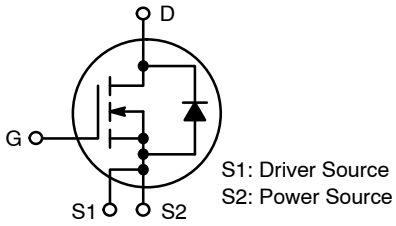
MOSFET - Power, N-Channel, SUPERFET® III, FRFET®

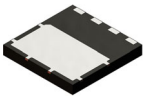
650 V, 20 A, 190 mΩ

NTMT190N65S3HF

V_{DSS}	$R_{DS(ON)}$ MAX	I_D MAX
650 V	190 mΩ @ 10 V	20 A



POWER MOSFET



TDFN4 8X8
CASE 520AB

Description

SUPERFET III MOSFET is **onsemi**'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 components and improve system reliability.

The TDFN4 package is an ultra−slim surface−mount package (1 mm high) with a low profile and small footprint (8x8 mm^2). SUPERFET III MOSFET in a TDFN4 package offers excellent switching performance due to lower parasitic source inductance and separated power and drive sources. TDFN4 offers Moisture Sensitivity Level 1 (MSL 1).

Features

- 700 V @ T_J = 150 °C
- Typ $R_{DS(on)}$ = 159 mΩ
- Ultra Low Gate Charge (Typ. Q_g = 34 nC)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)}$ = 316 pF)
- 100% Avalanche Tested
- These Devices are Pb−Free and are RoHS Compliant

Applications

- Telecom / Server Power Supplies
- Industrial Power Supplies
- UPS / Solar
- Lighting / Charger / Adapter

MARKING DIAGRAM

NTMT190N65S3HF	= Specific Device Code
A	= Assembly Location
WL	= Wafer Lot
Y	= Year
WW	= Work Week

ORDERING INFORMATION

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

ABSOLUTE MAXIMUM RATINGS (T_C = 25°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 Hz)	±30	V
I_D	Drain Current	Continuous (T_C = 25°C)	20	A
		Continuous (T_C = 100°C)	12.7	
I_{DM}	Drain Current	Pulsed (Note 1)	50	A
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		220	mJ
I_{AS}	Avalanche Current (Note 2)		3.7	A
E_{AR}	Repetitive Avalanche Energy (Note 1)		1.62	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)	162	W
		Derate Above 25°C	1.3	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 s		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} = 3.7 A, R_G = 25 Ω starting T_J = 25°C
3. $I_{SD} \le$ 10 A, di/dt ≤ 100 A/μs, $V_{DD} \le$ 400 V, starting T_J = 25°C

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.77	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max. (Note 4)	45	

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

ORDERING INFORMATION

Part Number	Top Marking	Package	Reel Size	Tape Width	Shipping†
NTMT190N65S3HF	NTMT190N65S3HF	TDFN4	13”	13.3 mm	3000 / 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.

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
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 = 10 mA, referenced to 25°C	–	0.65	–	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	–	15		
I_{GSS}	Gate to Source 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 = 0.43 mA	3.0	–	5.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 10 A	–	159	190	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 10 A	–	11	–	S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 400 V, V_{GS} = 0 V, f = 1 MHz	–	1610	–	pF
C_{oss}	Output Capacitance		–	30	–	pF
$C_{oss(eff.)}$	Effective Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V	–	316	–	pF
$C_{oss(er.)}$	Energy Related Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V	–	59	–	pF
$Q_{g(tot)}$	Total Gate Charge at 10 V	V_{DS} = 400 V, I_D = 10 A, V_{GS} = 10 V (Note 5)	–	34	–	nC
Q_{gs}	Gate to Source Gate Charge		–	11	–	nC
Q_{gd}	Gate to Drain “Miller” Charge		–	13	–	nC
ESR	Equivalent Series Resistance	f = 1 MHz	–	4.1	–	Ω
SWITCHING CHARACTERISTICS						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 400 V, I_D = 10 A, V_{GS} = 10 V, R_{GEN} = 4.7 Ω (Note 5)	–	22	–	ns
t_r	Rise Time		–	13	–	ns
$t_{d(off)}$	Turn-Off Delay Time		–	53	–	ns
t_f	Fall Time		–	3.3	–	ns
SOURCE−DRAIN DIODE CHARACTERISTICS						
I_S	Maximum Continuous Source to Drain Diode Forward Current		–	–	20	A
I_{SM}	Maximum Pulsed Source to Drain Diode Forward Current		–	–	50	A
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 10 A	–	–	1.3	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 10 A, di_F/dt = 100 A/μs	–	72	–	ns
Q_{rr}	Reverse Recovery Charge		–	255	–	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.

