# QUARTER-BRICK DC-DC CONVERTERS

## 4:1 ULTRA WIDE INPUT RANGE 100 WATT

RAILWAY APPLICATIONS

*QB100 SERIES*

### FEATURES

- Railway Systems Application
- 4:1 Ultra Wide Input Range
- No Minimum Load Required
- Low Standby Power Consumption
- High Efficiency (up to 90%)
- 2250Vdc Input to Output Basic Insulation
- Remote Control
- Compact 2.28" × 1.45" × 0.50" Quarter Brick Package
- Safety Meets UL60950-1, EN60950-1 & IEC60950-1
- CE Marked
- Compliant to RoHS II and Reach

**SELECTION GUIDE** All specifications are typical at nominal input, full load and 25°C, unless otherwise noted.

| Input Voltage Range Vdc | Output Voltage Vdc | Output Current at Full Load A | Input Current at No Load mA | Efficiency % | Model Number | Maximum Capacitor Load µF |
|---|---|---|---|---|---|---|
| 8.5 - 36 | 3.3 | 25 | 25 | 88 | QB100-24S33 | 75000 |
| 8.5 - 36 | 5 | 18 | 25 | 89 | QB100-24S5 | 36000 |
| 8.5 - 36 | 12 | 7.5 | 25 | 89 | QB100-24S12 | 6250 |
| 8.5 - 36 | 15 | 6 | 25 | 89 | QB100-24S15 | 4000 |
| 8.5 - 36 | 24 | 3.7 | 25 | 89 | QB100-24S24 | 1540 |
| 8.5 - 36 | 30 | 3 | 25 | 89 | QB100-24S30 | 1000 |
| 8.5 - 36 | 48 | 1.8 | 25 | 88 | QB100-24S48 | 380 |
| 16.5 - 75 | 3.3 | 25 | 15 | 88 | QB100-48S33 | 75000 |
| 16.5 - 75 | 5 | 18 | 15 | 89 | QB100-48S5 | 36000 |
| 16.5 - 75 | 12 | 7.5 | 15 | 89 | QB100-48S12 | 6250 |
| 16.5 - 75 | 15 | 6 | 15 | 90 | QB100-48S15 | 4000 |
| 16.5 - 75 | 24 | 3.7 | 15 | 90 | QB100-48S24 | 1540 |
| 16.5 - 75 | 30 | 3 | 15 | 90 | QB100-48S30 | 1000 |
| 16.5 - 75 | 48 | 1.8 | 15 | 90 | QB100-48S48 | 380 |
| 40 - 160 | 3.3 | 23 | 8 | 88 | QB100-110S3P3 | 70000 |
| 40 - 160 | 5 | 17 | 8 | 89 | QB100-110S05 | 34000 |
| 40 - 160 | 12 | 7 | 8 | 89 | QB100-110S12 | 5830 |
| 40 - 160 | 15 | 5.5 | 8 | 89 | QB100-110S15 | 3670 |
| 40 - 160 | 24 | 3.5 | 8 | 89 | QB100-110S24 | 1460 |
| 40 - 160 | 30 | 2.8 | 8 | 89 | QB100-110S30 | 930 |
| 40 - 160 | 48 | 1.8 | 8 | 89 | QB100-110S48 | 380 |



