

MOSFET – Power, N-Channel, SUPERFET[®] III, Automotive, Easy-drive

650 V, 12 A, 260 mΩ

NVB260N65S3

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 advance 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 various power system miniaturization and higher efficiency.

Features

- AEC-Q101 Qualified
- 700 V @ $T_J = 150^\circ\text{C}$
- Typ. $R_{DS(on)} = 222\text{ m}\Omega$
- Ultra Low Gate Charge (Typ. $Q_g = 24\text{ nC}$)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)} = 248\text{ pF}$)
- 100% Avalanche Tested
- These Devices are Pb-Free and are RoHS Compliant

Applications

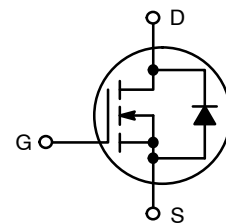
- Automotive On Board Charger
- Automotive DC/DC Converter for HEV



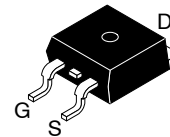
ON Semiconductor[®]

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V_{DS}	$R_{DS(on)}$ MAX	I_D MAX
650 V	260 mΩ @ 10 V	12 A

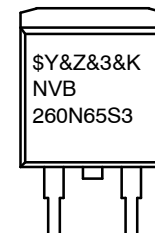


POWER MOSFET



D²-PAK
CASE 418AJ

MARKING DIAGRAM



\$Y	= ON Semiconductor Logo
&Z	= Assembly Plant Code
&3	= Data Code (Year & Week)
&K	= Lot
NVB260N65S3	= Specific Device Code

ORDERING INFORMATION

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

NVB260N65S3

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

Symbol	Parameter		Value	Unit
V_{DSS}	Drain to Source Voltage		650	V
V_{GSS}	Gate to Source Voltage	DC	± 30	V
		AC ($f > 1\text{ Hz}$)	± 30	V
I_D	Drain Current	Continuous ($T_C = 25^\circ\text{C}$)	12	A
		Continuous ($T_C = 100^\circ\text{C}$)	7.6	
I_{DM}	Drain Current	Pulsed (Note 1)	30	A
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		57	mJ
I_{AS}	Avalanche Current (Note 1)		2.3	A
E_{AR}	Repetitive Avalanche Energy (Note 1)		0.9	mJ
dv/dt	MOSFET dv/dt		100	V/ns
	Peak Diode Recovery dv/dt (Note 3)		20	
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	90	W
		Derate Above 25°C	0.72	W/ $^\circ\text{C}$
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 s		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. $I_{AS} = 2.3\text{ A}$, $R_G = 25\ \Omega$, starting $T_J = 25^\circ\text{C}$.

3. $I_{SD} \leq 6\text{ A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} \leq 400\text{ V}$, starting $T_J = 25^\circ\text{C}$.

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	1.39	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max. (Note 4)	40	

4. Device on 1 in² pad 2 oz copper pad on 1.5 x 1.5 in. board of FR-4 material.

PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Marking	Package	Reel Size	Tape Width	Shipping [†]
NVB260N65S3	NVB260N65S3	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.

NVB260N65S3

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 = 1 mA, T _J = 150°C	700			V
ΔBV _{DSS} /ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 1 mA, Referenced to 25°C		0.66		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		0.77		
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 = 0.29 mA	2.5		4.5	V
R _{DS(on)}	Static Drain to Source On Resistance	V _{GS} = 10 V, I _D = 6 A		222	260	mΩ
g _{FS}	Forward Transconductance	V _{DS} = 20 V, I _D = 6 A		7.4		S

DYNAMIC CHARACTERISTICS

C _{iss}	Input Capacitance	V _{DS} = 400 V, V _{GS} = 0 V, f = 1 MHz		1010		pF
C _{oss}	Output Capacitance			25		pF
C _{oss(eff.)}	Effective Output Capacitance	V _{DS} = 0 V to 400 V, V _{GS} = 0 V		248		pF
C _{oss(er.)}	Energy Related Output Capacitance	V _{DS} = 0 V to 400 V, V _{GS} = 0 V		33		pF
Q _{g(tot)}	Total Gate Charge at 10 V	V _{DS} = 400 V, I _D = 6 A, V _{GS} = 10 V (Note 5)		24		nC
Q _{gs}	Gate to Source Gate Charge			6.1		nC
Q _{gd}	Gate to Drain "Miller" Charge			9.7		nC
ESR	Equivalent Series Resistance	f = 1 MHz		8.7		Ω

