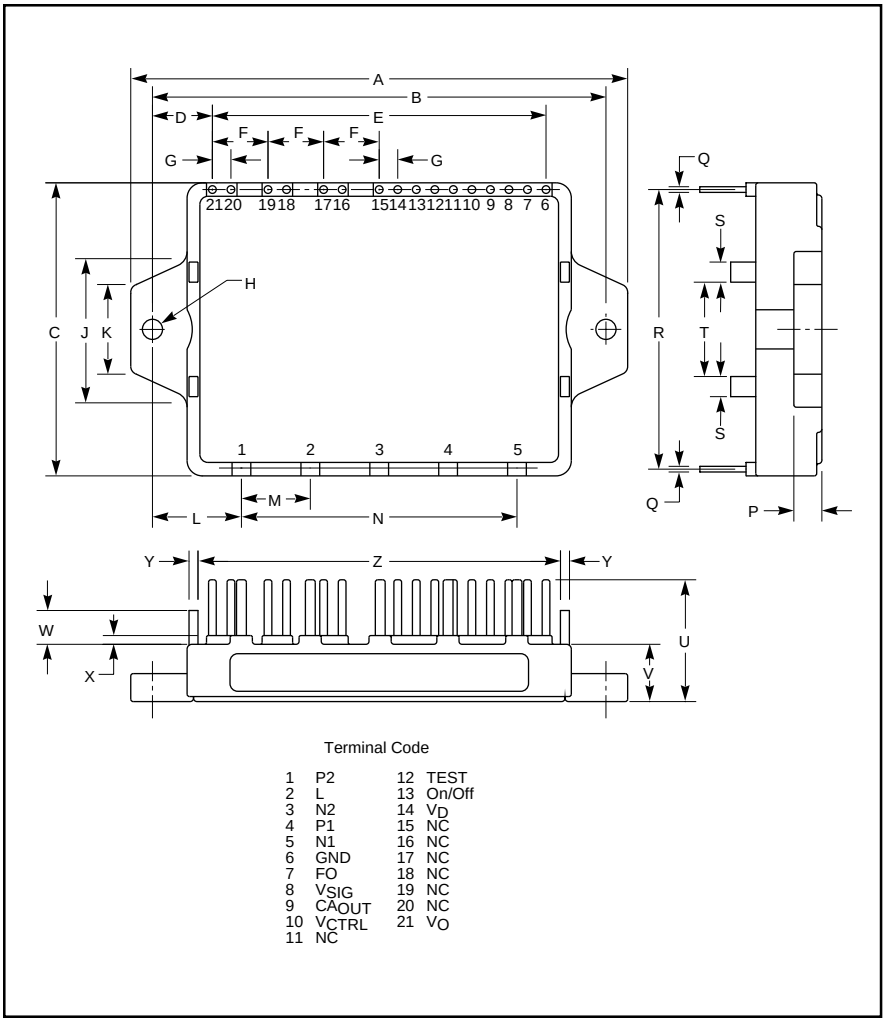
Powerex, Inc., 200 Hillis Street, Youngwood, Pennsylvania 15697-1800 (724) 925-7272

Intellimod™ Module Active Filter IPM

20 Amperes/600 Volts



Terminal Code

1	P2	12	TEST
2	L	13	On/Off
3	N2	14	V_D
4	P1	15	NC
5	N1	16	NC
6	GND	17	NC
7	FO	18	NC
8	V_{SIG}	19	NC
9	CA_{OUT}	20	NC
10	V_{CTRL}	21	V_O
11	NC		

Outline Drawing and Circuit Diagram

Dimensions	Inches	Millimeters
A	2.87±0.04	73.0±1.0
B	2.56±0.02	65.0±0.5
C	2.09	53.0
D	0.38	9.64
E	1.8±0.02	45.72±0.5
F	0.20	5.08
G	0.10	2.54
H	0.18	4.5
J	0.95	24.0
K	0.63	16.0
L	0.48	12.18
M	0.40±0.01	10.16±0.3

Dimensions	Inches	Millimeters
N	1.60±0.02	40.64±0.5
P	0.16±0.02	4.1±0.5
Q	0.02	0.6
R	1.98	50.4
S	0.10	2.5
T	0.77	19.5
U	0.63±0.04	16.0±1.0
V	0.31±0.02	8.0±0.5
W	0.14	3.5
X	0.04	1.0
Y	0.06	1.5
Z	2.09	53.0

Description:

Powerex Intellimod™ Intelligent Power Modules are isolated base modules designed for power switching applications operating at frequencies to 20kHz. The New Active Filter Intelligent Power Module (AFIPM) includes protection circuitry for the IGBT.

