PM56005A-60P Datasheet

600V, 5A, 3Phase Inteligent Power Module

Version：Rev.1.0

Release Date：2025-06-23

PANJIT International Inc.

www.panjit.com.tw

FEATURES

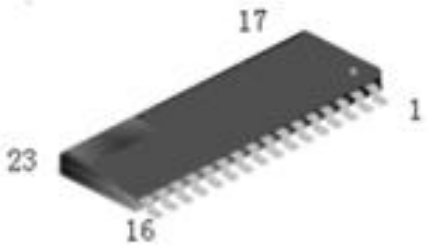
- Built-in six 6A/600V fast recovery power MOSFET
- Built-in high-voltage gate driver circuit (HVIC)
- Built-in undervoltage protection
- Built-in bootstrap diode
- Fully compatible with 3.3V and 5V MCU interfaces, active-high logic
- Temperature sensing function
- Three independent negative DC terminals for inverter current sensing applications
- Low-EMI optimized design
- Insulation rating：1500Vrms/min

APPLICATIONS

- Indoor and outdoor air conditioners
- Refrigerator compressors
- Exhaust fans
- Air purifiers
- Dishwasher pumps

MECHANICAL PROPERTIES

- Package：SOP23
- Encapsulation material: UL flammability classification rating 94V-0
- Pins: Dark tin-plated leads; solderability standard MIL-STD-202, Method 208



SOP23

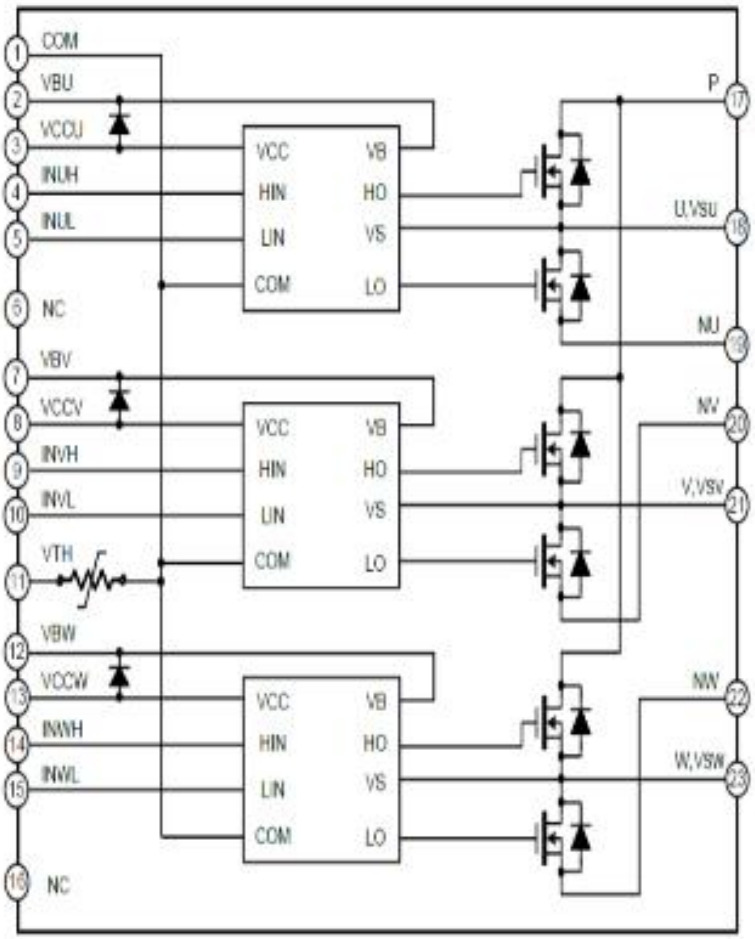
ORDERING INFORMATION

ORDER NUMBER	Marking ID	Package	Description
PM56005A-60P	PM56005A 60PYMDNN	SOP-23	Halogen Free RoHS compliant in Tube, 640pcs/bag

