

Silicon Carbide (SiC) MOSFET - EliteSiC, 16 mohm 650 V, M3S, TO247-4L NVH4L016N065M3S

Features

- Typical $R_{DS(on)} = 16\text{ m}\Omega$ @ $V_{GS} = 18\text{ V}$
- Low Effective Output Capacitance
- Ultra Low Gate Charge
- 100% UIS Tested
- Qualified According to AECQ101
- This Device is Halide Free and RoHS Compliant with Exemption 7a, Pb-Free 2LI (on second level interconnection)

Applications

- Automotive On and Off Board Charger
- Automotive DC-DC Converter for EV-HEV

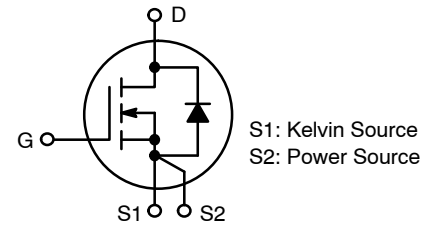
MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DSS}	650	V
Gate-to-Source Voltage	V_{GS}	-10/+22.6	V
Continuous Drain Current	$T_C = 25^\circ\text{C}$	I_D	71
Power Dissipation		P_D	300
Continuous Drain Current	$T_C = 100^\circ\text{C}$	I_D	50
Power Dissipation		P_D	150
Pulsed Drain Current (Note 1)	$T_C = 25^\circ\text{C}$ $t_p = 100\text{ }\mu\text{s}$	I_{DM}	243
Continuous Source-Drain Current (Body Diode)	$T_C = 25^\circ\text{C}$ $V_{GS} = -3\text{ V}$	I_S	48
	$T_C = 100^\circ\text{C}$ $V_{GS} = -3\text{ V}$		28
Pulsed Source-Drain Current (Body Diode) (Note 1)	$T_C = 25^\circ\text{C}$ $V_{GS} = -3\text{ V}$, $t_p = 100\text{ }\mu\text{s}$	I_{SM}	226
Single Pulse Avalanche Energy (Note 2)	$I_{LPK} = 60\text{ A}$, $L = 0.1\text{ mH}$	E_{AS}	180
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +175	$^\circ\text{C}$
Lead Temperature for Soldering Purposes (1/8" from case for 10 seconds)	T_L	270	$^\circ\text{C}$

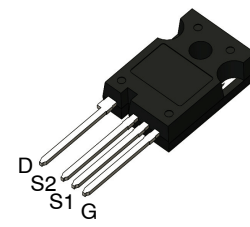
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Single pulse, limited by max junction temperature.
2. E_{AS} of 180 mJ is based on starting $T_J = 25^\circ\text{C}$, $L = 0.1\text{ mH}$, $I_{AS} = 60\text{ A}$, $V_{DD} = 100\text{ V}$, $V_{GS} = 18\text{ V}$.

$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	I_D MAX
650 V	16 m Ω @ $V_{GS} = 18\text{ V}$	71 A



N-CHANNEL MOSFET



TO-247-4LD
CASE 340CJ

MARKING DIAGRAM



H4L016065M3S = Specific Device Code

A = Assembly Location

Y = Year

WW = Work Week

ZZ = Lot Traceability

ORDERING INFORMATION

Device	Package	Shipping
NVH4L016N065M3S	TO-247-4L	30 Units / Tube

THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case (Note 3)	$R_{\theta JC}$	0.50	$^{\circ}\text{C/W}$

3. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value	Unit
Operation Values of Gate to Source Voltage	V_{GSop}	-3/+18	V

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

ELECTRICAL CHARACTERISTICS ($T_J = 25^{\circ}\text{C}$ unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
-----------	--------	-----------------	-----	-----	-----	------

OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}, T_J = 25^{\circ}\text{C}$	650			V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 650\text{ V}, T_J = 25^{\circ}\text{C}$			10	μA
		$V_{DS} = 650\text{ V}, T_J = 175^{\circ}\text{C}$ (Note 5)			500	μA
Gate-to-Source Leakage Current	I_{GSS}	$V_{GS} = -10\text{ V}, V_{DS} = 0\text{ V}$	-1			μA
		$V_{GS} = +22.6\text{ V}, V_{DS} = 0\text{ V}$			1	

ON CHARACTERISTICS

Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 18\text{ V}, I_D = 30\text{ A}, T_J = 25^{\circ}\text{C}$		16	23.5	$\text{m}\Omega$
		$V_{GS} = 18\text{ V}, I_D = 30\text{ A}, T_J = 175^{\circ}\text{C}$ (Note 5)		25		
		$V_{GS} = 15\text{ V}, I_D = 30\text{ A}, T_J = 25^{\circ}\text{C}$		21		
		$V_{GS} = 15\text{ V}, I_D = 30\text{ A}, T_J = 175^{\circ}\text{C}$ (Note 5)		27		
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 15\text{ mA}, T_J = 25^{\circ}\text{C}$	2.0	2.7	4.0	V
Forward Transconductance	g_{FS}	$V_{DS} = 10\text{ V}, I_D = 30\text{ A}$ (Note 5)		27		S

CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	C_{ISS}	$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ (Note 5)		2735		pF
Output Capacitance	C_{OSS}			208		
Reverse Transfer Capacitance	C_{RSS}			18		
Total Gate Charge	$Q_{G(TOT)}$	$V_{DD} = 400\text{ V}, I_D = 30\text{ A}, V_{GS} = -3/18\text{ V}$ (Note 5)		100		nC
Gate-to-Source Charge	Q_{GS}			33		
Gate-to-Drain Charge	Q_{GD}			25		
Gate Resistance	R_G	$f = 1\text{ MHz}$		3.0		Ω

SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -3/18\text{ V}, V_{DD} = 400\text{ V}, I_D = 30\text{ A}, R_G = 4.7\text{ }\Omega, T_J = 25^{\circ}\text{C}$ (Notes 4, 5)		6.5		ns
Turn-Off Delay Time	$t_{d(OFF)}$			45		
Rise Time	t_r			20		
Fall Time	t_f			45		
Turn-On Switching Loss	E_{ON}			103		μJ
Turn-Off Switching Loss	E_{OFF}			100		
Total Switching Loss	E_{TOT}			203		

NVH4L016N065M3S

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise specified) (continued)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	t _{d(ON)}	V _{GS} = -3/18 V, V _{DD} = 400 V, I _D = 30 A, R _G = 4.7 Ω, T _J = 175 °C (Notes 4, 5)		4.7		ns
Turn-Off Delay Time	t _{d(OFF)}			55		
Rise Time	t _r			20		
Fall Time	t _f			13		
Turn-On Switching Loss	E _{ON}			104		μJ
Turn-Off Switching Loss	E _{OFF}			108		
Total Switching Loss	E _{TOT}			212		

SOURCE-TO-DRAIN DIODE CHARACTERISTICS

Forward Diode Voltage	V _{SD}	I _{SD} = 30 A, V _{GS} = -3 V, T _J = 25 °C		4.6	6.0	V
		I _{SD} = 30 A, V _{GS} = -3 V, T _J = 175 °C (Note 5)		4.3		
Reverse Recovery Time	t _{RR}	V _{GS} = -3 V, I _S = 30 A, dI/dt = 1000 A/μs, V _{DS} = 400 V, T _J = 25 °C (Note 5)		23		ns
Charge Time	t _a			13		
Discharge Time	t _b			10		
Reverse Recovery Charge	Q _{RR}			146		nC
Reverse Recovery Energy	E _{REC}			12		μJ
Peak Reverse Recovery Current	I _{RRM}			11		A

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4. E_{ON}/E_{OFF} result is with body diode.

