

ASPM27 SERIES EVB

Automotive Smart Power Module, ASPM27 Series

INTRODUCTION

This user's guide is intended to provide practical guidelines for the 650 V, Automotive Smart Power Module series. From now on, these series are called the ASPM27 series. It should be used in conjunction with the datasheet and application note

Product Description

The 650 V, ASPM27 series is Intelligent Power Module (IPM) for 3-phase motor drives which contain the main power circuitry and the supporting control circuitry.

This is achieved by applying new gate-driving High-Voltage Integrated Circuit (HVIC), a new Insulated-Gate Bipolar Transistor (IGBT) of advanced silicon technology, and improved Direct Bonded Copper (DBC) substrate base transfer mold package. The 650 V, ASPM27 achieves reduced board size and improved reliability compared to existing discrete solutions. Target applications are inverter motor drives for Auto-motive use, such as E-compressor, Oil pump, Fuel pump, Water pump, cooling fans and other auxiliary motors in Hybrid and Electric Vehicles. The temperature sensing function of the 650 V ASPM27 products is implemented in the LVIC to enhance the system reliability. An analog voltage proportional to the temperature of the LVIC is provided for monitoring the module temperature and necessary protections against over-temperature situations.

Features

- Automotive Qualified (AEC-Q100, Q101 and AQG324)
- 650 V ASPM27, 3-Phase IGBT inverter with Integral Gate Drivers and Protection
- Very Low Thermal Resistance by Adopting DBC Substrate
- Separate Open-Emitter pins from Low-Side IGBTs for Three-Phase Current Sensing
- Built-in Temperature Sensing Unit of IC
- Isolation Rating of 2500 V_{RMS}/1 min
- Pb-Free and RoHS compliant

Table 1. LINE-UP

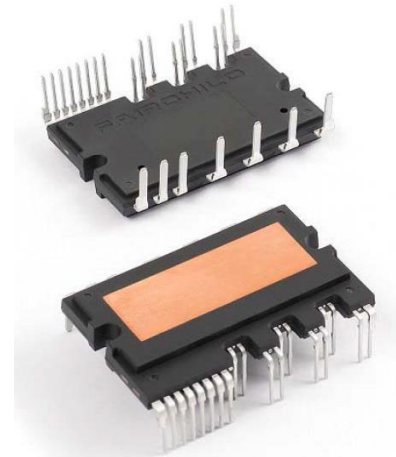
Device	NFVA33065L32	NFVA34065L32	NFVA35065L32
Package	ASPM27		
Voltage (V _{CEMAX})	650 V		
Current, I _C	30 A	40 A	50 A
Peak current, I _C MAX	60 A	80 A	100 A
Isolation Voltage	2500 V _{RMS}		



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EVAL BOARD USER'S MANUAL



ASPM27-CCA

Typical Application

- E-compressor, Oil Pump, Fuel Pump
- Water Pump, Cooling Fans

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EVALUATION BOARD DESCRIPTION

Schematic

0 shows a circuit of the evaluation board of ASPM27 series. The evaluation board consists of interface circuit, bootstrap capacitors and snubber capacitor. Also this board was included the short-circuit protection and fault out

circuit by using one shunt resistor. If need more detail schematic, please double check on web site, www.onsemi.com, we shared schematic, BOM list and Gerber data on web site.

