D1U54T-M-1500-12-HUxC Series

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

Pictorial View is NTS, HU4C model shown. EMI Gasket details may vary; refer to mechanical outline for additional details

FEATURES

- 80 Plus® certified titanium efficiency[1]
- 1500W output power
- 35W per inch density
- Anderson Saf-D-Grid® input connector
- 54.5 mm width x 40.6 mm height x 321.5 mm length
- 90-305Vac input voltage (192-400 Vdc)
- +12Vdc main output
- Selectable 3.3/5.0Vdc standby output voltage
- N+1 redundant, hot pluggable
- Active current sharing 12V main output
- Integral ORing /isolation provided for both outputs
- Integrated variable-speed cooling fan
- Overvoltage, overtemperature, overcurrent protection
- 64K Bytes of accessible EEPROM memory
- PMBus™ 1.2
- LED status indicators
- RoHS compliant
- Two-year warranty

[1]AC input mode, D1U54T-M-1500-12-HU4C model

Test Certificate and Test Report

For full details go to www.murata-ps.com/rohs

DEVELOPMENT OVERVIEW

D1U54T-M-1500-12-HUxC is a series of highly efficient AC/HVDC input front end power supply featuring a 12Vdc main output capable of active current sharing (up to four power modules) and a user selectable 3.3/5.0Vdc standby output. Hardware logic signals, LED status indicators with PMBus™ 1.2 digital communications capability and low profile 1U, 35W/cubic inch package make this series ideal for delivering reliable, efficient power to servers, workstations, storage systems and other 12V distributed power architectures.

ORDERING GUIDE

Model Number	Output Power at Nominal Vin			Main Output	Standby Output	Airflow
	90-140Vac	180-305Vac	192-400Vdc			
D1U54T-M-1500-12-HU3C	836W	1500W	1500W	12.0Vdc	3.3/5.0 Vdc	F⇨B
D1U54T-M-1500-12-HU4C						B⇨F

INPUT CHARACTERISTICS

Parameter		Conditions	Min.	Nom.	Max.	Units
Input Source Voltage, AC Operating Range		Low Line	90	100-120	140	Vac
		High Line	180	200-240	305	Vac
Input Source Voltage, DC Operating Range			192	240	400	Vdc
Input (AC) Source Frequency			47	50-60	63	Hz
Turn-on Input Voltage, AC Source		Ramp up		87	90	Vac
Turn-off Input Voltage	Low Line Mode	Ramp down		81	85	
	High Line Mode			160	170	
Turn-on Input Voltage, DC input mode		Ramp up	152	157	162	Vdc
		Ramp down	140	145	149	
Maximum current		200Vac; 1500W			9	Arms
		100Vac; 836W			10	
		240Vdc; 1500W			7.5	Adc
Inrush Current		Cold start, 0-200mS			20	Apk
Efficiency 80 Plus® Titanium Certification		80PLUS® Titanium Requirements[1]				
		Loading	Efficiency		PF; W/VA	
		10% load	90%		0.90	
		20% load	95%		0.98	
		50% load	96%		0.98	
		100% load	93%		0.98	

[1]230Vac, 25°C, excludes fan power, certificate based on D1U54T-M-1500-12-HU4C model

OUTPUT VOLTAGE CHARACTERISTICS

Output	Parameter	Conditions	Min.	Typ.	Max.	Units
12V Main	Initial Output Setpoint	230Vac input, 50% load; Tamb 25°C, not including aging	11.97	12.00	12.03	Vdc
	Line and Load Reg.[2]	Regulation Output Voltage Variation Due to Aging, Temperature, Drift, Input, Load, etc.	-3		+3	%
	Ripple & Noise[1,2]	Diff. & Com. Mode; 20MHz Bandwidth; Min Load Capacitance			120	mVpp
	Output Current	1500W; 180-305Vac, 192-400Vdc	0		125	Adc
		836W; 90-180Vac	0		69.5	
	Load Capacitance		2000		30,000	µF
3.3/5.0V SB[3]	Output Setpoint	50% load; Tamb =25°C	-1.00		-1.00	%
	Line and Load Reg.	Overall Regulation Including Load and Temperature	-5.00		+5.00	
	Ripple & Noise[1,2]	Diff. & Com. Mode; 20MHz Bandwidth; Min Load Capacitance			50	mVpp
	Output Current		0		2.0	Adc
	Load Capacitance		200		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 and minimum output bus capacitance specified in above table.

