V50SN12017

200W Non-isolated 1/16th Brick DCDC Power Modules

Photo is for reference only

Input voltage: 40~60V
Output Voltage: 12V
Output Power: 200W

FEATURES

Electrical

- High efficiency: 96.8% @ 54Vin/12Vo/10A
- Industry standard 1/16th brick form factor
- Fixed frequency operation
- Thermal limit, Input UVLO
- Output OCP Hiccup mode
- Monotonic startup into normal

Mechanical

Size: 33.0x22.8x10.0mm (1.30"x0.90"x0.39")

Safety & Reliability

- IEC/EN/UL/CSA 62368-1, 2nd edition
- IEC/EN/UL/CSA 60950-1, 2nd edition+A2
- ISO 9001, TL 9000, ISO 14001, QS 9000,
- OHSAS18001 certified manufacturing facility

APPLICATIONS

- Data Networking
- Communications
- Servers

Soldering method

- Wave soldering
- Hand soldering
- Reflow soldering (MSL rating of 3)

Recommended Part Number

Model Name	Input		Output		Eff. @ 60% Load	Others
V50SN12017NRFA	40V~60V	6.0A	12V	200W	96.8% @54Vin	Negative on/off
V50SN12017NMFA	40V~60V	6.0A	12V	200W	96.8% @54Vin	Negative on/off
V50SN12017NKFAR	40V~60V	6.0A	12V	200W	96.8% @54Vin	Negative on/off
V50SN12017NRFAR	40V~60V	6.0A	12V	200W	96.8% @54Vin	Negative on/off
V50SN12017PKFAR	40V~60V	6.0A	12V	200W	96.8% @54Vin	Positive on/off
V50SN12017PMFA	40V~60V	6.0A	12V	200W	96.8% @54Vin	Positive on/off
V50SN12017PRFA	40V~60V	6.0A	12V	200W	96.8% @54Vin	Positive on/off
V50SN12017PRFAR	40V~60V	6.0A	12V	200W	96.8% @54Vin	Positive on/off

Part Numbering System

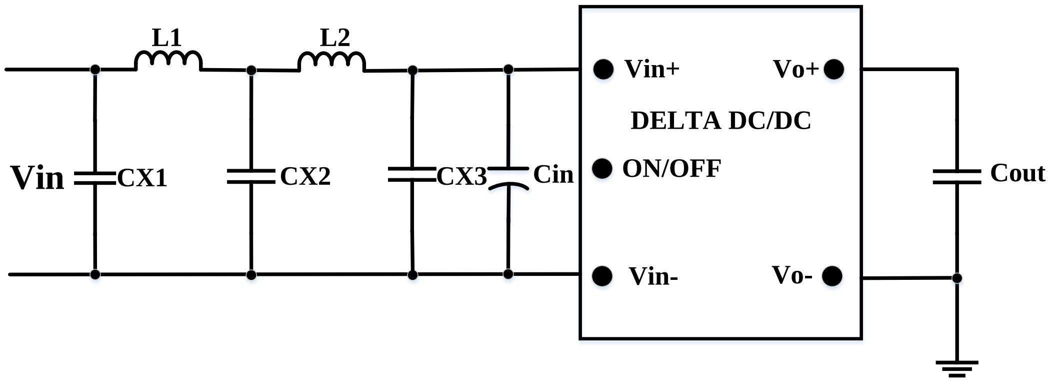
V	50	S	N	120	17	N	R	F	A	R
Form Factor	Input Voltage	Number Of Outputs	Product Series	Output Voltage	Output current	ON/OFF Logic	Pin Length	Pin Assignment	Package	Customer specific
V - 1/16 Brick	50 - 40~60V	S - Single	N - Non-isolated	120 - 12.0V	17 - 17A	N – Negative P - Positive	R - 0.170" N - 0.145" K - 0.110" M - SMD	F - IBC pin (No Trim pin, No sense Pins)	A - Open frame	Omit - Standard R – Reflow compliance F – Halogen Freew

(T_A=25°C, airflow rate=300 LFM, V_{in}=54Vdc, nominal Vout unless otherwise noted.)

PARAMETER	NOTES and CONDITIONS	V50SN12017			
		Min.	Typ.	Max.	Units
ABSOLUTE MAXIMUM RATINGS					
Input Voltage					Vdc
Continuous		0		65	Vdc
Voltage Slew Rate				10	V/mS
Operating Ambient Temperature		-40		85	°C
Storage Temperature		-55		125	°C
INPUT CHARACTERISTICS					
Operating Input Voltage		40		60	Vdc
Input Under-Voltage Lockout					
Turn-On Voltage Threshold			35	37	Vdc
Turn-Off Voltage Threshold			33	35	Vdc
Lockout Hysteresis Voltage			2		Vdc
Maximum Input Current	Vin= 40V , Io=Io,max			6.0	A
No-Load Input Current	Vin=54V,Vo=12V, Io=0A		40		mA
Off Converter Input Current	Vin=54V		3		mA
OUTPUT CHARACTERISTICS					
Output Voltage Set Point	V_{in}=54V, Vo=12V, I_o=$I_{o.max}$, T_c=25°C	11.7	12.0	12.3	Vdc
Output Regulation					
Load Regulation	Io=Io, min to Io, max	-1.5		+1.5	$\%V_{o,set}$
Line Regulation	V_{in}=40V to 60V	-1.5		+1.5	$\%V_{o,set}$
Temperature Regulation	T_c=-40°C to 85°C	-2		+2	$\%V_{o,set}$
Total Output Voltage Range	Over sample load, line and temperature	-5		+5	$\%V_{o,set}$
Output Voltage Ripple and Noise	5Hz to 20MHz bandwidth				
Peak-to-Peak	Vin=54V,Vo=12V ,Full Load, 580uF Cap(110uF Ceramic Capacitor,470uF Oscon cap)		50	150	mV
RMS	Vin=54V,Vo=12V ,Full Load, 580uF Cap(110uF Ceramic Capacitor,470uF Oscon cap)		10	50	mV
Operating Output Current Range		0		17	A
Output Over Current Protection(hiccup mode)		19			A
DYNAMIC CHARACTERISTICS					
Output Voltage Current Transient	$54V_{in}$, Vo=12V, 580uF Cap(110uF Ceramic Capacitor,470uF Oscon cap)				
Positive Step Change in Output Current	75% $I_{o.max}$ to 25% $I_{o.max}$, 1 A/µs		330	600	mV
Negative Step Change in Output Current	25% $I_{o.max}$ to 75% $I_{o.max}$, 1 A/µs	-600	-330		mV
Settling Time (within 1% nominal V_{out})			0.3	1	ms
Turn-On Delay and Rise Time					
Start-Up Delay Time From Input Voltage	On/Off=On, from V_{in}=Turn-On Threshold to V_o=10% $V_{o,nom}$		4	10	mS
Start-Up Delay Time From On/Off Control	V_{in}=$V_{in,nom}$, from On/Off=On to V_o=10% $V_{o,nom}$		6	15	mS
Output Voltage Rise Time	V_o=10% to 90% $V_{o,nom}$		12		mS
Output Capacitance (note1)	Full load; 5% overshoot of V_{out} at startup	580		2400	µF
EFFICIENCY					
60% Load	V_{in}=54V		96.8		%
100% Load	V_{in}=54V		96.2		%
FEATURE CHARACTERISTICS					
Switching Frequency			186		KHz
On/Off Control, Negative Remote On/Off logic					
Logic Low (Module On)	$V_{on/off}$	0		0.5	V
Logic High (Module Off)	$V_{on/off}$	4.5		13.2	V
On/Off Control, Positive Remote On/Off logic					
Logic Low (Module Off)	$V_{on/off}$	0		0.5	V
Logic High (Module On)	$V_{on/off}$	3.1		13.2	V
On/Off Current (for both remote On/Off logic)	$I_{on/off}$ at $V_{on/off}$=0.0V		1.2		mA
GENERAL SPECIFICATIONS					
MTBF	I_o=80% of $I_{o,max}$; T_a=40°C, airflow rate=300LFM		TBD		Mhours
Weight	Open frame		17		grams

