

# MOSFET – Power, N-Channel, SUPERFET® III 800 V, 600 mΩ, 8 A

## NTD600N80S3Z

### 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.  $R_{DS(on)}$  = 550 mΩ
- Ultra Low Gate Charge (Typ.  $Q_g$  = 15.5 nC)
- Low Stored Energy in Output Capacitance ( $E_{oss}$  = 1.74 μJ @ 400 V)
- 100% Avalanche Tested
- ESD Improved Capability with Zener Diode
- RoHS Compliant

### Applications

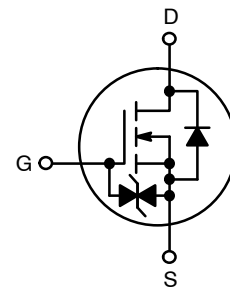
- Adapters / Chargers
- LED Lighting
- AUX Power
- Audio
- Industrial Power



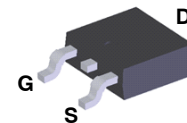
ON Semiconductor®

[www.onsemi.com](http://www.onsemi.com)

$V_{(BR)DSS}$	$R_{DS(ON)}$ MAX	$I_D$ MAX
800 V	600 mΩ	8 A



POWER MOSFET



D-PAK  
TO-252  
CASE 369AS

### MARKING DIAGRAM



T600N80S3Z	= Specific Device Code
A	= Assembly Location
Y	= Year
WW	= Work Week
ZZ	= Lot Code

### ORDERING INFORMATION

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

# NTD600N80S3Z

## ABSOLUTE MAXIMUM RATINGS (T<sub>J</sub> = 25°C, unless otherwise noted)

Symbol	Parameter		Value	Unit
V <sub>DSS</sub>	Drain-to-Source Voltage		800	V
V <sub>GS</sub>	Gate-to-Source Voltage	DC	±20	V
		AC (f > 1 Hz)	±30	
I <sub>D</sub>	Drain Current	Continuous (T <sub>C</sub> = 25°C)	8*	A
		Continuous (T <sub>C</sub> = 100°C)	5*	
I <sub>DM</sub>	Drain Current	Pulsed (Note 1)	21*	A
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)		24	mJ
I <sub>AS</sub>	Avalanche Current (Note 2)		1.2	A
E <sub>AR</sub>	Repetitive Avalanche Energy (Note 1)		0.6	mJ
dv/dt	MOSFET dv/dt		100	V/ns
	Peak Diode Recovery dv/dt (Note 3)		10	
P <sub>D</sub>	Power Dissipation	(T <sub>C</sub> = 25°C)	60	W
		Derate Above 25°C	0.48	W/°C
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range		-55 to +150	°C
T <sub>L</sub>	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.

\*Drain current limited by maximum junction temperature.

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. I<sub>AS</sub> = 1.2 A, R<sub>G</sub> = 25 Ω, starting T<sub>J</sub> = 25°C.
3. I<sub>SD</sub> ≤ 2 A, di/dt ≤ 200 A/μs, V<sub>DD</sub> ≤ 400 V, starting T<sub>J</sub> = 25°C.

## THERMAL RESISTANCE RATINGS

Symbol	Parameter	Value	Unit
R <sub>θJC</sub>	Junction-to-Case - Steady State	2.08	°C/W
R <sub>θJA</sub>	Junction-to-Ambient - Steady State	62.5	

## PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Marking	Package	Reel Size	Tape Width	Quantity
NTD600N80S3Z	NTD600N80S3Z	TO-252	330 mm	16 mm	2500 Units

# NTD600N80S3Z

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
--------	-----------	-----------------	-----	-----	-----	------

### OFF CHARACTERISTICS

BV <sub>DSS</sub>	Drain-to-Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 1 mA, T <sub>J</sub> = 25°C	800			V
		V <sub>GS</sub> = 0 V, I <sub>D</sub> = 1 mA, T <sub>J</sub> = 150°C	900			V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Drain-to-Source Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 1 mA, Referenced to 25°C		1.1		V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 800 V, V <sub>GS</sub> = 0 V			1	μA
		V <sub>DS</sub> = 640 V, T <sub>C</sub> = 125°C		0.8		
I <sub>GSS</sub>	Gate-to-Body Leakage Current	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V			1	μA