5. Essentially independent of operating temperature typical characteristics.

TYPICAL CHARACTERISTICS

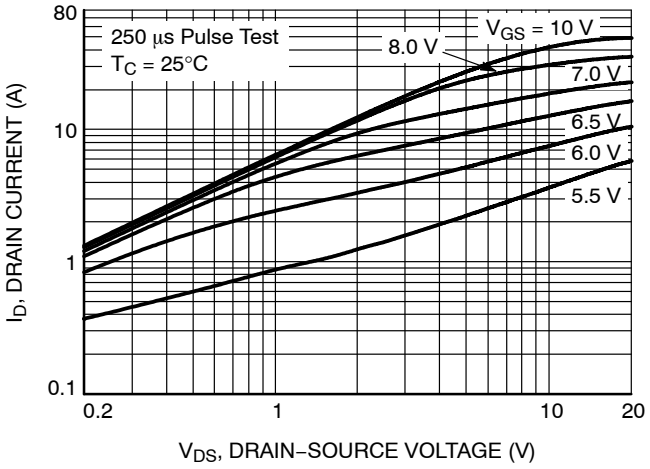


Figure 1. On−Region Characteristics

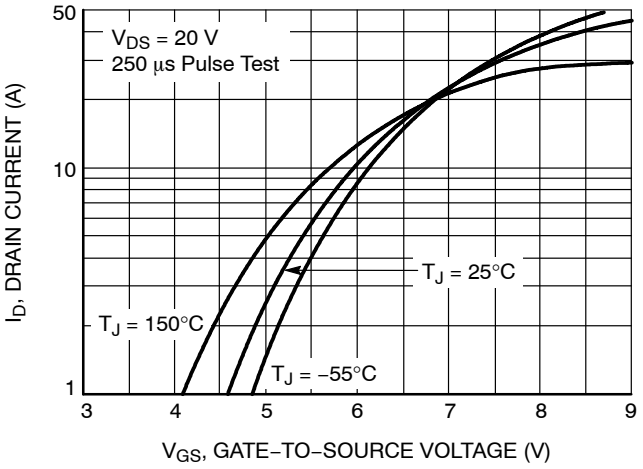


Figure 2. Transfer Characteristics

