

NTB110N65S3HF

MOSFET – N-Channel, SUPERFET III, FRFET

650 V, 30 A, 110 mΩ

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 systems 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. $R_{DS(on)} = 98 \text{ m}\Omega$
- Ultra Low Gate Charge (Typ. $Q_g = 62 \text{ nC}$)
- Low Effective Output Capacitance (Typ. $C_{oss(\text{eff.})} = 522 \text{ pF}$)
- 100% Avalanche Tested
- These Devices are Pb-Free and are RoHS Compliant

Applications

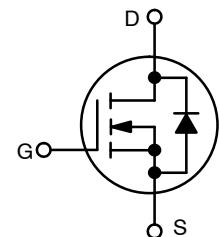
- Telecom / Server Power Supplies
- Industrial Power Supplies
- EV Charger
- UPS / Solar



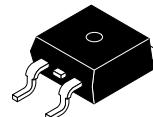
ON Semiconductor®

www.onsemi.com

V_{DSS}	$R_{DS(\text{ON}) \text{ MAX}}$	$I_D \text{ MAX}$
650 V	110 mΩ @ 10 V	30 A



N-CHANNEL MOSFET



D²PAK
(TO-263 3-Lead)
CASE 418AJ

MARKING DIAGRAM



\$Y = ON Semiconductor Logo
&Z = Assembly Plant Code
&3 = Data Code (Year & Week)
&K = Lot
NTB110N65S3HF = Specific Device Code

ORDERING INFORMATION

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

NTB110N65S3HF

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)	19.5	
I _{DM}	Drain Current	– Pulsed (Note 1)	69	A
E _{AS}	Single Pulsed Avalanche Energy (Note 2)		380	mJ
I _{AS}	Avalanche Current (Note 2)		4.4	A
E _{AR}	Repetitive Avalanche Energy (Note 1)		2.4	mJ
dv/dt	MOSFET dv/dt		100	V/ns
	Peak Diode Recovery dv/dt (Note 3)		50	
P _D	Power Dissipation	(T _C = 25°C)	240	W
		– Derate Above 25°C	1.92	W/°C
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 ≤ 100 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.	0.52	°C/W
R _{θJA}	Thermal Resistance, Junction to Ambient, Max.	45	

PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Marking	Package	Reel Size	Tape Width	Shipping [†]
NTB110N65S3HF	NTB110N65S3HF	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.

NTB110N65S3HF

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
OFF CHARACTERISTICS						
BV _{DSS}	Drain to Source Breakdown Voltage	$V_{GS} = 0 \text{ V}$, $I_D = 1 \text{ mA}$, $T_J = 25^\circ\text{C}$	650	–	–	V
		$V_{GS} = 0 \text{ V}$, $I_D = 1 \text{ mA}$, $T_J = 150^\circ\text{C}$	700	–	–	V
$\Delta V_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 15 \text{ mA}$, Referenced to 25°C	–	0.64	–	$^\circ\text{C}$
Id _{SS}	Zero Gate Voltage Drain Current	$V_{DS} = 650 \text{ V}$, $V_{GS} = 0 \text{ V}$	–	–	10	μA
		$V_{DS} = 520 \text{ V}$, $T_C = 125^\circ\text{C}$	–	97	–	
I _{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 30 \text{ V}$, $V_{DS} = 0 \text{ V}$	–	–	± 100	nA

ON CHARACTERISTICS

$V_{GS(\text{th})}$	Gate Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 0.74 \text{ mA}$	3.0	–	5.0	V
$R_{DS(\text{on})}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}$, $I_D = 15 \text{ A}$	–	98	110	$\text{m}\Omega$
g_{FS}	Forward Transconductance	$V_{DS} = 20 \text{ V}$, $I_D = 15 \text{ A}$	–	18	–	S