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# QB100 SERIES

## Input Specifications

| | | |
|---|---|---|
| Operating input voltage range, Vdc | 8.5 Min., 24 Typ., 36 Max. | 24Vin(nom) |
| | 16.5 Min., 48 Typ., 75 Max. | 48Vin(nom) |
| | 40 Min., 110 Typ., 160 Max. | 110Vin(nom) |
| Start up voltage, Vdc | 9 Max. | 24Vin(nom) |
| | 18 Max. | 48Vin(nom) |
| | 43 Max. | 110Vin(nom) |
| Shutdown voltage, Vdc | 7.3 Min., 8.1 Max. | 24Vin(nom) |
| | 15.5 Min., 16.3 Max. | 48Vin(nom) |
| | 33 Min., 36 Max. | 110Vin(nom) |
| Start up time, ms | 75 Typ., 100 Max. | Constant resistive load, Power up |
| | 75 Typ., 100 Max. | Constant resistive load, Remote ON/OFF |
| Input surge voltage, Vdc | 50 Max. | 1 second, max., 12Vin(nom) |
| | 100 Max. | 1 second, max., 24Vin(nom) |
| | 185 Max. | 1 second, max., 148Vin(nom) |
| Input filter[1] | Pi type | |
| Remote ON/ OFF | | Referenced to -Vin pin |
| | Short or 0 - 1.2Vdc | Negative logic, DC-DC ON |
| | Open or 3 - 12Vdc | (Standard), DC-DC OFF |
| | Open or 3 - 12Vdc | Positive logic, DC- DC ON |
| | Short or 0 - 1.2Vdc | (Option), DC-DC OFF |
| | -0.5 Min., 1 Max., mA | Input current of Ctrl pin |
| | 3mA Typ. | Remote off input current |

## Output Specifications

| | | |
|---|---|---|
| Voltage accuracy, % | -1.0 Min., +1.0 Max. | |
| Line regulation, % | -0.1 Min., +0.1 Max. | Low Line to High Line at Full Load |
| Load regulation, % | -0.2 Min., +0.2 Max. | No Load to Full Load, 3.3 and 5Vout |
| | -0.1 Min., +0.1 Max. | No Load to Full Load, Others |
| Voltage and adjustability, % | -20 Min., +10 Max. | Maximum output deviation is inclusive of remote sense |
| Remote sense, % | 10 Max. | % of Vout(nom). If remote sense is not being used, sense pins should connect to the corresponding polarity OUTPUT pins. |
| Ripple and noise, mVp-p | | Measured by 20MHz bandwidth |
| | 75 Typ. | With a 22µF/25V X7R MLCC, 3.3Vout, 5Vout |
| | 100 Typ. | With a 22µF/25V X7R MLCC, 12Vout, 15Vout |
| | 200 Typ. | With a 4.7µF/50V X7R MLCC, 24Vout, 30Vout |
| | 300 Typ. | With a 2.2µF/100V X7R MLCC, 48Vout |
| Temperature coefficient, %/°C | -0.02 Min., +0.02 Max. | |
| Transient response recovery time, µs | 250 Typ. | 25% load step change |
| Over voltage protection, % | 115 Min., 130 Max. | % of Vout(nom); Hiccup mode |
| Over load protection, % | 110 Min., 140 Max. | % of Iout rated; Hiccup mode |
| Short circuit protection | Continuous, automatic recovery | |

## General Specifications

| | | | | | |
|---|---|---|---|---|---|
| Isolation voltage, Vdc | 1 minute (Basic insulation) | Input to Output | 2250 Min. | | |
| | 1 minute (Basic insulation) | Input (Output) to Base-Plate | 2250 Min. | | |
| Isolation resistance, GΩ | 500Vdc | | 1 Min. | | |
| Isolation capacitance, pF | Continuous, automatic recovery | | | | 1500 Max. |
| Switching frequency, kHz | | | 270 Min. | 300 Typ. | 330 Max. |

## Environmental Specifications

| | | | | |
|---|---|---|---|---|
| Operating case temperature, °C | | -40 Min. | | +110 Max. |
| Over temperature protection, °C | | | +110 Typ. | |
| Storage temperature range, °C | | -55 Min. | | +125 Max. |
| Thermal impedance[2], °C/W | Vertical direction by natural convection (20LFM) | | | |
| | Without Heat-sink | | 9 Typ. | |
| | Mount on 2U iron base-plate | | 2.8 Typ. | |
| | With 0.24" Height Heat-sink | | 7.1 Typ. | |
| | With 0.5" Hight Heat-sink | | 5.5 Typ. | |
| Thermal shock | | MIL-STD-810F | | |
| Vibration | | MIL-STD-810F | | |
| Relative humidity | | 5% to 95% RH | | |

