

ON Semiconductor

Is Now

onsemi™

To learn more about onsemi™, please visit our website at
www.onsemi.com

onsemi and **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** product/patent coverage may be accessed at 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. Other names and brands may be claimed as the property of others.

MOSFET – Power, N-Channel, SUPERFET® III 800 V, 450 mΩ, 11 A

NTPF450N80S3Z

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. $R_{DS(on)} = 380\text{ m}\Omega$
- Ultra Low Gate Charge (Typ. $Q_g = 19.3\text{ nC}$)
- Low Stored Energy in Output Capacitance ($E_{oss} = 2.2\text{ }\mu\text{J @ }400\text{ V}$)
- 100% Avalanche Tested
- ESD Improved Capability with Zener Diode
- RoHS Compliant

Applications

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

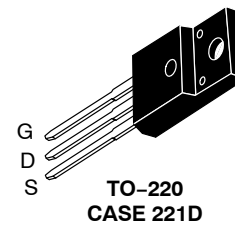
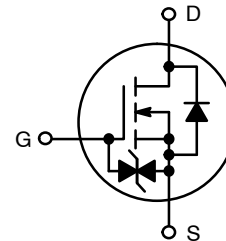


ON Semiconductor®

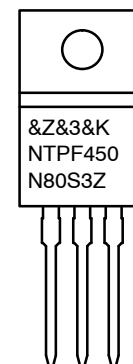
www.onsemi.com

$V_{(BR)DSS}$	$R_{DS(ON)}\text{ MAX}$	$I_D\text{ MAX}$
800 V	450 mΩ @ $V_{GS} = 10\text{ V}$	11 A

N-CHANNEL MOSFET



MARKING DIAGRAM



&Z = Assembly Plant Code
 &3 = Data Code (Year & Week)
 &K = Lot
 NTPF450N80S3Z = Specific Device Code

ORDERING INFORMATION

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

NTPF450N80S3Z

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	V
I _D	Drain Current	Continuous (T _C = 25°C)	11*	A
		Continuous (T _C = 100°C)	7*	A
I _{DM}	Drain Current	Pulsed (Note 1)	25*	A
E _{AS}	Single Pulsed Avalanche Energy (Note 2)		32	mJ
I _{AS}	Avalanche Current (Note 2)		1.55	A
E _{AR}	Repetitive Avalanche Energy (Note 1)		0.295	mJ
dv/dt	MOSFET dv/dt		100	V/ns
	Peak Diode Recovery dv/dt (Note 3)		10	V/ns
P _D	Power Dissipation	T _C = 25°C	29.5	W
		Derate above 25°C	0.236	W/°C
T _J , T _{stg}	Operating Junction and Storage Temperature Range		-55 to +150	°C
T _L	Lead Temperature 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_{AS} = 1.55 A, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 2.75 A, di/dt ≤ 200 A/μs, V_{DD} ≤ 400 V, starting T_J = 25°C.

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
R _{θJC}	Thermal Resistance, Junction-to-Case, Max.	4.23	°C/W
R _{θJA}	Thermal Resistance, Junction-to-Ambient, Max.	62.5	

PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Marking	Package	Packing Method	Reel Size	Tape Width	Quantity
NTPF450N80S3Z	NTPF450N80S3Z	TO-220F	Tube	N/A	N/A	50 Units

NTPF450N80S3Z

ELECTRICAL CHARACTERISTICS

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
ΔBV _{DSS} /ΔT _J	Drain-to-Source Breakdown Voltage Temperature Coefficient	I _D = 1 mA, Reference 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-Source 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 = 0.24 mA	2.2	-	3.8	V
R _{DS(on)}	Static Drain-to-Source On Resistance	V _{GS} = 10 V, I _D = 5.5 A	-	380	450	mΩ
g _{FS}	Forward Transconductance	V _{DS} = 20 V, I _D = 5.5 A	-	11.8	-	S

