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Solid State Relays

DS11 Series SSR For DC Loads up to 2A @ 60Vdc

Product Facts

- Standard options: short circuit/overload protection, switch status and trip status
- Optically coupled all solid state relay
- TTL & CMOS compatible input
- Low on-resistance power MOSFET output
- Tested per MIL-PRF-28750D and approved to DSCC drawing 88062 with “Y” level screening

DS11 series SSRs feature 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 extremely low on-resistance. Standard options include integral current overload/short circuit protection to provide protection of the relay, load and wiring; and isolated switch status or trip status. The overload feature provides protection if a short or overload develops while the relay is in the on state or if the relay is turned on into a dead short. Switch status, optically isolated from the load, signals the status of the output and provides a logic “0” when the output is off and a logic “1” when the output is on. Trip status, also optically isolated from the load, provides a logic “1” if the output trips off and a logic “0” when the output is in a normal condition, on or off, and is available only in conjunction with short circuit protection.

<table>
<thead>
<tr>
<th>CII Part No.</th>
<th>DSCC Dwg. No.</th>
<th>Relay Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS11-1Y</td>
<td>88062-008</td>
<td>Basic relay</td>
</tr>
<tr>
<td>DS11-1000</td>
<td>88062-004</td>
<td>Relay w/ short circuit protection</td>
</tr>
<tr>
<td>DS11-1001</td>
<td>88062-006</td>
<td>Relay w/ switch status</td>
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<tr>
<td>DS11-1002</td>
<td>88062-002</td>
<td>Relay w/ short circuit protection and switch status</td>
</tr>
<tr>
<td>DS11-1003</td>
<td>N/A</td>
<td>Relay w/ short circuit protection and trip status</td>
</tr>
</tbody>
</table>

2 Terminal Input Configuration

Direct Drive (Status Optional)

TTL Drive

3 Terminal Input Configuration

With Output Status

Without Output Status

Dimensions are in inches and millimeters unless otherwise specified. Values in brackets are metric equivalents.
# Solid State Relays

## Environmental Characteristics
- **Ambient Temperature Range**
  - Operating: -55°C to +105°C
  - Storage: -55°C to +105°C
- **Vibration Resistance**
  - 100 G's, 10-3,000 Hz
- **Shock Resistance**
  - 50 G's, 11 ms pulse
- **Constant Acceleration Resistance (Y1 axis)**
  - 5,000 G's

## Mechanical Characteristics
- **Weight (approx.)**
  - .176 oz. (5 grams)
- **Materials**
  - Header: KOVAR
  - Cover: Nickel
  - Pins: KOVAR, gold plated

KOVAR is a trademark of Carpenter Technology Corporation.

---

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

### Input (2 terminal configuration)
- **Input supply voltage range (Vcc)**: 3.8 - 32 Vdc (Notes 1 & 2, Figures 1 & 2)
- **Input current (max.) @ 5Vdc**: 15mA (Notes 1 & 2, Figures 1 & 2)
- **Must turn-on voltage**: 3.8Vdc
- **Must turn-off voltage**: 1.5Vdc
- **Reverse voltage protection**: -32Vdc

### Input (3 terminal configuration)
- **Control voltage range**: 0 - 18 Vdc
- **Control current (max.)**: 250µA @ 5V, 1mA @ 18V
- **Input supply voltage range (Vcc)**: 3.8 - 32 Vdc (Notes 1 & 2, Figures 1 & 2)
- **Input current (max.) @ 5Vdc**: 15mA (Notes 1 & 2, Figures 1 & 2)
- **Must turn-on voltage**: 0.3Vdc
- **Must turn-off voltage**: 3.2Vdc

### I/O
- **Dielectric strength (min.)**: 1,000V rms
- **Insulation resistance (min.) @ 500Vdc**: 10^9 ohms
- **Capacitance (max.)**: 10pF

### Output
- **Continuous load current (max.) @ 25°C**: 2.1A (Figure 7)
- **Continuous load voltage (max.)**: 60Vdc
- **Transient blocking voltage (max.)**: 80Vdc (Note 5)
- **On resistance (max.) @ Tj = 25°C, IL = 100mA**: 0.15 ohm (Note 6, Figure 6)
- **Output voltage drop (max.)**: 0.5Vdc
- **Leakage current (max.) @ V = 60Vdc**: 100µA
- **Leakage current (max.) @ V = 60Vdc, with switch status**: 2mA
- **Turn-on time (max.)**: 3 ms (Figure 3)
- **Turn-off time (max.)**: 1 ms (Figure 3)
- **dv/dt (min.)**: 100V / µs
- **Electrical system spike**: 600Vdc (Note 5)
- **Output chip junction temperature (max.)**: 125°C
- **Thermal resistance (max.), junction to ambient**: 90°C/W
- **Thermal resistance (max.), junction to case**: 25°C/W

