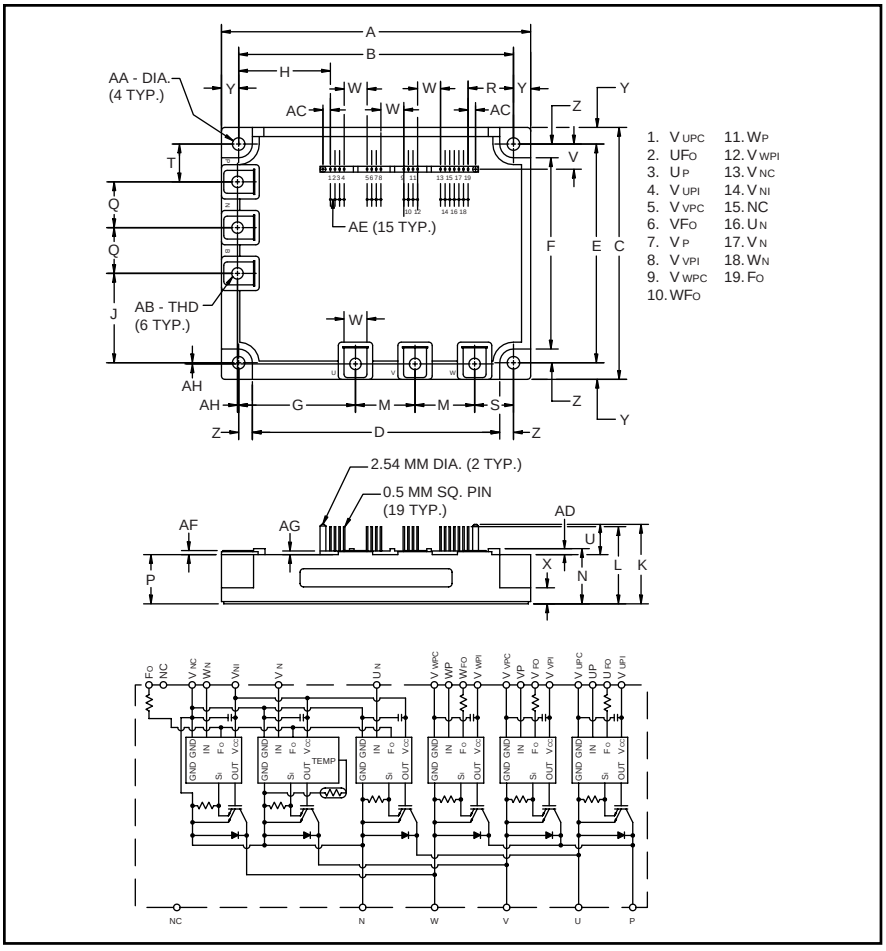
Powerex, Inc., 200 Hillis Street, Youngwood, Pennsylvania 15697-1800 (724) 925-7272

# PM100CSD120

## Intellimod™ Module

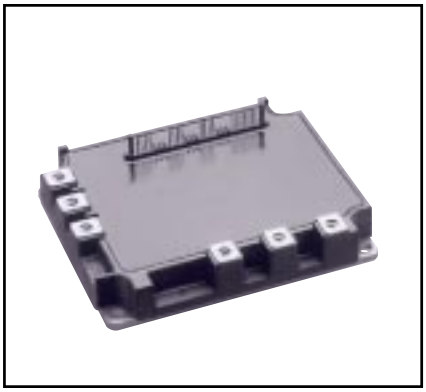
***Three Phase***
***IGBT Inverter Output***
***100 Amperes/1200 Volts***




**Outline Drawing and Circuit Diagram**

| Dimensions | Inches | Millimeters |
|---|---|---|
| A | 5.31±0.04 | 135.0±1.0 |
| B | 4.74±0.02 | 120.5±0.5 |
| C | 4.33±0.04 | 110.0±1.0 |
| D | 4.27 | 108.5 |
| E | 3.76±0.02 | 95.5±0.5 |
| F | 3.29 | 83.5 |
| G | 2.01 | 51.0 |
| H | 1.602 | 40.68 |
| J | 1.54 | 39.0 |
| K | 1.37 | 34.7 |
| L | 1.33 | 33.7 |
| M | 1.02 | 26.0 |
| N | 0.95 +0.06/-0.0 | 24.1 +1.5/-0.0 |
| P | 0.85 | 21.5 |
| Q | 0.79 | 20.0 |
| R | 0.780 | 19.82 |