DYNAMIC CHARACTERISTICS

C _{iss}	Input Capacitance	V _D = 400 V, V _{GS} = 0 V, f = 250 kHz	-	885	-	pF
C _{oss}	Output Capacitance		-	15	-	
C _{oss(eff.)}	Effective Output Capacitance	V _{DS} = 0 V to 400 V, V _{GS} = 0 V	-	188	-	
C _{oss(er.)}	Energy Related Output Capacitance		-	27	-	
Q _{g(tot)}	Total Gate Charge at 10 V	V _{DS} = 400 V, I _D = 5.5 A, V _{GS} = 10 V (Note 4)	-	19.3	-	nC
Q _{gs}	Gate-to-Source Charge		-	4.2	-	
Q _{gd}	Gate-to-Drain "Miller" Charge		-	6.6	-	
ESR	Equivalent Series Resistance	f = 1 MHz	-	4.0	-	Ω

SWITCHING CHARACTERISTICS

t _{d(on)}	Turn-On Delay Time	V _{DD} = 400 V, I _D = 5.5 A, V _{GS} = 10 V, R _G = 4.7 Ω (Note 4)	-	13.3	-	ns
t _r	Turn-On Rise Time		-	6.7	-	
t _{d(off)}	Turn-Off Delay Time		-	44.3	-	
t _f	Turn-Off Fall Time		-	4.6	-	

SOURCE-TO-DRAIN DIODE CHARACTERISTICS

I _S	Maximum Continuous Source-to-Drain Diode Forward Current		-	-	11	A
I _{SM}	Maximum Pulsed Source-to-Drain Diode Forward Current		-	-	25	A
V _{SD}	Source-to-Drain Diode Forward Voltage	V _{GS} = 0 V, I _{SD} = 5.5 A	-	-	1.2	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _{SD} = 2.75 A, di _F /dt = 100 A/μs	-	170	-	ns
Q _{rr}	Reverse Recovery Charge		-	1.5	-	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.

4. Essentially independent of operating temperature typical characteristics.

SUPERFET is a registered trademark of Semiconductor Components Industries, LLC (SCILLC) or its subsidiaries in the United States and/or other countries.

