



# FNA25012A

## PIN DESCRIPTIONS

Pin Number	Pin Name	Pin Description
1	P <sub>+</sub>	Positive DC-Link Input
2	W	Output for W-Phase
3	V	Output for V-Phase
4	U	Output for U-Phase
5	N <sub>W</sub>	Negative DC-Link Input for W-Phase
6	N <sub>V</sub>	Negative DC-Link Input for V-Phase
7	N <sub>U</sub>	Negative DC-Link Input for U-Phase
8	R <sub>TH</sub>	Series Resistor for Thermistor (Temperature Detection)
9	V <sub>TH</sub>	Thermistor Bias Voltage
10	V <sub>CC(L)</sub>	Low-Side Bias Voltage for IC and IGBTs Driving
11	COM <sub>(L)</sub>	Low-Side Common Supply Ground
12	IN <sub>(UL)</sub>	Signal Input for High-Side U-Phase
13	IN <sub>(VL)</sub>	Signal Input for High-Side V-Phase
14	IN <sub>(WL)</sub>	Signal Input for High-Side W-Phase
15	V <sub>FO</sub>	Fault Output
16	C <sub>FOD</sub>	Capacitor for Fault Output Duration Selection
17	C <sub>SC</sub>	Capacitor (Low-Pass Filter) for Short-Circuit Current Detection Input
18	R <sub>SC</sub>	Resistor for Short-Circuit Current Detection
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## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C UNLESS OTHERWISE NOTED)

### INVERTER PART

Symbol		Parameter	Conditions	Min.	Typ.	Max.	Unit	
V <sub>CE(SAT)</sub>		Collector – Emitter Saturation Voltage	V <sub>DD</sub> = V <sub>BS</sub> = 15 V, V <sub>IN</sub> = 5 V	I <sub>C</sub> = 50 A, T <sub>J</sub> = 25°C	–	2.20	2.80	V
V <sub>F</sub>		FWDi Forward Voltage	V <sub>IN</sub> = 0 V	I <sub>F</sub> = 50 A, T <sub>J</sub> = 25°C	–	2.40	3.00	V
HS	t <sub>ON</sub> t	Switching Times	V <sub>PN</sub> = 600 V, V <sub>CC</sub> = 15 V, I <sub>C</sub> = 50 A, T <sub>J</sub> = 25°C V <sub>IN</sub> = 0 V 5 V, Inductive Load See Figure 5 (Note 6)	0.90	1.40	2.00	μs	

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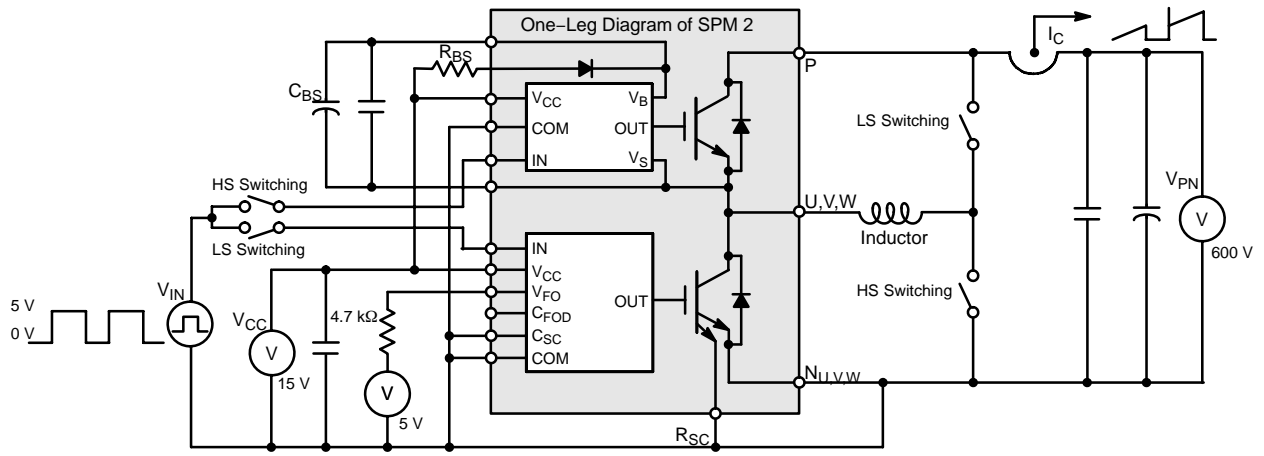


