

PM52AUBW060

FLAT-BASE TYPE
INSULATED PACKAGE

PM52AUBW060



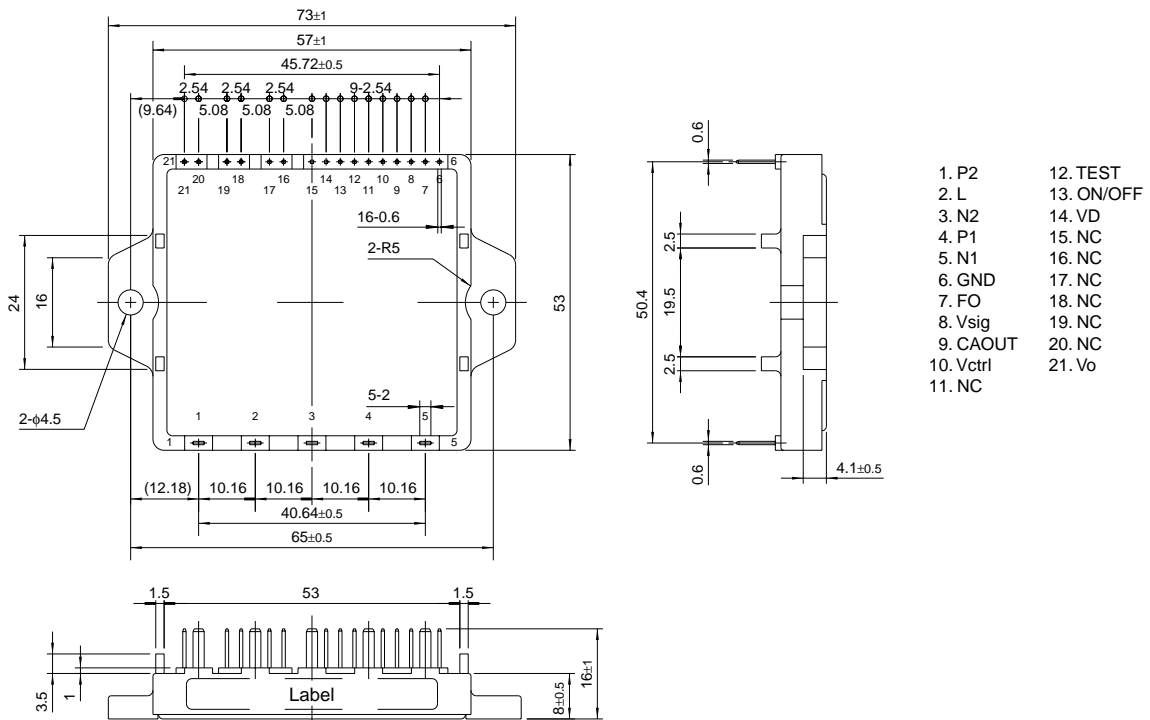
OUTLINE AND RATING

- A/F IPM Input Current Rating I_i: 100% load: 20A(rms)
125% load: 25A(rms), 1min.
- Variable DC Output Voltage Control Function
- With control function of output voltage repression under light load
- With Function of Soft Start
- Protection Functions
 - Output Voltage repression under light load ----- OV1
 - Output Over Voltage protection ----- OV2 (OV2 > OV1)
 - Under Voltage lockout protection ----- UV
 - Over Temperature protection ----- OT
 - Short circuit current protection ----- SC

APPLICATION

AC100V/20A, 200V/20A input Power Factor Corrector, PAM controller for Air Conditioner and General purpose Condenser Input Type Invertor use.

