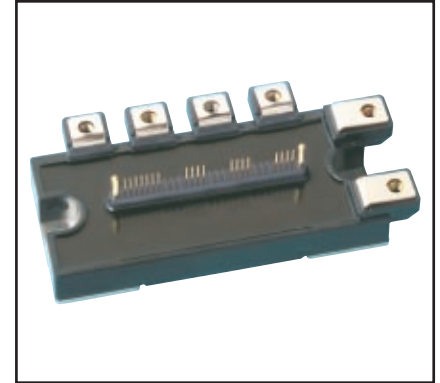
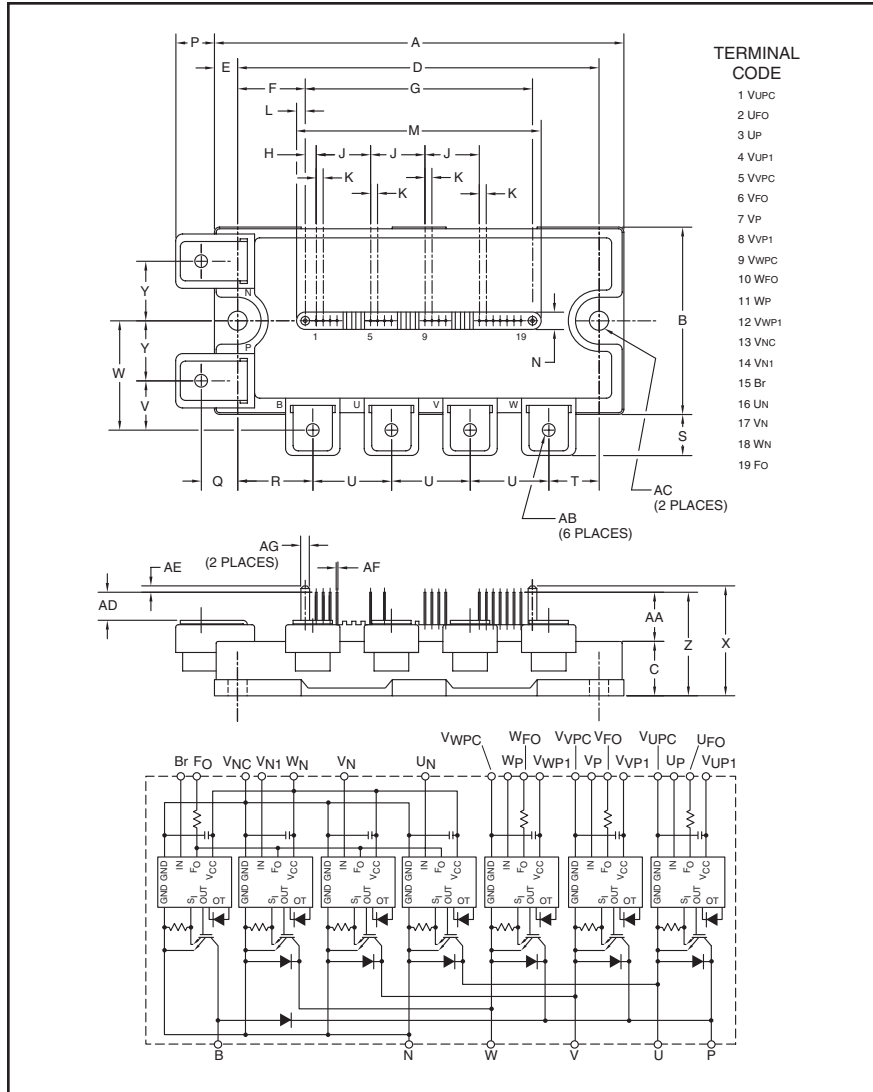


### Intellimod™ L-Series

Three Phase

IGBT Inverter + Brake

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
  - 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. PM150RLA060 is a 600V, 150 Ampere Intellimod™ Intelligent Power Module.