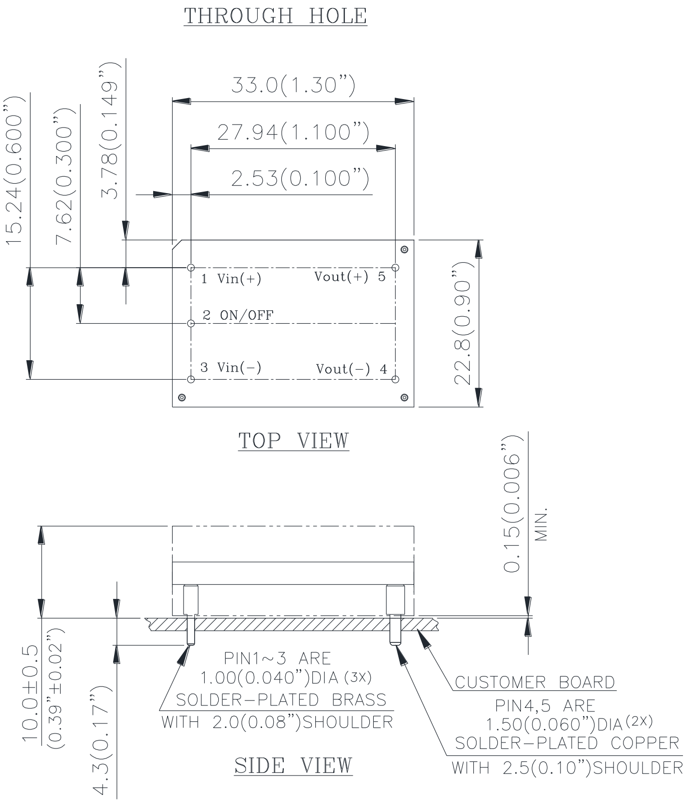
Note: For applications with higher output capacitive load, please contact Delta.

Typical Application Schematic

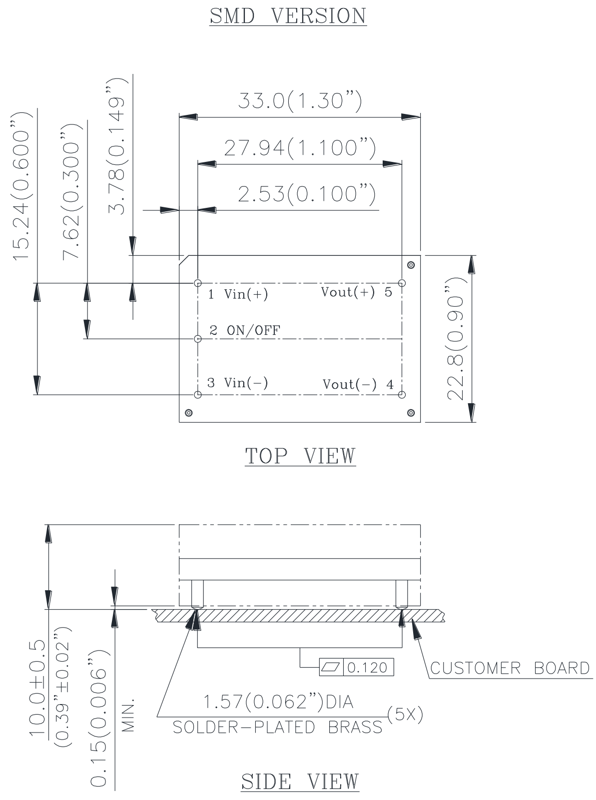


Position	Vendor P/N	Description	QTY	Vendor	Note
CX1	GRM31CR72A225K	MLCC 100V 2.2uF	8	MURATA	For EMC purpose, can be deleted if don't have EMC requirement.
CX2	GRM31CR72A225K	MLCC 100V 2.2uF	8	MURATA	
CX3	GRM31CR72A225K	MLCC 100V 2.2uF	8	MURATA	
L1	PCMB063T-3R3MS	3.3uH 6.5A	1	CYNTEC	
L2	PCMB063T-3R3MS	3.3uH 6.5A	1	CYNTEC	
Cin	100YXG47MEFCT810X12.5	E-Cap 100V 47uF	2	RUBYCON	Near to the Vin+ and Vin- pin of the Module.
Cout	RBS1C471MCS1KX	E-Cap 16V 470uF	1	NICHICON	Near to the Vo+ and Vo- pin of the Module.
	GRM31CC71C226M	MLCC 16V 22uF	5	MURATA	

Mechanical Drawing



NOTES:
DIMENSIONS ARE IN MILLIMETERS AND (INCHES)
TOLERANCES: X.Xmm±0.5mm(X.XX in.±0.02 in.)
X.XXmm±0.25mm(X.XXX in.±0.010 in.)



