D1U54T-W-2000-12-HC4TC

54mm 1U Front End AC-DC Power Supply Converter

Murata Power Solutions

FEATURES

- 2000W continuous output power
- Anderson Saf-D-Grid® input connector
- 80+ Titanium Compliant
- 12Vdc Main output, 120% surge current capability
- 3.3Vdc Standby Output
- 1U height: 2.15" x 12.65" x 1.57"
- > 46 Watts per cubic inch density
- N+N redundant, Hot Swap Capable
- Active current sharing on 12V main output; Integral ORing /isolation provided for both outputs; compatible with DC input series
- Internal cooling fan (variable speed)
- Overvoltage, overcurrent, overtemperature Protection
- PMBus™/I²C interface with LED status indicators
- RoHS compliant
- Two Year Warranty

PRODUCT OVERVIEW

D1U54T-W-2000-12-HC4TC is a high-density, Titanium efficient, power factor corrected front end power supply converter that provides a 2000W, 12Vdc Main output and a 3.3Vdc Auxiliary/Standby output.

The D1U54T-W-2000-12-HC4TC is capable of active current sharing, PMBus™ digital communications, and provides hardware logic signals and status LED.

The compact 1U profile package achieves a power density >46W/cubic inch and is ideal for delivering redundant, reliable and efficient power to datacenters, servers, workstations, networking equipment, storage systems and other 12Vdc distributed power architectures.

ORDERING GUIDE

Part Number	Output power at Nominal Input Voltage		Main Output	Standby Output	Airflow
	200-240Vac	100-120Vac			
D1U54T-W-2000-12-HC4TC	2000W	1000W	12Vdc	3.3Vdc	B ⇨ F

INPUT CHARACTERISTICS

Parameter	Conditions	Min.	Nom.	Max.	Units
Input Source Voltage AC					
Low Line		90	100-120	132	Vac
High Line		180	200-240	264	Vac
Input Source Frequency		47	50/60	63	Hz
Turn-on Input Voltage, Low Line	Ramp up	85	87	90	Vac
Turn-off Input Voltage, Low Line	Ramp down	78	81	85	
Turn-on Input Voltage, High Line	Ramp up	170	174	180	
Turn-off Input Voltage, High Line	Ramp down	165	165	170	
Input OVP		270			
Power Factor	At 230Vac, full load		0.99		W/VA
Maximum current at Vin = 180Vac/60Hz	2,000W			15	Arms
Input Source Voltage DC		192	240	288	Vdc
Turn-on Input Voltage	Ramp up	185		192	
Turn-off Input Voltage	Ramp down	180		190	
Input OVP		288			
Inrush Current	Cold start between 0 to 200msec, 264Vac			25	Apk
Efficiency (230Vac), excluding fan load Ecova 80Plus™ Titanium Compliant	10% Load ;200W	90			%
	20% load;400W	94			
	50% load; 1000W	96			
	100% load; 2000W	91			

Insert power supply into mating connector prior to applying input voltage.

OUTPUT VOLTAGE CHARACTERISTICS

Output	Parameter	Conditions	Min.	Typ.	Max.	Units
12V	Nominal Output Voltage			12		Vdc
	Output Set Point Accuracy	50% load; Tamb =25°C	-0.25		+0.25	%
	Overall Regulation[2]	Measured at remote sense	-3.0		+3.0	
	Ripple Voltage & Noise[1,2]	20MHz Bandwidth			120	mV p-p
	Output Current	2000W (180-264 Vac) Continuous[4]	1		166.7	A
		1000W (90-132Vac) Continuous	1		83.3	
	Load Capacitance				30,000	µF
3.3VSB	Nominal Output Voltage	50% load; Tamb =25°C		3.30		Vdc
	Line and Load Regulation[3]	Measured at PSU side of connector	3.201		3.465	Vdc
	Ripple Voltage & Noise[1,3]	20MHz Bandwidth			50	mV p-p
	Output Current		0.1		3.0	A
	Load Capacitance				2000	µF

[1] Ripple and noise are measured with 0.1 µF of ceramic capacitance and 10 µF of tantalum capacitance on each of the power supply outputs. A short coaxial cable to the scope termination is used.
[2] Minimum Load of 1A applied to meet these limits., overall regulation covers the combined effects of line, load, temperature.
[3] Minimum Load of 0.1A applied to meet these limits
[4] Peak current 200A, 100ms max.