### Status
- **Status supply voltage range**: 1 - 18Vdc
- **Status current (max.) @ Vstatus = 0.4Vdc**: 600µADC (Figure 5, Note 8)
- **Status leakage current (max.) @ 16Vdc**: 10µA
- **Status turn-on time (max.)**: 3.5 ms (Figure 4)
- **Status turn-off time (max.)**: 8 ms (Figure 4)

### Short Circuit Protection
- **Current surge without tripping (max.), 100ms pulse**: 4.25A
- **Overload trip current (max.), 0.5 ms pulse, V = 60Vdc**: 10A
- **Trip time (typical), turning on into short**: 400µs
- **Trip time (typical), shorting while relay is on**: 280µs

---

10-3 Solid State Relays
DS11 Series SSR For DC Loads up to 2A @ 60Vdc (Continued)

Figure 1 - Maximum Input Current vs. Input Voltage

Figure 2 - Series Resistance vs. Vcc Supply Voltage (Note 1)

Figure 3 - Turn-on and Turn-off Timing

Figure 4 - Output Status Timing

Figure 5 - Status Resistor vs. Status Supply Voltage

Figure 6 - On-Resistance vs. Temperature (Note 6)
### Notes

1. 2 terminal input configuration is compatible with CMOS or open collector TTL (with pull-up resistor). For Vcc levels above 6Vdc, a series limiting resistor is required. See Fig. 2 for resistor value. Use standard resistor value equal to or less than value from the curve.

2. Input transitions to be ≤ 1ms duration, and input direct drive should be “bounceless contact” type.

3. Vcc = 5Vdc for all tests unless otherwise specified.

4. All DS11 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.

5. Transient blocking voltage and electrical system spike tests are performed per MIL-STD-704 (28VDC systems).

6. To determine the maximum on-resistance at any given junction temperature, multiply on-resistance at 25°C (0.15 ohm) by normalized on-resistance factor from curve (Fig. 6).

7. Overload testing per MIL-R-28750 is constrained to the limits imposed by the short circuit protection requirements of this specification and DSCC drawing 88062. Load circuit series inductance for “load shorted” mode of operation to be limited to 50mH max. Maximum repetition rate into a shorted load should not exceed 10 Hz.

8. Proper operation of the status feedback requires a status pull-up resistor. See Fig. 5 for status resistor value.
Product Facts

- 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-PRF-28750D and approved to DSCC drawing 90091.
- All versions available with Tyco Electronics “W” level screening for CII relays.

DS13 series SSRs employ state of the art photovoltaic 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 through hole or surface mount pins.

### CII Part No.  DSCC Dwg. No.  Relay Version

| DS13-1Y   | 90091-008  | Basic relay |
| DS13-1000 | 90091-004  | Relay w/ short circuit protection |
| DS13-1001 | 90091-006  | Relay w/ control status |
| DS13-1002 | 90091-002  | Relay w/ short circuit protection and control status |

Notes: Add suffix “S” to part number for surface mount versions.
Add suffix “T” to part number for tinned leads.
Add suffix “W” to part number for lower screening level.

### 2 Terminal Input Configuration

**Direct Drive**

### 3 Terminal Input Configuration

**With Status**

**Without Status**
Environmental Characteristics

Ambient Temperature Range:
- Operating: -55°C to +105°C.
- Storage: -55°C to +125°C.

Vibration Resistance:
100 G's, 10-3,000 Hz.

Shock Resistance:
1,500 G's, 0.5 ms pulse.

Constant Acceleration Resistance:
5,000 G's.

Mechanical Characteristics

Weight (max.):
.07 oz. (2 grams)

