53507-002 SELECTABLE OUTPUT SOLID STATE POWER CONTROLLER	Mii MICROCIRCUITS DIVISION

Features:	Applications:
• Switch Status Output • I^2T circuit protection • SPST, normally open • 10A and 15A Outputs, 10A, 15A or 25A Operation • Power FET output with Low on-state resistance • Full military temperature operation: -55ºC to +125ºC. • Military environmental screening available • Continuous Coverage from 5.0A to 25A	• Designed for 30V bus applications • Aircraft Power Distribution • Military/High Reliability Systems • Satellite/Space Systems

DESCRIPTION:

The 53507 Series Solid-State Power Controllers are designed to replace electromechanical breakers and solid-state relays. They overcome the arcing and contamination problems of breakers and provide protection from overload and shorted load conditions.

Transformer coupling between input and output provides effective isolation of 1000VDC. The Power MOSFET switches used in the output stage provide low "on" resistance and minimal internal power dissipation.

The Control input is CMOS or TTL logic compatible and is operable from a bias supply of 4.5 to 5.5 VDC. Full specification performance is from 4.75 to 5.25 VDC.(See Figure 1).

Integral short-circuit protection, I^2T trip and output status is provided. The output current flow is continuously monitored and responds to over-load conditions by opening the output with an I^2T trip curve. An open-collector Output Status or (optional) Fault Status is provided. When tripped, the output remains blocked averting further system damage. Status is an open collector output High with an ON SSPC and Low with an OFF SSPC (Command OFF or Faulted). The optional Fault Status is an open collector high (Open) for all SSPC conditions except Faulted. Resetting the unit is accomplished by cycling the input control.

A Trip current adjust is provided to allow customer trimming of the trip current between the design I_{trip} and one half of I_{trip}.

Connecting Pins 3 and 8 will reduce the "Steady State Trip Current" by one half without changing the "Instant Trip" let-through current. An intermediate trip point may be achieved by connecting a resistor per the following between Pins 3 and 8.

$I_{(trim)} = I_{(design)} \left[1 - \left[\frac{50}{100 + R_{(trim)}}\right]\right]$, $R_{(trim)}$ is in kohms and I is in Amperes.

RADIATION TOLERANT:

The 53507 contains radiation hardened components and / or other features that provide a level of radiation tolerance. Micropac does not offer this device as compliant to Appendix G (RHA Requirements) of MIL-PRF-38534, and does not guarantee any level of radiation hardness. Specific lot testing is required to determine the level of radiation hardness.

PRECAUTIONS:

SSPC's must always be operated with adequate transient voltage protection. When the SSPC turns off rapidly due to overload or fault conditions, external wiring impedance may generate transient voltages when current is interrupted. The resultant voltages and currents must not exceed the published Maximum ratings of the SSPC.

ABSOLUTE MAXIMUM RATINGS

Isolation voltage ..... 1000 VDC
Continuous operating output voltage[1] ..... 100 VDC
Transient output voltage[2] ..... 100 VDC
Load Current ..... Less Than 9 Times Rated Operating Current / Self Limiting
Bias supply voltage ..... -.6 to 5.5 VDC
Control Voltage ..... 1 Volt above V_{Bias} / 1 Volt below Return
Status Voltage 35V
Status Current 10mA
Operating temperature ..... -55ºC to +125ºC Case
Storage temperature ..... -55ºC to +125ºC

Notes:
[1] Reversing polarity on the output may cause permanent damage
[2] Device rating. Application derating is not included in these values

ELECTRICAL CHARACTERISTICS

T_A = -55 to 125° C

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Input characteristics **CMOS configurations (Figure 1)**					
Bias supply range		4.75	5.0	5.25	VDC
Bias current			25	30	mA
Input current (Control)	5 VDC Input			500	µA
Control voltage range		-0.5		6.0	VDC
Turn-on voltage			2.8	3.9	VDC
Turn-off voltage		0.5	2.7		VDC
Dielectric strength	Input /output / Power Bus/ Case	1000			VDC
Output characteristics					
Output current, sustainable: of Selected Output	Steady state load Current (1)	110		145	% ADC
Load Start current (not adjustable)	Current factor above sustaining 0 to 80ms	550		700	%
Steady State Current adjustment range:		100		50	% of Initial
Continuous blocking voltage	Output device Rating			100	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		1.0	3.0	mSec
Turn-off time @ 25ºC case	Figure 2		0.5	1.7	mSec
Off-state leakage	At 80% Blocking Voltage		100	300	µA
Output Capacitance	Per each 5A of output		2,200		pF
Status Output Specification					
Trip Reset Time	Remove overload & Cycle input	50			mSec
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	µSec
Junction temperature				150	ºC
Thermal resistance, θ_{JC}				2.0	ºC/W