SWITCHING CHARACTERISTICS

t _{d(on)}	Turn-On Delay Time	V _{DD} = 400 V, I _D = 6 A, V _{GS} = 10 V, R _g = 4.7 Ω (Note 5)		18		ns
t _r	Turn-On Rise Time			18		ns
t _{d(off)}	Turn-Off Delay Time			49		ns
t _f	Turn-Off Fall Time			12		ns

SOURCE-DRAIN DIODE CHARACTERISTICS

I _S	Maximum Continuous Source to Drain Diode Forward Current			12	A
I _{SM}	Maximum Pulsed Source to Drain Diode Forward Current			30	A
V _{SD}	Source to Drain Diode Forward Voltage	V _{GS} = 0 V, I _{SD} = 6 A		1.2	V
t _{rr}	Reverse Recovery Time	V _{DD} = 400 V, I _{SD} = 6 A, dI _F /dt = 100 A/μs		251	ns
Q _{rr}	Reverse Recovery Charge			3.4	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.

5. Essentially independent of operating temperature typical characteristics.

TYPICAL PERFORMANCE CHARACTERISTICS

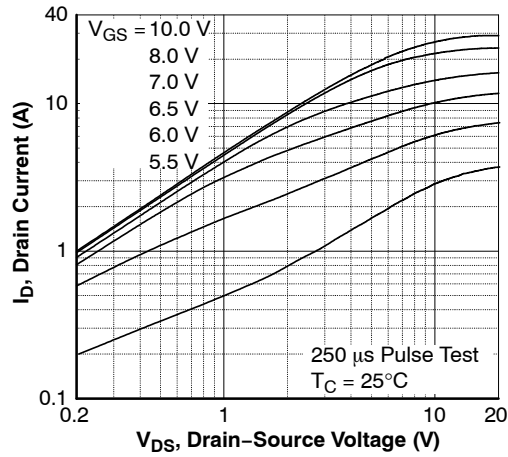


Figure 1. On-Region Characteristics 25°C

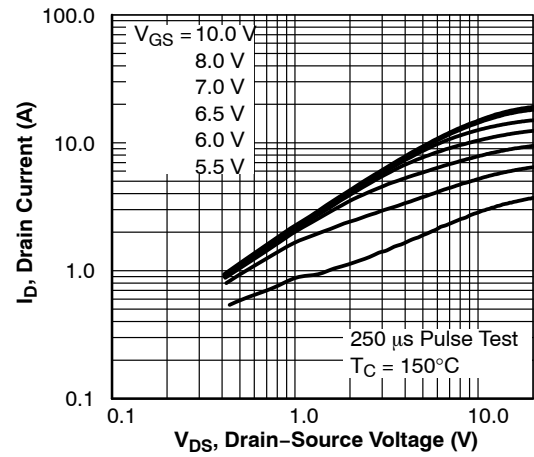


Figure 2. On-Region Characteristics 150°C

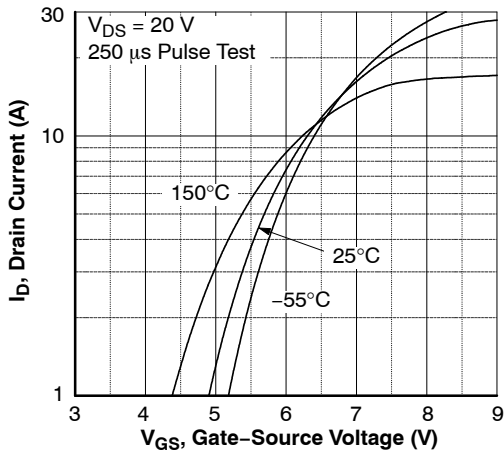


Figure 3. Transfer Characteristics

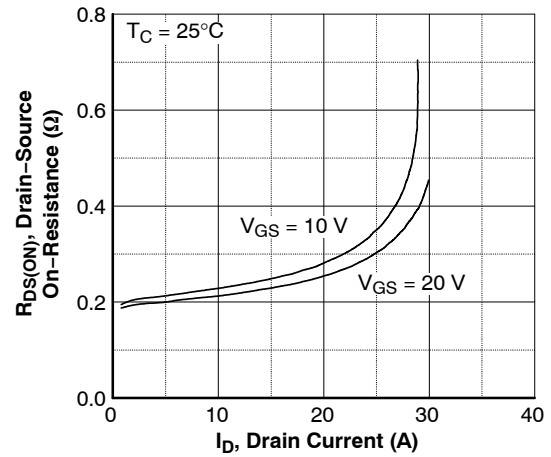


Figure 4. On-Resistance Variation vs. Drain Current and Gate Voltage

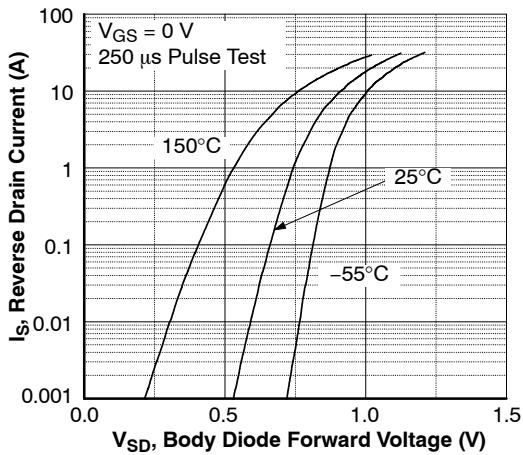


Figure 5. Body Diode Forward Voltage Variation vs. Source Current and Temperature