### ON CHARACTERISTICS

V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 0.18 mA	2.2		3.8	V
R <sub>DS(on)</sub>	Static Drain-to-Source On Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 4 A		550	600	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 20 V, I <sub>D</sub> = 4 A		9.4		S

### DYNAMIC CHARACTERISTICS

C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 400 V, V <sub>GS</sub> = 0 V, f = 250 kHz		725		pF
C <sub>oss</sub>	Output Capacitance			12		pF
C <sub>oss(eff.)</sub>	Effective Output Capacitance	V <sub>DS</sub> = 0 V to 400 V, V <sub>GS</sub> = 0 V		139		pF
C <sub>oss(er.)</sub>	Energy Related Output Capacitance	V <sub>DS</sub> = 0 V to 400 V, V <sub>GS</sub> = 0 V		21		pF
Q <sub>g(tot)</sub>	Total Gate Charge at 10 V	V <sub>DD</sub> = 400 V, I <sub>D</sub> = 4 A, V <sub>GS</sub> = 10 V (Note 4)		15.5		nC
Q <sub>gs</sub>	Gate-to-Source Gate Charge			3.1		nC
Q <sub>gd</sub>	Gate-to-Drain "Miller" Charge			5.1		nC
ESR	Equivalent Series Resistance	f = 1 MHz		3.5		Ω

### SWITCHING CHARACTERISTICS

t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 400 V, I <sub>D</sub> = 4 A, V <sub>GS</sub> = 10 V, R <sub>g</sub> = 4.7 Ω (Note 4)		12.3		ns
t <sub>r</sub>	Turn-On Rise Time			5.9		ns
t <sub>d(off)</sub>	Turn-Off Delay Time			39.5		ns
t <sub>f</sub>	Turn-Off Fall Time			8.2		ns

### SOURCE-TO-DRAIN DIODE CHARACTERISTICS

I <sub>S</sub>	Maximum Continuous Source-to-Drain Diode Forward Current			8		A
I <sub>SM</sub>	Maximum Pulsed Source-to-Drain Diode Forward Current			21		A
V <sub>SD</sub>	Source-to-Drain Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 4 A			1.2	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 2 A, dI <sub>F</sub> /dt = 100 A/μs		137		ns
Q <sub>rr</sub>	Reverse Recovery Charge			0.91		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.

