QBR SERIES Quarter-Brick

Up to 100 Watts DC-DC Converter

PRODUCT OVERVIEW

This QBR railway series offers up to 100 watts of output power housed in an industry standard quarter-brick package with high power density. This QBR series features wide input voltage range from 66 to 160VDC (110 Volts nominal), high efficiency isolation of 2250VDC and provide a precise regulated voltage output.

All QBR models operate over the temperature range of – 40°C to +105°C. The modules offer Input under voltage lock out (UVLO), and are fully protected against output overvoltage and over temperature conditions. All models have internal over current and continuous short circuit protection. The output voltage can be trimmed to the required voltage and the product includes remote on/off function.

This QBR series provides efficiency up to 93%, meet industrial standard and is the best choice for railway system, industrial, distributed power architectures, telecommunications, and mobile applications.

Please contact DATEL if your application requires different output voltage or any other special feature.

FEATURES

- Isolated Output up to 100 Watts
- Wide input range (66 – 160 VDC)
- Regulated Outputs
- Efficiency to 93%
- Remote On/Off
- Continuous Short Circuit Protection
- -40 °C to +100 °C
- Voltage/Current/Over-temperature Protection
- Quarter Brick Dimension
- Meet Industrial Standard
- Designed to meet UL60950-1 and EN50155

APPLICATIONS:

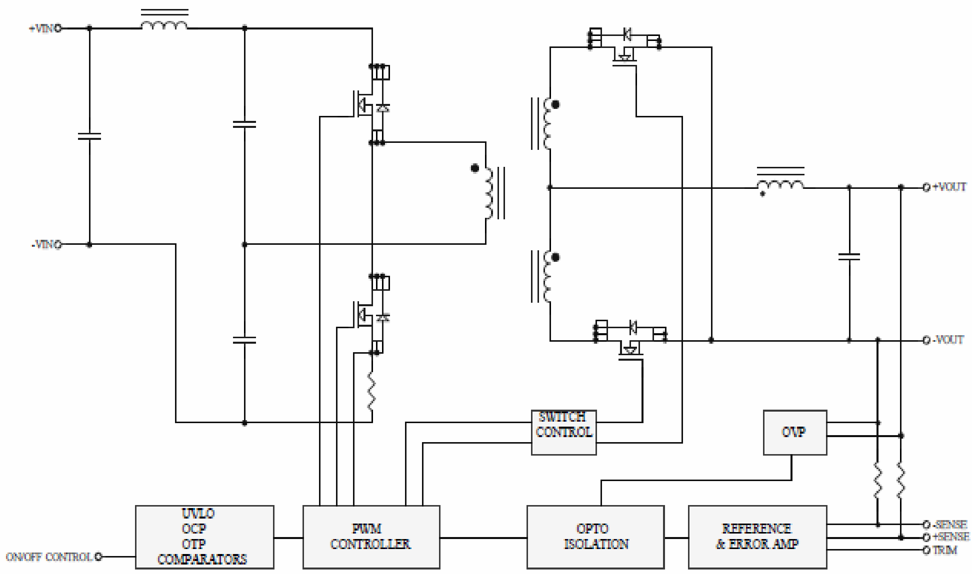
- Railway Systems
- Distributed Power Systems
- mobile equipment
- Telecommunications

AVAILABLE OPTIONS

- Customizable Input/ Output voltages
- Heatsink, customizable packaging
- UL/CSA60950-1
- CE Mark 2004/108/EC

MODEL NUMBER	INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT MAX	EFFICIENCY %	LOAD REGULATION	OPTIONS
QBR113S3.3-25	66-160 VDC	3.3VDC	25 A	90	± 0.2 %	N, M
QBR113S5-20	66-160 VDC	5.0 VDC	20 A	92.5	± 0.2 %	N, M
QBR113S12-8.4	66-160 VDC	12 VDC	8.4 A	93	± 0.2 %	N, M
QBR113S24-4.2	66-160 VDC	24 VDC	4.2 A	92	± 0.2 %	N, M

BLOCK DIAGRAM



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ABSOLUTE MAXIMUM RATINGS

PARAMETER	CONDITIONS	Model	Min.	Typical	Max.	Units
Input Voltage						
Continuous	DC	All	-0.3		160	Volts
Transient	100 ms, DC	All			180	Volts
Operating Case Temperature		All	-40		+100	°C
Storage Temperature		All	-55		+105	°C
Isolation Voltage	1 minute; input/output, input/case, DC	All	2250			Volts
	1 minute; output/case, DC	All	1500			

Stresses above the absolute maximum ratings can cause permanent damage to the device.

FUNCTIONAL SPECIFICATIONS

The following specifications apply over the operating temperature range, under the following conditions TA = +25°C unless otherwise specified

INPUT CHARACTERISTICS

PARAMETER	CONDITIONS	Model	Min.	Typical	Max.	Units
Operating Input Voltage	**DC**	All	66	110	160	Volts
Input Under-voltage Lockout						
Turn-On Voltage Threshold	DC	All	60	62	64	Volts
Turn-Off Voltage Threshold	DC	All	54	56	58	Volts
Lockout Hysteresis Voltage	DC	All		6		Volts
Maximum Input Current	100% Load, V_{in}= 66V	All		1700		mA
No-Load Input Current	V_{in}=Nominal	Vo=3.3V Vo=5.0V Vo=12V Vo=24V		40 30 40 60		mA
Inrush Current (I^2t)		All			0.1	A^2s
Input Reflected Ripple Current	P-P thru 12µH inductor, 5Hz to 20MHz	All		30		mA