# QB100 SERIES

## Physical Specifications

| | |
|---|---|
| Design meet safety standard | UL60950-1, EN60950-1, IEC60950-1 |
| Case material | Aluminum base-plate with plastic case |
| Potting material | Silicone (UL94 V-0) |
| Weight | 64g (2.26oz) |
| MTBF | 3.873 x $10^5$ hrs , MIL-HDBK-217F, Full load |

## EMC Specifications

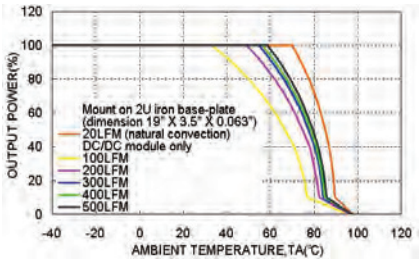
| Specifications | Conditions | | Level |
|---|---|---|---|
| EMI[3] | EN55022 | | Class B |
| ESD | EN61000-4-2 | Air ±8kV and Contact ±6kV | Perf. Criteria A |
| Radiated immunity | EN61000-4-3 | 20V/m | Perf. Criteria A |
| Fast transient[4] | EN61000-4-4 | ±2kV | Perf. Criteria A |
| Surge[4] | EN61000-4-5 | EN55024:±2kV | Perf. Criteria A |
| Conducted immunity | EN61000-4-6 | 10 Vr.m.s | Perf. Criteria A |

**Note:**

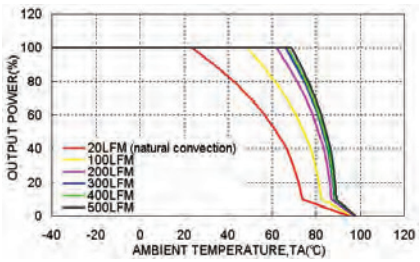
1. Input source impedance: The power modules will operate as specifications without external components, assuming that the source voltage has a very low impedance and reasonable input voltage regulation. Highly inductive source impedances can affect the stability of the power module. Since real-world voltage source has finite impedance, performance can be improved by adding external filter capacitor. Recommended Nippon Chemi-con KY series, 100μF/100V.
2. The heat-sink is optional and P/N: 7G-0029A-F , 7G-0030A-F , 7G-0031A-F , 7G-0032A-F. Please refer to heat-sink selection guide.
3. The standard modules meet EMI Class A or Class B with external components. For further information, please contact Polytron Devices.
4. An external input filter capacitor is required if the module has to meet EN61000-4-4, EN61000-4-5. Recommended 2 pcs of aluminum electrolytic capacitor (Nippon chemi-con KY series, 220μF/100V) to connect in parallel.
5. BASE-PLATE GROUNDING: When connect two screw bolts to shield plane, the EMI could be reduced.

