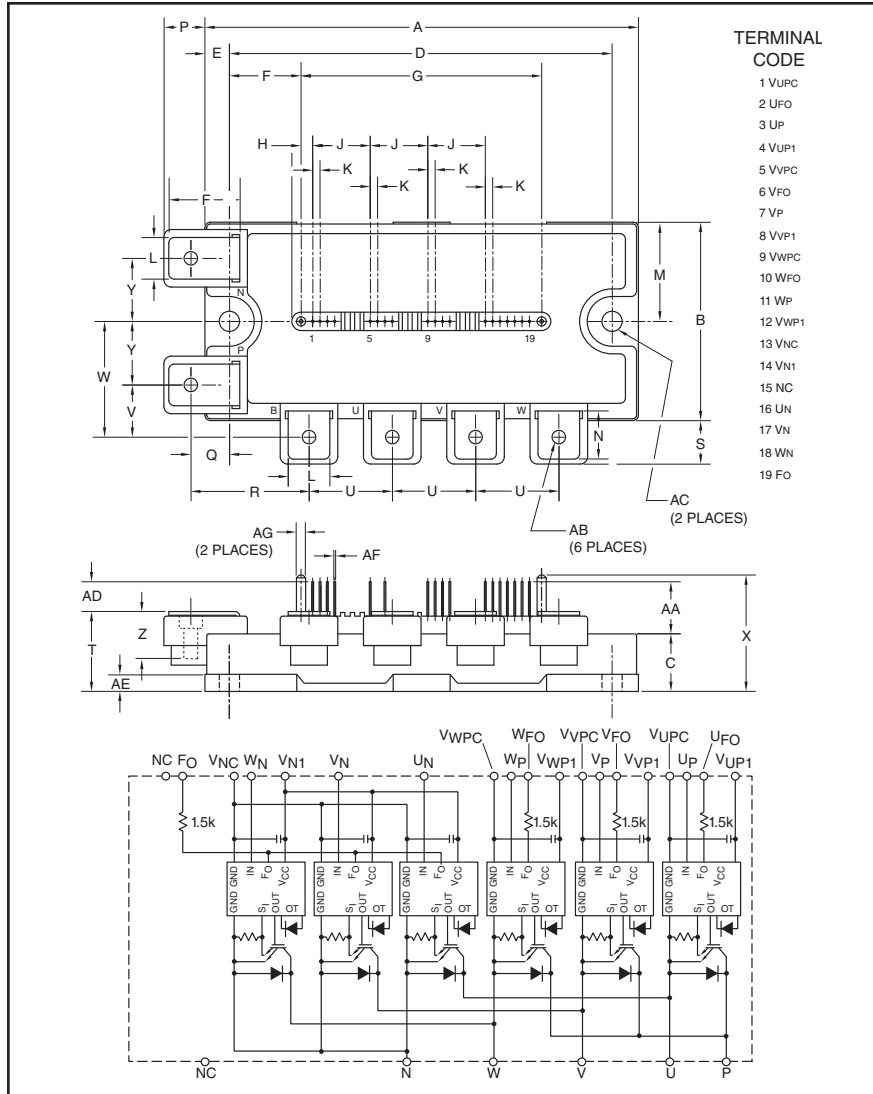
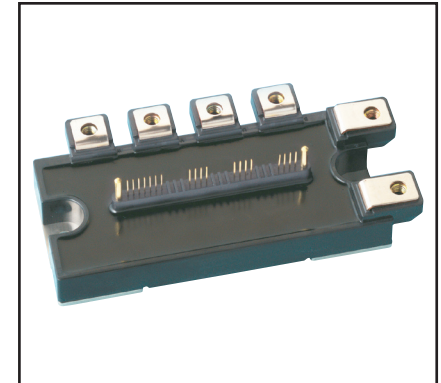


### Intellimod™ L1-Series Three Phase IGBT Inverter 50 Amperes/600 Volts



**TERMINAL CODE**

- 1 VUPC
- 2 WFO
- 3 UP
- 4 VUP1
- 5 VVPC
- 6 VFO
- 7 VP
- 8 VVP1
- 9 VVPC
- 10 WFO
- 11 WP
- 12 VWP1
- 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. PM50CL1A060 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	0.47	12.0
M	1.08	27.5
N	0.57	13.5
P	0.43	11.0
Q	0.42	10.75
R	1.29	32.75

Dimensions	Inches	Millimeters
S	0.46	11.75
T	0.86+0.04/0.02	22.0+1.0/-0.5
U	0.91	23.0
V	0.57	14.5
W	1.26	32.0
X	1.24	31.5
Y	0.69	17.5
Z		Screw Depth 12
AA	0.51	13.0
AB	M5 Metric	M5
AC	0.22 Dia.	5.5 Dia.
AD	0.28	7.0
AE	0.12	3.0
AF	0.02 Sq.	0.5 Sq.
AG	0.10 Dia.	2.5 Dia.

