

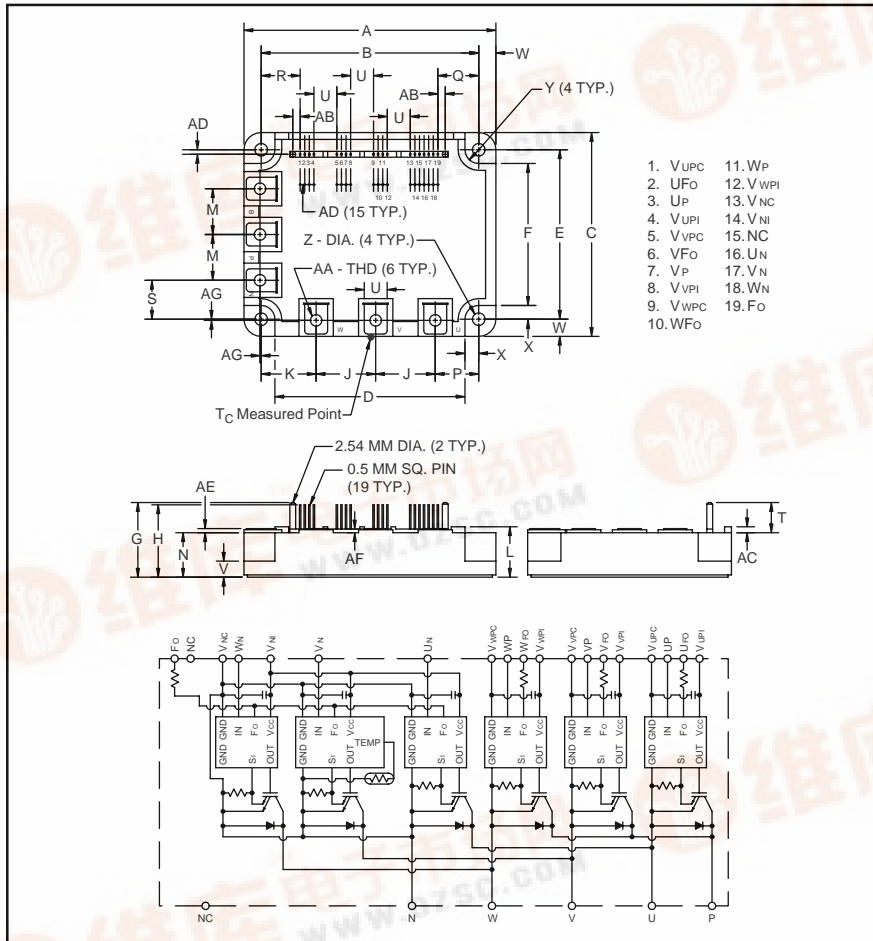


Powerex, Inc., 200 Hillis Street, Youngwood, Pennsylvania 15697-1800 (724) 925-7272

## PM50CSD060

### Intellimod™ Module

Three Phase  
IGBT Inverter Output  
50 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 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. PM50CSD060 is a 600V, 50 Ampere Intellimod™ Intelligent Power Module.

#### Outline Drawing and Circuit Diagram

Dimensions	Inches	Millimeters
A	4.33±0.04	110.0±1.0
B	3.74±0.02	95.0±0.5
C	3.50±0.04	89.0±1.0
D	3.27	83.0
E	2.91±0.02	74.0±0.5
F	2.44	62.0
G	1.28	32.6
H	1.24	31.6
J	1.02	26.0
K	0.94	24.0
L	0.87 +0.06/-0	22.0 +1.5/-0.0
M	0.79	20.0
N	0.76	19.4
P	0.75	19.0
Q	0.708	17.98
R	0.670	17.02

Dimensions	Inches	Millimeters
S	0.67	17.0
T	0.52	13.2
U	0.39	10.0
V	0.28	7.0
W	0.30	7.5
X	0.24	6.0
Y	0.24 Rad.	Rad. 6.0
Z	0.22 Dia.	Dia. 5.5
AA	Metric M5	M5
AB	0.127	3.22
AC	0.10	2.6
AD	0.08±0.02	2.0±0.5
AE	0.07	1.8
AF	0.06	1.6
AG	0.02±0.01	0.5±0.3

