PM52AUBW060

FLAT-BASE TYPE
INSULATED PACKAGE

PM52AUBW060

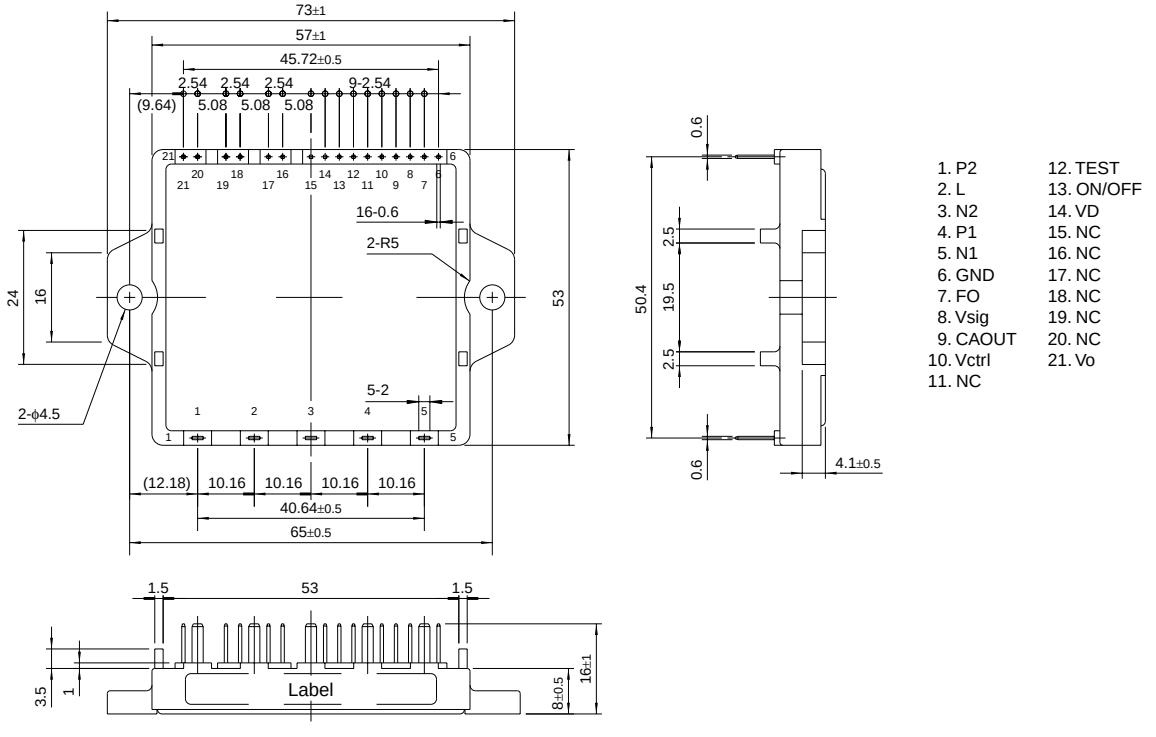
OUTLINE AND RATING

- A/F IPM Input Current Rating Ii: 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 contoroller for Air Conditioner and General purpose Condenser Input Type Invertor use.

Fig.1 PACKAGE OUTLINES



1. P2	12. TEST
2. L	13. ON/OFF
3. N2	14. VD
4. P1	15. NC
5. N1	16. NC
6. GND	17. NC
7. FO	18. NC
8. Vsig	19. NC
9. CAOUT	20. NC
10. Vctrl	21. Vo
11. NC	

