

NSH013N06L5



N-Channel Enhanced Shielded Gate Trench Power MOSFET

Voltage: 60 Volts

Current: 223 Ampers

Package: LFPAK5*6

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)

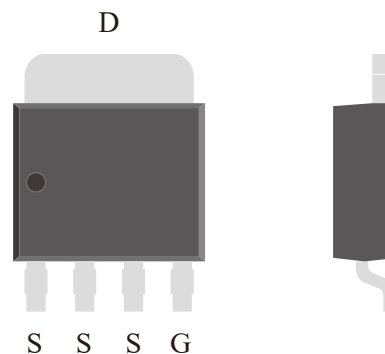
Typical Applications

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

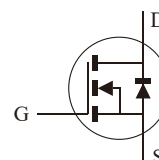
Product Summary

VDS Min.@T _j	60	V
I _D Min.@Ta	223.0	A
RDS(ON)(TYP)@10V	1.3	mΩ

Diagram:



Polarity:



***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 ℃	I _D	223	A
	Ta= 100 ℃		178	
Drain Current-Pulse (Note 1)	T _j < 175 ℃	I _{DM}	558	A
Maximum Power Dissipation Power Dissipation Derating Factor Above 25℃	Ta= 25 ℃	P _D	167	W
	Ta= 100 ℃		83	
Derating Factor		D _F	1.11	W/℃
Avalanche Current,Single Pulse (Note 1)	L= 0.5 mH	I _{AS}	33.0	A
Single Pulse Avalanche Energy (Note 1) Test Circuit & Waveform See Fig.16	L= 0.5 mH IAS= 33.0 A, RG= 10.0 Ω Starting T _j =25 ℃, VG= 10.0 V	E _{AS}	272	mJ

Thermal Characteristics (Ta=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 Ta=25℃	R _{θJA}	45.0	℃/W
Thermal Resistance Junction-Case With Steady-State	Device Mounted On 1 in2 FR-4 Board With 2oz. Copper	R _{θJC}	0.90	

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

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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}	60	--	--	V
Bvdss Temperature Coefficient	ID=250uA,Reference25℃	ΔBV _{DSS} /ΔT _J	--	0.06	--	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	g _{fs}	--	48.0	--	S
Static On Characteristics						
Gate Threshold Voltage	VGS= VDS ID=250uA	V _{GS(TH)}	2.1	2.6	3.1	V
Drain-Source On Resistance	ID= 20.0 A,VGS= 10.0 V	R _{DS(ON)}	--	1.3	1.55	mΩ
	ID= 20.0 A,VGS= 4.5 V		--	1.5	2.1	
Dynamic Characteristics						
Input Capacitance	VDS= 30 V	C _{iss}	--	7100.0	--	pF
Output Capacitance	VGS= 0 V	C _{oss}	--	8400.0	--	pF
Reverse Transfer Capacitance	F= 1 MHZ	C _{rss}	--	74.0	--	pF
Switching Paramters (Test Circuit & Waveform See Fig.14)						
Turn-On Delay Time	VDS= 30 V	t _{d(on)}	--	20.0	--	ns
Turn-On Rise Time	VGS= 10.0 V	t _r	--	10.0	--	ns
Turn-Off Delay Time	RG= 10.0 Ω	t _{d(off)}	--	55.0	--	ns
Turn-Off Rise Time		t _f	--	72.0	--	ns
Gate Charge Paramters (Test Circuit & Waveform See Fig.15)						
Total Gate Charge	VDS= 30 V	Q _g	--	93.0	--	nC
Gate-Source Charge	VGS= 10.0 V	Q _{gs}	--	27.0	--	nC
Gate-Drain Charge	ID= 20.0 A	Q _{gd}	--	12.0	--	nC
Drain-Source Diode Characteristics And Maximum Ratings (Test Circuit & Waveform See Fig.17)						
Max. Diode Forward Cuurent		I _s	--	--	223	A
Max. Pulsed Forward Cuurent		I _{SM}	--	--	558	A
Diode Forward Voltage	ID= 20.0 A,VGS=0V	V _{SD}	--	0.72	1.1	V
Reverse Recovery Time	ID= 20.0 A,di/dt= 100 A/us	t _{rr}	--	55.0	--	ns
Reverse Recovery Charge	VGS= 10.0 V,VDD= 30 V	Q _{rr}	--	104.0	--	nC

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Typical Characteristics Curves

