MQ7804bt/ MQ7814bt

Isolated 42~57VDC input, single output, 72W DC-DC Converter with PoE bt interface

FEATURES

- Wide operating voltage:
  - 42V ~ 57V
- 802.3bt interface built-in
- Active bridge to reduce power loss
- Output Current:
  - 5V, 14A
  - 12V, 6A
  - 28V, 2.6A
- Output voltage ripple: 120 mVpp (input 48V, 12V@6A)
- High Efficiency 90% (input 48V, 12V@6A including bridge)
- Overcurrent/short-circuit protection
- Supports Ultra-Low Power Standby Modes
- High reliability: designed to meet 500k hour MTBF
- Minimal space on PCB:
  - 58.42 mm x 22.86 mm x 10.5 mm
  - 2.3 in x 0.9 in x 0.41 in
- No derating to +TBD℃, natural convection
- Design to meet UL/IEC/EN60950
- Operating Temperature: -40 ~ +85℃

APPLICATIONS

- IP Camera & Tilt
- Wireless Access Point
- Video Supervisory
- Remote BBU

Description

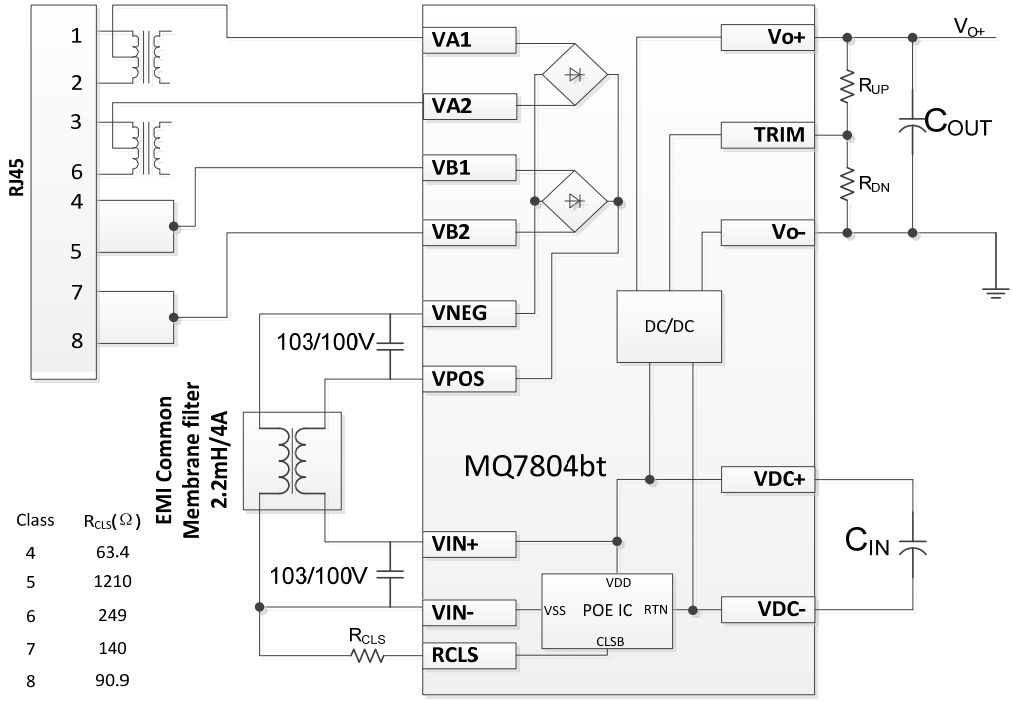
The ***POE MQ7804bt/ MQ7814bt*** series of modules are designed to extract power from a conventional twisted pair Category 5 Ethernet cable, conforming to the IEEE 802.3bt Power-over-Ethernet (PoE) standard but with 72W output power. The MQ7804bt series of modules embedded 2 active rectifier bridges which extremely reduce the power dispassion comparing with the traditional Schottky diodes bridges, have two pairs of power inputs pins: - VA1&2 and VB1&2 to accommodate high power PoE application with 4-pair wire power transfer.

In some applications, the input polarity is certain, or there is an external rectifier bridge, the MQ7814bt series modules are more cost effective options; compare with MQ7804bt series, MQ7814bt series products have exactly the same performance except the embedded 2 active rectifier bridges removed.

The ***MQ7804bt/ MQ7814bt*** signature and control circuit provides the PoE bt compatibility signature and power classification required by the Power Sourcing Equipment (PSE) before applying up to power to the port. The ***MQ7804bt/ MQ7814bt*** can be set to class4 to class 8 by external one classification resistor to get different power class from PSE.

