PM52AUBW060

FLAT-BASE TYPE
INSULATED PACKAGE

PM52AUBW060

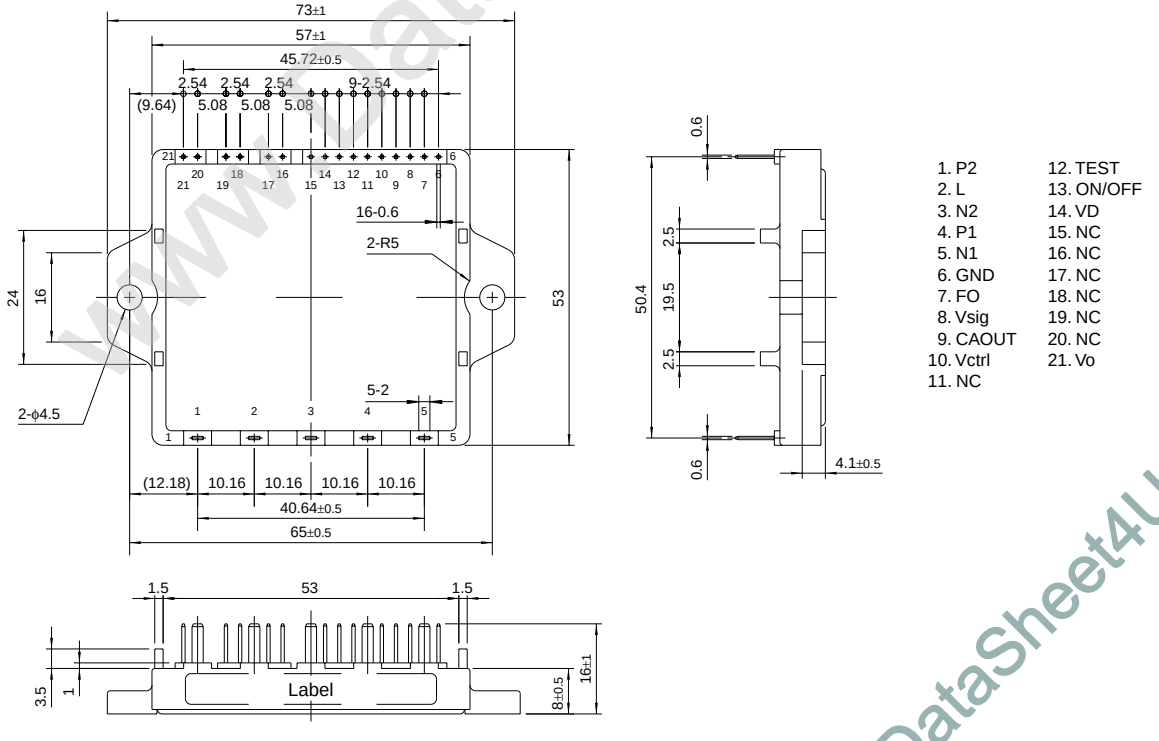
OUTLINE AND RATING

- 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

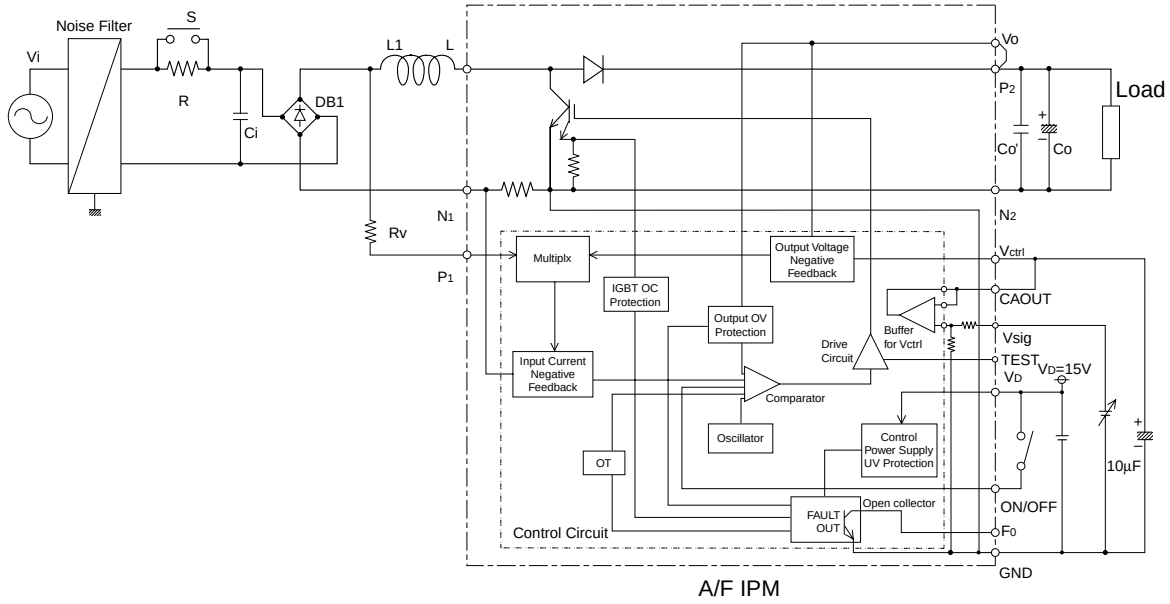
AC100V/20A, 200V/20A input Power Factor Corrector, PAM contoroller for Air Conditioner and General purpose Condenser Input Type Invertor use.

