

Intellimod™ L-Series

Three Phase

IGBT Inverter

450 Amperes/600 Volts

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
- ☐ Low EMI/RFI

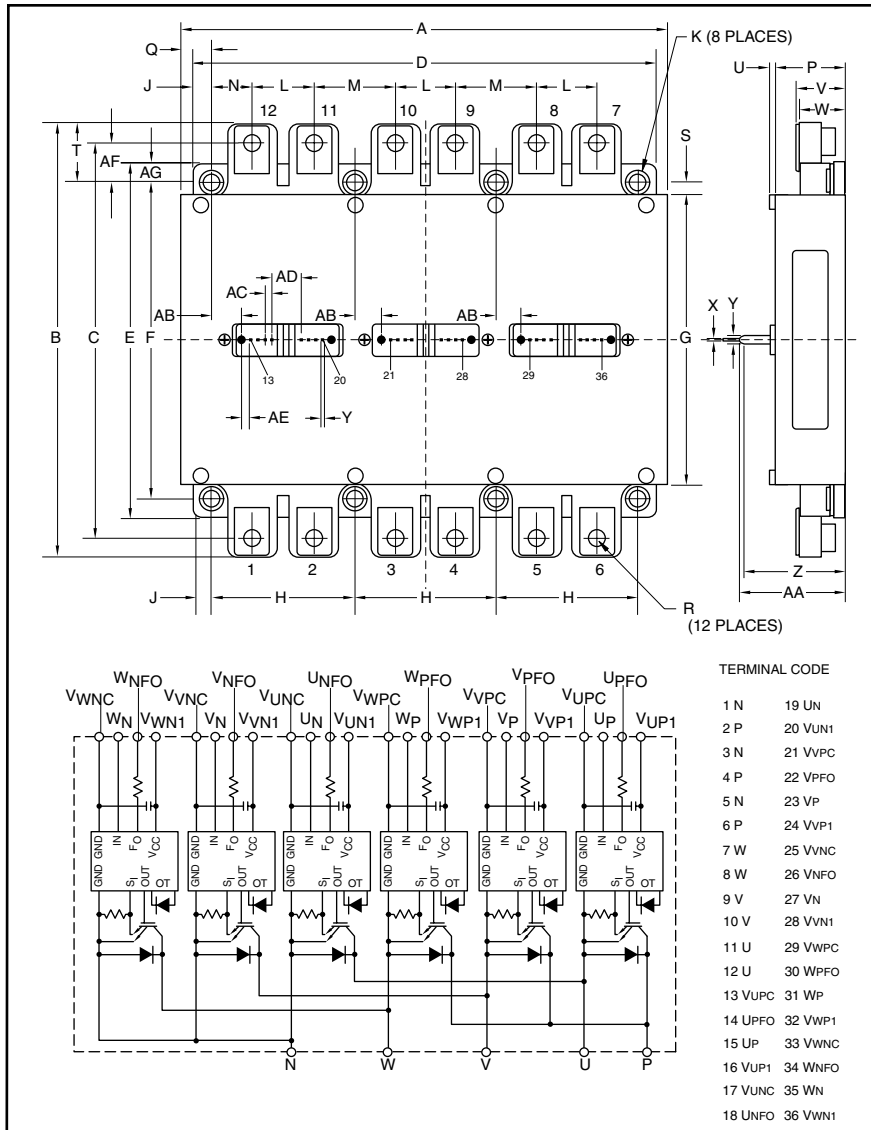
Applications:

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

Ordering Information:

Example: Select the complete part number from the table below -i.e. PM450CLA060 is a 600V, 450 Ampere Intellimod™ Intelligent Power Module.

Type	Current Rating Amperes	V _{CE} Volts (x 10)
PM	450	60



Outline Drawing and Circuit Diagram

Dimensions	Inches	Millimeters
A	6.77	172.0
B	5.90	150.0
C	5.39	137.0
D	6.38	162.0
E	4.84	123.0
F	4.33	110.0
G	3.90	99.0
H	1.97	50.0
J	0.236	6.0
K	5.5 Metric	M5.5
L	0.866	22.0
M	1.10	28.0
N	0.55	14.0
P	0.945	24.0
Q	0.43	11.0
R	M6 Metric	M6

Dimensions	Inches	Millimeters
S	0.217	5.5
T	0.79	20.0
U	0.08	2.0
V	0.67	17.0
W	0.62	15.8
X	0.025 Sq.	Sq. 0.64
Y	0.1 Dia	Dia. 2.5
Z	1.40	35.5
AA	1.44	36.6
AB	0.36	9.08
AC	0.10	2.54
AD	0.40	10.16
AE	0.127	3.22
AF	0.53	13.5
AG	0.256	6.5



