Murata Power Solutions

D1U54-D-1500-HxxC Series

54mm 1U Front End DC-DC Power Converter

FEATURES

- 1500W output power (no derating across the full DC input voltage range)
- 1.57"(1U) x 12.65" x 2.15" (40.0mm x 321.5mm x 54.5mm)
- 93% efficiency
- 12VDC Main output
- 3.3VSB, 5VSB or 12VSB Standby output options
- >35W/in³ power density
- N+1 Redundancy Capable; hot plug/swap (up to 8 modules in parallel)
- Active current sharing on 12V main output; integral MOSFET ORING
- Over-Voltage, Over-Current; Over-Temperature Protection
- Internal variable speed cooling fans
- PMBus™ Power Management Bus
- RoHS Compliant
- Two Year Warranty

Available now at: www. murata-ps.com/en/3d/acdc.html

PRODUCT OVERVIEW

D1U54-D-1200-HxxC series are highly efficient 1500 watt, DC input front end power modules with a 12V main output and a choice of 3.3V, 5V or 12VDC (30W max) standby rail. The power module is able to current share with up to eight (8) other power modules of the same type operating in parallel or N+1 redundancy. The supplies may be hot plugged, and include integral output isolation devices.

The power modules are fully protected from overload and overvoltage and are able to auto-recover from overtemperature faults. A Status LED is provided on the front panel and additional control and status reporting is provided by hardware logic signals and via a PMBus™ digital interface.

A low profile sub 1U height enclosure with power density of >35W/in³ make this an excellent choice for delivering reliable, efficient power to servers, workstations, storage systems and other 12V distributed power systems including direct operation from intermediate bus converters.

ORDERING GUIDE

Part Number	Internal MPN	Power Output	Main Output	Standby Output	Airflow
D1U54-D-1500-12-HC4C	M1900	1500W -48 to -60Vdc 45°C	12V	3.3V	Back to Front
D1U54-D-1500-12-HA4C	M1897			5V	
D1U54-D-1500-12-HB4C	M1903			12V	
D1U54-D-1500-12-HC3C	M1901			3.3V	Front to Back
D1U54-D-1500-12-HA3C	M1898			5V	

INPUT CHARACTERISTICS

Parameter	Conditions	Min	Typical	Max	Units
DC Input Voltage Operating Range		-40	-48/-60	-72	Vdc
Turn-on Input Voltage	Ramp Up	-39	-40	-41	
Turn-off Input Voltage	Ramp Down	-35	-36	-37	
Maximum Current	1500W, Vin = -48Vdc to -60Vdc			51	Adc
DC Input Inrush Peak Current	Cold start between 0 to 200ms -48Vdc			50	Apk
	-72Vdc			100	
Efficiency (-48Vdc)	20% FL		92		%
	50% FL		93		
	100% FL		90		
Reverse polarity protection	Withstand Reversed input cables; no internal/external fuse failure	+40		+72	Vdc

OUTPUT VOLTAGE CHARACTERISTICS

Output Voltage	Parameter	Conditions	Min.	Typical	Max.	Units
Main 12V	Voltage Set Point			12		Vdc
	Line & Load Regulation	Combined regulation	11.4		12.6	
	Ripple & Noise[1,2]	20MHz Bandwidth			120	mV P-P
	Output Current	-40Vdc to -72Vdc DC input	0		125A	A
	Load Capacitance				30,000	µF
3.3VSB	Voltage Set Point			3.3		Vdc
	Line & Load Regulation	Combined regulation	3.14		3.46	
	Ripple Voltage & Noise[1,3]	20MHz Bandwidth			120	mV P-P
	Output Current		0		4	A
	Load Capacitance				3,000	µF
5VSB	Voltage Set Point			5.0		Vdc
	Line & Load Regulation		4.76		5.24	
	Ripple Voltage & Noise[1,3]	20MHz Bandwidth			120	mV P-P
	Output Current		0		4	A
	Load Capacitance				3,000	µF
12VSB	Voltage Set Point			12.0		Vdc
	Line & Load Regulation		11.4		12.6	
	Ripple Voltage & Noise[1,3]	20MHz Bandwidth			120	mV P-P
	Output Current		0		2.5	A
	Load Capacitance				1,000	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 measurement 'scope input, is used.
[2] Minimum load 5A
[3] Minimum load 0.25A

