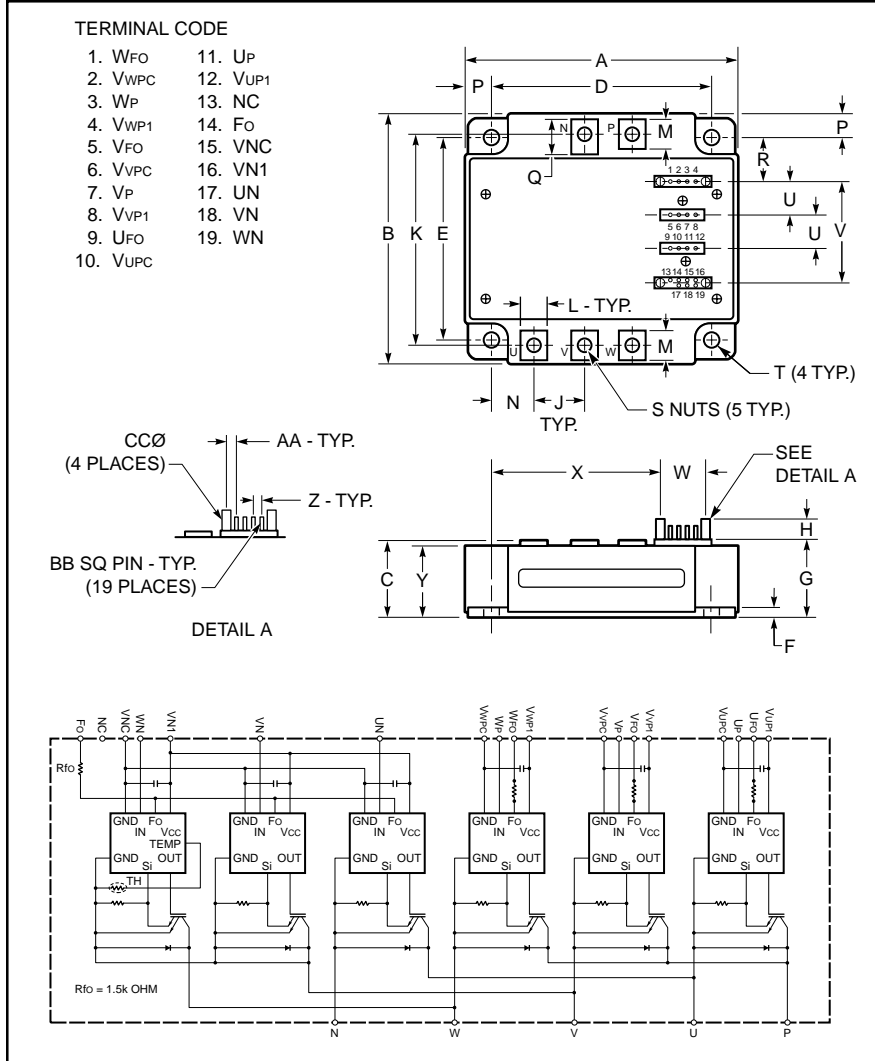


Intellimod™ Module

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 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. PM150CVA060 is a 600V, 150 Ampere Intellimod™ Intelligent Power Module.

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

Outline Drawing and Circuit Diagram

| Dimensions | Inches | Millimeters |
|------------|------------------|----------------|
| A | 4.72 | 120.0 |
| B | 4.02 | 102.0 |
| C | 0.95 +0.04/-0.02 | 24.1 +1.0/-0.5 |
| D | 4.13±0.010 | 105.0±0.25 |
| E | 3.43±0.010 | 87.0±0.25 |
| F | 0.16 | 4.0 |
| G | 0.95 | 24.1 |
| H | 0.42 | 10.6 |
| J | 0.87 | 22.0 |
| K | 3.51±0.02 | 89.2±0.5 |
| L | 0.47 | 12.0 |
| M | 0.48 | 12.3 |
| N | 0.77 | 19.5 |
| P | 0.30 | 7.5 |

| Dimensions | Inches | Millimeters |
|------------|------------------|---------------|
| Q | 0.59 | 15.1 |
| R | 0.72 | 18.25 |
| S | M5 Metric | M5 |
| T | 0.22 Dia. | Dia. 5.5 |
| U | 0.56±0.010 | 14.1±0.25 |
| V | 1.72±0.012 | 43.57±0.3 |
| W | 0.57 ±0.012 | 14.6±0.3 |
| X | 3.35 | 85.2 |
| Y | 0.85 | 21.6 |
| Z | 0.10±0.010 | 2.54±0.25 |
| AA | 0.137±0.010 | 3.49±0.25 |
| BB | 0.02 SQ | 0.64 SQ |
| CC | 0.12 +0.04/-0.02 | 3.0 +1.0/-0.5 |



