

ON Semiconductor

Is Now



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www.onsemi.com

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MOSFET – Power, N-Channel, SUPERFET® III, Automotive, Easy Drive

650 V, 30 A, 99 mΩ

NVB099N65S3

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, provides superior switching performance, and withstand extreme dv/dt rate.

Consequently, SUPERFET III MOSFET Easy drive series helps manage EMI issues and allows for easier design implementation.

Features

- AEC-Q101 Qualified
- 700 V @ $T_J = 150^\circ\text{C}$
- Typ. $R_{DS(on)} = 79\text{ m}\Omega$
- Ultra Low Gate Charge (Typ. $Q_g = 61\text{ nC}$)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)} = 544\text{ pF}$)
- 100% Avalanche Tested
- These Devices are Pb-Free and are RoHS Compliant

Applications

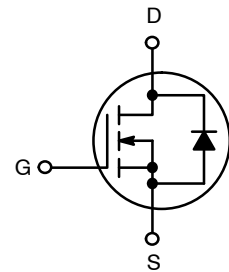
- Automotive On Board Charger
- Automotive DC/DC Converter for HEV



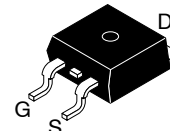
ON Semiconductor®

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V_{DS}	$R_{DS(on)}\text{ MAX}$	$I_D\text{ MAX}$
650 V	99 mΩ @ 10 V	30 A

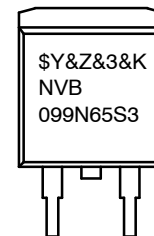


POWER MOSFET



D²-PAK
CASE 418AJ

MARKING DIAGRAM



\$Y	= ON Semiconductor Logo
&Z	= Assembly Plant Code
&3	= Data Code (Year & Week)
&K	= Lot
NVB099N65S3	= Specific Device Code

ORDERING INFORMATION

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

NVB099N65S3

ABSOLUTE MAXIMUM RATINGS (T_C = 25°C, Unless otherwise noted)

Symbol	Parameter		Value	Unit
V _{DSS}	Drain to Source Voltage		650	V
V _{GSS}	Gate to Source Voltage	– DC	±30	V
		– AC (f > 1 Hz)	±30	
I _D	Drain Current	– Continuous (T _C = 25°C)	30	A
		– Continuous (T _C = 100°C)	19	
I _{DM}	Drain Current	– Pulsed (Note 1)	75	A
E _{AS}	Single Pulsed Avalanche Energy (Note 2)		145	mJ
I _{AS}	Avalanche Current (Note 2)		4.4	A
E _{AR}	Repetitive Avalanche Energy (Note 1)		2.27	mJ
dv/dt	MOSFET dv/dt		100	V/ns
	Peak Diode Recovery dv/dt (Note 3)		20	
P _D	Power Dissipation	(T _C = 25°C)	227	W
		– Derate Above 25°C	1.82	
T _J , T _{STG}	Operating and Storage Temperature Range		–55 to +150	°C
T _L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 seconds		300	°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} = 4.4 A, R_G = 25 Ω, starting T_J = 25°C.

3. I_{SD} ≤ 15 A, di/dt ≤ 200 A/μs, V_{DD} ≤ 400 V, starting T_J = 25°C.

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
R _{θJC}	Thermal Resistance, Junction to Case, Max.	0.55	°C/W
R _{θJA}	Thermal Resistance, Junction to Ambient, Max.	40	

PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Marking	Package	Reel Size	Tape Width	Shipping [†]
NVB099N65S3	NVB099N65S3	D ² –PAK	330 mm	24 mm	800 / Tape & Reel

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

NVB099N65S3

ELECTRICAL CHARACTERISTICS (T_C = 25°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 = 1 mA, T _J = 150°C	700			V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 1 mA, Referenced to 25°C		0.68		V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 650 V, V _{GS} = 0 V			1	μA
		V _{DS} = 520 V, T _C = 125°C		1.4		
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 = 0.74 mA	2.5		4.5	V
R _{DS(on)}	Static Drain to Source On Resistance	V _{GS} = 10 V, I _D = 15 A		79	99	mΩ
g _{FS}	Forward Transconductance	V _{DS} = 20 V, I _D = 15 A		19		S

