PM50CL1A120

Powerex, Inc., 173 Pavilion Lane, Youngwood, Pennsylvania 15697 (724) 925-7272
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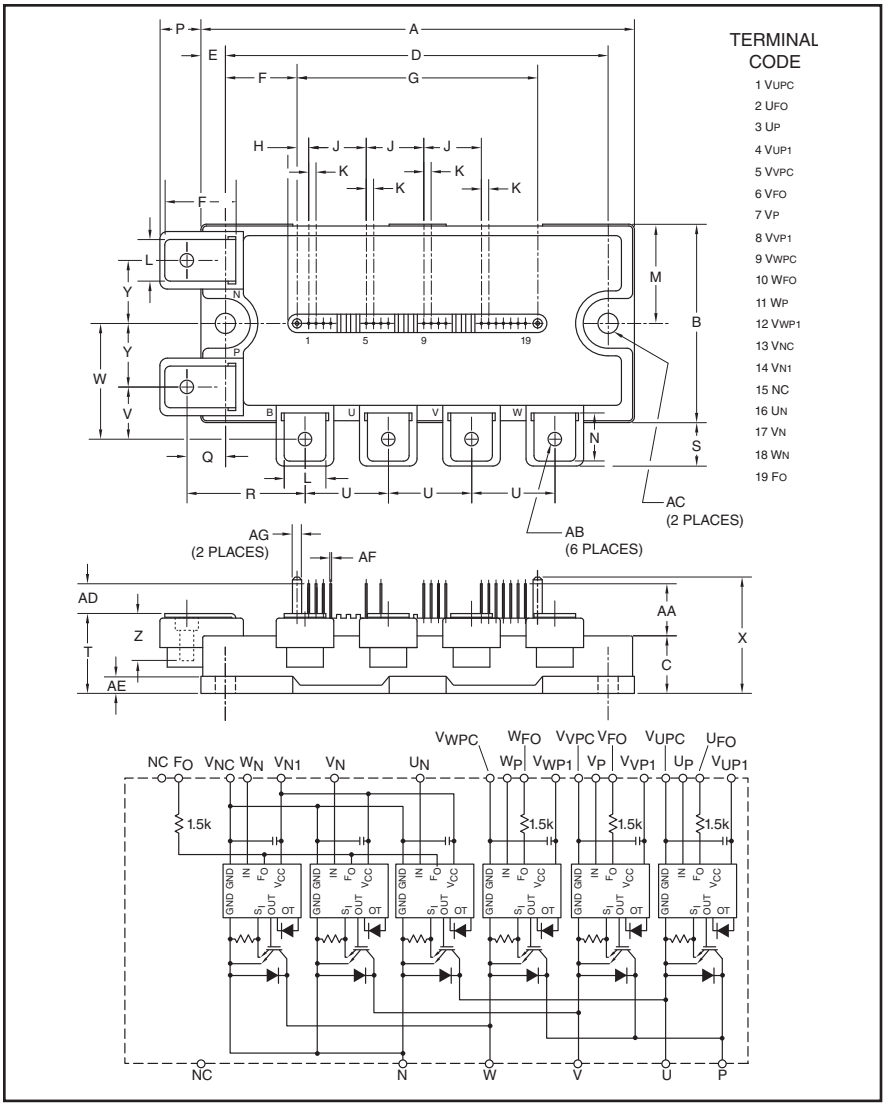
Intellimod™ L1-Series

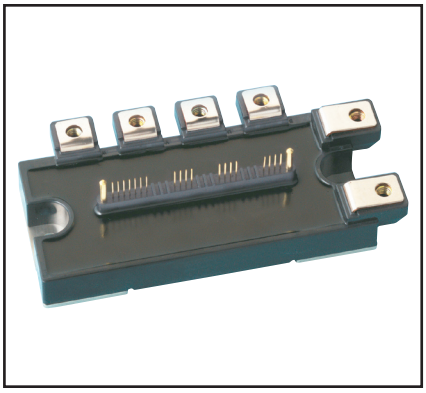
Three Phase
IGBT Inverter
50 Amperes/1200 Volts



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.



