

NSH039N12C

N-Channel Enhanced Shielded Gate Trench Power MOSFET



Voltage: 120 Volts

Current: 167 Ampers

Polarity And Marking

Package: TO-220C

Features

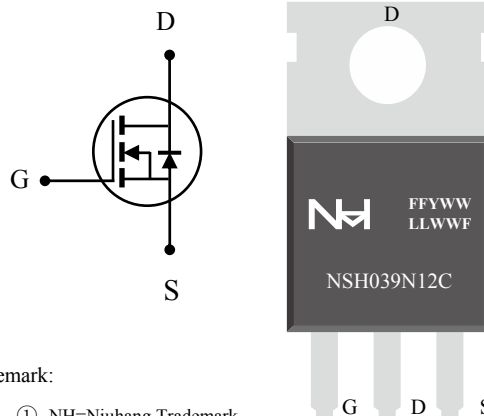
- NH'S Advanced SGT Technology
- Low Reverse Transfer Capacitances
- Low Gate Charge For Low Switching Loss
- Excellent $Q_g \cdot R_{ds(on)}$ Product(FOM)

Typical Applications

- Synchronous Rectification
- High-Frequency Circuits
- The Motor Drives
- Automotive Electronics
- Weight: App. 2.057 Grams (0.072557 Ounce)

Product Summary

V _{DS} Min.@T _j	120	V
I _D Min.@T _a	167	A
R _{DS(ON)} Typ.@10V	3.6	mΩ



Remark:

- ①. NH=Niuhang Trademark
- ②. FF=Product Line Code,According To Actual Changes
YWW=Date Code,According To Actual Changes
LLWWF=Internal Code,According To Actual Changes
- ③. NSH039N12C=Model

***100% UIS TESTED**

***100% ΔV_{DS} TESTED**

Absolute Maximum Ratings (T_a=25℃ Unless Otherwise Specified)

Parameter	Test Conditions	Symbol	Ratings	Unit
Drain-Source Voltage		V _{DS}	120	V
Gate-Source Voltage		V _{GS}	±20	V
Continuous Drain Current (Note 1)	T _a = 25 ℃	I _D	167	A
	T _a = 100 ℃		133.6	
Drain Current-Pulse (Note 1)	T _j < 175 ℃	I _{DM}	668	A
Maximum Power Dissipation Power Dissipation Derating Factor Above 25℃	T _a = 25 ℃	P _D	300	W
	T _a = 100 ℃		150	
Derating Factor		D _F	2.00	W/℃
Avalanche Current,Single Pulse (Note 1)	L= 0.3 mH	I _{AS}	60.0	A
Single Pulse Avalanche Energy (Note 1) Test Circuit & Waveform See Fig.16	L= 0.3 mH I _{AS} = 60.0 A,R _G = 10.0 Ω Starting T _j =25 ℃,V _G = 10.0 V	E _{AS}	540	mJ

Thermal Characteristics (T_a=25℃ Unless Otherwise Specified)

Parameter	Test Conditions	Symbol	Typ.	Unit
Junction Temperature		T _J	-55 to 175	℃
Storage Temperature Range		T _{STD}	-55 to 175	℃
Thermal Resistance Junction To Ambient With Steady-State	Still Air Environment With T _a =25℃	R _{θJA}	60.0	℃/W
Thermal Resistance Junction-Case With Steady-State	Device Mounted On 75mm x 45mm x 2.5mm Alu. Heat.	R _{θJC}	0.50	

Notes: 1.Pulse Width Limited By Max. Junction Temperature. (See Fig. 13).

NSH039N12C
N-Channel Enhanced Shielded Gate Trench Power MOSFET

Electrical Characteristics (Ta=25°C Unless Otherwise Specified)