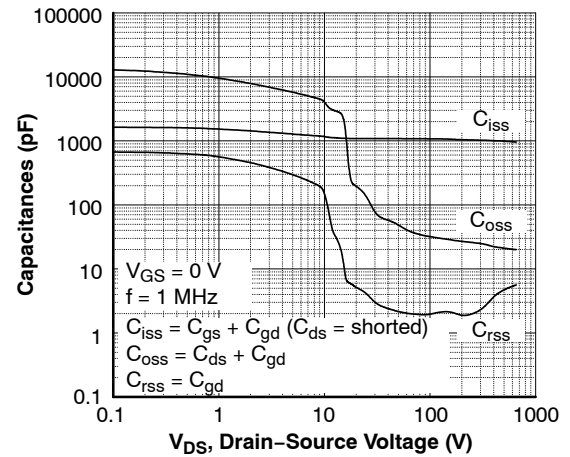


Figure 6. Capacitance Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS

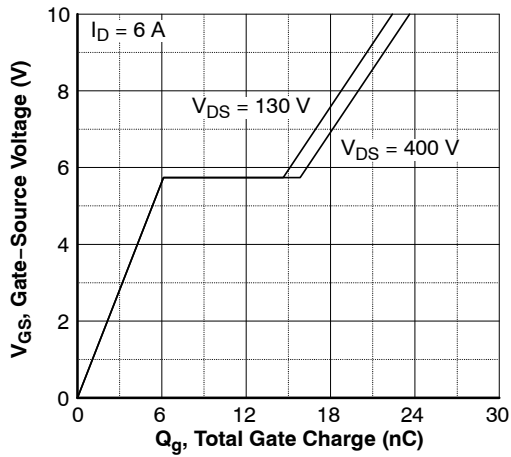


Figure 7. Gate Charge Characteristics

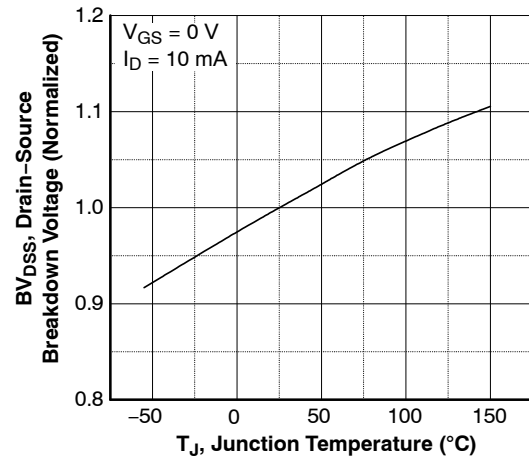


Figure 8. Breakdown Voltage Variation vs. Temperature

