DELPHI SERIES

Photo is for reference only

Delphi Series V48SC, 1/16th Brick 90W DC/DC Power Modules: 48V in, 12V, 7.5A out

The Delphi Series V48SC, 1/16th Brick, 48V input, single output, isolated DC/DC converters, are the latest offering from a world leader in power systems technology and manufacturing — Delta Electronics, Inc. This product family provides up to 90 watts of power or 30A of output current in the 1/16th brick form factor (1.3”x0.90”) and pinout. With creative design technology and optimization of component placement, these converters possess outstanding electrical and thermal performance, as well as extremely high reliability under highly stressful operating conditions. Typical efficiency of the 12V/7.5A module is greater than 92.0%. All modules are protected from abnormal input/output voltage, current, and temperature conditions. For lower power needs, but in a similar small form factor, please check out Delta V36SE (50W), S48SP (36W or 10A) and S36SE (17W or 5A) series standard DC/DC modules.

FEATURES

- High efficiency: 92.0% @ 12V/7.5A
- Size:
  Without heat spreader:
  33.0x22.8x9.5mm (1.30”x0.90”x0.37”)
  With heat spreader
  33.0x22.8x12.1mm (1.30”x0.90”x0.48”)
- Industry standard footprint and pinout
- Fixed frequency operation
- SMD or through-hole versions
- Input UVLO
- OTP and output OCP, OVP
- Output voltage trim: -20%, +10%
- Monotonic startup into normal and pre-biased loads
- 1500V isolation and basic insulation
- No minimum load required
- No negative current during power or enable on/off
- ISO 9001, TL 9000, ISO 14001, QS 9000, OHSAS18001 certified manufacturing facility
- IEC/EN/UL/CSA62368-1, 2ndedition

OPTIONS

- SMD pins
- Short pin lengths available
- Positive remote On/Off
- Heat spreader

SOLDERING METHODS

- Wave soldering
- Hand soldering
- Reflow soldering

APPLICATIONS

- Optical Transport
- Data Networking
- Communications
- Servers

Delta Electronics, Inc.

TECHNICAL SPECIFICATIONS

(T_A=25°C, airflow rate=300 LFM, V_{in}=48Vdc, nominal Vout unless otherwise noted.)

PARAMETER	NOTES and CONDITIONS	V48SC12007NMFA/B V48SC12007NRFA/H			
		Min.	Typ.	Max.	Units
ABSOLUTE MAXIMUM RATINGS					
Input Voltage					
Continuous				80	Vdc
Transient (100ms)	100ms			100	Vdc
Operating Ambient Temperature		-40		85	°C
Storage Temperature		-55		125	°C
Input/Output Isolation Voltage				1500	Vdc
INPUT CHARACTERISTICS					
Operating Input Voltage		36	48	75	Vdc
Input Under-Voltage Lockout					
Turn-On Voltage Threshold		32.5	34.5	35.5	Vdc
Turn-Off Voltage Threshold		29.5	31.5	33.5	Vdc
Lockout Hysteresis Voltage		1.5	3	4	Vdc
Maximum Input Current	100% Load, 36Vin			4	A
No-Load Input Current			60		mA
Off Converter Input Current			8	12	mA
Inrush Current (I^2t)	With 100uF external input capacitor			1	A^2s
Input Reflected-Ripple Current	P-P thru 12µH inductor, 5Hz to 20MHz			20	mA
Input Voltage Ripple Rejection	120 Hz		-60		dB
OUTPUT CHARACTERISTICS					
Output Voltage Set Point	Vin=48V, Io=Io.max, Tc=25°C	11.82	12	12.18	Vdc
Output Voltage Regulation					
Load Regulation	Io=Io, min to Io, max		±5		mV
Line Regulation	Vin=36V to 75V		±5		mV
Temperature Regulation	Tc=-40°C to125°C		±180		mV
Total Output Voltage Range	Over sample load, line and temperature	11.64		12.36	V
Output Voltage Ripple and Noise	5Hz to 20MHz bandwidth				
Peak-to-Peak	max load on output, 20MHz bandwidth 10uF tantalum + 1uF ceramic capacitor		100		mV
RMS	max load on output, 20MHz bandwidth 10uF tantalum + 1uF ceramic capacitor		30		mV
Operating Output Current Range		0		7.5	A
Output Over Current Protection	Output Voltage 10% Low	110		140	%
DYNAMIC CHARACTERISTICS					
Output Voltage Current Transient	load capacitor10uF tantalum + 1u ceramic 0.1A/uS Frequency= 250Hz				
Positive Step Change in Output Current	50% Io.max to 75% Io.max		300		mV
Negative Step Change in Output Current	75% Io.max to 50% Io.max		300		mV
Settling Time (within 1% Vout nominal)			200		us
Turn-On Transient					
Start-Up Delay Time, From On/Off Control or Input	From On/Off Control or Input to 10%Vo			15	ms
Start-Up Rise Time, From On/Off Control or Input	From 10%Vo to 90% Vo			40	ms
Maximum Output Capacitance	Full load; 5% overshoot of Vout at startup;	0		3300	µF
EFFICIENCY					
100% Load	Vin=48V		92.0		%
60% Load	Vin=48V		92.0		%
ISOLATION CHARACTERISTICS					
Input to Output				1500	Vdc
Isolation Resistance		10			MΩ
Isolation Capacitance			1000		pF
FEATURE CHARACTERISTICS					
Switching Frequency			420		kHz
ON/OFF Control, Negative Remote On/Off logic					
Logic Low (Module On)	Von/off	0		0.7	V
Logic High (Module Off)	Von/off	2.4		5	V
ON/OFF Control, Positive Remote On/Off logic					
Logic Low (Module Off)	Von/off	0		0.7	V
Logic High (Module On)	Von/off	2.4		5	V
ON/OFF Current (for both remote on/off logic)	Ion/off at Von/off=0.0V			1	mA
ON/OFF Current (for both remote on/off logic)	Ion/off at Von/off=2.4V				uA
Leakage Current (for both remote on/off logic)	Logic High, Von/off=5V				uA
Output Voltage Trim Range	Max rated current guaranteed at full trim range	-20		10	%
Output Voltage Remote Sense Range	Max rated current guaranteed at full remote sense range			10	%
Output Over-Voltage Protection	Over full temp range; % of nominal Vout	110		140	%
GENERAL SPECIFICATIONS					
MTBF	Per Telecordia SR-332, 80% load, 25°C, 48Vin, 300LFM		4.9		M hours
Weight	Open frame		15		grams
weight	With heat-spreader		24		grams
Over-Temperature Shutdown (Open Frame)	Refer to Figure 21 for Hot spot1 location (48Vin,80%Io, 200LFM,Airflow from Vout+ to Vin+)		132		°C
Over-Temperature Shutdown (With Heat Spreader)	Refer to Figure 23 for Hot spot2 location (48Vin,80%Io, 200LFM,Airflow from Vout+ to Vin+)		120		°C
Over-Temperature Shutdown (NTC Resistor)	Refer to Figure 21 for NTC resistor location		125		°C
Note: Please attach thermocouple on NTC resistor to test OTP function, the hot spot's temperature is just for reference.					

TECHNICAL SPECIFICATIONS

(T_A=25°C, airflow rate=300 LFM, V_{in}=48Vdc, nominal Vout unless otherwise noted.)

