MOSFET – Power, N-Channel, SUPERFET® III

800 V, 360 mΩ, 13 A

NTD360N80S3Z

ON Semiconductor®

www.onsemi.com

$V_{(BR)DSS}$	$R_{DS(ON)}$ MAX	I_D MAX
800 V	360 mΩ	13 A

Description

800 V SUPERFET III MOSFET is ON Semiconductor's high performance MOSFET family offering 800 V breakdown voltage.

New 800 V SUPERFET III MOSFET which is optimized for primary switch of flyback converter, enables lower switching losses and case temperature without sacrificing EMI performance thanks to its optimized design. In addition, internal Zener Diode significantly improves ESD capability.

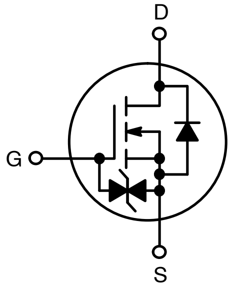
This new family of 800 V SUPERFET III MOSFET enables to make more efficient, compact, cooler and more robust applications because of its remarkable performance in switching power applications such as Laptop adapter, Audio, Lighting, ATX power and industrial power supplies.

Features

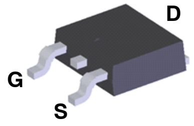
- Typ. $R_{DS(on)}$ = 300 mΩ
- Ultra Low Gate Charge (Typ. Q_g = 25.3 nC)
- Low Stored Energy in Output Capacitance (Eoss = 2.72 μJ @ 400 V)
- 100% Avalanche Tested
- ESD Improved Capability with Zener Diode
- RoHS Compliant

Applications

- Adapters / Chargers
- LED Lighting
- AUX Power
- Audio
- Industrial Power

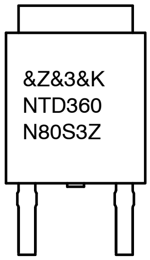


POWER MOSFET



D–PAK
TO–252
CASE 369AS

MARKING DIAGRAM



&Z = Assembly Plant Code
&3 = Data Code (Year & Week)
&K = Lot
NTD360N80S3Z = Specific Device Code

ORDERING INFORMATION

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

April, 2020 − Rev. 0

ABSOLUTE MAXIMUM RATINGS (T_J = 25°C, unless otherwise noted)

Symbol	Parameter		Value	Unit
V_{DSS}	Drain–to–Source Voltage		800	V
V_{GS}	Gate–to–Source Voltage	DC	±20	V
		AC (f > 1 Hz)	±30	
I_D	Drain Current	Continuous (T_C = 25°C)	13	A
		Continuous (T_C = 100°C)	8.2	
I_{DM}	Drain Current	Pulsed (Note 1)	32.5	A
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		40	mJ
I_{AS}	Avalanche Current (Note 2)		2.0	A
E_{AR}	Repetitive Avalanche Energy (Note 1)		0.96	mJ
dv/dt	MOSFET dv/dt		100	V/ns
	Peak Diode Recovery dv/dt (Note 3)		10	
P_D	Power Dissipation	(T_C = 25°C)	96	W
		Derate Above 25°C	0.768	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		–55 to +150	°C
T_L	Lead Temperature Soldering Reflow for Soldering Purposes (1/8″ from Case for 10 seconds)		260	°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} = 2.0 A, R_G = 25 Ω, starting T_J = 25°C.
3. $I_{SD} \leq 3.25$ A, di/dt ≤ 200 A/μs, $V_{DD} \leq 400$ V, starting T_J = 25°C.

