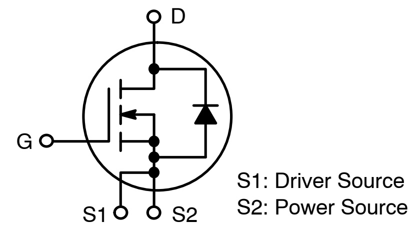
MOSFET - Power, N-Channel, SUPERFET® III, Easy-drive

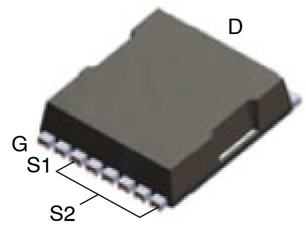
650 V, 70 mΩ, 44 A

NTBL070N65S3

BV_{DSS}	$R_{DS(on)}$ MAX	I_D MAX
650 V	70 mΩ @ 10 V	44 A

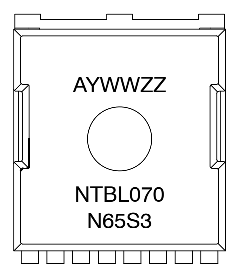


POWER MOSFET



H−PSOF8L
CASE 100DC

MARKING DIAGRAM



A	= Assembly Location
Y	= Year
WW	= Work Week
ZZ	= Assembly Lot Code
NTBL070N65S3	= Specific Device Code

ORDERING INFORMATION

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

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 with− stand extreme dv/dt rate. Consequently, SUPERFET III MOSFET Easy−drive series helps manage EMI issues and allows for easier design implementation.

The TOLL package offers improved thermal performance and excellent switching performance thanks to Kelvin Source configuration and lower parasitic source inductance. TOLL offers Moisture Sensitivity Level 1 (MSL 1).

Features

- 700 V @ T_J = 150°C
- Typ. R_{DS}(on) = 57 mΩ
- Ultra Low Gate Charge (Typ. Q_G = 82 nC)
- Low Effective Output Capacitance (Typ. C_{OSS}(eff.) = 724 pF)
- 100% Avalanche Tested
- Kelvin Source Configuration and Low Parasitic Source Inductance
- MSL1 Qualified
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

Typical Applications

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

April, 2022 − Rev. 2

Publication Order Number:
NTBL070N65S3/D

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)	44	A
		Continuous (T_C = 100°C)	28	A
I_{DM}	Pulsed Drain Current	Pulsed (Note 1)	110	A
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		214	mJ
E_{AR}	Repetitive Avalanche (Note 1)		3.12	mJ
dv/dt	MOSFET dv/dt		100	V/ns
	Peak Diode Recovery dv/dt (Note 3)		20	V/ns
P_D	Power Dissipation	(T_C = 25°C)	312	W
		Derate Above 25°C	2.5	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} = 4.8 A, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} < 22 A, di/dt ≤ 200 A/μs, VDD ≤ BVDSS, starting T_J = 25°C.

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction−to−Case, Steady State	0.37	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction−to−Ambient, Steady State (Note 4)	43	