PARAMETER	NOTES and CONDITIONS	V48SC12007NMFP			
		Min.	Typ.	Max.	Units
ABSOLUTE MAXIMUM RATINGS					
Input Voltage					
Continuous				80	Vdc
Transient (100ms)	100ms			100	Vdc
Operating Ambient Temperature		0		85	°C
Storage Temperature		-55		125	°C
Input/Output Isolation Voltage				1500	Vdc
INPUT CHARACTERISTICS					
Operating Input Voltage		36	48	75	Vdc
Input Under-Voltage Lockout					
Turn-On Voltage Threshold		32.5	34.5	35.5	Vdc
Turn-Off Voltage Threshold		29.5	31.5	33.5	Vdc
Lockout Hysteresis Voltage		1.5	3	4	Vdc
Maximum Input Current	100% Load, 36Vin			4	A
No-Load Input Current			60		mA
Off Converter Input Current			8	12	mA
Inrush Current (I^2t)	With 100uF external input capacitor			1	A^2s
Input Reflected-Ripple Current	P-P thru 12µH inductor, 5Hz to 20MHz			20	mA
Input Voltage Ripple Rejection	120 Hz		-60		dB
OUTPUT CHARACTERISTICS					
Output Voltage Set Point	Vin=48V, Io=Io.max, Tc=25°C	11.82	12	12.18	Vdc
Output Voltage Regulation					
Load Regulation	Io=Io, min to Io, max		±5		mV
Line Regulation	Vin=36V to 75V		±5		mV
Temperature Regulation	Tc=-40°C to125°C		±180		mV
Total Output Voltage Range	Over sample load, line and temperature	11.64		12.36	V
Output Voltage Ripple and Noise	5Hz to 20MHz bandwidth				
Peak-to-Peak	max load on output, 20MHz bandwidth 10uF tantalum + 1uF ceramic capacitor		100		mV
RMS	max load on output, 20MHz bandwidth 10uF tantalum + 1uF ceramic capacitor		30		mV
Operating Output Current Range		0		7.5	A
Output Over Current Protection	Output Voltage 10% Low	110		140	%
DYNAMIC CHARACTERISTICS					
Output Voltage Current Transient	load capacitor10uF tantalum + 1u ceramic 2.5A/uS Frequency= 250Hz				
Positive Step Change in Output Current	45% Io.max to 0% Io.max		400		mV
Negative Step Change in Output Current	0% Io.max to 45% Io.max		400		mV
Settling Time (within 1% Vout nominal)			100		us
Turn-On Transient					
Start-Up Delay Time, From On/Off Control or Input	From On/Off Control or Input to 10%Vo			15	ms
Start-Up Rise Time, From On/Off Control or Input	From 10%Vo to 90% Vo			40	ms
Maximum Output Capacitance	Full load; 5% overshoot of Vout at startup;	0		3300	µF
EFFICIENCY					
100% Load	Vin=48V		92.0		%
60% Load	Vin=48V		92.0		%
ISOLATION CHARACTERISTICS					
Input to Output				1500	Vdc
Isolation Resistance		10			MΩ
Isolation Capacitance			1000		pF
FEATURE CHARACTERISTICS					
Switching Frequency			420		kHz
ON/OFF Control, Negative Remote On/Off logic					
Logic Low (Module On)	Von/off	0		0.7	V
Logic High (Module Off)	Von/off	2.4		5	V
ON/OFF Control, Positive Remote On/Off logic					
Logic Low (Module Off)	Von/off	0		0.7	V
Logic High (Module On)	Von/off	2.4		5	V
ON/OFF Current (for both remote on/off logic)	Ion/off at Von/off=0.0V			1	mA
ON/OFF Current (for both remote on/off logic)	Ion/off at Von/off=2.4V				uA
Leakage Current (for both remote on/off logic)	Logic High, Von/off=5V				uA
Output Voltage Trim Range	Max rated current guaranteed at full trim range	-20		10	%
Output Voltage Remote Sense Range	Max rated current guaranteed at full remote sense range			10	%
Output Over-Voltage Protection	Over full temp range; % of nominal Vout	110		140	%
GENERAL SPECIFICATIONS					
MTBF	Per Telecordia SR-332, 80% load, 25°C, 48Vin, 300LFM		4.9		M hours
Weight	Open frame		15		grams
Over-Temperature Shutdown (Hot Spot)	Refer to Figure 21 for Hot spot location (48Vin,80%Io, 200LFM,Airflow from Vout+ to Vin+)		132		°C
Over-Temperature Shutdown (NTC Resistor)	Refer to Figure 21 for NTC resistor location		125		°C
Note: Please attach thermocouple on NTC resistor to test OTP function, the hot spot's temperature is just for reference.					

ELECTRICAL CHARACTERISTICS CURVES

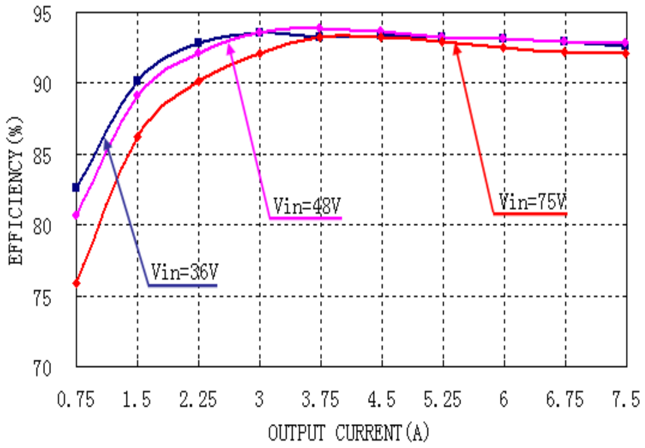


Figure 1: *Efficiency vs. load current for minimum, nominal, and maximum input voltage at 25°C*

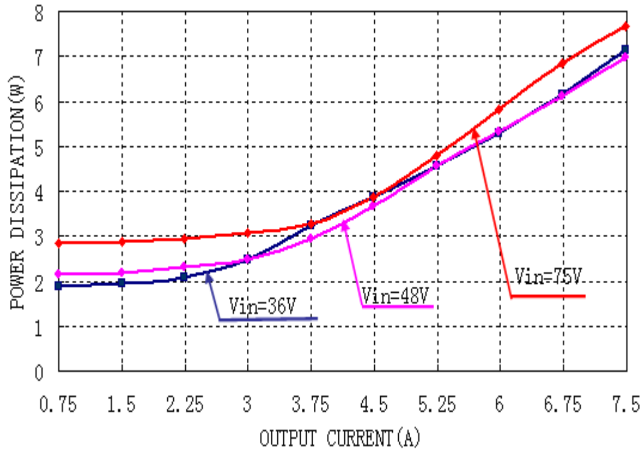


Figure 2: *Power dissipation vs. load current for minimum, nominal, and maximum input voltage at 25°C.*

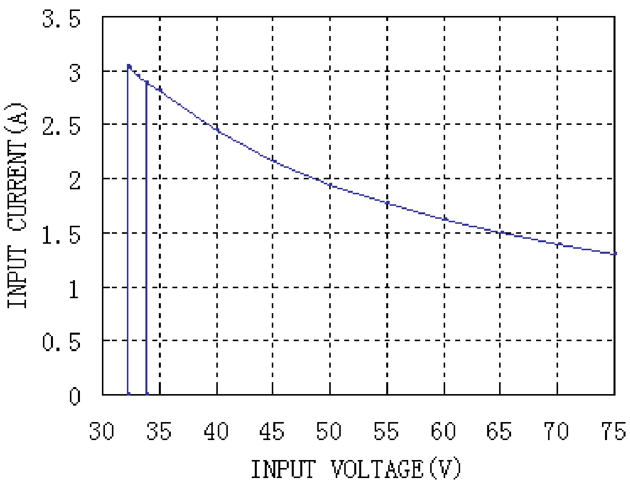


Figure 3: *Typical full load input characteristics at room temperature*

ELECTRICAL CHARACTERISTICS CURVES

For Negative Remote On/Off Start up

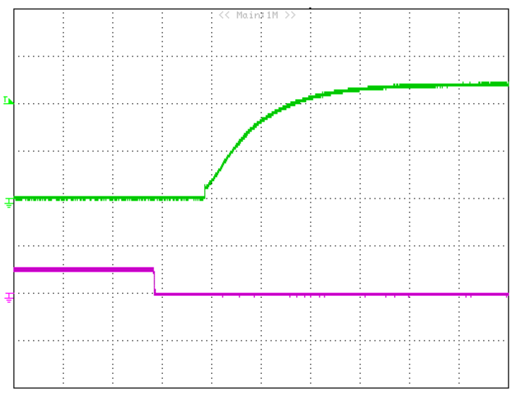


***Figure 4:** Turn-on transient at full rated load current (10 ms/div). Vin=48V. Top Trace: Vout, 5.0V/div; Bottom Trace: ON/OFF input, 5V/div*