Type	Current Rating Amperes	V <sub>CEs</sub> Volts (x 10)
PM	50	60





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

Characteristics	Symbol	PM50CSD060	Units
Power Device Junction Temperature	$T_j$	-20 to 150	$^\circ\text{C}$
Storage Temperature	$T_{\text{stg}}$	-40 to 125	$^\circ\text{C}$
Case Operating Temperature	$T_C$	-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)	—	560	Grams
Supply Voltage Protected by OC and SC ( $V_D = 13.5 - 16.5\text{V}$ , Inverter Part) $T_j = 125^\circ\text{C}$	$V_{\text{CC(prot.)}}$	400	Volts
Isolation Voltage, AC 1 minute, 60Hz Sinusoidal	$V_{\text{ISO}}$	2500	Volts

**IGBT Inverter Sector**

Collector-Emitter Voltage ( $V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ )	$V_{\text{CES}}$	600	Volts
Collector Current, $\pm$ ( $T_C = 25^\circ\text{C}$ )	$I_C$	50	Amperes
Peak Collector Current, $\pm$ ( $T_C = 25^\circ\text{C}$ )	$I_{\text{CP}}$	100	Amperes
Supply Voltage (Applied between P - N)	$V_{\text{CC}}$	400	Volts
Supply Voltage, Surge (Applied between P - N)	$V_{\text{CC(surge)}}$	500	Volts
Collector Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_C$	125	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 ( $U_P-V_{\text{UPC}}$ , $V_P-V_{\text{VPC}}$ , $W_P-V_{\text{WPC}}$ , $U_N-V_N-V_{\text{NC}}$ )	$V_{\text{CIN}}$	20	Volts
Fault Output Supply Voltage (Applied between $F_O$ and $V_C$ )	$V_{\text{FO}}$	20	Volts
Fault Output Current ( $U_{\text{FO}}$ , $V_{\text{FO}}$ , $W_{\text{FO}}$ , $F_O$ )	$I_{\text{FO}}$	20	mA

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

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
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**IGBT Inverter Sector**

Collector Cutoff Current	$I_{\text{CES}}$	$V_{\text{CE}} = V_{\text{CES}}$ , $T_j = 25^\circ\text{C}$ , $V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$	—	—	1.0	mA
		$V_{\text{CE}} = V_{\text{CES}}$ , $T_j = 125^\circ\text{C}$ , $V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$	—	—	10	mA
Diode Forward Voltage	$V_{\text{EC}}$	$-I_C = 50\text{A}$ , $V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$	—	2.2	3.3	Volts
Collector-Emitter Saturation Voltage	$V_{\text{CE(sat)}}$	$V_D = 15\text{V}$ , $V_{\text{CIN}} = 0\text{V}$ , $I_C = 50\text{A}$ , $T_j = 25^\circ\text{C}$	—	1.70	2.3	Volts
		$V_D = 15\text{V}$ , $V_{\text{CIN}} = 0\text{V}$ , $I_C = 50\text{A}$ , $T_j = 125^\circ\text{C}$	—	1.70	2.3	Volts
Inductive Load Switching Times	$t_{\text{on}}$		0.8	1.2	2.4	$\mu\text{S}$
	$t_{\text{rr}}$	$V_D = 15\text{V}$ , $V_{\text{CIN}} = 0 \sim 15\text{V}$	—	0.15	0.3	$\mu\text{S}$
	$t_{\text{C(on)}}$	$V_{\text{CC}} = 300\text{V}$ , $I_C = 50\text{A}$	—	0.4	1.0	$\mu\text{S}$
	$t_{\text{off}}$	$T_j = 125^\circ\text{C}$	—	2.4	3.3	$\mu\text{S}$
	$t_{\text{C(off)}}$		—	0.6	1.2	$\mu\text{S}$