| Type | Current Rating<br>Amperes | V <sub>CES</sub><br>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          | 0.43   | 11.0        |
| Q          | 0.42   | 10.75       |
| R          | 0.87   | 22.0        |

| Dimensions | Inches    | Millimeters |
|------------|-----------|-------------|
| S          | 0.46      | 11.75       |
| T          | 0.59      | 15.0        |
| U          | 0.91      | 23.0        |
| V          | 0.57      | 14.5        |
| W          | 1.26      | 32.0        |
| X          | 1.22      | 31.0        |
| Y          | 0.69      | 17.5        |
| Z          | 1.14      | 29.0        |
| AA         | 0.51      | 13.0        |
| AB         | M5 Metric | M5          |
| AC         | 0.22 Dia. | Dia. 5.5    |
| AD         | 0.28      | 7.0         |
| AE         | 0.08      | 2.0         |
| AF         | 0.02 Sq.  | Sq. 0.5     |
| AG         | 0.10 Dia. | Dia. 2.5    |



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**PM150RLA060**  
**Intellimod™ L-Series**  
**Three Phase IGBT Inverter + Brake**  
**150 Amperes/600 Volts**

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

| Characteristics                                                             | Symbol                 | PM150RLA060 | Units            |
|-----------------------------------------------------------------------------|------------------------|-------------|------------------|
| Power Device Junction Temperature                                           | $T_j$                  | -20 to 150  | $^\circ\text{C}$ |
| Storage Temperature                                                         | $T_{\text{stg}}$       | -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                             | $V_{\text{ISO}}$       | 2500        | Volts            |

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

### IGBT Inverter Sector

|                                                                                  |                     |     |         |
|----------------------------------------------------------------------------------|---------------------|-----|---------|
| Collector-Emitter Voltage ( $V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ ) | $V_{\text{CES}}$    | 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   |

### IGBT Brake Sector

|                                                                                  |                     |     |         |
|----------------------------------------------------------------------------------|---------------------|-----|---------|
| Collector-Emitter Voltage ( $V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ ) | $V_{\text{CES}}$    | 600 | Volts   |
| Collector Current ( $T_C = 25^\circ\text{C}$ )                                   | $\pm I_C$           | 75  | Amperes |
| Peak Collector Current ( $T_C = 25^\circ\text{C}$ )                              | $\pm I_{\text{CP}}$ | 150 | Amperes |
| Collector Dissipation ( $T_C = 25^\circ\text{C}$ ) (Note 1)                      | $P_C$               | 300 | Watts   |
| Diode Rated DC Reverse Voltage ( $T_C = 25^\circ\text{C}$ )                      | $V_{\text{R(DC)}}$  | 600 | Volts   |
| Diode Forward Current                                                            | $I_F$               | 75  | Amperes |

### Control Sector

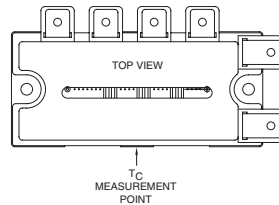
|                                                                                                                                                                          |                  |    |       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----|-------|
| 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 $U_P-V_{\text{UPC}}$ , $V_P-V_{\text{VPC}}$ , $W_P-V_{\text{WPC}}$ , $U_N-V_N$ , $W_N-V_{\text{NC}}$ , $Br-V_{\text{NC}}$ )               | $V_{\text{CIN}}$ | 20 | Volts |
| Fault Output Supply Voltage<br>(Applied between $U_{\text{FO}}-V_{\text{UPC}}$ , $V_{\text{FO}}-V_{\text{VPC}}$ , $W_{\text{FO}}-V_{\text{WPC}}$ , $F_O-V_{\text{NC}}$ ) | $V_{\text{FO}}$  | 20 | Volts |
| Fault Output Current ( $U_{\text{FO}}$ , $V_{\text{FO}}$ , $W_{\text{FO}}$ , $F_O$ Terminals)                                                                            | $I_{\text{FO}}$  | 20 | mA    |