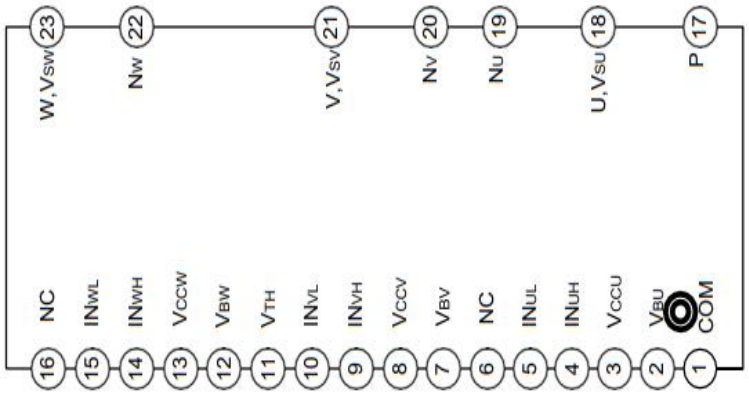
MARKING INFORMATION

Marking	Package	Definition
PM56005A 60PYMDNN	SOP-23	Product code : PM56005A, Voltage/Package code : 60P Y : Year code M : Month code D : Day code NN: Serial Number

FUNCTION BLOCK DIAGRAM

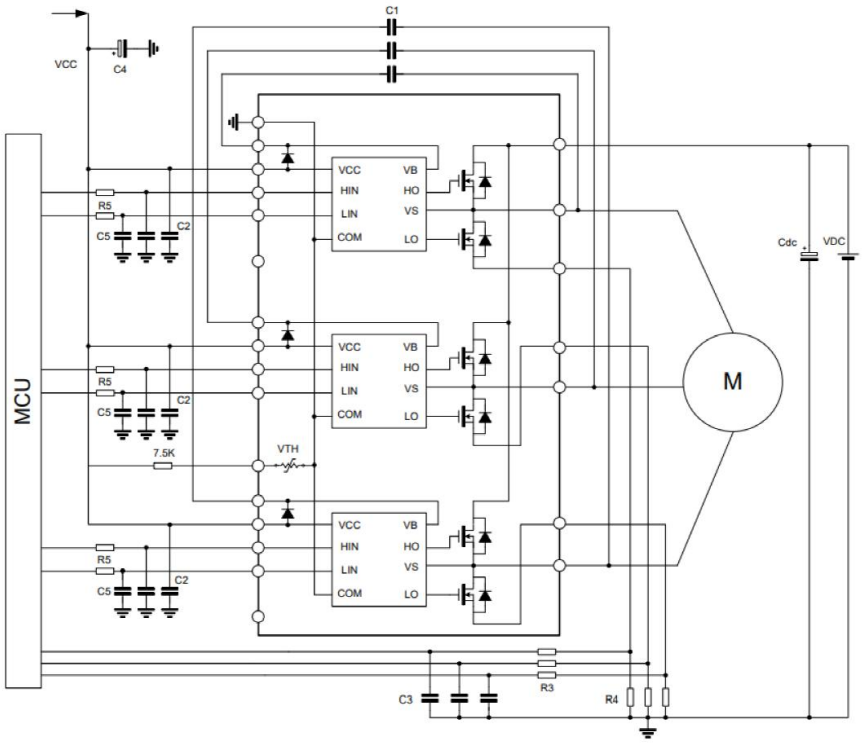


PIN CONFIGURATION



Terminal		Description
Pin No.	Name	
1	COM	Common ground
2	V_{BU}	U-phase high-side floating power supply voltage
3	V_{CCU}	U-phase high and low drive power supply voltage
4	IN_{UH}	U-phase high-side signal input
5	IN_{UL}	U-phase low-side signal input
6	NC	No connection
7	V_{BV}	V-phase high-side floating power supply voltage
8	V_{CCV}	V-phase high and low drive power supply voltage
9	IN_{VH}	V-phase high side signal input
10	IN_{VL}	V-phase low-side signal input
11	VTH	Thermistor output
12	V_{BW}	W-phase high-side floating power supply voltage
13	V_{CCW}	W-phase high and low drive power supply voltage
14	IN_{WH}	W-phase high-side signal input
15	IN_{WL}	W-phase low-side signal input
16	NC	No connection
17	P	DC positive terminal
18	U, V_{SU}	U-phase output and high-side floating ground
19	NU	U-phase DC negative terminal
20	NV	V-phase DC negative terminal
21	V, V_{SV}	W-phase DC negative terminal
22	NW	W phase DC negative terminal
23	W, V_{SW}	W-phase output and high-side floating ground for W-phase drive

