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

650 V, 80 mΩ, 38 A

FCMT080N65S3

General 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 Easy−drive series helps manage EMI issues and allows for easier design implementation.

The Power88 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 Power88 package offers excellent switching performance due to lower parasitic source inductance and separated power and drive sources. Power88 offers Moisture Sensitivity Level 1 (MSL 1).

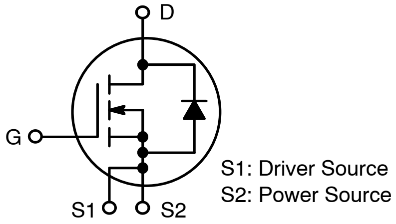
Features

- 700 V @ T_J = 150°C
- Typ $R_{DS(on)}$ = 70 mΩ
- Ultra Low Gate Charge (Typ. Q_g = 71 nC)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)}$ = 570 pF)
- 100% Avalanche Tested
- These Devices are Pb−Free and are RoHS Compliant

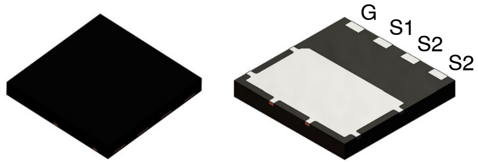
Applications

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

V_{DSS}	$R_{DS(ON)}$ MAX	I_D MAX
650 V	80 mΩ @ 10 V	38 A

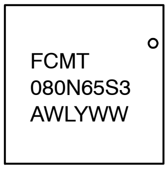


POWER MOSFET



TDFN4 8X8
CASE 520AB

MARKING DIAGRAM



FCMT080N65S3 = 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)	38	A
		Continuous (T_C = 100°C)	24	
I_{DM}	Drain Current	Pulsed (Note 1)	95	A
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		180	mJ
I_{AS}	Avalanche Current (Note 2)		4.6	A
E_{AR}	Repetitive Avalanche Energy (Note 1)		2.6	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)	260	W
		Derate Above 25°C	2.08	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} = 4.6 A, R_G = 25 Ω starting T_J = 25°C
3. $I_{SD} \le 19$ A, di/dt ≤ 200 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.	0.48	°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

Device	Marking	Package	Reel Size	Tape Width	Quantity†
FCMT080N65S3	FCMT080N65S3	TDFN4	13″	13.3 mm	3000 Units

†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 Conditions	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
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	I_D = 1 mA, Referenced to 25°C	–	0.63	–	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	–	3.0	–	
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 = 0.88 mA	2.5	–	4.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 19 A	–	70	80	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 19 A	–	21	–	S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 400 V, V_{GS} = 0 V, f = 1 MHz	–	2765	–	pF
C_{oss}	Output Capacitance		–	65	–	pF
$C_{oss(eff.)}$	Effective Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V	–	570	–	pF
$C_{oss(er.)}$	Energy Related Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V	–	94	–	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	V_{DS} = 400 V, I_D = 19 A, V_{GS} = 10 V (Note 5)	–	71	–	nC
Q_{gs}	Gate to Source Gate Charge		–	16	–	nC
Q_{gd}	Gate to Drain “Miller” Charge		–	29	–	nC
ESR	Equivalent Series Resistance	f = 1 MHz	–	0.55	–	Ω
SWITCHING CHARACTERISTICS						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 400 V, I_D = 19 A, V_{GS} = 10 V, R_g = 4.7 Ω (Note 5)	–	24	–	ns
t_r	Turn-On Rise Time		–	28	–	ns
$t_{d(off)}$	Turn-Off Delay Time		–	71	–	ns
t_f	Turn-Off Fall Time		–	5.4	–	ns
SOURCE-DRAIN DIODE CHARACTERISTICS						
I_S	Maximum Continuous Source to Drain Diode Forward Current		–	–	38	A
I_{SM}	Maximum Pulsed Source to Drain Diode Forward Current		–	–	95	A
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 19 A	–	–	1.2	V
t_{rr}	Reverse Recovery Time	V_{DD} = 400 V, I_{SD} = 19 A, dI_F/dt = 100 A/μs	–	405	–	ns
Q_{rr}	Reverse Recovery Charge		–	7.7	–	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 CHARACTERISTICS

