NSH024N06C

N-Channel Enhanced Shielded Gate Trench Power MOSFET

Pb-Free RoHS COMPLIANT

Voltage:	60	Volts	**Current:**	162	Amperes	**Package:**	TO-220C

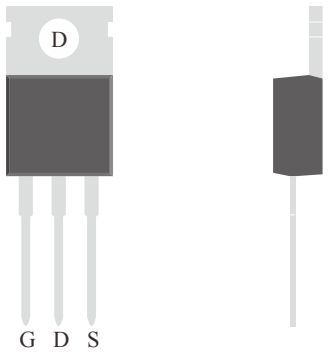
Features

- NH'S Advanced SGT Technology
- Low Reverse Transfer Capacitances
- Low Gate Charge For Low Switching Loss
- Excellent Qg*Rds(on) Product(FOM）

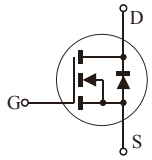
Typical Applications

- Synchronous Rectification
- High-Frequency Circuits
- The Motor Drives
- Automotive Electronics

Diagram:



Polarity:



Product Summary

VDS Min.@T_j	60	**V**
I_D Min.@Ta	162	**A**
RDS(ON)(TYP)@10V	2.9	**mΩ**

***100% UIS TESTED**

***100% ΔVDS TESTED**

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

Parameter	Test Conditions	Symbol	Ratings	Unit
Drain-Source Voltage		V_{DS}	60	V
Gate-Source Voltage		V_{GS}	±20	V
Continuous Drain Current (Note 1)	Ta= 25 ℃ Ta= 100 ℃	I_D	162 104	A
Drain Current-Pulse (Note 1)	T_J< 150 ℃	I_{DM}	648	A
Maximum Power Dissipation Power Dissipation Derating Factor Above 25℃	Ta= 25 ℃ Ta= 100 ℃	P_D	171 68	W
Derating Factor		D_F	1.37	W/℃
Avalanche Current,Single Pulse (Note 1)	L= 0.5 mH	I_{AS}	47	A
Single Pulse Avalanche Energy (Note 1) Test Circuit & Waveform See Fig.17	L= 0.5 mH IAS= 47 A,RG= 10.0 Ω Starting Tj=25 ℃,VG = 10.0 V	E_{AS}	552	mJ

Thermal Characteristcs (Ta=25℃ Unless Otherwise Specified)

Parameter	Test Conditions	Symbol	Typ.	Unit
Junction Temperature		T_J	-55 to 150	℃
Storage Temperature Range		T_{STD}	-55 to 150	℃
Thermal Resistance Junction To Ambient With Steady-State	Still Air Environment With Ta=25℃	$R_{\theta JA}$	62	℃/W
Thermal Resistance Junction-Case With Steady-State	Device Mounted On 75mm x 45mm x 2.5mm Alu. Heat.	$R_{\theta JC}$	0.73	

Notes: 1.Pulse Width Limited By Max. Junction Temperature. (See Fig.14)

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Electrical Characteristcs (Ta=25℃ Unless Otherwise Specified)

