D1U86P-W-1600-12-HBxDC Series

86mm 1U Front End AC-DC Power Supply

NB: D1U86P-W-1600-12-HB3DC Model Shown

PRODUCT OVERVIEW

The D1U86P-W-1600-12-HBxDC products are high efficiency 1600 watt, power factor corrected front end supplies with a 12V main output and a 12V (30W) standby. They have current sharing and up to 8 supplies may be operated in parallel. The supplies may be hot plugged, they recover from over-temperature faults, and have logic and PMBus™ monitoring and control. Their low profile 1U package and >38.6W/cubic inch power density make them ideal for delivering reliable, efficient power to servers, workstations, storage systems and other 12V distributed power systems.

FEATURES

- 1600W output power
- 94% minimum efficiency at 50% load
- 12V main output
- 12V standby output of 30W
- 1U height: 3.4" x 7.78" x 1.59"
- 38.6 Watts per cubic inch density
- N+1 redundancy, including hot plugging (up to 8 in parallel)
- Droop Current sharing both outputs
- Overvoltage, overcurrent, overtemperature protection
- Internal cooling fan (variable speed)
- PMBus™ / I²C interface monitoring and control
- RoHS compliant
- Two Year Warranty

ORDERING GUIDE

Part Number	Power Output; AC Line			Main Output	Standby Output	Airflow	Handle Colour
	(90-264V)	(108-264V)	(180-264V)				
D1U86P-W-1600-12-HB4DC	1200W	1350W	1600W	12V	12V	Back to Front	Red
D1U86P-W-1600-12-HB3DC						Front to Back	Blue

INPUT CHARACTERISTICS

Parameter	Conditions	Min.	Nom.	Max.	Units
Input Voltage Operating Range		90	115/230	264	Vac
Frequency		47	50/60	63	Hz
Turn-on Voltage	Ramp up	81		89	Vac
Turn-off Voltage	Ramp down	70.5	73	78	
Maximum Input Current	1200W, 100Vac			14.1	Arms
Inrush Current	At 264Vac at 25°C cold start			35	Apk
Power Factor	At 230Vac, half load		0.98		
Efficiency (230Vac) excluding fan load	20% load	90			%
	50% load	94			
	100% load	91			

OUTPUT VOLTAGE CHARACTERISTICS

Output Voltage	Parameter	Conditions	Min.	Typ.	Max.	Units
12V	Voltage Set Point	50% load	12.17	12.2	12.23	Vdc
	Line and Load Regulation		11.4		12.6	
	Droop			3.10		mV/A
	Ripple Voltage & Noise[1]	20MHz Bandwidth			120	mV p-p
	Output Current (230 Vac)[2]		0		133.4	A
	Output Current (120 Vac)[2]		0		112.5	A
	Output Current (100 Vac)[2]		0		100.0	A
	Load Capacitance				10,000	µF
12VSB	Voltage Set Point	50% load	11.97	12.0	12.02	Vdc
	Ripple Voltage & Noise[1]	20MHz Bandwidth			120	mV p-p
	Output Current		0		2.5	A

[1]Ripple and noise measured with a parallel combination of a 1.0µF ceramic and 10µF tantalum capacitor on each of the power module outputs. A short coaxial cable connected directly to the input of a scope is required.

[2]To meet ripple and transient step load specifications a minimum load of 4A is required.

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

Certificate and Test Report

www.murata-ps.com/support

OUTPUT CHARACTERISTICS					
Parameter	Conditions	Min.	Typ.	Max.	Units
Output Rise Monotonicity	No voltage excursion				
Startup Time	AC ramp up		1.5	3	s
Transient Response	12V, 50% load step, 1.0Aμs di/dt		600		mV
	12VSB, 50% load step,1.0Aμs di/dt		600		
Current sharing accuracy (up to 8 in parallel)[3]	At 100% load			±5	%
Hot Swap Transients	All outputs remain in regulation			5	%
Holdup Time	At full load	12			ms

[3] Load current of 100% applies to each power module max load connected in an N+1 configuration; therefore the total load will be "N" x 100%. The share accuracy of ±5% is a fixed percentage irrespective of total loading and number of units connected in parallel.