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Static Off Characteristics						
Drain-Source Breakdown Voltage	VGS=0V,ID=250uA	BV _{DSS}	120	--	--	V
Bvdss Temperature Coefficient	ID=250uA,Reference25℃	ΔBV _{DSS} /ΔT _J	--	0.11	--	V/℃
Drain-Source Leakage Current	VDS= 120 V,VGS=0V	I _{DSS}	--	--	1	uA
Gate-Body Leakage Current	VGS= ±20 V,VDS=0V	I _{GSS}	--	--	±100	nA
Forward Transconductance	ID= 20.0 A,VDS= 5 V	g _{fs}	--	80.0	--	S
Static On Characteristics						
Gate Threshold Voltage	VGS= VDS ID=250uA	V _{GS(TH)}	2.0	3.0	4.0	V
Drain-Source On Resistance	ID= 20.0 A,VGS= 10.0 V	R _{DS(ON)}	--	3.6	4.5	mΩ
	ID= 20.0 A,VGS= 4.5 V		--	4.1	6.0	
Dynamic Characteristics						
Gate Resistance	VGS=0V,VDS=0V, Freq.=1MHz	R _g	--	2.7	--	Ω
Input Capacitance	VDS= 50 V	C _{iss}	--	5300.0	--	pF
Output Capacitance	VGS= 0 V	C _{oss}	--	620.0	--	pF
Reverse Transfer Capacitance	F= 1 MHZ	C _{rss}	--	12.0	--	pF
Switching Paramters (Test Circuit & Waveform See Fig.14)						
Turn-On Delay Time	VDS= 60 V	t _{d(on)}	--	20.0	--	ns
Turn-On Rise Time	VGS= 10.0 V	t _r	--	16.0	--	ns
Turn-Off Delay Time	RG= 10.0 Ω	t _{d(off)}	--	30.0	--	ns
Turn-Off Rise Time		t _f	--	10.0	--	ns
Gate Charge Paramters (Test Circuit & Waveform See Fig.15)						
Total Gate Charge	VDS= 60 V	Q _g	--	62.0	--	nC
Gate-Source Charge	VGS= 10.0 V	Q _{gs}	--	28.0	--	nC
Gate-Drain Charge	ID= 20.0 A	Q _{gd}	--	8.0	--	nC
Drain-Source Diode Characteristics And Maximum Ratings (Test Circuit & Waveform See Fig.17)						
Max. Diode Forward Cuurent		I _s	--	--	167.0	A
Max. Pulsed Forward Cuurent		I _{SM}	--	--	584.5	A
Diode Forward Voltage	ID= 20.0 A,VGS=0V	V _{SD}	--	0.90	1.3	V
Reverse Recovery Time	ID= 20.0 A,di/dt= 100 A/us	t _{rr}	--	50.0	--	ns
Reverse Recovery Charge	VGS= 10.0 V,VDD= 60 V	Q _{rr}	--	310.0	--	nC