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Static Off Characteristics						
Drain-Source Breakdown Voltage	VGS=0V,ID=250uA	BV_{DSS}	60	--	--	V
Bvdss Temperature Coefficient	ID=250uA,Reference25℃	$\Delta BV_{DSS}/\Delta T_J$	--	0.07	--	V/℃
Drain-Source Leakage Current	VDS= 60 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	gfs	--	35	--	S
Static On Characteristics						
Gate Threshold Voltage	VGS= VDS ID=250uA	$V_{GS(TH)}$	2	3	4	V
Drain-Source On Resistance	ID= 20.0 A,VGS= 10.0 V	$R_{DS(ON)}$	--	2.9	3.8	mΩ
	ID= 20.0 A,VGS= 5.0 V		--	4.2	5.7	
Dynamic Characteristics						
Gate Resistance	VGS=0V,VDS=0V, Freq.=1MHz	R_g	--	0.85	--	Ω
Input Capacitance	VDS= 30 V	C_{iss}	--	3030	--	pF
Output Capacitance	VGS= 0 V	C_{oss}	--	1140	--	pF
Reverse Transfer Capacitance	F= 1 MHZ	C_{rss}	--	44	--	pF
Switching Paramters With Inductive Load(Test Circuit & Waveform See Fig.15)						
Turn-On Delay Time	VDS= 30 V	$t_{d(on)}$	--	14	--	ns
Turn-On Rise Time	VGS= 10.0 V	t_r	--	26	--	ns
Turn-Off Delay Time	RG= 10.0 Ω	$t_{d(off)}$	--	32	--	ns
Turn-Off Rise Time	L= 0.5 mH	t_f	--	15	--	ns
Gate Charge Paramters (Test Circuit & Waveform See Fig.16)						
Total Gate Charge	VDS= 30 V	Q_g	--	61	--	nC
Gate-Source Charge	VGS= 10.0 V	Q_{gs}	--	14	--	nC
Gate-Drain Charge	ID= 20.0 A	Q_{gd}	--	10	--	nC
Drain-Source Diode Characteristics And Maximum Ratings (Test Circuit & Waveform See Fig.18)						
Max. Diode Forward Current		I_S	--	--	162.0	A
Max. Pulsed Forward Current		I_{SM}	--	--	648	A
Diode Forward Voltage	ID= 20.0 A,VGS=0V	V_{SD}	--	0.7	1.3	V
Reverse Recovery Time	IS= 20.0 A,di/dt= 100 A/us	t_{rr}	--	50	--	ns
Reverse Recovery Charge	VGS= 0.0 V	Q_{rr}	--	57	--	nC
Reverse Recovery Current		I_{RRM}	--	2.0	--	A

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Typical Characteristics Curves