Features:

- ☐ Variable DC Output Voltage Control Function
- ☐ Soft Start Function
- ☐ Protection Logic
  - – Output Voltage Repression
  - – Output Over Voltage
  - – Under Voltage Lockout
  - – Over Temperature
  - – Short Circuit Current

Applications:

- ☐ Front End for Pulse Amplitude Modulation (PAM) Motor Control
- ☐ PFC (Power Factor Correction)

Ordering Information:

Use complete type name PM52AUBW060

PM52AUBW060
Intellimod™ Module
Active Filter IPM
20 Amperes/600 Volts

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

Characteristics	Symbol	PM52AUBW060	Units
Junction Temperature	T_j	–20 to 125	°C
Storage Temperature	T_{stg}	–40 to 125	°C
Case Operating Temperature (Note 1)	T_C	–20 to 100	°C
Mounting Torque M4 Mounting Screws	–	13	in-lb
Module Weight (Typical)	–	50	Grams
Output Voltage	V_O	370	Volts
Isolation Voltage, AC 1 Minute, 60Hz Sinusoidal	V_{RMS}	2500	Volts

Control Sector

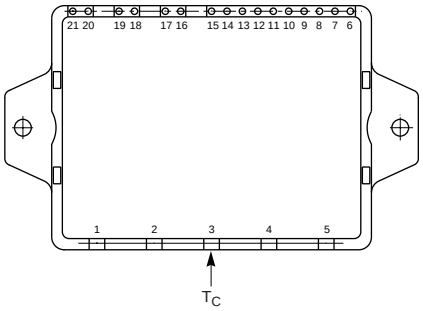
Supply Voltage (Applied between V_D-GND)	V_D	20	Volts
Control Voltage (Applied between V_{ctrl}-GND)	V_{ctrl}	0 ~ V_D	Volts
ON / OFF Signal Voltage	$V_{on/off}$	0 ~ VD	Volts

IGBT Sector

Supply Voltage (Applied between P_1-N_1)	Vi	255	V_{RMS}
Surge Supply Voltage (Applied between P_1-N_1, Surge Value, Non-operating)	$V_{CC(surge)}$	500	Volts
Surge Output Voltage (Applied between P_2-N_2, Surge Value, Non-operating)	$V_{O(surge)}$	500	Volts
Collector-Emitter Voltage	V_{CES}	600	Volts
Repetitive Peak Reverse Voltage	V_{RRM}	600	Volts
Input Current (100% Load, $T_C \leq 90°C$, V_i = 100 ~ 200, V_O = 300V)	I_i	20	A_{RMS}
Input Current (125% Load, $T_C \leq 90°C$, V_i = 100 ~ 200, V_O = 300V, Non-repetitive)	$I_{i(over\ load)}$	25	A_{RMS}
I^2t for Fusing (1 msec of Surge Current)	I^2t	120	A^2s
Load (V_i = 100V)		2.0	kW
Load (V_i = 200V)		4.0	kW

Note 1:

T_c Measurement Point



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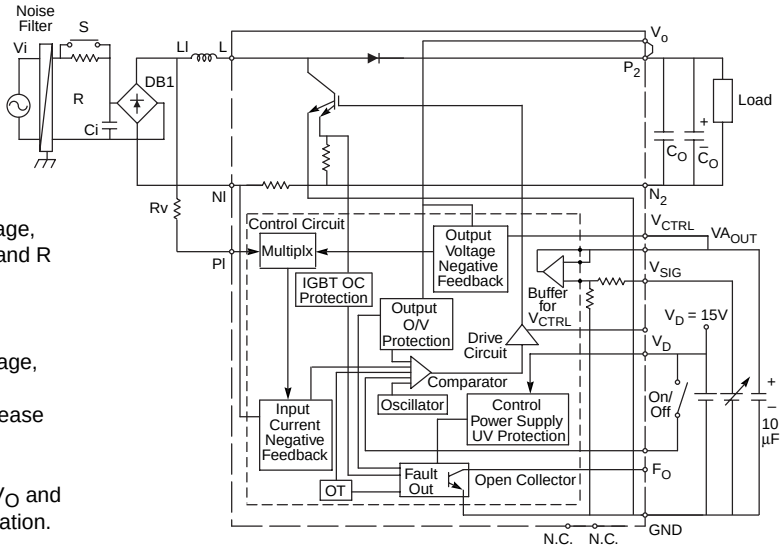
Electrical Characteristics, T_j = 25 °C unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Output Voltage Adjust (1)	V_O	V_i = 100V, LR = 400Ω, V_{sig} = 1.38V	353	360	367	Volts
Output Voltage Adjust (2)	V_O	V_i = 100V, LR = 400Ω, V_{sig} = 2.08V	293	300	307	Volts
Output Voltage Adjust (3)	V_O	V_i = 100V, LR = 400Ω, V_{sig} = 3.26V	193	200	207	Volts
Output Voltage Stability vs Input Voltage		V_O = 300V, LR = 400Ω				
(1-1)		$\frac{V_O(V_i = 90V) - V_O(V_i = 100V)}{V_O(V_i = 100V)}$ x 100%	-1	–	+1	%
(1-2)		$\frac{V_O(V_i = 110V) - V_O(V_i = 100V)}{V_O(V_i = 100V)}$ x 100%	-1	–	+1	%
Output Voltage Stability vs Load		V_i = 100V, V_O = 300V				
(2)		$\frac{V_O(Load = 400Ω) - V_O(Load = 48Ω)}{V_O(Load = 48Ω)}$ x 100%	0	–	+6	%
Output Voltage Stability vs Ambient Temperature		V_i = 100V, V_O = 300V, LR = 400Ω				
(3-1)		$\frac{V_O(T_a = -20°C) - V_O(T_a = +25°C)}{V_O(T_a = +25°C)}$ x 100%	-3	–	0	%
(3-2)		$\frac{V_O(T_a = +100°C) - V_O(T_a = +25°C)}{V_O(T_a = +25°C)}$ x 100%	0	–	+3	%
Rise Time		V_i = 100V, V_O = 300V, LR = 48Ω	–	–	100	ms
Over Shoot Voltage		V_i = 100V, V_O = 300V, LR = 400Ω, L1 = 1mH	–	–	30	Volts
Power Factor	cosΦ	V_i = 100V, V_O = 300V, LR = 400Ω	0.99	0.995	1.0	

