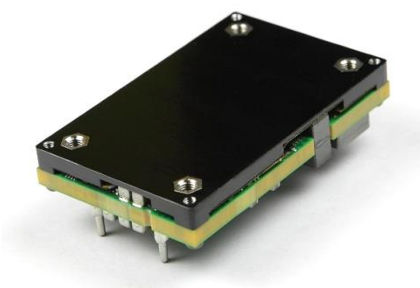
Q48SJ12056

750W DC/DC Power Modules



FEATURES

- High efficiency:
- 96.2% @ 12.2V/62A out
- size:
  57.9 x 36.8 x 13.4mm (2.28"x1.45"x0.53")
- Standard footprint
- Pre-bias startup
- No minimum load required
- Fixed frequency operation
- Input UVP/OVP, output OTP
- Hiccup output over current protection (OCP)
- Auto recovery UVP/OVP
- Auto recovery OTP
- 500V isolation
- Remote on/off
- UL/cUL 60950-1 (US & Canada)

Q48SJ12056, 750W Quarter Brick DC/DC Power Modules: 46~60Vin, 12.2V/ 62A out

The Delphi Module Q48SJ12056, Quarter Brick, 46~60V 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 750 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 Q48SJ12056 offers more than 96.2% high efficiency at 62A load. The Q48SJ12056 is fully protected from abnormal input voltage, output current, and temperature conditions and meets 500V isolation.

OPTIONS

- Negative or Positive remote On/Off

APPLICATIONS

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

PARAMETER	NOTES and CONDITIONS	Q48SJ12056			
		Min.	Typ.	Max.	Units
ABSOLUTE MAXIMUM RATINGS					
Input Voltage					
Continuous		46		60	Vdc
Operating Temperature (IBC base plate)		-40		70	°C
Storage Temperature		-40		125	°C
Input/Output Isolation Voltage				500	Vdc
INPUT CHARACTERISTICS					
Operating Input Voltage		46	54	60	Vdc
Input Under-Voltage Lockout					
Turn-On Voltage Threshold		42		44	Vdc
Turn-Off Voltage Threshold		40		42	Vdc
Lockout Hysteresis Voltage		2			Vdc
Maximum Input Current	62A Load, 46Vin			17.2	A
No-Load Input Current	Vin=54V, Io=0A		210		mA
Off Converter Input Current	Vin=54V, Io=0A		22		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=54V, Io=0, Tc=25°C	12.1	12.2	12.3	Vdc
Output Voltage Regulation					
Load Regulation	Vin=54V, Io=Io min to Io max			1	%Vo,set
Line Regulation	Vin=46V to 60V, Io=Io min			1	%Vo,set
Temperature Regulation	Vin=54V, Tc= min to max case temperatrue			1	%Vo,set
Total Output Voltage Range	over sample load, line and temperature	11.4		12.6	Vdc
Output Voltage Ripple and Noise	5Hz to 20MHz bandwidth				
Peak-to-Peak	Full Load, Co=6500uF, 1µF ceramic, 10µF tantalun			120	mV
RMS	Full Load, Co=6500uF, 1µF ceramic, 10µF tantalun			50	mV
Operating Output Current Range(long term)		0		62	A
Output Peak Power(4ms)				1150	W
Output Over Current Protection	Vin=54V, when Vo<10%Vo.set Io step=0.2A/50ms	73		83	A
DYNAMIC CHARACTERISTICS					
Output Voltage Current Transient	54V, 6500uF&10µF Tan & 1µF Ceramic load cap, 1A/µs				
Positive Step Change in Output Current	0% Io.max to 65%			450	mV
Negative Step Change in Output Current	65% Io.max to 0%			450	mV
Settling Time (within 1% Vout nominal)			20		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;	6500		10000	µF
EFFICIENCY					
100% Load	Vin=54V		96.2		%
60% Load	Vin=54V		95.8		%
ISOLATION CHARACTERISTICS					
Input to Output				500	Vdc
Isolation Capacitance			1000		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		3.7		M hours
Weight			75		grams
Over-Temperature Shutdown (With Heat Spreader)	Refer to Figure 17 for Hot spot location (54Vin,100%Io)		88		°C