DYNAMIC CHARACTERISTICS

C_{iss}	Input Capacitance	$V_{DS} = 400 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$	–	2635	–	pF
C_{oss}	Output Capacitance		–	52	–	pF
$C_{oss(\text{eff.})}$	Effective Output Capacitance	$V_{DS} = 0 \text{ V}$ to 400 V , $V_{GS} = 0 \text{ V}$	–	522	–	pF
$C_{oss(\text{er.})}$	Energy Related Output Capacitance	$V_{DS} = 0 \text{ V}$ to 400 V , $V_{GS} = 0 \text{ V}$	–	91	–	pF
$Q_{g(\text{tot})}$	Total Gate Charge at 10V	$V_{DS} = 400 \text{ V}$, $I_D = 15 \text{ A}$, $V_{GS} = 10 \text{ V}$ (Note 4)	–	62	–	nC
Q_{gs}	Gate to Source Gate Charge		–	18	–	nC
Q_{gd}	Gate to Drain "Miller" Charge		–	25	–	nC
ESR	Equivalent Series Resistance	$f = 1 \text{ MHz}$	–	4.6	–	Ω

SWITCHING CHARACTERISTICS

$t_{d(\text{on})}$	Turn-On Delay Time	$V_{DD} = 400 \text{ V}$, $I_D = 15 \text{ A}$, $V_{GS} = 10 \text{ V}$, $R_g = 4.7 \Omega$ (Note 4)	–	24	–	ns
t_r	Turn-On Rise Time		–	25	–	ns
$t_{d(\text{off})}$	Turn-Off Delay Time		–	85	–	ns
t_f	Turn-Off Fall Time		–	25	–	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	–	–	69	A	
V_{SD}	Source to Drain Diode Forward Voltage	$V_{GS} = 0 \text{ V}$, $I_{SD} = 15 \text{ A}$	–	–	1.3	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0 \text{ V}$, $I_{SD} = 15 \text{ A}$, $dI_F/dt = 100 \text{ A}/\mu\text{s}$	–	95	–	ns
Q_{rr}	Reverse Recovery Charge		–	371	–	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.