OUTPUT CHARACTERISTICS

PARAMETER	CONDITIONS	Device	Min.	Typical	Max.	Units
Output Voltage Set Point	V_{in}=Nominal V_{in}, I_o = I_{o_max}, Tc=25°C DC	Vo=3.3 V Vo=5.0 V Vo=12 V Vo=24 V	3.2505 4.925 11.82 23.64	3.3 5 12 24	3.3495 5.075 12.18 24.36	Volts
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	TC=-40°C to 100°C	All			±0.03	%/°C
Output Voltage Ripple and Noise (5Hz to 20MHz bandwidth)						
Peak-to-Peak	Full load, 10µF tantalum and 1.0uF ceramic capacitors	Vo=3.3V Vo=5V Vo=12V Vo=24V			100 100 150 240	mV

RMS	Full load, 10μF solid tantalum and 1.0μF ceramic capacitors	Vo=3.3V Vo=5V Vo=12V Vo=24V			40 40 60 100	mV
Operating Output Current Range		Vo=3.3V Vo=5.0V Vo=12V Vo=24V	0 0 0 0		25 20 8.4 4.2	A
Output DC Current Limit Inception	Vo = 90% Nominal Output Voltage	All	110	150	180	%
Maximum Output Capacitance	Full resistive load	Vo=3.3V Vo=5.0V Vo=12V Vo=24V	0 0 0 0		10000 10000 8800 1500	μF

DYNAMIC CHARACTERISTICS

PARAMETER	CONDITIONS	Model	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% Vout nominal)	d_i/d_t=0.1A/μs	All			200	μs
Turn-On Delay and Rise Time						
Turn-On Delay Time from On/Off Control	$V_{on/off}$ to 10%V_{o_set}	All		15		ms
Turn-On Delay Time from Input	$V_{in\ min}$ to 10%V_{o_set}	All		25		ms
Output Voltage Rise Time	10%V_{o_set} to 90%V_{o_set}	All		20		ms

EFFICIENCY

PARAMETER	CONDITIONS	Device	Min.	Typical	Max.	Units
Full Load	V_{in}=Nominal V_{in}, Tc=25°C	Vo=3.3V Vo=5.0V Vo=12V Vo=24V		90 92.5 93 92		%

ISOLATION CHARACTERISTICS

PARAMETER	CONDITIONS	Model	Min.	Typical	Max.	Units
Isolation Voltage	1minute; input/output, input/case,	All			2250	Volts
	1 minute; output/case	All			1500	Volts
Isolation Resistance		All	10			MΩ
Isolation Capacitance		All		1000		pF

FEATURE CHARACTERISTICS

PARAMETER	CONDITIONS	Model	Min.	Typical	Max.	Units
Switching Frequency		All		200		KHz
On/Off Control, Positive Remote On/Off logic						
Logic Low (Module Off)	$V_{on/off}$ at $I_{on/off}$=1.0mA	All			1.8	V
Logic High (Module On)	$V_{on/off}$ at $I_{on/off}$=0.0uA	All	3.5 or Open Circuit		75	V
On/Off Control, Negative Remote On/Off logic						
Logic High (Module Off)	$V_{on/off}$ at $I_{on/off}$=0.0uA	All	3.5 or Open Circuit		75	V
Logic Low (Module On)	$V_{on/off}$ at $I_{on/off}$=1.0mA	All			1.8	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	μA
Off Converter Input Current	Shutdown input idle current	All		5	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		105		°C

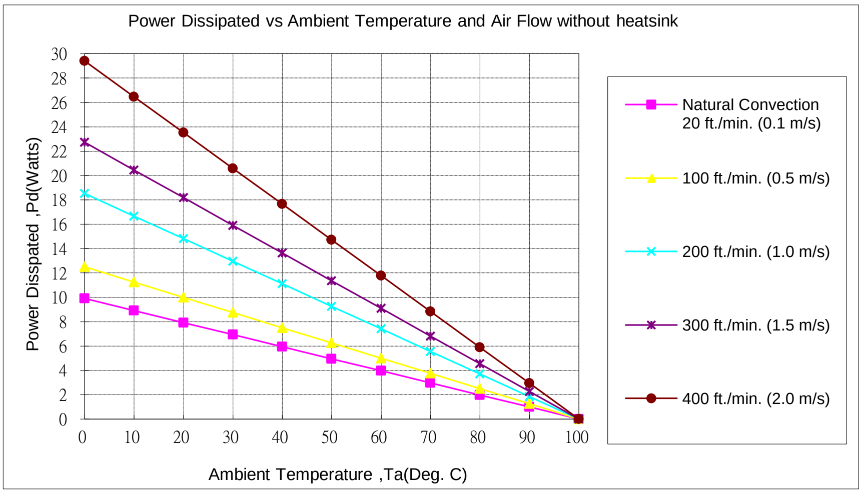
GENERAL SPECIFICATIONS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
MTBF	I_o=100% of $I_{o\ max}$; T_a=25°C per MIL-HDBK-217F	Vo=3.3V Vo=5.0V Vo=12V Vo=24V		400 240 320 320		K hours
Weight		All		61.5		grams
Safety	Meet UL60950-1 2nd(Basic Insulation) Approval (Except 3.3Vout)					
EMC (see Item 7.2)	Meet EN50155(EN50121-3-2) With External Filter					
EMI	Meet EN55011 Class A					
ESD	Meet EN61000-4-2 Air ±8KV Perf. Criteria B					
	Meet EN61000-4-2 Contactr ±6KV Perf. Criteria A					
Radiated Immunity	Meet EN61000-4-3 10V/m Per. Criteria A					
Fast Transient	Meet EN61000-4-4 ±2KV Perf. Criteria A					
Surge	Meet EN61000-4-5 ±1KV Perf. Criteria B					
Conducted Immunity	Meet EN61000-4-6 10Vr.m.s Perf. Criteria A					
Shock/Vibration	Meet EN50155(EN61373)					
Environmental	Meet EN50155(EN60068-2-1, EN60068-2-2, EN60068-2-30)					
Humidity	95% RH max. Non Condensing					

POWER DERATING

The operating case temperature range of this QBR series is -40°C to +100°C. When operating this QBR series, proper derating or cooling is needed. The maximum case temperature under any operating condition should not exceed + 100°C.

