PIN CONFIGURATION

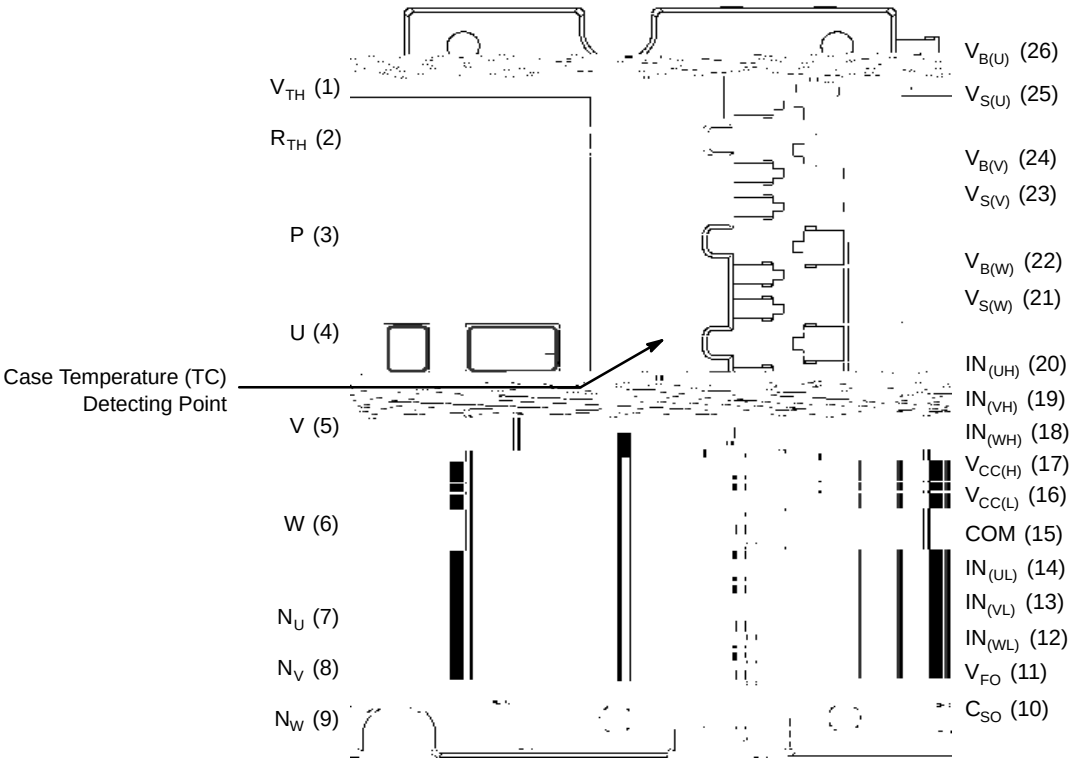


Figure 1. Top View

PIN DESCRIPTIONS

Pin Number	Pin Name	Pin Description
1	V_{TH}	Thermistor Bias Voltage
2	R_{TH}	Series Resistor for the Use of Thermistor (Temperature Detection)
3	P	Positive DC−Link Input
4	U	Output for U−Phase
5	V	Output for V−Phase
6	W	Output for W−Phase
7	N_U	Negative DC−Link Input for U−Phase
8	N_V	Negative DC−Link Input for V−Phase
9	N	

PIN DESCRIPTIONS (continued)

Pin Number	Pin Name	Pin Description
19	$IN_{(VH)}$	Signal Input for High−Side V−Phase
20	$IN_{(UH)}$	Signal Input for High−Side U−Phase
21	$V_{S(W)}$	High−Side Bias Voltage Ground for W−Phase IGBT Driving
22	$V_{B(W)}$	High−Side Bias Voltage for W−Phase IGBT Driving
23	$V_{S(V)}$	High−Side Bias Voltage Ground for V−Phase IGBT Driving
24	$V_{B(V)}$	High−Side Bias Voltage for V−Phase IGBT Driving
25	$V_{S(U)}$	High−Side Bias Voltage Ground for U−Phase IGBT Driving
26	$V_{B(U)}$	High−Side Bias Voltage for U−Phase IGBT Driving

INTERNAL High−Side Bias Voltage for V−Phase IGBT Driving

ABSOLUTE MAXIMUM RATINGS (T_J = 25 C unless otherwise specified)