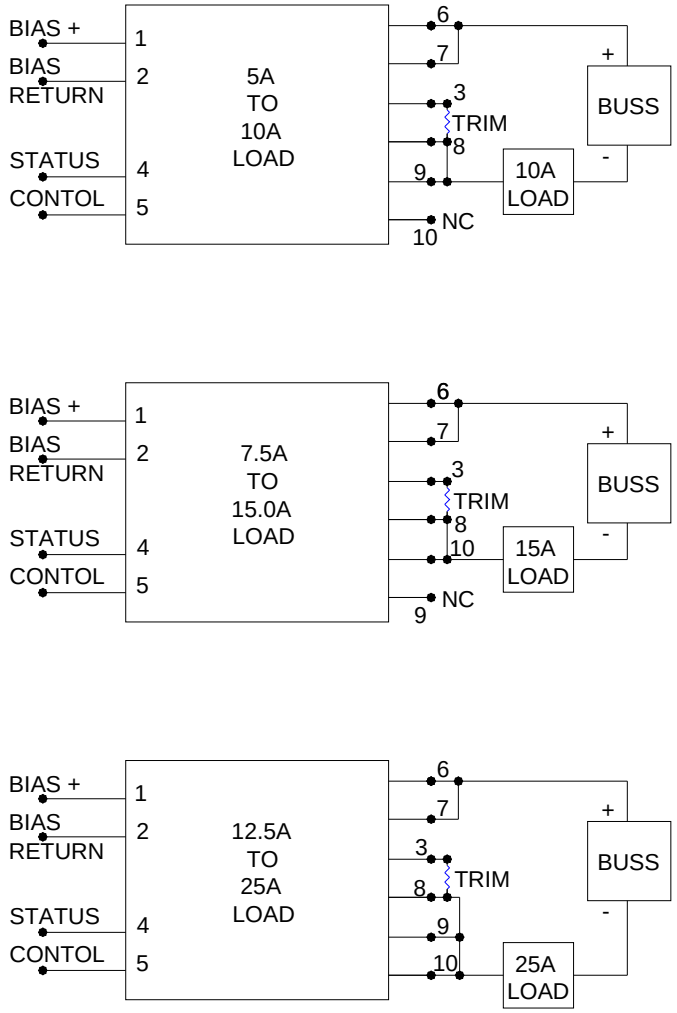
1. Selected output is determined by connecting either or both outputs to the output sense (Pin 8).

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

	10A Sustaining	**15A Sustaining**	**25A Sustaining**
100 VDC Units	12 / 16	10 / 14	8 / 12

TABLE 1
25ºC / 125ºC R_{ds} On.

FIGURE 1
Low side isolated switch connection. Full isolation exists between Inputs (1, 2, 4, 5) and Outputs (3, 6, 7, 8, 9, 10) and case.



Currents Available			
CURRENT	**10A TAP**	**15A TAP**	**I (ADJj)**
5.0 to 10	YES	NO	YES
7.5 to 15	NO	YES	YES
12.5 to 25	YES	YES	YES

Continuous Coverage from 5.0A to 25A.

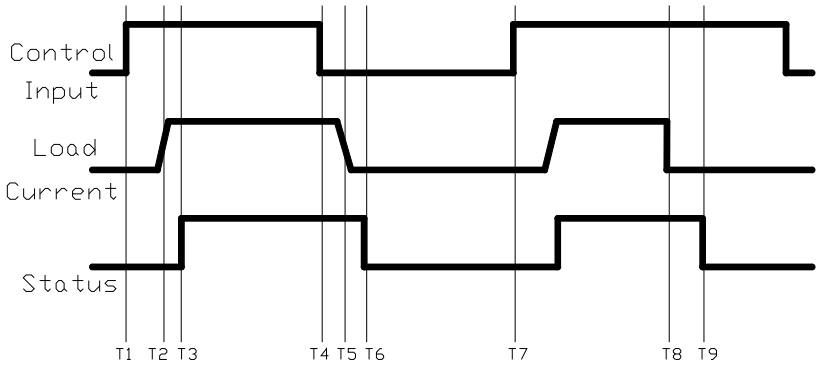


Figure 2.

