400QBW_2.25 series

400W -Brick - Single Output DC-DC Converter - Wide Input
Isolated & Regulated

DC-DC Converter 400 Watt

- **Wide input voltage range: 36-75VDC**
- **High efficiency up to 95%**
- **Basic insulation, I/O isolation test voltage 2250VDC**
- **Operating ambient temp. range -40°C to +85°C**
- **Input under-voltage protection, output over–voltage, over-current, short-circuit, over-temperature protection**
- **Industry standard 1/4-Brick package and pin-out**
- **Meets EN62368 standards**

The 400QBW_2.25 series meets CLASS B of CISPR32/EN55032 standards by adding the recommended external components, and they are widely used in applications such as battery power supplies, industrial control, electricity, instruments, communication and intelligent robotic. It's a high-performance product designed for the field of communication power supply. The DC-DC converters feature 400W output power with no requirement for minimum load, wide input voltage from 36-75VDC, and allowing operating temperature as high as 85°C. Additional product features include input under-voltage protection, output over-voltage, over-current, short-circuit and over-temperature protection, remote On/Off control, remote sense compensation, output voltage trim adjustment.

Common specifications

Short circuit protection	Hiccup Mode Automatic recovery
Efficiency	94% (Vin = 48V, 30% to 100% load Ambient Temperature 25°C)
Operation temperature	-40°C~+85°C (Ambient Temperature)
Storage temperature	-55°C ~+125°C
Storage humidity range	5% MIN. 90% MAX. Non-condensing
Lead Temperature	300°C MAX. Soldering spot is 1.5mm away from case for 10 seconds
Shock And Vibration	10-150Hz, 5G, 0.75mm. along X, Y and Z
MTBF	1000 k hours (MIL-HDBK-217F@25°C)
Case Material	Aluminum alloy case
Cooling Method	Free air convection or forced air convection
Dimension	Without heat sink mounting. 57.9x36.8x12.9mm Heat sink mounting. 57.9x36.8 x 25.6mm Aluminum baseplate mounting. 62.0x56.0x14.7mm
Weight	Without heat sink mounting. 71.4g(Typ.) Heat sink mounting. 102.8g(Typ.) Aluminum baseplate mounting. 91.4g(Typ.)

Output specifications

Item	Test condition	Min	Typ	Max	Units
Voltage accuracy			±1	±3	%
Line regulation	Input voltage variation from low to high at full load		±0.2	±0.5	%
Load regulation	5%-100% load		±0.5	±0.75	%
Transient Recovery Time	25% load step change		300	500	μs
Transient Response Deviation	25% load step change		±3	±5	%
Temperature Coefficient	Full load			±0.03	%/°C
Ripple & Noise* (Nominal input voltage, 100%Io)	400QBW_4812S2.25 400QBW_4815S2.25			150	mVp-p
	400QBW_4824S2.25 400QBW_4828S2.25			220	mVp-p
Trim		90		110	%Vo
Sense				105	%Vo

* The "Tip and barrel" method is used for ripple and noise test, please refer to DC-DC Converter Application Notes for specific information.

Input specifications

Item	Test condition	Min	Typ	Max	Units
Input Current (Nominal input voltage, Full load/no load)	400QBW_4812S2.25 400QBW_4815S2.25 400QBW_4824S2.25 400QBW_4828S2.25			8961/120 8961/150 8961/120 8961/150	mA mA mA mA
Reflected Ripple Current	Nominal input voltage		200		mA
Surge Voltage (1sec. max.)		-0.7		90	VDC
Start-up Voltage				36	VDC
Input Under-voltage Protection		32	33		VDC
Start-up Time	Nominal input voltage, Constant resistance load			100	ms
Input Filter	LC filter				
Hot Plug	Unavailable				
Ctrl①	Module on Module off Input current when off Respond Time	Ctrl open circuit or connected to TTL high level (3.3-12VDC) Ctrl pin connected to -Vin or low level (0-1.2VDC) 13mA Typ. 50ms Max.			