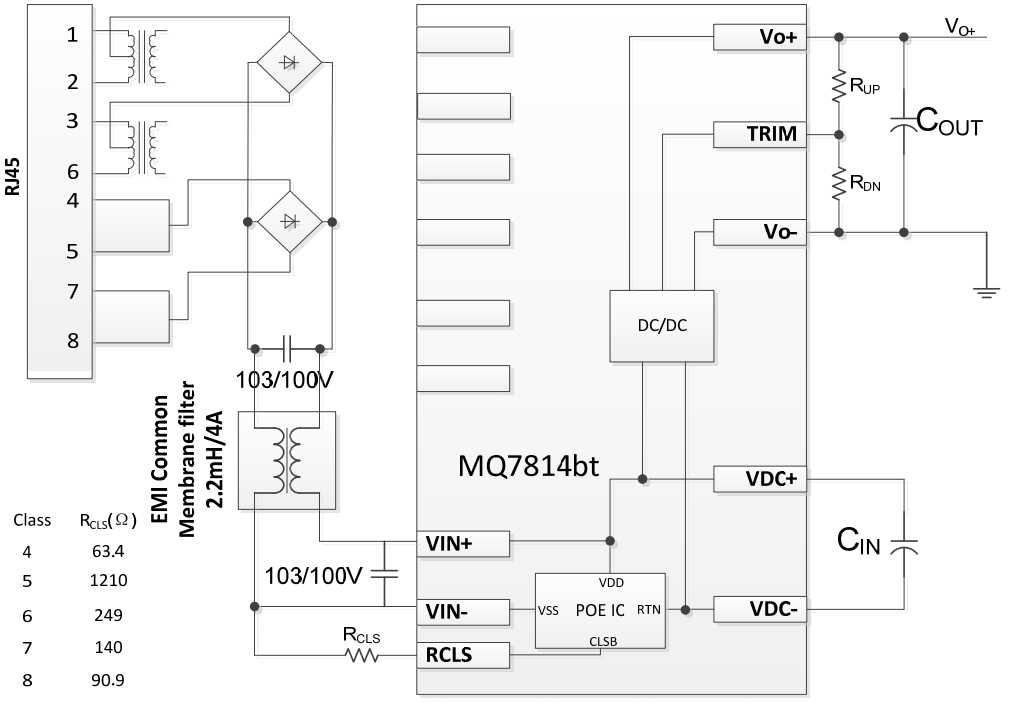
The high efficiency DC/DC converter operates over a wide input voltage range and provides a regulated low ripple and low noise output. The DC/DC converter also has built-in overload and short-circuit output protection.

********** Typical Application Circuit **********



Class	$R_{CLS}(\Omega)$
4	63.4
5	1210
6	249
7	140
8	90.9

MQ7804bt application diagram



Class	$R_{CLS}(\Omega)$
4	63.4
5	1210
6	249
7	140
8	90.9

MQ7814bt application diagram, with external rectifier bridges

Note:
C_{IN} recommended from 47μF to 220μF AL-cap with 5~10μF ceramic cap;

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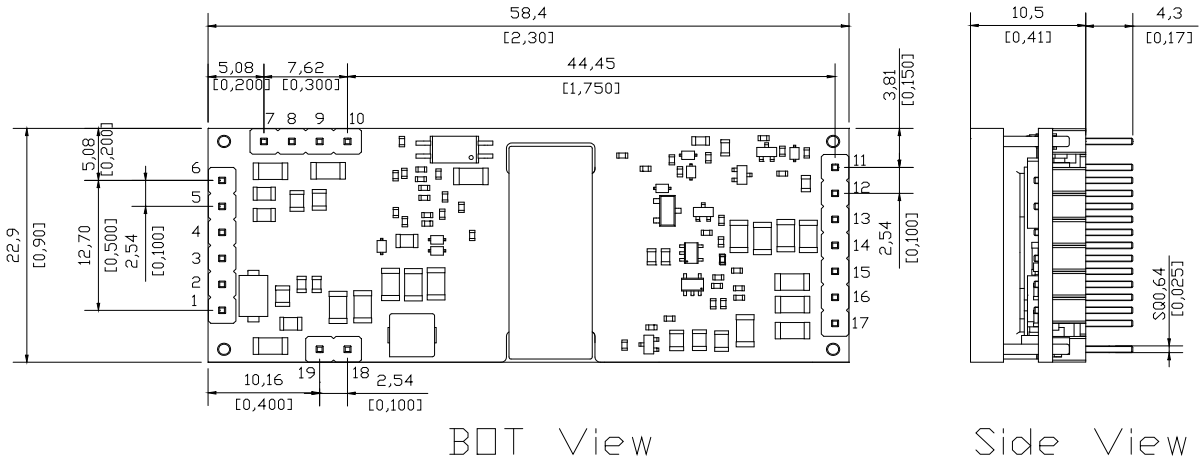
Performance Specifications (at Ta=+25℃)

Model	Input V_{IN} Range (V)	Output				Efficiency (%)
		$I_{OUT.MAX}$ (A)	V_{out} (V)	Regulation		
				Line (%)	Load (%)	
MQ7804BTT050	42 ~57	14	5	0.5	0.5	TBD
MQ7804BTT120		6.0	12	0.5	0.5	90
MQ7804BTT280		2.6	28	0.5	0.5	TBD
MQ7814BTT050		14	5	0.5	0.5	TBD
MQ7814BTT120		6.0	12	0.5	0.5	91
MQ7814BTT280		2.6	28	0.5	0.5	TBD