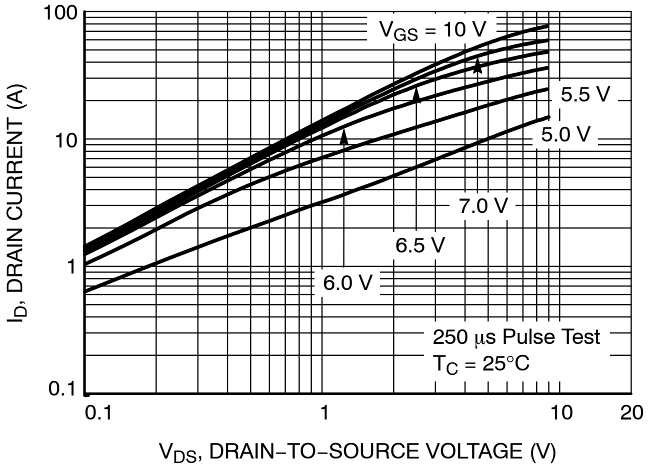


Figure 1. On−Region Characteristics

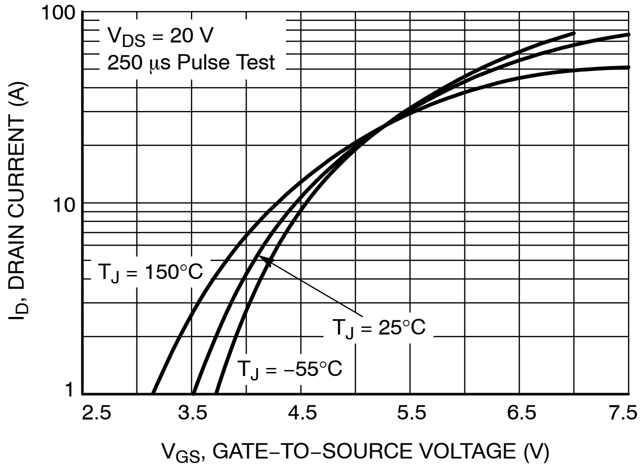


Figure 2. Transfer Characteristics

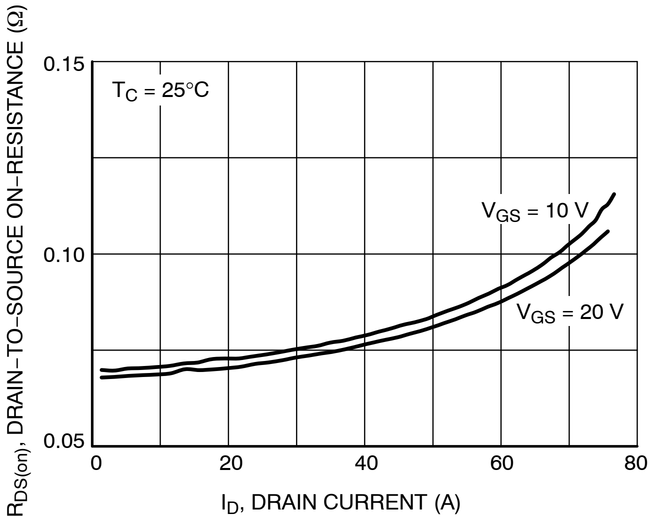


Figure 3. On−Resistance Variation vs. Drain Current and Gate Voltage