NSH039N12C

N-Channel Enhanced Shielded Gate Trench Power MOSFET



Typical Characteristics Curves

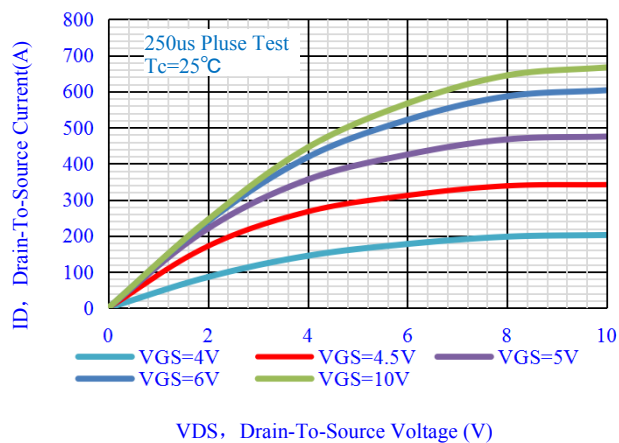


Fig.1-Output Characteristics

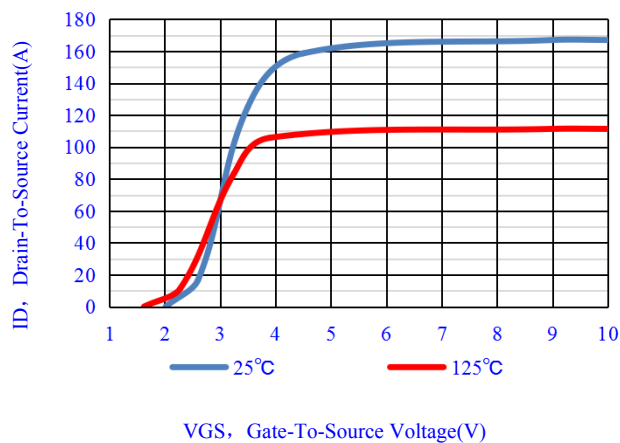


Fig.2- Transfer Characteristics

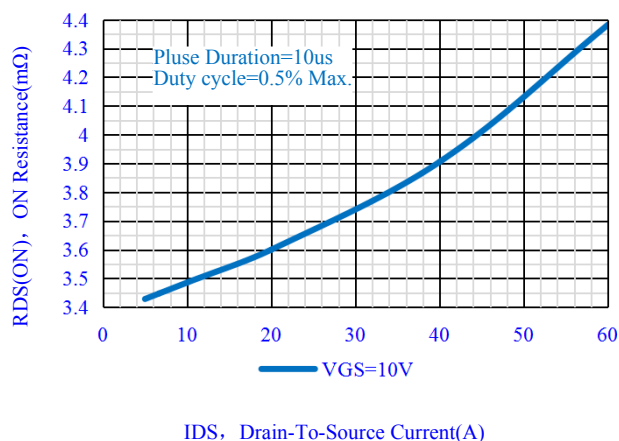


Fig.3- On Resistance vs. Drain Current

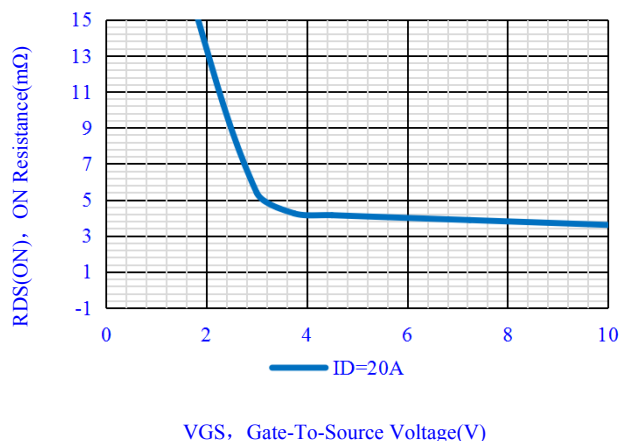


Fig.4- On Resistance vs. Gate Source Voltage

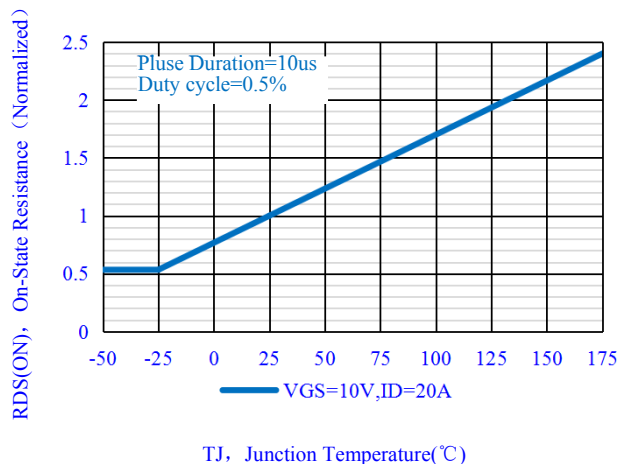


Fig.5- On Resistance vs. Junction Temperature

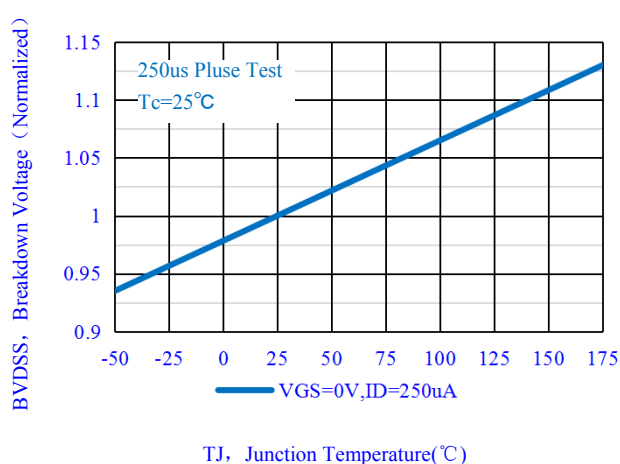


Fig.6- Breakdown Voltage vs. Junction Temperature

NSH039N12C