5. Defined by design, not subject to production test.

TYPICAL CHARACTERISTICS

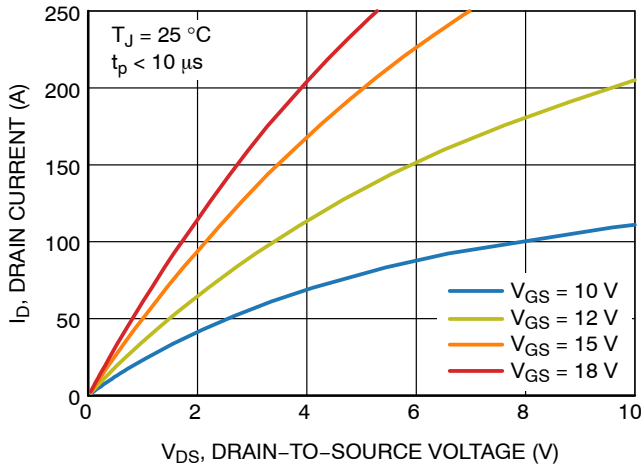


Figure 1. Output Characteristics

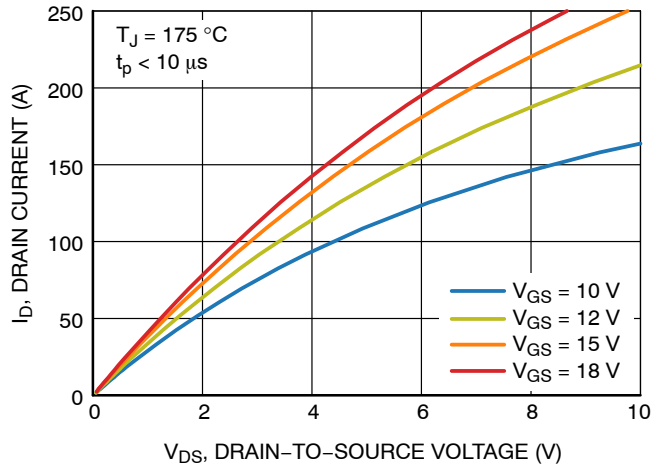


Figure 2. Output Characteristics

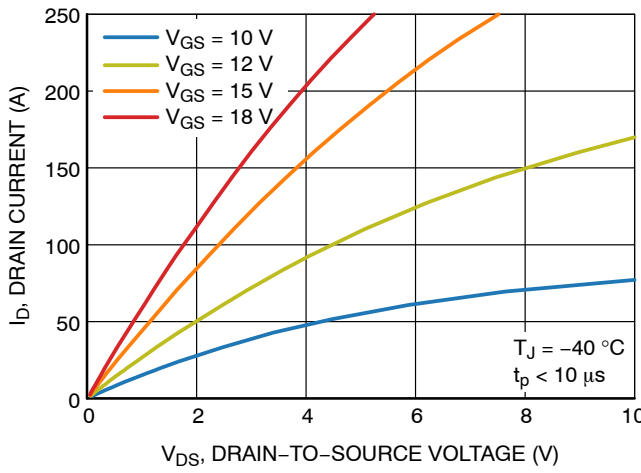


Figure 3. Output Characteristics

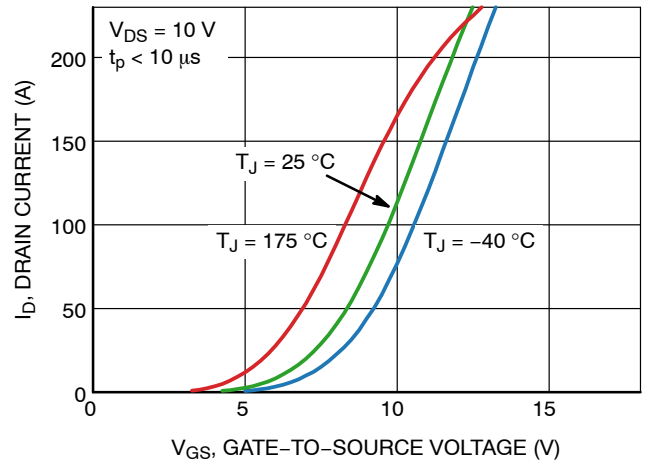


Figure 4. I_D vs. V_{GS}

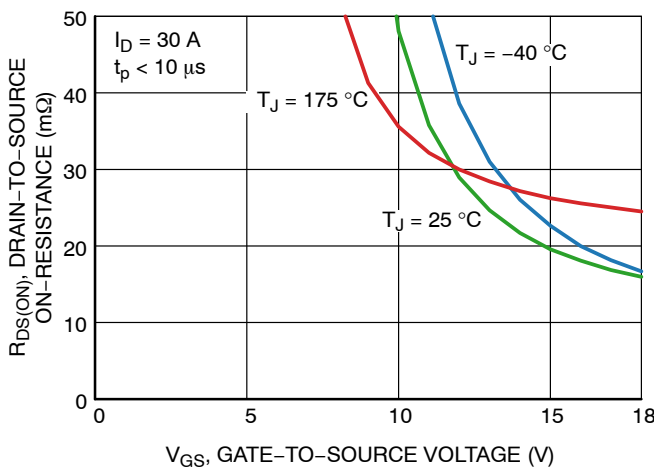


Figure 5. $R_{DS(ON)}$ vs. V_{GS}