TYPICAL PERFORMANCE CHARACTERISTICS

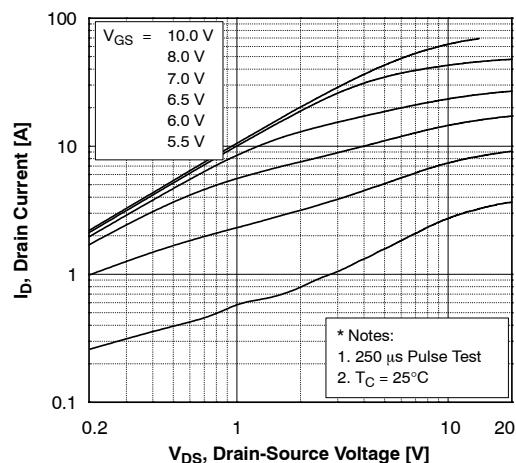


Figure 1. On-Region Characteristics

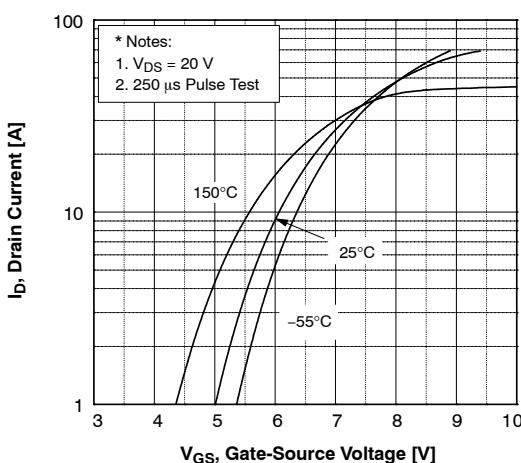


Figure 2. Transfer Characteristics

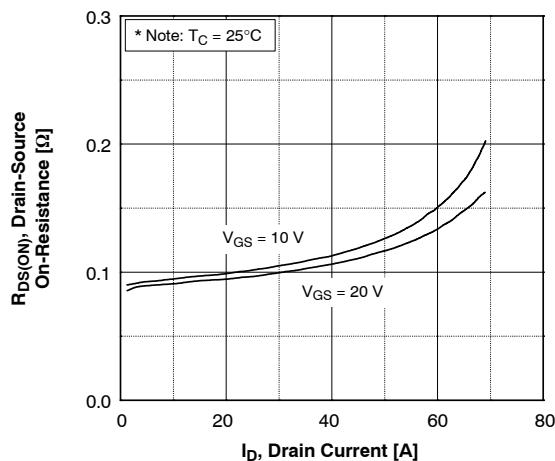


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

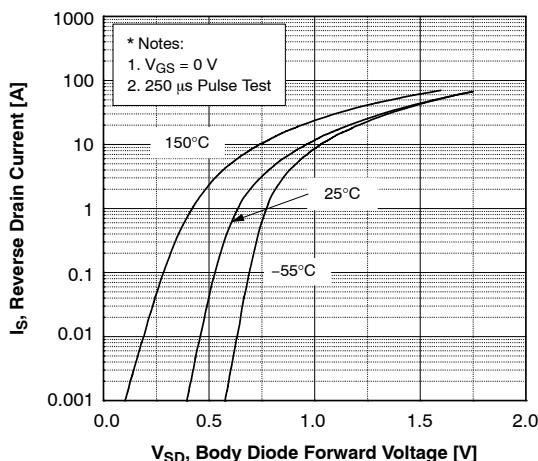


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

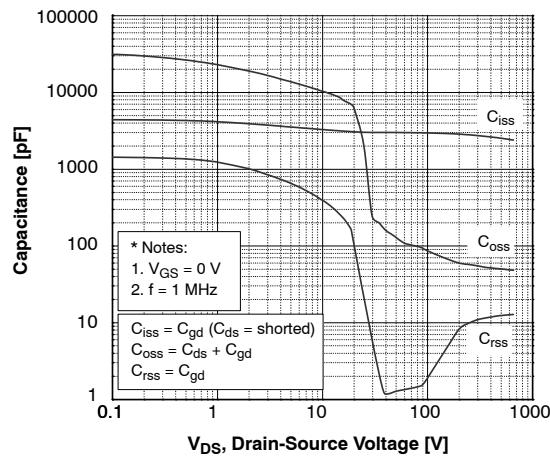


Figure 5. Capacitance Characteristics