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

PACKAGE MARKING AND ORDERING INFORMATION

Device	Device Marking	Package	Reel Size	Tape Width	Quantity
NTBL070N65S3	NTBL070N65S3	H−PSOF8L	13 mm	24 mm	2000 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
ΔBVDSS / ΔTJ	Breakdown Voltage Temperature Coefficient	I_D = 1 mA, Referenced to 25°C	–	0.72	–	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 650 V, V_{GS} = 0 V	–	–	1	μA
		V_{DS} = 520 V, V_{GS} = 0 V, Tc = 125°C	–	3.4	–	
I_{GSS}	Gate to Body Leakage Current	V_{GS} = ±30 V, V_{DS} = 0 V	–	–	±100	nA
ON CHARACTERISTICS						
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 1.0 mA	2.5	–	4.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 22 A, T_J = 25°C	–	57	70	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 22 A	–	26	–	S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 400 V, V_{GS} = 0 V, f = 1 MHz	–	3300	–	pF
C_{oss}	Output Capacitance		–	72.8	–	pF
C_{rss}	Reverse Transfer Capacitance		–	14.6	–	pF
$C_{oss(eff.)}$	Effective Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V	–	724	–	pF
$C_{oss(er.)}$	Energy Related Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V	–	104	–	pF
$Q_{g(tot)}$	Total Gate Charge	V_{DS} = 400 V, V_{GS} = 10 V, I_D = 22 A (Note 5)	–	82.0	–	nC
Q_{gs}	Gate to Source Gate Charge		–	21	–	nC
Q_{gd}	Gate to Drain “Miller” Charge		–	34.0	–	nC
R_G	Gate Resistance	f = 1 MHz	–	0.685	–	mΩ
SWITCHING CHARACTERISTICS						
$t_{d(on)}$	Turn−On Delay Time	V_{DD} = 400 V, I_D = 22 A, V_{GS} = 10 V, R_G = 4.7 Ω (Note 5)	–	27	–	ns
t_r	Turn−On Rise Time		–	24	–	ns
$t_{d(off)}$	Turn−Off Delay Time		–	74	–	ns
t_f	Fall Time		–	13	–	ns
DRAIN−SOURCE DIODE CHARACTERISTICS						
I_S	Maximum Continuous Drain to Source Diode Forward Current		–	–	44	A
I_{SM}	Maximum Plused Drain to Source Diode Forward Current		–	–	110	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 22 A	–	–	1.2	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 22 A dI_F/dt = 100 A/μs	–	449	–	nS
Q_{rr}	Reverse Recovery Charge		–	9.5	–	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 (T_C = 25°C unless otherwise noted)