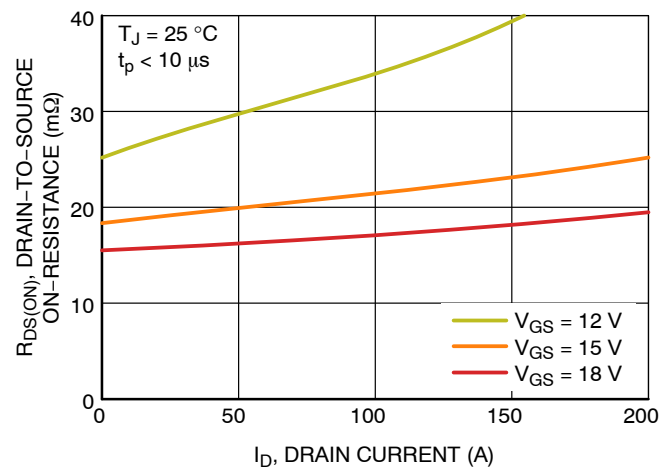


Figure 6. $R_{DS(ON)}$ vs. I_D

TYPICAL CHARACTERISTICS

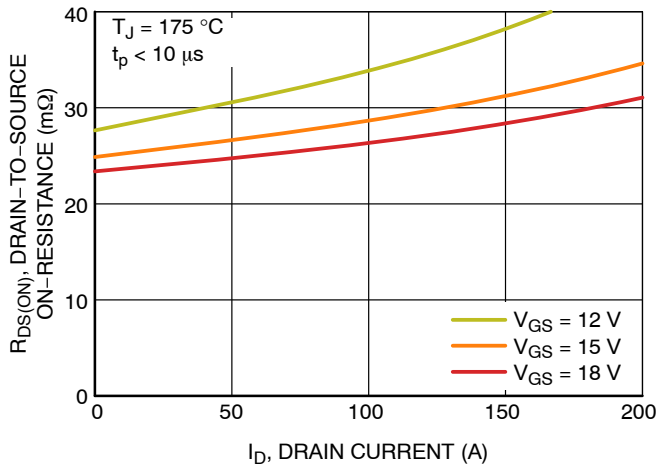


Figure 7. $R_{DS(ON)}$ vs. I_D

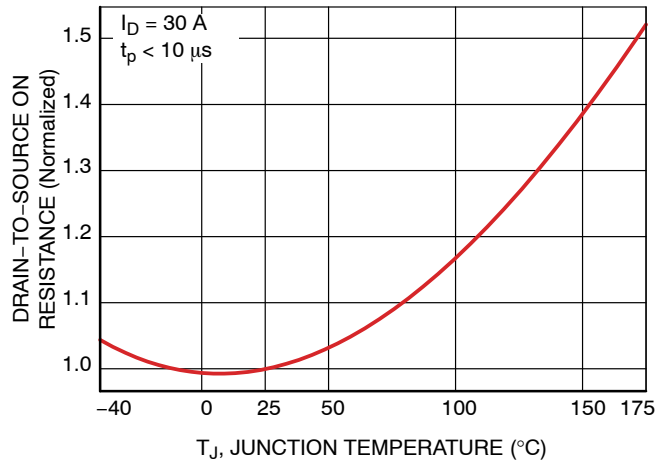


Figure 8. $R_{DS(ON)}$ vs. T_J

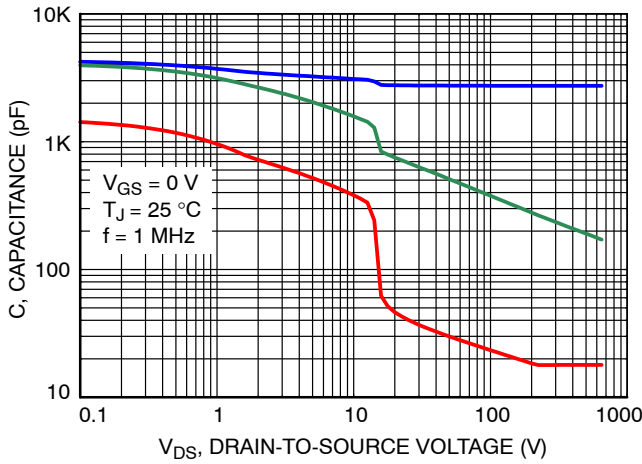


Figure 9. Capacitance Characteristics

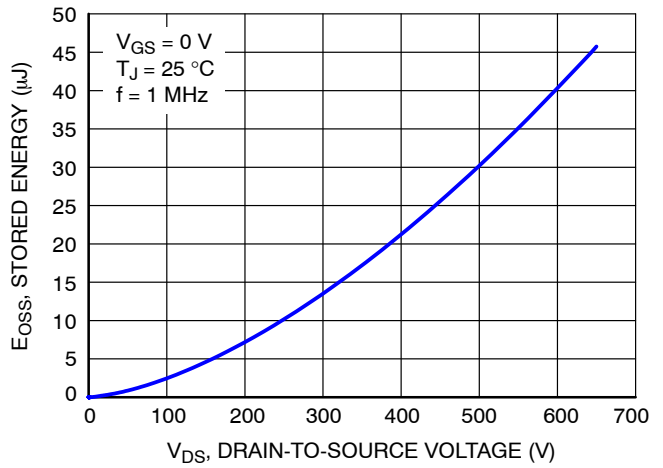


Figure 10. Stored Energy vs. Drain-to-Source Voltage

