53290-270-060

270V DC INDUSTRIAL POWER CONTROLLER (IPC)

Mii
MICROCIRCUITS DIVISION

Features:

- Conformal coated open frame / PC Board design
- Light weight – 200 grams
- Operation temperature of -40ºC to +85ºC
- SPST, normally open DC power control
- MIL-STD-704E and MIL-STD-1760E compliant I^2T overload protected output with Switch Status Output
- I^2c telemetry reporting of Switch voltage, current and base-plate temperature
- Power MOSFET output with Low on-state resistance

DESCRIPTION:

This Isolated DC IPC is a low mass open construction DC switch intended for applications within an enclosure. In addition to load switching, the incorporated I^2t overload protection / fault protection provides a circuit breaker function. A status output signals output switch conditions of On / Off and Overload. An I^2c interface communicates switch voltage, current and base plate temperature.

Transformer and opto-coupling isolate the output to all Control / Status and Data lines and base plate to 1,500 VDC. Power MOSFETs output switch provides soft start and low On voltage drop for cool operation.

The Logic Control input operates from a bias supply of 18 to 32V.

This IPC combines the functionality of a relay and circuit breaker. Output current is monitored for over-current with an I^2T trip curve. Fault currents beyond the I^2T trip limits are terminated instantly. Over-current conditions include Over-Load and Shorted Output during Turn-On. An open-collector Output Status is available to indicate the State of the Output Switch MOSFETs. The output remains blocked until the short is removed and the unit reset. Output Status is an Active Low for Control Off or Tripped condition and High into a pull up resistance for a (Control High) Normally On Output State. Controlling the IPC Off then back on resets a Tripped condition.

Application:

- 270V 60A Power Switching

ABSOLUTE MAXIMUM RATINGS

Isolation voltage	1500 VDC
Load Voltage[1]	475 VDC
Load Current[2]	Not more Than 5 Times Rated Operating Current / Self Protecting
Bias supply voltage, V_{DD}	-0.6 to 32 VDC
Control Voltage	1 Volt above V_{DD} / 1 Volt below Return
Operating temperature	-40ºC to +85ºC Case
Storage temperature	-55ºC to +125ºC

Notes:

[1] Reversing output polarity may cause permanent damage
[2] The (circuit breaker) I^2t function immediately terminates surge currents per Figure 2 or 3.

ELECTRICAL CHARACTERISTICS: T_C = -40°C to 85°C unless specified.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Output characteristics					
Operating Voltage	*Intended system voltage		270		VDC
Continuous blocking voltage	Output device Rating			475	VDC
Rated Output Current	270V system			50	ADC
Output Current Shutdown	270V system (Figure 3)	50	60	70	ADC
Load Start current for up to 50ms adjust range	270V system (Figure 3)	100		300	ADC
Maximum On Stage Voltage drop	25ºC @ 50A (phase 1)			1.25	VDC
On-state resistance, R_{ds}	25ºC @ 50A (phase 1)			0.025	Ohms
Turn-on time / Rise Time	Figure 2	0.2	4.0/1.0	5.0/3.0	mS
Turn-off time / Fall Time	Figure 2	0.2	4.0/1.0	5.0/3.0	mS
Maximum Off State leakage	@ Continuous Blocking Voltage			500	µA
Snubbing	Internal between output connections			7	uH
Input characteristics **CMOS configurations (Figure 1)**					
Bias supply range, V_{DD}	MIL-STD-704A Compliant (50V peak)	18	28	32	VDC
Bias current			50	80	mA
Control voltage range		-0.5		5.5	VDC
Turn-on voltage	Phase 1		2.9		VDC
Turn-off voltage	Phase 1		2.9		VDC
Status Output Specification					
Trip Reset Time	Remove overload & Cycle input	50			mS
Status Supply Voltage (open Collector)	MIL-STD-704A Compliant			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
General Specifications	**@ 25ºC**				
Dielectric withstanding	Output to all Inputs and base	1,500			VDC
Junction temperature				150	ºC
Thermal resistance, θ_{JC}				0.13	ºC/W
Output Capacitance			30,000		pF
Input to Output Capacitance			250		pF
Data Communication I²c B / Phase 2 - 3					
Address	4 bits / jumper programmable				
Data:					
Switch Voltage / Resolution			0.0735V		LSB
Switch Voltage / Accuracy			±5% F.S.		
Output Current / Resolution			25.5mA		LSB
Output Current / Accuracy			±5%		
Temperature / Resolution			0.0367ºC		LSB
Temperature / Accuracy			2.0ºC		
Mass				200	gram