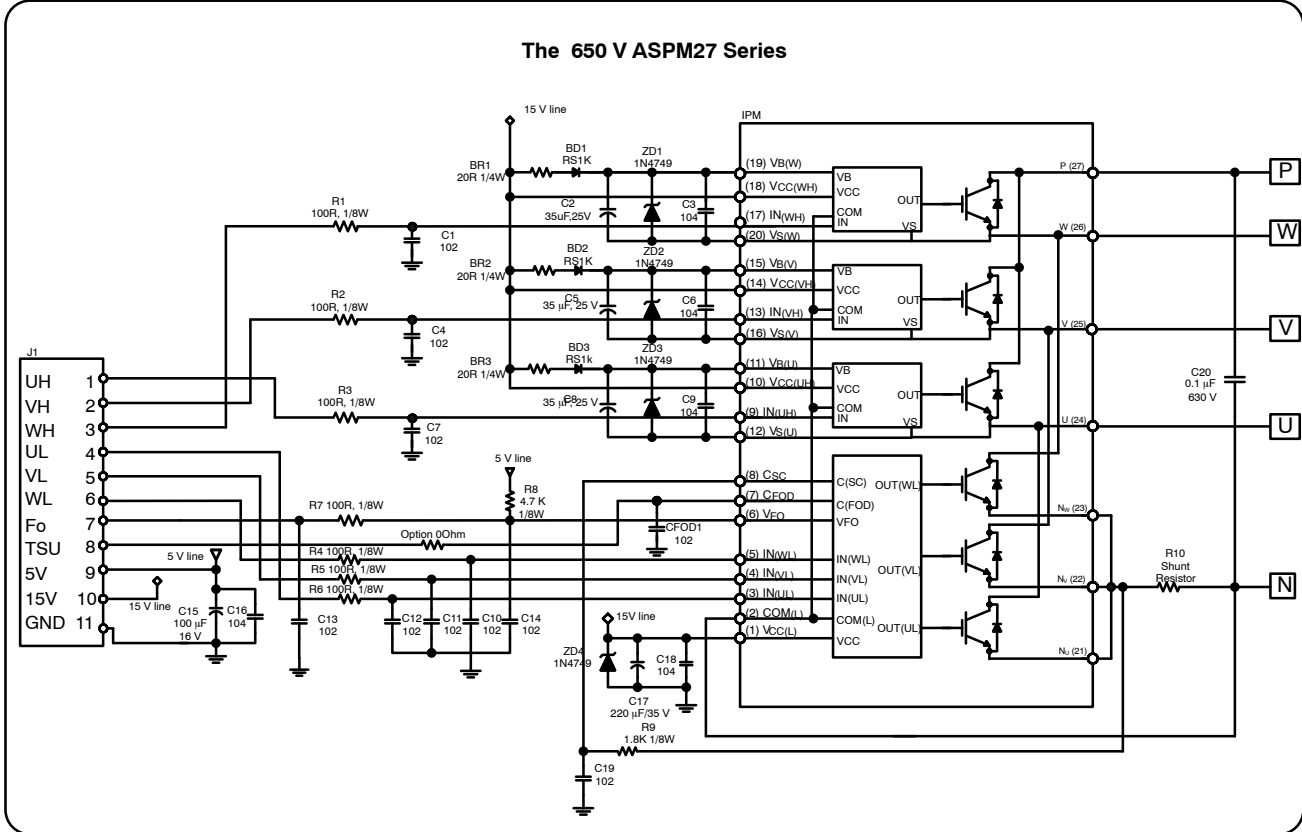


Figure 1. Evaluation Board Circuits

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Figure 2, Shows the real evaluation board of the 650 V, ASPM27.

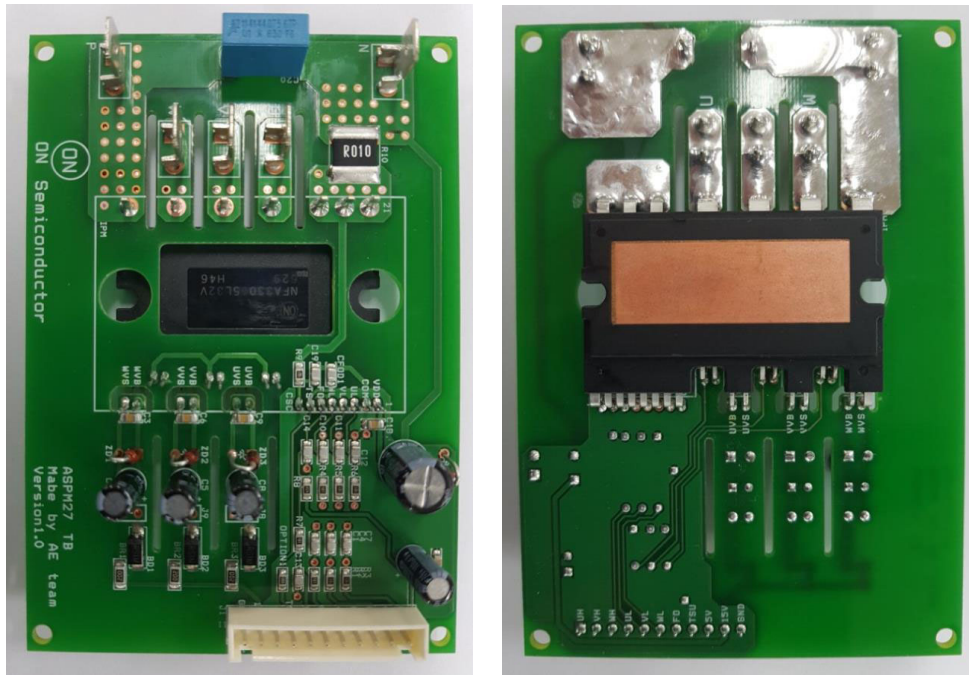


Figure 2. Real Evaluation Board of the 650 V ASPM27

PCB Map

Figure 3 shows the PCB layout of the 650 V ASPM27 series.

