Q54SJ12058

700W DC/DC Power Modules

Q54SJ12058, 700W Quarter Brick DC/DC Power Modules: 40~60Vin, 12.2V/ 57.4A out

The Delphi Module Q54SJ12058, Quarter Brick, 40~60V input, single output, isolated DC/DC converter is the latest offering from a world leader in power system and technology and manufacturing — Delta Electronics, Inc. This product provides up to 700 watts of power in an industry standard footprint and pin out. With creative design technology and optimization of component placement, these converters possess outstanding electrical and thermal performances, as well as extremely high reliability under highly stressful operating conditions. The Q54SJ12058 offers more than 96.4% high efficiency at 57.4A load. The Q54SJ12058 is fully protected from abnormal input voltage, output current, and temperature conditions and meets 800V isolation.

FEATURES

- High efficiency:
- 96.4% @ 12.2V/57.4A out
- size :
  57.9 x 36.8 x 12.0mm
  (2.28"x1.45"x0.47") (open frame)
  57.9 x 36.8 x 13.4mm
  (2.28"x1.45"x0.53") (with base plate)
  57.9 x 36.8 x 25.4mm
  (2.28"x1.45"x1.00") (with heat sink)
- Standard footprint
- Pre-bias startup
- No minimum load required
- Fixed frequency operation
- Input UVP , output OTP
- Hiccup output over current protection (OCP)
- Auto recovery UVP
- Auto recovery OTP
- 800V isolation
- Remote on/off

OPTIONS

- open frame/with base plate

SOLDERING METHOD

- Wave soldering
- Hand soldering

APPLICATIONS

- Telecom / Datacom
- Wireless Networks
- Optical Network Equipment
- Server and Data Storage
- Industrial / Testing Equipment

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http://www.deltaww.com/dcdc

TECHNICAL SPECIFICATIONS

(TA=25°C, airflow rate=300 LFM, Vin=50Vdc, nominal Vout unless otherwise noted.)

PARAMETER	NOTES and CONDITIONS	Q54SJ12058			
		Min.	Typ.	Max.	Units
ABSOLUTE MAXIMUM RATINGS					
Input Voltage					
Continuous		40		60	Vdc
Operating Ambient Temperature		-40		85	°C
Storage Temperature		-40		125	°C
Input/Output Isolation Voltage				800	Vdc
INPUT CHARACTERISTICS					
Operating Input Voltage		40	50	60	Vdc
Input Under-Voltage Lockout					
Turn-On Voltage Threshold		39		40	Vdc
Turn-Off Voltage Threshold		37		39	Vdc
Lockout Hysteresis Voltage		1	2		Vdc
Maximum Input Current	57.4A Load, 40Vin			18.5	A
No-Load Input Current	Vin=50V, Io=0A	120	187	220	mA
Off Converter Input Current	Vin=50V, Io=0A		20	30	mA
Inrush Current (I^2t)				1	A^2s
Input Reflected-Ripple Current(RMS)	thru 0.68µH inductor, 2*100uF E-cap and 2*1uF ceramic cap 5Hz to 20MHz			100	mA
OUTPUT CHARACTERISTICS					
Output Voltage Set Point	Vin=50V, Io=0, Tc=25°C	12.1	12.2	12.3	Vdc
Output Voltage Regulation					
Load Regulation	Vin=50V, Io=Io min to Io max			±0.4	%Vo,set
Line Regulation	Vin=40V to 60V, Io=Io min			±0.4	%Vo,set
Temperature Regulation	Vin=50V, Tc= min to max case temperatrue			±1	%Vo,set
Total Output Voltage Range	over sample load, line and temperature	11.75		12.55	Vdc
Output Voltage Ripple and Noise	5Hz to 20MHz bandwidth				
Peak-to-Peak (under min Cout)	Full Load, 1µF ceramic, 10µF tantalum			300	mV
RMS (under min Cout)	Full Load, 1µF ceramic, 10µF tantalum			100	mV
Peak-to-Peak (under 6500uF Cout)	Full Load, Co=6500uF			120	mV
RMS (under 6500uF Cout)	Full Load, Co=6500uF			50	mV
Operating Output Current Range		0		57.4	A
Output Over Current Protection	Vin=50V, Io step=0.2A/50ms	70	75	80	A
DYNAMIC CHARACTERISTICS					
Output Voltage Current Transient					
Voltage Overshoot/Undershoot	0% to 65% to 0% Io max, Co 6500uF, 1A/µs			450	mV
Voltage Overshoot/Undershoot	50% to 75% to 50% Io max, Co1µF ceramic, 10µF tantalum, 1A/µs			750	mV
Settling Time (within 1% Vout nominal)				200	µs
Turn-On Delay and Rise Time					
Start-Up Delay Time From Input Voltage	On/off=On, from Vin=Turn-On Threshold to Vo=10% Vo,nom	15	25	35	mS
Start-Up Delay Time From On/Off Control	Vin=Vin,nom, from On/off=On to Vo=10% Vo,nom	0	3	5	mS
Output Voltage Rise Time	Vo=10% to 90% Vo,nom	15	20	25	mS
Output Capacitance	Low ESR CAP (OSCON), 100% load;	0		10000	µF
EFFICIENCY					
100% Load	Vin=50V		96.4		%
60% Load	Vin=50V		96.1		%
ISOLATION CHARACTERISTICS					
Input to Output				800	Vdc
Isolation Capacitance			1500		pF
FEATURE CHARACTERISTICS					
Switching Frequency			200		kHz
ON/OFF Control, Negative Remote On/Off logic					
Logic Low (Module On)	Von/off at Ion/off=1.0mA			0.8	V
Logic High (Module Off)	Von/off at Ion/off=0.0 µA	2.4			V
ON/OFF Current	Ion/off at Von/off=0.0V			0.2	mA
Leakage Current	Logic High, Von/off=15V			10	uA
GENERAL SPECIFICATIONS					
MTBF	Io=80% of Io, max; Ta=25°C		3.26		M hours
Weight	Open frame		63		grams
Weight	With base plate		75		grams
Weight	With heat sink		94		grams
Over-Temperature Shutdown (Without heat spreader)	Refer to Figure 17 for Hot spot1 location (50Vin,80%Po, 200LFM,Airflow from Vin+ to Vin-)		130		°C
Over-Temperature Shutdow (With heat spreader)	Refer to Figure 19 for Hot spot 2 location (50Vin,80% Io, 200LFM,Airflow from Vin+ to Vin-)		120		°C
Over-Temperature Shutdow (With 0.45" Height Heat Sink)	Refer to Figure 21 for Hot spot 3 location (50Vin,80% Io, 200LFM,Airflow from Vin+ to Vin-)		115		°C
Over-Temperature Shutdown (NTC resistor)			130		°C
Note: Please attach thermocouple on NTC resistor to test OTP function, the hot spots' temperature is just for reference.					