Internal Function Block Diagram



Note 1:
When applying 200V class input voltage, please use In-rush current limitter S and R for stable and safe operation.

Note 2:
Selection of R_V:
When applying 200V class Input Voltage, please use 270kΩ, 0.25W.
When applying 100V input voltage please use R_V = 0Ω (short).

Note 3:
Please make sure to short between V_O and P2 terminals for stable and safe operation.

Control Sector

Supply Voltage	V_D	Applied between V_D-GND	13.5	15	16.5	Volts
Circuit Current (Active)	I_D		–	25	30	mA
Circuit Current	I_D		–	13	–	mA
Input ON Threshold Voltage	$V_{th(on)}$		–	2.75	3.3	Volts
Input OFF Threshold Voltage	$V_{th(off)}$		1.9	2.45	–	Volts
Switching Frequency	f_{SW}		18	20	22	kHz
Supply Circuit Under Voltage Protection	U_V	Trip Level (Note 2)	11.5	12.0	12.5	Volts
	U_{VR}	Reset Level (Note 2)	12.0	12.5	13.0	Volts
V_{ctrl} Current	I_{ctrl}	V_O = 300V, V_D = 15V, V_{ctrl} = 1.04V	–	-0.31	–	mA
Output Voltage Protection	OV_1	Trip Level (Note 2)	V_O+10	V_O+20	V_O+30	Volts
	OV_{1R}	Reset Level (Note 2)	OV1-9	OV1-7	OV1-5	Volts
Over Voltage Protection	OV_2	Trip Level (Note 2)	400	415	430	Volts
Short Circuit Current Trip Level	SC	Trip Level (Note 2)	–	150	–	A
Over Temperature Protection	OT	Trip Level (Note 2)	100	110	120	°C
	OT_R	Reset Level (Note 2)	–	90	–	°C
Fault Output Voltage	V_{FOH}	$I_{FOL} \leq 20\mu A$ (Non-operating)	4.5	–	–	Volts
	V_{FOL}	$I_{FOL} \leq 10mA$ (Operating)	–	–	1.0	Volts

Note 2:
Fault output is given when the internal UV protection (Auto-reset)
Fault output is not given when the internal OV1 protection (Auto-reset)
Fault output is given when the internal OV2 protection (Reset when ON/OFF [terminal 13] is low)
Fault output is given when the internal SC protection (Reset when ON/OFF [terminal 13] is low)
Fault output is given when the internal OT protection (Auto-reset)

Electrical Characteristics, (T_j = 25°C, V_D = 15V, L1 = 1mH, C_O = 1mF unless otherwise noted)

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
IGBT Sector						
Inductive Load Switching Times	$t_{C(on)}$	V_{CE} = 300V, I_{CE} = 30A,	–	0.07	–	µS
	$t_{C(off)}$	T_j = 125°C	–	0.24	–	µS
	t_{rr}	V_{CE} = 300V, I_F = 30A, T_j = 125°C	–	0.07	–	µS
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_{CE} = 50A	–	1.8	2.4	Volts
Diode Forward Voltage	V_{EC}	I_E = 50A	–	2.1	2.6	Volts
Collector-Emitter Cutoff Current	I_{CES}	V_{CE} = 600V	–	–	1.0	mA
Repetitive Peak Reverse Current	I_{RRM}	V_{RRM} = 600V	–	–	1.0	mA
Reverse Recovery Current	I_{rr}	V_{CE} = 300V, I_{CE} = 30A	–	45	–	A