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

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

Characteristics	Symbol	PM450CLA060	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, M6 Main Terminal Screws	—	40	in-lb
Module Weight (Typical)	—	1250	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

* $V_D = 13.5 \sim 16.5\text{V}$, 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_{CES}	600	Volts
Collector Current ($T_C = 25^\circ\text{C}$)	$\pm I_C$	450	Amperes
Peak Collector Current ($T_C = 25^\circ\text{C}$)	$\pm I_{\text{CP}}$	900	Amperes
Collector Dissipation ($T_C = 25^\circ\text{C}$)	P_C	1041	Watts

Control Sector

Supply Voltage (Applied between $V_{\text{UP1}}-V_{\text{UPC}}$, $V_{\text{VP1}}-V_{\text{VPC}}$, $V_{\text{WP1}}-V_{\text{WPC}}$, $V_{\text{UN1}}-V_{\text{UNC}}$, $V_{\text{WN1}}-V_{\text{WNC}}$, $V_{\text{N1}}-V_{\text{NC}}$)	V_D	20	Volts
Input Voltage (Applied between U_P-V_{UPC} , V_P-V_{VPC} , W_P-V_{WPC} , U_N-V_{UNC} , V_N-V_{VNC} , W_N-V_{WNC})	V_{CIN}	20	Volts
Fault Output Supply Voltage (Applied between $U_{\text{PFO}}-V_{\text{UPC}}$, $V_{\text{PFO}}-V_{\text{VPC}}$, $W_{\text{PFO}}-V_{\text{WPC}}$, $U_{\text{NFO}}-V_{\text{UNC}}$, $V_{\text{NFO}}-V_{\text{VNC}}$, $W_{\text{NFO}}-V_{\text{WNC}}$)	V_{FO}	20	Volts
Fault Output Sink Current at U_{PFO} , V_{PFO} , W_{PFO} , U_{NFO} , V_{NFO} , W_{NFO} Terminals	I_{FO}	20	mA

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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 _{CES}	V _{CE} = V _{CES} , V _{CIN} = 15V, T _j = 25°C	—	—	1.0	mA
		V _{CE} = V _{CES} , V _{CIN} = 15V, T _j = 125°C	—	—	10	mA
Diode Forward Voltage	V _{EC}	-I _C = 450A, V _{CIN} = 15V, V _D = 15V	—	2.6	3.7	Volts
Collector-Emitter Saturation Voltage	V _{CE(sat)}	V _D = 15V, V _{CIN} = 0V, I _C = 450A, T _j = 25°C	—	1.7	2.2	Volts
		V _D = 15V, V _{CIN} = 0V, I _C = 450A, T _j = 125°C	—	1.8	2.3	Volts
Inductive Load Switching Times	t _{on}	V _D = 15V, V _{CIN} = 0 ↔ 15V V _{CC} = 300V, I _C = 450A T _j = 125°C	0.5	1.0	2.4	μs
	t _{rr}		—	0.2	0.4	μs
	t _{C(on)}		—	0.4	1.0	μs
	t _{off}		—	2.2	3.5	μs
	t _{C(off)}		—	0.6	1.1	μs
Control Sector						
Short Circuit Trip Level	SC	-20°C ≤ T _j ≤ 125°C, V _D = 15V	900	—	—	Amperes
Short Circuit Current Delay Time	t _{off(SC)}	V _D = 15V	—	0.2	—	μs
Over Temperature Protection	OT	Trip Level	135	145	—	°C
(Detect T _j of IGBT Chip)	OT _R	Reset Level	—	125	—	°C
Supply Circuit Under-voltage Protection	UV	Trip Level	11.5	12.0	12.5	Volts
(-20 ≤ T _j ≤ 125°C)	UV _R	Reset Level	—	12.5	—	Volts
Circuit Current	I _D	Upper Arm V _D = 15V, V _{CIN} = 15V	—	11	18	mA
		Lower Arm V _D = 15V, V _{CIN} = 15V	—	11	18	mA
Input ON Threshold Voltage	V _{th(on)}	Applied between U _P -V _{UPC} , V _P -V _{VPC} ,	1.2	1.5	1.8	Volts
Input OFF Threshold Voltage	V _{th(off)}	W _P -V _{WPC} , U _N -V _{UNC} , V _N -V _{VNC} , W _N -V _{WNC}	1.7	2.0	2.3	Volts
Fault Output Current*	I _{FO(H)}	V _D = 15V, V _{FO} = 15V	—	—	0.01	mA
	I _{FO(L)}	V _D = 15V, V _{FO} = 15V	—	10	15	mA
Fault Output Pulse Width*	t _{FO}	V _D = 15V	1.0	1.8	—	ms

*Fault output is given only when the internal SC, OT and UV protection of either upper or lower arms is tripped.