ELECTRICAL CHARACTERISTICS CURVES

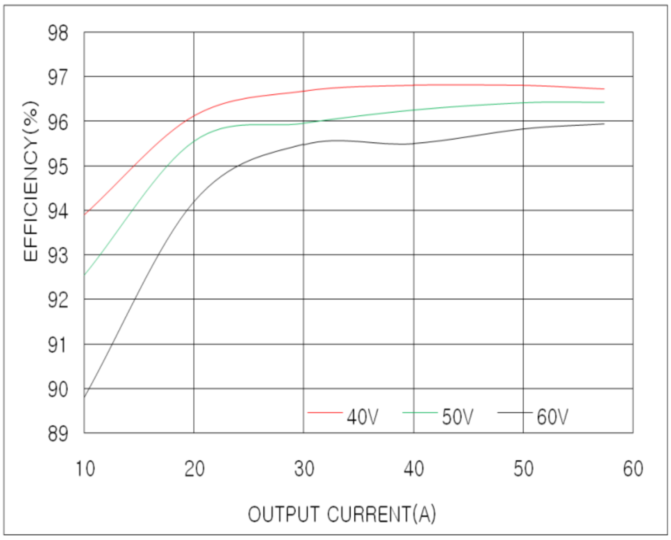


Figure 1: *Efficiency vs. load current for 40V, 50V, and 60V input voltage at 25°C.*

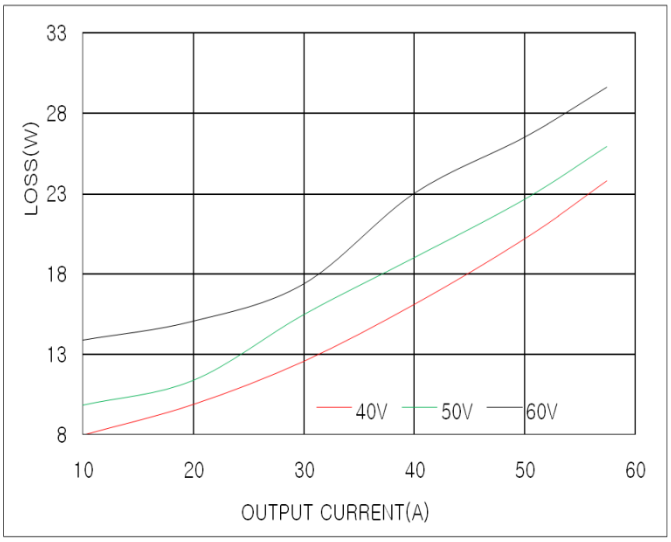


Figure 2: *Power dissipation vs. load current for 40V, 50V, and 60V input voltage at 25°C.*

ELECTRICAL CHARACTERISTICS CURVES

Start Up Waveform for Negative Remote On/Off Logic

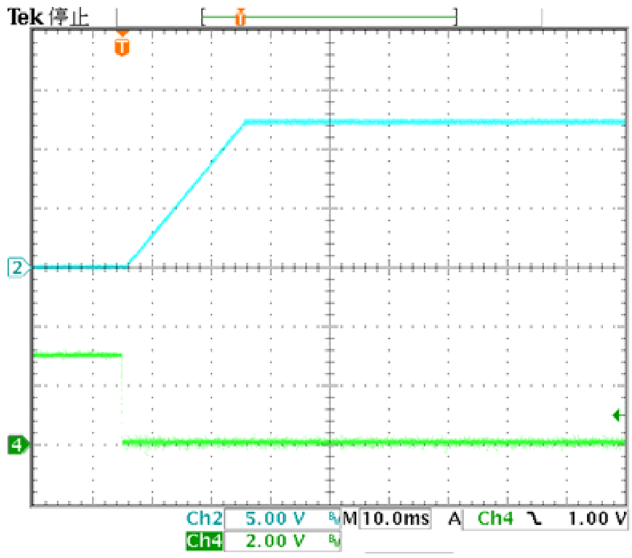


Figure 3: *Turn-on transient at zero load current) (10ms/div). Top Trace: Vout; 5V/div; Bottom Trace: ON/OFF input: 3V/div.*

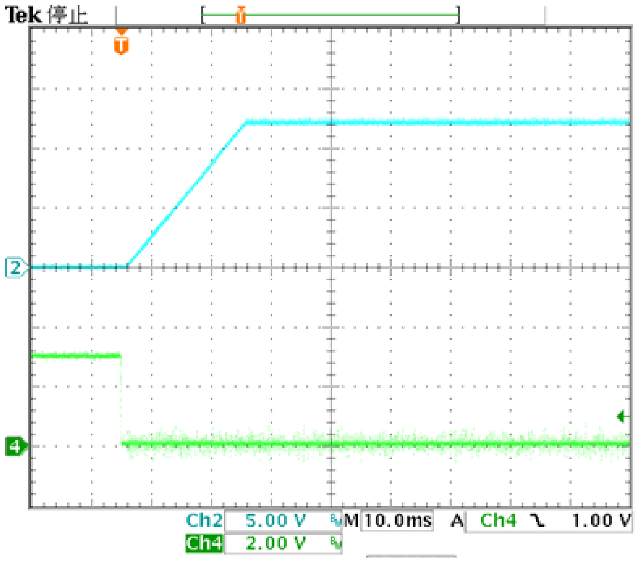


Figure 4: *Turn-on transient at full load current (10ms/div). Top Trace: Vout: 5V/div; Bottom Trace: ON/OFF input: 3V/div.*

Start Up Waveform for Input Voltage On/off

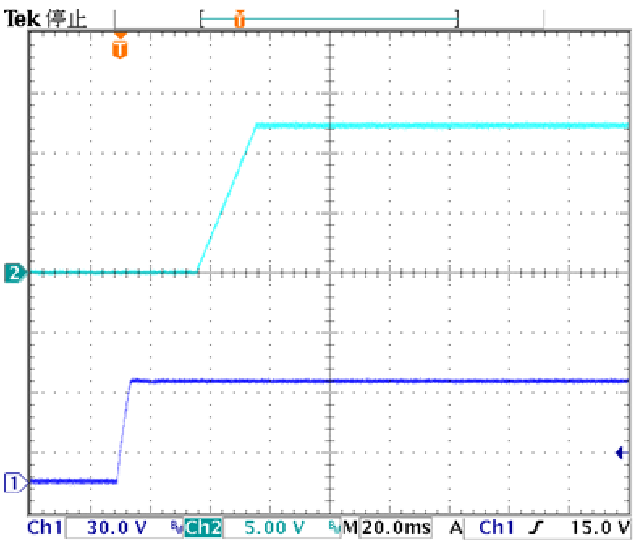


Figure 5: *Turn-on transient at zero load current (20 ms/div). Top Trace: Vout; 5V/div; Bottom Trace: input voltage: 30V/div.*

