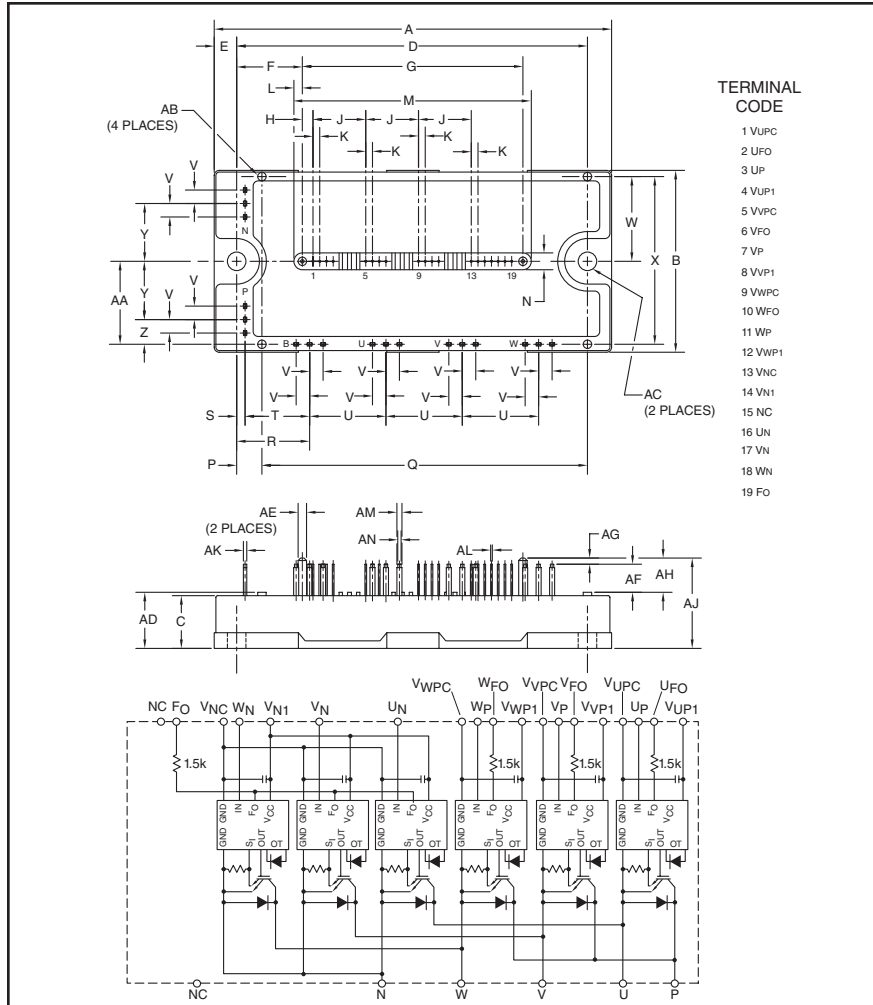
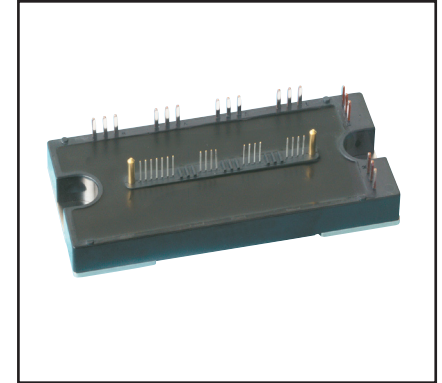


### Intellimod™ L1-Series Three Phase IGBT Inverter 50 Amperes/600 Volts



**TERMINAL CODE**

- 1 VUPC
- 2 VFO
- 3 UP
- 4 VUP1
- 5 VVPC
- 6 VFO
- 7 VP
- 8 VVP1
- 9 VVPC
- 10 WFO
- 11 WP
- 12 WVP1
- 13 VNC
- 14 VN1
- 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 Full Gate CSTBT™ IGBT Chip

#### Applications:

- Inverters
- UPS
- Motion/Servo Control
- Power Supplies

#### Ordering Information:

Example: Select the complete part number from the table below -i.e. PM50CL1B060 is a 600V, 50 Ampere Intellimod™ Intelligent Power Module.

