

NVH040N65S3F Datasheet

 onsemi

DiGi Electronics Part Number	NVH040N65S3F-DG
Manufacturer	onsemi
Manufacturer Product Number	NVH040N65S3F
Description	SF3 FRFET AUTO 40MOHM TO-247
Detailed Description	N-Channel 650 V 65A (Tc) 446W (Tc) Through Hole TO-247-3

<https://www.DiGi-Electronics.com>



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Purchase and inquiry

Manufacturer Product Number:

NVH040N65S3F

Series:

SuperFET® III

FET Type:

N-Channel

Drain to Source Voltage (Vdss):

650 V

Drive Voltage (Max Rds On, Min Rds On):

10V

Vgs(th) (Max) @ Id:

5V @ 2.1mA

Vgs (Max):

±30V

FET Feature:

-

Operating Temperature:

-55°C ~ 150°C (Tj)

Supplier Device Package:

TO-247-3

Manufacturer:

onsemi

Product Status:

Active

Technology:

MOSFET (Metal Oxide)

Current - Continuous Drain (Id) @ 25°C:

65A (Tc)

Rds On (Max) @ Id, Vgs:

40mOhm @ 32.5A, 10V

Gate Charge (Qg) (Max) @ Vgs:

153 nC @ 10 V

Input Capacitance (Ciss) (Max) @ Vds:

5875 pF @ 400 V

Power Dissipation (Max):

446W (Tc)

Mounting Type:

Through Hole

Package / Case:

TO-247-3

Environmental & Export classification

RoHS Status:

ROHS3 Compliant

REACH Status:

REACH Unaffected

HTSUS:

8541.29.0095

Moisture Sensitivity Level (MSL):

Not Applicable

ECCN:

EAR99

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MOSFET – Power, N-Channel, SUPERFET® III, FRFET®

650 V, 65 A, 40 mΩ

NVH040N65S3F

Description

SUPERFET III MOSFET is ON Semiconductor's brand-new high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance. This advanced technology is tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate.

Consequently, SUPERFET III MOSFET is very suitable for the various power system for miniaturization and higher efficiency.

SUPERFET III FRFET MOSFET's optimized reverse recovery performance of body diode can remove additional component and improve system reliability.

Features

- 700 V @ $T_J = 150^\circ\text{C}$
- Typ. $R_{DS(on)} = 33.8\text{ m}\Omega$
- Ultra Low Gate Charge (Typ. $Q_g = 153\text{ nC}$)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)} = 1333\text{ pF}$)
- 100% Avalanche Tested
- AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

Applications

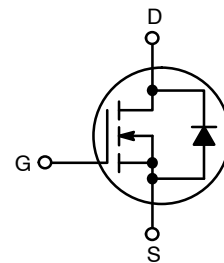
- Automotive On Board Charger HEV-EV
- Automotive DC/DC converter for HEV-EV



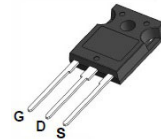
ON Semiconductor®

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V_{DSS}	$R_{DS(on)}\text{ MAX}$	$I_D\text{ MAX}$
650 V	40 mΩ @ 10 V	65 A



POWER MOSFET



TO-247-3LD
CASE 340CK

MARKING DIAGRAM



NVH040N65S3F = Specific Device Code
 A = Assembly Plant Code
 YWW = Data Code (Year & Week)
 ZZ = Lot

ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

NVH040N65S3F**ABSOLUTE MAXIMUM RATINGS** ($T_C = 25^\circ\text{C}$, Unless otherwise noted)

Symbol	Parameter	Value	Unit
V_{DSS}	Drain to Source Voltage	650	V
V_{GSS}	Gate to Source Voltage	- DC	± 30
		- AC ($f > 1$ Hz)	± 30
I_D	Drain Current	- Continuous ($T_C = 25^\circ\text{C}$)	65
		- Continuous ($T_C = 100^\circ\text{C}$)	45
I_{DM}	Drain Current	- Pulsed (Note 1)	162.5
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	1009	mJ
E_{AR}	Repetitive Avalanche Energy (Note 1)	4.46	mJ
dv/dt	MOSFET dv/dt	100	V/ns
	Peak Diode Recovery dv/dt (Note 3)	50	
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	446
		- Derate Above 25°C	3.57
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 seconds	300	$^\circ\text{C}$

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. Repetitive rating; pulse-width limited by maximum junction temperature.
2. $I_{AS} = 9$ A, $R_G = 25 \Omega$, starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 32.5$ A, $di/dt \leq 200$ A/ μs , $V_{DD} \leq 400$ V, starting $T_J = 25^\circ\text{C}$.