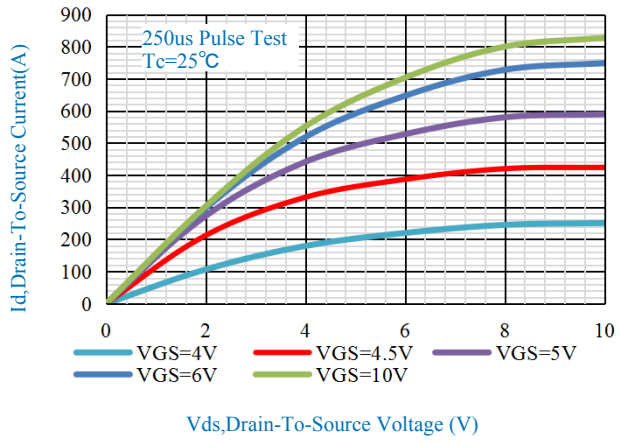


Fig.1-Output Characteristic

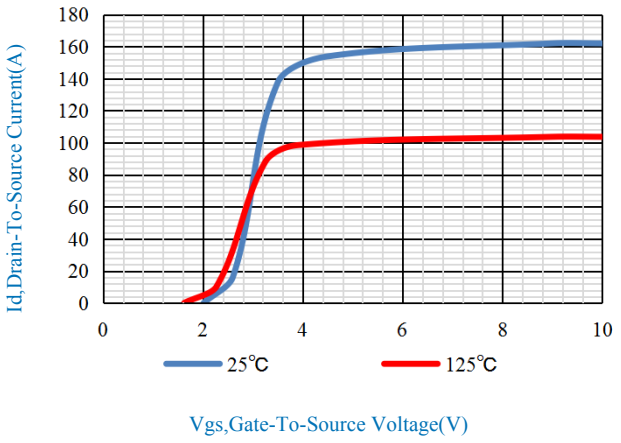


Fig.2-Transfer Characteristic

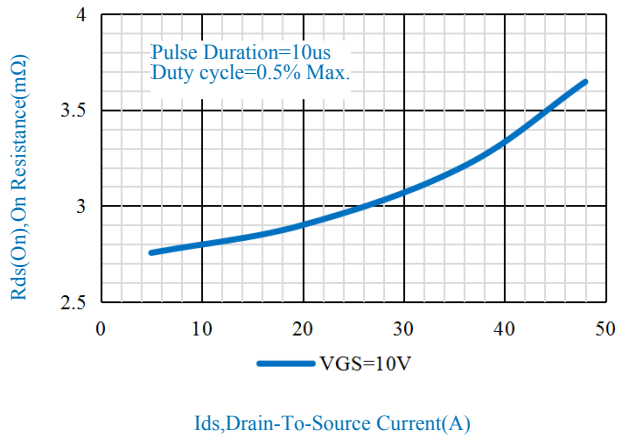


Fig.3-On Resistance Vs. Drain Current

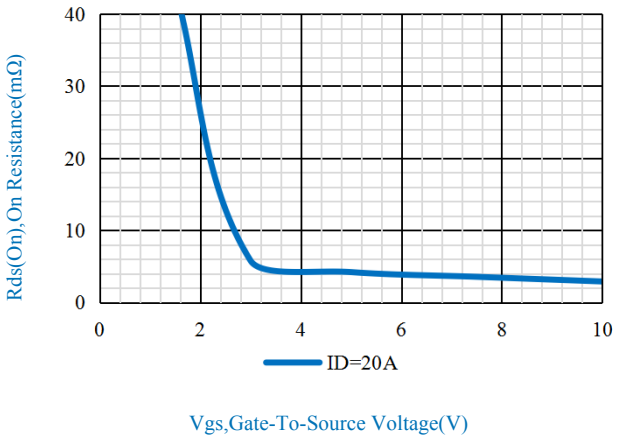


Fig.4-On Resistance Vs. Gate Source Voltage

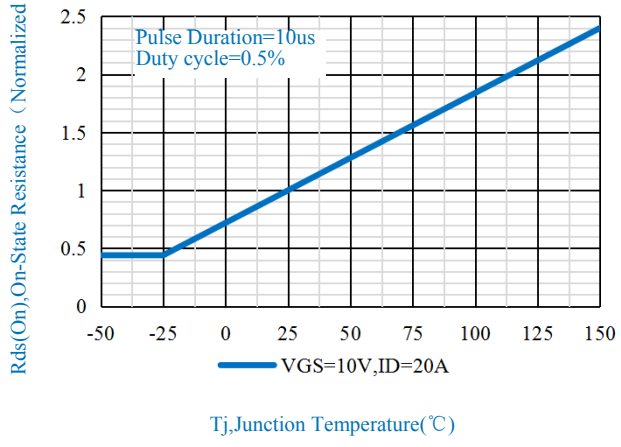


Fig.5-On Resistance Vs. Junction Temperature

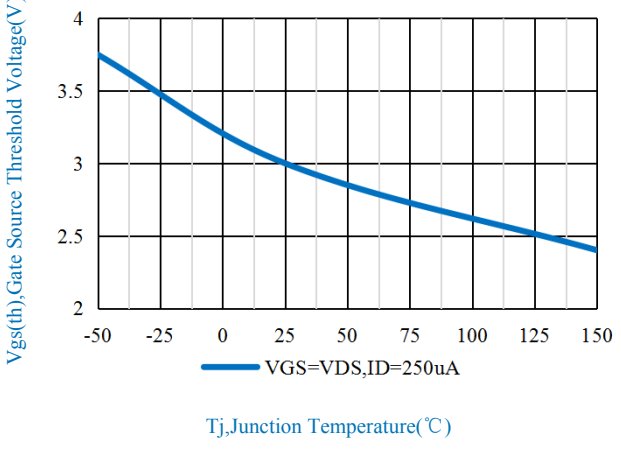


Fig.6-Gate Source Threshold Voltage Vs. Junction Temperature

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Typical Characteristics Curves