N-Channel Enhanced Shielded Gate Trench Power MOSFET



Typical Characteristics Curves

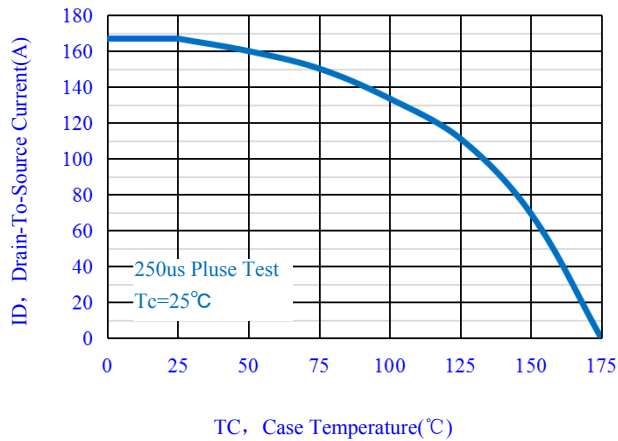


Fig.7-Maximum Continuous Drain Current vs. Case Temperature

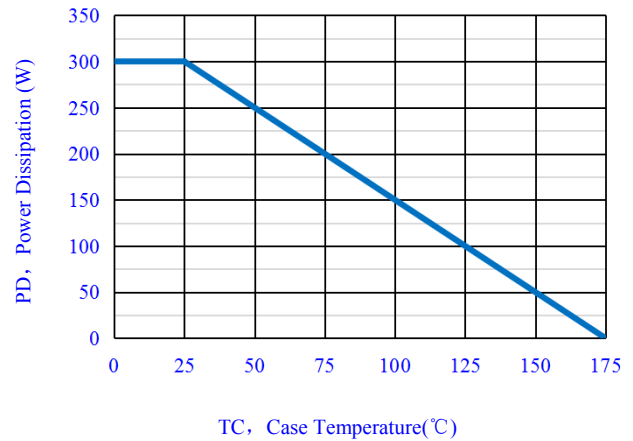


Fig.8-Maximum Power Dissipation vs. Case Temperature

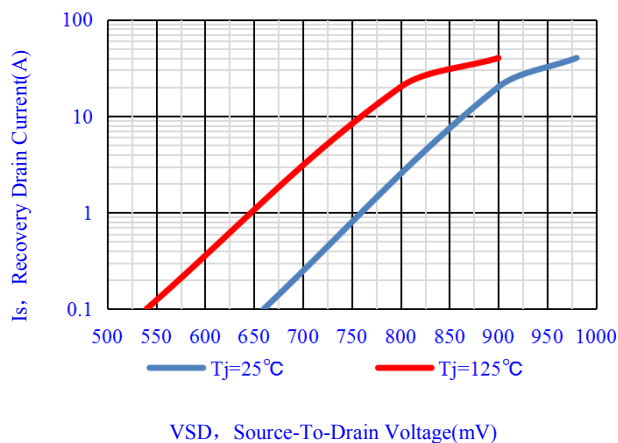


Fig.9- Source-To-Drain Diode Forward Voltage

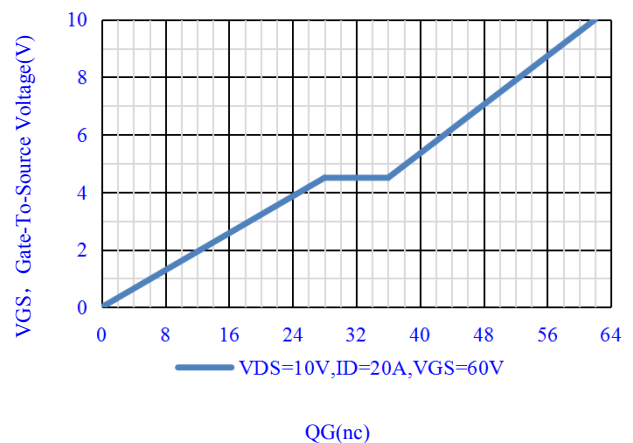


Fig.10-Gate Charge Waveform

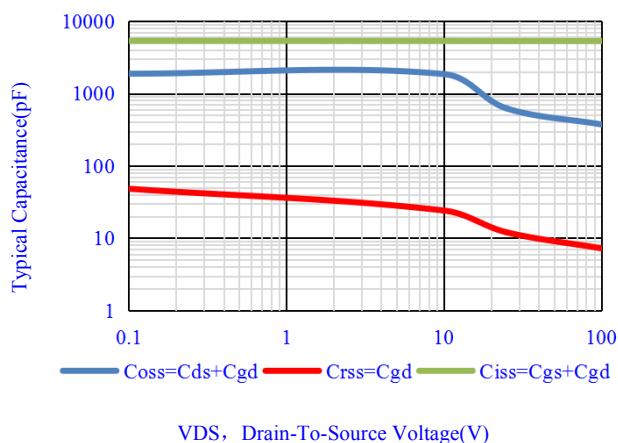


Fig.11-Typical Capacitance vs. Drain-To-Source Voltage

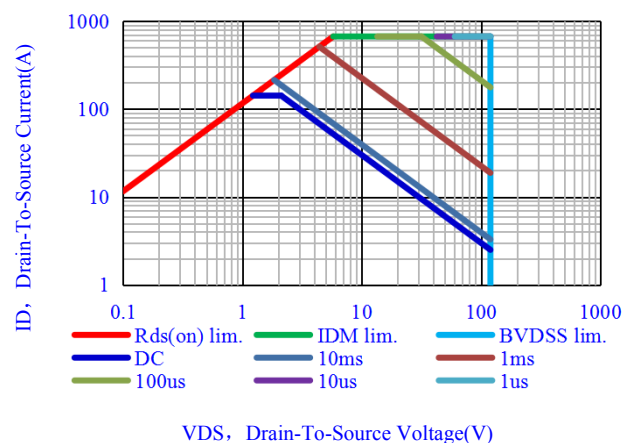


Fig.12-Maximum Safe Operating Area(SOA)