NOTES:

1) Minimum Commanded “Off “or “On” time is 100msec.
2) These IPCs have load current memory. Allow 100 seconds between overload or shorted load restarts for full current startup.
3) Input transitions should be “bounce-less contact” with transitions of <1 msec.
4) Inductive loads must be suppressed for operational command transients and Internal Fault shutdown times as short as 5µs.

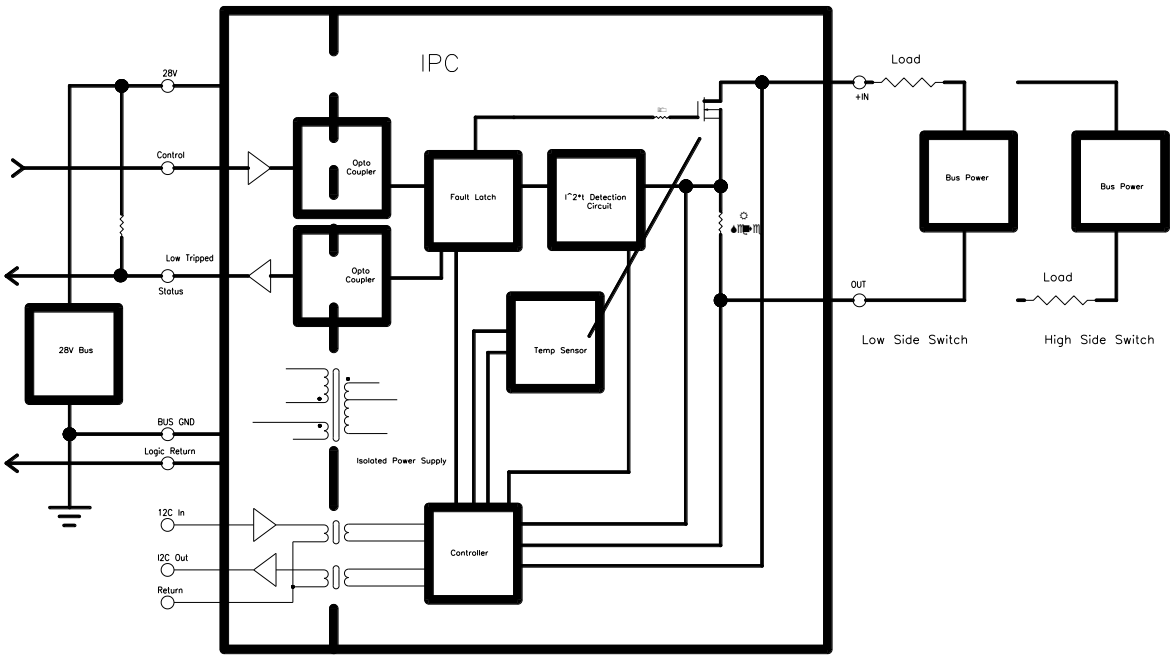


FIGURE 1

Full isolation between Input Logic, Output Switch Connects and Base allows high or low side switch connections.