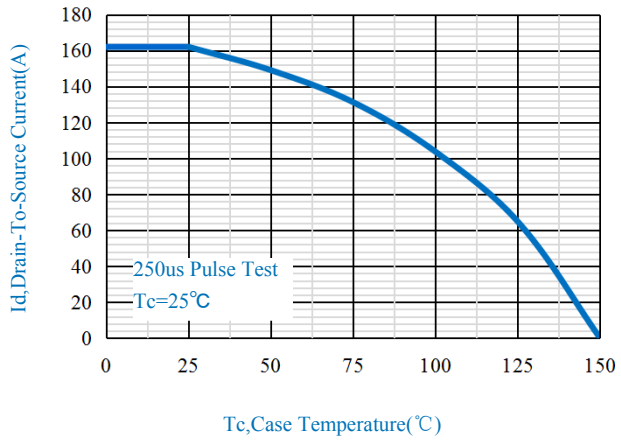


Fig.7-Maximum Continuous Drain Current Vs. Case Temperature

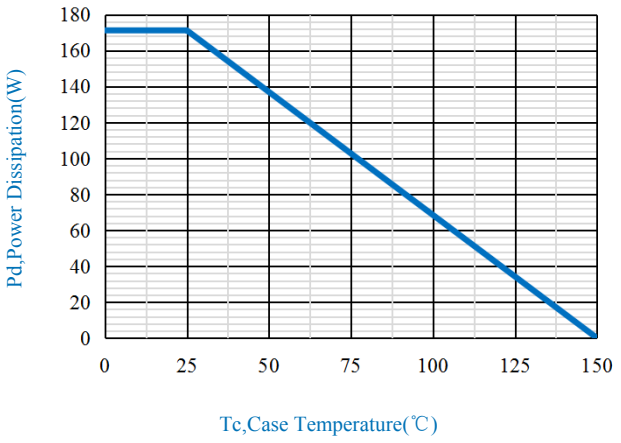


Fig.8-Maximum Power Dissipation Vs. Case Temperature

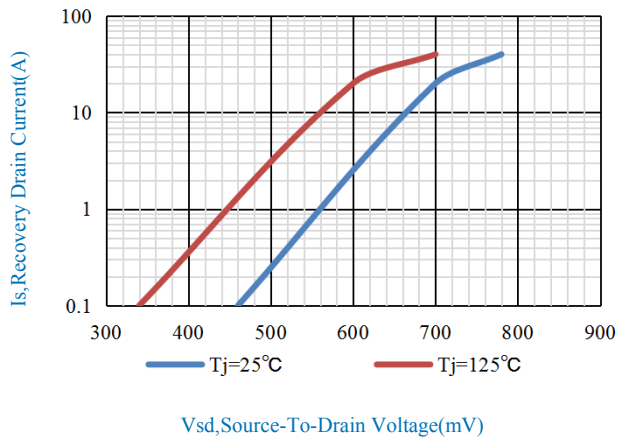


Fig.9-Source-To-Drain Diode Forward Voltage

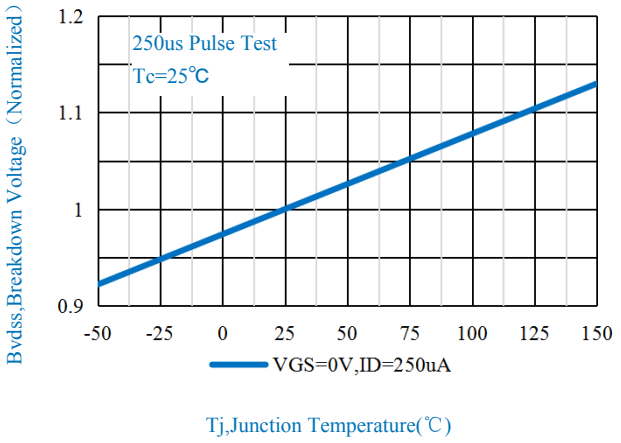


Fig.10-Breakdown Voltage Vs. Junction Temperature

