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### PRODUCT OVERVIEW

The D1U54P-W-450-12-HxxC series power modules are very high efficiency, 450 watt power factor corrected front end supplies, with a 12V main output and standby output. An active (digital) current share characteristic is provided to allow units to operate in parallel and share load current. The power supply may be hot plugged; recovers from overtemperature faults, and has status LEDs on the front panel in addition to hardware signal logic and PMBus™ status signals. The low profile 1U package and 14.8W/cubic inch power density make them ideal for delivering reliable, efficient power to networking

equipment, workstations, storage systems and other 12V distributed power architectures.

### ORDERING GUIDE

Part Number	Murata Internal Part Number	Power Output 90-264Vac	Main Output	Standby Output	Airflow
D1U54P-W-450-12- HA3C	M1910	450W	12Vdc	5Vdc	Front to Back
D1U54P-W-450-12- HB3C	M1908			12Vdc	
D1U54P-W-450-12- HA4C	M1909			5Vdc	Back to front
D1U54P-W-450-12- HB4C	M1907			12Vdc	

### FEATURES

- 450W output power
- 94% efficiency at 50% load
- 12V main output
- 5V, 12V standby output options
- <1U height:  
54.5mm x 228.6mm x 40mm  
(2.15" x 9.0" x 1.57")
- Card Edge DC Output and Signal I/O Connector
- IEC60320-C14 AC Inlet
- 14.8 Watts per cubic inch density
- N+1 redundancy capable
- Active (digital) current sharing on 12V main output; ORing FET
- Overvoltage, Overcurrent, Overtemperature protection
- Internal cooling fan (variable speed)
- PMBus™/I2C interface with status indicators
- RoHS compliant
- Two Year Warranty

### INPUT CHARACTERISTICS

Parameter	Conditions	Min.	Nom.	Max.	Units
Input Source Voltage		90	120/240	264	Vac
Input Source		47	50/60	63	Hz
Turn-on Input	Ramp up	74		84	Vac
Turn-off Input	Ramp down	70		80	
Maximum current at Inrush Current	450W; 100Vac Cold start between 0 to 200msec			7 20	Arms Apk
Power Factor	At 230Vac, 100%	0.96			W/WA
	At 230Vac, 50%	0.95			
Efficiency	20% load		90		%
	50% load		94		
	100% load		91		

### OUTPUT VOLTAGE CHARACTERISTICS

Nominal Output Voltage	Parameter	Conditions	Min.	Typ.	Max.	Units
12V	Output Set Point Accuracy	50% load; Tamb =25°C	11.96	12.00	12.04	Vdc
	Line and Load Regulation <sup>2</sup>	Setpoint; temperature; line and load	-1.0%		+1.5	%
	Ripple Voltage & Noise <sup>1,2</sup>	20MHz Bandwidth			120	mV p-p
	Output Current Range		0		37.5	A
	Load Capacitance		500		4000	µF
5VSB	Nominal Output Voltage			5.0		Vdc
	Line and Load Regulation <sup>3</sup>		4.76		5.24	
	Ripple Voltage & Noise <sup>13</sup>	20MHz Bandwidth			75	mV p-p
12VSB	Output Current		0		2	A
	Load Capacitance		250		1000	µF
	Nominal Output Voltage			12.0		Vdc
	Line and Load Regulation <sup>3</sup>		11.7		12.3	
	Ripple Voltage & Noise <sup>13</sup>	20MHz Bandwidth			120	mV p-p
Output Current		0		2	A	
Load Capacitance		250		1000	µF	

<sup>1</sup> 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.

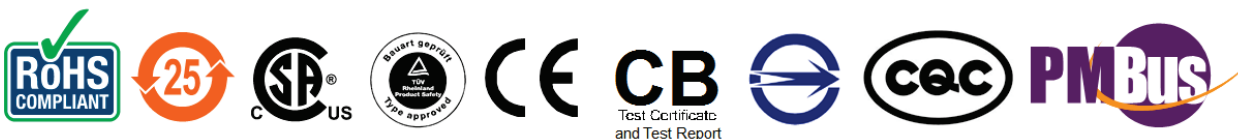
<sup>2</sup> Minimum Load of 1.75A

<sup>3</sup> Minimum load of 0.28A



Available now at:  
[www.murata-ps.com/en/3d/acdc.html](http://www.murata-ps.com/en/3d/acdc.html)

