

# DC Solid State Relays

## 2A / 60 Vdc

### DS13 Series

The DS13 series SSRs employ state of the art photo-voltaic optical isolation and power MOSFET output chips for ultra-reliable high speed switching of DC loads up to 2 amps, with low on-resistance. Standard options include integral current overload/short circuit protection and a separate input control status line. The overload feature provides protection of the relay, load, and load circuit wiring in the event of a sustained current overload or short circuit while the relay is on or when it is turned on into a short. The control status provides a built-in test function which provides a logic (0) when the input circuit is energized and functional. The relay is packaged into a custom hermetically sealed low profile 8-pin ceramic DIP package, with optional through hole or surface mount pins.

## Features

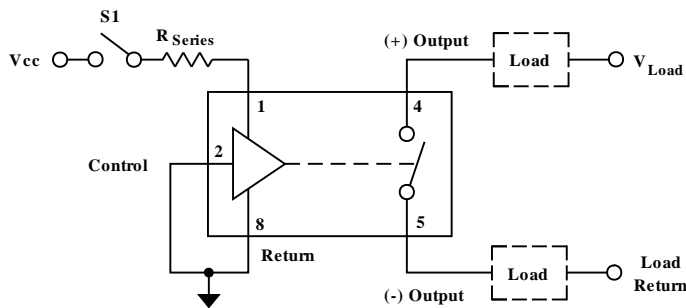
- Standard options : short circuit/overload protection and control status.
- Optically coupled all solid state relay
- TTL & CMOS compatible input
- Low on-resistance power MOSFET output
- Tested per MIL-R-28750 and approved to DESC dwg 90091.
- All versions available with CII "W" level screening.

CII P/N	DESC Dwg. P/N	Relay Version
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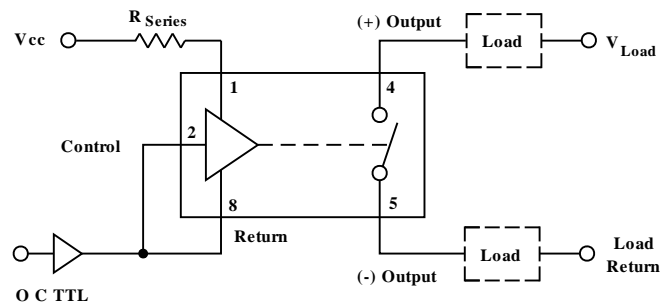
• Standard options : short circuit/overload protection and control status.	DS13-1Y	90091-008	Basic relay
• Optically coupled all solid state relay	DS13-1000	90091-004	Relay w/short circuit protection
• TTL & CMOS compatible input	DS13-1001	90091-006	Relay w/control status
• Low on-resistance power MOSFET output	DS13-1002	90091-002	Relay w/short circuit protection and control status