TYPICAL APPLICATION CIRCUIT



Note:

(1)The connection of each input pin should be as short as possible to prevent malfunctions. Additionally, an RC filter circuit can be added at the input to suppress surge noise caused by unintended signals.

(2)External capacitors should be placed as close as possible to the IPM pins.

(3)To prevent surge damage, in addition to the filter capacitor, it is recommended to add a high-frequency, non-inductive smoothing capacitor between PN. The capacitor connection should also be kept as short as possible.

(4)It is recommended to add a filter capacitor at the VCC input, with a capacitance of at least seven times that of the bootstrap capacitor C1.

(5)A high-frequency capacitor is recommended for the bootstrap capacitor C1 to effectively absorb high-frequency ripple currents. Its capacitance should be greater than 2.2uF.

(6)The connection between the current-limiting resistor R4 and the IPM should be as short as possible to prevent excessive surge voltage due to connection inductance.

(7)Pin 11 is the NTC output pin, and it is recommended to connect a 7.5 kΩ pull-up resistor to VCC.

ABSOLUTE MAXIMUM RATINGS

T_A = 25°C unless otherwise specified

Symbol	Parameter	Rating	Unit
V_{PN}	Applied to P-N Power Voltage	600	V
I_{D25}	Continuous Drain Current per MOSFET (T_C = 25°C)	3.6	A
I_{D80}	Continuous Drain Current per MOSFET (T_C = 80°C)	2.4	A
I_{DP}	Peak Drain Current of a Single MOSFET, Pulse Width of Less Than 100μs at T_C = 25°C	6	A
V_{CC}	Control Supply Voltage	20	V
V_{BS}	High-Side Control Voltage	20	V
V_{IN}	Input Signal Voltage	-0.3~V_{CC}+0.3	V
V_{ISO}	Insulation Voltage: 60Hz Sine Wave, AC, 1 Minute, from Connecting Pin to Heat Sink	1500	V_{rms}

THERMAL CHARACYERISTICS

Symbol	Parameter	Rating	Unit
P_D	Maximum Power Dissipation (Tc = 25°C)	83	W
$R_{\theta JC}$	Thermal Resistance, Junction to Case	8.5	°C/W
T_C	Operating Case Temperature Range	-40~ +125	°C
T_J	Operating Junction Temperature Range	-40~ +150	°C
T_{STG}	Storage Temperature Range	-40 ~ +125	°C

RECOMMENDED OPERATING CONDITIONS

T_A = 25°C unless otherwise specified

Symbol	Parameter	Values			Unit
		Min	Typ	Max	
V_{PN}	Power Supply Voltage	-	360	480	V
V_{CC}	Control Supply Voltage	13.5	15	16.5	V
V_{BS}	High-Side Control Voltage	13.5	15	16.5	V
$V_{IN\ (ON)}$	Input Turn-On Threshold Voltage	3	-	V_{CC}	V
$V_{IN\ (OFF)}$	Input Turn-Off Threshold Voltage	0	-	0.8	V
T_{DEAD}	Dead Time to Prevent Short-Circuit in Bridge Arm V_{CC} = V_{BS} = 13.5~16.5V, T_J ≤150°C	1.0	-	-	μs
f_{PWM}	PWM Switching Frequency, T_J ≤ 150°C	-	15	-	kHz

ELECTRICAL CHARACTERISTICS

Inverter Section – Specifically for a Single Fast Recovery MOSFET

T_A = 25°C, V_{CC} = V_B = 15V，V_S = COM = 0 unless otherwise specified.