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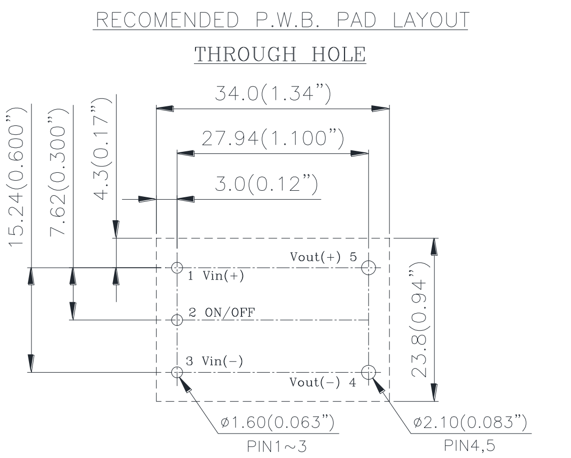
X.XXmm±0.25mm(X.XXX in.±0.010 in.)

Recommended Layout



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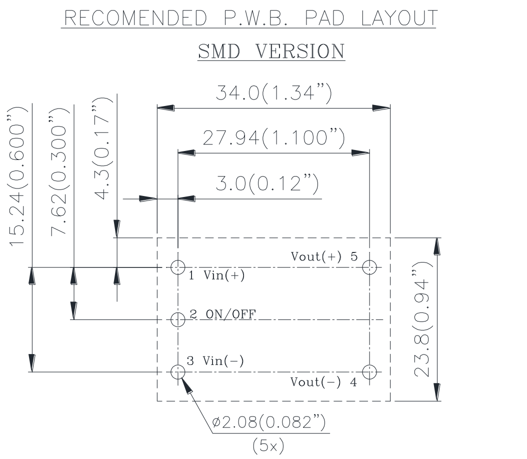


NOTES:
DIMENSIONS ARE IN MILLIMETERS AND (INCHES)
TOLERANCES: X.Xmm±0.5mm(X.XX in.±0.02 in.)
X.XXmm±0.25mm(X.XXX in.±0.010 in.)

Note：All pins are copper alloy with matte tin(Pb free) plated over Ni under-plating.