RoHS COMPLIANT

For full details please visit our website:
www.murata-ps.com/rohs

Test Certificate and Test Report

OUTPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Startup Delay/Rise Time	AC application: PS_ON enabled			3000/50	ms
Turn On/Off Overshoot/Undershoot				5	% nom
Transient Response	12V Main: load step 50% of full load, min. load: 5% of full load; 1A/µs slew rate; minimum 4700µF load capacitance	-4		+4	
	Recovery Time to within 1% Vnom		0.25		ms
	VSB: load step 50% of full load, min. load: 0.2A; 0.5A/µs slew rate; minimum 2000µF load capacitance	-3		+5	% nom
Current sharing accuracy	≥25% load	-5		+5	%
	<25% load; percentage of full load	-5		+5	
Holdup Time	180-264Vac in voltage ranges, 2000W load, output dropping to 11.64V	10			ms

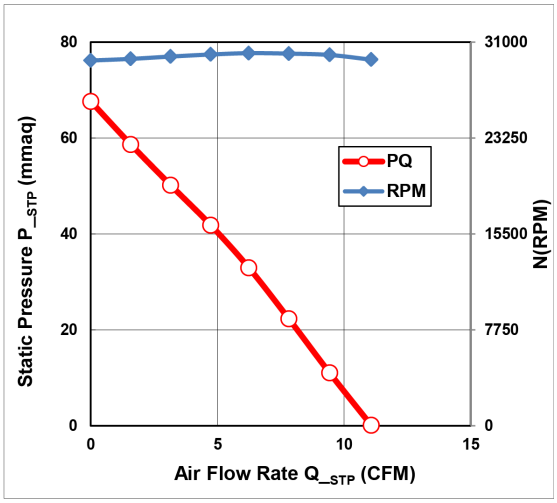
ENVIRONMENTAL CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Storage Temperature Range		-40		85	°C
Operating Temperature Range		-5		45[1]	
Operating Humidity	Noncondensing	5		90	%
Storage Humidity		5		95	
Altitude				3000[1]	m
Shock	30G non-operating				
Non-Operating Vibration	random vibration, 5-500Hz, 0.71G				
MTBF	Per Telcordia SR-332 M1C1 @40°C	300K			hrs.
Safety Approval Standards	UL62368-1: 2014 (2nd Edition) (Information Technology Equipment - safety - Part 1: General Requirements). CAN/CSA-C22.2 No. 62368-1: 2014 (2nd Edition) (Information Technology Equipment - Safety - Part 1: General Requirements) TUV: EN 62368-1:2014 (2nd Edition) CQC: GB4943.1-2011 BSMI: CNS14336-1 CB: IEC 60950-1:2005, AMD1:2009, AMD2:2013 CB: IEC 62368-1:2014 (2nd Edition)				
Input Fuse	Dual 16A 420VAC/420DC fuses provided as a series protective element in both input "line" and "neutral" connection; allows for "phase to phase" operation of (suitably rated) three phase "delta" connected systems.				
Weight	2.56 lbs. (1.16 kg)				

[1] Tested in free-air environment; backpressure imposed by host/system may impact results

AIRFLOW CHARACTERISTICS

P-Q Curve, Sunon VF40281BX-1Q017-S9H



P-Q Curve B-F Airflow
Fan: Sunon VF40281BX-1Q017-S9H

OVERCURRENT PROTECTION CHARACTERISTICS

OC condition	High Line	Low Line	SMBALERT# delay	PSU fault delay	OC/SCP Response
12V-OCW	192A ± 5%	87.5A ± 5%	> 20µsec	None	Warning Issued
12V-OCP[1,2]	208A ± 5%	95.8A ± 5%	> 20µsec	≥ 100 msec	Latching[3,7]
12V-SCP	> 212 A	> 104 A	None, immediate[6]	Immediate	Latching[3,7]
3.3VSB-OCP[1]	3.5 A – 4.5 A	3.5 A – 4.5 A	None	Immediate	Latching[3,7]

Notes:
1. The above current limits will be satisfied throughout AC input and the entire operating temperature range.
2. Dynamic loading shall not cause a false trigger of OCP. For redundant mode, current sharing shall function correctly to prevent any false trigger of OPP, OCP, SCP and SMBALERT# cannot change state to a logic low.
3. A fault on any output other than Standby will not cause the Standby to turn off.
4. The Standby output shall latch off if the Sstandby enters OCP.
5. The OCP point considers the design tolerances and shall not false trigger at peak power condition running..
6. SCP shall raise an SMBALERT# while the condition exists.
7. Power Module requires to be "recycled" after a latching state either by removal of the AC source (allow a minimum 10s to elapse before reapplication) or toggling of the PS_ON signal (allow a minimum of 100ms cycle time).

