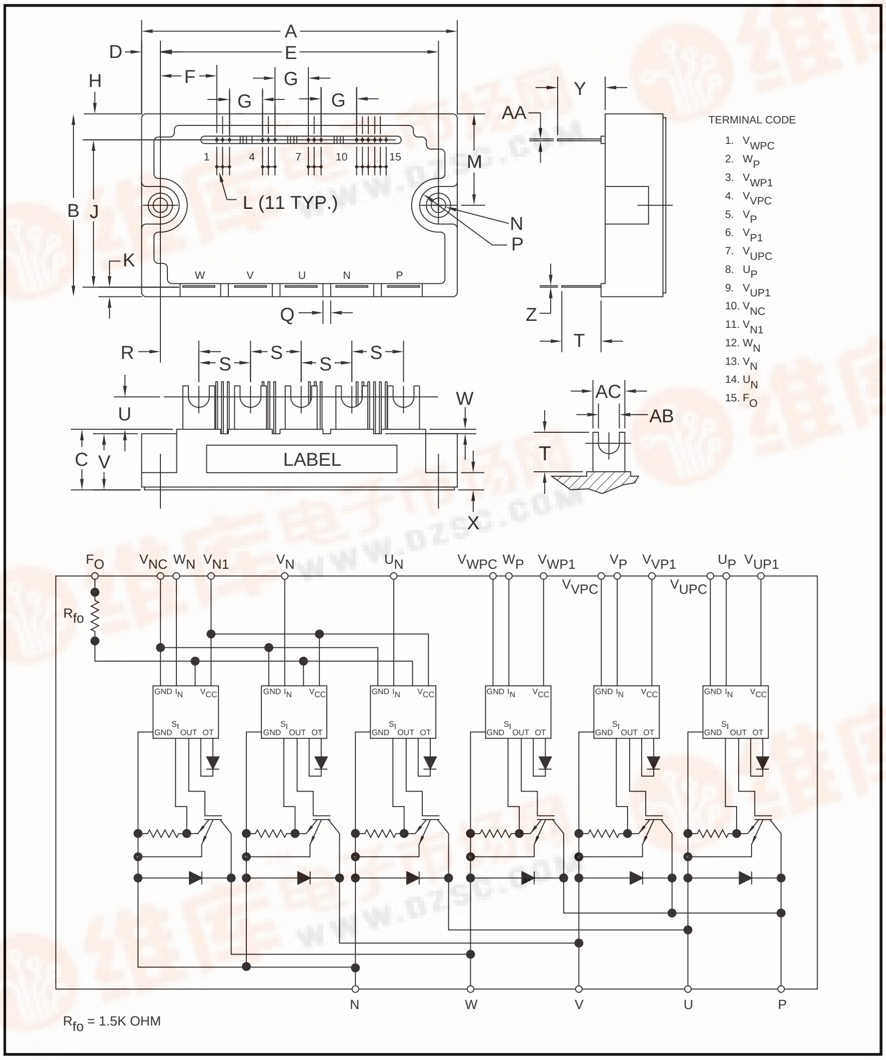
POWEREX

# PM100CBS060

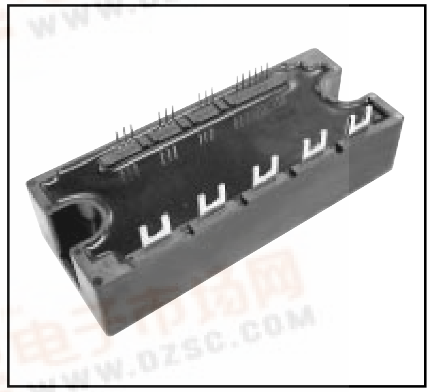
Powerex, Inc., 200 Hillis Street, Youngwood, Pennsylvania 15697-1800 (724) 925-7272

