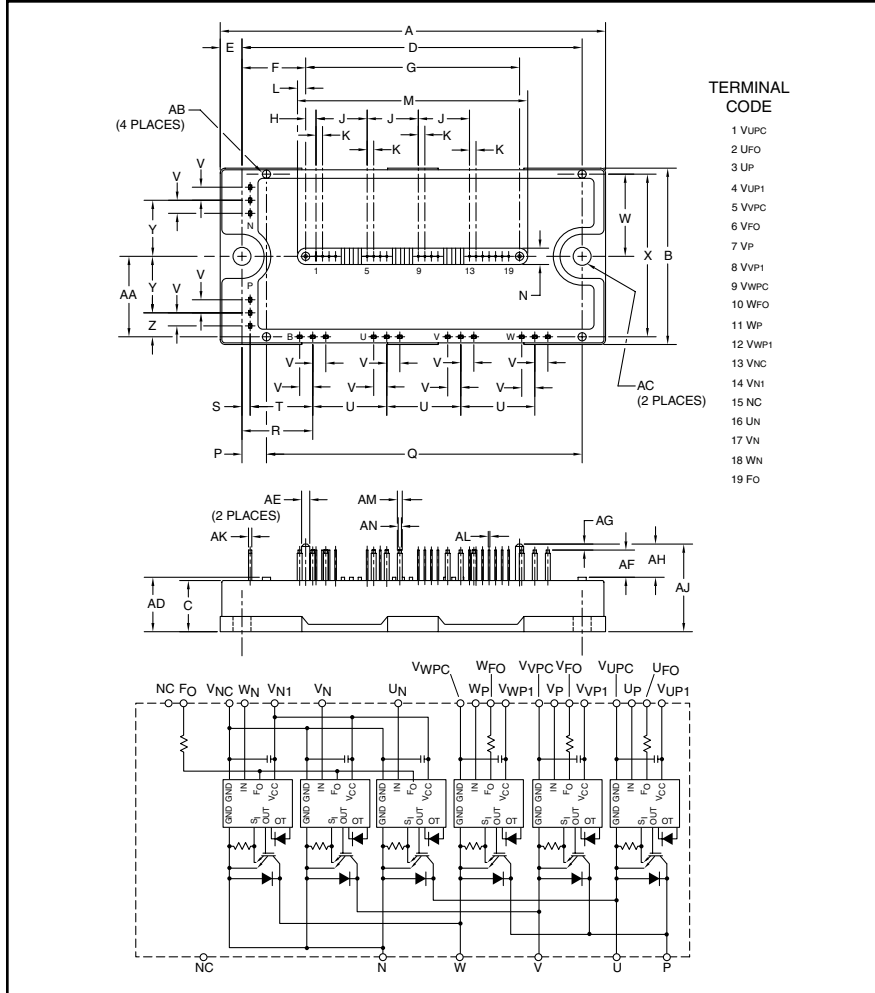
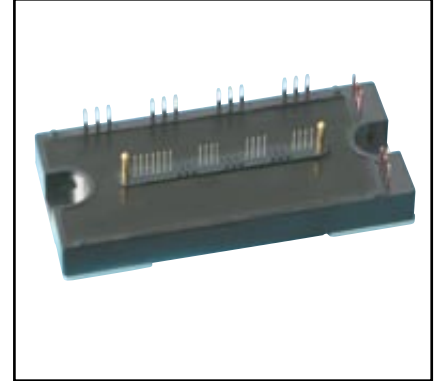


### Intellimod™ L-Series Three Phase IGBT Inverter 50 Amperes/600 Volts



#### TERMINAL CODE

- 1 VUPC
- 2 UFO
- 3 UP
- 4 VUP1
- 5 VVPC
- 6 VFO
- 7 VP
- 8 VVP1
- 9 VWPC
- 10 WFO
- 11 WP
- 12 WVP1
- 13 VNC
- 14 VNI
- 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 5th 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. PM50CLB060 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

**PM50CLB060**  
**Intellimod™ Module**  
**Three Phase Current-sense IGBT Inverter**  
**50 Amperes/600 Volts**

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

Characteristics	Symbol	PM50CLB060	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
Module Weight (Typical)	—	340	Grams
Supply Voltage, Surge (Applied between P - N)	$V_{\text{CC(surge)}}$	550	Volts
Self-protection Supply Voltage Limit (Short Circuit protection Capability)*	$V_{\text{CC(prot.)}}$	400	Volts
Isolation Voltage, AC 1 minute, 60Hz Sinusoidal	$V_{\text{ISO}}$	2500	Volts