ENVIRONMENTAL CHARACTERISTICS					
Parameter	Conditions	Min.	Typ.	Max.	Units
Storage Temperature Range		-40		85	°C
Operating Temperature Range		0		55	
Operating Humidity	Noncondensing	5		90	%
Storage Humidity		5		95	
Altitude (without derating at 45°C)		3000			m
Shock	30G non-operating				
Vibration	10-500Hz, 0.5G (non-operational)				
MTBF	Per Telcordia SR-322 M1C1@40°C	559K			hrs
Acoustic				65	dBA/@1m
Safety Approvals	CSA 60950-1-07+A1:2011 ANSI/UL 60950-1-2011, Second Edition IEC 60950-1:2005 (2nd Edition) + A1:2009 EN 60950-1:2006 +A11+A1+A2 BIS IS13252(Part 1):2010/ IEC 60950-1: 2005 BSMI CNS13438 (095/06/01), CNS14336 (099/09/30), CNS15663 5 (102)				
Input Fuse	Power Supply has internal 16A/25 0V fast blow fuse on the AC line input				
Weight				2.33/1.06	lbs/Kg

PROTECTION CHARACTERISTICS						
Output Voltage	Parameter	Conditions	Min.	Typ.	Max.	Units
	Overtemperature (intake)	An OTP warning will be issued via the PMBus™ interface when the air inlet exceeds 65°C; however the power module shall not shut down until critical internal hotspot temperatures are exceeded.		65		°C
12V	Overvoltage	Latching	13.2		14.4	V
	Overcurrent at 220Vac	Shutdown of the output followed by auto-recovery after one second. The output shall attempt three such auto-recovery attempts and then enter a permanent latched state. Recovery of the permanent latched state shall require cycling of the incoming AC source or toggling of the PSON# signal.	140		153	A
	Overcurrent at 120Vac		118		129	
12VSB	Overvoltage	Latching	13.2		14.4	V
	Overcurrent	Auto-recovery	2.75		3	A

ISOLATION CHARACTERISTICS					
Parameter	Conditions	Min.	Typ.	Max.	Units
Insulation Safety Rating / Test Voltage	Input to Output - Reinforced	3000			Vrms
	Input to Chassis - Basic	1500			Vrms
Isolation	Output to Chassis	500			Vdc
Leakage Current	1.5mA at 264Vac, 50/60Hz				

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, 6dB margin
ESD Immunity	IEC/EN 61000-4-2	Level 3 criteria A
Radiated Field Immunity	IEC/EN 61000-4-3	Level 3 criteria B
Electrical Fast Transient Immunity	IEC/EN 61000-4-4	Level 3 criteria A
Surge Immunity	IEC/EN 61000-4-5	Level 3 criteria A
Radiated Field 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	230Vin, 100% load, Phase 0°, Dip 100% Duration 10ms (A) 230Vin, 50% load, Phase 0°, Dip 100% Duration 20ms (VSB:A, V1:A) 230Vin, 100% load, Phase 0°, Dip 100% Duration > 20ms (VSB, V1:B)

STATUS AND CONTROL SIGNALS

Signal Name	I/O	Description	Interface Details
PSOK (Output OK)	Output	The PSOK output is a logical "OR" of three internal signals; however the output is not strictly a "digital" signal that transitions between "low" and "high" but is analogue in nature. The internal logic signals are as follows: 1. DC_OK_H 2. PWR_GOOD_H 3. PS_FAULT_L The following is a "truth table" that shows the analogue levels of operation of the signal dependent upon the three internal logic signals:	Each internal signal is buffered and provided with a series or pull up resistor: 1. DC_OK_H; 1K62 series resistor 2. PWR_GOOD_H; 3K32 series resistor 3. PS_FAULT_L; a 10K pull up resistor to VDD_OR (an internally derived 3.3VDC rail) The embedded truth table shows the appropriate levels.

