CQE50W Series
Application Note V15

ISOLATED DC-DC CONVERTER
CQE50W SERIES
APPLICATION NOTE

Approved By:

Department	Approved By	Checked By	Written By
Research and Development Department	Jacky	Astray	Sean
Design Quality Department	Benny	JoJo	

Contents

CQE50W Series
Application Note V15

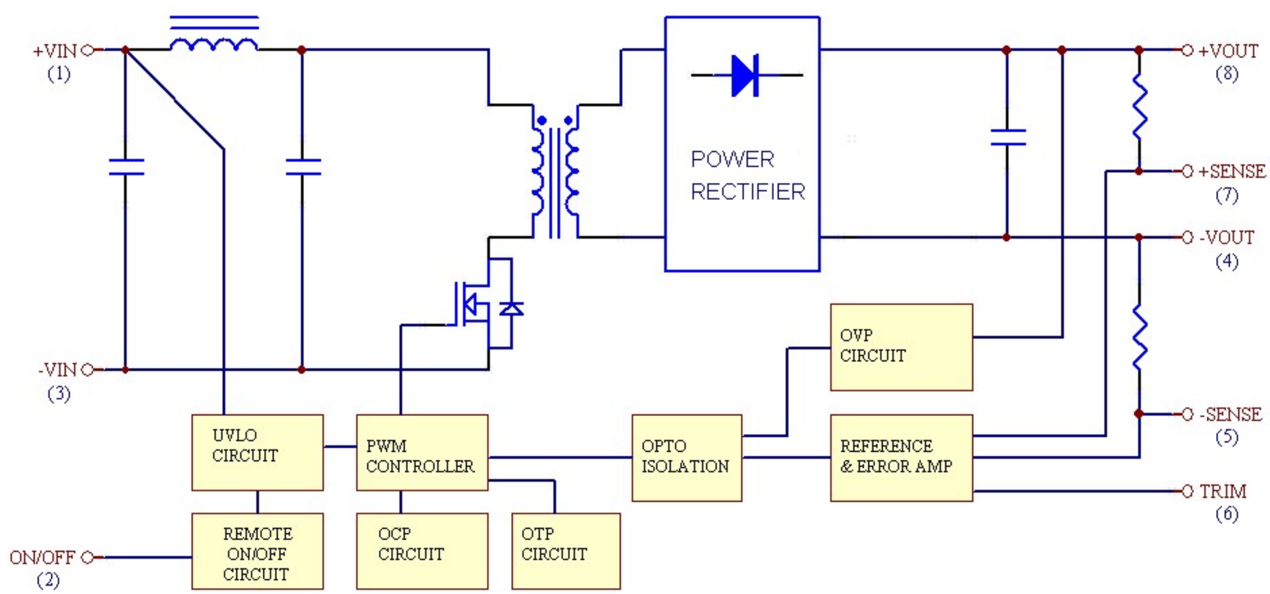
1. Introduction

This specification describes the features and functions of Cincon's CQE50W series of isolated DC-DC Converters. These are highly efficient, reliable and compact, high power density, single output DC/DC converters. The modules can be used in the field of telecommunications, data communications, wireless communications, servers etc. The CQE50W series can deliver up to 10A output current and provide a precisely regulated output voltage over a wide range of input voltages (Vi = 9- 36 or 18- 75Vdc). The modules can achieve high efficiency up to 92%. The module offers direct cooling of dissipative components for excellent thermal performance. Standard features include remote On/Off, remote sense, output voltage adjustment, over voltage, over current and over temperature protection. The CQE50W series also have the following options: remote On/Off (positive or negative).

2. DC-DC Converter Features

- 50W Isolated Output
- No Tantalum Capacitor inside
- Quarter-Brick Size, Six-Sided Shield Metal Case
- High Efficiency up to 92%
- 300K Hz Switching Frequency
- 4:1 Input Range
- Regulated Output
- Input Under Voltage Lockout Protection
- Over Current Protection
- Remote On/Off
- Continuous Short Circuit Protection
- Full Load Operation up to 80℃ with Heat-sink QBT210 (M-C421) Natural Convention
- UL60950-1 2nd Approval

3. Electrical Block Diagram



Electrical Block Diagram for other modules

4. Technical Specifications

(All specifications are typical at nominal input, full load at 25℃ unless otherwise noted.)

ABSOLUTE MAXIMUM RATINGS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Input Voltage						
Continuous		24SXX	-0.7		36	V_{dc}
		48SXX	-0.7		75	
Transient	100ms	24SXX			50	V_{dc}
		48SXX			100	
Operating Case Temperature		All	-40		105	℃
Storage Temperature		All	-55		125	℃
Isolation Voltage	1 minute; input/output, input/case, output/case	All	1500			V_{dc}

INPUT CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Operating Input Voltage		24SXX	9	24	36	V_{dc}
		48SXX	18	48	75	
Input Undervoltage Lockout						
Turn-On Voltage Threshold		24SXX	8	8.5	8.8	V_{dc}
		48SXX	16.5	17	17.5	
Turn-Off Voltage Threshold		24SXX	7.7	8	8.3	V_{dc}
		48SXX	15.5	16	16.5	
Lockout Hysteresis Voltage		24SXX		0.8		V_{dc}
		48SXX		1		
Maximum Input Current	100% Load, V_{in}=9V for 24SXX	24SXX		6.5		A
	100% Load, V_{in} =18V for 48SXX	48SXX		3.2		
No-Load Input Current		24S3V3		100		mA
		24S05		100		
		24S12		100		
		24S15		100		
		24S24		60		
		24S48		60		
		48S3V3		60		
		48S05		60		
		48S12		60		
		48S15		60		
		48S24		60		
		48S48		60		
Inrush Current (I^2t)		All			0.1	A^2s
Input Reflected Ripple Current	P-P thru 12uH inductor, 5Hz to 20MHz	All		30		mA

OUTPUT CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Output Voltage Set Point	V_{in}=Nominal V_{in}, $I_o = I_{o\_max.}$, T_c=25°C	Vo=3.3V	3.267	3.3	3.333	V_{dc}
		Vo=5.0V	4.95	5	5.05	
		Vo=12V	11.88	12	12.12	
		Vo=15V	14.85	15	15.15	
		Vo=24 V	23.76	24	24.24	
		Vo=48V	47.52	48	48.48	
Output Voltage Regulation						
Load Regulation	$I_o=I_{o\_min.}$ to $I_{o\_max.}$	All			±0.2	%
Line Regulation	V_{in}=Low line to high line	All			±0.2	%
Temperature Coefficient	T_c=-40℃ to 105℃	All			±0.03	%/℃
Output Voltage Ripple and Noise	5Hz to 20MHz bandwidth					
Peak-to-Peak	Full load 10uF tantalum and 1.0uF ceramic capacitors (for Vo:48V: full load 10uF aluminum and 1uF ceramic)	Vo= 3.3V&5.0V			100	mV
		Vo=12V&15V			150	
		Vo=24V			240	
		Vo=48V			480	
RMS	Full load, 10uF tantalum and 1.0uF ceramic capacitors (for Vo:48V: full load 10uF aluminum and 1uF ceramic)	Vo= 3.3V&5.0V			40	mV
		Vo=12V&15V			60	
		Vo=24V			100	
		Vo=48V			200	
Operating Output Current Range		Vo=3.3V	0		10	A
		Vo=5.0V	0		10	
		Vo=12V	0		4.16	
		Vo=15V	0		3.33	
		Vo=24 V	0		2.08	
		Vo=48V	0		1.04	
Output DC Current Limit Inception	Output voltage=90% nominal output voltage	All	110	125	165	%
Maximum Output Capacitance	Full load (resistive)	Vo=3.3V			10000	uF
		Vo=5.0V			10000	
		Vo=12V			4160	
		Vo=15V			3330	
		Vo=24 V			2080	
		Vo=48V	10		1040	

DYNAMIC CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Output Voltage Current Transient						
Step Change in Output Current	75% to 100% of $I_{o\_max.}$	All			±5	%
Setting Time (within 1% V_{out} nominal)	d_i/d_t=0.1A/us	All			500	us

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Turn-On Delay and Rise Time						
Turn-On Delay Time, From On/Off Control	$V_{on/off}$ to 10%V_{o_set}	All		10		ms
Turn-On Delay Time, From Input	V_{in_min} to 10%V_{o_set}	All		10		ms
Output Voltage Rise Time	10%V_{o_set} to 90%V_{o_set}	All		10		ms