# NTD600N80S3Z

## TYPICAL CHARACTERISTICS

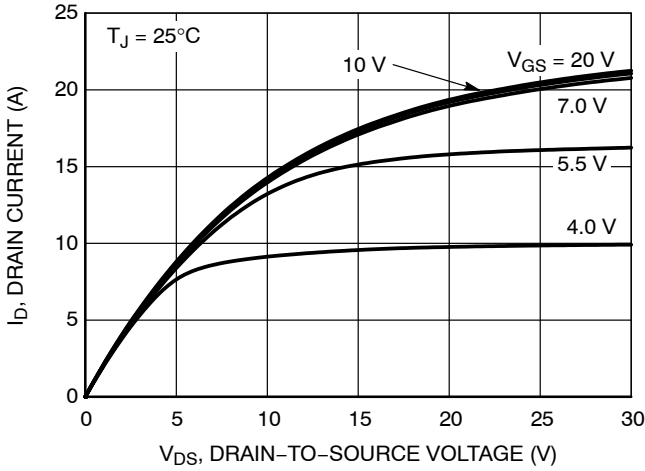


Figure 1. On-Region Characteristics

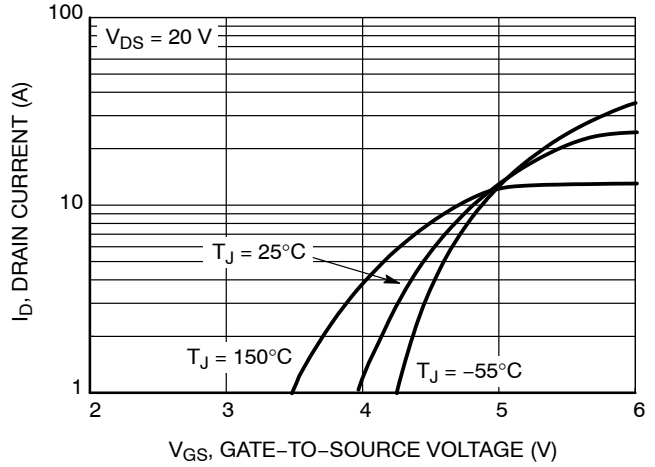


Figure 2. Transfer Characteristics

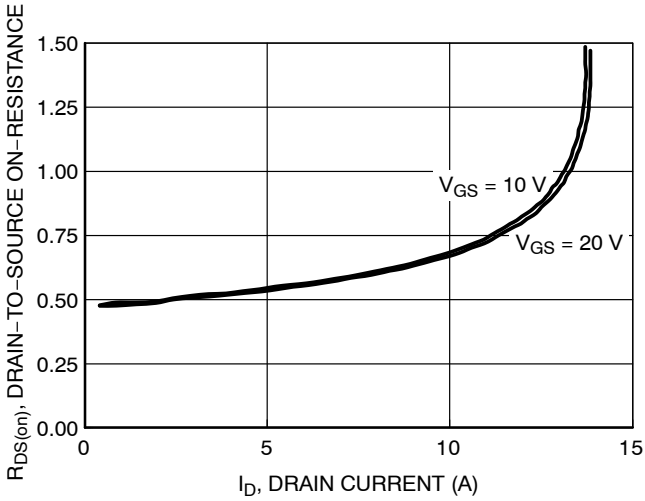


Figure 3. On Resistance vs. Drain Current

