOP, Tape and Reel (1000/Reel)

NOTE: Suffixes listed above are not included in marking on device for part number identification

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Electrical Characteristics, T_A = 25°C (unless otherwise specified)

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Input Specifications						
Recommended Control Voltage	V_{CC}	5	-	15	V	-
Control Current[1]	I_{SET}	-	3	-	mA	-
Output Specifications (Same for both NO and NC poles)						
Blocking Voltage	V_B	100	-	-	V	-
Continuous Load Current	I_O	-	-	750	mA	-
Maximum Pulsed Current	$I_{O(Pulse)}$			2	A	Period = 100mS @ 10% Duty Cycle
On Resistance	R_{ON}	-	500	750	mΩ	I_O=750mA
Leakage Current	I_{Oleak}	-	-	100	nA	V_O=100V
		-	-	1		V_O=80V
Output Capacitance	C_{OUT}	-	75	-	pF	V_O=0, f=1MHz
		-	18	-		V_O=25, f=1MHz
		-	12	-		V_O=60, f=1MHz
Coupled Specifications						
Turn-On Time	T_{ON}	-	1	3	mS	-
Turn-Off Time	T_{OFF}	-	0.05	-	mS	-
Input to Output Capacitance	C_S	-	0.6	-	pF	V=0, f=1MHz
Contact Transient Ratio	-	2,000	7,000	0	V/µS	dV = 50V
Isolation Specifications						
Isolation Voltage	V_{ISO}	1500	-	-	V_{RMS}	RH ≤ 50%, t=1min
Input-Output Resistance	R_{I-O}	-	10^{12}	-	Ω	V_{I-O} = 500V_{DC}

NOTES:

1. Control Current is referred to as "I_{SET}" in the connection diagram found on page 4. Reference Note 4 found there for more details

SMC1309 Performance & Characteristics Plots, T_A = 25°C (unless otherwise specified)

Figure 1: *Typical On-Resistance Distribution* (N = 100, T_a = 25ºC)

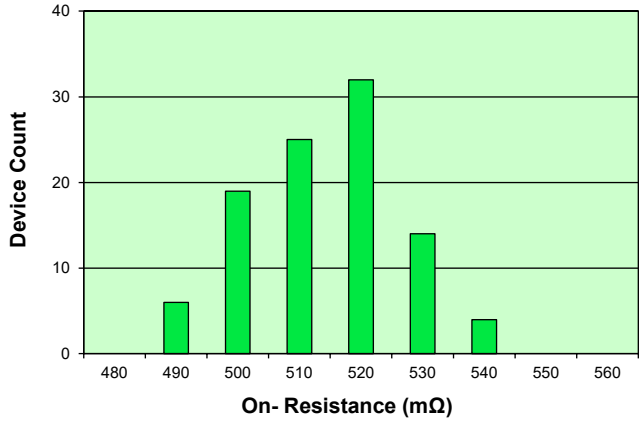


Figure 2: *Typical Blocking Voltage Distribution* (N = 100, Ta = 25ºC)

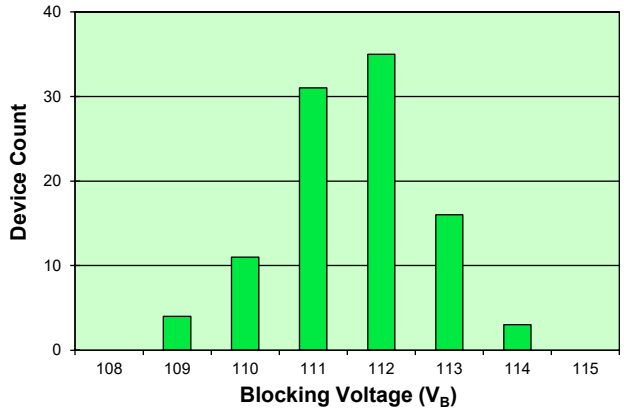


Figure 3: *Typical Output Leakage Current Distribution* (N = 100, T_a = 25ºC)