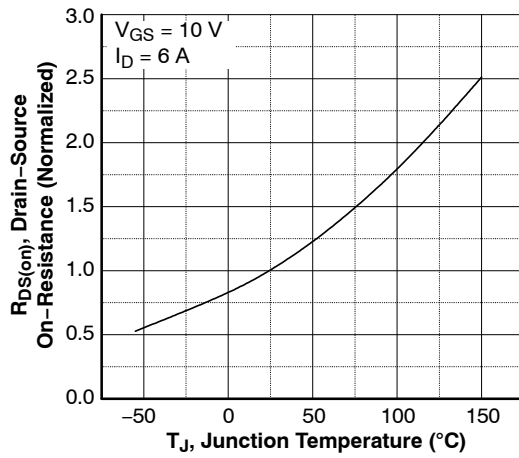


Figure 9. On-Resistance Variation vs. Temperature

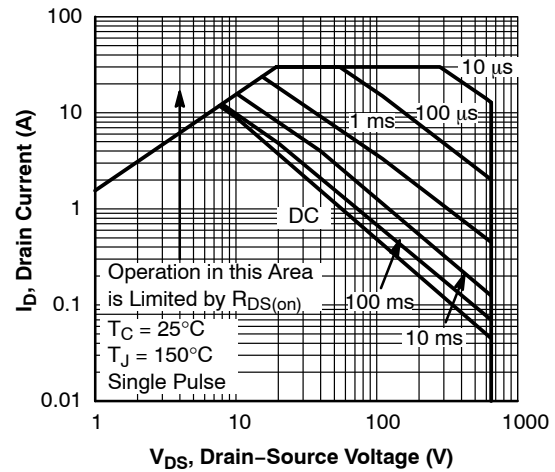


Figure 10. Maximum Safe Operating Area

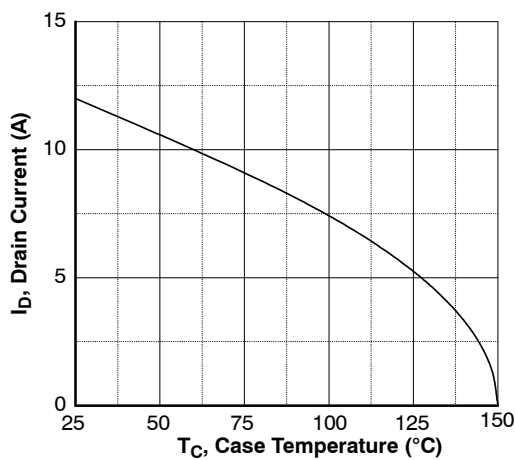


Figure 11. Maximum Drain Current vs. Case Temperature

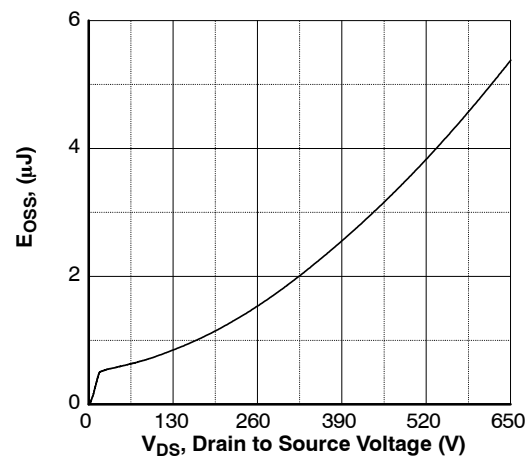