Control Input, Load Current and Status Timing.				
Time	Description	Maximum	Units	Notes
T1 to T2	Turn On Delay	5	ms	
T2 to T3	Load Current to Status Delay	200	microseconds	
T4 to T5	Turn Off Delay	12	ms	
T4 to T6	Load Current to Status Delay	300	microseconds	
T7 to T8	Trip Time after Turn On			Refer to Figure 5
T8 to T9	Trip to Status Delay	300	microseconds	

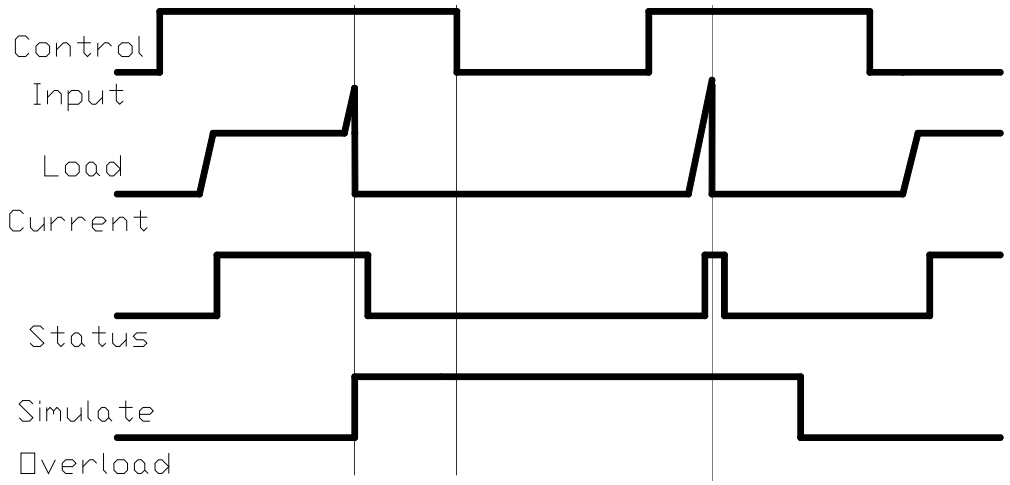


Figure 3.

NOTES:

1. Unit powers up in the “OFF” state.
2. No power sequencing is required.
3. Output “Status” reports only when V_{Bias} is present.
4. Bus power-up with Control and Control power ON requires a Control OFF and ON to turn the Unit On.
5. A turn-on into an overload results in a shutdown defined by time and current expressed in Figure 5.
6. Turning on into a shorted load may cause damage.