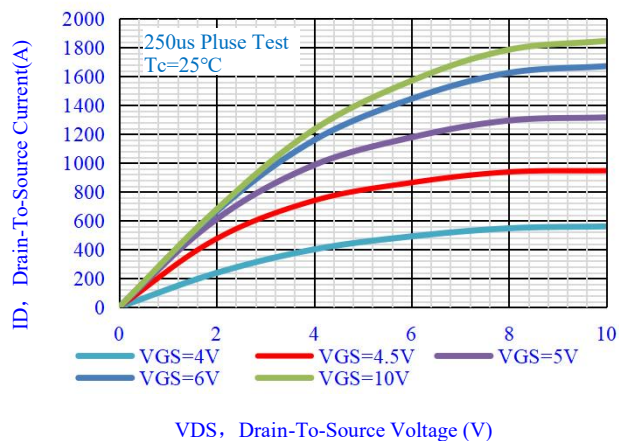


Fig.1-Output Characteristics

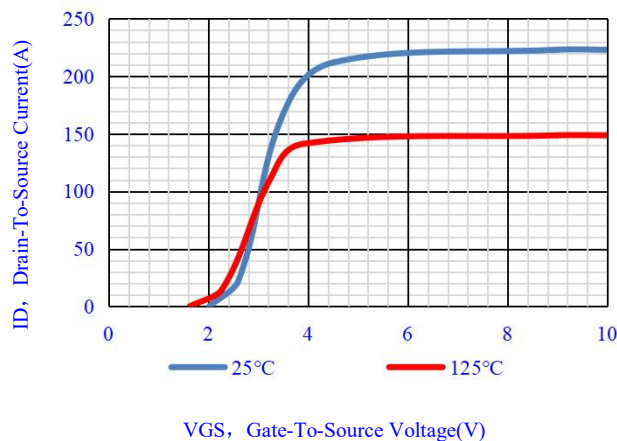


Fig.2- Transfer Characteristics

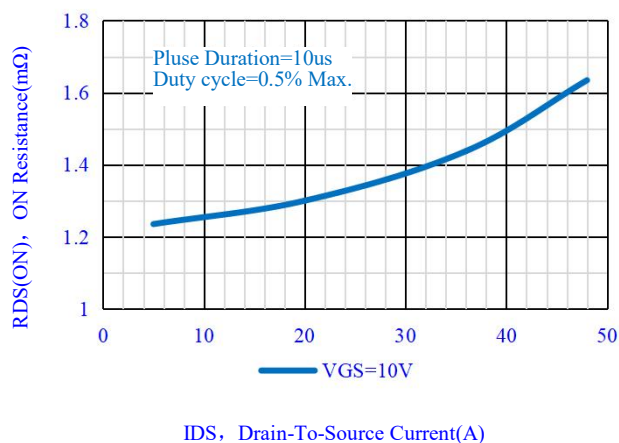


Fig.3- On Resistance vs. Drain Current

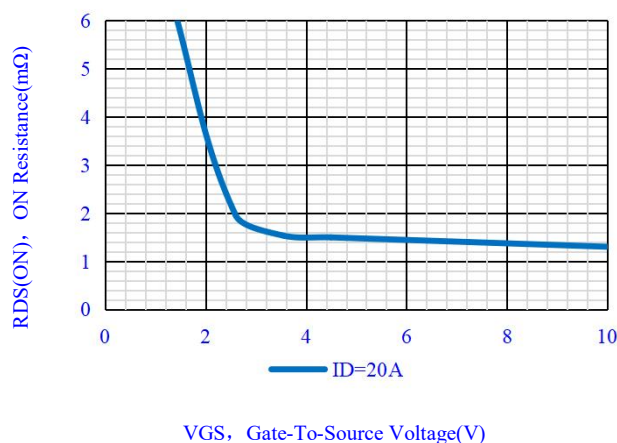


