# 53513 NON-LATCHING, ISOLATED OUTPUT SOLID STATE POWER CONTROLLERS

**Mii**
**MICROCIRCUITS**

**Features:**
- Switch Status Output
- $I^2T$ circuit protection with status output
- SPST, normally open
- 5A, 10A and 15A Operating Current
- Power FET output with Low on-state resistance
- Full military temperature operation: -55ºC to +125ºC
- Radiation tolerant
- Military environmental screening available

**Applications:**
- Designed for 28V bus applications
- Aircraft Power Distribution
- Military/High Reliability Systems
- Satellite/Space Systems

## DESCRIPTION

The 53513 Solid-State Power Controllers are lightweight, resistant to damage from shock and vibration, and immune to contact-related problems (contamination, arcing) associated with mechanical equivalents. They share the heritage and features of the 53503 Solid State Controller family.

Transformer coupling between the input, output and Power Bus stages provides isolation of 500 V RMS. The Power FET output eliminates bipolar offset and minimizes output voltage drop.

The Control input is CMOS or TTL logic compatible and may operate from a bias supply of 4.5 to 5.5VDC. (See Figure 1)

Short-circuit protection and $I^2T$ trip and output status is provided. The output current is continuously monitored and responds to an over-current condition with an $I^2T$ trip curve by opening the output. Over-current conditions include Over-Load and Shorted Output during Turn-On. An open-collector Fault Status or Output Status (optional) is available to indicate the fault or switch state. The output remains blocked until the short is removed and the unit reset. This feature prevents damage to the controller while averting further system failures that may be caused by the short circuit. Standard Output Fault is an Active Low output remaining high (open) under all operating conditions except during an Output Fault. The optional Output Status is High when the output is On and Low when the output is Off. Resetting the unit is accomplished by recycling the input control.

These devices contain radiation hardened components and/or other features that provide a level of radiation tolerance. Micropac does not guarantee any level of radiation hardness. Specific lot testing is required to determine the level of radiation hardness. Micropac does not offer this device as compliant to Appendix G (RHA Requirements) of MIL-PRF-38534.

## ABSOLUTE MAXIMUM RATINGS

| | |
|---|---|
| Isolation voltage[1] | 500 V RMS |
| Load voltage[2] | 100 VDC |
| Load Current | Less Than 8 Times Rated Operating Current / Self Protecting |
| Bias supply voltage, $V_{DD}$ | -0.6 to 5.5 VDC |
| Control Voltage | 1 Volt above $V_{DD}$ / Volt below Return |
| Operating temperature | -55ºC to +125ºC Case |
| Storage temperature | -55ºC to +125ºC |

**Notes**:
[1] 60 Hz sine wave
[2] Reversing polarity on the output may cause permanent damage

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## ELECTRICAL CHARACTERISTICS

$T_C$ = -55 to 125° C

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| **Input characteristics**<br>**CMOS configurations (Figure 1)** | | | | | |
| Bias supply range, $V_{DD}$ | | 4.5 | 5.0 | 5.5 | VDC |
| Bias current | | | 25 | 30 | mA |
| Input current | $V_{DD}$ = 5 VDC | | | 500 | µA |
| Control voltage range | | -0.5 | | 5.5 | VDC |
| Turn-on voltage | | | 2.8 | 3.9 | VDC |
| Turn-off voltage | | 0.5 | 2.0 | | VDC |
| Dielectric strength | 60 Hz / Input /output / Power Bus/ Case | 500 | | | V RMS |
| | | | | | |
| **Output characteristics** | | | | | |
| Output current, sustaining: | Steady state load Current | 120 | | 160 | % |
| Load Start current (not adjusted) | Current factor above sustaining<br>0 to 100ms | 500 | | 900 | % |
| Trip Current adjustment range: | 0 to 100ms | 100 | | 50 | % of Initial |
| Continuous blocking voltage | Output device Rating | | | 95 | VDC |
| On-state resistance, $R_{ds}$ | 25ºC Case (Table 1) | | | | Ohms |
| On-state resistance, $R_{ds}$ | 125ºC Case (Table 1) | | | | Ohms |
| Turn-on time @ 25ºC case | Figure 2 | 0.5 | 1.0 | 3.0 | mS |
| Turn-off time @ 25ºC case | Figure 2 | 0.5 | 1.0 | 3.0 | mS |
| Off-state leakage | At 95 VDC | | 100 | 300 | µA |
| Output Capacitance | | | | 3,000 | pF |
| | | | | | |
| Status Output Specification | | | | | |
| Trip Reset Time | Remove overload & Cycle input | 50 | | | mS |
| Status Supply Voltage (open Collector) | | | | 32 | VDC |
| Status off leakage current | VS = 15 VDC | | | 4 | µADC |
| Status on voltage | $I_{STATUS}$ = 5 MA @ 25ºC | | | 0.4 | VDC |
| High-To-Low Transition Time | $I_{STATUS}$ = 5 MA | | 20 | 50 | µS |
| | | | | | |
| Junction temperature | | | | 150 | ºC |
| Thermal resistance, $\theta_{JA}$<br>$\theta_{JC}$ | | | | 30<br>5 | ºC/W<br>ºC/W |