Note: ①The Ctrl pin voltage is referenced to input -Vin.

Example:
400QBW_4812S1.5
W = 400 Watt; QB = Quarter-Brick; W = Wide input (2:1);
48 = 36-72 Vin; 48 = 48Vout; S = Single Output; 2.25 = 2.25kVDC Isolation

Note:
1. Operation under minimum load will not damage the converter; However, they may not meet all specification listed, and that will reduce the life of product.
2. All specifications measured at Ta = 25°C, humidity <75%, nominal input voltage and rated output load unless otherwise specified.
3. In this datasheet, all the test methods of indications are based on corporate standards.

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Isolation specifications

Item	Test condition	Min	Typ	Max	Units
Isolation voltage	Tested for 1 minute leakage current 1mA				
	• Input-output	2250			VDC
	• Input-case	1500			VDC
	• Output-case	500			VDC
Isolation resistance	Input-output resistance at 500VDC	100			MΩ
Isolation Capacitor (Input-Output)	Input-output capacitance at 100KHz/0.1V		2200		pF

Protection specifications

Item	Test condition	Min	Typ	Max	Units
Over-temperature Protection	Max. Case Temperature		110	120	°C
Over-voltage Protection	Input voltage range	110	130	160	%Vo
Over-current Protection	Input voltage range	110	140	170	%Io

EMC specifications

Emissions	CE	CISPR32/EN55032 CLASS A (see Fig.6-1 for recommended circuit) CISPR32/EN55032 CLASS B (see Fig.6-2 for recommended circuit)
Emissions	RE	CISPR32/EN55032 CLASS A (see Fig.6-1 for recommended circuit) CISPR32/EN55032 CLASS B (see Fig.6-2 for recommended circuit)
Immunity	ESD	IEC61000-4-2 Contact ±6KV, Air ±8KV perf. Criteria B
Immunity	RS	IEC61000-4-3 10V/m perf. Criteria A
Immunity	EFT	IEC61000-4-4 ±2KV (see Fig.6-1 or Fig.6-2 for recommended circuit) perf. Criteria A
Immunity	Surge	IEC/EN61000-4-5 line to line ±2KV (see Fig.6-1 or Fig.6-2 for recommended circuit) perf. Criteria B
Immunity	CS	IEC61000-4-6 10Vr.m.s perf. Criteria A

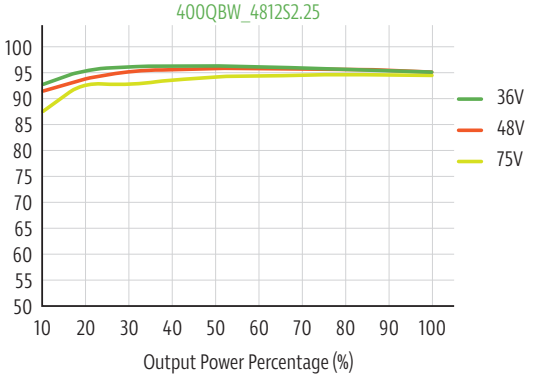
Product Selection Guide

Part Number	Input Voltage [V] Nominal	Range	Max.	Output Voltage [VDC]	Output Current [mA, Max./Min.]	Efficiency* [%, min/typ]	Capacitive Load(µF) Max	Min
400QBW_4812S2.25	48	36-75	80	12	33000/0	93/95	10000	470
400QBW_4815S2.25	48	36-75	80	15	26500/0	93/95	6800	470
400QBW_4824S2.25	48	36-75	80	24	16500/0	93/95	3300	470
400QBW_4828S2.25	48	36-75	80	28	14200/0	93/95	3300	470