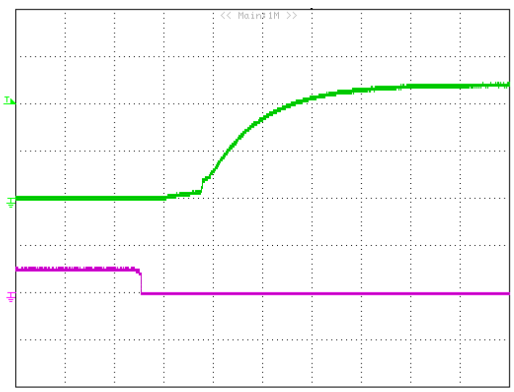


***Figure 5:** Turn-on transient at zero load current (10 ms/div). Vin=48V. Top Trace: Vout: 5.0V/div, Bottom Trace: ON/OFF input, 5V/div*

For Input Voltage Start up

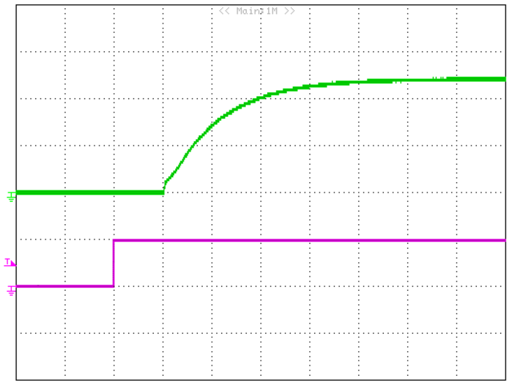


***Figure 6:** Turn-on transient at full rated load current (10 ms/div). Vin=48V. Top Trace: Vout, 5.0V/div; Bottom Trace: Vin, 50V/div*

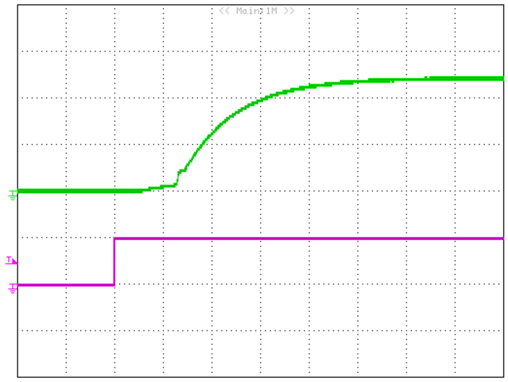


***Figure 7:** Turn-on transient at zero load current (10 ms/div). Vin=48V. Top Trace: Vout, 5.0V/div; Bottom Trace: Vin, 50V/div*

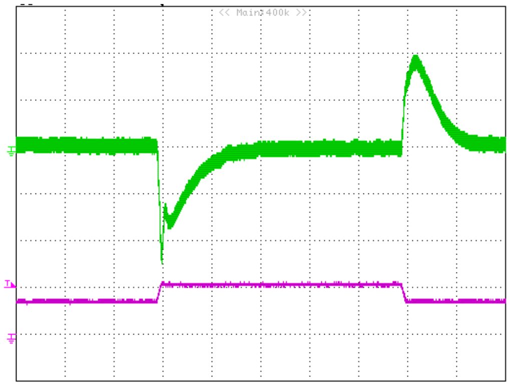


***Figure 8.1:** Output voltage response to step-change in load current (75%-50%-75% of Io, max; di/dt = 0.1A/µs). Load cap: 10µF tantalum capacitor and 1µF ceramic capacitor. Top Trace: Vout (0.15V/div, 200us/div), Bottom Trace: Iout (5A/div). Scope measurement should be made using a BNC cable (length shorter than 20 inches). Position the load between 51 mm to 76 mm (2 inches to 3 inches) from the module*

Note: for module **V48SC12007NMFA**, **V48SC12007NMFB** and **V48SC12007NRFA**

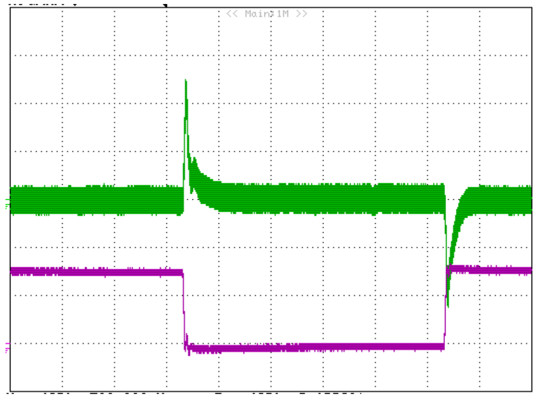


***Figure 8.2:** Output voltage response to step-change in load current 0A-3.2A-0A, max; di/dt =2.5A/µs). Load cap: 10µF tantalum capacitor and 1µF ceramic capacitor. Top Trace: Vout (0.2V/div, 200us/div), Bottom Trace: Iout (2A/div). Scope measurement should be made using a BNC cable (length shorter than 20 inches). Position the load between 51 mm to 76 mm (2 inches to 3 inches) from the module*

Note: for module **V48SC12007NMFP**

ELECTRICAL CHARACTERISTICS CURVES

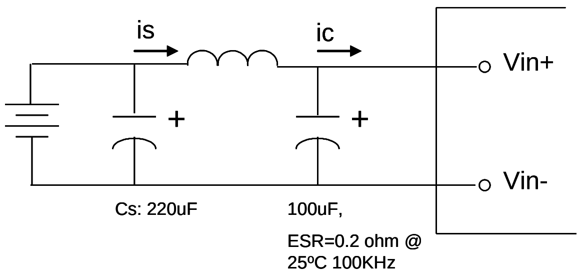


Figure 9: *Test set-up diagram showing measurement points for Input Terminal Ripple Current and Input Reflected Ripple Current.*
Note: Measured input reflected-ripple current with a simulated source Inductance (L_{TEST}) of 12 μH. Capacitor Cs offset possible battery impedance. Measure current as shown above

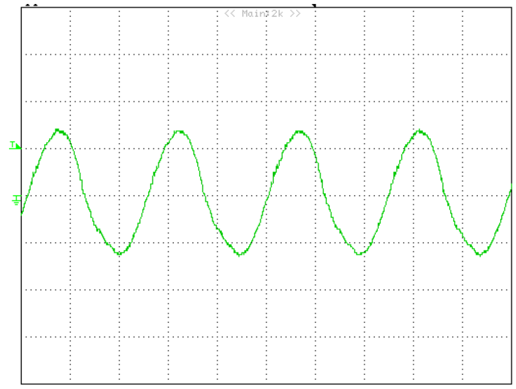


Figure 10: *Input Terminal Ripple Current, i_c, at full rated output current and nominal input voltage with 12μH source impedance and 33μF electrolytic capacitor (200 mA/div, 1us/div)*

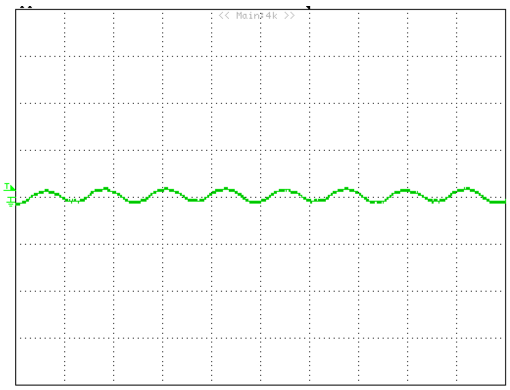


Figure 11: *Input reflected ripple current, i_s, through a 12μH source inductor at nominal input voltage and rated load current (20 mA/div, 2us/div)*