## Intellimod™ Module

***MAXISS Series™***
***Multi AXIS Servo IPM***
***100 Amperes/600 Volts***




Outline Drawing and Circuit Diagram



| Dimensions | Inches | Millimeters |
|---|---|---|
| A | 4.72 | 120.0 |
| B | 1.97 | 50.0 |
| C | 1.18 | 30.0 |
| D | 0.3 | 7.0 |
| E | 4.17±0.1 | 106.0±0.3 |
| F | 0.94 | 23.79 |
| G | 0.40 | 10.16 |
| H | 0.34 | 8.5 |
| J | 1.54 | 39.0 |
| K | 0.10 | 2.5 |
| L | 0.10 | 2.54 |
| M | 0.98 | 25.0 |
| N | 5.5 Dia. | Dia 5.5 |

| Dimensions | Inches | Millimeters |
|---|---|---|
| Q | 0.12 | 3.0 |
| R | 0.59 | 15.0 |
| S | 0.75 | 19.0 |
| T | 0.39 | 10.0 |
| U | 0.24 | 6.0 |
| V | 1.10 | 28.0 |
| W | 0.08 | 2.0 |
| X | 0.26 | 6.5 |
| Y | 0.43 | 11.0 |
| Z | 0.04 | 1.0 |
| AA | 0.03 | 0.64 |
| AB | 0.20 | 5.0 |
| AC | 0.35 | 9.0 |

### 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
  - – Under Voltage
  - – Over Temperature by On-Chip Temperature Sensor
- ☐ Low Loss Using 4th Generation IGBT Chip

### Applications:

- ☐ Motion Control
- ☐ Servo Control

### Ordering Information:

Example: Select the complete part number from the table below -i.e. PM100CBS060 is a 600V, 100 Ampere Intellimod™ Intelligent Power Module.

| Type | Current Rating Amperes | $V_{CES}$ Volts (x 10) |
|---|---|---|
| PM | 100 | 060 |

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

| Characteristics | Symbol | PM100CBS060 | Units |
|---|---|---|---|
| Storage Temperature | $T_{stg}$ | -40 to 125 | °C |
| Case Operating Temperature* | $T_C$ | -20 to 100 | °C |
| Mounting Torque, M5 Mounting Screws | — | 31 | in-lb |
| Mounting Torque, M5 Main Terminal Screws | — | 31 | in-lb |
| Module Weight (Typical) | — | 400 | Grams |
| Supply Voltage Protected by OC and SC ($V_D$ = 13.5 - 16.5V, Inverter Part, $T_j$ = 125°C) | $V_{CC(prot.)}$ | 400 | Volts |
| Supply Voltage, Surge (Applied between P - N) | $V_{CC(surge)}$ | 500 | Volts |
| Isolation Voltage, AC 1 minute, 60Hz Sinusoidal | $V_{ISO}$ | 2500 | $V_{rms}$ |

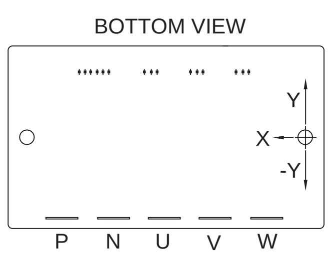
## IGBT Inverter Sector

| Characteristics | Symbol | PM100CBS060 | Units |
|---|---|---|---|
| Collector-Emitter Voltage ($V_D$ = 15V, $V_{CIN}$ = 15V) | $V_{CES}$ | 600 | Volts |
| Collector Current, ± ($T_C$ = 25°C) | $I_C$ | 100 | Amperes |
| Peak Collector Current, ± ($T_C$ = 25°C) | $I_{CP}$ | 200 | Amperes |
| Collector Dissipation | $P_C$ | 568 | Watts |
| Power Device Junction Temperature | $T_j$ | -20 to 150 | °C |

## Control Sector

| Characteristics | Symbol | PM100CBS060 | Units |
|---|---|---|---|
| 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 ($U_P$-$V_{UPC}$, $V_P$-$V_{VPC}$, $W_P$-$V_{WPC}$, $U_N$- $V_N$- $W_N$-$V_{NC}$) | $V_{CIN}$ | 20 | Volts |
| Fault Output Supply Voltage (Applied between $F_O$ and $V_{NC}$) | $V_{FO}$ | $V_D$ +0.5 | Volts |
| Fault Output Current (Sink Current at $F_O$ Terminal) | $I_{FO}$ | 20 | mA |

*$T_C$ Measure Point (Under the Chip)




(mm)

| ARM / AXIS | $U_P$ | | $V_P$ | | $W_P$ | | $U_N$ | | $V_N$ | | $W_N$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | IGBT | FWDi | IGBT | FWDi | IGBT | FWDi | IGBT | FWDi | IGBT | FWDi | IGBT | FWDi |
| X | 83.3 | 83.3 | 41.8 | 41.8 | 16.8 | 16.8 | 70.8 | 70.8 | 54.3 | 54.3 | 29.3 | 29.3 |
| Y | 4.9 | -4.8 | 4.9 | -4.8 | 4.9 | -4.8 | -1.2 | -10.8 | -1.2 | -10.8 | -1.2 | -10.8 |