Mechanical Specifications

Dimensions are in millimeters (inches)



PIN	MQ7804BT		MQ7814BT
	DESCRIPTION		
1	VIN+	PoE positive input	
2	VIN-	PoE negative input	
3	RCLS	classification resistor	
4	N/C	No internal connect	N/C
5	VNEG	Bridge negative output	
6	VPOS	Bridge positive output	
7	VA1	Pair from network transformer's central tap	N/A
8	VA2		
9	VB1	Pair from network transformer's central tap	
10	VB2		
11、12、13	Vo-	Output negative end	
14	Trim	Output Trim	
15、16、17	Vo+	Output positive end	
18	VDC+	DC/DC positive input end	
19	VDC-	DC/DC negative input end	

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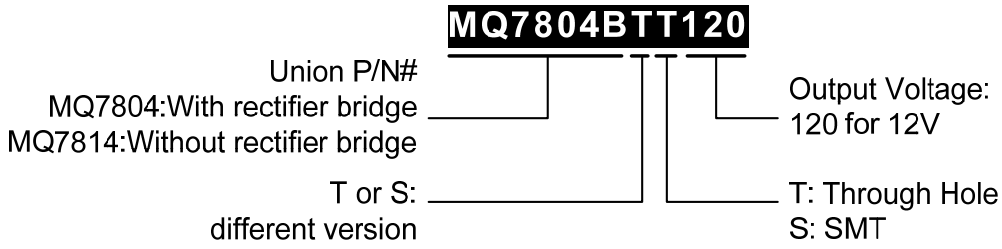
Ordering Information



Absolute Maximum Ratings

Note: These are stress ratings. Exposure of devices to any of these conditions may adversely affect long-term reliability. Proper operation under conditions other than those listed in the Performance Specifications Table is not implied.

Parameter	Symbol	Min	Max	Unit
Operating Ambient Temperature	T_A	-40	85	℃
Storage Temperature	T_{STG}	-40	85	℃
Altitude			4000	m
I/O Isolation voltage (100% factory Hi-pot tested)			2250	V_{DC}

MQ7804BTT050 Electrical Specifications： *(TA=+25℃)*

Parameter	Condition	Symbol	Min	Typ.	Max	Unit
Operating Input Voltage Range	100% Load	V_{IN}	42		57	V_{DC}
V_{IN}- Inrush current limit	(VDC-) — (V_{IN}-)> 2 V, During C_{IN} charge period		275	335	395	mA
Input No Load Current	V_{IN}=48V, V_o=$V_{O,SET}$, I_o=0, module enabled	$I_{IN,NOLOAD}$				mA
Input Current Limit	V_{IN}=$V_{IN.MIN}$ To $V_{IN.MAX}$		1.9	2.2	2.5	A
Input Turn-ON Threshold	10% Max Load, input rising	$V_{IN.ONTH}$	40.5		41.5	V_{DC}
Input Turn-OFF Threshold	10% Max Load, input falling	$V_{IN.OFFTH}$	38.3		39.3	V_{DC}
Maximum load	$V_{IN.MIN}$ to $V_{IN.MAX}$				14.4	A
Output Voltage Set point	100% load	ΔVo	-1		+1	%$V_{O.SET}$
Output Ripple and Noise Voltage	V_{IN} =48V Io=10A,5~20MHz					mVpp
Transient Response	0% to 100%I_{Omax}, V_O = 12 V					mS
				400		mV
Efficiency	V_{IN}=48, 100% Load	η				%
Switching Frequency		Fo		400		KHz
Over Temperature	Hiccup Auto Restart			125		℃
External Capacitive Load		$C_{O,EXTERNAL}$				μF
Output Continuous Short-circuit Protection	V_{IN}=$V_{IN.MIN}$ To $V_{IN.MAX}$				YES	
Inrush Current	V_{IN}=55V	I_{inrush}		150		mA
Output Power	V_{IN}=$V_{IN.MIN}$ To $V_{IN.MAX}$	Po	0		72	W
MTBF		500,000				Hours

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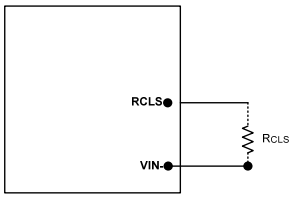
MQ7804BTT120 Electrical Specifications：*(TA=+25℃)*

