

**53278**

**28 V HIGH SIDE LATCHING SOLID-STATE  
POWER CONTROLLER**



**Features:**

- Switch Status Output
- I<sup>2</sup>T circuit protection
- SPST, normally open
- 1A , 2A Pin Configurable Operating Current
- Power FET output with Low on-state resistance
- Full military temperature operation:  
-55°C to +125°C.
- Radiation hardened capable.
- Military environmental screening available

**Applications:**

- Ideal for 24V bus applications
- Aircraft Power Distribution
- Military/High Reliability Systems
- Satellite/Space Systems

**DESCRIPTION**

The 53278 is a military SPST, solid-state relay. It is a lightweight device resistant to damage from shock and vibration, and immune to contact-related problems (contamination, arcing) associated with mechanical equivalents.

Transformer coupling between the input and output stages provides effective isolation up to 1000 V RMS. The Power FET output eliminates bipolar offset and minimizes output voltage drop.

The preferred control input is CMOS compatible operating from a bias supply of 4.5 to 5.5VDC. (See Figure 1)

Integral short-circuit protection, I<sup>2</sup>T trip and status output is provided. This unit is Pin configurable for 1A or 2A output. The output current flow is sensed while under load or while switching, and responds to an over-current with an I<sup>2</sup>T trip curve by opening the output. An open-collector Status is available to indicate the switch state. The output will remain blocked indefinitely until the short is removed and the unit reset. This feature prevents damage to the controller and also averts further system failures that may be caused by the short circuit. Output Status is On (High) when the output is switched on and is Off (Low) whenever the output is commanded off or tripped. Resetting the unit is accomplished by recycling the input control.

This device is available in a variety of quality levels from COTS to class K including any custom screening requirements and all components have radiation-hardened equivalents. The basic data sheet part is environmentally screened to H level in accordance with Table C-IX of MIL-PRF-38534 with no element evaluation or QCI.

**ABSOLUTE MAXIMUM RATINGS**

|  |                      |
|--|----------------------|
| Isolation voltage <sup>1</sup> .....                   | 1000 V RMS           |
| Continuous operating output voltage <sup>2</sup> ..... | 50 VDC               |
| Transient output voltage.....                          | 60 VDC               |
| Load Current.....                                      | 18A / Self Limiting  |
| Bias supply voltage, V <sub>DD</sub> .....             | 4.5 to 5.5 VDC       |
| Operating temperature .....                            | -55°C to +125°C Case |
| Storage temperature .....                              | -55°C to +125°C      |

**Notes:**

<sup>1</sup> 60 Hz sine wave

<sup>2</sup> Reversing polarity on the output may cause permanent damage

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## ELECTRICAL CHARACTERISTICS

