chanhvinh.com

MOSFET - Power, N-Channel, SUPERFET® III, FRFET®

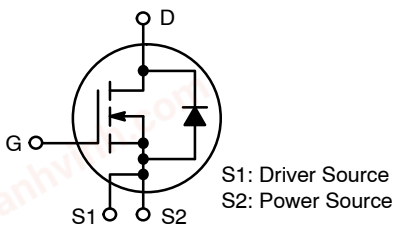
650 V, 20 A, 190 mΩ

NTMT190N65S3HF

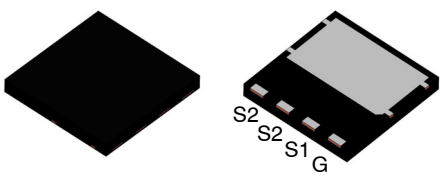
ON Semiconductor®

www.onsemi.com

V_{DSS}	$R_{DS(ON)}$ MAX	I_D MAX
650 V	190 mΩ @ 10 V	20 A



POWER MOSFET



Power88
PQFN4 8X8 2P
CASE 483AP

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 withstand extreme dv/dt rate.

Consequently, SUPERFET III MOSFET is very suitable for the various power systems for miniaturization and higher efficiency.

SUPERFET III FRFET MOSFET's optimized reverse recovery performance of body diode can remove additional components and improve system reliability.

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 $R_{DS(on)}$ = 159 mΩ
- Ultra Low Gate Charge (Typ. Q_g = 34 nC)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)}$ = 316 pF)
- 100% Avalanche Tested
- These Devices are Pb−Free and are RoHS Compliant

Applications

- Telecom / Server Power Supplies
- Industrial Power Supplies
- UPS / Solar
- Lighting / Charger / Adapter

MARKING DIAGRAM



NTMT190N65S3HF	= 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.

© Semiconductor Components Industries, LLC, 2018

chanhvinh.com

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)	20	A
		Continuous (T_C = 100°C)	12.7	
I_{DM}	Drain Current	Pulsed (Note 1)	50	A
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		220	mJ
I_{AS}	Avalanche Current (Note 2)		3.7	A
E_{AR}	Repetitive Avalanche Energy (Note 1)		1.62	mJ
dv/dt	MOSFET dv/dt		100	V/ns
	Peak Diode Recovery dv/dt (Note 3)		50	
P_D	Power Dissipation	(T_C = 25°C)	162	W
		Derate Above 25°C	1.3	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} = 3.7 A, R_G = 25 Ω starting T_J = 25°C
3. I_{SD} ≤ 10 A, di/dt ≤ 100 A/μs, V_{DD} ≤ 400 V, starting T_J = 25°C

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.77	°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

Part Number	Top Marking	Package	Reel Size	Tape Width	Shipping†
NTMT190N65S3HF	NTMT190N65S3HF	Power88	13”	13.3 mm	3000 / Tape & Reel

†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.

chanhvinh.com

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

Symbol	Parameter	Test Condition	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
ΔBV_{DSS} /ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 10 mA, referenced to 25°C	–	0.65	–	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	–	15		
I_{GSS}	Gate to Source 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 = 0.43 mA	3.0	–	5.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 10 A	–	159	190	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 10 A	–	11	–	S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 400 V, V_{GS} = 0 V, f = 1 MHz	–	1610	–	pF
C_{oss}	Output Capacitance		–	30	–	pF
$C_{oss(eff.)}$	Effective Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V	–	316	–	pF
$C_{oss(er.)}$	Energy Related Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V	–	59	–	pF
$Q_{g(tot)}$	Total Gate Charge at 10 V	V_{DS} = 400 V, I_D = 10 A, V_{GS} = 10 V (Note 5)	–	34	–	nC
Q_{gs}	Gate to Source Gate Charge		–	11	–	nC
Q_{gd}	Gate to Drain “Miller” Charge		–	13	–	nC
ESR	Equivalent Series Resistance	f = 1 MHz	–	4.1	–	Ω
SWITCHING CHARACTERISTICS						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 400 V, I_D = 10 A, V_{GS} = 10 V, R_{GEN} = 4.7 Ω (Note 5)	–	22	–	ns
t_r	Rise Time		–	13	–	ns
$t_{d(off)}$	Turn-Off Delay Time		–	53	–	ns
t_f	Fall Time		–	3.3	–	ns
SOURCE−DRAIN DIODE CHARACTERISTICS						
I_S	Maximum Continuous Source to Drain Diode Forward Current		–	–	20	A
I_{SM}	Maximum Pulsed Source to Drain Diode Forward Current		–	–	50	A
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 10 A	–	–	1.3	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 10 A, di_F/dt = 100 A/μs	–	72	–	ns
Q_{rr}	Reverse Recovery Charge		–	255	–	nC