OVERTEMPERATURE PROTECTION CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Over temperature	Auto restart	60	65	70	°C

Notes:
1 Refer to PMBus ACAN for additional details, regarding fault/warning reporting limits and register bit flags.
2 Operating the power supply above the maximum operating temperature limit stated in the environment table is considered an abnormal condition, may impact product life, and is not recommended.
3 As reported by the internal PMBus Intake airflow temperature sensor.

ISOLATION (HI-POT) CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Insulation Safety Rating / Test Voltage	Input to Output - Reinforced	4243			Vdc
	Input to Chassis - Basic	2719			Vdc

EMISSIONS AND IMMUNITY

Characteristic	Standard	Compliance
Input Current Harmonics	IEC/EN 61000-3-2	Complies with Class A limits
Voltage Fluctuation and Flicker	IEC/EN 61000-3-3	Complies
Conducted Emissions	FCC 47 CFR Part15/CISPR22/EN55032	Class A with 8dB margin
ESD Immunity	IEC/EN 61000-4-2	±8KV Contact; ±15KV air discharge; Criteria A
Radiated Field Immunity	IEC/EN 61000-4-3	10V/m, 1KHz, 80% AM, 80MHz to 6GHz Criteria A[2]
Electrical Fast Transients/Burst Immunity	IEC/EN 61000-4-4	[1] 1KV, (L1, L2, L1-L2, L1-PE, L2-PE, L1-L2-PE)5kHz and 100kHz repetition rates, Criteria A
Surge Immunity	IEC/EN 61000-4-5	[1] Level 3 (2kV Line-Earth, 2kV Line-Line), criteria A
RF Conducted Immunity	IEC/EN 61000-4-6	10Vrms, 0.15-80MHz, 80%AM (1KHz), Criteria A
Voltage Dips, Interruptions	IEC/EN 61000-4-11	240Vac / 50Hz 100% load, Phase 0°, Dip 100% Duration 10ms (A) 240Vac / 50Hz, 100% load, Phase 0°, Dip 100% Duration > 20ms (VSB, V1:B) 240Vac / 50Hz, 100% load, Phase 0°, Dip 30%, Duration 500ms, Criteria C 240Vac / 50Hz, 100% load, Phase 0°, Dip 100%, Duration 5000ms, Criteria C

[1] Measured at the power module AC input connector.
[2] Contingent upon final system design

STATUS INDICATOR (BICOLOUR LED; BLUE/AMBER)

Conditions	LED Status
Output ON and OK	Blue
No AC power to all power supplies	OFF
AC present / Only 3.3VSB on (PS off)	1Hz blinking Blue
PSU firmware upgrade in process	0.5s Blue 0.5s Amber
Standby power failed (OCP, SCP, OVP/UVP) Auto-recover upon removal of abnormal condition.	OFF
12V Fault causing a shutdown; failure(OCP, SCP, OVP/UVP), OTP, Fan Fail, Input OVP	Amber
Warning Event: No AC input power; however other parallel connected power supplies installed in the system operating	1Hz Blinking Amber

ADDR ADDRESS SELECTION

ADDR pin (D4) resistor to GND (K-ohm)1	Power Supply Main Controller (Slave Address)	Power Supply External EEPROM (Address)
0.82	0xB0	0xA0
2.7	0xB2	0xA2
5.6	0xB4	0xA4
8.2 or OPEN	0xB6	0xA6

