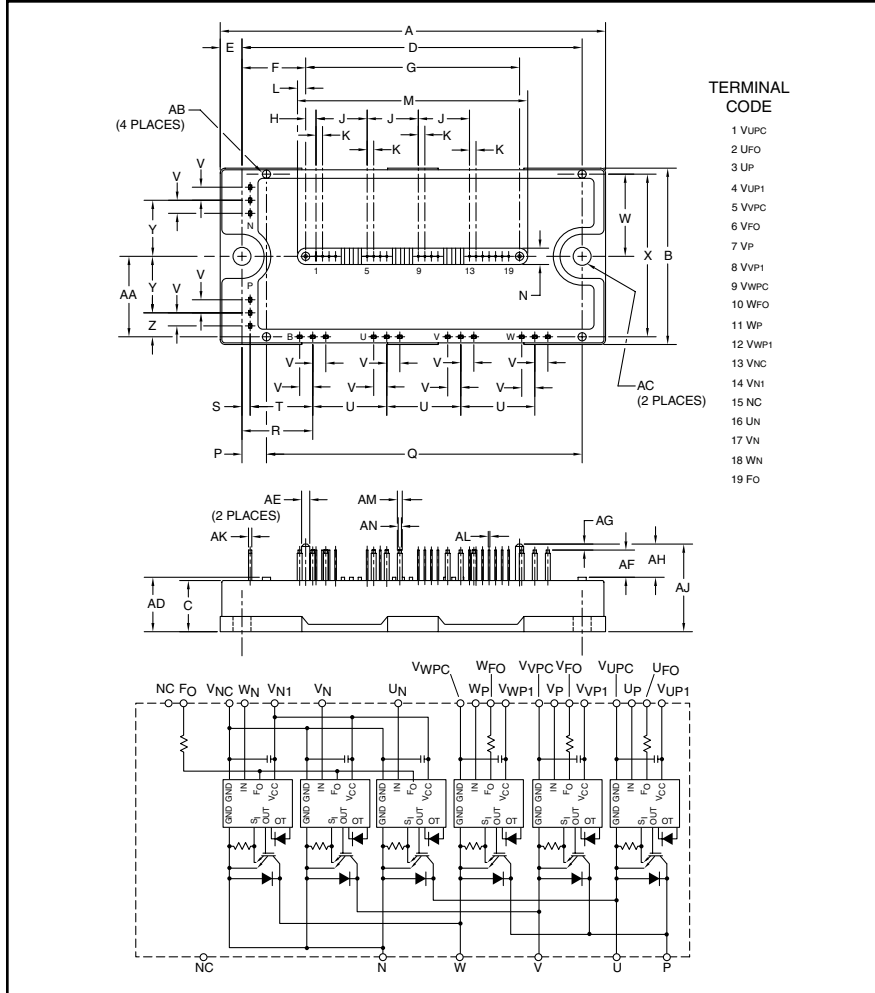
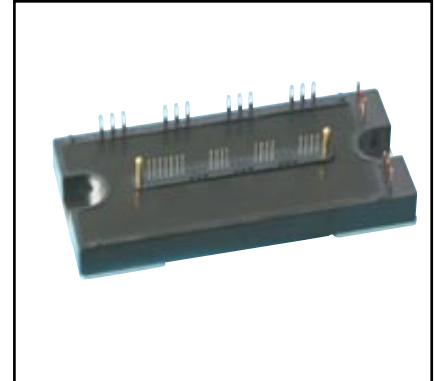


Intellimod™ L-Series Three Phase IGBT Inverter 150 Amperes/600 Volts



TERMINAL CODE

- 1 VUPC
- 2 UFO
- 3 UP
- 4 VUP1
- 5 VVPC
- 6 VFO
- 7 VP
- 8 VVP1
- 9 WVPC
- 10 WFO
- 11 WP
- 12 WVP1
- 13 VNC
- 14 VNI
- 15 NC
- 16 UN
- 17 VN
- 18 WN
- 19 FO



