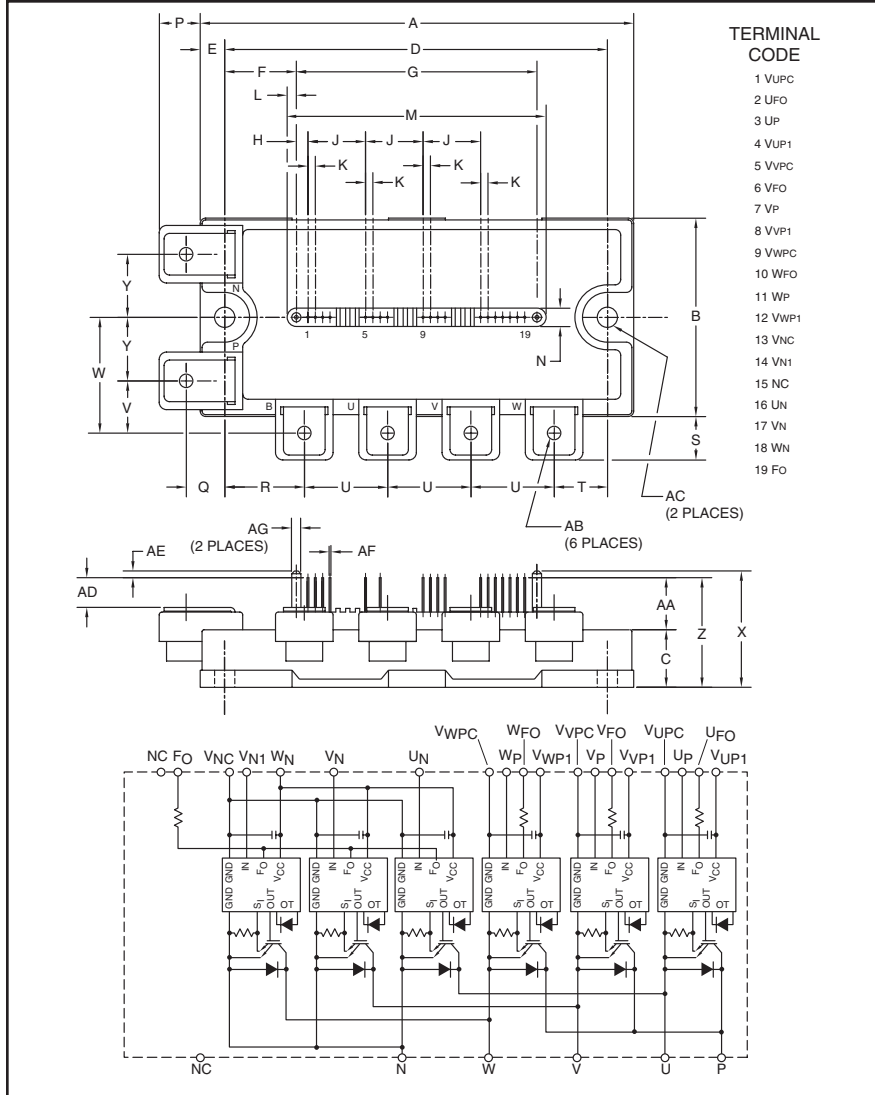
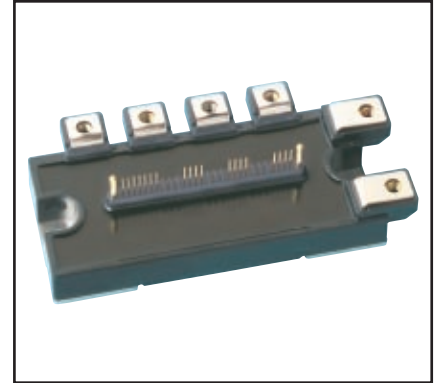


### Intellimod™ L-Series Three Phase IGBT Inverter 50 Amperes/1200 Volts



**TERMINAL CODE**

- 1 VUPC
- 2 UFO
- 3 UP
- 4 VUP1
- 5 VVPC
- 6 VFO
- 7 VP
- 8 VVP1
- 9 VVWP
- 10 WFO
- 11 WP
- 12 VVWP1
- 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 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. PM50CLA120 is a 1200V, 50 Ampere Intellimod™ Intelligent Power Module.