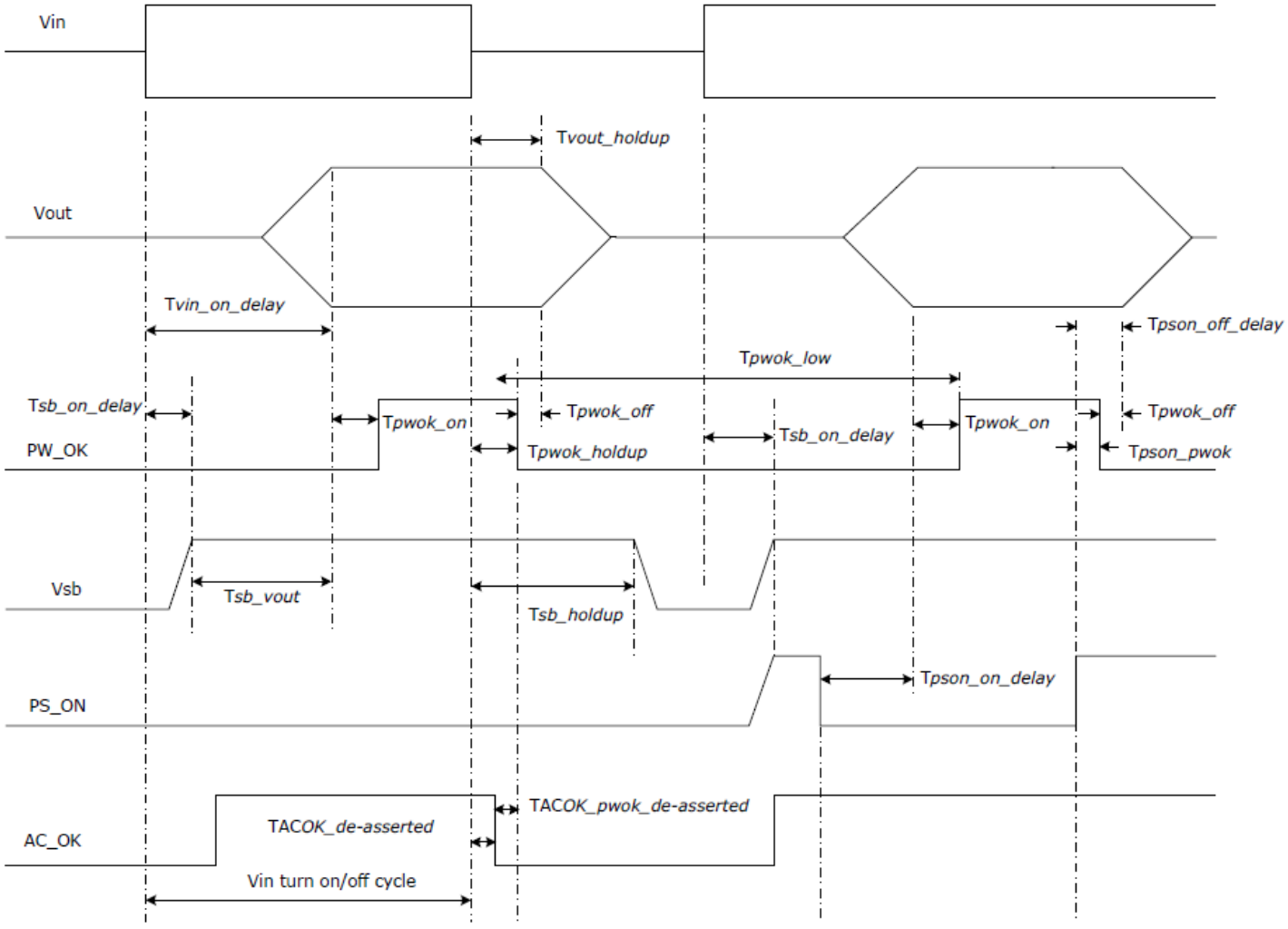
[1] The resistor shall be +/-5% tolerance or better
[2] VDD is an internal voltage rail derived from VSB and an internal housekeeping rail ("diode ORED") and is compatible with the voltage levels of TTL and CMOS logic families.