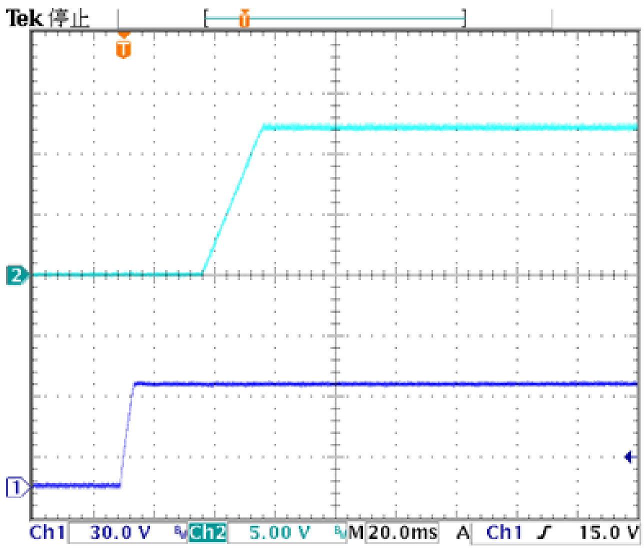


Figure 6*: Turn-on transient at full load current (20 ms/div). Top Trace: Vout; 5V/div; Bottom Trace: input voltage: 30V/div.*

ELECTRICAL CHARACTERISTICS CURVES

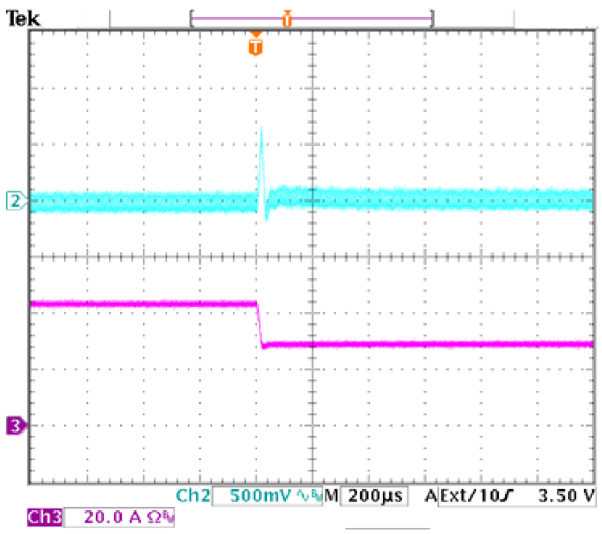


Figure 7: *Output voltage response to step-change in load current (75%-50% of full load; di/dt = 1A/µs). Load cap: minimum output capacitor, 10µF tantalum capacitor and 1µF ceramic capacitor. Trace: Vout; 500mV/div; Time: 200us/div*

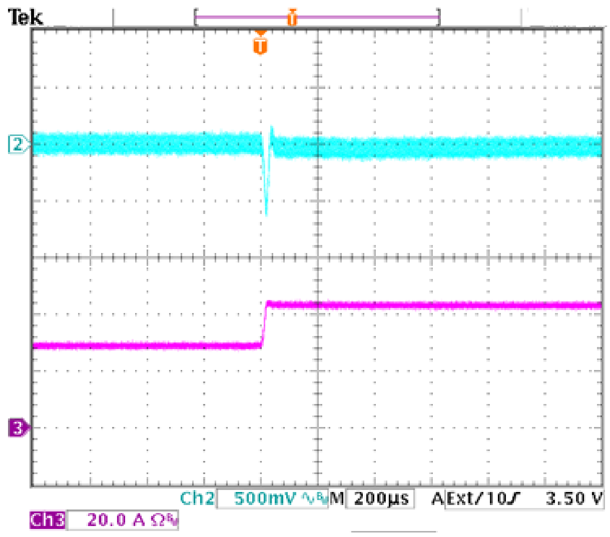


Figure 8: *Output voltage response to step-change in load current (50%-75% of full load; di/dt = 1A/µs). Load cap: minimum output capacitor, 10µF tantalum capacitor and 1µF ceramic capacitor. Trace: Vout; 500mV/div; Time: 200us/div*

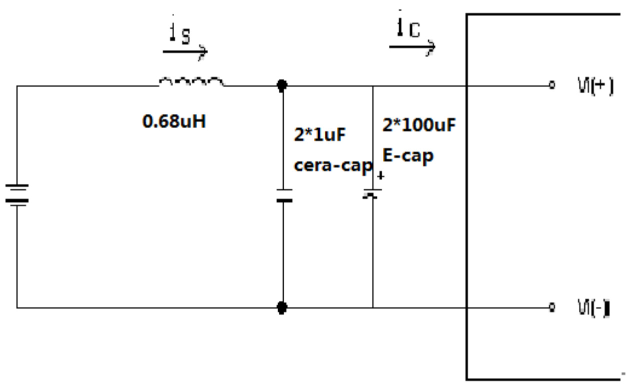


Figure 9: *Test set-up diagram showing measurement points for Input Terminal Ripple Current and Input Reflected Ripple Current.*
*Note: Measured input reflected-ripple current with a simulated source Inductance (L_{TEST}) of 0.68 µH and simulated source Inductance Capacitor of 2*1uF ceramic capacitor and 2*100uF electrolytic capacitor.*