Forced Convection Power De-rating without Heat Sink
Example (without heatsink):



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

What is the minimum airflow necessary for a QBR113S12-8.4 operating at nominal line voltage, an output current of 8.4A, and a maximum ambient temperature of 40°C?

Solution:
Given:
Vin =110Vdc, Vo=12Vdc, Io=8.4A

Determine Power dissipation (Pd):
Pd =Pi-Po=Po(1-η)/η
Pd =12V×8.4A×(1-0.92)/0.92=8.77 Watts

Determine airflow:
Given: Pd =8.77W and Ta=40°C

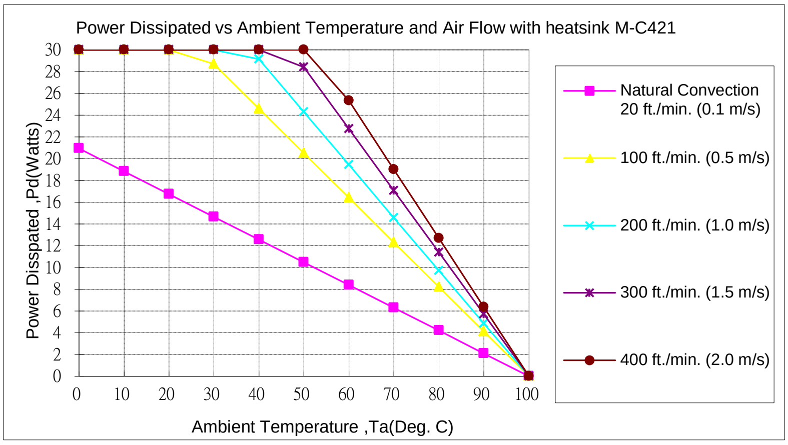
Check Power Derating curve:
Minimum airflow= 200 ft./min.

Verify:
Maximum temperature rise is
ΔT = Pd × Rca = 8.77W×5.4=47.36°C.

Maximum case temperature is
Tc=Ta + ΔT = 87.36°C <100°C.

Where:
The Rca is thermal resistance from case to ambient environment.
Ta is ambient temperature and Tc is case temperature.

Example (with heatsink M-C421)



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

What is the minimum airflow necessary for a QBR113S12-8.4 operating at nominal line voltage, an output current of 8.4A, and a maximum ambient temperature of 40℃?

Solution:

Given:

$Vin=110V_{dc}$, $Vo=12V_{dc}$, $Io=8.4^{a}$

Determine Power dissipation (P_d):

$Pd=Pi-Po=Po(1-\eta)/\eta$

$Pd=12\times8.4\times(1-0.92)/0.92=8.77Watts$

Determine airflow:

Given: Pd=8.77W and Ta=40℃

Check above Power de-rating curve:

$P_d<12.6W$, Natural Convection

Verify:

Maximum temperature rise is

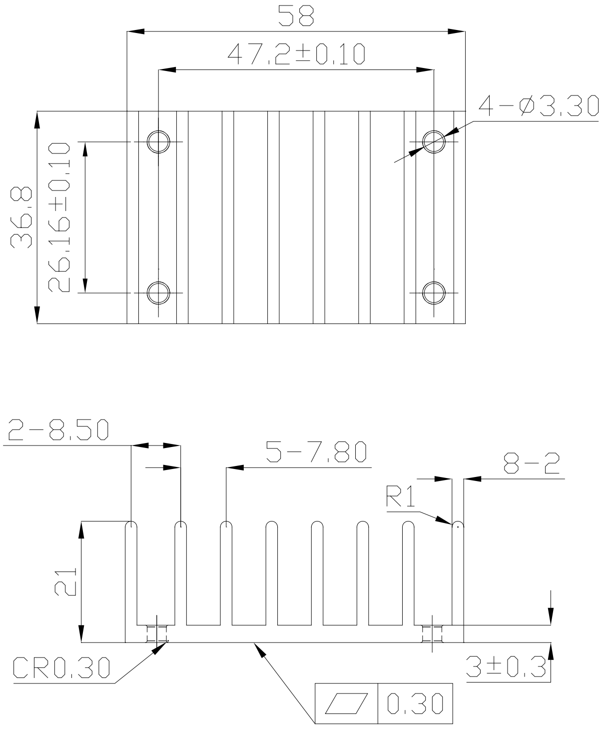
$\Delta T = P_d \times R_{ca}=8.77\times4.78=41.92$℃

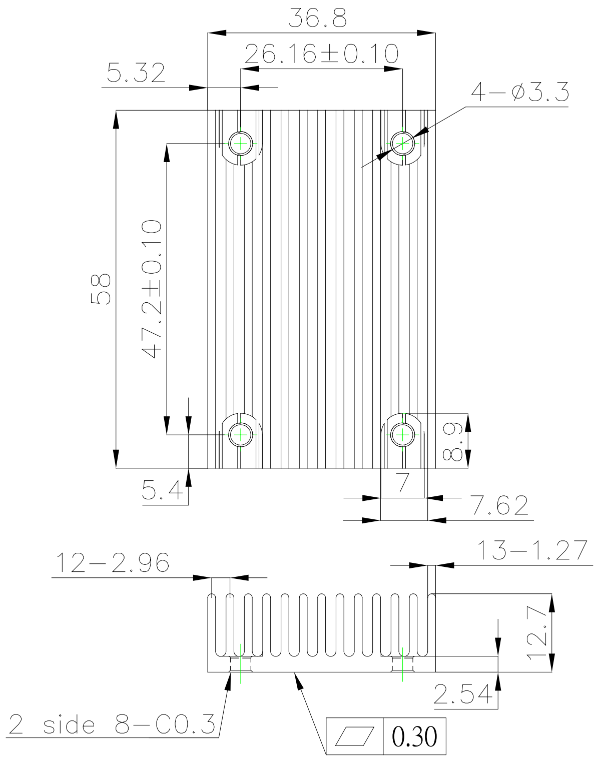
Maximum case temperature is $T_c=T_a+\Delta T=81.92$℃ <100℃

Where:

The R_{ca} is thermal resistance from case to ambient environment.
T_a is ambient temperature and T_c is case temperature.