 $T_A = +25^\circ\text{C}$ 

| PARAMETER  | TEST CONDITIONS                       | MIN       | TYP    | MAX       | UNITS              |
|--|---------------------------------------|-----------|--------|-----------|--------------------|
| <b>Input characteristics</b>                     |                                       |           |        |           |                    |
| <b>CMOS configurations (Figure 1)</b>            |                                       |           |        |           |                    |
| Bias supply range, $V_{DD}$                      |                                       | 3.3       |        | 5.5       | VDC                |
| Bias current                                     |                                       |           | 5      | 10        | mA                 |
| Input current                                    | 5 VDC Input                           |           |        | 500       | $\mu\text{A}$      |
| Control voltage range                            |                                       | -0.5      |        | 5.5       | VDC                |
| Turn-on voltage                                  | At $V_{DD} = 5.0\text{V}$             |           | 2.8    | 3.2       | VDC                |
| Turn-off voltage                                 | At $V_{DD} = 5.0\text{V}$             | 0.5       | 2.0    |           | VDC                |
| Dielectric strength                              | 60 Hz                                 | 1000      |        |           | V RMS              |
|  |                                       |           |        |           |                    |
|  |                                       |           |        |           |                    |
|  |                                       |           |        |           |                    |
| Bus Return Bias Current:                         | <b>28V Bus Voltage</b>                |           | 10     | 20        | mA                 |
| <b>Output characteristics</b>                    |                                       |           |        |           |                    |
| Output current, sustaining:                      | Steady state load                     | 1.2 / 2.4 |        | 2.4 / 4.8 | A                  |
| Continuous blocking voltage                      |                                       |           |        | 50        | VDC                |
| On-state resistance, $R_{ds}$ (1A Configuration) | 25°C Case                             |           | 0.075  | 0.1       | Ohms               |
| On-state resistance, $R_{ds}$ (2A Configuration) | 25°C Case                             |           | 0.050  | 0.075     | Ohms               |
| Turn-on time @ 25°C case                         | Figure 2                              |           | 0.8    | 2.0       | mS                 |
| Turn-off time @ 25°C case                        | Figure 2                              |           | 0.5    | 1.0       | mS                 |
| Off-state leakage                                | At Maximum Blocking Voltage           |           | 40     | 100       | $\mu\text{A}$      |
| Output Capacitance                               |                                       |           |        | 700       | pF                 |
| Load Start current                               | 25°C                                  | 6/12      | 7.5/15 | 9/18      | A                  |
| Short-circuit peak                               |                                       |           |        | 100       | A                  |
| Trip Reset Time                                  | Remove short / overload & Cycle input | 50        |        |           | mS                 |
| Status Output Specification                      |                                       | 5.0       |        | 32        | VDC                |
| Status Supply Voltage (open Collector)           |                                       |           |        |           |                    |
| Status off leakage current                       | $V_S = 30\text{VDC}$                  |           |        | 100       | $\mu\text{ADC}$    |
| Status off leakage current                       | $V_S = 15\text{VDC}$                  |           |        | 4         | $\mu\text{ADC}$    |
| Status on voltage                                | $I_{STATUS} = 5\text{MA}$             |           |        | 0.4       | VDC                |
| High-To-Low Transition Time                      | $I_{STATUS} = 5\text{MA}$             |           | 20     | 50        | $\mu\text{S}$      |
| Junction temperature                             |                                       |           |        | 150       | $^\circ\text{C}$   |
| Thermal resistance, $\theta_{JA}$                |                                       |           |        | 30        | $^\circ\text{C/W}$ |
| $\theta_{JC}$                                    |                                       |           |        | 5         | $^\circ\text{C/W}$ |

## APPLICATION NOTES:

1. Maximum input switching frequency not to exceed 20 Hz under normal conditions, or 1 Hz if output is shorted.
2. Input transitions should be  $<1\text{ms}$  and duration and input source should be "bounceless contact" type.
3. Inductive loads must be suppressed.
4. Peak current that may flow when output is shorted.

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Connect 6,7 or 7,8 for 1A  
 Connect 6,7,8 for 2A