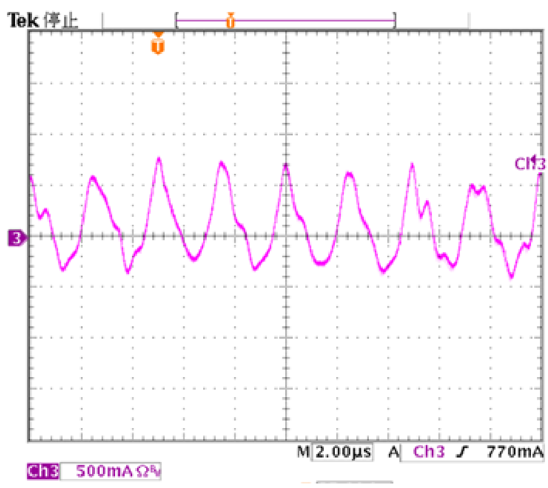
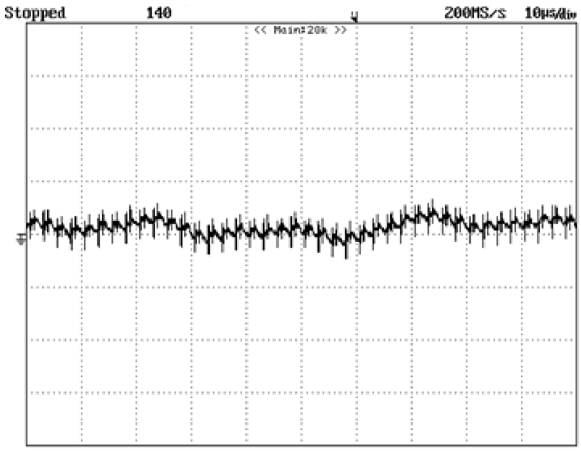


Figure 10: *Input Terminal Ripple Current, i_c, at max output current and nominal input voltage with 0.68µH source impedance and Capacitor of 2*1uF ceramic capacitor and 2*100uF electrolytic capacitor. (500mA/div，2us/div).*



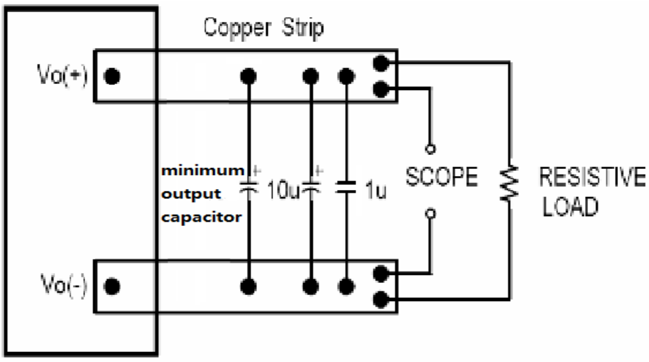
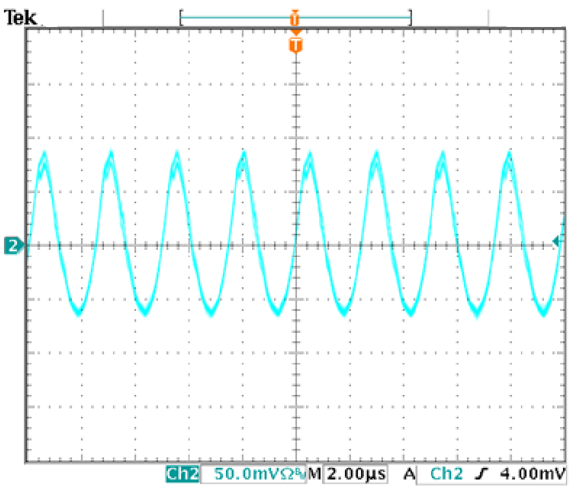


Figure 11: *Input reflected ripple current, i_s, through a 0.68µH source inductor at nominal input voltage and max load current (50mA/div，10us/div).*

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



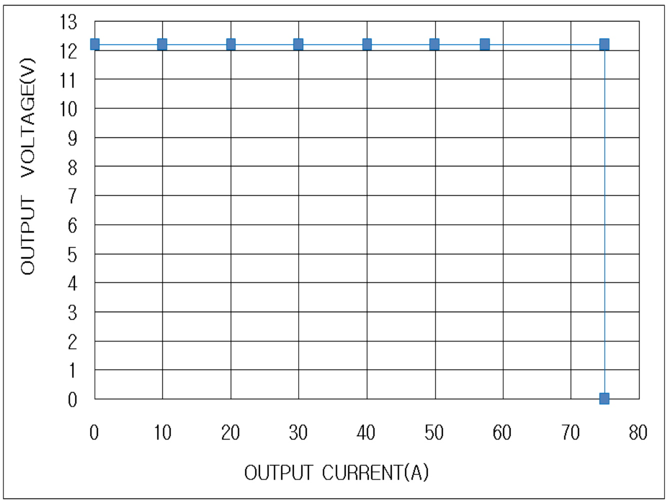


Figure 13: *Output voltage ripple at nominal input voltage and max load current (50 mV/div, 2us/div)*
Load capacitance: 1µF ceramic capacitor and 10µF tantalum capacitor. Bandwidth: 20 MHz.

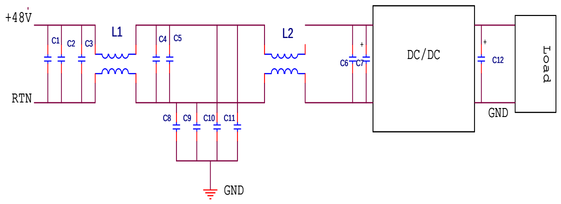
Figure 14: *Output voltage vs. load current (Vin=50V)*

LAYOUT AND EMC CONSIDERATIONS

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. 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.

Below is the schematic of input filter for the test of Q48SJ12056NNFH to meet class B.

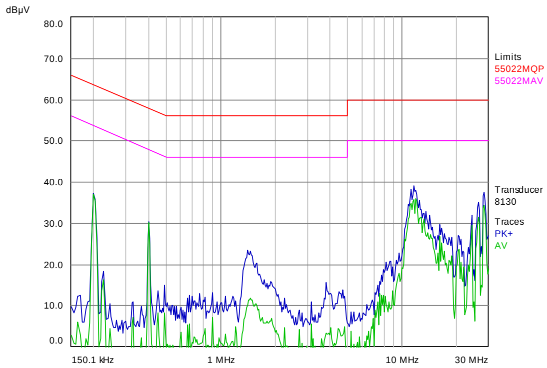
Schematic and Components List



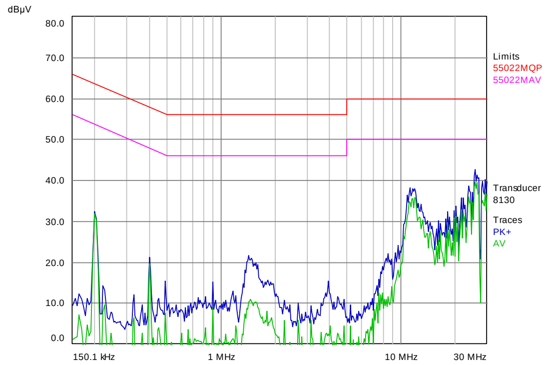
C1 - C5 are 100V/1uF/K/1210, GRM32CR72A105K, MURATA;
L1, L2 are 0.47mH±35%/14A, P0502NL, Pulse;
C6 is 100V/0.1uF/K/1206, GCM319R72A104K, MURATA;
C7 are 2*(100V/0.1uF/M/P5), EGXE101ELL101MK20S, NCC;
C8, C10 are 2*(630V/0.22uF/K/2220), CKG57KX7R2J224KT, TDK;
C9, C11 are 250VAC/0.01uF Y2/X1, CS17-F2GA103MYNSC, TDK;
C12 is 16V/470uF/m/TP, EMZA160ADA471MHA0G, NCC.