[2] Minimum 12V main output Load of 1A to comply with these limits.

[3] The standby output voltage is pin selectable to either 3.0 or 5.0Vdc. See VSB_SEL signal for details

OUTPUT CHARACTERISTICS

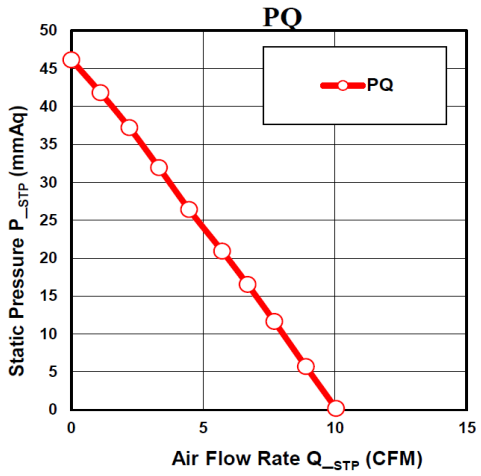
Parameter	Conditions	Min.	Typ.	Max.	Units
Startup Time	AC ramp up; delay until Main output start			3	s
Transient load response (12V Main Output)	Transient Response (Load Step 50% to 100% of Full Load, 5%-55% of Full Load); 1A/µS load step slew rate; 250µS typical settling time; minimum load capacitance	-5		+5	%
Current sharing accuracy (12V Main Output)	Current Sharing Accuracy for loads >25% max. load Loading ≤25% max. typically ≤5% power supply's max. load current, up to QTY 4 power modules		±5		
Hot Swap Transients	All outputs remain in regulation	-5		+5	
Holdup Time	≥200V, 100% load	10			ms

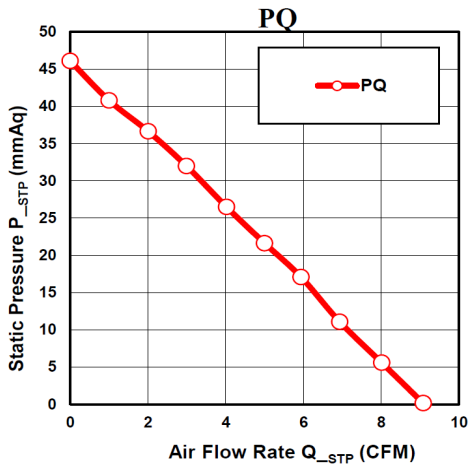
ENVIRONMENTAL CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Storage Temperature Range		-40		85	°C
Operating Temperature Range (Sea Level)	100% full load	-5		45	
Humidity	Operating; non-condensing	5		90	%
	Storage; non-condensing	5		95	
Altitude Operating [1]				3000	m
Shock	non-operating			30	
Operational Vibration	Sine sweep; 5-150Hz, 2G; random vibration, 5-500Hz, 1.11G				
MTBF	Telcordia SR332 Issue 3; Method 1 Case 1; 40°C	300K			Hrs.
Safety Approval Standards	UL60950-1, 2nd Edition, 2014-10-14 (Information Technology Equipment – safety - Part 1: General Requirements). CAN/CSA-C22.2 No. 60950-1-7, 2nd Edition 2014-10 (Information Technology Equipment - Safety - Part 1: General Requirements) CB: IEC 60950-1:2005, IEC 60950-1:2005/AMD1:2009, IEC60950-1:2005/AMD2:2013 IEC/EN 62368-1 (Planned) GB4943.1-2011(CQC) CNS14336-1 (099/09/30); CNS13438 (095/06/01) (BSMI) IEC 60950-1-2014 (EAC)				
Input Fuse	Dual fast acting 16A, 420V fuses				
Weight	1.24kg				

[1] Meets the safety compliance spacing requirements for altitude; performance based on power module outside of a system. Actual performance may vary based on effects of end-user's system backpressure.