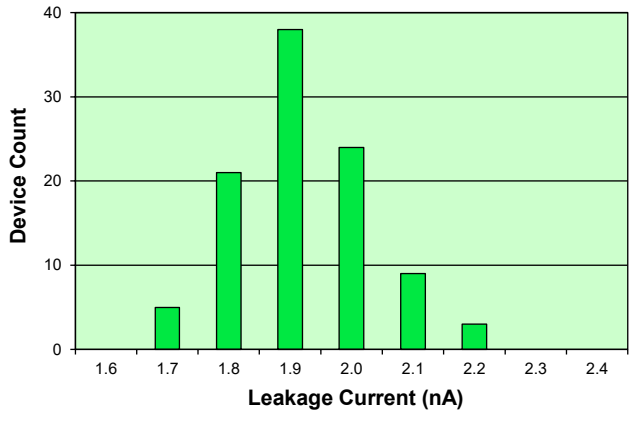
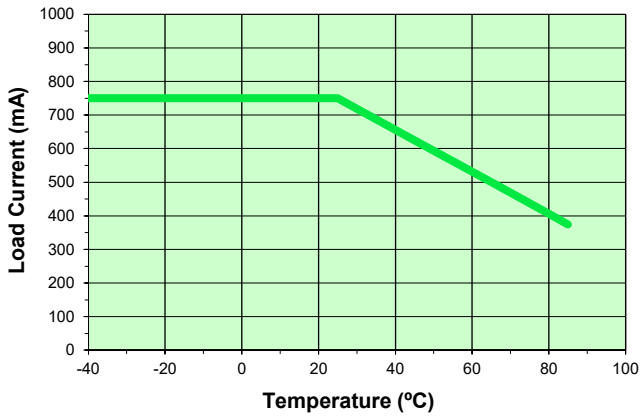
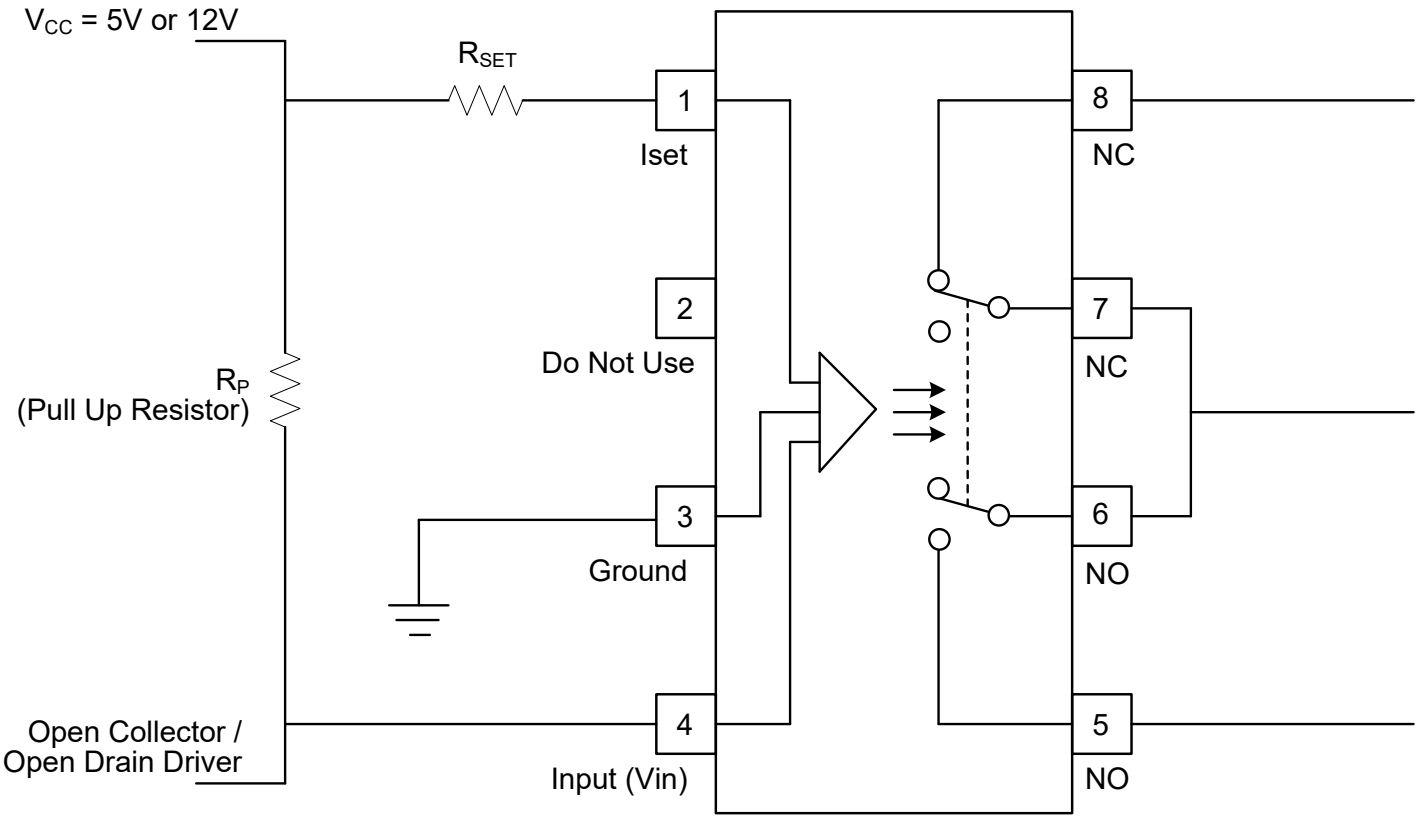