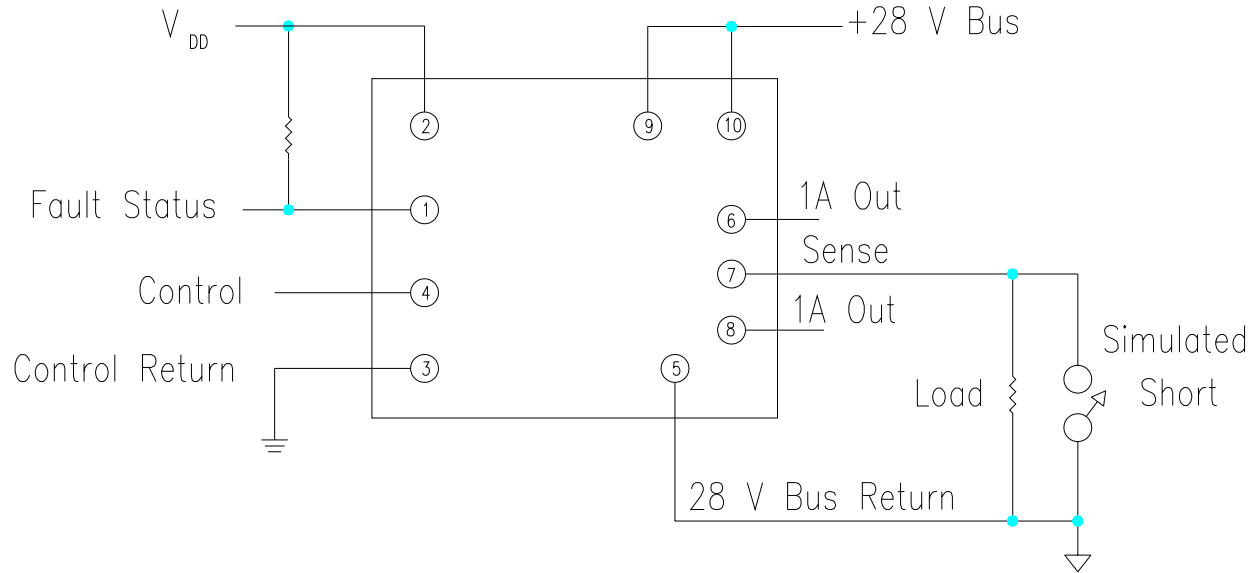


Figure 1 Typical Connection Diagram

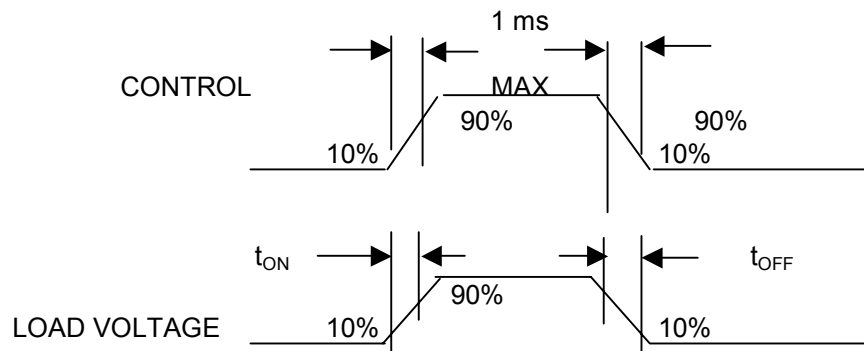


Figure 2 Switching Characteristics

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Truth Table – Power Sequencing

|                       |          |          |            |          |            |          |          |
|-----------------------|----------|----------|------------|----------|------------|----------|----------|
| <b>Bus Voltage</b>    | 0        | On       | 0          |          |            | On       | On       |
| <b>V<sub>DD</sub></b> | 0        | 0        | On         |          |            |          |          |
| <b>Control</b>        | X        | X        | X          | 0        |            | X        | X        |
| <b>I Out</b>          | Open     | Open     | Open       | Open     |            | 0        | 1        |
| <b>Output Status</b>  | Open “1” | Open “1” | 0          | 0        |            |          | Open “1” |
| <b>Short</b>          | X        | X        | X          | Off      | Off        | Off      | Off      |
|                       |          | (Note 1) | (Note 1,2) | (Note 3) | (Note 3,4) | (Note 5) | (Note 5) |

Truth Table – Short circuit and Status

|                       | Turn on into Short Sequence |         |     |     |          | Short while on Sequence |     |     |     |          |
|-----------------------|-----------------------------|---------|-----|-----|----------|-------------------------|-----|-----|-----|----------|
| <b>Control</b>        | 0                           | 1       | 1   | 0   | 1        | 1                       | 1   | 1   | 0   | 1        |
| <b>I out</b>          | Off                         | Off     | Off | Off | On       | On                      | Off | Off | Off | On       |
| <b>Output Status</b>  | 0                           | 0       | 0   | 0   | Open “1” | Open “1”                | 0   | 0   | 0   | Open “1” |
| <b>Shorted Output</b> | Shorted                     | Shorted | X   | Off | Off      | Off                     | On  | X   | X   | Off      |

Note 1: Unit Powers up in the Off condition with application of either Bus power or V<sub>DD</sub>.

