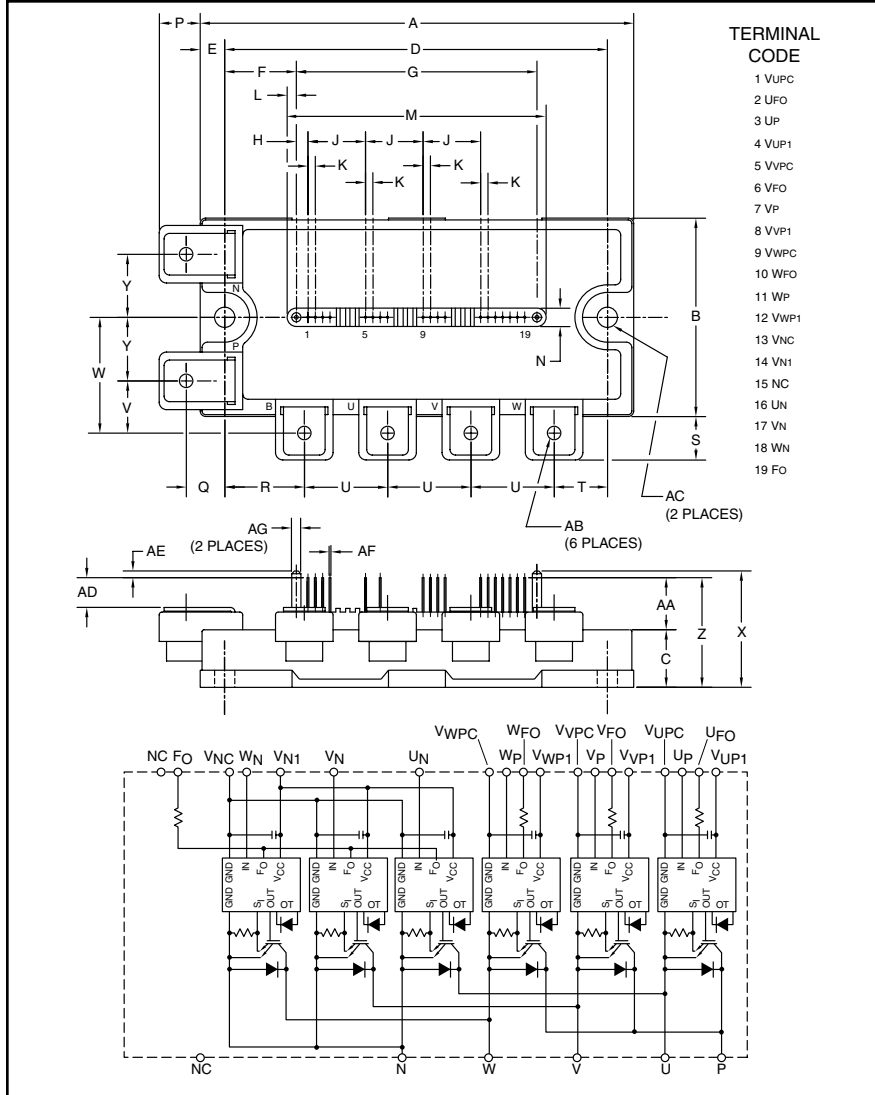
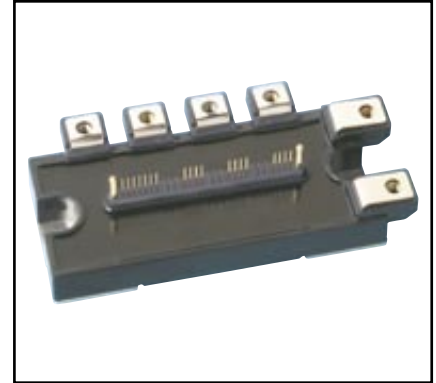


Intellimod™ L-Series Three Phase IGBT Inverter 50 Amperes/600 Volts



TERMINAL CODE

- 1 VUPC
- 2 UFO
- 3 UP
- 4 VUP1
- 5 VVPC
- 6 VFO
- 7 VP
- 8 VVP1
- 9 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. PM50CLA060 is a 600V, 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 _{CES} Volts (x 10)
PM	50	60