Planned Certifications:



**OUTPUT CHARACTERISTICS**

Parameter	Conditions	Min.	Typ.	Max.	Units
Startup Time	AC ramp up			3	s
Current sharing accuracy (main 12V output)	> 10% load (* % total Current)	-5		+5	* %
Transient Response	10% to 60% load step; 1A/μs slew rate	-5		+5	% nom
Hot Swap Transients	Recovery Time to within 1% Vnom		2		ms
Holdup Time (Total Effective Hold Up - See Timing Waveforms)	Full AC Input Source Range; 100% load	-5		+5	%
		12			ms

**ENVIRONMENTAL CHARACTERISTICS**

Parameter	Conditions	Min.	Typ.	Max.	Units
Storage Temperature Range		-40		70	°C
Operating Temperature Range	90V-264Vac, 450W	-5		50	
Operating Humidity	Noncondensing; +45°C	5		90	%
Storage Humidity		5		95	
Altitude (without derating at 40°C)				3000	m
Acoustic noise levels	25°C, 50%load		45	50	dB
Shock	30G non-operating				
Operational Vibration	Sine sweep; 5-200Hz, 2G; random vibration, 5-500Hz, 1.11G				
MTBF (Target)	Per Telcordia SR-332 Issue 3 M1C3 at		520K		hrs
Safety Approval Standards (Planned; Pending Submission)	CAN/CSA C22.2 No 60950-1-07, Am.1:2011 UL 60950-1-2011, 2nd Ed, IEC60950-1:2005 (2nd Ed.) w A1:2009 EN 60950-1:2006+A11:2009 +A1:2010 +A12:2011 BSMI: CNS14336-1 (1999/09/30), CNS13438 (1995/06/01) CQC: GB4943.1-2011; GB9254-1-2008; GB17625, 1-2012				
Input Fuse	Power Supply has internal 8A/250V fast blow fuse on the AC line input				
Weight	1.51 lbs (0.685 kg)				

**TYPICAL AIRFLOW; PRESSURE VS. FLOW (PQ) CURVES TBD**

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**PROTECTION CHARACTERISTICS**

Output	Parameter	Conditions	Min.	Typ.	Max.	Units
	Overtemperature (intake)	Autorestart with 4°C hysteresis for recovery (warning issued at 70°C)		75		°C
12V	Overtoltage	Latching	13.0		14.5	Vdc
	Overcurrent (target)	The output shall shutdown when an overcurrent condition is detected. It will auto restart after 1sec; however if the overcurrent condition is re-detected the output will once again shutdown. The output will once again re-start, however if the overcurrent condition persists it will latch of after the fifth unsuccessful attempt. To reset the latch it will be necessary to toggle the PS_ON_L signal or recycle the incoming DC source.	40		50	Adc
5VSB	Overtoltage	Latching	5.4		6.0	Vdc
	Overcurrent	The output shall shutdown when an overcurrent is detected. It will auto restart after 2sec; however if the overcurrent is re-detected the output will once again shutdown. This cycle will occur indefinitely while the overcurrent condition persists.	2.1		3.0	Adc
12VSB	Over-Voltage	Latching; toggle PS_ON or recycle DC input to reset	13.0		14.5	Vdc
	Over-Current	The output shall shutdown when an overcurrent is detected. It will auto restart after 2sec; however if the overcurrent is re-detected the output will once again shutdown. This cycle will occur indefinitely while the overcurrent condition persists	1.2		2	Adc

ISOLATION CHARACTERISTICS					
Parameter	Conditions	Min.	Typ.	Max.	Units
Insulation Safety Rating	Input to Output - Reinforced	3000			Vrms
	Input to Chassis - Basic	1500			Vrms
Isolation	Output to Chassis	500			Vdc