AIRFLOW PERFORMANCE DATA





Above curves are approximate, based on similar product D1U54T-W-1500-12-HxxC

PROTECTION CHARACTERISTICS

Output	Parameter	Conditions	Min.	Typ.	Max.	Units
	Over temperature (intake) [1]	Shutdown and auto-recovery	60		70	°C
Main 12V	Overvoltage	Latching[2] (VSB output maintains operation)	13.3		14.8	Vdc
	Overcurrent	90-140Vac (main output latch-off, VSB maintains operation)	76		91	A
		180-264Vac (main output latch-off, VSB maintains operation)	137.5		162.5	A
3.3VSB	Overvoltage	Latching[2] Main and VSB outputs	3.8		4.2	Vdc
	Overcurrent	Latching[2] both outputs	2.5		3.5	A
5.0VSB	Overvoltage	Latching[2] Main and VSB outputs	5.6		6.4	Vdc

[1] Operating the power supply module above the maximum operating temperature (see "ENVIRONMENTAL CHARACTERISTICS") is considered an abnormal condition, may negatively impact power supply life and is not recommended.
[2] Latch-off requires elimination of fault condition and then recycling either the AC input or PS_ON re-cycle to resume operation

ISOLATION CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Insulation Safety Rating / Test Voltage	Input to Output – Reinforced	3000			Vrms
	Input to Chassis – Basic	2034			

EMISSIONS AND IMMUNITY[2,3]

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 limits, 6db margin
ESD Immunity	IEC/EN 61000-4-2	±8KV Contact; ±15KV air discharge; Criteria A
Radiated Field Immunity	IEC/EN 61000-4-3	3V/m, 1KHz, 80% AM, 80MHz to 1GHz Criteria A
Electrical Fast Transients/Burst Immunity	IEC/EN 61000-4-4	Level 2 (1kV), criteria A
Surge Immunity	IEC/EN 61000-4-5	Level 3 (2kV Line-Earth, 2kV Line-Line), criteria A, measured at input connector
RF Conducted Immunity	IEC/EN 61000-4-6	Level 2, 3Vrms, 1KHz, 80% AM, 150kHz to 80MHz criteria A
Magnetic Field Immunity	IEC/EN 61000-4-8	1A/m criteria A
Voltage Dips, Interruptions	IEC/EN 61000-4-11[4]	200-240Vac input; 100% load, Dip 100%, Duration 10ms (Criteria Class A) 200-240Vac input; 50% load, Dip 100% Duration 20ms (Criteria Class A) 200-240Vac input;100% load, Dip 60% Duration > 200ms Criteria Class (B) 200-240Vac input;100% load, Dip 30% Duration > 500ms (Criteria Class A) 200-240Vac input;100% load, Dip 20% Duration > 10 sec (Criteria Class A)

[1] Measured at power supply's AC input connector
[2] Installed in End User system and contingent upon final system design
[3] Radiated performance designed to meet Class A limits; however contingent on deployment; final qualification and certification testing to be performed by End User in system installation
[4] During ride-through, peak current cannot be greater than three times the operating current before ride-through

STATUS INDICATORS AND CONTROL SIGNALS

Event	Blue LED Status	Amber LED Status
12V main on and in voltage regulation band (Active mode)	Solid Blue	Off
12V main off (Standby mode)	1HZ Blinking	Off
No AC input power to any of the system power supplies	Off	Off
No AC input power, but other PSU in the system operating	Off	1HZ Blinking
[1] Warning event (Output OCW/ OTW/ Fan fail)	Off	1HZ Blinking
[1] Fault event (Input OVP/ Output OVP, UVP, OCP/ OTP/ Other internal fault)	Off	Solid Amber