Figure 12. E_{OSS} vs. Drain to Source Voltage

TYPICAL PERFORMANCE CHARACTERISTICS

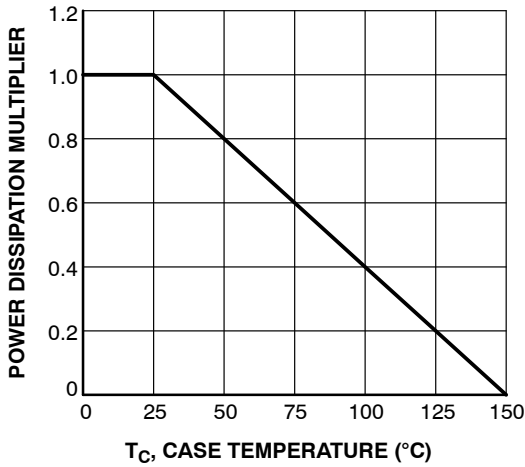


Figure 13. Normalized Power Dissipation vs. Case Temperature

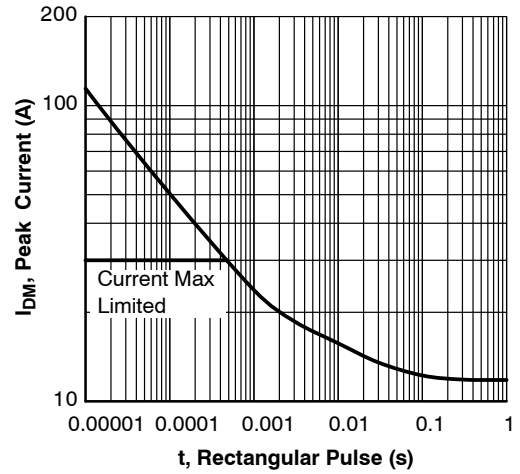


Figure 14. Peak Current Capability

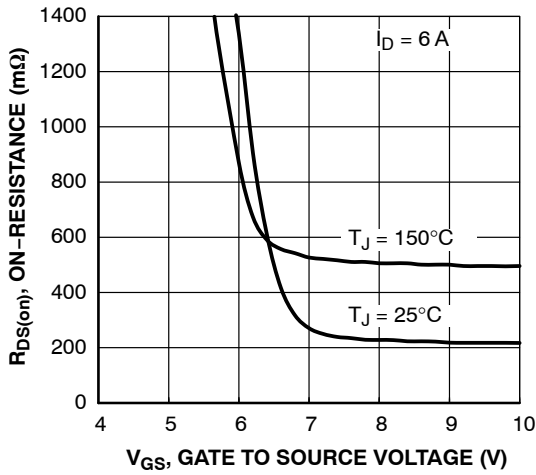