DYNAMIC CHARACTERISTICS

C _{iss}	Input Capacitance	V _{DS} = 400 V, V _{GS} = 0 V, f = 1 MHz		2480		pF
C _{oss}	Output Capacitance			55		pF
C _{oss(eff.)}	Effective Output Capacitance	V _{DS} = 0 V to 400 V, V _{GS} = 0 V		544		pF
C _{oss(er.)}	Energy Related Output Capacitance	V _{DS} = 0 V to 400 V, V _{GS} = 0 V		78		pF
Q _{g(tot)}	Total Gate Charge at 10 V	V _{DS} = 400 V, I _D = 15 A, V _{GS} = 10 V (Note 4)		61		nC
Q _{gs}	Gate to Source Gate Charge			15		nC
Q _{gd}	Gate to Drain "Miller" Charge			25		nC
ESR	Equivalent Series Resistance	f = 1 MHz		0.4		Ω

SWITCHING CHARACTERISTICS

t _{d(on)}	Turn-On Delay Time	V _{DD} = 400 V, I _D = 15 A, V _{GS} = 10 V, R _g = 4.7 Ω (Note 4)		23		ns
t _r	Turn-On Rise Time			24		ns
t _{d(off)}	Turn-Off Delay Time			60		ns
t _f	Turn-Off Fall Time			5		ns

SOURCE-DRAIN DIODE CHARACTERISTICS

I _S	Maximum Continuous Source to Drain Diode Forward Current			30		A
I _{SM}	Maximum Pulsed Source to Drain Diode Forward Current			75		A
V _{SD}	Source to Drain Diode Forward Voltage	V _{GS} = 0 V, I _{SD} = 15 A			1.2	V
t _{rr}	Reverse Recovery Time	V _{DD} = 400 V, I _{SD} = 15 A, dI _F /dt = 100 A/μs		408		ns
Q _{rr}	Reverse Recovery Charge			8.4		μC

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.

TYPICAL PERFORMANCE CHARACTERISTICS

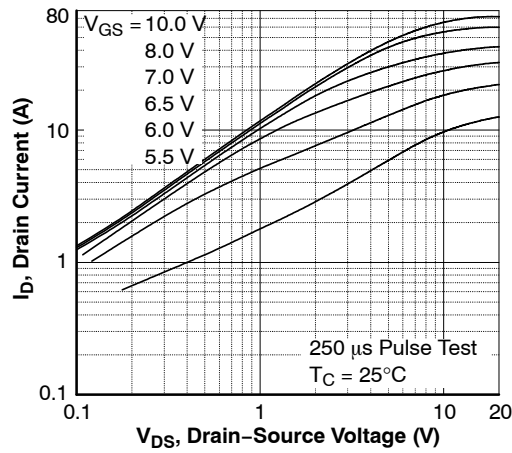


Figure 1. On-Region Characteristics (25°C)

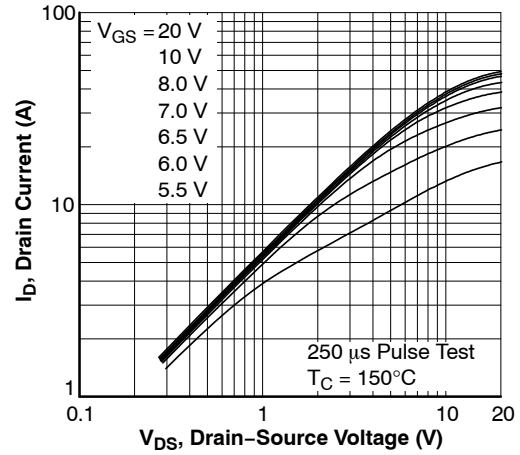


Figure 2. On-Region Characteristics (150°C)