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.28	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	40	

PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Marking	Package	Packing Method	Shipping (Qty / Packing)
NVH040N65S3F	NVH040N65S3F	TO-247 G03	Tube	30 Units / Tube

NVH040N65S3F**ELECTRICAL CHARACTERISTICS** ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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OFF CHARACTERISTICS

BV _{DSS}	Drain to Source Breakdown Voltage	V _{GS} = 0 V, I _D = 1 mA, T _J = 25°C	650	–	–	V
		V _{GS} = 0 V, I _D = 10 mA, T _J = 150°C	700	–	–	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 10 mA, Referenced to 25°C	–	0.64	–	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 650 V, V _{GS} = 0 V	–	–	10	μA
		V _{DS} = 520 V, T _C = 125°C	–	103	–	
I _{GSS}	Gate to Body Leakage Current	V _{GS} = ±30 V, V _{DS} = 0 V	–	–	±100	nA

ON CHARACTERISTICS

V _{GS(th)}	Gate Threshold Voltage	V _{GS} = V _{DS} , I _D = 2.1 mA	3.0	–	5.0	V
R _{DS(on)}	Static Drain to Source On Resistance	V _{GS} = 10 V, I _D = 32.5 A	–	33.8	40	mΩ
g _{FS}	Forward Transconductance	V _{DS} = 20 V, I _D = 32.5 A	–	40	–	S

DYNAMIC CHARACTERISTICS

C _{iss}	Input Capacitance	V _{DS} = 400 V, V _{GS} = 0 V, f = 1 MHz	–	5875	–	pF
C _{oss}	Output Capacitance		–	140	–	pF
C _{oss(eff.)}	Effective Output Capacitance	V _{DS} = 0 V to 400 V, V _{GS} = 0 V	–	1333	–	pF
C _{oss(er.)}	Energy Related Output Capacitance	V _{DS} = 0 V to 400 V, V _{GS} = 0 V	–	241	–	pF
Q _{g(tot)}	Total Gate Charge at 10 V	V _{DS} = 400 V, I _D = 32.5 A, V _{GS} = 10 V (Note 4)	–	153	–	nC
Q _{gs}	Gate to Source Gate Charge		–	51	–	nC
Q _{gd}	Gate to Drain “Miller” Charge		–	61	–	nC
ESR	Equivalent Series Resistance	f = 1 MHz	–	1.9	–	Ω

SWITCHING CHARACTERISTICS

t _{d(on)}	Turn-On Delay Time	V _{DD} = 400 V, I _D = 32.5 A, V _{GS} = 10 V R _g = 2.2 Ω (Note 4)	–	41	–	ns
t _r	Turn-On Rise Time		–	53	–	ns
t _{d(off)}	Turn-Off Delay Time		–	96	–	ns
t _f	Turn-Off Fall Time		–	28	–	ns

SOURCE-DRAIN DIODE CHARACTERISTICS

I _S	Maximum Continuous Source to Drain Diode Forward Current	–	–	65	A	
I _{SM}	Maximum Pulsed Source to Drain Diode Forward Current	–	–	162.5	A	
V _{SD}	Source to Drain Diode Forward Voltage	V _{GS} = 0 V, I _{SD} = 32.5 A	–	–	1.3	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _{SD} = 32.5 A, dI _F /dt = 100 A/μs	–	159	–	ns
Q _{rr}	Reverse Recovery Charge		–	840	–	nC

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. Essentially independent of operating temperature typical characteristics.