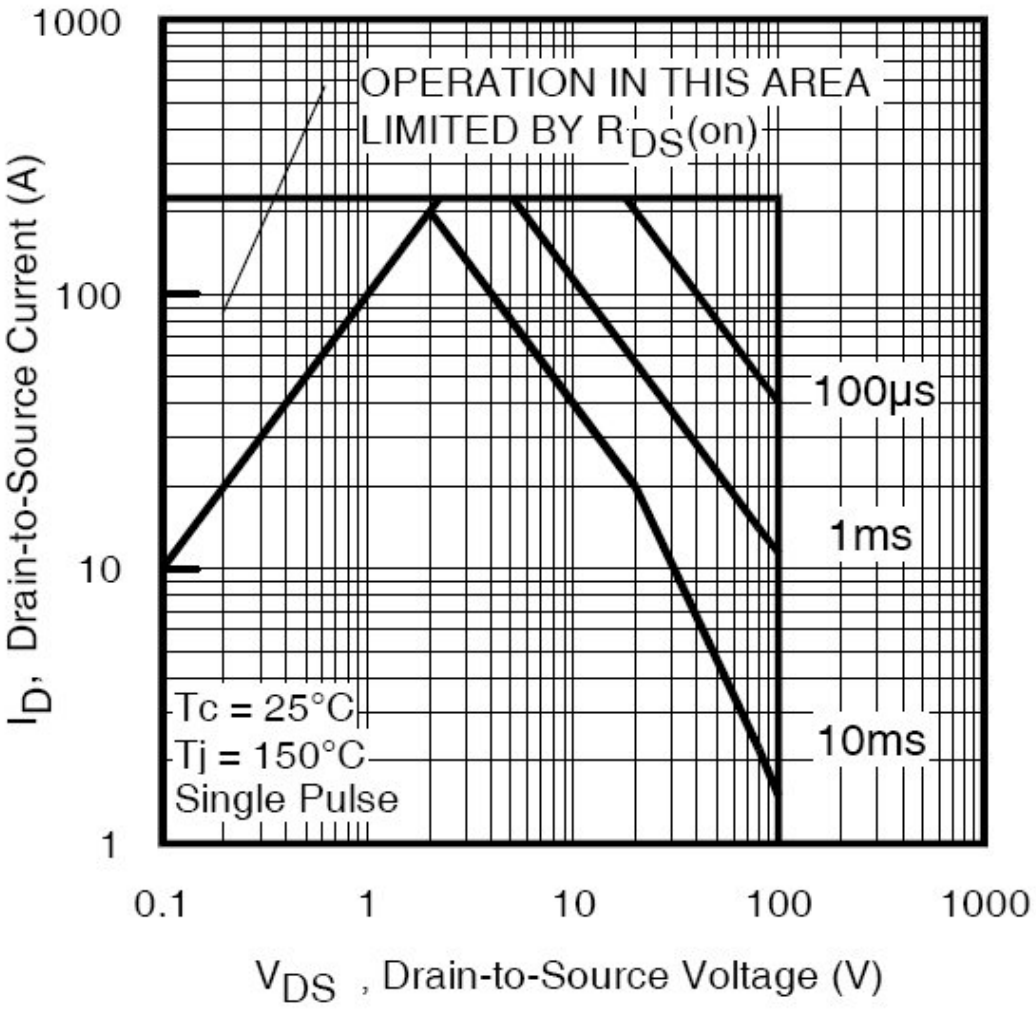


Fig 8. Maximum Safe Operating Area

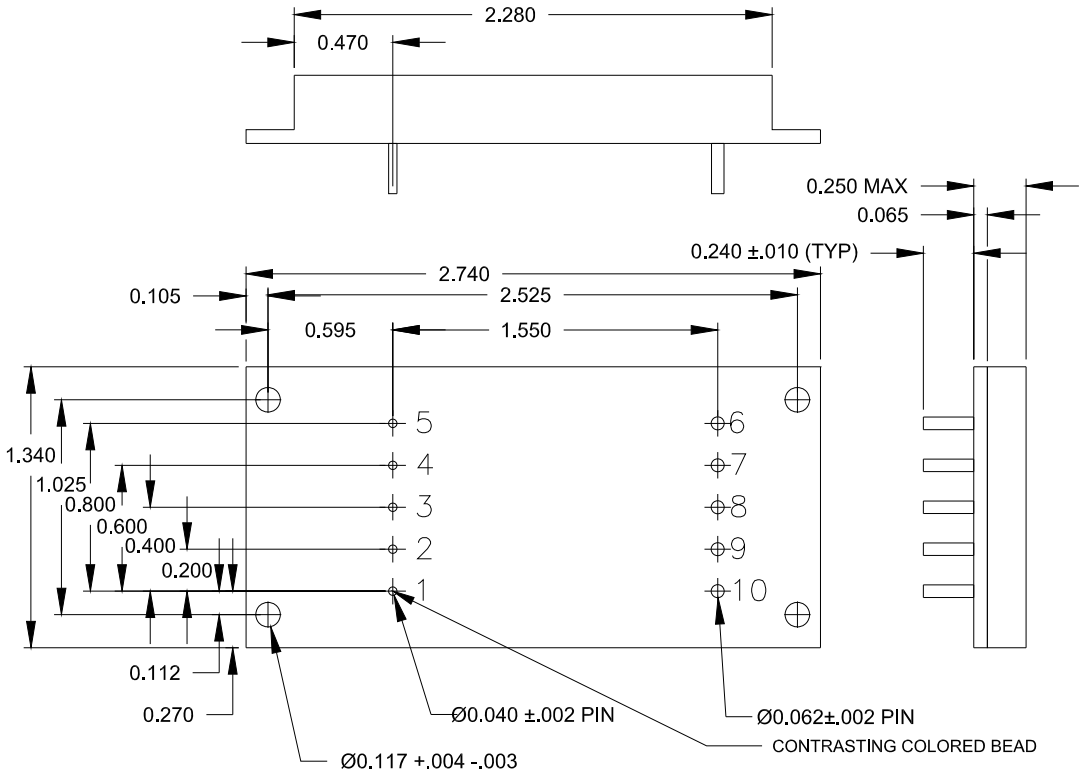
S.O.A. represents the family of voltage, current and time curves that produce a 125°C junction rise. These curves give time (On time), Voltage applied across the FET and Current through the FET.

The 53507-002 SSPC uses 4 each of the FETs represented by the included SOA curves. Junction temperature rise is shared between the four devices.

A full understanding of circuit conditions / application that contribute to load current and device dissipation is strongly recommended.

Reactive Loads: Capacitive loads can be the most demanding. The initial charge current of a capacitive load approximates the conditions of the S.O.A. and produce the greatest die heating compared to resistive and inductive loads.