ELECTRICAL CHARACTERISTICS CURVES

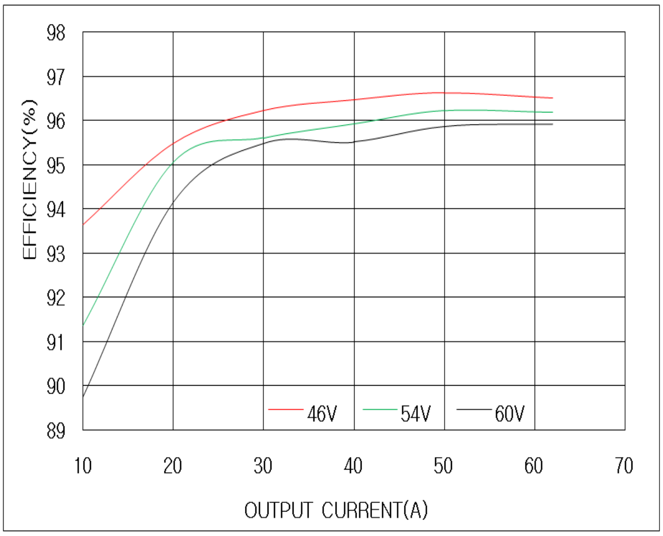


Figure 1: *Efficiency vs. load current for 46V, 54V, and 60V input voltage at 25°C.*

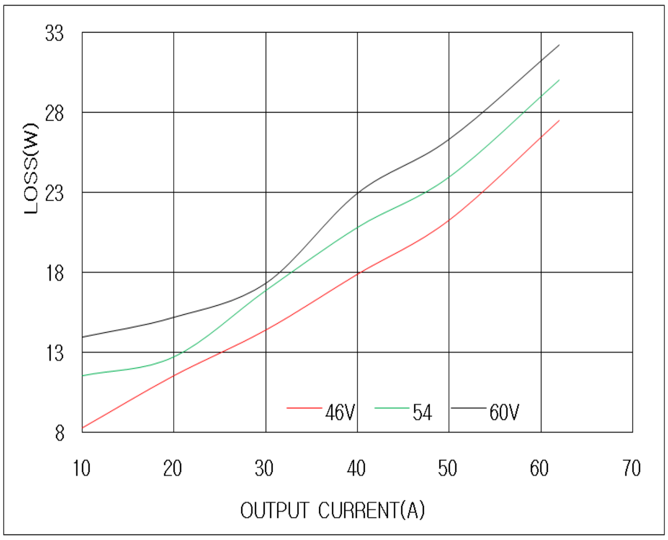


Figure 2: *Power dissipation vs. load current for 46V, 54V, and 60V input voltage at 25°C.*

ELECTRICAL CHARACTERISTICS CURVES

For Negative Remote On/Off Logic

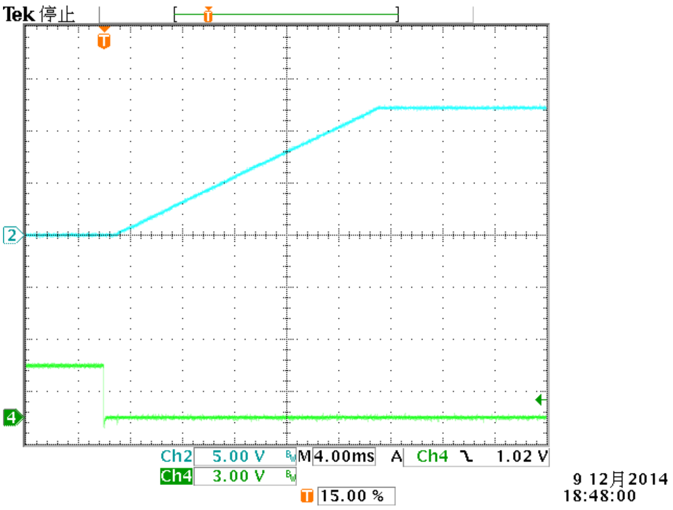


Figure 3: *Turn-on transient at zero load current) (4ms/div). Top Trace: Vout; 5V/div; Bottom Trace: ON/OFF input: 3V/div.*