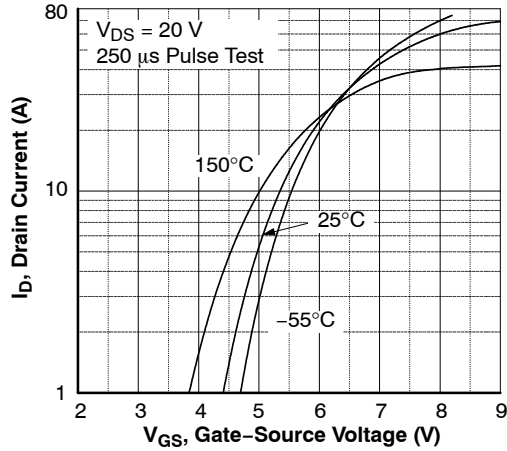


Figure 3. Transfer Characteristics

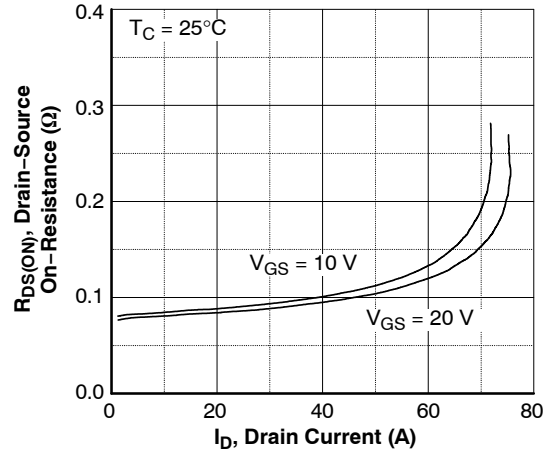


Figure 4. On-Resistance Variation vs. Drain Current and Gate Voltage

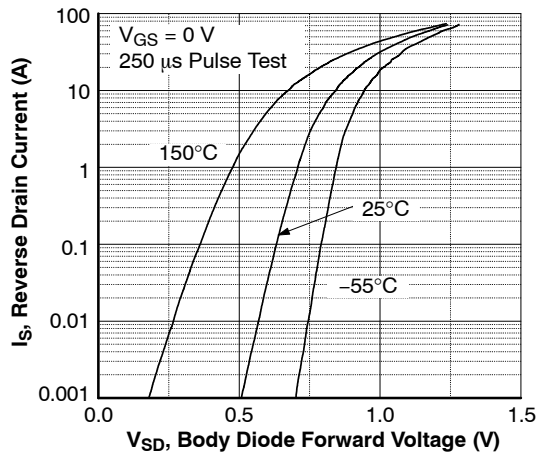


Figure 5. Body Diode Forward Voltage Variation vs. Source Current and Temperature