STATUS AND CONTROL SIGNALS			
Signal Name	I/O	Description	Interface Details
AC_OK	Output	Output is driven high when input source is available and within acceptable limits. The output is driven low to indicate loss of input power. This signal de-asserts a minimum of 5ms before loss of main output and provides an accurate indication of loss of AC input voltage.	Pulled up via 10K to VDD[1]. A logic high >2.4Vdc A logic low <0.4Vdc
PW_OK	Output	The signal is asserted, driven high, by the power supply to indicate 12V main output is valid. Should a 12Vmain output fault occur, the PW_OK signal will de-assert i.e. driven low. The PW_OK output is driven low to indicate at least 1ms prior to the main output falling outside of lower limit of regulation.	Pulled up internally via 1K to VDD[1]. A logic high >2.4Vdc A logic low <0.4Vdc
SMBALERT#	Output	This signal is driven low to alert the system that the power supply has detected a warning/fault condition(s) as defined in the PMBus ACAN, supported STATUS_XX Register bits. This signal is driven high to indicate normal operation. SMBALERT#, once asserted, is negated by either of the following, provided the fault condition is removed: 1) Recycling input power 2) Issuing "CLEAR_FAULTS" PMBus command 3) Toggling the PS_ON signal The LED indication reflects the SMBALERT# status	Pulled up internally via 10K to VDD[1]. A logic high >2.4Vdc A logic low <0.4Vdc
PRESENT_L (Power Supply Absent)	Output	The signal is used to detect the presence/installation of a PSU by the host system. The signal is connected internally to the power module common return logic SGND within the power module.	Passive connection to +VSB_Return. A logic low <0.8Vdc
PS_ON (Main Out Enable/Disable)	Input	This signal is pulled up, within the power supply, to the internal housekeeping supply. The power supply main 12Vdc output will be enabled when this signal is pulled low (to output return). In the low state the signal input shall not source more than 1mA of current. The 12Vdc output will be disabled when the input is driven higher than 2.4V, or open circuited. Cycling this signal shall clear latched fault conditions.	Pulled up internally via 10K to VDD[1]. A logic high >2.4Vdc A logic low <1.0Vdc
ADDR (Address Select)	Input	The signal is used to set the slave device addresses (slave microprocessor and EEPROM) used for digital communications When the power module is inserted into a system this pin will be pulled (via a suitable external select resistor to +VSB_Return, and in conjunction with an internal resistor divider chain, shall configure the required slave (EEPROM and microprocessor) address used for digital communications. Note: An external pulldown resistor is required from ADDR to +VSB_Return for operation of the main output.	DC voltage between the limits of 0 and +3.3Vdc. System side pull-down resistor required, ≤180K
SCL (Serial Clock	Both	A serial clock line compatible with PMBus™ Power Systems Management Protocol Part 1 – General Requirements Rev 1.2. No additional internal capacitance is added that would affect the speed of the bus. The signal is provided with a series isolator device to disconnect the internal power supply bus in the event that the power module is unpowered.	Pulled up internally via 10K to VDD[1] VIL is 1.1V maximum VOL is 0.4V maximum when sinking 3mA VIH is 2.1V minimum
SDA (Serial Data)	Both	A serial data line compatible with PMBus™ Power Systems Management Protocol Part 1 – General Requirements Rev 1.2. The signal is provided with a series isolator device to disconnect the internal power supply bus in the event that the power module is unpowered.	Pulled up internally via 10K to VDD[1] VIL is 1.1V maximum VOL is 0.4V maximum when sinking 3mA VIH is 2.1V minimum
V1_SENSE & V1SENSE_RTN	Input	Remote sense connections intended to be connected at and sense the voltage at the point of load. The voltage sense will interact with the internal module regulation loop to compensate for voltage drops due to connection resistance between the output connector and the load. If remote sense compensation is not required, then the voltage can be configured for local sense by: V1_SENSE directly connected to main output V1_SENSE_RTN directly connected to main output RTN	Compensation for up to 0.2Vdc total connection drop (output and return connections).
ISHARE	Both	This signal is connected between sharing units forming an ISHARE bus. It is a bi-directional analog bus voltage controls the current share between sharing units. PSU responds to change in bus voltage and also can change the bus voltage based on the load drawn from it. For single PSU, the voltage on the pin/ISHARE bus would read approximately 8VDC at 100% load. For two identical units sharing the same 100% load this would read approximately 4VDC for perfect current sharing (i.e. 50% module load capability per unit). This signal is also used by cold redundant enabled power supplies to determine Main output on/off state).	Analogue voltage: 7.76Vdc (8V nominal) 8,24Vdc maximum; 100K to +12V_RTN Slope of current V/A = 8.00/Imax