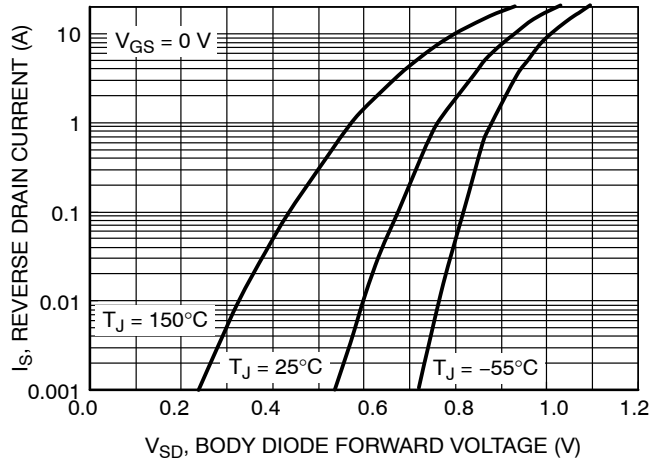


Figure 4. Diode Forward Voltage vs. Current

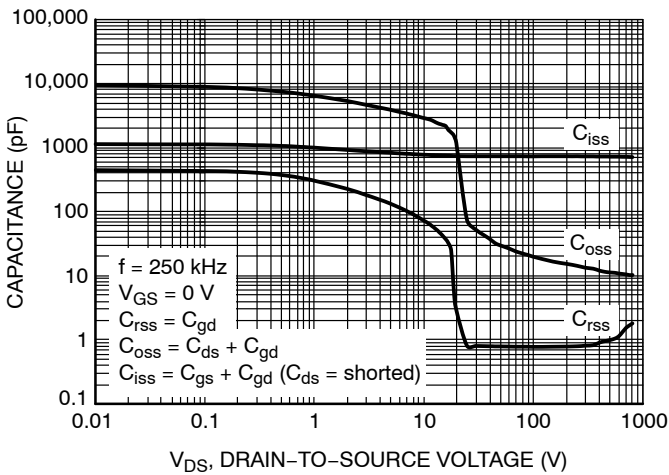


Figure 5. Capacitance Characteristics

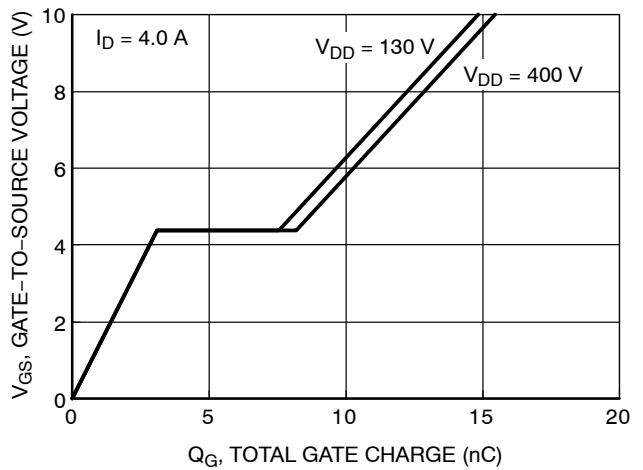


Figure 6. Gate Charge Characteristics

# NTD600N80S3Z

## TYPICAL CHARACTERISTICS

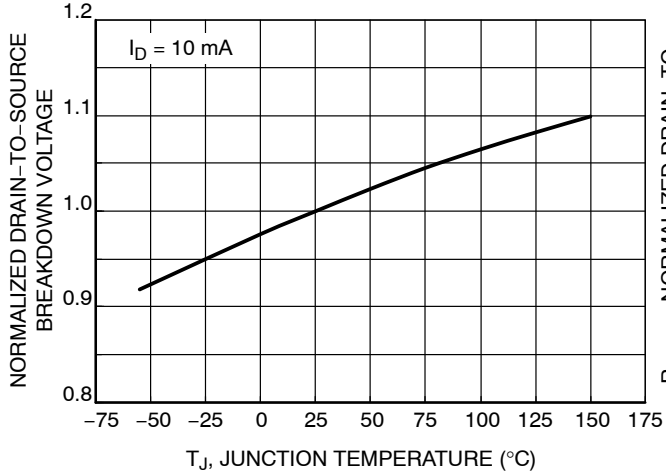