NTPF450N80S3Z

TYPICAL CHARACTERISTICS

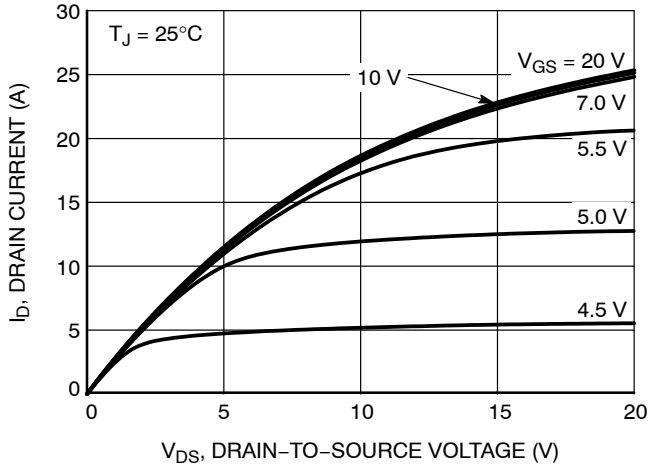


Figure 1. On-Region Characteristics

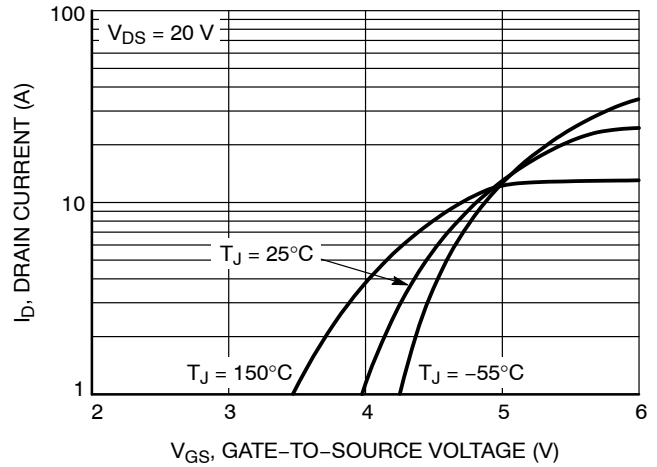


Figure 2. Transfer Characteristics

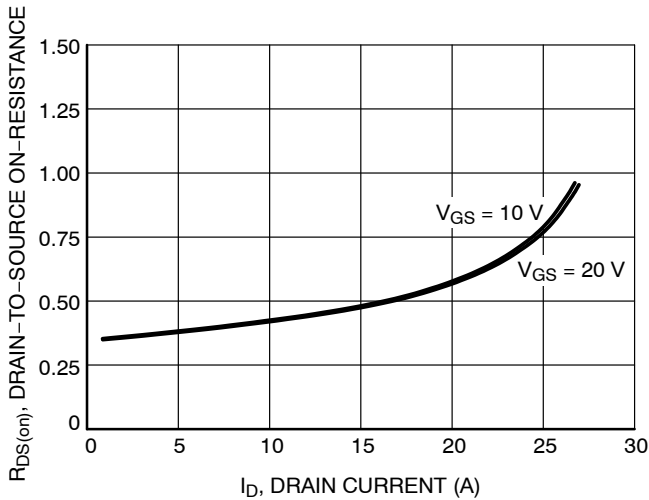


Figure 3. On Resistance vs. Drain Current

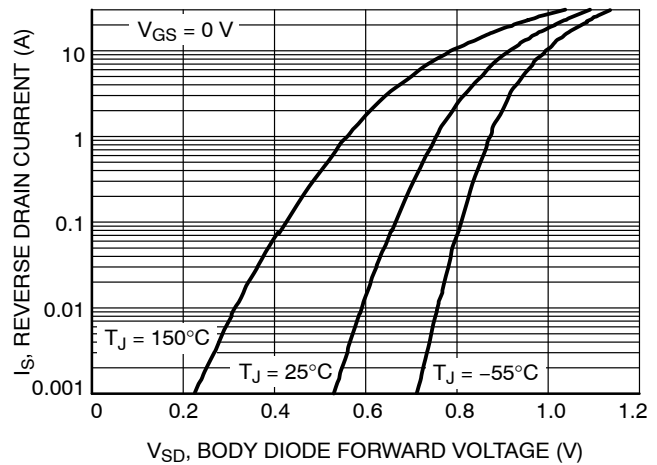


Figure 4. Diode Forward Voltage vs. Current

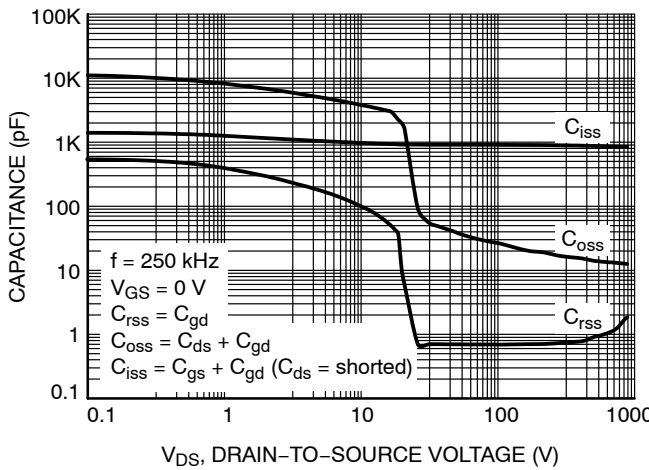


Figure 5. Capacitance Characteristics

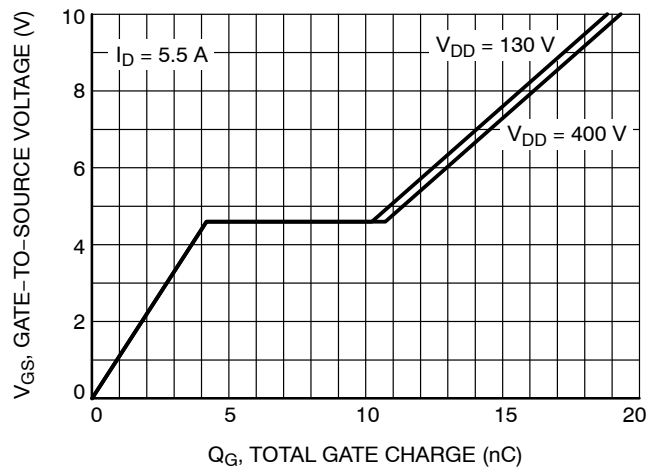


Figure 6. Gate Charge Characteristics

NTPF450N80S3Z

TYPICAL CHARACTERISTICS