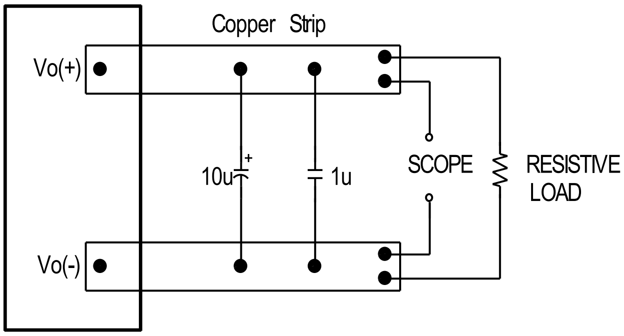


Figure 12: *Output voltage noise and ripple measurement test setup*

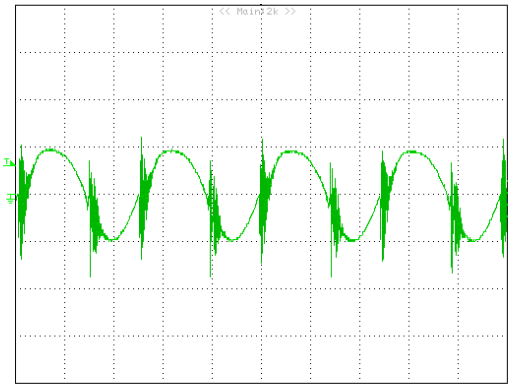


Figure 13: *Output voltage ripple at nominal input voltage and rated load current (Io=7.5A)(50 mV/div, 1us/div)*
Load capacitance: 1μF ceramic capacitor and 10μF tantalum capacitor. Bandwidth: 20 MHz. Scope measurements should be made using a BNC cable (length shorter than 20 inches). Position the load between 51 mm to 76 mm (2 inches to 3 inches) from the module.

DESIGN CONSIDERATIONS

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. If the source inductance is more than a few μH, we advise adding a 100 μF electrolytic capacitor (ESR < 0.7 Ω at 100 kHz) mounted close to the input of the module to improve the stability.

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. An external input filter module is available for easier EMC compliance design. Below is the reference design for an input filter tested with V48SC12007 to meet EN55032 (VDE0878) class B (both q. peak and average)

Schematic and Components List

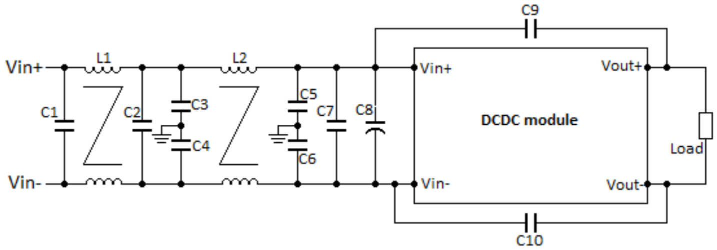


Figure 14 - EMI test schematic

1. C1=2.2uF*3pcs
2. C2=2.2uF*2pcs
3. C3=C4=1nF (note1)
4. C5=C6=C9=C10=10nF(Note1)
5. C7=2.2uF*2pcs
6. C8=100uF
7. L1=L2=0.65mH

Note1: Voltage rating can be either 1500Vdc or < 1500Vdc which is depend on end product's safety requirement.

Test Result:

At T = +25℃ , Vin = 48 V and full load

Blue line is quasi peak mode; Green line is average mode.

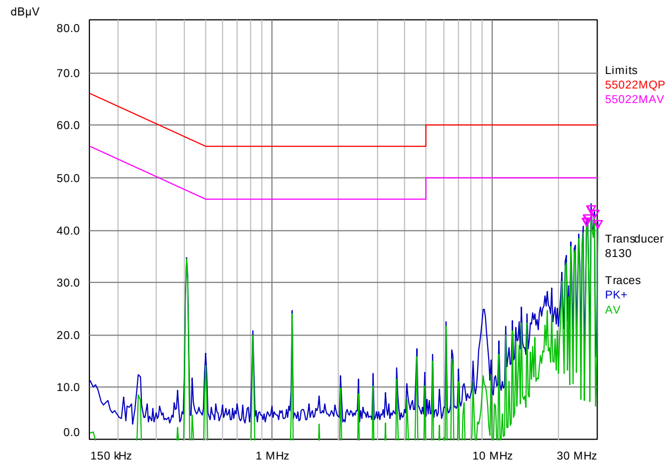


Figure 15 - EMI test

Safety Considerations

The power module must be installed in compliance with the spacing and separation requirements of the safety agency standard, i.e. IEC 62368-1: 2014 (2nd edition), EN 62368-1: 2014 (2nd edition), UL 62368-1, 2nd Edition, 2014-12-01 and CSA C22.2 No. 62368-1-14, 2nd Edition, 2014-12, if the system in which the power module is to be used must meet safety agency requirements.

This product is provided with basic insulation between DC input and DC output with 1500Vdc isolation.

Heat spreader is an optional used and considered as floating, the additional consideration is required during end-use application where the higher grade of isolation is required.

DC input is considered as ES2, basic safeguard shall be provided between ES2 and MAINS.

This product is not designed for the ordinary person accessible.

The DC output is classified as ES1, the need for evaluate end-use application shall be considered if on the system where the module is used, in combination with the module, to ensure that under a single fault, the output voltage does not exceed ES1 limit.

This product has been evaluated and tested in the combination with a supplementary external fast-acting fuse in parallel, rated 20A/100Vdc from littlefuse type 456 series during the safety abnormal test. The need for repeat in these tests in the end-use application shall be considered if installed with a higher rated or difference type of protective device.

When installed into a Class II equipment (without grounding), spacing consideration should be given to the end-use application, as the spacing between this product and mounting surface have not been evaluated.

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.

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 automatically shut down, and enter hiccup mode or latch mode, which is optional, the default is hiccup mode.

For hiccup mode, the module will try to restart after shutdown. If the over current condition still exists, the module will shut down again. This restart trial will continue until the over-current condition is corrected.

Over-Voltage Protection

The modules include an internal output over-voltage protection circuit, which monitors the voltage on the output terminals. If this voltage exceeds the over-voltage set point, the module will shut down, and enter in hiccup mode or latch mode, which is optional, the default is hiccup mode.
For hiccup mode, the module will try to restart after shutdown. If the over voltage condition still exists, the module will shut down again. This restart trial will continue until the over-voltage condition is corrected.

For latch mode, the module will latch off once it shutdown. The latch is reset by either cycling the input power or by toggling the on/off signal for one second.

Over-Temperature Protection

The over-temperature protection consists of circuitry that provides protection from thermal damage. If the temperature exceeds the over-temperature threshold the module will shut down, and enter in auto-restart mode or latch mode, which is optional, the default is auto-restart mode.

For auto-restart mode, the module will monitor the module temperature after shutdown. Once the temperature is dropped and within the specification, the module will be auto-restart.

Remote On/Off

The remote on/off feature on the module can be either negative or positive logic. Negative logic turns the module on during a logic low and off during a logic high. Positive logic turns the modules on during a logic high and off during a logic low.

Remote on/off can be controlled by an external switch between the on/off terminal and the Vi(-) 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 Vi(-). For positive logic if the remote on/off feature is not used, please leave the on/off pin floating.