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TYPICAL CHARACTERISTICS

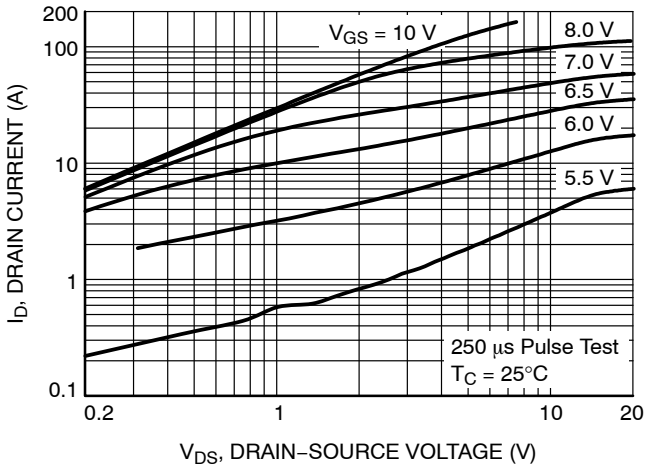


Figure 1. On-Region Characteristics

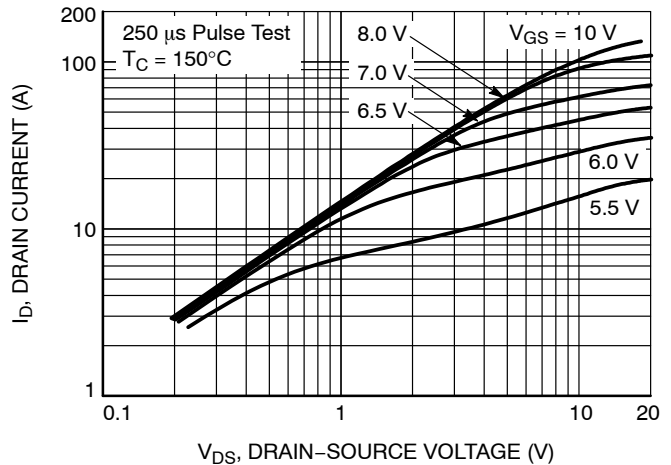


Figure 2. On-Region Characteristics

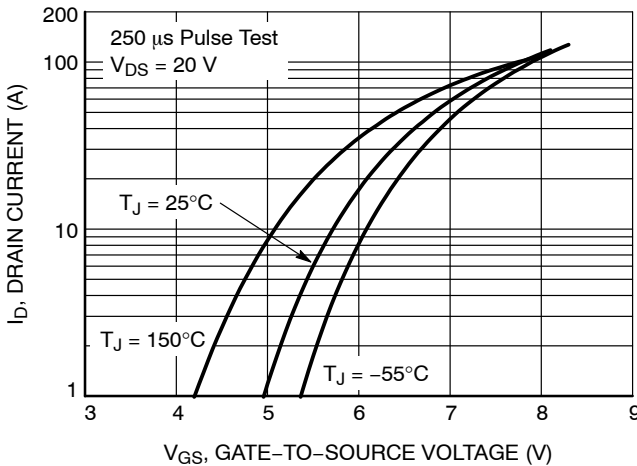


Figure 3. Transfer Characteristics

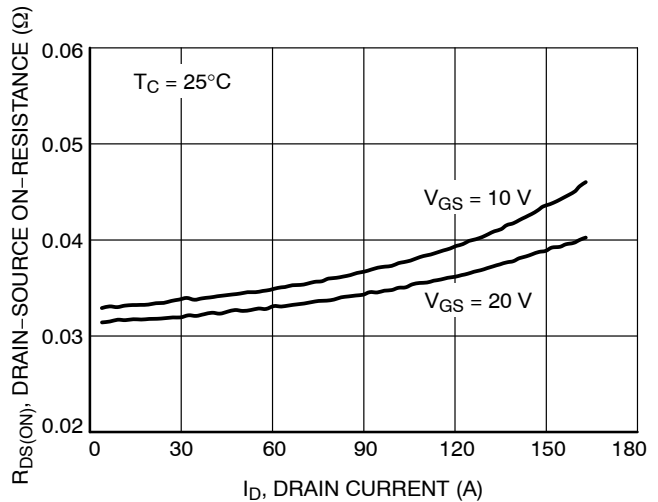


Figure 4. On-Resistance Variation vs. Drain Current and Gate Voltage

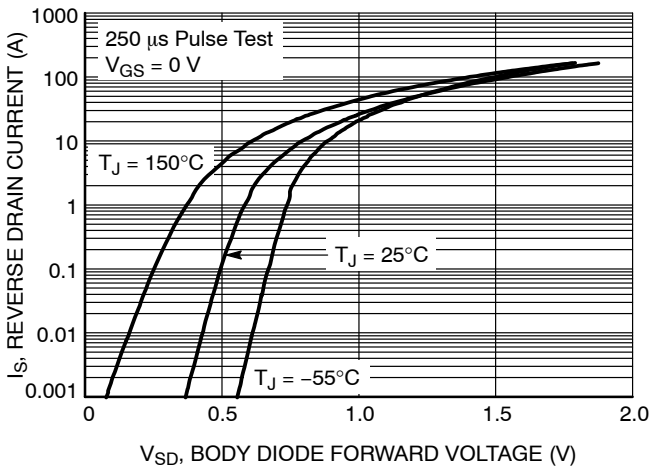


Figure 5. Body Diode Forward Voltage Variation vs. Source Current and Temperature