PIN	FUNCTION	PIN	FUNCTION
5	CONTROL	10	15A OUTPUT
4	STATUS	9	10A OUTPUT
3	TRIP ADJUSTMENT	8	OUTPUT SENSE
2	BIAS (-)	7	POWER IN
1	BIAS (+)	6	POWER IN



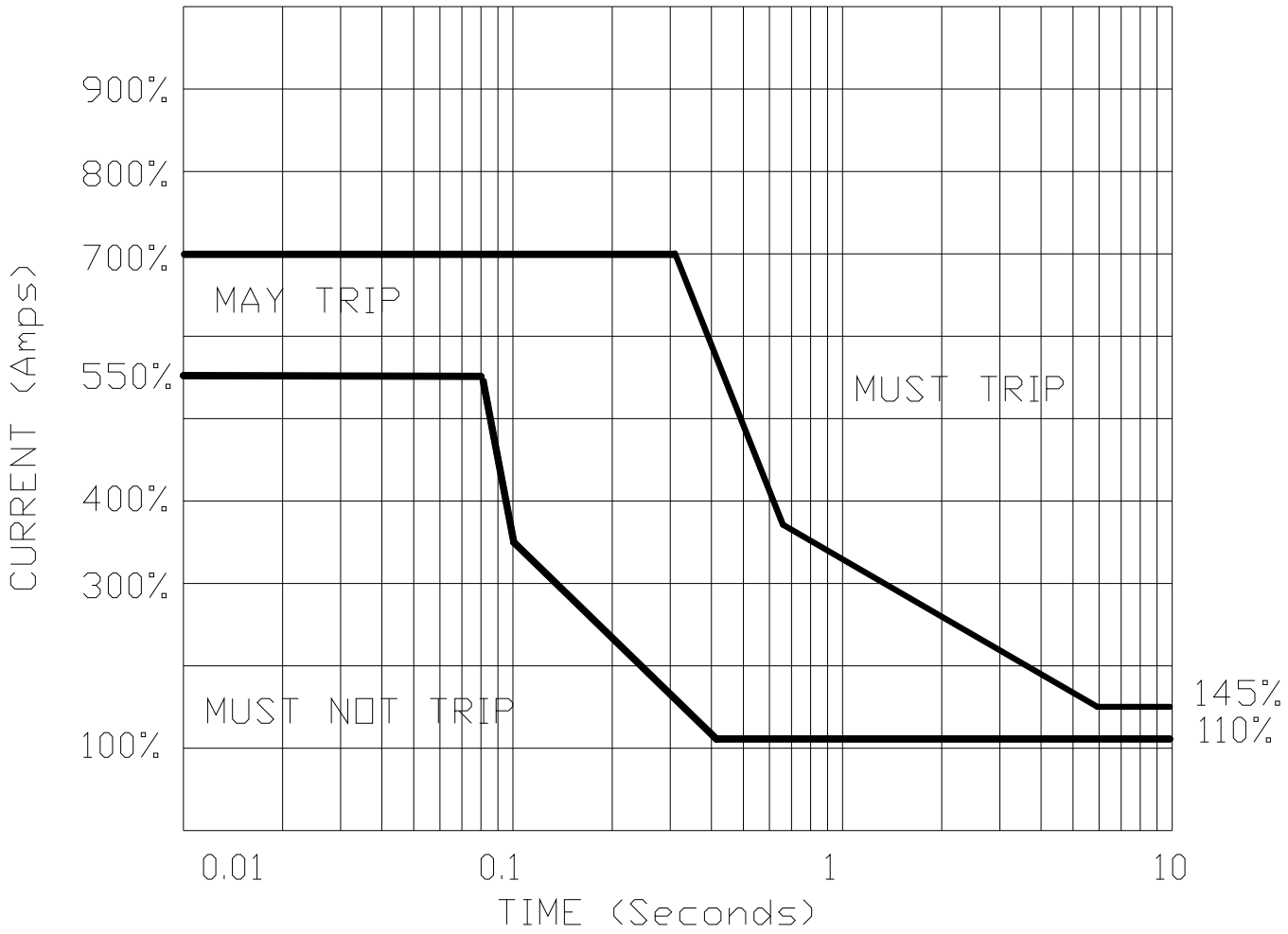


Figure 5.

NOTES:

1) Figure 5 curves are shown from 10m sec to 10 Sec. Dynamic behavior conditions apply below 10m sec.
2) All Values normalized to Rated Current.
3) Steady State output current (sustaining) is 110% of Rated Current.

Ordering Information: 53507-102-Y-Z

53507-102	Base part number
- XXX	Voltage
- Y	A - No Screening B - Screened to Table C-IX of MIL-PRF-38534 Class H D - Screened to Table C-IX of MIL-PRF-38534 Class K F - Custom
- Z	S – Standard R – Radiation Tolerant