

**Product Description**

The NVH950S75L4SPB is a power module from the VE-Trac™ Direct family of highly integrated power modules with industry standard footprints for Hybrid (HEV) and Electric Vehicle (EV) traction inverter application.

The module integrates six Field Stop 4 (FS4) 750 V Narrow Mesa IGBTs in a 6-pack configuration, which excels in providing high current density, while offering robust short circuit protection and increased blocking voltage. Additionally, FS4 750 V Narrow Mesa IGBTs show low power losses during lighter loads, which helps to improve overall system efficiency in automotive applications.

For assembly ease and reliability, a new generation of press-fit pins are integrated into the power module signal terminals. In addition, the power module has an optimized pin-fin heatsink in the baseplate.

**Features**

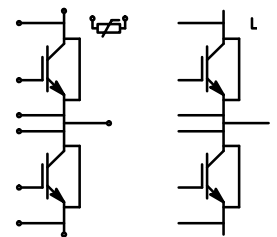
- Direct Cooling w/ Integrated Pin-fin Heatsink
- Ultra-low Stray Inductance
- $T_{vjmax} = 175^{\circ}C$  Continuous Operation
- Low  $V_{CESAT}$  and Switching Losses
- Automotive Grade FS4 750 V Narrow Mesa IGBT
- Fast Recovery Diode Chip Technologies
- 4.2 kV Isolated DBC Substrate
- Easy to Integrate 6-pack Topology
- This Device is Pb-Free and is RoHS Compliant

**Typical Applications**

- Hybrid and Electric Vehicle Traction Inverter
- High Power Converters



SSDC33, 154.50x92.0 (SPB)  
CASE 183AB



**ORDERING INFORMATION**

See detailed ordering and shipping information on page 5 of this data sheet.

# NVH950S75L4SPB

## Pin Description

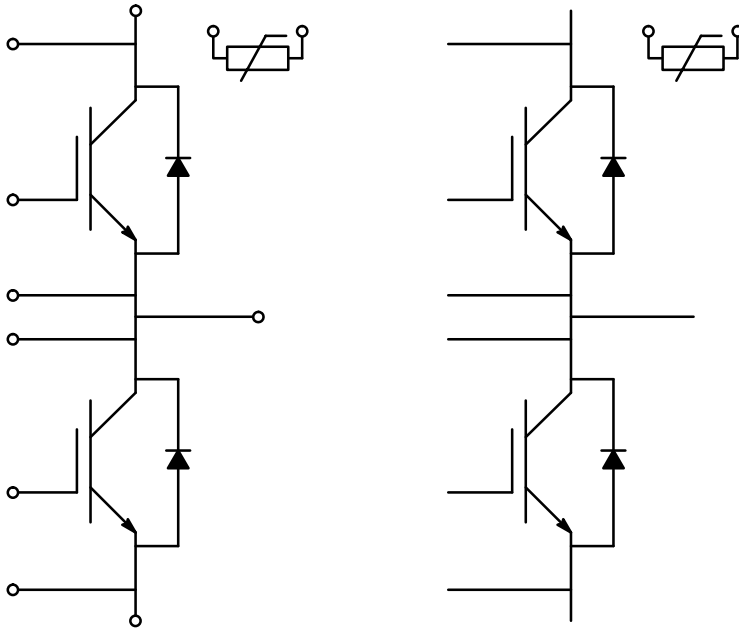


Figure 1. Pin Description

# NVH950S75L4SPB

## MODULE CHARACTERISTICS (T<sub>vj</sub> = 25°C, Unless Otherwise Specified)

Symbol	Parameter	Rating	Unit
T <sub>vj</sub>	Operating Junction Temperature	-40 to 175	°C
T <sub>STG</sub>	Storage Temperature	-40 to 125	°C
V <sub>ISO</sub>	Isolation Voltage (DC, 0 Hz, 1 s)	4200	V
L <sub>sCE</sub>	Stray Inductance	8	nH
RCC'+EE'	Module Lead Resistance, Terminals – Chip	0.75	mΩ
G			