RoHS COMPLIANT

25

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

Test Certificate and Test Report

OUTPUT CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Remote Sense (Main Output)	Overall compensation at full load; +VE & -VE connections			120	mV
Output Rise (Monotonic)	10% to 95% rise time	No positive voltage excursion above set point			
Startup Time	DC Ramp Up			3	s
	PS_ON activation		200		ms
Transient Response	12V, 10%-60% and 50-100% or 60%-10% and 100-50% step		±600		mV
	3.3/5VSB 50-100% or 100-50% step load 1A/µs slew rate		±165/±250		
Current Sharing Accuracy (between sharing modules; up to 8 in parallel)	At 100% load			±10	%
Hot Swap Transients				5	%
Hold Up Time[2]	FL (Full Load); 48VDC nominal input prior to hold up	1			ms

[2] Assumes deployment within systems utilizing dual redundant "A" and "B" DC input feeds

ENVIRONMENTAL CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Storage Temperature Range	Non-Condensing	-40		70	°C
Operating Temperature Range	1500W Output Power; See Derating Curves	-5		45	
Operating Humidity	Non-Condensing	5		90	%
Storage Humidity		5		95	
Altitude (no derating at 40°C)		3000			m
Shock	Non-Operating			30	G
Sinusoidal Vibration	Non-operating, 0.5G; 5-500Hz				
MTBF (Target)	Telcordia SR-332 M1C1 @ 40°C	452			K Hours
Safety Approvals (Standards) – Pending Submission	CAN/CSA C22.2 No 60950-1-07, Am.1:2011, Am 2:2014 ANSI/UL 60950-1-2014 IEC60950-1:2005 (2nd Ed.), Am 1:2009 + Am 2:2013				
Input Fusing	Internal 60A/170VDC fast blow fuse on the DC line input				
Weight				2.314/1.05	lbs/kg

PROTECTION CHARACTERISTICS

Output Voltage	Parameter	Conditions	Min.	Typ	Max.	Units
N/A	Over-Temperature	Air inlet temperature; Auto re-start	60		70	°C
	Over-Voltage	Latching; toggle PS_ON or recycle DC input to reset	13		14	V
12V (Main)	Over-Current	For slow overload events a constant current will be sustained for 1sec followed by a latch off that will auto reset in 5secs. For hard (short circuit) events the output will shut down within 50ms and auto restart within 200ms. This cycle will be repeated ten times at which point the output will permanently latch off. The power module will require to be reset by recycling the incoming DC source or by "toggling" PS_ON.	140		160	A
3.3VSB	Over-Voltage	Latching; toggle PS_ON or recycle DC input to reset	3.4		4.0	V
	Over-Current	Shutdown followed by auto-recovery	4.5		6	A
5VSB	Over-Voltage	Latching; toggle PS_ON or recycle DC input to reset	5.4		6.0	V
	Over-Current	Shutdown followed by auto-recovery	4.5		6	A
12VSB	Over-Voltage	Latching; toggle PS_ON or recycle DC input to reset	13.0		14.5	V
	Over-Current	Shutdown followed by auto-recovery	2.75		3.75	A

ISOLATION CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Insulation Safety Rating/Test Voltage	Input to Outputs		1500		Vdc
Isolation	Output to Chassis (Ground)		500		Vdc

EMISSIONS AND IMMUNITY

Characteristic	Standard	Compliance
Conducted Emissions	FCC 47 CFR Part 15 CSIPR 22/EN55022	Class A with 6dB margin
ESD Immunity	IEC/EN 61000-4-2;	Level 4; Criteria A
Radiated Field Immunity	IEC/EN 61000-4-3	Level 2; Criteria B
Electrical Fast Transients/Burst Immunity	IEC/EN 61000-4-4	Level 2; Criteria A
Surge Immunity	IEC/EN 61000-4-5	Level 2; Criteria A
RF Conducted Immunity	IEC/EN 61000-4-6	Level 2; Criteria A
Magnetic Field Immunity	IEC/EN 61000-4-8	3A/m; Criteria B
Voltage Dips & Interruptions	NEBS GR-1089-CORE Issue	Relevant sections and compliance levels TBD