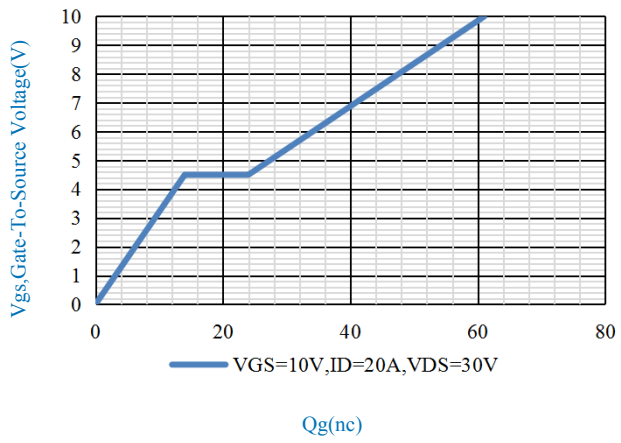


Fig.11-Gate Charge Waveform

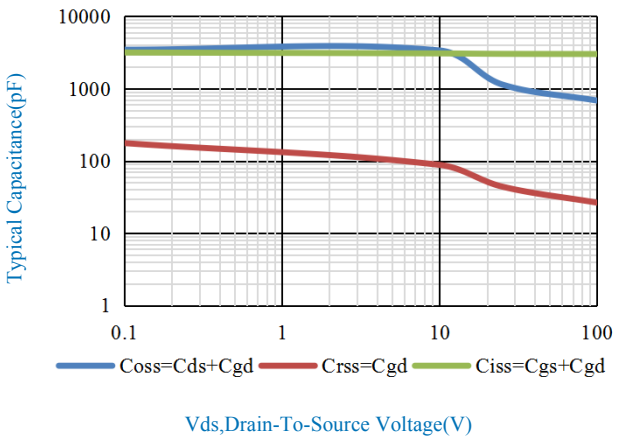


Fig.12-Typical Capacitance Vs. Drain-To-Source Voltage

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Typical Characteristics Curves

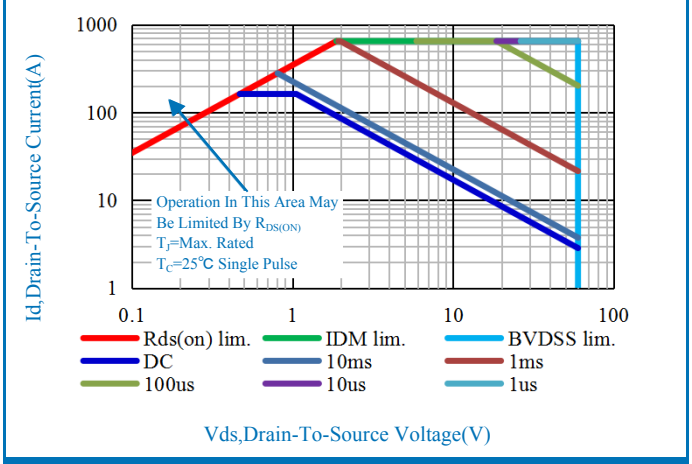


Fig.13-Maximum Safe Operating Area(SOA)

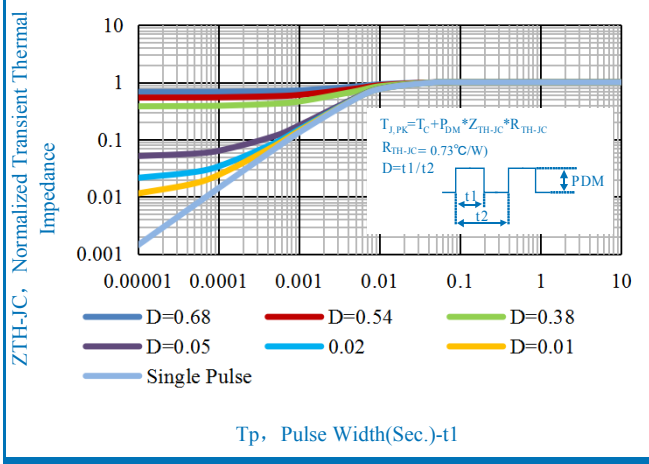
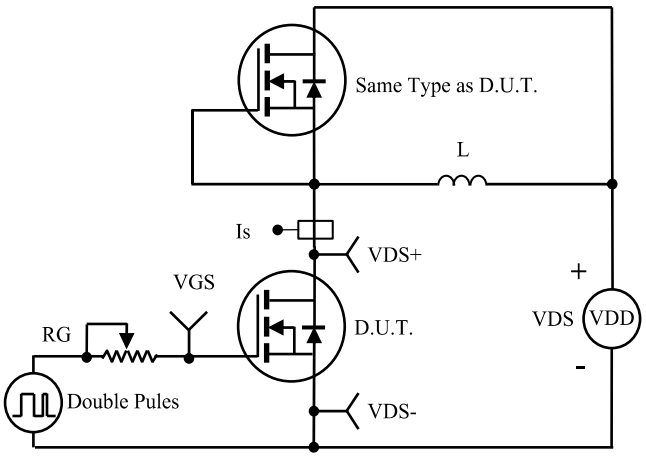