Figure 7. Normalized  $BV_{DSS}$  vs. Temperature

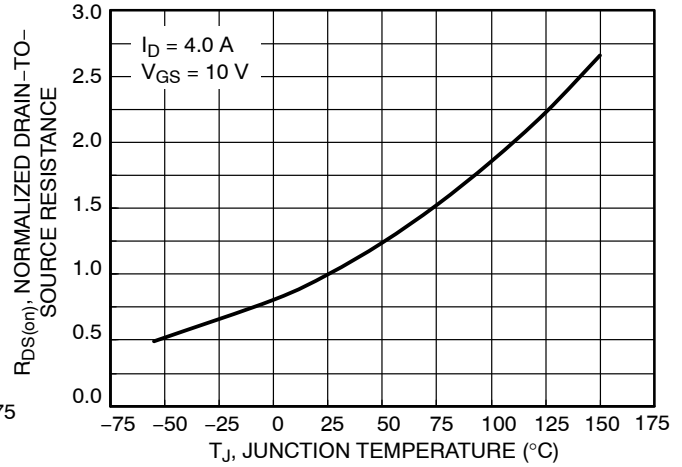


Figure 8. On-Resistance Variation vs. Temperature

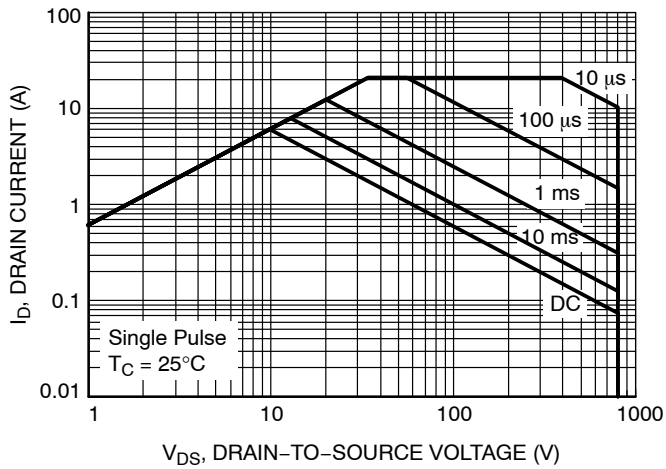


Figure 9. Safe Operating Area

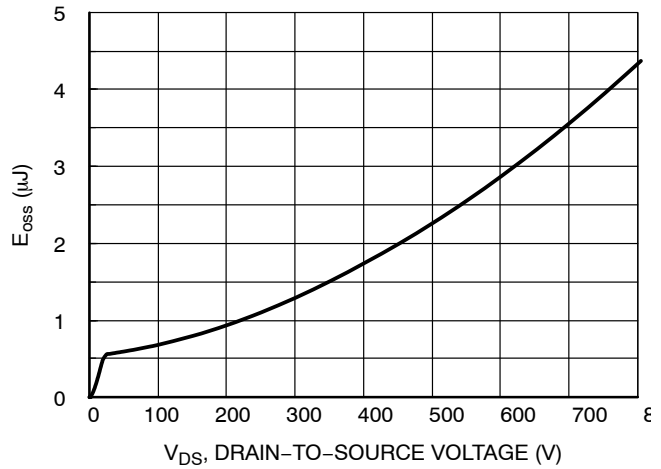


Figure 10.  $E_{OSS}$  vs. Drain-to-Source Voltage