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## Electrical and Mechanical Characteristics, $T_j$ = 25°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°C | — | — | 1.0 | mA |
| | | $V_{CE} = V_{CES}$, $V_D$ = 15V, $T_j$ = 125°C | — | — | 10 | mA |
| Diode Forward Voltage | $V_{EC}$ | $-I_C$ = 100A, $V_D$ = 15V, $V_{CIN}$ = 15V | — | 2.2 | 3.3 | Volts |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_D$ = 15V, $V_{CIN}$ = 0V, $I_C$ = 100A, $T_j$ = 25°C | — | 1.7 | 2.3 | Volts |
| | | $V_D$ = 15V, $V_{CIN}$ = 0V, $I_C$ = 100A, $T_j$ = 125°C | — | 1.7 | 2.3 | Volts |
| Inductive Load Switching Times | $t_{on}$ | $V_D$ = 15V, $V_{CIN}$ = 0 ~ 15V, $V_{CC}$ = 300V, $I_C$ = 100A, $T_j$ = 125°C, Inductive Load | 0.8 | 1.2 | 2.4 | µS |
| | $t_{rr}$ | | — | 0.15 | 0.3 | µS |
| | $t_{C(on)}$ | | — | 0.4 | 1.0 | µS |
| | $t_{off}$ | | — | 2.4 | 3.3 | µS |
| | $t_{C(off)}$ | | — | 0.5 | 1.0 | µS |
| **Control Sector** | | | | | | |
| Over Current Trip Level | OC | $T_j$ = -20°C, $V_D$ = 15V | — | — | 470 | Amperes |
| | | $T_j$ = 25°C, $V_D$ = 15V | 220 | 290 | 390 | Amperes |
| | | $T_j$ = 125°C, $V_D$ = 15V | 158 | — | — | Amperes |
| Short Circuit Trip Level | SC | -20°C ≤ $T_j$ ≤ 125°C, $V_D$ = 15V | — | 360 | — | Amperes |
| Over Current Delay Time | $t_{off(OC)}$ | $V_D$ = 15V | — | 10 | — | µS |
| Over Temperature Protection | OT | Trip Level | 135 | 145 | 155 | °C |
| (Detect $T_j$ of IGBT Chip) | $OT_R$ | Reset Level | — | 125 | — | °C |
| Supply Circuit Under Voltage Protection | UV | Trip Level | 11.5 | 12.0 | 12.5 | Volts |
| (-20 ≤ $T_j$ ≤ 125°C) | $UV_R$ | Reset Level | — | 12.5 | — | Volts |
| Circuit Current | $I_D$ | $V_D$ = 15V, $V_{CIN}$ = 15V, $V_{N1}$-$V_{NC}$ | — | 40 | 60 | mA |
| | | $V_D$ = 15V, $V_{CIN}$ = 15V, $V_{XP1}$-$V_{XPC}$ | — | 13 | 18 | mA |
| Input ON Threshold Voltage | $V_{th(on)}$ | Applied between $U_P$-$V_{UPC}$, $V_P$-$V_{VPC}$, $W_P$-$V_{WPC}$, $U_N$, $V_N$, $W_N$-$V_{NC}$ | 1.2 | 1.5 | 1.8 | Volts |
| Input OFF Threshold Voltage | $V_{th(off)}$ | | 1.7 | 2.0 | 2.3 | Volts |
| Fault Output Current | $I_{FO(H)}$ | $V_D$ = 15V, $V_{FO}$ = 15V | — | — | 0.01 | mA |
| | $I_{FO(L)}$ | $V_D$ = 15V, $V_{FO}$ = 15V | — | 10 | 15 | mA |
| Minimum Fault Output Pulse Width | $t_{FO}$ | $V_D$ = 15V | 1.0 | 1.8 | — | mS |

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## Thermal Characteristics

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Junction to Case Thermal Resistance | $R_{th(j-c')Q}$ | Each IGBT* | — | — | 0.22** | °C/Watt |
| | $R_{th(j-c')F}$ | Each FWDi* | — | — | 0.36** | °C/Watt |
| Contact Thermal Resistance | $R_{th(c-f)}$ | Case to Fin Per Module, Thermal Grease Applied | — | — | 0.046 | °C/Watt |