EMISSIONS AND IMMUNITY		
Characteristic	Standard	Compliance
Input Current Harmonics	IEC/EN 61000-3-2	Complies
Voltage Fluctuation and Flicker	IEC/EN 61000-3-3	Complies
Conducted Emissions	FCC 47 CFR Part 15 CISPR 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 3 criteria B
Electrical Fast Transients/Burst Immunity	IEC/EN 61000-4-4	Level 3 criteria A
Surge Immunity	IEC/EN 61000-4-5	1. EN61000-4-5, Lev. 3 (Com. Mode: 2kV, 12Ω, Diff. Mode: 1kV, 2Ω), criteria A 2. GR-1089-CORE (NEBS) Level 1 Table 4-30 (Com/Diff. Mode: 2kV, 2Ω)
RF Conducted Immunity	IEC/EN 61000-4-6	Level 3 criteria A
Magnetic Field Immunity	IEC/EN 61000-4-8	3 A/m criteria B
Voltage Dips, Interruptions	IEC/EN 61000-4-11	230V <sub>in</sub> , 80% load, Phase 0°, Dip 100% Duration 10ms (A) 230V <sub>in</sub> , 50% load, Phase 0°, Dip 100% Duration 20ms (VSB:A, V1:B) 230V <sub>in</sub> , 100% load, Phase 0°, Dip 100% Duration > 20ms (VSB, V1:B)

STATUS INDICATORS AND CONTROL SIGNALS	
<b>INPUT LED</b>	
Condition	LED Status
Input Voltage Present	Solid Green
Input Voltage fault or warning	Blinking Green
Input off	Off
<b>POWER LED</b>	
Condition	LED Status
Fault concurrent indication via PMBus Status_x registers	Solid Amber
Warning, concurrent indication via PMBus Status_x registers	Blinking Amber
Standby, 12V Main output off, Vstby On	Blinking Green
Power Good 12V Main output on, Vstby On	Solid Green
Power Off 12V Main output off, Vstby Off	Off

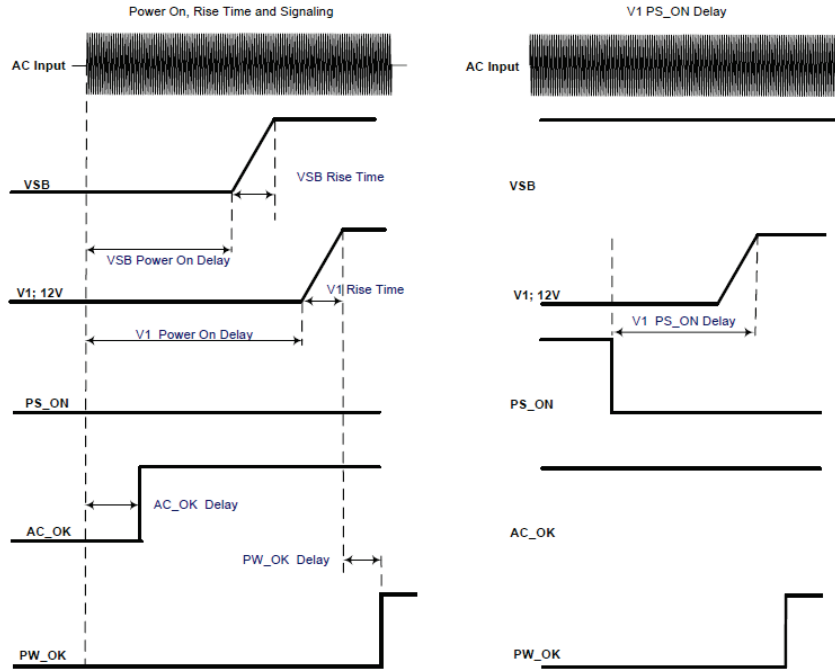
STATUS AND CONTROL SIGNALS			
Signal Name	I/O	Description	Interface Details
INPUT_OK (AC Source)	Output	The signal output is driven high when input source is available and within acceptable limits. The output is driven low to indicate loss of input power. There is a minimum of 1ms pre-warning time before 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 AC power is lost.	Pulled up internally via 10K to VDD*. 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.	Pulled up internally via 10K to VDD*. 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. As reported by PMBus Status_x Registers, with exception of Status_CML.	Pulled up internally via 10K to VDD*. 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 (installation) of a PSU by the host system. The signal is connected to PSU logic +VSB_Return 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 this signal shall clear latched fault conditions.	Pulled up internally via 10K to VDD*. 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 VDD* (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*. 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,	** V <sub>IL</sub> is 0.8V maximum V <sub>OL</sub> is 0.4V maximum when sinking 3mA V <sub>IH</sub> 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,	** V <sub>IL</sub> is 0.8V maximum V <sub>OL</sub> is 0.4V maximum when sinking 3mA V <sub>IH</sub> 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 gold fingers P1-P8 (inclusive) 2. V1_SENSE_RTN directly connected to gold fingers P9 to P16 (inclusive)	Compensation for a up to 0.12Vdc total connection drop (output and return connections).
ISHARE	Bi-Directional Digital Bus	The current sharing signal 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 8VDC at 100% load (module capability). For two identical units sharing the same 100% load this would read	Analogue voltage: +8V maximum; 10K to +12V_RTN