APPLICATION NOTES:
1. Maximum input switching frequency not to exceed 20 Hz under normal conditions, or into a shorted output.
2. Input transitions should be “bounceless contact” with transitions of <1 ms.
3. Inductive loads must be suppressed.

| 5A Rated | 10A Rated | 15A Rated |
|---|---|---|
| 30 / 40 mΩ | 18 / 25 mΩ | 14 / 22 mΩ |

TABLE 1
25ºC / 125ºC $R_{ds}$ On Versus Current Rating.

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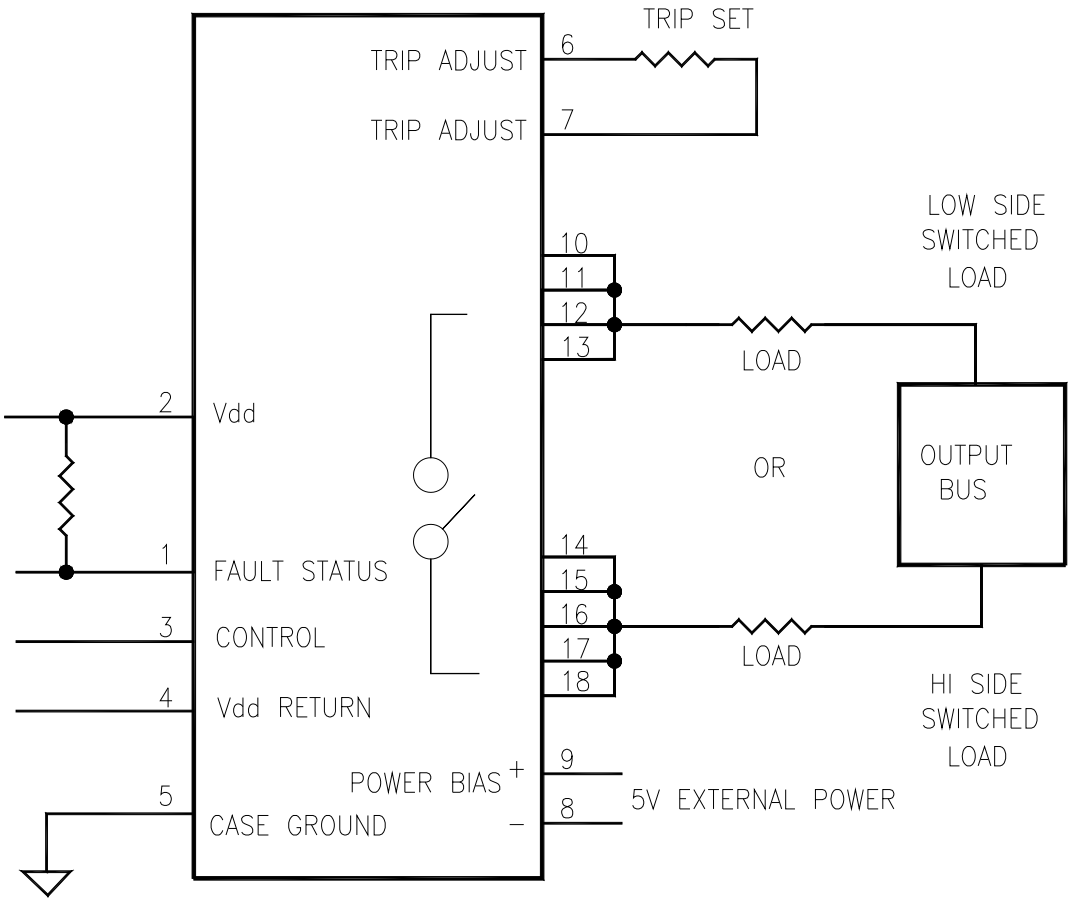



FIGURE 1
High or Low side isolated switch connection. Full isolation exists between Input Logic and status, Output Switch connects, Power Bias and Case.