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

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

| Characteristics | Symbol | PM150CVA060 | 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 (Typical) | — | 17 | in-lb |
| Mounting Torque, M5 Main Terminal Screws (Typical) | — | 17 | in-lb |
| Module Weight (Typical) | — | 730 | Grams |
| Supply Voltage (Applied between P - N) | $V_{\text{CC(surge)}}$ | 500 | Volts |
| Supply Voltage Protected by SC ($V_D = 13.5 \sim 16.5\text{V}$, Inverter Part, $T_j = 125^\circ\text{C}$ Start) | $V_{\text{CC(prot.)}}$ | 400 | Volts |
| Isolation Voltage, AC 1 minute, 60Hz Sinusoidal | V_{RMS} | 2500 | Volts |

Control Sector

| | | | |
|--|------------------|----|-------|
| Supply Voltage Applied between ($V_{\text{UP1}}-V_{\text{UPC}}$, $V_{\text{VP1}}-V_{\text{VPC}}$, $V_{\text{WP1}}-V_{\text{WPC}}$, $V_{\text{N1}}-V_{\text{NC}}$) | 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-V_{NC} , $*F_O-V_{\text{PC}}$) | V_{FO} | 20 | Volts |
| Fault Output Current (Sink Current at F_O Terminals) | I_{FO} | 20 | mA |

IGBT Inverter Sector

| | | | |
|--|------------------|-----|---------|
| Collector-Emitter Voltage ($V_D = 15\text{V}$, $V_{\text{CIN}} = 15\text{V}$) | V_{CES} | 600 | Volts |
| Collector Current, \pm ($T_C = 25^\circ\text{C}$) | I_C | 150 | Amperes |
| Peak Collector Current, \pm ($T_C = 25^\circ\text{C}$) | I_{CP} | 300 | Amperes |
| Collector Dissipation ($T_C = 25^\circ\text{C}$) | P_C | 446 | 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 | | | | | | |
| Short Circuit Trip Level | SC | $-20^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$, $V_D = 15\text{V}$ | 210 | — | — | Amperes |
| Short Circuit Current Delay Time | $t_{\text{off(SC)}}$ | $V_D = 15\text{V}$ | — | 10 | — | μS |
| Over Temperature Protection | OT | Trip Level | 100 | 110 | 120 | $^\circ\text{C}$ |
| ($V_D = 15\text{V}$) | OT_r | Reset Level | 85 | 95 | 105 | $^\circ\text{C}$ |
| Supply Circuit Under Voltage Protection | UV | Trip Level | 11.5 | 12.0 | 12.5 | Volts |
| ($-20^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$) | UV_r | Reset Level | — | 12.5 | — | Volts |
| Circuit Current | I_D | $V_D = 15\text{V}$, $V_{\text{CIN}} = 15\text{V}$, $V_{\text{N1}}-V_{\text{NC}}$ | — | 40 | 55 | mA |
| | | $V_D = 15\text{V}$, $V_{\text{CIN}} = 15\text{V}$, $V_{\text{XP1}}-V_{\text{XPC}}$ | — | 13 | 18 | mA |
| Input ON Threshold Voltage | $V_{\text{CIN(on)}}$ | Applied between U_P-V_{UPC} , V_P-V_{VPC} , | 1.2 | 1.5 | 1.8 | Volts |
| Input OFF Threshold Voltage | $V_{\text{CIN(off)}}$ | W_P-V_{WPC} , U_N , V_N , W_N-V_{NC} | 1.7 | 2.0 | 2.3 | Volts |
| Fault Output Current | $I_{\text{FO(H)}}$ | $V_D = 15\text{V}$, $V_{\text{FO}} = 15\text{V}$ | — | — | 0.01 | mA |
| | $I_{\text{FO(L)}}$ | $V_D = 15\text{V}$, $V_{\text{FO}} = 15\text{V}$ | — | 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-Emitter Cutoff Current | I_{CES} | $V_{CE} = V_{CES}, V_D = 15V, T_j = 25^\circ\text{C}$ | — | — | 1.0 | mA |
| | | $V_{CE} = V_{CES}, V_D = 15V, T_j = 125^\circ\text{C}$ | — | — | 10.0 | mA |
| FWDi Forward Voltage | V_{EC} | $-I_C = 150A, V_D = 15V, V_{CIN} = 15V$ | — | 2.20 | 3.30 | Volts |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_D = 15V, V_{CIN} = 0V, I_C = 150A,$ Pulsed, $T_j = 25^\circ\text{C}$ | — | 2.35 | 2.80 | Volts |
| | | $V_D = 15V, V_{CIN} = 0V, I_C = 150A,$ Pulsed, $T_j = 125^\circ\text{C}$ | — | 2.55 | 3.05 | Volts |
| Inductive Load Switching Times (Upper-Lower Arm) | t_{on} | | 0.4 | 0.8 | 2.1 | μS |
| | t_{rr} | $V_D = 15V, V_{CIN} = 0V \sim 15V$ | — | 0.2 | 0.3 | μS |
| | $t_{C(on)}$ | $V_{CC} = 300V, I_C = 150A,$ $T_j = 125^\circ\text{C}$ | — | 0.3 | 1.1 | μS |
| | t_{off} | | — | 1.8 | 2.9 | μS |
| | $t_{C(off)}$ | | — | 0.6 | 1.2 | μS |