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	0.43	11.0
Q	0.42	10.75
R	0.87	22.0

Dimensions	Inches	Millimeters
S	0.46	11.75
T	0.59	15.0
U	0.91	23.0
V	0.57	14.5
W	1.26	32.0
X	1.22	31.0
Y	0.69	17.5
Z	1.14	29.0
AA	0.51	13.0
AB	M5 Metric	M5
AC	0.22 Dia.	Dia. 5.5
AD	0.28	7.0
AE	0.08	2.0
AF	0.02 Sq.	Sq. 0.5
AG	0.10 Dia.	Dia. 2.5

Type	Current Rating Amperes	V <sub>CES</sub> Volts (x 10)
PM	50	120



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

**PM50CLA120**  
**Intellimod™ L-Series**  
**Three Phase IGBT Inverter**  
**50 Amperes/1200 Volts**

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

Characteristics	Symbol	PM50CLA120	Units
Power Device Junction Temperature	$T_j$	-20 to 150	$^\circ\text{C}$
Storage Temperature	$T_{\text{stg}}$	-40 to 125	$^\circ\text{C}$
Module Case Operating Temperature (See $T_C$ Measurement point Illustration)	$T_C$	-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)	—	380	Grams
Supply Voltage, Surge (Applied between P - N)	$V_{\text{CC(surge)}}$	1000	Volts
Self-protection Supply Voltage Limit (Short Circuit protection Capability)*	$V_{\text{CC(prot.)}}$	800	Volts
Isolation Voltage, AC 1 minute, 60Hz Sinusoidal	$V_{\text{ISO}}$	2500	Volts

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

**IGBT Inverter Sector**

Collector-Emitter Voltage ( $V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ )	$V_{\text{CES}}$	1200	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 ( $T_C = 25^\circ\text{C}$ )	$P_C$	480	Watts

**Control Sector**

Supply Voltage (Applied between $V_{\text{UP1}}-V_{\text{UPC}}$ , $V_{\text{VP1}}-V_{\text{VPC}}$ , $V_{\text{WP1}}-V_{\text{WPC}}$ , $V_{\text{N1}}-V_{\text{N1C}}$ )	$V_D$	20	Volts
Input Voltage (Applied between $U_P-V_{\text{UPC}}$ , $V_P-V_{\text{VPC}}$ , $W_P-V_{\text{WPC}}$ , $U_N-V_{\text{N1C}}$ , $V_N-V_{\text{N1C}}$ , $W_N-V_{\text{N1C}}$ )	$V_{\text{CIN}}$	20	Volts
Fault Output Supply Voltage (Applied between $U_{\text{FO}}-V_{\text{UPC}}$ , $V_{\text{FO}}-V_{\text{VPC}}$ , $W_{\text{FO}}-V_{\text{WPC}}$ , $F_O-V_{\text{N1C}}$ )	$V_{\text{FO}}$	20	Volts
Fault Output Current ( $U_{\text{FO}}$ , $V_{\text{FO}}$ , $W_{\text{FO}}$ , $F_O$ 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 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	$V_{\text{EC}}$	$-I_C = 50\text{A}$ , $V_{\text{CIN}} = 15\text{V}$ , $V_D = 15\text{V}$	—	2.5	3.5	Volts
Collector-Emitter Saturation Voltage	$V_{\text{CE(sat)}}$	$V_D = 15\text{V}$ , $V_{\text{CIN}} = 0\text{V}$ , $I_C = 50\text{A}$ , $T_j = 25^\circ\text{C}$	—	1.9	—	Volts
		$V_D = 15\text{V}$ , $V_{\text{CIN}} = 0\text{V}$ , $I_C = 50\text{A}$ , $T_j = 125^\circ\text{C}$	—	1.9	—	Volts
Inductive Load Switching Times	$t_{\text{on}}$	$V_D = 15\text{V}$ , $V_{\text{CIN}} = 0 \Leftrightarrow 15\text{V}$ $V_{\text{CC}} = 600\text{V}$ , $I_C = 50\text{A}$ $T_j = 125^\circ\text{C}$	0.5	1.0	2.5	$\mu\text{s}$
	$t_{\text{rr}}$		—	0.15	0.3	$\mu\text{s}$
	$t_{\text{C(on)}}$		—	0.4	1.0	$\mu\text{s}$
	$t_{\text{off}}$		—	2.0	3.0	$\mu\text{s}$
	$t_{\text{C(off)}}$		—	0.7	1.2	$\mu\text{s}$

**PM50CLA120**  
**Intellimod™ L-Series**  
**Three Phase IGBT Inverter**  
 50 Amperes/1200 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	$t_{\text{off(SC)}}$	$V_D = 15\text{V}$	—	10	—	$\mu\text{s}$
Over Temperature Protection	OT	Trip Level	135	145	155	$^\circ\text{C}$
(Detect $T_j$ of IGBT Chip)	$\text{OT}_R$	Reset Level	—	125	—	$^\circ\text{C}$
Supply Circuit Under-voltage Protection	UV	Trip Level	11.5	12.0	12.5	Volts
( $-20 \leq T_j \leq 125^\circ\text{C}$ )	$\text{UV}_R$	Reset Level	—	12.5	—	Volts
Circuit Current	$I_D$	$V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ , $V_{\text{N1}}-V_{\text{NC}}$	—	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)	—	—	0.26**	$^\circ\text{C/Watt}$
	$R_{\text{th(j-c)D}}$	FWDi (Per 1/6 Module)	—	—	0.39**	$^\circ\text{C/Watt}$
Contact Thermal Resistance	$R_{\text{th(c-f)}}$	Case to Fin Per Module, Thermal Grease Applied	—	—	0.038	$^\circ\text{C/Watt}$

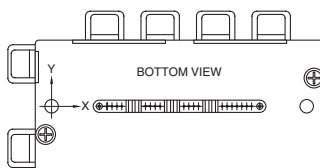
\*\* If you use this value,  $R_{\text{th(t-a)}}$  should be measured just under the chips.