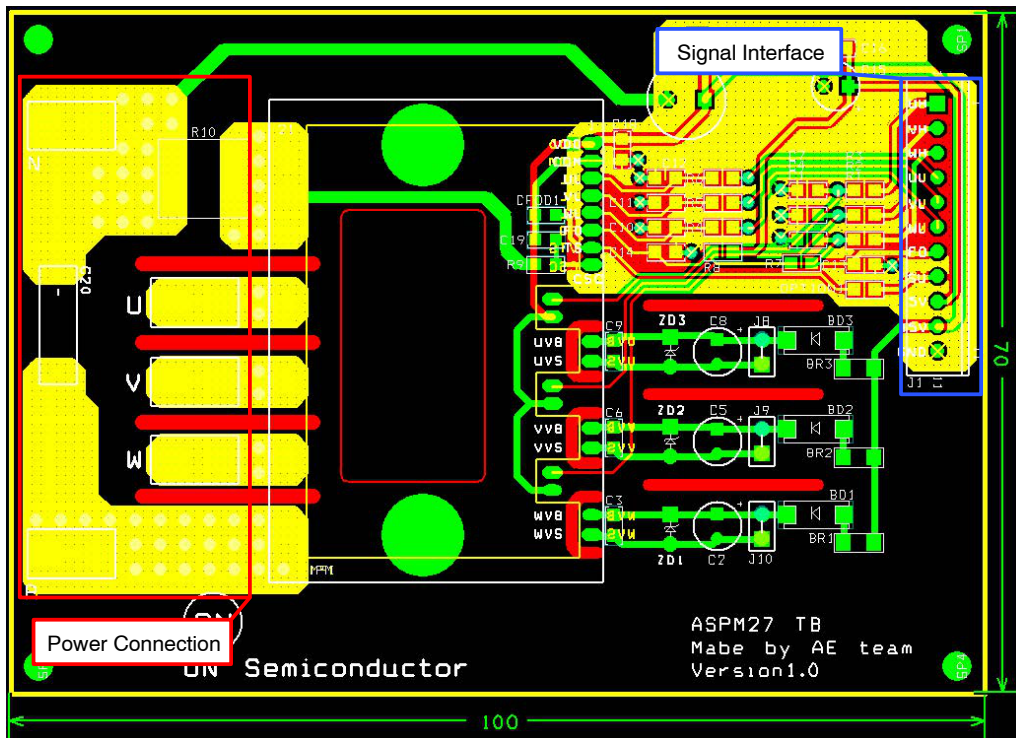


Figure 3. PCB Layout of the 650 V ASPM27 Series

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Circuit Layout Design Guidance

1. PCB size is 100.0 mm x 70.0 mm
2. To avoid malfunction, the wiring of each input should be as short as possible. (Less than 2–3 cm)
3. To prevent protection function errors, the “R9” and “R10” wiring should be as short as possible
4. All the de-coupling capacitors and filter capacitors should be placed very close to IPM
5. The short-circuit protection time constant $R9 \cdot C19$ should be set in the range of 1.5~2.0 μsec
6. The isolation distance of DC-P, U, V, W-phase, DC-N/GND block should be over 2.54 mm(100mil) for 300 V~500 V P-N voltage
7. Power-GND and signal-GND should be connected with each other through only one 1.5~2 mm width pattern
8. To prevent surge destruction, the wiring between the filter capacitor and the P & Ground pins should be as short as possible. The use of a high frequency non-inductive capacitor (Snubber, C20) between the P & Ground pins is recommended. In addition to reducing local voltage spikes, the placement and quality of this capacitor will have a direct impact on both conducted and radiated EMI

This evaluation board is simply, customer have to connect just signal interface with MCU (+5 and +15 V), VPN voltage (DC bus voltage) and Motor connection (U/V/W). For future detail information, refer to the datasheet and application note.

Table 2. PIN DESCRIPTION

Column Head	Pin	Description
Signal Interface (J1)	1	High-Side Input Signal from MCU (Phase U)
	2	High-Side Input Signal from MCU (Phase V)
	3	High-Side Input Signal from MCU (Phase W)
	4	Low-Side Input Signal from MCU (Phase U)
	5	Low-Side Input Signal from MCU (Phase V)
	6	Low-Side Input Signal from MCU (Phase W)
	7	Fault-Out Signal to MCU
	8	T_C Monitoring to MCU
	9	SPM Bias Supply +5 V Terminal
	10	SPM Bias Supply +15 V Terminal
	11	SPM Bias Supply GND Terminal
Power Connection	P	Positive DC Link Input Connection
	N	Negative DC Link Input Connection
	U	Motor Input Connection (Phase U)
	V	Motor Input Connection (Phase V)
	W	Motor Input Connection (Phase W)