PSOK TRUTH TABLE VS. ANALOG OUTPUT

DC_OK_H	PWR_GOOD_H	PS_FAULT_L	PSOK		OPERATION MODE
0	0	1	< 0.1Vdc	VDD = 3.3Vdc	No AC Input
0	1	1	(1/3) VDD		Invalid
1	0	1	(2/3) VDD		Standby
1	1	1	VDD		Power Good
X	X	0	0.2-0.4Vdc		PS Fault

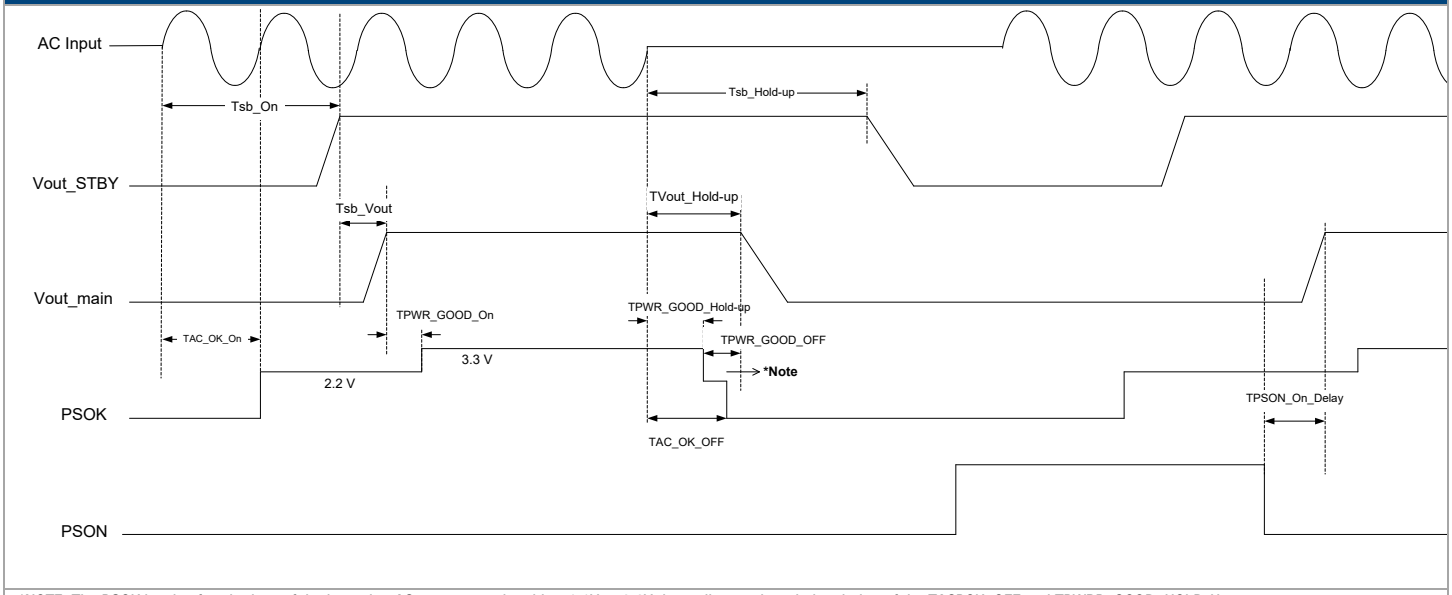
The timing relationship of this signal is shown in the Timing Specification section that follows.

PS_INTERRUPT (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 3.3Vdc. A logic high >2.0Vdc A logic low <0.8Vdc Driven low by internal buffer (open drain output).
PRESENT#	Output	Based on the industry standard Common Slot requirement this signal is used to detect the presence of an (installed) power module within the host system. However, it is also intended to "Enable" the Main 12Vdc output. The signal is also designed to control the power module during hot-plug insertion/extraction in conjunction with the host system and is provided on a short "last to make; first to break" signal pin. To "enable" the Main 12Vdc output the signal requires to be pulled "high" with respect +12V_GND. In the host system. The value of the pull-up resistor is as follows: 1. If the signal is to be pulled up to the 12VSB output then the resistor value should be 21KΩ 2. If the signal is to be pulled up to a 3.3Vdc rail (locally derived within the host system) then the resistor value should be 5.11KΩ	The voltage level on the system side of the PSPRESENT# signal will be follows: 1. When the power module is not installed the voltage will be the as per the rail to which it is pulled up to 3.3Vdc or 12Vdc (host system) 2. When the power module is installed the voltage will be pulled down to 0.54Vdc ±5%) by the PSU
PS_ON (Power Supply Enable/Disable	Input	The PS_ON can be permanently connected to +12V_GND (via the host system mid/backplane) to "enable" the Main 12Vdc output. Alternatively, the signal can be connected via the host system electronics to provide the ability to switch between "enable/disable" states. The 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 +12V_GND. In the low state, the signal input shall source a nominal 1.2mAdc. The 12Vdc output will be disabled when the input is driven higher than 2.4V, or open circuit. Cycling this signal shall clear latched fault conditions.	Pulled up internally via 10K to 3.3Vdc. A logic high >2.0Vdc A logic low <0.8Vdc Input is via CMOS Schmitt trigger buffer.
ADDR (Address Select)	Input	An analogue 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 +12V_GND, in conjunction with an internal resistor divider chain, will configure the required address.	DC voltage between the limits of 0 and +3.3Vdc.