EFFICIENCY

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
100% Load	Vin = 12Vdc	24S3V3		90		%
		24S05		91		
		24S12		91		
		24S15		91.5		
		24S24		90		
		24S48		88.5		
	Vin = 24Vdc	48S3V3		90		
		48S05		91.5		
		48S12		92		
		48S15		91		
		48S24		91		
		48S48		89		
	Vin = 24Vdc	24S3V3		90.5		
		24S05		91.5		
		24S12		91.5		
		24S15		91.5		
		24S24		90		
		24S48		88.5		
	Vin = 48Vdc	48S3V3		90		
		48S05		92		
		48S12		92		
		48S15		91		
		48S24		90.5		
		48S48		89		

ISOLATION CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Isolation Voltage	1 Minute; input/output, input/case, output/case	All			1500	V_{dc}
Isolation Resistance		All	10			MΩ
Isolation Capacitance	Input/output	All		1500		pF
	Input/case			1000		
	Output/case					

FEATURE CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Switching Frequency		All		300		KHz
On/Off Control, Positive Remote On/Off Logic						
Logic Low (Module Off)	$V_{on/off}$	All	0		1.2	V
Logic High (Module On)	$V_{on/off}$	All	3.5 or Open Circuit		75	V
On/Off Control, Negative Remote On/Off Logic						
Logic High (Module Off)	$V_{on/off}$	All	3.5 or Open Circuit		75	V
Logic Low (Module On)	$V_{on/off}$	All	0		1.2	V
ON/OFF Current (for Both Remote On/Off Logic)	$I_{on/off}$ at $V_{on/off}$=0.0V	All		0.3	1	mA
Leakage Current (for Both Remote On/Off Logic)	Logic high, $V_{on/off}$=15V	All			30	uA
Off Converter Input Current	Shutdown input idle current	All		4	10	mA
Output Voltage Trim Range	P_{out}=max. rated power	All	-10		+10	%
Output Over Voltage Protection		All	115	125	140	%
Over-Temperature Shutdown		All		110		℃

GENERAL SPECIFICATIONS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
MTBF	I_o=100% of $I_{o\_max.}$; T_a=25℃ per MIL-HDBK-217F	XXS24 XXS48		800		K hours
		Others		600		
Weight		All		63		grams

5. Main Features and Functions

5.1 Operating Temperature Range

The CQE50W series converters can be operated within a wide case temperature range of -40 ℃ to 105 ℃. Consideration must be given to the derating curves when ascertaining maximum power that can be drawn from the converter. The maximum power drawn from quarter brick models is influenced by usual factors, such as:

- Input voltage range
- Output load current
- Forced air or natural convection

5.2 Output Voltage Adjustment

Section 6.8 describes in detail how to trim the output voltage with respect to its set point. The output voltage on all models is adjustable within the range of +10% to -10%.

5.3 Over Current Protection

The converter is protected against over current or short circuit conditions. At the instance of current-limit inception, the module enters a hiccup mode of operation, whereby it shuts down and automatically attempts to restart. While the fault condition exists, the module will remain in this hiccup mode, and can remain in this mode until the fault is cleared. The unit operates normally once the output current is reduced back into its specified range.

5.4 Output Overvoltage Protection

The output overvoltage protection consists of circuitry that internally limits the output voltage. If more accurate output over voltage protection is required then an external circuit can be used via the remote on/off pin.

5.6 Remote On/Off

The CQE50W series allows the user to switch the module on and off electronically with the remote **on/off** feature. All models are available in “positive logic” and “negative logic” (optional) versions. The converter turns on if the remote **on/off** pin is high (>3.5Vdc or open circuit). Setting the pin low (0 to <1.2Vdc) will turn the converter off. The signal level of the remote **on/off** input is defined with respect to ground. If not using the remote **on/off** pin, leave the pin open (converter will be on). Models with part number suffix “N” are the “negative logic” remote **on/off** version. The unit turns off if the remote **on/off** pin is high (>3.5Vdc or open circuit). The converter turns on if the on/off pin input is low (0 to <1.2Vdc). Note that the converter is off by default.

5.7 UVLO (Under Voltage Lock Out)

Input under voltage lockout is standard on the CQE50W unit. The unit will shut down when the input voltage drops below a threshold, and the unit will operate when the input voltage goes above the upper threshold.

5.8 Over Temperature Protection

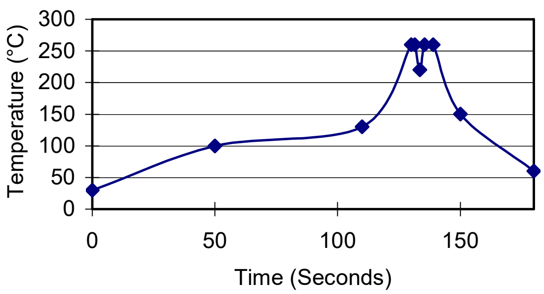
These modules have an overtemperature protection circuit to safeguard against thermal damage. Shutdown occurs with the maximum case reference temperature is exceeded. The module will restart when the case temperature falls below over temperature shutdown threshold.

6. Applications

6.1 Recommended Layout, PCB Footprint and Soldering Information

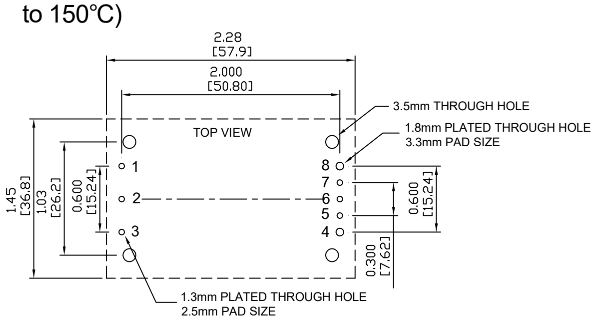
The system designer or end user must ensure that metal and other components in the vicinity of the converter meet the spacing requirements for which the system is approved. Low resistance and inductance PCB layout traces are the norm and should be used where possible. Due consideration must also be given to proper low impedance tracks between power module, input and output grounds. The recommended soldering profile and PCB layout are shown below.

Lead Free Wave Soldering Profile



Note :

1. Soldering Materials: Sn/Cu/Ni
2. Ramp up rate during preheat: 1.4 ℃/Sec (from 50℃ to 100℃)
3. Soaking temperature: 0.5 ℃/Sec (from 100℃ to 130℃), 60±20 seconds
4. Peak temperature: 260℃, above 250℃ 3~6 Seconds
5. Ramp up rate during cooling: -10.0 ℃/Sec (from 260℃ to 150℃)



6.2 Convection Requirements for Cooling

To predict the approximate cooling needed for the Quarter brick module, refer to the power derating curves in section 6.4. These derating curves are approximations of the ambient temperatures and airflows required to keep the power module temperature below its maximum rating. Once the module is assembled in the actual system, the module's temperature should be monitored to ensure it does not exceed 105°C as measured at the center of the top of the case (thus verifying proper cooling).

6.3 Thermal Considerations

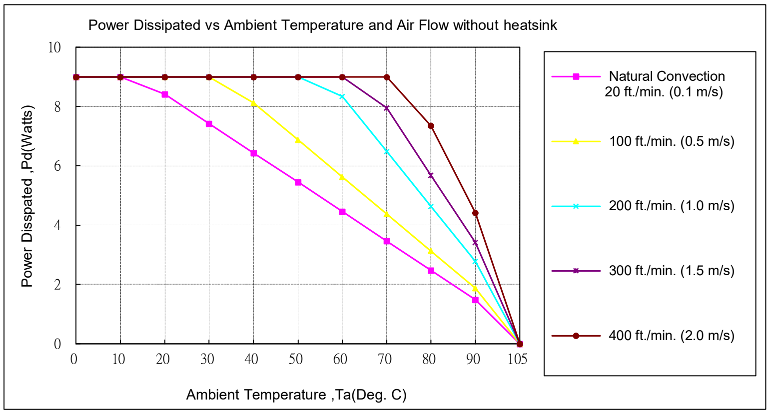
The power module operates in a variety of thermal environments; however, sufficient cooling should be provided to help ensure reliable operation of the unit. Heat is removed by conduction, convection, and radiation to the surrounding environment. The power output of the module should not be allowed to exceed rated power (V_{o_set} x $I_{o\_max.}$).

The power modules have through-threaded,M3 x0.5 mounting holes, which enable heat sinks or cold plates to be attached to the module. Thermal de-rating with heat sinks is expressed by using the overall thermal resistance of the module (R_{ca}).

6.4 Power Derating

The operating case temperature range of CQE50W series is -40℃ to +105℃. When operating the CQE50W series, proper de-rating or cooling is needed. The maximum case temperature under any operating condition should not exceed 105℃.

Forced Convection Power De-rating without Heat Sink



AIR FLOW RATE	TYPICAL R_{ca}
Natural Convection 20ft./min. (0.1m/s)	10.1 ℃/W
100 ft./min. (0.5m/s)	8.0 ℃/W
200 ft./min. (1.0m/s)	5.4 ℃/W
300 ft./min. (1.5m/s)	4.4 ℃/W
400 ft./min. (2.0m/s)	3.4 ℃/W

Example (without heatsink):

What is the minimum airflow necessary for a CQE50W-48S05 operating at nominal line voltage, an output current of 10A, and a maximum ambient temperature of 60℃?