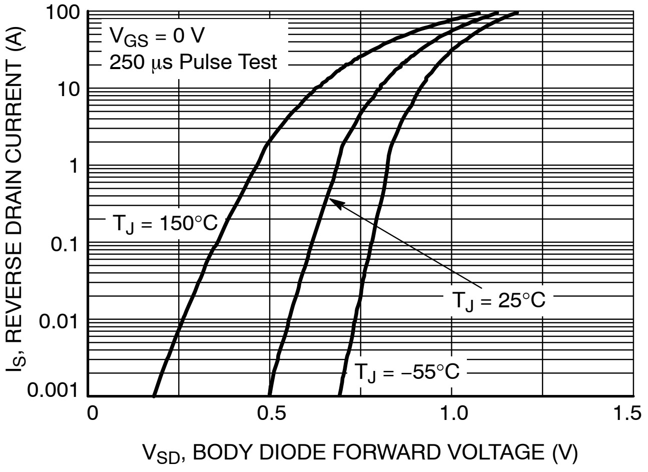


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

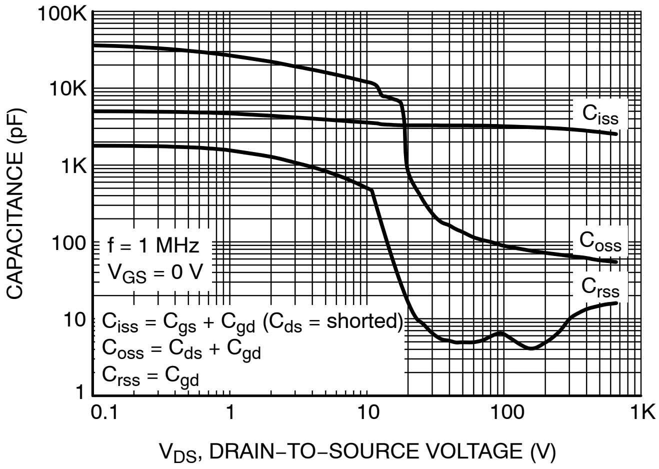


Figure 5. Capacitance Characteristics

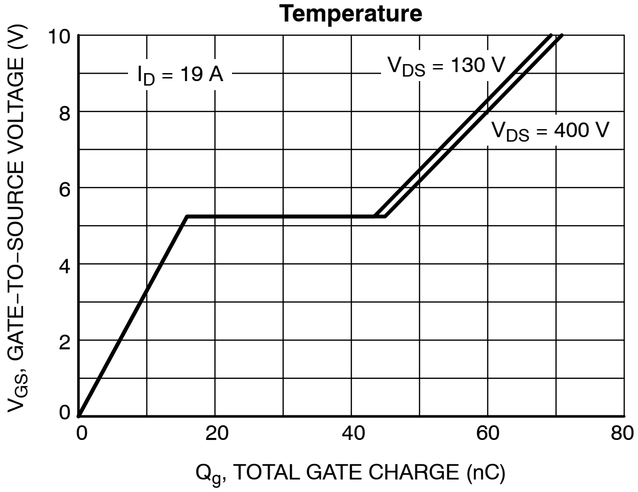


Figure 6. Gate Charge Characteristics