Symbol	Parameter	Condition	Min	Typ	Max	Unit
BV_{DSS}	Drain-to-Source Breakdown Voltage (with Zero Gate Voltage)	V_{IN} = 0V, I_D = 250μA(1)	600	-	-	V
I_{DSS}	Drain Current	V_{IN} = 0V, V_{DS} = 500V	-	-	1	μA
$R_{DS(ON)}$	Static Drain-to-Source On-Resistance	V_{CC} = V_{BS} = 15V, V_{IN} = 5V, I_D = 1.2A	-	1.7	2.0	Ω
V_{SD}	Forward Voltage of Drain-to-Source Diode	V_{CC} = V_{BS} = 15V, V_{IN} = 0V, I_D = -1.2A	-	-	1.2	V
t_{ON}	Switching Time	V_{PN} = 250V V_{CC} = V_{BS} = 15V I_D = 1.2A V_{IN} = 0V~5V Inductive load(2)	-	700	900	ns
t_{OFF}			-	170	300	ns
t_{RR}			-	87	-	ns
E_{ON}			-	70	-	μJ
E_{OFF}			-	10	-	μJ

Note:

(1)BV_{DSS} refers to the maximum voltage limit between the source and drain of each power MOSFET. In practical applications, considering the influence of stray inductance,，V_{PN} voltage should be much lower than this value to ensure that the voltage applied to the MOSFET at any time does not exceed BV_{DSS}

(2)t_{ON} and t_{OFF} include the internal transmission delay of the HVIC. The typical values listed are test values under laboratory test conditions and may vary in practical applications depending on the printed circuit board and circuitry used. For detailed definitions and test circuits of switching times, please refer to Figure 2 below.