QUARTER BRICK HEAT SINKS:





M-C421 (G6620510201)
Transverse Heat Sink

M-C488 (G6620570202)
Longitudinal Heat Sink

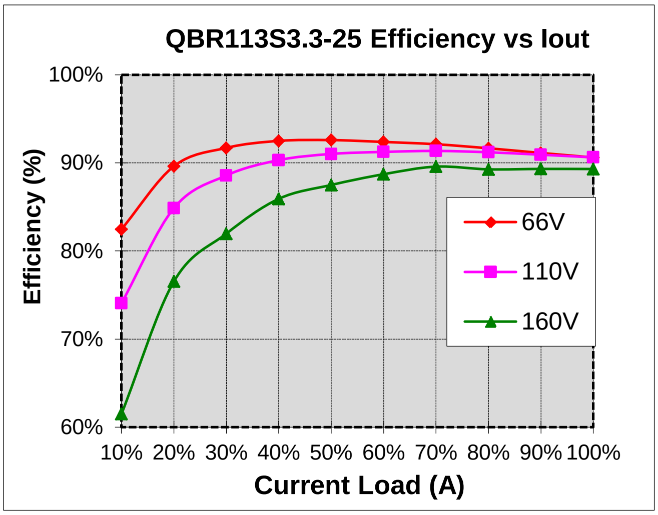
All Dimensions in mm

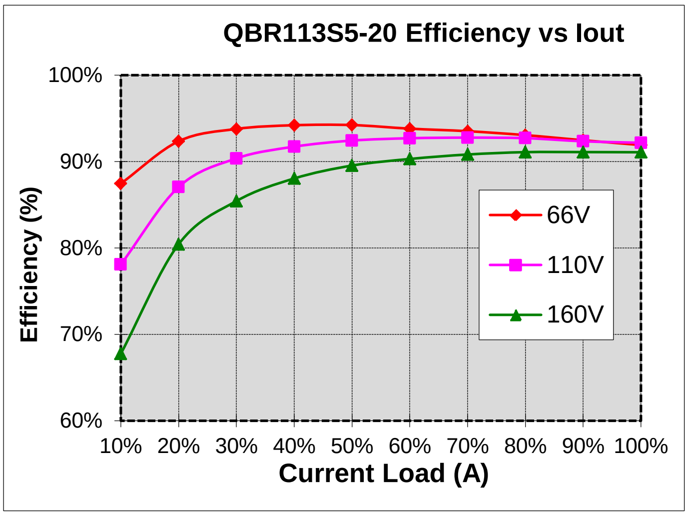
Rca: 4.78°C/W (typ.), At natural convection
2.44°C/W (typ.), At 100LFM
2.06°C/W (typ.), At 200LFM
1.76°C/W (typ.), At 300LFM
1.58°C/W (typ.), At 400LFM

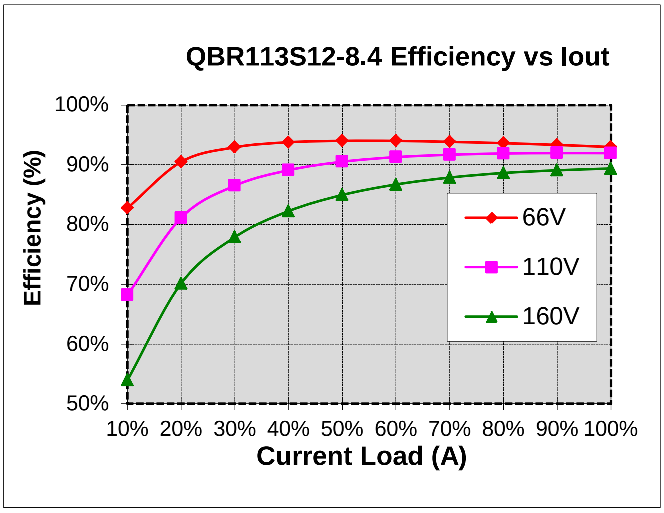
Rca: 5.61°C/W (typ.), At natural convection
4.01°C/W (typ.), At 100LFM
3.39°C/W (typ.), At 200LFM
2.86°C/W (typ.), At 300LFM
2.49°C/W (typ.), At 400LFM

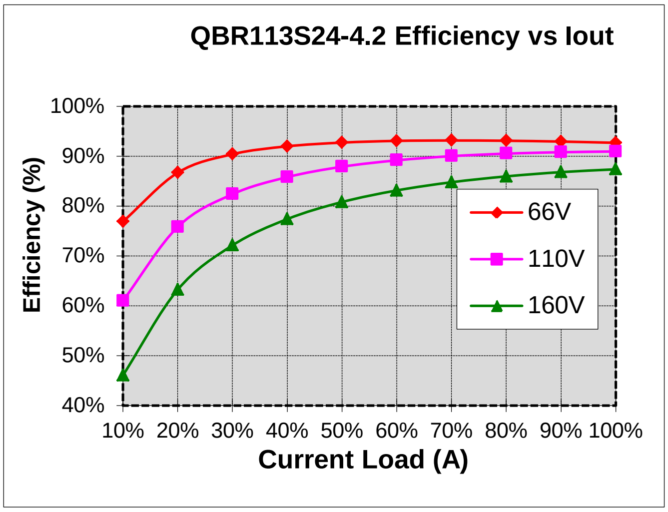
THERMAL PAD: SZ 35.8*56.9*0.25 mm (G6135041041)
SCREW: SMP+SW M3*8L (G75A1300322)

EFFICIENCY vs. LOAD









Operating Temperature Range

The QBR series converters can be operated over a wide case temperature range of -40°C to + 100°C. Consideration must be given to the derating curves when maximum power is drawn from the converter. The maximum power drawn from open half brick models is influenced by multiple factors, such as:

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

Output Voltage Adjustment

The next page 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%.