THERMAL RESISTANCE RATINGS

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Junction–to–Case – Steady State	1.3	°C/W
$R_{\theta JA}$	Junction–to–Ambient – Steady State	62.5	

PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Marking	Package	Reel Size	Tape Width	Quantity
NTD360N80S3Z	NTD360N80S3Z	TO–252	330 mm	16 mm	2500 Units

ELECTRICAL CHARACTERISTICS (T_J = 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	800			V
		V_{GS} = 0 V, I_D = 1 mA, T_J = 150°C	900			V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	I_D = 1 mA, Referenced to 25°C		1.1		V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 800 V, V_{GS} = 0 V			1	μA
		V_{DS} = 640 V, T_C = 125°C		0.8		
I_{GSS}	Gate−to−Body Leakage Current	V_{GS} = ±20 V, V_{DS} = 0 V			1	μA
ON CHARACTERISTICS						
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 0.3 mA	2.2		3.8	V
$R_{DS(on)}$	Static Drain−to−Source On Resistance	V_{GS} = 10 V, I_D = 6.5 A		300	360	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 6.5 A		13.8		S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 400 V, V_{GS} = 0 V, f = 250 kHz		1143		pF
C_{oss}	Output Capacitance			18.1		pF
$C_{oss(eff.)}$	Effective Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V		236.4		pF
$C_{oss(er.)}$	Energy Related Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V		34		pF
$Q_{g(tot)}$	Total Gate Charge at 10 V	V_{DS} = 400 V, I_D = 6.5 A, V_{GS} = 10 V (Note 4)		25.3		nC
Q_{gs}	Gate−to−Source Gate Charge			5.3		nC
Q_{gd}	Gate−to−Drain “Miller” Charge			8.3		nC
ESR	Equivalent Series Resistance	f = 1 MHz		4		Ω
SWITCHING CHARACTERISTICS						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 400 V, I_D = 6.5 A, V_{GS} = 10 V, R_g = 25 Ω (Note 4)		21.2		ns
t_r	Turn-On Rise Time			18.5		ns
$t_{d(off)}$	Turn-Off Delay Time			110		ns
t_f	Turn-Off Fall Time			17.7		ns
SOURCE-DRAIN DIODE CHARACTERISTICS						
I_S	Maximum Continuous Source−to−Drain Diode Forward Current				13	A
I_{SM}	Maximum Pulsed Source−to−Drain Diode Forward Current				32.5	A
V_{SD}	Source−to−Drain Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 6.5 A			1.2	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 3.25 A, dI_F/dt = 100 A/μs		370		ns
Q_{rr}	Reverse Recovery Charge			3.2		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.