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. PM50CL1A120 is a 1200V, 50 Ampere Intellimod™ Intelligent Power Module.

Type	Current Rating Amperes	V_{CES} Volts (x 10)
PM	50	120

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50 Amperes/1200 Volts

Absolute Maximum Ratings, T_j = 25°C unless otherwise specified

Characteristics	Symbol	PM50CL1A120	Units
Power Device Junction Temperature	T_j	-20 to 150	°C
Storage Temperature	T_{stg}	-40 to 125	°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)	$V_{CC(surge)}$	1000	Volts
Supply Voltage Protected by Short Circuit Protection Capability*	$V_{CC(prot.)}$	800	Volts
Isolation Voltage, AC 1 minute, 60Hz Sinusoidal	V_{ISO}	2500	Volts

IGBT Inverter Sector

Collector-Emitter Voltage (V_D = 15V, V_{CIN} = 15V)	V_{CES}	1200	Volts
Collector Current (T_C = 25°C) (Note 1)	$\pm I_C$	50	Amperes
Peak Collector Current (T_C = 25°C)	$\pm I_{CP}$	100	Amperes
Collector Dissipation (T_C = 25°C) (Note 1)	P_C	462	Watts

Control Sector

Supply Voltage (Applied between V_{UP1}-V_{UPC}, V_{VP1}-V_{VPC}, V_{WP1}-V_{WPC}, V_{N1}-V_{NC})	V_D	20	Volts
Input Voltage (Applied between U_P-V_{UPC}, V_P-V_{VPC}, W_P-V_{WPC}, U_N- V_N- W_N-V_{NC})	V_{CIN}	20	Volts
Fault Output Supply Voltage (Applied between U_{FO}-V_{UPC}, V_{FO}-V_{VPC}, W_{FO}-V_{WPC}, F_O-V_{NC})	V_{FO}	20	Volts
Fault Output Current (Sink Current at U_{FO}, V_{FO}, W_{FO}, F_O Terminals)	I_{FO}	20	mA

Electrical and Mechanical Characteristics, T_j = 25°C unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
IGBT Inverter Sector						
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	V_D = 15V, V_{CIN} = 0V, I_C = 50A, T_j = 25°C	—	1.65	2.15	Volts
		V_D = 15V, V_{CIN} = 0V, I_C = 50A, T_j = 125°C	—	1.85	2.35	Volts
Diode Forward Voltage	V_{EC}	$-I_C$ = 50A, V_{CIN} = 15V, V_D = 15V	—	2.3	3.3	Volts
Inductive Load Switching Times	t_{on}	V_D = 15V, V_{CIN} = 0 ↔ 15V V_{CC} = 600V, I_C = 50A T_j = 125°C	0.3	0.8	2.0	µs
	t_{rr}		—	0.3	0.8	µs
	$t_{C(on)}$		—	0.4	1.0	µs
	t_{off}		—	1.2	2.8	µs
	$t_{C(off)}$		—	0.4	1.2	µs
Collector-Emitter Cutoff Current	I_{CES}	V_{CE} = V_{CES}, V_D = 15V, T_j = 25°C	—	—	1.0	mA
		V_{CE} = V_{CES}, V_D = 15V, T_j = 125°C	—	—	10	mA

*VD = 13.5 ~ 16.5V, Inverter Part, T_j = 125°C

Electrical and Mechanical Characteristics, T_j = 25°C unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Control Sector						
Circuit Current	I_D	V_D = 15V, V_{CIN} = 15V, V_{N1}-V_{NC}	—	6	12	mA
		V_D = 15V, V_{CIN} = 15V, 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°C ≤ T_j ≤ 125°C, V_D = 15V	100	—	—	Amperes
Short Circuit Current Delay Time	$t_{off(SC)}$	V_D = 15V	—	0.2	—	µs
Over Temperature Protection	OT	Trip Level	135	—	—	°C
(Detect T_j of IGBT Chip)	$OT_{(hys)}$	Hysteresis Level	—	20	—	°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
Fault Output Current*	$I_{FO(H)}$	V_D = 15V, V_{CIN} = 15V	—	—	0.01	mA
	$I_{FO(L)}$	V_D = 15V, V_{CIN} = 15V	—	10	15	mA
Fault Output Pulse Width*	t_{FO}	V_D = 15V	1.0	1.8	—	ms