Over Current Protection

All models have internal over current and continuous short circuit protection. Once the fault condition is removed, the unit will operate normally. The converter will go into hiccup mode protection once the point of current limit inception is reached.

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.

Remote On/Off

The QBR 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 (<1.8VDC) 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 (<1.8VDC). The converter is off by default.

UVLO (Under voltage Lock Out)

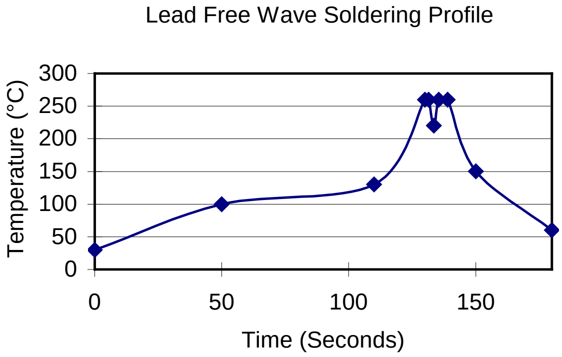
Input under voltage lockout is standard on the QBR unit. The unit will shut down when the input voltage drops below a threshold, and the unit will operate when the input voltage goes above the upper threshold.

Over Temperature Protection

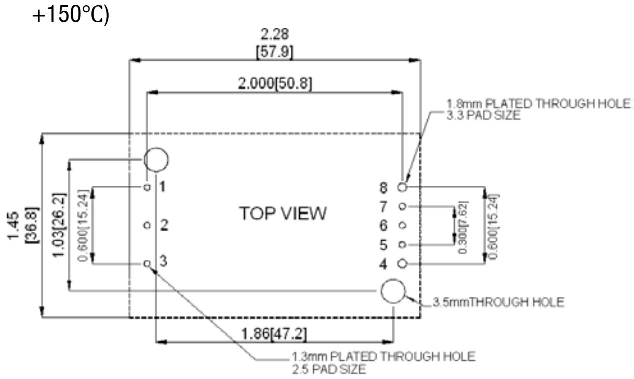
These modules have an over temperature protection circuit to safeguard against thermal damage. Shutdown occurs with the maximum case reference temperature is exceeded. The module will restart when the case temperature falls below over temperature shutdown threshold.

PCB Foot print, Recommended Layout, and Soldering Information

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



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



Convection Requirements for Cooling

To predict the approximate cooling needed for the Quarter brick module, refer to the power derating curves. 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 +100°C as measured at the center of the top of the case (thus verifying proper cooling).

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}).

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
- 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:

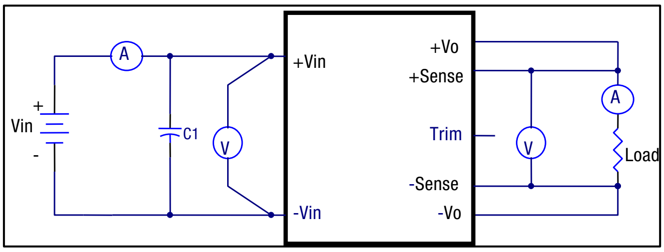
V_{FL} is the output voltage at full load
V_{NL} is the output voltage at no load

The value of line regulation is defined as:

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

Where:

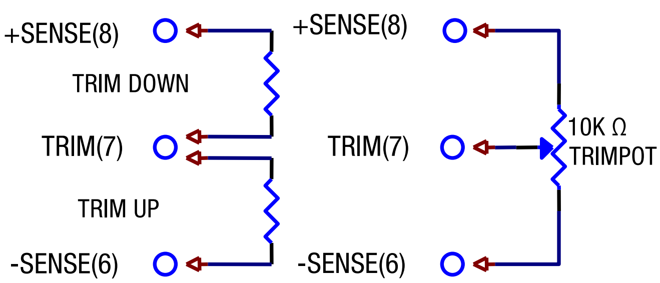
V_{HL} is the output voltage of maximum input voltage at full load.
V_{LL} is the output voltage of minimum input voltage at full load.



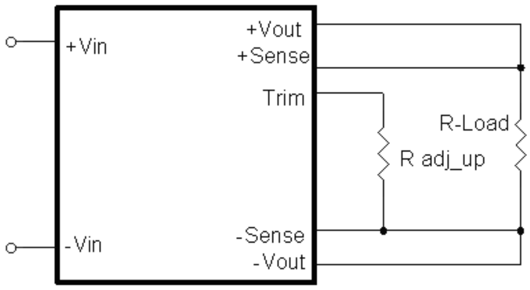
QBR Series Test Setup

Output Voltage Adjustment

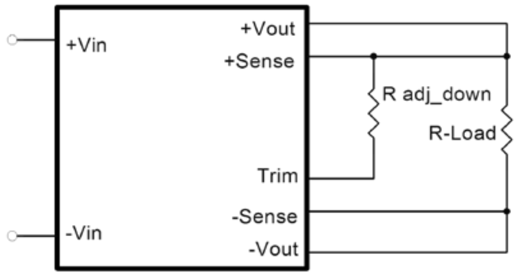
Output may be externally trimmed (±10%) with a fixed resistor or an external trim pot as shown (optional). Model specific formulas for calculating trim resistors are available upon request as a separate document.