Solution:

Given: V_{in}=48V_{dc}, V_o=5V_{dc}, I_o=10A

Determine Power dissipation (P_d):

$P_d=P_i-P_o=P_o(1-\eta)/\eta$

$P_d=5.0\times10\times(1-0.92)/0.92=4.3478$Watts

Determine airflow:

Given: P_d=4.3478W and T_a=60℃

Check above Power de-rating curve:

Airflow ≦ 200 ft./min.

Verifying:

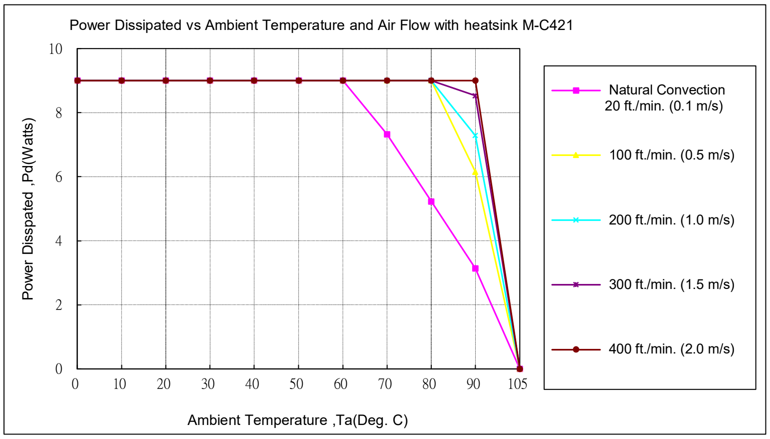
The maximum temperature rise $\triangle T = P_d\times R_{ca}=4.3478\times5.4=23.48$℃

The maximum case temperature $T_c=T_a+\triangle T$=83.48℃ <105℃

Where:

The R_{ca} is thermal resistance from case to ambience

The T_a is ambient temperature and the T_c is case temperature



AIR FLOW RATE	TYPICAL R_{ca}
Natural Convection 20ft./min. (0.1m/s)	4.78 ℃/W
100 ft./min. (0.5m/s)	2.44 ℃/W
200 ft./min. (1.0m/s)	2.06 ℃/W
300 ft./min. (1.5m/s)	1.76 ℃/W
400 ft./min. (2.0m/s)	1.58 ℃/W

Example with heat sink QBT210 (M-C421):
What is the minimum airflow necessary for a CQE50W-48S12 operating at nominal line voltage, an output current of 4.16A, and a maximum ambient temperature of 60℃?

Solution:

Given: V_{in}=48V_{dc}, V_o=12V_{dc}, I_o=4.16A

Determine Power dissipation (P_d):

$P_d=P_i-P_o=P_o(1-\eta)/\eta$

$P_d=12\times4.16\times(1-0.92)/0.92=4.3478$Watts

Determine airflow:

Given: P_d=4.3478W and T_a=60℃

Check above Power de-rating curve:

P_d<12.55W, Natural Convection

Verify:

The maximum temperature rise $\triangle T=P_d\times R_{ca}=4.3475\times4.78=20.8$℃

The maximum case temperature $T_c=T_a+\triangle T=80.8$℃ <105℃

Where:

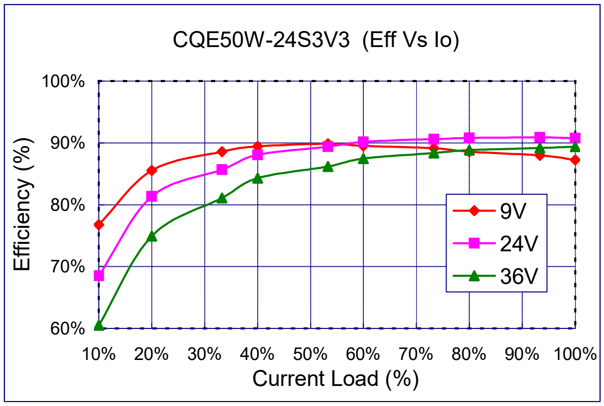
The R_{ca} is thermal resistance from case to ambience

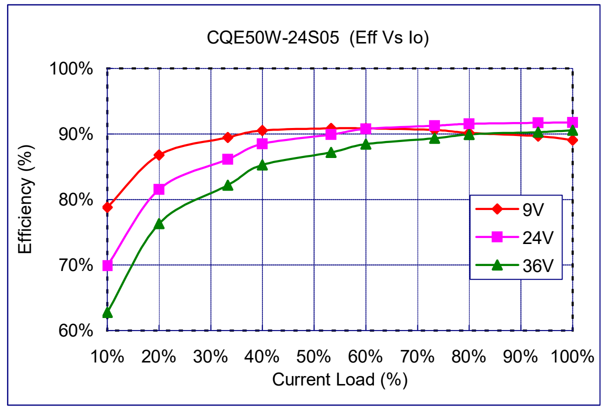
The T_a is ambient temperature and the T_c is case temperature

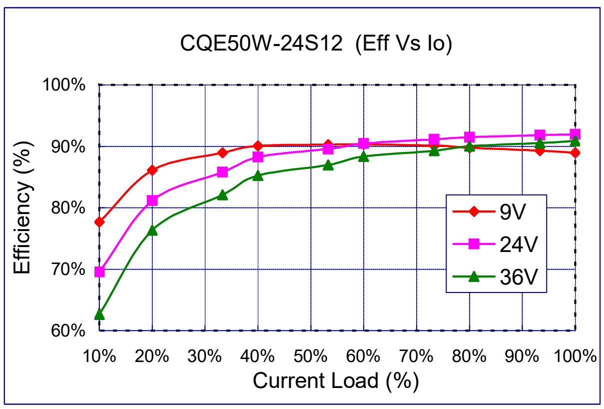
6.5 Quarter Brick Heat Sinks:

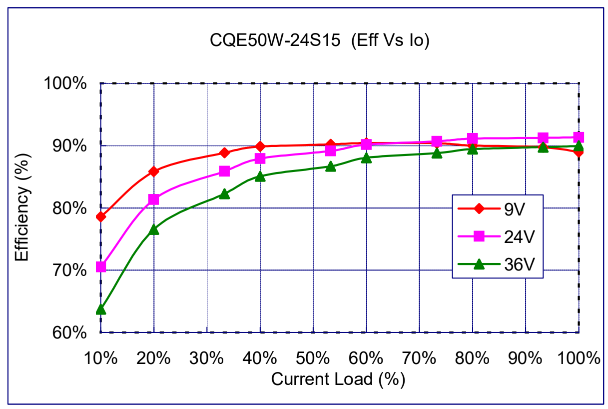
Heat sinks assembly **refer to Datasheet-Thermal**

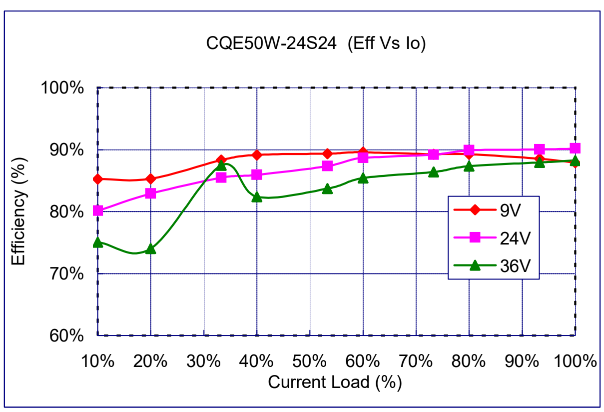
6.6 Efficiency VS. Load:

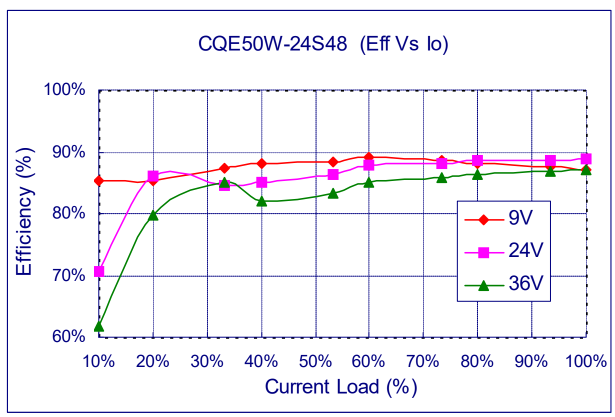


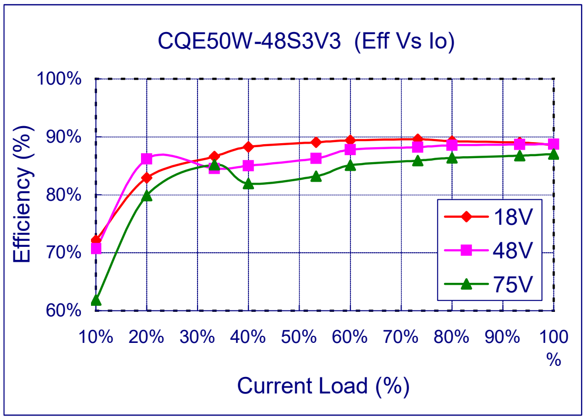




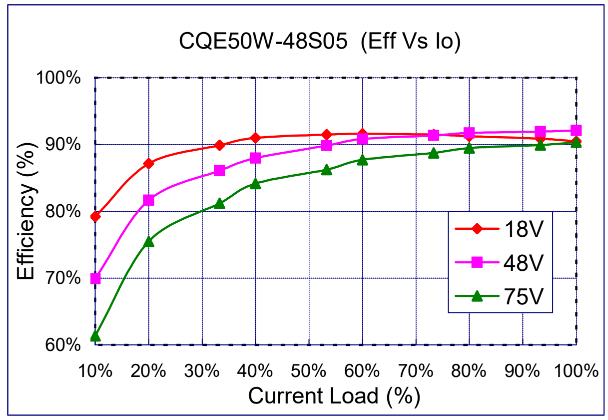




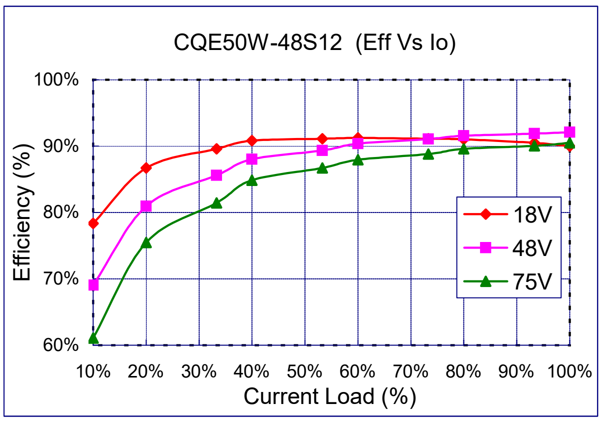




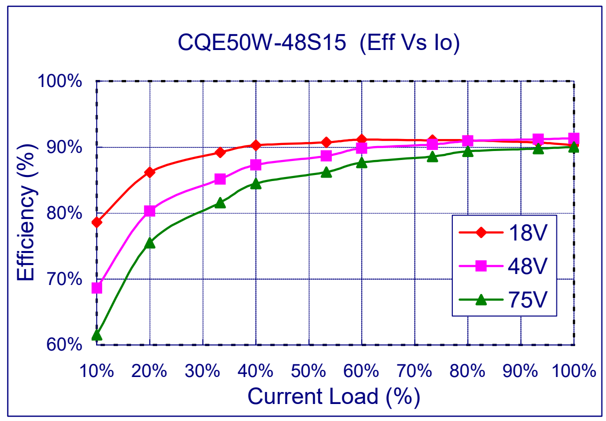
CQE50W-48S3V3 (Eff Vs Io)
Efficiency (%)
100%
90%
80%
70%
60%
10% 20% 30% 40% 50% 60% 70% 80% 90% 100 %
Current Load (%)
18V
48V
75V



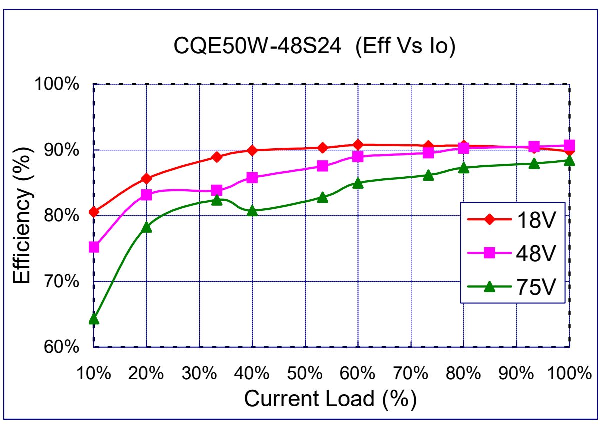
CQE50W-48S05 (Eff Vs Io)
Efficiency (%)
100%
90%
80%
70%
60%
10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
Current Load (%)
18V
48V
75V



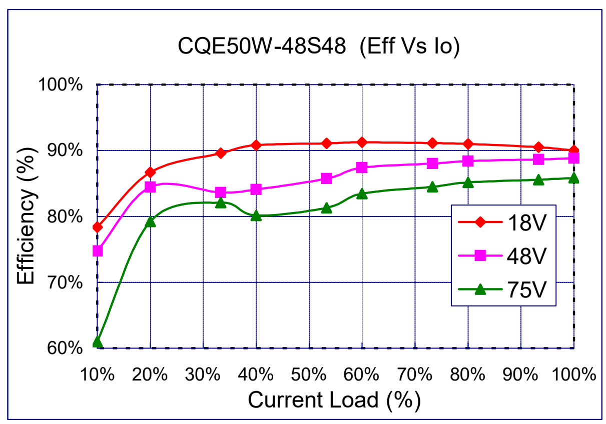
CQE50W-48S12 (Eff Vs Io)
Efficiency (%)
100%
90%
80%
70%
60%
10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
Current Load (%)
18V
48V
75V



CQE50W-48S15 (Eff Vs Io)
Efficiency (%)
100%
90%
80%
70%
60%
10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
Current Load (%)
18V
48V
75V



CQE50W-48S24 (Eff Vs Io)
Efficiency (%)
100%
90%
80%
70%
60%
10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
Current Load (%)
18V
48V
75V



CQE50W-48S48 (Eff Vs Io)
Efficiency (%)
100%
90%
80%
70%
60%
10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
Current Load (%)
18V
48V
75V

6.7 Test Set-Up

The basic test set-up to measure parameters such as efficiency and load regulation is shown below. When testing the modules under any transient conditions please ensure that the transient response of the source is sufficient to power the equipment under test. We can calculate:

- Efficiency
- Load regulation and line regulation

The value of efficiency is defined as:

$$\eta = \frac{V_o \times I_o}{V_{in} \times I_{in}} \times 100\%$$

Where:

V_o is output voltage,
I_o is output current,
V_{in} is input voltage,
I_{in} is input current

The value of load regulation is defined as:

$$Load.reg = \frac{V_{FL} - V_{NL}}{V_{NL}} \times 100\%$$

Where:

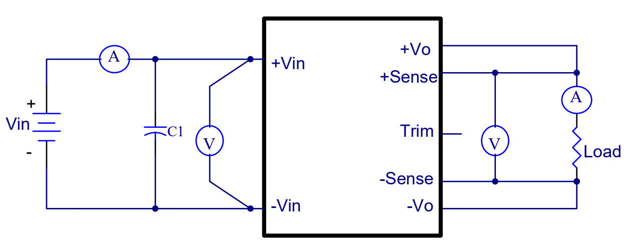
V_{FL} is the output voltage at full load
V_{NL} is the output voltage at no load

The value of line regulation is defined as:

$$Line.reg = \frac{V_{HL} - V_{LL}}{V_{LL}} \times 100\%$$

Where:

V_{HL} is the output voltage of maximum input voltage at full load
V_{LL} is the output voltage of minimum input voltage at full load



CQB100W Series Test Setup

6.8 Output Voltage Adjustment

In order to trim the voltage up or down one needs to connect the trim resistor either between the trim pin and -Vo for trim-up and between trim pin and +Vo for trim-down. The output voltage trim range is ±10%. This is shown in Figures 1 and 2:

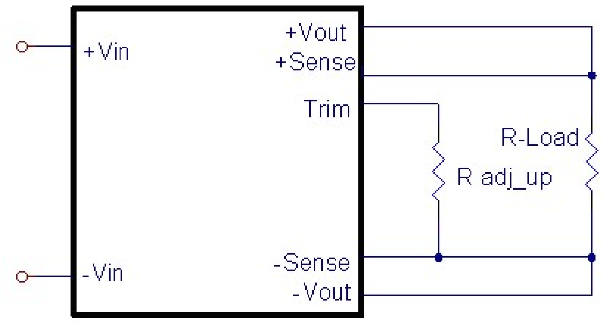


Figure 1. Trim-up Voltage Setup

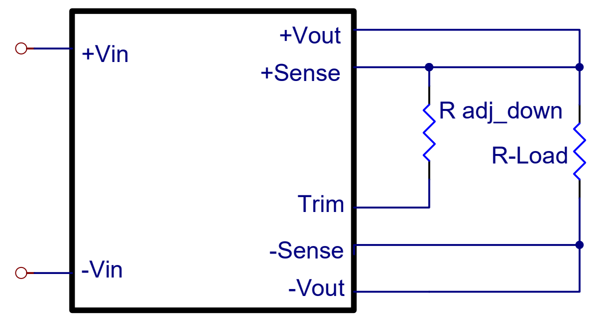


Figure 2. Trim-down Voltage Setup

1. The value of R_{trim_up} defined as:

For Vo=5V R_{trim_up} decision:

$$Rtrim\_up = \left(\frac{R_1 Vr}{Vo - Vo\_nom}\right) - R_2\ (K\Omega)$$

For others R_{trim_up} decision:

$$Rtrim\_up = \left(\frac{R_1\left(Vr - Vf\left(\frac{R2}{R2+R3}\right)\right)}{Vo - Vo_nom}\right) - \frac{R2R3}{R2+R3}\ (K\Omega)$$

Where:

R trim_up is the external resistor in KΩ.
Vo_nom is the nominal output voltage.
Vo is the desired output voltage.
R1, R2, R3 and Vr are internal to the unit and are defined in Table 1.