Fig.14- Normalized Maximum Transient Thermal Impedance Vs.Pulse Width

Inductive Load Test Circuit & Waveform



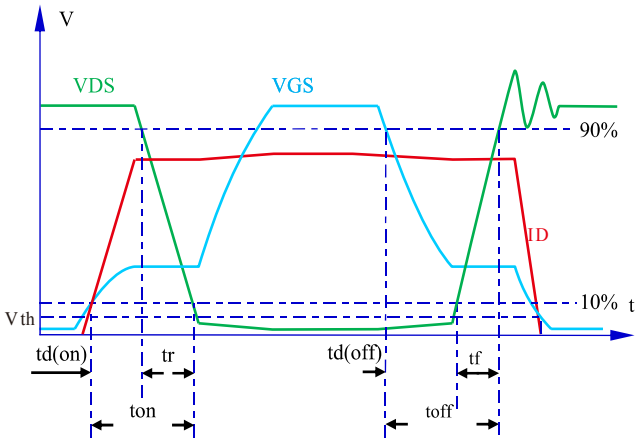


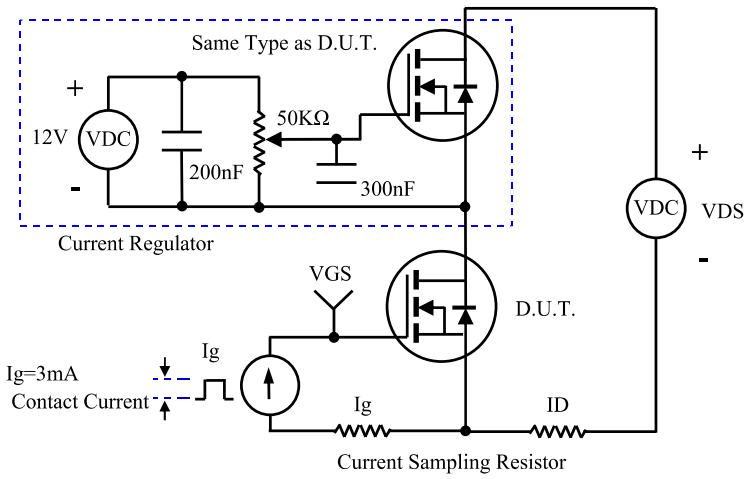
Fig.15- Inductive Switching Test Circuit & Waveform

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Test Circuit & Waveform



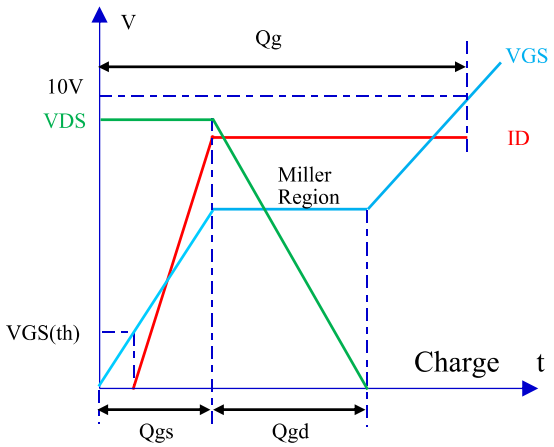
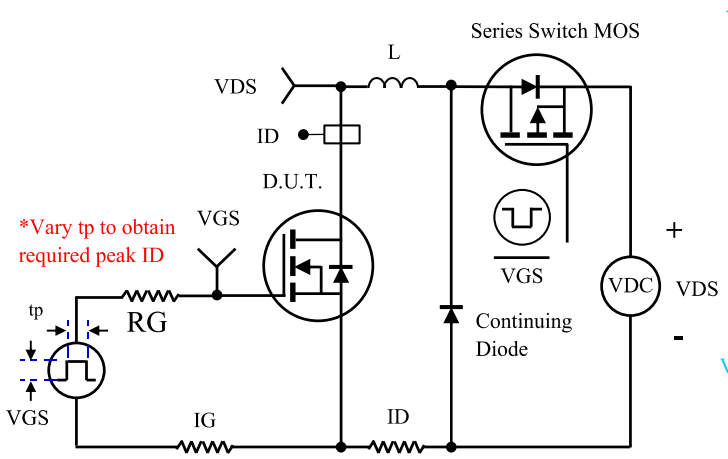