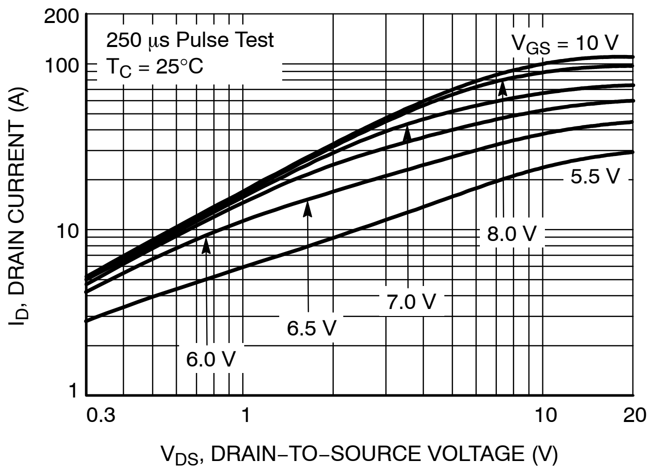


Figure 1. On−Region Characteristics

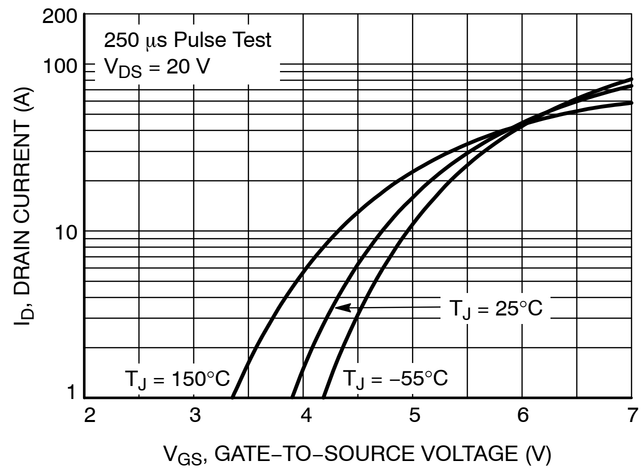


Figure 2. Transfer Characteristics

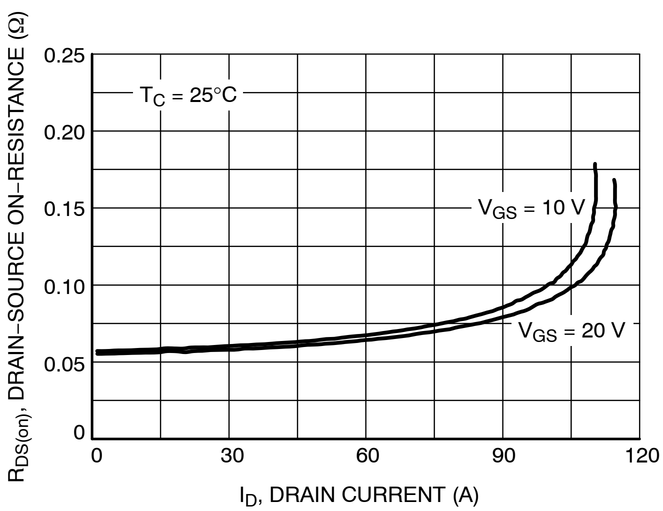


Figure 3. On−Resistance Variation vs. Drain Current and Gate Voltage

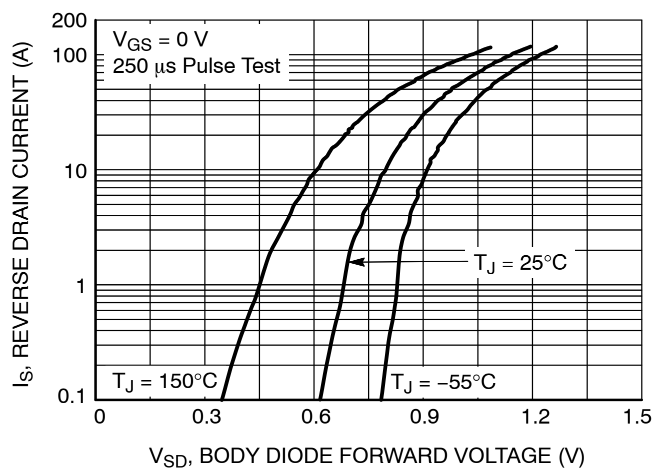


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