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
 - Using On-chip Temperature Sensing
 - Under Voltage
 - Low Loss Using 5th Generation IGBT Chip

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

Ordering Information:
Example: Select the complete part number from the table below -i.e. PM150CLB060 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 | 2.17 | 55.0 |
| C | 0.63 | 16.0 |
| D | 4.17 | 106.0 |
| E | 0.28 | 7.0 |
| F | 0.78 | 19.75 |
| G | 2.62 | 66.5 |
| H | 0.13 | 3.25 |
| J | 0.63 | 16.0 |
| K | 0.08 | 2.0 |
| L | 0.10 | 2.5 |
| M | 2.81 | 71.5 |
| N | 0.20 | 5.0 |
| P | 0.31 | 7.75 |
| Q | 3.87 | 98.25 |
| R | 0.87 | 22.0 |
| S | 0.10 | 2.5 |
| T | 0.77 | 19.5 |
| U | 0.91 | 23.0 |

| Dimensions | Inches | Millimeters |
|------------|-----------|-------------|
| V | 0.16 | 4.0 |
| W | 1.01 | 25.75 |
| X | 2.00 | 50.75 |
| Y | 0.69 | 17.5 |
| Z | 0.30 | 7.5 |
| AA | 0.98 | 25.0 |
| AB | 0.10 Dia. | Dia. 2.5 |
| AC | 0.22 Dia. | Dia. 5.5 |
| AD | 0.67 | 17.0 |
| AE | 0.10 Dia. | Dia. 2.5 |
| AF | 0.33 | 8.5 |
| AG | 0.08 | 2.0 |
| AH | 0.41 | 10.5 |
| AJ | 1.08 | 27.5 |
| AK | 0.04 | 1.0 |
| AL | 0.02 Sq. | Sq. 0.5 |
| AM | 0.06 | 1.5 |
| AN | 0.04 | 1.0 |



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

PM150CLB060
Intellimod™ L-Series
Three Phase IGBT Inverter
150 Amperes/600 Volts

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

| Characteristics | Symbol | PM150CLB060 | Units |
|---|------------------------|-------------|------------------|
| Power Device Junction Temperature | T_j | -20 to 150 | $^\circ\text{C}$ |
| Storage Temperature | T_{stg} | -40 to 125 | $^\circ\text{C}$ |
| Module Case Operating Temperature (Note 1) | T_C | -20 to 100 | $^\circ\text{C}$ |
| Mounting Torque, M5 Mounting Screws | — | 31 | in-lb |
| Mounting Torque, M5 Main Terminal Screws | — | 31 | in-lb |
| Module Weight (Typical) | — | 380 | Grams |
| Supply Voltage, Surge (Applied between P - N) | $V_{\text{CC(surge)}}$ | 550 | Volts |
| Self-protection Supply Voltage Limit (Short Circuit protection Capability)* | $V_{\text{CC(prot.)}}$ | 400 | Volts |
| Isolation Voltage, AC 1 minute, 60Hz Sinusoidal | V_{ISO} | 2500 | Volts |

* $V_D = 13.5 \sim 16.5\text{V}$, Inverter Part, $T_j = 125^\circ\text{C}$

IGBT Inverter Sector

| | | | |
|--|---------------------|-----|---------|
| Collector-Emitter Voltage ($V_D = 15\text{V}$, $V_{\text{CIN}} = 15\text{V}$) | V_{CES} | 600 | Volts |
| Collector Current ($T_C = 25^\circ\text{C}$) | $\pm I_C$ | 150 | Amperes |
| Peak Collector Current ($T_C = 25^\circ\text{C}$) | $\pm I_{\text{CP}}$ | 300 | Amperes |
| Collector Dissipation ($T_C = 25^\circ\text{C}$) (Note 1) | P_C | 480 | Watts |

