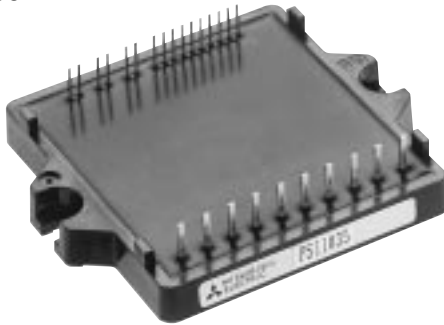


PS11035

FLAT-BASE TYPE
INSULATED TYPE

PS11035



INTEGRATED FUNCTIONS AND FEATURES

- Converter bridge for 3 phase AC-to-DC power conversion.
- 3 phase IGBT inverter bridge configured by the latest 3rd generation IGBT and diode technology.
- Inverter output current capability I_O (Note 1):

Type Name	Motor Rating	I_O (100%)	I_O (150%; 60sec)
PS11035	1.5 kW/200V AC	7.0Arms	10.5Arms

(Note 1) : The inverter output current is assumed to be sinusoidal and the peak current value of each of the above loading cases is defined as : $I_{OP} = I_O \times \sqrt{2}$, $T_c < 100^\circ\text{C}$

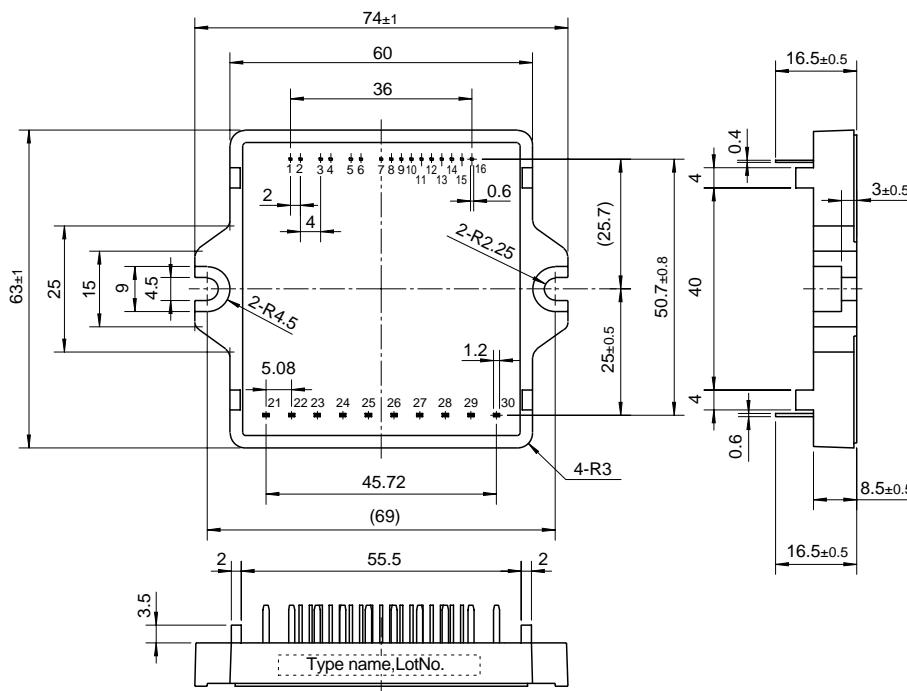
INTEGRATED DRIVE, PROTECTION AND SYSTEM CONTROL FUNCTIONS:

- P-Side IGBTs : Drive circuit, high-level-shift circuit, bootstrap circuit supply scheme for Single Control-Power-Source drive, and under voltage (UV) protection.
- N-Side IGBTs : Drive circuit, DC-Link current sense and amplifier circuits for overcurrent protection, control-supply under-voltage protection (UV), and fault output (Fo) signaling circuit.
- Fault Output : N-side IGBT short circuit (SC), over-current (OC), and control supply under-voltage (UV).
- Inverter Analog Current Sense : N-Side IGBT DC-Link Current Sense.
- Input Interface : 5V CMOS/TTL compatible, Schmitt Trigger input, and Arm-Shoot-Through interlock protective function.