**PM150RLA060**  
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 150 Amperes/600 Volts

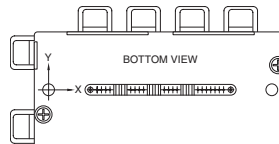
**Electrical and Mechanical Characteristics,  $T_j = 25^\circ\text{C}$  unless otherwise specified**

| Characteristics                      | Symbol        | Test Conditions                                                                                     | Min. | Typ. | Max. | Units   |
|--------------------------------------|---------------|-----------------------------------------------------------------------------------------------------|------|------|------|---------|
| IGBT Inverter Sector                 |               |                                                                                                     |      |      |      |         |
| Collector-Emitter Cutoff Current     | $I_{CES}$     | $V_{CE} = V_{CES}, V_D = 15V, T_j = 25^{\circ}C$                                                    | —    | —    | 1.0  | mA      |
|                                      |               | $V_{CE} = V_{CES}, V_D = 15V, T_j = 125^{\circ}C$                                                   | —    | —    | 10   | mA      |
| Diode Forward Voltage                | $V_{EC}$      | $-I_C = 150A, V_{CIN} = 15V, V_D = 15V$                                                             | —    | 2.2  | 3.3  | Volts   |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_D = 15V, V_{CIN} = 0V, I_C = 150A, T_j = 25^{\circ}C$                                            | —    | 1.6  | 2.1  | Volts   |
|                                      |               | $V_D = 15V, V_{CIN} = 0V, I_C = 150A, T_j = 125^{\circ}C$                                           | —    | 1.5  | 2.0  | Volts   |
| Inductive Load Switching Times       | $t_{on}$      | $V_D = 15V, V_{CIN} = 0 \Leftrightarrow 15V$<br>$V_{CC} = 300V, I_C = 150A$<br>$T_j = 125^{\circ}C$ | 0.5  | 1.0  | 2.4  | $\mu s$ |
|                                      | $t_{rr}$      |                                                                                                     | —    | 0.2  | 0.4  | $\mu s$ |
|                                      | $t_{C(on)}$   |                                                                                                     | —    | 0.4  | 1.0  | $\mu s$ |
|                                      | $t_{off}$     |                                                                                                     | —    | 1.2  | 2.5  | $\mu s$ |
|                                      | $t_{C(off)}$  |                                                                                                     | —    | 0.5  | 1.0  | $\mu s$ |
| IGBT Brake Sector                    |               |                                                                                                     |      |      |      |         |
| Collector-Emitter Cutoff Current     | $I_{CES}$     | $V_{CE} = V_{CES}, V_D = 15V, T_j = 25^{\circ}C$                                                    | —    | —    | 1.0  | mA      |
|                                      |               | $V_{CE} = V_{CES}, V_D = 15V, T_j = 125^{\circ}C$                                                   | —    | —    | 10   | mA      |
| Diode Forward Voltage                | $V_{FM}$      | $I_F = 75A$                                                                                         | —    | 2.2  | 3.3  | Volts   |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_D = 15V, V_{CIN} = 0V, I_C = 75A, T_j = 25^{\circ}C$                                             | —    | 1.6  | 2.1  | Volts   |
|                                      |               | $V_D = 15V, V_{CIN} = 0V, I_C = 75A, T_j = 125^{\circ}C$                                            | —    | 1.5  | 2.0  | Volts   |

Note 1:  $T_C$  (base plate) Measurement Point



Note 2:  $T_C$  (under the chip) Measurement Point



| Arm<br>Axis | UP   |      | VP   |      | WP   |      | UN   |      | VN   |      | WN   |      | Br    |      |
|-------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|------|
|             | IGBT | FWDi | IGBT | FWDi | IGBT | FWDi | IGBT | FWDi | IGBT | FWDi | IGBT | FWDi | IGBT  | FWDi |
| X           | 28.3 | 28.3 | 65.0 | 65.0 | 87.0 | 87.0 | 39.3 | 39.3 | 54.0 | 54.0 | 76.0 | 76.0 | 18.1  | 18.1 |
| Y           | -7.7 | 2.4  | -7.7 | 2.4  | -7.7 | 2.4  | 5.7  | -4.4 | 5.7  | -4.4 | 5.7  | -4.4 | -10.5 | 4.0  |



