



Description:

The Powerex POW-R-PAK™ is a configurable IGBT based power assembly that may be used as a converter, chopper, half or full bridge, or three phase inverter for motor control, power supply, UPS or other power conversion applications.

The power assembly is mounted on a forced air-cooled heatsink and features state-of-the-art Powerex IGBTs with low conduction and low switching losses for high efficiency operation. The POW-R-PAK™ includes a low inductance laminated bus structure, optically isolated gate drive interfaces, isolated gate drive power supplies, and a DC-link capacitor bank. The control board provides a simple user interface along with built-in protection features including overvoltage, undervoltage lockout, overcurrent, overtemperature, and short circuit detection.

Depending on application characteristics, the POW-R-PAK™ is suitable for operation with DC bus voltages up to 800VDC and switching frequencies below 20kHz.

Features:

- High performance IGBT inverter bridge
- Integrated gate drive with fault monitoring and protection
- System status / troubleshooting LEDs to verify or monitor proper operation
- Isolated gate drive power supplies
- Low inductance laminated bus
- Output current measurement and feedback
- Superior short circuit detection & shoot through prevention

Outline Drawing and Circuit Diagram

| Dim. | Inches | mm | Dim. | Inches | mm |
|------|--------|-------|------|------------|----------|
| A | 14.9 | 378.4 | K | 5.91 | 150.0 |
| B | 14.25 | 362.0 | L | 8.0 | 203.2 |
| C | 7.6 | 193.0 | M | M6 Metric | M6 |
| D | 5.43 | 138.0 | N | 0.256 Dia. | 6.5 Dia. |
| E | 10.15 | 257.8 | P | 1.0 | 25.4 |
| F | 7.2 | 183.0 | Q | 0.32 | 8.2 |
| G | 2.01 | 51.0 | R | 14.32 | 363.6 |
| H | 0.79 | 20.0 | S | 2.05 | 52.0 |
| J | 0.3 | 7.7 | T | 5.4 | 137.1 |

PP100B120-ND
H-Bridge POW-R-PAK™ IGBT Assembly
100 Amperes/1200 Volts

Absolute Maximum Ratings, $T_j = 25^\circ\text{C}$ unless otherwise specified

Module

| Characteristics | Symbol | Rating | Units |
|---|------------------|-------------|------------------|
| IGBT Junction Temperature | T_j | -40 to +150 | $^\circ\text{C}$ |
| Storage Temperature | T_{stg} | -40 to +65 | $^\circ\text{C}$ |
| Operating Temperature | T_{op} | -20 to +60 | $^\circ\text{C}$ |
| Voltage Applied to DC Terminals | V_{CC} | 900 | Volts |
| Isolation Voltage, Main Terminals to Heatsink | V_{iso} | 2500 | Volts |

IGBT Part

| Characteristics | Symbol | Rating | Units |
|---|-----------------|--------|---------|
| Collector Current (DC, $T_C = 84^\circ\text{C}$) | I_C | 100 | Amperes |
| Peak Collector Current | I_{CM} | 200 | Amperes |
| Emitter Current ($T_C = 25^\circ\text{C}$) | I_E | 100 | Amperes |
| Peak Emitter Current | I_{EM} | 200 | Amperes |
| Maximum Collector Dissipation ($T_j < 150^\circ\text{C}$ per Module) | P_C | 672 | Watts |

Interface Board

| Characteristics | Symbol | Rating | Units |
|-------------------------------------|--------|--------|-------|
| Unregulated +24V Power Supply Input | — | 30 | Volts |
| IGBT Command Signal Input Voltage | — | 20 | Volts |
| Fault Output Supply Voltage | — | 30 | Volts |
| Fault Output Current | — | 50 | mA |

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Electrical Characteristics, $T_j = 25^\circ\text{C}$ unless otherwise specified