TYPICAL CHARACTERISTICS

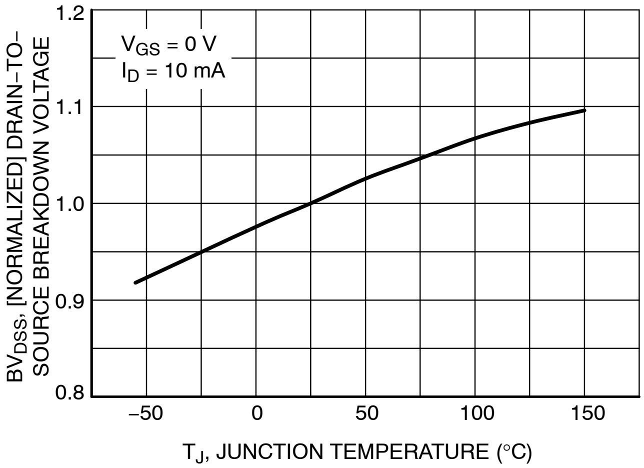


Figure 7. Breakdown Voltage Variation vs. Temperature

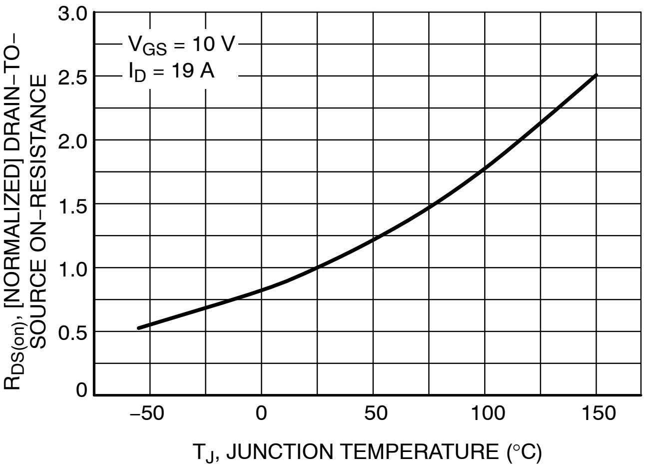


Figure 8. On−Resistance Variation vs. Temperature

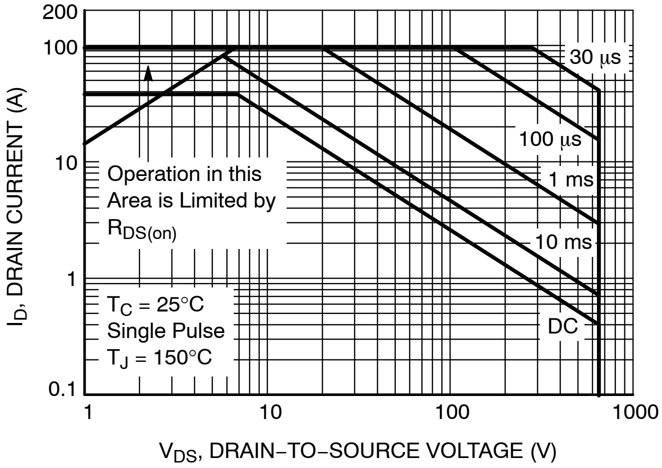