NSH039N12C

N-Channel Enhanced Shielded Gate Trench Power MOSFET



Typical Characteristics Curves

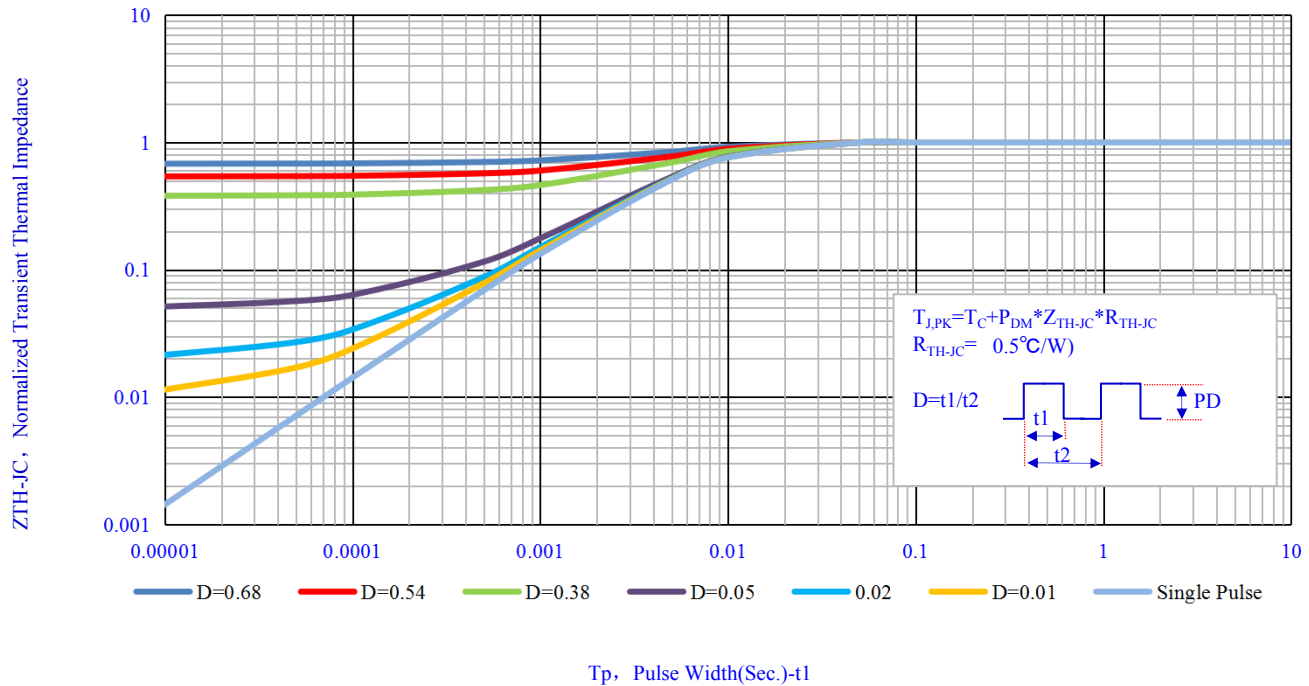


Fig.13- Normalized Maximum Transient Thermal Impedance vs.Pulse Width

Test Circuit & Waveform

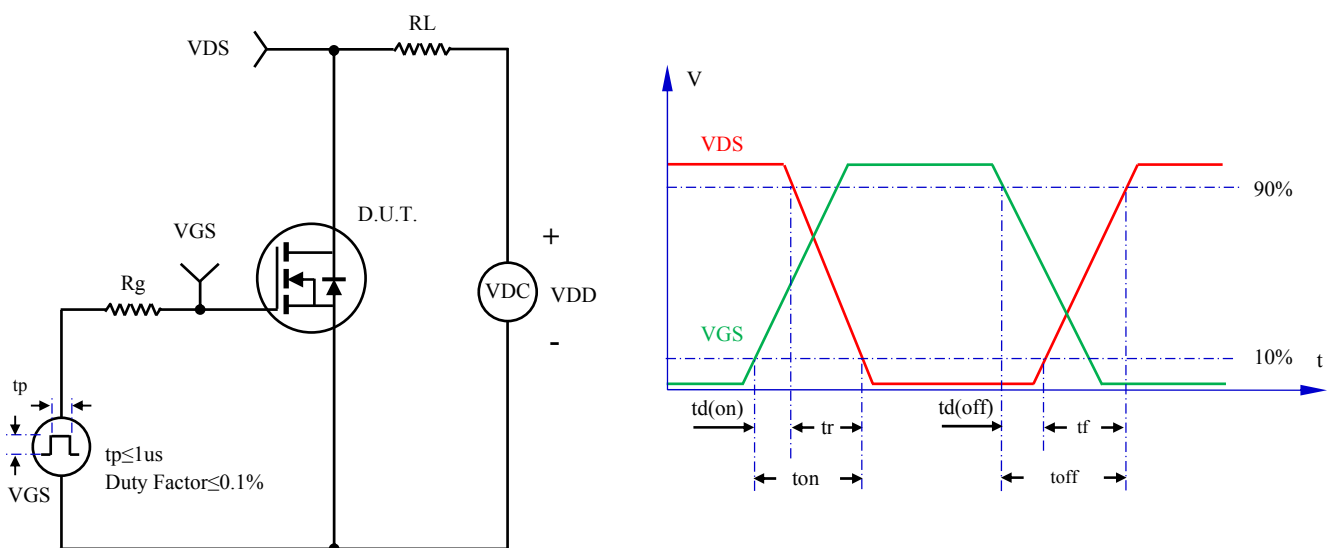


Fig.14- Resistive Switching Test Circuit & Waveform

NSH039N12C

N-Channel Enhanced Shielded Gate Trench Power MOSFET



Test Circuit & Waveform

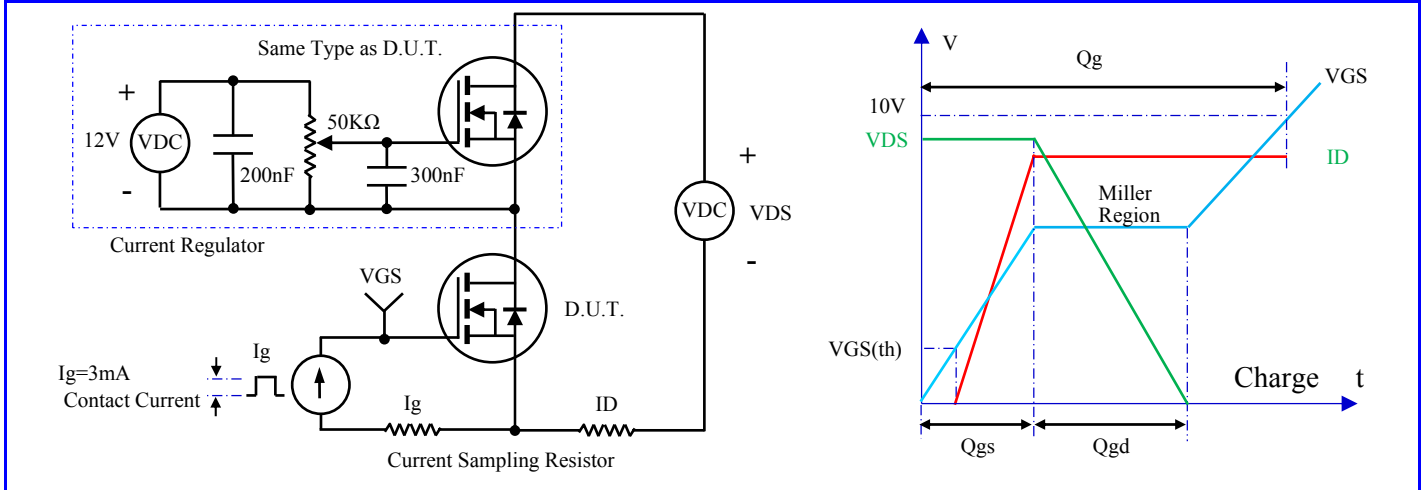