Thermal Characteristics

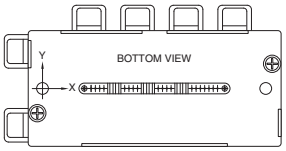
Characteristic	Symbol	Condition	Min.	Typ.	Max.	Units
Junction to Case Thermal Resistance	$R_{th(j-c)Q}$	IGBT (Per 1 Element) (Note 1)	—	—	0.27	°C/Watt
	$R_{th(j-c)D}$	FWDi (Per 1 Element) (Note 1)	—	—	0.47	°C/Watt
Contact Thermal Resistance	$R_{th(c-f)}$	Case to Fin Per Module, Thermal Grease Applied (Note 1)	—	—	0.038	°C/Watt

Recommended Conditions for Use

Characteristic	Symbol	Condition	Value	Units
Supply Voltage	V_{CC}	Applied across P-N Terminals	≤800	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 ± 1.5	Volts
Input ON Voltage	$V_{CIN(on)}$	Applied between U_P-V_{UPC},	≤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}	≥9.0	Volts
PWM Input Frequency	f_{PWM}	—	≤20	kHz
Arm Shoot-through Blocking Time	t_{DEAD}	Input Signal	≥2.5	µs

*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 ≤ ±5V/µs, Variation ≤ 2V 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	28.6	28.6	65.4	65.4	87.4	87.4	38.6	38.6	54.6	54.6	76.6	76.6
Y	-8.4	0.2	-8.4	0.2	-8.4	0.2	-1.8	6.8	-1.8	6.8	-1.8	6.8

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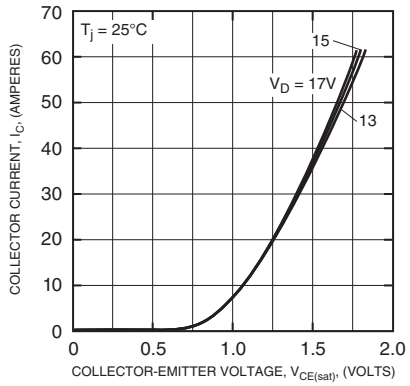
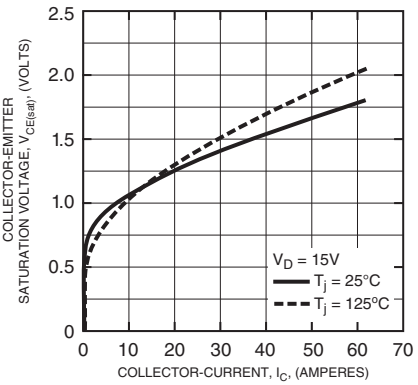
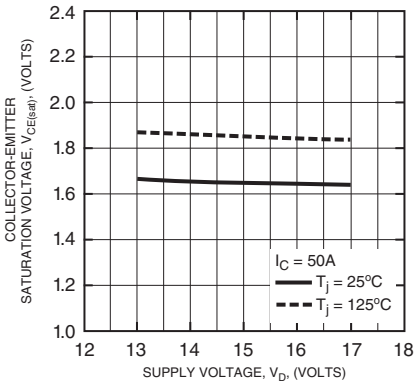
OUTPUT CHARACTERISTICS (TYPICAL)



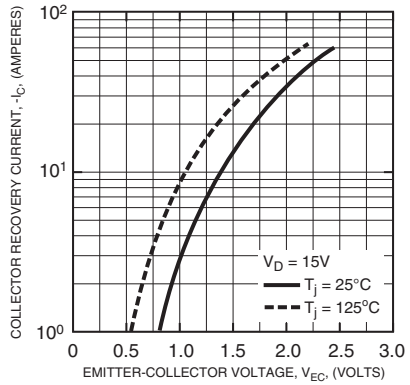
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