Note : add suffix "S" to P/N for surface mount versions

### 2 Terminal Input Configuration

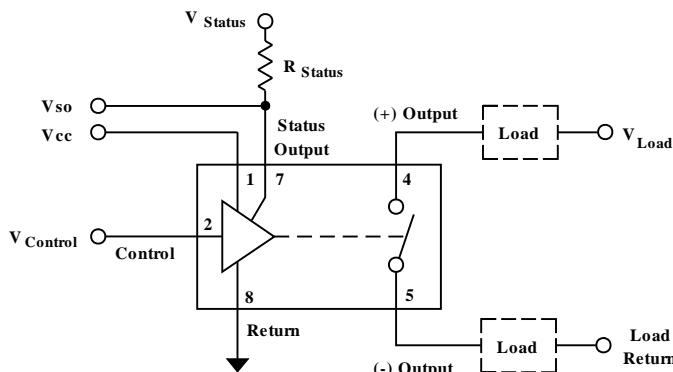


Direct Drive

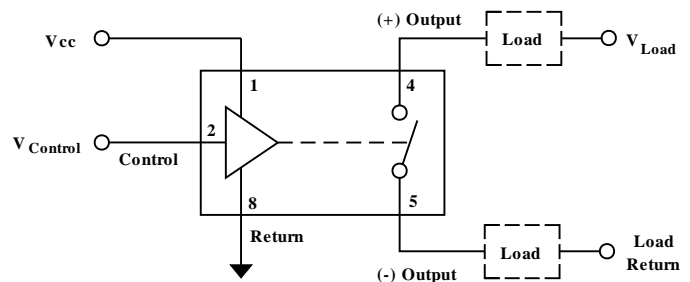


TTL Drive

### 3 Terminal Input Configuration



With Status



Without Status

## Electrical Specifications (-55°C to +105°C unless otherwise specified)

<b>Input</b> (2 Terminal Configuration)	Input supply voltage range (Vcc)	3.8 - 32 Vdc	} Notes 1 & 2 Figures 1 & 2
	Input current (max.) @ 5V	15 mAdc	
	Must turn-on voltage	3.8 Vdc	
	Must turn-off voltage	1.5 Vdc	
	Reverse voltage protection	-32 Vdc	
<b>Input</b> (3 Terminal Configuration)	Control voltage range	0 - 18 Vdc	} Notes 1 & 2 Figures 1 & 2
	Control current (max.) @ 5V	250 $\mu$ Adc	
	Control current (max.) @ 18V	1 mAdc	
	Input supply voltage (Vcc) range	3.8 - 32 Vdc	
	Input current (max.) @ 5V	15 mAdc	
	Must turn-on voltage	0.3 Vdc	
	Must turn-off voltage	3.2 Vdc	
<b>I/O</b>	Dielectric strength (min.)	1000 Vrms	
	Insulation resistance (min.) @ 500 Vdc	10 <sup>9</sup> ohms	
	Capacitance (max.)	10 pF	
<b>Output</b>	Continuous load current (max.) @ 25°C (without short circuit protection)	2.0 Adc	Figure 5, Note 3
	Continuous load current (max.) @ 25°C (with short circuit protection)	1.0 Adc	Figure 5, Note 3
	Continuous load voltage (max.)	60 Vdc	
	Transient blocking voltage (max.)	80 Vdc	Note 4
	On resistance (max.) @ Tj = 25°C, I <sub>E</sub> 100 mA (with short circuit protection)	0.45 ohms	Note 5, Figure 4
	On resistance (max.) @ Tj = 25°C, I <sub>E</sub> 100 mA (without short circuit protection)	0.22 ohms	Note 5, Figure 4
	Output voltage drop (max.) (with short circuit protection)	0.6 Vdc	
	Output voltage drop (max.) (without short circuit protection)	0.75 Vdc	
	Leakage current (max.) @ V = 60 Vdc	100 $\mu$ Adc	
	Turn-on time (max.)	1.5 mSec	Figure 3
	Turn-off time (max.)	.25 mSec	Figure 3
	dv/dt (min.)	100 V/ $\mu$ Sec	
	Electrical system spike	$\pm$ 600 Vdc	Note 4
	Junction temperature (max.)	150°C	
	Thermal resistance (max.), junction to ambient	80°C/W	
	Thermal resistance (max.), junction to case	20°C/W	
	<b>Status</b>	Status supply voltage	30 Vdc
Status sink current (max.) @ Vstatus 0.3 Vdc		2 mAdc	Note 7
Status leakage current (max.) @ 15 Vdc		4 $\mu$ Adc	

### Short Circuit Protection

See Figure 6, Note 7

## Environmental Specifications

Ambient temperature (operating)	-55°C to +105°C
Ambient temperature (storage)	-55°C to +125°C
Vibration	100 g, 10 to 3000 Hz
Shock	1500 g, 0.5 mSec pulse
Constant acceleration	5000 g