STATUS INDICATORS

Conditions	GREEN (Power) LED Status	AMBER (Fault) LED Status
No incoming DC supply present; power module is completely off.	LED not illuminated	LED not illuminated
Standby Rail ON; Main Output OFF; DC input present & correct	Blinking	LED not illuminated
Standby Rail ON; Main Output ON	Solid Green	LED not illuminated
Main Output overcurrent; undervoltage, overvoltage warning	LED not illuminated	Solid Amber
FAN_FAULT; overtemperature; standby rail overcurrent, Main Output overcurrent or overvoltage	LED not illuminated	Solid Amber
Power Module Warning Event	LED not illuminated	Blinking

ADDR ADDRESS SELECTION

ADDR pin (A3) resistor to GND (K-ohm)*	Power Supply Main Controller (Serial Communications Slave Address)	Power Supply External EEPROM (Serial Communications Slave Address)
0.82	0xB0	0xA0
2.7	0xB2	0xA2
5.6	0xB4	0xA4
8.2	0xB6	0xA6
15	0xB8	0xA8
27	0xBA	0xAA
56	0xBC	0xAC
180	0xBE	0xAE

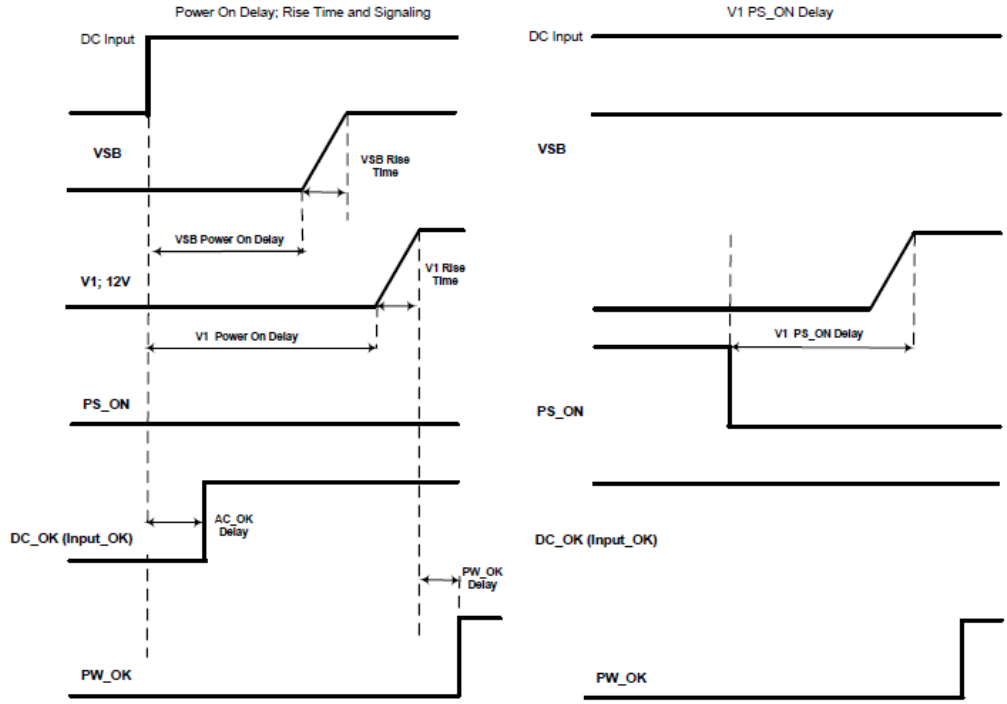
* The resistor shall be +/-5% tolerance

STATUS AND CONTROL SIGNALS			
Signal Name	I/O	Description	Interface Details
INPUT_OK (DC Source)	Output	The signal output is driven high when the input source is available and within acceptable limits. The output is driven low to indicate loss of input power. There is a minimum of 0.5ms pre-warning time before the signal is driven low prior to the PWR_OK signal going low. The power supply must ensure that this interface signal provides accurate status when input source is lost.	Pulled up internally via 10K to VDD[1]. A logic high >2.0Vdc A logic low <0.8Vdc Driven low by internal CMOS buffer (open drain output).
PW_OK (Output OK)	Output	The signal is asserted (driven high) by the power supply to indicate that all outputs are valid. If any of the outputs fail then this output will be hi-Z or driven low. The output is driven low to indicate that the Main output is outside of lower limit of regulation (11.4Vdc).	Pulled up internally via 10K to VDD[1]. A logic high >2.0Vdc A logic low <0.8Vdc Driven low by internal CMOS buffer (open drain output).
SMB_ALERT (FAULT/WARNING)	Output	The signal output is driven low to indicate that the power supply has detected a warning or fault and is intended to alert the system. This output must be driven high when the power is operating correctly (within specified limits). The signal will revert to a high level when the warning/fault stimulus (that caused the alert) is removed.	Pulled up internally via 10K to VDD[1]. A logic high >2.0Vdc A logic low <0.8Vdc Driven low by internal CMOS buffer (open drain output).
PRESENT_L (Power Supply Absent)	Output	The signal is used to detect the presence (installed) of a module by the host system. The signal is connected to PSU logic SGND within the power module.	Passive connection to +VSB_Return. A logic low <0.8Vdc