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.

chanhvinh.com

TYPICAL CHARACTERISTICS

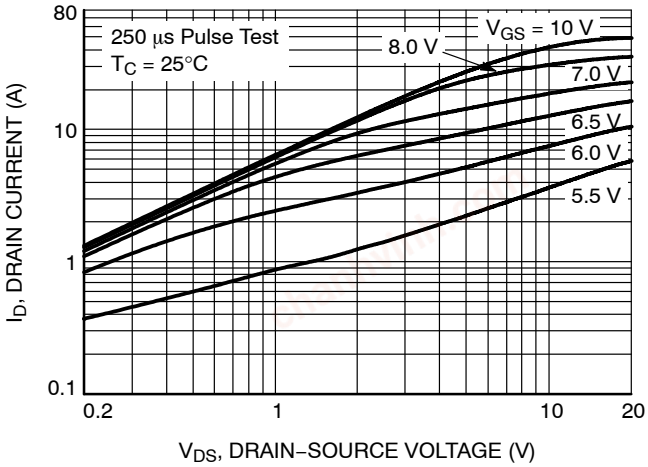


Figure 1. On−Region Characteristics

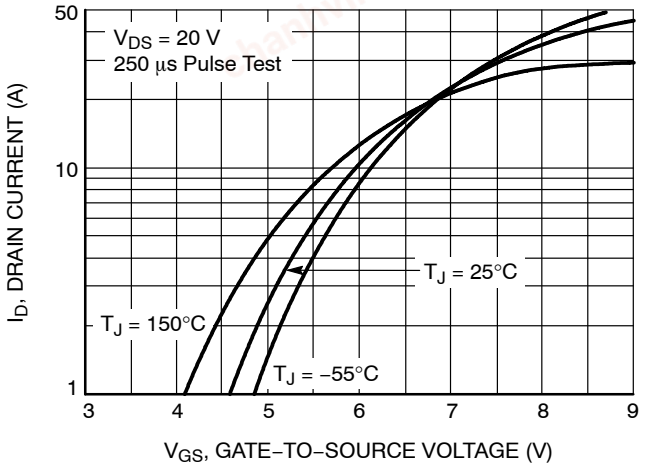


Figure 2. Transfer Characteristics

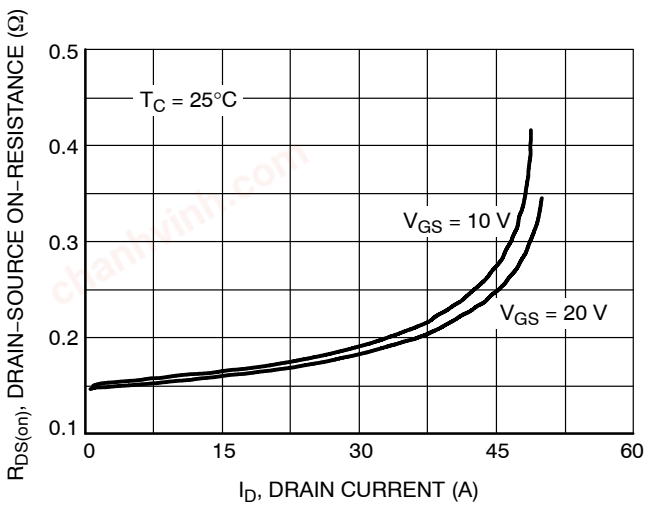