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 or between trim pin and +Vo for trim-down. The output voltage trim range is ±10%. This is shown:



Trim-up Voltage Setup



Trim-down Voltage Setup

V_{out} (V)	R1 (KΩ)	R2 (KΩ)	R3 (KΩ)	V_r (V)	V_f (V)
3.3V	3	12	4.3	1.24	0.46
5V	2.32	3.3	0	2.5	0
12V	9.1	51	5.1	2.5	0.46
24V	20	100	7.5	2.5	0.46

Trim Resistor Values

The value of Rtrim_up is defined as:

For Vo = 5V Rtrim_up decision:

$$R_{trim\_up} = \frac{R_1 V_r}{Vo - V_{o\_nom}} - R_2 \quad (K\Omega)$$ Where:

For others Rtrim_up decision:

$$R_{trim\_up} = \left(\frac{R_1\left(V_r - V_f\left(\frac{R_2}{R_2 + R_3}\right)\right)}{Vo - V_{o\_nom}}\right) - \frac{R_2 R_3}{R_2 + R_3} \quad (K\Omega)$$

Where:

R_{trim_up} is the external resistor in KΩ.
V_{o_nom} is the nominal output voltage.
V_o is the desired output voltage.
R1, R2, R3 and V_r are internal components.

For example, to trim-up the output voltage of QBR113S12-8.4, 12V output module by 5% to 12.6V, R_{trim_up} is calculated as follows:

$V_o - V_{o\_nom} = 12.6 - 12 = 0.6V$
R1 = 9.1 KΩ , R2 = 51 KΩ, R3 = 5.1KΩ
V_r= 2.5 V, V_f=0.46 V

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

The value of R_{trim_down} defined as:

$$R_{trim\_down} = \frac{R_1 \times (V_o - V_r)}{V_{o\_nom} - V_o} - R_2 \;\; (K\Omega)$$

Where:

R_{trim_down} is the external resistor in KΩ.
V_{o_nom} is the nominal output voltage.
V_o is the desired output voltage.
R1, R2, R3 and V_r are internal components.

For example: to trim-down the output voltage of QBR113S12-8.4, 12V module by 5% to 11.4V, R_{trim_down} is calculated as follows:

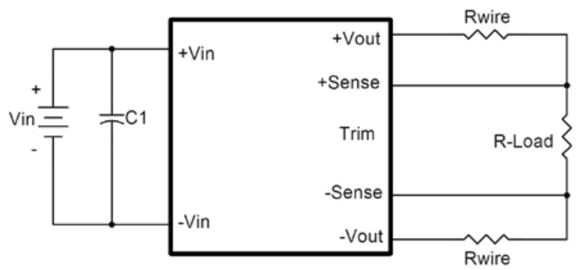
$V_{o\_nom} - V_o = 12 - 11.4 = 0.6$ V
R1 = 9.1 KΩ, R2 = 51 KΩ, V_r = 2.5 V

$$R_{trim\_down} = \frac{9.1 \times (11.4 - 2.5)}{0.6} - 51 = 83.98 \;\; (K\Omega)\cdot$$

Output Remote Sensing

This QBR 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 QBR 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: $[(+V_{out}) - (-V_{out})] - [(+Sense) - (-Sense)] \leqq 10\%$ of $V_{o\_nominal}$

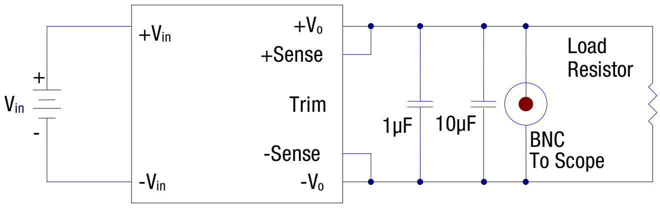
If the remote sense feature is not to be used, the sense pins should be connected locally. The +Sense pin should be connected to the +Vout pin at the module and the -Sense pin should be connected to the -Vout pin at the module. This is shown in the schematic below.



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, $P_{out.max} = V_{o.set} \times I_{o.max}$ is also an absolute limit.

Output Ripple and Noise



Output ripple and noise is measured with 10μF tantalum and 1μF ceramic capacitors across the output.

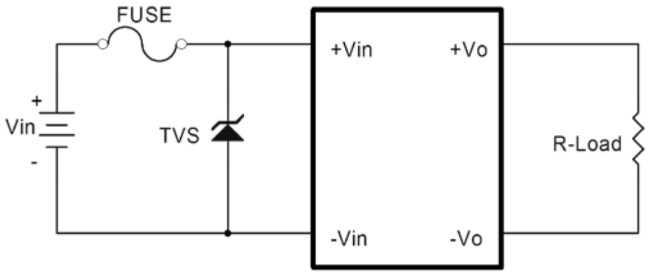
Output Capacitance

The QBR 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. DATEL converters are designed to work with load capacitance to meet the technical specification.

SAFETY and EMC

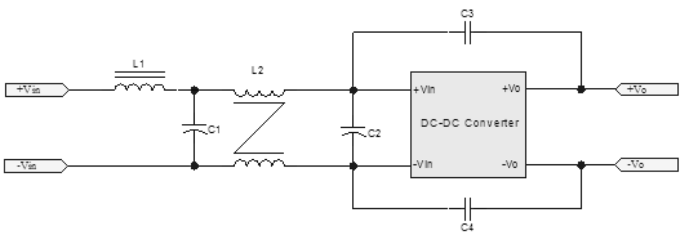
Input Fusing and Safety Considerations

The QBR series converters have no internal fuse. In order to achieve maximum safety and system protection, always use an input line fuse. We recommended a time delay fuse 2.5A. 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).