4. Essentially independent of operating temperature typical characteristics.

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TYPICAL CHARACTERISTICS

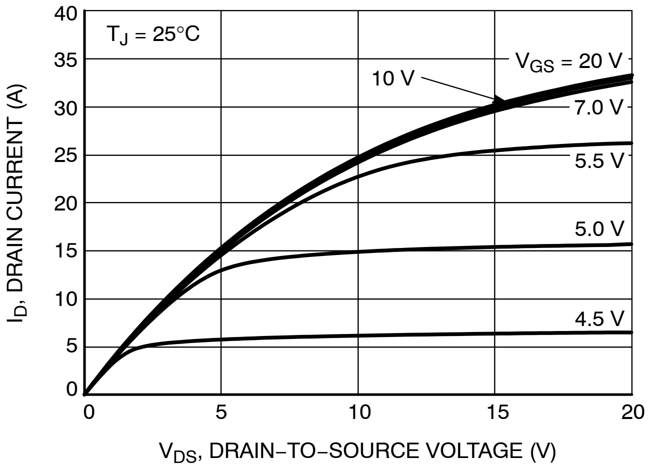


Figure 1. On−Region Characteristics

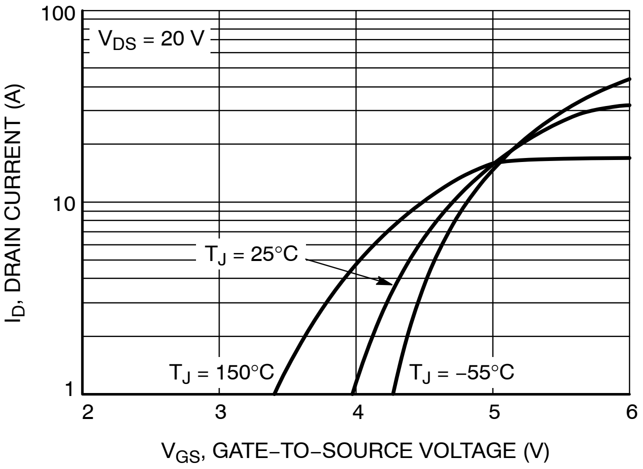