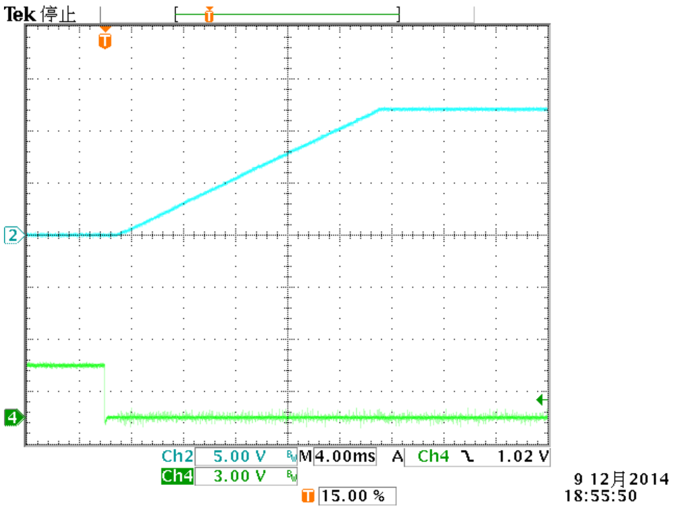


Figure 4: *Turn-on transient at full load current (4ms/div). Top Trace: Vout: 5V/div; Bottom Trace: ON/OFF input: 3V/div.*

For Input Voltage Start up

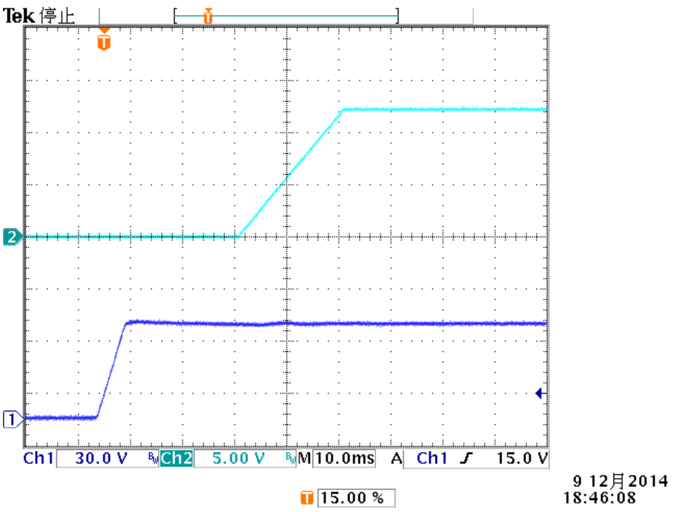


Figure 5: *Turn-on transient at zero load current (10 ms/div). Top Trace: Vout; 5V/div; Bottom Trace: input voltage: 30V/div.*

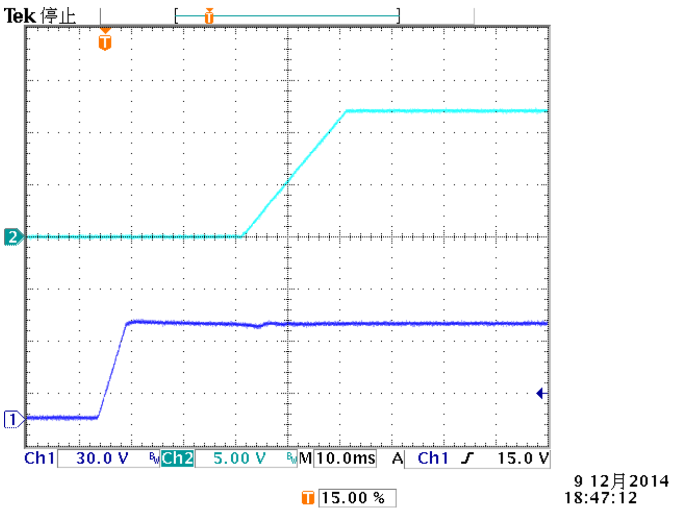


Figure 6*: Turn-on transient at full load current (10 ms/div). Top Trace: Vout; 5V/div; Bottom Trace: input voltage: 30V/div.*