Test Result

Test result is in compliance with VCCI class B, which is shown as below:



L line@Vin=48V



N line@Vin=48V

FEATURES DESCRIPTIONS

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.

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.

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. The module will restart after the temperature is within specification.

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.

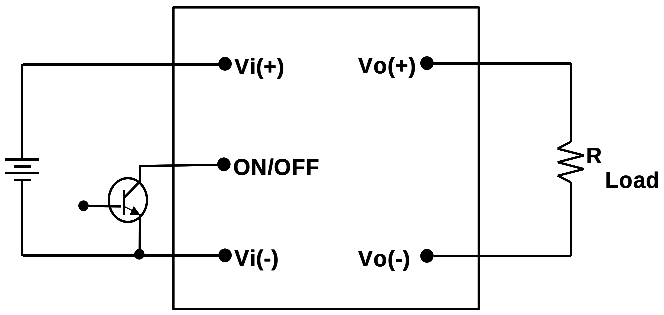


Figure 15: *Remote on/off implementation*

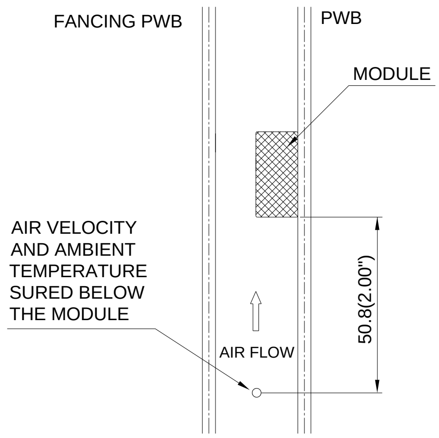
THERMAL CONSIDERATIONS

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.

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 185mmX185mm,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 (WITHOUT HEAT SPREADER)

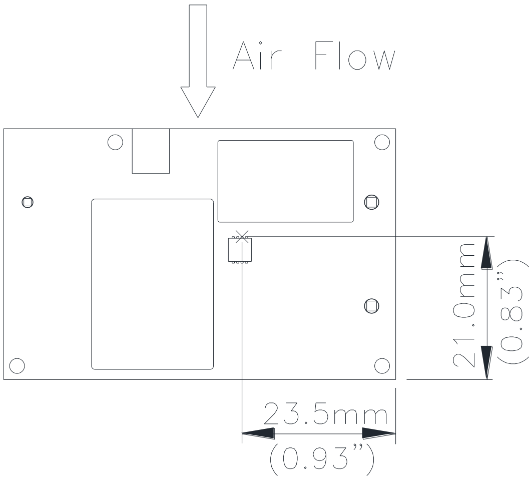


Figure 17: *Hot spot's temperature measurement location*
The allowed maximum hot spot's temperature is defined at 120 ℃.

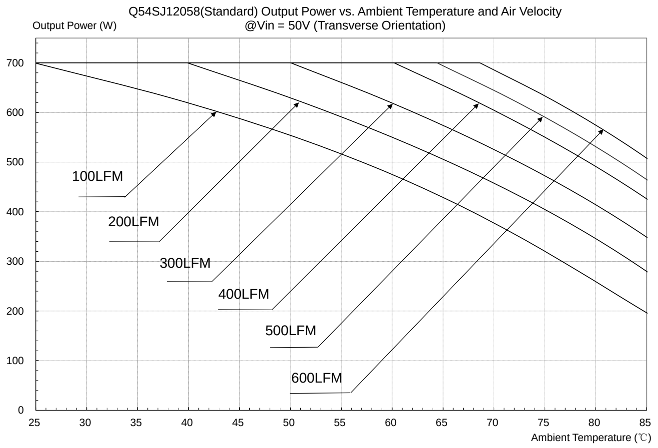


Figure 18: *Output power vs. ambient temperature and air velocity @ Vin=50Vin (Transverse Orientation, airflow from Vin+ to Vin-, without heat spreader)*

THERMAL CURVES (WITH HEAT SPREADER)

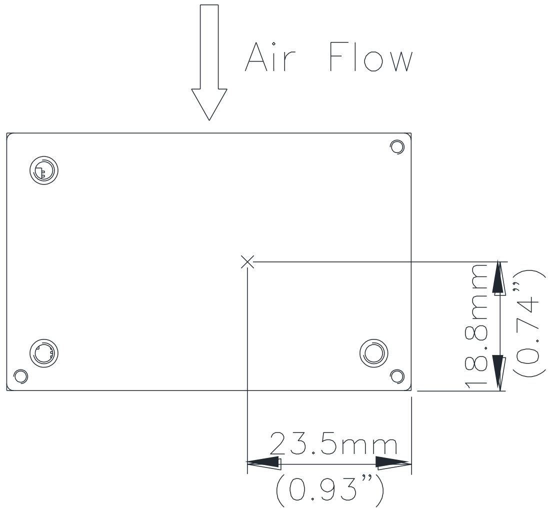


Figure 19: *Hot spot's temperature measurement location*
The allowed maximum hot spot's temperature is defined at 110 ℃.