STATUS AND CONTROL SIGNALS (CONTINUED)			
Signal Name	**I/O**	**Description**	**Interface Details**
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_{IL} is 0.8V maximum V_{OL} is 0.4V maximum when sinking 3mA V_{IH} 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_{IL} is 0.8V maximum V_{OL} is 0.4V maximum when sinking 3mA V_{IH} is 2.1V minimum
IMONITOR	Analogue Voltage	An analogue DC output voltage signal directly proportional to load current and can be used as an indication of the power supply's load current. This signal of multiple connected units should not be tied together.	Analogue output voltage: 60.15mV/Amp

STATUS INDICATOR CONDITIONS			
	LED State	Mode	Operating Condition
1.	Off	AC Turn-off	The incoming AC source is below the minimum power module turn-on specification
2.	Green – blinking 1Hz	Standby	The power module VStandby output is operating within normal parameters and main output is disabled
3.	Green – solid	Power-good	The power module active; VStandby & Main outputs are operating within normal parameters and delivering
4.	Yellow – blinking 1Hz	Warning	A warning condition within the power supply has been detected
5.	Yellow – solid	Fault	A fault condition within the power supply has been detected.

TIMING DIAGRAM



*NOTE: The PSOK levels after the loss of the incoming AC source may be either 1.1V or 2.2V depending on the relative timing of the TACPOK_OFF and TPWRP_GOOD_HOLD-Up

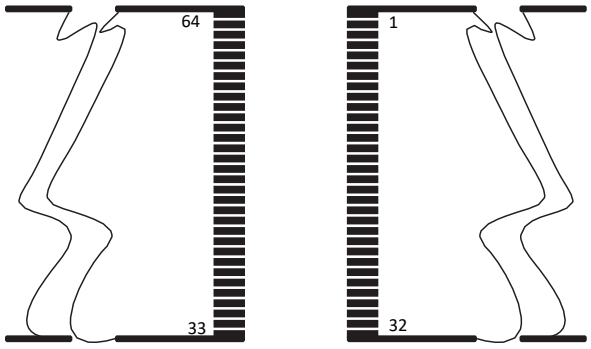
TIMING SPECIFICATIONS

Parameter	Description	Min	Max	Unit
Tsb_On	Delay from AC being applied to standby output being within regulation	0	3000	ms
Tsb_Vout	Delay from standby output to main output voltage being within regulation	50	500	ms
TPWR_GOOD_On	Delay from output voltages within regulation limits to PWR_GOOD assertion	20	500	ms
TAC_OK_OFF	Delay from loss of AC to deassertion of AC_OK	20	60	ms
TAC_OK_On	Delay from AC being applied to assertion of AC_OK	1	3000	ms
TPWR_GOOD_Hold-up	Delay from loss of AC to deassertion of PWR_GOOD	7	30	ms
TVout_Hold-up	Delay from loss of AC to main output being out of regulation	12	20	ms
Tsb_Hold-up	Delay from loss of AC to standby output being out of regulation	20	2000	ms
TPWR_GOOD_OFF	Delay from deassertion of PWR_GOOD to output falling out of regulation	0	2	ms
TPSON_On_Delay	Delay from PSON assertion to output being within regulation	1	200	ms