Symbol	Parameter	Conditions	Rating	Unit
INVERTER PART				
V_{PN}	Supply Voltage	Applied between P − N_U, N_V, N_W	450	V
$V_{PN(Surge)}$	Supply Voltage (Surge)	Applied between P − N_U, N_V, N_W	500	V
V_{CES}	Collector−Emitter Voltage		600	V
$+I_C$	Each IGBT Collector Current	T_C = 25 C, T_J < 150 C	20	A
$+I_{CP}$	Each IGBT Collector Current (Peak)	T_C = 25 C, T_J < 150 C, Under 1 ms Pulse Width	40	A
P_C	Collector Dissipation	T_C = 25 C per Chip	50	W
T_J	Operating Junction Temperature	(Note 4)	−40~150	C
CONTROL PART				
V_{CC}	Control Supply Voltage	Applied between $V_{CC(H)}$, $V_{CC(L)}$ − COM	20	V
V_{BS}	High−Side Control Bias Voltage	Applied between $V_{B(U)}$ − $V_{S(U)}$, $V_{B(V)}$ − $V_{S(V)}$, $V_{B(W)}$ − $V_{S(W)}$	20	V

V

ELECTRICAL CHARACTERISTICS (T_J = 25 C unless otherwise specified)

Symbol		Parameter	Conditions		Min	Typ	Max	Unit
INVERTER PART								
$V_{CE(SAT)}$		Collector−Emitter Saturation Voltage	V_{CC} = V_{BS} = 15 V V_{IN} = 5 V	I_C = 20 A, T_J = 25 C	−	1.85	2.35	V
V_F		FWDi Forward Voltage	V_{IN} = 0 V	I_F = 20 A, T_J = 25 C	−	1.95	2.45	V
HS	t_{ON}	Switching Times	V_{PN} = 300 V, V_{CC} = V_{BS} = 15 V, I_C = 20 A, T_J = 25 C V_{IN} = 0 V 5 V, Inductive Load (Note 6)		0.45	0.75	1.25	μs
	$t_{C(ON)}$				−	0.20	0.45	μs
	t_{OFF}				−	0.70	1.20	μs
	$t_{C(OFF)}$				−	0.15	0.40	μs
	t_{rr}				−	0.15	−	μs
LS	t_{ON}		V_{PN} = 300 V, V_{CC} = V_{BS} = 15 V, I_C = 20 A, T_J = 25 C V_{IN} = 0 V 5 V, Inductive Load (Note 6)			0.75	1.25	

C(OFF)

μs

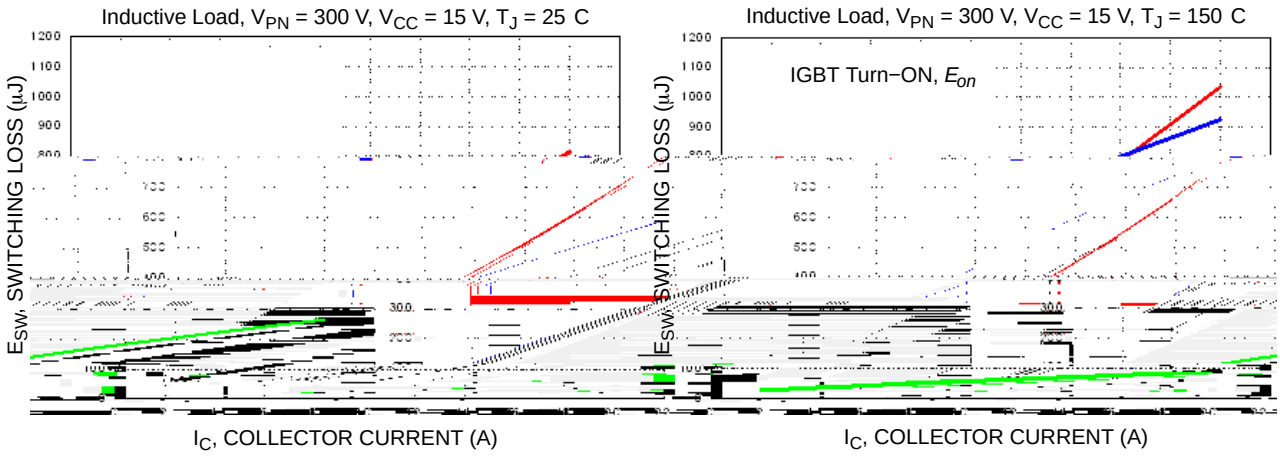


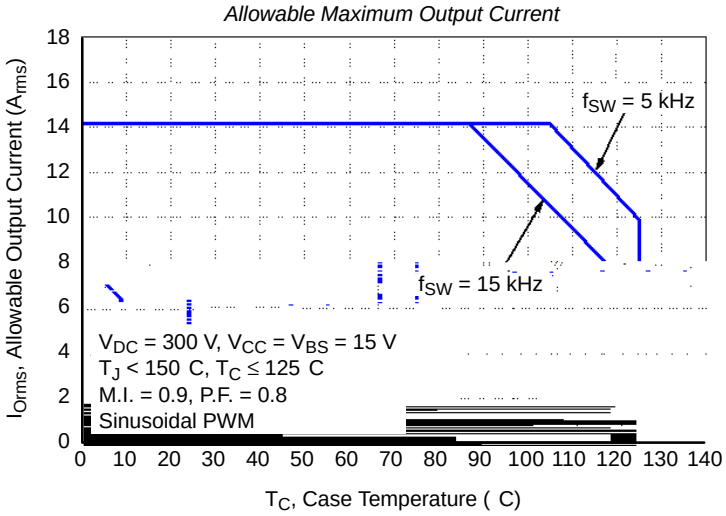
Figure 4. Switching Loss Characteristics (Typical)