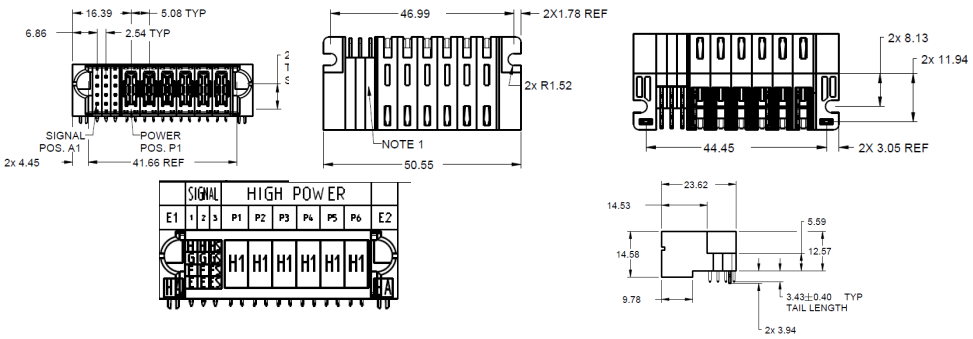
TIMING SPECIFICATIONS

The following table show the timing requirements for the power module. All output shall rise monotonically. The timing is for AC applied with PS_ON enabled:

ITEM	DESCRIPTION	MIN	MAX	UNITS
Tvout_rise	Output voltage rise time for 12V1	10	50	ms
	Output voltage rise for Vsb	10	100	ms
Tsb_on_delay	Delay from Vin being applied to Vsb being within regulation		2000	ms
Tvin_on_delay	Delay from Vin being applied to 12V1 being within regulation		3000	ms
Tvout_holdup	Time of 12V output voltage stay within regulation after loss of Vin	10		ms
Tvout_holdup (2200W)	Time of 12V output voltage stay within regulation after loss of Vin	7		ms
Tpwok_holdup	Delay from loss of Vin to de-assertion of PWOK	9		ms
Tpson_off_delay	Delay from PSON# de-asserted to power supply turning off		5	ms
Tpson_on_delay	Delay from PSON# active to output voltages within regulation limits	5	400	ms
Tpson_pwok	Delay from PSON# de-activated to PWOK being de-asserted		4	ms
Tpwok_on	Delay from output voltages within regulation limits to PWOK asserted	100	500	ms
Tpwok_off	Delay from PW_OK de-asserted to output voltages dropping out of regulation limits	1		ms
Tpwok_low	Duration of PW_OK being in the de-asserted state during an off/on cycle using Vin or the PSON signal	100		ms
Tsb_vout	Delay from Vsb being in regulation to O/Ps being in regulation at Vin turn on	50	1000	ms
Tsb_holdup	Time of Vsb output voltage stays within regulation after loss of Vin	100		ms
Tac_ok_de-asserted	Delay from Vin drop being 0V to de-assertion of AC_OK		8	ms



DC OUTPUT & SIGNAL INTERFACE CONNECTOR

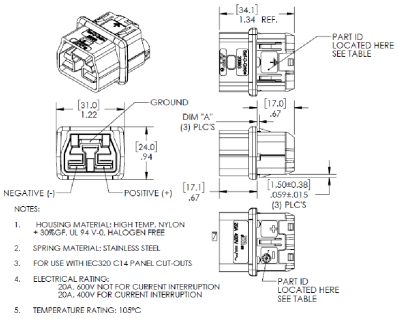
Part Number	Description
Power Supply Side Manufacturer: Amphenol/FCI **PSU Side connector:** FCI: 10106262-6003006LF Mating Connector: 10106264-6003003LF	

PIN ASSIGNMENTS - Power Module Output & Signal Interface Connector: FCI 10106262-6003006LF