ELECTRICAL CHARACTERISTICS CURVES

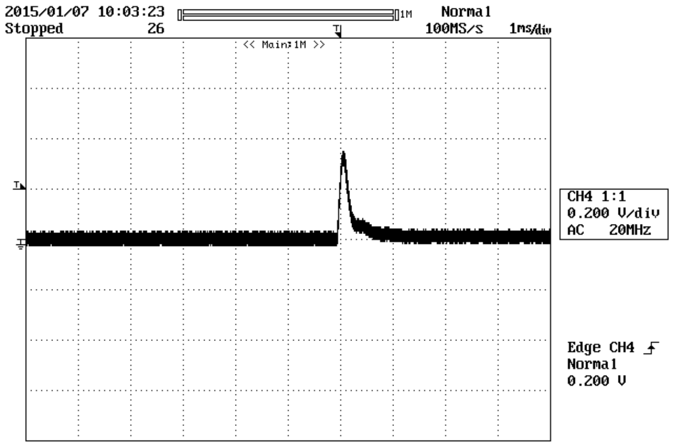


Figure 7: *Output voltage response to step-change in load current (65%-0% of full load; di/dt = 1A/µs). Load cap: minimum output capacitor, 10µF tantalum capacitor and 1µF ceramic capacitor. Trace: Vout; 200mV/div; Time: 1ms/div*

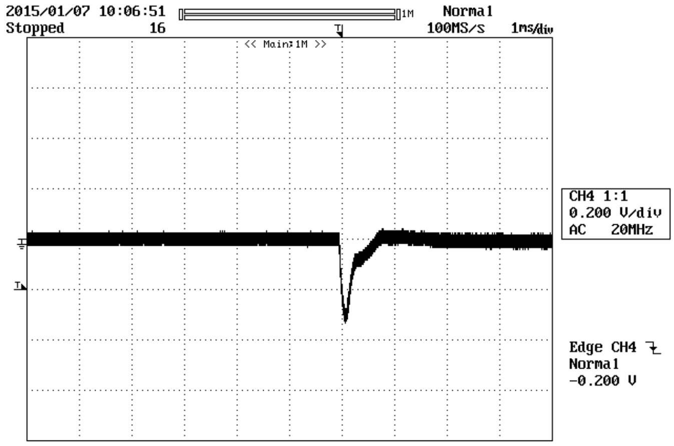


Figure 8: *Output voltage response to step-change in load current (0%-65% of full load; di/dt = 1A/µs). Load cap: minimum output capacitor, 10µF tantalum capacitor and 1µF ceramic capacitor. Trace: Vout; 200mV/div; Time: 1ms/div*

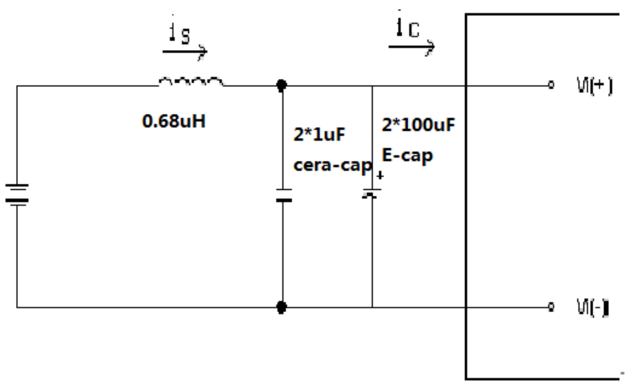


Figure 9: *Test set-up diagram showing measurement points for Input Terminal Ripple Current and Input Reflected Ripple Current.*
*Note: Measured input reflected-ripple current with a simulated source Inductance (L_{TEST}) of 0.68 µH and simulated source Inductance Capacitor of 2*1uF ceramic capacitor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

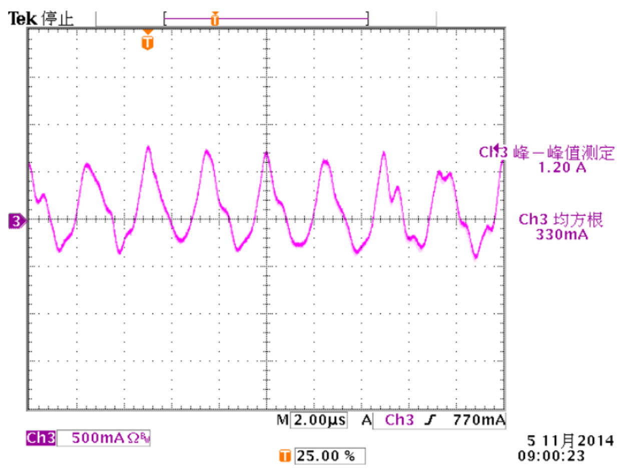


Figure 10: *Input Terminal Ripple Current, i_c, at max output current and nominal input voltage with 0.68µH source impedance and Capacitor of 2*1uF ceramic capacitor and 2*100uF electrolytic capacitor. (500mA/div，2us/div).*