Figure 3. On−Resistance Variation vs. Drain Current and Gate Voltage

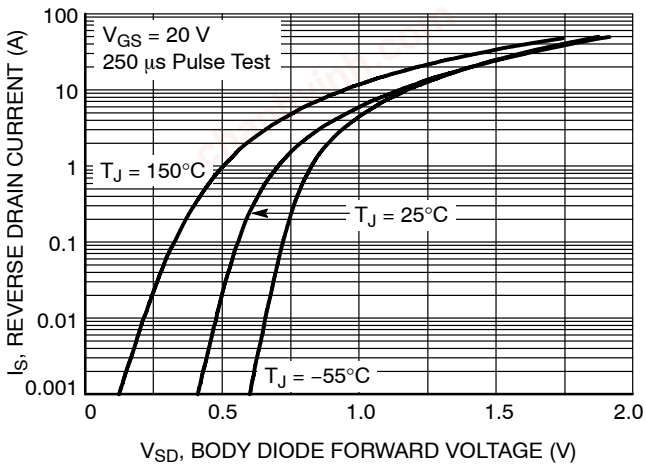


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

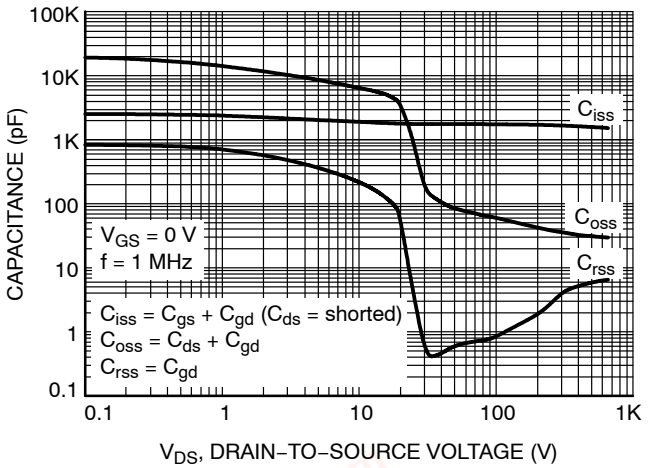


Figure 5. Capacitance Characteristics

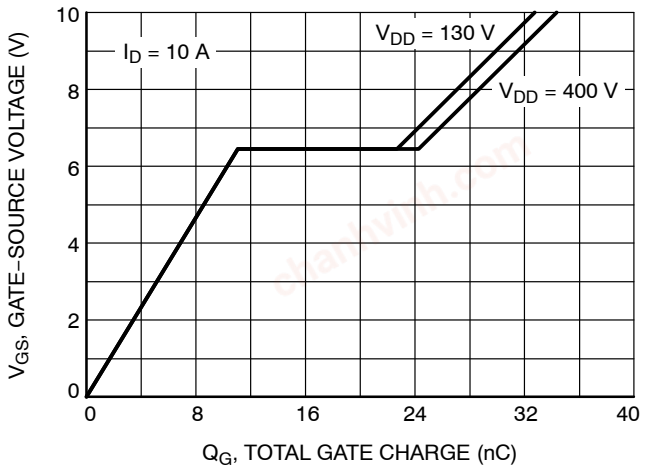