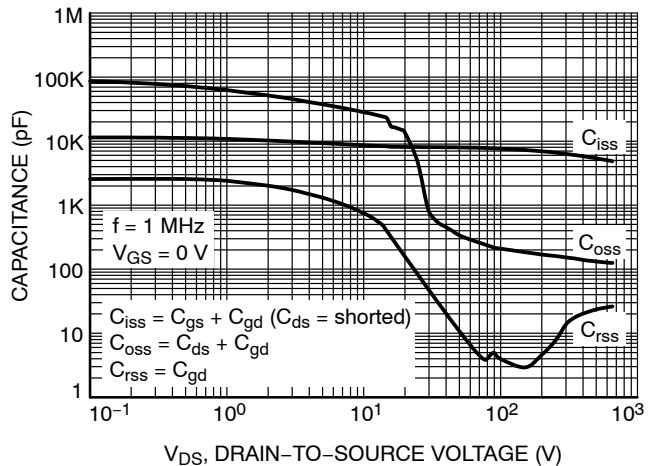


Figure 6. Capacitance Characteristics

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TYPICAL CHARACTERISTICS

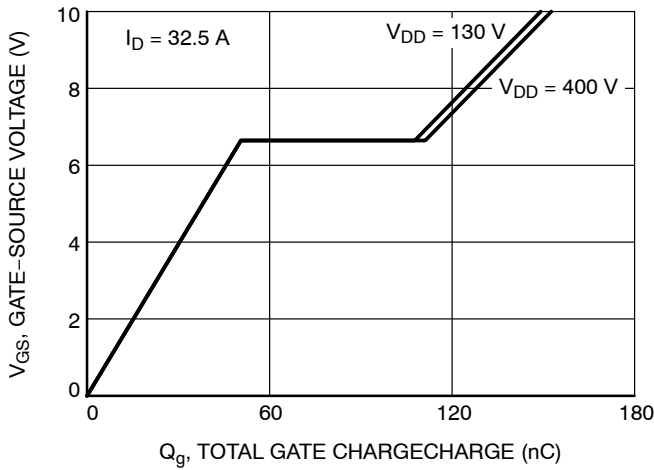


Figure 7. Gate Charge Characteristics

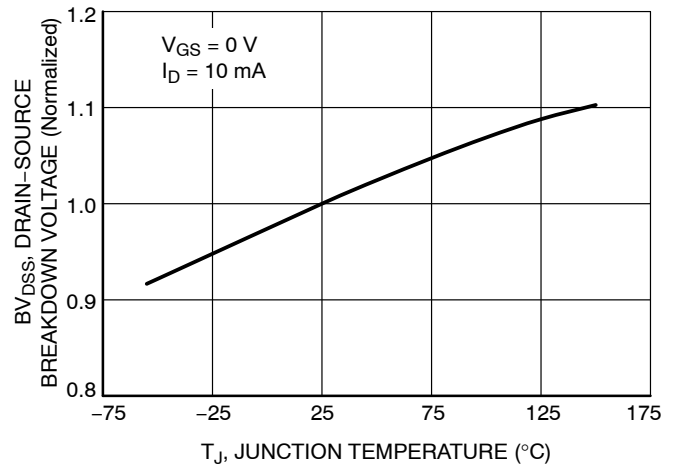


Figure 8. Breakdown Voltage Variation vs. Temperature

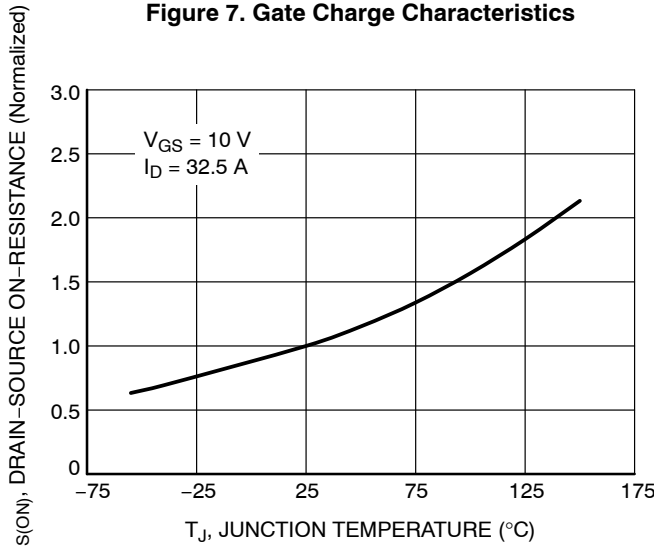