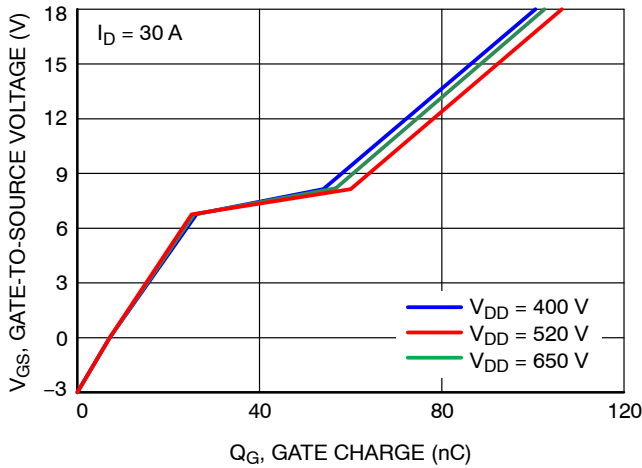


Figure 11. Gate Charge Characteristics

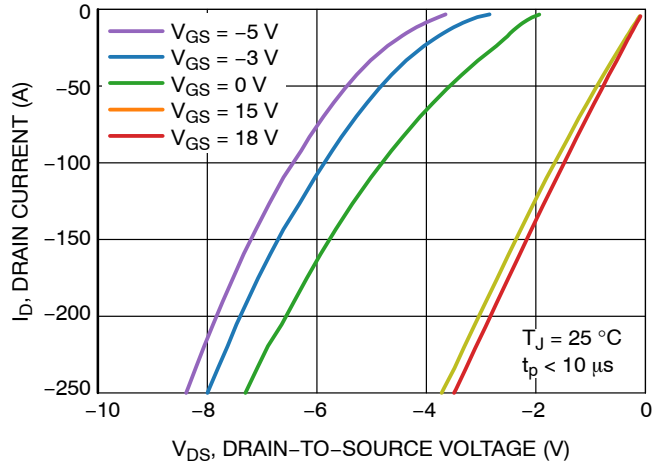


Figure 12. Reverse Conduction Characteristics

TYPICAL CHARACTERISTICS

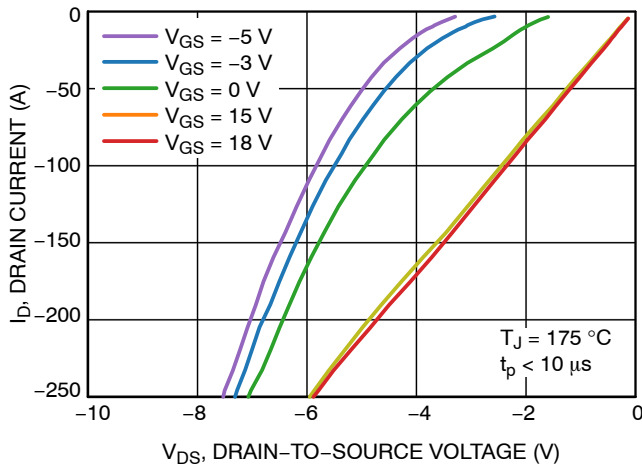


Figure 13. Reverse Conduction Characteristics

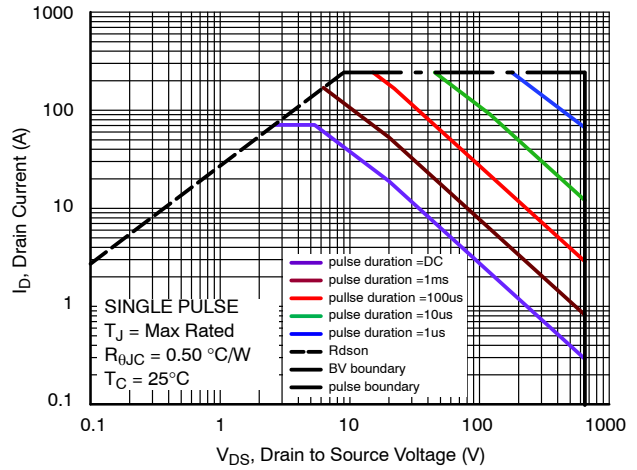


Figure 14. Safe Operating Area

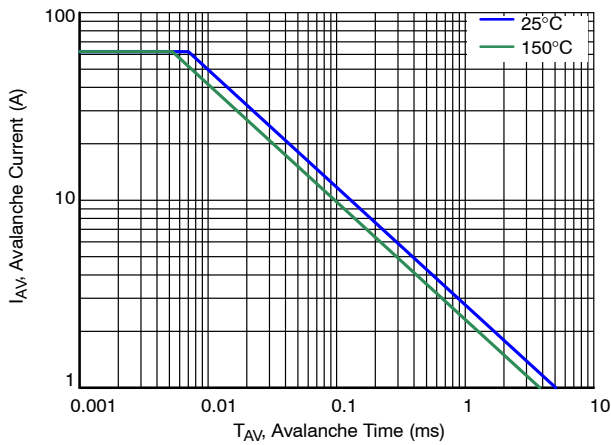


Figure 15. Avalanche Current vs Pulse Time (UIS)