Materials:
Casing: DIP, hermetically sealed, ceramic
Pins: Copper, gold plated

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

<table>
<thead>
<tr>
<th>Input (2 terminal configuration)</th>
<th></th>
</tr>
</thead>
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<tr>
<td>Input supply voltage range (Vcc)</td>
<td>3.8 - 32 Vdc (Notes 1 &amp; 2, Figures 1 &amp; 2)</td>
</tr>
<tr>
<td>Input current (max.) @ 5Vdc</td>
<td>15mA/dc (Notes 1 &amp; 2, Figures 1 &amp; 2)</td>
</tr>
<tr>
<td>Must turn-on voltage</td>
<td>3.8Vdc</td>
</tr>
<tr>
<td>Must turn-off voltage</td>
<td>1.5Vdc</td>
</tr>
<tr>
<td>Reverse voltage protection</td>
<td>-32Vdc</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input (3 terminal configuration)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Control voltage range</td>
<td>0 - 18 Vdc</td>
</tr>
<tr>
<td>Control current (max.)</td>
<td>240µA/dc @ 5V, 1mA @ 18V</td>
</tr>
<tr>
<td>Input supply voltage range (Vcc)</td>
<td>3.8 - 32 Vdc (Notes 1 &amp; 2, Figures 1 &amp; 2)</td>
</tr>
<tr>
<td>Input current (max.) @ 5Vdc</td>
<td>15mA/dc (Notes 1 &amp; 2, Figures 1 &amp; 2)</td>
</tr>
<tr>
<td>Must turn-on voltage</td>
<td>0.3Vdc</td>
</tr>
<tr>
<td>Must turn-off voltage</td>
<td>3.2Vdc</td>
</tr>
</tbody>
</table>

I/O

Dielectric Strength (min.) 1,000V rms
Insulation Resistance (min.) @ 500Vdc 10³ ohms
Capacitance (max.) 10pF

Output

Continuous load current (max.) @ 25°C, without short circuit protection 2.0A/dc (Figure 5, Note 3)
Continuous load current (max.) @ 25°C, with short circuit protection 1.0A/dc (Figure 5, Note 3)
Continuous load voltage (max.) 60Vdc
Transistor blocking voltage (max.) 80Vdc (Note 4)
On resistance (max.) @ Tj = 25°C, Ii = 100ma, with short circuit protection 0.45 ohm (Note 5, Figure 4)
On resistance (max.) @ Tj = 25°C, Ii = 100ma, without short circuit protection 0.22 ohm (Note 5, Figure 4)
Output voltage drop (max.), with short circuit protection 0.6Vdc
Output voltage drop (max.), without short circuit protection 0.75Vdc
Off-state leakage current (max.) @ 60Vdc 100µA/dc
Turn-on time (max.) 1.5 ms (Figure 3)
Turn-off time (max.) 25 ms (Figure 3)
dv/dt (min.) 100V / µs
Electrical system spike ±600Vdc (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

Status

Status supply voltage 30Vdc
Status sink current (max.) @ Vstatus= 0.3Vdc 2mA/dc (Note 7)
Status leakage current (max.) @ 15Vdc 4µA/dc

Environmental Characteristics

Ambient Temperature Range:
- Operating: -55°C to +105°C.
- Storage: -55°C to +125°C.

Vibration Resistance:
100 G’s, 10-3,000 Hz.

Shock Resistance:
1,500 G’s, 0.5 ms pulse.

Constant Acceleration Resistance:
5,000 G’s.

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

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<tr>
<td>Must turn-on voltage</td>
<td>0.3Vdc</td>
</tr>
<tr>
<td>Must turn-off voltage</td>
<td>3.2Vdc</td>
</tr>
</tbody>
</table>

I/O

Dielectric Strength (min.) 1,000V rms
Insulation Resistance (min.) @ 500Vdc 10³ ohms
Capacitance (max.) 10pF

Output

Continuous load current (max.) @ 25°C, without short circuit protection 2.0A/dc (Figure 5, Note 3)
Continuous load current (max.) @ 25°C, with short circuit protection 1.0A/dc (Figure 5, Note 3)
Continuous load voltage (max.) 60Vdc
Transistor blocking voltage (max.) 80Vdc (Note 4)
On resistance (max.) @ Tj = 25°C, Ii = 100ma, with short circuit protection 0.45 ohm (Note 5, Figure 4)
On resistance (max.) @ Tj = 25°C, Ii = 100ma, without short circuit protection 0.22 ohm (Note 5, Figure 4)
Output voltage drop (max.), with short circuit protection 0.6Vdc
Output voltage drop (max.), without short circuit protection 0.75Vdc
Off-state leakage current (max.) @ 60Vdc 100µA/dc
Turn-on time (max.) 1.5 ms (Figure 3)
Turn-off time (max.) 25 ms (Figure 3)
dv/dt (min.) 100V / µs
Electrical system spike ±600Vdc (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

Status

Status supply voltage 30Vdc
Status sink current (max.) @ Vstatus= 0.3Vdc 2mA/dc (Note 7)
Status leakage current (max.) @ 15Vdc 4µA/dc

Short Circuit Protection
See Figure 6, Note 7
DS13 SSR for loads up to 2A @ 60Vdc (Continued)

Figure 1 - Maximum Input Current vs. Input Voltage

![Graph showing maximum input current vs. input voltage](image1)