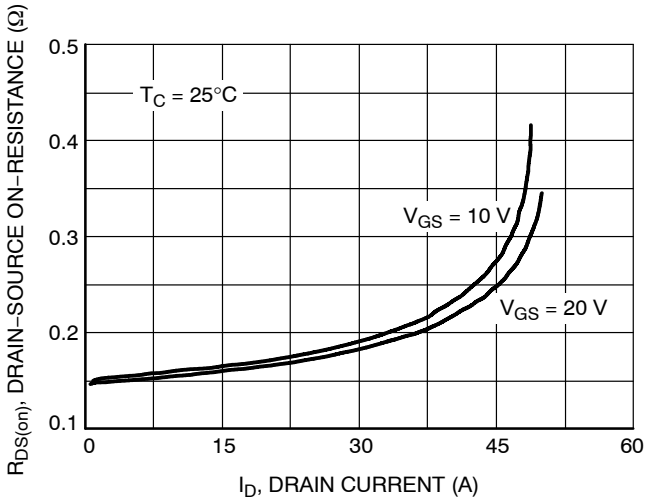


Figure 3. On−Resistance Variation vs. Drain Current and Gate Voltage

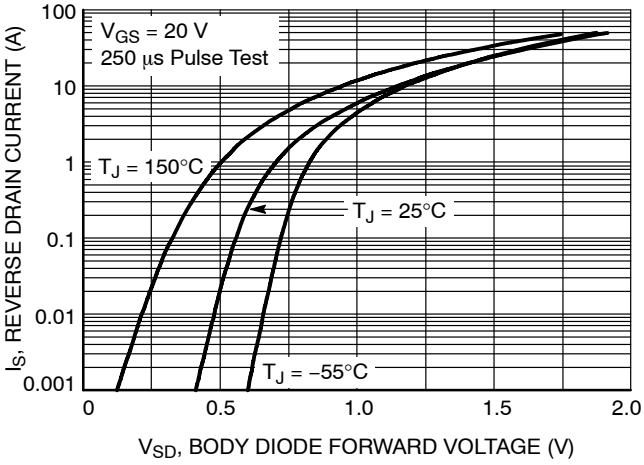


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

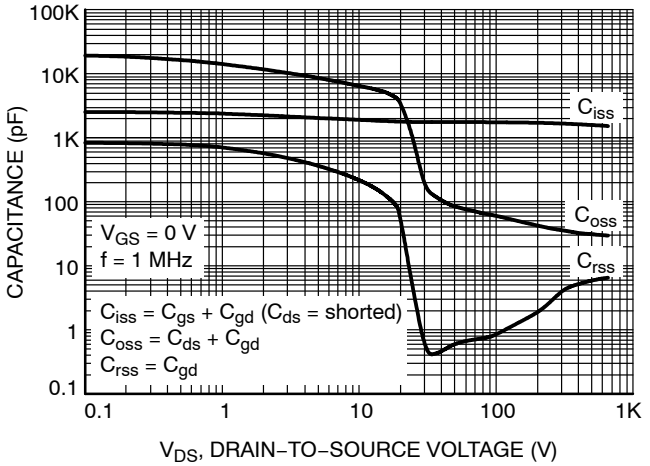


Figure 5. Capacitance Characteristics