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{PN}	Supply Voltage	Applied between P − N_U, N_V, N_W	−	300	400	V
V_{CC}	Control Supply Voltage	Applied between $V_{CC(H)}$, $V_{CC(L)}$ − COM	13.5	15.0	16.5	V
V_{BS}	High−Side Bias Voltage	Applied between $V_{B(U)} - V_{S(U)}$, $V_{B(V)} - V_{S(V)}$, $V_{B(W)} - V_{S(W)}$	13.0	15.0	18.5	V
dV_{CC} / dt, dV_{BS} / dt	Control Supply Variation		−1	−	1	V / μs
t_{dead}	Blanking Time for Preventing Arm−Short	For each input signal	1.5	−	−	μs
f_{PWM}	PWM Input Signal	−40 C < T_J < 150 C	−	−	20	kHz
V_{SEN}	Voltage for Current Sensing	Applied between N_U, N_V, N_W − COM (Including Surge−Voltage)	−4	−	4	V
$P_{WIN(ON)}$	Minimum Input Pulse Width	(Note 10)	0.7	−	−	μs
$P_{WIN(OFF)}$			0.7	−	−	

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

10. This product might not make response if input pulse width is less than the recommended value.



NOTE:

11. This allowable output current value is the reference data for the safe operation of this product. This may be different from the actual application and operating condition.

Figure 7. Allowable Maximum Output Current

MECHANICAL CHARACTERISTICS AND RATINGS

Parameter	Conditions		Min	Typ	Max	Unit
Device Flatness	See Figure 8		0	−	+120	μm
Mounting Torque	Mounting Screw: M3 See Figure 9	Recommended 0.7 N · m	0.6	0.7	0.8	N · m
		Recommended 7.1 kg · cm	6.2	7.1	8.1	kg · cm
Weight			−	11.00	−	g

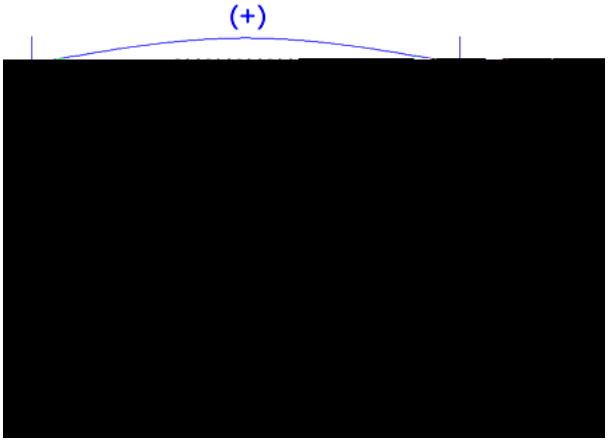
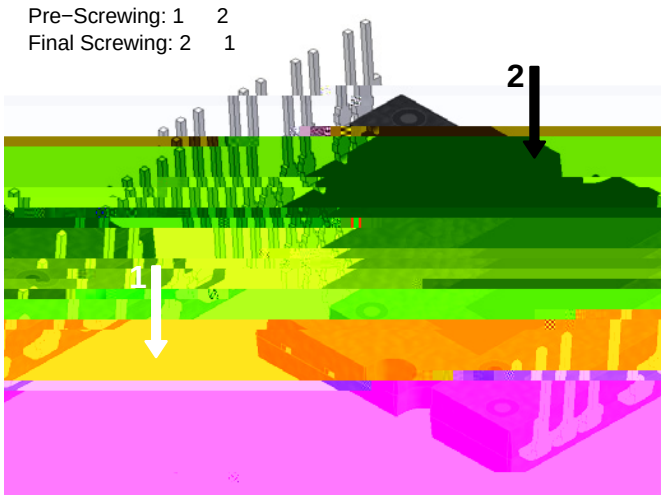