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Thermal Characteristics

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Junction to Case Thermal Resistance	$R_{th(j-c)Q}$	IGBT (Per 1/6 Module) (Note 1)	—	—	0.12	°C/Watt
	$R_{th(j-c)D}$	FWDi (Per 1/6 Module) (Note 1)	—	—	0.19	°C/Watt
Contact Thermal Resistance	$R_{th(c-f)}$	Case to Fin Per Module, Thermal Grease Applied	—	—	0.014	°C/Watt

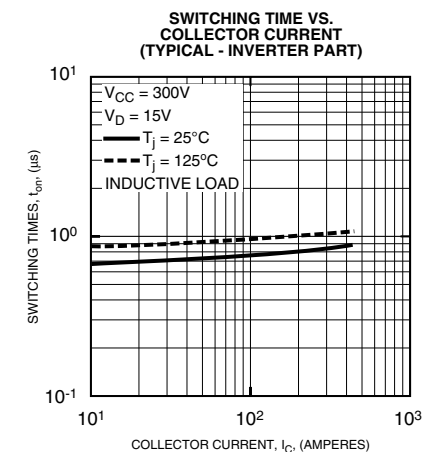
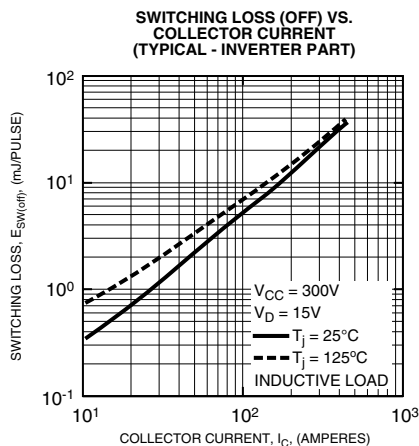
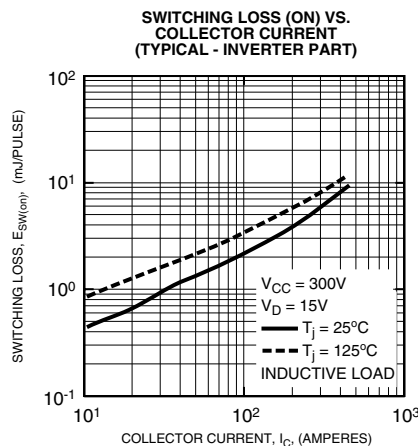
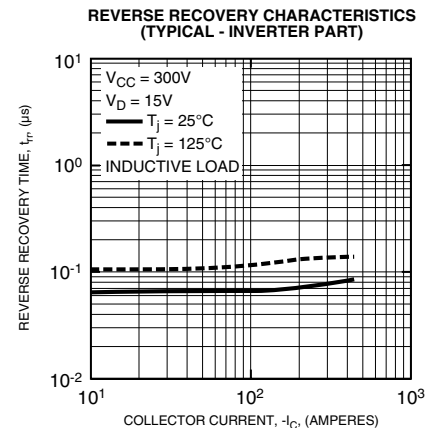
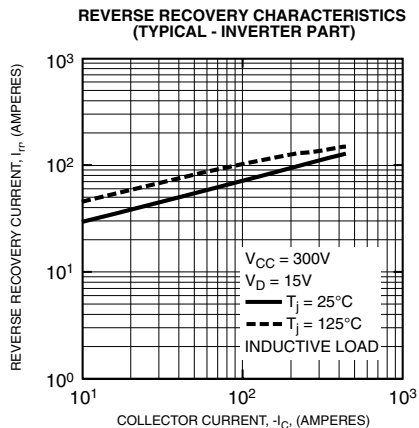
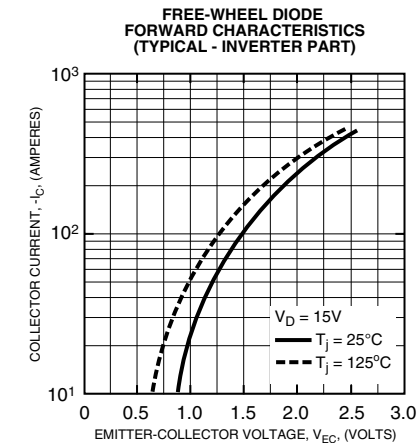
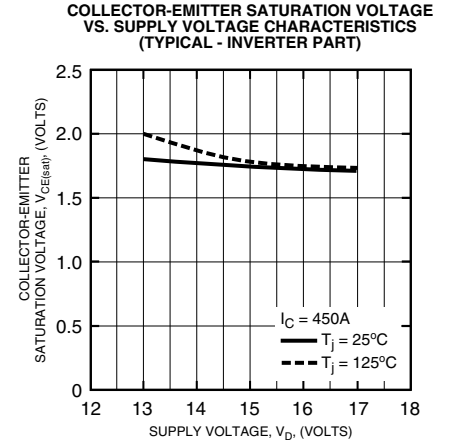
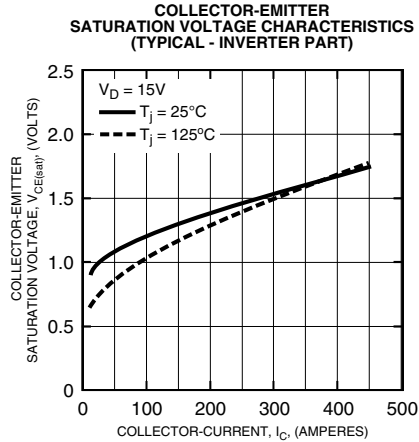
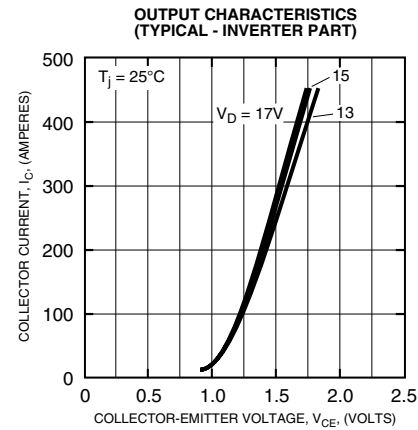
Note 1: If you use this value, $R_{th(t-a)}$ should be measured just under the chips.