**PM50CL1A060**  
**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	PM50CL1A060	Units
Power Device Junction Temperature	$T_j$	-20 to 150	$^\circ\text{C}$
Storage Temperature	$T_{\text{stg}}$	-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)	$V_{\text{CC(surge)}}$	500	Volts
Supply Voltage Protected by Short Circuit Protection Capability*	$V_{\text{CC(prot.)}}$	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 ( $T_C = 25^\circ\text{C}$ ) (Note 1)	$\pm I_C$	50	Amperes
Peak Collector Current ( $T_C = 25^\circ\text{C}$ )	$\pm I_{\text{CP}}$	100	Amperes
Collector Dissipation ( $T_C = 25^\circ\text{C}$ ) (Note 1)	$P_C$	284	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 $U_P-V_{\text{UPC}}$ , $V_P-V_{\text{VPC}}$ , $W_P-V_{\text{WPC}}$ , $U_N-V_{\text{NC}}$ , $W_N-V_{\text{NC}}$ )	$V_{\text{CIN}}$	20	Volts
Fault Output Supply Voltage (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 (Sink Current at $U_{\text{FO}}$ , $V_{\text{FO}}$ , $W_{\text{FO}}$ , $F_O$ Terminals)	$I_{\text{FO}}$	20	mA

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

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Collector-Emitter Saturation Voltage	$V_{\text{CE(sat)}}$	$V_D = 15\text{V}$ , $V_{\text{CIN}} = 0\text{V}$ , $I_C = 50\text{A}$ , $T_j = 25^\circ\text{C}$	—	1.75	2.35	Volts
		$V_D = 15\text{V}$ , $V_{\text{CIN}} = 0\text{V}$ , $I_C = 50\text{A}$ , $T_j = 125^\circ\text{C}$	—	1.75	2.35	Volts
Diode Forward Voltage	$V_{\text{EC}}$	$-I_C = 50\text{A}$ , $V_{\text{CIN}} = 15\text{V}$ , $V_D = 15\text{V}$	—	1.7	2.8	Volts
Inductive Load Switching Times	$t_{\text{on}}$		0.3	0.8	2.0	$\mu\text{s}$
	$t_{\text{rr}}$	$V_D = 15\text{V}$ , $V_{\text{CIN}} = 0 \leftrightarrow 15\text{V}$	—	0.4	0.8	$\mu\text{s}$
	$t_{\text{C(on)}}$	$V_{\text{CC}} = 300\text{V}$ , $I_C = 50\text{A}$	—	0.4	1.0	$\mu\text{s}$
	$t_{\text{off}}$	$T_j = 125^\circ\text{C}$	—	1.0	2.3	$\mu\text{s}$
	$t_{\text{C(off)}}$		—	0.3	1.0	$\mu\text{s}$
Collector-Emitter Cutoff Current	$I_{\text{CES}}$	$V_{\text{CE}} = V_{\text{CES}}$ , $V_D = 15\text{V}$ , $T_j = 25^\circ\text{C}$	—	—	1.0	mA
		$V_{\text{CE}} = V_{\text{CES}}$ , $V_D = 15\text{V}$ , $T_j = 125^\circ\text{C}$	—	—	10	mA

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

**PM50CL1A060**  
**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	$^\circ\text{C/Watt}$

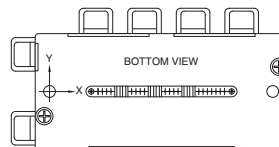
**Recommended Conditions for Use**

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.

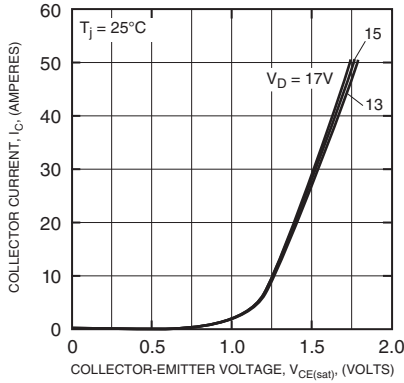
Note 1:  $T_C$  (under the chip) Measurement Point



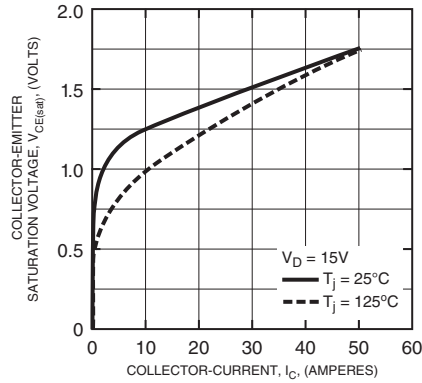
Arm \ Axis	UP		VP		WP		UN		VN		WN	
	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi
X	28.7	28.7	65.4	65.4	85.0	85.0	37.2	37.2	55.8	55.8	75.4	75.4
Y	-6.3	0.2	-6.3	0.2	-6.3	0.2	5.4	-0.9	5.4	-0.9	5.4	-0.9