T_A=25°C

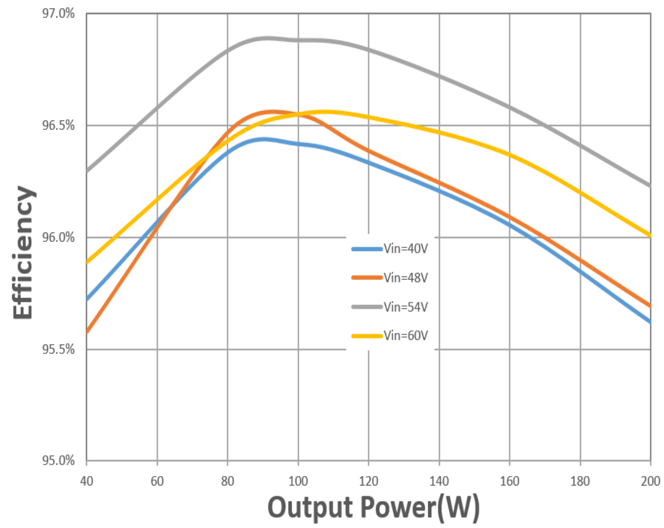


Figure 1: Efficiency vs. Output Power

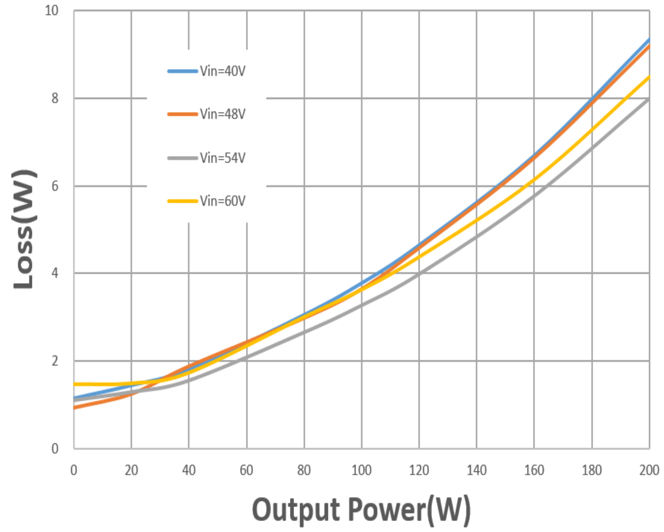


Figure 2: Loss vs. Output Power

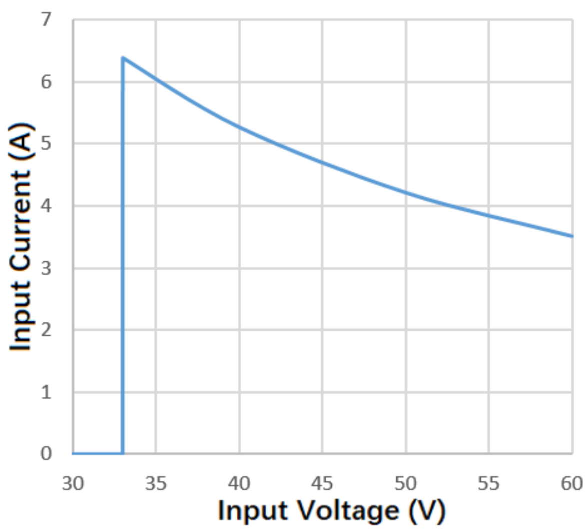


Figure 3: Full Load Input Characteristics

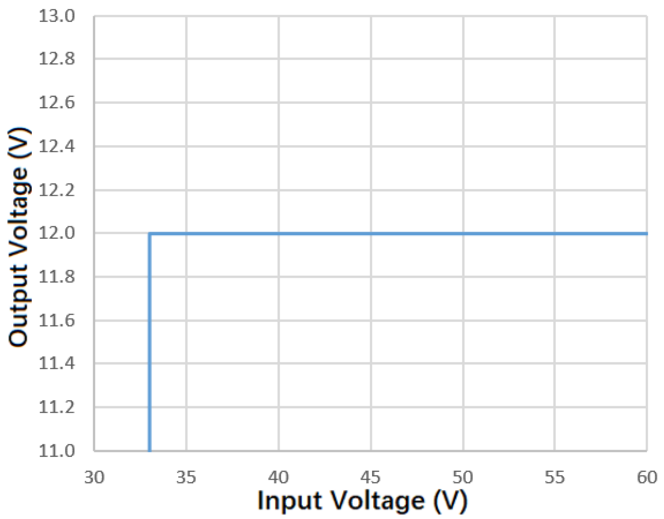


Figure 4: Input Voltage vs. Output Voltage

T_A=25°C,

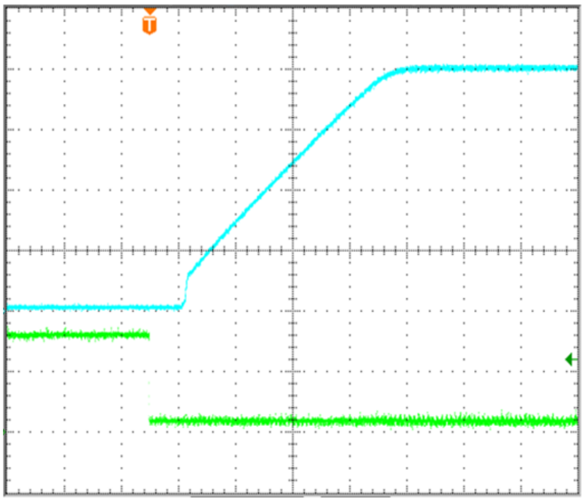


Figure 5: Remote On/Off (negative logic) at full load
Vin=54V, I_{out} = $I_{o, max}$
Time: 4ms/div.
V_{out} (top trace): 3V/div;
$V_{remote\ On/Off\ signal}$ (bottom trace): 1V/div.

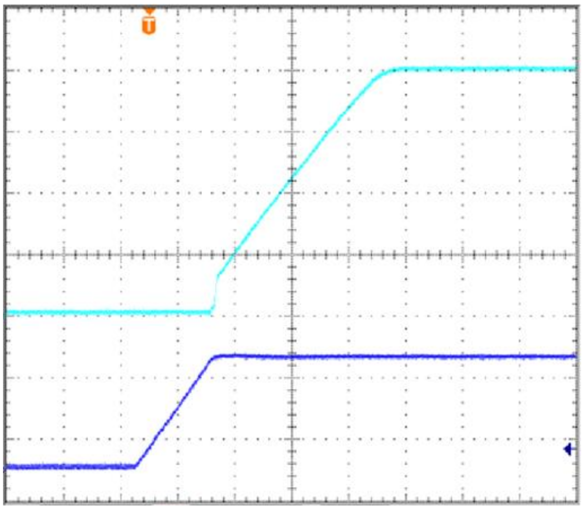


Figure 6: Input Voltage Start-up at full load
Vin=54V, I_{out} = $I_{o, max}$
Time: 4ms/div.
V_{out} (top trace): 3V/div;
V_{in} (bottom trace): 30V/div.

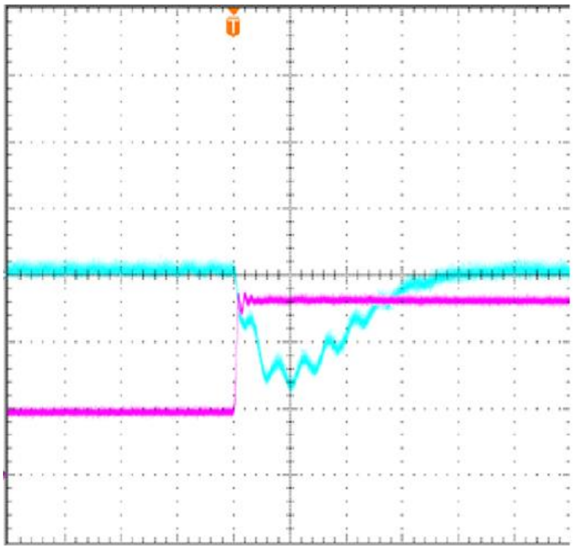


Figure 7: Transient Response
(Vin=54V, 1A/µs step change in load from 25% to 75% of $I_{o, max}$)
V_{out} (top trace): 0.2 V/div, 50us/div;
I_{out} (bottom trace): 5A/div.
Scope measurement should be made using a BNC cable (length shorter than 20 inches). Position the load between 51 mm to 76 mm (2 inches to 3 inches) from the module

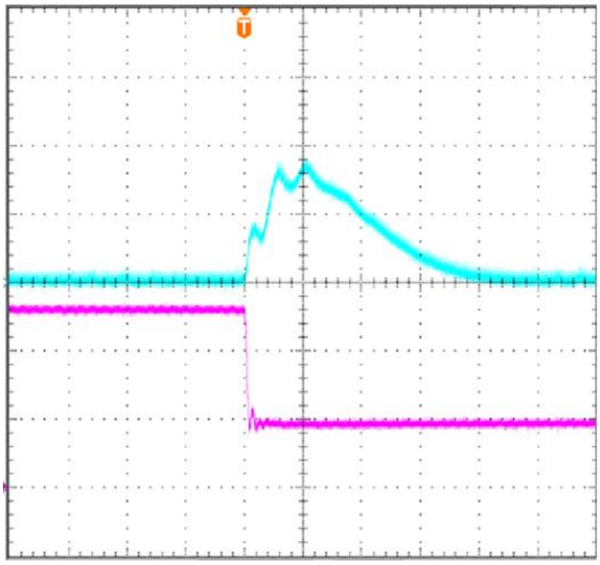


Figure 8: Transient Response
(Vin=54V, 1A/µs step change in load from 75% to 25% of $I_{o, max}$)
V_{out} (top trace):0.2V/div, 100us/div;
I_{out} (bottom trace): 5A/div.
Scope measurement should be made using a BNC cable (length shorter than 20 inches). Position the load between 51 mm to 76 mm (2 inches to 3 inches) from the module