Type	Current Rating Amperes	V <sub>CEs</sub> Volts (x 10)
PM	50	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., 173 Pavilion Lane, Youngwood, Pennsylvania 15697 (724) 925-7272 www.pwr.com

**PM50CL1B060**  
**Intellimod™ L1-Series**  
**Three Phase IGBT Inverter**  
 50 Amperes/600 Volts

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

Characteristics	Symbol	PM50CL1B060	Units
Power Device Junction Temperature	$T_j$	-20 to 150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-40 to 125	$^\circ\text{C}$
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)	$V_{CC(surge)}$	500	Volts
Supply Voltage Protected by Short Circuit Protection Capability*	$V_{CC(prot.)}$	400	Volts
Isolation Voltage, AC 1 minute, 60Hz Sinusoidal	$V_{ISO}$	2500	Volts

**IGBT Inverter Sector**

Collector-Emitter Voltage ( $V_D = 15\text{V}$ , $V_{CIN} = 15\text{V}$ )	$V_{CES}$	600	Volts
Collector Current ( $T_C = 25^\circ\text{C}$ ) (Note 1)	$\pm I_C$	50	Amperes
Peak Collector Current ( $T_C = 25^\circ\text{C}$ )	$\pm I_{CP}$	100	Amperes
Collector Dissipation ( $T_C = 25^\circ\text{C}$ ) (Note 1)	$P_C$	284	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 $U_P$ - $V_{UPC}$ , $V_P$ - $V_{VPC}$ , $W_P$ - $V_{WPC}$ , $U_N$ - $V_{N1}$ - $W_N$ - $V_{NC}$ )	$V_{CIN}$	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 (Sink Current at $U_{FO}$ , $V_{FO}$ , $W_{FO}$ , $F_O$ 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 Saturation Voltage	$V_{CE(sat)}$	$V_D = 15\text{V}$ , $V_{CIN} = 0\text{V}$ , $I_C = 50\text{A}$ , $T_j = 25^\circ\text{C}$	—	1.75	2.35	Volts
		$V_D = 15\text{V}$ , $V_{CIN} = 0\text{V}$ , $I_C = 50\text{A}$ , $T_j = 125^\circ\text{C}$	—	1.75	2.35	Volts
Diode Forward Voltage	$V_{EC}$	$-I_C = 50\text{A}$ , $V_{CIN} = 15\text{V}$ , $V_D = 15\text{V}$	—	1.7	2.8	Volts
Inductive Load Switching Times	$t_{on}$		0.3	0.8	2.0	$\mu\text{s}$
	$t_{rr}$	$V_D = 15\text{V}$ , $V_{CIN} = 0 \leftrightarrow 15\text{V}$	—	0.4	0.8	$\mu\text{s}$
	$t_{C(on)}$	$V_{CC} = 300\text{V}$ , $I_C = 50\text{A}$	—	0.4	1.0	$\mu\text{s}$
	$t_{off}$	$T_j = 125^\circ\text{C}$	—	1.0	2.3	$\mu\text{s}$
	$t_{C(off)}$		—	0.3	1.0	$\mu\text{s}$
Collector-Emitter Cutoff Current	$I_{CES}$	$V_{CE} = V_{CES}$ , $V_D = 15\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	1.0	mA
		$V_{CE} = V_{CES}$ , $V_D = 15\text{V}$ , $T_j = 125^\circ\text{C}$	—	—	10	mA