Parameter	Condition	Symbol	Min	Typ.	Max	Unit
Operating Input Voltage Range	100% Load	V_{IN}	42		57	V_{DC}
V_{IN}- Inrush current limit	(VDC-) — (V_{IN}-)> 2 V, During C_{IN} charge period		275	335	395	mA
Input No Load Current	V_{IN}=48V, V_o=$V_{O,SET}$, I_o=0, module enabled	$I_{IN,NOLOAD}$		70		mA
Input Current Limit	V_{IN}=$V_{IN.MIN}$ To $V_{IN.MAX}$		1.9	2.2	2.5	A
Input Turn-ON Threshold	10% Max Load, input rising	$V_{IN.ONTH}$	40.5		41.5	V_{DC}
Input Turn-OFF Threshold	10% Max Load, input falling	$V_{IN.OFFTH}$	38.3		39.3	V_{DC}
Maximum load	$V_{IN.MIN}$ to $V_{IN.MAX}$				6	A
Output Voltage Set point	100% load	ΔVo	-1		+1	%$V_{O.SET}$
Output Ripple and Noise Voltage	V_{IN} =48V Io=4.2A,5~20MHz			120		mVpp
Transient Response	50% to 100%I_{Omax}, V_O = 12 V			100		μS
				350		mV
Efficiency	V_{IN}=48, 100% Load	η	89	90		%
Switching Frequency		Fo		400		kHz
Over Temperature	Hiccup Auto Restart			125		℃
External Capacitive Load		$C_{O,EXTERNAL}$	0		2000	μF
Output Continuous Short-circuit Protection	V_{IN}=$V_{IN.MIN}$ To $V_{IN.MAX}$		YES			
Inrush Current	V_{IN}=55V	I_{inrush}		150		mA
Output Power	V_{IN}=$V_{IN.MIN}$ To $V_{IN.MAX}$	Po	0		72	W
MTBF		500,000				Hours

MQ7804BTT280 Electrical Specifications：*(TA=+25℃)*

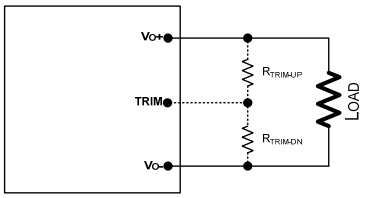
Parameter	Condition	Symbol	Min	Typ.	Max	Unit
Operating Input Voltage Range	100% Load	V_{IN}	42		57	V_{DC}
VIN- Inrush current limit	(VDC-) — (VIN-)> 2 V, During C_{IN} charge period		275	335	395	mA
Input No Load Current	V_{IN}=48V, V_o=$V_{O,SET}$, I_o=0, module enabled	$I_{IN,NOLOAD}$				mA
Input Current Limit	V_{IN}=$V_{IN.MIN}$ To $V_{IN.MAX}$		1.9	2.2	2.5	A
Input Turn-ON Threshold	10% Max Load, input rising	$V_{IN.ONTH}$	40.5		41.5	V_{DC}
Input Turn-OFF Threshold	10% Max Load, input falling	$V_{IN.OFFTH}$	38.3		39.3	V_{DC}
Maximum load	$V_{IN.MIN}$ to $V_{IN.MAX}$				2.8	A
Output Voltage Set point	100% load	ΔVo	-1		+1	%$V_{O.SET}$
Output Ripple and Noise Voltage	V_{IN} =48V Io=2.1A,5~20MHz					mVpp
Transient Response	0% to 100%I_{Omax}, V_O = 28 V					mS
						mV
Efficiency	V_{IN}=48, 100% Load	η				%
Switching Frequency		Fo		400		KHz
Over Temperature	Hiccup Auto Restart			125		℃
External Capacitive Load		$C_{O,EXTERNAL}$				μF
Output Continuous Short-circuit Protection	V_{IN}=$V_{IN.MIN}$ To $V_{IN.MAX}$		YES			
Inrush Current	V_{IN}=55V	I_{inrush}		150		mA
Output Power	V_{IN}=$V_{IN.MIN}$ To $V_{IN.MAX}$	Po	0		72	W
MTBF		500,000				Hours

Test Configurations



NOTE: Class Resistor Selection

Fig 1. Classification Resistors



NOTE: Trimming function is allowed the output voltage set point to be adjusted from the default value in a allowed range.

Fig 2. Output Trim

Output Trim

MQ7804B output can be trimmed up or down by connecting one resistor to output negative or positive end as **Fig 2. Output Trim**. Connecting an external resistor (R_{DN}) between the TRIM pin and the $V_{O(-)}$ (or Sense(-)) pin decreases the output voltage set point. To maintain set point accuracy, the trim resistor tolerance should be ±1.0%.The following equation determines the required external resistor value:

$$R_{DN} = \left(\frac{5.11 * V_{O,SET}}{V_{O,SET} - V_{O.DN}} - 10.22\right)\text{K}\Omega$$

$V_{O,SET}$ is the output default set-point voltage of the module, $V_{O.DN}$ is the desired trim-down output voltage.