Note 2: Fault Status reports only when V<sub>DD</sub> is present.

Note 3: Control “0” Off must be invoked upon simultaneous applications of 5V and Bus Power for an unambiguous output and fault status.

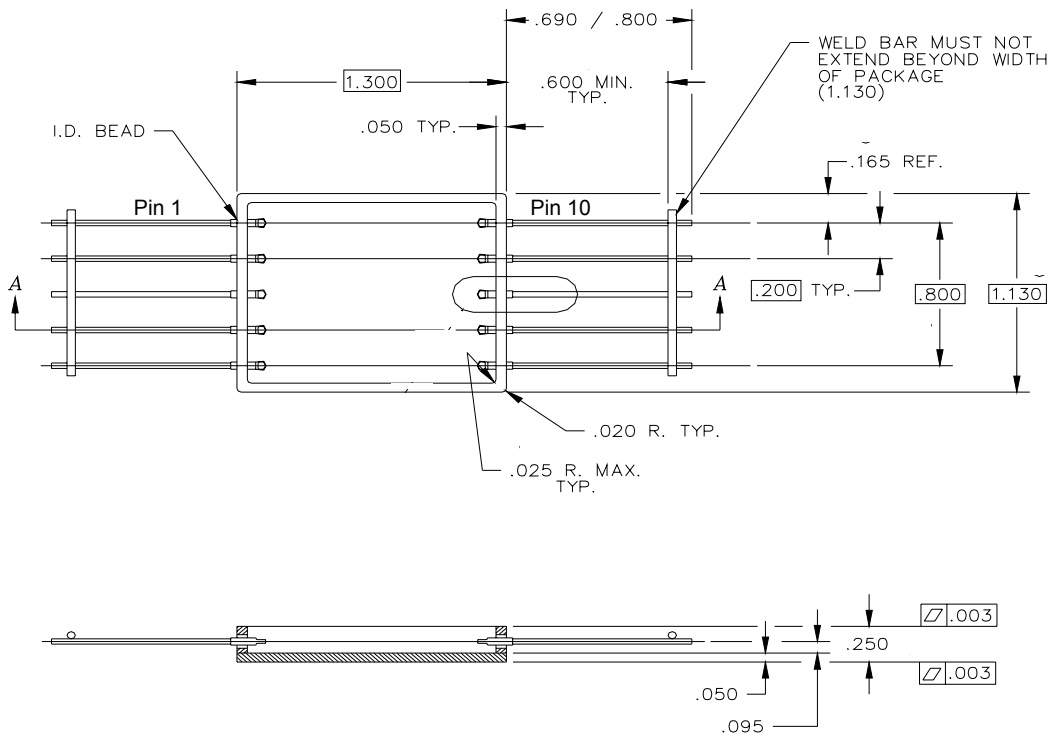
Note 4: An Off Control to On Control transition is required to first turn the Unit On.

Note 5: Loss of V<sub>DD</sub> will not change output state during normal operation.

Note 6: Truth Table-Power sequencing: Output Status open collector pull-up resistor is assigned a separate and always present voltage, producing a “1” when “Open”.

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Package Dimensions



NOTES:

1. MATERIAL:  
PACKAGE: ASTM F-15 ALLOY  
LEADS: ASTM F-15 ALLOY BRAZED TO ZIRCONIUM COPPER.

| IN | FUNCTION       |
|----|----------------|
| 1  | FAULT STATUS   |
| 2  | $V_{DD}$       |
| 3  | CONTROL RETURN |
| 4  | CONTROL        |
| 5  | BUS RETURN     |
| 6  | OUT (1A)       |
| 7  | OUT SENSE      |
| 8  | OUT (1A)       |
| 9  | + BUS          |
| 10 | + OUT BUS      |