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

**PM50CL1B060**  
**Intellimod™ L1-Series**  
**Three Phase IGBT Inverter**  
 50 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>						
Circuit Current	$I_D$	$V_D = 15\text{V}, V_{CIN} = 15\text{V}, V_{N1}-V_{NC}$	—	6	12	mA
		$V_D = 15\text{V}, V_{CIN} = 15\text{V}, V_{*P1}-V_{*PC}$	—	2	4	mA
Input ON Threshold Voltage	$V_{th(on)}$	Applied between $U_P-V_{UPC}$ ,	1.2	1.5	1.8	Volts
Input OFF Threshold Voltage	$V_{th(off)}$	$V_P-V_{VPC}, W_P-V_{WPC}, U_N-V_N, W_N-V_{NC}$	1.7	2.0	2.3	Volts
Short Circuit Trip Level	SC	$-20^\circ\text{C} \leq T_j \leq 125^\circ\text{C}, V_D = 15\text{V}$	100	—	—	Amperes
Short Circuit Current Delay Time	$t_{off(SC)}$	$V_D = 15\text{V}$	—	0.2	—	$\mu\text{s}$
Over Temperature Protection (Detect $T_j$ of IGBT Chip)	OT	Trip Level	135	—	—	$^\circ\text{C}$
	$OT_{(hys)}$	Hysteresis Level	—	20	—	$^\circ\text{C}$
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
Fault Output Current*	$I_{FO(H)}$	$V_D = 15\text{V}, V_{CIN} = 15\text{V}$	—	—	0.01	mA
	$I_{FO(L)}$	$V_D = 15\text{V}, V_{CIN} = 15\text{V}$	—	10	15	mA
Fault Output Pulse Width*	$t_{FO}$	$V_D = 15\text{V}$	1.0	1.8	—	ms

**Thermal Characteristics**

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Units
Junction to Case Thermal Resistance	$R_{th(j-c)Q}$	IGBT (Per 1 Element) (Note 1)	—	—	0.44	$^\circ\text{C/Watt}$
	$R_{th(j-c)D}$	FWDi (Per 1 Element) (Note 1)	—	—	0.75	$^\circ\text{C/Watt}$
Contact Thermal Resistance	$R_{th(c-f)}$	Case to Fin Per Module, Thermal Grease Applied (Note 1)	—	—	0.038	$^\circ\text{C/Watt}$

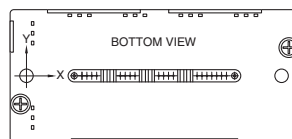
**Recommended Conditions for Use**

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

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

\*\* 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:  $T_C$  (under the chip) Measurement Point

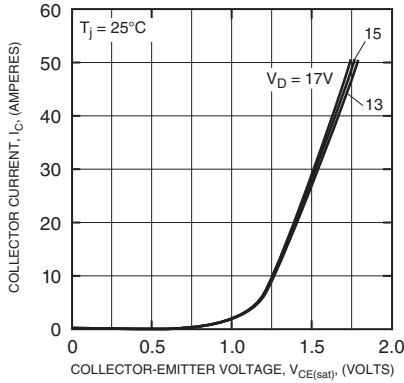


Arm Axis	UP		VP		WP		UN		VN		WN	
	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi
X	28.7	28.7	65.4	65.4	85.0	85.0	37.2	37.2	55.8	55.8	75.4	75.4
Y	-6.3	0.2	-6.3	0.2	-6.3	0.2	5.4	-0.9	5.4	-0.9	5.4	-0.9