Fig.15- Gate Charge Test Circuit & Waveform

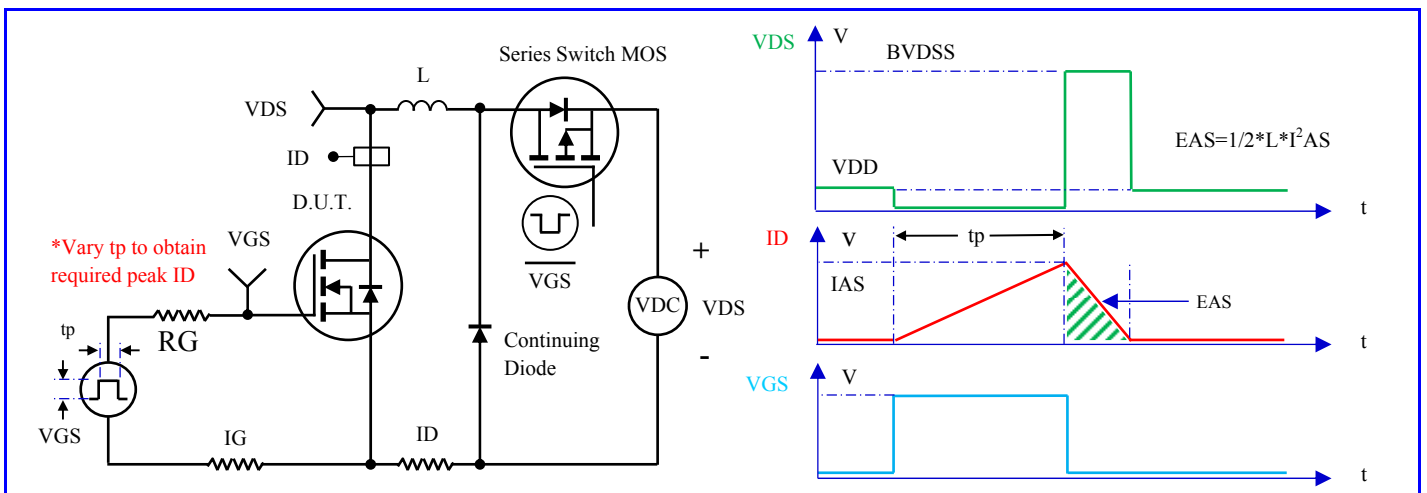


Fig.16- Unclamped Inductive Switching (UIS) Test Circuit & Waveform

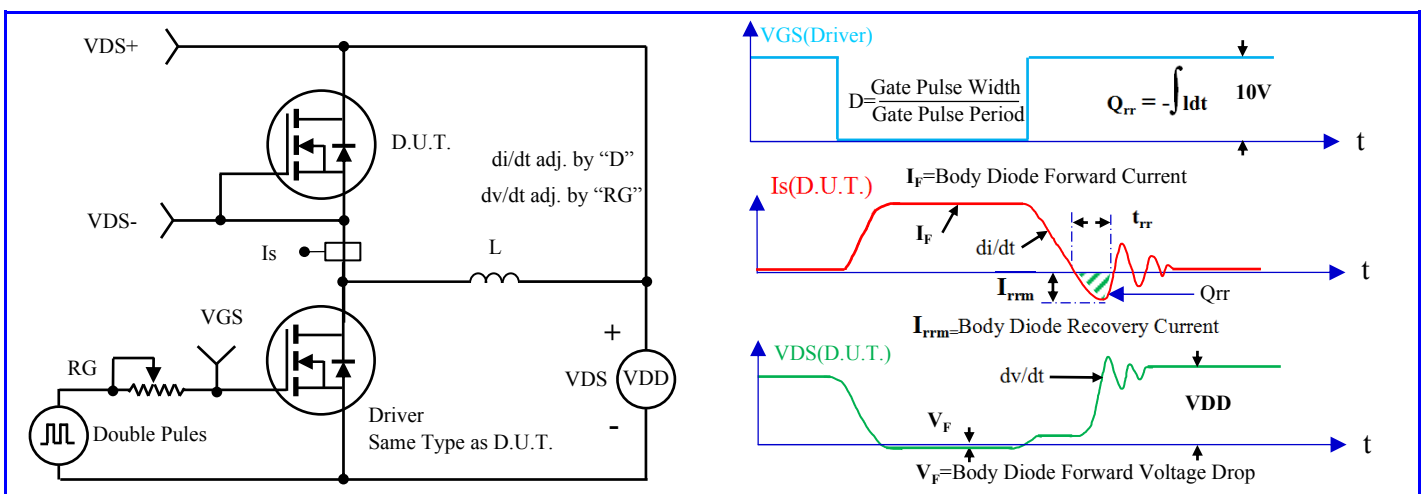


Fig.17- Diode Recovery Test Circuit & Waveform

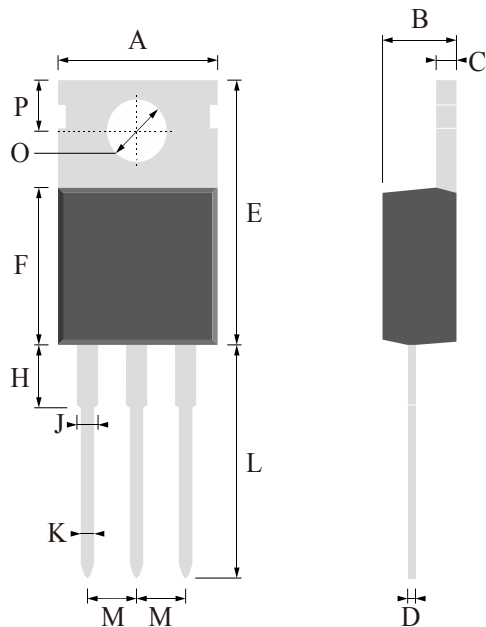
NSH039N12C

N-Channel Enhanced Shielded Gate Trench Power MOSFET



OUTLINE DRAWINGS

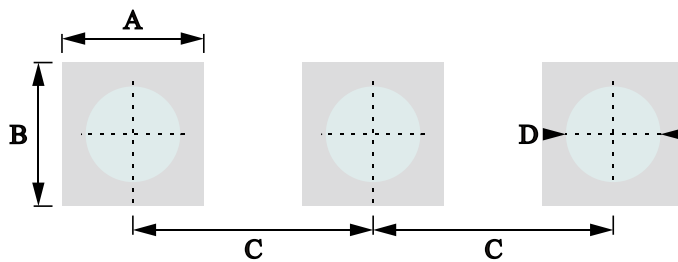
TO-220C



OUTLINE DIMENSIONS						
Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	9.25	-	10.75	0.3642	-	0.4232
B	1.10	-	1.65	0.0433	-	0.0650
C	4.15	-	4.95	0.1634	-	0.1949
D	0.25	-	0.65	0.0098	-	0.0256
E	14.50	-	16.70	0.5709	-	0.6575
F	8.40	-	9.95	0.3307	-	0.3917
L	12.15	-	14.30	0.4783	-	0.5630
H	3.00	-	3.80	0.1181	-	0.1496
J	1.05	-	1.60	0.0413	-	0.0630
K	0.65	-	0.95	0.0256	-	0.0374
M	2.10	-	2.90	0.0827	-	0.1142
O	3.20	-	4.10	0.1260	-	0.1614
P	2.45	-	3.10	0.0965	-	0.1220