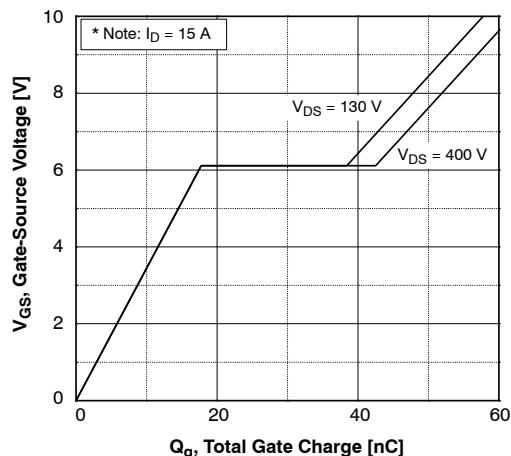


Figure 6. Gate Charge Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

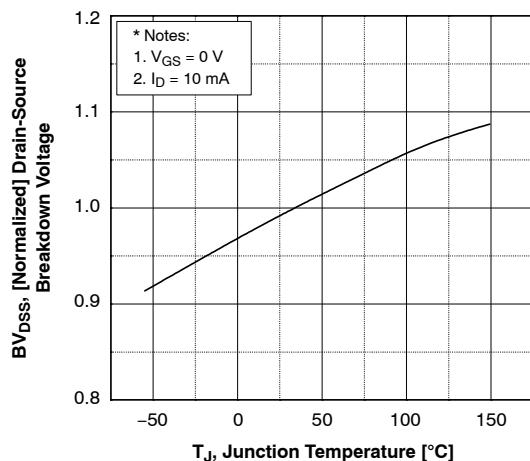


Figure 7. Breakdown Voltage Variation vs. Temperature

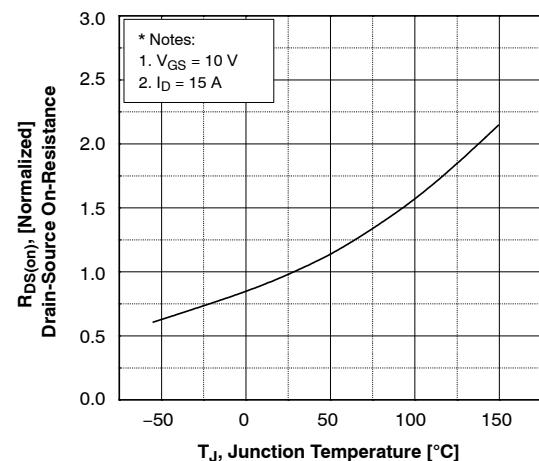


Figure 8. On-Resistance Variant vs. Temperature

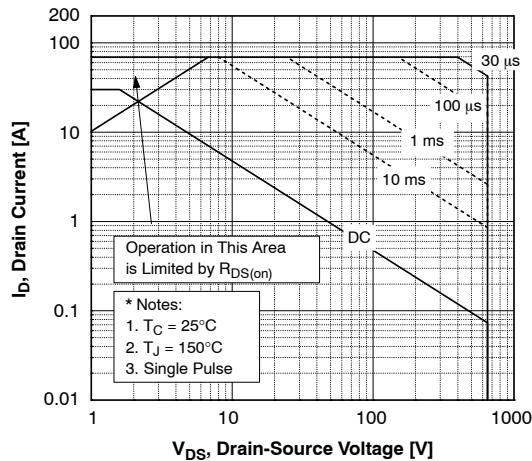


Figure 9. Maximum Safe Operation Area

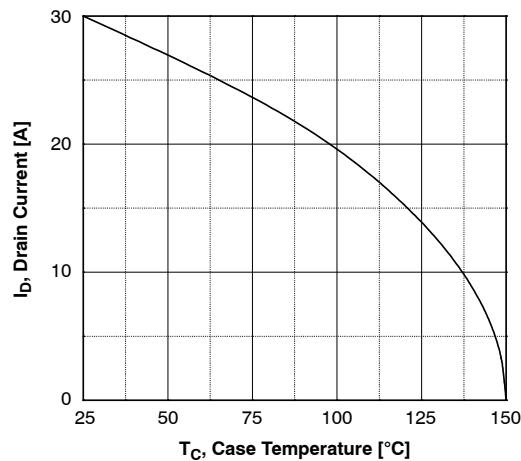
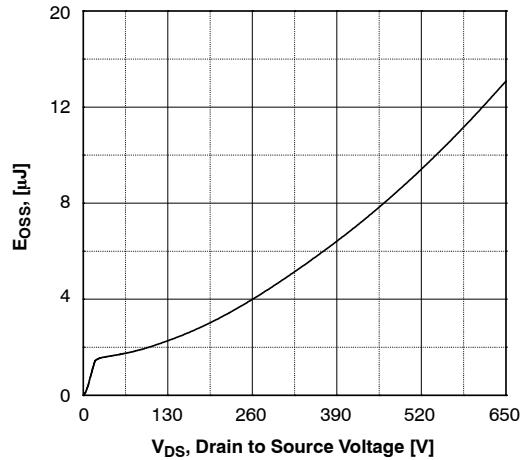


