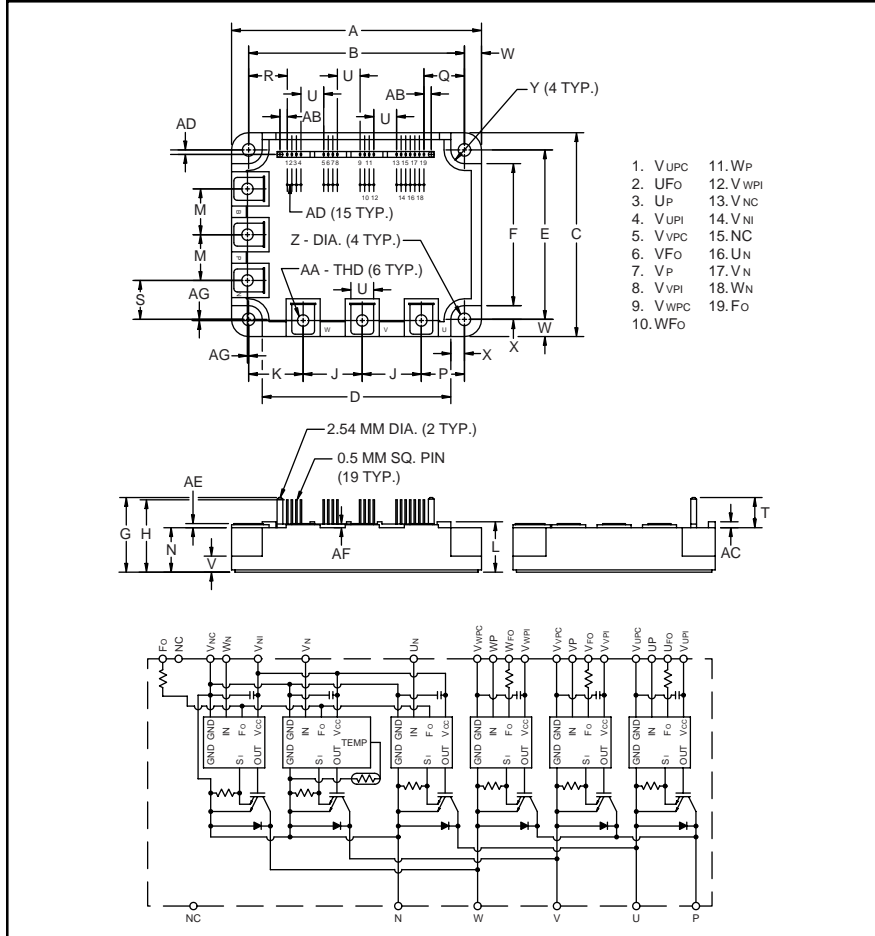


Intellimod™ Module Three Phase IGBT Inverter Output 150 Amperes/600 Volts



Description:
Powerex Intellimod™ Intelligent Power Modules are isolated base modules designed for power switching applications operating at frequencies to 20kHz. Built-in control circuits provide optimum gate drive and protection for the IGBT and free-wheel diode power devices.

- Features:**
- Complete Output Power Circuit
 - Gate Drive Circuit
 - Protection Logic
 - Short Circuit
 - Over Current
 - Over Temperature
 - Under Voltage

- Applications:**
- Inverters
 - UPS
 - Motion/Servo Control
 - Power Supplies

Ordering Information:
Example: Select the complete part number from the table below -i.e. PM150CSA060 is a 600V, 150 Ampere Intellimod™ Intelligent Power Module.

Outline Drawing and Circuit Diagram

| Dimensions | Inches | Millimeters |
|------------|---------------|----------------|
| A | 4.33±0.04 | 110.0±1.0 |
| B | 3.74±0.02 | 95.0±0.5 |
| C | 3.50±0.04 | 89.0±1.0 |
| D | 3.27 | 83.0 |
| E | 2.91±0.02 | 74.0±0.5 |
| F | 2.44 | 62.0 |
| G | 1.28 | 32.6 |
| H | 1.24 | 31.6 |
| J | 1.02 | 26.0 |
| K | 0.94 | 24.0 |
| L | 0.87 +0.06/-0 | 22.0 +1.5/-0.0 |
| M | 0.79 | 20.0 |
| N | 0.76 | 19.4 |
| P | 0.75 | 19.0 |
| Q | 0.708 | 17.98 |
| R | 0.670 | 17.02 |