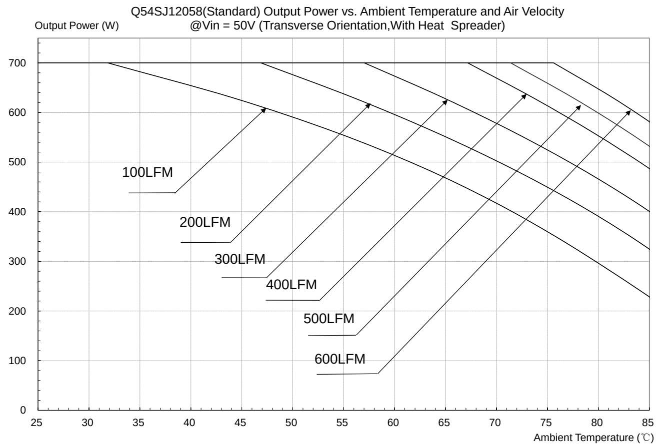


Figure 20: *Output power vs. ambient temperature and air velocity @ Vin=50Vin (Transverse Orientation, airflow from Vin+ to Vin-, with heat spreader)*

![DELTA logo]

THERMAL CURVES
(WITH 0.45" HEIGHT HEAT SINK)

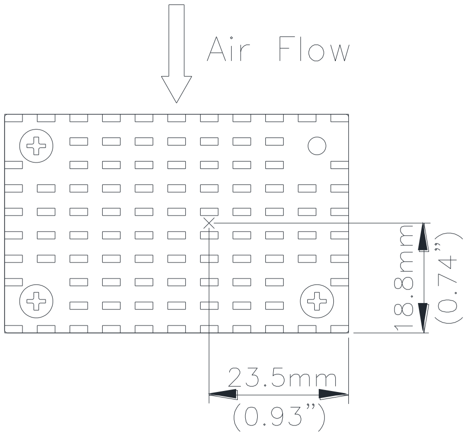


Figure 21: *Hot spot 3's temperature measurement location*
The allowed maximum hot spot's temperature is defined at 105℃

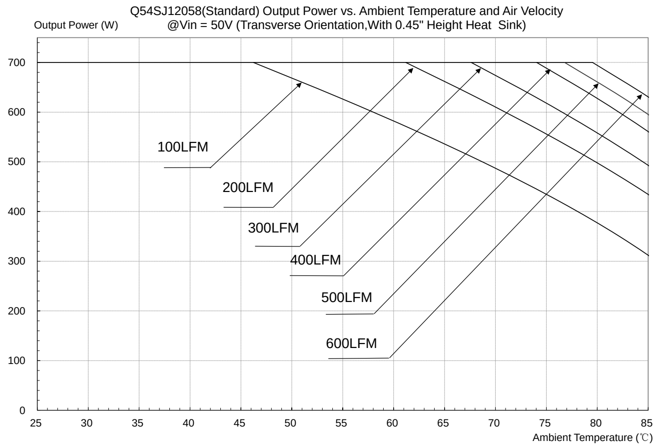
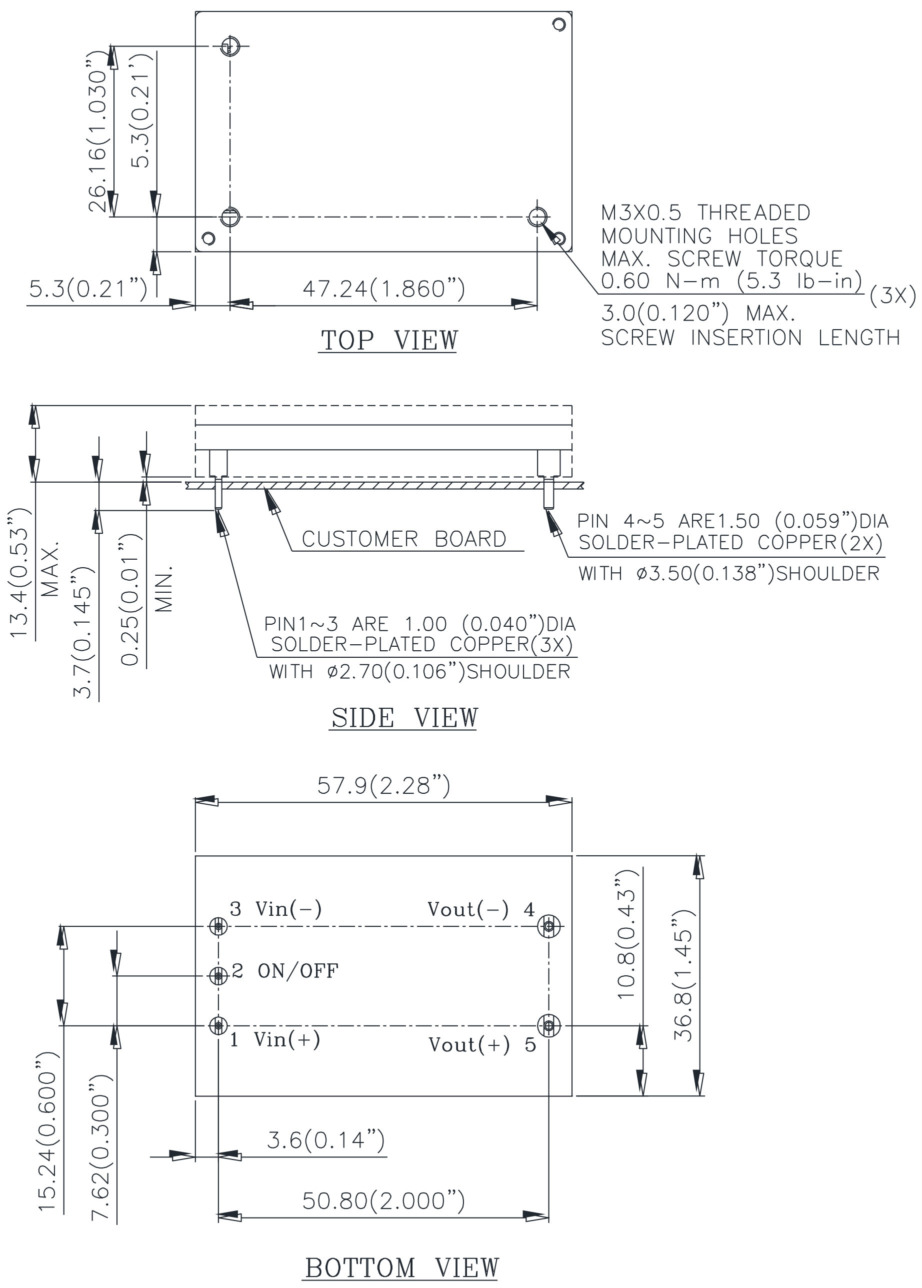


Figure 21: *Output power vs. ambient temperature and air velocity @ Vin=50Vin (Transverse Orientation, airflow from Vin+ to Vin-, with 0.45" Height Heat Sink)*

MECHANICAL DRAWING (WITH BASE PLATE)