OUTPUT CONNECTOR AND SIGNAL SPECIFICATION

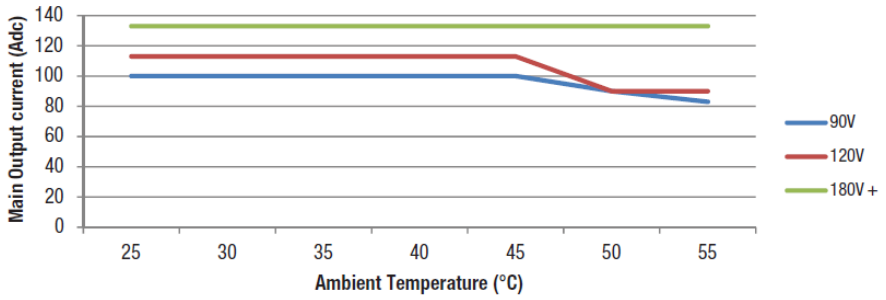
Pin#	Function	Pin Type	Description
14-26, 39-51	+12V_GND/RTN	Power Ground	Power and Standby Return
1-13, 52-64	+12V	Power	12V Output
37	+12VSB	Power	12V Standby Output
38	PSINTERRUPT	Output	Active low; interrupt line for power supply fault & warning detection as per PMBus™ spec
36	PRESENT#	Input	Power Supply Present Signal (shortest pin)
35	PSOK	Analog output	Combination of three power supply output indicator signals: 1. AC input OK 2. Power Good 3. Power Supply Fault
34	IMONITOR	Analog I/O	main output current signal ypical analog voltage shall be 60.15mV/Amp of main output current.
33	PSON#	Input	Power Supply on/off control signal
32	SCL	Input	SMBus/PMBus Clock
31	SDA	I/O	SMBus/PMBus Data
30	+12V_GND/RTN	Analog I/O	Power Supply Signal Ground
29	N/A	N/A	Reserved; no User connection
28	N/A	N/A	Reserved; no User connection
27	ADDR	Analog input	PMBus Address