[1] reported by PMBus Status Register(s) and asserts SMB_Alert

STATUS AND CONTROL SIGNALS

Signal Name	I/O	Description	Interface Details
INPUTOK_H	Output	Active High signal; Indicates the status of the input voltage. Logic "High"- Input is OK Logic "Low"- Input is not OK	Pulled up via 10Kohm to an internal 3.3V rail. A logical level Low, 0-0.4Vdc;Isink =4mA A logical Level High, 2.4-3.46Vdc; 40uA max
PW_OK_H	Output	Active High signal; Indicates the status of the output voltage. Logic "High"- Output is OK Logic "Low"- Output is not OK	Pulled up internally via 1Kohm to internal an 3.3Vdc rail A logic high 2.4-3.46Vdc; Isource =50uA A logical level Low, 0-0.4Vdc; Isink =4mA
SMB_ALERT_L	Output	Active Low signal alerting the system / host of the presence of a fault or warning condition. Such as OCP/OVP/UVP or fan failure. This signal may also indicate the power supply operating in an environment exceeding the specified limits. This signal coincides with LED indicators associated Warning/Fault assertion.	Pulled up internally via 4.7kohm to 3.3Vdc A logic high 2.4-3.46Vdc; Isource =50uA A logical level Low, 0-0.8Vdc; Isink =4mA

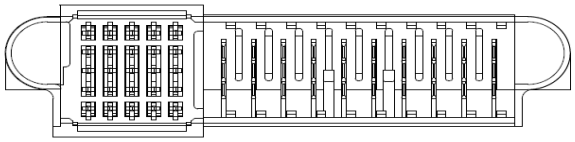
STATUS AND CONTROL SIGNALS

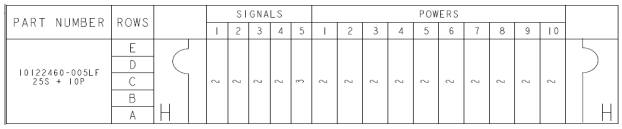
Signal Name	I/O	Description	Interface Details
PRESENT_L	Output	This signal pin will be tied internally (within PSU) to SGND. It shall be a "Last Make, First Break" (LMFB) sequenced signal that indicates the "presence" of the installed power module.	
PSON_L	Input	The PS_ON signal can be used to turn the main 12V output on or off when the following conditions are true, with respect to VSB_RT: Logic "Low " = turn On Logic "High"- turn Off	Pulled up internally via 10Kohm to internal 3.3Vdc rail A logic high 2.0 - 3.46Vdc; Isource =4mA A logical level Low, 0-1.0Vdc; Isink =400µA
PSKILL	Input	This signal is used by the PSU for main 12Vdc output power on/off processing as follows: Logic "Low" : PSU turn on main output Logic "High": PSU shutdown main output. This signal must be pulled down within the system/host to SGND via "0" OHM resistor	Pulled up via 10K to internal 3.3VDC A logic low <0.8Vdc
SCL	Both	Serial clock line compatible with PMBus™ Power Systems Management Protocol Part 1 – General Requirements Rev 1.2	Pulled up internally via 100K ohm to internal 3.3Vdc rail A logic high 2.1 - 3.46Vdc; Isource =4mA A logical level Low, 0-0.4Vdc; Isink =400µA
SDA	Both	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 100K ohm to internal 3.3Vdc rail A logic high 2.1 - 3.46Vdc; Isource =4mA A logical level Low, 0-0.4Vdc;
V1SENSE, V1SENSE_RTN & VSB_SENSE, VSB_SENSE_R	Input	Analog input/output voltage sense lines to compensate for power path voltage drop. These low level analog signals should be isolated from digital circuit noise. When one or more remote sense lines are opened, regulation measured at the power supply output connector shall maintain the specified regulation window within ± 200mVdc. If the REMOTE SENSE+ is shorted to DC_RETURN, the 12V Main output shall enter protection and the power supply shall shut down.	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 that controls the current share between sharing units. A power module responds to changes in bus voltage but also can change the bus voltage based on the load drawn from it. For single power module, the voltage on the ISHARE signal pin (bus) would read approximately 8Vdc at 100% load of high line input. 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).	Analogue voltage: +8V nominal; 0.064V/A; ISHARE sink = 0.5mA (at 4.00V) ISHARE source = 4.0mA (at 4.00V)
VSB SEL	Input	Selects the standby voltage as follows: Left Open (no pull down)= 3.3Vdc is selected Pulled down to VSB Return = 5.0Vdc Once set and PSU operating, changing the setting will requires recycling of the input voltage to be activated.	Pulled up internally via 10K
APS	Input	A single analog input is provided for the host system to set the address of the internal slave devices (microprocessor and EEPROM) for digital communications. By pulling down the APS signal through a resistor within the system / host specified below, these addresses can be selected.	Pulled up internally via 12.1K ohm to 3.3Vdc