Figure 1

Maximum Input Current vs. Input Voltage

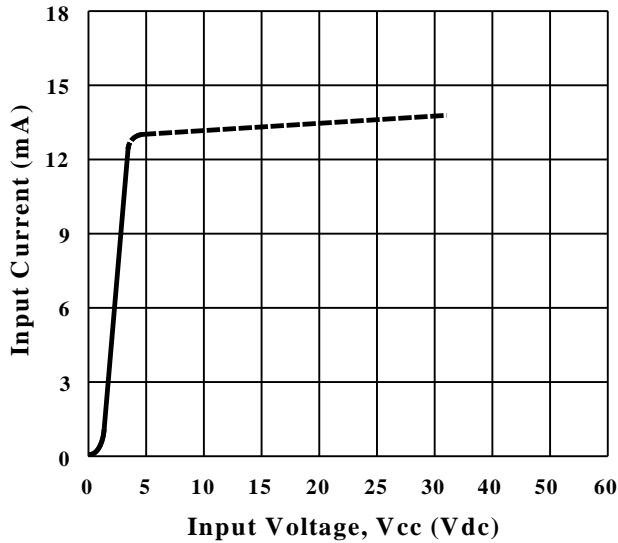


Figure 2

Series Resistance vs. Vcc Supply Voltage (Note 1)

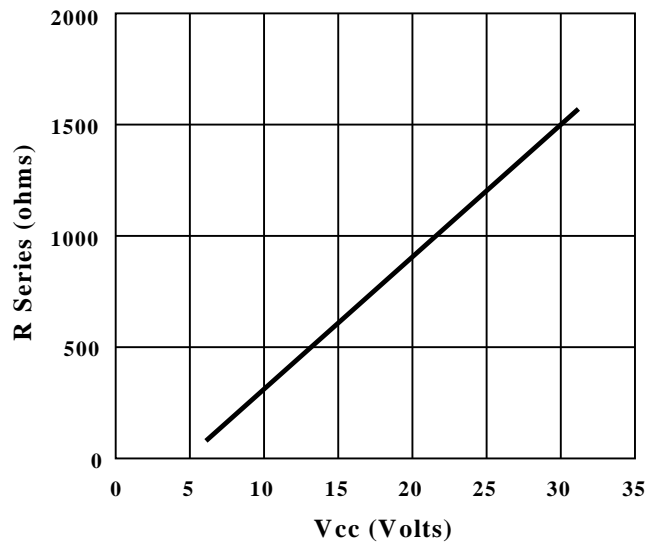


Figure 3

Output Turn-on and Turn-off Timing

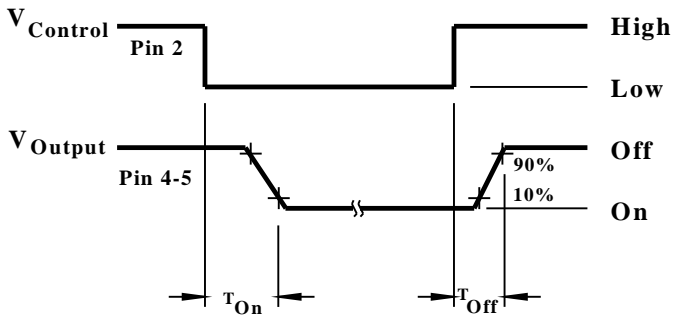


Figure 4

On-Resistance vs. Temperature (Note 6)