Power Supply Output Card Edge

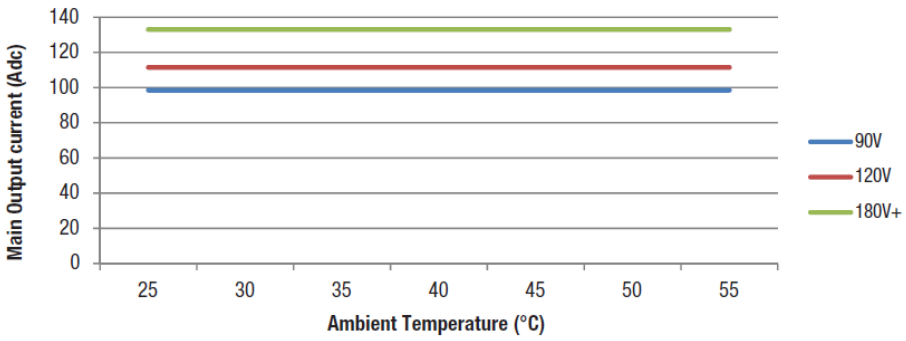


DERATING CURVES

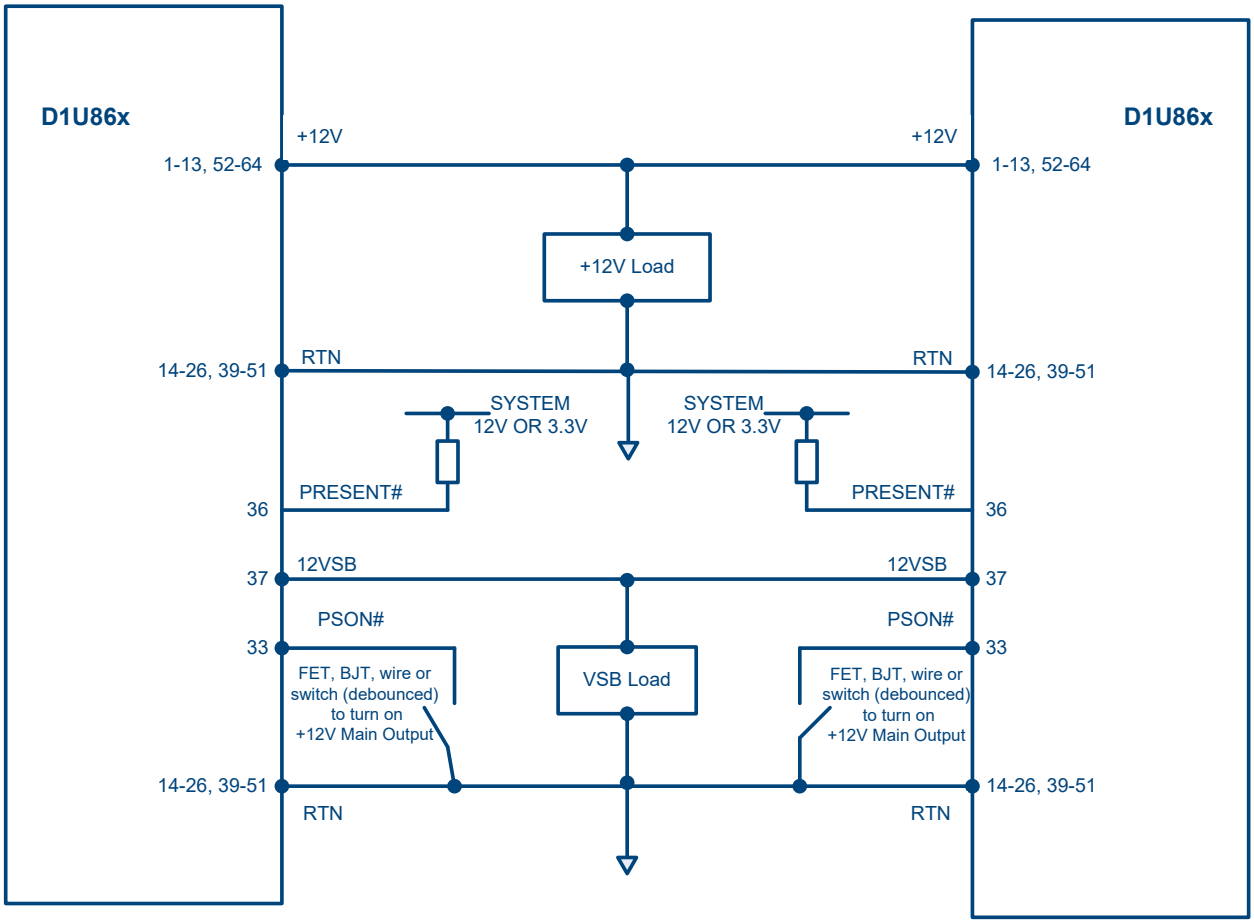
Output Current Derating vs. Ambient Temperature (back to front airflow)
D1U86P-W-1600-HB4DC; VSB 1.0A
12Vdc @90Vac - 113A to 45°C; derates to 90A at 50°C



Output Current Derating vs. Ambient Temperature (front to back airflow)
D1U86P-W-1600-12-HB3DC; VSB 2.5A (No Derating)