Output Voltage(V)	R1 (KΩ)	R2 (KΩ)	R3 (KΩ)	Vr (V)	Vf (V)
3.3V	3.0	12	4.3	1.24	0.46
5V	2.32	3.3	NC	2.5	0
12V	9.1	51	5.1	2.5	0.46
15V	12	56	8.25	2.5	0.46
24V	20	100	7.5	2.5	0.46
48V	36	270	5.1	2.5	0.46

Table 1 – Trim Resistor Values

For example, to trim-up the output voltage of 12V module
(CQE50W-48S12) by 5% to 12.6V, R trim_up is calculated as follows:

Vo – Vo_nom = 12.6 – 12 = 0.6V

R1 = 9.1KΩ, R2 = 51KΩ, R3 = 5.1KΩ,

Vr= 2.5V, Vf=0.46

$$Rtrim\_up = \frac{18.944}{0.6} - 4.636 = 26.94\ (K\Omega)$$

2. The value of R trim_down defined as:

$$Rtrim\_down = \frac{R1 \times (Vo - Vr)}{Vo\_nom - Vo} - R2\ (K\Omega)$$

Where:

R_{trim_down} is the external resistor in Kohm.
V_o_nom is the nominal output voltage.
V_o is the desired output voltage.
R1, R2, R3 and Vr are internal to the unit and are defined in Table 1.

For example, to trim-down the output voltage of 12V module
(CQE50W-48S12) by 5% to 11.4V, R trim-down is calculated as follows:

Vo_nom – Vo = 12 – 11.4 = 0.6V
R1 = 9.1KΩ, R2 = 51KΩ, Vr= 2.5V

$$Rtrim\_down = \frac{9.1 \times (11.4 - 2.5)}{0.6} - 51 = 83.98\ (K\Omega)$$

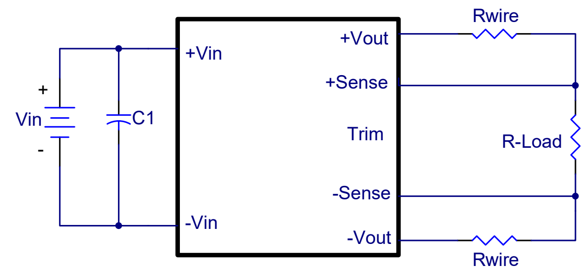
6.9 Output Remote Sensing

The CQE50W SERIES converter has the capability to remotely sense both lines of its output. This feature moves the effective output voltage regulation point from the output of the unit to the point of connection of the remote sense pins. This feature automatically adjusts the real output voltage of the CQE50W series in order to compensate for voltage drops in distribution and maintain a regulated voltage at the point of load. The remote-sense voltage range is:

[(+Vout) - (-Vout)] – [(+Sense) – (-Sense)] ≦ 10% of Vo_nominal

If the remote sense feature is not to be used, the sense pins should be connected locally. The +Sense pin should be connected to the +V_{out} pin at the module and the -Sense pin should be connected to the -V_{out} pin at the module.

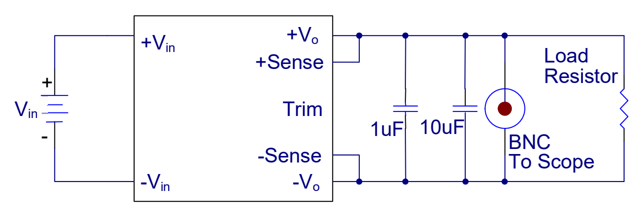
This is shown in the schematic below.



Note:

Although the output voltage can be varied (increased or decreased) by both remote sense and trim, the maximum variation for the output voltage is the larger of the two values not the sum of the values. The output power delivered by the module is defined as the voltage at the output terminals multiplied by the output current. Using remote sense and trim can cause the output voltage to increase and consequently increase the power output of the module if output current remains unchanged. Always ensure that the output power of the module remains at or below the maximum rated power. Also be aware that if $V_{o.set}$ is below nominal value, $P_{out.max.}$ will also decrease accordingly because $I_{o.max}$ is an absolute limit. Thus, $P_{out.max.} = V_{o.set}$ x $I_{o.max}$ is also an absolute limit.

6.10 Output Ripple and Noise



Output ripple and noise is measured with 1.0uF ceramic and 10uF solid tantalum capacitors across the output. (for Vo: 48V: Output ripple and noise is measured with 1.0uF ceramic and 10uF aluminum capacitors across the output.)

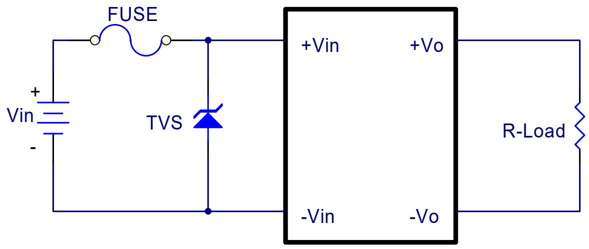
6.11 Output Capacitance

The CQE50W series converters provide unconditional stability with or without external capacitors. For good transient response, low ESR output capacitors should be located close to the point of load. PCB design emphasizes low resistance and inductance tracks in consideration of high current applications. Output capacitors with their associated ESR values have an impact on loop stability and bandwidth. These series converters are designed to work with load capacitance to see technical specifications

7. Safety & EMC

7.1 Input Fusing and Safety Considerations

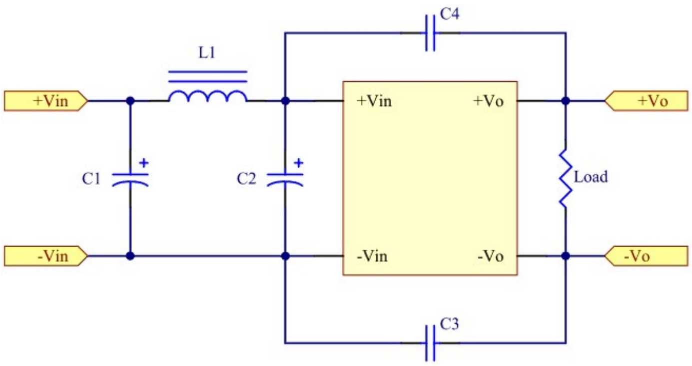
The CQE50W series converters have no internal fuse. In order to achieve maximum safety and system protection, always use an input line fuse. We recommended a 10A time delay fuse for the 24Vin models and a 5A time delay fuse for the 48Vin models. It is recommended that the circuit have a transient voltage suppressor diode (TVS) across the input terminal to protect the unit against surge or spike voltage and input reverse voltage (as shown).