Thermal Characteristics

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Units
Junction to Case Thermal Resistance	$R_{th(j-c)}$	IGBT	–	–	0.94	°C/Watt
	$R_{th(j-c)}$	FWDi	–	–	1.15	°C/Watt
Contact Thermal Resistance	$R_{th(c-f)}$	Case to Fin Per Module, Thermal Grease Applied	–	–	0.09	°C/Watt

Recommended Conditions for Use

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Units
Supply Voltage	V_i	Applied between P_1-N_1	90	–	255	V_{rms}
	V_D	Applied between V_D-GND	13.5	15	16.5	Volts
Input Current	I_i		–	–	20	Arms
Output Voltage	V_O		170	300	350	Volts
Load		V_i = 100V, V_O = 300V	100	–	2000	Watts
Reactor	L		–	1	–	mF
Input Capacitor	C_i		–	3.3	–	µF
Output Capacitor	C_O		1000	–	–	µF
	C_O'		–	3.3	–	µF

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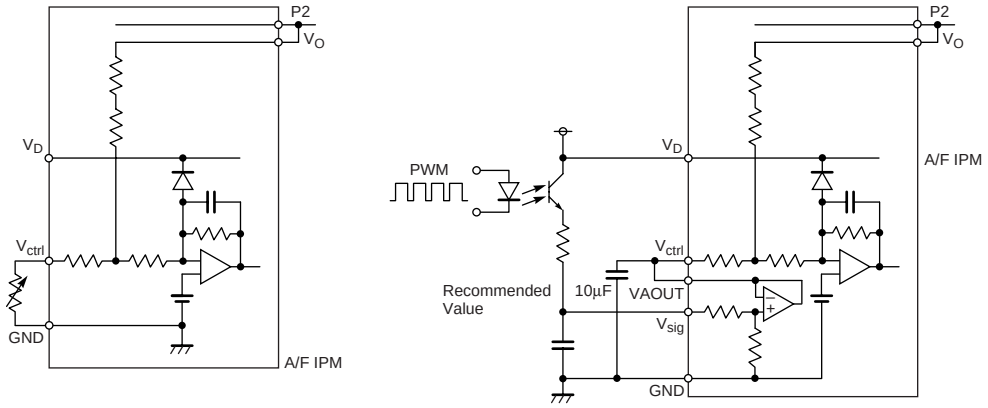
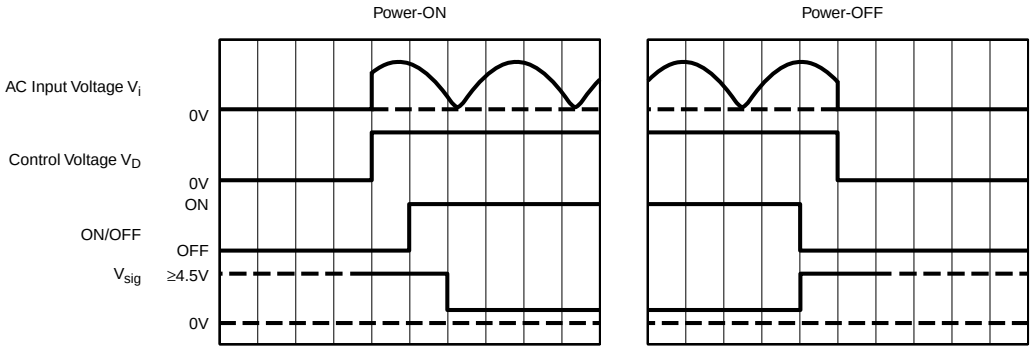
Circuit of Terminal V_{ctrl}

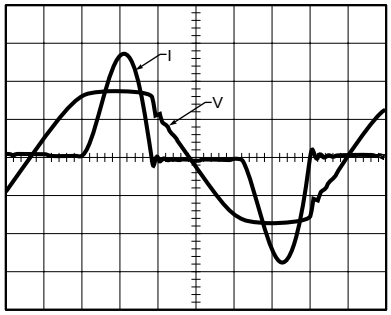


AC Input Voltage and Control Signal Timing Chart



Please apply the POWER-ON/OFF signals as described in the above timing chart.
And please apply to adjust the PAM control signal (V_{sig}) after turning on the ON/OFF switch.

AC Input Waveforms without A/F IPM



AC Input Waveform with A/F IPM