Figure 4: *Maximum Load Current vs. Temperature*



SMC1309 Recommended Output Connections and Components



Notes

1) SSO recommends a Pull Up Resistor (Rp) value of 10kΩ or less
2) NO (Normally Open) contacts between pins 5 & 6 are defined as OPEN when the Open Collector is open and pin 4 is pulled up with the Pull Up Resistor (Rp). These contacts will CLOSE when the Open Collector driver pulls pin 4 to ground (below 0.5V). The NC (Normally Closed) contacts between pins 7 & 8 operate in an inverse manner
3) The Open Collector Transition Time should be less than 5μS for proper performance
4) I_{SET} (Control Current as found in Parameters on Page 2) is used to set the internal photo drive current. SSO recommends an Iset value of 3mA for optimal device performance. Rset can be calculated for Vcc of either 5V or 12V. Assume a voltage drop of 2.2V for the Optical Control Circuit and Rset values for a 3mA Iset become:

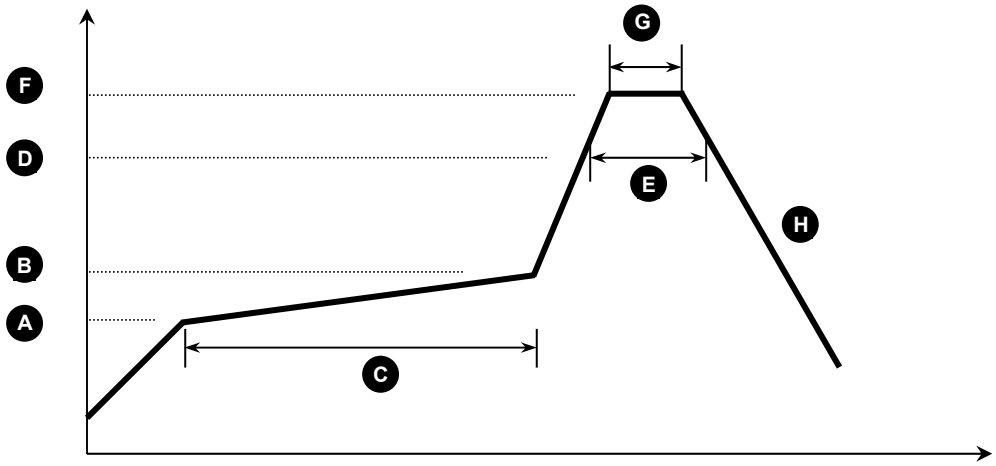
Rset (@5Vcc)	=	(Vcc-Vopticalcircuit) / (target Iset)	Rset (@12Vcc)	=	(Vcc-Vopticalcircuit) / (target Iset)
	=	(5V-2.2V) / (0.003A)		=	(12V-2.2V) / (0.003A)
	=	2.8 / 0.003 (933 ohms)		=	9.8 / 0.003 (3266 ohms)
Rset (@5Vcc)	**=**	**910 Ohm (5%)**	**Rset (@12Vcc)**	**=**	**3300 ohms (5%)**

5) Pins 6 & 7 can be connected externally forming a common point, in effect the common point of the Form C relay