Microcontroller Address	External EEPROM Address	Resistor selection
0xB0	0xA0	820
0xB2	0xA2	2700
0xB4	0xA4	5600
0xB6	0xA6	8200

CONNECTOR INTERFACE, OUTPUT POWER & SIGNAL

Output Power and Signal: FCI PN 10122460-005LF (Power Supply Side)





Pin Description

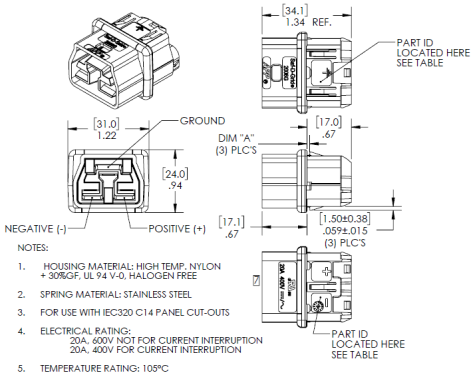
Rows:	1	2	3	4	5[1]	PGND	V1
A	VSB	SGND/VSB_RTN[2]	APS	SCL	PSKILL_H	1,2,3,4,5[2]	6,7,8,9,10
B	VSB	SGND/VSB_RTN[2]	N/C	PSON_L	ISHARE		
C	VSB	Reserved for future use	SDA	SMB_ALERT_L	PWOK_H		
D	VSB	VSB_SENSE_R	V1_SENSE_R	N/C	VSB_SEL		
E	VSB	VSB_SENSE	V1_SENSE	ACOK_H	PRESENT_L		

[1] Pins in columns 5, are the shortest level signal pin and the "last to make, first to break" in the mating sequence.
[2] SGND/VSB_RTN and PGND are internally connected and intended to be connected to Protective Earth within the host/system