Figure 6. Gate Charge Characteristics

chanhvinh.com

TYPICAL CHARACTERISTICS

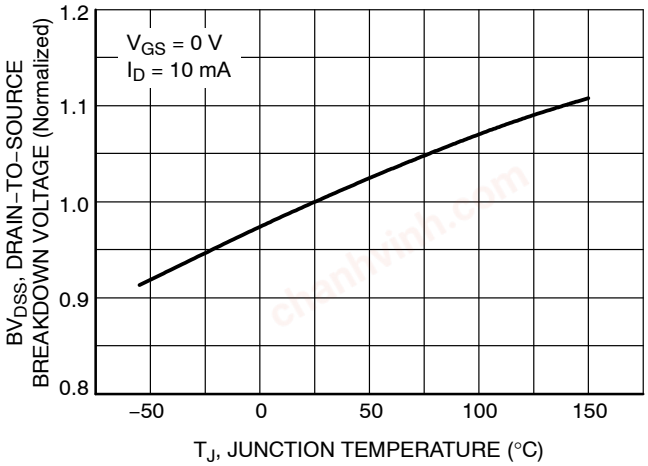


Figure 7. Breakdown Voltage Variation vs. Temperature

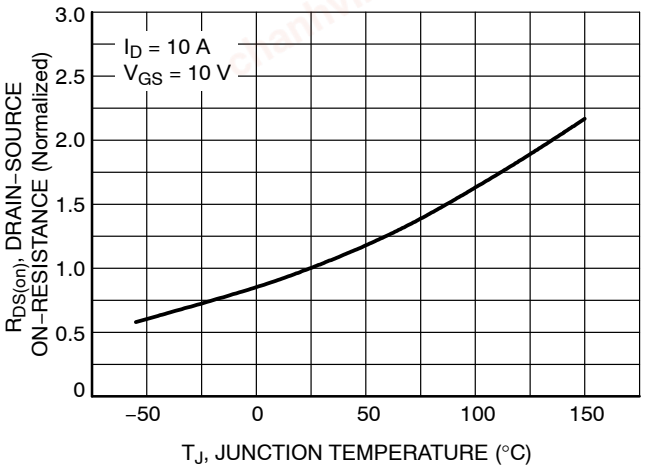


Figure 8. On−Resistance Variation vs. Temperature