Fig.16-Gate Charge Test Circuit & Waveform



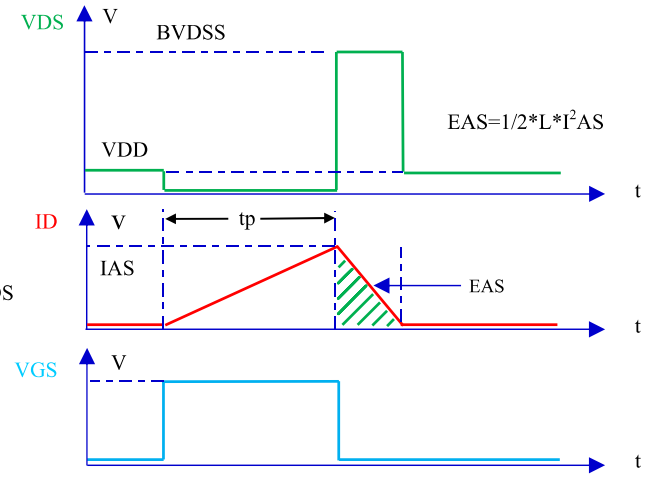
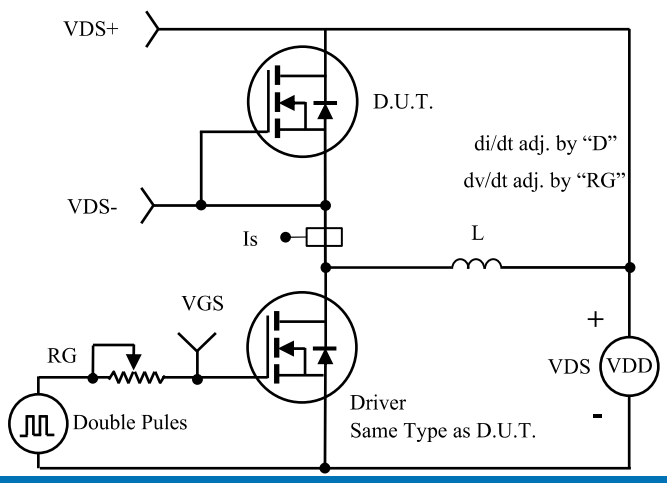


Fig.17- Unclamped Inductive Switching (UIS) Test Circuit & Waveform



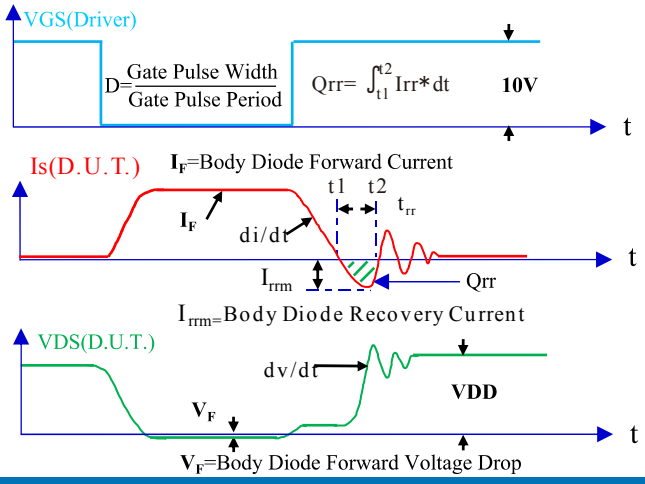


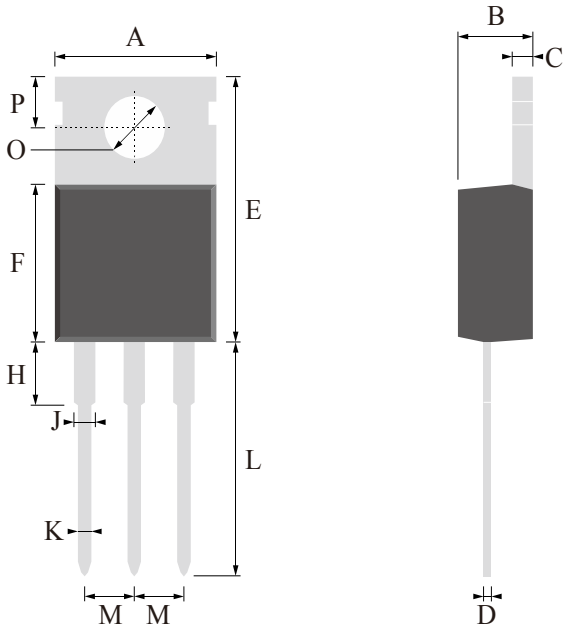
Fig.18- Diode Recovery Test Circuit & Waveform