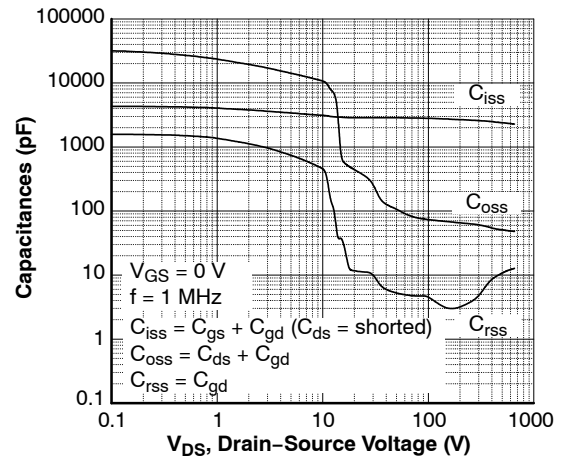


Figure 6. Capacitance Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

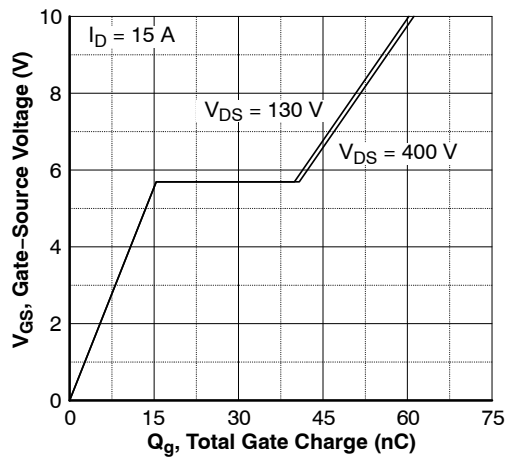


Figure 7. Gate Charge Characteristics

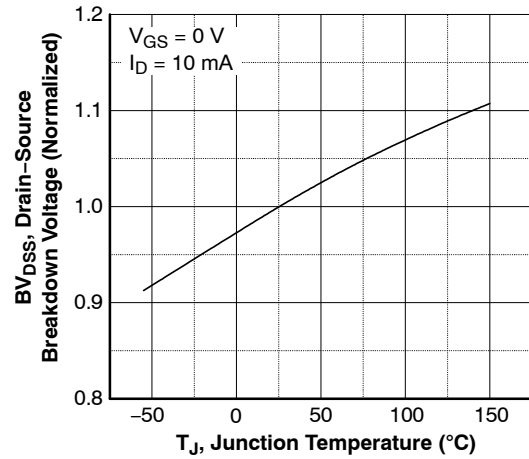


Figure 8. Breakdown Voltage Variation vs. Temperature

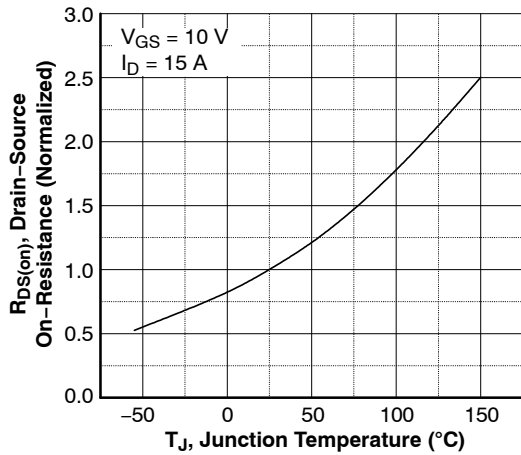


Figure 9. On-Resistance Variation vs. Temperature

