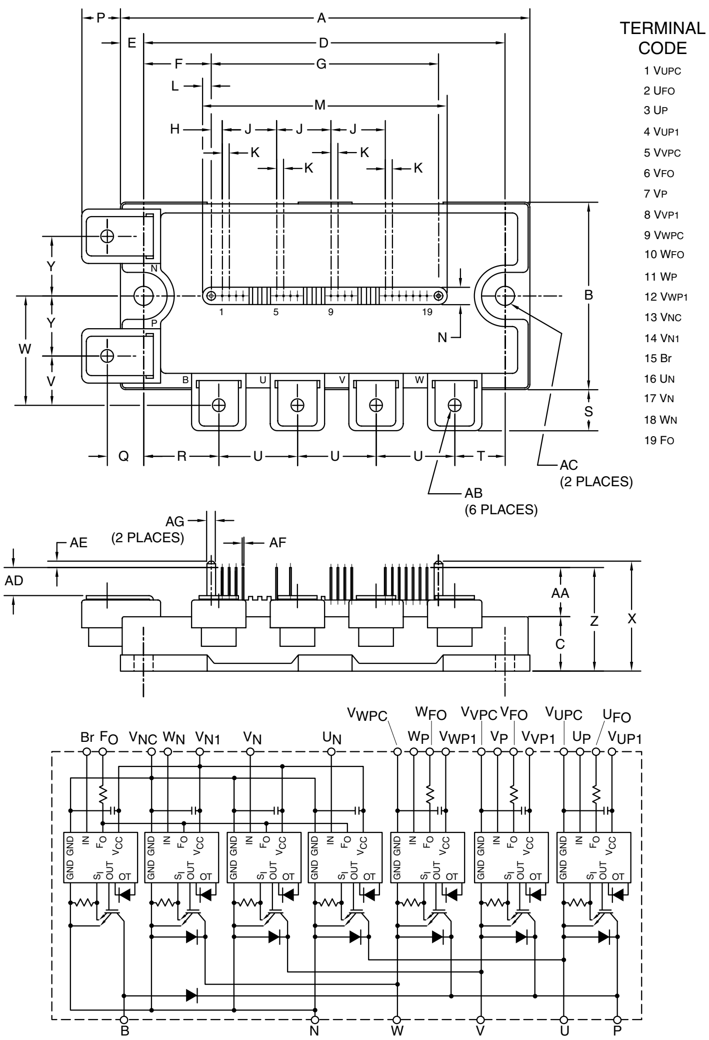
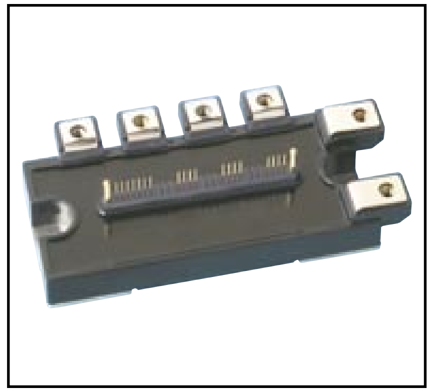
Powerex, Inc., 200 E. Hillis Street, Youngwood, Pennsylvania 15697-1800 (724) 925-7272

Intellimod™ L-Series

Three Phase
IGBT Inverter + Brake
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	0.10	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

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. PM50RLA120 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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Absolute Maximum Ratings, T_j = 25°C unless otherwise specified

Characteristics	Symbol	PM50RLA120	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
Self-protection Supply Voltage Limit (Short Circuit protection Capability)*	$V_{CC(prot.)}$	800	Volts
Isolation Voltage, AC 1 minute, 60Hz Sinusoidal	V_{ISO}	2500	Volts

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

IGBT Inverter Sector

Characteristics	Symbol	PM50RLA120	Units
Collector-Emitter Voltage (V_D = 15V, V_{CIN} = 15V)	V_{CES}	1200	Volts
Collector Current (T_C = 25°C)	$\pm I_C$	50	Amperes
Peak Collector Current (T_C = 25°C)	$\pm I_{CP}$	100	Amperes
Collector Dissipation (T_C = 25°C)	P_C	369	Watts