Figure 2 - Series Resistance vs. Vcc Supply Voltage (Note 1)

![Graph showing series resistance vs. Vcc supply voltage](image2)

Figure 3 - Output Turn-on and Turn-off Timing

![Graph showing output turn-on and turn-off timing](image3)

Figure 4 - On-Resistance vs. Temperature (Note 6)

![Graph showing on-resistance vs. temperature](image4)

Figure 5 - Temperature Derating Curve

![Graph showing temperature derating curve](image5)

Figure 6 - Typical Current Trip Levels

![Graph showing typical current trip levels](image6)
Notes

1. 2 terminal input configuration is compatible with CMOS or open collector TTL (with pull-up resistor). For Vcc levels above 6Vdc, a series limiting resistor is required. See Fig. 2 for resistor value. Use standard resistor value equal to or less than value form the curve.

2. Vcc = 5Vdc 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 (28Vdc 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 (Fig. 4).

6. Overload testing per MIL-R-28750 is constrained to the limits imposed by the short circuit protection requirements of this specification and DSCC drawing 90091.

Load circuit series inductance for “load shorted” mode of operation to be limited to 50mH max. Maximum repetition rate into a shorted load should not exceed 10 Hz. To calculate maximum on-resistance at any temperature, use the following equation: \( R_{on} = R_{on} @ 25°C \times NF \) (without short circuit protection) and \( R_{on} = 0.2 \times NF + .21 \) (with short circuit protection) where NF = normalized on-resistance factor from Fig. 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: \( R_{status} = V_{status} – 0.3V / 2mA \).
Tyco Electronics

Solid State Relays

JTS5, 6, & 7 Series, DC & Bi-Directional Output,
Up to 250mA & 250V Output Rating, TO-5 Package

Input Characteristics
Input Voltage Range — 4.0 – 7.0 Vdc
Maximum Turn-on Voltage — 5.0 Vdc
Minimum Turn-off Voltage — 1.0 Vdc
I/O Dielectric — 1000 Vac pk-pk

Output Characteristics
Max. Output Current (Continuous, 25°C) —
50 mAac or mAdc (JTS5-1Y)
250 mAac (JTS6-1Y)
100 mAac (JTS7-1Y)
Max. Output Voltage —
40 Vac or Vdc (JTS5-1Y)
40 Vdc (JTS6-1Y)
250 Vdc (JTS7-1Y)
Max. On-resistance — 5 ohms (JTS5-1Y)
Turn-on Time — 10 µsec.
Turn-off Time — 15 µsec.

Environmental Characteristics
Shock — 1500 G’s, 0.5 ms.
Vibration — 100 G’s, 10 to 2000 Hz
Operating Ambient Temperature — -55 to +125°C

Product Facts
■ Hermetically sealed TO-5 package
■ Transformer coupled
■ High speed switching
■ JTS5-1Y switches AC or DC
■ Qualified to M28750/5, 6, & 7

Notes:
1) Reversing polarity of input (or output except for JTS5-1) may cause permanent damage.
2) Input must be a step function. Rise or fall time, as applicable, not to exceed 100 µsec.
3) Inductive loads must be diode suppressed.
4) For any control voltage, the maximum load current shown on graphs must not be exceeded. Attempting to draw currents in excess of those specified on graphs can cause permanent damage.

Terminal View

Output Current Vs. Input Control Voltage and Ambient Temperature

JTS5-1Y

JTS6-1Y

JTS7-1Y

Dimensions are in inches and millimeters unless otherwise specified. Values in brackets are metric equivalents.

Dimensions are shown for reference purposes only. Specifications subject to change.

USA: 1-800-522-6752
Canada: 1-905-470-4425
Mexico: 01-800-733-8926
C. America: 55-55-1106-0803

South America: 55-11-2103-6000
Hong Kong: 852-2735-1628
Japan: 81-44-844-8013
UK: 44-8706-080-208

Catalog 5-1773450-5
Revised 9-08
www.tycoelectronics.com
Solid State Relays

MS18-1006 High Performance DC and Bi-directional Solid State Relay For Loads up to 2A @ 80Vdc

Product Facts
- Bi-directional power FET output
- Optically coupled
- Low on-resistance
- Extremely low leakage current
- Subminiature hermetically sealed package
- Tested per MIL-PRF-28750D and approved to DSCC drawing 89116-006

The MS18-1006 is an optically coupled SSR employing power MOSFET output chips in a inverse series configuration for switching DC or bi-directional loads. A common source connection is provided for the user to configure the output switching circuit for DC operation up to 2A with very low on-resistance. The relay features fast switching speeds, low off-state leakage, virtually zero offset voltage and the capability to withstand high inrush currents up to 350% of rated. The low profile subminiature package is hermetically sealed with pinouts on a 0.1” x 0.3” grid pattern.