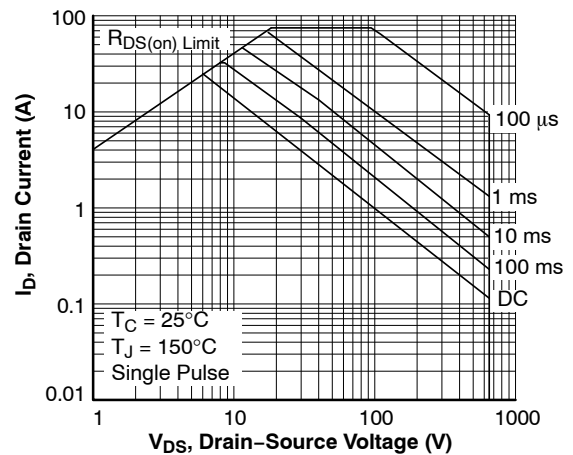


Figure 10. Maximum Safe Operating Area

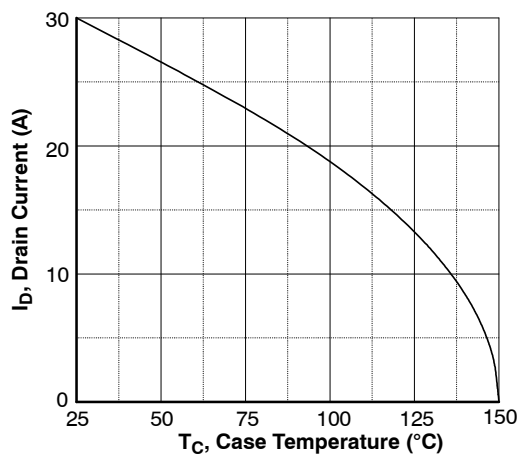


Figure 11. Maximum Drain Current vs. Case Temperature

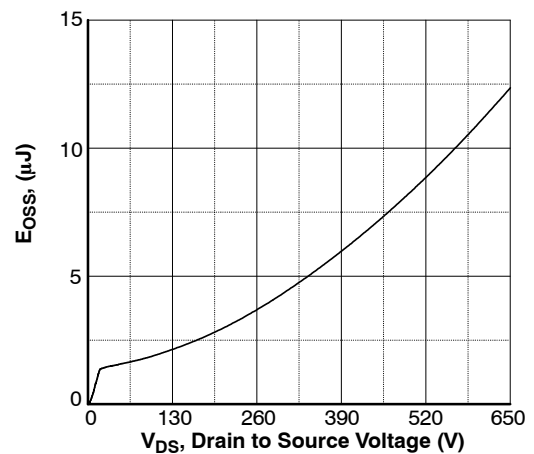


Figure 12. E_{OSS} vs. Drain to Source Voltage

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

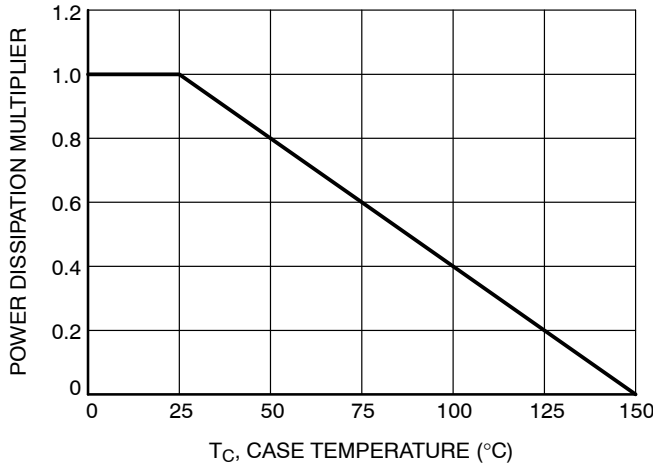


