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March 2016

FNA27560

600 V Motion SPM® 2 Series

Features

- UL Certified No. E209204 (UL1557)
- 600 V - 75 A 3-Phase IGBT Inverter, Including Control ICs for Gate Drive and Protections
- Low-Loss, Short-Circuit-Rated IGBTs
- Very Low Thermal Resistance Using Al_2O_3 DBC Substrate
- Built-In Bootstrap Diodes and Dedicated Vs Pins Simplify PCB Layout
- Separate Open-Emitter Pins from Low-Side IGBTs for Three-Phase Current Sensing
- Single-Grounded Power Supply Supported
- Built-In NTC Thermistor for Temperature Monitoring and Management
- Adjustable Over-Current Protection via Integrated Sense-IGBTs
- Isolation Rating of 2500 Vrms / 1 min.

Applications

- Motion Control - Industrial Motor (AC 200 V Class)

Related Resources

- *AN-9121 - Users Guide for 600V SPM® 2 Series*
- *AN-9076 - Mounting Guide for New SPM® 2 Package*
- *AN-9079 - Thermal Performance of Motion SPM® 2 Series by Mounting Torque*

General Description

The FNA27560 is a Motion SPM® 2 module providing a fully-featured, high-performance inverter output stage for AC induction, BLDC, and PMSM motors. These modules integrate optimized gate drive of the built-in IGBTs to minimize EMI and losses, while also providing multiple on-module protection features: under-voltage lockouts, over-current shutdown, temperature sensing, and fault reporting. The built-in, high-speed HVIC requires only a single supply voltage and translates the incoming logic-level gate inputs to high-voltage, high-current drive signals to properly drive the module's internal IGBTs. Separate negative IGBT terminals are available for each phase to support the widest variety of control algorithms.

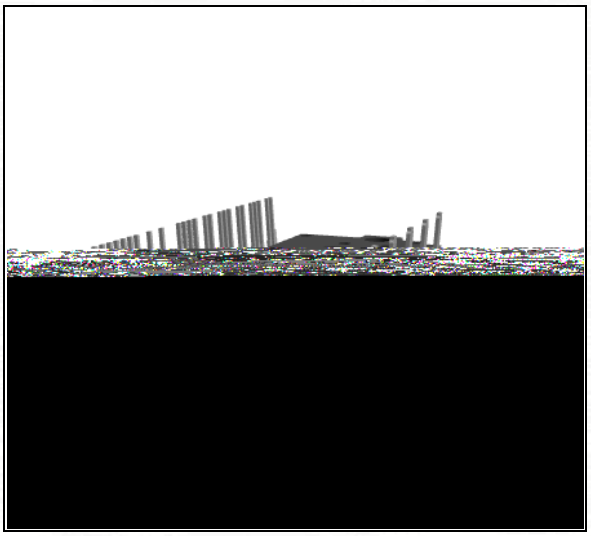

Figure 1. 3D Package Drawing

(Click to Activate 3D Content)

Package Marking and Ordering Information

Device	Device Marking	Package	Packing Type	Quantity
FNA27560	FNA27560	SPMCA-A34	Rail	6

Pin Descriptions

Pin Number	Pin Name	Pin Description
1	P	Positive DC-Link Input
2	W	Output for W Phase
3	V	Output for V Phase
4	U	Output for U Phase
5	N_W	Negative DC-Link Input for W Phase
6	N_V	Negative DC-Link Input for V Phase
7	N_U	Negative DC-Link Input for U Phase
8	R_{TH}	Series Resistor for Thermistor (Temperature Detection)
9	V_{TH}	Thermistor Bias Voltage
10	$V_{CC(L)}$	Low-Side Bias Voltage for IC and IGBTs Driving
11	$COM_{(L)}$	Low-Side Common Supply Ground
12	$IN_{(UL)}$	Signal Input for Low-Side U Phase
13	$IN_{(VL)}$	Signal Input for Low-Side V Phase
14	$IN_{(WL)}$	Signal Input for Low-Side W Phase
15	V_{FO}	Fault Output
16	C_{FOD}	Capacitor for Fault Output Duration Selection
17	C_{SC}	Capacitor (Low-Pass Filter) for Short-Circuit Current Detection Input
18	R_{SC}	Resistor for Short-Circuit Current Detection
19	$IN_{(UH)}$	Signal Input for High-Side U Phase
20	$COM_{(H)}$	High-Side Common Supply Ground
21	$V_{CC(UH)}$	High-Side Bias Voltage for U Phase IC
22	$V_{BD(U)}$	Anode of Bootstrap Diode for U Phase High-Side Bootstrap Circuit
23	$V_{B(U)}$	High-Side Bias Voltage for U Phase IGBT Driving
24	$V_{S(U)}$	High-Side Bias Voltage Ground for U Phase IGBT Driving
25	$IN_{(VH)}$	Signal Input for High-Side V Phase
26	$V_{CC(VH)}$	High-Side Bias Voltage for V Phase IC
27	$V_{BD(V)}$	Anode of Bootstrap Diode for V Phase High-Side Bootstrap Circuit
28	$V_{B(V)}$	High-Side Bias Voltage for V Phase IGBT Driving
29	$V_{S(V)}$	High-Side Bias Voltage Ground for V Phase IGBT Driving
30	$IN_{(WH)}$	Signal Input for High-Side W Phase
31	$V_{CC(WH)}$	High-Side Bias Voltage for W Phase IC
32	$V_{BD(W)}$	Anode of Bootstrap Diode for W Phase High-Side Bootstrap Circuit
33	$V_{B(W)}$	High-Side Bias Voltage for W Phase IGBT Driving
34	$V_{S(W)}$	High-Side Bias Voltage Ground for W Phase IGBT Driving