RECOMMENDED LAYOUT DRAWINGS

TO-220C



OUTLINE DIMENSIONS						
Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	-	1.60	-	-	0.0630	-
B	-	1.60	-	-	0.0630	-
C	-	2.54	-	-	0.1000	-
D	-	1.00	-	-	0.0394	-

PACKING INFORMATION

Package Code	Package Method	Min. Pack. Size (mm)	Quantity (Pcs/Min. Pack.)	Inner Box Size L×W×H(mm)	Quantity (Pcs/Inner Box)	Outer Carton Size L×W×H(mm)	Quantity (Pcs/Carton)
TO-220C	T/P	545x35x7	50	570x155x40	1000	585x235x185	5000

NSH039N12C

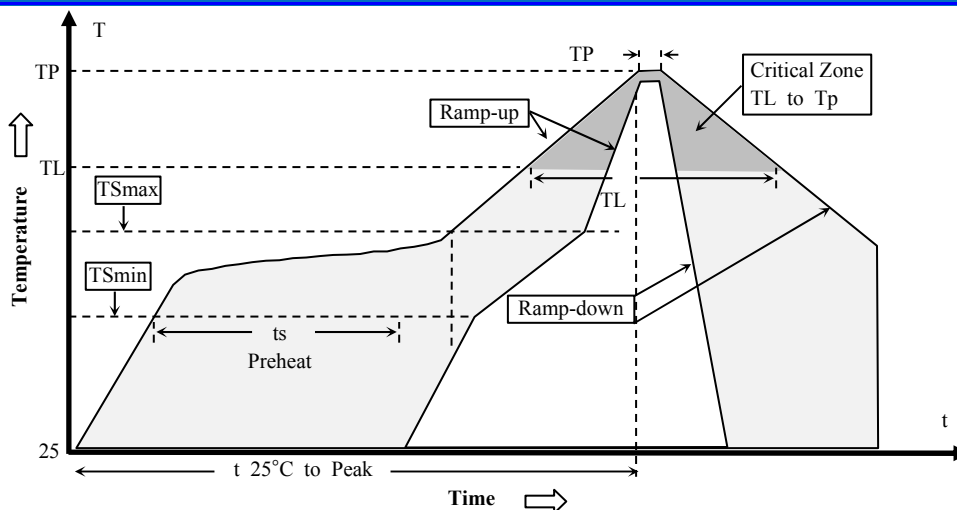
N-Channel Enhanced Shielded Gate Trench Power MOSFET



Recommended wave soldering condition

Product	Peak Temperature	Soldering Time
Pb-free devices	260 +0/-5 °C	5 +1/-1 seconds

Recommended temperature profile for IR reflow



Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (T _{smax} to T _p)	3°C/second max.	3°C/second max.
Preheat -Temperature Min(T _S min) -Temperature Max(T _S max) -Time(t _s min to t _s max)	100°C 150°C 60-120 seconds	150°C 200°C 60-180 seconds
Time maintained above: -Temperature (T _L) - Time (t _L)	183°C 60-150 seconds	217°C 60-150 seconds
Peak Temperature(T _P)	240 +0/-5 °C	260 +0/-5 °C
Time within 5°C of actual peak temperature(tp)	10-30 seconds	20-40 seconds
Ramp down rate	6°C/second max.	6°C/second max.
Time 25 °C to peak temperature	6 minutes max.	8 minutes max.

Note : All temperatures refer to topside of the package, measured on the package body surface.

NSH039N12C

N-Channel Enhanced Shielded Gate Trench Power MOSFET



Disclaimer

- Reproducing and modifying information of the document is prohibited without permission from niuhang Electronics Technology co., LTD
- Niuhan Electronics Technology co., LTD. reserves the rights to make changes of the content herein the document anytime without notification.
- Niuhan Electronics Technology co., LTD. disclaims any and all liability arising out of the application or use of any product including damages incidentally and consequentially occurred.
- Niuhan Electronics Technology co., LTD. does not assume any and all implied warranties,including warranties of fitness for particular purpose,non-infringement and merchantability.
- Applications shown on the herein document are examples of standard use and operation.Customers are responsible in comprehending the suitable use in particular applications.niuhan Electronics Technology co., LTD.makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.
- The products shown herein are not designed and authorized for equipments requiring high level of reliability or relating to human life and for any applications concerning life-saving or life-sustaining,such as medical instruments.transportation equipment,aerospae machinery et cetera.Customers usin or selling these products for use in such applications do so at their own rish and agree to fully indemnify niuhang Electronics Technology co., LTD.for any damages resulting resulting from such improper use or sale.
- When the appearance of the product and chip size does not change, in order to product the customer. quality, change the internal structure and the production process Niuhan can not notify