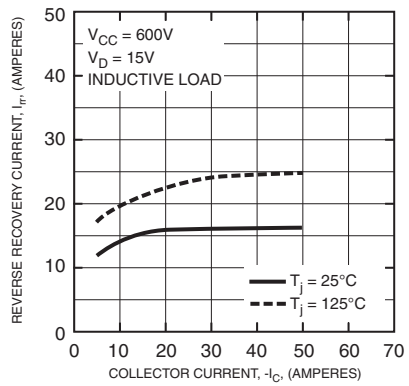
COLLECTOR-EMITTER SATURATION VOLTAGE VS. SUPPLY VOLTAGE CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



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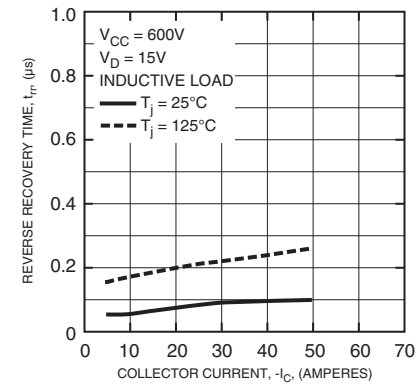
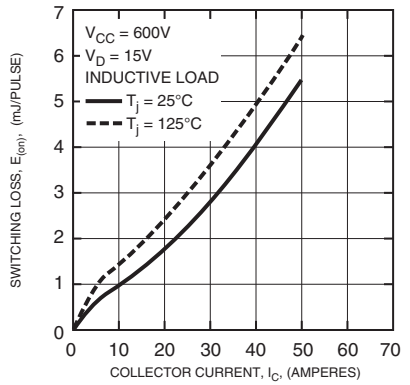
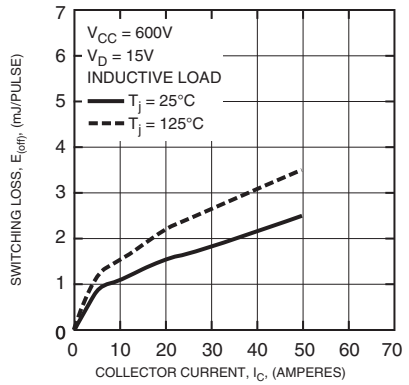


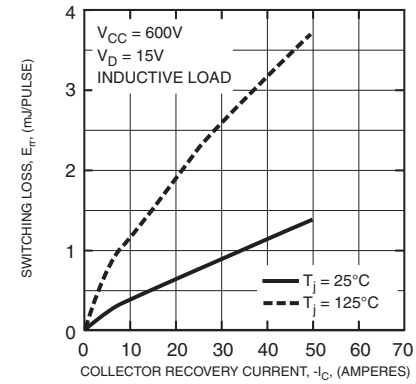
SWITCHING LOSS (ON) VS. COLLECTOR CURRENT (TYPICAL)



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



SWITCHING RECOVERY LOSS CHARACTERISTICS (TYPICAL)



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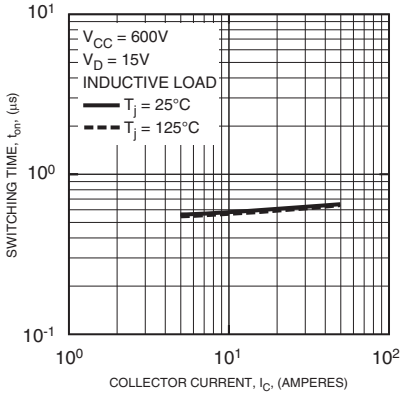
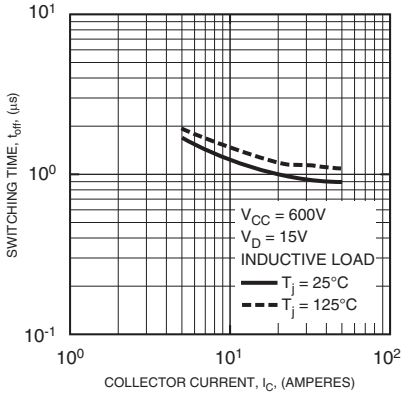
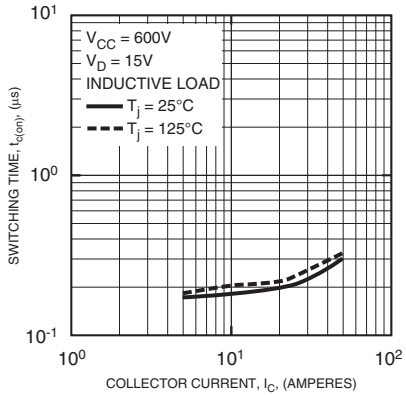
SWITCHING TIME (ON) VS. COLLECTOR CURRENT (TYPICAL)



