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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<sub>2</sub>O<sub>3</sub> 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

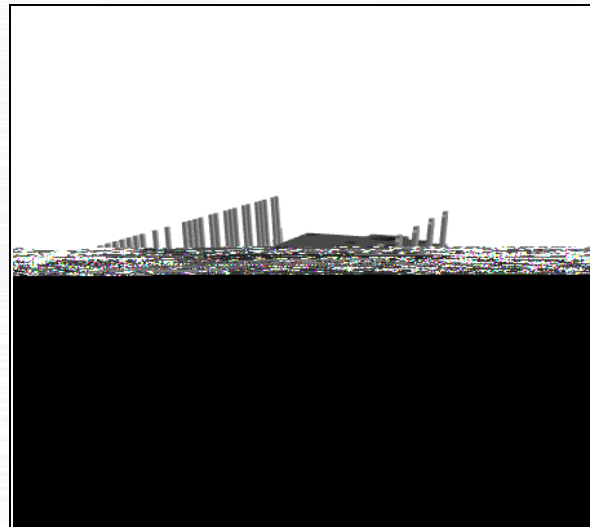
- Motion Control - Industrial Motor (AC 200 V Class)

### 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

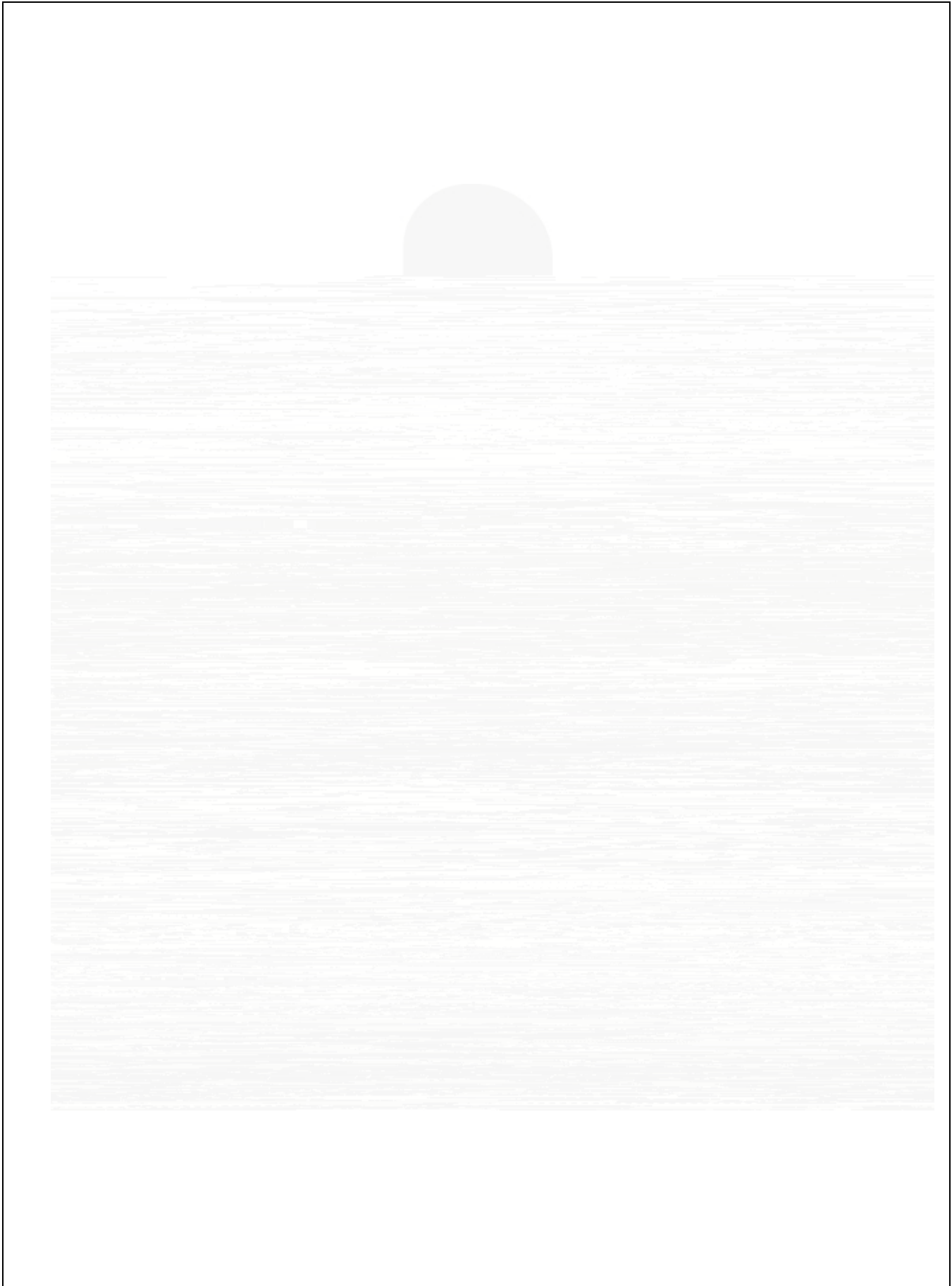
The FNA27560 is a Motion SPM® 2 module providing a fully-featured, high-performance inverter output stage for AC induction, BLDC, and PMSM motors. These modules integrate optimized gate drive of the built-in IGBTs to minimize EMI and losses, while also providing multiple on-module protection features: 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 <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 Low-Side U Phase
13	IN <sub>(VL)</sub>	Signal Input for Low-Side V Phase
14	IN <sub>(WL)</sub>	Signal Input for Low-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
19	IN <sub>(UH)</sub>	Signal Input for High-Side U Phase