IGBT Part

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|--------------------------------------|---------------|---|------|------|------|---------------|
| Collector Cutoff Current | I_{CES} | $V_{CE} = V_{CES}, V_{GE} = 0V$ | — | — | 1.0 | mA |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $I_C = 100A, T_j = 25^\circ\text{C}$ | — | 2.1 | 3.0 | Volts |
| | | $I_C = 100A, T_j = 125^\circ\text{C}$ | — | 2.4 | — | Volts |
| Emitter-Collector Voltage | V_{EC} | $I_E = 100A$ | — | — | 2.4 | Volts |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{CC} = 600V, I_C = 100A, V_{GE} = \pm 15V,$ $R_G = 4.2\Omega, \text{ Inductive Load}$ | — | — | 100 | Ns |
| Rise Time | t_r | | — | — | 70 | Ns |
| Turn-off Delay Time | $t_{d(off)}$ | | — | — | 400 | Ns |
| Fall Time | t_f | | — | — | 300 | Ns |
| Diode Reverse Recovery Time | t_{rr} | $I_E = 100A$ | — | — | 150 | Ns |
| Diode Reverse Recovery Charge | Q_{rr} | $I_E = 100A$ | — | 5.0 | — | μC |

Interface Board

| Characteristics | Min. | Typ. | Max. | Units |
|---------------------------------------|------|------|------|---------------|
| Unregulated +24V Power Supply Input | 20 | 24 | 30 | Volts |
| Power Supply Current Consumption | — | — | 800 | mA |
| IGBT Command Signal ON Threshold | 12 | 15 | — | Volts |
| IGBT Command Signal OFF Threshold | — | 0 | 2 | Volts |
| IGBT Command Signal Input Impedance | — | 10 | — | k Ω |
| IGBT Command Signal Input Capacitance | — | 1 | — | nF |
| Dead Time | — | 3.0 | — | μs |

Feedback Signal and Fault Characteristics

| Characteristics | Min. | Typ. | Max. | Units |
|-----------------------------------|------|-------------------------|------|------------------|
| Output Over Current Trip | — | — | — | Amperes |
| Heatsink Over Temperature Trip | — | 95 | — | $^\circ\text{C}$ |
| Bus Over Voltage Trip | — | 920 | — | Volts |
| Power Supply Under Voltage Trip | — | 18.9 | — | Volts |
| Fault Reset Time | — | 9 | — | μs |
| Heatsink Temperature Feedback | — | 0.1 V/ $^\circ\text{C}$ | — | Volts |
| Output Current Feedback (Bipolar) | — | ± 0.01 V/Amp | — | Volts |
| DC Link Feedback | — | 0.01 V/V | — | Volts |



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Other Electrical Component Specifications

| Characteristics | Min. | Typ. | Max. | Units |
|--|------|-----------|------|-------------------------|
| DC Link Capacitor Bank | | | | |
| Total Nominal Capacitance | — | 3450 | — | μF |
| Nominal Ripple Current Rating per Capacitor (@ 85°C , 120Hz) | — | 11.6 | — | A_{RMS} |
| Nominal Total Voltage Rating | — | 1000 | — | Volts |
| Minimum Life @ Nominal Ripple Current (80°C) | — | 10 | — | khrs |
| Output Current Sensor | | | | |
| Primary Current Measuring Range | — | ± 100 | — | Amperes |
| Accuracy (@ I_{PN} , 25°C) | — | $< \pm 1$ | — | % |
| Linearity Error | — | $< \pm 1$ | — | % |
| Response Time | — | < 5 | — | μs |
| Bandwidth (-3 dB) | DC | — | 25 | kHz |

Thermal Characteristics, $T_j = 25^\circ\text{C}$ unless otherwise specified

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|-----------------------|----------------------|------|-------|-------|---------------------------|
| IGBT Thermal Resistance, Junction-to-Case | $R_{\text{th}(j-c)Q}$ | Per IGBT, 1/2 Module | — | — | 0.186 | $^\circ\text{C}/\text{W}$ |
| FWD Thermal Resistance, Junction-to-Case | $R_{\text{th}(j-c)D}$ | Per FWD, 1/2 Module | — | — | 0.34 | $^\circ\text{C}/\text{W}$ |
| Contact Thermal Resistance | $R_{\text{th}(c-f)}$ | Per 1/2 Module | — | 0.19 | — | $^\circ\text{C}/\text{W}$ |
| Heatsink Thermal Resistance | $R_{\text{th}(f-a)}$ | 286 CFM Airflow | — | 0.022 | — | $^\circ\text{C}/\text{W}$ |