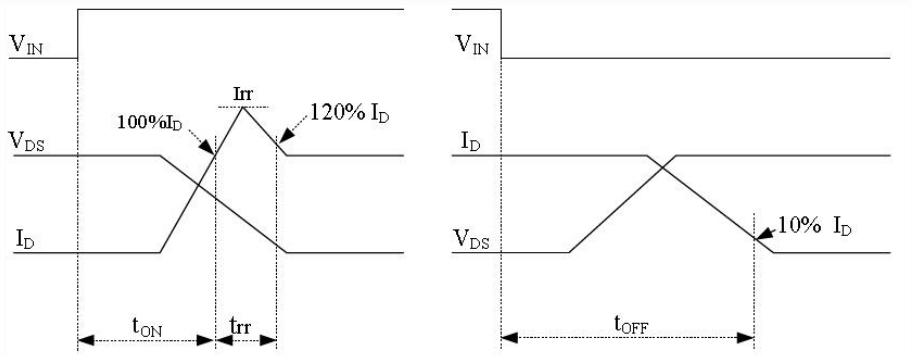


Figure 1 Definition of Switching Time

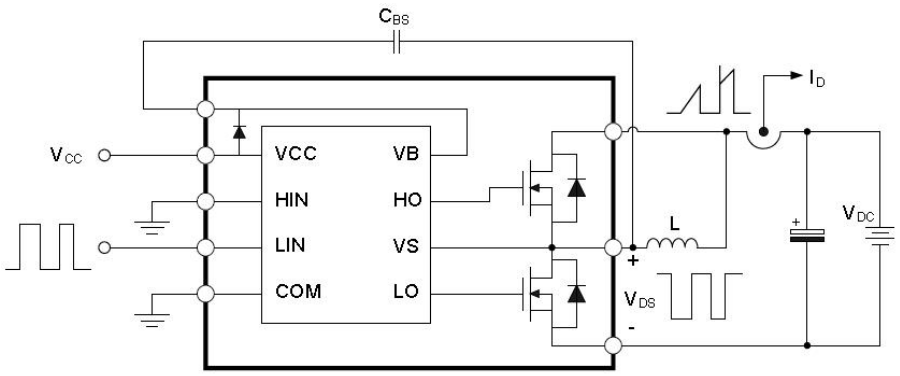


Figure 2 Switching time and low side of RBSOA test circuit

Control Part Single HVIC

Symbol	Parameter	Condition	Min	Typ	Max	Unit
V_{IH}	High-Level Conduction Threshold Voltage	(Logic high level, between input and COM)	3	-	-	V
V_{IL}	Low-Level Turn-Off Threshold Voltage	(Logic low level, between input and COM)	-	-	0.8	V
UV_{BSD}	High-Side Undervoltage Protection Action Voltage	Detection level(1)	7.2	8.2	9.0	V
UV_{BSR}	High-Side Undervoltage Protection Recovery Voltage	Reset leve(1)	8.0	8.9	9.9	V
UV_{CCD}	Low-Side Undervoltage Protection Action Voltage	Detection level(1)	7.2	8.2	9.0	V
UV_{CCR}	Low-Side Undervoltage Protection Recovery Voltage	Reset level(1)	8.0	8.9	9.9	V
I_{QBS}	Static Current of V_{BS} Terminal	V_{BS} = 15V, V_{IN} = 0V Between $V_{B(U)}$-U, $V_{B(V)}$-V, $V_{B(W)}$-W	-	-	100	μA
I_{QCC}	Static Current of V_{CC} Terminal	V_{CC} = 15V, V_{IN} = 0V, Between V_{CC} and COM	-	-	230	μA
I_{IN+}	High-Level Input Bias Current	V_{IN} = 5V, between input and COM	-	10	20	μA
I_{IN-}	Low-Level Input Bias Current	V_{IN} = 0V between input and COM	-	-	2	μA

Note:

(1)The timing diagram of the high and low side undervoltage protection function is shown in Figure 3/Figure 4

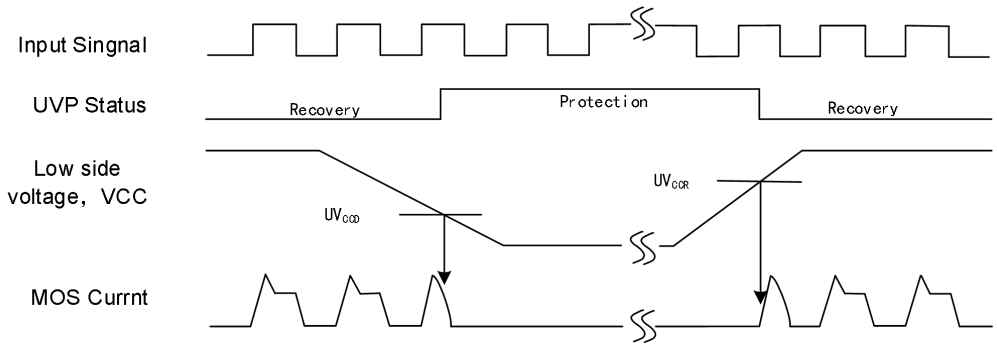


Figure 3 Undervoltage protection low side:

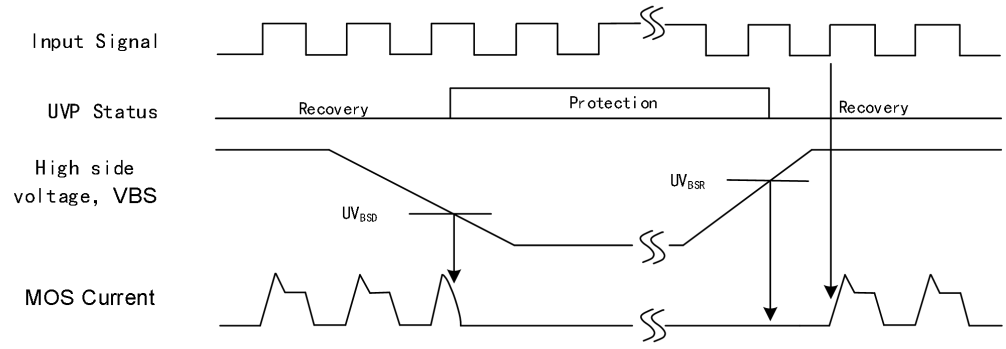


Figure 4 Undervoltage protection high side:

Strap Diode Section

Symbol	Parameter	Condition	Min	Typ	Max	Unit
V_F	Forward Voltage	I_F = 0.5A, T_C = 25°C	-	-	1.5	V
t_{RR}	Reverse Recovery Time	I_F = 0.5A, T_C = 25°C	-	-	50	ns

NTC (Negative Temperature Coefficient) Resistor

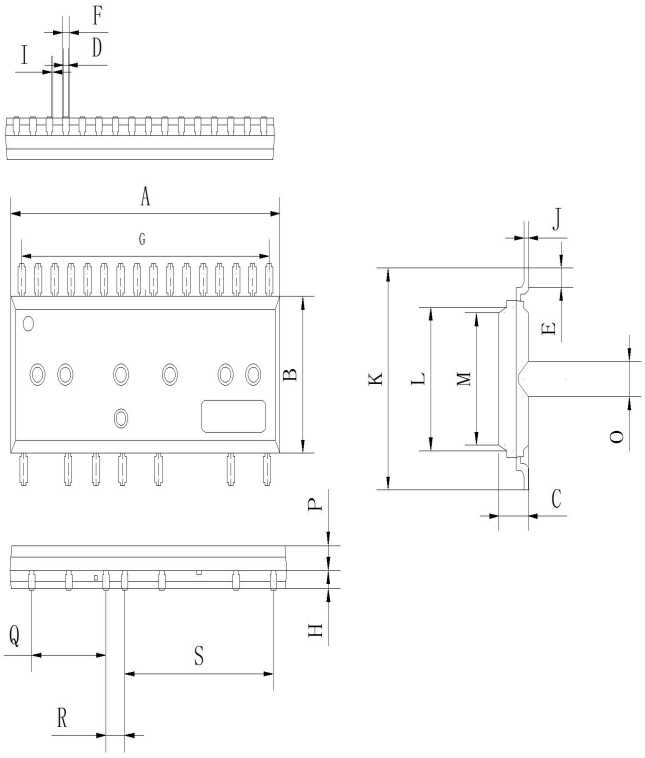
Symbol	Parameter	Condition	Min	Typ	Max	Unit
R_{TH}	Thermistor Resistance(1)	T_{TH} = 25°C	-	48	-	KΩ
		T_{TH} = 100°C	-	3.1	-	KΩ

Note:

(1)T_{TH} is the temperature of the thermistor itself. In the application circuit, the Vth pin is pulled up to VCC through a 7.50kΩ resistor. NTC tolerance ±5%. If you need to test the shell temperature (Tc), please conduct experiments based on actual applications.

PHYSICAL DIMENSIONS-SOP-23

Unit:mm



Symbol	Dimensions In Millimeters	
	Min.	Max.
A	28.80	29.20
B	11.80	12.20
C	3.05	3.25
D	0.50	0.70
E	1.05	1.75
F	0.75	1.05
G	26.37	26.97
H	1.15	1.45
I	0.00	0.15
J	0.40	0.60
K	16.70	17.30
L	10.80	11.20
M	9.90	10.30
O	2.58	2.78
P	1.70	2.00
Q	7.60	8.00
R	1.75	2.15
S	15.40	15.80

VERSION HISTORY

Version	Date	Changes
Rev.1.0	2025-06-23	Initial release

Disclaimer

- Reproducing and modifying information of the document is prohibited without permission from Panjit International Inc..
- Panjit International Inc. reserves the rights to make changes of the content herein the document anytime without notification. Please refer to our website for the latest document.
- Panjit International Inc. disclaims any and all liability arising out of the application or use of any product including damages incidentally and consequentially occurred.
- Panjit International Inc. does not assume any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.
- Applications shown on the herein document are examples of standard use and operation. Customers are responsible in comprehending the suitable use in particular applications. Panjit International Inc. makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.
- The products shown herein are not designed and authorized for equipments requiring high level of reliability or relating to human life and for any applications concerning life-saving or life-sustaining, such as medical instruments, transportation equipment, aerospace machinery et cetera. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Panjit International Inc. for any damages resulting from such improper use or sale.
- Since Panjit International Inc. uses lot number as the tracking base, please provide the lot number for tracking when complaining

Website：www.panjit.com.tw