PS_ON (Power Supply Enable/Disable	Input	This signal is pulled up internally to the internal housekeeping supply (within the power supply). The power supply main 12Vdc output will be enabled when this signal is pulled low to +VSB_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 (toggling) this signal shall clear latched fault conditions.	Pulled up internally via 10K to VDD[1]. A logic high >2.0Vdc A logic low <0.8Vdc Input is via CMOS Schmitt trigger buffer.
PS_KILL	Input	This signal is used during hot swap to disable the main output during hot swap extraction. The input is pulled up internally to the internal housekeeping supply (within the power supply). The signal is provided on a short (lagging pin) and should be connected to +VSB_Return.	Pulled up internally via 10K to VDD[1]. A logic high >2.0Vdc A logic low <0.8Vdc Input is via CMOS Schmitt trigger buffer.
ADDR (Address Select)	Input	An analog input that is used to set the address of the internal slave devices (EEPROM and microprocessor) used for digital communications. Connection of a suitable resistor to +VSB_Return, in conjunction with an internal resistor divider chain, will configure the required address.	DC voltage between the limits of 0 and +3.3Vdc.
SCL (Serial Clock)	Both	A serial clock line compatible with PMBus™ Power Systems Management Protocol Part 1 – General Requirements Rev 1.1. 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.	VIL is 0.8V 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 1.1. 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,	VIL is 0.8V 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: 1. V1_SENSE directly connected to power blades 6 to 10 (inclusive) 2. V1_SENSE_RTN directly connected to power blades 1 to 5 (inclusive)	Compensation for up to 0.12Vdc total connection drop (output and return connections).
ISHARE	Bi-Directional Bus	The current sharing signal is connected between sharing units (forming an ISHARE bus). It is an input and/or an output (bi-directional 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; however 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 8VDC at 100% load (module capability). For two identical units sharing the same 100% load this would read 4VDC for perfect current sharing (i.e. 50% module load capability per unit).	Analogue voltage: +8V maximum; 10K to +12V_RTN

[1]. VDD is an internal voltage rail derived from VSB and an internal housekeeping rail ("diode ORed"); this rail is compatible with the voltage levels of TTL and CMOS logic families.

TIMING SPECIFICATIONS

Turn-On Delay & Output Rise Time:

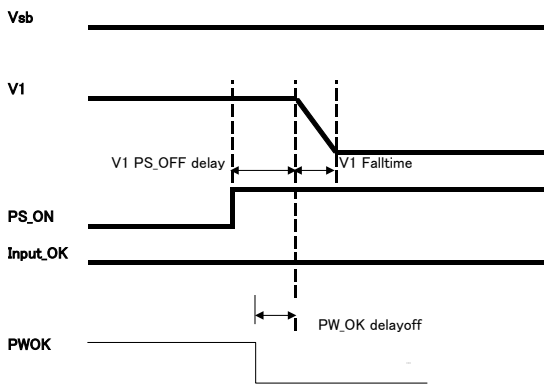


1. The turn-on delay after application of DC input within the operating range shall as defined in the following tables.
2. The output rise times shall be measured from 10% of the nominal output to the lower limit of the regulation band as defined in the following tables.