Mechanical Characteristics, $T_j = 25^\circ\text{C}$ unless otherwise specified

| Characteristics | Min. | Typ. | Max. | Units |
|---|------|------|------|-------|
| Mounting Torque, Output Power Terminals | — | 75 | 90 | in-lb |
| Mounting Torque, DC Bus Terminals | — | 130 | 150 | in-lb |
| Weight | — | 39 | — | lb |

Relevant Standards

- UL508C: Power Conversion Equipment
- EN50178: Electronic Equipment for Use in Power Installations

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Interface Board Signal Definitions (Table 1)

| Pin | Signal Name | Description |
|-----|-------------------------------|--|
| 1 | Shield | Internally Connected to PGND |
| 2 | Gate 1 Neg. | 0-15V Signal Controlling, Lower IGBT, HIGH = IGBT on |
| 3 | Leg 1 Error ¹ | Open Collector Output, External Pull-up Resistor Required LOW = No Error; HIGH = Phase A Over Current or Short Circuit OR Power Supply UV |
| 4 | Gate 1 Pos. | 0-15V Signal Controlling, Upper IGBT, HIGH = IGBT on |
| 5 | Gate 2 Neg. | 0-15V Signal Controlling, Lower IGBT, HIGH = IGBT on |
| 6 | Leg 2 Error ¹ | Open Collector Output, External Pull-up Resistor Required LOW = No Error; HIGH = Phase A Over Current or Short Circuit OR Power Supply UV |
| 7 | Gate 2 Pos. | 0-15V Signal Controlling, Upper IGBT, HIGH = IGBT on |
| 8 | N/C | No Connect - Do Not Ground |
| 9 | N/C | No Connect - Do Not Ground |
| 10 | N/C | No Connect - Do Not Ground |
| 11 | Over Temperature ¹ | Open Collector Output, External Pull-up Resistor Required LOW = No Error; HIGH = Heatsink OT |
| 12 | External Fault Reset | Active Low: Must be High for Operation; Low for 10microseconds to Reset Faults ³ |
| 13 | DC Link Voltage | Analog Voltage Feedback of DC Link Voltage |
| 14 | 24 VDC Input Power | 20-30 VDC Input Power Supply |
| 15 | 24 VDC Input Power | 20-30 VDC Input Power Supply |
| 16 | N/C | No Connect - Do Not Ground |
| 17 | N/C | No Connect - Do Not Ground |
| 18 | PGND | Ground Reference for 24 VDC Power Supply |
| 19 | PGND | Ground Reference for 24 VDC Power Supply |
| 20 | Heatsink Temperature | Analog Voltage Representation of Heatsink Temperature |
| 21 | AGND ² | Tied to Pins 10 and 11 |
| 22 | I _{OUT} Phase A | Analog Voltage Representation of Output Current |
| 23 | AGND ² | Tied to Pins 10 and 11 |
| 24 | I _{OUT} Phase B | Analog Voltage Representation of Output Current |
| 25 | AGND ² | Tied to Pins 10 and 11 |
| 25 | N/C | No Connect - Do Not Ground |

1. Open collectors can be pulled up to 30V max. and sink 50mA continuous.
 2. AGND signals to be used for analog feedback signals (i.e. twisted pair with I_{OUT} Phase A).
 3. On the board is a jumper that enables fault reset by bringing all leg control signals low for 10 microseconds (default).

Interface Board Connector

| Description | Symbol | Type | Manufacturer |
|-----------------------------------|--------|---|-----------------------------|
| Gate Drive Board Interface Header | P1 | 0.100" x 0.100" Latching Header, 26 Pin | 3M# 3429-6002 or Equivalent |
| Recommended Mating Socket | — | 0.100" x 0.100" IDC Socket, 26 Pin | 3M# 3499-7600 or Equivalent |
| Recommended Strain Relief | — | Plastic Strain Relief | 3M# 3448-3026 or Equivalent |