| Dimensions | Inches | Millimeters |
|---|---|---|
| S | 0.69 | 17.5 |
| T | 0.65 | 16.5 |
| U | 0.52 | 13.2 |
| V | 0.43 | 11.0 |
| W | 0.39 | 10.0 |
| X | 0.16 | 4.0 |
| Y | 0.285 | 7.25 |
| Z | 0.24 | 6.0 |
| AA | 0.22 Dia. | Dia. 5.5 |
| AB | Metric M5 | M5 |
| AC | 0.128 | 3.22 |
| AD | 0.10 | 2.6 |
| AE | 0.08 | 2.0 |
| AF | 0.07 | 1.8 |
| AG | 0.06 | 1.6 |
| AH | 0.02 | 0.5 |



**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
- ☐ Low Loss Using 4th 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. PM100CSD120 is a 1200V, 100 Ampere Intellimod™ Intelligent Power Module.

| Type | Current Rating Amperes | $V_{CES}$ Volts (x 10) |
|---|---|---|
| PM | 100 | 120 |

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***PM100CSD120***
***Intellimod™ Module***
***Three Phase IGBT Inverter Output***
*100 Amperes/1200 Volts*

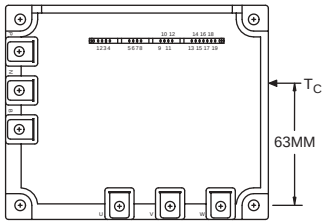
## Absolute Maximum Ratings, $T_j$ = 25°C unless otherwise specified

| Characteristics | Symbol | PM100CSD120 | Units |
|---|---|---|---|
| Power Device Junction Temperature | $T_j$ | -20 to 150 | °C |
| 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) | — | 920 | Grams |
| Supply Voltage Protected by OC and SC ($V_D$ = 13.5 - 16.5V, Inverter Part) $T_j$ = 125°C | $V_{CC(prot.)}$ | 800 | Volts |
| Isolation Voltage, AC 1 minute, 60Hz Sinusoidal | $V_{ISO}$ | 2500 | Volts |
| **IGBT Inverter Sector** | | | |
| Collector-Emitter Voltage ($V_D$ = 15V, $V_{CIN}$ = 15V) | $V_{CES}$ | 1200 | Volts |
| Collector Current, ± ($T_C$ = 25°C) | $I_C$ | 100 | Amperes |
| Peak Collector Current, ± ($T_C$ = 25°C) | $I_{CP}$ | 200 | Amperes |
| Supply Voltage (Applied between P - N) | $V_{CC}$ | 800 | Volts |
| Supply Voltage, Surge (Applied between P - N) | $V_{CC(surge)}$ | 1000 | Volts |
| Collector Dissipation ($T_C$ = 25°C) | $P_C$ | 595 | Watts |
| **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 ($U_P$-$V_{UPC}$, $V_P$-$V_{VPC}$, $W_P$-$V_{WPC}$, $U_N$- $V_N$- $W_N$-$V_{NC}$) | $V_{CIN}$ | 20 | Volts |
| Fault Output Supply Voltage (Applied between $U_{FO}$-$V_{UPC}$, $V_{FO}$-$V_{VPC}$, $W_{FO}$-$V_{WPC}$, $F_O$-$V_{NC}$) | $V_{FO}$ | 20 | Volts |
| Fault Output Current ($U_{FO}$, $V_{FO}$, $W_{FO}$, $F_O$) | $I_{FO}$ | 20 | mA |