EMC Considerations

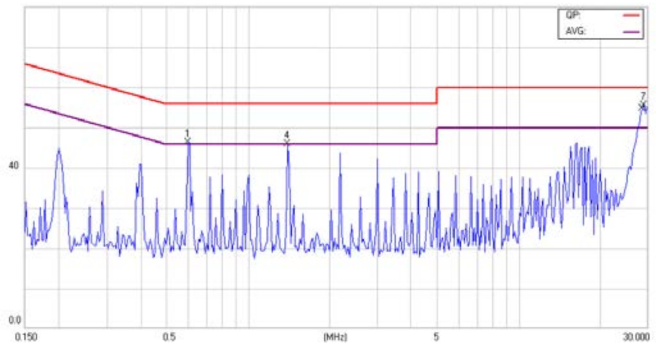
(1) EMI Test standard: EN55022 Class B Conducted Emission
Test Condition: Input Voltage: Nominal, Output Load: Full Load



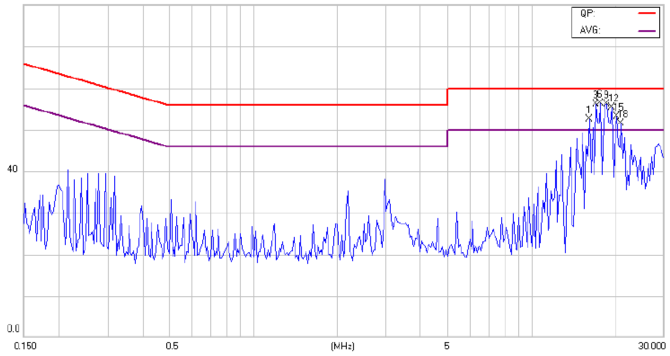
Model No.	C1	C2	C3	C4	L1	L2
QBR113S3.3-25	220µF/200V YXF	220µF/200V YXF	2200pF//1500pF	2200pF//1500pF	5.5uH	0.83mH
QBR113S5-20	220µF/200V YXF	220µF/200V YXF	2200pF	2200pF	5uH	0.33mH
QBR113S12-8.4	220µF/200V YXF	220µF/200VYXF	2200pF	2200pF	5uH	0.33mH
QBR113S24-4.2	220µF/200V YXF	220µF/200V YXF	2200pF	2200pF	5uH	0.33mH

Note: C1, C2 Aluminum Capacitors and C3, C4 Ceramic Capacitors

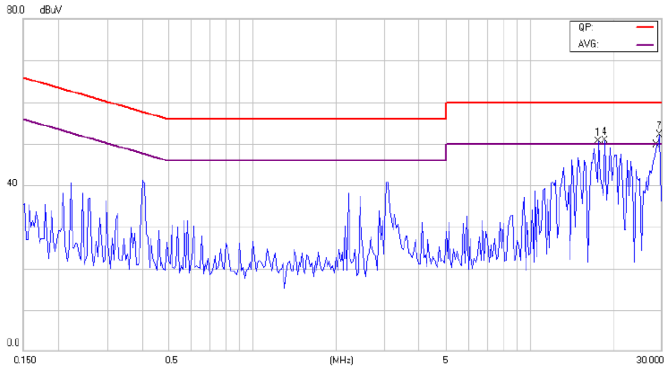
EMI and conducted noise meet EN55022 Class B



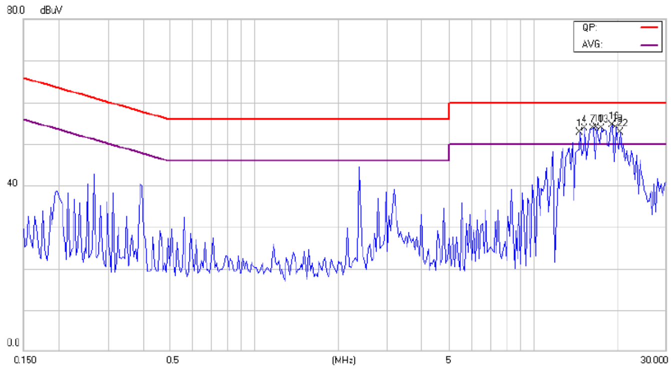
Class B test conducted for QBR113S3.3-25



Class B test conducted for QBR113-5-20

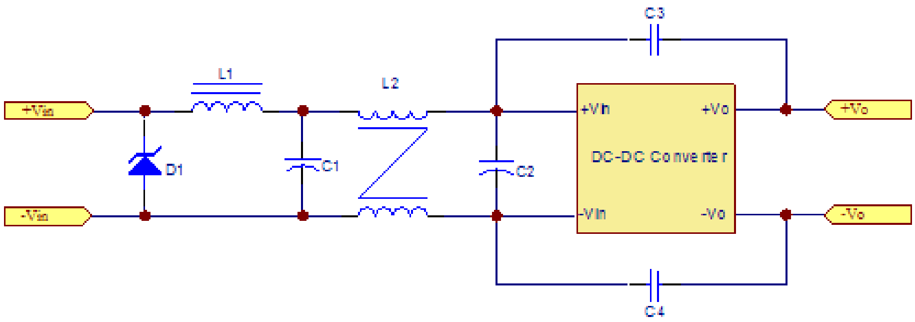


Class B test conducted for QBR113S12-8.4



Class B test conducted for QBR113S24-4.2

(2) EMI Test standard: EN50121-3-2 (EN55011 Class A Conducted & Radiated Emission)
Test Condition: Input Voltage: Nominal, Output Load: Full Load

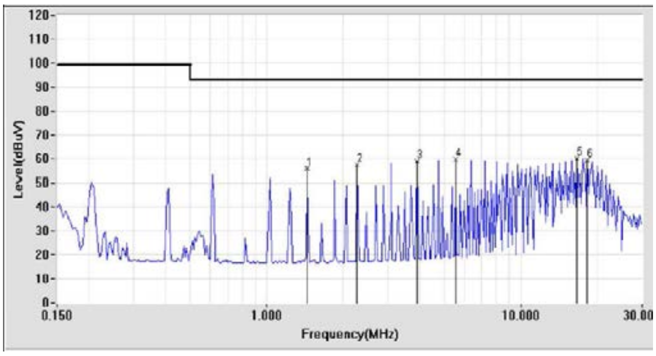


Model No.	D1	C1	C2	C3	C4	L1	L2
QBR113S5-20	1.5KE180A Littlefuse	220µF/200V YXF	220µF/200V YXF	2200pF	2200pF	5uH	0.33mH
QBR113S12-8.4	1.5KE180A Littlefuse	220µF/200V YXF	220µF/200V YXF	2200pF	2200pF	5uH	0.33mH
QBR113S24-4.2	1.5KE180A Littlefuse	220µF/200V YXF	220µF/200V YXF	2200pF	2200pF	5uH	0.33mH