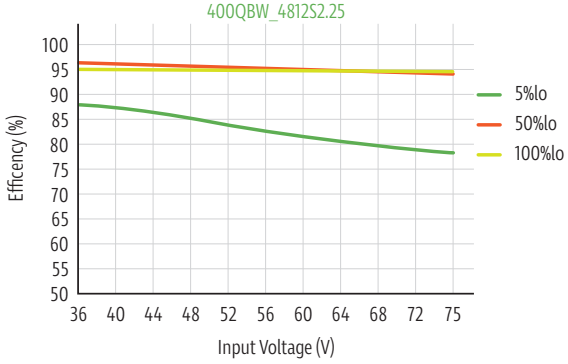
①Use"/BP"suffix is for added aluminum baseplate and "/HS" suffix for heat sink mounting. We recommend to choose modules with a heat sink for enhanced heat dissipation and applications with extreme temperature requirements;
②Exceeding the maximum input voltage may cause permanent damage;
③In order to ensure the output stability, a minimum capacitive load must be connected to the output side of the product.

Efficiency

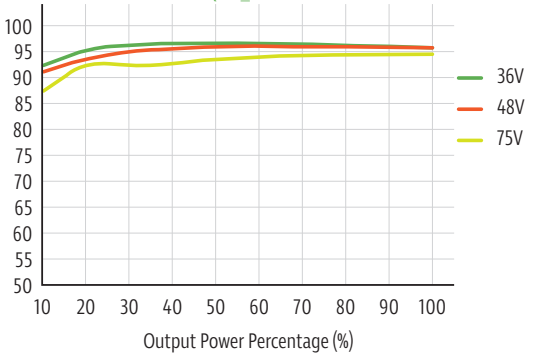
Efficiency Vs Output Load
400QBW_4812S2.25



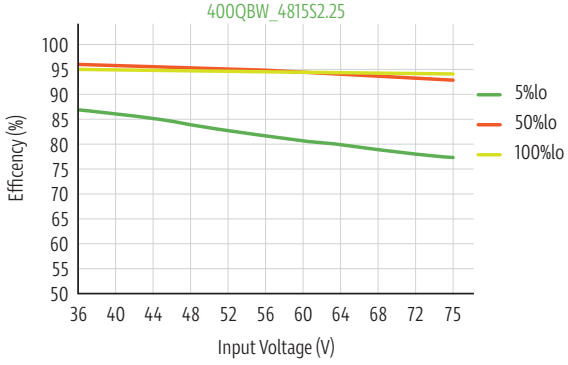
Efficiency Vs Input Voltage
400QBW_4812S2.25



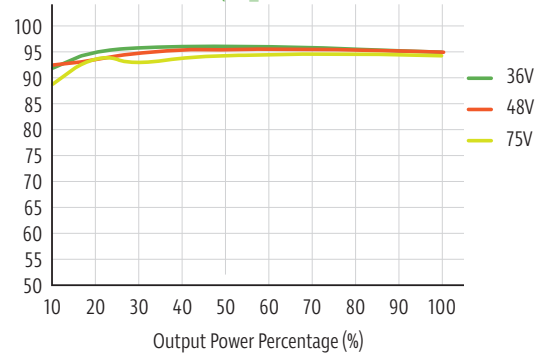
Efficiency Vs Output Load
400QBW_4815S2.25



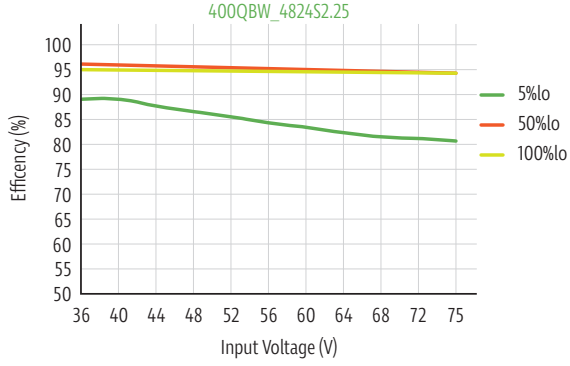
Efficiency Vs Input Voltage
400QBW_4815S2.25