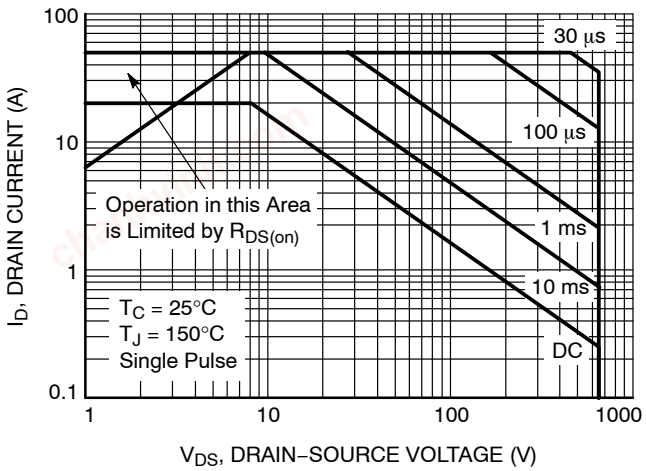


Figure 9. Maximum Safe Operating Area

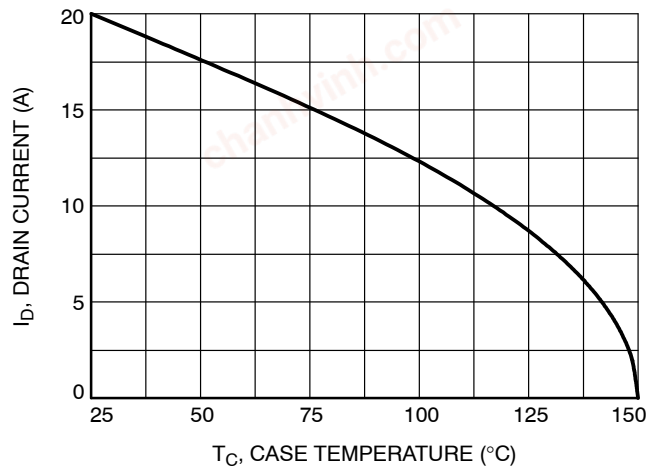


Figure 10. Maximum Drain Current vs. Case Temperature

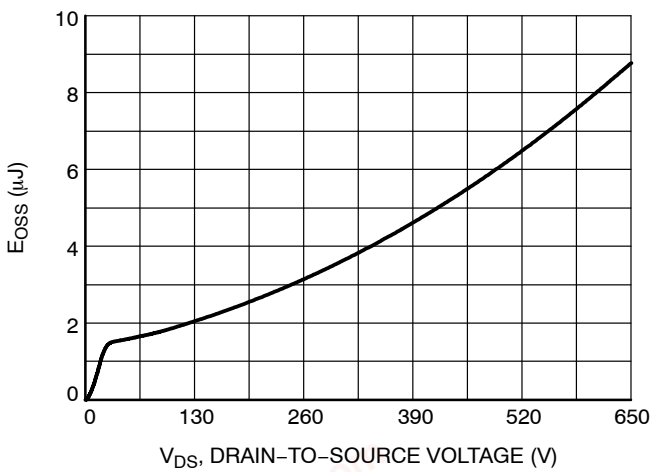


Figure 11. E_{OSS} vs. Drain−to−Source Voltage

chanhvinh.com