\*VDD is an internal voltage rail derived from VSB and an internal housekeeping rail ("diode ORed") and is compatible with the voltage tolerances of VSB).

\*\*For robust PMBus communications, it is recommended SDA and SCA lines be pulled up via external resistors to a voltage of 3.3V or greater.

**TIMING SPECIFICATIONS**

**Turn-On Delay & Output Rise Time:**

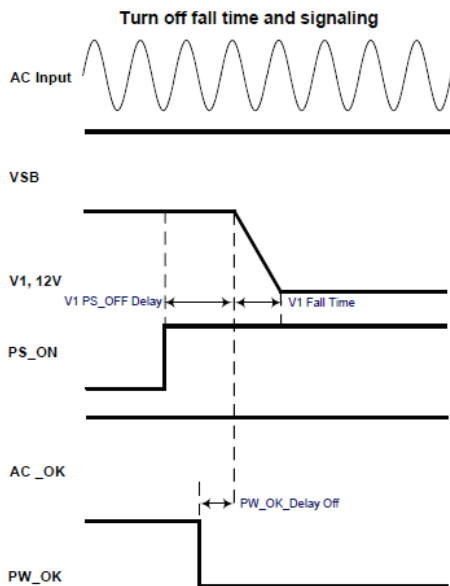


1. The turn-on delay after application of AC input within the operating range shall as defined in the following tables.
2. The output rise times shall be measured from 10% of the nominal output to the lower limit of the regulation band as defined in the following tables.

Time	Min	Max
Vsb Rise time	2ms	20ms
V1 Rise time	6ms	60ms
Vsb Power-on-delay	-	2700ms
V1 Power-on-delay	-	3000ms
V1 PS_ON delay	100ms	150ms
V1 PWOK delay	100ms	300ms
ACOK detect	300ms	1000ms

**TIMING SPECIFICATIONS**

**Turn-Off (Shutdown by PS\_ON)**



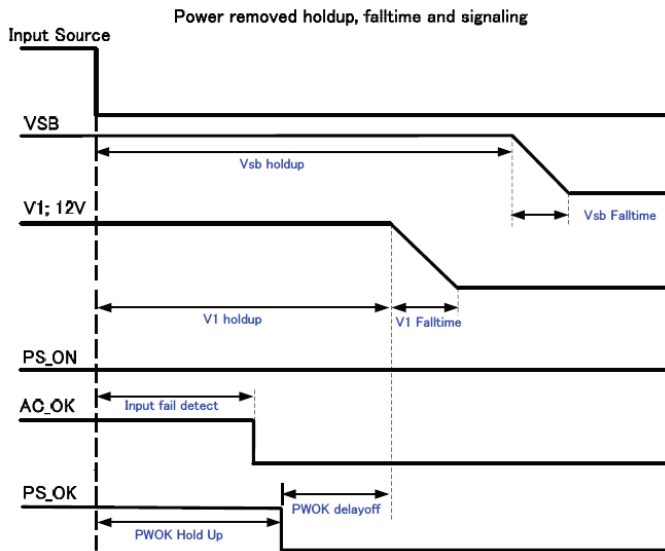
Turn-Off Timing	Min	Max	Notes
V1 Fall time	-	-	Must be monotonic
V1 PS_OFF delay	-	5ms	
PW_OK delay off	1ms	-	