Fig.4- On Resistance vs. Gate Source Voltage

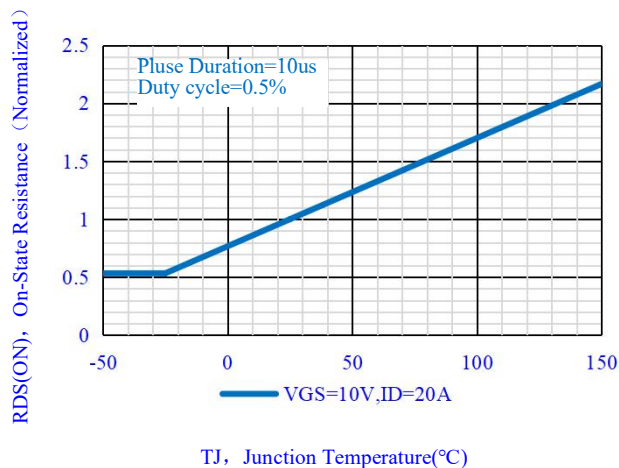


Fig.5- On Resistance vs. Junction Temperature

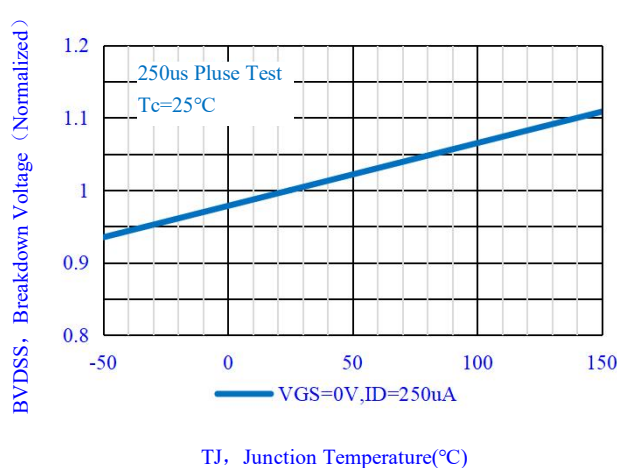


Fig.6- Breakdown Voltage vs. Junction Temperature

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Typical Characteristics Curves