T_A=25°C, V_{in}=54Vdc

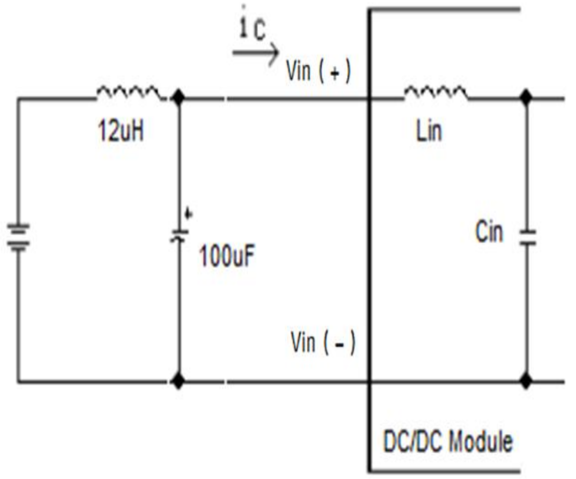


Figure 9: Test Setup Diagram for Input Ripple Current
Note: Measured input reflected-ripple current with a simulated source Inductance of 12μH. Measure current as shown above.

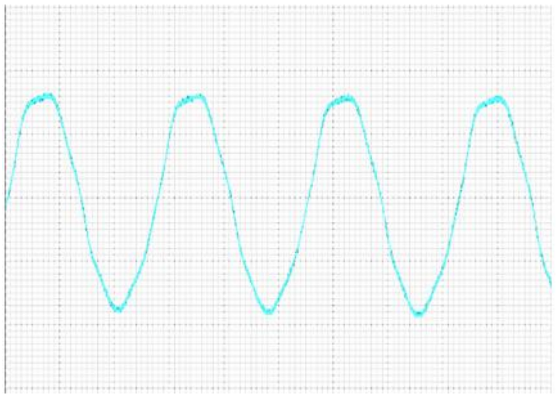


Figure 10: Input Terminal Ripple Current, i_c, at max output current and nominal input voltage with 12μH source impedance and 100μF electrolytic capacitor (1A/div, 2us/div).

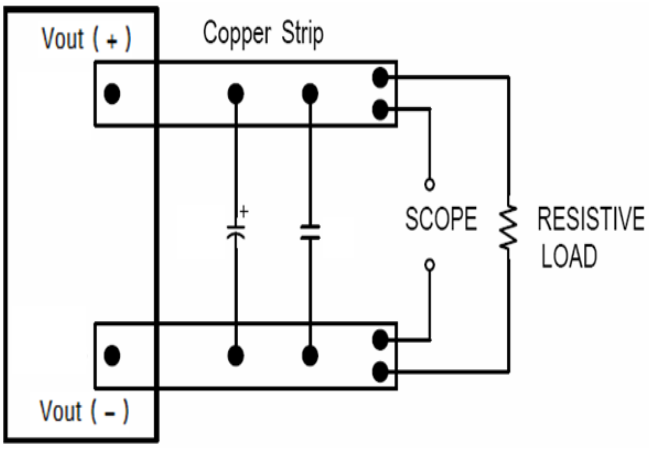


Figure 11: Test Setup for Output Voltage Noise and Ripple

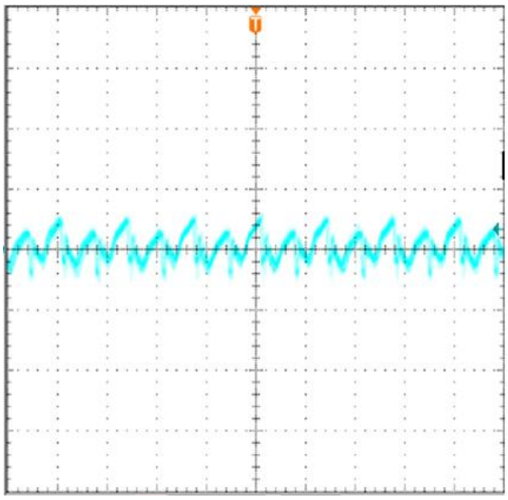


Figure 12: Output Voltage Ripple and Noise at nominal input voltage and max load current (30mV/div, 4us/div)
Load cap: 580uF, 110uF Ceramic Capacitor,470uF Oscon cap.

Input Source Impedance

The impedance of the input source connecting to the DC/DC power modules will interact with the modules and affect the stability. A low ac-impedance input source is recommended. A low ESR electrolytic capacitor higher than 100µF (ESR < 0.7Ω at 100kHz) is suggested.

Layout and EMC Considerations

Delta's DC/DC power modules are designed to operate in a wide variety of systems and applications. For design assistance with EMC compliance and related PWB layout issues, please contact Delta's technical support team.

Schematic and Components List

Cin are 47uF low ESR Aluminum cap×2pcs in parallel; CX1、CX2 and CX3 are 2.2uF ceramic cap×8pcs in parallel; L1 and L2 is 3.3uH;

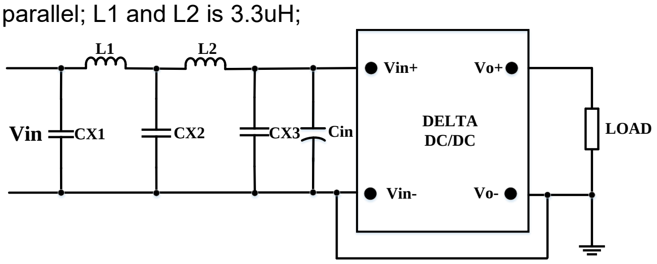


Figure 13-1: Recommended Input Filter

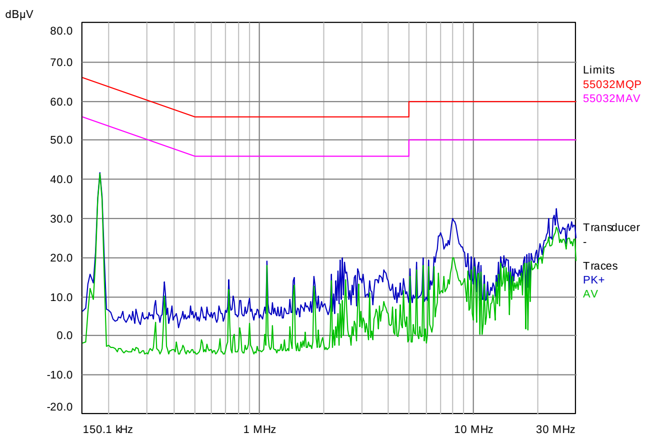


Figure 13-2: Test Result of EMC (Vin=54V, full load).