Thermal Characteristics

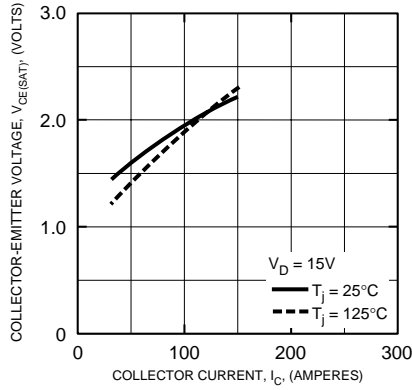
| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Units |
|-------------------------------------|----------------|---|------|------|-------|-----------------------|
| Junction to Case Thermal Resistance | $R_{th(j-c)Q}$ | Each Inverter IGBT | — | — | 0.28 | $^\circ\text{C/Watt}$ |
| | $R_{th(j-c)D}$ | Each Inverter FWDi | — | — | 0.47 | $^\circ\text{C/Watt}$ |
| Contact Thermal Resistance | $R_{th(c-f)}$ | Case to Fin Per Module, Thermal Grease Applied | — | — | 0.022 | $^\circ\text{C/Watt}$ |

Recommended Conditions for Use

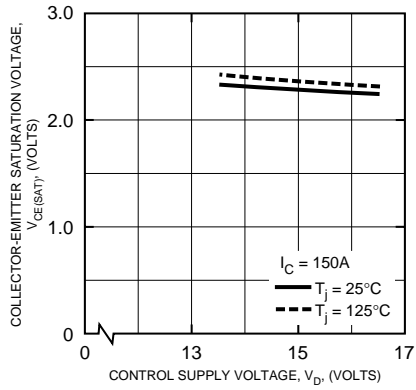
| Characteristic | Symbol | Condition | Value | Units |
|---------------------------------|-----------------|---|--------------|---------------|
| Supply Voltage | V_{CC} | Applied across P-N Terminals | ≤ 400 | Volts |
| | $V_{CE(surge)}$ | Applied across Terminals P-U, P-V, P-W, U-N, V-N, W-N | ≤ 500 | 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 | ≤ 0.8 | Volts |
| Input OFF Voltage | $V_{CIN(off)}$ | $U_P, V_P, W_P, U_N, V_N, W_N$ | ≥ 4.0 | Volts |
| Arm Shoot-Through Blocking Time | t_{DEAD} | For IPM's each Input Signal | ≥ 2.5 | μS |