Figure 9. On-Resistance Variation vs. Temperature

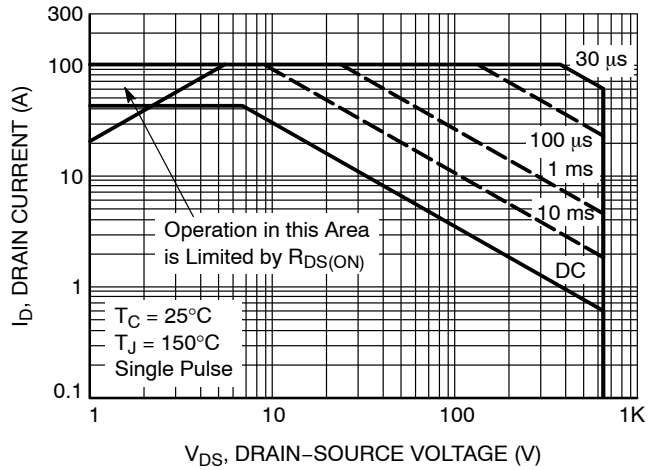


Figure 10. Maximum Safe Operating Area

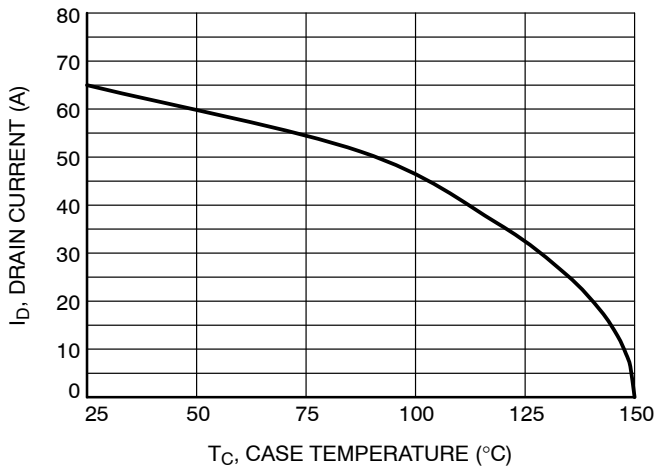


Figure 11. Maximum Drain Current vs. Case Temperature

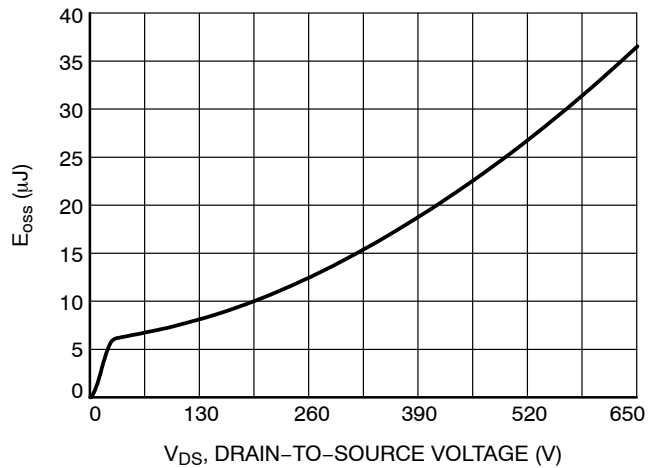


Figure 12. E_OSS vs. Drain-to-Source Voltage

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TYPICAL CHARACTERISTICS