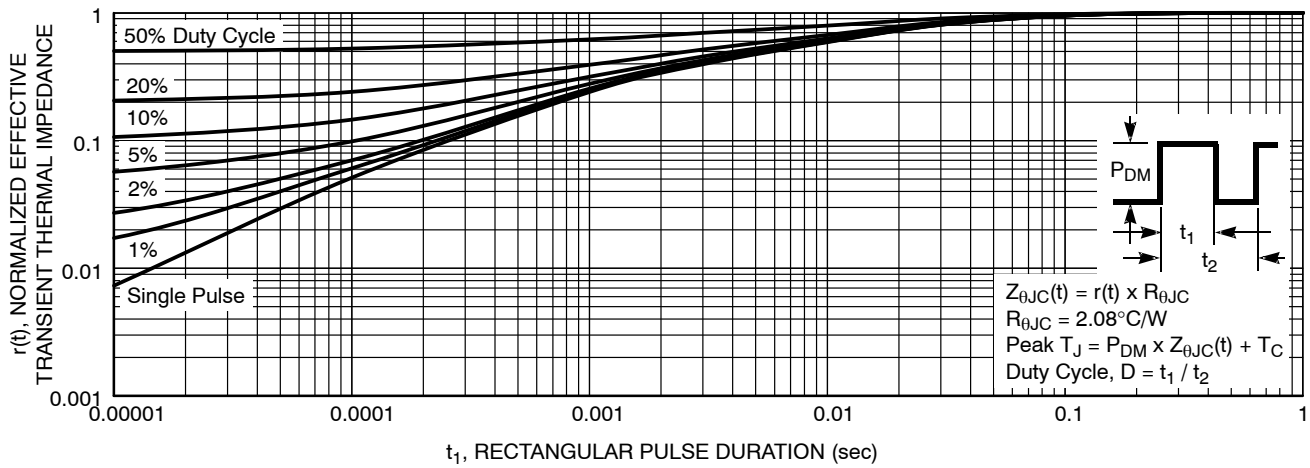


Figure 11. Transient Thermal Impedance

# NTD600N80S3Z

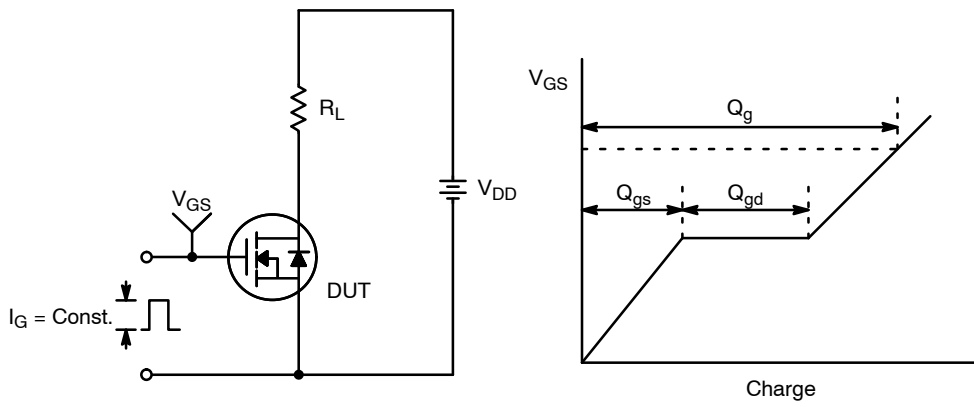


Figure 12. Gate Charge Test Circuit & Waveform

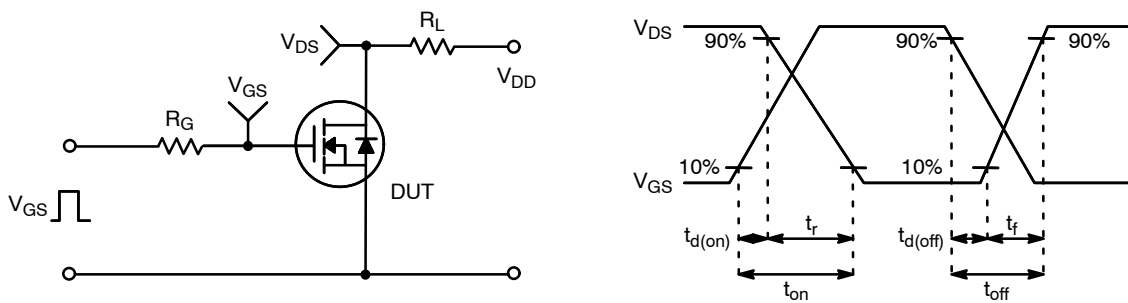


Figure 13. Resistive Switching Test Circuit & Waveforms