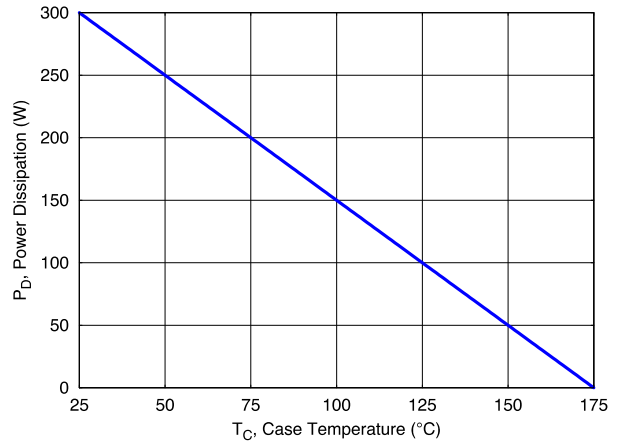


Figure 16. Maximum Power Dissipation vs Case Temperature

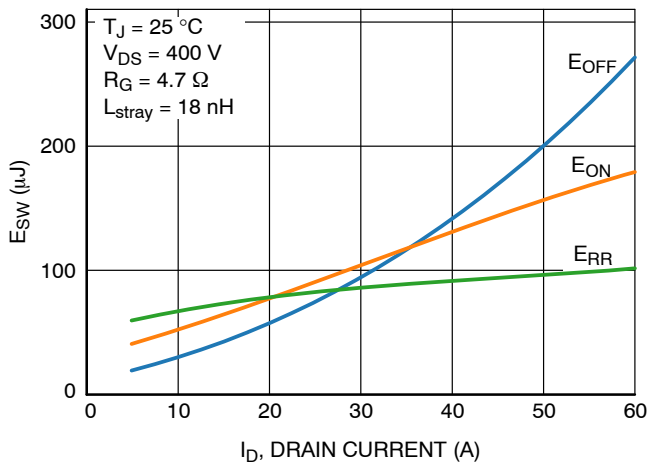


Figure 17. E_{SW} vs. I_D

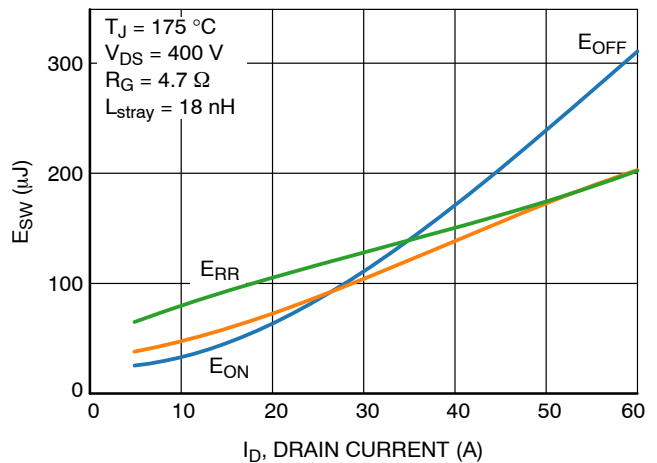


Figure 18. E_{SW} vs. I_D

TYPICAL CHARACTERISTICS

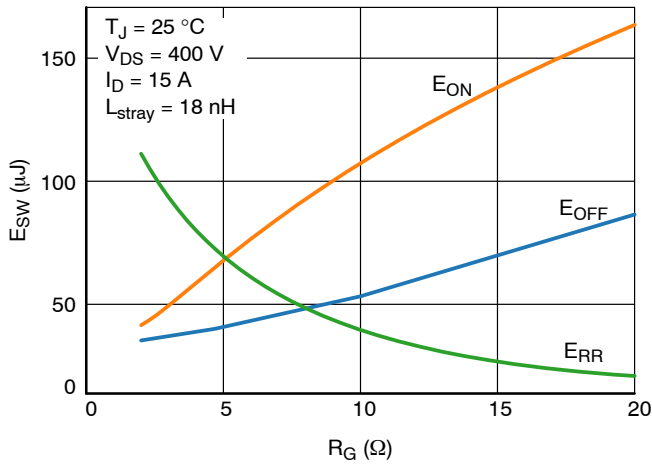


Figure 19. E_{SW} vs. R_G

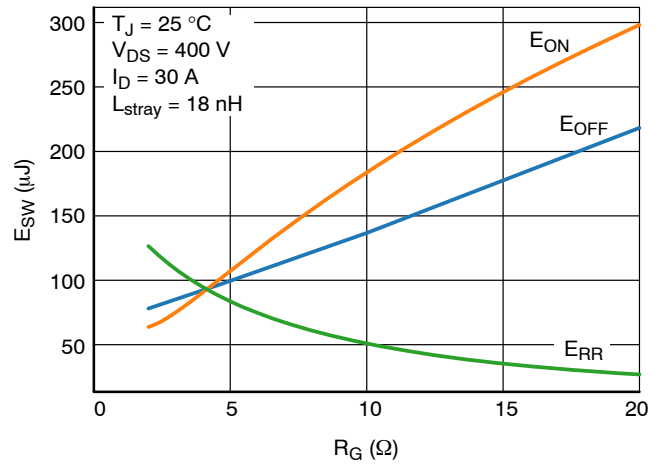


Figure 20. E_{SW} vs. R_G

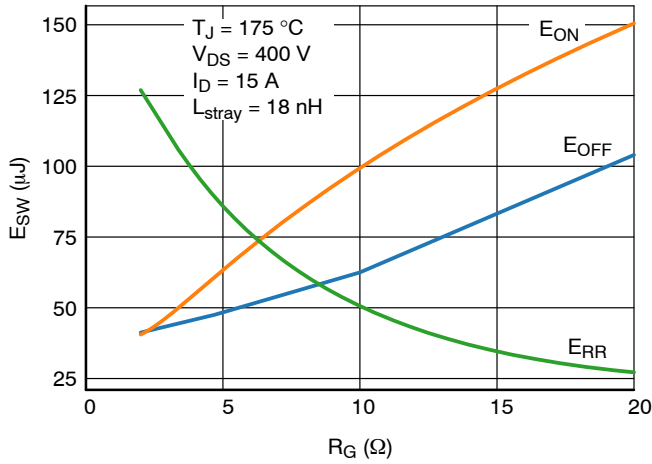


Figure 21. E_{SW} vs. R_G

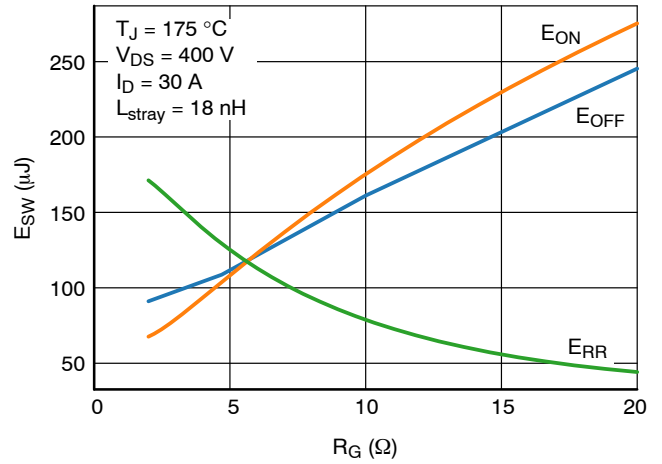