7.2 EMC Considerations

Suggested Circuits for Conducted EMI Class A & Class B

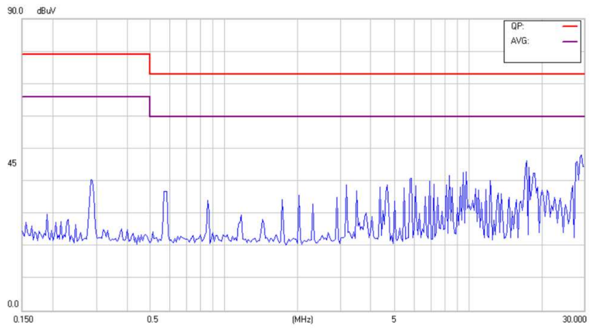
(1) EMI and conducted noise meet EN 55032 Class A specifications:



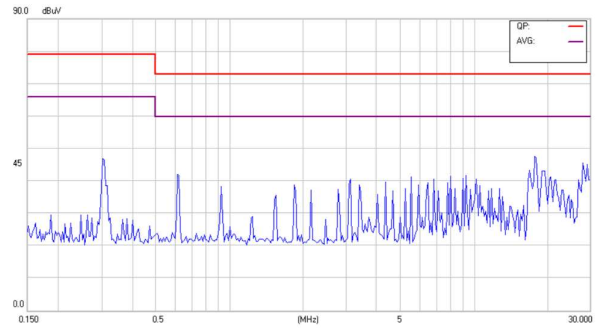
Model No.	C1	C2	C3	C4	L1
CQE50W-24S3V3	220u/63V ESR < 0.046Ω	220u/63V ESR < 0.046Ω	2200pF/2KV	2200pF/2KV	3.4uH
CQE50W-24S05	220u/63V ESR < 0.046Ω	220u/63V ESR < 0.046Ω	2200pF/2KV	2200pF/2KV	3.4uH
CQE50W-24S12	220u/63V ESR < 0.046Ω	220u/63V ESR < 0.046Ω	2200pF/2KV	2200pF/2KV	3.4uH
CQE50W-24S15	220u/63V ESR < 0.046Ω	220u/63V ESR < 0.046Ω	2200pF/2KV	2200pF/2KV	3.4uH
CQE50W-24S24	220u/63V ESR < 0.046Ω	220u/63V ESR < 0.046Ω	2200pF/2KV	2200pF/2KV	3.4uH
CQE50W-24S48	220u/63V ESR < 0.046Ω	220u/63V ESR < 0.046Ω	2200pF/2KV	2200pF/2KV	3.4uH
CQE50W-48S3 V 3	82u/100V ESR < 0.084Ω	82u/100V ESR < 0.084Ω	2200pF/2KV	2200pF/2KV	3.4uH
CQE50W-48S05	82u/100V ESR < 0.084Ω	82u/100V ESR < 0.084Ω	2200pF/2KV	2200pF/2KV	3.4uH
CQE50W-48S12	82u/100V ESR < 0.084Ω	82u/100V ESR < 0.084Ω	2200pF/2KV	2200pF/2KV	3.4uH
CQE50W-48S15	82u/100V ESR < 0.084Ω	82u/100V ESR < 0.084Ω	2200pF/2KV	2200pF/2KV	3.4uH
CQE50W-48S24	82u/100V ESR < 0.084Ω	82u/100V ESR < 0.084Ω	2200pF/2KV	2200pF/2KV	3.4uH
CQE50W-48S48	82u/100V ESR < 0.084Ω	82u/100V ESR < 0.084Ω	2200pF/2KV	2200pF/2KV	3.4uH

Note:

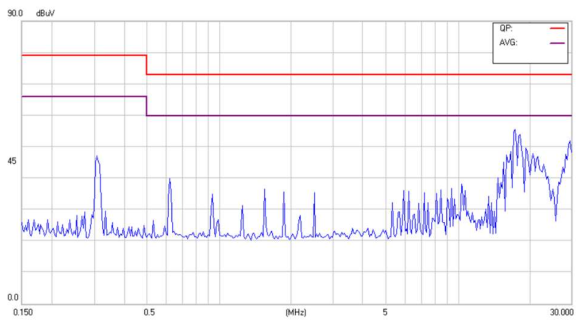
The C1 and C2 are aluminum capacitors, C3 and C4 are ceramic capacitors.