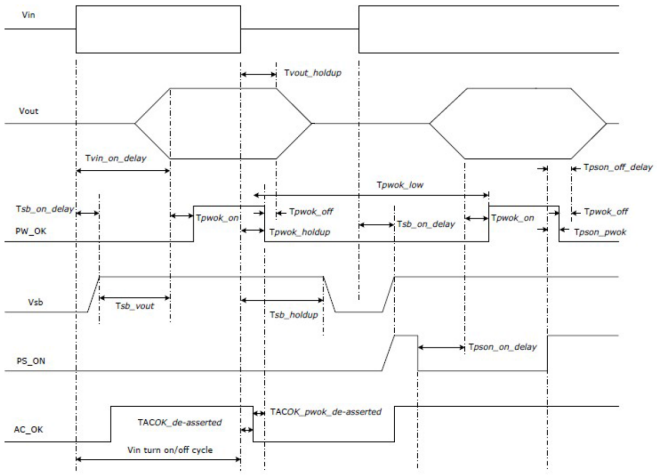
Mating Connector

FCI 10108888-R10253SLF, right-angle

INPUT POWER CONNECTOR

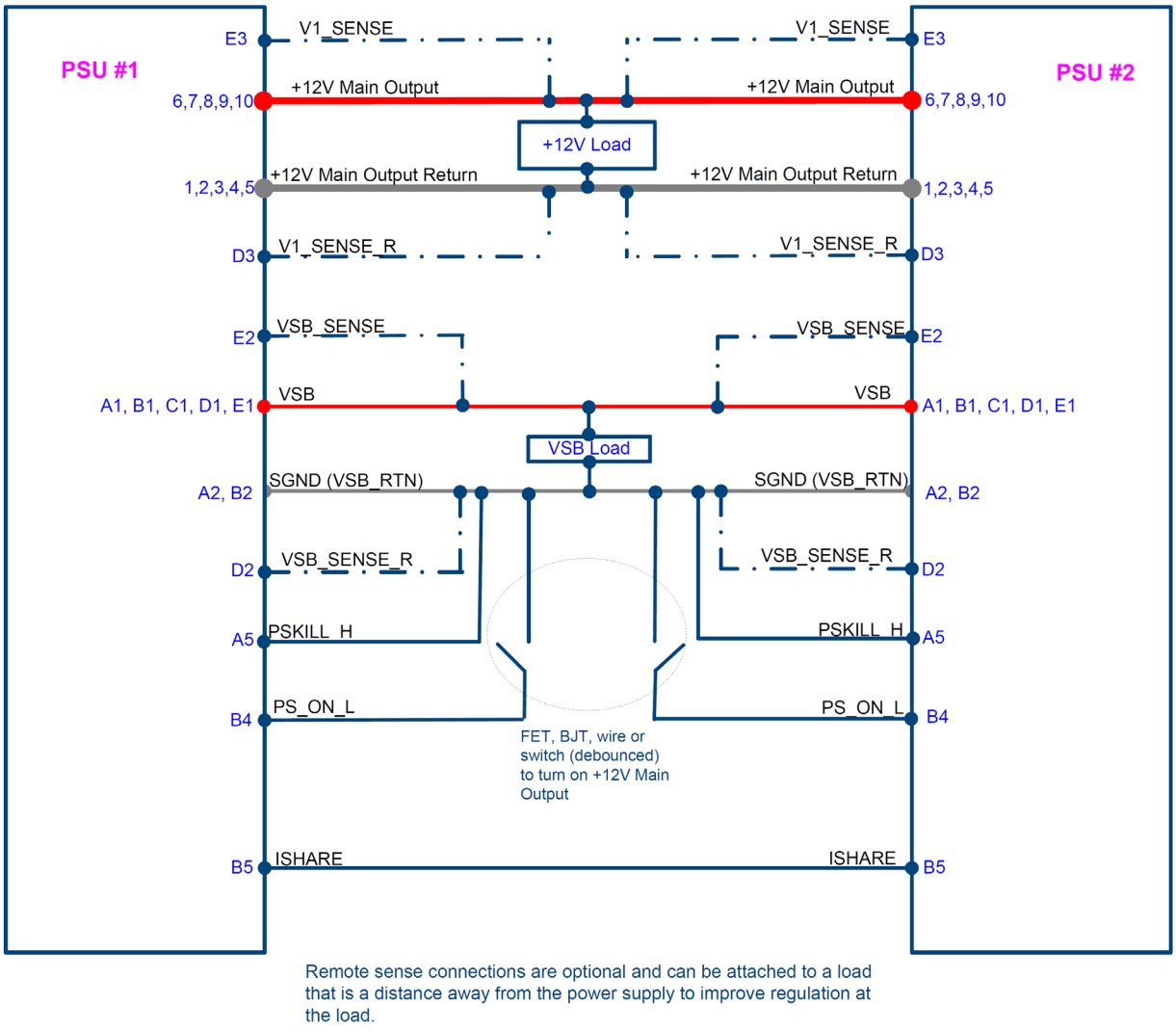
Part Number	Description	Outline	Notes
Anderson Saf-D-Grid® Receptacle: 2006G3-NC	Power Module two position PCB mounted Receptacle Connector		It is the End User's remit to choose the correct mating connector from the Anderson Saf-D-Grid® range commensurate with the system AC mains and or DC cabling and distribution scheme