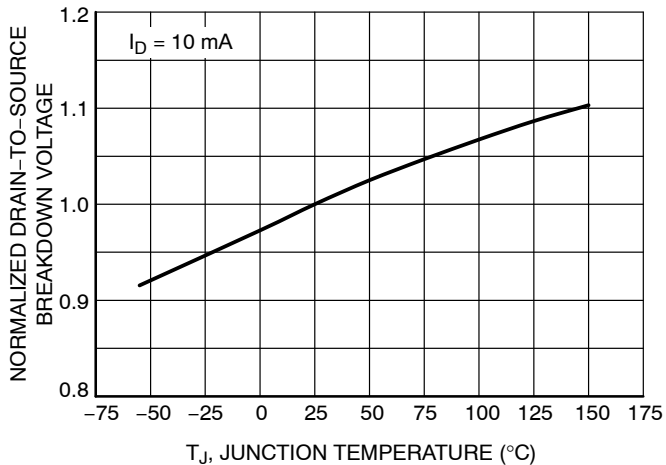


Figure 7. Normalized BV_{DSS} vs. Temperature

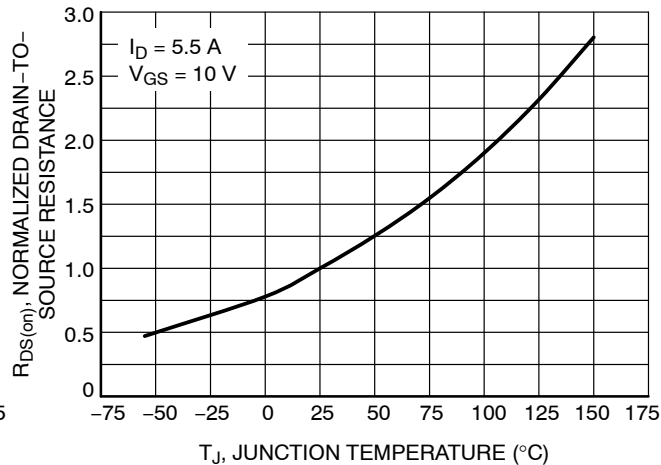


Figure 8. On-Resistance Variation vs. Temperature

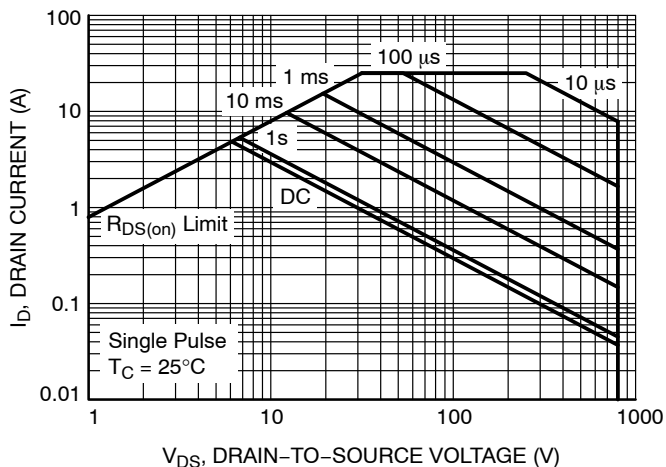


Figure 9. Safe Operating Area

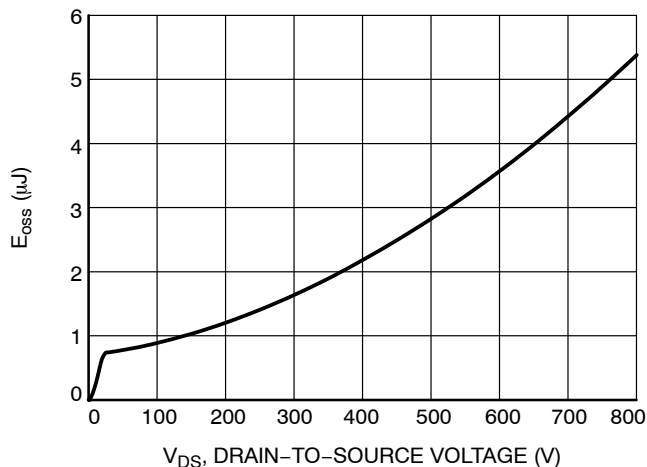


Figure 10. E_{oss} vs. Drain-to-Switching Voltage

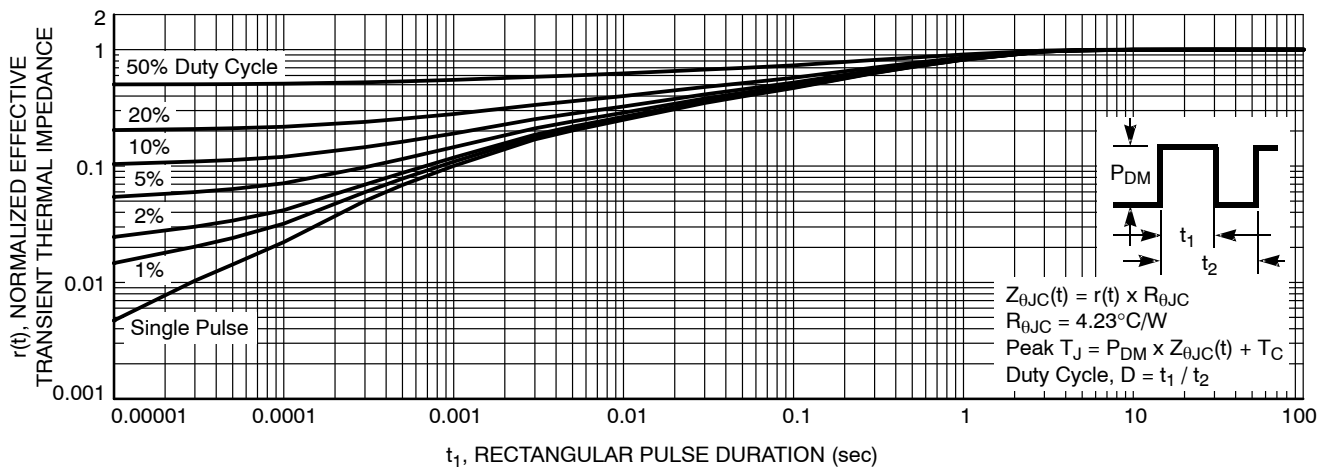


Figure 11. Transient Thermal Impedance

NTPF450N80S3Z

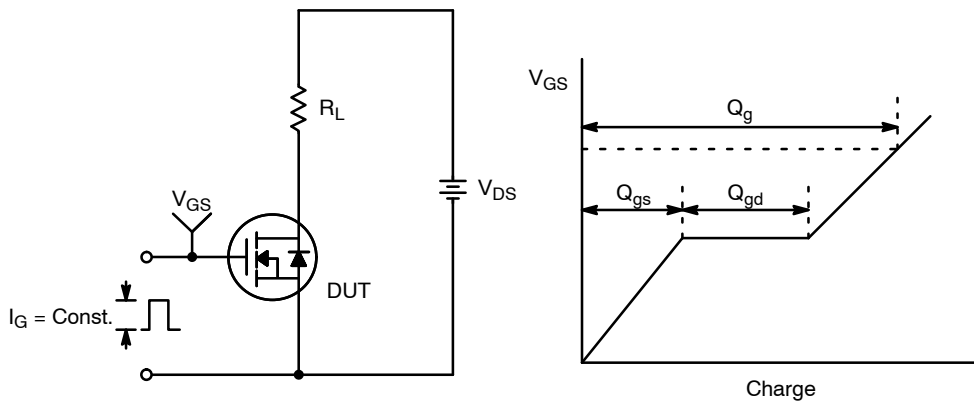


Figure 12. Gate Charge Test Circuit & Waveform

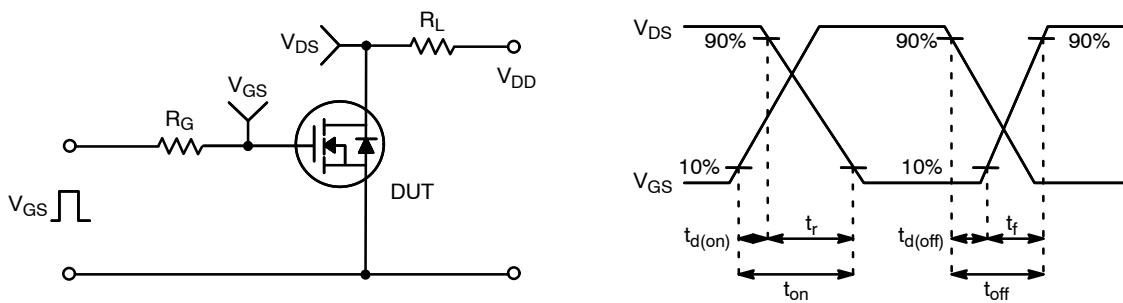