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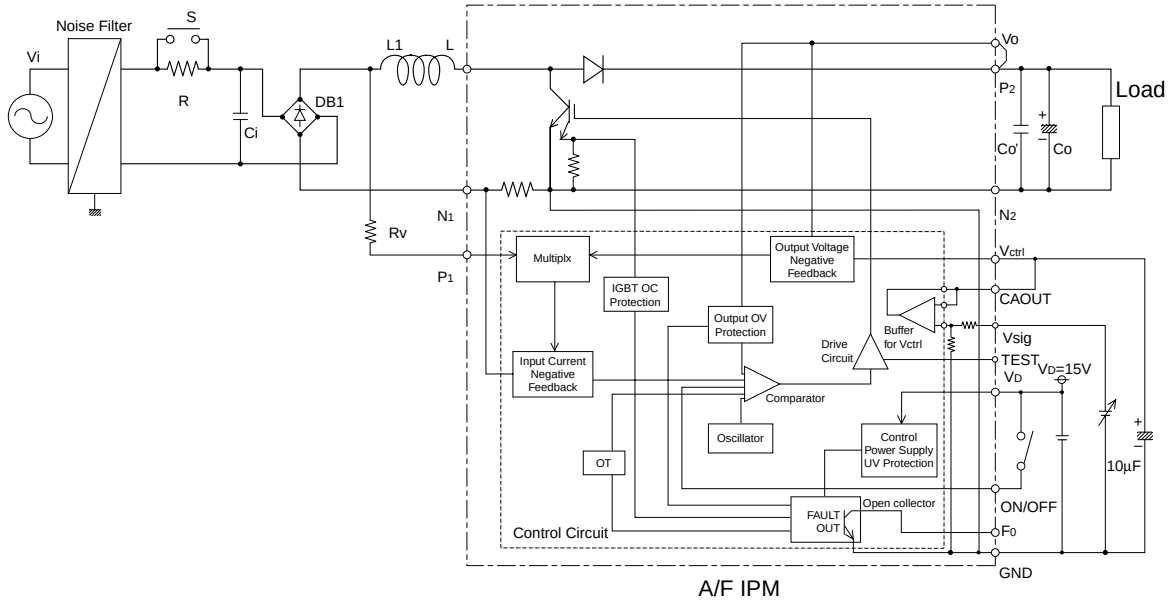
Fig.2 PM52AUBW060 INTERNAL FUNCTIONS BLOCK



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 a 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 = 1mH, Ci = 3.3µF, Co' = 3.3µF, Co = 1000µF
Note 7: Selection of Rv:
7-1) When applying 100V input voltage, please use Rv = 0Ω.
7-2) When applying 200V class input voltage, please use 270kΩ.

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

MAIN CIRCUIT PART

Symbol	Parameter	Conditions	Ratings	Unit
V_i	Supply Voltage	Applied Between: L-N1, P1-N1	255	V_{rms}
$V_{i(surge)}$	Supply Voltage (surge)	Applied Between: L-N1, P1-N1, Surge value, Non-operating	500	V
$V_{O(surge)}$	Output Voltage (surge)	Applied Between: P2-N2, Surge value, Non-operating	500	V
V_{CES}	Collector-Emitter Voltage	—	600	V
V_{RRM}	Repetitive Peak Reverse Voltage	—	600	V
I_i	Input Current (100% Load)	$T_C \leq +90°C$, V_i = 100~200V, V_O = 300V	20	A_{rms}
$I_{i(OVER\ LOAD)}$	Input Current (125% Load)	$T_C \leq +90°C$, V_i = 100~200V, V_O = 300V 1 min Non-repetitive	25	A_{rms}
I^2t	I^2t for Fu sing	Value for 1msec of Surge Current	120	A^2s
—	Load	V_i = 100V	2.0	kW
—	Load	V_i = 200V	4.0	kW
Tj	Junction Temperature	(Note 1)	–20 ~ +125	°C

CONTROL PART

Symbol	Parameter	Conditions	Ratings	Unit
V_D	Supply Voltage	Applied Between: V_D-GND	20	V
V_{sig}	Control Voltage	Applied Between: V_{sig}-GND	0 ~ V_D	V
$V_{ON/OFF}$	ON/OFF Signal Voltage	Applied Between: ON/OFF-GND	0 ~ V_D	V