Figure 22. E_{SW} vs. R_G

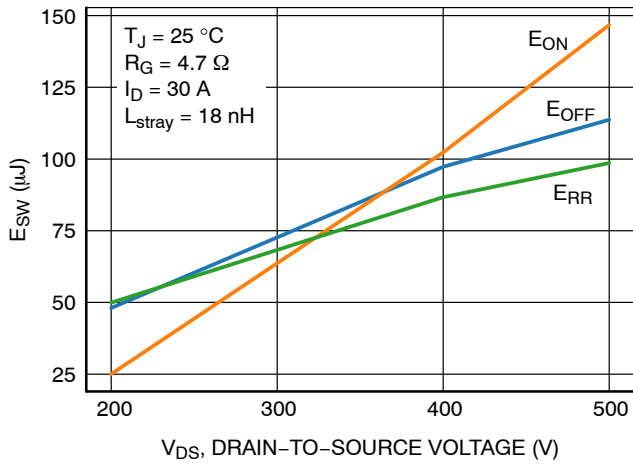


Figure 23. E_{SW} vs. V_{DS}

TYPICAL CHARACTERISTICS

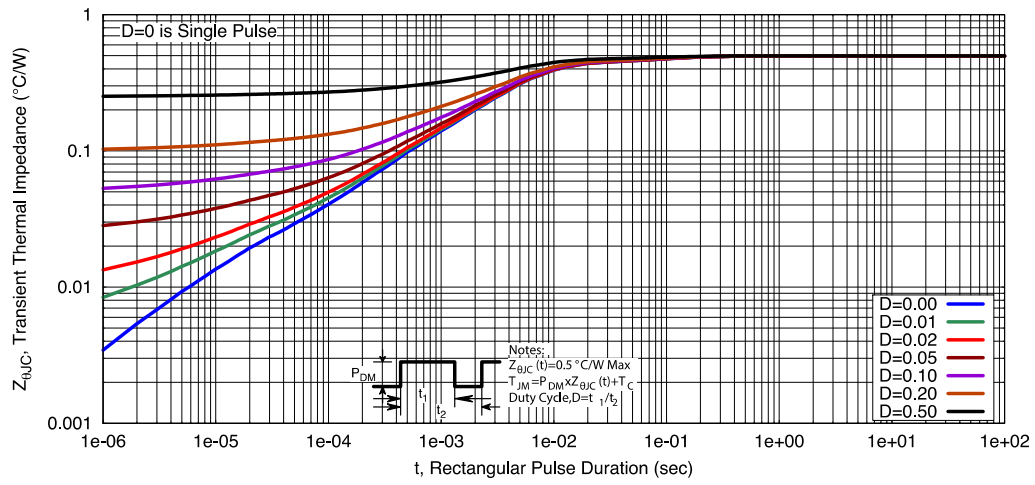


Figure 24. Thermal Response Characteristics

NVH4L016N065M3S

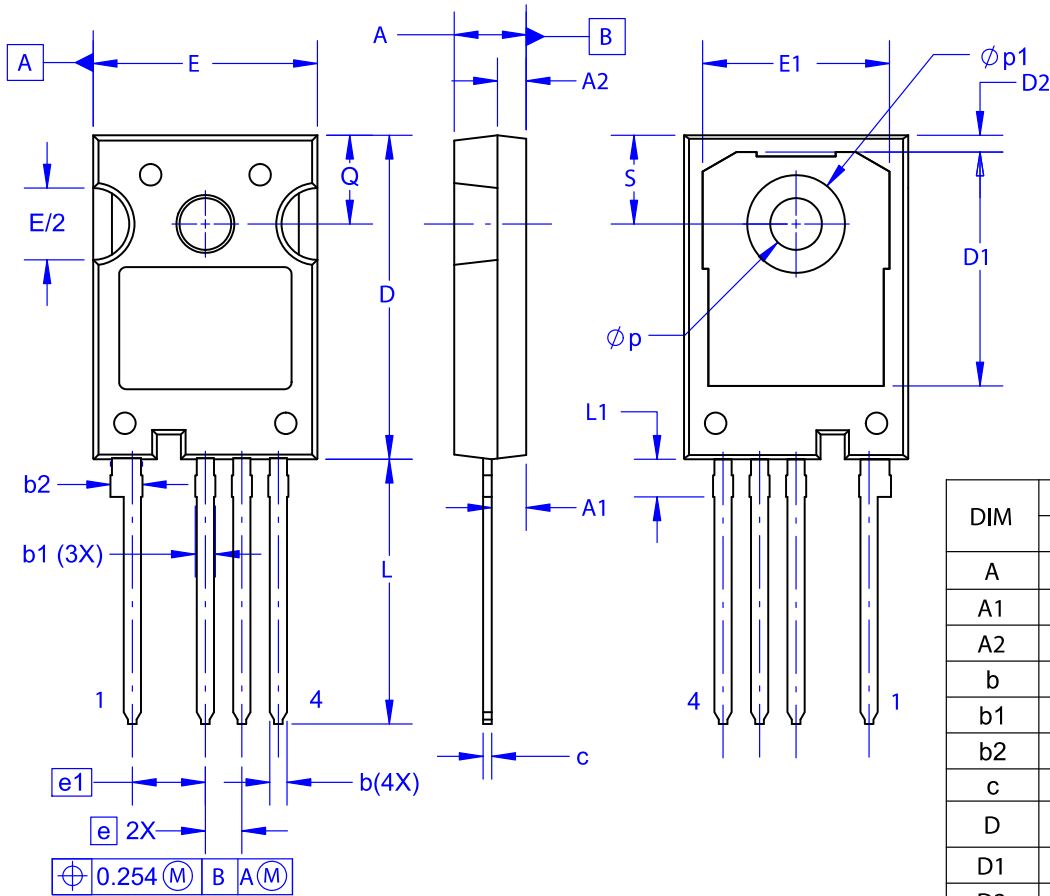
REVISION HISTORY

Revision	Description of Changes	Date
0	Initial datasheet release	11/4/2025

NVH4L016N065M3S

PACKAGE DIMENSIONS

TO-247-4LD
CASE 340CJ
ISSUE A



NOTES:

- A. NO INDUSTRY STANDARD APPLIES TO THIS PACKAGE.
- B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DRAWING CONFORMS TO ASME Y14.5-2009.

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-Markings.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** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:

Technical Library: www.onsemi.com/design/resources/technical-documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support

For additional information, please contact your local Sales Representative at
www.onsemi.com/support/sales