<table>
<thead>
<tr>
<th>CII Part No.</th>
<th>DSCC Dwg. No.</th>
<th>Relay Version</th>
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</thead>
<tbody>
<tr>
<td>MS18-1006</td>
<td>89116-006</td>
<td>Basic relay</td>
</tr>
</tbody>
</table>

Environmental Characteristics

Ambient Temperature Range — Operating — -55°C to +120°C
Storage — -55°C to +125°C
Vibration Resistance — 100 G's, 10-2,000 Hz
Shock Resistance — 1,500 G's, 0.5 ms pulse
Constant Acceleration Resistance (Y-1 axis) — 5,000 G's

Mechanical Characteristics

Weight (approx.) — 0.07 oz. (5 grams)
Materials —
Header — Kovar® Alloy
Cover — Grade A Nickel
Pins — Kovar® Alloy, gold plated

KOVAR is a trademark of Carpenter Technology Corporation.

Electrical Specifications (-55°C to +120°C unless otherwise specified)

<table>
<thead>
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<th>Input</th>
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<tbody>
<tr>
<td>Input current (max.)</td>
<td>25mAdc</td>
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<tr>
<td>Input voltage drop (max. @ 25mA)</td>
<td>1.5 Vdc</td>
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<tr>
<td>Must turn-on current</td>
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<td>Must turn-off current</td>
<td>10µA</td>
</tr>
<tr>
<td>Reverse voltage protection</td>
<td>-5.0Vdc</td>
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</table>

I/O

Dielectric strength (60Hz., 1mA leakage) | 500V rms
Insulation resistance (min.) @ 500Vdc | 10^9 ohms
Capacitance (max. @ 25Vdc, 1 MHz) | 5pF

Output

Continuous load current, parallel (DC) configuration (max.) | 2A (Figure 2)
Continuous load current, series (bi-directional) configuration (max.) | 1A (Figure 2)
Continuous operating load voltage (max.) | +/- 80V
Transient blocking voltage (5 sec max.) | +/- 90V
Overload (100ms, 10% duty cycle, 10 cycles max.) | 350% of rated
dv/dt (min.) | 100V / µs
On resistance (max.), parallel (DC) configuration | 0.4 ohm
On resistance (max.), series (bi-directional) configuration | 0.6 ohm
Turn-on time (max, @ +/- 80V) | 800µs (Figure 3)
Turn-off time (max, @ +/- 80V) | 500µs (Figure 3)
Thermal resistance, junction to ambient | 110°C/W
Thermal resistance, junction to case | 20°C/W

Figure 1 – Wiring Diagrams

Parallel Connection

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<tr>
<th>V(in)</th>
<th>TOP VIEW</th>
<th>V(LOAD)</th>
</tr>
</thead>
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<tr>
<td>1</td>
<td>CASE GROUND</td>
<td>LOAD</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>4</td>
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<td>5</td>
<td>6</td>
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Series Connection

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<th>TOP VIEW</th>
<th>V(LOAD)</th>
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<td>1</td>
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<td>N/C</td>
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</tbody>
</table>
MS18-1006 High Performance DC and Bi-directional Solid State Relay For Loads up to 2A @ 80Vdc (Continued)

Figure 2 - Temperature Derating Curves

![Temperature Derating Curves](image)

**Series Configuration**

- AMBIENT TEMPERATURE (°C)
- LOAD CURRENT (AMPS RMS)

**Parallel Configuration**

- AMBIENT TEMPERATURE (°C)
- LOAD CURRENT (AMPS RMS)

Figure 3 - Turn-on and Turn-off Timing

![Turn-on and Turn-off Timing](image)

Figure 4 - Functional Block Diagram

![Functional Block Diagram](image)

Figure 5 - Outline Dimensions

![Outline Dimensions](image)

Notes

1. An external resistor must be in series with the input at all times.
2. Do not ramp input current. Input transition should be <1.0ms.
3. Input current-series resistor calculation (Approx.): \( I_{\text{input}} = V_{\text{IN}} - V_{\text{DROP}} / R_{\text{SERIES}} \)
4. Unless otherwise specified parametric testing is accomplished at 25mA input current.
5. To calculate \( R_{\text{DS(on)}} \) for temperatures other than 25°C, use the following equation: \( T_{\text{TEMP}} = (R_{\text{DS(on)}}) \cdot e^{(X \cdot T)} \) where \( x = 0.0065 \).
6. Inductive loads must be diode suppressed.
7. Continuous load current is rated under conditions of still air.
8. Load may be connected to either side of relay, sink or source modes.
9. Reverse polarity >5Vdc may cause permanent damage
10. Acceptance testing is accomplished in the series (bi-directional) mode.
Solid State Relays