Absolute Maximum Ratings (T_J = 25°C, unless otherwise specified.)

Inverter Part

Control Part

Bootstrap Diode Part

Total System

Thermal Resistance

Notes:

4. These values had been made an acquisition by the calculation considered to design factor.

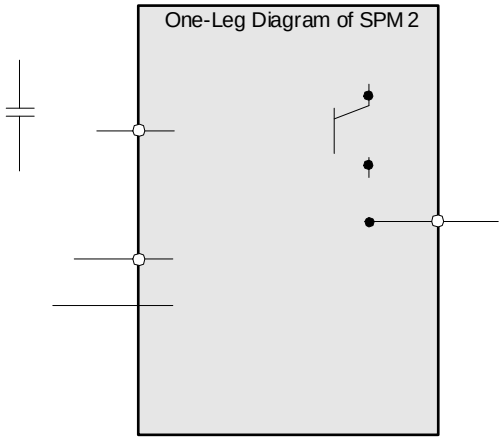

Figure 5. Example Circuit for Switching Test

Figure 6. Switching Loss Characteristics (Typical)

Figure 7. R-T Curve of Built-in Thermistor

Bootstrap Diode Part

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_F	Forward Voltage	I_F = 1.0 A, T_J = 25°C	-	2.2	-	V
t_{rr}	Reverse-Recovery Time	I_F = 1.0 A, dI_F / dt = 50 A / μ				

Control Part

Notes:

7. Short-circuit current protection functions only at the low-sides because the sense current is divided from main current at low-side IGBTs. Inserting the shunt resistor for monitoring the phase current at N_U, N_V, N_W terminal, the trip level of the short-circuit current is changed.
8. The fault-out pulse width t_{FOD} depends on the capacitance value of C_{FOD} according to the following approximate equation : $t_{FOD} = 0.8 \times 10^6 \times C_{FOD}$ [s].
9. T_{TH} is the temperature of thermistor itself. To know case temperature (T_C), conduct experiments considering the application.

Time Charts of SPMs Protective Function

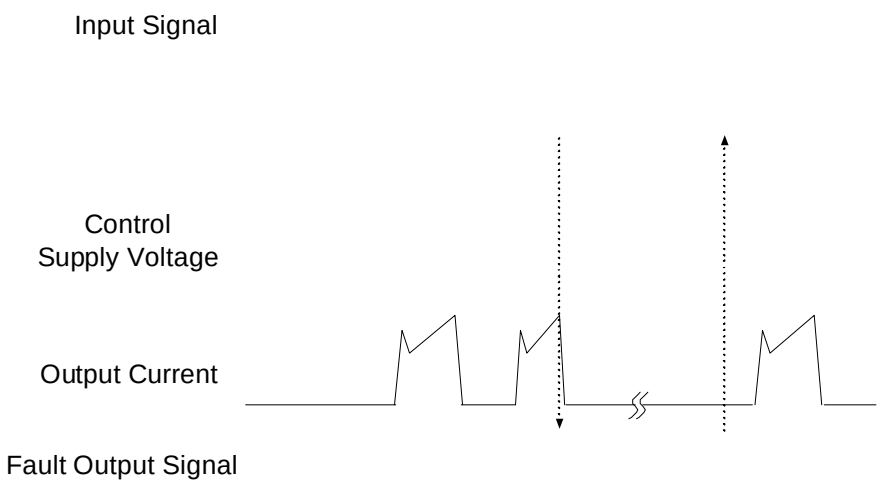

Figure 11. Under-Voltage Protection (Low-Side)

a1 : Control supply voltage rises: after the voltage rises UV_{CCR}, the circuits start to operate when the 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 with a fixed pulse width according to the condition of the external capacitor C_{FOD}.

a6 : Under-voltage reset (UV_{CCR}).

a7 : Normal operation: IGBT ON and carrying current by triggering next signal from LOW to HIGH.