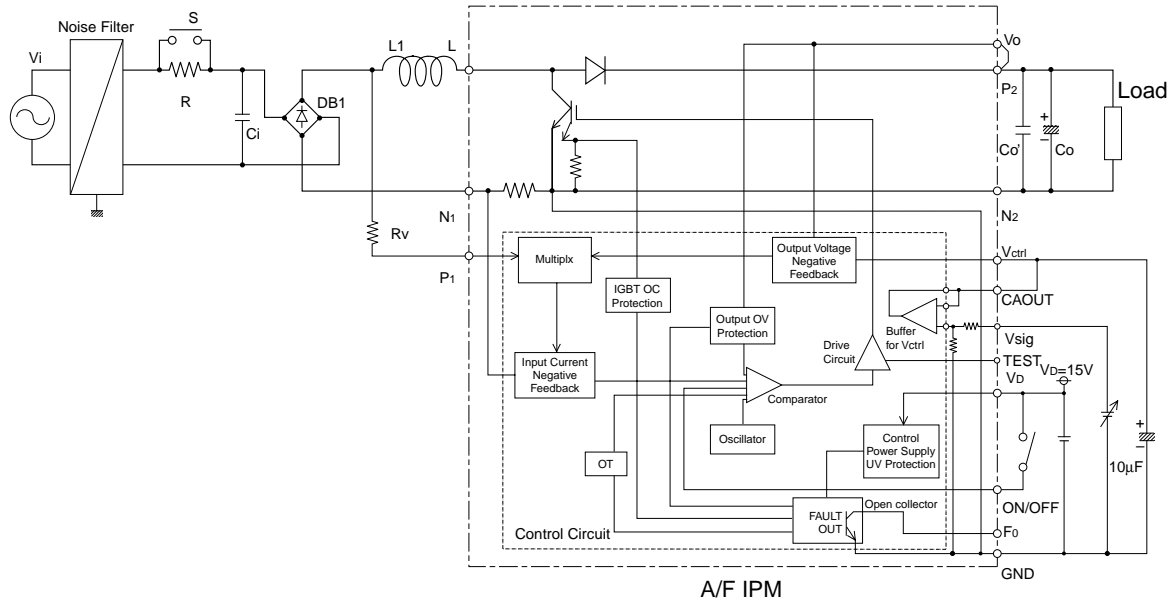
Fig.1 PACKAGE OUTLINES



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Fig.2 PM52AUBW060 INTERNAL FUNCTIONS BLOCK



Note 1: When applying 200V class input voltage, please use in-rush current blocking circuits S and R in order to prevent the AF IPM from being Damaged by the capacitor (Co)'s charge current when the power supply is turned on.

Note 2: For EMI suppression, please connect noise filter and Ci.

Note 3: For A/F IPM action, diode bridge (DB1) and DC reactor (L1) are necessary.

Note 4: Due to high-speed switching, a surge voltage can be easily generated between P2 and N2.

Because rectangular wave current that is switched by A/F IPM flows between P2-Co-N2, the area between P2-Co-N2 should be kept as small as possible (with short wiring.) Please use a high frequency electrolytic capacitor for the Co and connect it to a capacitor (Co') that is capable of handling high frequency such as polypropylene film capacitor.

Note 5: Please make sure to short-circuit between VO and P2 terminals because the VO terminal is output DC voltage negative feedback. When the VO terminal is opened, A/F IPM can be damaged.

Note 6: Recommended circuit constant:

$L = 1\text{mH}$, $C_i = 3.3\mu\text{F}$, $C_o' = 3.3\mu\text{F}$, $C_o = 1000\mu\text{F}$

Note 7: Selection of Rv:

7-1) When applying 100V input voltage, please use $R_v = 0\Omega$.

7-2) When applying 200V class input voltage, please use $270\text{k}\Omega$.

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MAXIMUM RATINGS (Tj = 25°C, unless otherwise noted)

MAIN CIRCUIT PART

Symbol	Parameter	Conditions	Ratings	Unit
Vi	Supply Voltage	Applied Between: L-N1, P1-N1	255	Vrms
Vi(surge)	Supply Voltage (surge)	Applied Between: L-N1, P1-N1, Surge value, Non-operating	500	V
VO(surge)	Output Voltage (surge)	Applied Between: P2-N2, Surge value, Non-operating	500	V
VCEs	Collector-Emitter Voltage	—	600	V
VRRM	Repetitive Peak Reverse Voltage	—	600	V
Ii	Input Current (100% Load)	Tc ≤ +90°C, Vi = 100~200V, Vo = 300V	20	Arms
Ii(OVER LOAD)	Input Current (125% Load)	Tc ≤ +90°C, Vi = 100~200V, Vo = 300V 1 min Non-repetitive	25	Arms
I ² t	I ² t for Fu sing	Value for 1msec of Surge Current	120	A ² s
—	Load	Vi = 100V	2.0	kW
—	Load	Vi = 200V	4.0	kW
Tj	Junction Temperature	(Note 1)	-20 ~ +125	°C

CONTROL PART

Symbol	Parameter	Conditions	Ratings	Unit
VD	Supply Voltage	Applied Between: VD-GND	20	V
Vsig	Control Voltage	Applied Between: Vsig-GND	0 ~ VD	V
VON/OFF	ON/OFF Signal Voltage	Applied Between: ON/OFF-GND	0 ~ VD	V