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

**IGBT Inverter Sector**

Collector-Emitter Voltage ( $V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ )	$V_{\text{CES}}$	600	Volts
Collector Current ( $T_C = 25^\circ\text{C}$ )	$\pm I_C$	50	Amperes
Peak Collector Current ( $T_C = 25^\circ\text{C}$ )	$\pm I_{\text{CP}}$	100	Amperes
Collector Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_C$	101	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 $U_{\text{FO}}-V_{\text{UPC}}$ , $V_{\text{FO}}-V_{\text{VPC}}$ , $W_{\text{FO}}-V_{\text{WPC}}$ , $\text{FO}-V_{\text{Nc}}$ )	$V_{\text{FO}}$	20	Volts
Fault Output Current ( $U_{\text{FO}}$ , $V_{\text{FO}}$ , $W_{\text{FO}}$ , $\text{FO}$ 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
-----------------	--------	-----------------	------	------	------	-------

**IGBT Inverter Sector**

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
Diode Forward Voltage	$V_{\text{EC}}$	$-I_C = 50\text{A}$ , $V_{\text{CIN}} = 15\text{V}$ , $V_D = 15\text{V}$	—	2.2	3.3	Volts
Collector-Emitter Saturation Voltage	$V_{\text{CE(sat)}}$	$V_D = 15\text{V}$ , $V_{\text{CIN}} = 0\text{V}$ , $I_C = 50\text{A}$ , $T_j = 25^\circ\text{C}$	—	1.6	2.1	Volts
		$V_D = 15\text{V}$ , $V_{\text{CIN}} = 0\text{V}$ , $I_C = 50\text{A}$ , $T_j = 125^\circ\text{C}$	—	1.5	2.0	Volts
Inductive Load Switching Times	$t_{\text{on}}$		0.5	1.0	2.4	$\mu\text{s}$
	$t_{\text{rr}}$	$V_D = 15\text{V}$ , $V_{\text{CIN}} = 0 \Leftrightarrow 15\text{V}$	—	0.2	0.4	$\mu\text{s}$
	$t_{\text{C(on)}}$	$V_{\text{CC}} = 300\text{V}$ , $I_C = 50\text{A}$	—	0.4	1.0	$\mu\text{s}$
	$t_{\text{off}}$	$T_j = 125^\circ\text{C}$	—	1.2	2.5	$\mu\text{s}$
	$t_{\text{C(off)}}$		—	0.5	1.0	$\mu\text{s}$

**PM50CLB060**  
**Intellimod™ Module**  
**Three Phase Current-sense 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>						
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	$t_{\text{off(SC)}}$	$V_D = 15\text{V}$	—	0.2	—	$\mu\text{s}$
Over Temperature Protection (Detect $T_j$ of IGBT Chip)	OT	Trip Level	135	145	155	$^\circ\text{C}$
	$OT_R$	Reset Level	—	125	—	$^\circ\text{C}$
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
Circuit Current	$I_D$	$V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ , $V_{N1}-V_{NC}$	—	15	25	mA
		$V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ , $V_{\text{XP1}}-V_{\text{XPC}}$	—	5	10	mA
Input ON Threshold Voltage	$V_{\text{th(on)}}$	Applied between $U_P-V_{\text{UPC}}$ ,	1.2	1.5	1.8	Volts
Input OFF Threshold Voltage	$V_{\text{th(off)}}$	$V_P-V_{\text{VPC}}$ , $W_P-V_{\text{WPC}}$ , $U_N-V_N$ , $W_N-V_{\text{NC}}$	1.7	2.0	2.3	Volts
Fault Output Current*	$I_{\text{FO(H)}}$	$V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$	—	—	0.01	mA
	$I_{\text{FO(L)}}$	$V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$	—	10	15	mA
Fault Output Pulse Width*	$t_{\text{FO}}$	$V_D = 15\text{V}$	1.0	1.8	—	ms

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

**Thermal Characteristics**

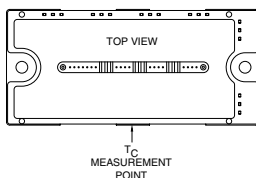
Characteristic	Symbol	Condition	Min.	Typ.	Max.	Units
Junction to Case Thermal Resistance	$R_{\text{th(j-c)Q}}$	IGBT (Per 1/6 Module) (Note 1)	—	—	1.24	$^\circ\text{C/Watt}$
	$R_{\text{th(j-c)D}}$	FWDi (Per 1/6 Module) (Note 1)	—	—	2.09	$^\circ\text{C/Watt}$
	$R_{\text{th(j-c)Q}}$	IGBT (Per 1/6 Module) (Note 2)	—	—	0.95	$^\circ\text{C/Watt}$
	$R_{\text{th(j-c)D}}$	FWDi (Per 1/6 Module) (Note 2)	—	—	1.61	$^\circ\text{C/Watt}$
Contact Thermal Resistance	$R_{\text{th(c-f)}}$	Case to Fin Per Module, Thermal Grease Applied (Note 1)	—	—	0.038	$^\circ\text{C/Watt}$

**Recommended Conditions for Use**

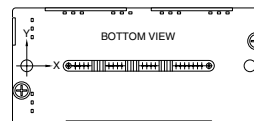
Characteristic	Symbol	Condition	Value	Units
Supply Voltage	$V_{\text{CC}}$	Applied across P-N Terminals	$\leq 400$	Volts
Control Supply Voltage**	$V_D$	Applied between $V_{\text{UP1}}-V_{\text{UPC}}$ , $V_{\text{VP1}}-V_{\text{VPC}}$ , $V_{\text{WP1}}-V_{\text{WPC}}$ , $V_{\text{N1}}-V_{\text{NC}}$	$15.0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

\*\* 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.