Figure 12. Under-Voltage Protection (High-Side)

b1 : Control supply voltage rises: after the voltage reaches UV_{BSR}, the circuits start to operate when the 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 by triggering next signal from LOW to HIGH.

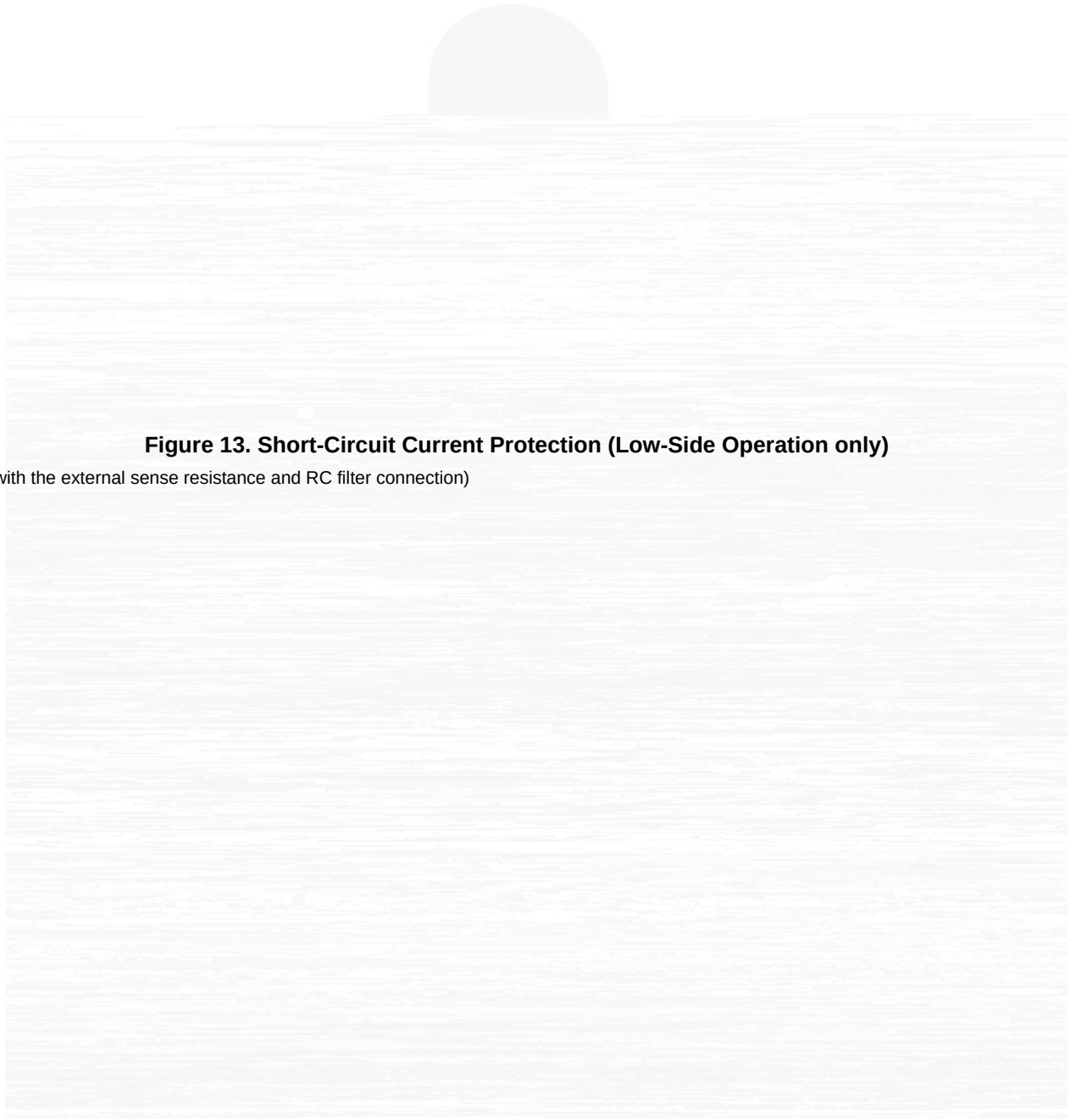

Figure 13. Short-Circuit Current Protection (Low-Side Operation only)

(with the external sense resistance and RC filter connection)

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
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