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_{UPC} , V_P-V_{VPC} , W_P-V_{WPC} , $U_N-V_N-V_{\text{Nc}}$) | V_{CIN} | 20 | Volts |
| Fault Output Supply Voltage (Applied between $U_{\text{FO}}-V_{\text{UPC}}$, $V_{\text{FO}}-V_{\text{VPC}}$, $W_{\text{FO}}-V_{\text{WPC}}$, $\text{FO}-V_{\text{Nc}}$) | V_{FO} | 20 | Volts |
| Fault Output Current (U_{FO} , V_{FO} , W_{FO} , FO Terminals) | I_{FO} | 20 | mA |

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

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|--------------------------------------|----------------------|--|------|------|------|---------------|
| Collector-Emitter Cutoff Current | I_{CES} | $V_{\text{CE}} = V_{\text{CES}}$, $V_D = 15\text{V}$, $T_j = 25^\circ\text{C}$ | — | — | 1.0 | mA |
| | | $V_{\text{CE}} = V_{\text{CES}}$, $V_D = 15\text{V}$, $T_j = 125^\circ\text{C}$ | — | — | 10 | mA |
| Diode Forward Voltage | V_{EC} | $-I_C = 150\text{A}$, $V_{\text{CIN}} = 15\text{V}$, $V_D = 15\text{V}$ | — | 2.2 | 3.3 | Volts |
| Collector-Emitter Saturation Voltage | $V_{\text{CE(sat)}}$ | $V_D = 15\text{V}$, $V_{\text{CIN}} = 0\text{V}$, $I_C = 150\text{A}$, $T_j = 25^\circ\text{C}$ | — | 1.6 | 2.1 | Volts |
| | | $V_D = 15\text{V}$, $V_{\text{CIN}} = 0\text{V}$, $I_C = 150\text{A}$, $T_j = 125^\circ\text{C}$ | — | 1.5 | 2.0 | Volts |
| Inductive Load Switching Times | t_{on} | | 0.5 | 1.0 | 2.4 | μs |
| | t_{rr} | $V_D = 15\text{V}$, $V_{\text{CIN}} = 0 \Leftrightarrow 15\text{V}$ | — | 0.2 | 0.4 | μs |
| | $t_{\text{C(on)}}$ | $V_{\text{CC}} = 300\text{V}$, $I_C = 150\text{A}$ | — | 0.4 | 1.0 | μs |
| | t_{off} | $T_j = 125^\circ\text{C}$ | — | 1.2 | 2.5 | μs |
| | $t_{\text{C(off)}}$ | | — | 0.5 | 1.0 | μs |

PM150CLB060
Intellimod™ L-Series
Three Phase IGBT Inverter
 150Amperes/600 Volts

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 | $-20^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$, $V_D = 15\text{V}$ | 300 | 420 | — | Amperes |
| Short Circuit Current Delay Time | $t_{\text{off(SC)}}$ | $V_D = 15\text{V}$ | — | 0.2 | — | μs |
| Over Temperature Protection (Detect T_j of IGBT Chip) | OT | Trip Level | 135 | 145 | 155 | $^\circ\text{C}$ |
| | OT_R | Reset Level | — | 125 | — | $^\circ\text{C}$ |
| Supply Circuit Under-voltage Protection ($-20 \leq T_j \leq 125^\circ\text{C}$) | UV | Trip Level | 11.5 | 12.0 | 12.5 | Volts |
| | UV_R | Reset Level | — | 12.5 | — | Volts |
| Circuit Current | I_D | $V_D = 15\text{V}$, $V_{\text{CIN}} = 15\text{V}$, $V_{N1}-V_{NC}$ | — | 15 | 25 | mA |
| | | $V_D = 15\text{V}$, $V_{\text{CIN}} = 15\text{V}$, $V_{\text{XP1}}-V_{\text{XPC}}$ | — | 5 | 10 | mA |
| Input ON Threshold Voltage | $V_{\text{th(on)}}$ | Applied between U_P-V_{UPC} , | 1.2 | 1.5 | 1.8 | Volts |
| Input OFF Threshold Voltage | $V_{\text{th(off)}}$ | V_P-V_{VPC} , W_P-V_{WPC} , U_N-V_{N-} , W_N-V_{NC} | 1.7 | 2.0 | 2.3 | Volts |
| Fault Output Current* | $I_{\text{FO(H)}}$ | $V_D = 15\text{V}$, $V_{\text{CIN}} = 15\text{V}$ | — | — | 0.01 | mA |
| | $I_{\text{FO(L)}}$ | $V_D = 15\text{V}$, $V_{\text{CIN}} = 15\text{V}$ | — | 10 | 15 | mA |
| Fault Output Pulse Width* | t_{FO} | $V_D = 15\text{V}$ | 1.0 | 1.8 | — | ms |