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

PM50CLA060
Intellimod™ L-Series
Three Phase IGBT Inverter
50 Amperes/600 Volts

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

Characteristics	Symbol	PM50CLA060	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)	$V_{\text{CC(surge)}}$	500	Volts
Self-protection Supply Voltage Limit (Short Circuit protection Capability)*	$V_{\text{CC(prot.)}}$	400	Volts
Isolation Voltage, AC 1 minute, 60Hz Sinusoidal	V_{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_{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 $V_{\text{UP1}}-V_{\text{U1PC}}$, $V_{\text{VP1}}-V_{\text{V1PC}}$, $V_{\text{WP1}}-V_{\text{W1PC}}$, $V_{\text{N1}}-V_{\text{N1C}}$)	V_D	20	Volts
Input Voltage (Applied between U_P-V_{U1PC} , V_P-V_{V1PC} , W_P-V_{W1PC} , U_N-V_{N1C} , W_N-V_{N1C})	V_{CIN}	20	Volts
Fault Output Supply Voltage (Applied between $U_{\text{FO}}-V_{\text{U1PC}}$, $V_{\text{FO}}-V_{\text{V1PC}}$, $W_{\text{FO}}-V_{\text{W1PC}}$, F_O-V_{N1C})	V_{FO}	20	Volts
Fault Output Current (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 Cutoff Current	I_{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_{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_{on}	$V_D = 15\text{V}$, $V_{\text{CIN}} = 0$ 15V $V_{\text{CC}} = 300\text{V}$, $I_C = 50\text{A}$ $T_j = 125^\circ\text{C}$	0.5	1.0	2.4	μs
	t_{rr}		—	0.2	0.4	μs
	$t_{\text{C(on)}}$		—	0.4	1.0	μs
	t_{off}		—	1.2	2.5	μs
	$t_{\text{C(off)}}$		—	0.5	1.0	μs

PM50CLA060
Intellimod™ L-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
Control Sector						
Short Circuit Trip Level	SC	$-20^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$, $V_D = 15\text{V}$	100	132	—	Amperes
Short Circuit Current Delay Time	$t_{\text{off(SC)}}$	$V_D = 15\text{V}$	—	0.2	—	μs
Over Temperature Protection (Detect T_j of IGBT Chip)	OT	Trip Level	135	145	—	$^\circ\text{C}$
	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_{UPC} ,	1.2	1.5	1.8	Volts
Input OFF Threshold Voltage	$V_{\text{th(off)}}$	V_P-V_{VPC} , W_P-V_{WPC} , U_N-V_N , W_N-V_{NC}	1.7	2.0	2.3	Volts
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_{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

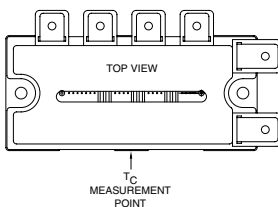
Characteristic	Symbol	Condition	Min.	Typ.	Max.	Units
Junction to Case Thermal Resistance	$R_{\text{th(j-c)Q}}$	IGBT (Per 1/6 Module) (Note 1)	—	—	1.24	$^\circ\text{C/Watt}$
	$R_{\text{th(j-c)D}}$	FWDi (Per 1/6 Module) (Note 1)	—	—	2.09	$^\circ\text{C/Watt}$
	$R_{\text{th(j-c)Q}}$	IGBT (Per 1/6 Module)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

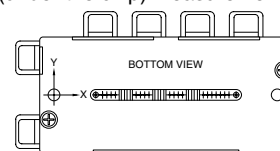
Characteristic	Symbol	Condition	Value	Units
Supply Voltage	V_{CC}	Applied across P-N Terminals	≤ 400	Volts
Control Supply Voltage**	V_D	Applied between $V_{\text{UP1}}-V_{\text{UPC}}$, $V_{\text{VP1}}-V_{\text{VPC}}$, $V_{\text{WP1}}-V_{\text{WPC}}$, $V_{N1}-V_{\text{NC}}$	15.0 ± 1.5	Volts
Input ON Voltage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