# NVH950S75L4SPB

## CHARACTERISTICS OF IGBT ( $T_{vj} = 25^{\circ}\text{C}$ , Unless Otherwise Specified)

Symbol	Parameters	Conditions	Min	Typ	Max	Unit	
$V_{CESAT}$	Collector to Emitter Saturation Voltage (Terminal)	$V_{GE} = 15\text{ V}$ , $I_C = 600\text{ A}$	$T_{vj} = 25^{\circ}\text{C}$	–	1.30	1.55	V
	Collector to Emitter Saturation Voltage (Chip)	$V_{GE} = 15\text{ V}$ , $I_C = 600\text{ A}$	$T_{vj} = 25^{\circ}\text{C}$	–	1.25	1.50	
			$T_{vj} = 150^{\circ}\text{C}$	–	1.37	–	
		$T_{vj} = 175^{\circ}\text{C}$	–	1.40	–		
		$V_{GE} = 15\text{ V}$ , $I_C = 950\text{ A}$	$T_{vj} = 25^{\circ}\text{C}$	–	1.47	–	
			$T_{vj} = 150^{\circ}\text{C}$	–	1.71	–	
			$T_{vj} = 175^{\circ}\text{C}$	–	1.77	–	
$I_{CES}$	Collector to Emitter Leakage Current	$V_{GE} = 0$ , $V_{CE} = 750\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$	–	–	500	$\mu\text{A}$
			$T_{vj} = 150^{\circ}\text{C}$	–	2.0	–	$\text{mA}$
$I_{GES}$	Gate – Emitter Leakage Current	$V_{CE} = 0$ , $V_{GE} = \pm 20\text{ V}$		–	–	$\pm 300$	nA
$V_{th}$	Threshold Voltage	$V_{CE} = V_{GE}$ , $I_C = 90\text{ mA}$		4.8	5.7	6.6	V
$Q_G$	Total Gate Charge	$V_{GE} = -8\text{ to }15\text{ V}$ , $V_{CE} = 400\text{ V}$		–	2.3	–	$\mu\text{C}$
$R_{Gint}$	Internal Gate Resistance			–	1.7	–	$\Omega$
$C_{ies}$	Input Capacitance	$V_{CE} = 30\text{ V}$ , $V_{GE} = 0\text{ V}$ , $f = 100\text{ kHz}$		–	60	–	nF
$C_{oes}$	Output Capacitance	$V_{CE} = 30\text{ V}$ , $V_{GE} = 0\text{ V}$ , $f = 100\text{ kHz}$		–	1.90	–	nF
$C_{res}$	Reverse Transfer Capacitance	$V_{CE} = 30\text{ V}$ , $V_{GE} = 0\text{ V}$ , $f = 100\text{ kHz}$		–	0.2	–	nF
$T_{d,on}$	Turn On Delay, Inductive Load	$I_C = 600\text{ A}$ , $V_{CE} = 400\text{ V}$ , $V_{GE} = +15/-8\text{ V}$ , $R_{g,on} = 4\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$	–	315	–	ns
			$T_{vj} = 150^{\circ}\text{C}$	–	320	–	
			$T_{vj} = 175^{\circ}\text{C}$	–	322	–	
$T_r$	Rise Time, Inductive Load	$I_C = 600\text{ A}$ , $V_{CE} = 400\text{ V}$ , $V_{GE} = +15/-8\text{ V}$ , $R_{g,on} = 4\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$	–	108	–	ns
			$T_{vj} = 150^{\circ}\text{C}$	–	127	–	
			$T_{vj} = 175^{\circ}\text{C}$	–	132	–	
$T_{d,off}$	Turn Off Delay, Inductive Load	$I_C = 600\text{ A}$ , $V_{CE} = 400\text{ V}$ , $V_{GE} = +15/-8\text{ V}$ , $R_{g,off} = 12\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$	–	1063	–	ns
			$T_{vj} = 150^{\circ}\text{C}$	–	1196	–	
			$T_{vj} = 175^{\circ}\text{C}$	–	1203	–	
$T_f$	Fall Time, Inductive Load	$I_C = 600\text{ A}$ , $V_{CE} = 400\text{ V}$ , $V_{GE} = +15/-8\text{ V}$ , $R_{g,off} = 12\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$	–	85	–	ns
			$T_{vj} = 150^{\circ}\text{C}$	–	144	–	
			$T_{vj} = 175^{\circ}\text{C}$	–	151	–	
$E_{ON}$	Turn On Switching Loss (Including Diode Reverse Recovery Loss)	$I_C = 600\text{ A}$ , $V_{CE} = 400\text{ V}$ , $V_{GE} = +15/-8\text{ V}$ , $L_s = 22\text{ nH}$ , $R_{g,on} = 4\ \Omega$	$di/dt = 4.5\text{ A/ns}$ , $T_{vj} = 25^{\circ}\text{C}$	–	26	–	mJ
			$di/dt = 3.9\text{ A/ns}$ , $T_{vj} = 150^{\circ}\text{C}$	–	36	–	
			$di/dt = 3.6\text{ A/ns}$ , $T_{vj} = 175^{\circ}\text{C}$	–	38	–	
$E_{OFF}$	Turn Off Switching Loss	$I_C = 600\text{ A}$ , $V_{CE} = 400\text{ V}$ , $V_{GE} = +15/-8\text{ V}$ , $L_s = 22\text{ nH}$ , $R_{g,off} = 12\ \Omega$	$dv/dt = 2.7\text{ V/ns}$ , $T_{vj} = 25^{\circ}\text{C}$	–	33	–	mJ
			$dv/dt = 1.9\text{ V/ns}$ , $T_{vj} = 150^{\circ}\text{C}$	–	46	–	
			$dv/dt = 1.9\text{ V/ns}$ , $T_{vj} = 175^{\circ}\text{C}$	–	50	–	
$E_{SC}$	Minimum Short Circuit Energy Withstand	$V_{GE} = 15\text{ V}$ , $V_{CC} = 400\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$	9	–	–	J
			$T_{vj} = 175^{\circ}\text{C}$	4.5	–	–	