Figure 13. Normalized Power Dissipation vs. Case Temperature

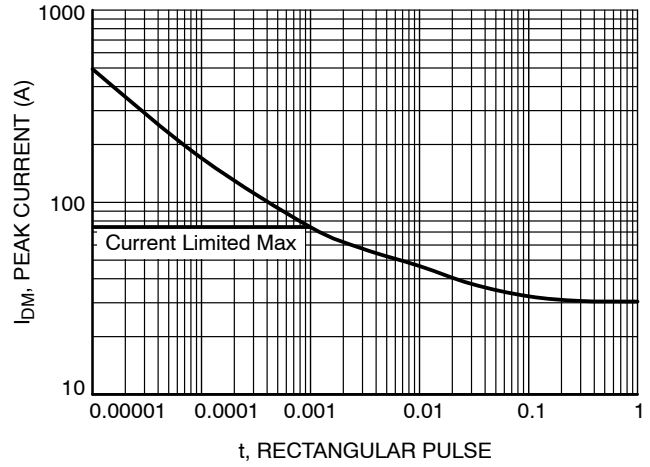


Figure 14. Peak Current Capability

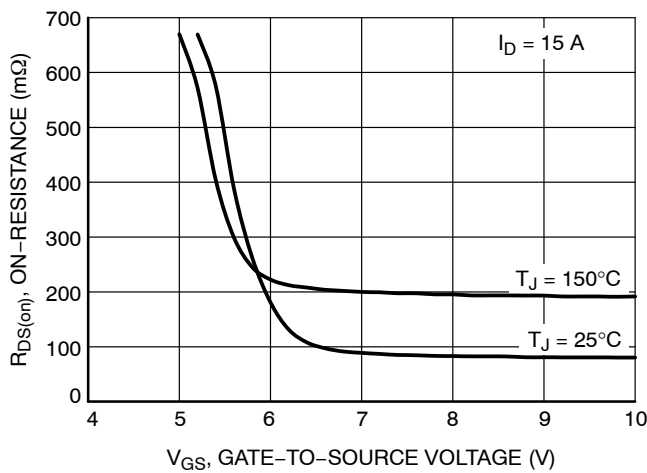


Figure 15. $R_{DS(on)}$ vs. Gate Voltage

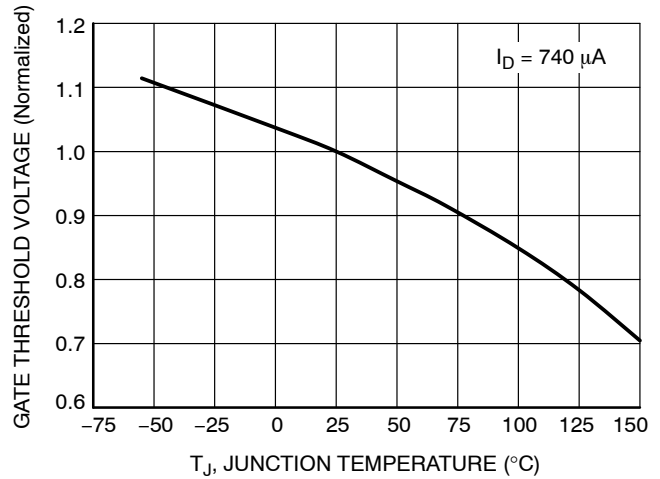


Figure 16. Normalized Gate Threshold Voltage vs. Temperature

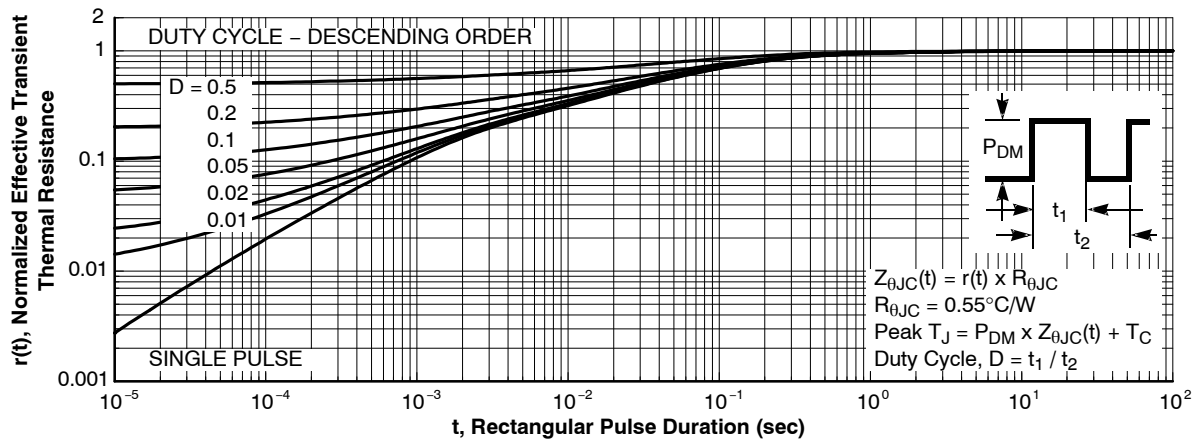


Figure 17. Transient Thermal Response Curve