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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
<b>Control Sector</b>						
Over Current Trip Level Inverter Part ( $V_D = 15\text{V}$ )	OC	$T_j = -20^\circ\text{C}$	—	—	220	Amperes
		$T_j = 25^\circ\text{C}$	109	128	180	Amperes
		$T_j = 125^\circ\text{C}$	65	—	—	Amperes
Short Circuit Trip Level Inverter Part	SC	$-20^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$ , $V_D = 15\text{V}$	—	132	—	Amperes
Over Current Delay Time	$t_{\text{off}}(\text{OC})$	$V_D = 15\text{V}$	—	10	—	$\mu\text{S}$
Over Temperature Protection ( $V_D = 15\text{V}$ ) (Lower Arm)	OT	Trip Level	111	118	125	$^\circ\text{C}$
	$\text{OT}_R$	Reset Level	—	100	—	$^\circ\text{C}$
Supply Circuit Under Voltage Protection ( $-20 \leq T_j \leq 125^\circ\text{C}$ )	UV	Trip Level	11.5	12.0	12.5	Volts
	$\text{UV}_R$	Reset Level	—	12.5	—	Volts
Circuit Current	$I_D$	$V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ , $V_{N1}-V_{NC}$	—	40	55	$\text{mA}$
		$V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ , $V_{\text{XP1}}-V_{\text{XPC}}$	—	13	18	$\text{mA}$
Input ON Threshold Voltage	$V_{\text{CIN(on)}}$	Applied between	1.2	1.5	1.8	Volts
Input OFF Threshold Voltage	$V_{\text{CIN(off)}}$	$U_P, V_P, W_P, U_N, V_N, W_N-V_{NC}$	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	$\text{mA}$
	$I_{\text{FO(L)}}$	$V_D = 15\text{V}$ , $V_{\text{FO}} = 15\text{V}$	—	10	15	$\text{mA}$
Minimum Fault Output Pulse Width*	$t_{\text{FO}}$	$V_D = 15\text{V}$	1.0	1.8	—	$\text{mS}$

\*Fault output is given only when the internal OC, 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	$R_{\text{th(j-c)Q}}$	Each IGBT	—	—	1.00	$^\circ\text{C/Watt}$
	$R_{\text{th(j-c)F}}$	Each FWDi	—	—	2.50	$^\circ\text{C/Watt}$
	$R_{\text{th(j-c)Q}}$	Each IGBT**	—	—	0.82 <sup>†</sup>	$^\circ\text{C/Watt}$
	$R_{\text{th(j-c)F}}$	Each FWDi**	—	—	1.51 <sup>†</sup>	$^\circ\text{C/Watt}$
Contact Thermal Resistance	$R_{\text{th(c-f)}}$	Case to Fin Per Module, Thermal Grease Applied	—	—	0.027	$^\circ\text{C/Watt}$

\*\*  $T_C$  measured point is just under chip.

† 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	0 ~ 400	Volts
Control Supply Voltage***	$V_D$	Applied between $V_{\text{UP1}}-V_{\text{UPC}}$ , $V_{N1}-V_{NC}$ , $V_{\text{VP1}}-V_{\text{VPC}}$ , $V_{\text{WP1}}-V_{\text{WPC}}$	$15 \pm 1.5$	Volts
Input ON Voltage	$V_{\text{CIN(on)}}$	Applied between	0 ~ 0.8	Volts
Input OFF Voltage	$V_{\text{CIN(off)}}$	$U_P, V_P, W_P, U_N, V_N, W_N-V_{NC}$	$4.0 \sim V_D$	Volts
PWM Input Frequency	$f_{\text{PWM}}$	Using Application Circuit	0 ~ 20	$\text{kHz}$
Minimum Dead Time	$t_{\text{DEAD}}$	Input Signal	$\geq 2.5$	$\mu\text{S}$

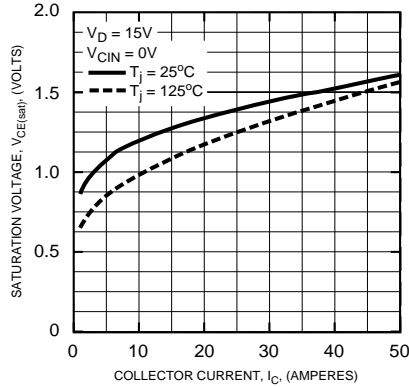
\*\*\* With ripple satisfying the following conditions:  $dv/dt$  swing  $\leq \pm 5\text{V}/\mu\text{s}$ , Variation  $\leq 2\text{V}$  peak to peak.