20	COM <sub>(H)</sub>	High-Side Common Supply Ground
21	V <sub>CC(UH)</sub>	High-Side Bias Voltage for U Phase IC
22	V <sub>BD(U)</sub>	Anode of Bootstrap Diode for U Phase High-Side Bootstrap Circuit
23	V <sub>B(U)</sub>	High-Side Bias Voltage for U Phase IGBT Driving
24	V <sub>S(U)</sub>	High-Side Bias Voltage Ground for U Phase IGBT Driving
25	IN <sub>(VH)</sub>	Signal Input for High-Side V Phase
26	V <sub>CC(VH)</sub>	High-Side Bias Voltage for V Phase IC
27	V <sub>BD(V)</sub>	Anode of Bootstrap Diode for V Phase High-Side Bootstrap Circuit
28	V <sub>B(V)</sub>	High-Side Bias Voltage for V Phase IGBT Driving
29	V <sub>S(V)</sub>	High-Side Bias Voltage Ground for V Phase IGBT Driving
30	IN <sub>(WH)</sub>	Signal Input for High-Side W Phase
31	V <sub>CC(WH)</sub>	High-Side Bias Voltage for W Phase IC
32	V <sub>BD(W)</sub>	Anode of Bootstrap Diode for W Phase High-Side Bootstrap Circuit
33	V <sub>B(W)</sub>	High-Side Bias Voltage for W Phase IGBT Driving
34	V <sub>S(W)</sub>	High-Side Bias Voltage Ground for W Phase IGBT Driving