1. Note this characteristic is applicable for the main 12Vdc output shutdown from PS\_ON pulled high.

**TIMING SPECIFICATIONS**

**Power Removal Holdup**

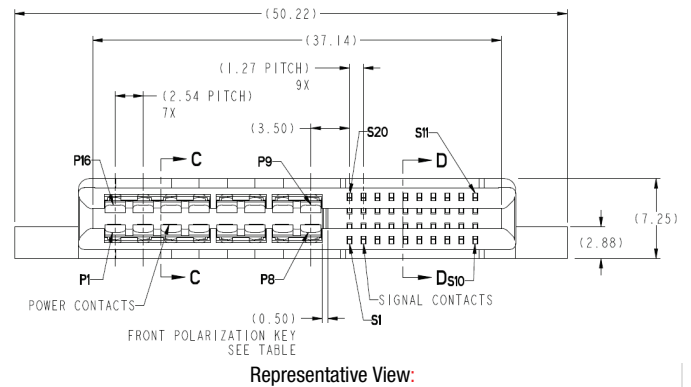
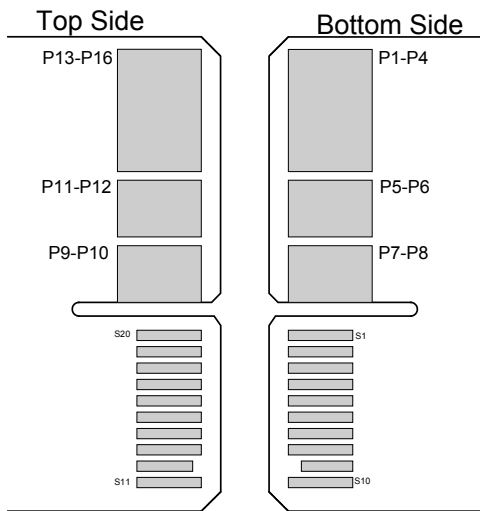
Power Removal Timing	Min	Max	Notes
Vsb holdup	40ms	2S	100% load
V1 holdup (Effective Total)	12ms	-	100% load
Input fail detect	5ms	11ms	100% load
PWOK delay off	1ms	-	100% load
PWOK Hold Up	11ms	-	100% load



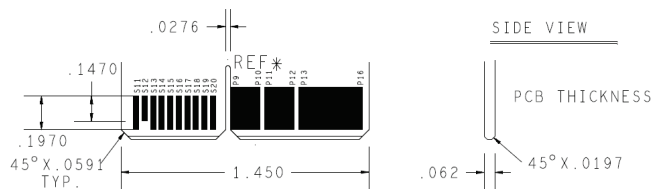
**OUTPUT CONNECTOR & SIGNAL INTERFACE**

**Gold Finger Layout & Pin Assignment**

Mating Connector: FCI 10126933080820xALF; "Straddle" Connector



Note: Gold Fingers S9 (PS\_KILL) and S12 (PS\_PRESENT/L) are "last to make; first to break" short pins. Dimensions as follows:



FINGER PLATING SHALL BE AS PER IPC 2221, SECTION 4.4.4, TABLE 4.3, CLASS 2.

**OUTPUT CONNECTOR PIN ASSIGNMENTS - D1U54P-W-450-12-HBxC; TO BE CONFIRMED**

(Power Supply Gold Finger/Card)

Pin#	Signal Name	Description/Comment
P1-P8 inclusive	V1 (+12VOUT)	+12V Main Output
P9-P16 inclusive	V1 (+12VOUT) RTN/PGND)	+12V Main Output and Standby Output Return
S1	+VSB	Standby Output
S2	+VSB	Standby Output
S3	Reserved	No User Connection
S4	ISHARE	Active Current Share Bus
S5	SDA	I <sup>2</sup> C Serial Data Line
S6	SCL	I <sup>2</sup> C Serial Clock Line
S7	SMB_ALERT	Alert signal to host system
S8	PS_ON	Remote On/Off (Enable/Disable)
S9	PS_KILL	Power Supply "kill"; short pin
S10	INPUT_OK	AC Input Source Present & "OK"
S11	PW_OK	Output DC Power "OK"
S12	PS PRESENT	Power Module Present; short pin
S13	Reserved	No User Connection
S14	Reserved	No User Connection
S15	V1_SENSE_RTN	+12V Main Output Remote Sense Return
S16	V1_SENSE	+12V Main Output Remote Sense
S17	ADDR	Address Protocol Selection; (select address by use of the appropriate pull down resistor – see table below)
S18	Reserved	No User Connection
S19	+VSB	Standby Output
S20	+VSB	Standby Output