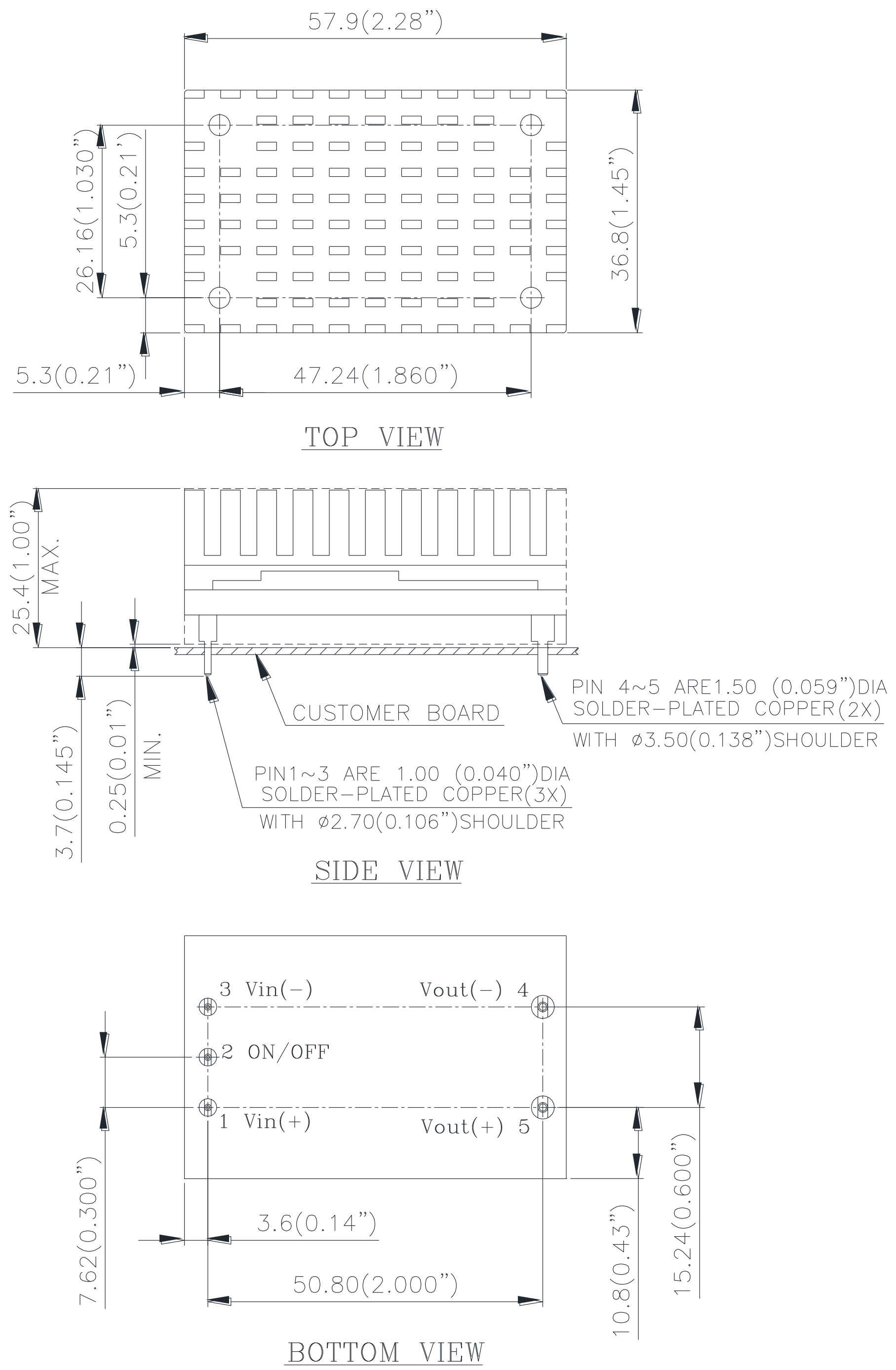
For modules with through-hole pins and the optional heat spreader, they are intended for wave soldering assembly onto system boards, please do not subject such modules through reflow temperature profile.



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.)

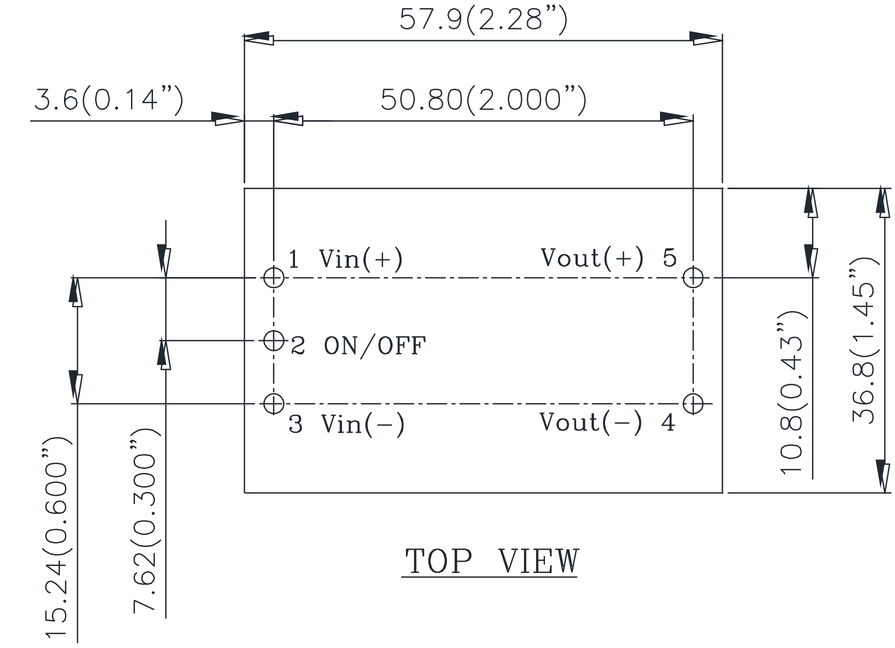
MECHANICAL DRAWING (WITH HEAT SINK)

For modules with through-hole pins and the optional heat spreader, they are intended for wave soldering assembly onto system boards, please do not subject such modules through reflow temperature profile.