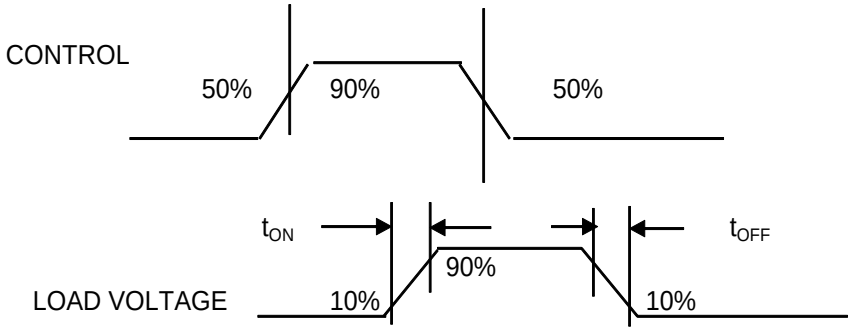


Figure 2 Switching Characteristics

	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

Notes:

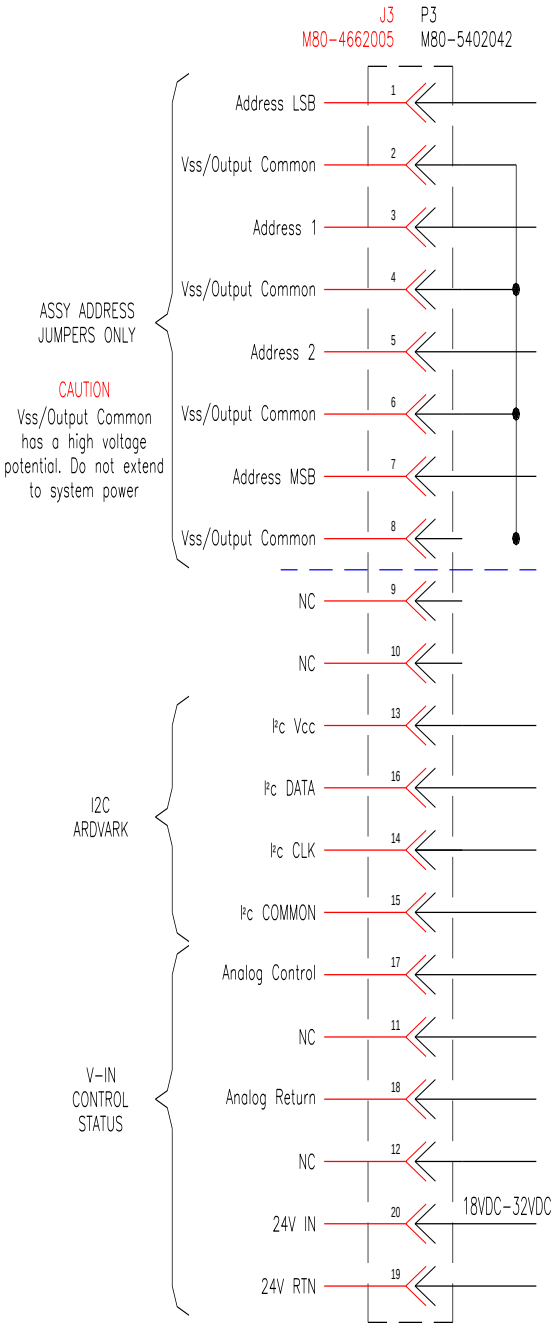
1) Unit Powers up in the OFF condition with application of Primary power.
2) Fault Status reports only when Primary Power is present.
3) An OFF Control to ON Control transition is required to first turn the Unit On.
4) A loss of V_{DD} will return the output state to OFF.
5) Truth Table Power sequencing: Output Status open collector pull-up resistor is assigned a separate and always On voltage producing a “1” when “Open”.

I^2c Data Protocol:

The data string is organized as a 8 byte string.

String (8 bytes)	Data
0	LSB Status Input
1	MSB Status Input
2	LSB Switch Voltage
3	MSB Switch Voltage
4	LSB Current Output
5	MSB Current Output
6	LSB Temperature
7	MSB Temperature

I^2c address is 7 bits. The 4 bit address is located from bit 3, to bit 7. A cont of 10 is added to the incoming address to position the 4 hardwired bits. Over bits 3 to 7.



J3 / P3 Pin Assignment:

1… Address LSB.

2... V_{SS} / Output Common.

3... Address 1.

4... V_{SS} / Output Common.

5... Address 3.

6... V_{SS} / Output Common.

7... Address MSB.

8... V_{SS} / Output Common.

9, 10, 11, 12… No Connect – isolation barrier.