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**PM150RLA060**  
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**150 Amperes/600 Volts**

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

| Characteristics                                                              | Symbol               | Test Conditions                                                                      | Min. | Typ. | Max. | Units            |
|------------------------------------------------------------------------------|----------------------|--------------------------------------------------------------------------------------|------|------|------|------------------|
| <b>Control Sector</b>                                                        |                      |                                                                                      |      |      |      |                  |
| Short Circuit Trip Level                                                     | SC                   | Inverter Part                                                                        | 300  | —    | —    | Amperes          |
| ( $-20^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$ , $V_D = 15\text{V}$ ) |                      | Brake Part                                                                           | 150  | —    | —    | Amperes          |
| Short Circuit Current Delay Time                                             | $t_{\text{off(SC)}}$ | $V_D = 15\text{V}$                                                                   | —    | 10   | —    | $\mu\text{s}$    |
| Over Temperature Protection                                                  | OT                   | Trip Level                                                                           | 135  | 145  | 155  | $^\circ\text{C}$ |
| (Detect $T_j$ of IGBT Chip)                                                  | $\text{OT}_R$        | Reset Level                                                                          | —    | 125  | —    | $^\circ\text{C}$ |
| Supply Circuit Under-voltage Protection                                      | UV                   | Trip Level                                                                           | 11.5 | 12.0 | 12.5 | Volts            |
| ( $-20 \leq T_j \leq 125^\circ\text{C}$ )                                    | $\text{UV}_R$        | Reset Level                                                                          | —    | 12.5 | —    | Volts            |
| Circuit Current                                                              | $I_D$                | $V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ , $V_{N1}-V_{\text{NC}}$          | —    | 20   | 30   | 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 $U_P-V_{\text{UPC}}$ ,                                               | 1.2  | 1.5  | 1.8  | Volts            |
| Input OFF Threshold Voltage                                                  | $V_{\text{th(off)}}$ | $V_P-V_{\text{VPC}}$ , $W_P-V_{\text{WPC}}$ , $U_N-V_N$ , $W_N-Br-V_{\text{NC}}$     | 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*                                                    | $t_{\text{FO}}$      | $V_D = 15\text{V}$                                                                   | 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, $T_j = 25^\circ\text{C}$ unless otherwise specified