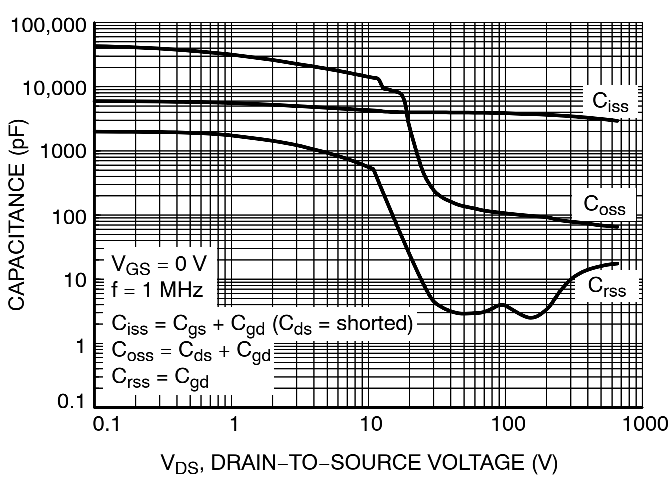


Figure 5. Capacitance Characteristics

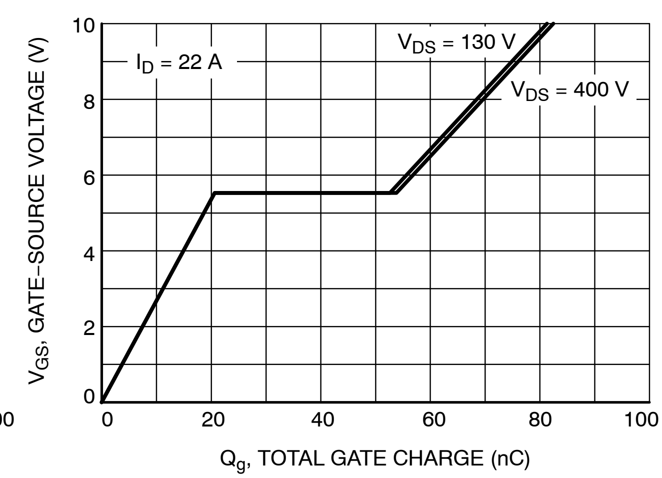


Figure 6. Gate Charge Characteristics

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

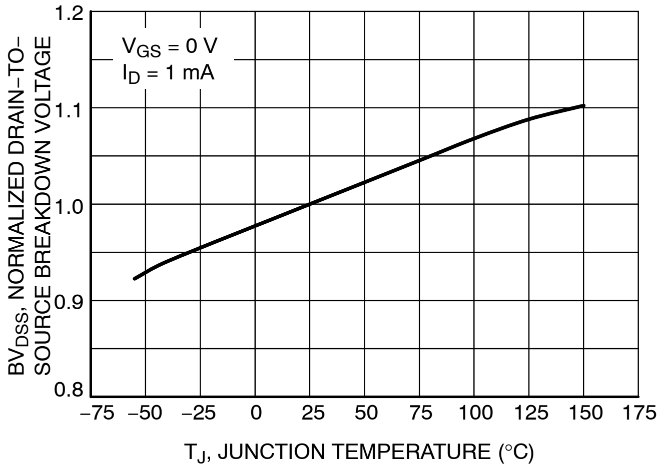


Figure 7. Breakdown Voltage Variation vs. Temperature