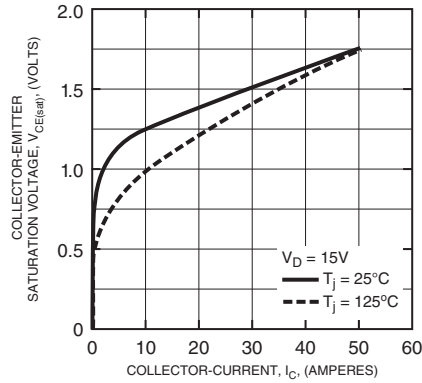


**PM50CL1B060**  
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 50 Amperes/600 Volts

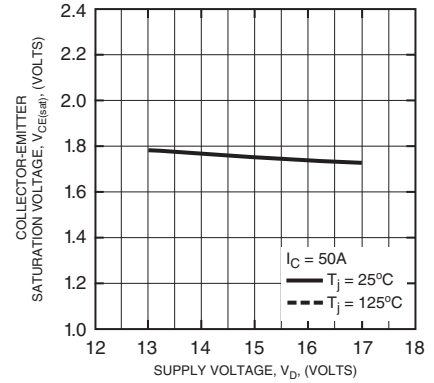
**OUTPUT CHARACTERISTICS (TYPICAL)**



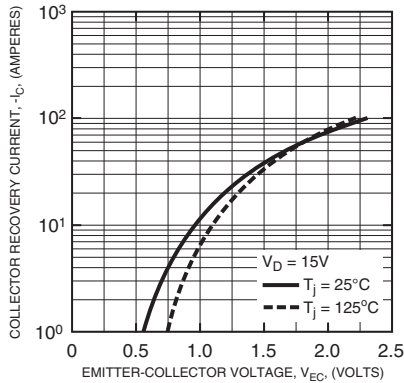
**COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)**



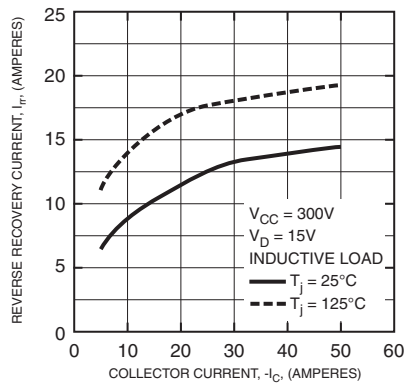
**COLLECTOR-EMITTER SATURATION VOLTAGE VS. SUPPLY VOLTAGE CHARACTERISTICS (TYPICAL)**



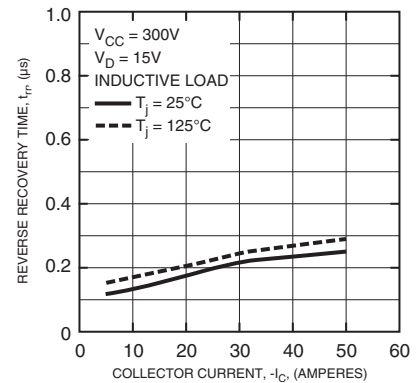
**FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)**



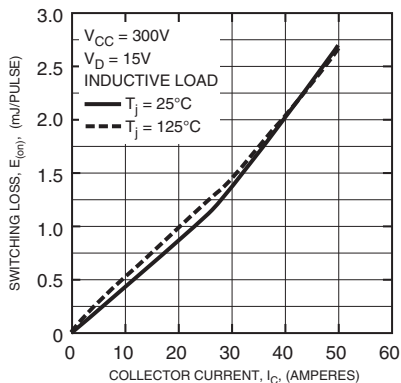
**REVERSE RECOVERY CHARACTERISTICS (TYPICAL)**



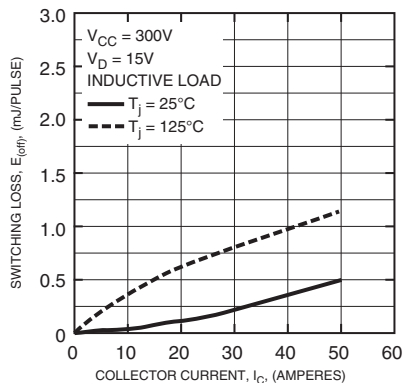
**REVERSE RECOVERY CHARACTERISTICS (TYPICAL)**



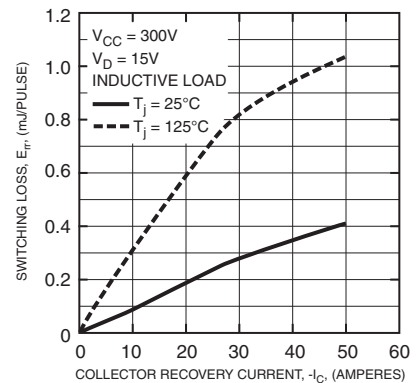
**SWITCHING LOSS (ON) VS. COLLECTOR CURRENT (TYPICAL)**



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



**SWITCHING RECOVERY LOSS CHARACTERISTICS (TYPICAL)**



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