| Dimensions | Inches | Millimeters |
|------------|-----------|-------------|
| S | 0.67 | 17.0 |
| T | 0.52 | 13.2 |
| U | 0.39 | 10.0 |
| V | 0.32 | 8.0 |
| W | 0.30 | 7.5 |
| X | 0.24 | 6.0 |
| Y | 0.24 Rad. | Rad. 6.0 |
| Z | 0.22 Dia. | Dia. 5.5 |
| AA | Metric M5 | M5 |
| AB | 0.127 | 3.22 |
| AC | 0.10 | 2.6 |
| AD | 0.08 | 2.0 |
| AE | 0.07 | 1.8 |
| AF | 0.06 | 1.6 |
| AG | 0.02 | 0.5 |

| Type | Current Rating Amperes | V _{CEs} Volts (x 10) |
|------|---------------------------|----------------------------------|
| PM | 150 | 60 |



Powerex, Inc., 200 Hillis Street, Youngwood, Pennsylvania 15697-1800 (724) 925-7272

PM150CSA060
Intellimod™ Module
Three Phase IGBT Inverter Output
150 Amperes/600 Volts

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

| Characteristics | Symbol | PM150CSA060 | Units |
|---|-----------------|-------------|------------------|
| Power Device Junction Temperature | T_j | -20 to 150 | $^\circ\text{C}$ |
| Storage Temperature | T_{stg} | -40 to 125 | $^\circ\text{C}$ |
| Case Operating Temperature | T_C | -20 to 100 | $^\circ\text{C}$ |
| Mounting Torque, M5 Mounting Screws | — | 17 | in-lb |
| Mounting Torque, M5 Main Terminal Screws | — | 17 | in-lb |
| Module Weight (Typical) | — | 550 | Grams |
| Supply Voltage Protected by OC and SC- ($V_D = 13.5 - 16.5\text{V}$, Inverter Part) | $V_{CC(prot.)}$ | 400 | Volts |
| Isolation Voltage, AC 1 minute, 60Hz Sinusoidal | V_{RMS} | 2500 | Volts |

Control Sector

| | | | |
|--|-----------|----|-------|
| Supply Voltage Applied between ($V_{UP1}-V_{UPC}$, $V_{VP1}-V_{VPC}$, $V_{WP1}-V_{WPC}$, $V_{N1}-V_{NC}$) | V_D | 20 | Volts |
| Input Voltage Applied between (U_P , V_P , W_P , U_N , V_N , W_N) | V_{CIN} | 20 | Volts |
| Fault Output Supply Voltage (Applied between F_O and V_C) | V_{FO} | 20 | Volts |
| Fault Output Current | I_{FO} | 20 | mA |

IGBT Inverter Sector

| | | | |
|---|-----------------|-----|---------|
| Collector-Emitter Voltage ($V_D = 15\text{V}$, $V_{CIN} = 15\text{V}$) | V_{CES} | 600 | Volts |
| Collector Current, \pm | I_C | 150 | Amperes |
| Peak Collector Current, \pm | I_{CP} | 300 | Amperes |
| Supply Voltage (Applied between P - N) | V_{CC} | 450 | Volts |
| Supply Voltage, Surge (Applied between P - N) | $V_{CC(surge)}$ | 500 | Volts |
| Collector Dissipation | P_C | 500 | Watts |