APPLICATION

Acoustic noise-less 1.5kW/200V AC Class 3 phase inverters, motor control applications, and motors with built-in small size inverter package

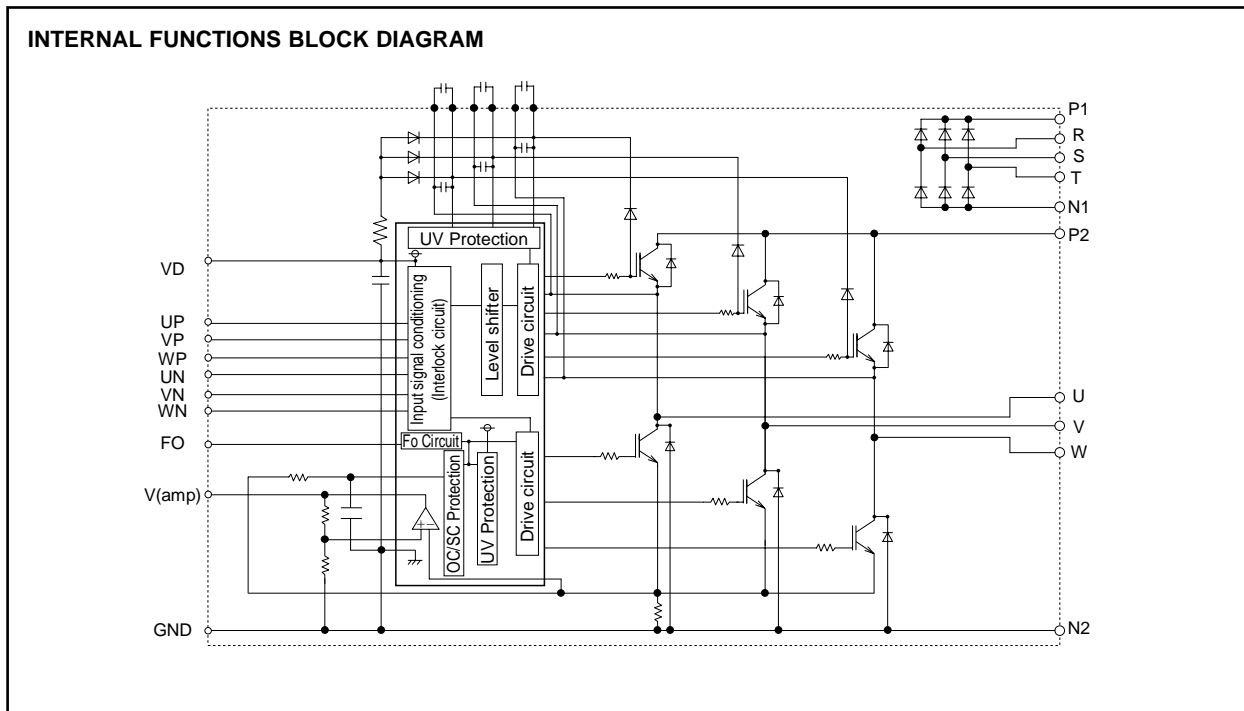
PACKAGE OUTLINES



(Fig. 1)

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(Fig. 2)

MAXIMUM RATINGS (Tj = 25°C)

INVERTER PART

Symbol	Item	Condition	Ratings	Unit
VCC	Supply voltage	Applied between P2-N2	450	V
VCC(surge)	Supply voltage (surge)	Applied between P2-N2, Surge-value	500	V
VP or VN	Each output IGBT collector-emitter static voltage	Applied between P2-U.V.W, U.V.W-N2	600	V
VP(S) or VN(S)	Each output IGBT collector-emitter switching voltage	Applied between P2-U.V.W, U.V.W-N2	600	V
±Ic(±Icp)	Each output IGBT collector current	Tc = 25°C, "()" means Ic peak value	±20 (±40)	A

CONVERTER PART

Symbol	Item	Condition	Ratings	Unit
VRRM	Repetitive peak reverse voltage		800	V
Ea	Recommended AC input voltage		220	Vrms
Io	DC output current	3φ rectifying circuit	20	A
IFSM	Surge (non-repetitive) forward current	1 cycle at 60Hz, peak value non-repetitive	196	A
I ² t	I ² t for fusing	Value for one cycle of surge current	165	A ² s