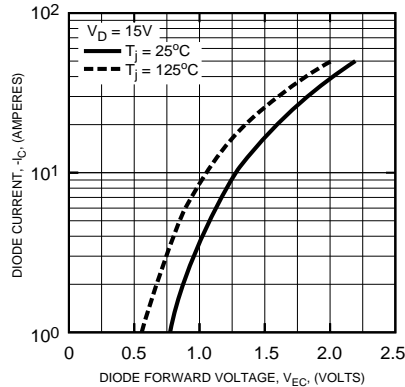
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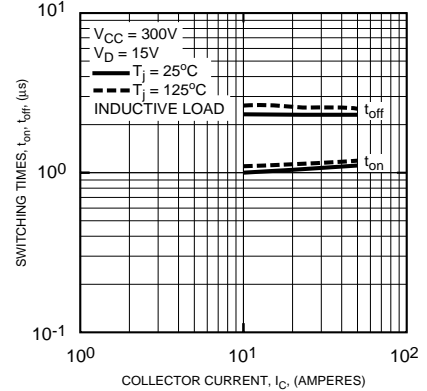
**SATURATION VOLTAGE CHARACTERISTICS (TYPICAL) (INVERTER PART)**



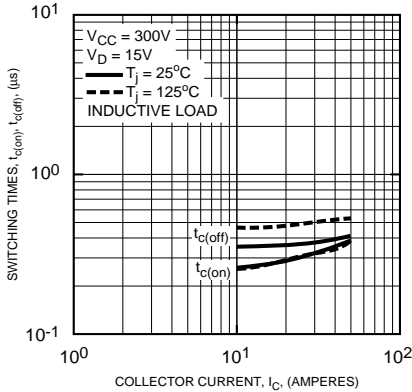
**DIODE FORWARD CHARACTERISTICS (INVERTER PART)**



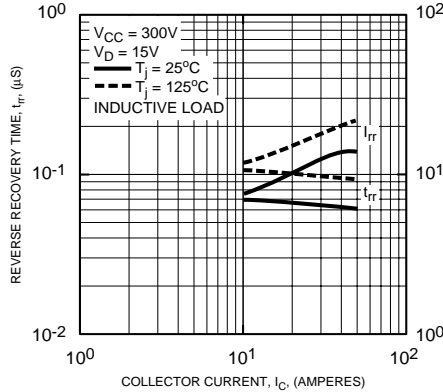
**SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)**



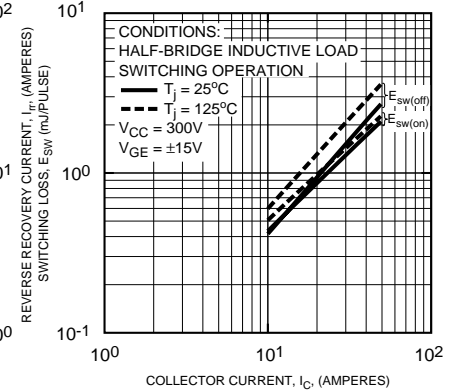
**SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)**



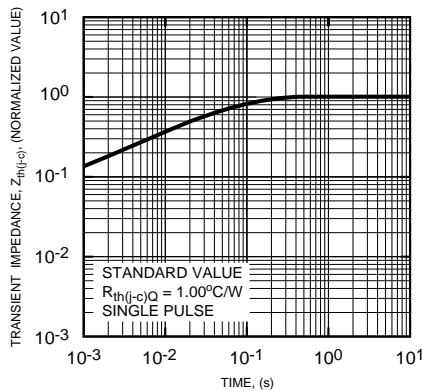
**REVERSE RECOVERY CURRENT VS. COLLECTOR CURRENT (TYPICAL)**



**SWITCHING LOSS CHARACTERISTICS**



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (IGBT)**



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (FWD)**