**Absolute Maximum Ratings** ( $T_J = 25^\circ\text{C}$ , unless otherwise specified.)

**Inverter Part**

**Control Part**

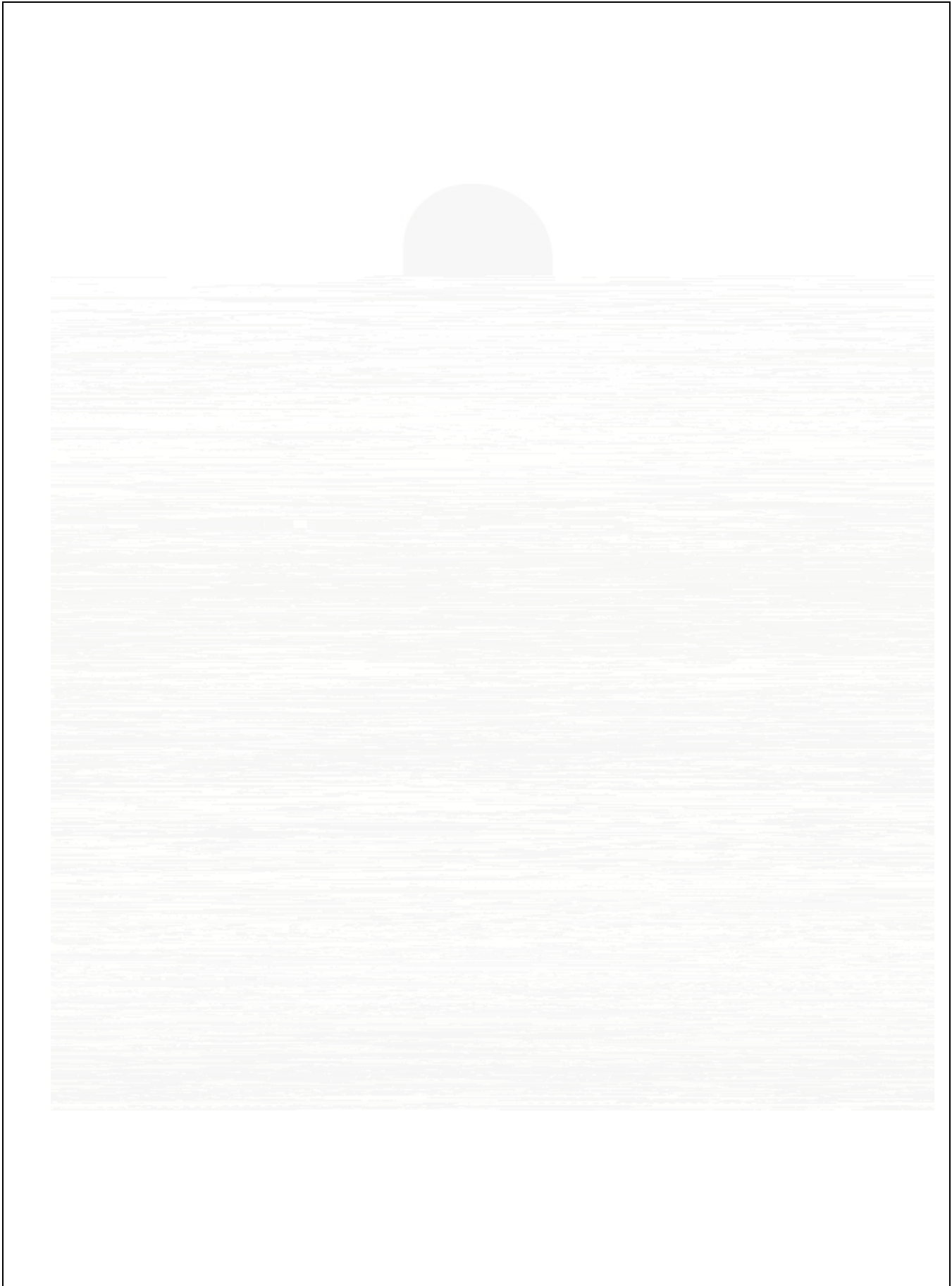
**Bootstrap Diode Part**

**Total System**

**Thermal Resistance**

**Notes:**

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



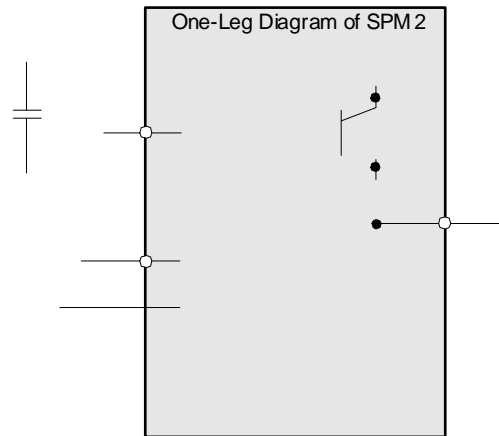


Figure 5. Example Circuit for Switching Test

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	$I_F = 1.0 \text{ A}, T_J = 25^\circ\text{C}$	-	2.2	-	V
$t_{rr}$	Reverse-Recovery Time	$I_F = 1.0 \text{ A}, di_F / dt = 50 \text{ A} / \mu$				