IGBT Brake Sector

Characteristics	Symbol	PM50RLA120	Units
Collector-Emitter Voltage (V_D = 15V, V_{CIN} = 15V)	V_{CES}	1200	Volts
Collector Current (T_C = 25°C)	$\pm I_C$	25	Amperes
Peak Collector Current (T_C = 25°C)	$\pm I_{CP}$	50	Amperes
Collector Dissipation (T_C = 25°C)	P_C	267	Watts
Diode Rated DC Reverse Voltage (T_C = 25°C)	$V_{R(DC)}$	1200	Volts
Diode Forward Current	I_F	25	Amperes

Control Sector

Characteristics	Symbol	PM50RLA120	Units
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-Br-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 (U_{FO}, V_{FO}, W_{FO}, F_O Terminals)	I_{FO}	20	mA

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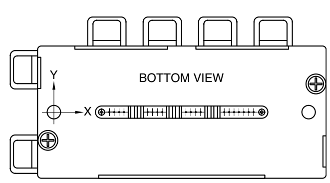
Electrical and Mechanical Characteristics, T_j = 25°C unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
IGBT Inverter Sector						
Collector-Emitter Cutoff Current	I_{CES}	$V_{CE} = V_{CES}$, V_D = 15V, T_j = 25°C	—	—	1.0	mA
		$V_{CE} = V_{CES}$, V_D = 15V, T_j = 125°C	—	—	10	mA
Diode Forward Voltage	V_{EC}	$-I_C$ = 50A, V_{CIN} = 15V, V_D = 15V	—	2.5	3.5	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	V_D = 15V, V_{CIN} = 0V, I_C = 50A, T_j = 25°C	—	1.8	2.3	Volts
		V_D = 15V, V_{CIN} = 0V, I_C = 50A, T_j = 125°C	—	1.9	2.4	Volts
Inductive Load Switching Times	t_{on}	V_D = 15V, V_{CIN} = 0 15V V_{CC} = 600V, I_C = 50A T_j = 125°C	0.5	1.0	2.5	μs
	t_{rr}		—	0.5	0.8	μs
	$t_{C(on)}$		—	0.4	1.0	μs
	t_{off}		—	2.0	3.0	μs
	$t_{C(off)}$		—	0.7	1.2	μs
IGBT Brake Sector						
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
Diode Forward Voltage	V_{FM}	I_F = 25A	—	2.5	3.5	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	V_D = 15V, V_{CIN} = 0V, I_C = 25A, T_j = 25°C	—	1.8	2.3	Volts
		V_D = 15V, V_{CIN} = 0V, I_C = 25A, T_j = 125°C	—	1.9	2.4	Volts

T_C (Base Plate) Measurement Point



Arm / Axis	UP		VP		WP		UN		VN		WN		Br	
	IGBT	FWDi	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	17.9	19.3
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	-10.5	4.3

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

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Control Sector						
Short Circuit Trip Level	SC	Inverter Part	100	—	—	Amperes
(-20°C ≤ T_j ≤ 125°C, V_D = 15V)		Brake Part	50	—	—	Amperes
Short Circuit Current Delay Time	$t_{off(SC)}$	V_D = 15V	—	0.2	—	μs
Over Temperature Protection	OT	Trip Level	135	145	155	°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	V_D = 15V, V_{CIN} = 15V, V_{N1}-V_{NC}	—	20	30	mA
		V_D = 15V, V_{CIN} = 15V, V_{XP1}-V_{XPC}	—	5	10	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-Br-V_{NC}	1.7	2.0	2.3	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

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

Thermal Characteristics, T_j = 25°C unless otherwise specified

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Units
Junction to Case Thermal Resistance	$R_{th(j-c)Q}$	IGBT (Per 1/6 Module)	—	—	0.26	°C/Watt
Inverter Part	$R_{th(j-c)D}$	FWDi (Per 1/6 Module)	—	—	0.39	°C/Watt
Junction to Case Thermal Resistance	$R_{th(j-c)Q}$	IGBT	—	—	0.36	°C/Watt
Brake Part	$R_{th(j-c)D}$	FWDi	—	—	0.60	°C/Watt
Contact Thermal Resistance	$R_{th(c-f)}$	Case to Fin Per Module, Thermal Grease Applied	—	—	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-Br-V_{NC}	≥9.0	Volts
PWM Input Frequency	f_{PWM}	—	≤20	kHz
Arm Shoot-through Blocking Time	t_{DEAD}	Input Signal	≥2.5	μs