## Recommended Conditions for Use

Characteristic	Symbol	Condition	Value	Units
Supply Voltage	$V_{\text{CC}}$	Applied across P-N Terminals	$\leq 800$	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	$V_{\text{CIN(off)}}$	$V_P-V_{\text{VPC}}$ , $W_P-V_{\text{WPC}}$ , $U_N-V_N$ , $W_N-V_{\text{NC}}$	$\geq 4.0$	Volts
PWM Input Frequency	$f_{\text{PWM}}$		$\leq 20$	kHz
Arm Shoot-through Blocking 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.

$T_C$  Measurement Point



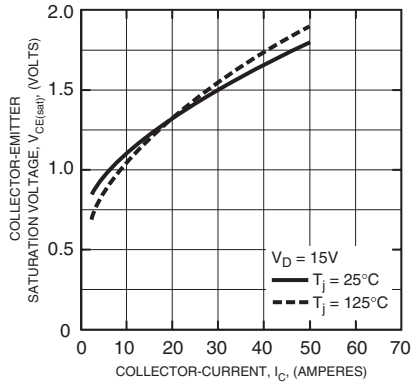
Arm \ Axis	UP		VP		WP		UN		VN		WN	
	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi
X	28.3	28.4	65.0	64.9	86.9	86.9	39.3	39.2	54.0	54.1	76.0	76.1
Y	-7.7	1.5	-7.7	1.5	-7.7	1.5	5.7	-3.5	5.7	-3.5	5.7	-3.5



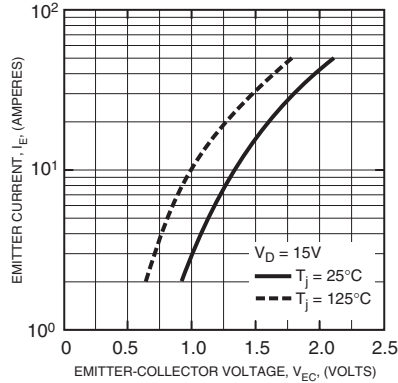
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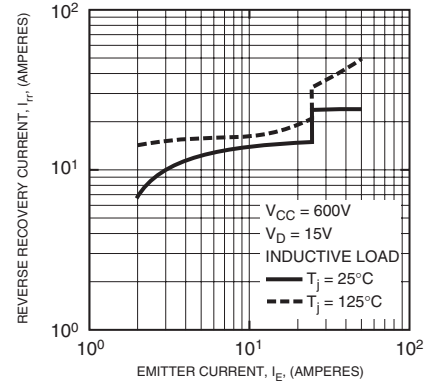
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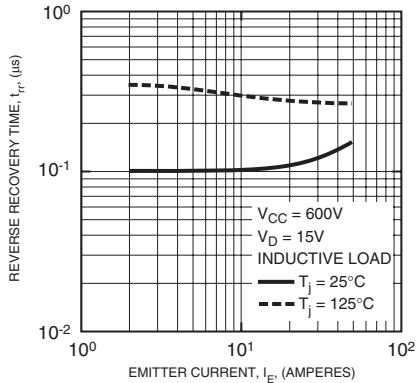
**FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)**



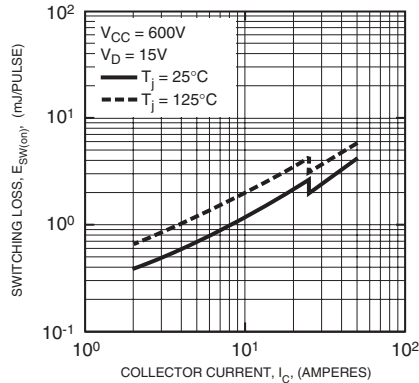
**REVERSE RECOVERY CHARACTERISTICS (TYPICAL)**



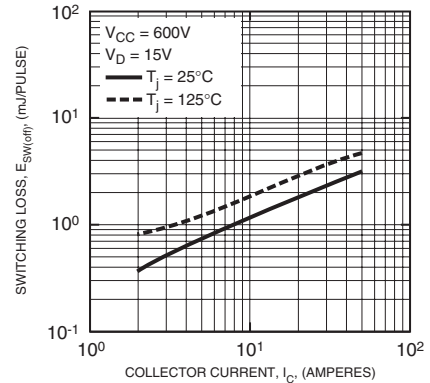
**REVERSE RECOVERY CHARACTERISTICS (TYPICAL)**



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



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



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