*$T_C$ measured point is just under the chips.
**If you use this value, $R_{th(f-a)}$ should be mesured 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 $V_{UP1}$-$V_{UPC}$, $V_{VP1}$-$V_{VPC}$, $V_{WP1}$-$V_{WPC}$, $V_{N1}$-$V_{NC}$ | 15 ± 1.5 | Volts |
| Input ON Voltage | $V_{CIN(on)}$ | Applied between $U_P$-$V_{UPC}$, $V_P$-$V_{VPC}$, $W_P$-$V_{WPC}$, $U_N$, $V_N$, $W_N$-$V_{NC}$ | ≤ 0.8 | Volts |
| Input OFF Voltage | $V_{CIN(off)}$ | | ≥ 4.0 | Volts |
| PWM Input Frequency | $f_{PWM}$ | Using Application Circuit | ≤ 20 | kHz |
| Minimum Dead Time | $t_{DEAD}$ | Input Signal | ≥ 2.5 | µS |

***With ripple satisfying the following conditions: dv/dt ≤ ±5v/µs, Variation ≤ 2V peak to peak.

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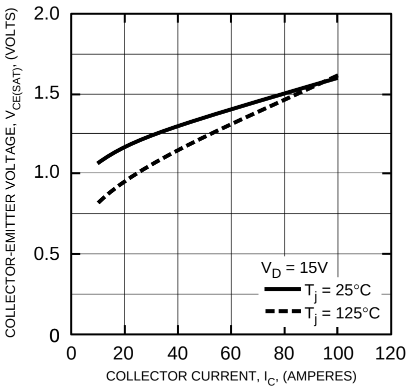
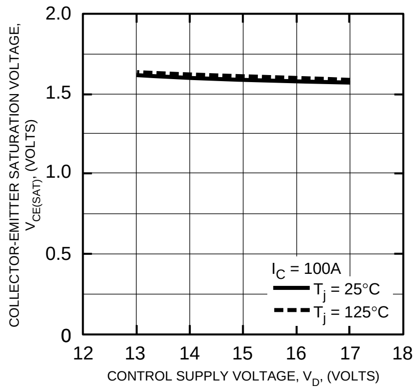
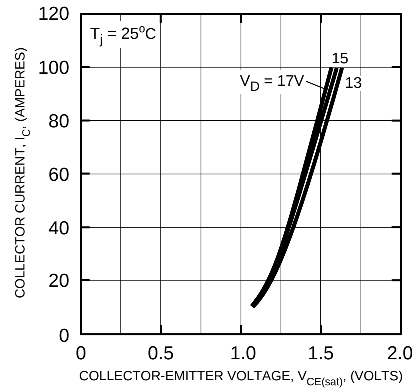
**SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)**