TOTAL SYSTEM

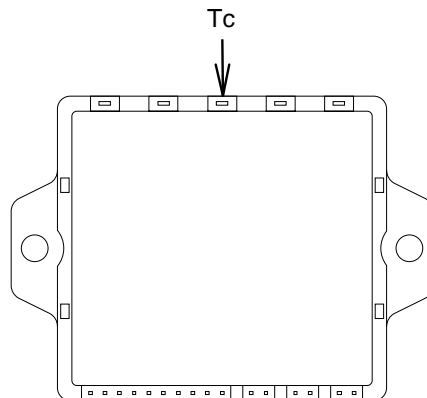
Symbol	Parameter	Conditions	Ratings	Unit
VO	Output Voltage	(Note 2)	370	V
Tc	Module Case Operating Temperature	(Note 3)	-20 ~ +100	°C
Tstg	Storage Temperature		-40 ~ +125	
Viso	Isolation Voltage	60Hz, Sinusoidal Charged part to Base, AC 1 min.	2500	Vrms

Note 1: The item defines the maximum junction temperature for the power elements (IGBT/Diode) of the A/F IPM to ensure safe operation. However, these power elements can endure junction temperature as high as 150°C if it is a short time. A/F IPM can use virtual junction temperature to 150°C if less than accumulation time 100hr.

Note 2: Peak value of output voltage VO (it has instantaneous value) is less than rated value (370V), including in the case that output voltage is overshooting.

Note 3: Tc measurement point: 3mm deep at the center of the side of the base plate.

Fig.3 Case Temperature (Tc) Measurement Point



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ELECTRICAL CHARACTERISTICS (T_j = 25°C, V_D = 15V, L₁ = 1mH, C_o = 1mF unless otherwise noted)

MAIN CIRCUIT PART

Symbol	Parameter	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
t _{c(on)}	Switching Time	V _{CE} = 300V, I _{CE} = 30A, T _j = 125°C	—	0.07	—	μs
t _{c(off)}			—	0.25	—	
t _{rr}			—	0.07	—	
V _{CE(sat)}	Collector-Emitter Saturation Voltage	I _{CE} = 50A	—	1.8	2.4	V
V _F	FWDi Forward Voltage	I _F = 50A	—	2.0	3.0	V
I _{CEs}	Collector-Emitter Cutoff Current	V _{CE} = 600V	—	—	1.0	mA
I _{RRM}	Repetitive Peak Reverse Current	V _{RRM} = 600V	—	—	1.0	mA
I _{rr}	Reverse Recovery Current	V _{CE} = 300V, I _{CE} = 30A	—	45	—	A

CONTROL PART

Symbol	Parameter	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
V _D	Supply Voltage	Applied between: V _D -GND	13.5	15	16.5	V
I _D	Circuit Current (Active)		—	25	30	mA
I _D	Circuit Current (Non-active)		—	13	—	mA
V _{th(ON)}	Input On Threshold Voltage		—	2.8	3.3	V
V _{th(OFF)}	Input Off Threshold Voltage		1.9	2.4	—	V
f _{sw}	Switching Frequency		18	20	22	kHz
UV	Supply Circuit Under Voltage Protection	Trip Level (Note 4)	11.5	12.0	12.5	V
UV _r		Reset Level (Note 4)	12.0	12.5	13.0	V
I _{ctrl}	V _{ctrl} Current	V _O = 300V, V _D = 15V, V _{ctrl} = 1.04V	—	-0.31	—	mA
OV1	Output Voltage Protection	Trip Level (Note 5)	V _O +10	V _O +20	V _O +30	V
OV1 _r		Reset Level (Note 5)	OV1-9	OV1-7	OV1-5	V
OV2	Over Voltage Protection	Trip Level (Note 6)	400	415	430	V
SC	Short Circuit Current Trip Level	Trip Level (Note 7)	—	150	—	A
OT	Oner Temperature Protection	Trip Level (Note 8)	100	110	120	°C
OT _r		Reset Level (Note 8)	—	90	—	°C
I _{FoH}	Fault Output Current	V _D = 15V, V _{Fo} = 15V (Non-Operating)	—	—	20	μA
V _{FoL}	Fault Output Voltage	V _D = 15V, I _{FoL} = 10mA (Operating)	—	—	1.0	V
t _{Fo}	Fault Output Pulse Width	V _D = 15V (Operating)	1.0	1.8	—	ms