Figure 5. Example Circuit for Switching Test

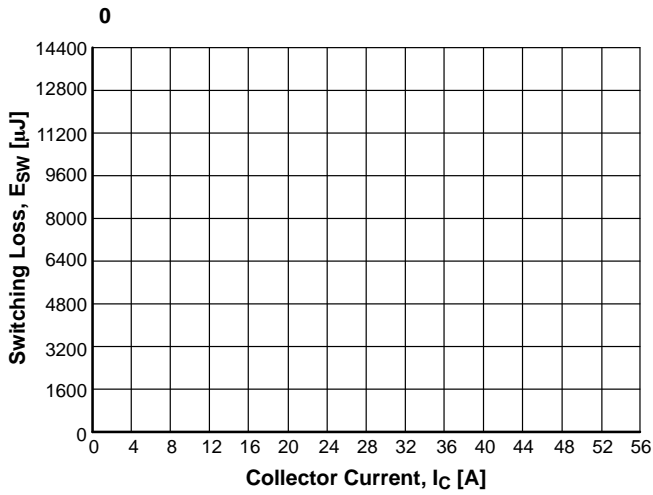


Figure 6. Switching Loss Characteristics (Typical)

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## BOOTSTRAP DIODE PART

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$V_F$	Forward Voltage	$I_F = 1.0 \text{ A}, T_J = 25^\circ\text{C}$	-	2.2	-	V
$t_{rr}$	Reverse-Recovery Time	$I_F = 1.0 \text{ A}, dI_F/dt = 50 \text{ A}, T_J = 25^\circ\text{C}$	-	80	-	ns



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## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Conditions	Value			Unit
			Min.	Typ.	Max.	
$V_{PN}$	Supply Voltage	Applied between P – $N_U, N_V, N_W$	300	600	800	V
$V_{CC}$	Control Supply Voltage	Applied between $V_{CC(UH, VH, WH)} - COM_{(H)}$ , $V_{CC(L)} - COM_{(L)}$	14.0	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
$dV_{DD}/dt$ , $dV_{BS}/dt$	Control Supply Variation		-1	-	1	V/ $\mu$ s
$t_{dead}$	Blanking Time for Preventing Arm-Short	For Each Input Signal	2.0	-	-	$\mu$ s
$f_{PWM}$	PWM Input Signal	$-40^{\circ}\text{C} \leq T_C \leq 125^{\circ}\text{C}$ , $-40^{\circ}\text{C} \leq T_J \leq 150^{\circ}\text{C}$	-	-	20	kHz
$V_{SEN}$	Voltage for Current Sensing	Applied between $N_U, N_V, N_W - COM_{(H,L)}$ (Including Surge Voltage)	-5	-	5	V
$PW_{IN(ON)}$	Minimum Input Pulse Width	$V_{CC} = V_{BS} = 15\text{ V}$ , $I_C \leq 75\text{ A}$ , Wiring Inductance between $N_{U,V,W}$ and DC Link $N < 10\text{ nH}$ (Note 10)	2.5	-	-	$\mu$ s
$PW_{IN(OFF)}$			2.5	-	-	
$T_J$	Junction Temperature		-40	-	150	$^{\circ}\text{C}$