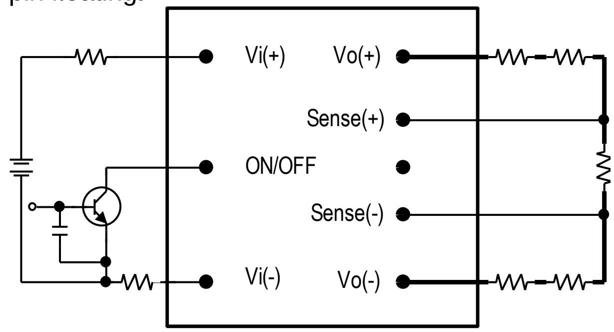


Figure 16: *Remote on/off implementation*

Remote Sense

Remote sense compensates for voltage drops on the output by sensing the actual output voltage at the point of load. The voltage between the remote sense pins and the output terminals must not exceed the output voltage sense range given here:

$$[Vo(+) – Vo(–)] – [SENSE(+) – SENSE(–)] \le 10\% \times Vout$$

This limit includes any increase in voltage due to remote sense compensation and output voltage set point adjustment (trim).

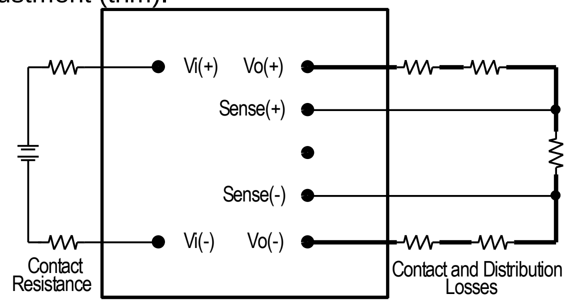


Figure 17: *Effective circuit configuration for remote sense operation*

If the remote sense feature is not used to regulate the output at the point of load, please connect SENSE(+) to Vo(+) and SENSE(–) to Vo(–) at the module.
The output voltage can be increased by both the remote sense and the trim; however, the maximum increase is the larger of either the remote sense or the trim, not the sum of both.

FEATURES DESCRIPTIONS (CON.)

When using remote sense and trim, the output voltage of the module is usually increased, which increases the power output of the module with the same output current.

Max rated current is guaranteed at full output voltage remote sense range.

Output Voltage Adjustment (TRIM)

To increase or decrease the output voltage set point, connect an external resistor between the TRIM pin and either the SENSE(+) or SENSE(-). The TRIM pin should be left open if this feature is not used.

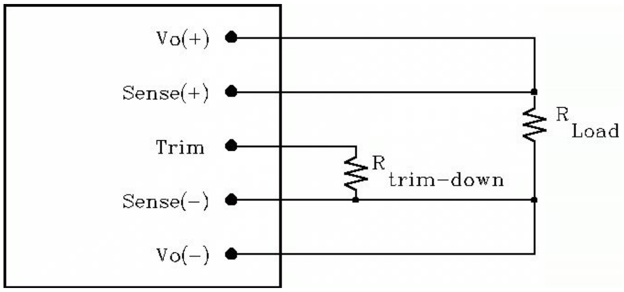


Figure 18: *Circuit configuration for trim-down (decrease output voltage)*

If the external resistor is connected between the TRIM and SENSE (-) pins, the output voltage set point decreases (Fig. 19). The external resistor value required to obtain a percentage of output voltage change △% is defined as:

$$Rtrim-down=\left[\frac{511}{\Delta}-10.22\right](K\Omega)$$

Ex. When Trim-down -10% (12V×0.9=10.8V)

$$Rtrim-down=\left[\frac{511}{10}-10.22\right](K\Omega)=40.88(K\Omega)$$

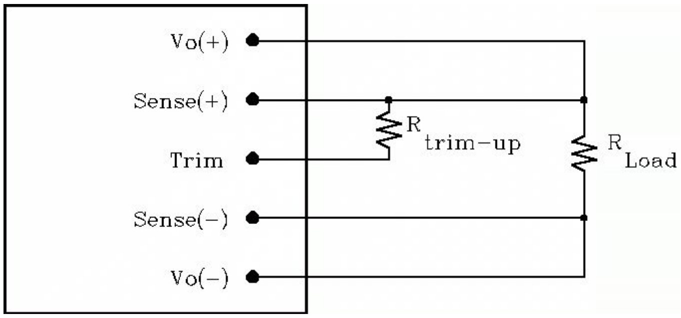


Figure 19: *Circuit configuration for trim-up (increase output voltage)*

If the external resistor is connected between the TRIM and SENSE (+) the output voltage set point increases (Fig. 20). The external resistor value required to obtain a percentage output voltage change △% is defined as:

$$Rtrim-up=\frac{5.11Vo\,(100+\Delta)}{1.225\Delta}-\frac{511}{\Delta}-10.22(K\Omega)$$

Ex. When Trim-up +10% (12V×1.1=13.2V)

$$Rtrim-up=\frac{5.11\times12\times(100+10)}{1.225\times10}-\frac{511}{10}-10.22=489.31(K\Omega)$$

Trim resistor can also be connected to Vo+ or Vo- but it would introduce a small error voltage than the desired value.

The output voltage can be increased by both the remote sense and the trim, however the maximum increase is the larger of either the remote sense or the trim, not the sum of both.

When using remote sense and trim, the output voltage of the module is usually increased, which increases the power output of the module with the same output current.

Max rated current is guaranteed at full output voltage trim range.

THERMAL CONSIDERATIONS

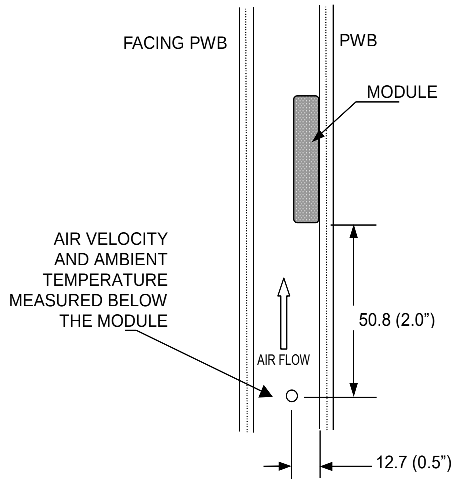
Thermal management is an important part of the system design. To ensure proper, reliable operation, sufficient cooling of the power module is needed over the entire temperature range of the module. Convection cooling is usually the dominant mode of heat transfer.

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

Thermal Testing Setup

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 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 20: *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)

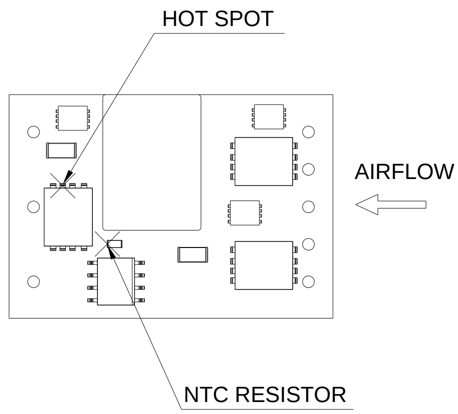


Figure 21: * *Hot spot 1& NTC resistor temperature measurement location. The allowed maximum hot spot temperature is defined at 120℃*

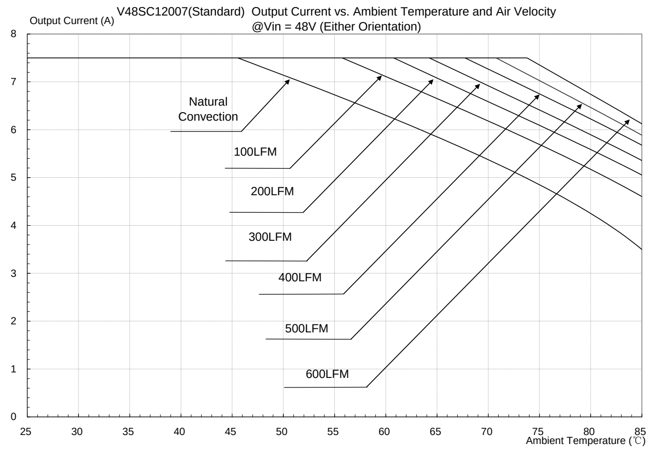


Figure 22: *Output Current vs. Ambient Temperature and Air Velocity @ Vin=48V (Either Orientation, Open Frame)*

THERMAL CURVES
(WITH HEAT SPREADER)