# NVH950S75L4SPB

## CHARACTERISTICS OF INVERSE DIODE ( $T_{vj} = 25^{\circ}\text{C}$ , Unless Otherwise Specified)

Symbol	Parameters	Conditions		Min	Typ	Max	Unit
$V_F$	Diode Forward Voltage (Terminal)	$I_F = 600 \text{ A}$	$T_{vj} = 25^{\circ}\text{C}$	–	1.70	1.95	V
	Diode Forward Voltage (Chip)	$I_F = 600 \text{ A}$	$T_{vj} = 25^{\circ}\text{C}$	–	1.60	1.85	
			$T_{vj} = 150^{\circ}\text{C}$	–	1.55	–	
			$T_{vj} = 175^{\circ}\text{C}$	–	1.50	–	
	$I_F = 950 \text{ A}$	$T_{vj} = 25^{\circ}\text{C}$	–	1.73	–		
			$T_{vj} = 150^{\circ}\text{C}$	–	1.75	–	
			$T_{vj} = 175^{\circ}\text{C}$	–	1.74	–	
$E_{rr}$	Reverse Recovery Energy	$I_F = 600 \text{ A}, V_R = 400 \text{ V},$ V					



# NVH950S75L4SPB

## TYPICAL CHARACTERISTICS

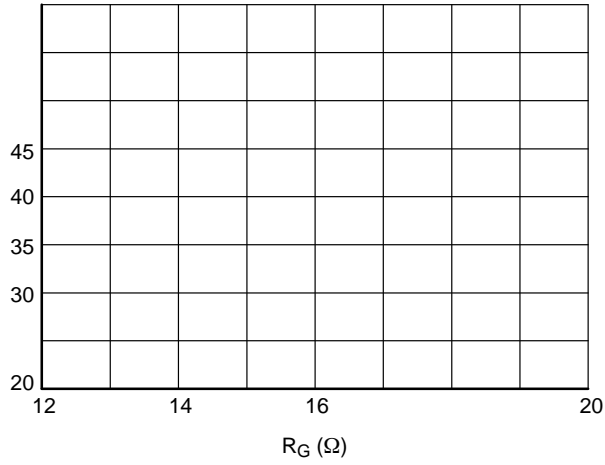


Figure 8.  $E_{OFF}$  vs.  $R_G$

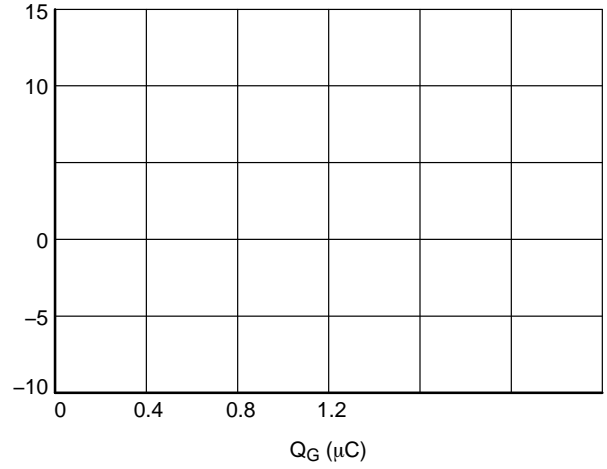


Figure 9. Gate Charge Characteristic

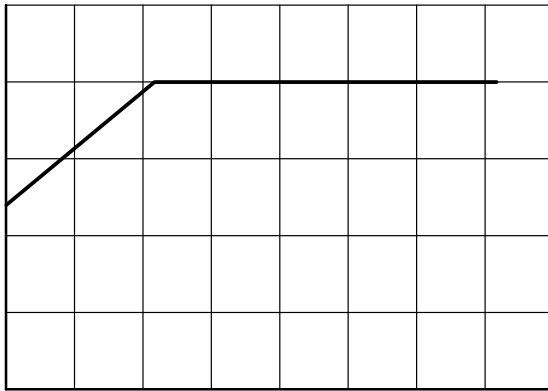


Figure 10. Maximum Allowed  $V_{CE}$

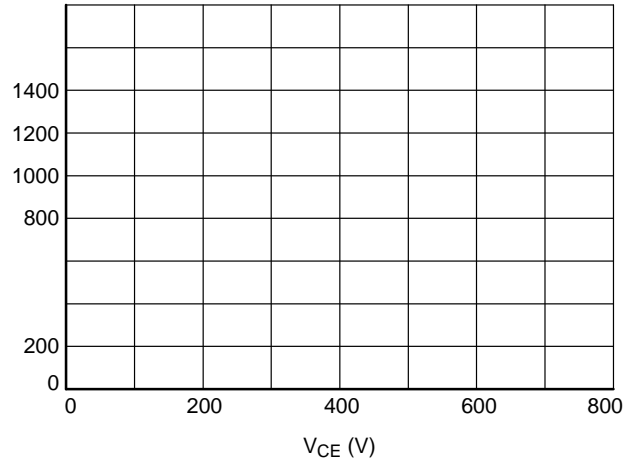
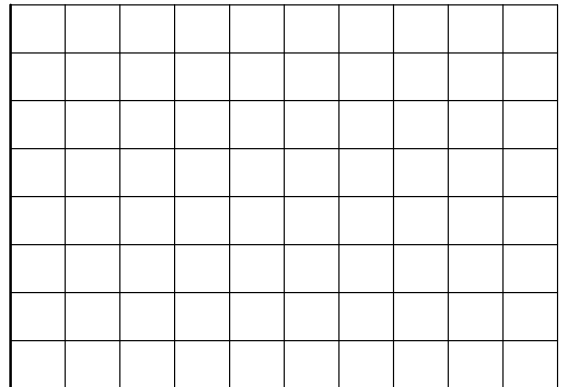
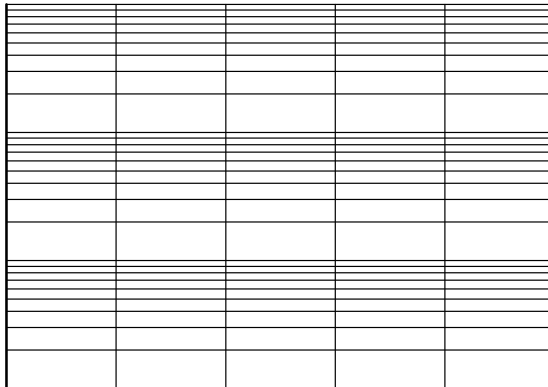