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

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|------------------------------|--|------|------|------|------------------|
| Control Sector | | | | | | |
| Over Current Trip Level Inverter Part | OC | $-20^\circ\text{C} \leq T \leq 125^\circ\text{C}$ | 210 | 300 | — | Amperes |
| Short Circuit Trip Level Inverter Part | SC | $-20^\circ\text{C} \leq T \leq 125^\circ\text{C}$ | — | 420 | — | Amperes |
| Over Current Delay Time | $t_{\text{off}}(\text{OC})$ | $V_D = 15\text{V}$ | — | 10 | — | μS |
| Over Temperature Protection | OT | Trip Level | 111 | 118 | 125 | $^\circ\text{C}$ |
| | OT _R | Reset Level | — | 100 | — | $^\circ\text{C}$ |
| Supply Circuit Under Voltage Protection | UV | Trip Level | 11.5 | 12.0 | 12.5 | Volts |
| | UV _R | Reset Level | — | 12.5 | — | Volts |
| Supply Voltage | V_D | Applied between $V_{\text{UP}1}$ - V_{UPC} , $V_{\text{VP}1}$ - V_{VPC} , $V_{\text{WP}1}$ - V_{WPC} , $V_{\text{N}1}$ - V_{NC} | 13.5 | 15 | 16.5 | Volts |
| Circuit Current | I_D | $V_D = 15\text{V}$, $V_{\text{CIN}} = 15\text{V}$, $V_{\text{N}1}$ - V_{NC} | — | 40 | 55 | mA |
| | | $V_D = 15\text{V}$, $V_{\text{CIN}} = 15\text{V}$, $V_{\text{XP}1}$ - V_{XPC} | — | 13 | 18 | mA |
| Input ON Threshold Voltage | $V_{\text{CIN}}(\text{on})$ | Applied between | 1.2 | 1.5 | 1.8 | Volts |
| Input OFF Threshold Voltage | $V_{\text{CIN}}(\text{off})$ | U_P , V_P , W_P , U_N , V_N , W_N | 1.7 | 2.0 | 2.3 | Volts |
| PWM Input Frequency | f_{PWM} | 3- \emptyset Sinusoidal | — | 15 | 20 | kHz |
| Fault Output Current | $I_{\text{FO}}(\text{H})$ | $V_D = 15\text{V}$, $V_{\text{FO}} = 15\text{V}$ | — | — | 0.01 | mA |
| | $I_{\text{FO}}(\text{L})$ | $V_D = 15\text{V}$, $V_{\text{FO}} = 15\text{V}$ | — | 10 | 15 | mA |
| Minimum Fault Output Pulse Width | t_{FO} | $V_D = 15\text{V}$ | 1.0 | 1.8 | — | mS |



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

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|--------------------------------------|---------------|---|------|------|------|---------------|
| IGBT Inverter Sector | | | | | | |
| Collector Cutoff Current | I_{CEX} | $V_{CE} = V_{CEX}, T_j = 25^\circ\text{C}$ | — | — | 1.0 | mA |
| | | $V_{CE} = V_{CEX}, T_j = 125^\circ\text{C}$ | — | — | 10 | mA |
| Diode Forward Voltage | V_{FM} | $-I_C = 150\text{A}, V_D = 15\text{V}, V_{CIN} = 15\text{V}$ | — | 2.2 | 3.3 | Volts |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 150\text{A}$ | — | 1.8 | 2.7 | Volts |
| | | $V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 150\text{A}, T_j = 125^\circ\text{C}$ | — | 1.75 | 2.63 | Volts |
| Inductive Load Switching Times | t_{on} | | 0.4 | 0.8 | 2.0 | μS |
| | t_{rr} | $V_D = 15\text{V}, V_{CIN} = 0 \sim 15\text{V}$ | — | 0.15 | 0.3 | μS |
| | $t_{C(on)}$ | $V_{CC} = 300\text{V}, I_C = 150\text{A}$ | — | 0.4 | 1.0 | μS |
| | t_{off} | $T_j = 125^\circ\text{C}$ (Fig. 4, Fig. 5) | — | 2.0 | 2.9 | μS |
| | $t_{C(off)}$ | | — | 0.6 | 1.2 | μS |