TYPICAL CHARACTERISTICS

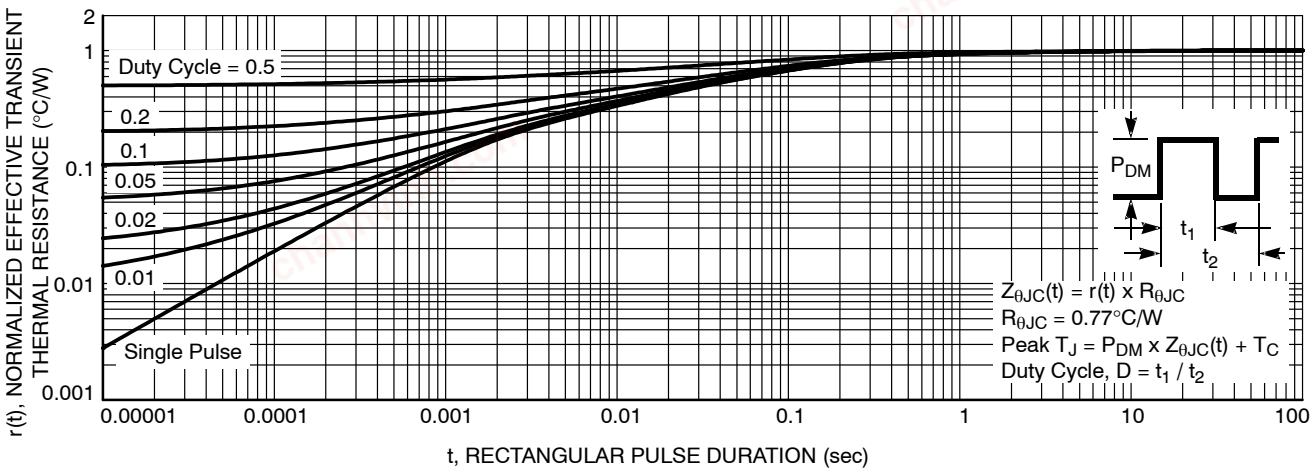


Figure 12. Transient Thermal Response Curve

chanhvinh.com

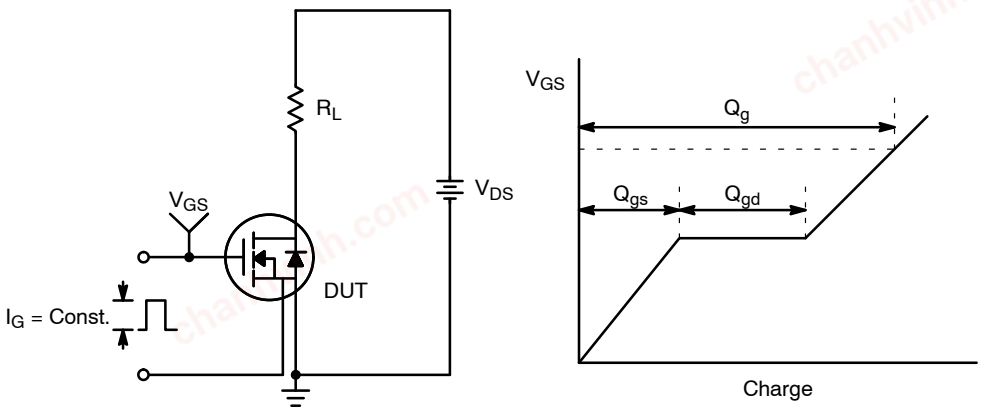


Figure 13. Gate Charge Test Circuit & Waveform

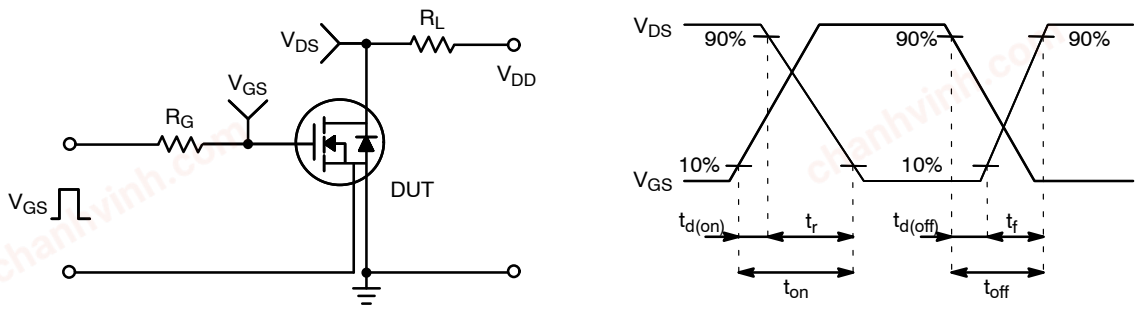