ELECTRICAL CHARACTERISTICS CURVES

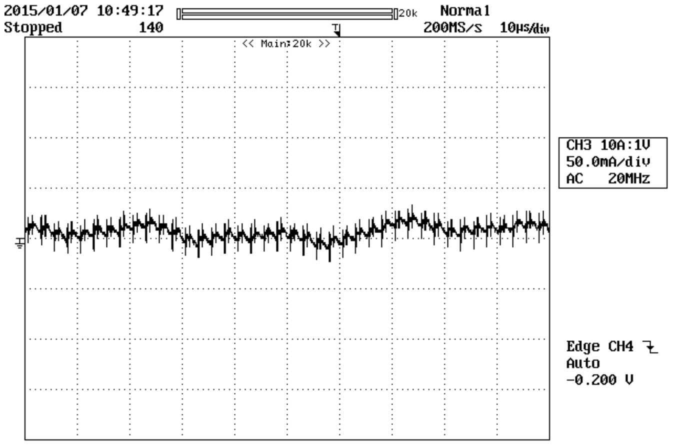


Figure 11: *Input reflected ripple current, i_s, through a 0.68µH source inductor at nominal input voltage and max load current (50mA/div，10us/div).*

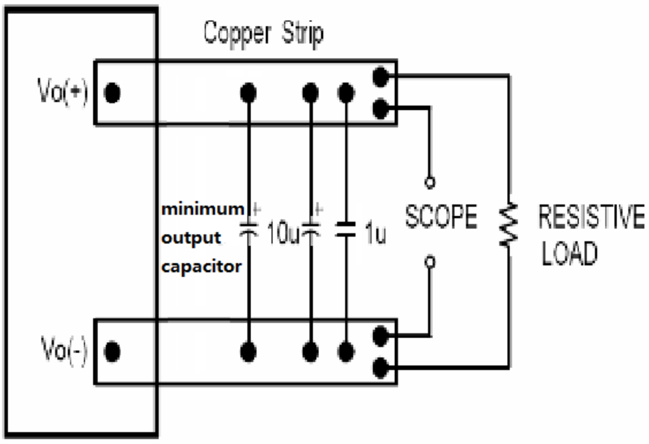


Figure 12: *Output voltage noise and ripple measurement test setup.*

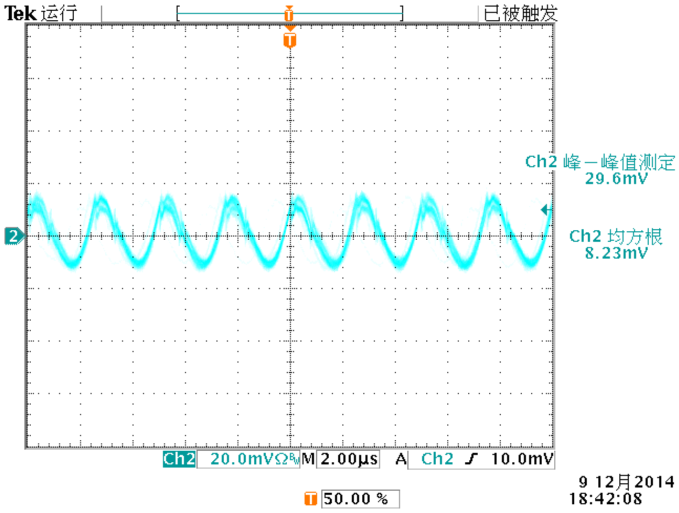


Figure 13: *Output voltage ripple at nominal input voltage and max load current (20 mV/div, 2us/div)*
Load capacitance: 1µF ceramic capacitor and 10µF tantalum capacitor. Bandwidth: 20 MHz.