**ADDR ADDRESS SELECTION**

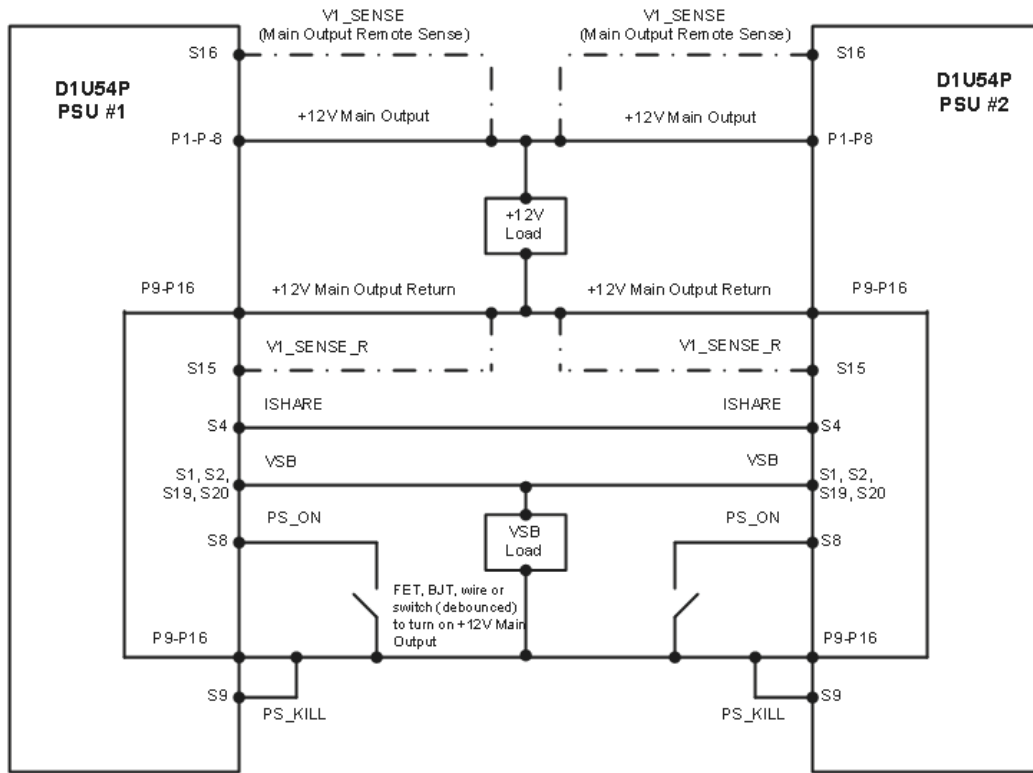
ADDR pin (A3) resistor to GND (K-ohm)*	Power Supply Main Controller (Serial Communications Slave Address)	Power Supply External EEPROM (Serial Communications Slave Address)
0.82	0xB0	0xA0
2.7	0xB2	0xA2
5.6	0xB4	0xA4
8.2	0xB6	0xA6
15	0xB8	0xA8
27	0xBA	0xAA
56	0xBC	0xAC
180	0xBE	0xAE