Figure 2. Transfer Characteristics

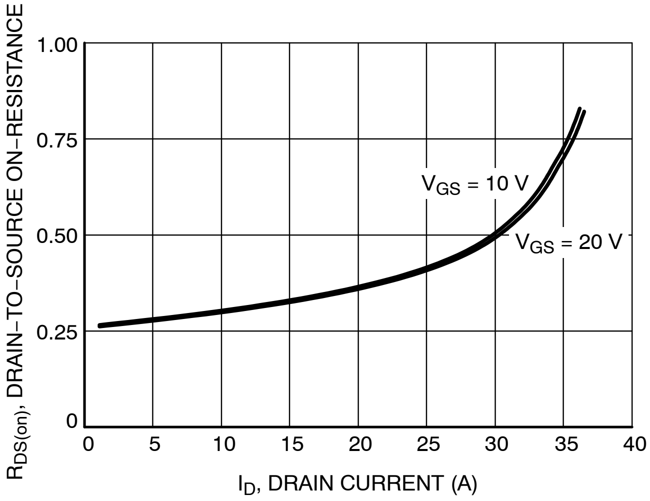


Figure 3. On Resistance vs. Drain Current

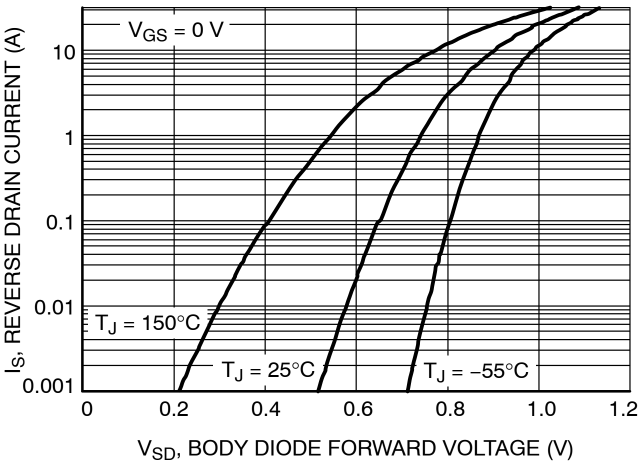


Figure 4. Diode Forward Voltage vs. Current

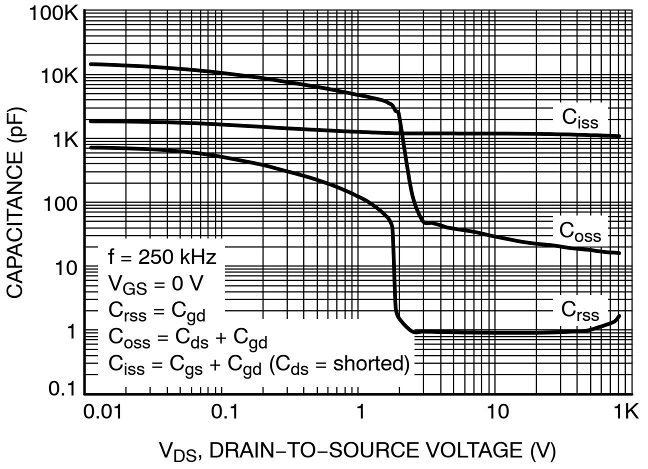


Figure 5. Capacitance Characteristics

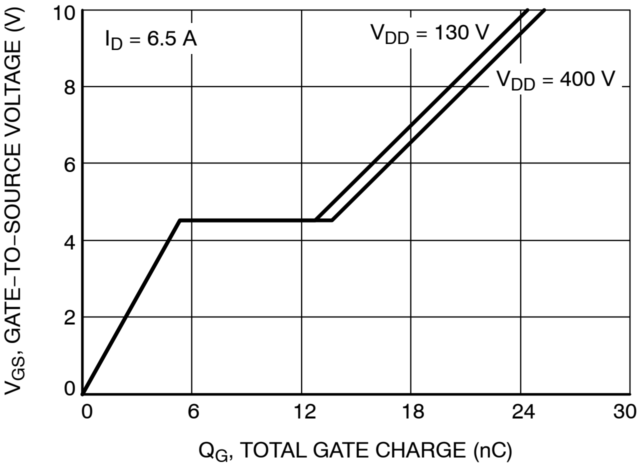