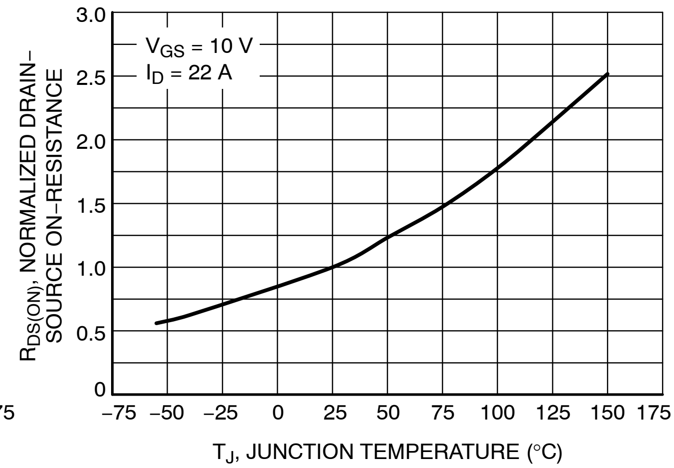


Figure 8. On−Resistance Variation vs. Temperature

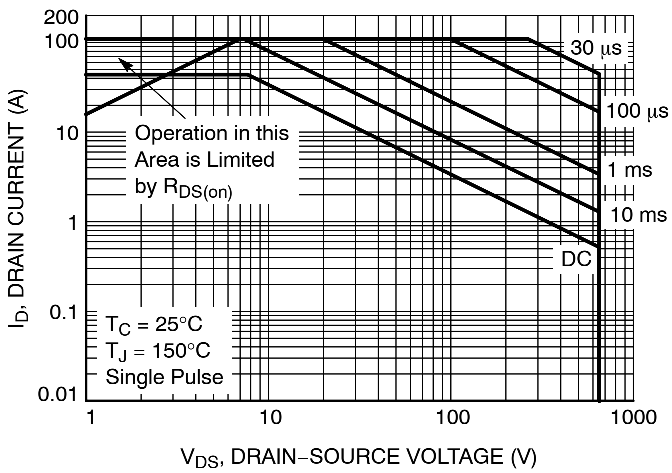


Figure 9. Maximum Safe Operating Area

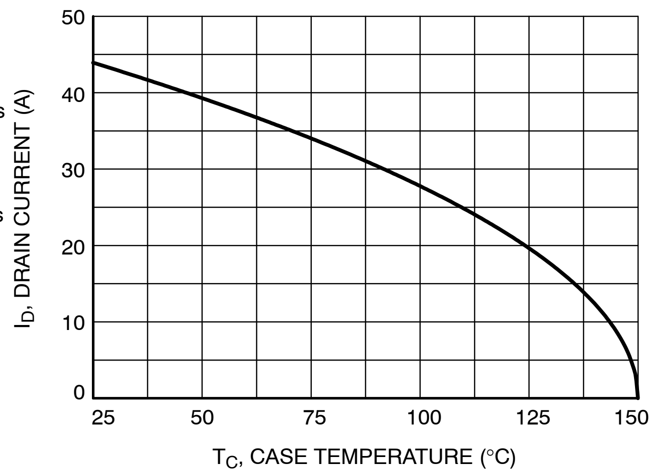


Figure 10. Maximum Drain Current vs. Case Temperature

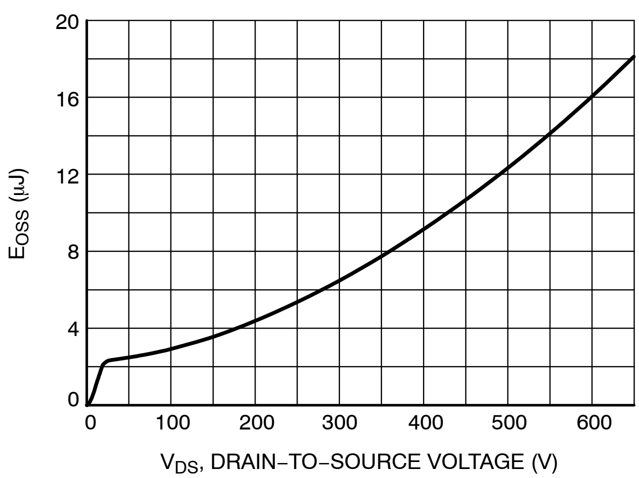


Figure 11. E_{OSS} vs. Drain to Source Voltage