*Fault output is given only when the internal SC, OT and UV protections schemes of either upper or lower device operate to protect it.

Thermal Characteristics

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Units |
|-------------------------------------|-----------------------|--|------|------|--------|-----------------------|
| Junction to Case Thermal Resistance | $R_{\text{th(j-c)Q}}$ | IGBT (Per 1/6 Module) (Note 1) | — | — | 0.26 | $^\circ\text{C/Watt}$ |
| | $R_{\text{th(j-c)D}}$ | FWDi (Per 1/6 Module) (Note 1) | — | — | 0.43 | $^\circ\text{C/Watt}$ |
| | $R_{\text{th(j-c)Q}}$ | IGBT (Per 1/6 Module) (Note 2) | — | — | 0.20** | $^\circ\text{C/Watt}$ |
| | $R_{\text{th(j-c)D}}$ | FWDi (Per 1/6 Module) (Note 2) | — | — | 0.33** | $^\circ\text{C/Watt}$ |
| Contact Thermal Resistance | $R_{\text{th(c-f)}}$ | Case to Fin Per Module, Thermal Grease Applied (Note 1) | — | — | 0.038 | $^\circ\text{C/Watt}$ |

** If you use this value, $R_{\text{th(f-a)}}$ should be measured just under the chips.

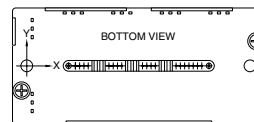
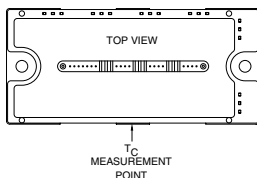
Recommended Conditions for Use

| Characteristic | Symbol | Condition | Value | Units |
|---------------------------------|-----------------------|--|----------------|---------------|
| Supply Voltage | V_{CC} | Applied across P-N Terminals | ≤ 400 | Volts |
| Control Supply Voltage*** | V_D | Applied between $V_{\text{UP1}}-V_{\text{UPC}}$, $V_{\text{VP1}}-V_{\text{VPC}}$, $V_{\text{WP1}}-V_{\text{WPC}}$, $V_{\text{N1}}-V_{\text{NC}}$ | 15.0 ± 1.5 | Volts |
| Input ON Voltage | $V_{\text{CIN(on)}}$ | Applied between U_P-V_{UPC} , | ≤ 0.8 | Volts |
| Input OFF Voltage | $V_{\text{CIN(off)}}$ | V_P-V_{VPC} , W_P-V_{WPC} , U_N-V_{N-} , W_N-V_{NC} | ≥ 9.0 | Volts |
| PWM Input Frequency | f_{PWM} | | ≤ 20 | kHz |
| Arm Shoot-through Blocking Time | t_{DEAD} | Input Signal | ≥ 2.0 | μs |

*** With ripple satisfying the following conditions: dv/dt swing $\leq \pm 5\text{V}/\mu\text{s}$, Variation $\leq 2\text{V}$ peak to peak.