** 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



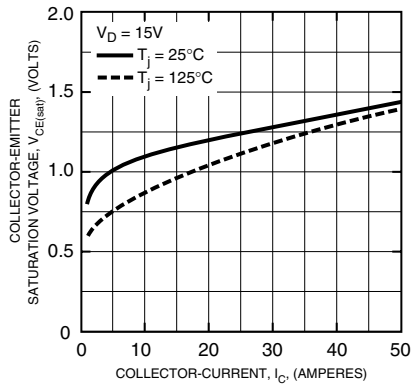
Note 2: T_C (under the chip) Measurement Point



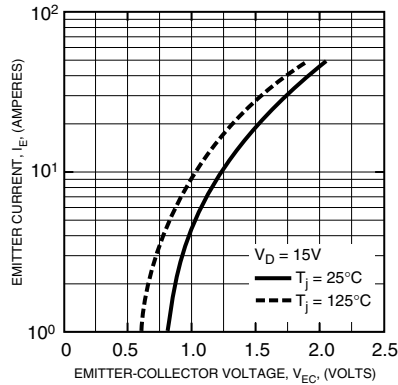
Axis	UP		VP		WP		UN		VN		WN	
	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi
X	29.0	29.5	64.6	65.1	85.9	86.4	38.1	37.6	54.8	55.3	76.1	75.6
Y	-7.3	1.6	-7.3	2.1	-7.3	2.1	5.3	-4.6	5.3	-4.6	5.3	-4.6

PM50CLA060
Intellimod™ L-Series
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 50 Amperes/600 Volts

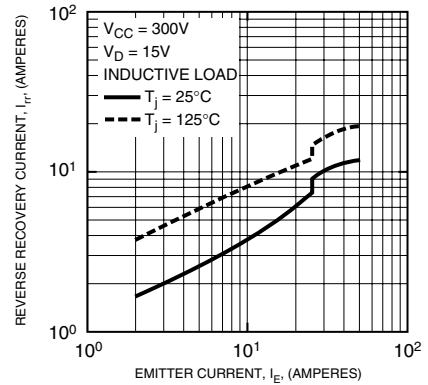
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



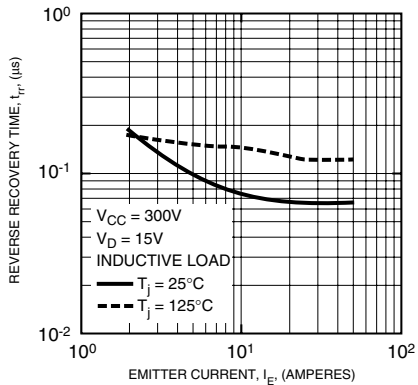
FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



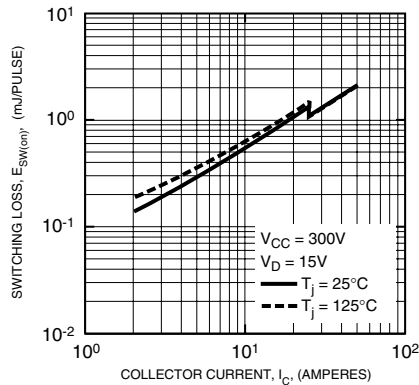
REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



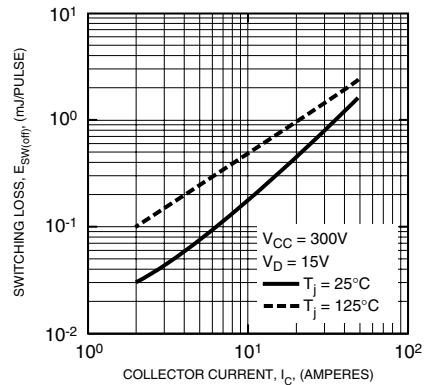
REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



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



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



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (IGBT & FWDi)