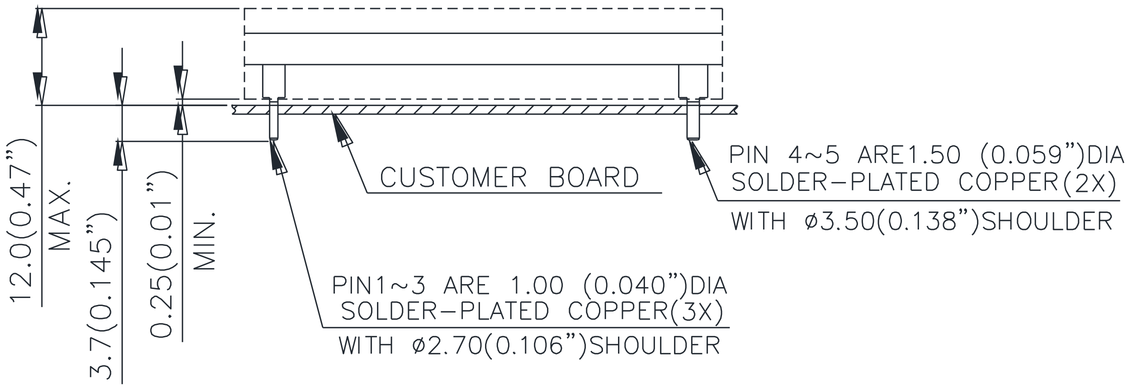


NOTES:
DIMENSIONS ARE IN MILLIMETERS AND (INCHES)
TOLERANCES: X.Xmm±0.5mm(X.XX in.±0.02 in.)
X.XXmm±0.25mm(X.XXX in.±0.010 in.)

MECHANICAL DRAWING (OPEN FRAME)



TOP VIEW



SIDE VIEW

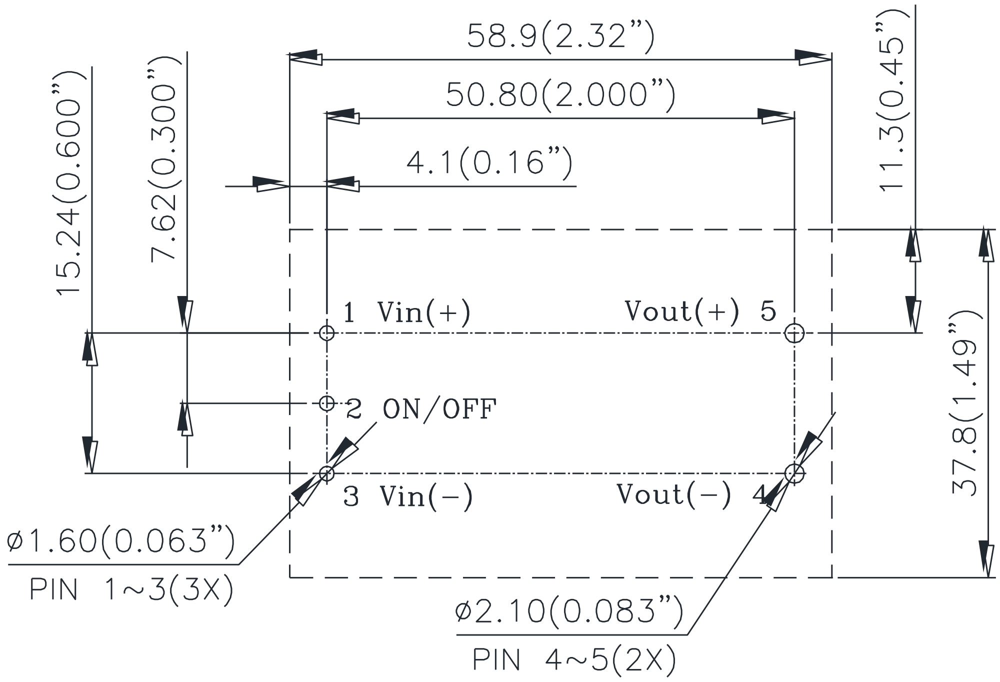
NOTES:
DIMENSIONS ARE IN MILLIMETERS AND (INCHES)
TOLERANCES: X.Xmm±0.5mm(X.XX in.±0.02 in.)
X.XXmm±0.25mm(X.XXX in.±0.010 in.)

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	+Vout	positive output voltage

Pin Specification:

Pins 1,2,3 1.00mm (0.040") diameter
Pins 4,5 1.50mm (0.060") diameter
All pins are copper alloy with matte Tin plating and Nickel under plating

RECOMMENDED PAD LAYOUT



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.)

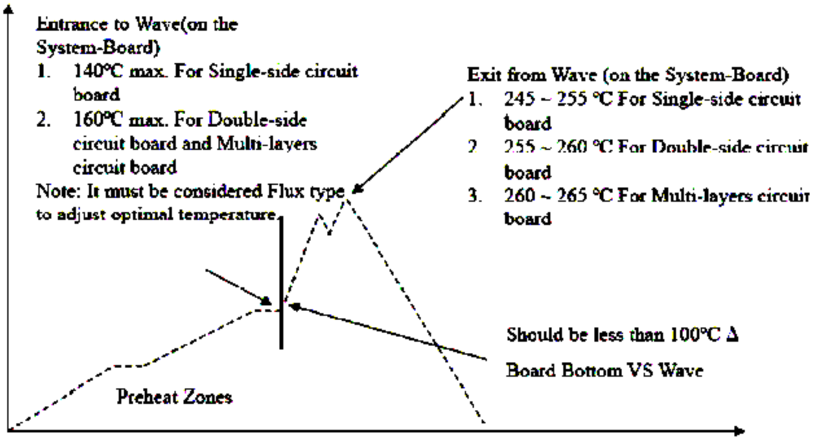
SOLDERING METHOD

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.

Reflow soldering is not a suggested method for through-hole power modules due to many process and reliability concerns. If you have this kind of application requirement, please contact Delta sales or FAE for further confirmation.

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

Table 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

PART NUMBERING SYSTEM

Q	54	S	J	120	58	N	N	F	A
Product Series	Input Voltage	Numbers of Outputs	Product Series	Output Voltage	Output Current	On/Off logic	Pin length		Option Code
Q - QB	54 - 40~60	S - Single	J - high power	120 - 12.2V	58 - 57.4A	N - negative P - positive	R - 0.170" N - 0.145" K - 0.110"-	F- RoHS 6/6 (Lead Free)	A - open frame H - with base plate F - with heat sink P - with base plate & hard tray

RECOMMENDED PART NUMBER

Model Name	Packaging	Input Voltage	Output Voltage	Output Current	Efficiency 54Vin,12.2Vdc @ 62A
Q54SJ12058NNFA	Through hole	40~60V	12.2V	57.4A	96.4%
Q54SJ12058NNFH	Through hole	40~60V	12.2V	57.4A	96.4%
Q54SJ12058NRFH	Through hole	40~60V	12.2V	57.4A	96.4%

*** For modules with through-hole pins and the optional heatspreader, they are intended for wave soldering assembly onto system boards; please do not subject such modules through reflow temperature profile.**

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