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 $V_{UP1}-V_{UPC}$, $V_{VP1}-V_{VPC}$, $V_{WP1}-V_{WPC}$, $V_{UN1}-V_{UNC}$, $V_{VN1}-V_{VNC}$, $V_{WN1}-V_{WNC}$	15.0 ± 1.5	Volts
Input ON Voltage	$V_{CIN(on)}$	Applied between U_P-V_{UPC} , U_N-V_{UNC} ,	≤ 0.8	Volts
Input OFF Voltage	$V_{CIN(off)}$	V_N-V_{VNC} , V_P-V_{VPC} , W_N-V_{WNC} , W_P-V_{WPC}	≥ 9.0	Volts
PWM Input Frequency	f_{PWM}	—	≤ 20	kHz
Arm Shoot-through Blocking Time	t_{DEAD}	Input Signal	≥ 3.0	μs

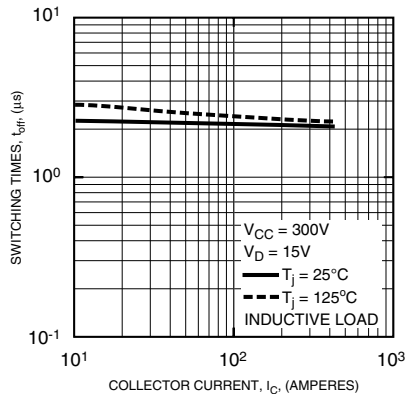
*With ripple satisfying the following conditions: dv/dt swing $\leq \pm 5V/\mu s$, Variation $\leq 2V$ peak to peak.

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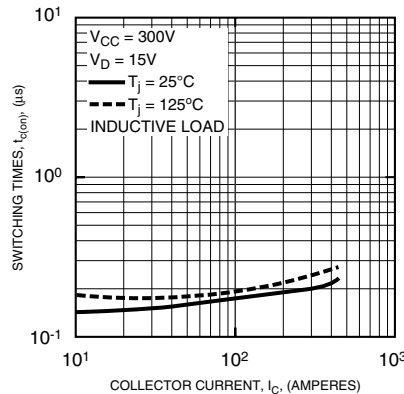


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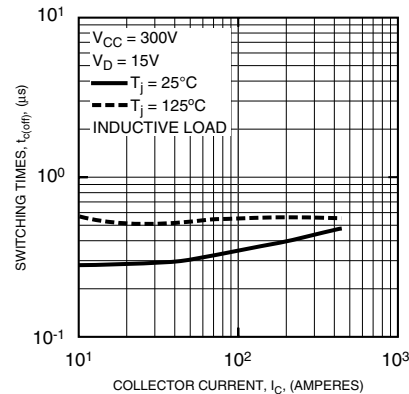
SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL - INVERTER PART)



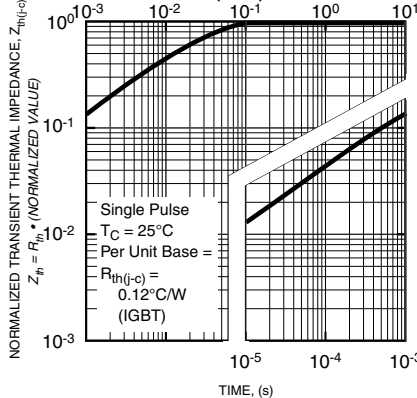
SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL - INVERTER PART)



SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL - INVERTER PART)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (IGBT)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (FWDI)

