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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

April 2017

FNB51560T1

Motion SPM® 55 Series

Features

- UL Certified No. E209204 (UL1557)
- 600 V - 15 A 3-Phase IGBT Inverter Including Control IC for Gate Drive and Protections
- Low-Loss, Short-Circuit Rated IGBTs
- Separate Open-Emitter Pins from Low-Side IGBTs for Three-Phase Current Sensing
- Active-HIGH interface, works with 3.3 / 5 V Logic, Schmitt-trigger Input
- HVIC for Gate Driving, Under-Voltage and Short-Circuit Current Protection
- Fault Output for Under-Voltage and Short-Circuit Current Protection
- Inter-Lock Function to Prevent Short-Circuit
- Shut-Down Input
- HVIC Temperature-Sensing Built-In for Temperature Monitoring
- Optimized for 15 kHz Switching Frequency
- Isolation Rating: 1500 V_{rms} / min.

Applications

- Motion Control - Home Appliance / Industrial Motor

Related Resources

General Description

FNB51560T1 is a Motion SPM 55 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 including under-voltage lockouts, inter-lock function, over-current shutdown, thermal monitoring of drive IC, and fault reporting. The built-in, high-speed HVIC requires only a single supply voltage and translates the incoming logic-level gate inputs to the high-voltage, high-current drive signals required to properly drive the module's robust short-circuit-rated IGBTs. Separate negative IGBT terminals are available for each phase to support the widest variety of control algorithms.

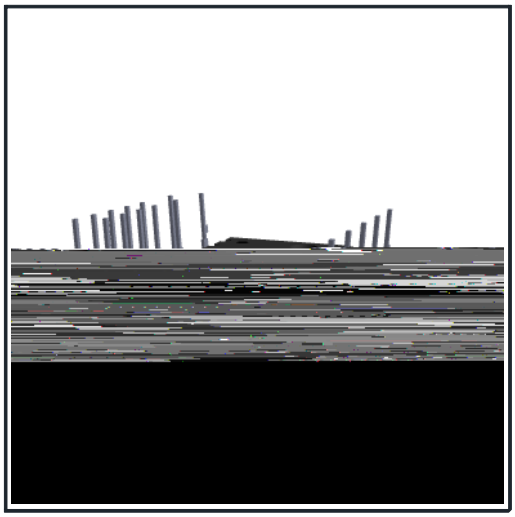


Figure 1. 3D Package Drawing
(Click to Activate 3D Content)

Package Marking and Ordering Information

Device	Device Marking	Package	Packing Type	Quantity

Integrated Power Functions

- 600 V - 15 A IGBT inverter for three phase DC / AC power conversion (Please refer to Figure 3)

Integrated Drive, Protection and System Control Functions

Pin Descriptions

Pin Number	Pin Name	Pin Description
1	P	Positive DC-Link Input
2	U, V_S(U)	Output for U Phase
3	V, V_S(V)	Output for V Phase
4	W, V_S(W)	Output for W Phase
5	N_U	Negative DC-Link Input for U Phase
6	N_V	Negative DC-Link Input for V Phase
7	N_W	Negative DC-Link Input for W Phase
8	$IN_{(UL)}$	Signal Input for Low-Side U Phase
9	$IN_{(UH)}$	Signal Input for High- ide U Phase
10	$IN_{(VL)}$	Signal Input for Low-Side V Phase
11	$IN_{(VH)}$	Signal Input for High-Side V Phase
12	$IN_{(WL)}$	Signal Input for Low-Side W Phase
13	$IN_{(WH)}$	Signal Input for High-Side W Phase
14	V_{DD}	Common Bias Voltage for IC and IGBTs Driving
15	COM	Common Supply Ground
16	C_{SC}	Capacitor (Low-Pass Filter) for Short-circuit Current Detection Input
17	V_F	Fault Output, Shut-Down Input, Temperature Output of Drive IC
18	$V_{B(W)}$	High-Side Bias Voltage for W-Phase IGBT Driving
19	$V_{B(V)}$	High-Side Bias Voltage for V-Phase IGBT Driving
20	$V_{B(U)}$	High-Side Bias Voltage for U-Phase IGBT Driving

Internal Equivalent Circuit and Input/Output Pins

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

Inverter Part

Note:

5. The maximum junction temperature rating of the power chips integrated within the Motion SPM®

Control Part

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
I_{QDD}	Quiescent V_{DD} Supply Current	V_{DD} = 15 V, $IN_{(UH,VH,WH,UL,VL,WL)}$ = 0 V	V_{DD} - COM	-	2.3	3.4	mA
I_{PDD}	Operating V_{DD} Supply Current	V_{DD} = 15 V, f_{PWM} = 20 kHz, duty = 50%, applied to one PWM signal input	V_{DD} - COM	-	2.7	4.0	mA
I_{QBS}	Quiescent V_{BS} Supply Current	V_{BS} = 15 V, $IN_{(UH, VH, WH)}$ = 0 V	$V_{B(U)}$ - $V_{S(U)}$, $V_{B(V)}$ - $V_{S(V)}$, $V_{B(W)}$ - $V_{S(W)}$	-	60	100	A
I_{PBS}	Operating V_{BS} Supply Current	V_{DD} = V_{BS} = 15 V, f_{PWM} = 20 kHz, duty = 50%, applied to one PWM signal input for high - side	$V_{B(U)}$ - $V_{S(U)}$, $V_{B(V)}$ - $V_{S(V)}$, $V_{B(W)}$ - $V_{S(W)}$	-	430	600	A
V_{FH}	Fault Output Voltage	V_{SC} = 0 V, V_F Circuit: 4.7 kΩ to 5 V Pull-up		4.5	-	-	V
V_{FL}		V_{SC} = 1 V, V_F Circuit: 4.7 kΩ to 5 V Pull-up		-	-	0.5	V
$V_{SC(ref)}$	Short-Circuit Trip Level	V_{DD} = 15 V (Note 4)		0.45	0.5	0.55	V
UV_{DDD}	Supply Circuit Under-Voltage Protection	Detection level		10.0	11.5	13.0	V
UV_{DDR}		S3PIN					

Note:

8. Short-circuit protection is functioning for all six IGBTs.

Figure. 5. V-T Curve of Temperature Output of IC (5V pull-up with 4.7kohm)

Recommended Operating Conditions

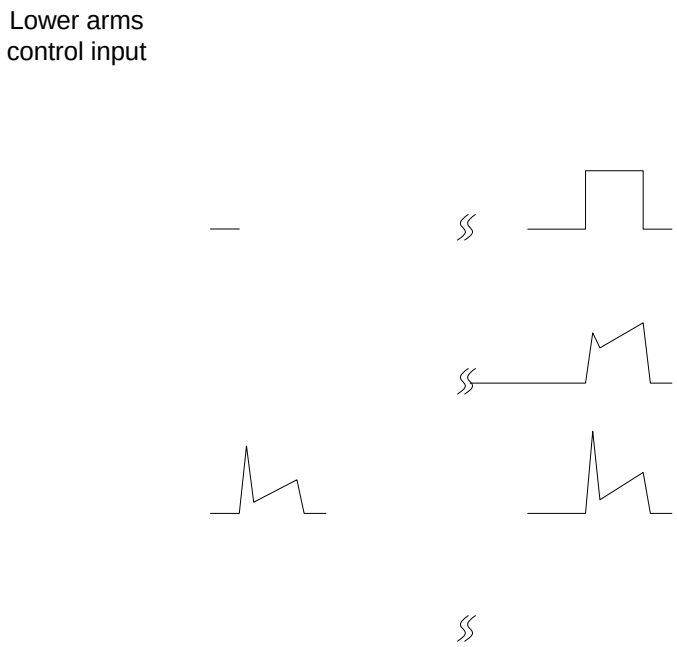
Note:

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

Note:

10. RC coupling at each input (parts shown dotted) might change depending on the PWM control scheme used in the application and the wiring impedance of the application's printed circuit board. The input signal section of the SPM 55 product integrates 5 kΩ (typ.) pull-down resistor. Therefore, when using an external filtering resistor, please pay attention to the signal voltage drop at input terminal.

Figure 6. Recommended MCU I/O Interface Circuit



(with the external shunt resistance and CR connection)

c1 : Normal operation: IGBT ON and carrying current.

c2 : Short circuit current detection (SC trigger).

c3 : Hard IGBT gate interrupt.

c4 : IGBT turns OFF.

c5 : Input “L” : IGBT OFF state.

c6 : Input “H”: IGBT ON state, but during the active period of fault output the IGBT doesn’t turn ON.

c7 : IGBT OFF state

Figure 11. Short-Circuit Protection

d1 : High Side First - Input - First - Output Mode

d2 : Low Side Noise Mode : No Lo

d3 : High Side Noise Mode : No Ho

d4 : Low Side First - Input - First - Output Mode

d5 : In - Phase Mode : No Ho

Figure 12. Inter-Lock Function

Note:

1) To avoid malfunction, the wiring of each input should be as short as possible. (less than 2 ~ 3 cm)

2) By virtue of integrating an application specific type of HVIC inside the SPM® 55 product, direct coupling to MCU terminals without any opto-coupler or transformer isolation is possible.

3) V_F is open-drain type. This signal line should be pulled up to the positive side of the MCU or control power supply with a resistor that makes I_{FO} up to 5 mA. Please refer to Figure 14.

4) C_{SP15} of around seven times larger than bootstrap capacitor C_{BS} is recommended.

5) Input signal is active-HIGH type. There is a 5 kΩ

Detailed Package Outline Drawings (FNB51560T1, Short Lead)

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

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19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
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Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
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