CONTROL PART

Symbol	Item	Ratings	Unit
VD, VDB	Supply voltage	-0.5 ~ 20	V
VCIN	Input signal voltage	-0.5 ~ +7.5	V
VFO	Fault output supply voltage	-0.5 ~ +7.5	V
I _{FO}	Fault output current	15	mA
I _{amp}	DC-Link IGBT current signal Amp output current	1	mA

PS11035

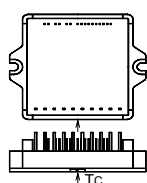
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TOTAL SYSTEM

Symbol	Item	Condition	Ratings	Unit
T _j	Junction temperature	(Note 2)	-20 ~ +125	°C
T _{stg}	Storage temperature	—	-40 ~ +125	°C
T _c	Module case operating temperature	(Fig. 3)	-20 ~ +100	°C
Viso	Isolation voltage	60 Hz sinusoidal AC applied between all terminals and the base plate for 1 minute.	2500	Vrms
—	Mounting torque	Mounting screw: M4	0.98 ~ 1.47	N·m

(Note 2) : The indicated values are specified considering the safe operation of all the parts within the ASIPM. The max. ratings for the ASIPM power chips (IGBT & FWDi) is T_j < 150.

CASE TEMPERATURE MEASUREMENT POINT



(Fig. 3)

THERMAL RESISTANCE

Symbol	Item	Condition	Ratings			Unit
			Min.	Typ.	Max.	
Rth(jc)Q	Junction to case Thermal Resistance	Inverter IGBT (1/6)	—	—	2.3	°C/W
Rth(jc)F		Inverter FWDi (1/6)	—	—	3.1	°C/W
Rth(jc)FR		Converter Di (1/6)	—	—	4.8	°C/W
Rth(cf)	Contact Thermal Resistance	Case to fin thermal, grease applied (1 Module)	—	—	0.074	°C/W

ELECTRICAL CHARACTERISTICS (T_j = 25°C, V_D = 15V, V_{DB} = 15V unless otherwise noted)

Symbol	Item	Condition	Ratings			Unit
			Min.	Typ.	Max.	
V _{CE(sat)}	Collector-emitter saturation voltage	T _j = 25°C, Input = ON, I _c = 20A, V _D = V _{DB} = 15V (Shunt voltage drop not included)	—	—	2.9	V
V _{EC}	FWDi forward voltage	T _j = 25°C, -I _c = 20A	—	—	2.9	V
V _{FR}	Converter diode voltage	T _j = 25°C, I _{FR} = 10A	—	—	1.5	V
I _{RRM}	Converter diode reverse current	V _R = V _{RRM} , T _j = 125°C	—	—	8	mA
ton	Switching times	1/2 Bridge inductive, Input = 5V ↔ 0V V _{CC} = 300V, I _c = 20A, T _j = 125°C V _D = 15V, V _{DB} = 15V Note: ton, toff include delay time of the internal control circuit.	0.3	0.6	1.5	μs
tc(on)			—	0.5	1.0	μs
toff			—	1.6	2.5	μs
tc(off)			—	0.5	1.3	μs
trr	FWDi reverse recovery time		—	0.12	—	μs
Short circuit endurance (Output, Arm, and Load Short Circuit Modes)		@V _{CC} ≤ 400V, Input = 5V → 0V (One-Shot) -20°C ≤ T _j (start) ≤ 125°C, 13.5V ≤ V _D = V _{DB} ≤ 16.5V	<ul style="list-style-type: none"> No destruction FO output by protection operation 			
Switching SOA		@V _{CC} ≤ 400V, Input = 5V ↔ 0V, T _j ≤ 125°C I _c < OC trip level, 13.5V ≤ V _D = V _{DB} ≤ 16.5V	<ul style="list-style-type: none"> No destruction No protecting operation No FO output 			

PS11035

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ELECTRICAL CHARACTERISTICS (Tj = 25°C, Vd = 15V, VDB = 15V unless otherwise noted)