Connecting an external resistor (R_{UP}) between the TRIM pin and the $V_{O(+)}$ (or Sense (+)) pin increases the output voltage set point. The following equation determines the required external resistor value:

$$R_{UP} = \left[\frac{5.11 * V_{O,SET}}{V_{O.UP} - V_{O,SET}} * \left(\frac{V_{O.UP}}{1.225} - 1\right) - 10.22\right]\text{K}\Omega$$

$V_{O,SET}$ is the output default set-point voltage of the module, $V_{O.UP}$ is the desired trim-up output voltage.

Over-temperature Protection

To provide protection under certain fault conditions, the unit is equipped with a thermal shutdown circuit. The unit will shutdown if the thermal reference points, Tref, exceed 125℃ respectively, but the thermal shutdown is not intended as a guarantee that the unit will survive temperatures beyond its rating. The module will automatically restart upon cool-down to a safe temperature.

Classification Resistors

Connect a resistor from RCLS to VIN- to program the classification current according to the IEEE 802.3bt standard. Table 1 lists the external resistor values required for each of the PD power ranges defined by IEEE802.3bt.

PD class	Power at PD(W)	$R_{CLS}(\Omega)$
4	25.5	63.4
5	40	1210
6	51	249
7	62	140
8	71	90.9

Table 1. Class Resistor Selection

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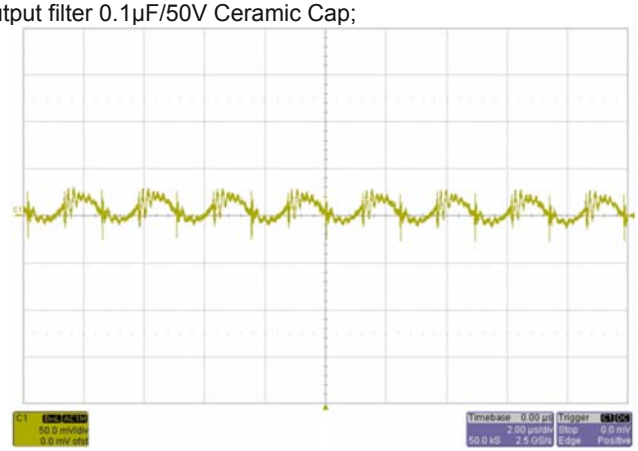
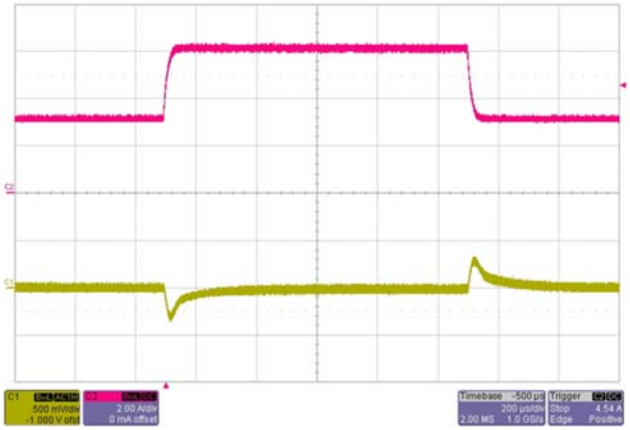
Typical Characteristics – MQ7804BTT120

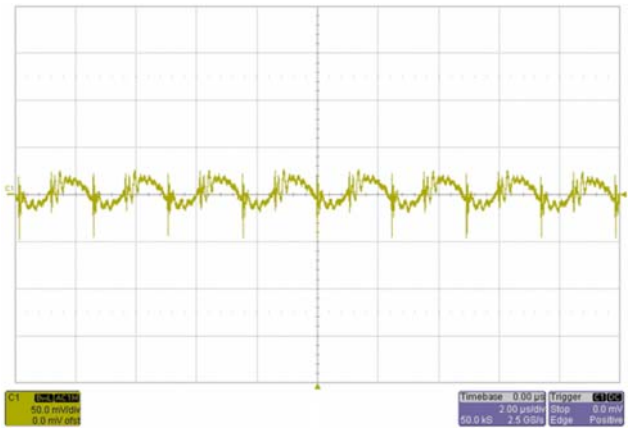
General conditions:
Input filter 100μF/100V AL-Cap;
Output filter 0.1μF/50V Ceramic Cap;



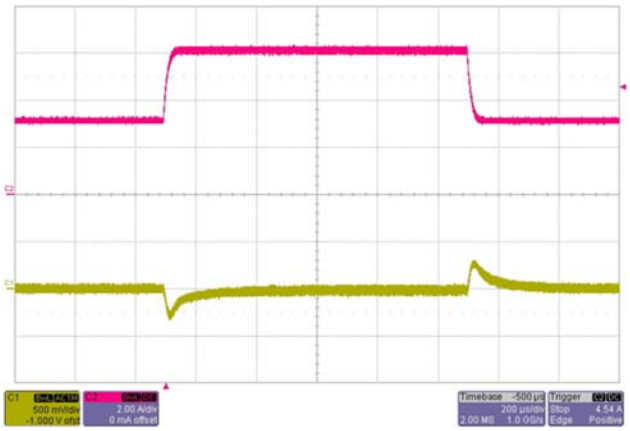
Noise & Ripple V_{IN}=42V, I_O=6A, 5~20MHz Bandwidth