Figure 15. $R_{DS(on)}$ vs. Gate Voltage

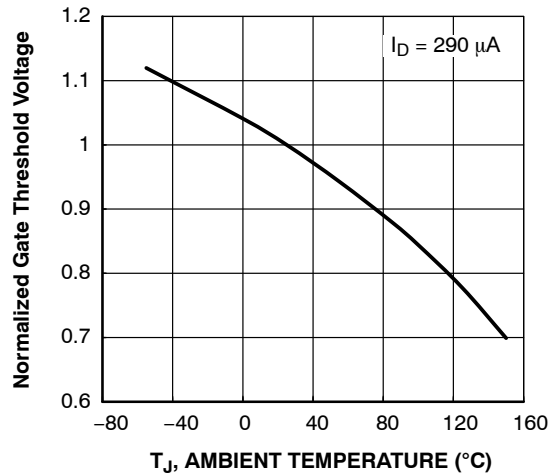


Figure 16. Normalized Gate Threshold Voltage vs. Temperature

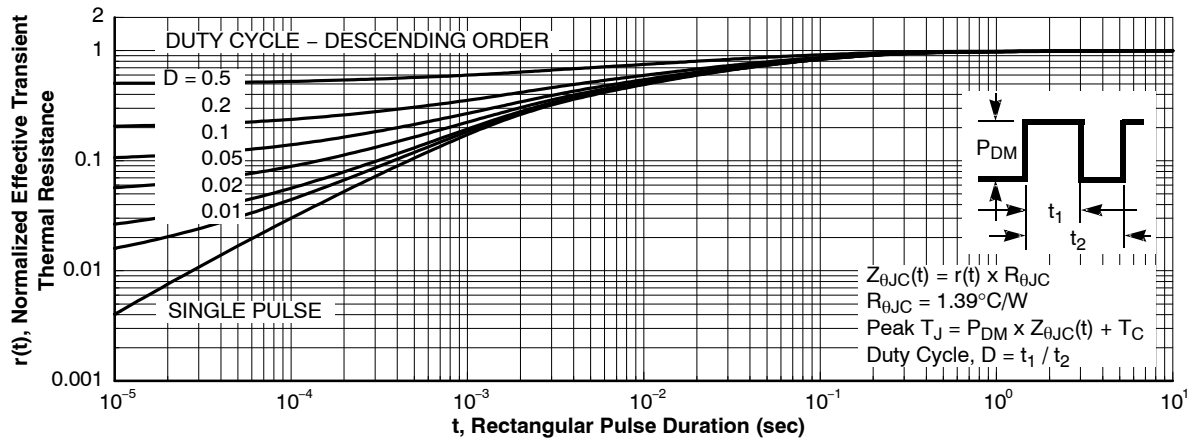


Figure 17. Transient Thermal Response Curve

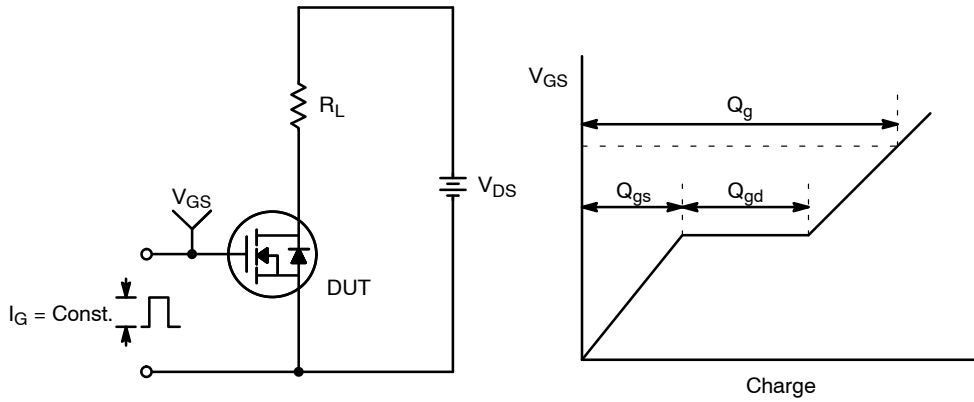


Figure 18. Gate Charge Test Circuit & Waveform