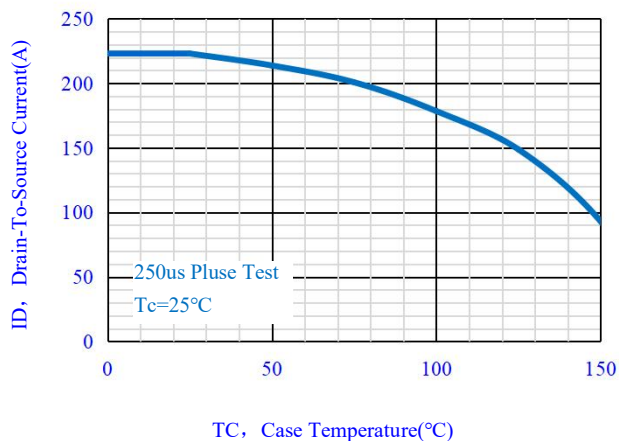


Fig.7-Maximum Continuous Drain Current vs. Case Temperature

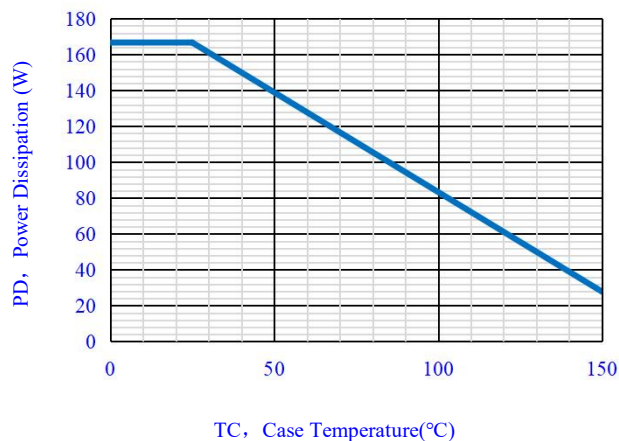


Fig.8-Maximum Power Dissipation vs. Case Temperature

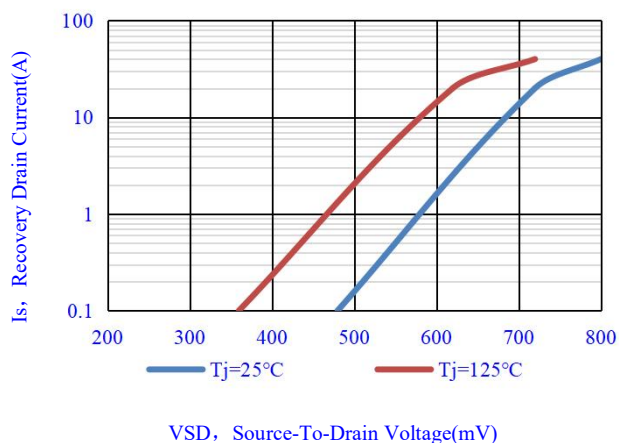


Fig.9- Source-To-Drain Diode Forward Voltage

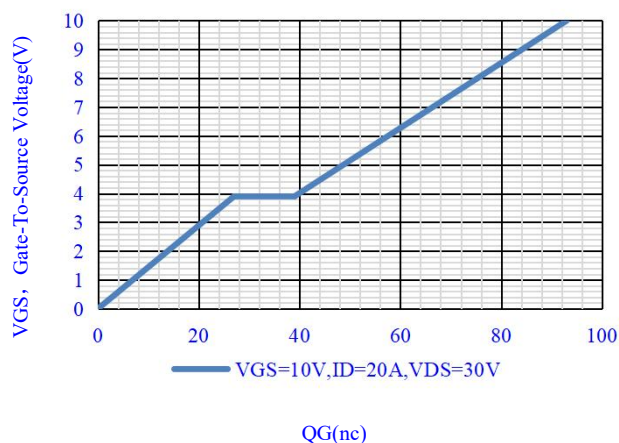


Fig.10-Gate Charge Waveform

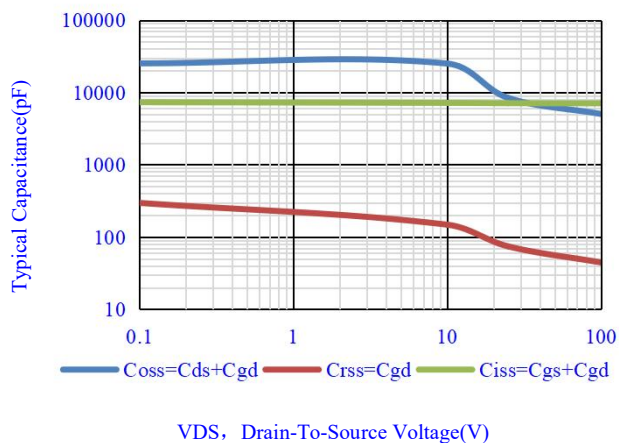


Fig.11-Typical Capacitance vs. Drain-To-Source Voltage

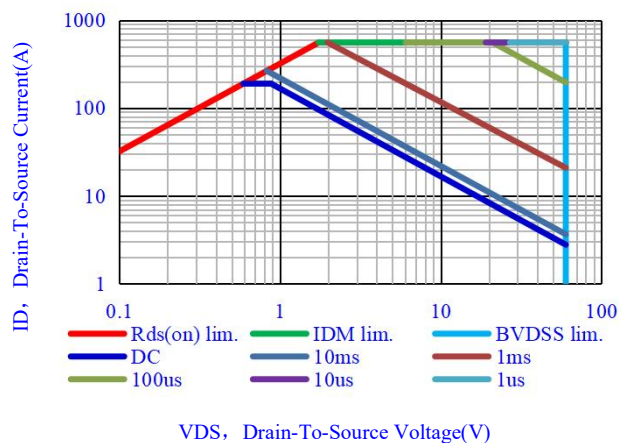


Fig.12-Maximum Safe Operating Area(SOA)

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Typical Characteristics Curves