Safety Considerations

The power module must be installed in compliance with the spacing and separation requirements of the end-user's safety agency standard, i.e., UL60950-1, CSA C22.2 NO. 60950-1 2nd, IEC 62368-1 2nd and IEC 60950-1 2nd: 2005 and EN 60950-1 2nd: 2006+A11+A1: 2010, if the system in which the power module is to be used must meet safety agency requirements.

This power module is not internally fused. To achieve optimum safety and system protection, an input line fuse is highly recommended. The safety agencies require a fast-blow fuse with 10A maximum rating to be installed in the ungrounded lead. A lower rated fuse can be used based on the maximum inrush transient energy and maximum input current.

Soldering and Cleaning Considerations

Post solder cleaning is usually the final board assembly process before the board or system undergoes electrical testing. Inadequate cleaning and/or drying may lower the reliability of a power module and severely affect the finished circuit board assembly test. Adequate cleaning and/or drying is especially important for un-encapsulated and/or open frame type power modules. For assistance on appropriate soldering and cleaning procedures, please contact Delta's technical support team.

Remote On/Off

The remote on/off feature on the module is negative logic. Negative logic turns the module on during a logic low and off during a logic high. Remote on/off can be controlled by an external switch between the on/off terminal and the Vin (-) terminal. The switch can be an open collector or open drain. For negative logic if the remote on/off feature is not used, please short the on/off pin to Vin (-). The DC level on/off signal is suggested.

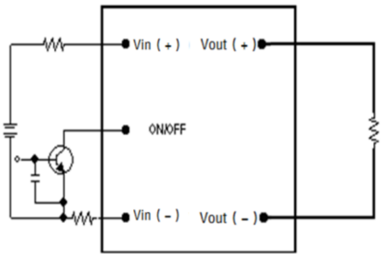


Figure 14: Remote On/Off Implementation

Over-Current Protection

The modules include an internal output over-current protection circuit, which will endure current limiting for an unlimited duration during output overload. If the output current exceeds the OCP set point, the modules will shut down (hiccup mode). The modules will try to restart after shutdown. If the overload condition still exists, the module will shut down again. This restart trial will continue until the overload condition is corrected.

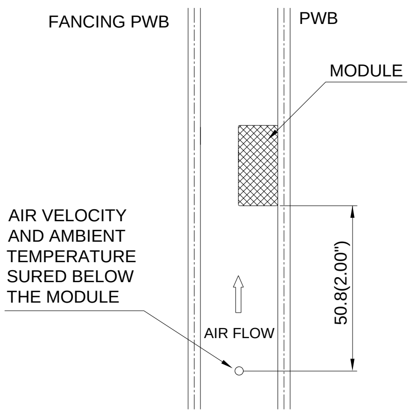
Thermal Testing Setup

Thermal management is an important part of the system design. To ensure proper, reliable operation, sufficient cooling of the power module is needed over the entire temperature range of the module. Convection cooling is usually the dominant mode of heat transfer.

Hence, the choice of equipment to characterize the thermal performance of the power module is a wind tunnel.

Delta's DC/DC power modules are characterized in heated vertical wind tunnels that simulate the thermal environments encountered in most electronics equipment. This type of equipment commonly uses vertically mounted circuit cards in cabinet racks in which the power modules are mounted.

The following figure shows the wind tunnel characterization setup. The power module is mounted on a 100mmX100mm,105μm (3Oz),6 layers test PWB and is vertically positioned within the wind tunnel. The space between the neighboring PWB and the top of the power module is constantly kept at 6.35mm (0.25'').



Note: Wind Tunnel Test Setup Figure Dimensions are in millimeters and (Inches)

Figure 16: Wind Tunnel Test Setup

Thermal Derating

Heat can be removed by increasing airflow over the module. To enhance system reliability, the power module should always be operated below the maximum operating temperature. If the temperature exceeds the maximum module temperature, reliability of the unit may be affected.

Thermal Curves (Open Frame)

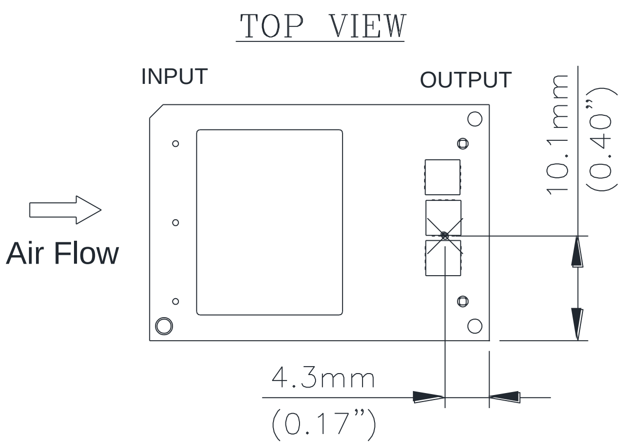


***Figure 17:** Hot spot temperature measurement location*

The allowed maximum hot spot temperature is defined at 118℃.