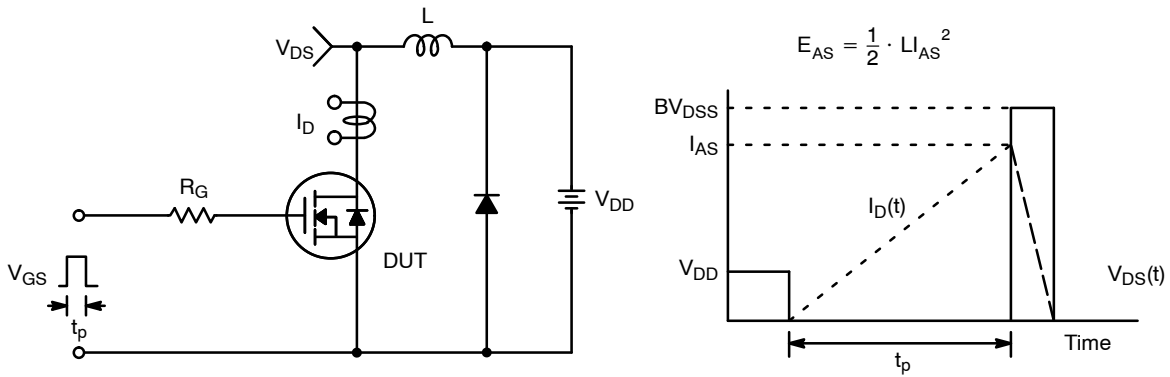
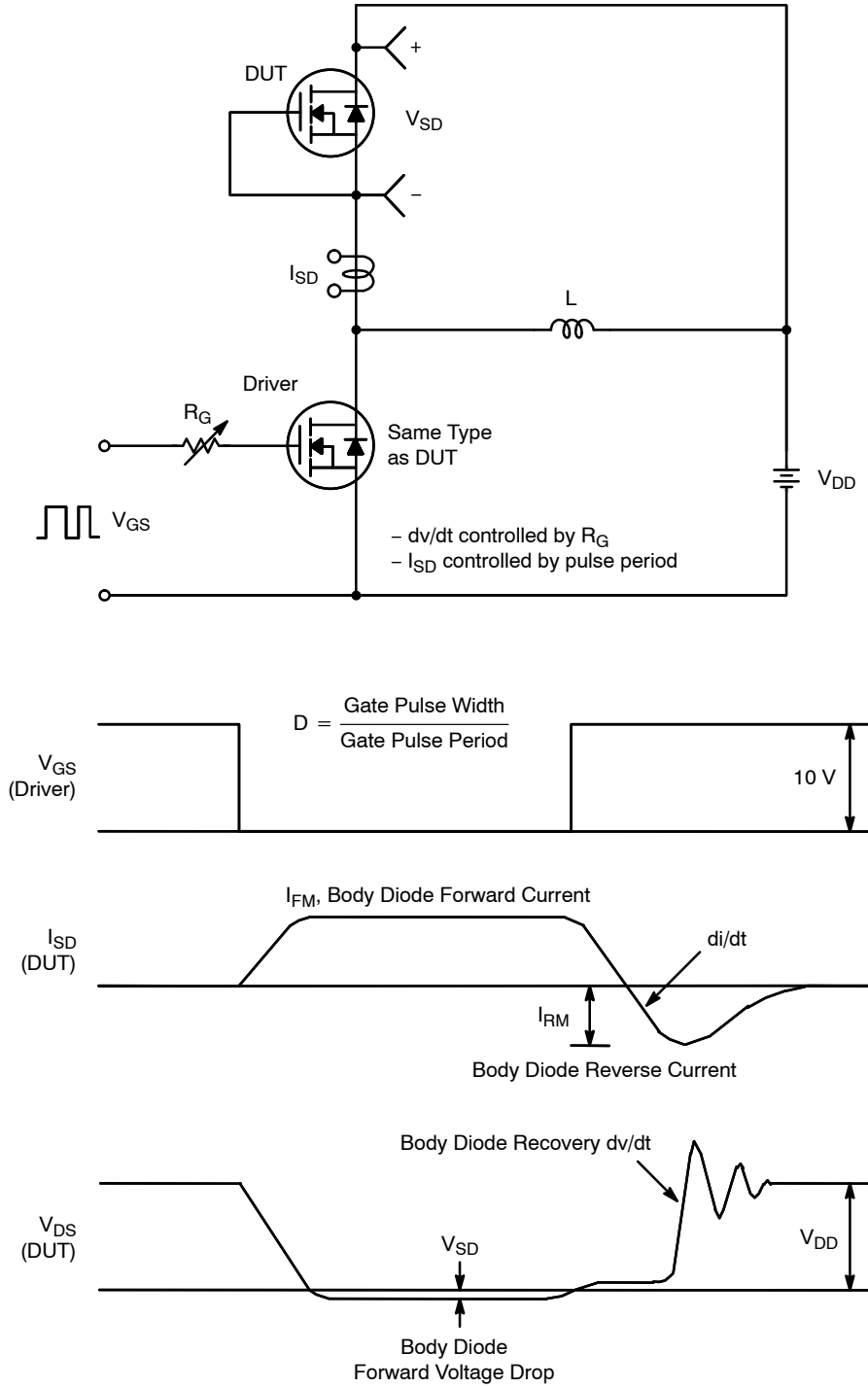


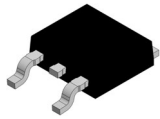
Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

# NTD600N80S3Z



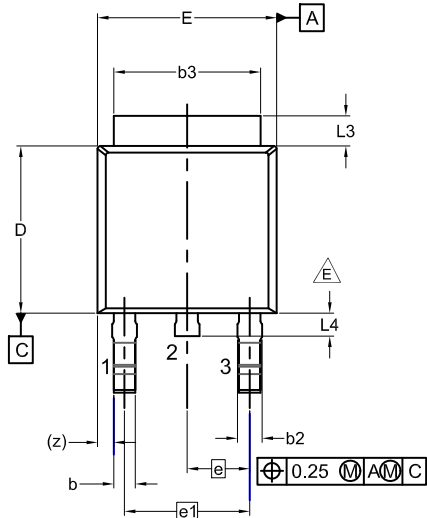
**Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms**

