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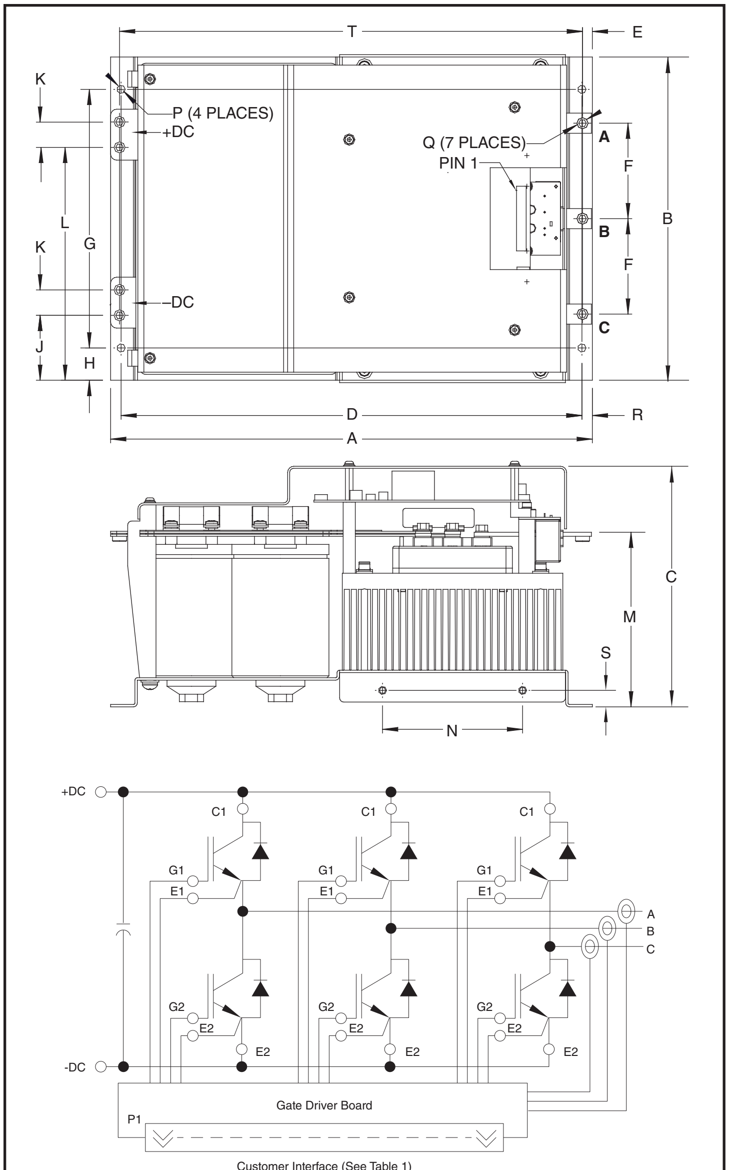
# PP150T120-ND

## 3-Phase POW-R-PAK™ IGBT Assembly

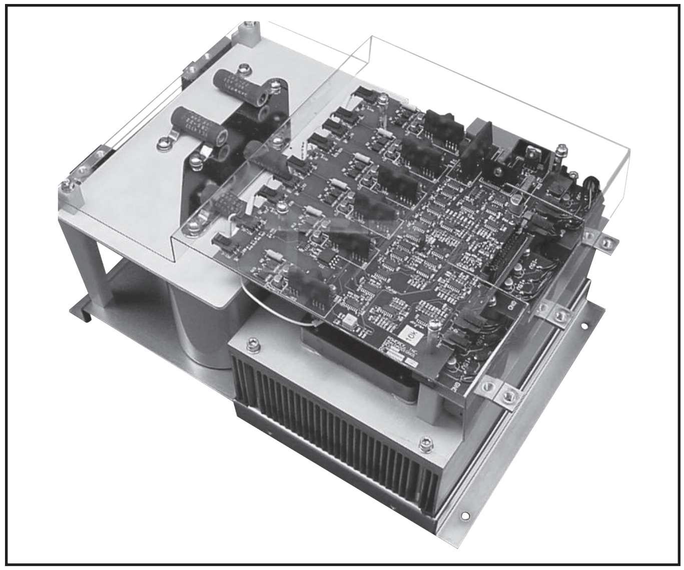
### 150 Amperes/1200 Volts




**Outline Drawing and Circuit Diagram**

| Dim. | Inches | mm |
|---|---|---|
| A | 14.9 | 378.4 |
| B | 10.15 | 257.8 |
| C | 7.4 | 193.0 |
| D | 14.25 | 362.0 |
| E | 0.3 | 7.7 |
| F | 2.95 | 75.0 |
| G | 8.0 | 203.2 |
| H | 1.0 | 25.4 |
| J | 2.01 | 51.0 |

| Dim. | Inches | mm |
|---|---|---|
| K | 0.79 | 20.0 |
| L | 7.20 | 183.0 |
| M | 5.4 | 137.2 |
| N | 4.33 | 110.0 |
| P | 0.256 Dia. | 6.5 Dia. |
| Q | M6 Metric | M6 |
| R | 0.32 | 8.2 |
| S | 0.51 | 12.9 |
| T | 14.32 | 363.6 |