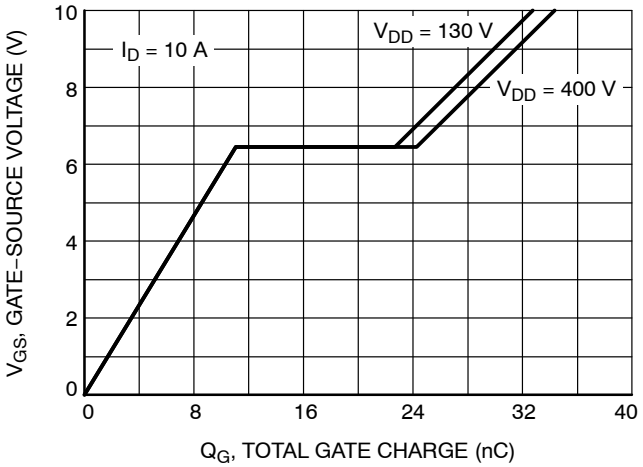


Figure 6. Gate Charge Characteristics

TYPICAL CHARACTERISTICS

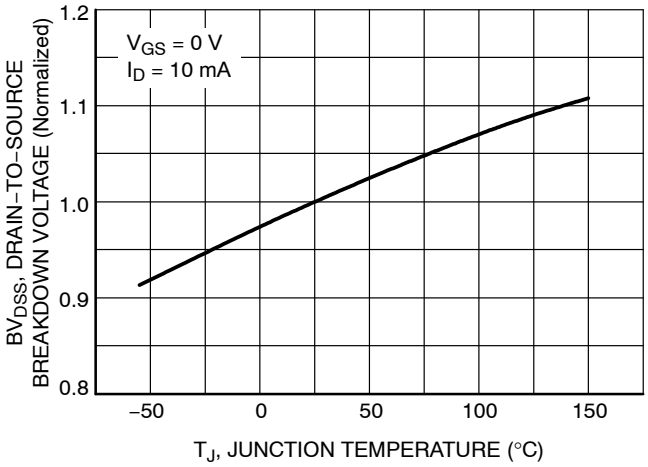


Figure 7. Breakdown Voltage Variation vs. Temperature

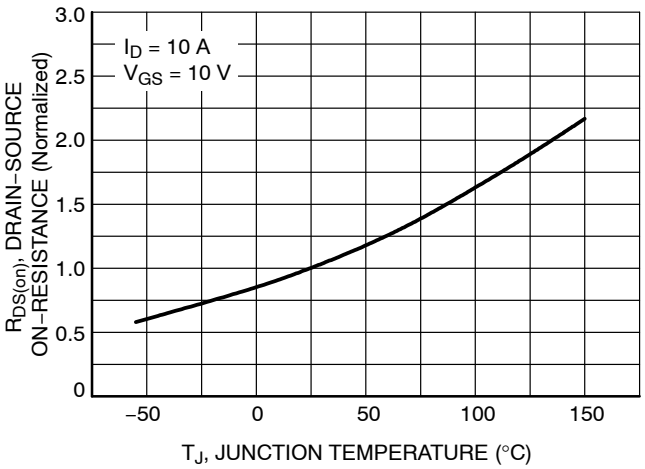