**Control Part**



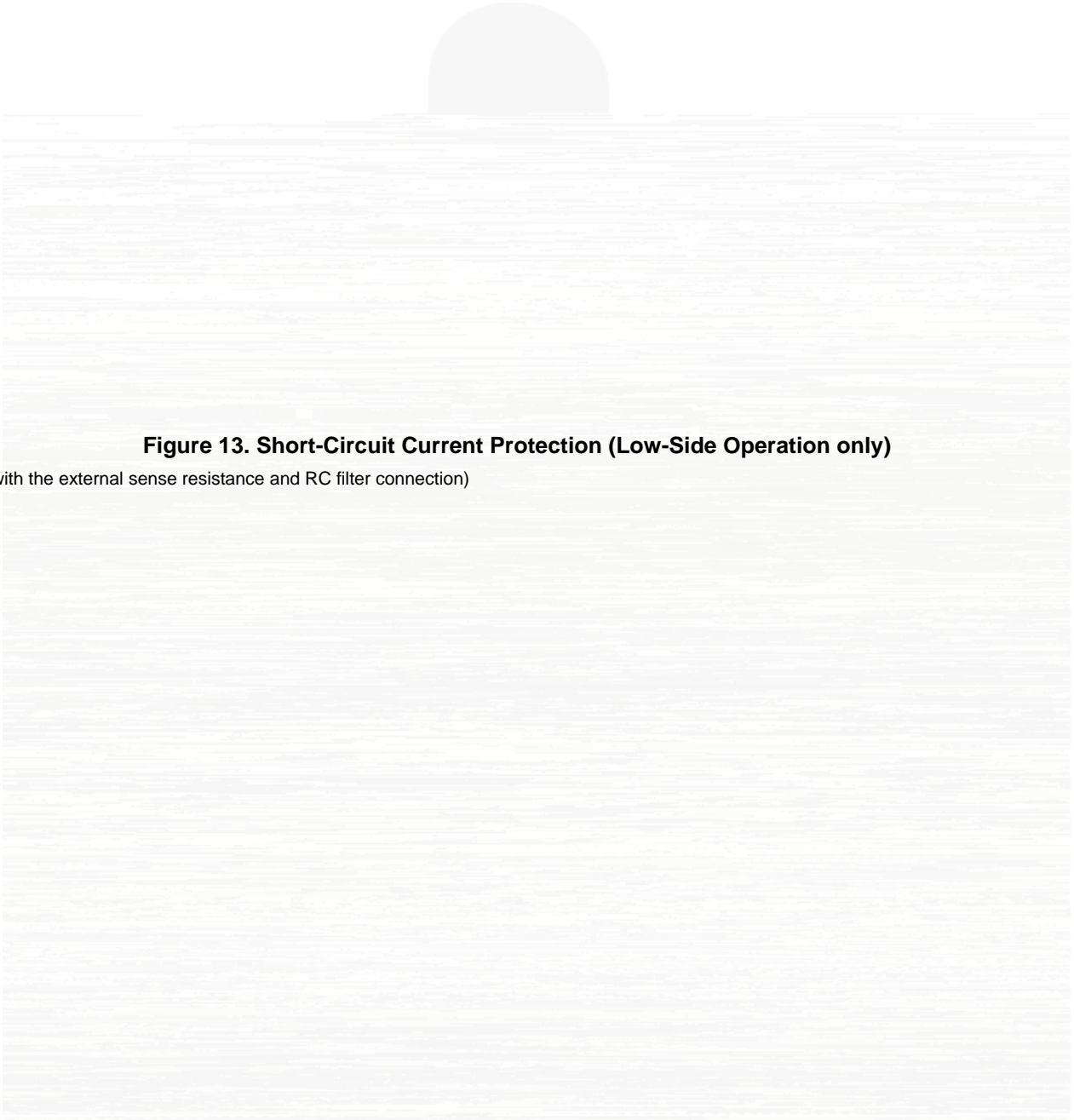
**Notes:**

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.