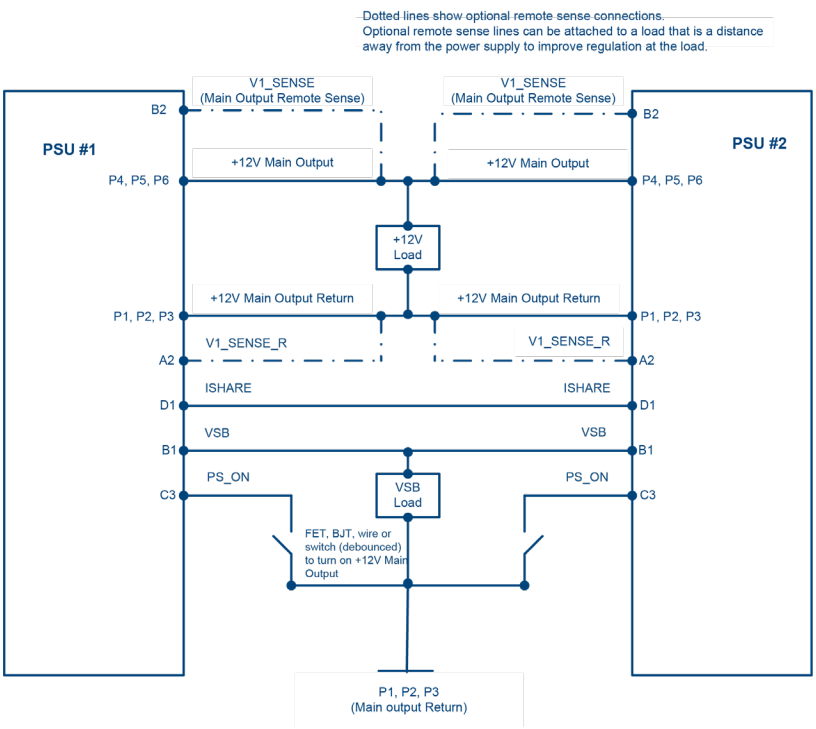
Pin	Signal Name	Comments; See
P4, P5, P6	V1	+ 12V main output
P1, P2, P3	V1 RETURN[1]	+ 12V main and standby output return
A3	SDA	Short Pin[1] I2C data signal line; shorter MLFB pin.
B3	SCL	Short Pin[1] I2C clock signal line; shorter MLFB pin.
C3	PS_ON	Short Pin[1] Remote on/off Short; shorter MLFB pin.
D3	SMBALERT#	Short Pin[1] 2C alert signal; shorter MLFB pin.
A2	V1_SENSE_R	- Remote Sense/ return
B2	V1_SENSE	+ Remote Sense.
C2	PWOK	Power OK.
D2	ADDR	Address Selection (select by external pull-down resistor).
A1	PRESENT_L	PS Present
B1	VSB	Standby output
C1	AC_OK	Input power okay
D1	ISHARE	Current share bus.