Figure 8. On−Resistance Variation vs. Temperature

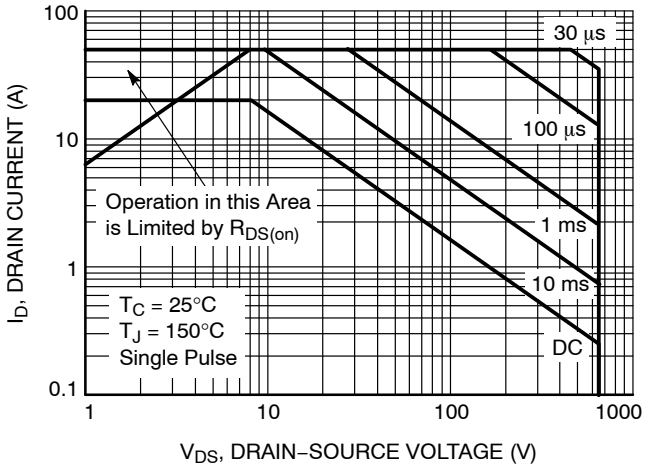


Figure 9. Maximum Safe Operating Area

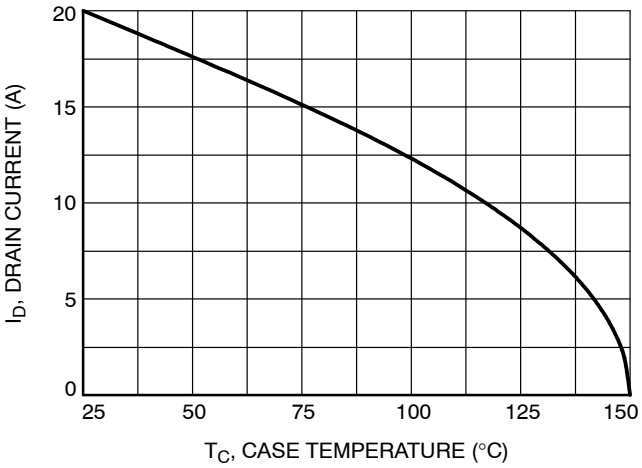


Figure 10. Maximum Drain Current vs. Case Temperature

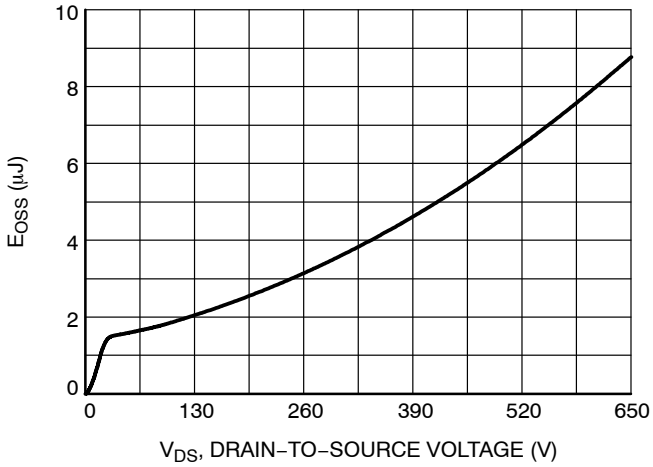


Figure 11. E_{OSS} vs. Drain−to−Source Voltage