Figure 11. Reverse Bias Safe Operating Area



# NVH950S75L4SPB

## TYPICAL CHARACTERISTICS




# NVH950S75L4SPB

## TYPICAL CHARACTERISTICS

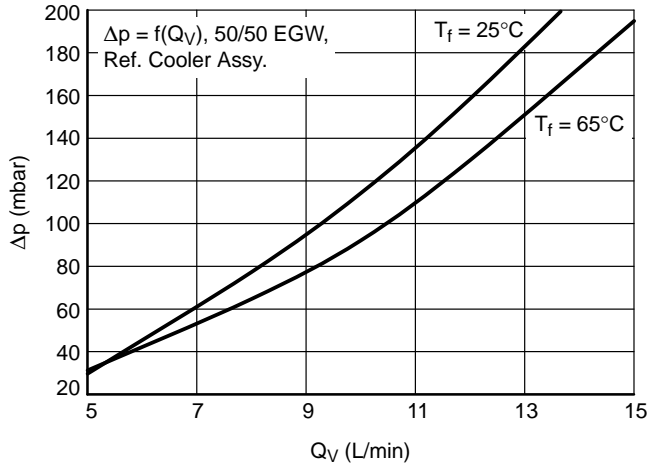


Figure 20. Pressure Drop in Cooling Circuit

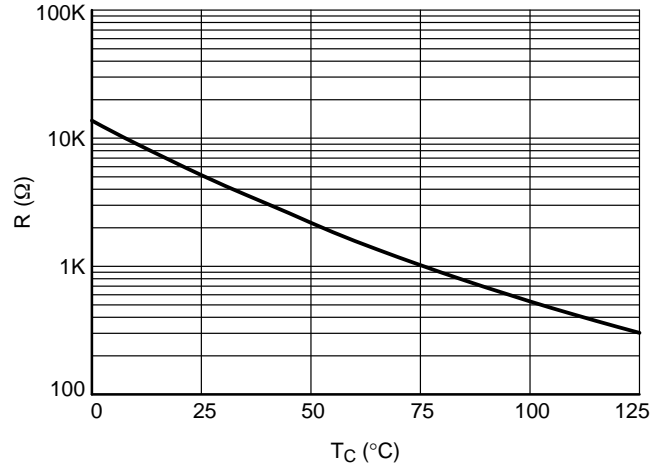


Figure 21. NTC Thermistor – Temperature Characteristic (Typ.)

**SSDC33, 154.50x92.0 (SPB)**  
CASE 183AB  
ISSUE A

DATE 05 DEC 2019

XXXXX = Specific Device Code  
G = Pb-Free Package  
AT = Assembly & Test Site Code  
YYWW= Year and Work Week Code

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "

**SSDC33, 154.50x92.0 (SPB)**  
CASE 183AB  
ISSUE A

DATE 05 DEC 2019

=  
:  
:

**onsemi**, **onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi**

---

---