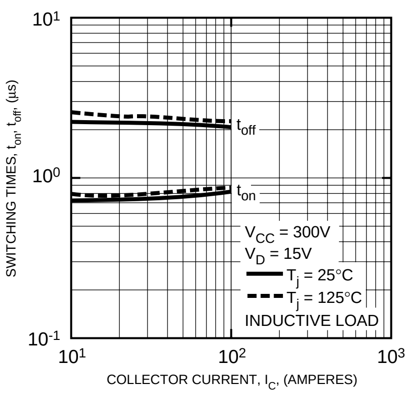

**COLLECTOR-EMITTER SATURATON VOLTAGE CHARACTERISTICS (TYPICAL)**



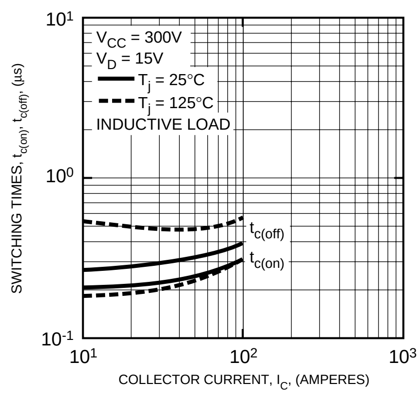

**OUTPUT CHARACTERISTICS (TYPICAL)**



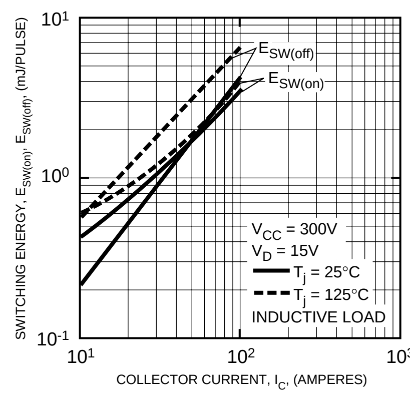

**SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)**



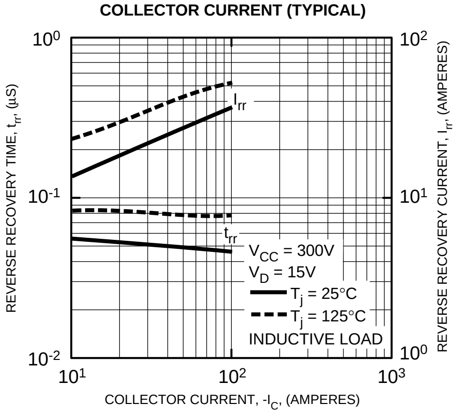

**SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)**



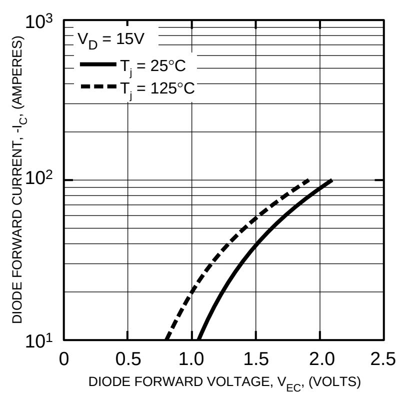

**SWITCHING LOSS CHARACTERISTICS (TYPICAL)**



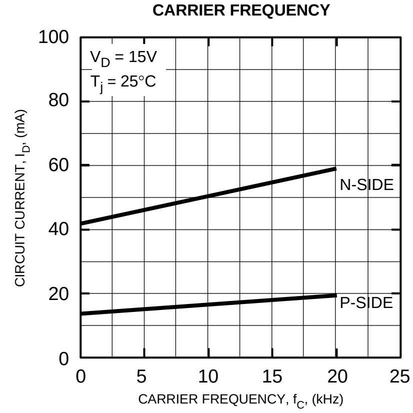

**REVERSE RECOVERY CURRENT VS. COLLECTOR CURRENT (TYPICAL)**




**DIODE FORWARD CHARACTERISTICS**




**CIRCUIT CURRENT VS. CARRIER FREQUENCY**



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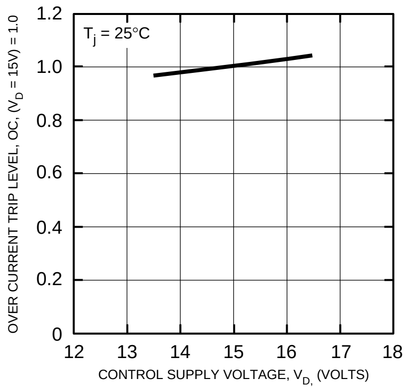
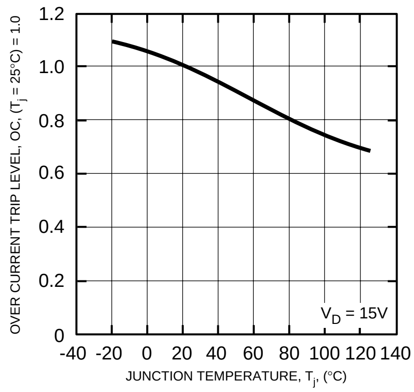
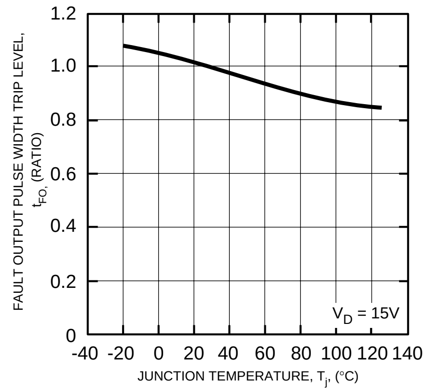
**OVER CURRENT TRIP LEVEL VS. SUPPLY VOLTAGE (TYPICAL)**




**OVER CURRENT TRIP LEVEL TEMPERATURE DEPENDENCY (TYPICAL)**




**FAULT OUTPUT PULSE WIDTH VS. TEMPERATURE (TYPICAL)**




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