Figure 6. Gate Charge Characteristics

TYPICAL CHARACTERISTICS

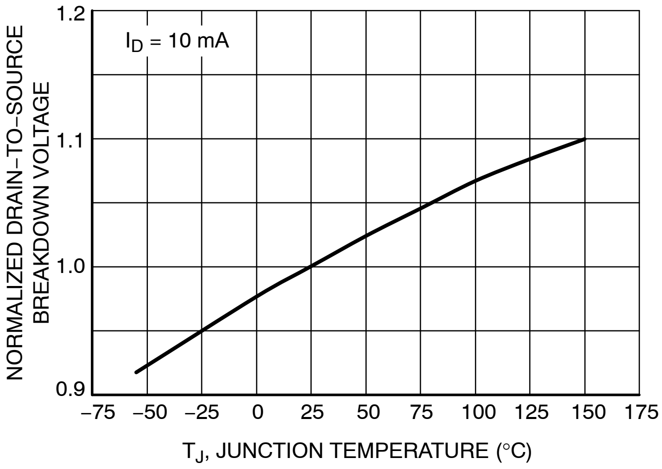


Figure 7. Normalized BV_{DSS} vs. Temperature

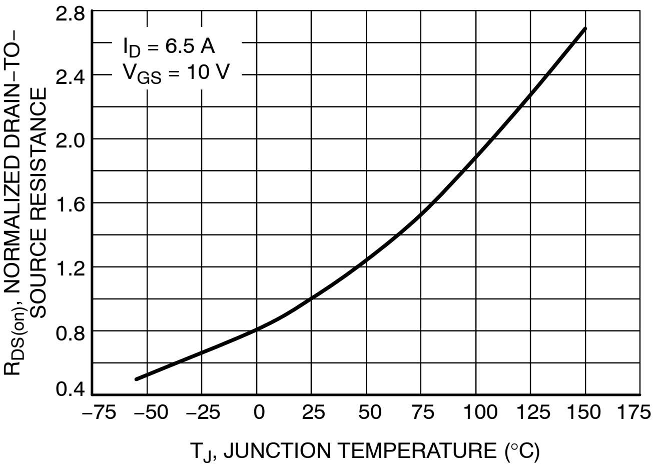


Figure 8. On−Resistance Variation vs. Temperature

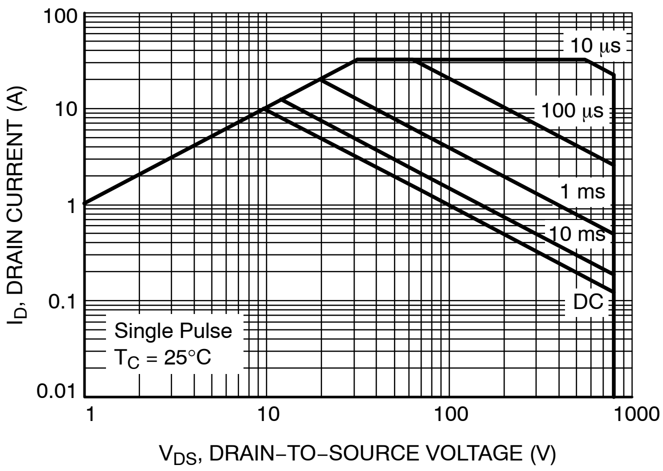