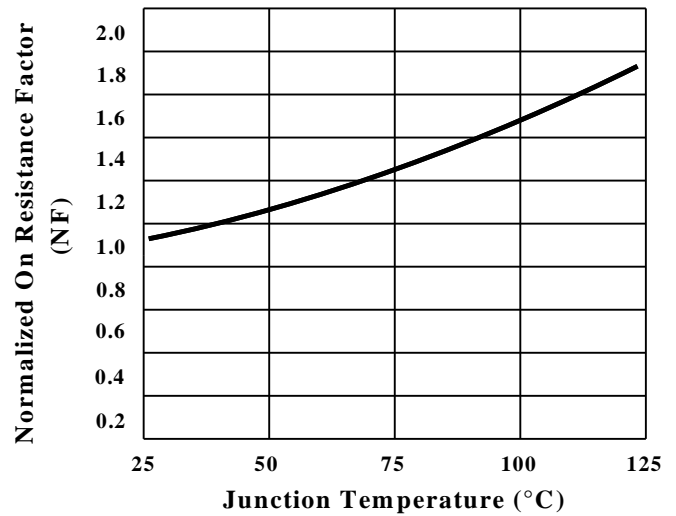


Figure 5

Temperature Derating Curve

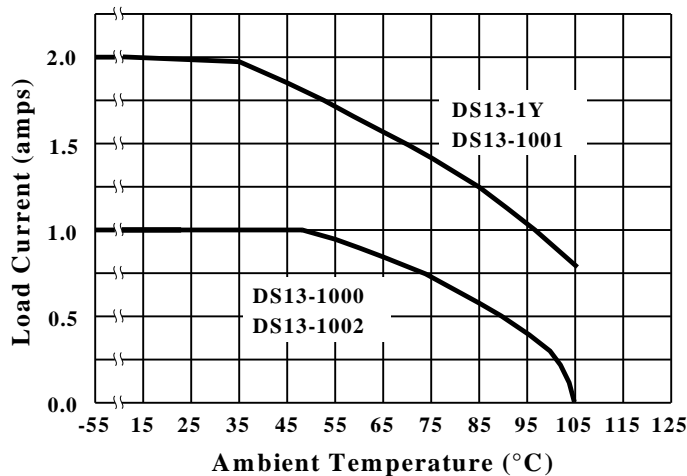


Figure 6

Typical Current Trip Levels

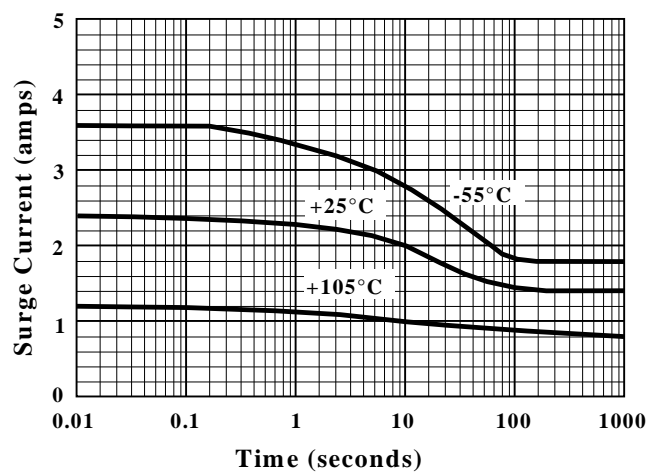
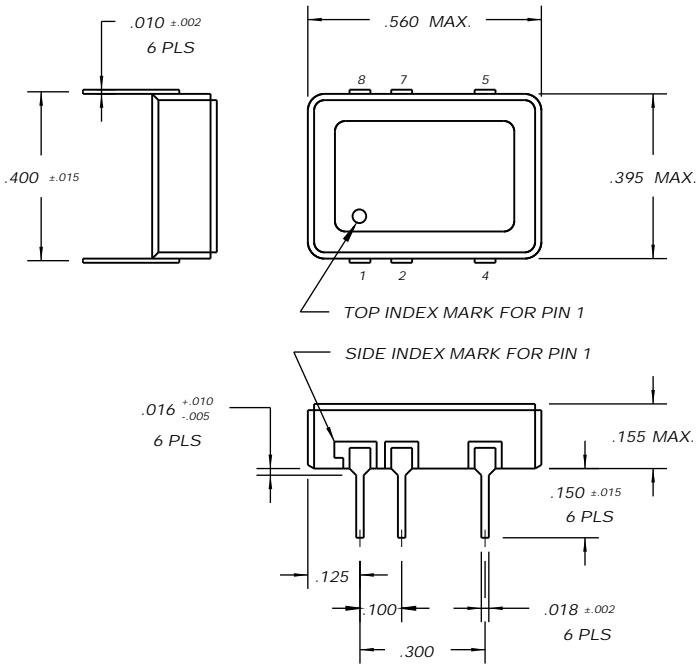