Figure 13. Resistive Switching Test Circuit & Waveforms

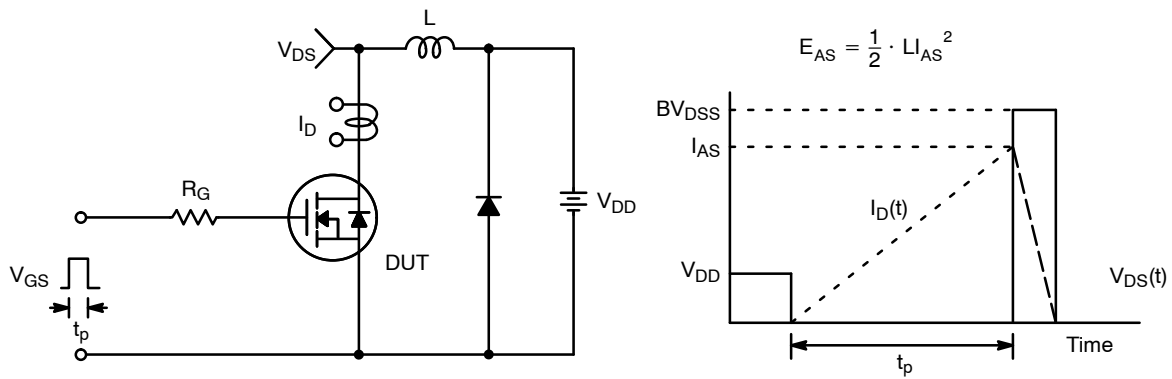


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

NTPF450N80S3Z

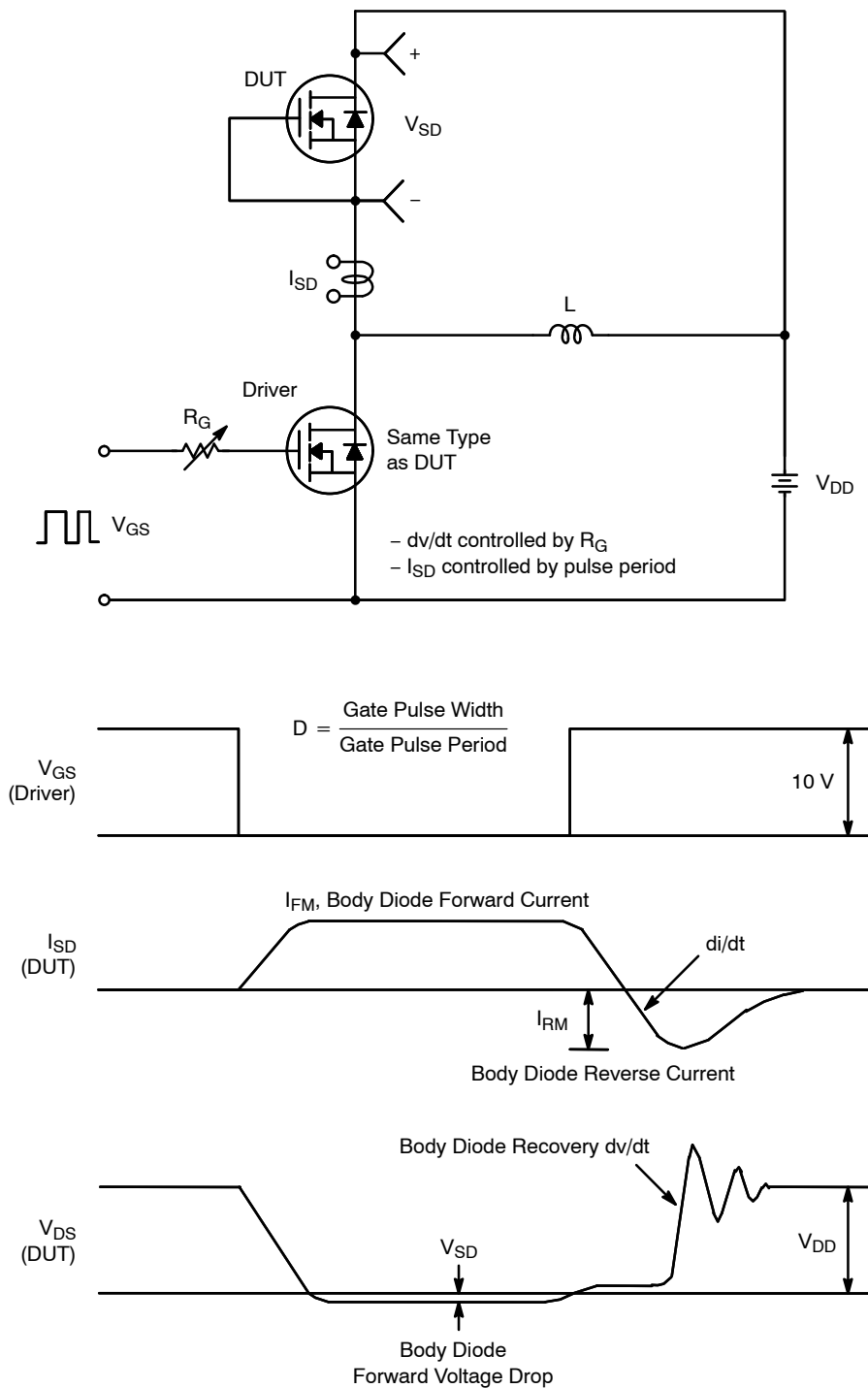
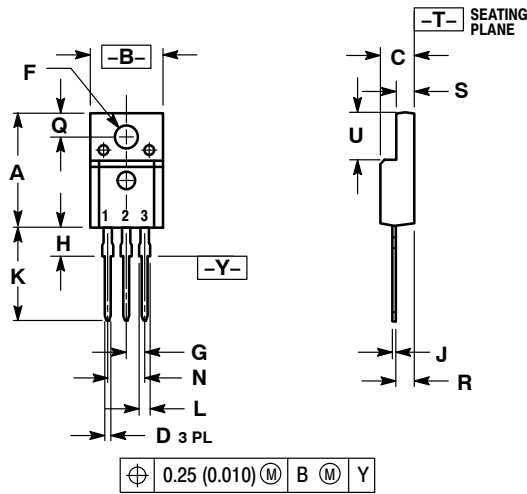


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

NTPF450N80S3Z

PACKAGE DIMENSIONS

TO-220 FULLPAK CASE 221D-03 ISSUE K



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH
 3. 221D-01 THRU 221D-02 OBSOLETE, NEW STANDARD 221D-03.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.617	0.635	15.67	16.12
B	0.392	0.419	9.96	10.63
C	0.177	0.193	4.50	4.90
D	0.024	0.039	0.60	1.00
F	0.116	0.129	2.95	3.28
G	0.100 BSC		2.54 BSC	
H	0.118	0.135	3.00	3.43
J	0.018	0.025	0.45	0.63
K	0.503	0.541	12.78	13.73
L	0.048	0.058	1.23	1.47
N	0.200 BSC		5.08 BSC	
Q	0.122	0.138	3.10	3.50
R	0.099	0.117	2.51	2.96
S	0.092	0.113	2.34	2.87
U	0.239	0.271	6.06	6.88

ON Semiconductor and $\text{\textcircled{ON}}$ are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marketing.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor 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 ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor 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 ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor 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 ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Email Requests to: orderlit@onsemi.com

TECHNICAL SUPPORT
North American Technical Support:
Voice Mail: 1 800-282-9855 Toll Free USA/Canada
Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support:
Phone: 00421 33 790 2910
For additional information, please contact your local Sales Representative