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

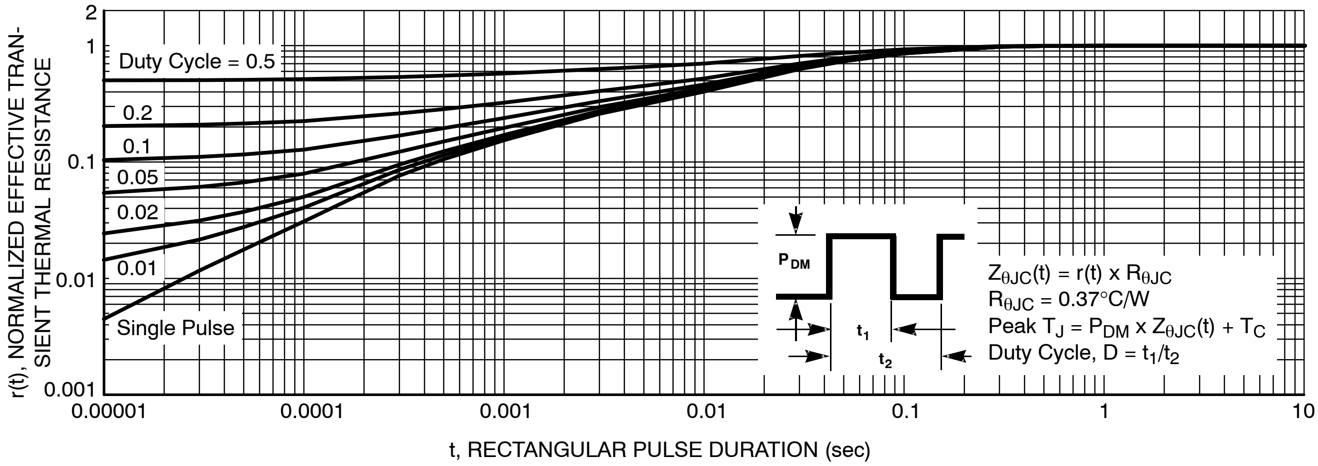


Figure 12. Transient Thermal Impedance

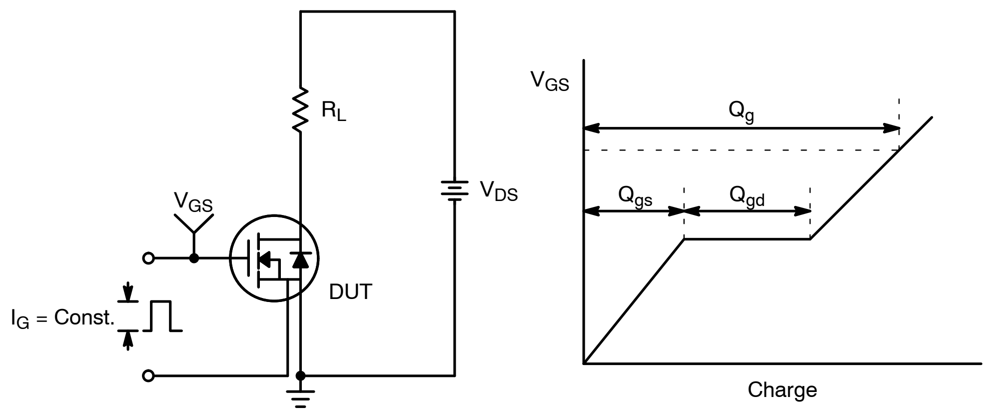


Figure 13. Gate Charge Test Circuit & Waveform

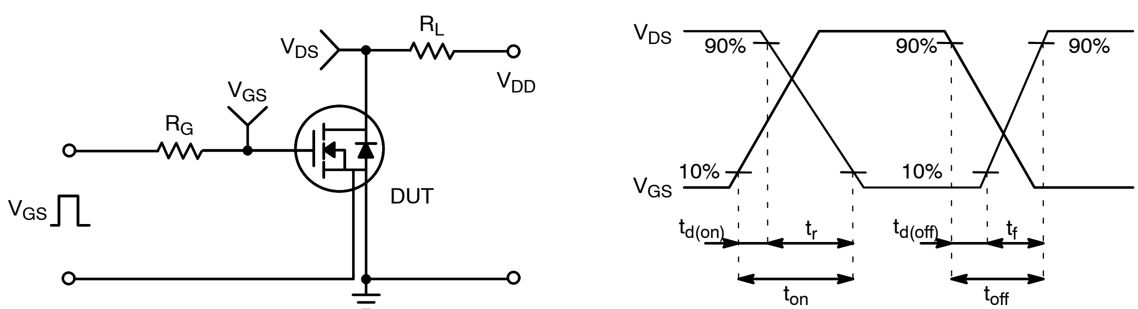


Figure 14. Resistive Switching Test Circuit & Waveforms

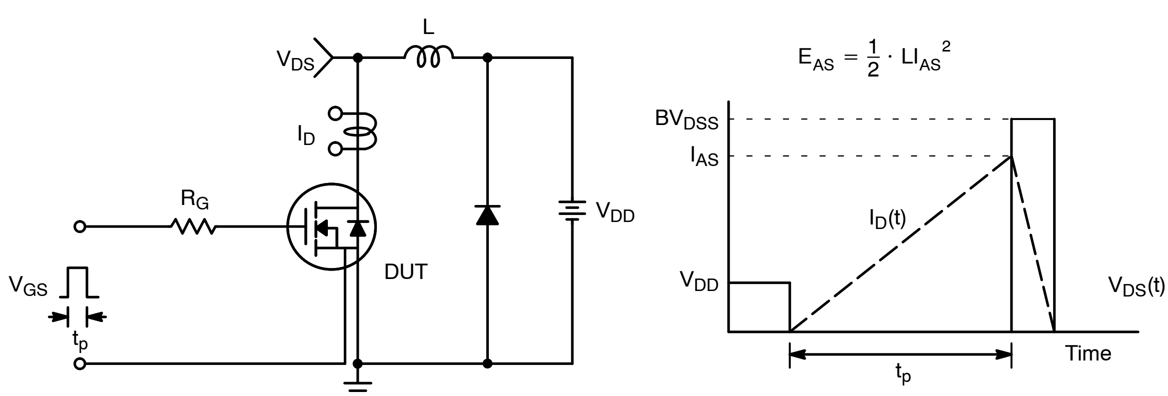