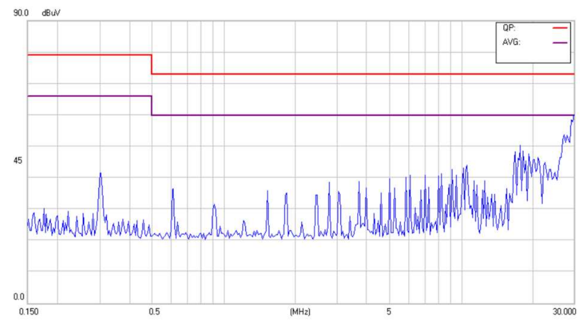
Conducted Class A of CQE50W-24S3V3



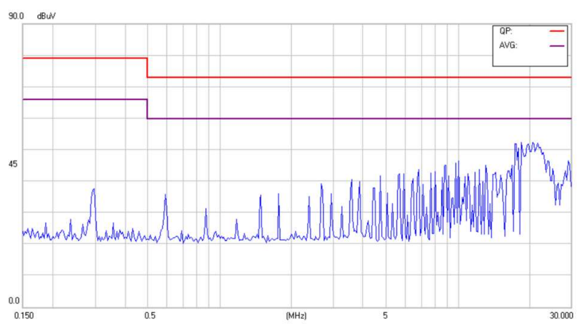
Conducted Class A of CQE50W-24S05



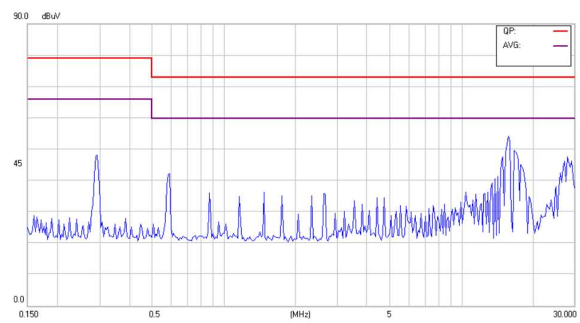
Conducted Class A of CQE50W-24S12



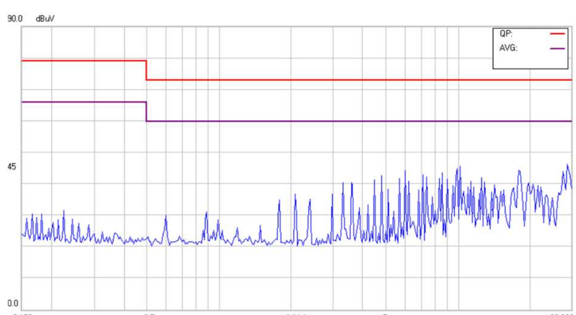
Conducted Class A of CQE50W-24S15



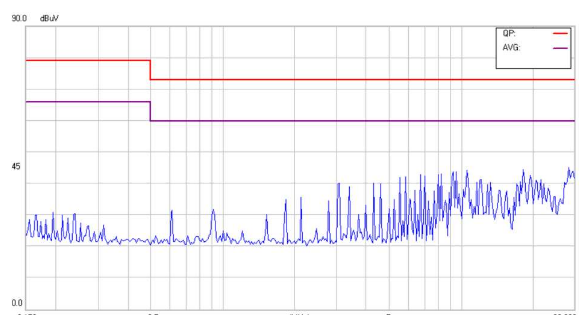
Conducted Class A of CQE50W-24S24



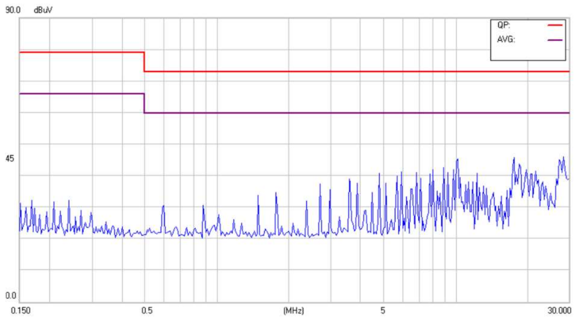
Conducted Class A of CQE50W-24S48



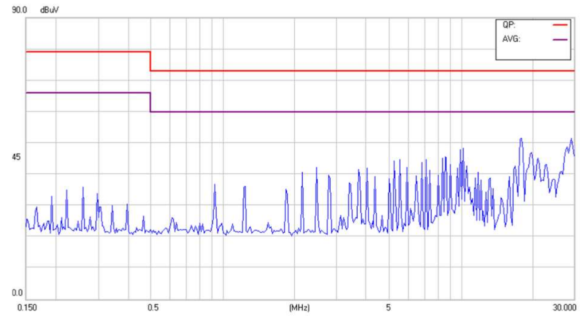
Conducted Class A of CQE50W-48S3V3



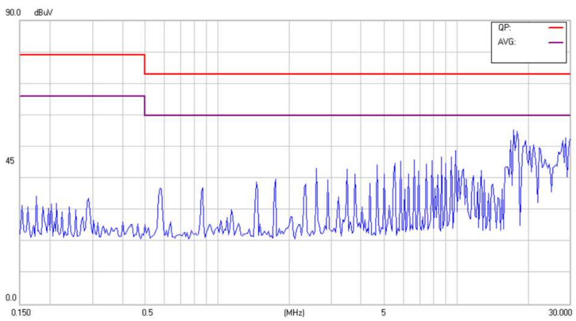
Conducted Class A of CQE50W-48S05



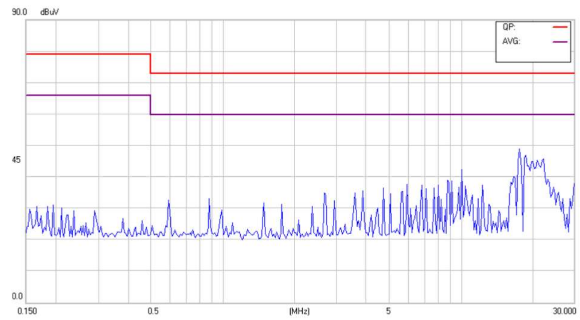
Conducted Class A of CQE50W-48S12



Conducted Class A of CQE50W-48S15

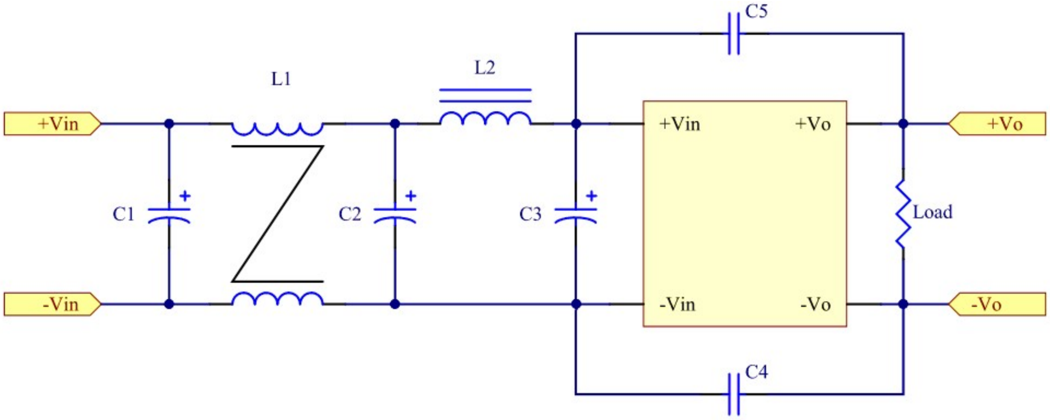


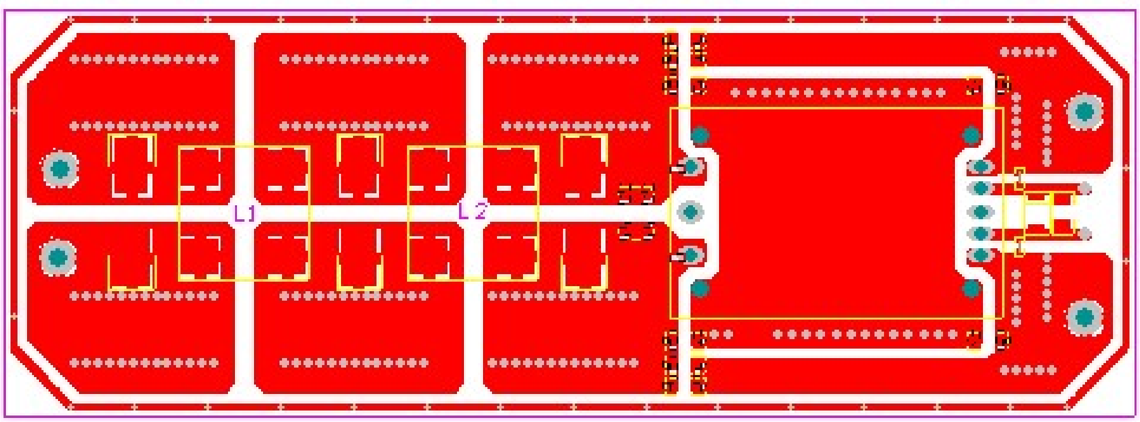
Conducted Class A of CQE50W-48S24



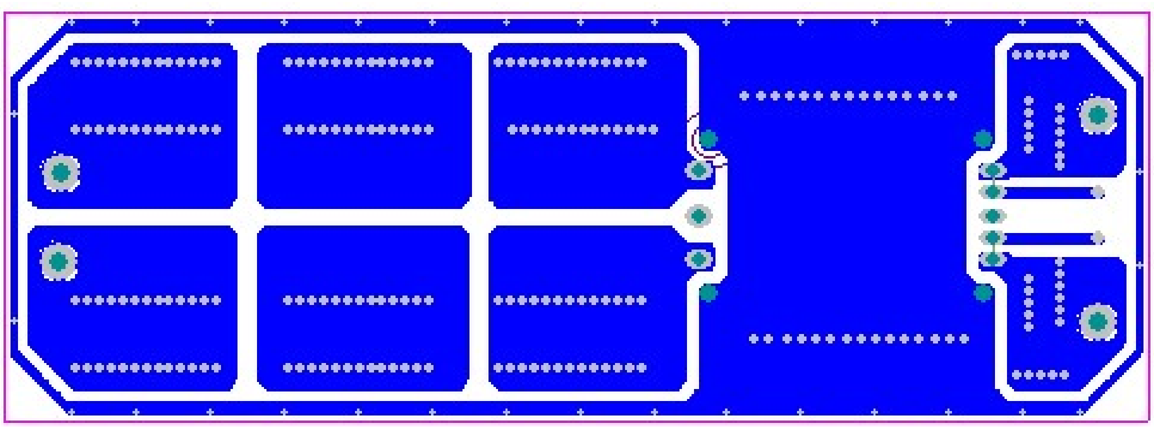
Conducted Class A of CQE50W-48S48

(2) EMI and conducted noise meet EN 55032 Class B specifications:





EMI Test Board Top Side



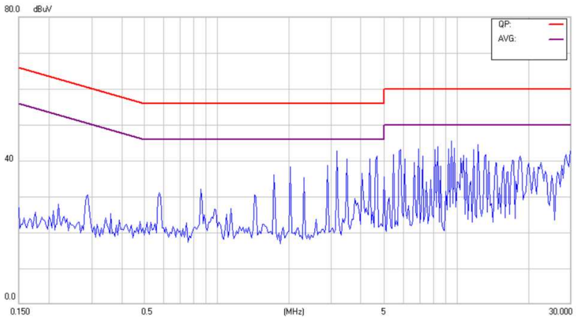
EMI Test Board Bottom Side

Components value:

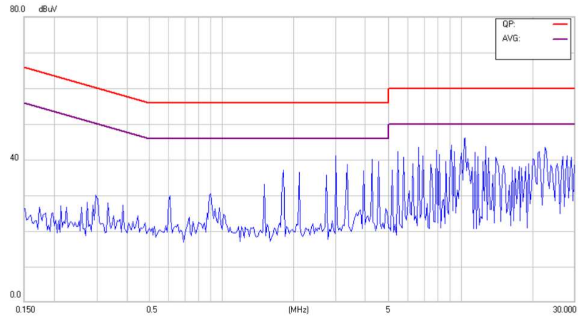
Model No.	C1	C2	C3	C4	C5	L1	L2
CQE50W-24S3V3	100u/50V ESR < 0.33Ω	100u/50V ESR < 0.33Ω	100u/50V ESR < 0.33Ω	1000pF/3KV	1000pF/3KV	0.5mH	12uH
CQE50W-24S05	100u/50V ESR < 0.33Ω	100u/50V ESR < 0.33Ω	100u/50V ESR < 0.33Ω	1000pF/3KV	1000pF/3KV	0.5mH	12uH
CQE50W-24S12	100u/50V ESR < 0.33Ω	100u/50V ESR < 0.33Ω	100u/50V ESR < 0.33Ω	3300pF/2KV	3300pF/2KV	0.5mH	12uH
CQE50W-24S15	100u/50V ESR < 0.33Ω	100u/50V ESR < 0.33Ω	100u/50V ESR < 0.33Ω	3300pF/2KV	3300pF/2KV	0.5mH	12uH
CQE50W-24S24	100u/50V ESR < 0.33Ω	100u/50V ESR < 0.33Ω	100u/50V ESR < 0.33Ω	3300pF/2KV	3300pF/2KV	0.5mH	12uH
CQE50W-24S48	100u/50V ESR < 0.33Ω	100u/50V ESR < 0.33Ω	100u/50V ESR < 0.33Ω	3300pF/2KV	3300pF/2KV	0.5mH	12uH
CQE50W-48S3V3	47u/100V ESR < 0.17Ω	47u/100V ESR < 0.17Ω	47u/100V ESR < 0.17Ω	3300pF/2KV	3300pF/2KV	0.5mH	12uH
CQE50W-48S05	47u/100V ESR < 0.17Ω	47u/100V ESR < 0.17Ω	47u/100V ESR < 0.17Ω	3300pF/2KV	3300pF/2KV	0.5mH	12uH
CQE50W-48S12	47u/100V ESR < 0.17Ω	47u/100V ESR < 0.17Ω	47u/100V ESR < 0.17Ω	3300pF/2KV	3300pF/2KV	0.5mH	12uH
CQE50W-48S15	47u/100V ESR < 0.17Ω	47u/100V ESR < 0.17Ω	47u/100V ESR < 0.17Ω	3300pF/2KV	3300pF/2KV	0.5mH	12uH
CQE50W-48S24	47u/100V ESR < 0.17Ω	47u/100V ESR < 0.17Ω	47u/100V ESR < 0.17Ω	3300pF/2KV	3300pF/2KV	0.5mH	12uH
CQE50W-48S48	47u/100V ESR < 0.17Ω	47u/100V ESR < 0.17Ω	47u/100V ESR < 0.17Ω	3300pF/2KV	3300pF/2KV	0.5mH	12uH