Time	Min	Max
Vsb Rise time	20ms	150ms
V1 Rise time	120ms	220ms
Vsb Power-on-delay	400ms	1200ms
V1 Power-on-delay	500ms	1500ms
V1 PS_ON delay	100ms	300ms
V1 PWOK delay	300ms	450ms
DC_OK (Input) detect	500ms	1500ms

TIMING SPECIFICATIONS

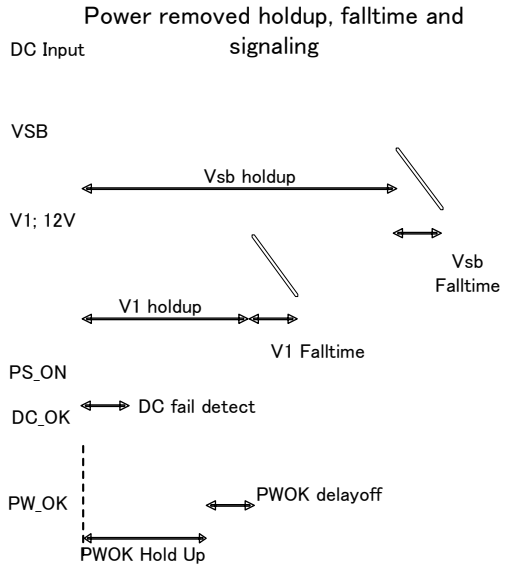
Turn-Off (Shutdown by PS_ON)



Turn-Off Timing	Min	Max	Notes
V1 Fall time	-	-	Must be monotonic
V1 PS_OFF delay	0ms	6ms	
PW_OK delay off	1.0ms		

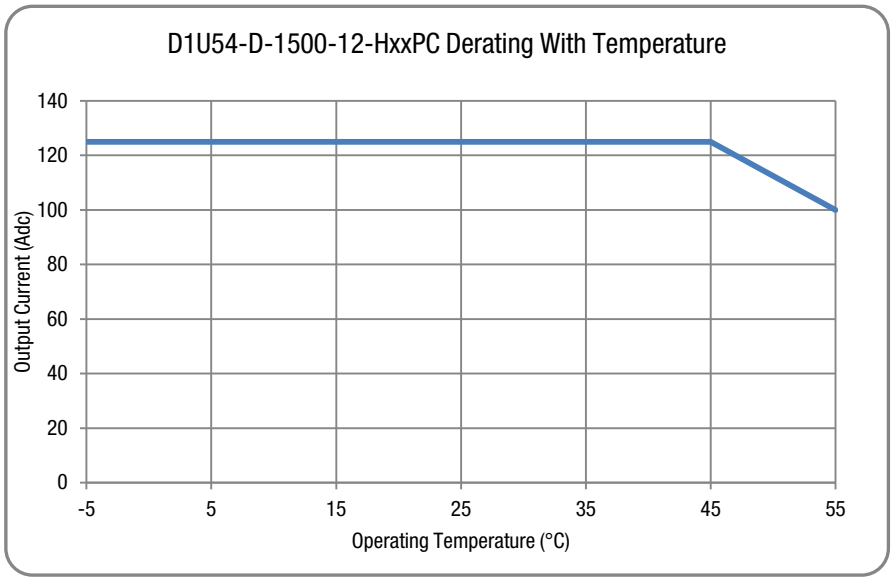
TIMING SPECIFICATIONS

Power Removal Holdup



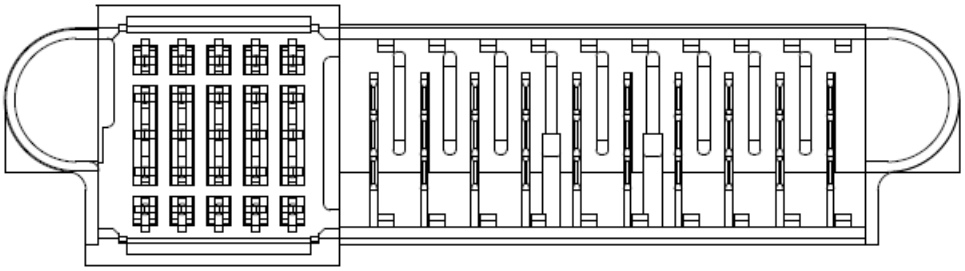
Power Removal Timing	Min	Max	Notes
Vsb holdup	3ms	25ms	+VSB Full Load
V1 holdup (Total Effective)	1ms	-	100% load
DC (Input) fail detect	400µs	1000µs	
PWOK delay off	-	0.8ms	100% load
PWOK Hold Up	-	2.2ms	

DERATING CURVES



NOTE: The D1U54-D-1500-12-HxxPC power supply has an integral fan; the fan speed is adjusted to achieve the required cooling airflow based on prevailing operating temperature/conditions and output loading.