Figure 10. Maximum Drain Current vs. Case Temperature

Figure 11. E_{oss} vs. Drain to Source Voltage

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

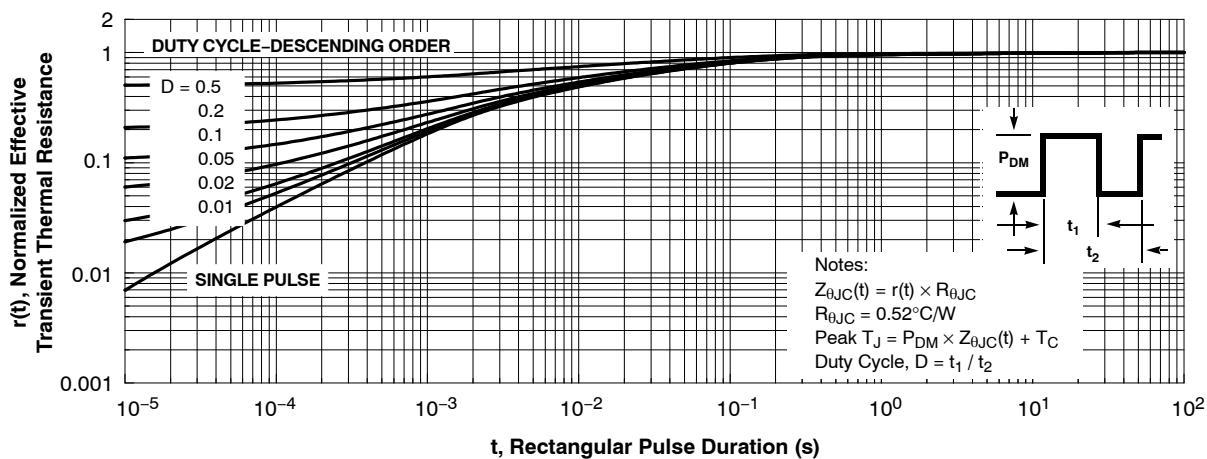


Figure 12. Transient Thermal Response Curve

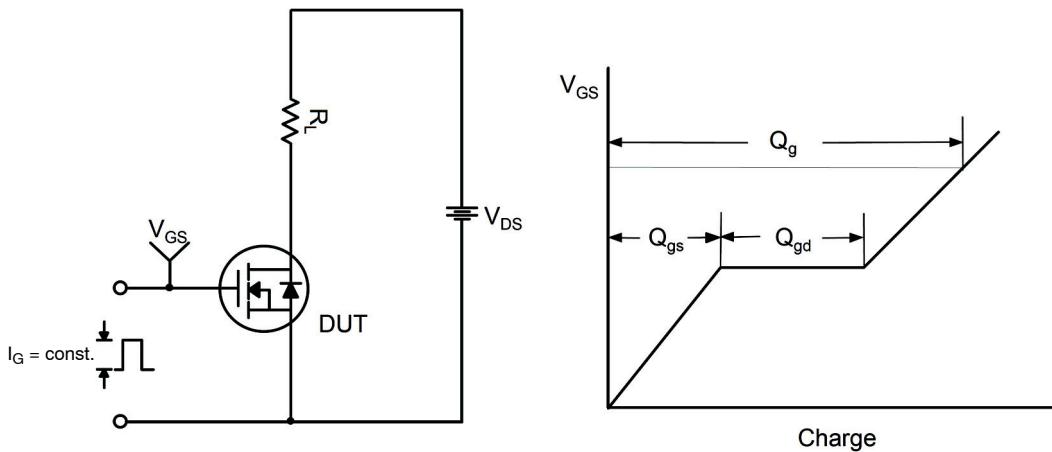


Figure 13. Gate Charge Test Circuit & Waveform