[1] GND/+12V RTN are connected internally to Chassis

INPUT POWER CONNECTOR

Part Number	Description
Anderson Saf-D-Grid® Receptacle: 2006G1-NC-BK	

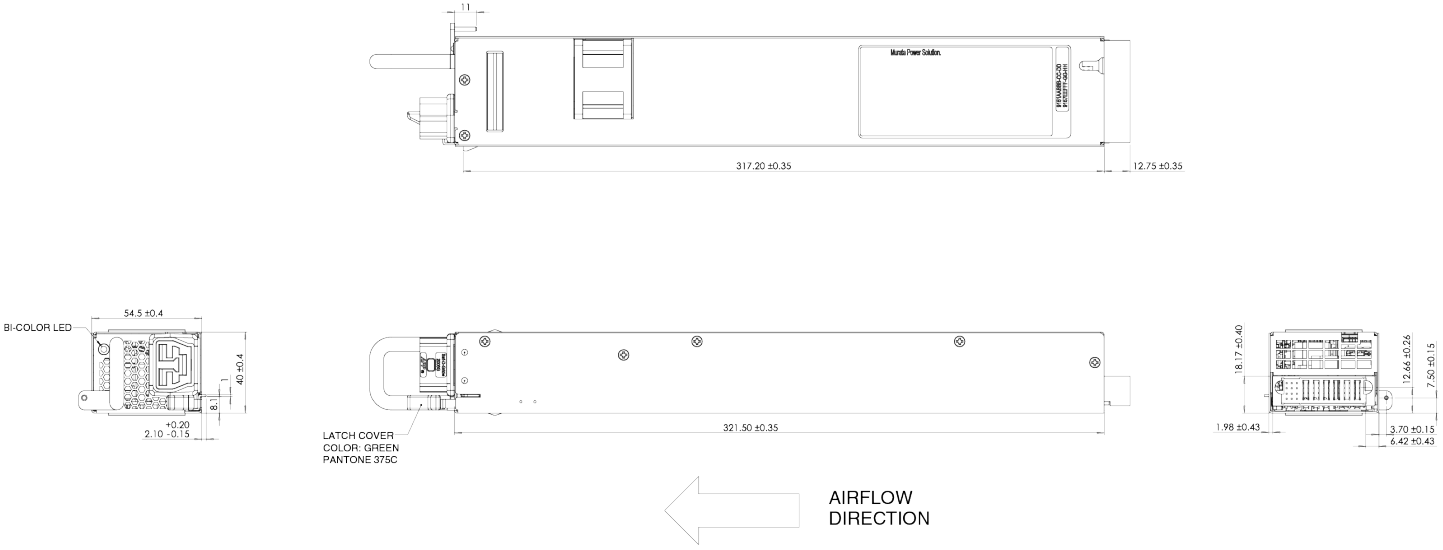
WIRING DIAGRAM



CURRENT SHARING NOTES

1. Main Output current sharing is achieved using the active current share method.
2. Current sharing can be achieved with or without the remote (V_SENSE) connected to the common load.
3. +VSB Outputs can be tied together for redundancy but total combined output power must not exceed the rated standby power of a single unit. The +VSB output has an internal ORING MOSFET for additional redundancy/internal short protection.
4. Main output power of units sharing must not exceed the rated power of a single unit during power up.
5. The current sharing pin D1 is connected between sharing units (forming an ISHARE bus). It is an input and/or an output (bi-directional analog bus) as the voltage on the line controls the current share between sharing units. A power supply will respond to a change (in this voltage) but a power supply can also change the voltage depending on the load drawn from it. On a single unit the voltage on the pin (and the common ISHARE bus would read approximately 8VDC at 100% load (power module capability). For two units sharing the same load this would read approximately 4VDC for perfect current sharing (i.e. 50% power capability per unit).
6. The load for both the main 12V and the VSB outputs at initial startup shall not be allowed to exceed the capability of a single unit. The load can be increased after a delay of 3 sec (minimum), to allow all sharing units to achieve steady state regulation
7. Four (4) power modules shall be operated in parallel and share within the overall ISHARE limits.

MECHANCIAL OUTLINE



1. HVDC input connector: Anderson Saf-D-Grid ® 2006G.
2. This drawing is a graphical representation of the product and may not show all fine details. Please contact Murata for 3D model for details
3. Dimensions in mm, Material: 0.80mm hot dipped galvanized steel, Grade G60 minimum spangle finished with a CR(6+) free corrosion resistant coating
4. Referenced Drawing: D75090058191 rev. 6

OPTIONAL ACCESSORIES

Description	Part Number
Connector Card	D1U54P-12-CONC2K
AC Line Cord[1], Adapts Saf-D-Grid® 400V to IEC 320 C14 or C20	Anderson Power Products (Saf-D-Grid® To IEC 320 cable configurations): 2050KN1-BK: C14, 1M Length, 14 AWG SJT 2050KN2-BK: C14 2M Length, 14 AWG SJT 2050KN3-BK: C14, 3M Length, 14 AWG SJT 2050KH1-BK: C20, 1M Length, 14 AWG SJT 2050KH2-BK: C20, 2M Length, 14 AWG SJT 2050KH3-BK: C20 3M Length, 14 AWG SJT 2058KN1-BK: C20, 1M Length, 12 AWG SJT 2058KN2-BK: C20, 2M Length, 12 AWG SJT 2058KN3-BK: C20 3M Length, 12 AWG SJT Contact your Anderson Power Products distributor for additional options, pricing and availability

[1] It is incumbent upon the end user to ensure operation with an input cable system that complies with the electrical code and safety requirements of the country, or region of deployment.

APPLICATION NOTES

Document Number	Description	Link
ACAN-82	D1U54P-12-CONC2K, Output Connector Card	URL link to document
ACAN-131	D1U54T-W-2000-12-HC4C PMBus™ Protocol	URL link to document
ACAN-80	Cold Redundancy; RAPID_ON	URL Link to Document

Murata Power Solutions, Inc.
129 Flanders Rd. Westborough,
Ma 01581, USA.
ISO 9001 REGISTERED