OUTPUT CONNECTOR AND SIGNAL INTERFACE; FCI 10122460-005LF or Equivalent



PART NUMBER	ROWS		SIGNALS					POWERS									
			1	2	3	4	5	1	2	3	4	5	6	7	8	9	10
10122460-005LF 25S + 10P	E		2	2	2	2	3	2	2	2	2	2	2	2	2	2	2
	D																
	C																
	B																
	A	H															H

1) With respect to signals columns 5, "3" refers to the shortest level signal pin; the "shortest" pins are the "last to make, first to break" in the mating sequence.
2) Actual connector may not appear exactly as shown above. Refer to the manufacturer's datasheet for details

PIN ASSIGNMENTS: D1U54-D-1500-12-HxxC

FCI 10122460-005LF or Equivalent (Power Supply)

Pin	Function	Description
6, 7, 8, 9, 10	V1 (+12VOUT)	+12V Main Output
1, 2, 3, 4, 5	+12V RTN/PGND	+12V Main Output Return
A1	+VSB	Standby Output
B1	+VSB	Standby Output
C1	+VSB	Standby Output
D1	+VSB	Standby Output
E1	+VSB	Standby Output
A2	+VSB_Return	Standby Output Return
B2	+VSB_Return	Standby Output Return
C2	Unused	No End User Connection
D2	Unused	No End User Connection
E2	Unused	No End User Connection
A3	ADDR	I2C Address Protocol Selection (Select by appropriate pull down resistor
B3	Unused	No End User Connection
C3	SDA	I2C Serial Data Line
D3	V1_SENSE_R	Remote Sense Return (-VE)
E3	V1_SENSE	Remote Sense (+VE)
A4	SCL	I2C Serial Clock Line
B4	PS_ON_L	Remote On/Off (Enable/Disable)
C4	SMB_ALERT	Alert signal to host system
D4	Unused	No End User Connection
E4	DC_OK	DC Input Source Present & "OK"
A5	PS_KILL	Power Supply "kill"; short pin
B5	ISHARE	Current Share bus; short pin
C5	PW_OK	Power "OK"; short pin
D5	Unused	No End User Connection
E5	PRESENT_L	Power Module Present; short pin