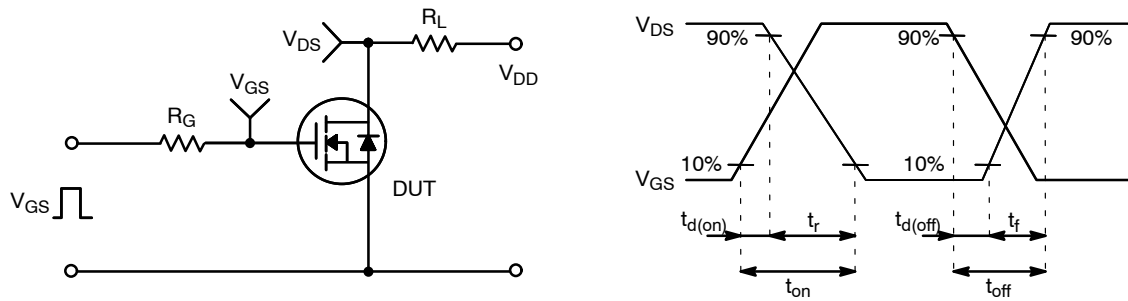


Figure 19. Resistive Switching Test Circuit & Waveforms

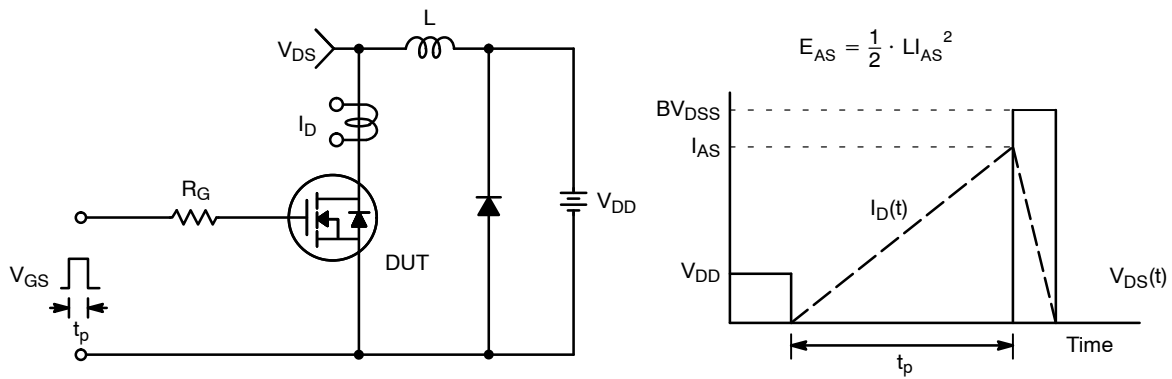


Figure 20. Unclamped Inductive Switching Test Circuit & Waveforms

NVB260N65S3

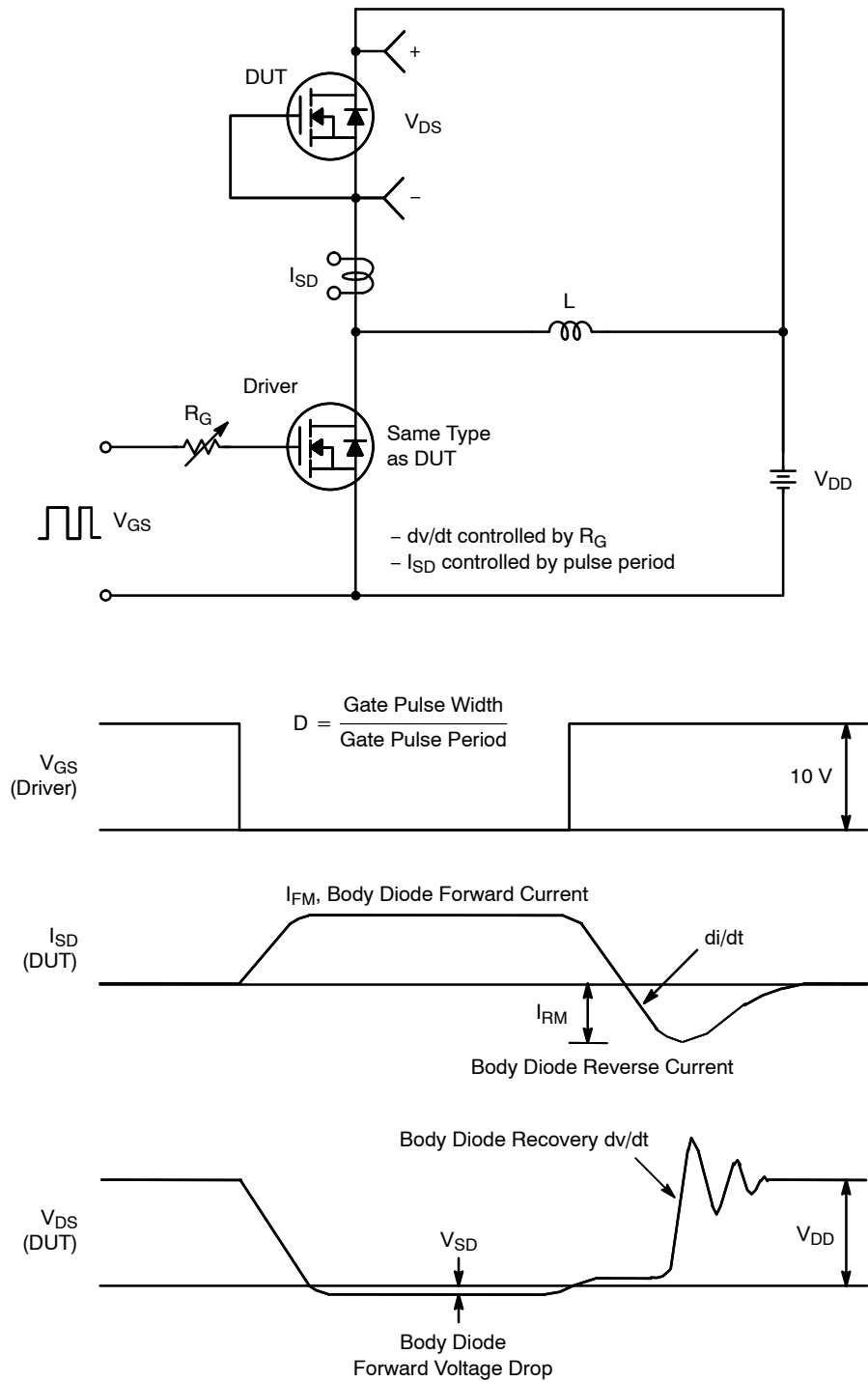
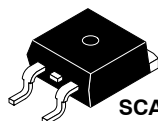