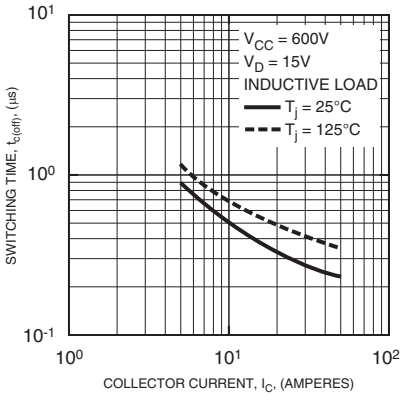
SWITCHING TIME (OFF) VS. COLLECTOR CURRENT (TYPICAL)



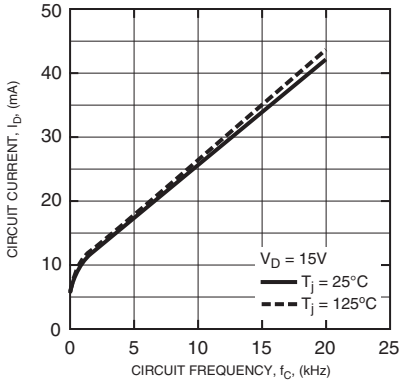
SWITCHING TIME (ON) VS. COLLECTOR CURRENT (TYPICAL)



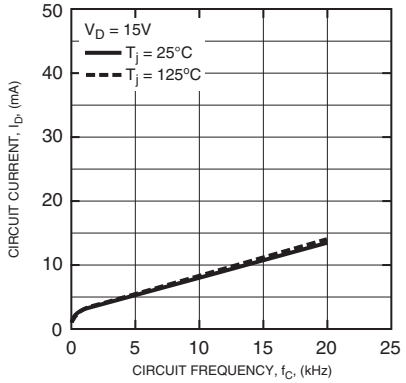
SWITCHING TIME (OFF) VS. COLLECTOR CURRENT (TYPICAL)



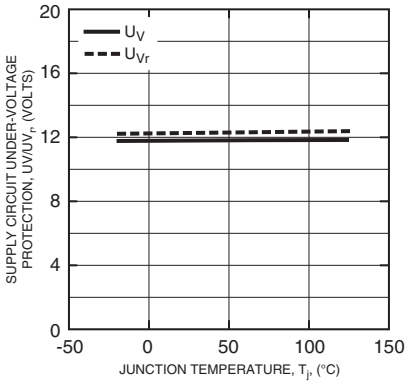
CIRCUIT CURRENT VS. CIRCUIT FREQUENCY CHARACTERISTICS (N-SIDE - TYPICAL)



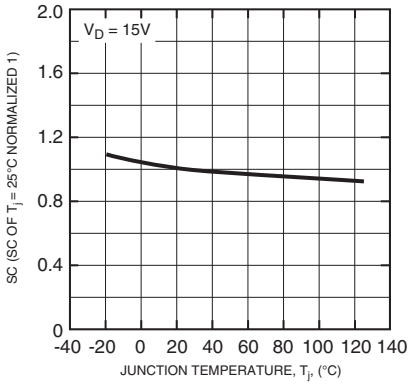
CIRCUIT CURRENT VS. CIRCUIT FREQUENCY CHARACTERISTICS (P-SIDE - TYPICAL)



TRIP LEVEL / RESET LEVEL VS. JUNCTION TEMPERATURE CHARACTERISTICS (TYPICAL)



SHORT CIRCUIT TRIP LEVEL VS. JUNCTION TEMPERATURE CHARACTERISTICS (TYPICAL)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (IGBT & FWDi - TYPICAL)