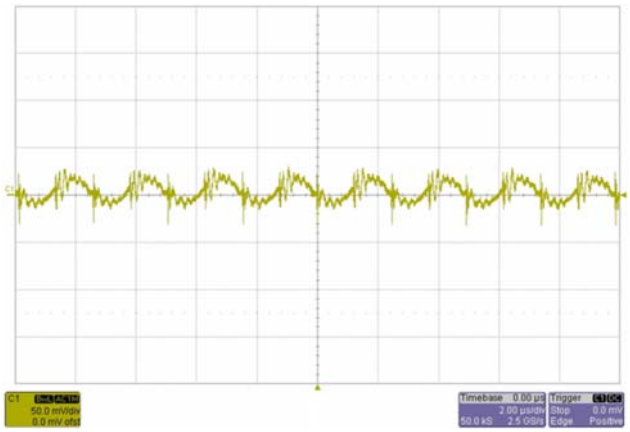
Transient Response, V_{IN}=42V 3A~6A~3A load step
Red: Load Current Yellow: Output Voltage



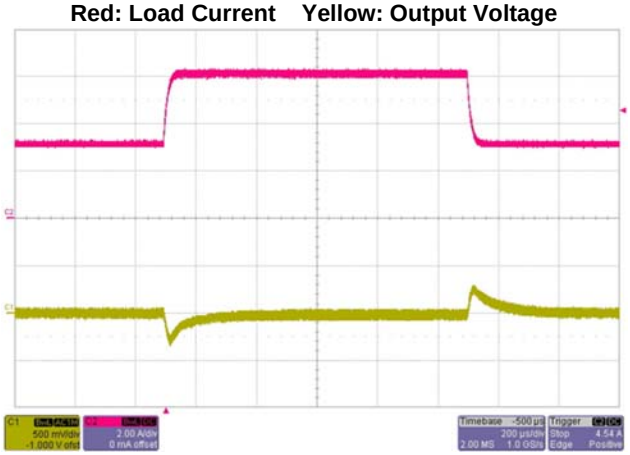
Noise & Ripple V_{IN}=48V, I_O=6A, 5~20MHz Bandwidth



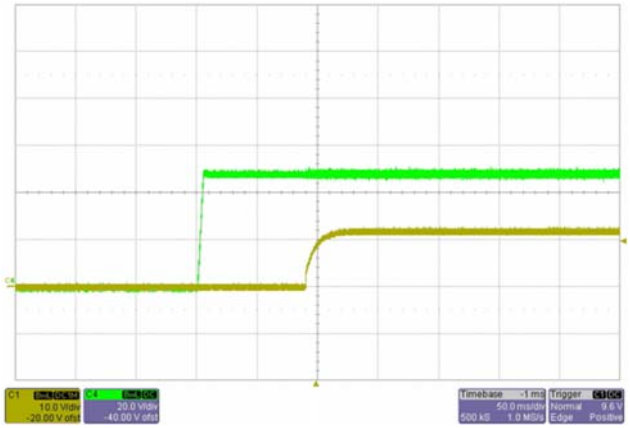
Transient Response, V_{IN}=48V 3A~6A~3A load step
Red: Load Current Yellow: Output Voltage



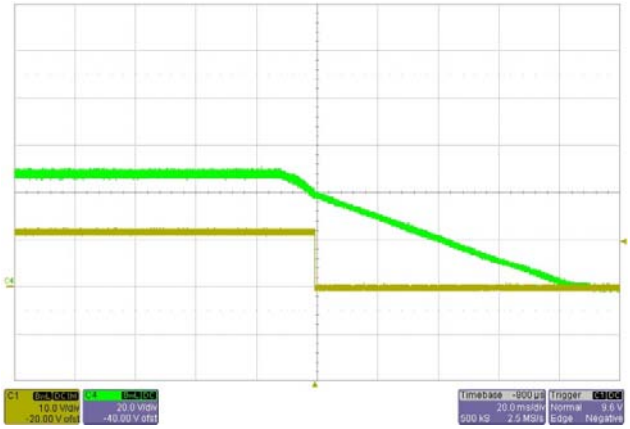
Noise & Ripple V_{IN}=57V, I_O=6A, 5~20MHz Bandwidth