JDS9 Series, AC Relays, 2A/250Vrms Rating

Input Characteristics
Input Voltage Range — 3.8 – 32 Vdc
Pick-up Voltage — 3.8 Vdc
Dropout Voltage — 1.5 Vdc
I/O Dielectric — 1500 Vrms

Output Characteristics
Max. Output Current (Continuous, 25°C) — 2 Arms
Max. Output Voltage — 250 Vrms
Peak Over Voltage Rating — 500 Vpk
Frequency Range — 40 – 440 Hz
Zero Switch Window — 15 Vpk
Thermal Resistance — Junction to Ambient — 65°C/Watt
Junction to Case — 15°C/Watt

Environmental Characteristics
Shock — 1500 G's, 0.5 ms.
Vibration — 30 G's, 10 to 3000 Hz
Operating Ambient Temperature — -55 to +110°C

Product Facts
■ Hermetically sealed
■ Thick film hybrid construction
■ Optically isolated
■ Zero voltage turn-on
■ Qualified to MIL–R–28750/9

Terminal View

Input Characteristics
Input Voltage Range — 3.8 – 32 Vdc
Pick-up Voltage — 3.8 Vdc
Dropout Voltage — 1.5 Vdc
I/O Dielectric — 1500 Vrms

Output Characteristics
Max. Output Current (Continuous, 25°C) — 2 Arms
Max. Output Voltage — 250 Vrms
Peak Over Voltage Rating — 500 Vpk
Frequency Range — 40 – 440 Hz
Zero Switch Window — 15 Vpk
Thermal Resistance — Junction to Ambient — 65°C/Watt
Junction to Case — 15°C/Watt

Environmental Characteristics
Shock — 1500 G's, 0.5 ms.
Vibration — 30 G's, 10 to 3000 Hz
Operating Ambient Temperature — -55 to +110°C

Product Facts
■ Hermetically sealed
■ Thick film hybrid construction
■ Optically isolated
■ Zero voltage turn-on
■ Qualified to MIL–R–28750/9

Terminal View

JDS9 Max. Output Current vs. Temperature

JDS9 Typical Input Current vs. Input Voltage
PS12 Series High Performance Solid State Relays
For AC Loads up to 10A @ 250Vrms

Product Facts

- Approved to DSCC drawing 86031
- Optically coupled all solid state relay
- TTL compatible input
- Zero voltage turn-on for low EMI
- Custom power package with screw terminals

The PS12 series solid state relay is designed for AC power switching up to 10 amps at 250Vrms. The circuit employs back-to-back SCRs with zero voltage turn-on for reliable switching of resistive or reactive loads. TTL compatible input circuitry is optically isolated to 1,500Vrms from the AC load circuit. The relay is offered in two versions: the PS12-1Y with "Y" level screening per MIL-PRF-28750D, and the PS12-1W screened per Tyco Electronics specifications for CII relays, equivalent to former "W" level of Mil-R-28750.

<table>
<thead>
<tr>
<th>CII Part Number</th>
<th>DSCC Part Number</th>
<th>Screening Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS12-1Y</td>
<td>86031-001 Y</td>
<td></td>
</tr>
<tr>
<td>PS12-1W</td>
<td>N/A W</td>
<td></td>
</tr>
</tbody>
</table>

Circuit Diagram

Outline Drawing
Solid State Relays

PS12 Series High Performance Solid State Relays
For AC Loads up to 10A @ 250Vrms (Continued)

Environmental Characteristics
Ambient Temperature Range —
Operating — -55°C to +95°C
Storage — -55°C to +110°C
Vibration Resistance —
30 G’s, 78-2,000 Hz
Shock Resistance —
100 G’s, 6 ms pulse
Constant Acceleration Resistance —
100 G’s

Electrical Specifications (-55°C to +95°C unless otherwise specified)