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

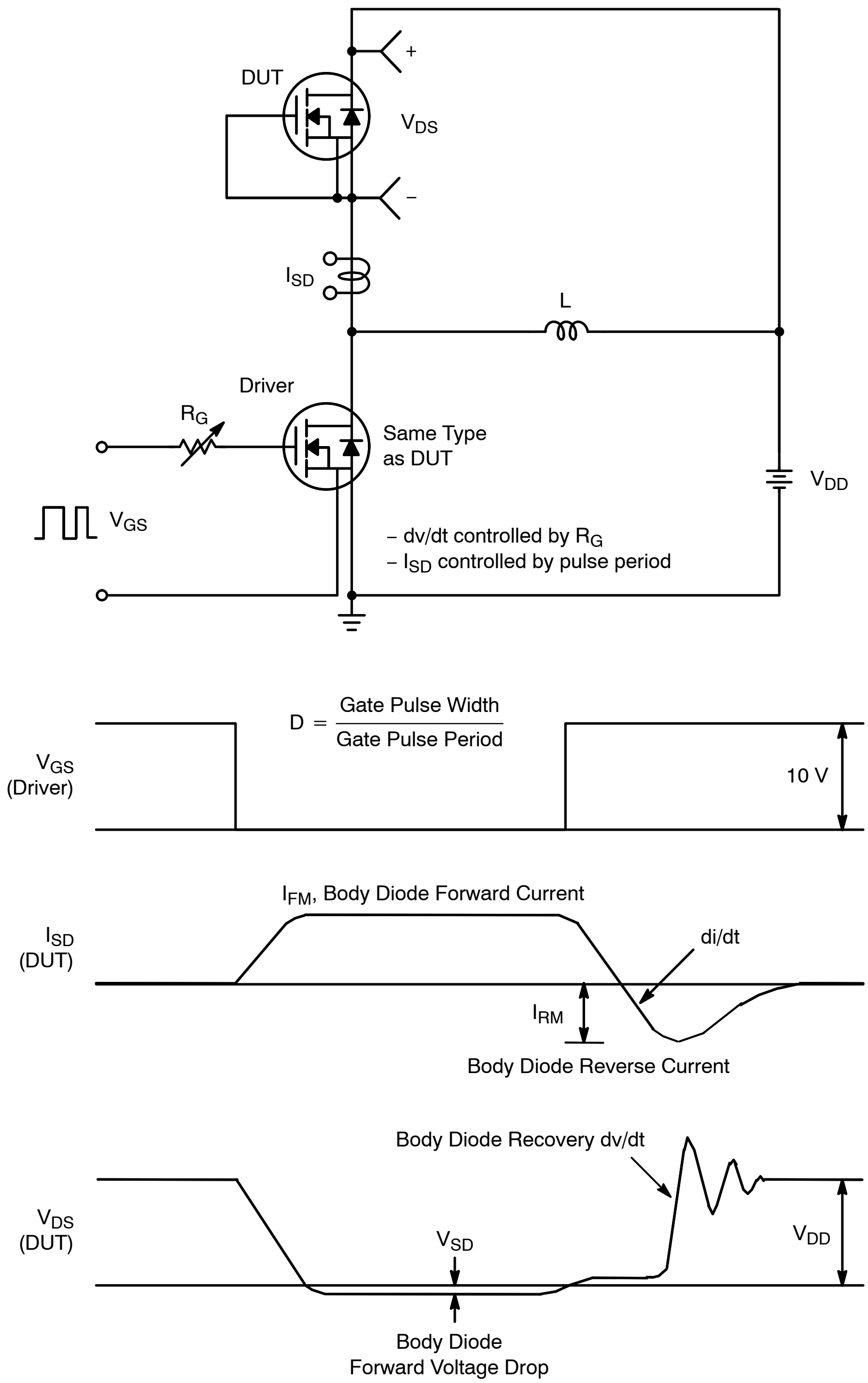
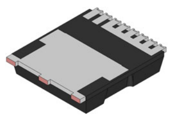


Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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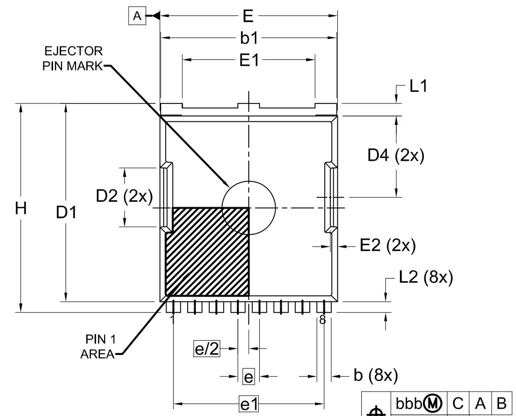
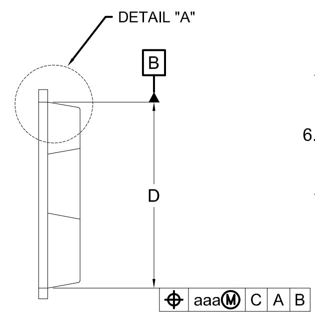
ISSUE A