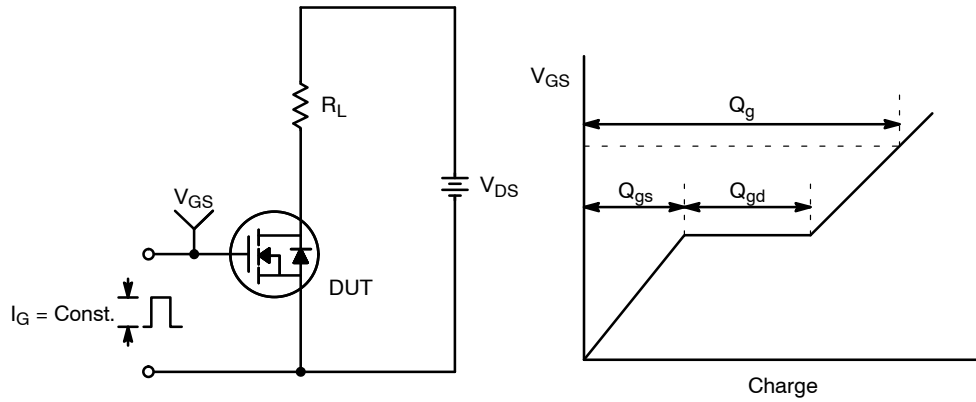


Figure 18. Gate Charge Test Circuit & Waveform

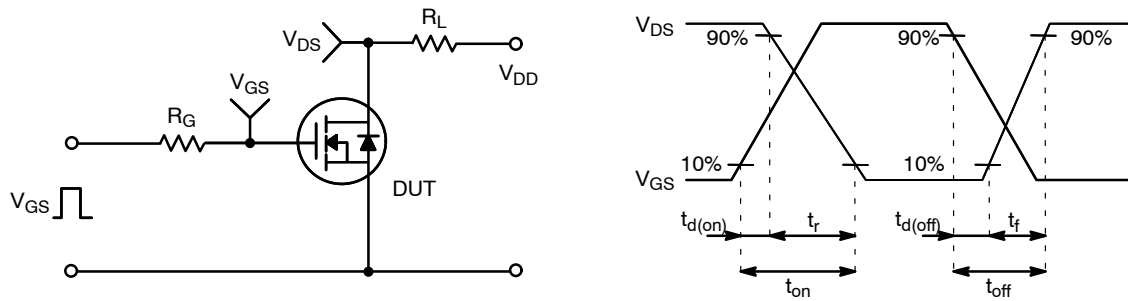


Figure 19. Resistive Switching Test Circuit & Waveforms

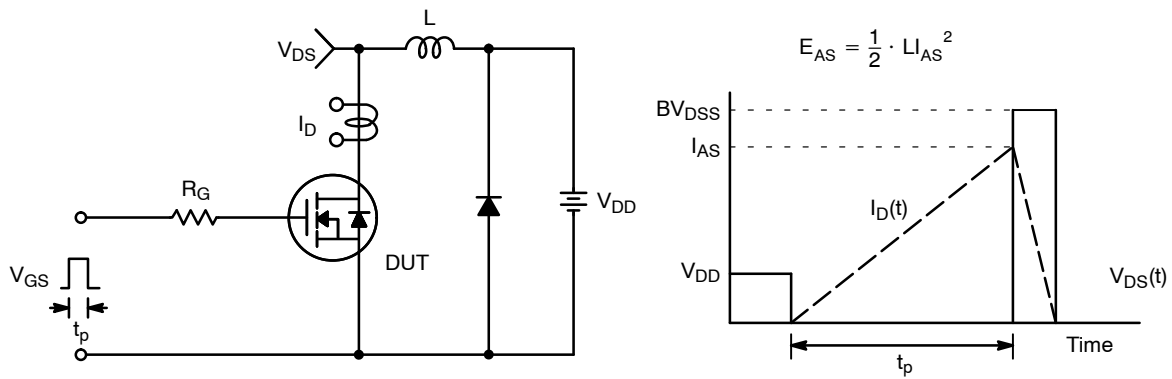


Figure 20. Unclamped Inductive Switching Test Circuit & Waveforms

NVB099N65S3

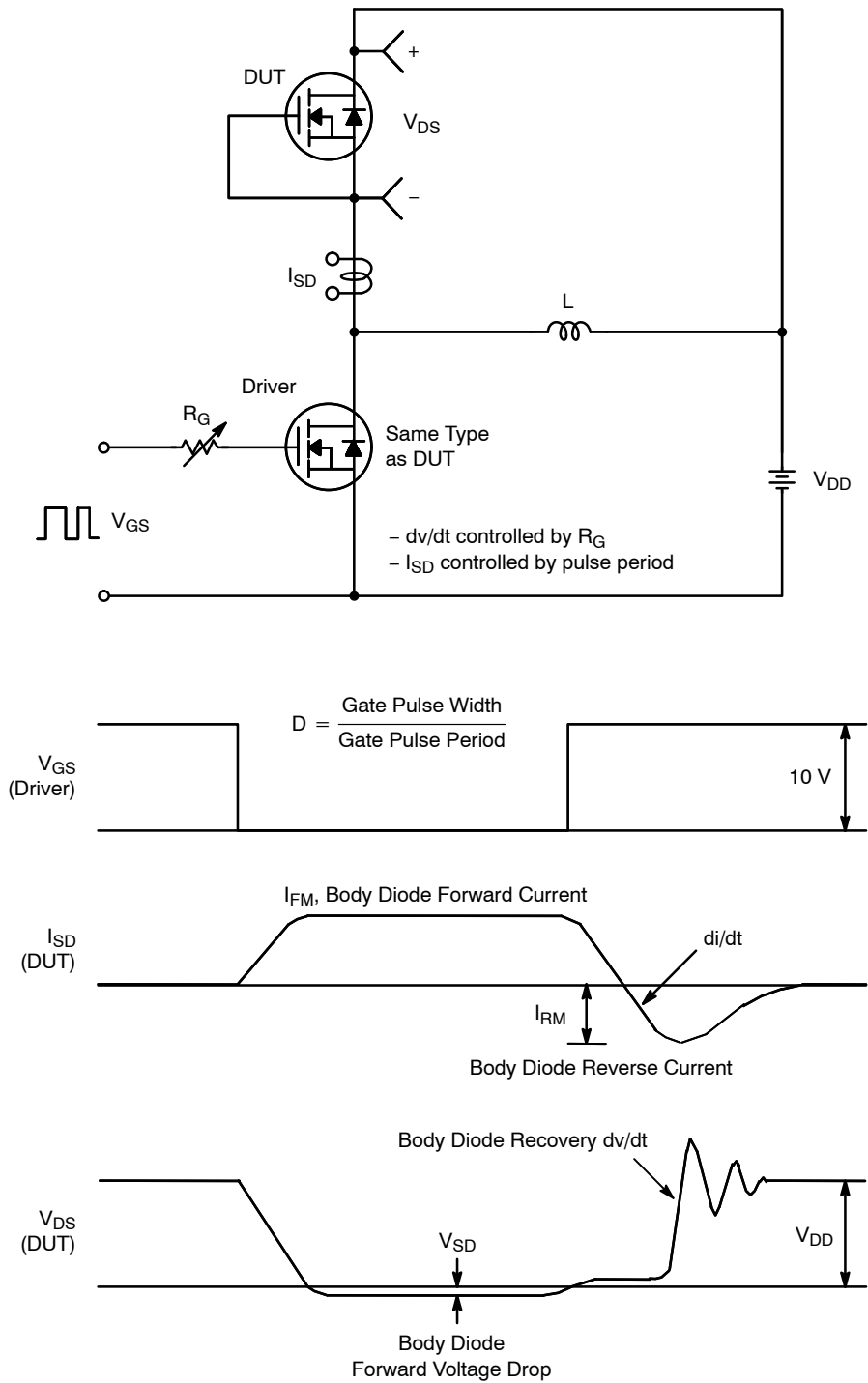
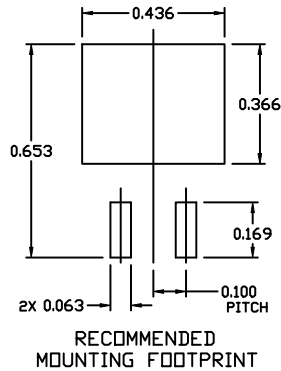