Figure 9. Maximum Safe Operating Area

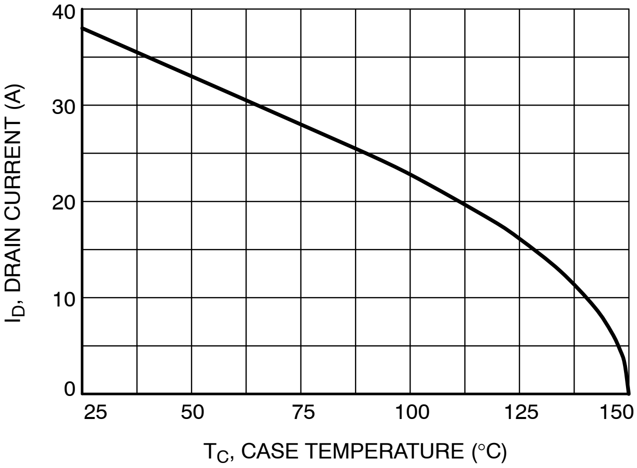


Figure 10. Maximum Drain Current vs. Case Temperature

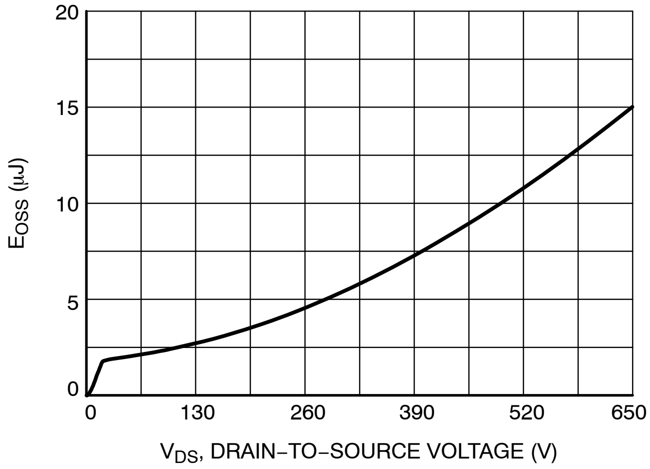


Figure 11. E_{OSS} vs. Drain−to−Source Voltage

TYPICAL CHARACTERISTICS

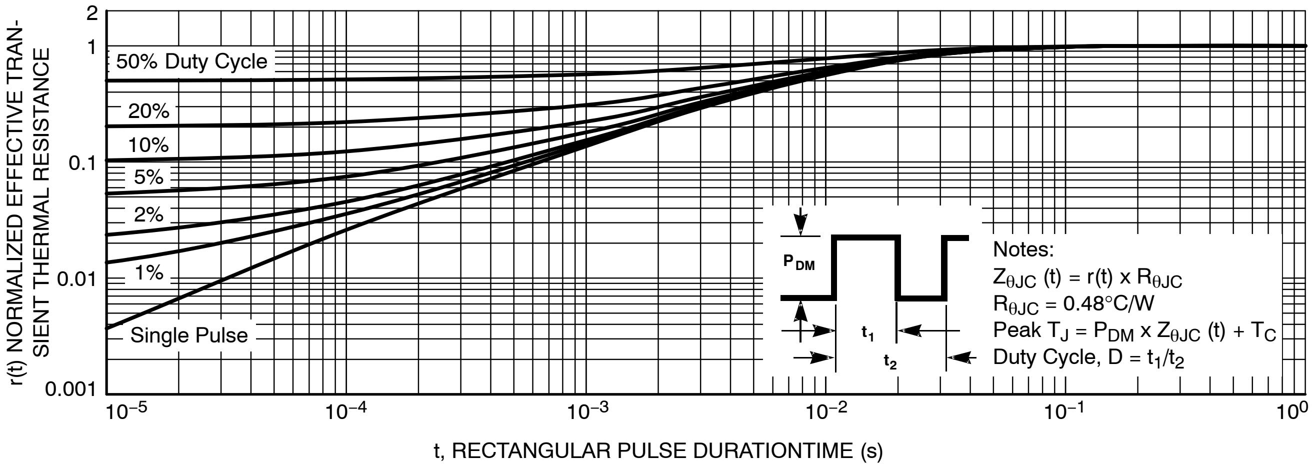