13… I^2c Vcc – 3.3V out or 5.5V max in.

14... I^2c CLK.

15... I^2c Common – Return.

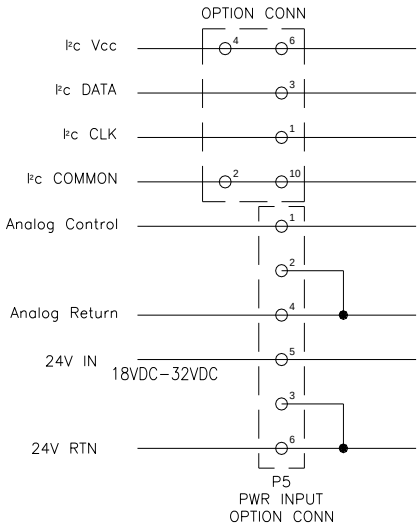
16… I^2c Data.

17… Analog Control.

18… Analog Return.

19… 24V Return.

20… 24V In.

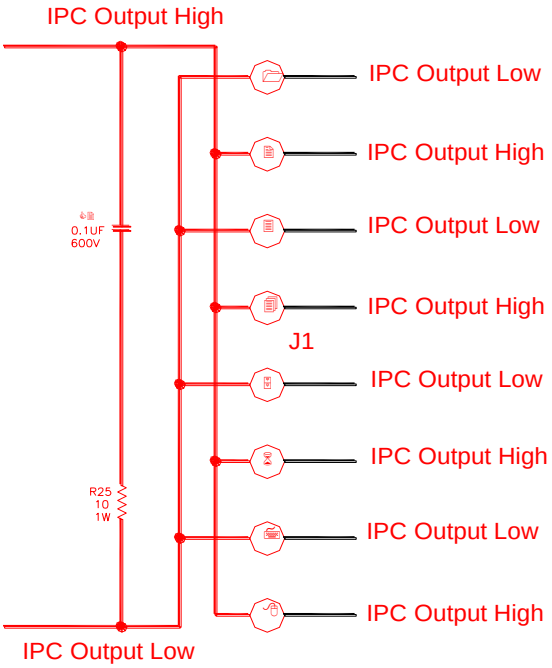


P6… I²c Arrdvark TP240141 I²c/SPI:
Pin Assignment (un-modified)
1… I²c Clock
2, 10… I²c Common
3… I²c Data
4, 6…I²c VCC

P5… Analog signals and Power:

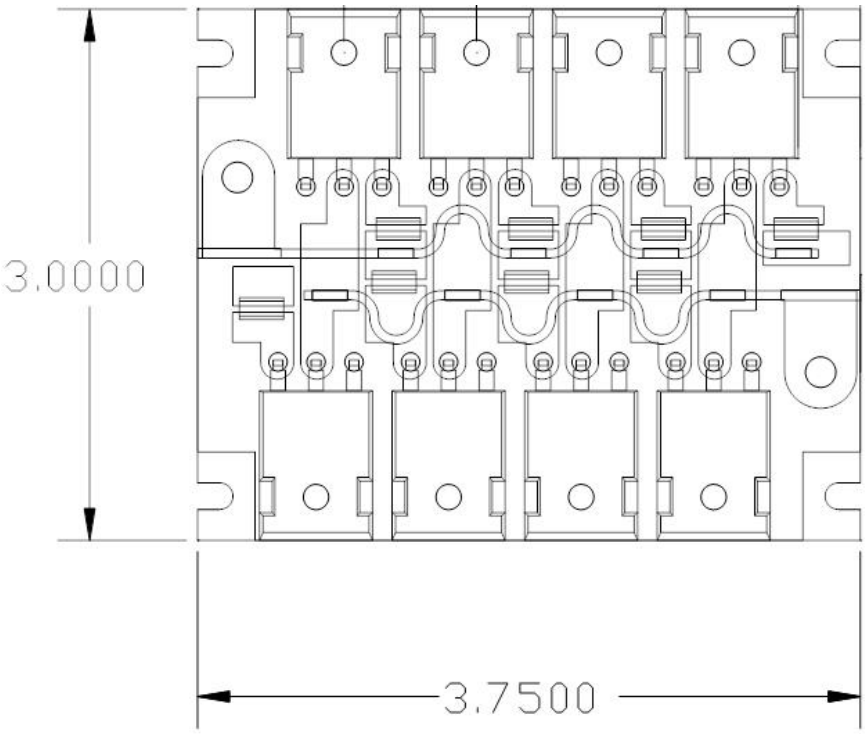
1… Analog Control.
2, 4… Analog Common, Return.
5… 24V In. (18VDC to 32VDC).
3, 6… 24V Return.