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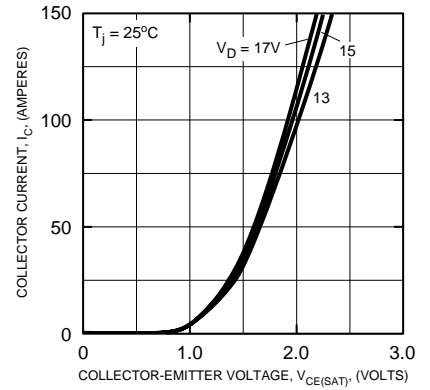
SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



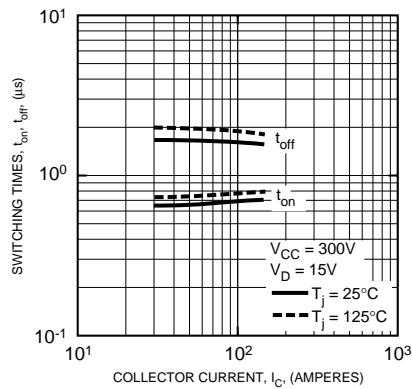
COLLECTOR-EMITTER SATURON VOLTAGE CHARACTERISTICS (TYPICAL)



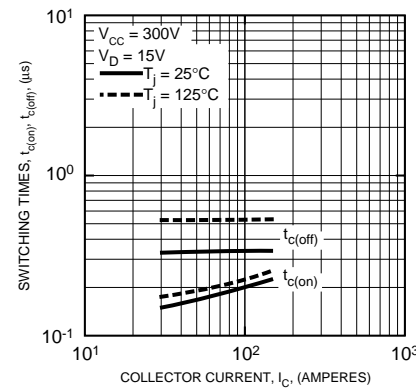
OUTPUT CHARACTERISTICS (TYPICAL)



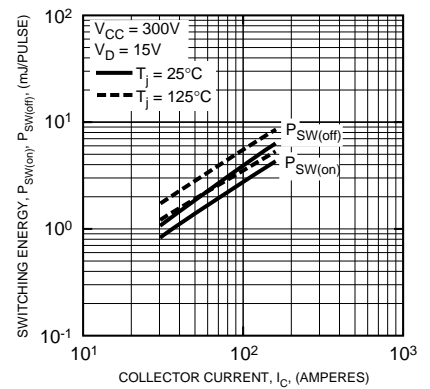
SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)



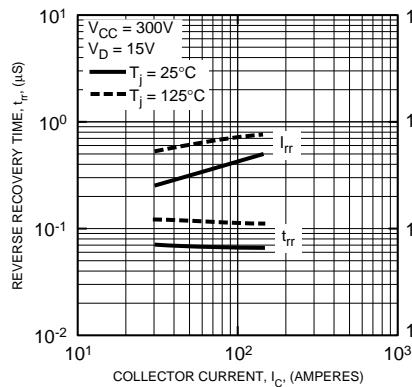
SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)



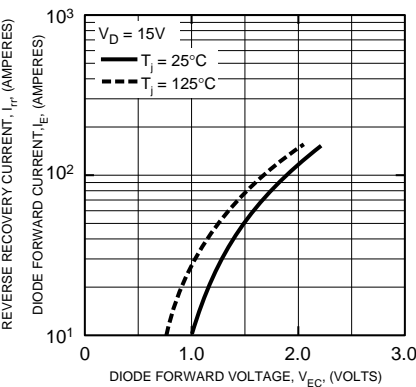
SWITCHING LOSS CHARACTERISTICS (TYPICAL)



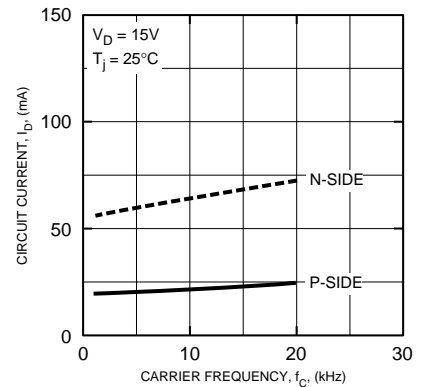
REVERSE RECOVERY CURRENT VS. COLLECTOR CURRENT (TYPICAL)



DIODE FORWARD CHARACTERISTICS



CIRCUIT CURRENT VS. CARRIER FREQUENCY



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