\* The resistor shall be +/-5% tolerance



WIRING DIAGRAM FOR OUTPUT

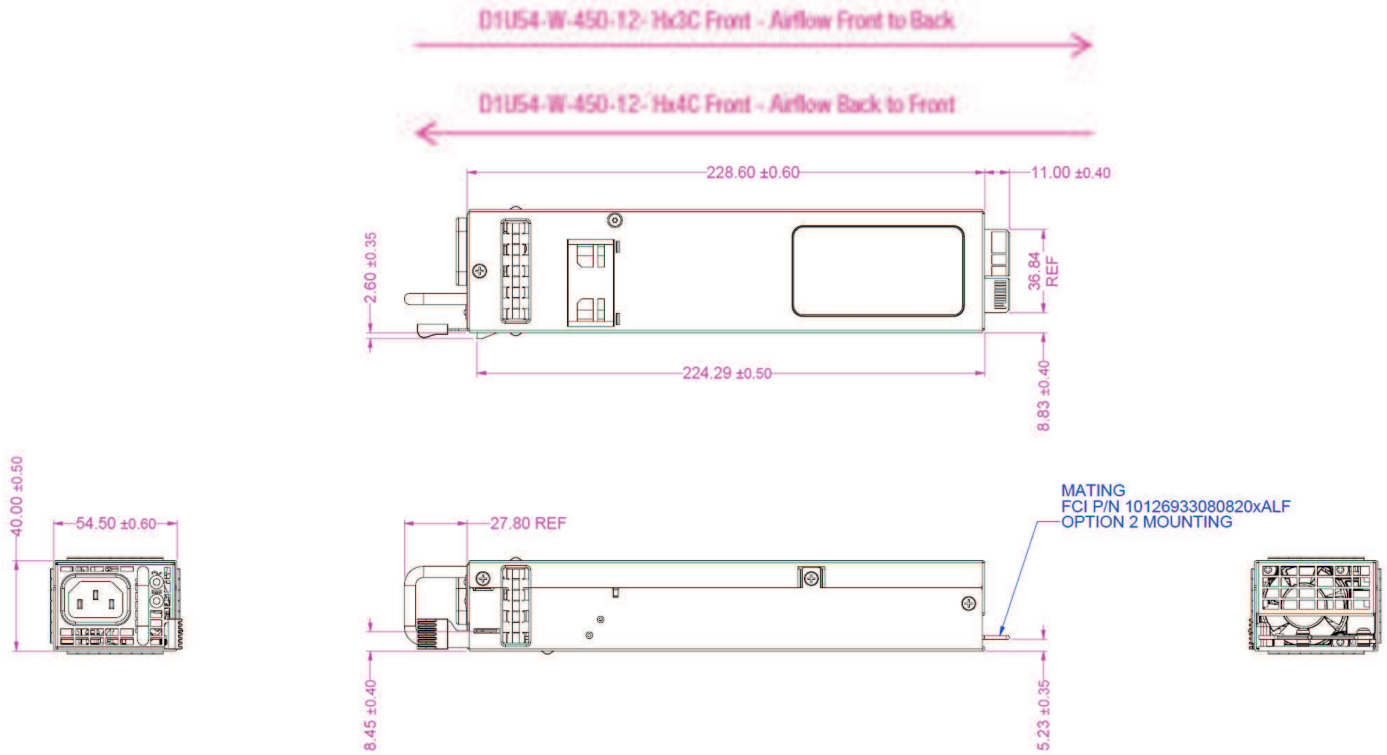
Dotted lines show optional remote sense connections.  
Optional remote sense lines can be attached to a load that is a distance away from the power supply to improve regulation at the load.



CURRENT SHARE NOTES

1. Main Output: Current sharing is achieved using the active current share method details.)
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. The +VSB output has an internal ORing MOSFET for additional redundancy/internal short protection.
4. The current sharing pin B5 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 8VDC at 100% load. For two units sharing the same load this would read 4VDC for perfect current sharing (i.e. 50% load per unit).
5. The load for both the main 12V and the VSB rails at initial startup shall not be allowed to exceed the capability of a single unit. The load can be increased after a delay of 3sec (minimum), to allow all sharing units to achieve steady state regulation.

### MECHANICAL DIMENSIONS



1. AC input connector: IEC 320-C14
2. Dimensions: 2.15" x 9.0" x 1.57" (54.5mm x 228.6mm x 40.0mm)
3. This drawing is a graphical representation of the product and may not show all fine details.
4. Reference File: D1U54P-W-450-12-HxxC\_RJC\_16\_Mar\_2016\_CardEdge\_WIP.pdf

### OPTIONAL ACCESSORIES

Description	Part Number
12V D1U54P 450W series Output Connector Card	D1U54P-12-EDGE

### APPLICATION NOTES

Document Number	Description	Link
ACAN-72	D1U54P-x Communication Protocol	<a href="http://power.murata.com/datasheet?/data/apnotes/acan-72.pdf">http://power.murata.com/datasheet?/data/apnotes/acan-72.pdf</a>
ACAN-73	Output Connector Card with edge connector	<a href="http://power.murata.com/datasheet?/data/apnotes/acan-73.pdf">http://power.murata.com/datasheet?/data/apnotes/acan-73.pdf</a>

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