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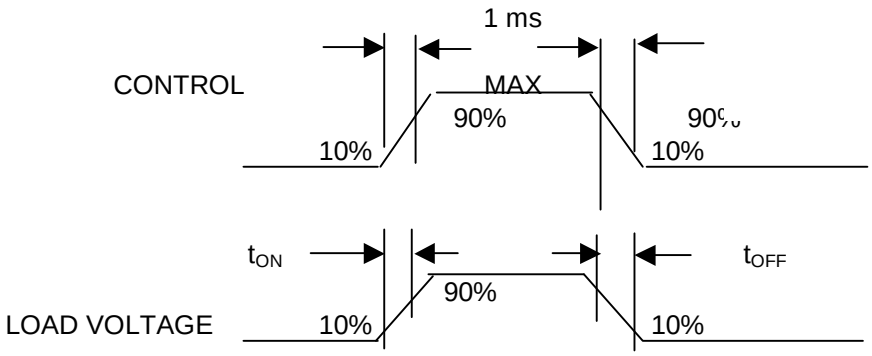



Figure 2 Switching Characteristics

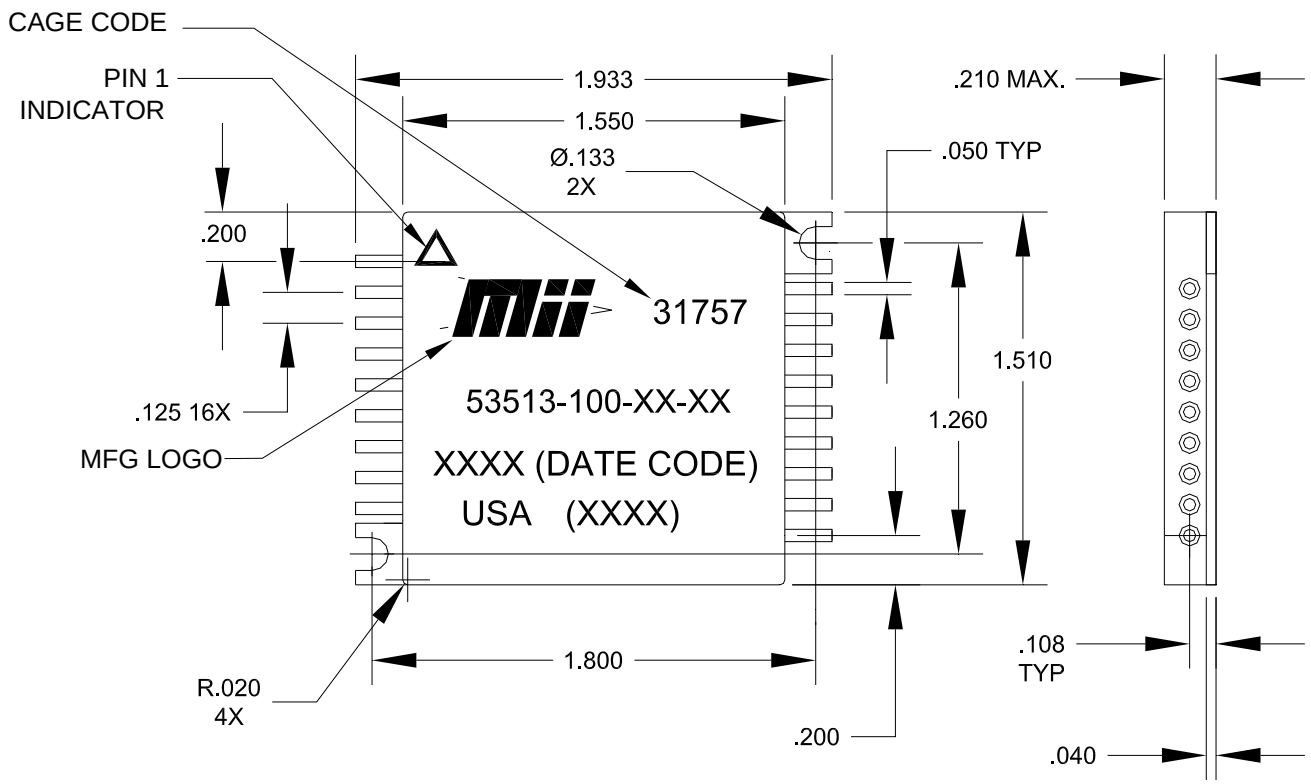
| | Turn on into Short Sequence | | | | | Short while on Sequence | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Control** | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 |
| **I out** | Off | Off | Off | Off | On | On | Off | Off | Off | On |
| **Switch Status** | 0 | 0 | 0 | 0 | Open “1” | Open “1” | 0 | 0 | 0 | Open “1” |
| **Shorted Output** | Shorted | Shorted | X | Off | Off | Off | On | X | X | Off |