TIMING SPECIFICATIONS



Item	Description	Min	Max	unit
Tvout_rise	Output voltage rise time for 12V1	10	50	ms
	Output voltage rise time 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
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# deactivate 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 PWOK de-asserted to output voltages dropping out of regulation limits	1		ms
Tpwok_low	Duration of PWOK 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 0/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
TACok_de- asserted	Delay from Vin drop being OV to de- assertion of AC OK		8	ms

1+1 WIRING DIAGRAM



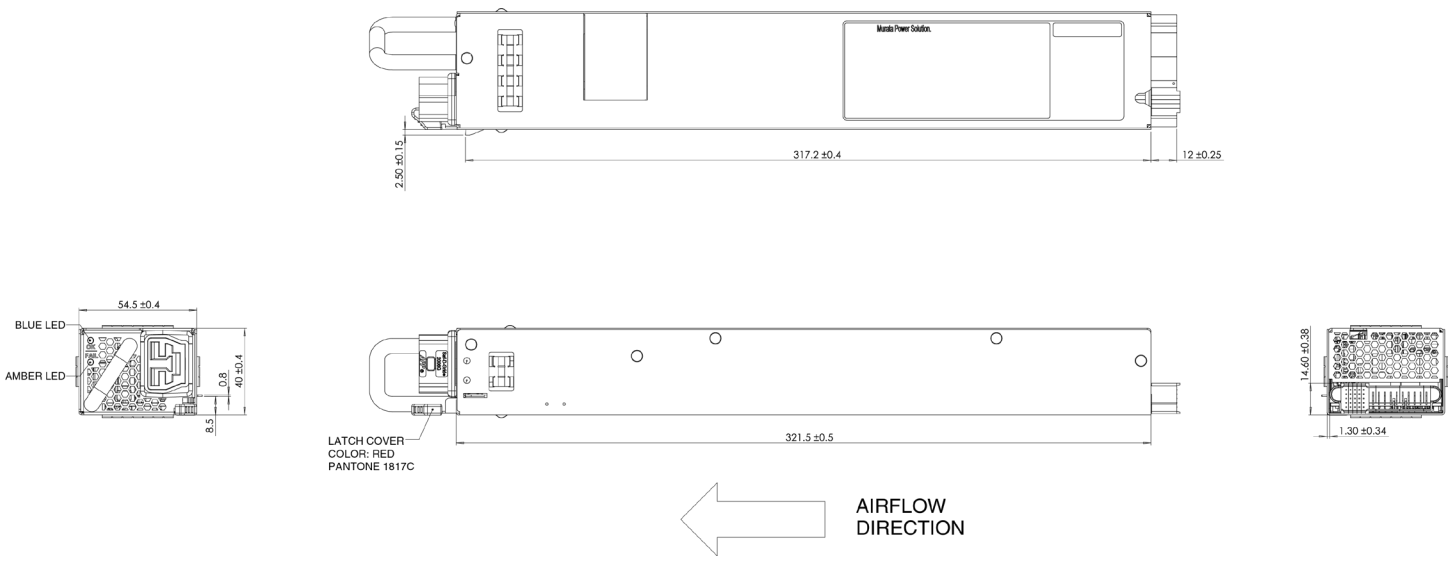
Remote sense connections are optional and can be attached to a load that is a distance away from the power supply to improve regulation at the load.