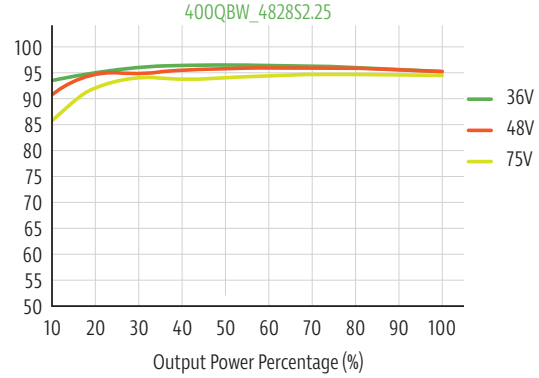
Efficiency Vs Output Load
400QBW_4824S2.25



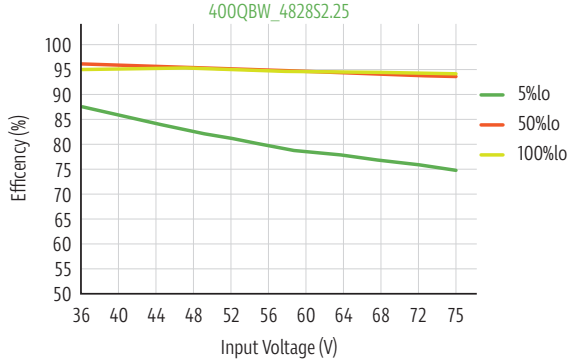
Efficiency Vs Input Voltage
400QBW_4824S2.25



Efficiency Vs Output Load
400QBW_4828S2.25



Efficiency Vs Input Voltage
400QBW_4828S2.25



Remote Sense Connection if not used

Notes:
(1) If the sense function is not used for remote regulation the user must connect the +Sense to +Vo and -Sense to 0V at the DC-DC converter
pins and will compensate for voltage drop across pins only.
(2) The connections between Sense lines and their respective power lines must be kept as short as possible, otherwise they may be picking
up noise, interference and/or causing unstable operation of the power module.

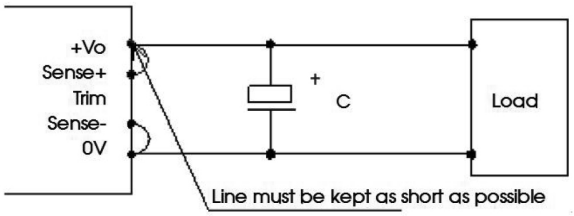


Fig.2

Remote Sense Connection used for Compensation

Notes:
(1) Using remote sense with long wires may cause unstable output, please contact technical support if long wires must be used.
(2) PCB-tracks or cables/wires for Remote Sense must be kept as short as possible. Twisted pair or shielded wairs are suggested for remote
compensation and must be kept as short as possible.
(3) We recommend using adequate cross section for PCB-track layout and/or cables to connect the power supply module to the load in