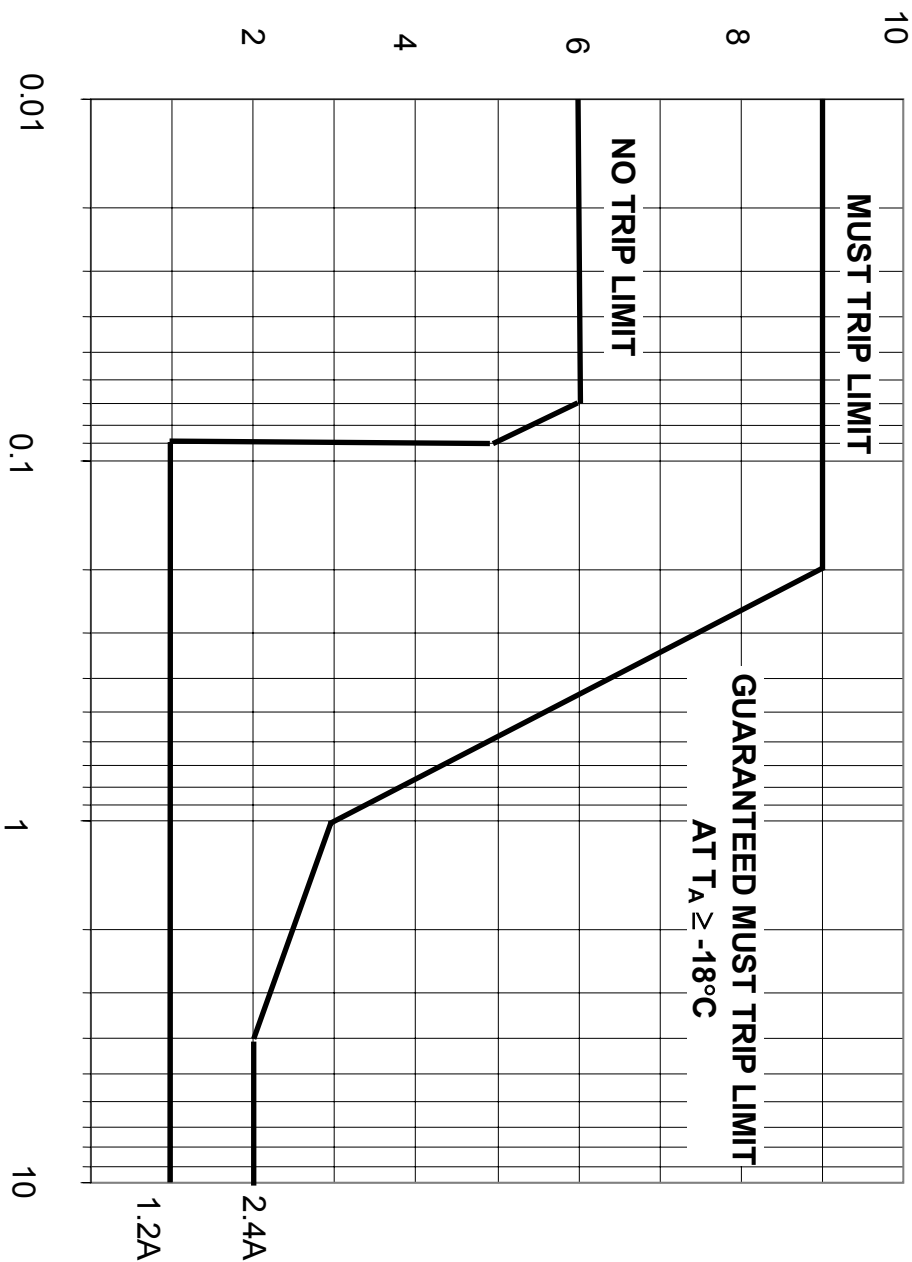
Note: For 1A output, connect Pins 6 and 7 or Pins 7 and 8; for 2A output connect Pins 6, 7 and 8.

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NOTES:

- 1) Initial current limits (NO TRIP and MUST TRIP) will be 6 and 9A for each of the 1A outputs.
- 2) 1A Output (Case pins 6 and 7 connected together). Output current per graph.
- 3) 2A Output (Case pins 6,7 and 8 connected together). Output current two times values of graph.

CURRENT (Amps) per Output



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