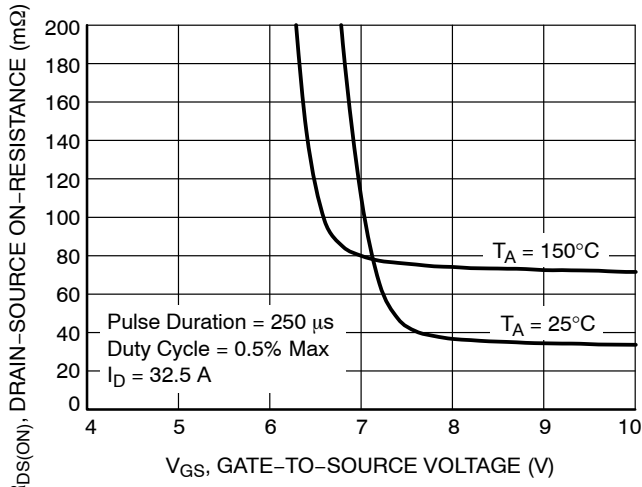


Figure 13. $R_{DS(ON)}$ vs. Gate Voltage

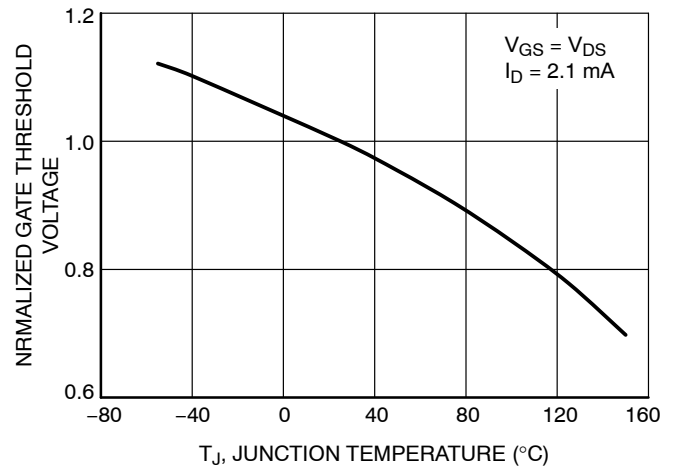


Figure 14. Normalized Gate Threshold Voltage vs. Temperature

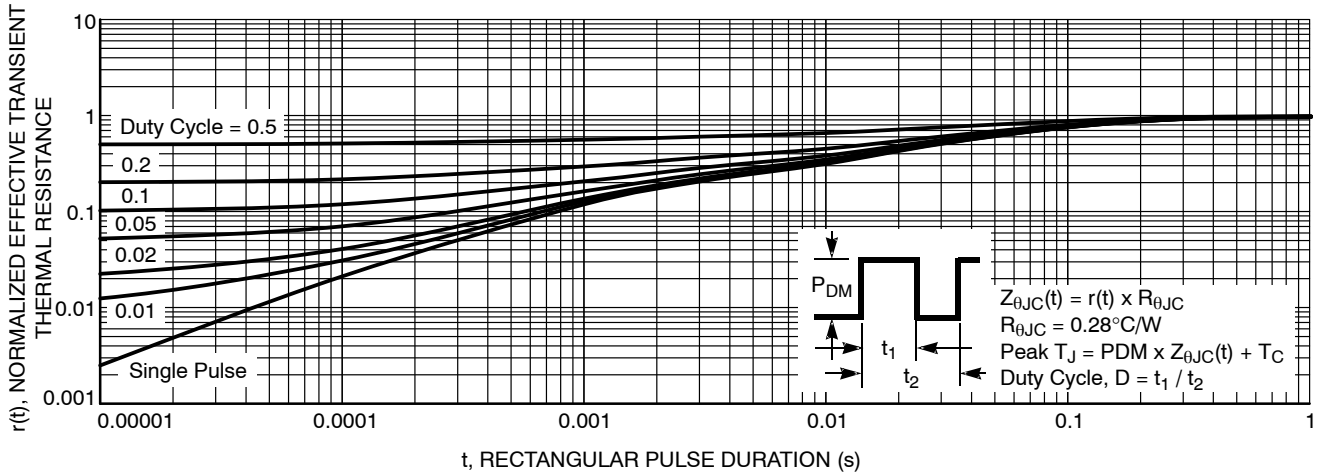


Figure 15. Transient Thermal Response Curve

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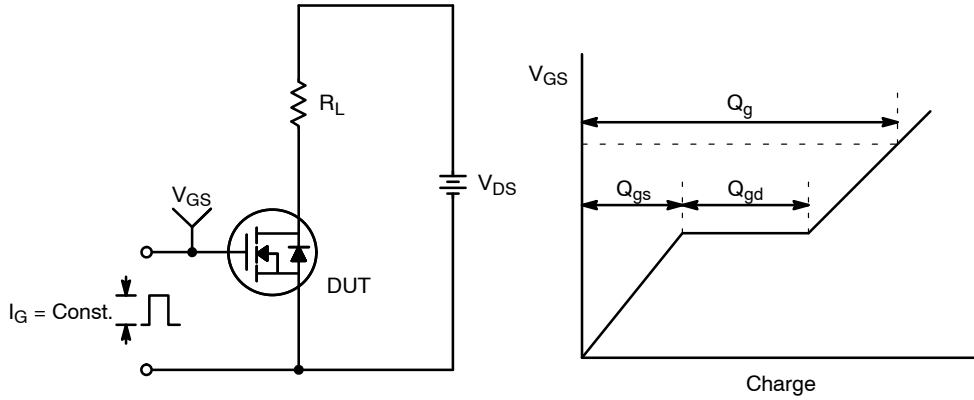