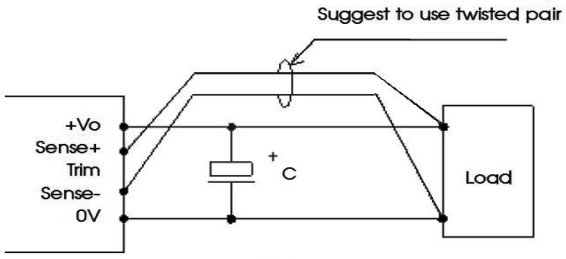


Fig.3

Typical application

Fig.5

Output Voltage	Cout	Cin
12V/15V/24V/28V	470µF	220 µF

EMC compliance circuit

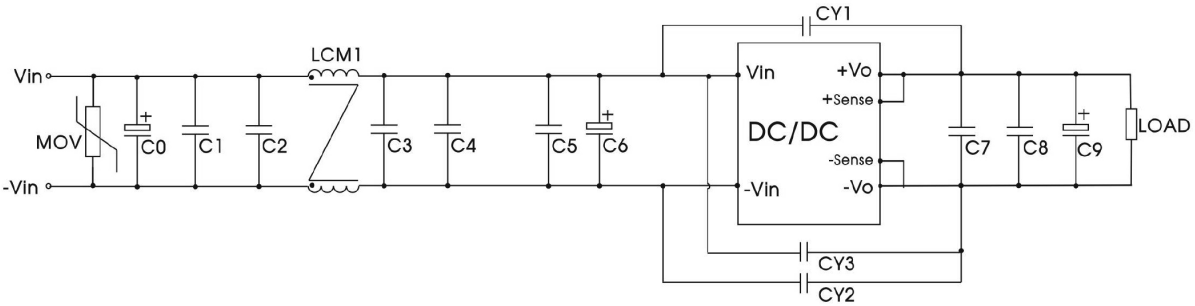


Fig. 6-1

Components	Recommended Component value
MOV	S14K60 Varistor
C0	680µF/100V electrolytic capacitor
C6	470µF/100V electrolytic capacitor
C9	470µF/63V electrolytic capacitor
C1, C2, C3, C4, C5, C7, C8	4.7µF/100V ceramic capacitor
LCM1	T24 x 23.5 x 19/4mH/35mΩmax
CY1, CY2, CY3	1nF/400VAC Y1 safety capacitor

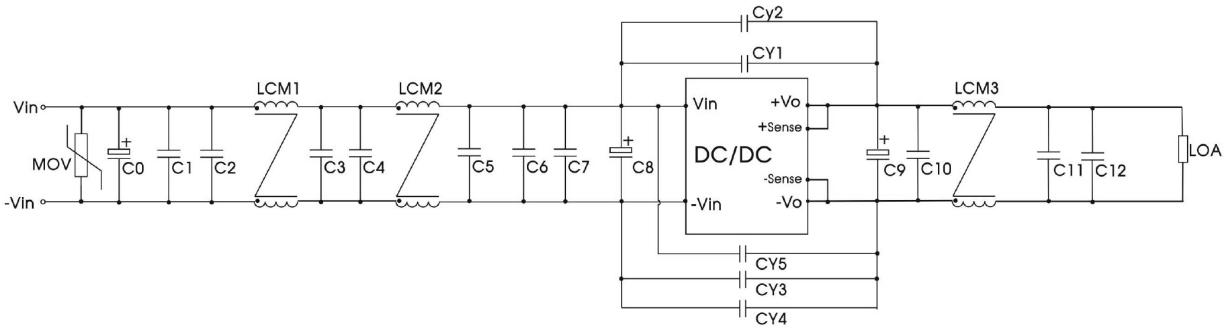
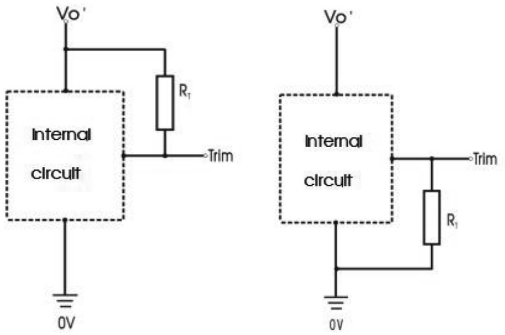


Fig. 6-2

Components	Recommended Component value
MOV C0 C8	S14K60 Varistor
C0	680μF/100V electrolytic capacitor
C8	470μF/100V electrolytic capacitor
C9	470μF/63V electrolytic capacitor
C1, C2, C3, C4, C5, C6, C7, C10, C11, C12	4.7μF/100V ceramic capacitor
LCM1, LCM2	T24 x 23.5 x 19/4mH/35mΩmax
LCM3	T26 x 26 x 12/130uH/4mΩmax
CY1, CY2, CY3, CY4, CY5	1nF/400VAC Y1 safety capacitor

Trim Function for Output Voltage Adjustment (open if unused)