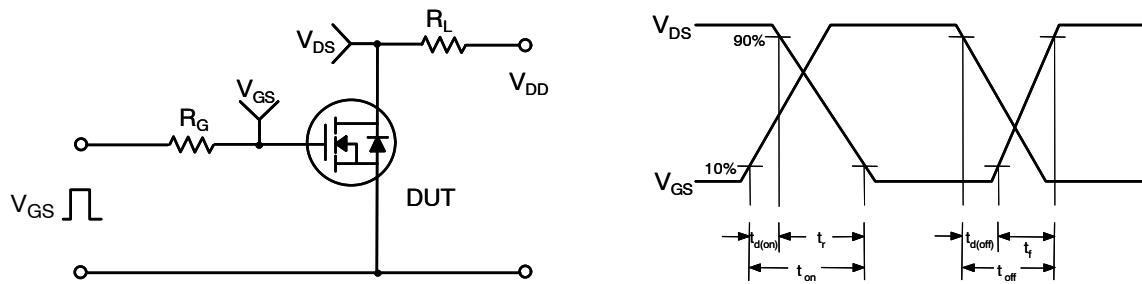


Figure 14. Resistive Switching Test Circuit & Waveforms

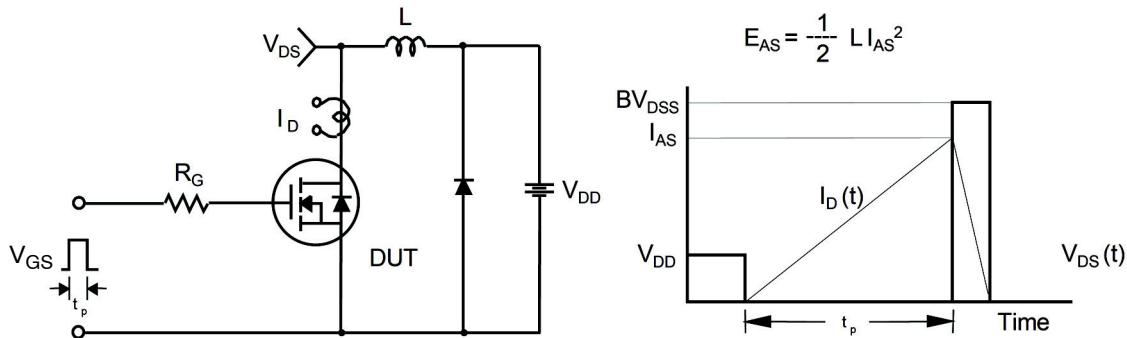


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

NTB110N65S3HF

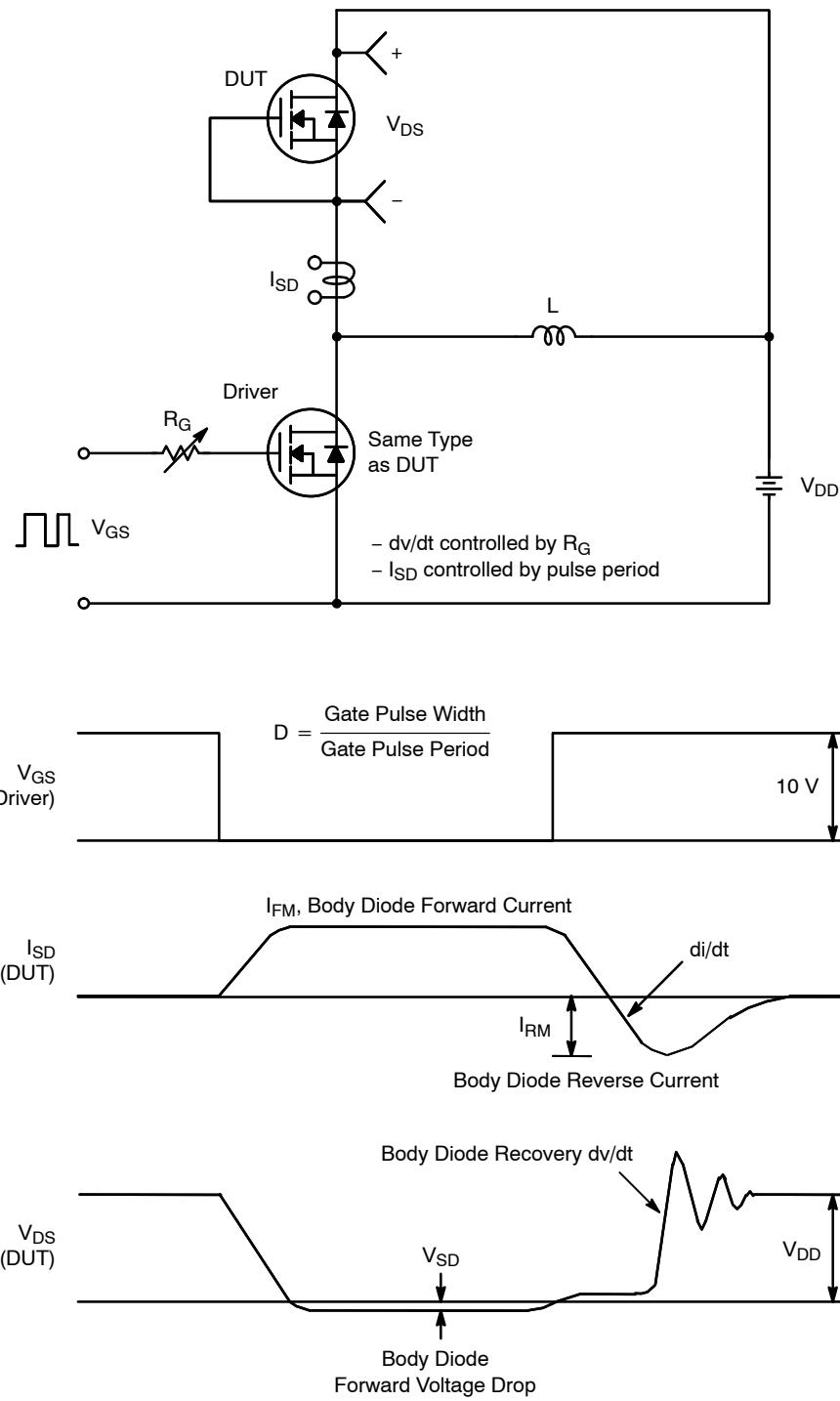
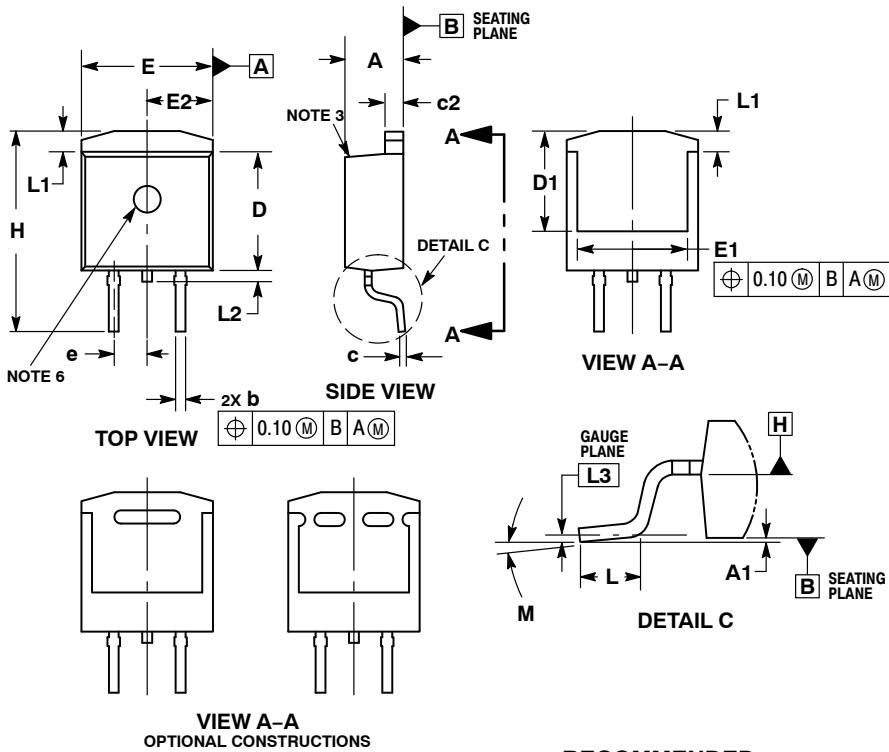
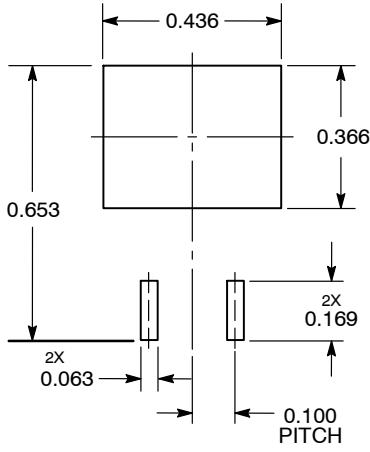


Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms

PACKAGE DIMENSIONS

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

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°

VIEW A-A
OPTIONAL CONSTRUCTIONSRECOMMENDED
SOLDERING FOOTPRINT*

DIMENSIONS: INCHES

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

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