Note:

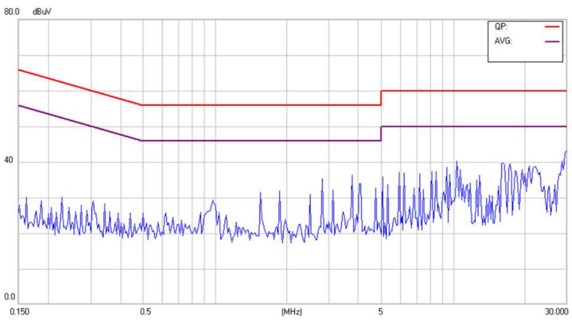
The C1, C2 and C3 are aluminum capacitors, C4 and C5 are ceramic capacitors



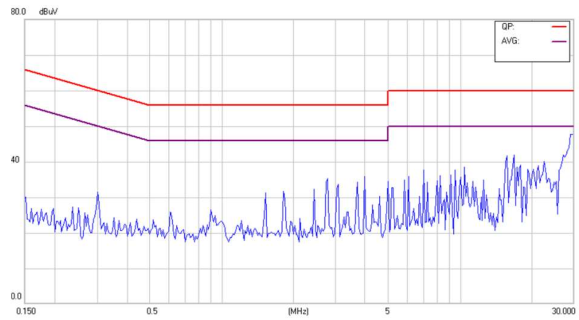
Conducted Class B of CQE50W-24S3V3



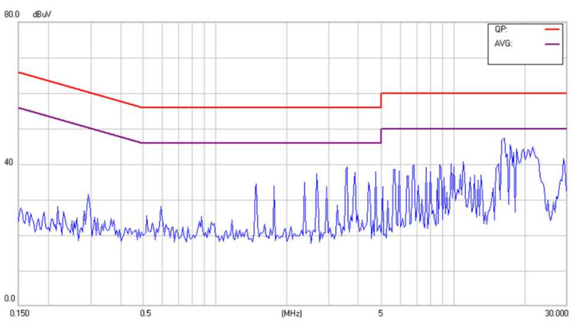
Conducted Class B of CQE50W-24S05



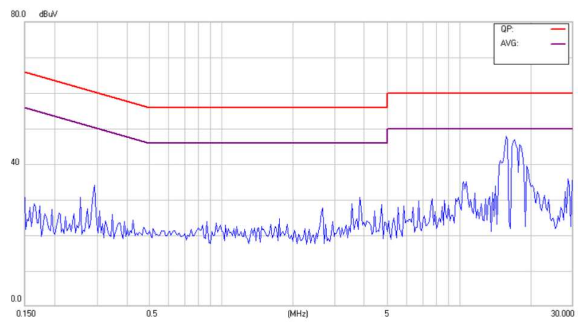
Conducted Class B of CQE50W-24S12



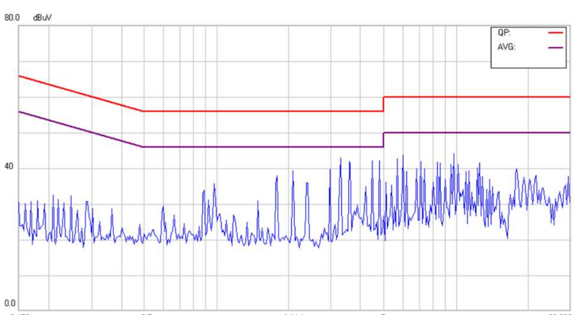
Conducted Class B of CQE50W-24S15



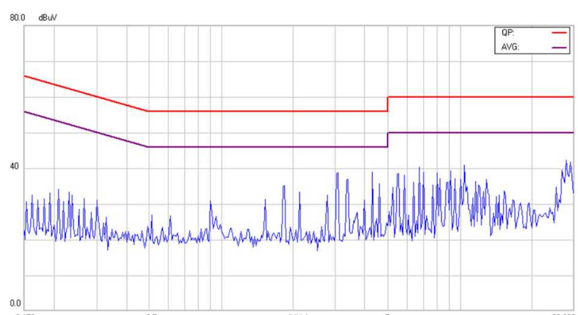
Conducted Class B of CQE50W-24S24



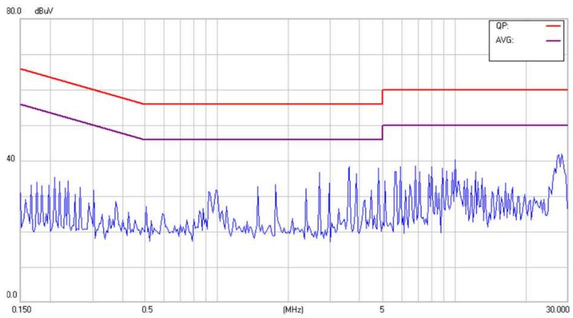
Conducted Class B of CQE50W-24S48



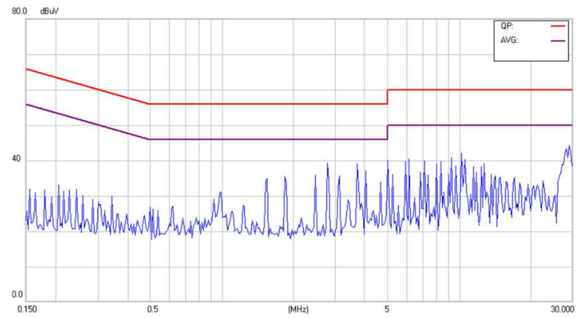
Conducted Class B of CQE50W-48S3V3



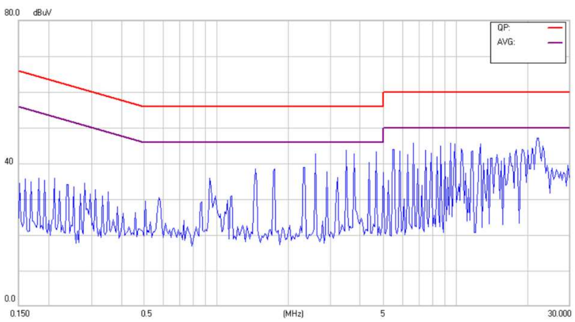
Conducted Class B of CQE50W-48S05



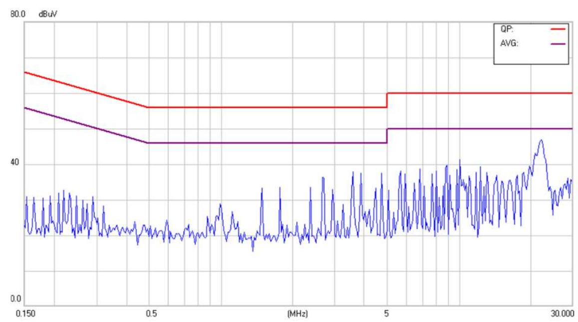
Conducted Class B of CQE50W-48S12



Conducted Class B of CQE50W-48S15



Conducted Class B of CQE50W-48S24



Conducted Class B of CQE50W-48S48

8. Part Number

Format: **CQE50W** – II X 00 L

Parameter	Series	Nominal Input Voltage	Number of Outputs	Output Voltage	Remote ON/OFF Logic
Symbol	CQE50W	II	X	00	L
Value	CQE50W	24 : 24 Volts 48 : 48 Volts	S : Single	3V3 : 3.3Volts 05 : 05Volts 12 : 12Volts 15 : 15Volts 24 : 24Volts 48 : 48Volts	None : Positive N : Negative

CINCON ELECTRONICS CO., LTD.

Headquarters:

14F, No.306, Sec.4, Hsin Yi Rd.
Taipei, Taiwan
Tel: 886-2-27086210
Fax: 886-2-27029852
E-mail: sales@cincon.com
Web Site: https://www.cincon.com

Factory:

No. 8-1, Fu Kung Rd.
Fu Hsing Industrial Park
Fu Hsing Hsiang,
ChangHua Hsien, Taiwan
Tel: 886-4-7690261
Fax: 886-4-7698031

Cincon North America:

1655Mesa Verde Ave. Ste 180
Ventura, CA93003
Tel: 805-639-3350
Fax: 805-639-4101
E-mail: info@cincon.com