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

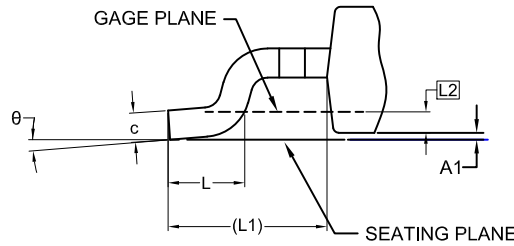


## DPAK3 (TO-252 3 LD) CASE 369AS ISSUE A

DATE 28 SEP 2022

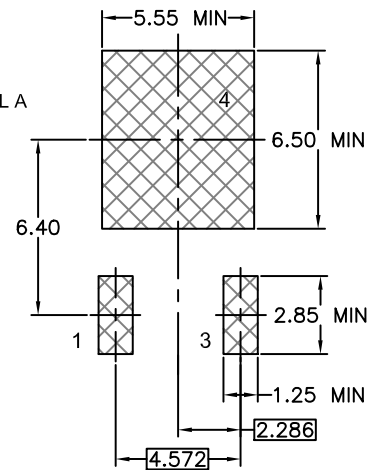
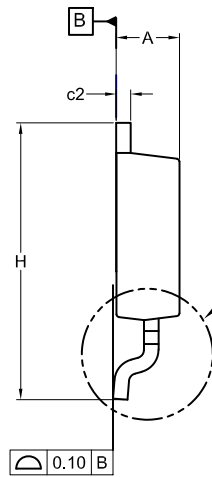
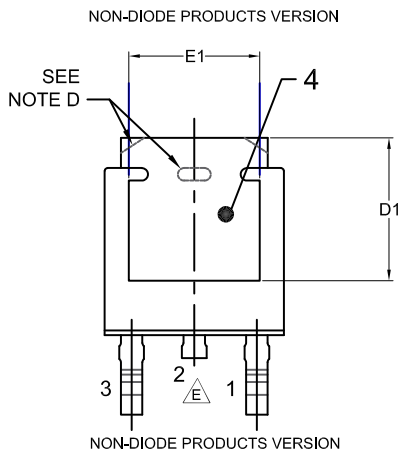


- NOTES: UNLESS OTHERWISE SPECIFIED  
 A) THIS PACKAGE CONFORMS TO JEDEC, TO-252, ISSUE C, VARIATION AA.  
 B) ALL DIMENSIONS ARE IN MILLIMETERS.  
 C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.  
 D) SUPPLIER DEPENDENT MOLD LOCKING HOLES OR CHAMFERED CORNERS OR EDGE PROTRUSION.  
 E) FOR DIODE PRODUCTS, L4 IS 0.25 MM MAX.  
 F) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR EXTRUSIONS.  
 G) LAND PATTERN RECOMMENDATION IS BASED ON IPC7351A STD TO228P991X239-3N.



**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°



### GENERIC MARKING DIAGRAM\*



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

\*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.

### 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.

<b>DOCUMENT NUMBER:</b>	<b>98AON13810G</b>	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
<b>DESCRIPTION:</b>	<b>DPAK3 (TO-252 3 LD)</b>	<b>PAGE 1 OF 1</b>

onsemi and ONSEMI are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.



**onsemi**, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## ADDITIONAL INFORMATION

### TECHNICAL PUBLICATIONS:

Technical Library: [www.onsemi.com/design/resources/technical-documentation](http://www.onsemi.com/design/resources/technical-documentation)  
onsemi Website: [www.onsemi.com](http://www.onsemi.com)

### ONLINE SUPPORT: [www.onsemi.com/support](http://www.onsemi.com/support)

For additional information, please contact your local Sales Representative at [www.onsemi.com/support/sales](http://www.onsemi.com/support/sales)