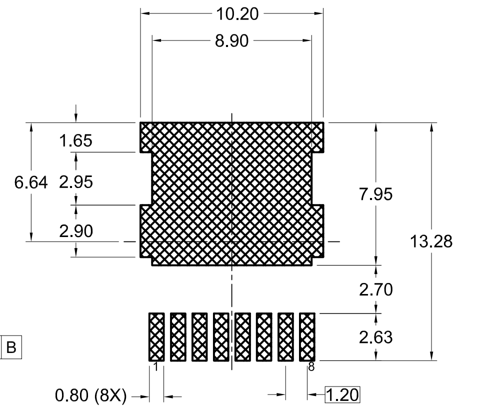
DATE 18 MAY 2023



TOP VIEW

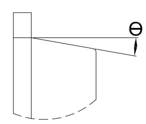


SIDE VIEW

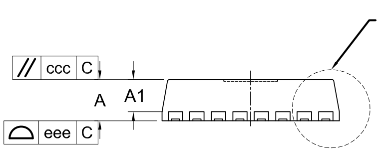


LAND PATTERN RECOMMENDATION

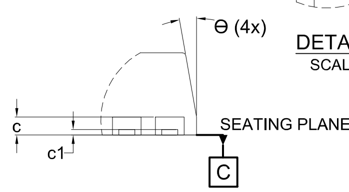
*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.



DETAIL "A"
SCALE: 2X

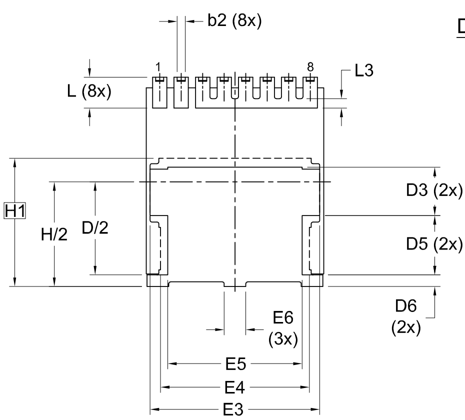


FRONT VIEW



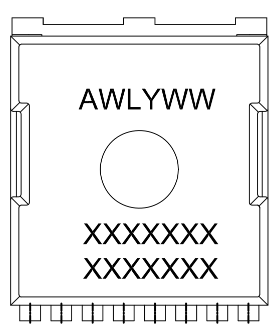
DETAIL "B"
SCALE: 2X

NOTES:
1. PACKAGE STANDARD REFERENCE: JEDEC MO-299, ISSUE A.
2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
3. CONTROLLING DIMENSION: MILLIMETERS.
4. COPLANARITY APPLIES TO THE EXPOSED WELL AS THE TERMINALS.
5. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
6. SEATING PLANE IS DEFINED BY THE TERMINALS. "A1" IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.



BOTTOM VIEW

GENERIC MARKING DIAGRAM*



A = ASSY LOCATION
WL = WAFER LOT CODE
Y = YEAR CODE
WW = WORK WEEK CODE
XXXXXXX = DEVICE CODE
XXXXXXX = DEVICE CODE

*THIS INFORMATION IS GENERIC. PLEASE REFER TO DEVICE DATA SHEET FOR ACTUAL PART MARKING.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	2.20	2.30	2.40
A1	1.70	1.80	1.90
b	0.70	0.80	0.90
b1	9.70	9.80	9.90
b2	0.35	0.45	0.55
c	0.40	0.50	0.60
c1	0.10	---	---
D	10.28	10.38	10.48
D/2	5.09	5.19	5.29
D1	10.98	11.08	11.18
D2	3.20	3.30	3.40
D3	2.60	2.70	2.80
D4	4.45	4.55	4.65
D5	3.20	3.30	3.40
D6	0.55	0.65	0.75
E	9.80	9.90	10.00
E1	7.30	7.40	7.50
E2	0.30	0.40	0.50
E3	9.36	9.46	9.56

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
E4	8.20	8.30	8.40
E5	7.40	7.50	7.60
E6	1.10	1.20	1.30
e	1.20 BSC		
e/2	0.60 BSC		
e1	8.40 BSC		
H	11.58	11.68	11.78
H/2	5.74	5.84	5.94
H1	7.15 BSC		
L	1.63	1.73	1.83
L1	0.60	0.70	0.80
L2	0.50	0.60	0.70
L3	0.70	0.80	0.90
Θ	0°	---	12°
aaa	0.20		
bbb	0.25		
ccc	0.20		
ddd	0.20		
eee	0.10		

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ADDITIONAL INFORMATION

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