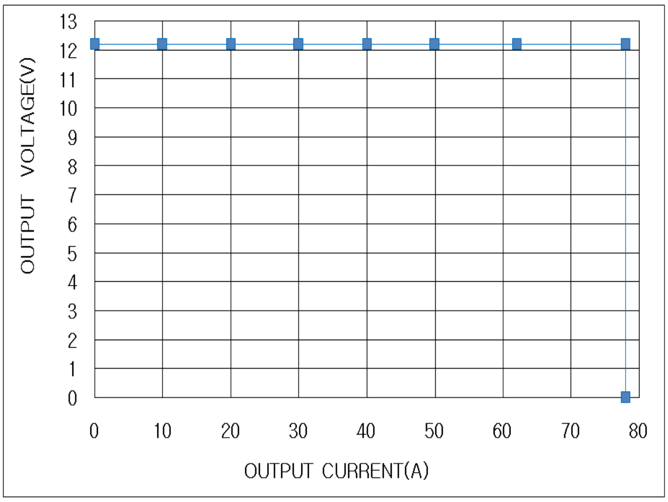


Figure 14: *Output voltage vs. load current (Vin=54V)*

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. An input filter between input source and DC/DC power modules is recommended, please refer to the Figure 9.

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. Application notes to assist designers in addressing these issues are pending release.

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.

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 shut down (hiccup mode).The hiccup time will last 1s.

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 modules will shut down, and enter the auto-restart mode.

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For auto-restart mode, the module will monitor the module temperature after shutdown. Once the temperature of module is decreased by an OTP hysteresis, the module will restart.

Remote On/Off

The remote on/off feature on the module can be either negative or positive logic depend on the part number options on the last page.

- For Negative logic version, turns the module on during a external logic low and off during a logic high. If the remote on/off feature is not used, please short the on/off pin to Vi (-).
- For Postive logic version, turns the modules on during a external logic high and off during a logic low. If the remote on/off feature is not used, please leave the on/off pin to floating.

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.

The DC level on/off signal is suggested.

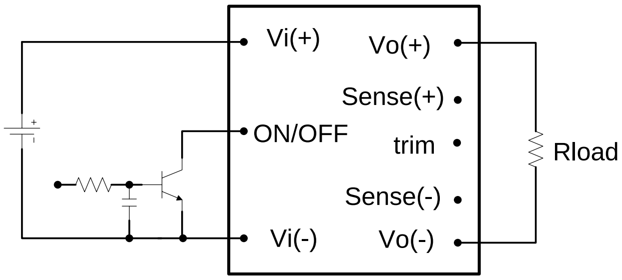


Figure 15: *Remote on/off implementation*

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

The following figure shows the thermal test setup. The power module is mounted on a test PWB in a sealed enclosure and the heat spreader top side is attached to a clod plate with thermal interface material.

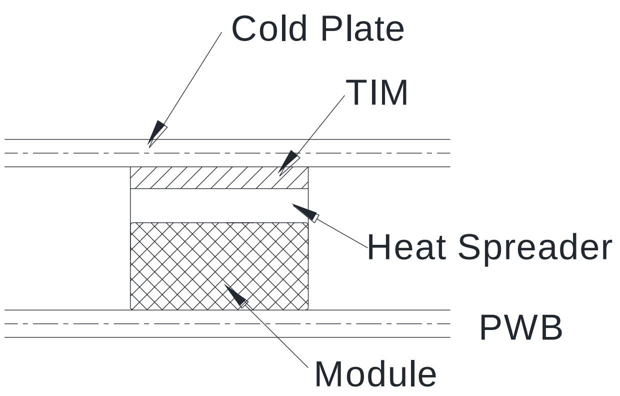


Figure 16: *Thermal test setup*

Thermal Derating

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 (WITH HEAT SPREADER)

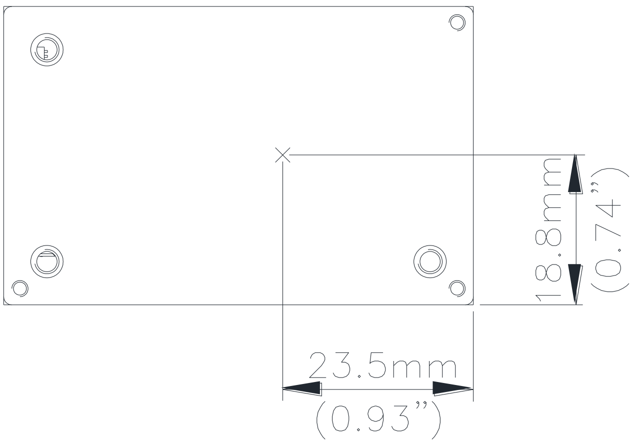


Figure 17: *Hot spot's temperature measurement location*
The allowed maximum hot spot on heat spreader temperature is defined at 70℃.