Figure 12. Transient Thermal Response Curve

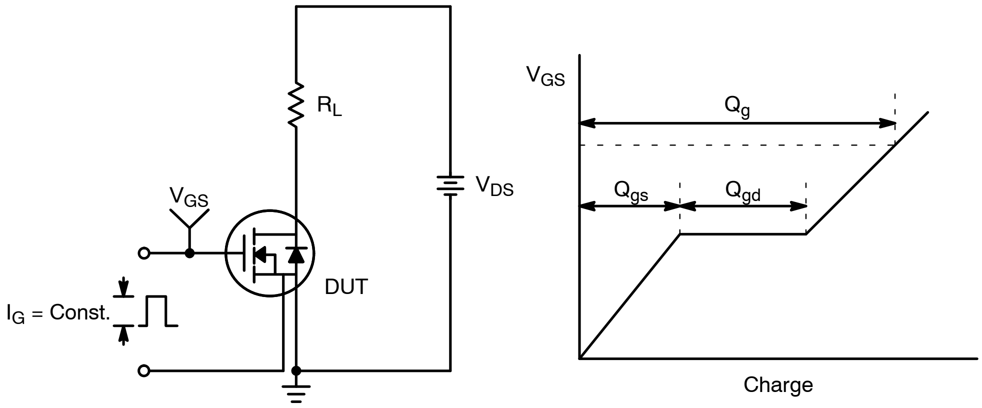


Figure 13. Gate Charge Test Circuit & Waveform

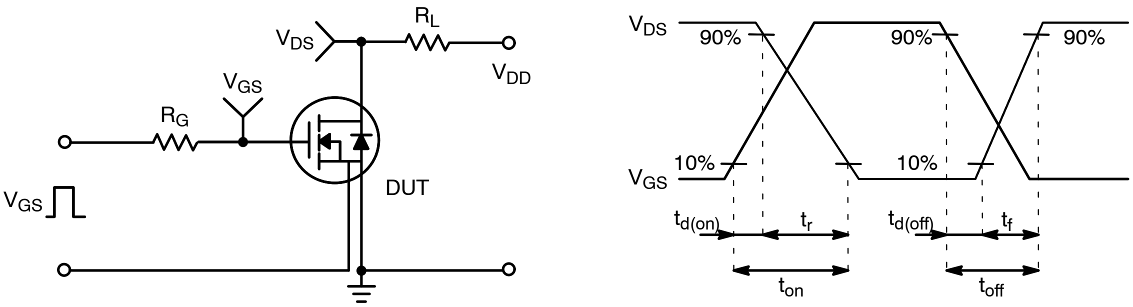


Figure 14. Resistive Switching Test Circuit & Waveforms