** With ripple satisfying the following conditions: dv/dt swing ≤ ±5V/μs, Variation ≤ 2V peak to peak.

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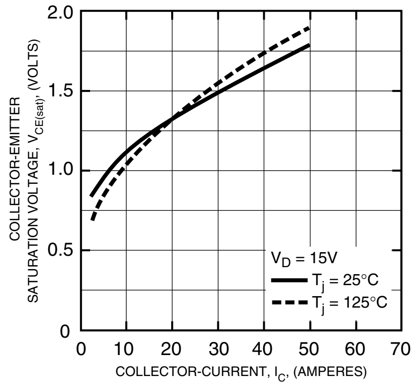
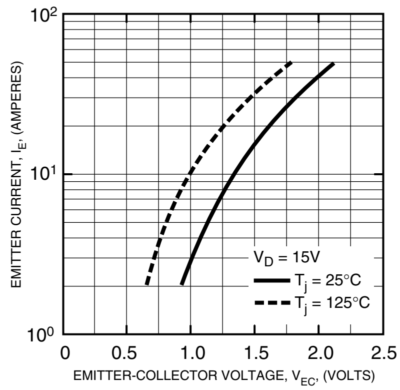
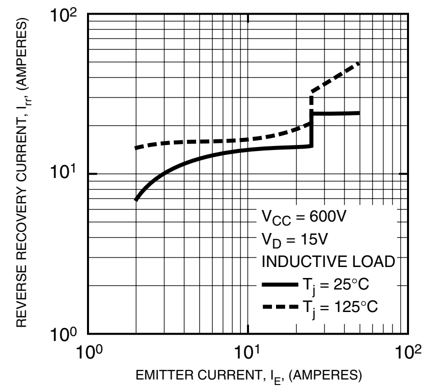
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL - INVERTER PART)



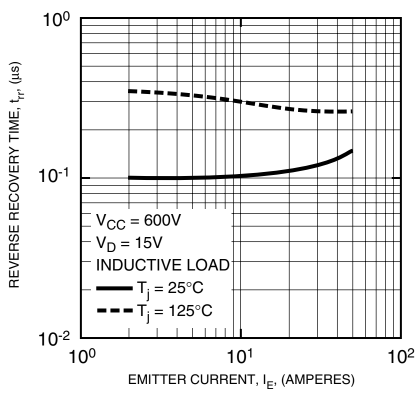
FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL - INVERTER PART)



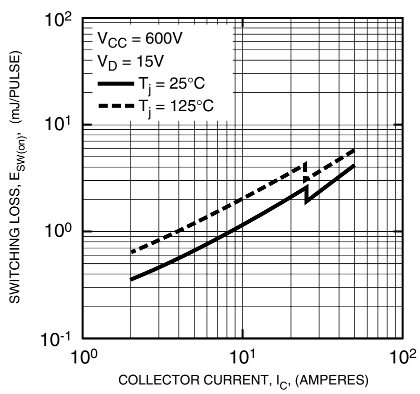
REVERSE RECOVERY CHARACTERISTICS (TYPICAL - INVERTER PART)



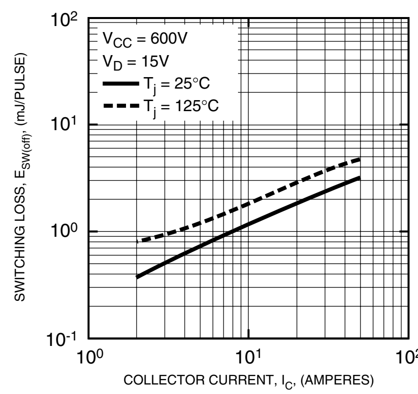
REVERSE RECOVERY CHARACTERISTICS (TYPICAL - INVERTER PART)



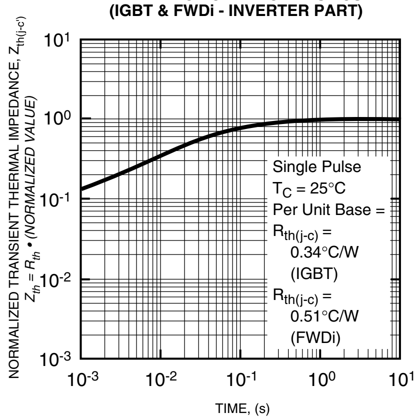
SWITCHING LOSS (ON) VS. COLLECTOR CURRENT (TYPICAL - INVERTER PART)



SWITCHING LOSS (OFF) VS. COLLECTOR CURRENT (TYPICAL - INVERTER PART)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (IGBT & FWDi - INVERTER PART)



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