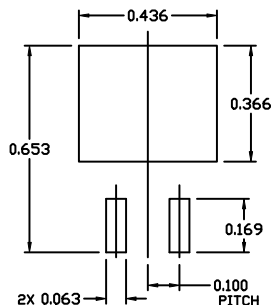
Figure 21. Peak Diode Recovery dv/dt Test Circuit & Waveforms



SCALE 1:1

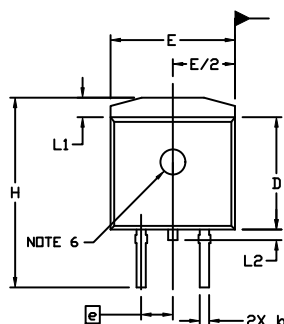
D²PAK-3 (TO-263, 3-LEAD)
CASE 418AJ
ISSUE F

DATE 11 MAR 2021



**RECOMMENDED
MOUNTING FOOTPRINT**

For additional information on our Pb-free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERM1.

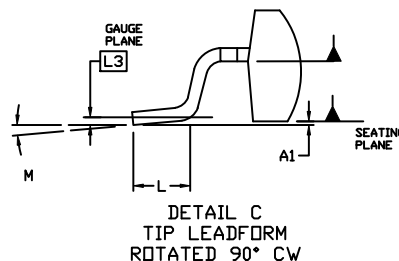
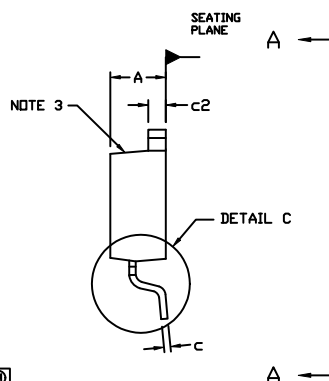


0.100 BSC 0.100 BSC

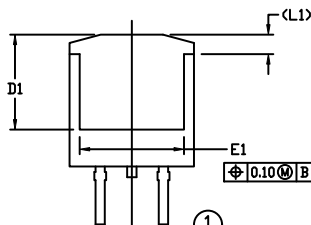
NOTES:

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.

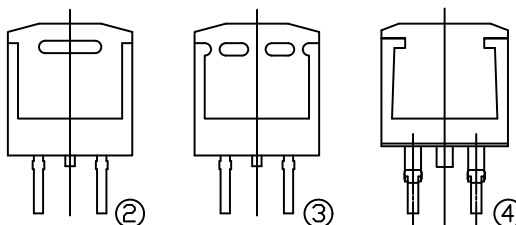
DIM	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.160	0.190	4.06	4.83
A1	0.000	0.010	0.00	0.25
b	0.020	0.039	0.51	0.99
c	0.012	0.029	0.30	0.74
c2	0.045	0.065	1.14	1.65
D	0.330	0.380	8.38	9.65
D1	0.260	---	6.60	---
E	0.380	0.420	9.65	10.67
E1	0.245	---	6.22	---
e	0.100 BSC	---	2.54 BSC	---
H	0.575	0.625	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	0°	8°	0°	8°



DETAIL C
TIP LEADFORM
ROTATED 90° CW

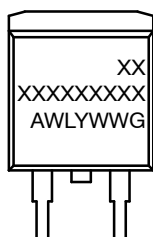


VIEW A-A

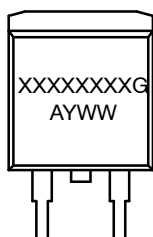


VIEW A-A
OPTIONAL CONSTRUCTIONS

GENERIC MARKING DIAGRAMS*



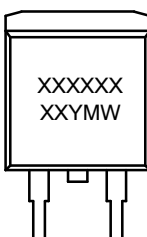
IC



Standard



Rectifier



SSG

XXXXXX = Specific Device Code
A = Assembly Location
WL = Wafer Lot
Y = Year
WW = Work Week
W = Week Code (SSG)
M = Month Code (SSG)
G = Pb-Free Package
AKA = Polarity Indicator

*This information is generic. Please refer to device data sheet for actual part marking. Pb-free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

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