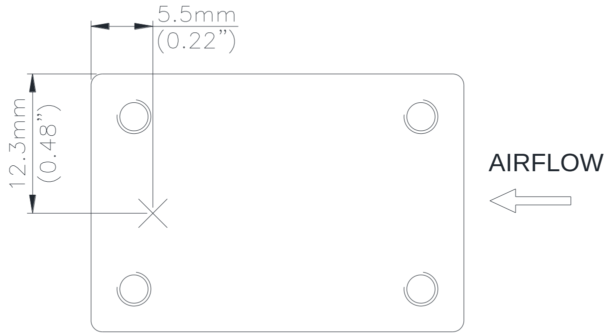


***Figure 23:* *** *Hot spot 2 temperature measurement location. The allowed maximum hot spot temperature is defined at 110℃*

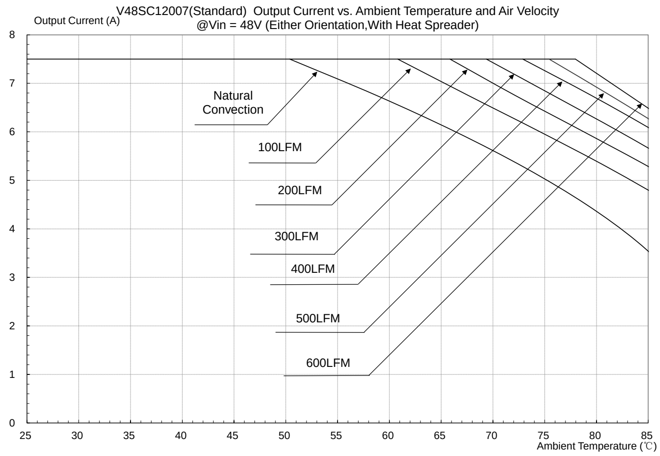
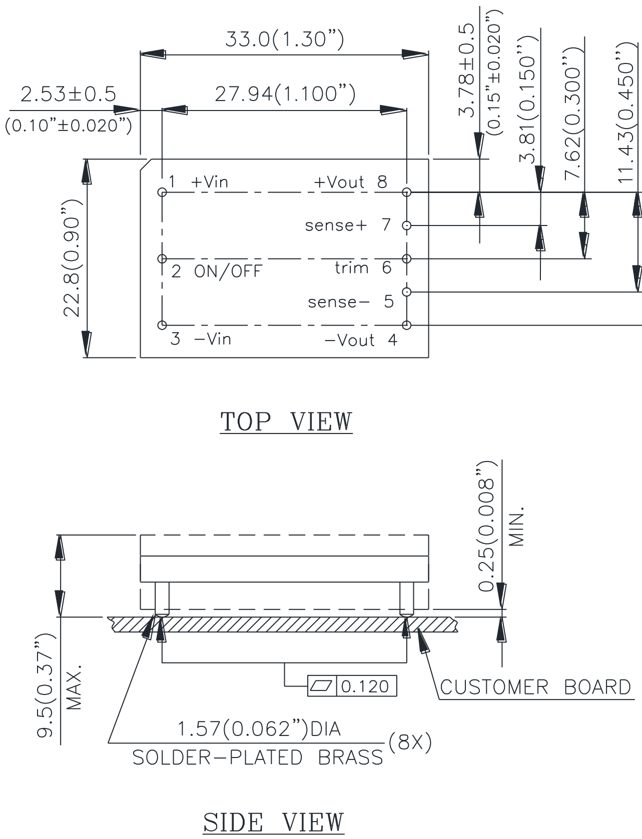


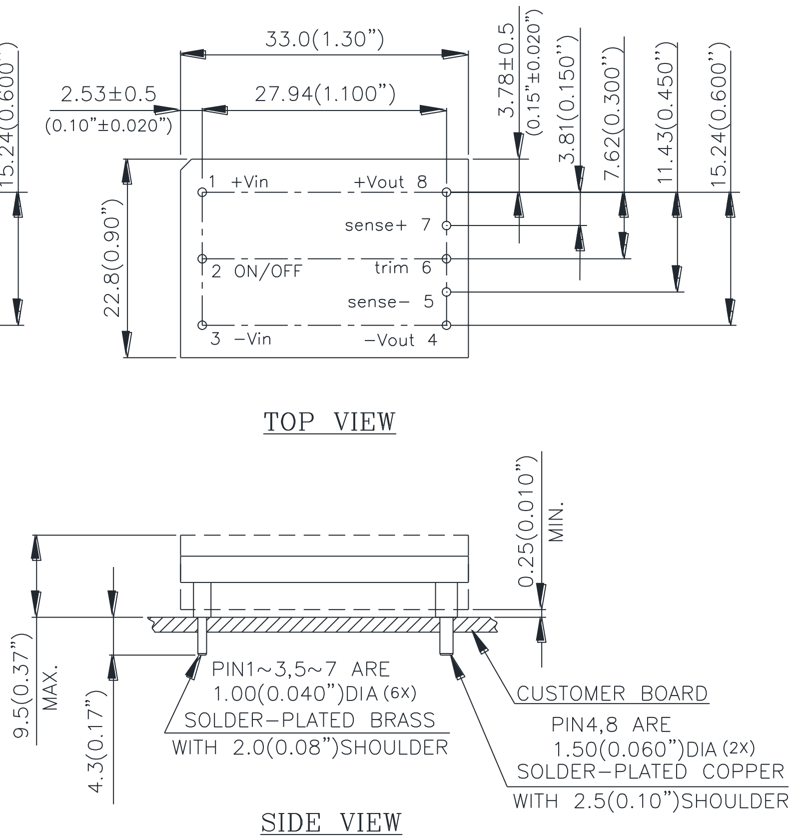
Figure 24: *Output Power vs. Ambient Temperature and Air Velocity @ Vin=48V (Either Orientation, with heat spreader)*