SMC1309 Solder Reflow Temperature Profile Recommendations

(1) *Infrared Reflow*:

Refer to the following figure as an example of an optimal temperature profile for single occurrence infrared reflow. Soldering process should not exceed temperature or time limits expressed herein. Surface temperature of device package should not exceed 250ºC:



Process Step	Description	Parameter
A	Preheat Start Temperature (ºC)	150ºC
B	Preheat Finish Temperature (ºC)	180ºC
C	Preheat Time (s)	90 - 120s
D	Melting Temperature (ºC)	230ºC
E	Time above Melting Temperature (s)	30s
F	Peak Temperature, at Terminal (ºC)	260ºC
G	Dwell Time at Peak Temperature (s)	10s
H	Cool-down (ºC/s)	<6ºC/s

(2) *Wave Solder*:

Maximum Temperature:	260ºC (at terminal)
Maximum Time:	10s
Pre-heating:	100 - 150ºC (30 - 90s)
Single Occurrence	

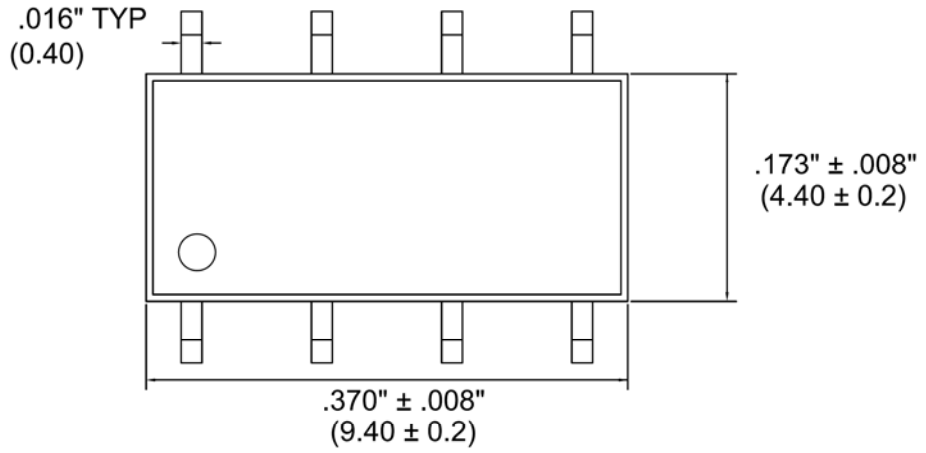
(3) *Hand Solder*:

Maximum Temperature:	350ºC (at tip of soldering iron)
Maximum Time:	3s
Single Occurrence	

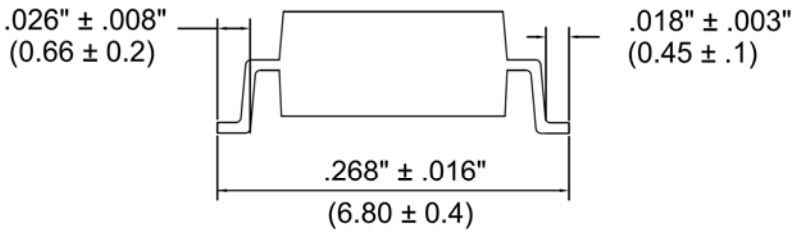
SMC1309 Package Dimensions

8 PIN SOP Package

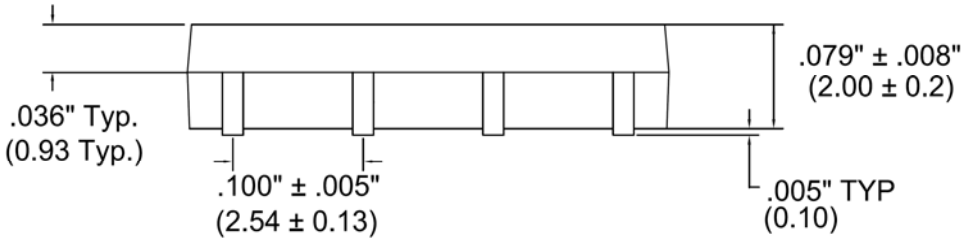
Note: *All dimensions in inches with millimeters [mm] in parenthesis ()*



TOP VIEW



END VIEW



SIDE VIEW

SMC1309 Package Marking / Pin Out