Note 4: Fault output is given when the internal UV protection (Auto-reset)

Note 5: Fault output is not given when the internal OV1 protection (Auto-reset)

Note 6: Fault output is given when the internal OV2 protection (Reset when ON/OFF (Terminal-11) is Low)

Note 7: Fault output is given when the internal SC protection (Reset when ON/OFF (Terminal-11) is Low)

Note 8: Fault output is given when the internal OT protection (Auto-reset)

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TOTAL SYSTEM

Symbol	Parameter	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
Vo	Output Voltage Adjust (1)	Vi = 100V, LR = 400Ω, Vsig = 1.38V	351	360	369	V
Vo	Output Voltage Adjust (2)	Vi = 100V, LR = 400Ω, Vsig = 2.08V	291	300	309	V
Vo	Output Voltage Adjust (3)	Vi = 100V, LR = 400Ω, Vsig = 3.26V	191	200	209	V
—	Output Voltage Stability (1-1) (vs Input Voltage)	Vo = 300V, LR = 400Ω $\frac{Vo (Vi = 90V) - Vo (Vi = 100V)}{Vo (Vi = 100V)} \times 100 (\%)$	-1	—	+1	%
—	Output Voltage Stability (1-2) (vs Input Voltage)	Vo = 300V, LR = 400Ω $\frac{Vo (Vi = 110V) - Vo (Vi = 100V)}{Vo (Vi = 100V)} \times 100 (\%)$	-1	—	+1	%
—	Output Voltage Stability (2) (vs Load)	Vi = 100V, Vo = 300V $\frac{Vo (Load = 400\Omega) - Vo (Load = 48\Omega)}{Vo (Load = 400\Omega)} \times 100 (\%)$	0	—	+6	%
—	Output Voltage Stability (3-1) (vs Ambient Temp.)	Vi = 100V, Vo = 300V, LR = 400Ω $\frac{Vo (Ta = -20^{\circ}C) - Vo (Ta = +25^{\circ}C)}{Vo (Ta = +25^{\circ}C)} \times 100 (\%)$	-3	—	0	%
—	Output Voltage Stability (3-2) (vs Ambient Temp.)	Vi = 100V, Vo = 300V, LR = 400Ω $\frac{Vo (Ta = +100^{\circ}C) - Vo (Ta = +25^{\circ}C)}{Vo (Ta = +25^{\circ}C)} \times 100 (\%)$	0	—	+3	%
—	Rise Time	Vi = 100V, Vo = 300V, LR = 48Ω	—	—	100	ms
—	Over Shoot Voltage	Vi = 100V, Vo = 300V, LR = 400Ω, L1 = 1mH	—	—	30	V
cosφ	Power Factor	Vi = 100V, Vo = 300V, LR = 48Ω	0.99	0.995	1.0	—

THERMAL RESISTANCE

Symbol	Parameter	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
Rth(j-c)Q	Junction to case Thermal Resistance	IGBT	—	—	0.94	°C/W
Rth(j-c)Di		FWDi	—	—	1.15	
Rth(c-f)	Contact Thermal Resistance	Case to fin, (per 1 module) Thermal grease applied	—	—	0.09	

MECHANICAL RATINGS AND CHARACTERISTICS

Symbol	Parameter	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
—	Mounting torque	Mounting part screw: M3.5	0.78	0.98	1.18	N·m
—	Weight	—	—	50	—	g

RECOMMENDED CONDITIONS FOR USE

Symbol	Parameter	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
Vi	Supply Voltage	Applied Between: P1-N1	90	—	255	Vrms
Vd	Supply Voltage	Applied Between: Vd-GND	13.5	15	16.5	V
Ii	Input Current		—	—	20	Arms
Vo	Output Voltage		170	300	350	V
—	Load	Vi = 100V, Vo = 300V	100	—	2000	W
L	Reactor		—	1	—	mH
Ci	Input Capacitor		—	3.3	—	μF
Co	Output Capacitor		1000	—	—	μF
Co'	Output Capacitor		—	3.3	—	μF

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Fig.4 CIRCUIT OF TERMINAL Vctrl