TOTAL SYSTEM

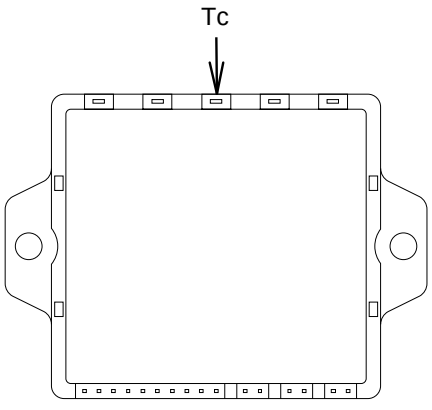
Symbol	Parameter	Conditions	Ratings	Unit
V_O	Output Voltage	(Note 2)	370	V
T_C	Module Case Operating Temperature	(Note 3)	–20 ~ +100	°C
T_{stg}	Storage Temperature		–40 ~ +125	
V_{iso}	Isolation Voltage	60Hz, Sinusoidal Charged part to Base, AC 1 min.	2500	V_{rms}

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 V_O (it has instantaneous value) is less than rated value (370V), including in the case that output voltage is overshooting.

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

Fig.3 Case Temperature (Tc) Measurement Point



ELECTRICAL CHARACTERISTICS (Tj = 25°C, V_D = 15V, L1 = 1mH, Co = 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, Tj = 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
UVr		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
OV1r		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
OTr		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.	
V_O	Output Voltage Adjust (1)	V_i = 100V, LR = 400Ω, Vsig = 1.38V	351	360	369	V
V_O	Output Voltage Adjust (2)	V_i = 100V, LR = 400Ω, Vsig = 2.08V	291	300	309	V
V_O	Output Voltage Adjust (3)	V_i = 100V, LR = 400Ω, Vsig = 3.26V	191	200	209	V
—	Output Voltage Stability (1-1) (vs Input Voltage)	V_O = 300V, LR = 400Ω $\frac{V_O (V_i = 90V) - V_O (V_i = 100V)}{V_O (V_i = 100V)} \times 100$ (%)	–1	—	+1	%
—	Output Voltage Stability (1-2) (vs Input Voltage)	V_O = 300V, LR = 400Ω $\frac{V_O (V_i = 110V) - V_O (V_i = 100V)}{V_O (V_i = 100V)} \times 100$ (%)	–1	—	+1	%
—	Output Voltage Stability (2) (vs Load)	V_i = 100V, V_O = 300V $\frac{V_O (Load = 400Ω) - V_O (Load = 48Ω)}{V_O (Load = 400Ω)} \times 100$ (%)	0	—	+6	%
—	Output Voltage Stability (3-1) (vs Ambient Temp.)	V_i = 100V, V_O = 300V, LR = 400Ω $\frac{V_O (Ta = –20°C) - V_O (Ta = +25°C)}{V_O (Ta = +25°C)} \times 100$ (%)	–3	—	0	%
—	Output Voltage Stability (3-2) (vs Ambient Temp.)	V_i = 100V, V_O = 300V, LR = 400Ω $\frac{V_O (Ta = +100°C) - V_O (Ta = +25°C)}{V_O (Ta = +25°C)} \times 100$ (%)	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	V
cosϕ	Power Factor	V_i = 100V, V_O = 300V, LR = 48Ω	0.99	0.995	1.0	—

THERMAL RESISTANCE

Symbol	Parameter	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
$R_{th(j-c)Q}$	Junction to case Thermal Resistance	IGBT	—	—	0.94	°C/W
$R_{th(j-c)Di}$		FWDi	—	—	1.15	
$R_{th(c-f)}$	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.	
V_i	Supply Voltage	Applied Between: P1-N1	90	—	255	V_{rms}
V_D	Supply Voltage	Applied Between: V_D-GND	13.5	15	16.5	V
I_i	Input Current		—	—	20	A_{rms}
V_O	Output Voltage		170	300	350	V
—	Load	V_i = 100V, V_O = 300V	100	—	2000	W
L	Reactor		—	1	—	mH
Ci	Input Capacitor		—	3.3	—	µF
Co	Output Capacitor		1000	—	—	µF
Co'	Outrut Capacitor		—	3.3	—	µF