## Electrical and Mechanical Characteristics, $T_j$ = 25°C unless otherwise specified

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| **IGBT Inverter Sector** | | | | | | |
| Collector Cutoff Current | $I_{CES}$ | $V_{CE}$ = $V_{CES}$, $T_j$ = 25°C, $V_D$ = 15V, $V_{CIN}$ = 15V | — | — | 1.0 | mA |
| | | $V_{CE}$ = $V_{CES}$, $T_j$ = 125°C, $V_D$ = 15V, $V_{CIN}$ = 15V | — | — | 10 | mA |
| Diode Forward Voltage | $V_{EC}$ | -$I_C$ = 100A, $V_D$ = 15V, $V_{CIN}$ = 15V | — | 2.5 | 3.5 | Volts |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_D$ = 15V, $V_{CIN}$ = 0V, $I_C$ = 100A, Pulsed, $T_j$ = 25°C | — | 2.4 | 3.2 | Volts |
| | | $V_D$ = 15V, $V_{CIN}$ = 0V, $I_C$ = 100A, Pulsed, $T_j$ = 125°C | — | 2.1 | 2.8 | Volts |
| Inductive Load Switching Times | $t_{on}$ | $V_D$ = 15V, $V_{CIN}$ = 0 ~ 15V<br>$V_{CC}$ = 600V, $I_C$ = 100A<br>$T_j$ = 125°C, Inductive Load | 0.5 | 1.0 | 2.5 | µS |
| | $t_{rr}$ | | — | 0.15 | 0.3 | µS |
| | $t_{C(on)}$ | | — | 0.4 | 1.0 | µS |
| | $t_{off}$ | | — | 2.5 | 3.5 | µS |
| | $t_{C(off)}$ | | — | 0.7 | 1.2 | µS |

*$T_C$ Measure Point



## Electrical and Mechanical Characteristics, $T_j$ = 25°C unless otherwise specified

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| **Control Sector** | | | | | | |
| Over Current Trip Level | OC | $T_j$ = 25°C | 228 | 345 | — | Amperes |
| ($V_D$ = 15V) | | $T_j$ = 125°C | 145 | — | — | Amperes |
| Short Circuit Trip Level | SC | -20°C ≤ $T_j$ ≤ 125°C, $V_D$ = 15V | — | 340 | — | Amperes |
| Over Current Delay Time | $t_{off(OC)}$ | $V_D$ = 15V | — | 10 | — | μS |
| Over Temperature Protection ($V_D$ = 15V) | OT | Trip Level | 111 | 118 | 125 | °C |
| (Lower Arm) | $OT_R$ | Reset Level | — | 100 | — | °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, $V_{N1}$-$V_{NC}$ | — | 45 | 62 | mA |
| | | $V_D$ = 15V, $V_{CIN}$ = 15V, $V_{XP1}$-$V_{XPC}$ | — | 15 | 20 | mA |
| Input ON Threshold Voltage | $V_{CIN(on)}$ | Applied between $U_P$-$V_{UPC}$, $V_P$-$V_{VPC}$, | 1.2 | 1.5 | 1.8 | Volts |
| Input OFF Threshold Voltage | $V_{CIN(off)}$ | $W_P$-$V_{WPC}$, $U_N$, $V_N$, $W_N$-$V_{NC}$ | 1.7 | 2.0 | 2.3 | Volts |
| Fault Output Current* | $I_{FO(H)}$ | $V_D$ = 15V, $V_{CIN}$ = 15V | — | — | 0.01 | mA |
| | $I_{FO(L)}$ | $V_D$ = 15V, $V_{CIN}$ = 15V | — | 10 | 15 | mA |
| Minimum Fault Output Pulse Width* | $t_{FO}$ | $V_D$ = 15V | 1.0 | 1.8 | — | mS |

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

## Thermal Characteristics

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Junction to Case Thermal Resistance | $R_{th(j-c)Q}$ | Each IGBT | — | — | 0.21 | °C/Watt |
| | $R_{th(j-c)F}$ | Each FWDi | — | — | 0.35 | °C/Watt |
| | $R_{th(j-c')Q}$ | Each IGBT** | — | — | 0.13† | °C/Watt |
| | $R_{th(j-c')F}$ | Each FWDi** | — | — | 0.21† | °C/Watt |
| Contact Thermal Resistance | $R_{th(c-f)}$ | Case to Fin Per Module, Thermal Grease Applied | — | — | 0.018 | °C/Watt |

** $T_C$ measured point is just under chip.
† If you use this value, $R_{th(f-a)}$ 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 | 0 ~ 800 | Volts |
| Control Supply Voltage*** | $V_D$ | 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 $U_P$-$V_{UPC}$, $V_P$-$V_{VPC}$, | 0 ~ 0.8 | Volts |
| Input OFF Voltage | $V_{CIN(off)}$ | $W_P$-$V_{WPC}$, $U_N$, $V_N$, $W_N$-$V_{NC}$ | 4.0 ~ $V_D$ | Volts |
| PWM Input Frequency | $f_{PWM}$ | Using Application Circuit | 0 ~ 20 | kHz |
| Minimum Dead Time | $t_{DEAD}$ | Input Signal | ≥ 3.0 | μS |