**CAUTION:** This power module is not internally fused. An input line fuse must always be used.

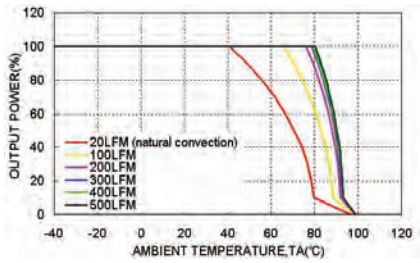
## Characteristic Curve



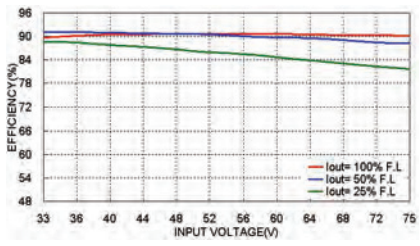

QB100-48S05 Derating Curve



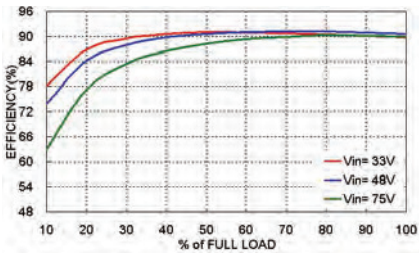

QB100-48S05 Derating Curve
With 0.24" Height Heat-sink




QB100-48S05 Derating Curve
With 0.5" Height Heat-sink

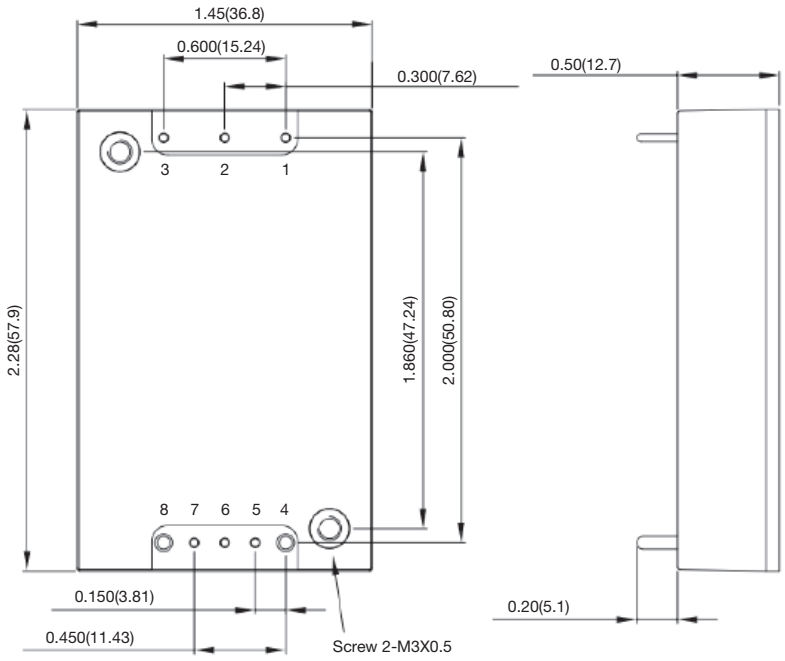



QB100-48S05 Efficiency vs. Input Voltage




QB100-48S05 Efficiency vs. Output Load

## Mechanical Drawing




**PIN CONNECTION**

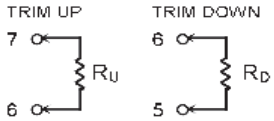
| PIN | DEFINE | DIAMETER |
|---|---|---|
| 1 | -Vin | 0.04 Inch |
| 2 | Ctrl | 0.04 Inch |
| 3 | +Vin | 0.04 Inch |
| 4 | -Vout | 0.06 Inch |
| 5 | -Sense | 0.08 Inch |
| 6 | Trim | 0.04 Inch |
| 7 | +Sense | 0.04 Inch |
| 8 | +Vout | 0.06 Inch |

**x.xxx±0.01 (x.xx±0.25)**

3. **Pin pitch tolerance ±0.01 (0.25)**
4. **Pin dimension tolerance ±0.004(0.1)**
5. **The screw locked torque: MAX3.5kgf-cm (0.34N-m)**

**EXTERNAL OUTPUT TRIMMING**

Output can be externally trimmed by using the method shown below.

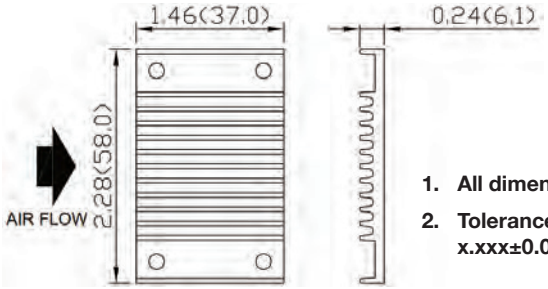



$$R_U = \left(\frac{5.11V_{OUT}(100+\Delta\%)}{1.225\Delta\%} - \frac{(511+10.22\Delta\%)}{\Delta\%}\right)k\Omega$$

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

## Heat-sink Type Options

7G-0029A-F




1. **All dimensions in inch (mm)**
2. **Tolerance :x.xx±0.02 (x.x±0.5) x.xxx±0.01 (x.xx±0.25)**