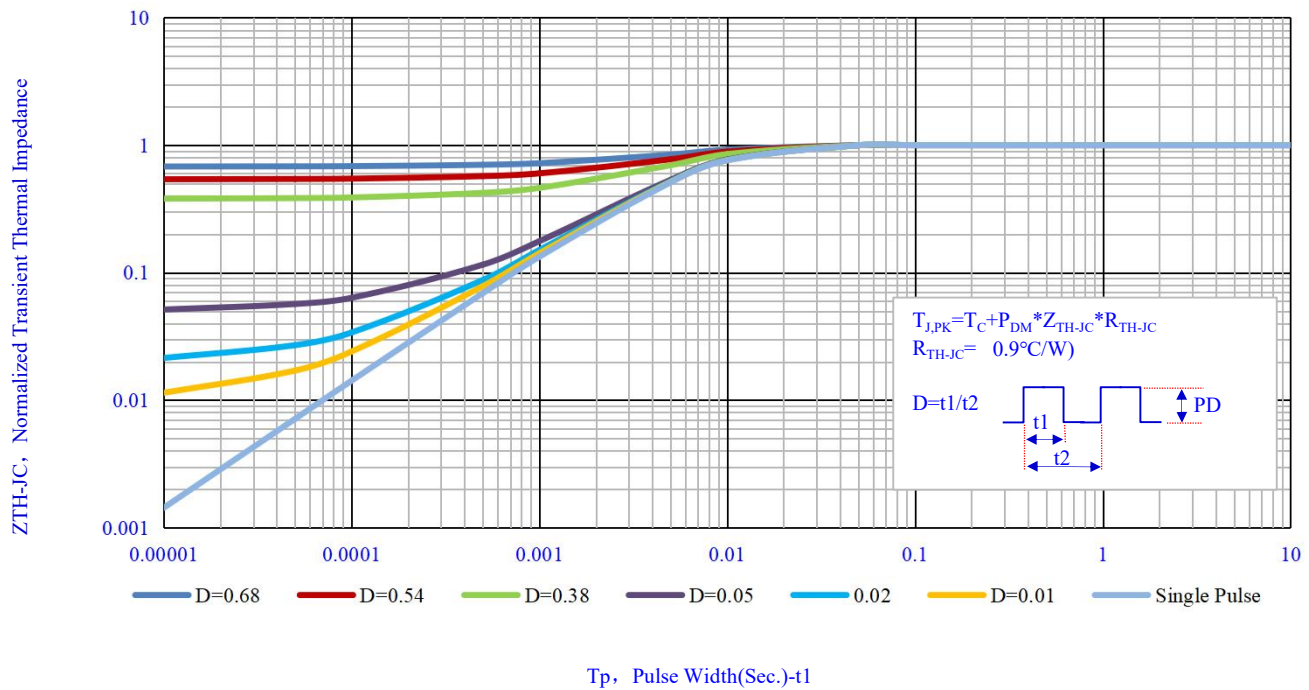


Fig.13- Normalized Maximum Transient Thermal Impedance vs.Pulse Width

Test Circuit & Waveform

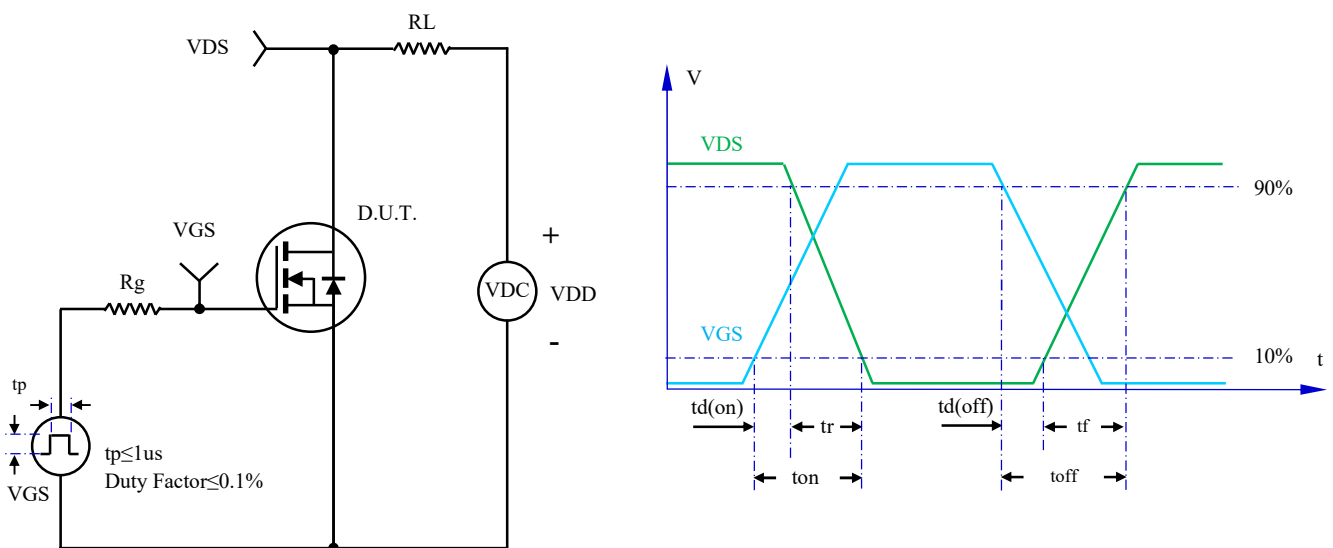


Fig.14- Resistive Switching Test Circuit & Waveform