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

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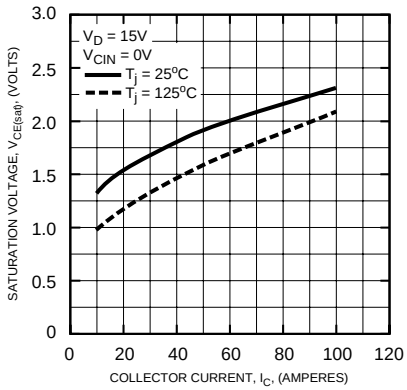
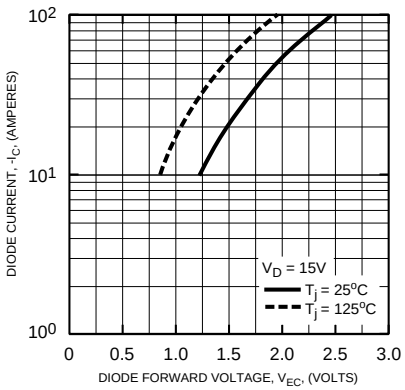
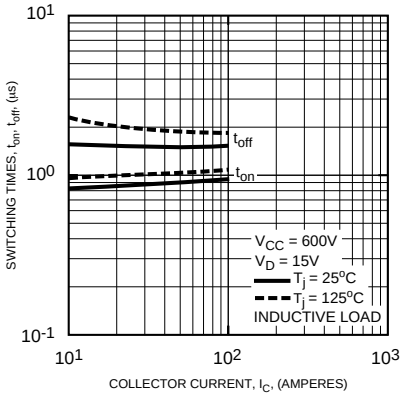
**SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)**



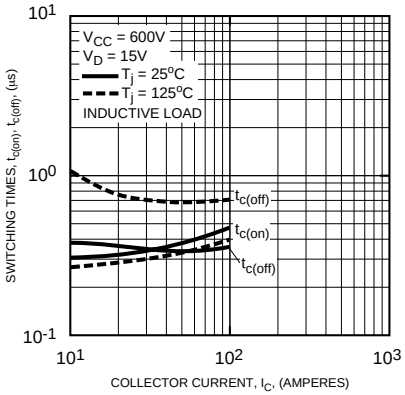

**DIODE FORWARD CHARACTERISTICS (TYPICAL)**



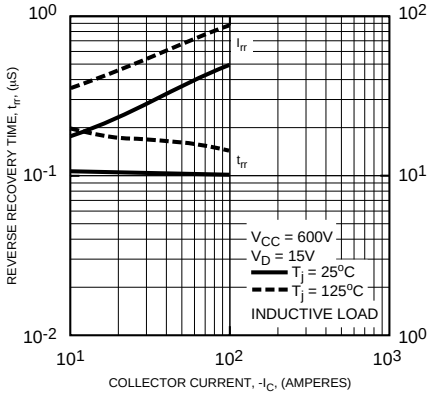

**SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)**



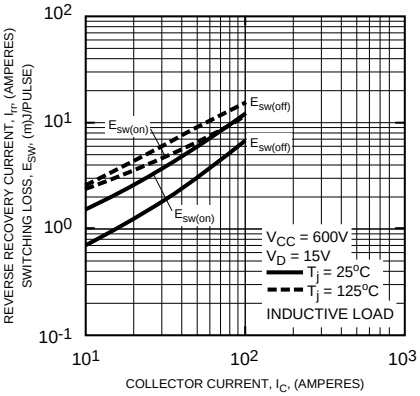

**SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)**



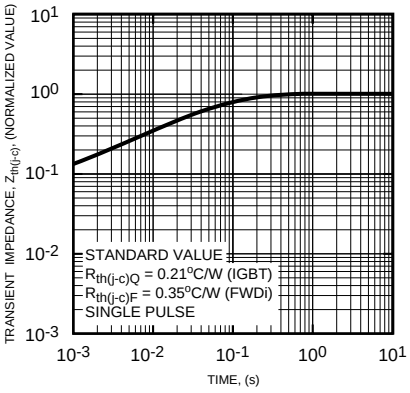

**REVERSE RECOVERY CURRENT VS. COLLECTOR CURRENT (TYPICAL)**




**SWITCHING LOSS CHARACTERISTICS (TYPICAL)**




**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (IGBT & FWDi - INVERTER PART)**




**CIRCUIT CURRENT VS. CARRIER FREQUENCY**