<table>
<thead>
<tr>
<th>Section</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>Input supply voltage range (Vcc) 3.8 - 32 Vdc</td>
</tr>
<tr>
<td></td>
<td>Input current (max.) @ 5Vdc 16mA</td>
</tr>
<tr>
<td></td>
<td>Must turn-on voltage 3.8Vdc</td>
</tr>
<tr>
<td></td>
<td>Must turn-off voltage 1Vdc</td>
</tr>
<tr>
<td></td>
<td>Reverse voltage protection -32Vdc</td>
</tr>
<tr>
<td>I/O</td>
<td>Dielectric strength (min.) 1,500V rms/60 Hz.</td>
</tr>
<tr>
<td></td>
<td>Insulation resistance (min.) @ 500Vdc 10⁸ ohms</td>
</tr>
<tr>
<td></td>
<td>Capacitance (max.) 15pF</td>
</tr>
<tr>
<td>Output</td>
<td>Output current rating (max.) 10A rms (Fig. 2, Note 1)</td>
</tr>
<tr>
<td></td>
<td>Surge current (max.) 100A pk (Fig. 1, Note 2)</td>
</tr>
<tr>
<td></td>
<td>Continuous load voltage (max.) 250V rms</td>
</tr>
<tr>
<td></td>
<td>Transient blocking voltage (max.) 460V pk</td>
</tr>
<tr>
<td></td>
<td>Frequency range 45 - 440 Hz.</td>
</tr>
<tr>
<td></td>
<td>Output voltage drop (max.) @ 25A load current 1.5V pk</td>
</tr>
<tr>
<td></td>
<td>Off-state leakage current (max.) @ 220V rms/400 Hz. 9mA rms</td>
</tr>
<tr>
<td></td>
<td>Turn-on time (max.) 1/2 cycle</td>
</tr>
<tr>
<td></td>
<td>Turn-off time (max.) 1 cycle</td>
</tr>
<tr>
<td></td>
<td>Off-state dv/dt (min.), with snubber 200V/µs (Note 3)</td>
</tr>
<tr>
<td></td>
<td>Zero voltage turn-on window (max.) ±15V pk</td>
</tr>
<tr>
<td></td>
<td>Output chip junction temperature (max.) 125°C (Note 1)</td>
</tr>
<tr>
<td></td>
<td>Thermal resistance (max.), junction to ambient 11.5°C/W</td>
</tr>
<tr>
<td></td>
<td>Thermal resistance (max.), junction to case 2.0°C/W</td>
</tr>
<tr>
<td></td>
<td>Fusing I²T, 1 ms (max.) 150A's</td>
</tr>
<tr>
<td></td>
<td>Load power factor (min.) 0.2</td>
</tr>
<tr>
<td></td>
<td>Power dissipation (max.) 1.5W/A</td>
</tr>
</tbody>
</table>

Mechanical Characteristics
Weight (max.) —
3 oz. (85 grams)
Materials —
Case — Plastic, self-extinguishing, epoxy filled
Terminals — Brass, nickel-plated
Base Plate — Aluminum

NOTE: Do not exceed 180 in-oz when tightening screws.

Notes
1. Operation at elevated load currents up to 10 amps is dependent on the use of suitable heatsink to limit junction temperature.
2. Heating of output chips during and after a surge may cause loss of output blocking capability until junction temperature falls below maximum rating.
3. Internal snubber network is provided across output chips.

Figure 1 - Peak Surge Current vs. Surge Current Duration
Figure 2 - Load Current vs. Temperature
JPS10 Series High Performance Solid State Relays
For AC Loads up to 2A @ 250Vrms

Product Facts
- Qualified to MIL-PRF-28750D (Mil Part Numbers M28750/10-001Y and M28750/10-002Y)
- Optically coupled all solid state relay
- TTL compatible input
- Zero voltage turn-on for low EMI
- Custom power package

The JPS10 series solid state relay is designed for AC power switching up to 25 amps at 250Vrms. The circuit employs back-to-back photoSCRs with zero voltage turn-on for reliable switching of resistive or reactive loads. TTL compatible input circuitry is optically isolated to 1,500Vrms from the AC load circuit. The relay is offered in two versions: the JPS10-1Y with a maximum zero voltage turn-on window of 15 volts (preferred version for resistive loads), and the JPS10-2Y with a maximum window of 40 volts (preferred version for reactive loads).

<table>
<thead>
<tr>
<th>CII Part Number</th>
<th>Military Part Number</th>
<th>Zero Crossing Window</th>
</tr>
</thead>
<tbody>
<tr>
<td>JPS10-1Y</td>
<td>M28750/10-001Y</td>
<td>15 V pk max.</td>
</tr>
<tr>
<td>JPS10-2Y</td>
<td>M28750/10-002Y</td>
<td>40 V pk max.</td>
</tr>
</tbody>
</table>

**Circuit Diagram**

**Terminal View**

<table>
<thead>
<tr>
<th>+ DC Control Source</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  2</td>
<td>3  4</td>
</tr>
</tbody>
</table>