TYPICAL CHARACTERISTICS

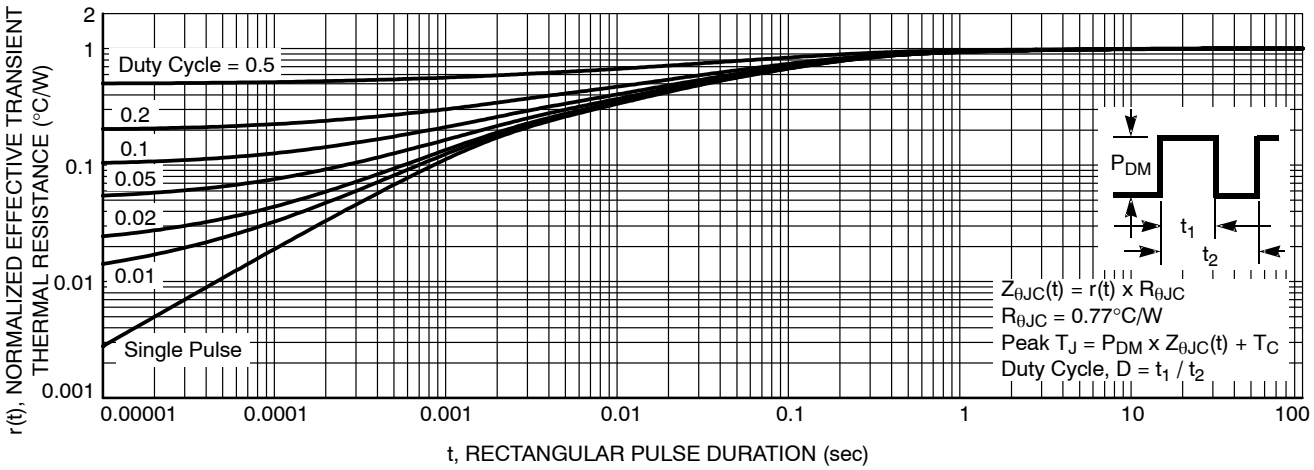


Figure 12. Transient Thermal Response Curve

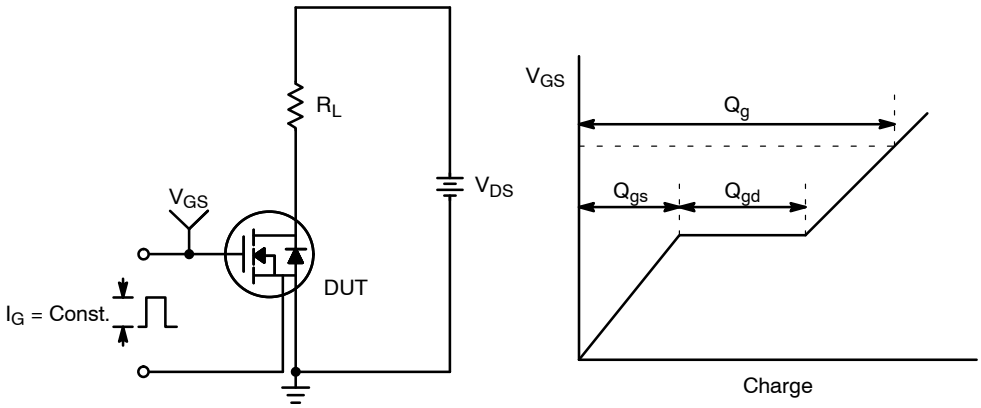


Figure 13. Gate Charge Test Circuit & Waveform

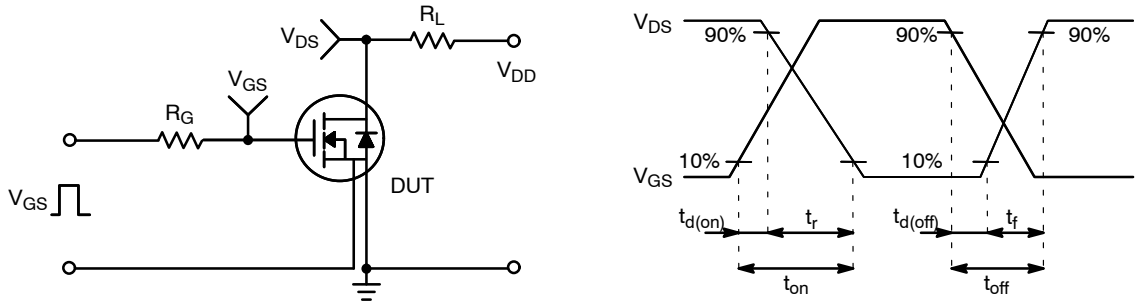