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

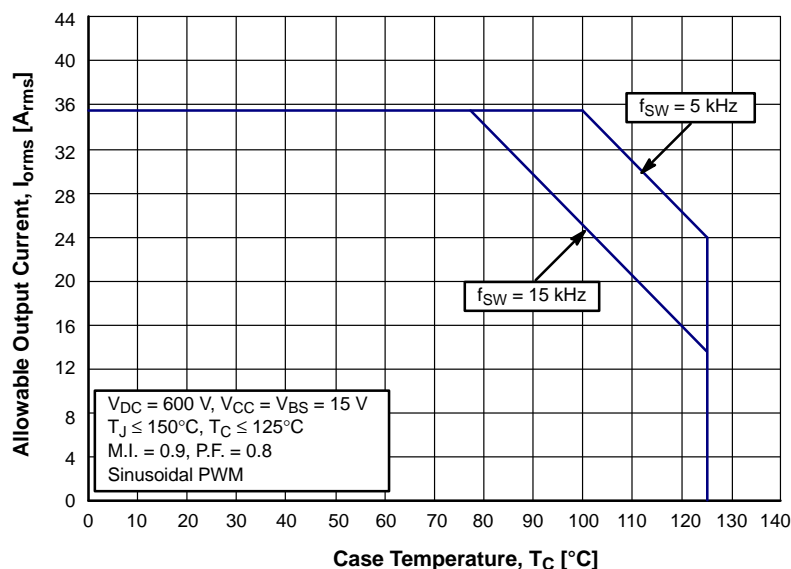


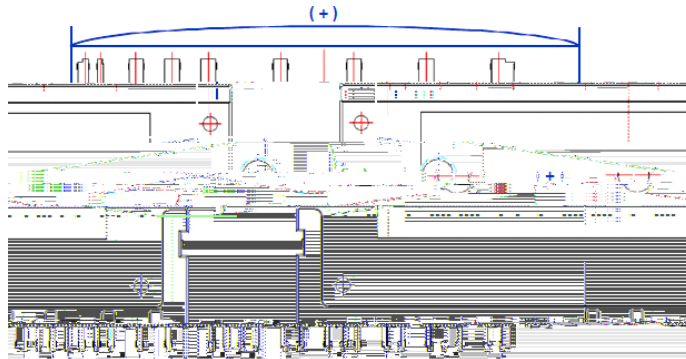
Figure 8. Allowable Maximum Output Current

NOTE:

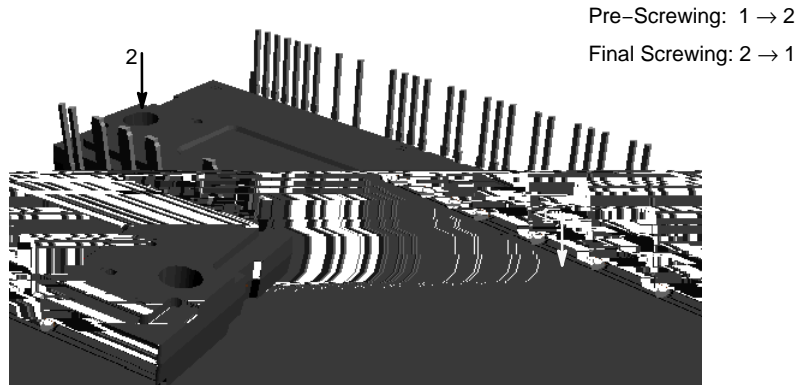
11. This allowable output current value is the reference data for the safe operation of this product. This may be different from the actual application and operating condition.

**MECHANICAL CHARACTERISTICS AND RATINGS**

	Min.	Typ.	Max.			
Device Flatness	See Figure 9		0	-	+200	μm
Mounting Torque	Mounting Screw: M4 See Figure 10	Recommended 1.0 N•m	0.9	1.0	1.5	N•m
		Recommended 10.1 kg•cm	9.1	10.1	15.1	kg•cm
Terminal Pulling Strength	Load 19.6 N		10	-	-	s
Terminal Bending Strength	Load 9.8 N, 90 degrees Bend		2	-	-	times
Weight			-	50	-	g