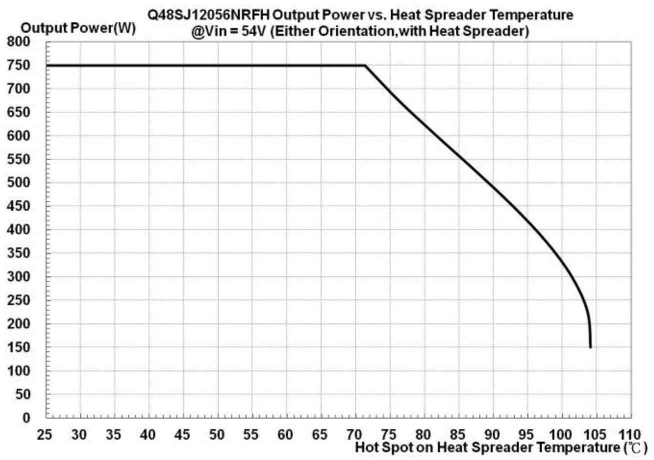
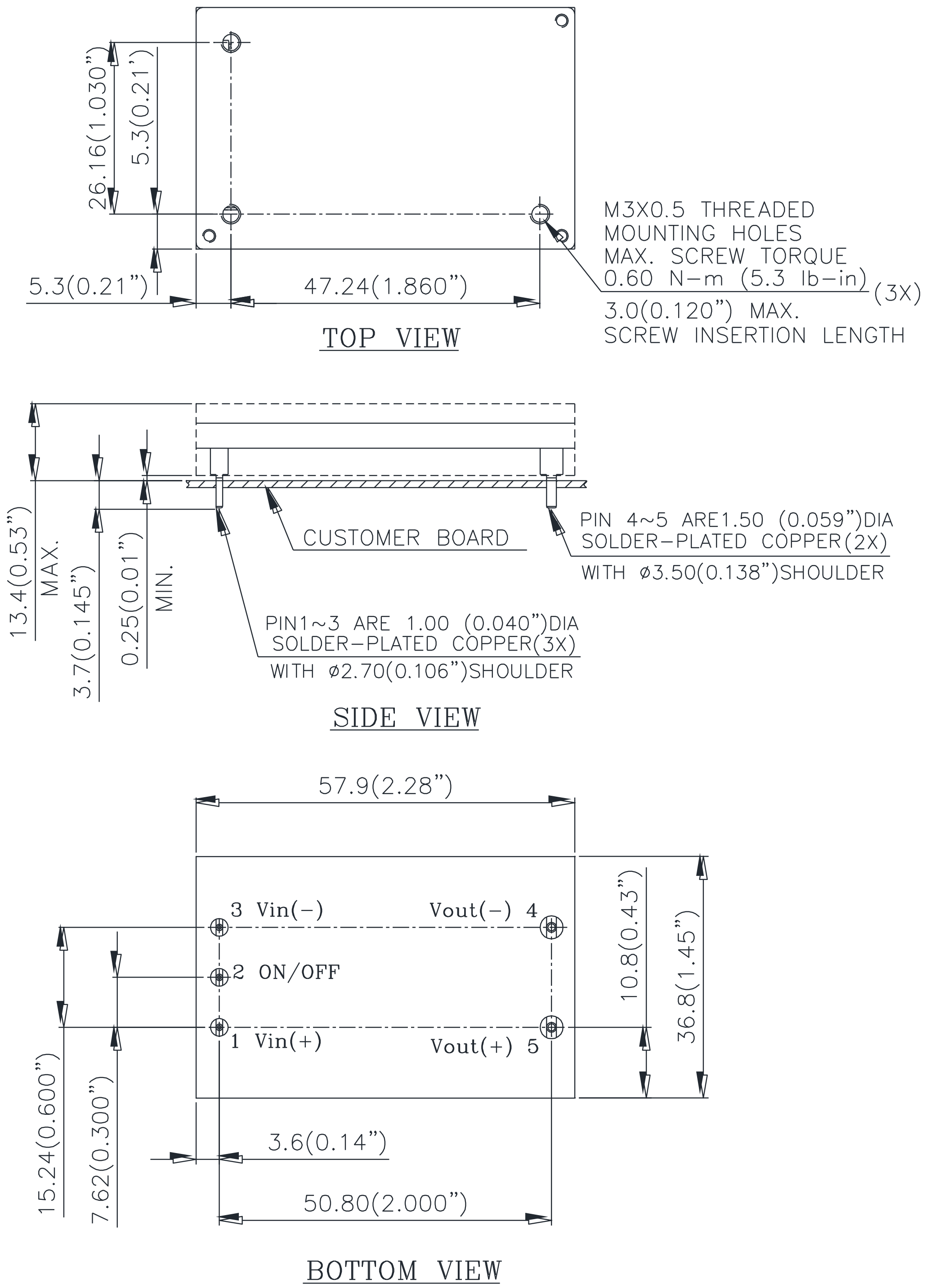