MECHANICAL DRAWING

Surface-mount module

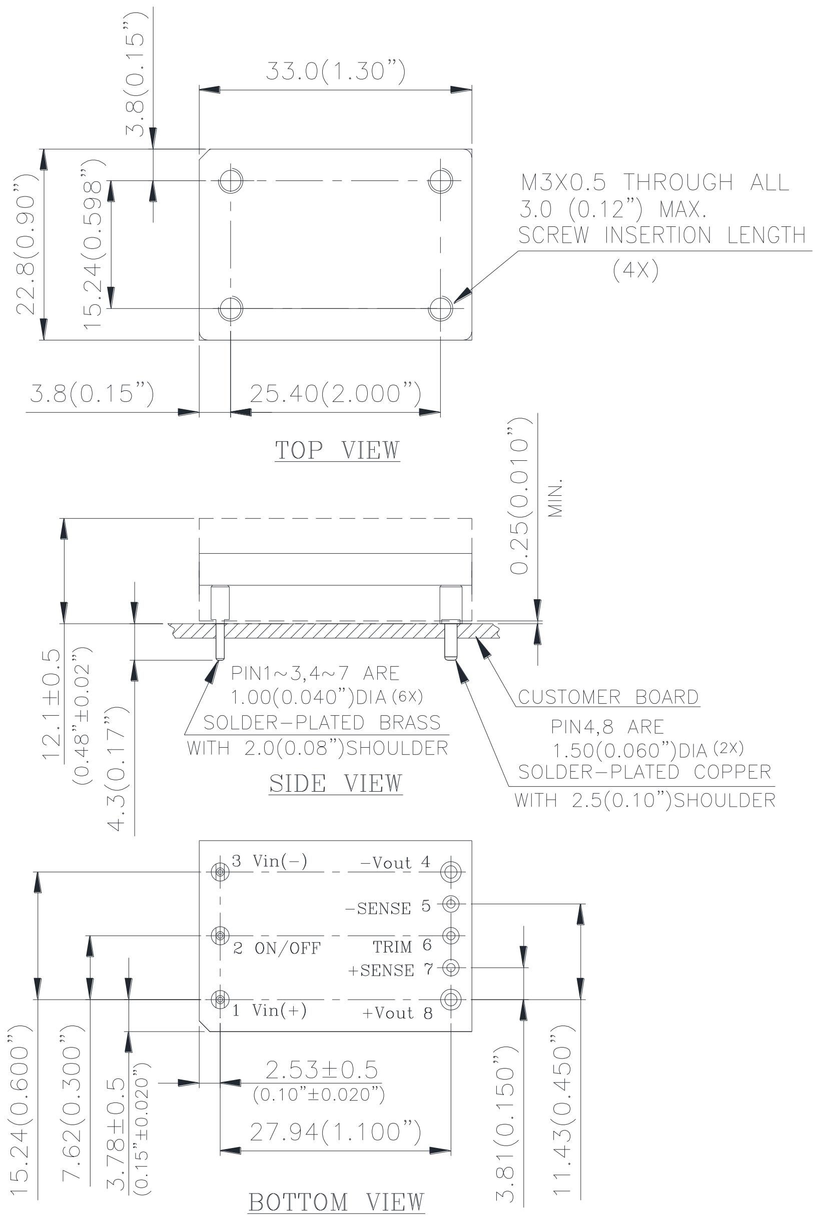


Through-hole module



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.)

Through-hole module with heat spreader



Pin No.	**Name**	**Function**
1	+Vin	Positive input voltage
2	ON/OFF	Remote ON/OFF
3	-Vin	Negative input voltage
4	-Vout	Negative output voltage
5	-SENSE	Negative remote sense
6	TRIM	Output voltage trim
7	+SENSE	Positive remote sense
8	+Vout	Positive output voltage

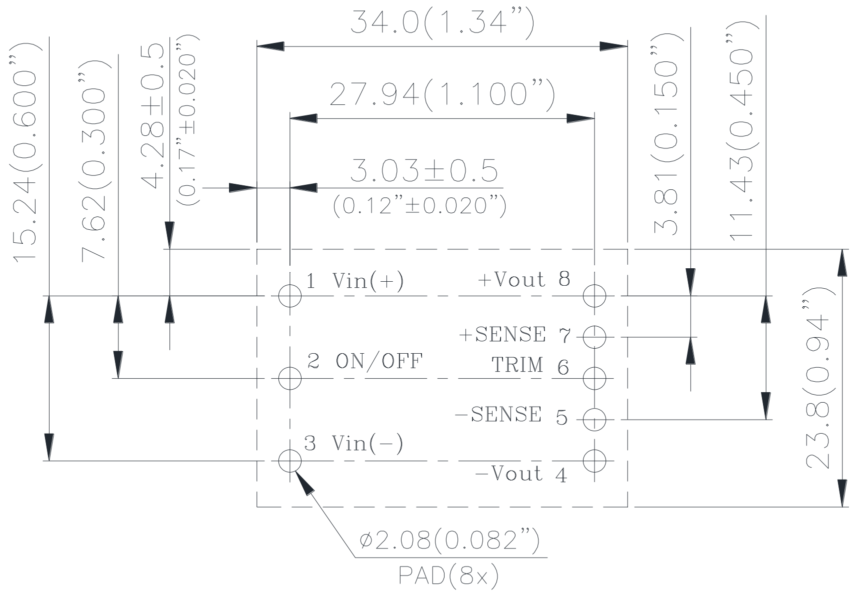
Pin Specification:(Through-hole)

Pins 1~3,5~7	1.00mm (0.040") diameter
Pins 4 & 8	1.50mm (0.059") diameter

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

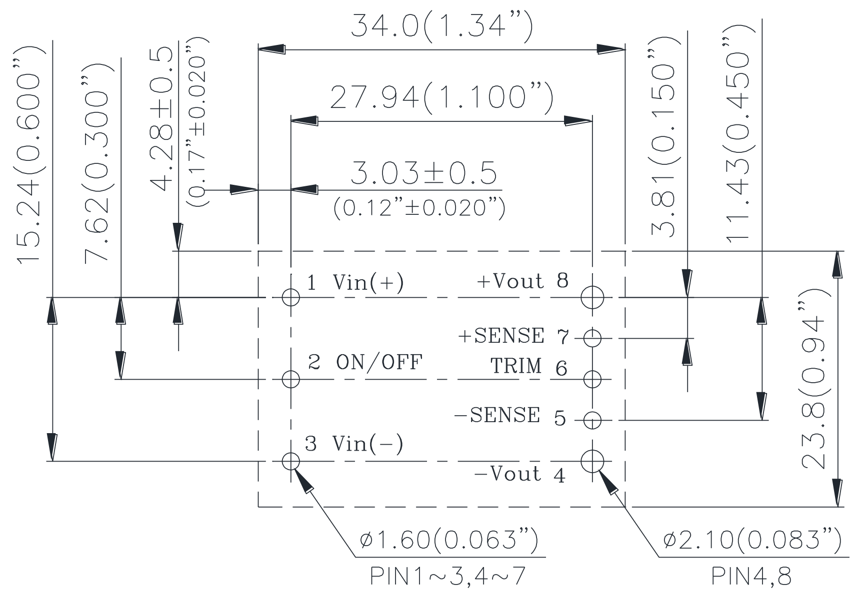
RECOMMENDED PAD LAYOUT

SURFACE-MOUNT MODULE



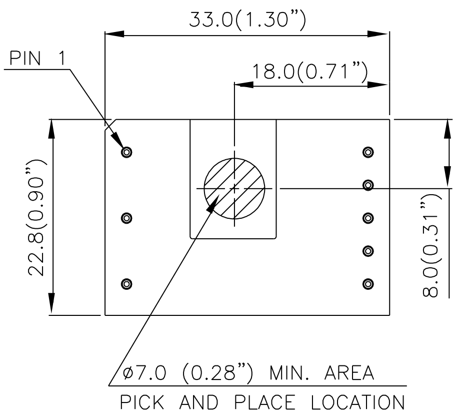
NOTES:
DIMENSIONS ARE IN MILLIMETERS AND (INCHES)
TOLERANCES: X.Xmm±0.5mm(X.XX in.±0.02 in.)
X.XXmm±0.25mm(X.XXX in.±0.010 in.)

THROUGH-HOLE MODULE



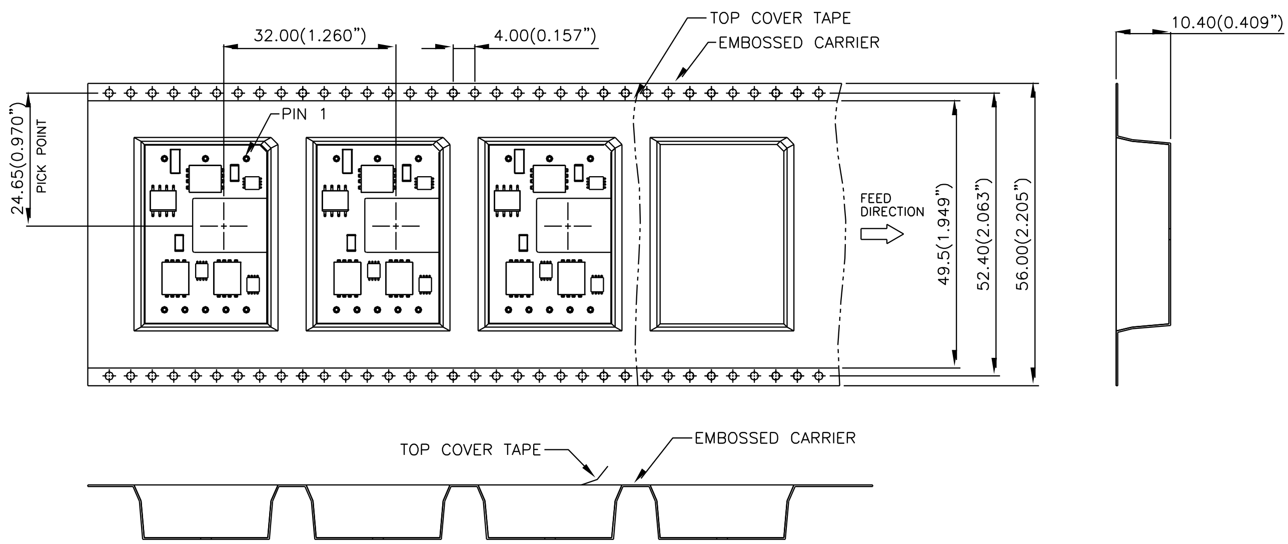
NOTES:
DIMENSIONS ARE IN MILLIMETERS AND (INCHES)
TOLERANCES: X.Xmm±0.5mm(X.XX in.±0.02 in.)
X.XXmm±0.25mm(X.XXX in.±0.010 in.)