Figure 16. Gate Charge Test Circuit & Waveform

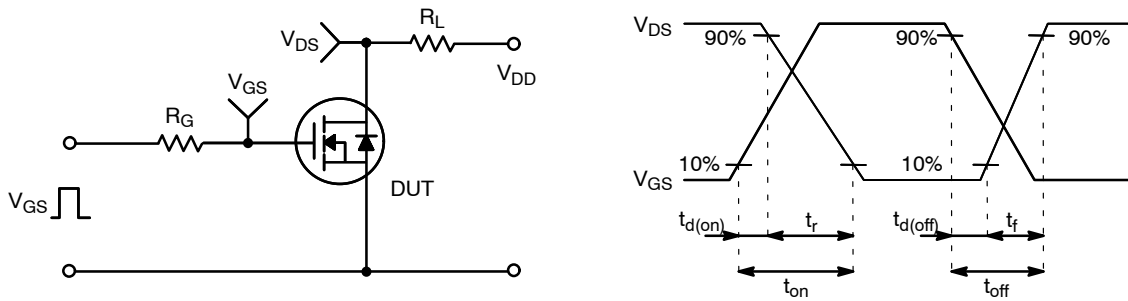


Figure 17. Resistive Switching Test Circuit & Waveforms

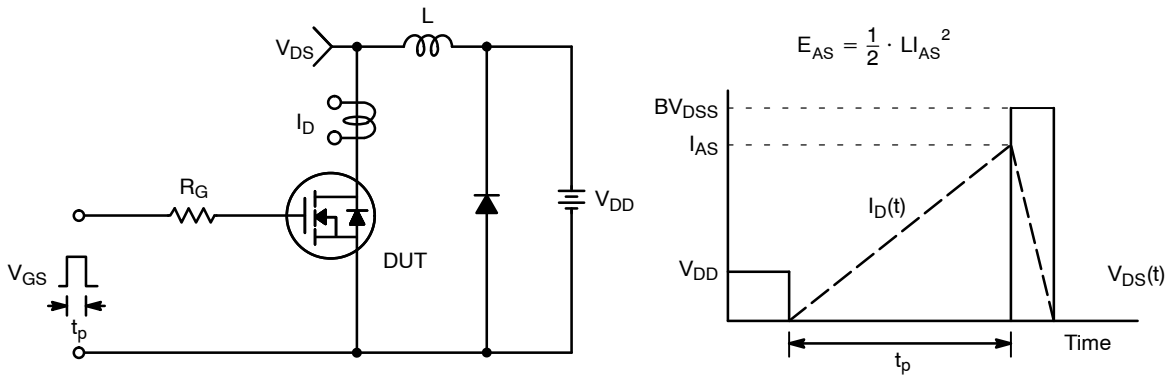


Figure 18. Unclamped Inductive Switching Test Circuit & Waveforms

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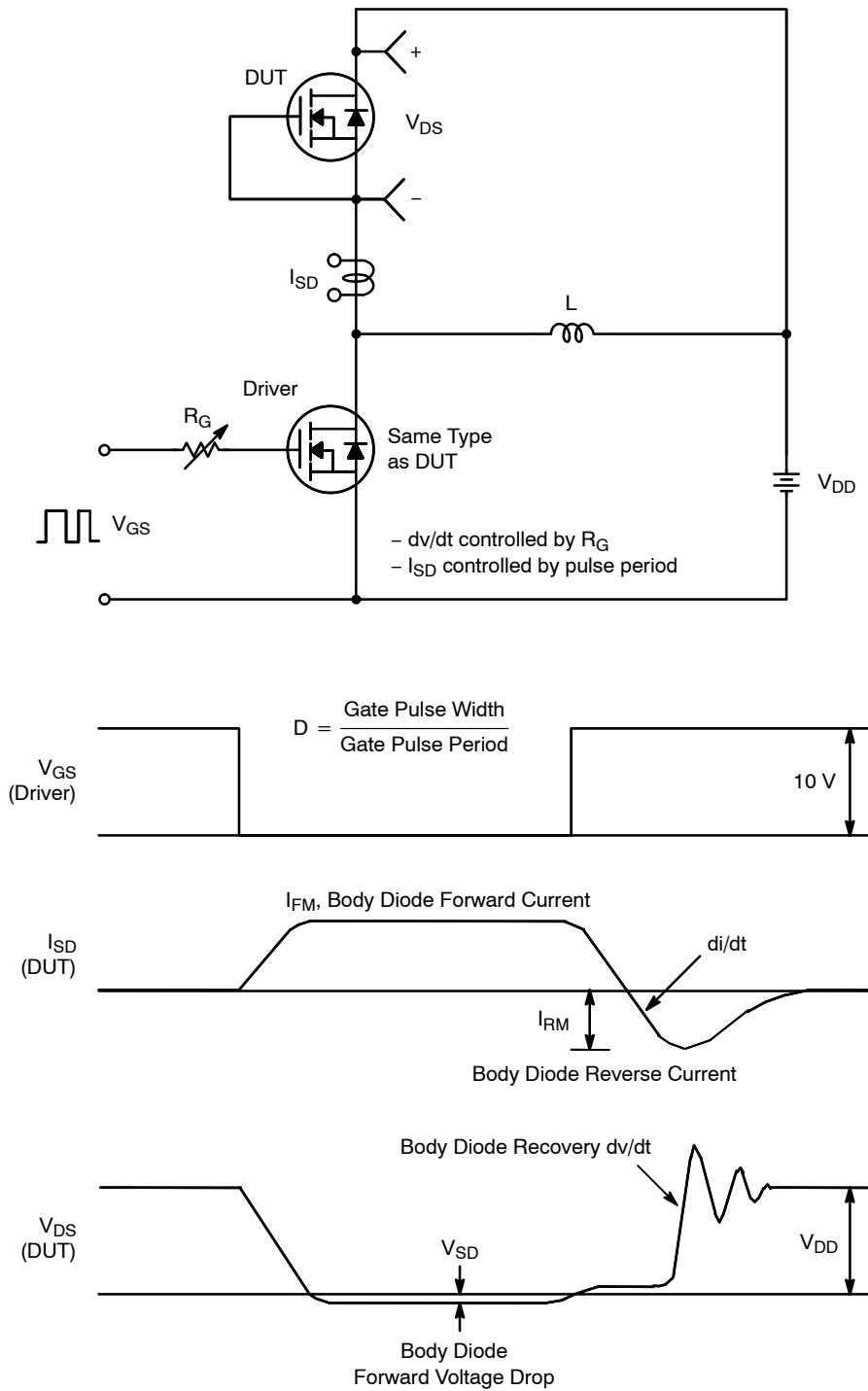
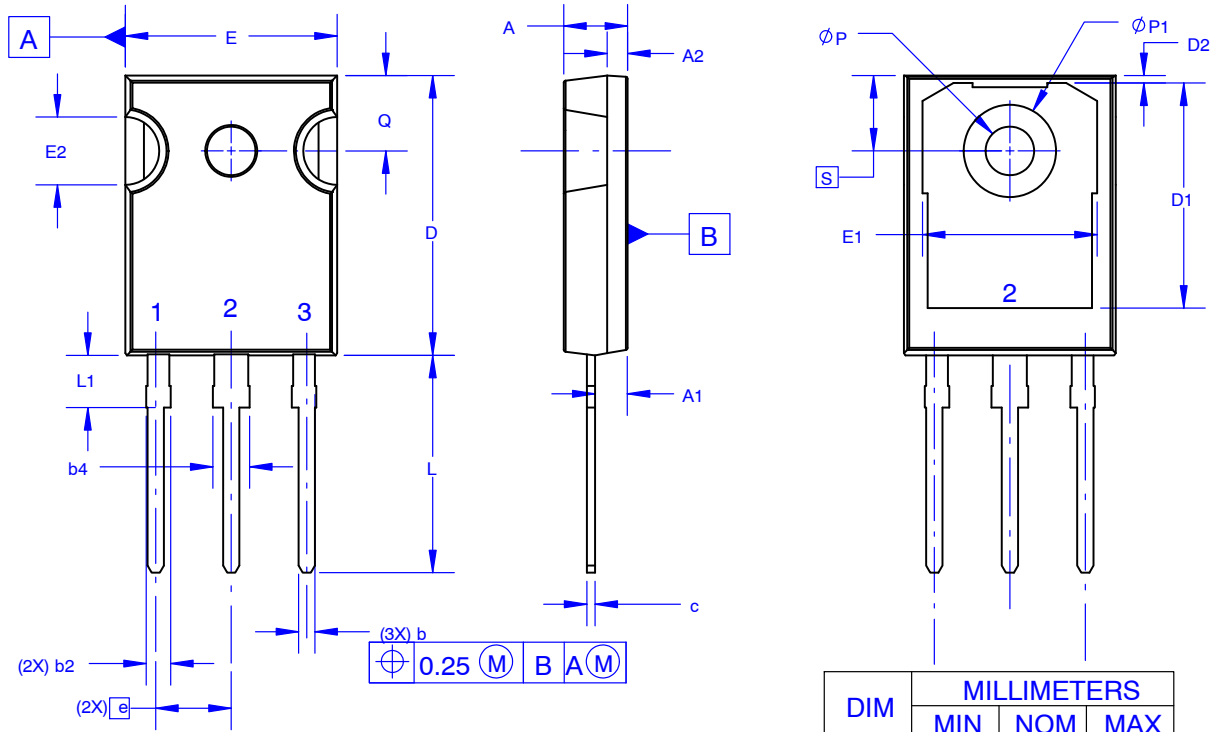


Figure 19. Peak Diode Recovery dv/dt Test Circuit & Waveforms

NVH040N65S3F

PACKAGE DIMENSIONS

TO-247-3LD SHORT LEAD
CASE 340CK
ISSUE A




NOTES: UNLESS OTHERWISE SPECIFIED.

- A. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DRAWING CONFORMS TO ASME Y14.5 - 2009.
- D. DIMENSION A1 TO BE MEASURED IN THE REGION DEFINED BY L1.
- E. LEAD FINISH IS UNCONTROLLED IN THE REGION DEFINED BY L1.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.58	4.70	4.82
A1	2.20	2.40	2.60
A2	1.40	1.50	1.60
b	1.17	1.26	1.35
b2	1.53	1.65	1.77
b4	2.42	2.54	2.66
c	0.51	0.61	0.71
D	20.32	20.57	20.82
D1	13.08	~	~
D2	0.51	0.93	1.35
E	15.37	15.62	15.87
E1	12.81	~	~
E2	4.96	5.08	5.20
e	~	5.56	~
L	15.75	16.00	16.25
L1	3.69	3.81	3.93
ØP	3.51	3.58	3.65
ØP1	6.60	6.80	7.00
Q	5.34	5.46	5.58
S	5.34	5.46	5.58

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