Note 1: T_C (base plate) Measurement Point

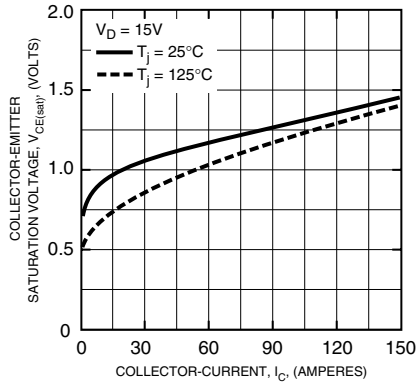
Note 2: T_C (under the chip) Measurement Point



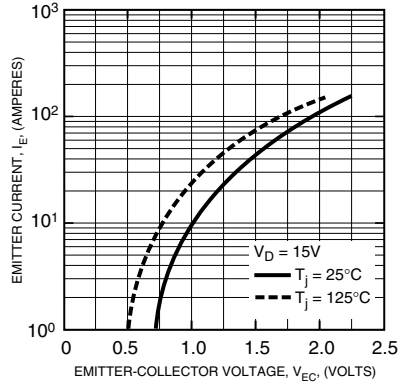
| Axis \ Arm | UP | | VP | | WP | | UN | | VN | | WN | |
|------------|------|------|------|------|------|------|------|------|------|------|------|------|
| | IGBT | FWDi | IGBT | FWDi | IGBT | FWDi | IGBT | FWDi | IGBT | FWDi | IGBT | FWDi |
| X | 29.0 | 29.5 | 64.6 | 65.1 | 85.9 | 86.4 | 38.1 | 37.6 | 54.8 | 55.3 | 76.1 | 75.6 |
| Y | -7.3 | 1.6 | -7.3 | 2.1 | -7.3 | 2.1 | 5.3 | -4.6 | 5.3 | -4.6 | 5.3 | -4.6 |

PM150CLB060
Intellimod™ L-Series
Three Phase IGBT Inverter
 150 Amperes/600 Volts

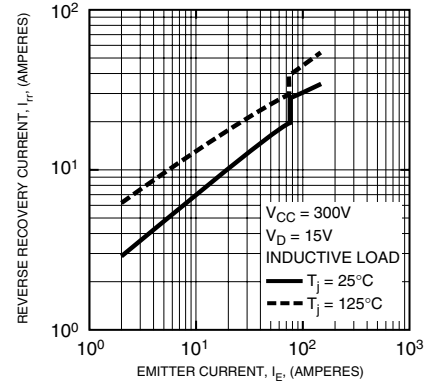
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



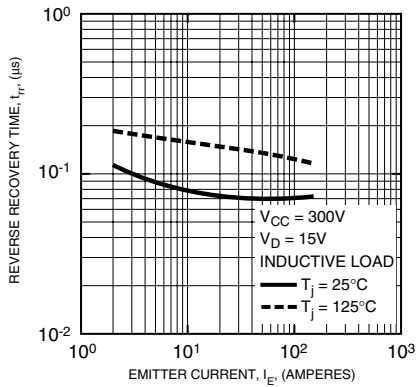
FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



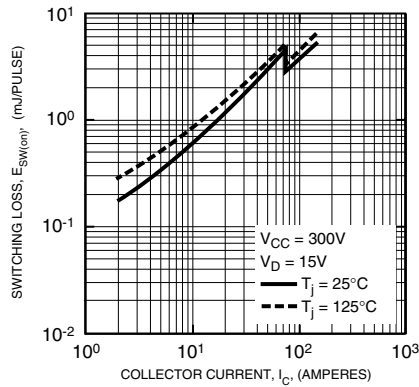
REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



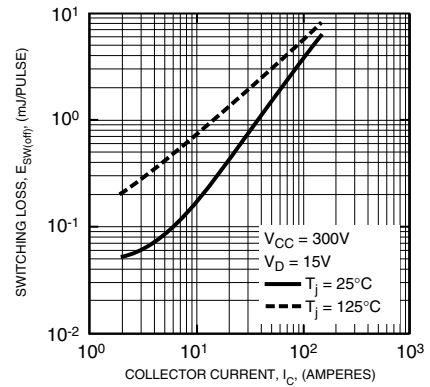
REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



SWITCHING LOSS (ON) VS. COLLECTOR CURRENT (TYPICAL)



SWITCHING LOSS (OFF) VS. COLLECTOR CURRENT (TYPICAL)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (IGBT & FWDi)