Figure 9. Safe Operating Area

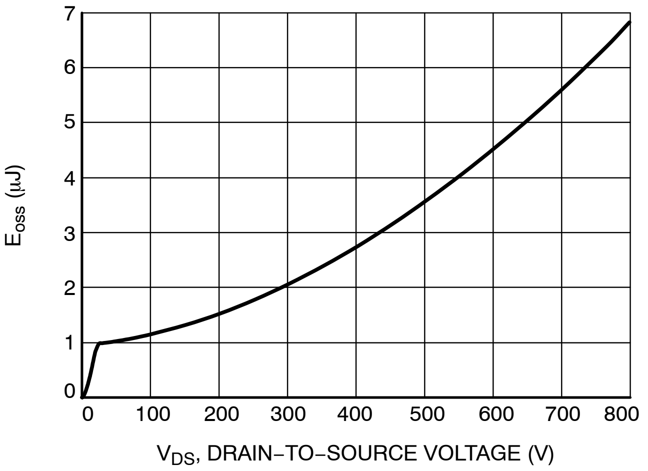


Figure 10. E_{oss} vs. Drain−to−Source Voltage

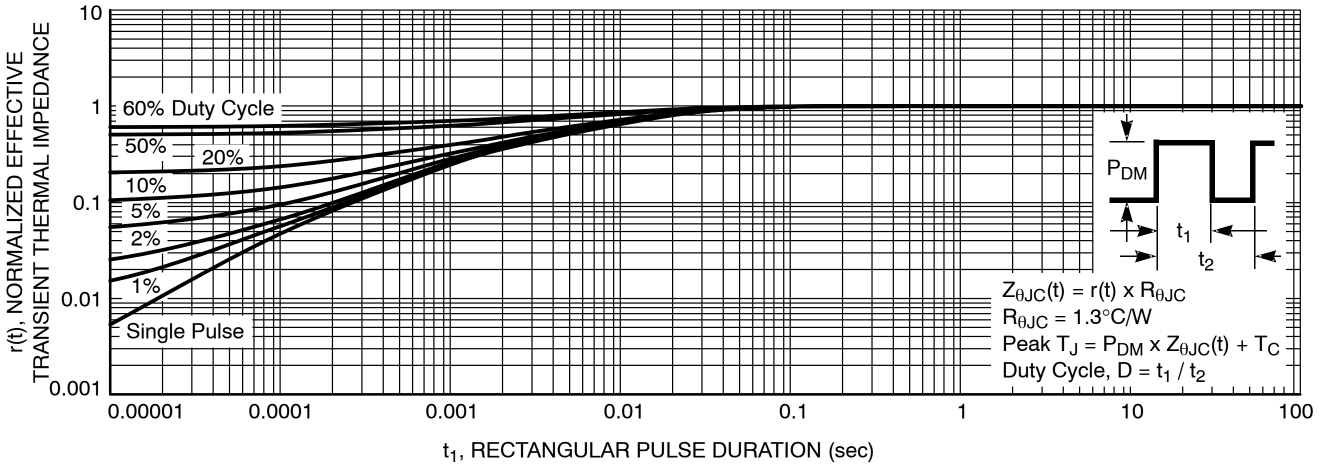


Figure 11. Transient Thermal Impedance

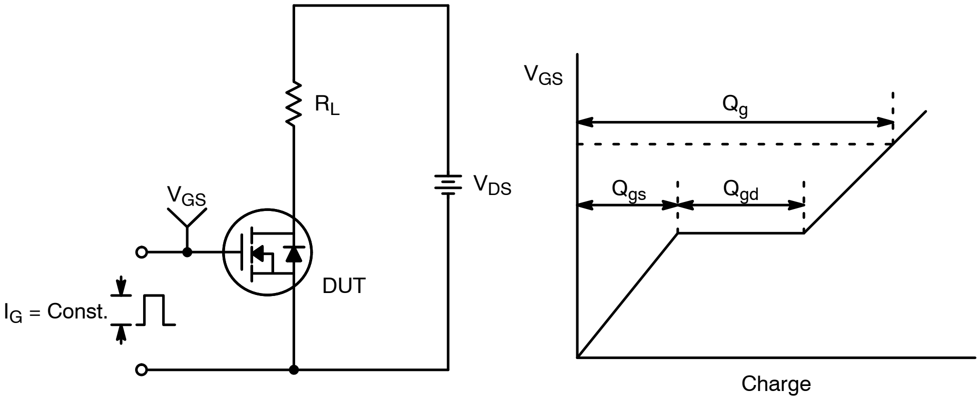


Figure 12. Gate Charge Test Circuit & Waveform