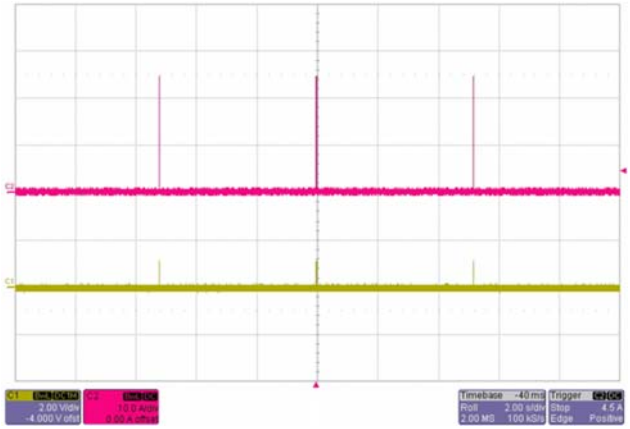
Transient Response, V_{IN}=57V 3A~6A~3A load step
Red: Load Current Yellow: Output Voltage



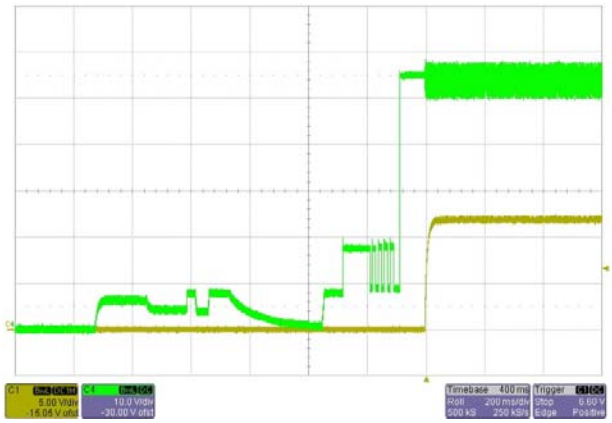
Startup V_{IN}=48V
Green: Input Voltage Yellow: Output Voltage



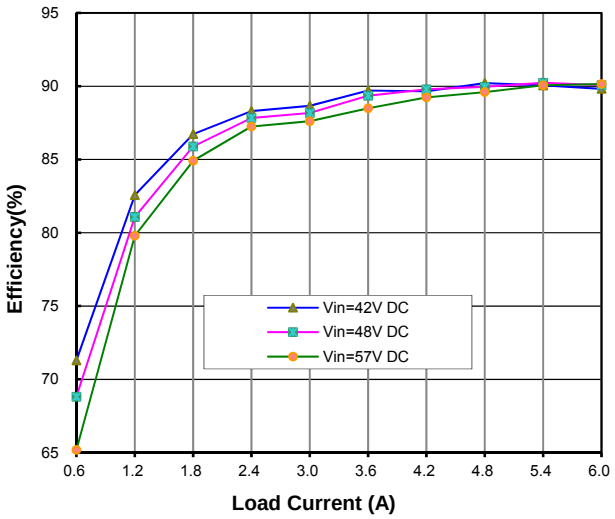
Shutdown V_{IN}=48V
Green: Input Voltage Yellow: Output Voltage



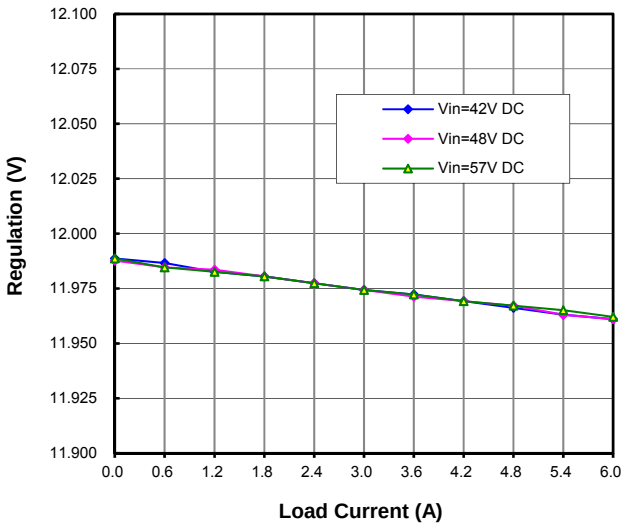
Load short protection V_{IN}=48V
Red: Load Current Yellow: Output Voltage