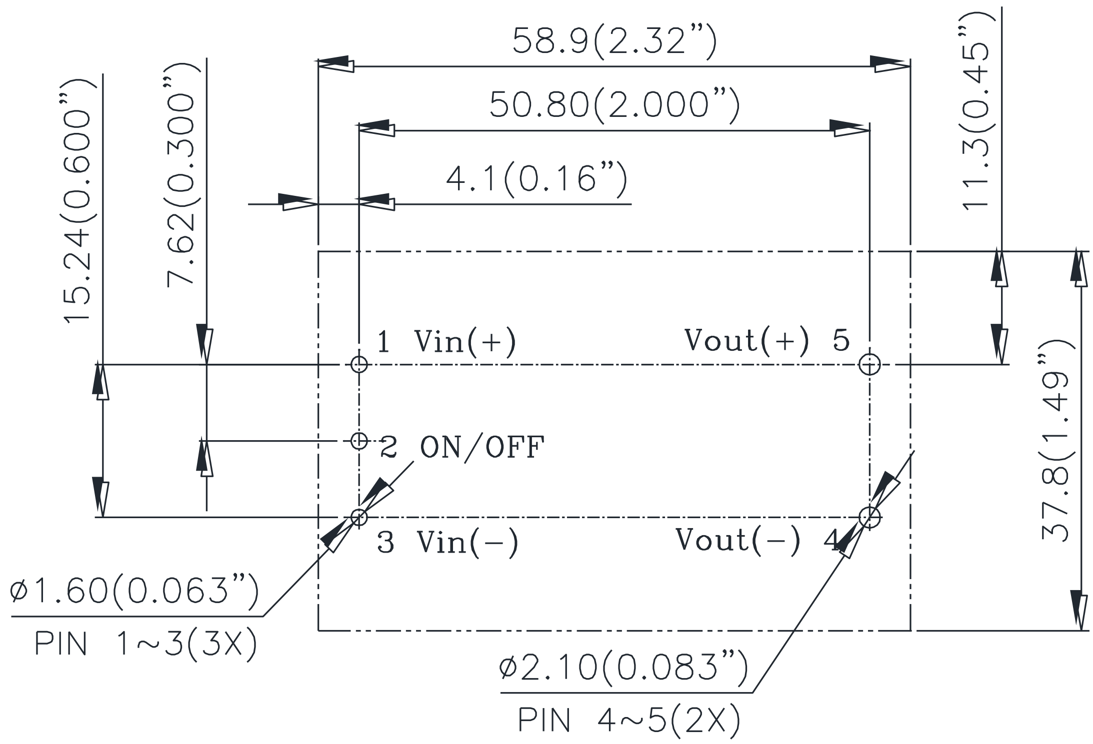
Figure 18: *Output power vs. Hot spot on the heat spreader temperature @Vin = 54V (Heat spreader is attached to Cold Plate)*

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.)

RECOMMENDED PAD LAYOUT (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.)

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

PART NUMBERING SYSTEM

Q	48	S	J	120	56	N	N	F	H
Type of Product	Input Voltage	Numbers of Outputs	Product Series	Output Voltage	Output Current	On/Off Logic	Pin Length		Option Code
Q - Quarter Brick	48 – 46~60	S - Single	J- High Power	120- 12.2V	56 - 62A	N- Negative P- Positive	C - 0.180" R - 0.170" N - 0.145"	F- RoHS 6/6 (Lead Free)	H - With heat-spreader

MODEL LIST

Model Name	Packaging	Input Voltage	Output Voltage	Output Current	Efficiency 54Vin,12.2Vdc @ 62A
Q48SJ12056NNFH	Through Hole	46~60V	12.2V	62A	96.0%

*** 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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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.

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