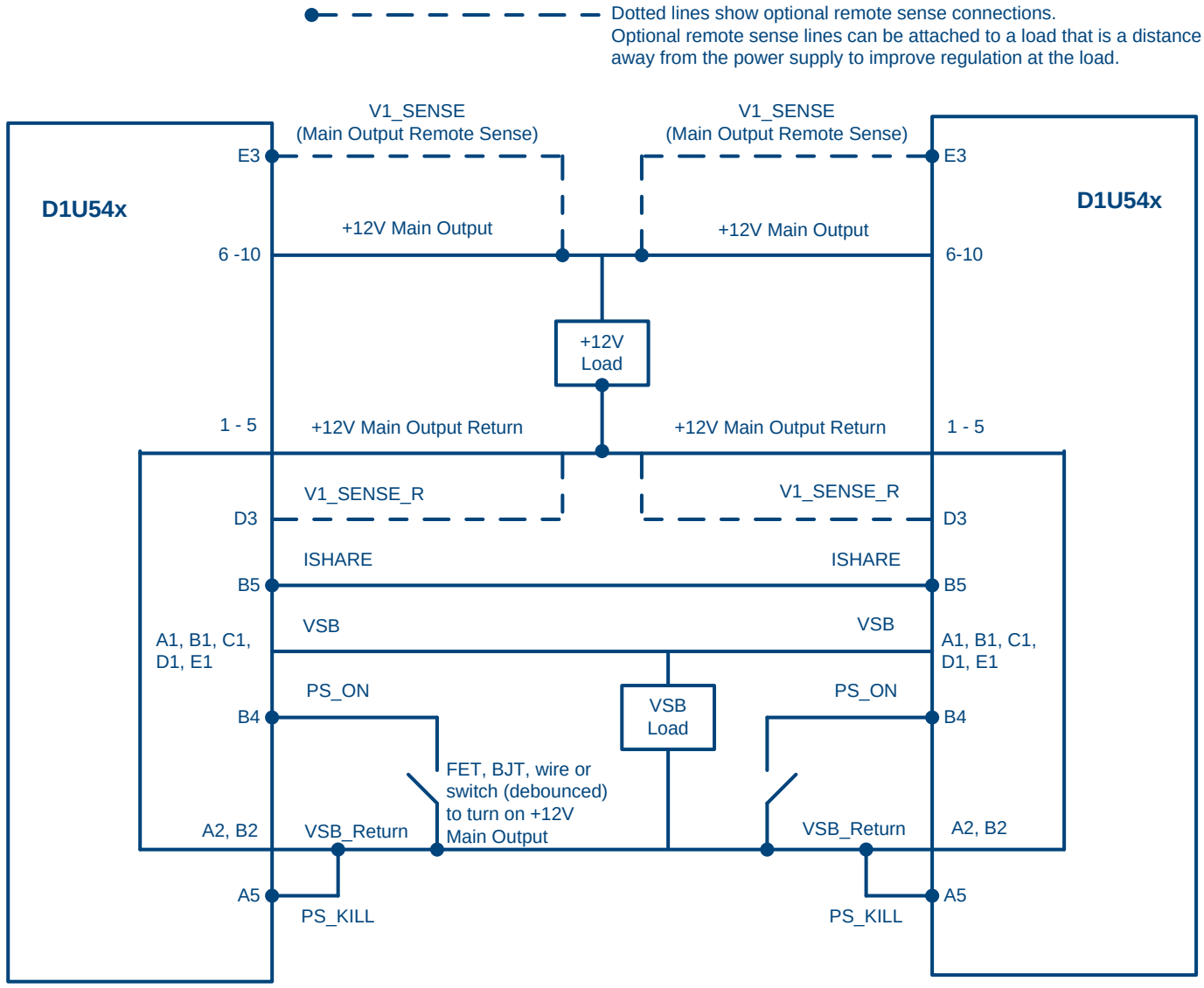
POWER SUPPLY INPUT TERMINAL BLOCK

Supplier	P/N
Dinkle Enterprise (Input Terminal Block)	DT-7C-B14W-02

MATING CONNECTORS

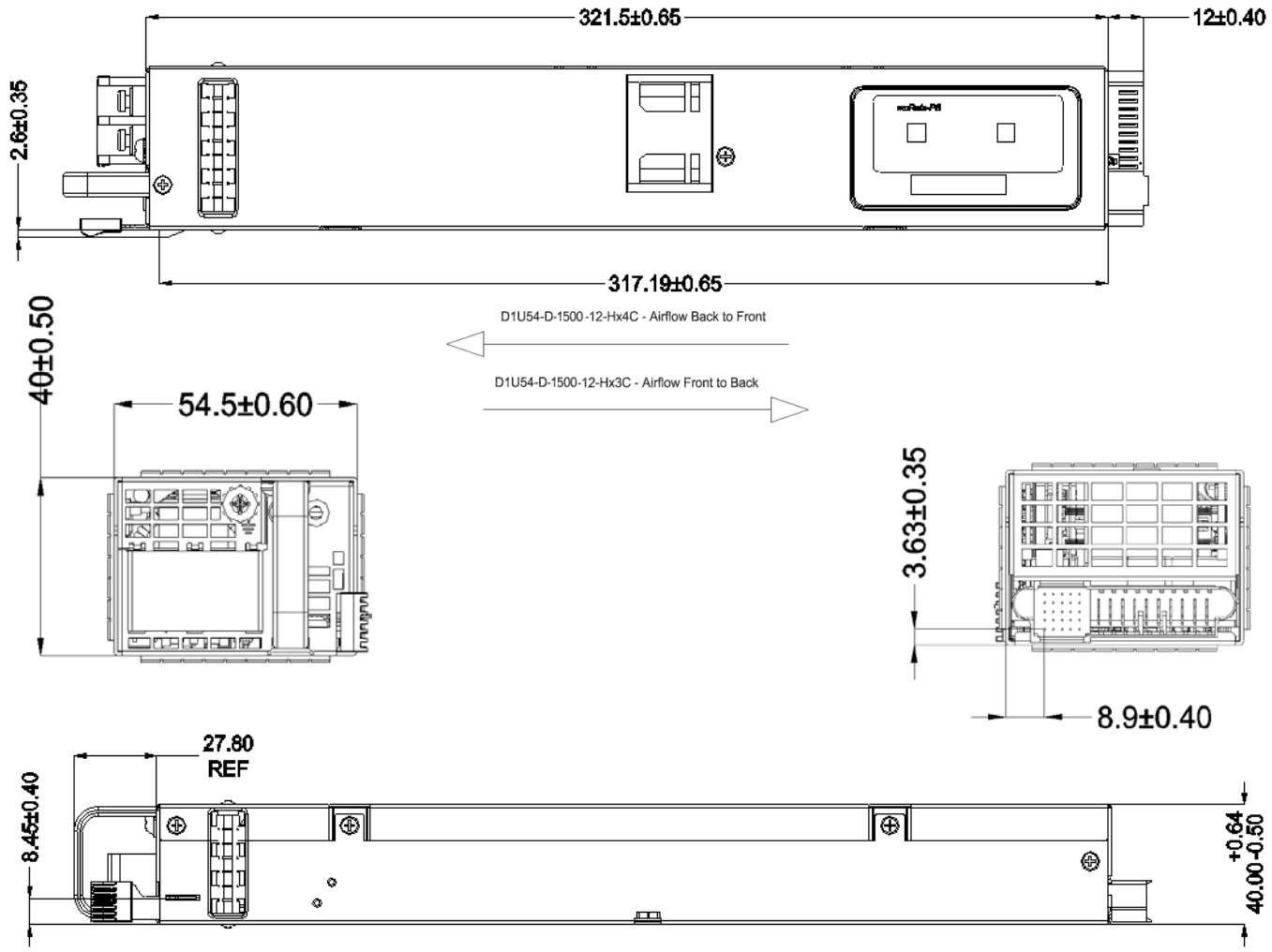
Supplier	Solder Right Angle
TE Connectivity (Tyco)	2-1926739-5
FCI Connect	10108888-R10253SLF

WIRING DIAGRAM



1. Main 12VDC Output: Active share bus. The ISHARE bus (Pin B5 or D4) must be connected on all sharing modules. It is not required that the SENSE signals are connected to the remote load for current share to operate correctly.
2. Up to eight (8) power modules can be connected in parallel (non-redundant) or N+1 configuration. The current share bus is bi-directional (can source or sink current from the ISHARE bus).
   The voltage of the bus would measure 8VDC for a single power module at 100% load; for two (2) modules sharing a common load the ISHARE bus voltage would be 4V for a perfect 50/50 current share scenario.
3. The VSB (Standby Output) output of the power module can also be connected in parallel; internal output isolation devices are provided however the combined available power is limited to that available from a single power module (3.3V @ 13.2W or 5V @ 20W; 12V @ 30W) irrespective of the number of modules connected in parallel.

MECHANICAL DIMENSIONS



1. Input Terminal Block is a Dinkle Enterprise DT-7C-B14W-02
2. Dimensions: 1.57" x 12.66" x 2.15" (40.0 x 321.5mm x 54.5mm)
3. Safety earth/ground connection via separate dedicated M4 pan head screw connection (located above terminal block)
4. This drawing is a graphical representation of the product and may not show all fine details.
5. Reference File: D1U54-D-1500-12-HxxC -1897_Drawing for Product Datasheet _20160411.pdf

OPTIONAL ACCESSORIES

Description	Part Number
D1U54P-12-CONC Output Interface Connector Card	D1U54P-12-CONC

APPLICATION NOTES

Document Number	Description	Link
ACAN-64	D1U54P-12-CONC Output Interface Connector Card	http://power.murata.com/datasheet?/data/apnotes/acan-64.pdf
ACAN-67	D1U54-D-12 Communications Protocol	http://power.murata.com/datasheet?/data/apnotes/acan-67.pdf

Murata Power Solutions, Inc.
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ISO 9001 and 14001 REGISTERED

This product is subject to the following operating requirements and the Life and Safety Critical Application Sales Policy:
Refer to: http://www.murata-ps.com/requirements/