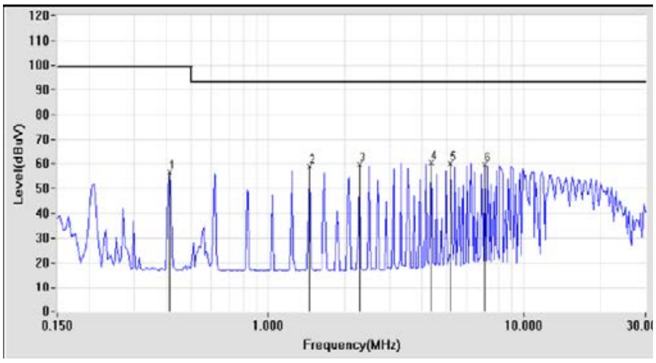
Note: C1, C2 Aluminum Capacitors and C3, C4 Ceramic Capacitors

Class A test conducted for QBR101S12-5

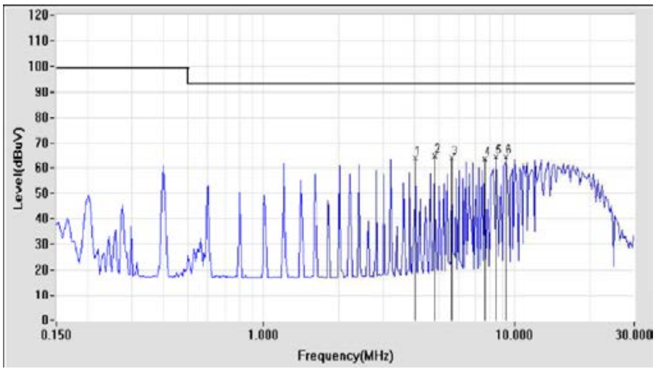
EMI and conducted noise meet EN55011 Class A



Class A test conducted for QBR113S5-20

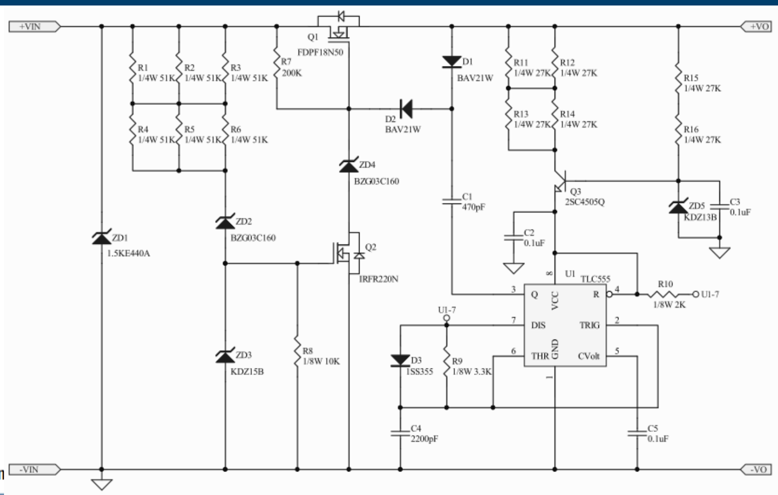


Class A test conducted for QBR113S12-8.4

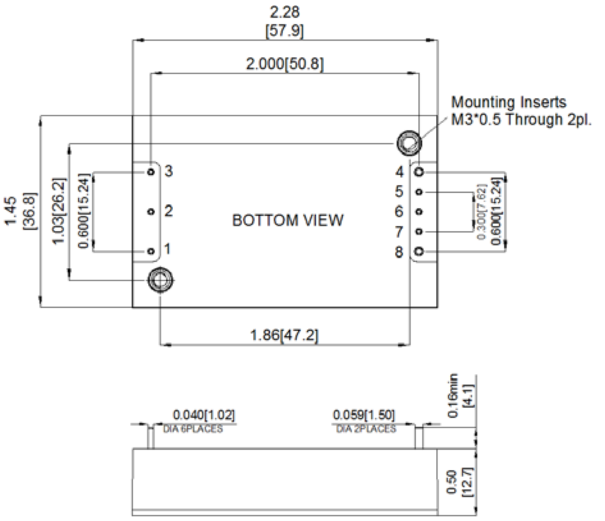


Class A test conducted for QBR113S24-4.2

SUGGESTED CONFIGURATION FOR RIA12 SURGE TEST



MECHANICAL SPECIFICATIONS



Note: All dimensions are in inches (millimeters). Tolerance: x.xx ±0.02 in. (0.5mm), x.xxx ±0.010 in. (0.25 mm) unless otherwise noted

PIN CONNECTIONS

PIN CONNECTIONS	
PIN	SINGLE OUTPUT
1	+ V Input
2	On/Off
3	- V Input
4	-V output
5	-Sense
6	Trim
7	+ Sense
8	+ V Output

PART NUMBER ORDERING INFORMATION

Family, Form, Factor Package	Nominal Input voltage	Number of Outputs	Voltage Output Volts		Current Output (A)	Options
QBR	113	S	5	—	20	N, M
	(66-160) 113 Volts	S - Single	3.3 Volts 5 Volts 12 Volts 24 Volts		3.3 Volts – 25A 5 Volts – 20A 12 Volts – 8.4A 24 Volts – 4.2A	None – Positive ON/OFF Control N - Negative On/Off control M – Clear Mounting Insert

Note: For proper part ordering, enter option suffixes in order listed in table above