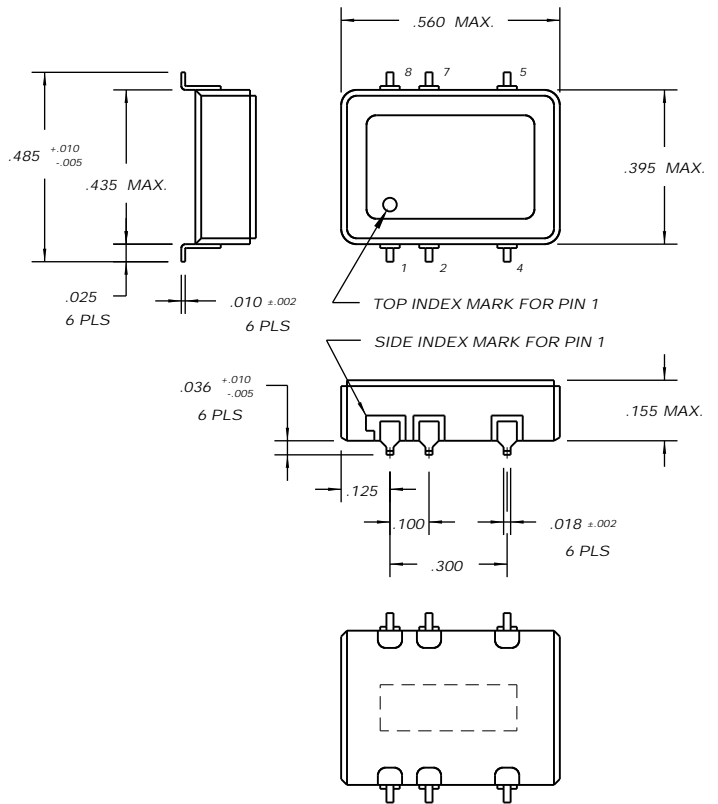
Figure 7

Outline Dimensions

Through-Hole Mount Version



Surface Mount Version



Inches	mm	Inches	mm
.002	0.05	.125	3.18
.005	0.13	.150	3.81
.010	0.25	.155	3.94
.015	0.38	.300	7.62
.016	0.41	.395	10.03
.018	0.46	.400	10.16
.025	0.64	.435	11.05
.036	0.91	.485	12.32
.100	2.54	.560	14.22

Notes :

1. Dimensions are in inches. (See table for metric equivalents.)
2. Weight : 2 gm max.
3. Case : DIP, hermetically sealed, ceramic.
4. Pins : Gold plated.

Notes

1. 2 terminal input configuration is compatible with CMOS or open collector TTL (with pull-up resistor). For Vcc levels above 6 Vdc, a series limiting resistor is required. See Figure 2 for resistor value. Use standard resistor value equal to or less than value from curve.
2. Vcc = 5 Vdc for all tests unless otherwise specified.
3. All DS13 Series relays may drive loads connected to either positive or negative referenced power supply lines. Reversing polarity of output may cause permanent damage. Inductive loads must be diode suppressed.
4. Transient blocking voltage & electrical system spike tests are performed per MIL-STD-704 (28 Vdc systems).
5. To determine the maximum on-resistance at any given junction temperature, multiply on-resistance at 25°C by normalized on-resistance factor from curve (Figure 4).
6. Overload testing per MIL-R-28750 is constrained to the limits imposed by the short circuit protection requirements of this specification and DESC drawing 90091. Load circuit series inductance for “load shorted” mode of operation to be limited to 50 mH max. Maximum repetition rate into a shorted load should not exceed 10Hz. To calculate maximum on-resistance at any temperature, use following equation :  $R(on) = R(on) @ 25^{\circ}C \times NF$  (without short circuit protection) and  $R(on) = 0.2 \times NF + .21$  (with short circuit protection) where NF = normalized on-resistance factor from Figure 4.
7. Proper operation of the status feedback requires a status pull-up resistor. Select the status resistor such that it limits status output current to 2mA :  $R_{status} = V_{status} - 0.3V / 2mA$ .