Fig.1 PACKAGE OUTLINES



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

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

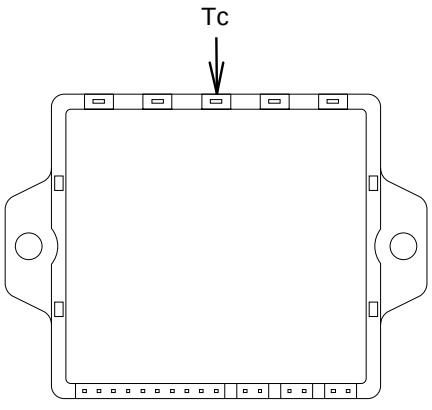
Symbol	Parameter	Conditions	Ratings	Unit
V_O	Output Voltage	(Note 2)	370	V
T_C	Module Case Operating Temperature	(Note 3)	–20 ~ +100	°C
T_{stg}	Storage Temperature		–40 ~ +125	
V_{iso}	Isolation Voltage	60Hz, Sinusoidal Charged part to Base, AC 1 min.	2500	V_{rms}

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)

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}

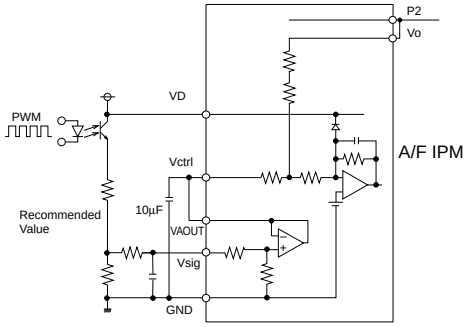
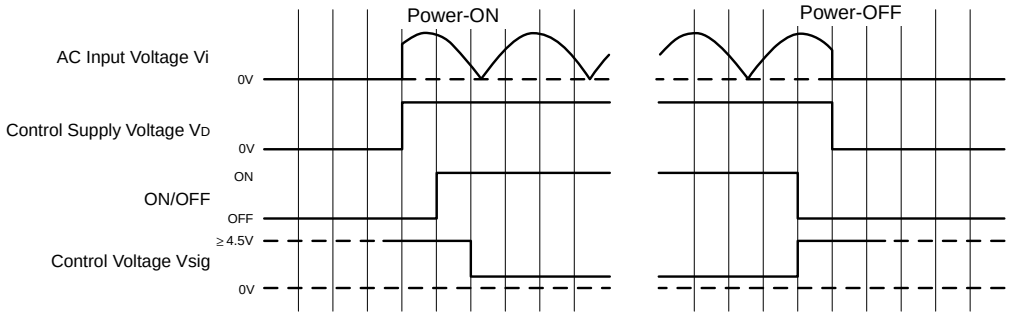


Fig.5-1 AC INPUT VOLTAGE AND CONTROL SIGNAL TIMING CHART



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)

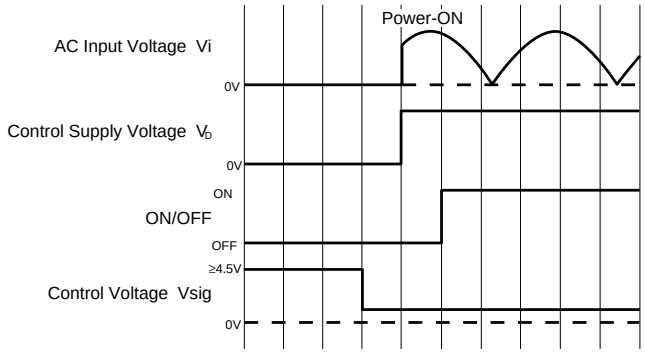
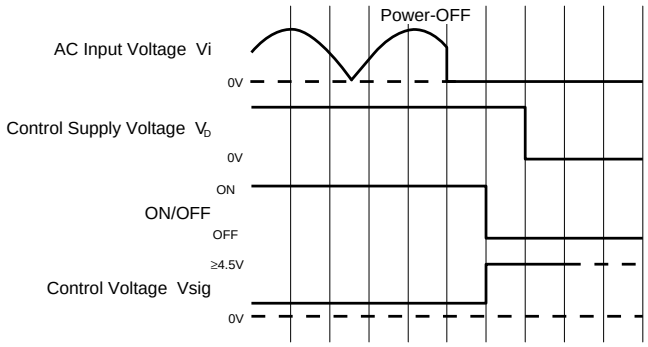


Fig.5-3 AC INPUT VOLTAGE AND CONTROL SIGNAL TIMING CHART (After Vi cut-off, ON/OFF signal ON → OFF)



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

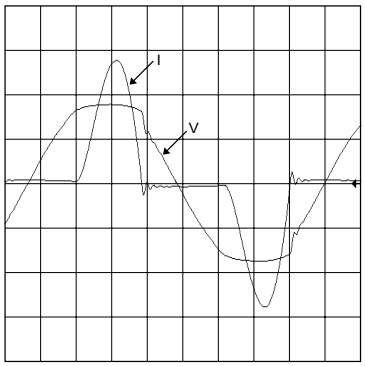


Fig.7 AC INPUT WAVEFORM WITH A/F IPM