**Outline Drawing**

<table>
<thead>
<tr>
<th>.245 ± .025</th>
<th>2 PLS</th>
<th>CONTRASTING BEAD IS + INPUT TERMINAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.41 MAX (61.2)</td>
<td>.040 ± .002 DIA. (1.02 ± .05)</td>
<td></td>
</tr>
<tr>
<td>.505 ± .025</td>
<td>2 PLS</td>
<td>COPER CORE WIRE</td>
</tr>
<tr>
<td>(12.3 ± .63)</td>
<td>.080 ± .002 DIA. (2.03 ± .05)</td>
<td></td>
</tr>
</tbody>
</table>

TOLERANCE: ± .010 (.25) UNLESS OTHERWISE NOTED
TERMINAL NUMBERS SHOWN ARE FOR REFERENCE ONLY, AND DO NOT APPEAR ON RELAY.
JPS10 Series High Performance Solid State Relays
For AC Loads up to 2A @ 250Vrms (Continued)

### Environmental Characteristics

**Ambient Temperature Range**
- Operating: -55°C to +110°C
- Storage: -55°C to +125°C

**Vibration Resistance**
30 Gs, 10-3,000 Hz

**Shock Resistance**
1,500 Gs, 0.5 ms pulse

**Constant Acceleration Resistance (Y1 axis)**
5,000 Gs

### Mechanical Characteristics

**Weight (max.)**
6 oz. (170 grams)

**Materials**
- Case: Aluminum, hot tin dipped
- Terminals: Copper cored wire, gold plated

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

<table>
<thead>
<tr>
<th>Input</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Input supply voltage range (Vcc)</td>
<td>4 - 32 Vdc</td>
</tr>
<tr>
<td>Input current (max.)</td>
<td>16mA dc</td>
</tr>
<tr>
<td>Must turn-on voltage</td>
<td>4V dc</td>
</tr>
<tr>
<td>Must turn-off voltage</td>
<td>1V dc</td>
</tr>
<tr>
<td>Reverse voltage protection</td>
<td>-32V dc</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I/O</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dielectric strength (min.)</td>
<td>1,500Vrms/60 Hz.</td>
</tr>
<tr>
<td>Insulation resistance (min.) @ 500Vdc</td>
<td>10^9 ohms</td>
</tr>
<tr>
<td>Capacitance (max.)</td>
<td>20pF</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Output current rating (max.)</td>
<td>25Arms (Fig. 2, Note 1)</td>
</tr>
<tr>
<td>Surge current (max.)</td>
<td>80A pk (Fig. 1, Note 2)</td>
</tr>
<tr>
<td>Continuous load voltage (max.)</td>
<td>250Vrms</td>
</tr>
<tr>
<td>Transient blocking voltage (max.)</td>
<td>500V pk</td>
</tr>
<tr>
<td>Frequency range</td>
<td>45 - 440 Hz</td>
</tr>
<tr>
<td>Output voltage drop (max.) @ 25A load current</td>
<td>1.5Vrms</td>
</tr>
<tr>
<td>Off-state leakage current (max.) @ 220Vrms/400 Hz.</td>
<td>10mA rms</td>
</tr>
<tr>
<td>Turn-on time (max.)</td>
<td>1/2 cycle</td>
</tr>
<tr>
<td>Turn-off time (max.)</td>
<td>1 cycle</td>
</tr>
<tr>
<td>Off-state dv/dt (min.), with snubber</td>
<td>200V/µs (Note 3)</td>
</tr>
<tr>
<td>Zero voltage turn-on window (max.), JPS10-1Y</td>
<td>15V pk</td>
</tr>
<tr>
<td>Zero voltage turn-on window (max.), JPS10-2Y</td>
<td>40V pk</td>
</tr>
<tr>
<td>Waveform distortion (max.)</td>
<td>4Vrms</td>
</tr>
<tr>
<td>Output chip junction temperature (max.)</td>
<td>125°C (Note 4)</td>
</tr>
<tr>
<td>Thermal resistance (max.), junction to ambient</td>
<td>6.8°C/W</td>
</tr>
<tr>
<td>Thermal resistance (max.), junction to case</td>
<td>1.2°C/W</td>
</tr>
</tbody>
</table>

### Notes

1. Operation at elevated load currents up to 25 amps is dependent on the use of suitable heatsink to maintain case temperature per Fig. 2.
2. Heating of output chips during and after a surge may cause loss of output blocking capability until junction temperature falls below maximum rating.
3. Internal snubber network is provided across output chips.
4. Case temperature measurement point is center of mounting surface.

#### Figure 1 - Peak Surge Current vs. Surge Current Duration

![Figure 1](image)

#### Figure 2 - Load Current vs. Temperature

![Figure 2](image)