Trim up Trim down

TRIM resistor connection (dashed line shows internal resistor network)

Fig. 7

Calculation formula of Trim resistance:

Trim up

$$R_T = \left(\frac{5.11 V_{nom}(100+\Delta\%)}{1.225\Delta\%} - \frac{511}{\Delta\%} - 10.22 \right)(k\Omega)$$

Trim down

$$R_T = \left(\frac{511}{\Delta\%} \right) - 10.22(k\Omega)$$

Note:

R_T: Resistance of Trim.

$$\Delta\% = \left| \frac{V_{nom} - V_{out}}{V_{nom}} \right| \times 100$$

V_{nom} :Nominal Input Voltage.

V_{out} : The trim up/down voltage.

Recommended solution for thermal testing

During the application process, the thermal design of the product can be evaluated in combination with the temperature derating curve of the product, or it can be determined by testing the temperature at point A, it is an safe operating area if the temperature lower than 125°C.

Reflected ripple current test circuit

All DC-DC converters of this series are tested using the recommended circuit shown in Fig. 9. Test point, T.

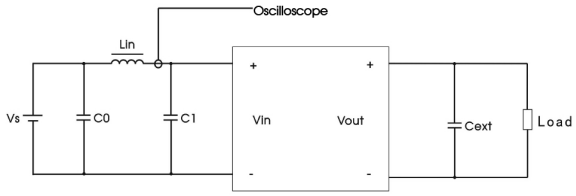
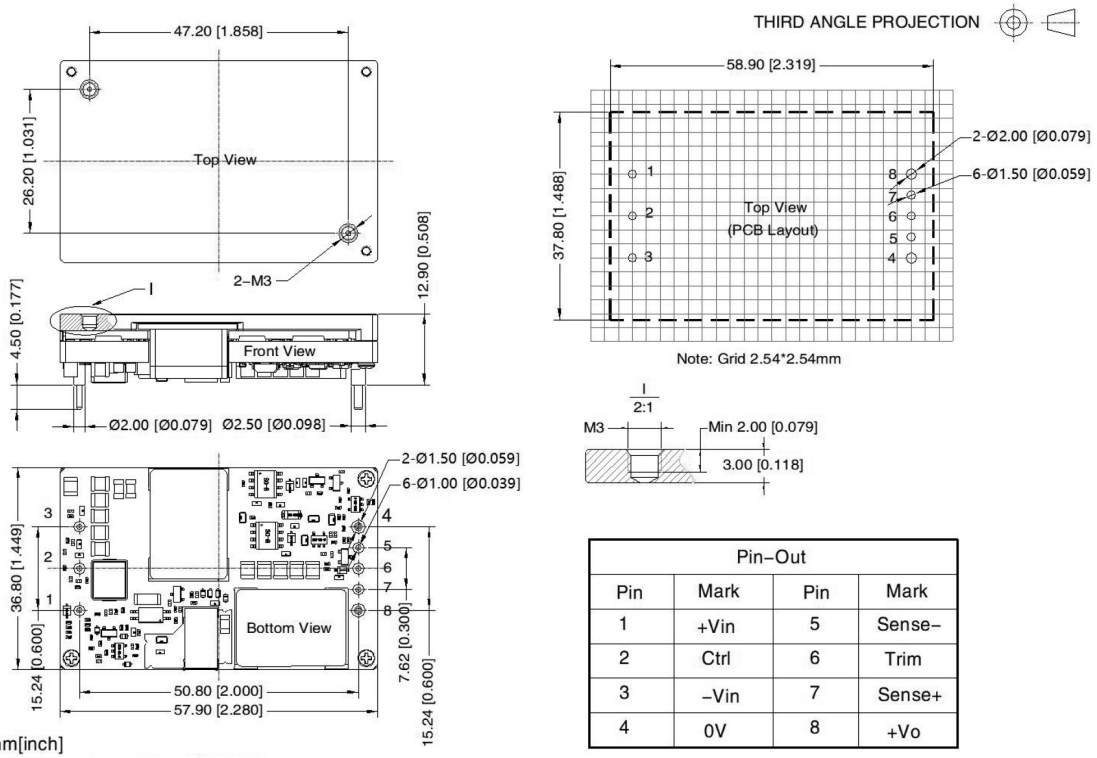