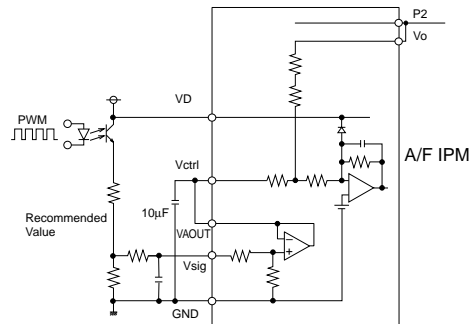
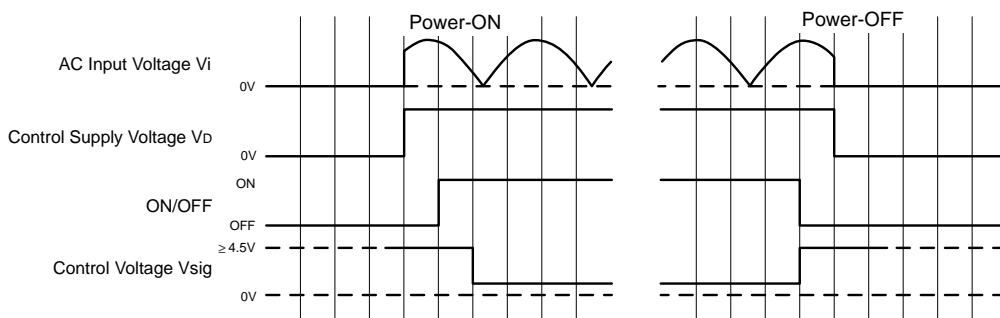
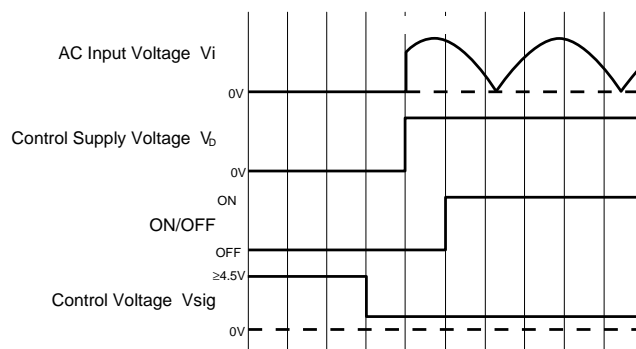


Fig.5-1 AC INPUT VOLTAGE AND CONTROL SIGNAL TIMING CHART



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

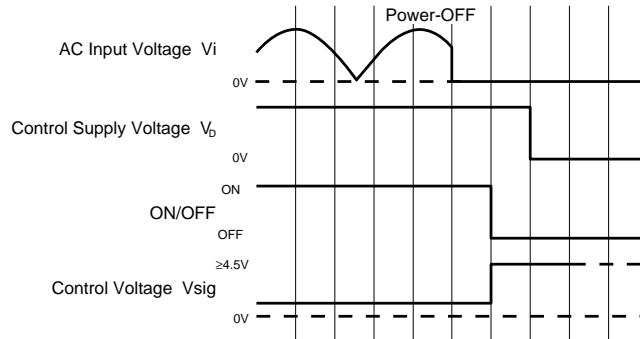
Fig.5-2 AC INPUT VOLTAGE AND CONTROL SIGNAL TIMING CHART (After Vsig set up, ON/OFF signal OFF → ON)



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Fig.5-3 AC INPUT VOLTAGE AND CONTROL SIGNAL TIMING CHART (After V_i cut-off, ON/OFF signal ON → OFF)



In condition to use A/F IPM by external circuit connection of Fig.2, A/F IPM is not damaged in the sequence of Fig.5-3 as well.

A/F IPM is not damaged in the sequence of Fig.5-2 and Fig.5-3, but give it when unavoidable. Please normally supply/cut-off the input power supply and input signals by the sequence of Fig.5-1.

Fig.6 AC INPUT WAVEFORMS WITHOUT A/F IPM

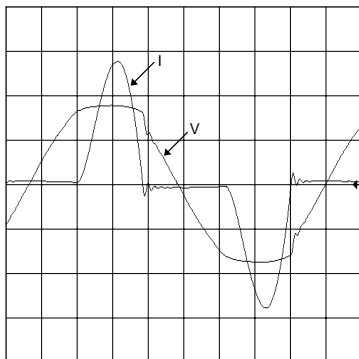


Fig.7 AC INPUT WAVEFORM WITH A/F IPM