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Printed Circuit Board

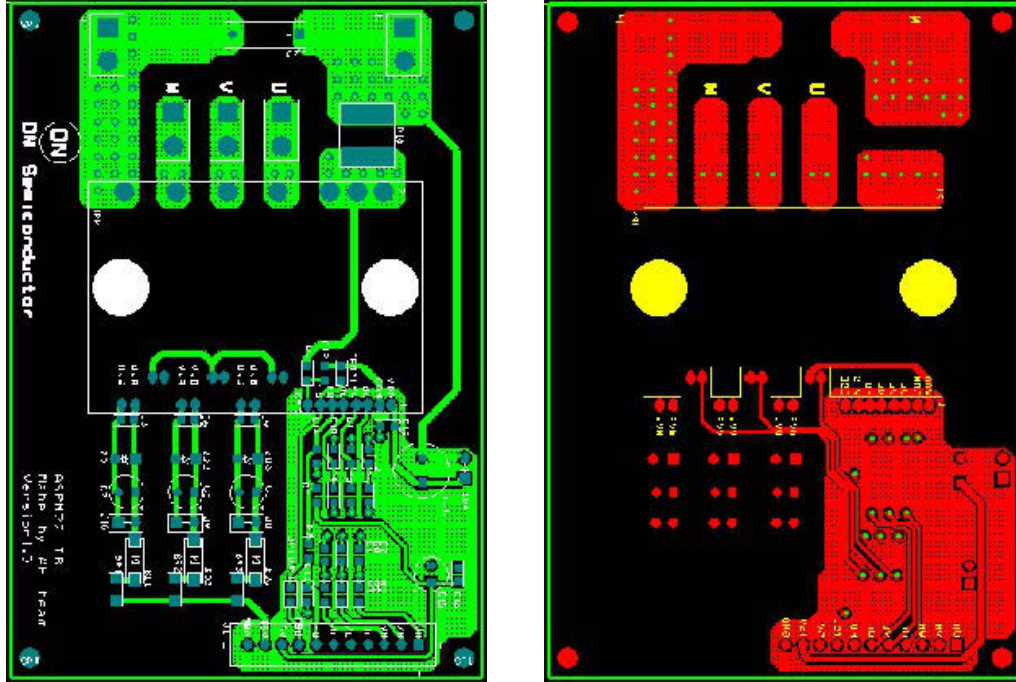


Figure 4. Top & Bottom Side View

Table 3. BILL OF MATERIAL

Part No	Part Number	Description	Qty	Manufacturer
IPM	NFVA3xx65L32	650 V, xxA	1	ASPM27 series
R1, 2, 3, 4, 5, 6, 7	MCR10EZPJ101	100 Ω , 1/8 W, 5%	7	ROHM
R8	MCR10EZPJ472	4.7 k Ω , 1/8 W, 5%	1	ROHM
R9	MCR10EZPK182	1.8 k Ω , 1/8 W, 5%	1	ROHM
R10 (Note 1) (Shunt resistor)	MPR 5RS XXX	10 m Ω , 5 W, 5%	1	RARA
Option1	MCR10EZPJ000	0 Ω , 1/8 W, 5%	1	ROHM
BR1, 2, 3	MCR18EZPJ20R0	20 Ω , 1/4 W, 5%	3	ROHM
C1, 4, 7, 10, 11, 12, 13, 14, 19	CL21B102KB	1 nF, 50 V	9	SAMSUNG ELEC
C3, 6, 9, 16, 18	CL21B104KB	0.1 μ F, 50 V	5	SAMSUNG ELEC
C2, 5, 8	KXL 33 μ F, 25V	33 μ F, 25 V	3	SAMYOUNG
C15	KXL 100 μ F, 16V	100 μ F, 16 V	1	SAMYOUNG
C17	KXL 220 μ F, 35V	220 μ F, 35 V	1	SAMYOUNG
C20	B32671P6104K	0.1 μ F, 630 V	1	EPCOS/TDK
CFOD1	CL21B102KB	1 nF, 50 V	1	SAMSUNG ELEC
ZD1, 2, 3, 4	1N4749A	24 V, 1.0 W, Zener or TVS	4	ON SEMI
BD1, 2, 3	RS1K	1 A, 800 V	3	ON SEMI
J1	CONNECTOR	2.54 mm, 11Pin	1	YEONHO
U, V, W, P, N	GP881191-2	Tab Terminal	5	KET

- R10(shunt resistor) needs to be changed accordingly based on the OC level
- For the over current level, usually, we recommended 1.5~1.7 times the current rating.
 - ASPM 30A : 10 m Ω (50 A),
 - ASPM 40A : 8 m Ω (62.5 A),
 - ASPM 50A : 6 m Ω (83.3 A)

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