WIRING DIAGRAM FOR OUTPUT

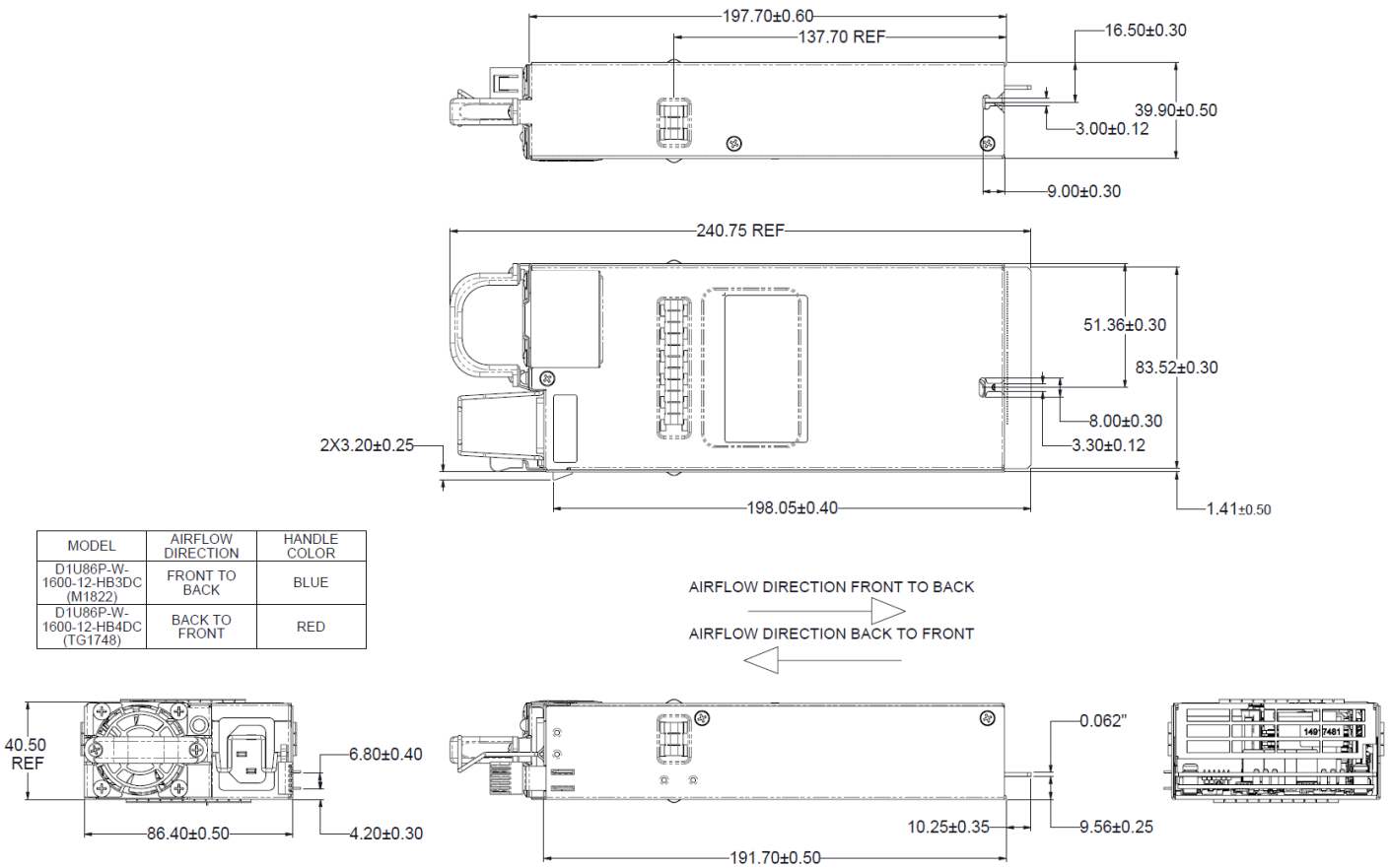


CURRENT SHARING NOTES

Main Output: Current share is achieved using the droop method. Nominal output voltage (12.20V) is achieved at 50% load and output voltage varies at a rate of 3.10mv per amp increase/decrease. Startup of parallel power supplies is not internally synchronized. If more than 1600W combined power is needed, start-up synchronization must be provided by using a common PS_ON signal. To account for ±5% full load current sharing accuracy and the reduction in full load output voltage due to droop, available output power must be derated by 10% when units are operated in parallel.

The Standby output can be tied together for redundancy however the total combined power must not exceed the Standby rail capability (30W) of a single supply. Internal MOSFET ORing devices are employed.

MECHANICAL DIMENSIONS



MODEL	AIRFLOW DIRECTION	HANDLE COLOR
D1U86P-W-1600-12-HB3DC (M1822)	FRONT TO BACK	BLUE
D1U86P-W-1600-12-HB4DC (TG1748)	BACK TO FRONT	RED

1. AC input connector: IEC 320-C14
2. 86.4mm x 197.7mm x 40.5mm [3.4" x 7.78" x 1.59"]
3. This drawing is a graphical representation of the product and may not show all fine details.
4. Reference File: D1U86P-W-1600-12-HBxDC (TG1748-M1822)_Drawing for Product Datasheet_20160106.PDF

MATING CONNECTOR

Part Number	Description
FCI 10053363-200LF	Right Angle
FCI 10046971-001LF	Vertical

OPTIONAL ACCESSORIES

Description	Part Number
12V D1U86P Output Connector Card	D1U86P-12-CONC

APPLICATION NOTES

Document Number	Description	Link
ACAN-50	D1U86P-12-CONC Interface Connector Card	https://power.murata.com/datasheet?/data/apnotes/acan-50.pdf
ACAN-51	D1U86P PMBus™ Communication Protocol	https://power.murata.com/datasheet?/data/apnotes/acan-51.pdf

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