**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

## Absolute Maximum Ratings, $T_j$ = 25°C unless otherwise specified

### Module

| Characteristics | Symbol | Rating | Units |
|---|---|---|---|
| IGBT Junction Temperature | $T_j$ | -40 to +150 | °C |
| Storage Temperature | $T_{stg}$ | -40 to +65 | °C |
| Operating Temperature | $T_{op}$ | -20 to +60 | °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, $T_{C'}$ = 83°C) | $I_C$ | 150 | Amperes |
| Peak Collector Current | $I_{CM}$ | 300 | Amperes |
| Emitter Current ($T_C$ = 25°C) | $I_E$ | 150 | Amperes |
| Peak Emitter Current | $I_{EM}$ | 300 | Amperes |
| Maximum Collector Dissipation ($T_j$ < 150°C per Module) | $P_C$ | 960 | 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 |

***PP150T120-ND***
***3-Phase POW-R-PAK™ IGBT Assembly***
*150 Amperes/1200 Volts*

## Electrical Characteristics, $T_j$ = 25°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 | $V_{CE(sat)}$ | $I_C$ = 150A, $T_j$ = 25°C | — | 2.1 | 3.0 | Volts |
| | | $I_C$ = 150A, $T_j$ = 125°C | — | 2.4 | — | Volts |
| Emitter-Collector Voltage | $V_{EC}$ | $I_E$ = 150A | — | — | 3.8 | Volts |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{CC}$ = 600V, $I_C$ = 150A, $V_{GE}$ = ±15V, $R_G$ = 1.6Ω, Inductive Load | — | — | 130 | Ns |
| Rise Time | $t_r$ | | — | — | 100 | Ns |
| Turn-off Delay Time | $t_{d(off)}$ | | — | — | 450 | Ns |
| Fall Time | $t_f$ | | — | — | 350 | Ns |
| Diode Reverse Recovery Time | $t_{rr}$ | $I_E$ = 150A | — | — | 150 | Ns |
| Diode Reverse Recovery Charge | $Q_{rr}$ | $I_E$ = 150A | — | 9.0 | — | 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 | — | kΩ |
| 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 | — | 250 | — | Amperes |
| Heatsink Over Temperature Trip | — | 95 | — | °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/°C | — | Volts |
| Output Current Feedback (Bipolar) | — | ±0.01 V/Amp | — | Volts |
| DC Link Feedback | — | 0.01 V/V | — | Volts |

## Electrical Characteristics, $T_j$ = 25°C unless otherwise specified

## Other Electrical Component Specifications

| Characteristics | Min. | Typ. | Max. | Units |
|---|---|---|---|---|
| **DC Link Capacitor Bank** | | | | |
| Total Nominal Capacitance | — | 2300 | — | 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 | — | ±200 | — | Amperes |
| Accuracy (@ $I_{PN}$, 25°C) | — | < ±1 | — | % |
| Linearity Error | — | < ±1 | — | % |
| Response Time | — | < 5 | — | μs |
| Bandwidth (-3 dB) | DC | — | 25 | kHz |

## Thermal Characteristics, $T_j$ = 25°C unless otherwise specified

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| IGBT Thermal Resistance, Junction-to-Case | $R_{th(j-c)}Q$ | Per IGBT, 1/2 Module | — | — | 0.13 | °C/W |
| FWD Thermal Resistance, Junction-to-Case | $R_{th(j-c)}D$ | Per FWD, 1/2 Module | — | — | 0.23 | °C/W |
| Contact Thermal Resistance | $R_{th(c-f)}$ | Per 1/2 Module | — | 0.022 | — | °C/W |
| Heatsink Thermal Resistance | $R_{th(f-a)}$ | 286 CFM Airflow | — | 0.037 | — | °C/W |

## Mechanical Characteristics, $T_j$ = 25°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 |

## Interface Board Signal Defintions (Table 1)

| Pin | Signal Name | Description |
|---|---|---|
| 1 | Shield | Internally Conected 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<br>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<br>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 | Gate 3 Neg. | 0-15V Signal Controlling, Lower IGBT, HIGH = IGBT on |
| 9 | Leg 3 Error[1] | Open Collector Output, External Pull-up Resistor Required<br>LOW = No Error; HIGH = Phase A Over Current or Short Circuit OR Power Supply UV |
| 10 | Gate 3 Pos. | 0-15V Signal Controlling, Upper IGBT, HIGH = IGBT on |
| 11 | Over Temperature[1] | Open Collector Output, External Pull-up Resistor Required<br>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 | $I_{OUT}$ Phase C | Analog Voltage Representation of Output Current |

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 |