Fig. 9

Components	Recommended Component value
C0	220μF/100V
Lin C1	10uH/15A
Cext	470μF/100V
C9	470μF/63V

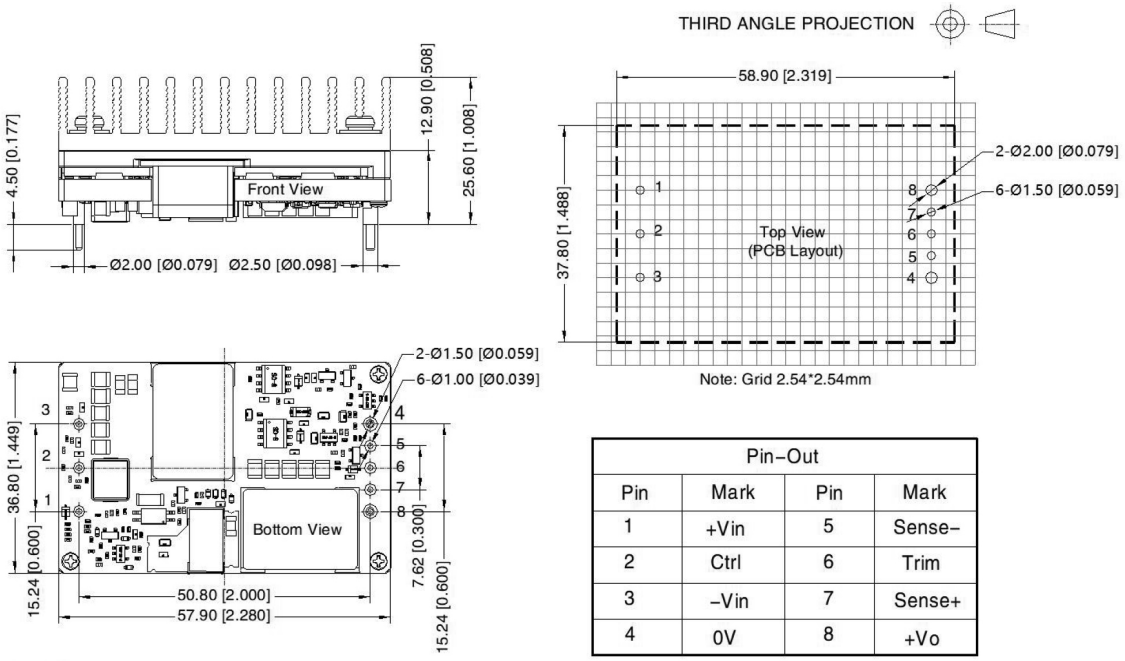
Mechanical dimensions (without heat sink)



Pin–Out			
Pin	Mark	Pin	Mark
1	+Vin	5	Sense–
2	Ctrl	6	Trim
3	–Vin	7	Sense+
4	0V	8	+Vo

Note:
Unit: mm[inch]
Pin1,2,3,5,6,7's diameter: 1.00[0.039]
Pin4,8's diameter: 1.50[0.059]
Pin diameter tolerances: ± 0.10[± 0.004]
General tolerances: ± 0.50[± 0.020]
Mounting hole screwing torque: Max 0.4 N·m
The layout of the device is for reference only , please refer to the actual product

Mechanical dimensions (with heat sink)



Pin–Out			
Pin	Mark	Pin	Mark
1	+Vin	5	Sense–
2	Ctrl	6	Trim
3	–Vin	7	Sense+
4	0V	8	+Vo

Note:
Unit: mm[inch]
Pin1,2,3,5,6,7's diameter: 1.00[0.039]
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