Figure 8. Flatness Measurement Position

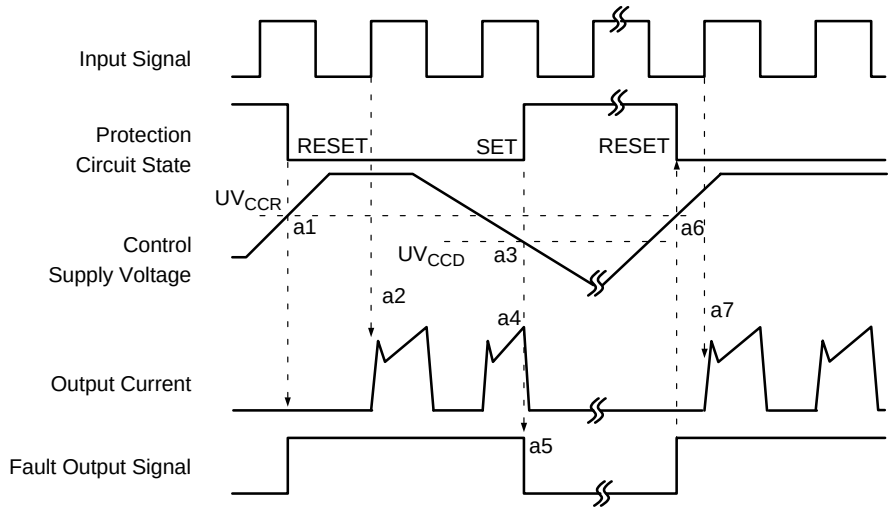


NOTES:

12. Do not make over torque when mounting screws. Much mounting torque may cause ceramic cracks, as well as bolts and Al heat−sink destruction.
13. Avoid one side tightening stress. Figure 9 shows the recommended torque order for mounting screws. Uneven mounting can cause the ceramic substrate of the SPM 45 package to be damaged. The pre−screwing torque is set to 20~30% of maximum torque rating.

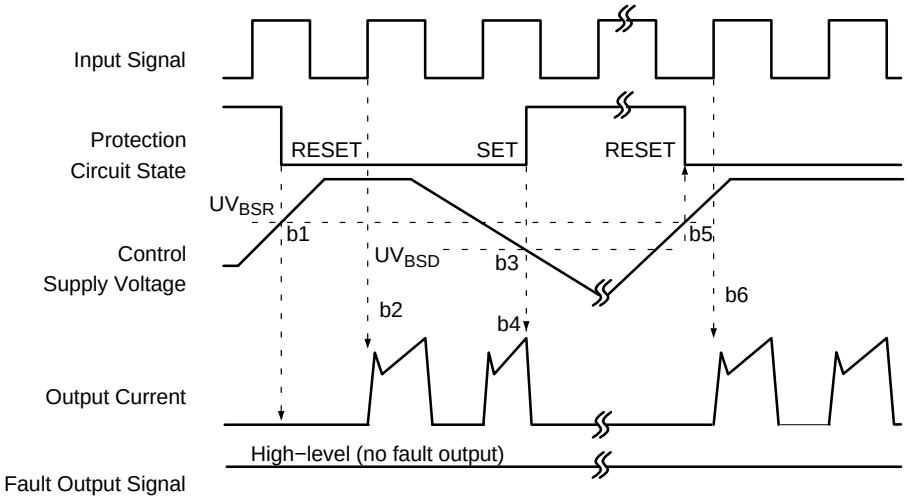
Figure 9. Mounting Screws Torque Order

TIME CHARTS OF PROTECTIVE FUNCTION



a1: Control supply voltage rises: after the voltage rises UV_{CCR}, the circuits start to operate when next input is applied.
a2: Normal operation: IGBT ON and carrying current.
a3: Under−voltage detection (UV_{CCD}).
a4: IGBT OFF in spite of control input condition.
a5: Fault output operation starts.
a6: Under−voltage reset (UV_{CCR}).
a7: Normal operation: IGBT ON and carrying current.

Figure 10. Under−Voltage Protection (Low−Side)



b1: Control supply voltage rises: after the voltage reaches UV_{BSR}, the circuits start to operate when next input is applied.
b2: Normal operation: IGBT ON and carrying current.
b3: Under−voltage detection (UV_{BSD}).
b4: IGBT OFF in spite of control input condition, but there is no fault output signal.
b5: Under−voltage reset (UV_{BSR}).
b6: Normal operation: IGBT ON and carrying current.

Figure 11. Under−Voltage Protection (High−Side)

NOTES:
15. To avoid malfunction, the wiring of each input should be as short as possible (less than 2−3 cm).
16. By virtue of integrating an application−specific type of HVIC

Figure 14. Typical Application Circuit

ORDERING INFORMATION

Device	Device Marking	Package	Shipping
FNC42060F	FNC42060F	SPMAA−A26	12 Units / Rail
FNC42060F2	FNC42060F2	SPMAA−C26	12 Units / Rail

PACKAGE DIMENSIONS

SPMAA−A26 / 26LD, PDD STD, CERAMIC TYPE, STANDARD DUAL FORM
CASE MODFA
ISSUE O

NOTES: UNLESS OTHERWI