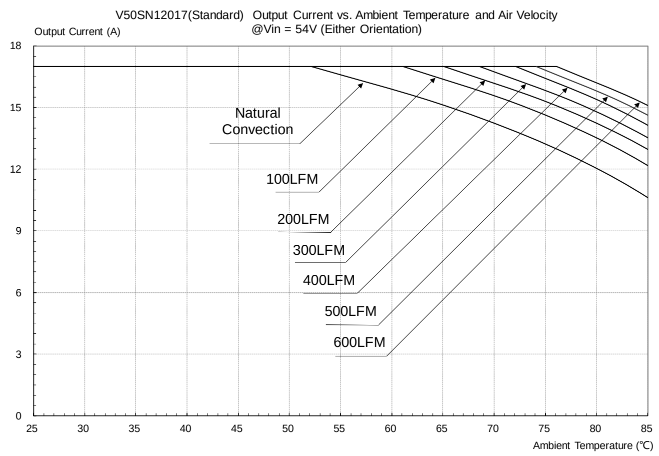
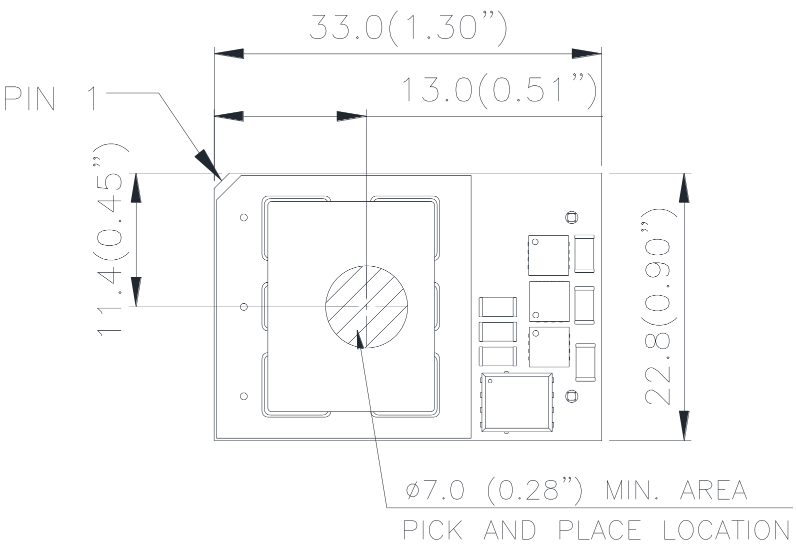
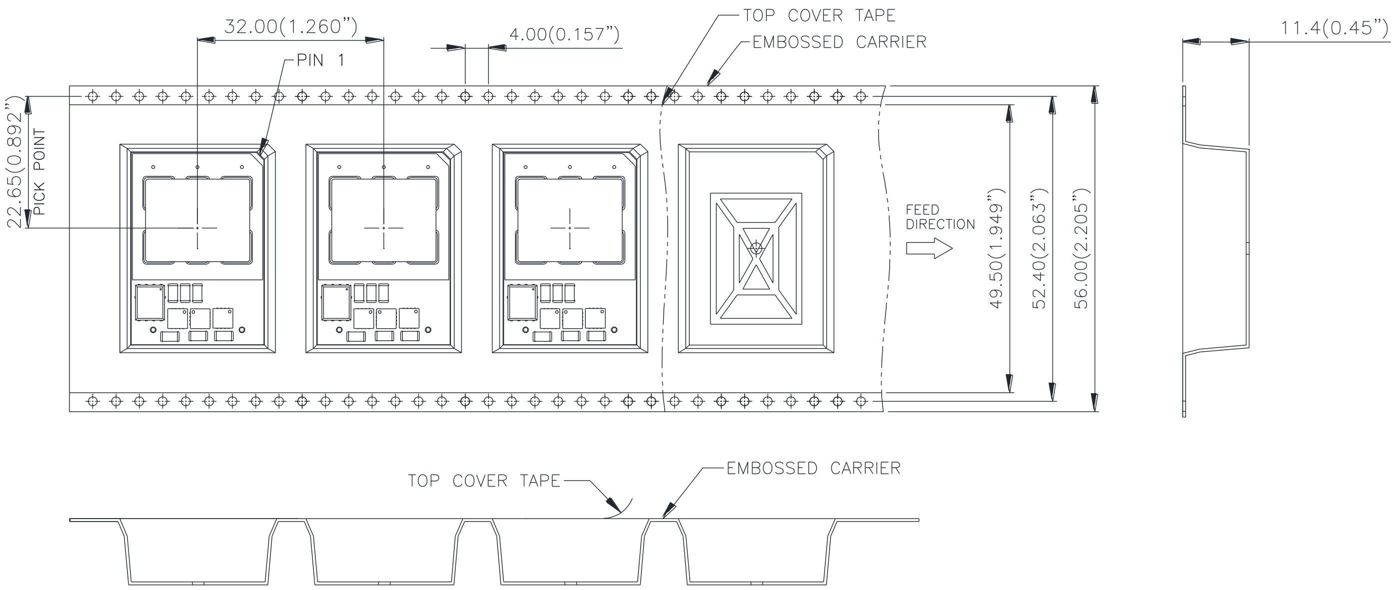


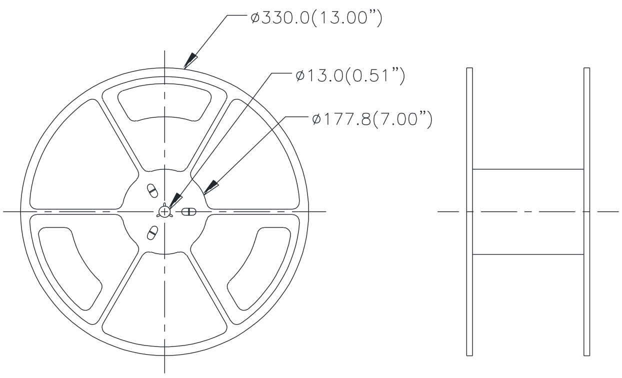
***Figure 18:** Output Power vs. Ambient Temperature and Air Velocity @Vin = 54V (Either Orientation, Open Frame)*

Pick and place location(SMD)



Surface mount tape & reel packing(SMD)





NOTES:

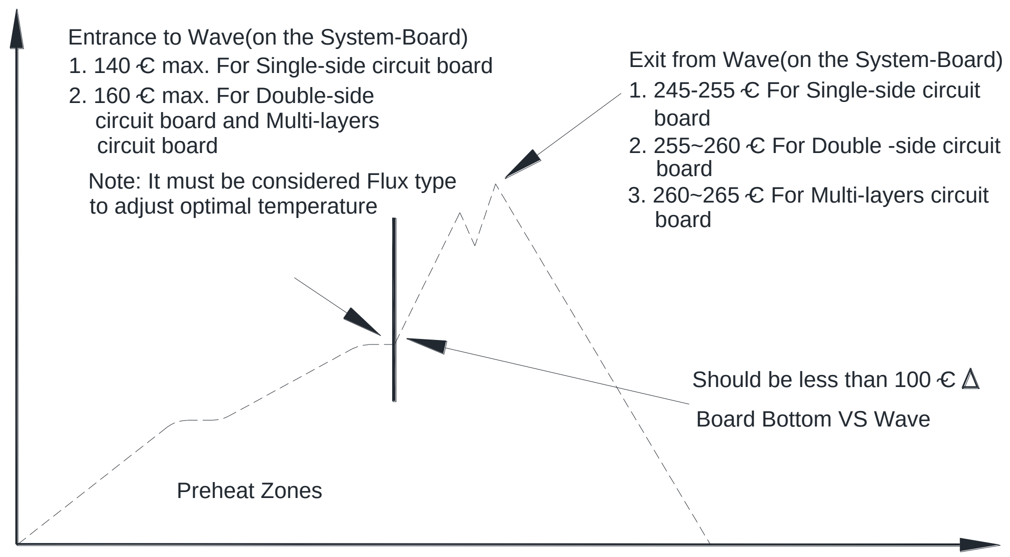
CONFORMS TO EIA-481 SATNDARD
MODULES ARE SHIPPED IN QUANTITIES OF 100 PER REEL.
ALL DIMENSIONS ARE IN MILLIMETERS AND (INCHES)
TOLERANCES: X.Xmm±0.5mm(X.XX in.±0.02 in.)
X.XXmm±0.25mm(X.XXX in.±0.010 in.)

Soldering method

Generally, as the most common mass soldering method for the solder attachment, wave soldering is used for through-hole power modules and reflow soldering is used for surface-mount ones. Delta recommended soldering methods and process parameters are provided in this document for solder attachment of power modules onto system board. SAC305 is the suggested lead-free solder alloy for all soldering methods.

Wave Soldering (Lead-free)

Delta's power modules are designed to be compatible with single-wave or dual wave soldering. The suggested soldering process must keep the power module's internal temperature below the critical temperature of 217℃ continuously. The recommended wave-soldering profile is shown in following figure.



Recommended Temperature Profile for Lead-free Wave Soldering
Note: The temperature is measured on solder joint of pins of power module.

The typical recommended (for double-side circuit board) preheat temperature is 115+/-10℃ on the top side (component side) of the circuit board. The circuit-board bottom-side preheat temperature is typically recommended to be greater than 135℃ and preferably within 100℃ of the solder-wave temperature. A maximum recommended preheat up rate is 3℃/s. A maximum recommended solder pot temperature is 255+/-5℃ with solder-wave dwell time of 3~6 seconds. The cooling down rate is typically recommended to be 6℃/s maximum.

Hand Soldering (Lead Free)

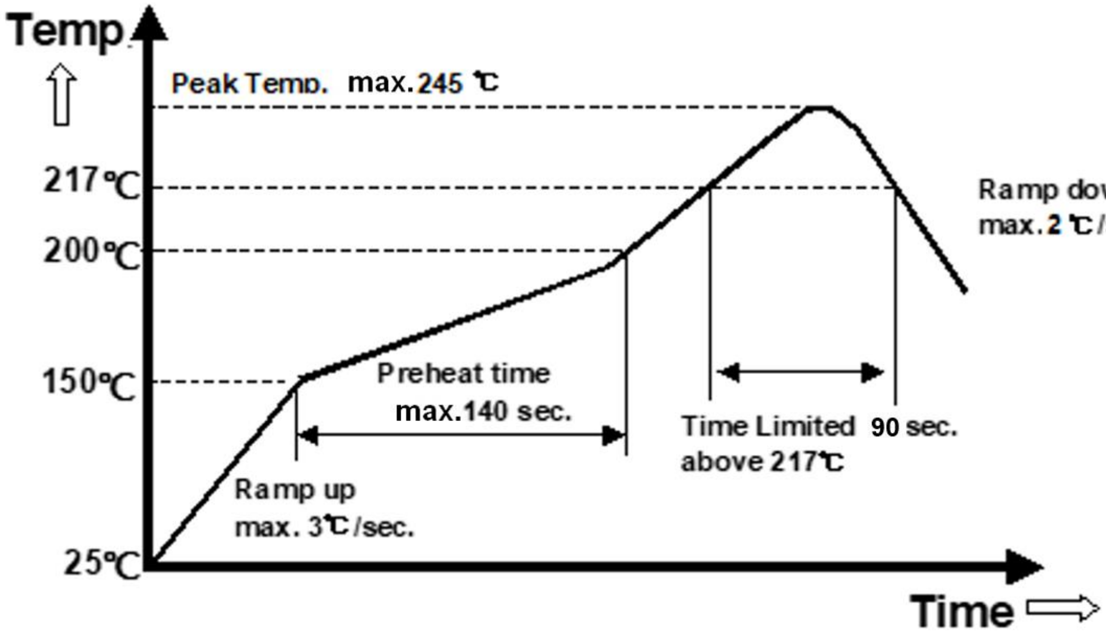
Hand soldering is the least preferred method because the amount of solder applied, the time the soldering iron is held on the joint, the temperature of the iron, and the temperature of the solder joint are variable. The recommended hand soldering guideline is listed in following table. The suggested soldering process must keep the power module's internal temperature below the critical temperature of 217℃ continuously.

Hand-Soldering Guideline

Parameter	Single-side Circuit Board	Double-side Circuit Board	Multi-layers Circuit Board
Soldering Iron Wattage Tip Temperature	90 385+/-10℃	90 420+/-10℃	90 420+/-10℃
Soldering Time	2 ~ 6 seconds	4 ~ 10 seconds	4 ~ 10 seconds

Reflow Soldering (Lead-free)

High temperature and long soldering time will result in IMC layer increasing in thickness and thereby shorten the solder joint lifetime. Therefore the peak temperature over 245℃ is not suggested due to the potential reliability risk of components under continuous high-temperature. In the meanwhile, the soldering time of temperature above 217℃ should be less than 90 seconds. Please refer to following fig for recommended temperature profile parameters.



Suggested Temperature Profile for Lead-free Reflow Soldering
Note: The temperature is measured on solder joint of pins of power module

CONTACT US:

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WARRANTY

Delta offers a two (2) year limited warranty. Complete warranty information is listed on our web site or is available upon request from Delta.