Figure 14. Resistive Switching Test Circuit & Waveforms

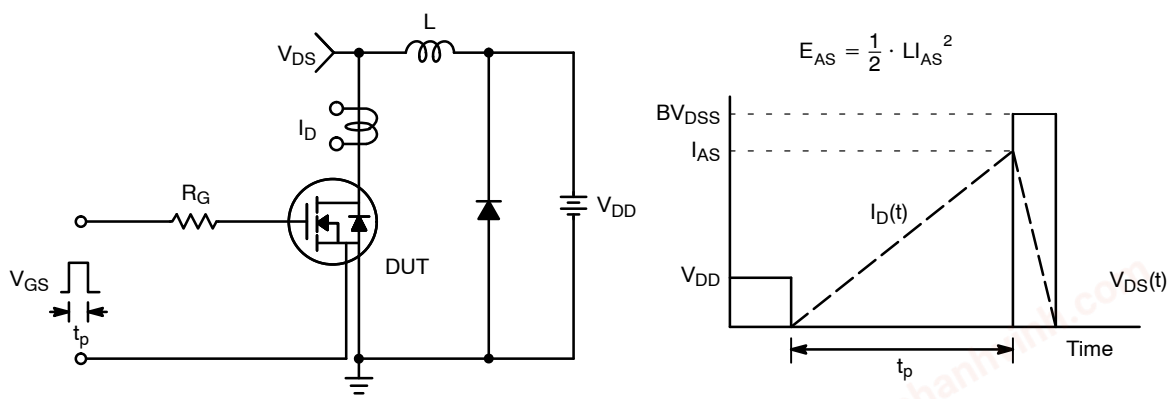


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

chanhvinh.com

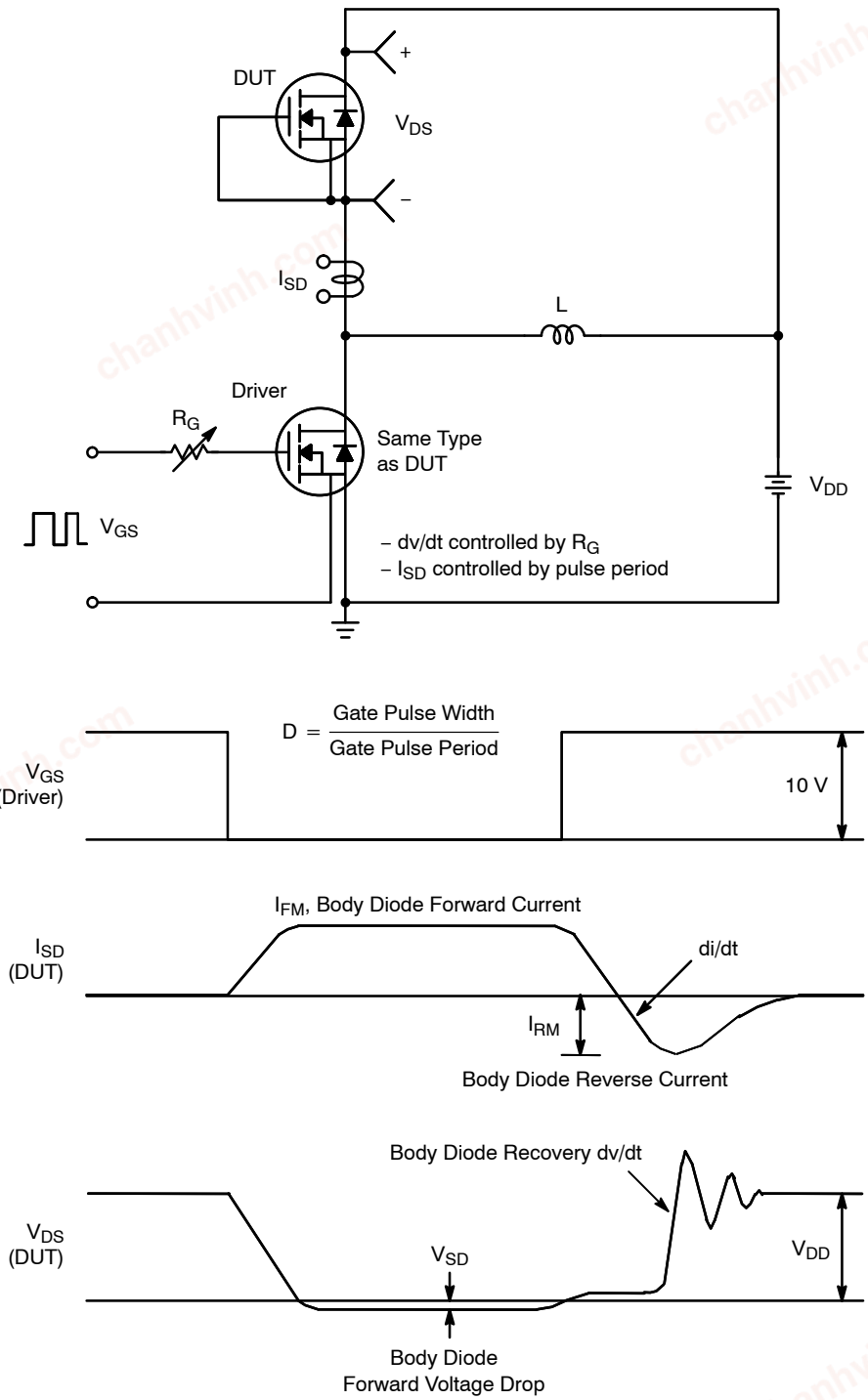


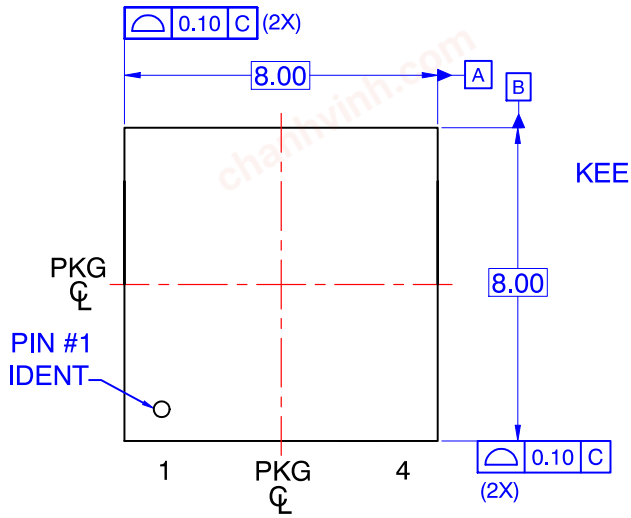
Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms