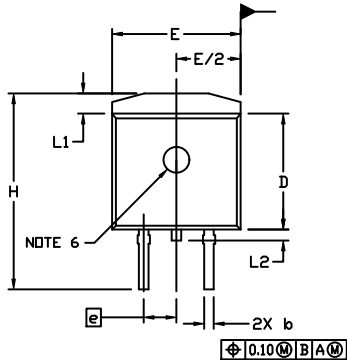
Figure 21. Peak Diode Recovery dv/dt Test Circuit & Waveforms

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PACKAGE DIMENSIONS

D²PAK-3 (TO-263, 3-LEAD)
CASE 418AJ
ISSUE E

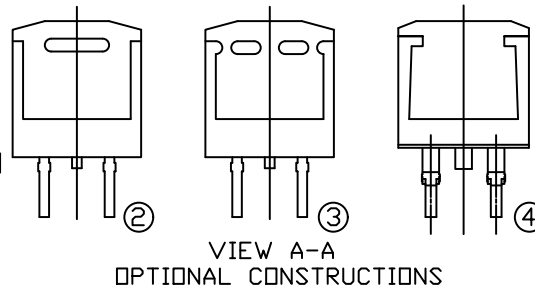
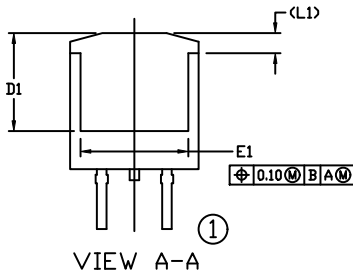
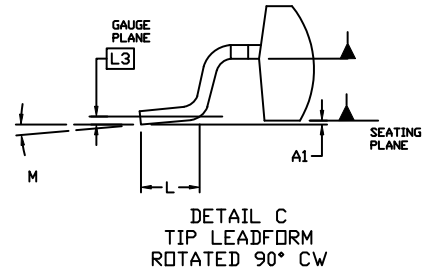
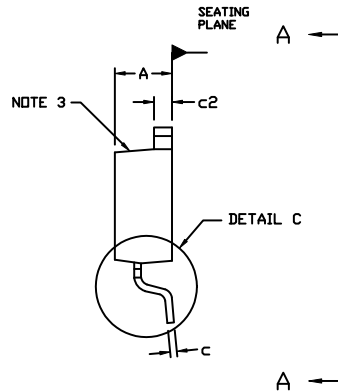
■ For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERM/D.



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: INCHES.
3. CHAMFER OPTIONAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.005 PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.
5. THERMAL PAD CONTOUR IS OPTIONAL WITHIN DIMENSIONS E, L1, D1, AND E1.
6. OPTIONAL MOLD FEATURE.
7. ①, ② ... OPTIONAL CONSTRUCTION FEATURE CALL OUTS.

DIM	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.160	0.190	4.06	4.83
A1	0.000	0.010	0.00	0.25
b	0.020	0.039	0.51	0.99
c	0.012	0.029	0.30	0.74
c2	0.045	0.065	1.14	1.65
D	0.330	0.380	8.38	9.65
D1	0.260	---	6.60	---
E	0.380	0.420	9.65	10.67
E1	0.245	---	6.22	---
e	0.100	BSC	2.54	BSC
H	0.575	0.625	14.60	15.88
L	0.070	0.110	1.78	2.79
L1	---	0.066	---	1.68
L2	---	0.070	---	1.78
L3	0.010	BSC	0.25	BSC
M	-8°	8°	-8°	8°



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