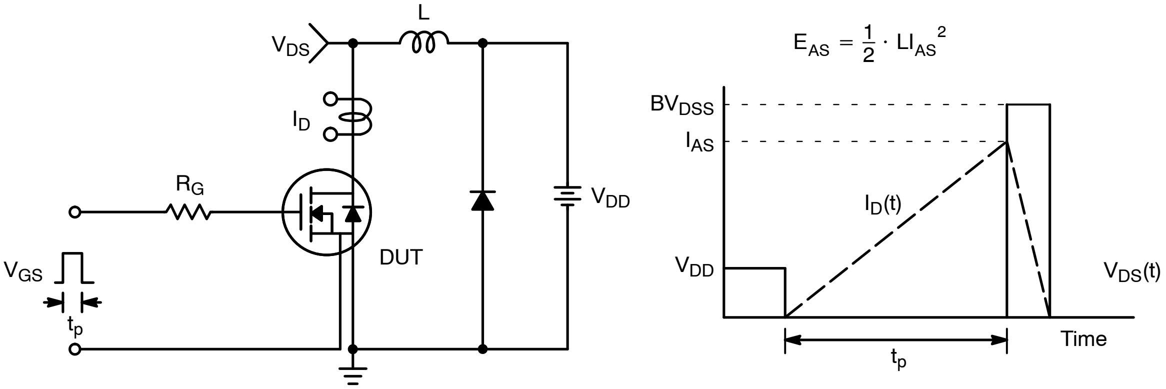


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

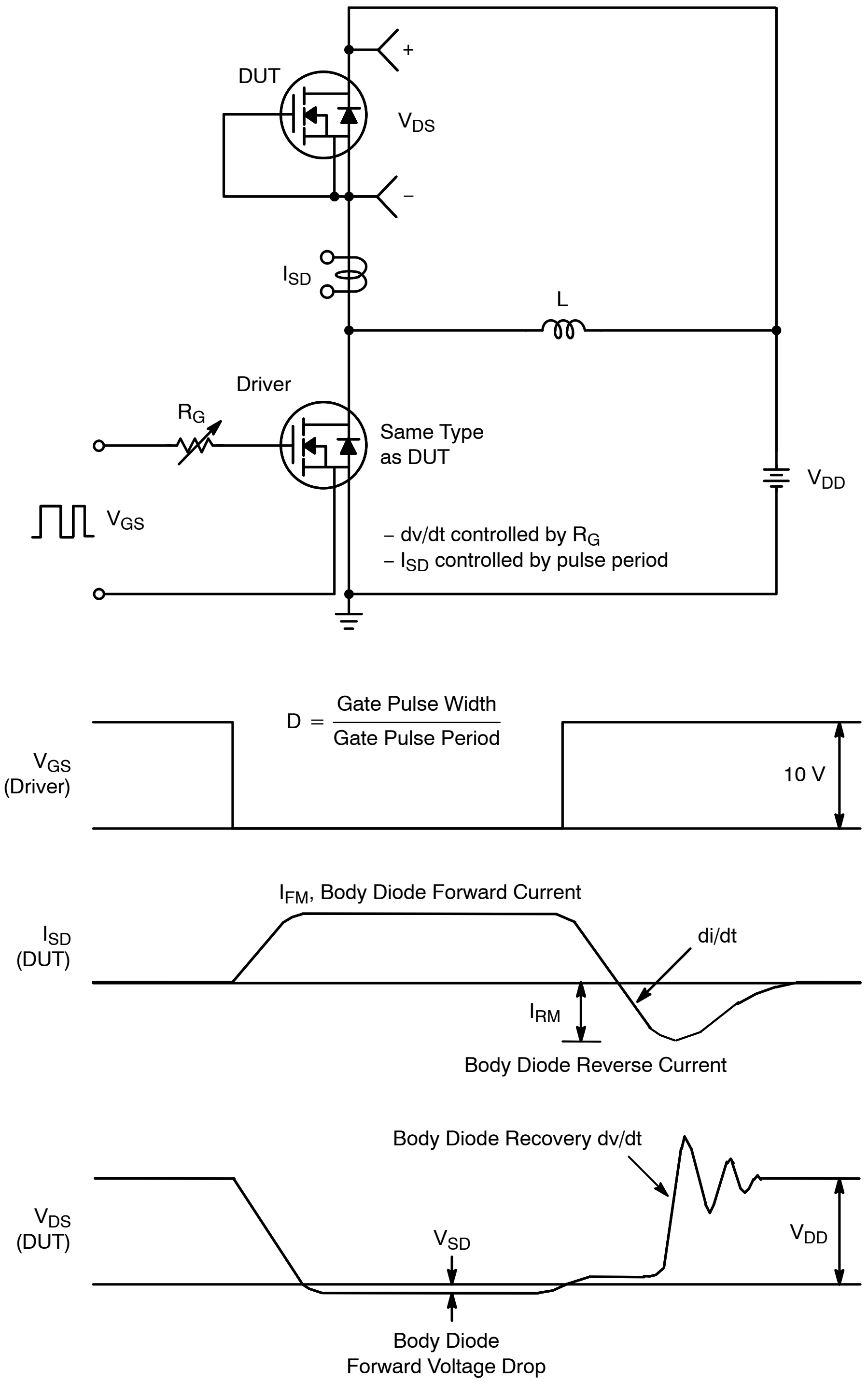
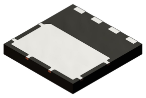


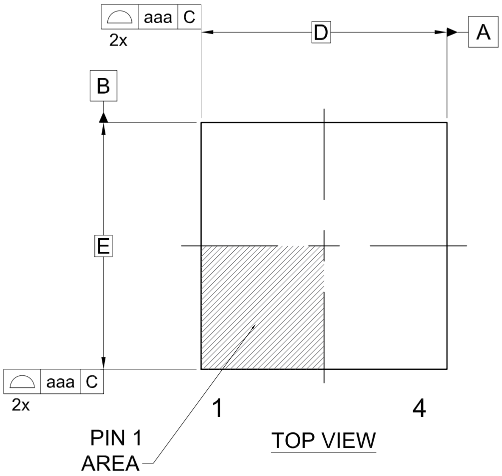
Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS



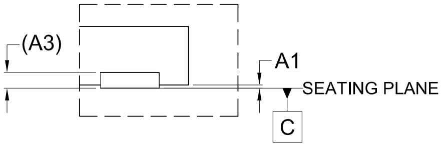
TDFN4 8.00x8.00x1.00, 2.00P
CASE 520AB
ISSUE A

DATE 07 JUN 2024



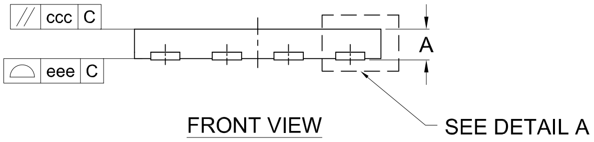
TOP VIEW

NOTES:
A) DIMENSIONS AND TOLERANCING CONFIRM TO ASME Y14.5-2018.
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.

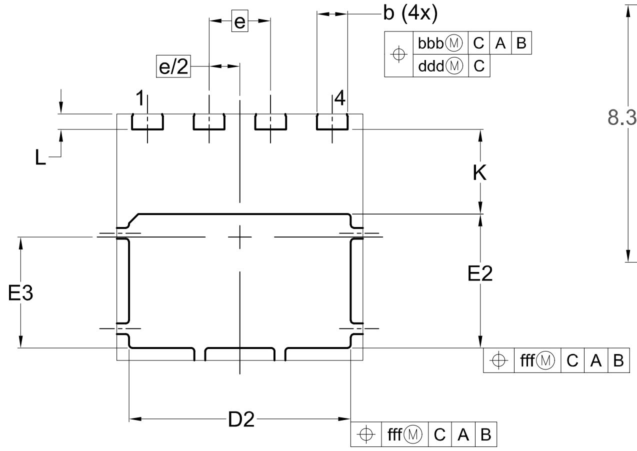


DETAIL A
SCALE: 1:2

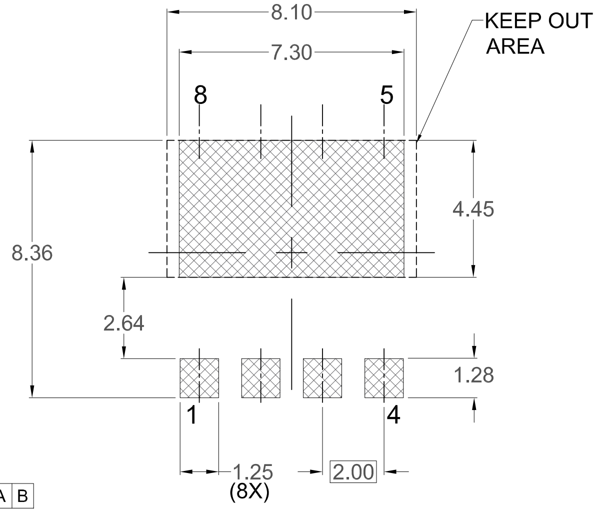
DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
A1	0.00	---	0.05
A3	0.20 REF		
b	0.90	1.00	1.10
D	8.00 BSC		
D2	7.10	7.20	7.30
E	8.00 BSC		
E2	4.25	4.35	4.45
E3	3.50	3.60	3.70
e	2.00 BSC		
e/2	1.00 BSC		
K	2.65	--	--
L	0.40	0.50	0.60
aaa	0.10		
bbb	0.10		
ccc	0.05		
ddd	0.05		
eee	0.10		
fff	0.10		



FRONT VIEW



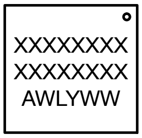
BOTTOM VIEW



RECOMMENDED LAND PATTERN

*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ONSEMI SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

GENERIC MARKING DIAGRAM*



XXXX = Specific Device Code
A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
▪ = Pb−Free Package

*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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