Note 1:  $T_C$  (Base Plate) Measurement Point



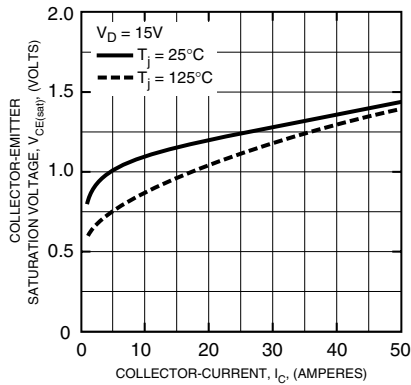
Note 2:  $T_C$  (Under the Chip) Measurement Point



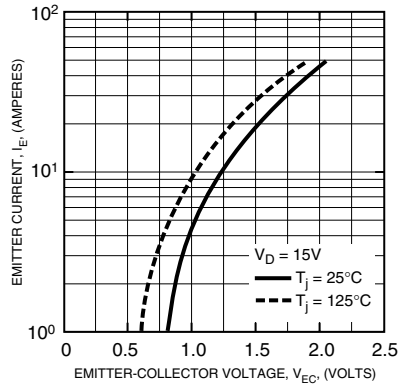
Arm Axis	UP		VP		WP		UN		VN		WN	
	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi
X	29.0	29.5	64.6	65.1	85.9	86.4	38.1	37.6	54.8	55.3	76.1	75.6
Y	-7.3	1.6	-7.3	2.1	-7.3	2.1	5.3	-4.6	5.3	-4.6	5.3	-4.6

**PM50CLB060**  
**Intellimod™ Module**  
**Three Phase Current-sense IGBT Inverter**  
**50 Amperes/600 Volts**

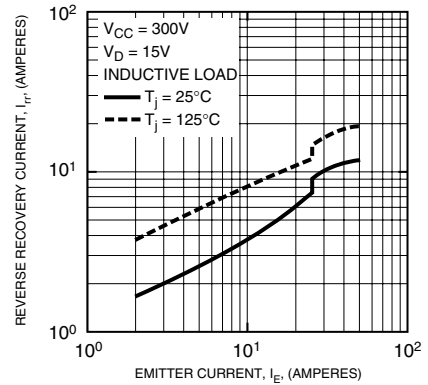
**COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)**



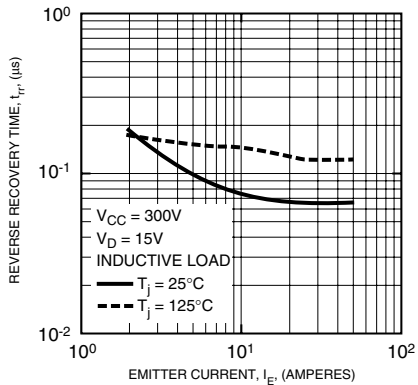
**FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)**



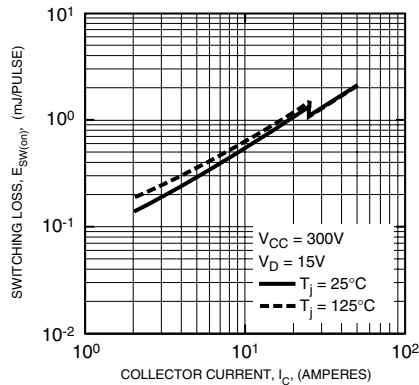
**REVERSE RECOVERY CHARACTERISTICS (TYPICAL)**



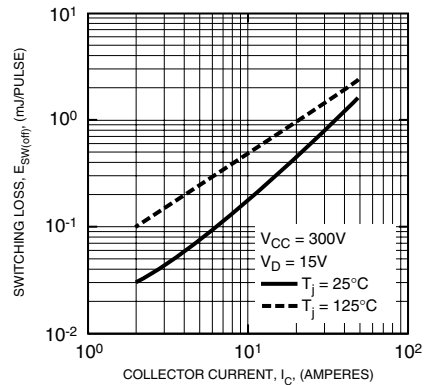
**REVERSE RECOVERY CHARACTERISTICS (TYPICAL)**



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



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



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (IGBT & FWDi)**