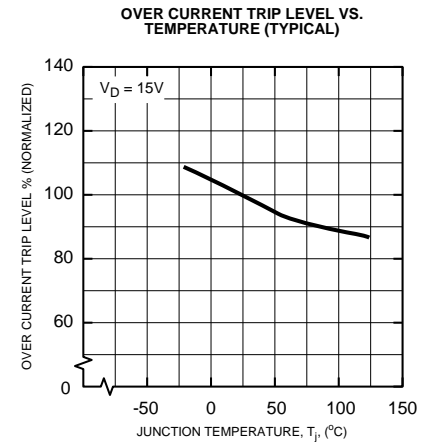
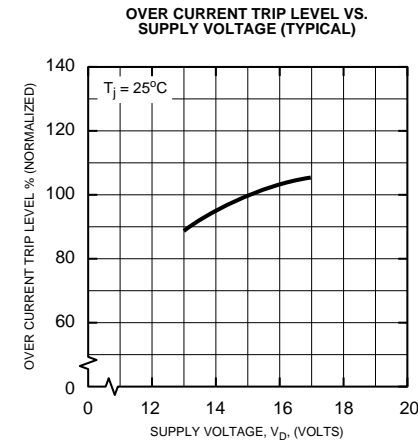
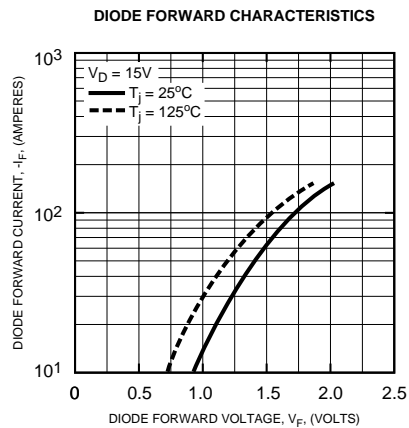
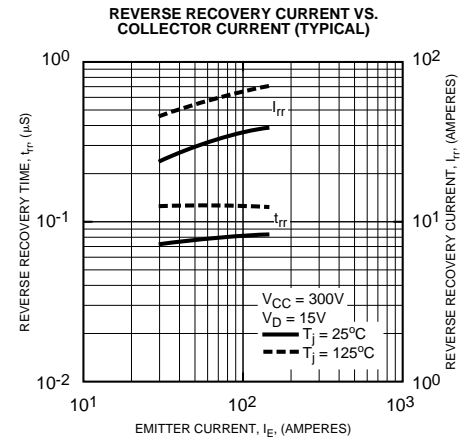
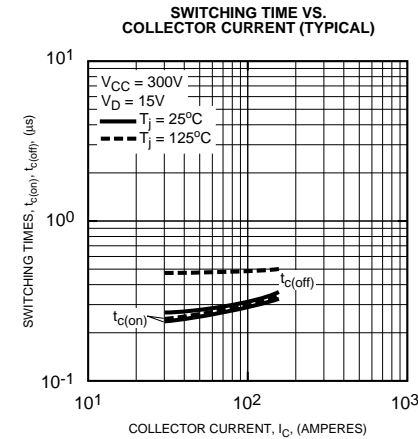
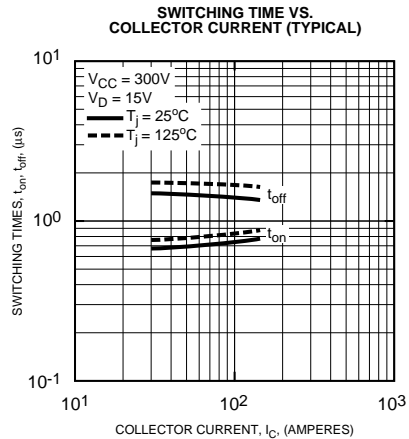
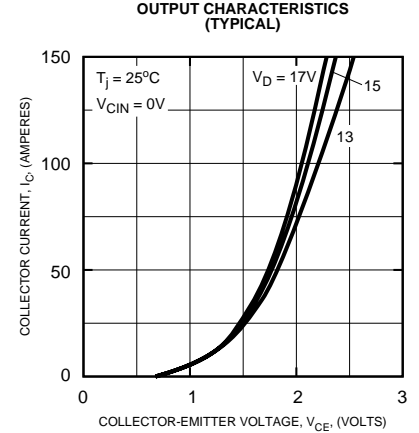
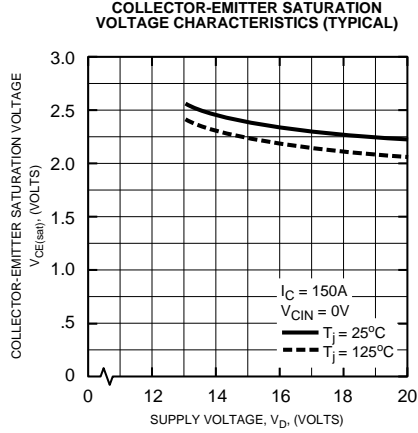
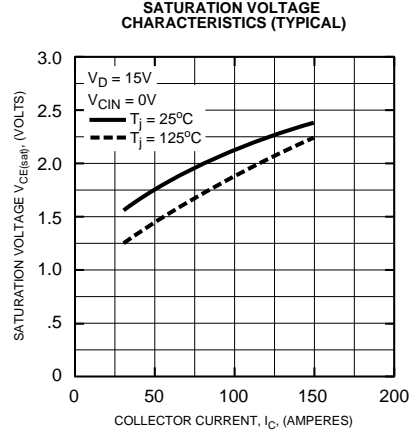
Thermal Characteristics