Fig.4 CIRCUIT OF TERMINAL V_{ctrl}

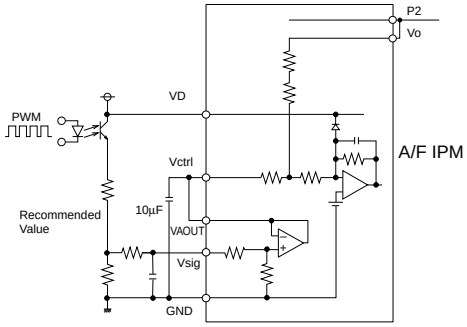
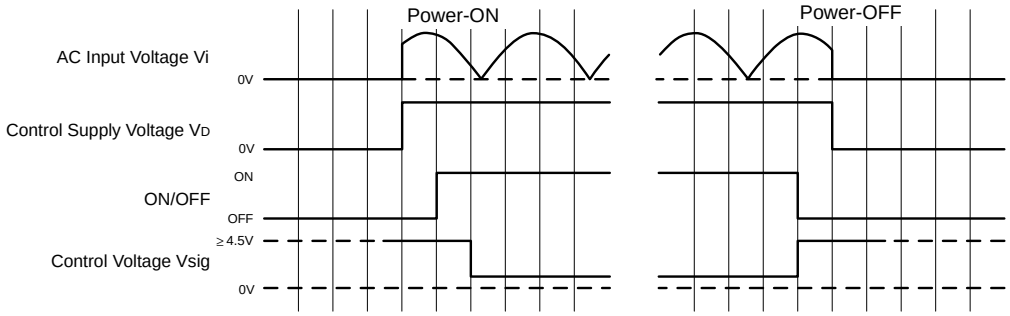


Fig.5-1 AC INPUT VOLTAGE AND CONTROL SIGNAL TIMING CHART



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)

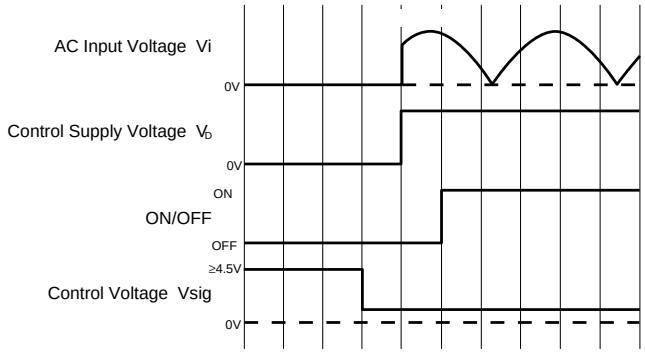
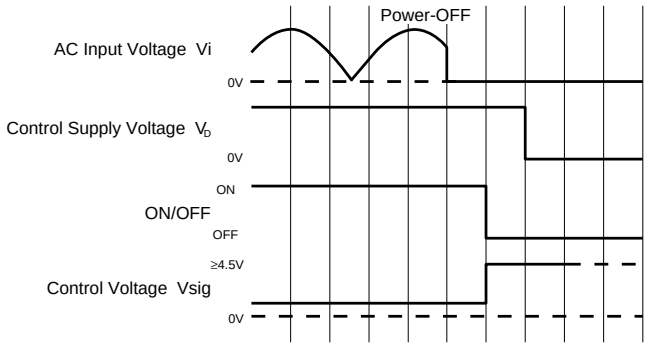


Fig.5-3 AC INPUT VOLTAGE AND CONTROL SIGNAL TIMING CHART (After Vi cut-off, ON/OFF signal ON → OFF)



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

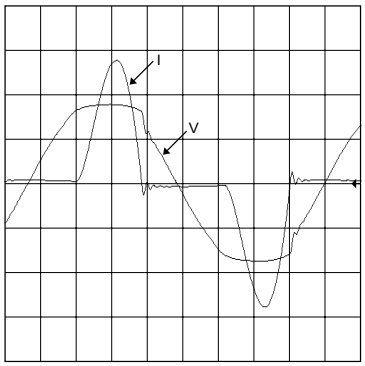


Fig.7 AC INPUT WAVEFORM WITH A/F IPM