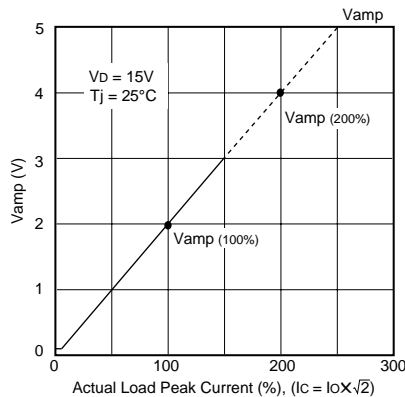
Symbol	Item	Condition	Ratings			Unit
			Min.	Typ.	Max.	
ID	Circuit current (Average)	Tj = 25°C, Vd = 15V, Vin = 5V	—	—	50	mA
IDB	Circuit current (Average)	Tj = 25°C, Vd = VDB = 15V, Vin = 5V	—	—	5	mA
Vth(on)	Input on threshold voltage		0.8	1.4	2.0	V
Vth(off)	Input off threshold voltage		2.5	3.0	4.0	V
Ri	Input pull-up resistor	Applied between input terminal-inside power supply	—	50	—	kΩ
fPWM	PWM input frequency	Tc ≤ 100°C, Tj ≤ 125°C	1	—	15	kHz
tdead	Arm shoot-through blocking time	Relates to corresponding inputs Tc = -20°C ~ +100°C (Note 3)	2.2	—	—	μs
tint	Input interlock sensing	Relates to corresponding input (Fig. 6)	—	100	—	ns
Vamp(100%)	Inverter DC-Link IGBT current sense voltage output signal	IC = IOP(100%) Vd = 15V	1.5	2.0	2.5	V
Vamp(200%)		IC = IOP(200%) Tj = 25°C (Fig. 4)	3.0	4.0	5.0	V
Vamp(250%)	Inverter DC-Link IGBT current sense voltage output limit	IC = IOP(250%) Vd = 15V	5.0	—	—	V
Vamp(0)		IC = 0A (Fig. 4)	—	50	100	mV
OC	Over current trip level	Tj = 25°C (Fig. 5)	19.8	24.7	35.0	A
tOC	Over current delay time	Tj = 25°C (Fig. 5)	—	10	—	μs
SC	Short circuit trip level	Tj = 25°C (Fig. 5)	—	40	—	A
tSC	Short circuit delay time	Tj = 25°C (Fig. 5)	—	2	—	μs
UVd	Supply circuit under voltage protection	Trip level	11.0	12.0	13.0	V
UVDr		Reset level	11.5	12.5	13.5	V
UVDB		Trip level	10.1	10.8	11.6	V
UVDBr		Reset level	10.6	11.3	12.1	V
tdV		Delay time	—	10	—	μs
tFO	Fault output pulse width	Tj = 25°C (Note 4)	1.0	1.8	—	ms
IFo(H)	Fault output current	Open collector output (Note 4)	—	—	1	μA
IFo(L)			—	—	15	mA

(Note 3) : The dead-time has to be set externally by the CPU; it is not part of the ASIPM internal functions.
 (Note 4) : Fault output signaling is given only when the internal OC, SC, & UV protection circuits are activated.
 The OC, SC and UV protection (and fault output) operate for the lower arms only. The OC and SC protection Fault output is given in a pulse format while that of UV protection is maintained throughout the duration of the under-voltage condition.

RECOMMENDED OPERATING CONDITIONS

Symbol	Item	Condition	Ratings			Unit
			Min.	Typ.	Max.	
VCC	Supply voltage	Applied across P2-N2 terminals	—	300	400	V
Vd	Supply voltage	Applied between Vd-GND	13.5	15.0	16.5	V
VDB	Supply voltage	Applied between CBU+ & CBU-, CBV+ & CBV-, CBW+ & CBW-	13.5	15.0	16.5	V
ΔVd, VDB	Supply voltage ripple		-1	—	+1	V/μs
VCIN(ON)	Input on voltage	Applied between UP • VP • WP • UN • VN • WN and GND	0	—	0.8	V
VCIN(OFF)	Input off voltage		4.0	—	5.0	V
tdead	Arm shoot-through blocking time	Relates to corresponding inputs	2.2	—	—	μs
Tc	Module case operating temperature		—	—	100	°C
fPWM	PWM Input frequency	Tc ≤ 100°C, Tj ≤ 125°C	—	—	15	kHz
tXX	Allowable minimum input on-pulse width		1	—	—	μs

INVERTER DC-LINK IGBT CURRENT ANALOGUE SIGNALING OUTPUT (TYPICAL)



(Fig. 4)