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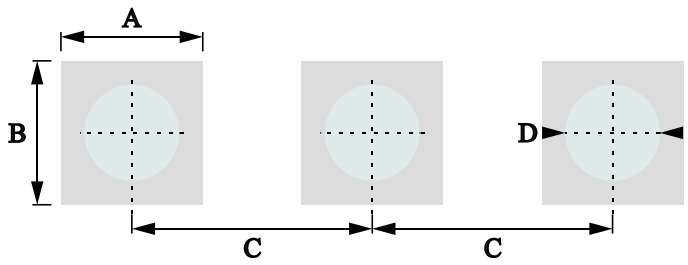
OUTLINE DRAWINGS



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OUTLINE DIMENSIONS						
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	9.25	-	10.75	0.3642	-	0.4232
B	4.15	-	4.95	0.1634	-	0.1949
C	1.10	-	1.65	0.0433	-	0.0650
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

RECOMMEDNED LAYOUT DRAWINGS



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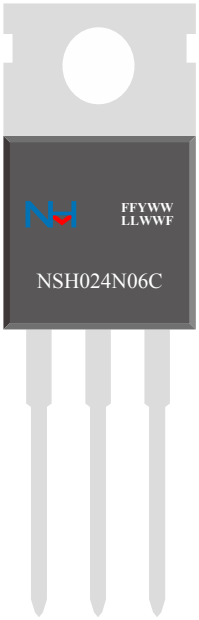
OUTLINE DIMENSIONS						
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	-	1.60	-	-	0.0630	-
B	-	1.60	-	-	0.0630	-
C	-	2.54	-	-	0.1000	-
D	-	1.00	-	-	0.0394	-

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MARKING



MARKING INSTRUCTION

NH=Niuhang Trademark

FF=Product Line Code,According To Actual Changes

YWW=Date Code,According To Actual Changes

LLWWF=Inernal Code,According To Actual Changes

NSH024N06C=Model

PACKING INFORMATION

Package Type	Package Code	Productor Weight Approx(g/Pcs)	Package Method	Quantity (Pcs/Min. Pack.)	Quantity (Pcs/Inner Box)	Quantity (Pcs/Carton)
TO-220C	P1	2.057	Tube	50	1000	5000

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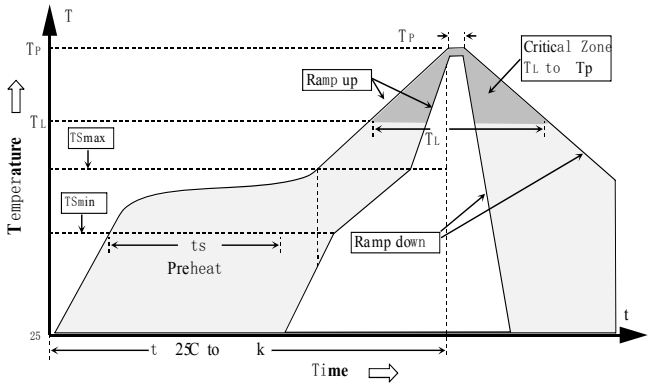
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Recommended wave soldering condition

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 (Tsmax to Tp)	3°C/second max.	3°C/second max.
Preheat−Temperature Min (TS min) −Temperature Max (TS max) −Time(ts min to ts max)	100°C 150°C 60-120 seconds	150°C 200°C 60-180 seconds
Time maintained above: −Temperature (TL) − Time (tL)	183°C 60-150 seconds	217°C 60-150 seconds
Peak Temperature(TP)	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.

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Specification Revision History

Rev.	Date	Changed Items	Pre-Changed Content	Changed Content
A/1	2014-10-20	First Issue		

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