| Characteristic                      | Symbol                | Condition                                                  | Min. | Typ. | Max.   | Units                 |
|-------------------------------------|-----------------------|------------------------------------------------------------|------|------|--------|-----------------------|
| Junction to Case Thermal Resistance | $R_{\text{th(j-c)Q}}$ | Inverter IGBT (Per 1/6 Module) (Note 1)                    | —    | —    | 0.26   | $^\circ\text{C/Watt}$ |
|                                     | $R_{\text{th(j-c)D}}$ | Inverter FWDi (Per 1/6 Module) (Note 1)                    | —    | —    | 0.43   | $^\circ\text{C/Watt}$ |
|                                     | $R_{\text{th(j-c)Q}}$ | Brake IGBT (Per 1/6 Module) (Note 1)                       | —    | —    | 0.42   | $^\circ\text{C/Watt}$ |
|                                     | $R_{\text{th(j-c)D}}$ | Brake FWDi (Per 1/6 Module) (Note 1)                       | —    | —    | 0.69   | $^\circ\text{C/Watt}$ |
|                                     | $R_{\text{th(j-c)Q}}$ | Inverter IGBT (Per 1/6 Module) (Note 2)                    | —    | —    | 0.20** | $^\circ\text{C/Watt}$ |
|                                     | $R_{\text{th(j-c)D}}$ | Inverter FWDi (Per 1/6 Module) (Note 2)                    | —    | —    | 0.33** | $^\circ\text{C/Watt}$ |
|                                     | $R_{\text{th(j-c)Q}}$ | Brake IGBT (Per 1/6 Module) (Note 2)                       | —    | —    | 0.32** | $^\circ\text{C/Watt}$ |
|                                     | $R_{\text{th(j-c)D}}$ | Brake FWDi (Per 1/6 Module) (Note 1)                       | —    | —    | 0.53** | $^\circ\text{C/Watt}$ |
| Contact Thermal Resistance          | $R_{\text{th(c-f)}}$  | Case to Fin Per Module,<br>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                  | $V_{\text{CC}}$       | Applied across P-N Terminals                                                                                                                           | $\leq 400$     | Volts         |
| Control Supply Voltage***       | $V_D$                 | Applied between $V_{\text{UP1}}-V_{\text{UPC}}$ ,<br>$V_{\text{VP1}}-V_{\text{VPC}}$ , $V_{\text{WP1}}-V_{\text{WPC}}$ , $V_{\text{N1}}-V_{\text{NC}}$ | $15.0 \pm 1.5$ | Volts         |
| Input ON Voltage                | $V_{\text{CIN(on)}}$  | Applied between $U_P-V_{\text{UPC}}$ ,                                                                                                                 | $\leq 0.8$     | Volts         |
| Input OFF Voltage               | $V_{\text{CIN(off)}}$ | $V_P-V_{\text{VPC}}$ , $W_P-V_{\text{WPC}}$ , $U_N-V_N$ , $W_N-Br-V_{\text{NC}}$                                                                       | $\geq 9.0$     | Volts         |
| PWM Input Frequency             | $f_{\text{PWM}}$      |                                                                                                                                                        | $\leq 20$      | kHz           |
| Arm Shoot-through Blocking Time | $t_{\text{DEAD}}$     | Input Signal                                                                                                                                           | $\geq 2.0$     | $\mu\text{s}$ |