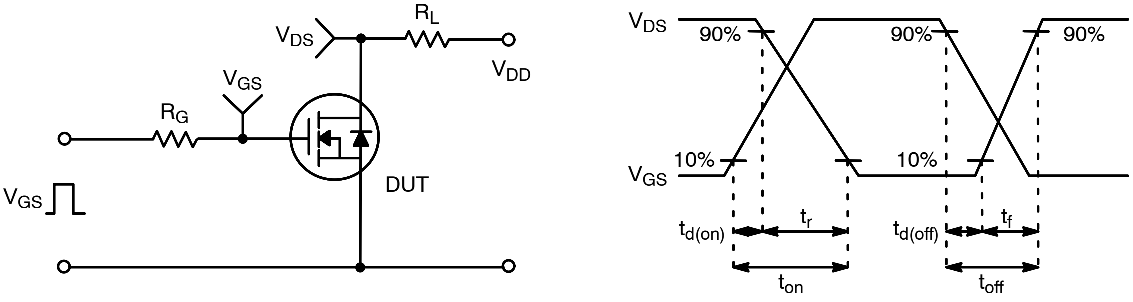


Figure 13. Resistive Switching Test Circuit & Waveforms

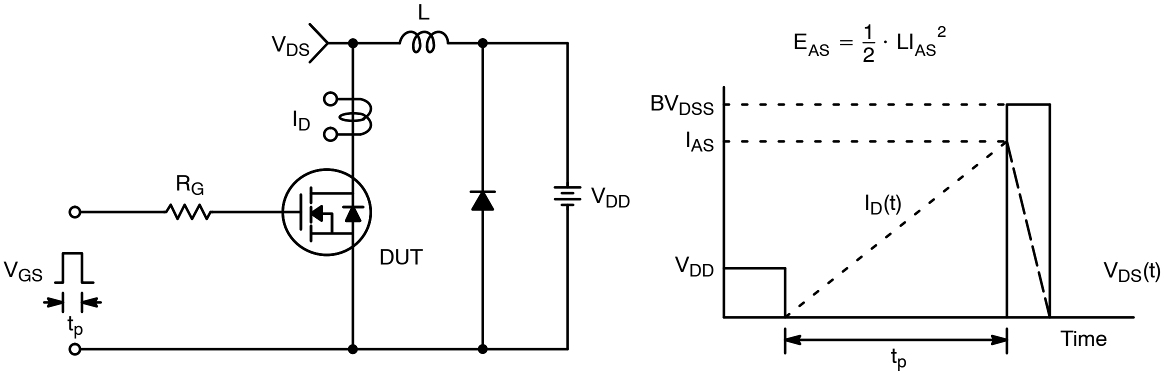


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

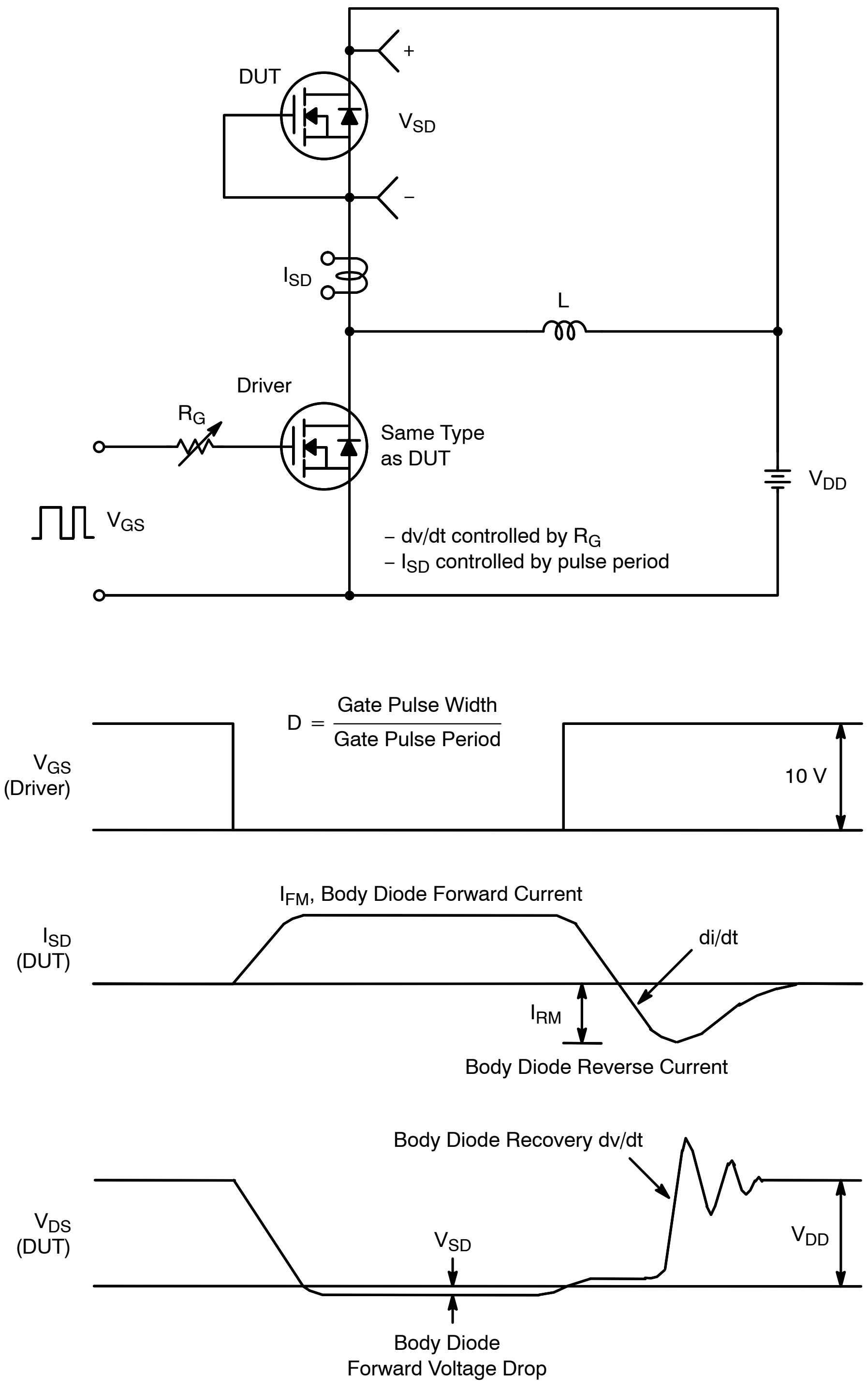
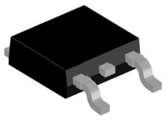