**Figure 9. Flatness Measurement Position**

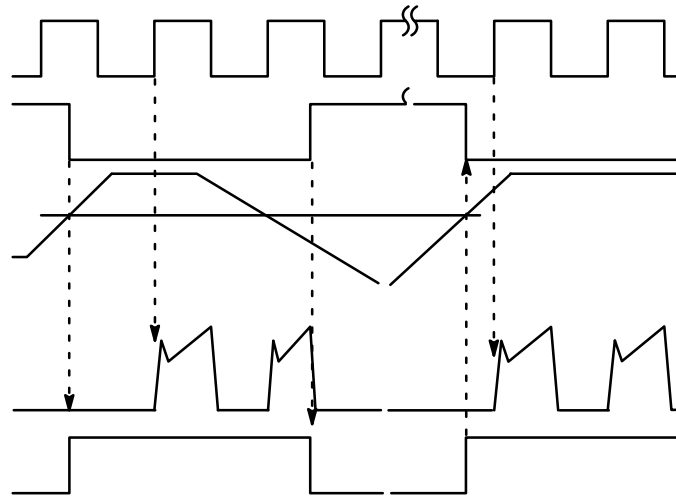


**Figure 10. Mounting Screws Torque Order**

**NOTES:**

- 12. Do not make over torque when mounting screws. Much mounting torque may cause DBC cracks, as well as bolts and Al heat-sink destruction.
- 13. Avoid one-sided tightening stress. Figure 10 shows the recommended torque order for mounting screws. Uneven mounting can cause the DBC substrate of package to be damaged. The pre-screwing torque is set to 20 ~ 30% of maximum torque rating.

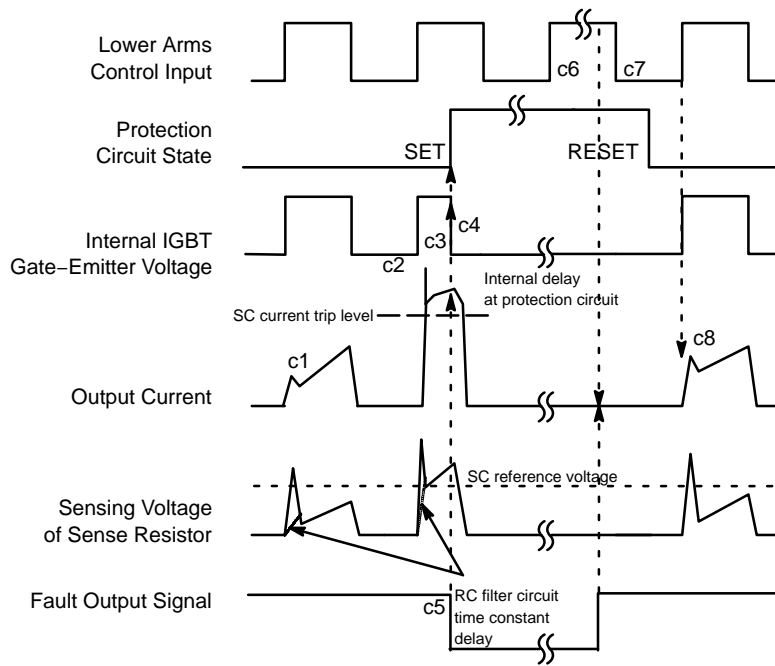
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a1: Control supply voltage rises: After the voltage rises  $UV_{CCR}$ , the circuits start to operate when next input is applied.

**Figure 11. Under-Voltage Protection (Low-Side)**

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c1: Normal operation: IGBT ON and carrying current.

c2: Short circuit current detection (SC trigger).

c3: All low-side IGBTs gate are hard interrupted.

c4: All low-side IGBTs turn OFF.

c5: Fault output operation starts with a fixed pulse width according to the condition of the external capacitor  $C_{FOD}$ .

c6: Input HIGH: IGBT ON state, but during the active period of fault output the IGBT doesn't turn ON.

**Figure 13. Short-Circuit Current Protection (Low-Side Operation Only)**

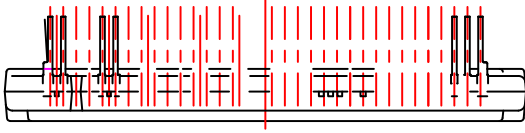


Figure 15. Ty



**SPMCA-A34 / 34LD, PDD STD, DBC DIP TYPE**  
CASE MODFQ  
ISSUE O

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