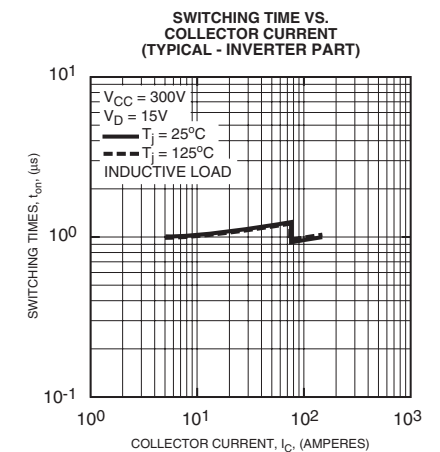
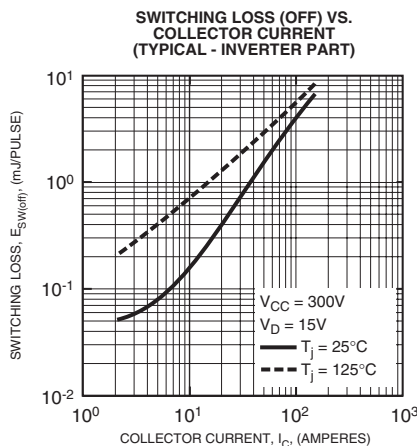
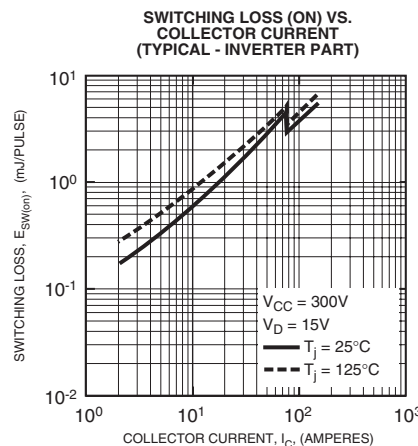
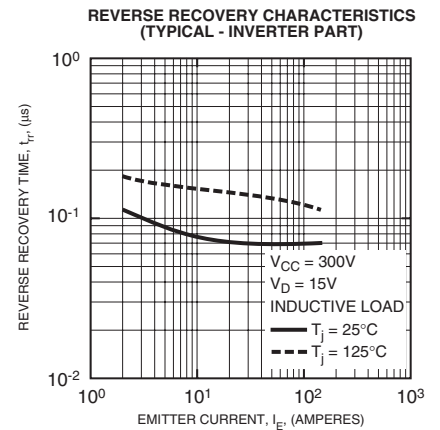
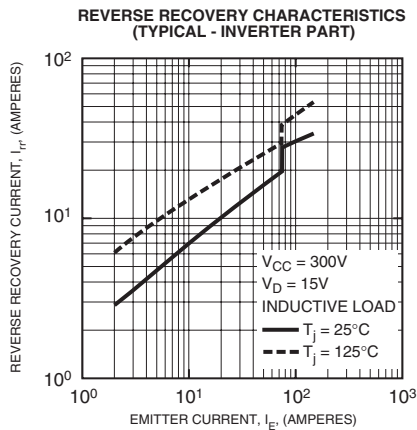
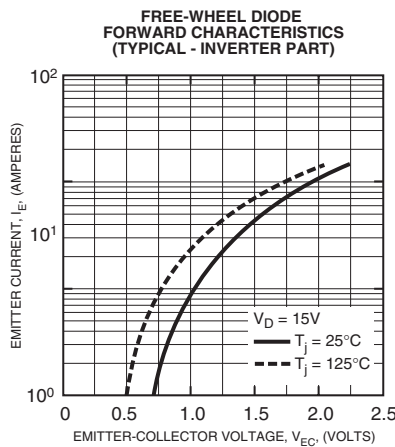
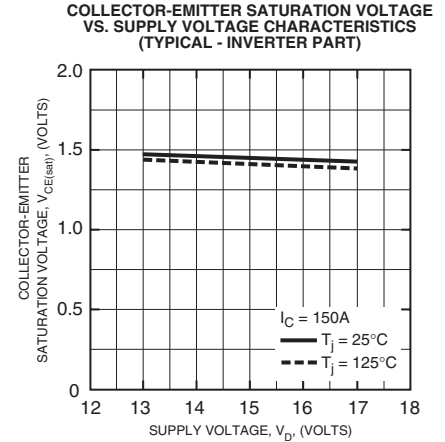
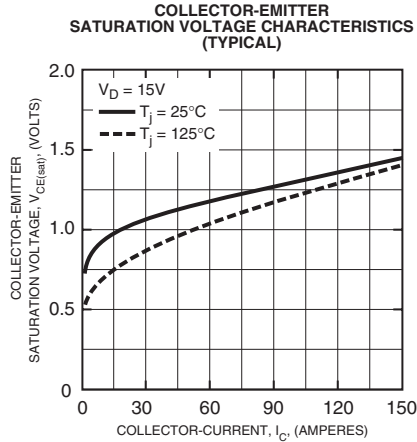
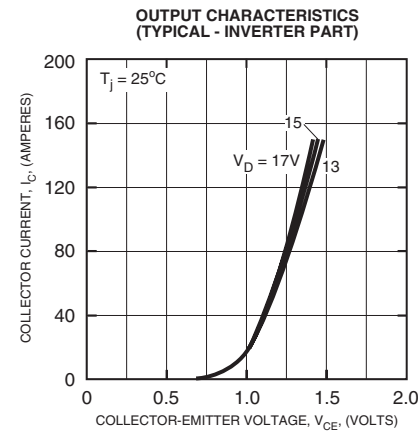
\*\*\* With ripple satisfying the following conditions:  $dv/dt$  swing  $\leq \pm 5\text{V}/\mu\text{s}$ , Variation  $\leq 2\text{V}$  peak to peak.

## PM150RLA060

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150 Amperes/600 Volts



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