CURRENT SHARING NOTES

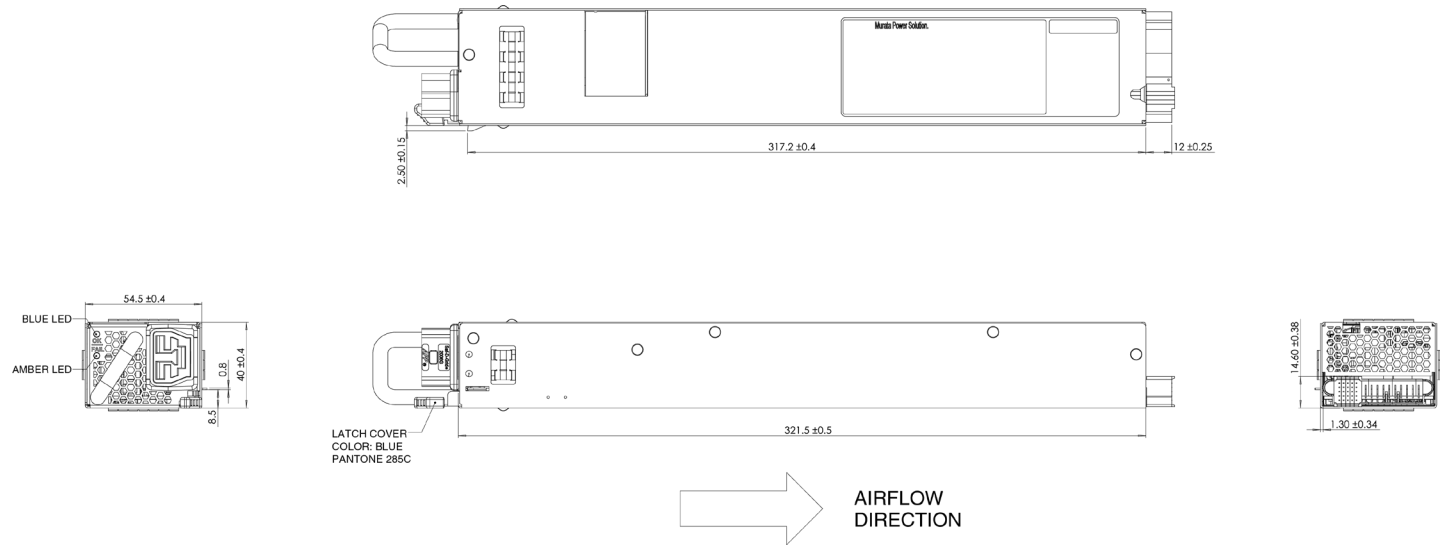
1. Main Output current sharing is achieved using the active current share method.
2. Current sharing can be achieved with or without connection of the main output sense signals to the common load.
3. +VSB Outputs can be tied together for redundancy but total combined output power must not exceed the 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 signal is connected between sharing units (forming an ISHARE bus). It is a bi-directional analog bus utilizing the bus voltage to control the current share between sharing units. Each power supply responds to a change in this voltage and each 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 must not exceed the capability of a single unit. The main output load may be increases after steady state regulation has been achieved (approximately 3 sec).

MECHANICAL OUTLINE

D1U54T-M-1500-12-HU4C, Back to Front Airflow



D1U54T-M-1500-12-HU3C, Front to Back Airflow



1. These drawings are a graphical representation of the product and may not show all fine details such as molded part surface features, internal components, screw head type. Please contact Murata for 3D model for additional details
2. Dimensions are expressed in mm
3. Subject to change without notice; contact factory for latest version
4. Power module retainer latch button colour: HU4C models Pantone 1817C (Red); HU3C models Pantone 285C (Blue)

OPTIONAL ACCESSORIES

Description	Part Number
Output Connector/Interface Card	D1U54T-12-CONC(M5803)
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 to Document
ACAN-92	D1U54T-12-CONC(M5803) Output Connector Card	https://www.murata.com/-/media/webrenewal/products/power/appnote/acan-92.ashx?la=ja-jp
ACAN-102	D1U54T-M-1500-12-HUxC PMBus™ Protocol	https://www.murata.com/-/media/webrenewal/products/power/appnote/acan-102.ashx?la=ja-jp

Murata Power Solutions, Inc.
129 Flanders Rd. Westborough,
Ma 01581, USA.
ISO 9001 and 14001 REGISTERED