Figure 14. Resistive Switching Test Circuit & Waveforms

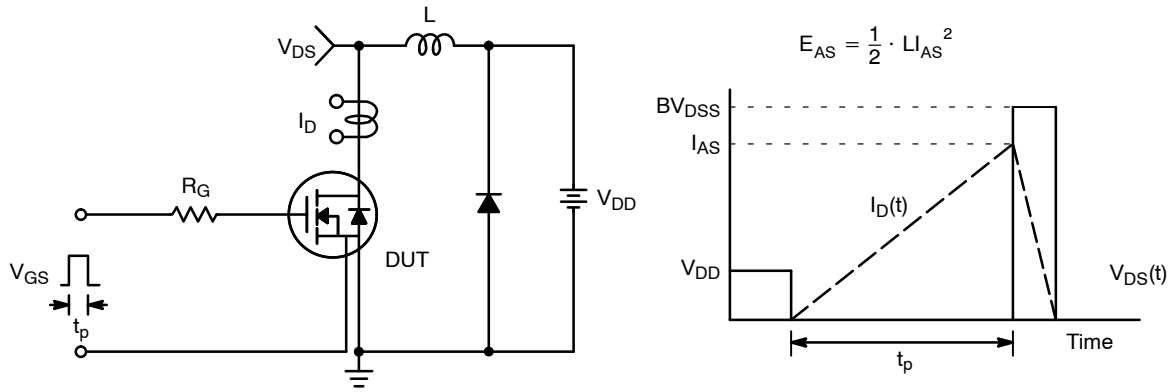


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

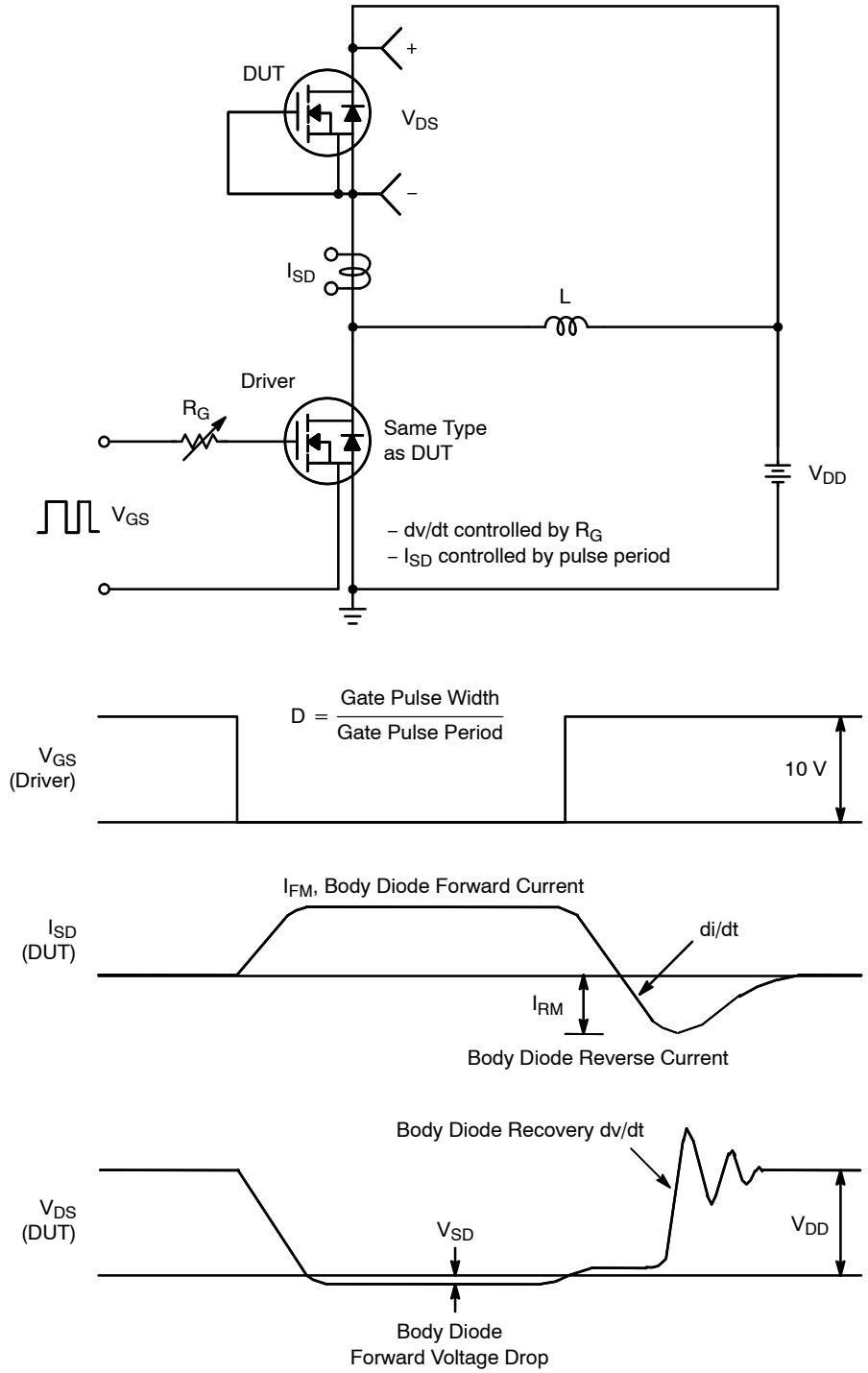
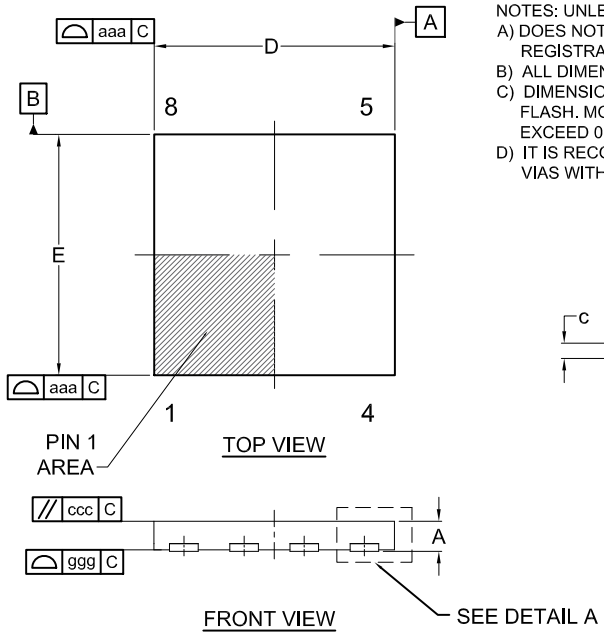
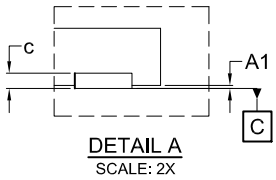


Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms

PACKAGE DIMENSIONS

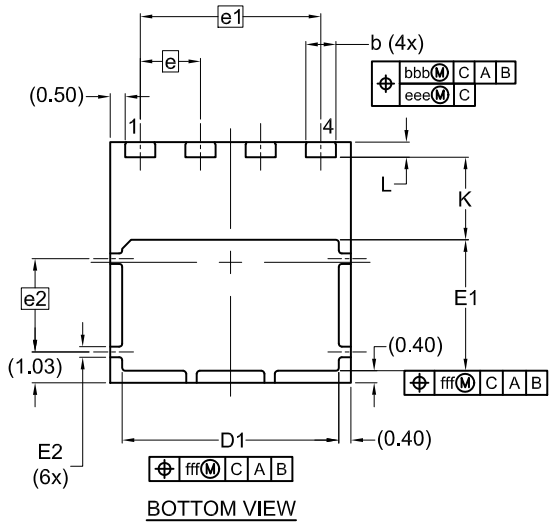
TDFN4 8x8, 2P
CASE 520AB
ISSUE O

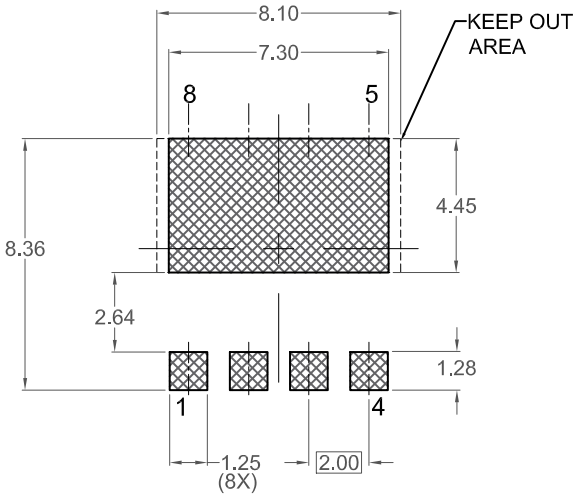




NOTES: UNLESS OTHERWISE SPECIFIED
A) DOES NOT FULLY CONFORM TO JEDEC REGISTRATION MO-220.
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
D) IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
A1	0.00	---	0.05
b	0.90	1.00	1.10
c	0.10	0.20	0.30
D	7.90	8.00	8.10
D1	7.10	7.20	7.30
E	7.90	8.00	8.10
E1	4.25	4.35	4.45
E2	0.15	0.25	0.35
e	2.00 BSC		
e1	6.00 BSC		
e2	3.10 BSC		
K	(2.75)		
L	0.40	0.50	0.60
aaa	0.10		
bbb	0.10		
ccc	0.05		
eee	0.05		
fff	0.10		
ggg	0.15		





*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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