NOTE: Analog Return and 24V Return are not connected at the Power Controller to prevent ground loops at system level. These points must be connected external to the Power Controller for correct operation.



Output Connections:

1, 3, 5, 7… Output Switch Connections – Most negative.
2, 4, 6, 8… Output Switch Connections – Most positive.



Package Dimensions

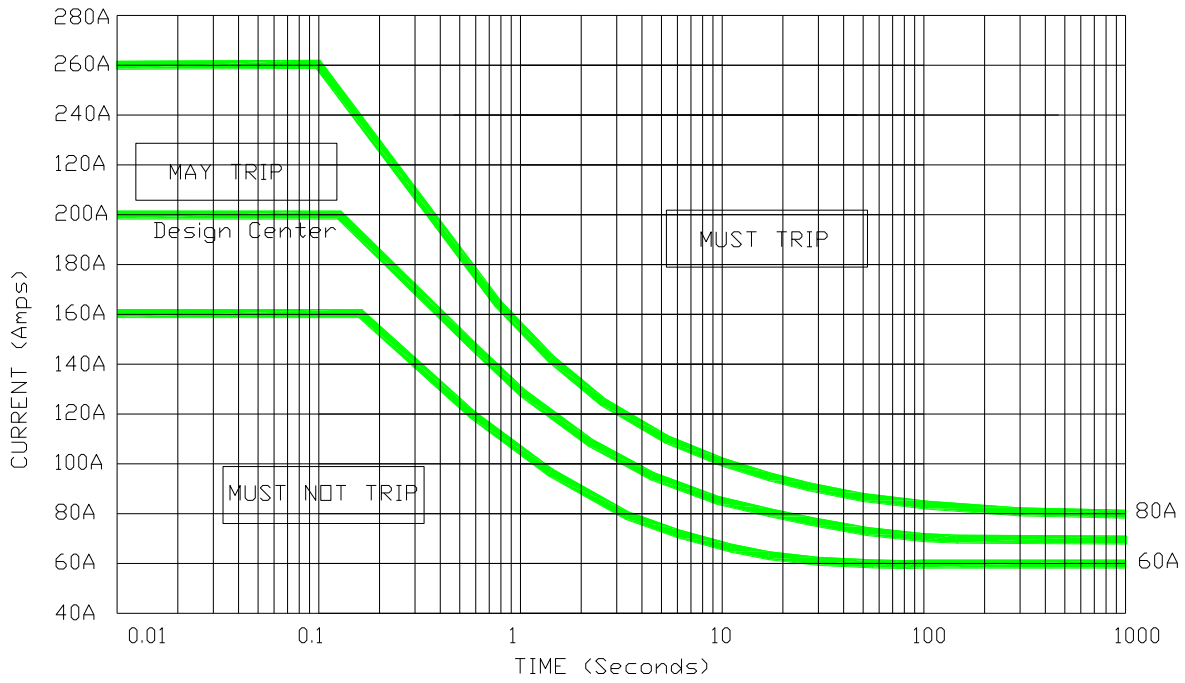


FIGURE 3

TRIP CURVE NOTES:

1) Output currents are interrupted in the Must Trip / May Trip / Must Not Trip per the following graph.
2) Output (sustaining) Current is 60 to 80A.
3) Load fault current from the “ON” operating condition are limited by the source and load impedance.
4) Over current and fault trip currents terminate abruptly and are snubbed for up to 3µH of load inductance.

Product Status:

This document contains information on a product under development. Micropac reserves the right to change this product.