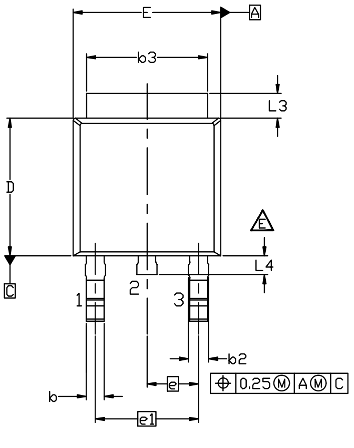
Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



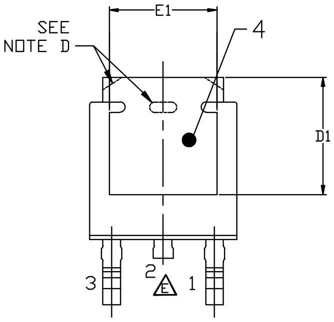
DPAK3 6.10x6.54x2.29, 4.57P
CASE 369AS
ISSUE B

DATE 20 DEC 2023

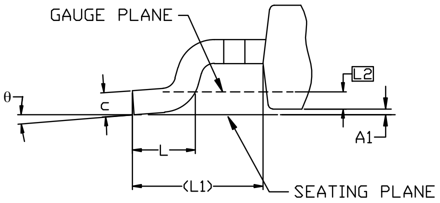
NOTES: UNLESS OTHERWISE SPECIFIED
- A) THIS PACKAGE CONFORMS TO JEDEC, TO-252, ISSUE F, VARIATION AA.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2018.
- D) SUPPLIER DEPENDENT MOLD LOCKING HOLES OR CHAMFERED CORNERS OR EDGE PROTRUSION.
- △E FOR DIODE PRODUCTS, L4 IS 0.25 MM MAX PLASTIC BODY STUB WITHOUT CENTER LEAD.
- F) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR EXTRUSIONS.
- G) LAND PATTERN RECOMMENDATION IS BASED ON IPC7351A STD TO228P991X239-3N.



NON-DIODE PRODUCTS VERSION

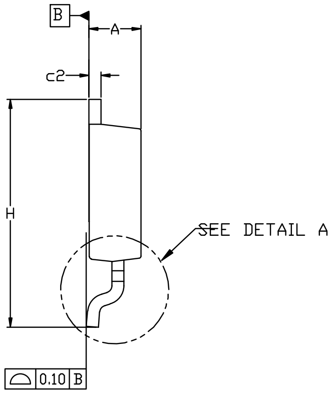


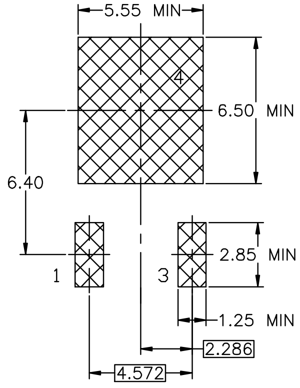
NON-DIODE PRODUCTS VERSION



DETAIL A
(ROTATED -90°)
SCALE: 12X

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	2.18	2.29	2.39
A1	0.00	-	0.127
b	0.64	0.77	0.89
b2	0.76	0.95	1.14
b3	5.21	5.34	5.46
c	0.45	0.53	0.61
c2	0.45	0.52	0.58
D	5.97	6.10	6.22
D1	5.21	---	---
E	6.35	6.54	6.73
E1	4.32	---	---
e	2.286 BSC		
e1	4.572 BSC		
H	9.40	9.91	10.41
L	1.40	1.59	1.78
L1	2.90 REF		
L2	0.51 BSC		
L3	0.89	1.08	1.27
L4	---	---	1.02
θ	0°	---	10°





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.

GENERIC MARKING DIAGRAM*

XXXXXX
XXXXXX
AYWWZZ
○

*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.

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

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DESCRIPTION:	**DPAK3 6.10x6.54x2.29, 4.57P**	**PAGE 1 OF 1**

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