Truth Table – Short circuit and Status

Note 1: Unit Powers up in the Off condition with application of either Bus power and or $V_{DD}$.
Note 2: Fault Status reports only when $V_{DD}$ is present.
Note 3: An Off Control to On Control transition is required to first turn the Unit On.
Note 4: Loss of $V_{DD}$ will return the output state to OFF.
Note 5: 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**

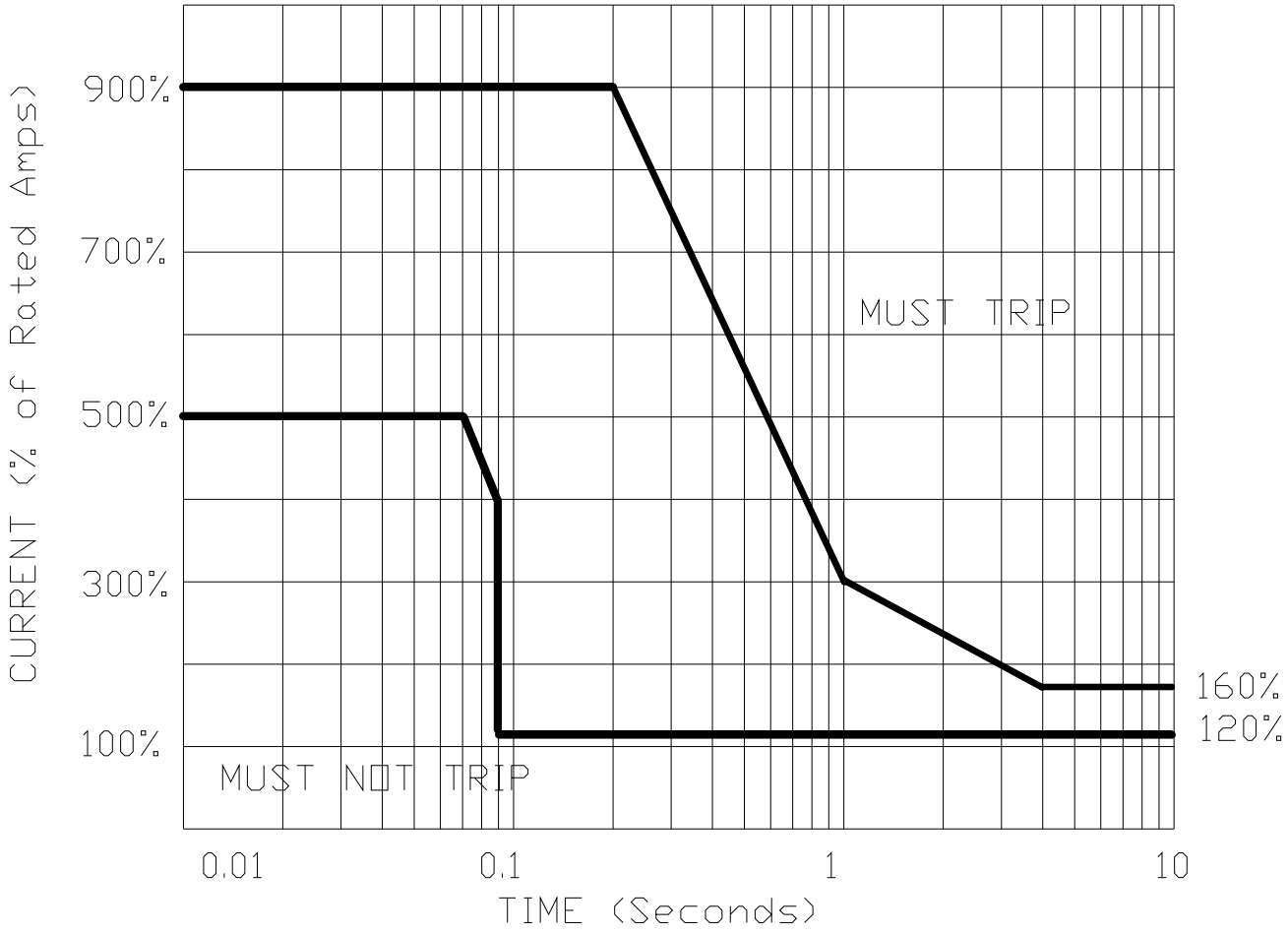



| IN | FUNCTION |
|---|---|
| 1 | FAULT STATUS |
| 2 | $V_{DD}$ |
| 3 | CONTROL |
| 4 | CONTROL RETURN |
| 5 | CASE GROUND |
| 6, 7 | TRIP CURRENT ADJUST |
| 8 | POWER BIAS RETURN |
| 9 | POWER BIAS |
| 10, 11, 12, 13 | + BUS |
| 14,15, 16,17 18 | OUTPUT |

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**NOTES:**

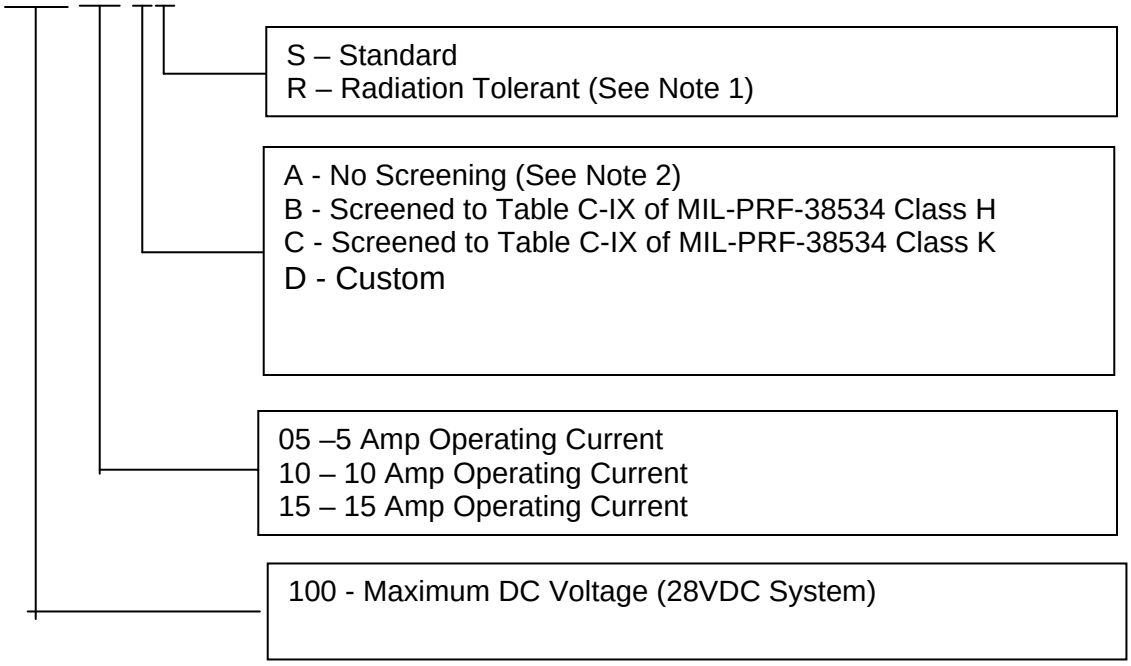
1) Initial current limits, NO TRIP and MUST TRIP, will be 500% and 900%, respectively above the rated operating current.
2) Minimum output current (sustaining) is 120% of the Device Rating.
3) Maximum output current (sustaining) is 160% of the Device Rating.
5) Shorted while On from any On operating condition can have a μs surge current of as much as 100A.




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# Ordering Information:

**53513-XXX-XX-XX**




NOTES:

1. The device contains radiation hardened components and/or other features that provide a level of radiation tolerance. Micropac does not guarantee any level of radiation hardness. Specific lot testing is required to determine the level of radiation hardness. Micropac does not offer this device as compliant to Appendix G (RHA Requirements) of MIL-PRF-38534.
2. Devices are electrically tested at -55°C, +25°C and +125°C with no environmental screening or qualification.
3. Fully compliant Class H or Class K devices will require Element Evaluation and QCI.

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