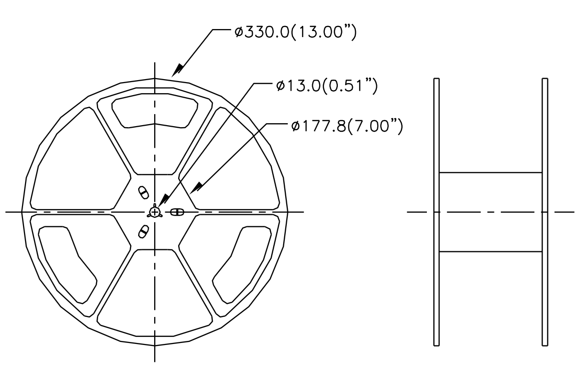
PICK AND PLACE LOCATION(SMD)



NOTES:
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.)

SURFACE-MOUNT TAPE & REEL





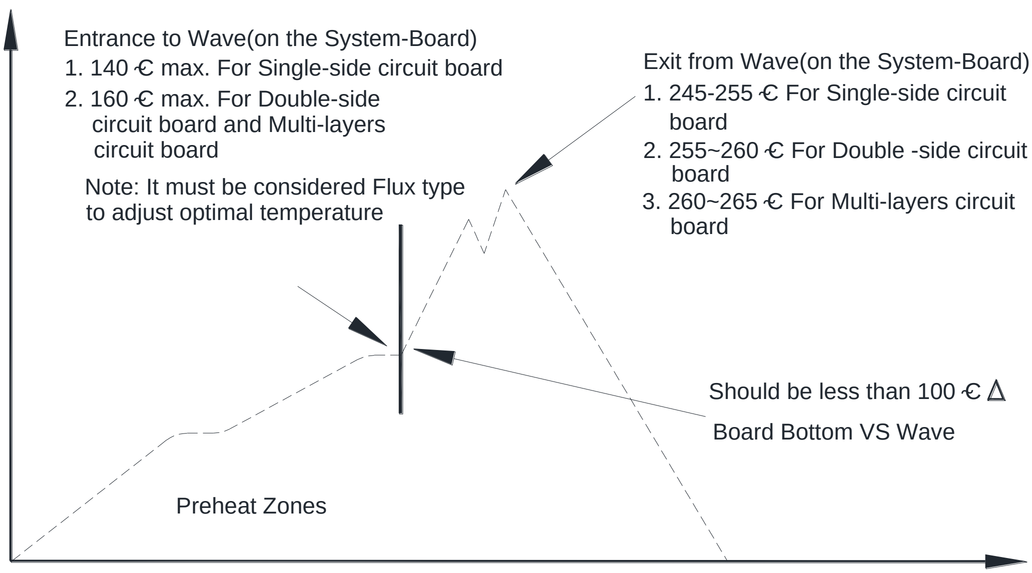
NOTES:
CONFORMS TO EIA−481 SATNDARD
MODULES ARE SHIPPED IN QUANTITIES OF 100 PER REEL.
ALL DIMENSIONS ARE IN MILLIMETERS AND (INCHES)
TOLERANCES: X.Xmm±0.5mm(X.XX in.±0.02 in.)
X.XXmm±0.25mm(X.XXX in.±0.010 in.)

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. The soldering temperature profile presented in this document is based on SAC305 solder alloy.

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 below:



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 Table below. The suggested soldering process must keep the power module's internal temperature below the critical temperature of 217℃ continuously.

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

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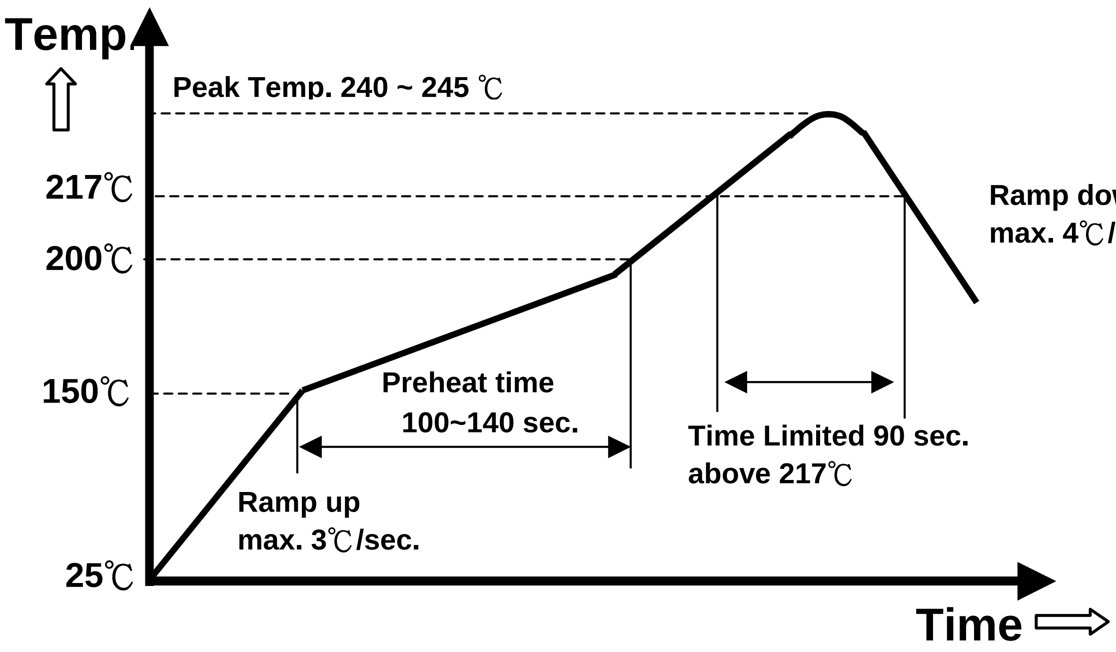

Note: The temperature is measured on solder joint of pins of power module.

PART NUMBERING SYSTEM

V	48	S	C	120	07	N	R	F	A
Type of Product	**Input Voltage**	**Number of Outputs**	**Product Series**	**Output Voltage**	**Output Current**	**ON/OFF Logic**	**Pin Length/Type**		**Option Code**
V - 1/16 Brick	48 - 36V~75V	S - Single	C - Serial number	120 - 12V	07 - 7.5A	N - Negative P - Positive	R - 0.170" N - 0.145" K - 0.110" M - SMD	F - RoHS (Lead Free)	A - Standard Functions B - no sense and trim pin P - for quick load transient response application H - With heat spreader

MODEL LIST

MODEL NAME	INPUT		OUTPUT		EFF @ 100% LOAD
V48SC12007NMFA	36~75V	4A	12V	7.5A	92%
V48SC12007NMFB	36~75V	4A	12.1V	7.5A	92%
V48SC12007NMFP	36~75V	4A	12V	7.5A	92%
V48SC12007NRFA	36~75V	4A	12V	7.5A	92%
V48SC12007NRFH	36~75V	4A	12V	7.5A	92%

Default remote on/off logic is negative and pin length is 0.170"
For different remote on/off logic and pin length, please refer to part numbering system above or contact your local sales office.

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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.