chanhvinh.com

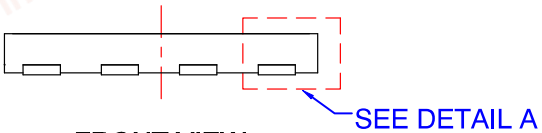
NTMT190N65S3HF

PACKAGE DIMENSIONS

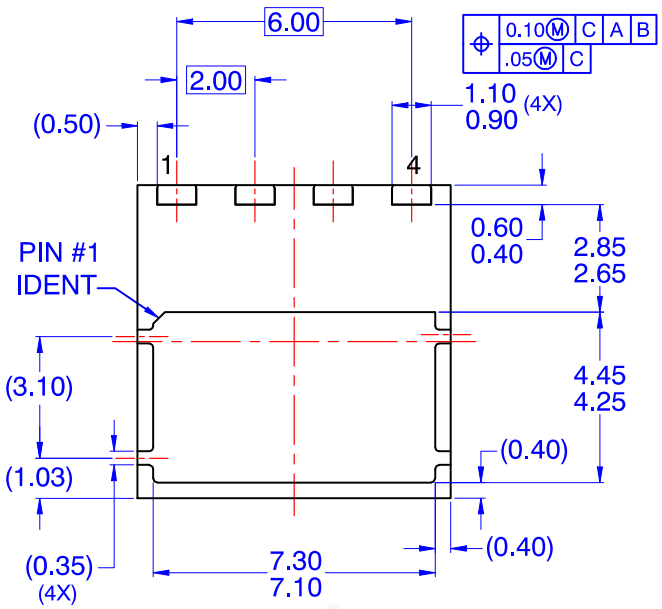
PQFN4 8X8, 2P
CASE 483AP
ISSUE O



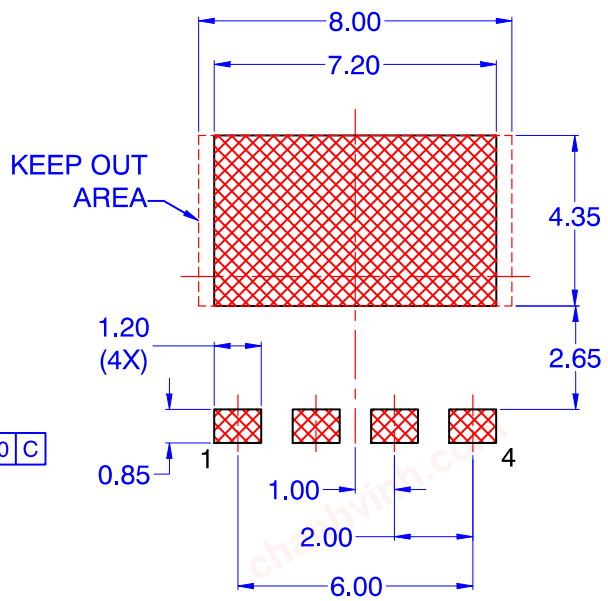
TOP VIEW



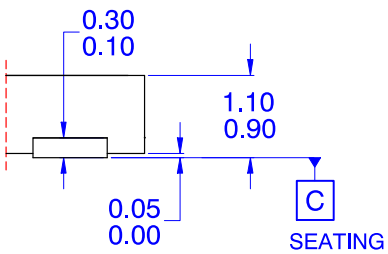
FRONT VIEW



BOTTOM VIEW



LAND PATTERN
RECOMMENDATION



DETAIL A
SCALE: 2X

NOTES: UNLESS OTHERWISE SPECIFIED
A) THIS PACKAGE IS NOT PRESENTLY REGISTERED WITH ANY STANDARDS COMMITTEE.
B) DIMENSIONS ARE INCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR PROTRUSIONS.
C) ALL DIMENSIONS ARE IN MILLIMETERS.
D) DRAWING CONFORMS TO ASME Y14.5M–1994.

chanhvinh.com

NTMT190N65S3HF

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

ON Semiconductor and 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−Marking.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

ON Semiconductor Website: www.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

◊