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Units |
|-------------------------------------|----------------|---|------|------|-------|-----------------------|
| Junction to Case Thermal Resistance | $R_{th(j-c)Q}$ | Each IGBT | — | — | 0.25 | $^\circ\text{C/Watt}$ |
| | $R_{th(j-c)D}$ | Each FWDi | — | — | 0.47 | $^\circ\text{C/Watt}$ |
| Contact Thermal Resistance | $R_{th(c-f)}$ | Case to Fin Per Module, Thermal Grease Applied | — | — | 0.027 | $^\circ\text{C/Watt}$ |

Recommended Conditions for Use

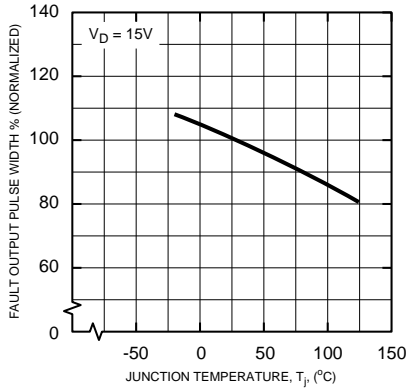
| Characteristic | Symbol | Condition | Value | Units |
|---------------------|----------------|--|----------------|---------------|
| Supply Voltage | V_{CC} | Applied across P-N Terminals | 0 ~ 400 | Volts |
| | V_D | Applied between $V_{UP1}-V_{UPC}, V_{N1}-V_{NC}, V_{VP1}-V_{VPC}, V_{WP1}-V_{WPC}$ | 15 ± 1.5 | Volts |
| Input ON Voltage | $V_{CIN(on)}$ | Applied between | 0 ~ 0.8 | Volts |
| Input OFF Voltage | $V_{CIN(off)}$ | $U_P, V_P, W_P, U_N, V_N, W_N$ | $4.0 \sim V_D$ | Volts |
| PWM Input Frequency | f_{PWM} | Using Application Circuit | 5 ~ 20 | kHz |
| Minimum Dead Time | t_{DEAD} | Input Signal | ≥ 2.5 | μS |

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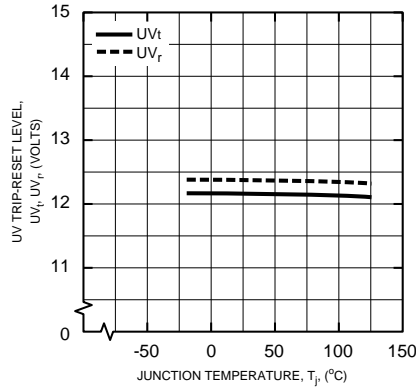


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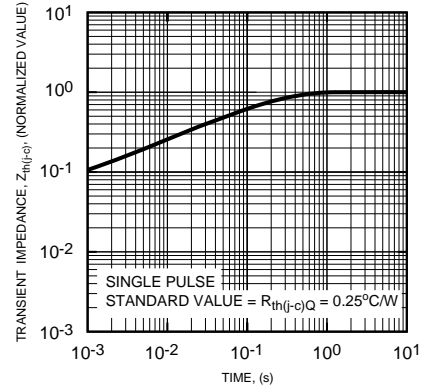
FAULT OUTPUT PULSE WIDTH VS. TEMPERATURE (TYPICAL)



CONTROL SUPPLY VOLTAGE TRIP-RESET LEVEL TEMPERATURE DEPENDENCY (TYPICAL)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (IGBT)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (FWD)