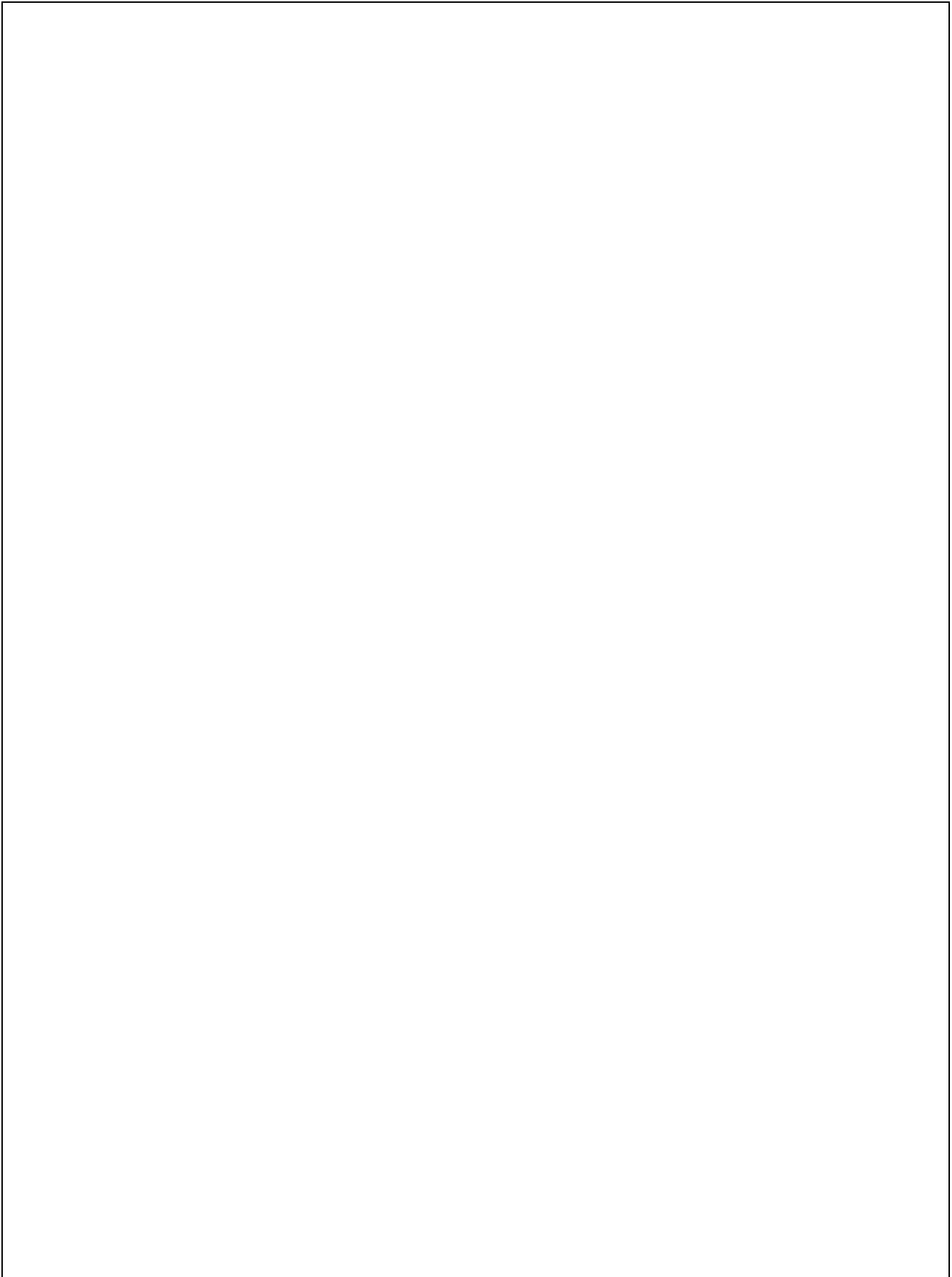


**Figure 13. Short-Circuit Current Protection (Low-Side Operation only)**


(with the external sense resistance and RC filter connection)









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