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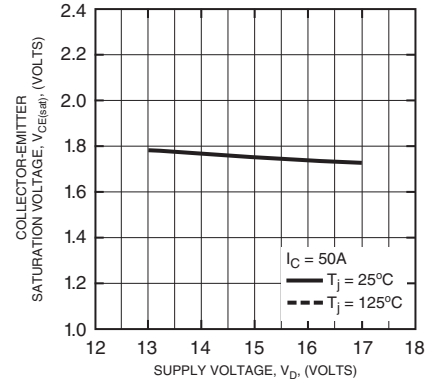
**OUTPUT CHARACTERISTICS (TYPICAL)**



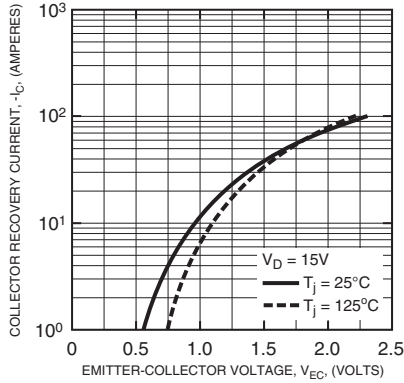
**COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)**



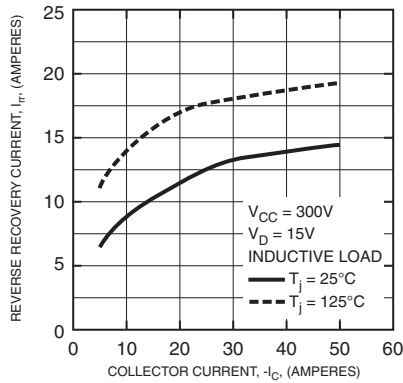
**COLLECTOR-EMITTER SATURATION VOLTAGE VS. SUPPLY VOLTAGE CHARACTERISTICS (TYPICAL)**



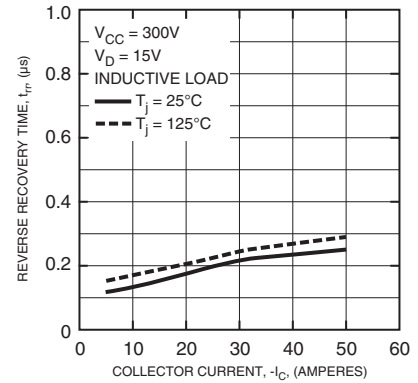
**FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)**



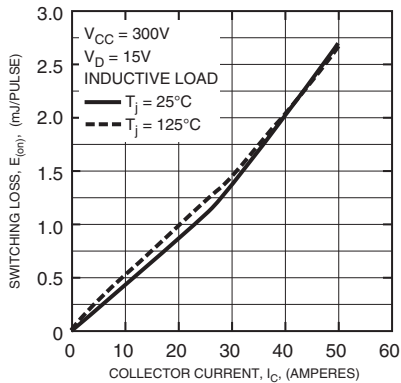
**REVERSE RECOVERY CHARACTERISTICS (TYPICAL)**



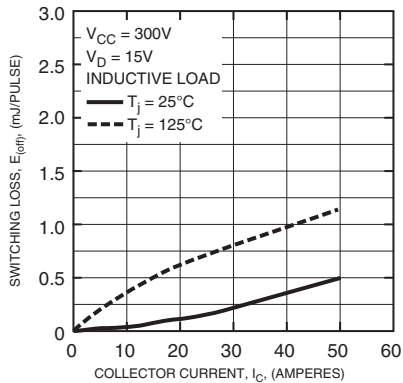
**REVERSE RECOVERY CHARACTERISTICS (TYPICAL)**



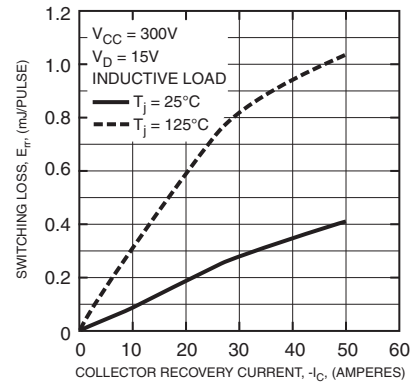
**SWITCHING LOSS (ON) VS. COLLECTOR CURRENT (TYPICAL)**



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



**SWITCHING RECOVERY LOSS CHARACTERISTICS (TYPICAL)**





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