Startup from PSE
Green: Input Voltage Yellow: Output Voltage



Efficiency



Regulation

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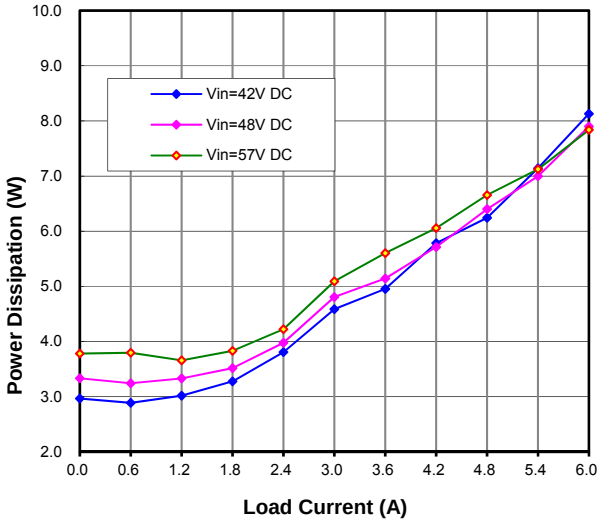
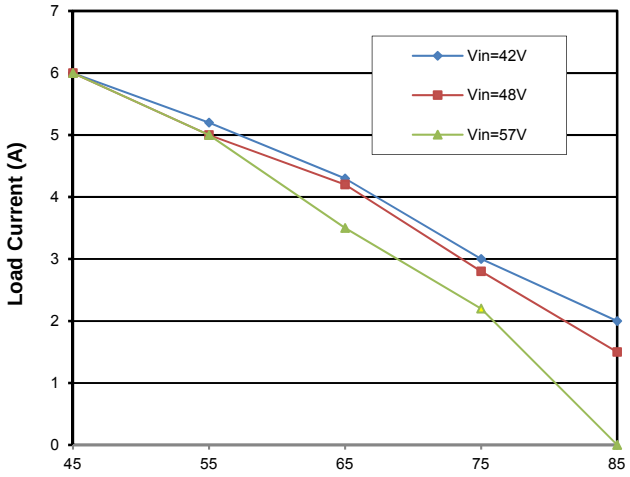
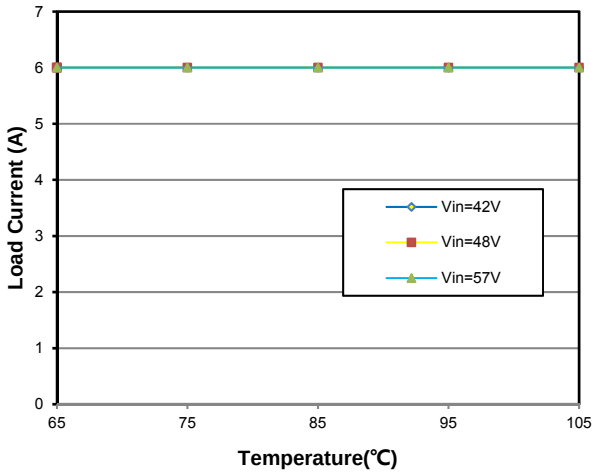


Power Dissipation



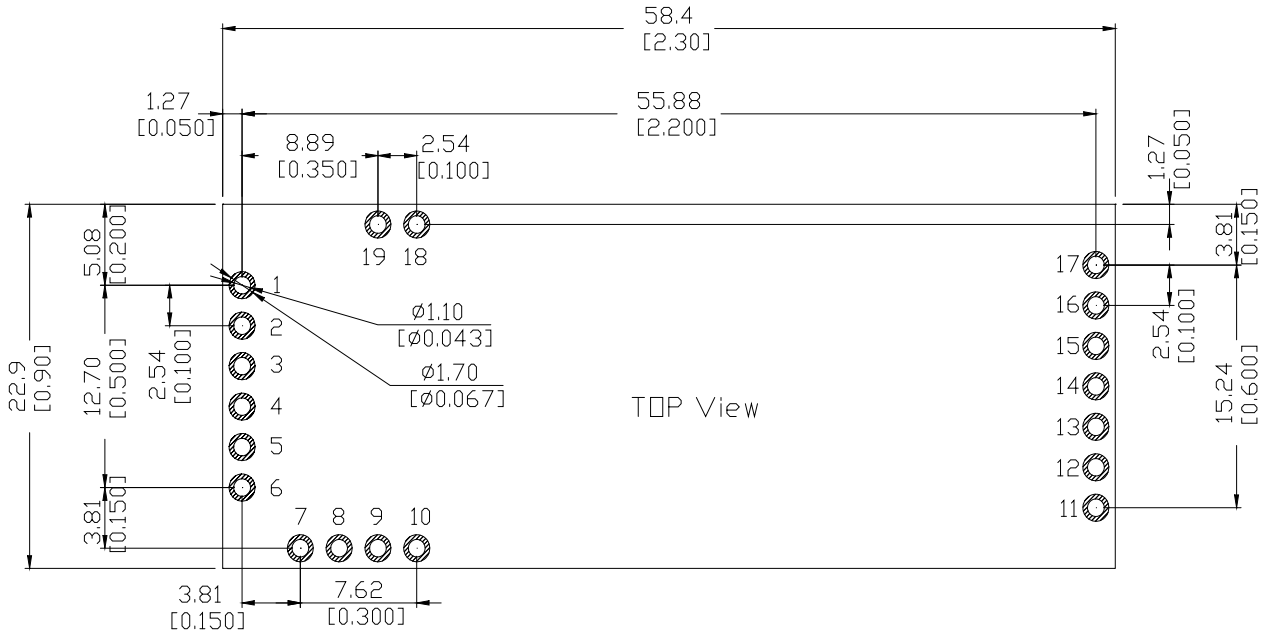
Derating
Box size:36cm*26cm*10cm



Derating
Aluminum plate size：270mm*165mm*10mm

Recommended Hole Pattern

Dimensions are in millimeters (inches)



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