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Test Circuit & Waveform

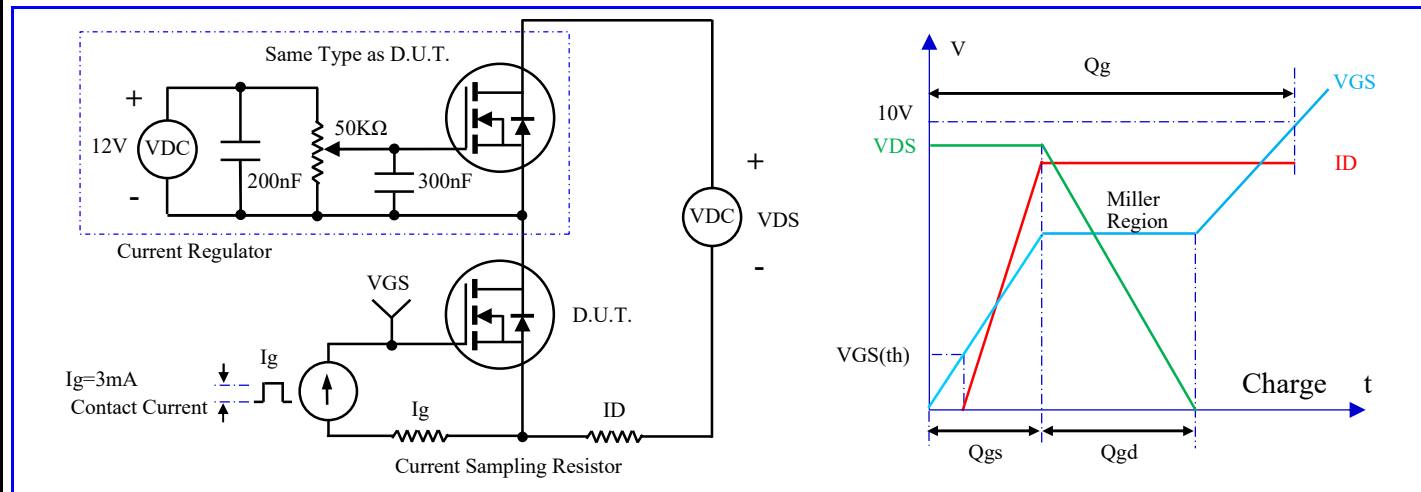


Fig.15-Gate Charge Test Circuit & Waveform

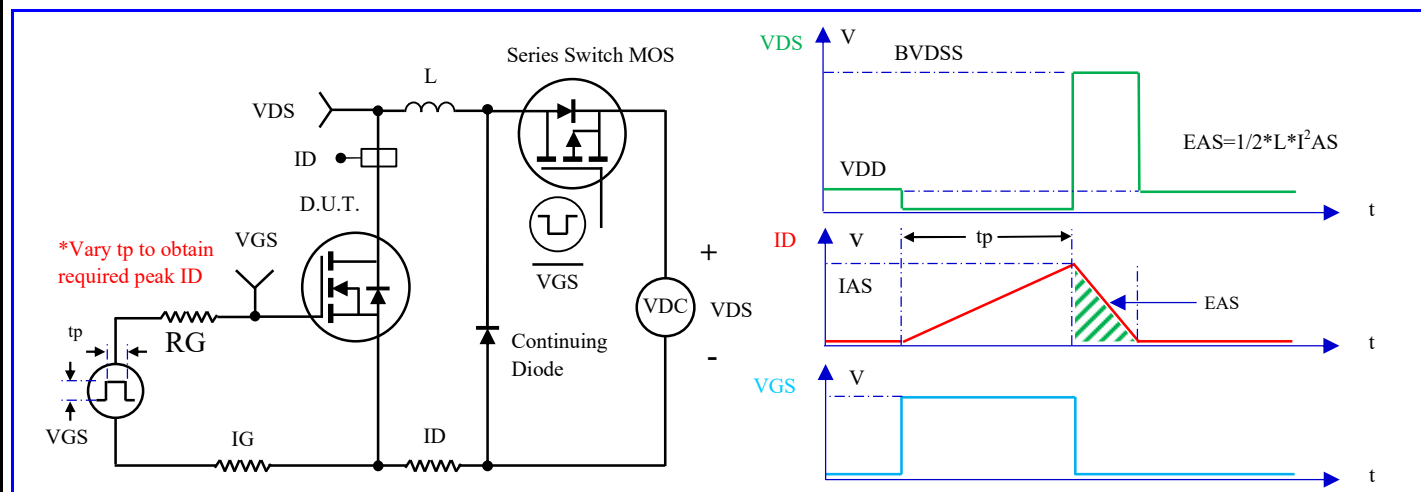


Fig.16- Unclamped Inductive Switching (UIS) Test Circuit & Waveform

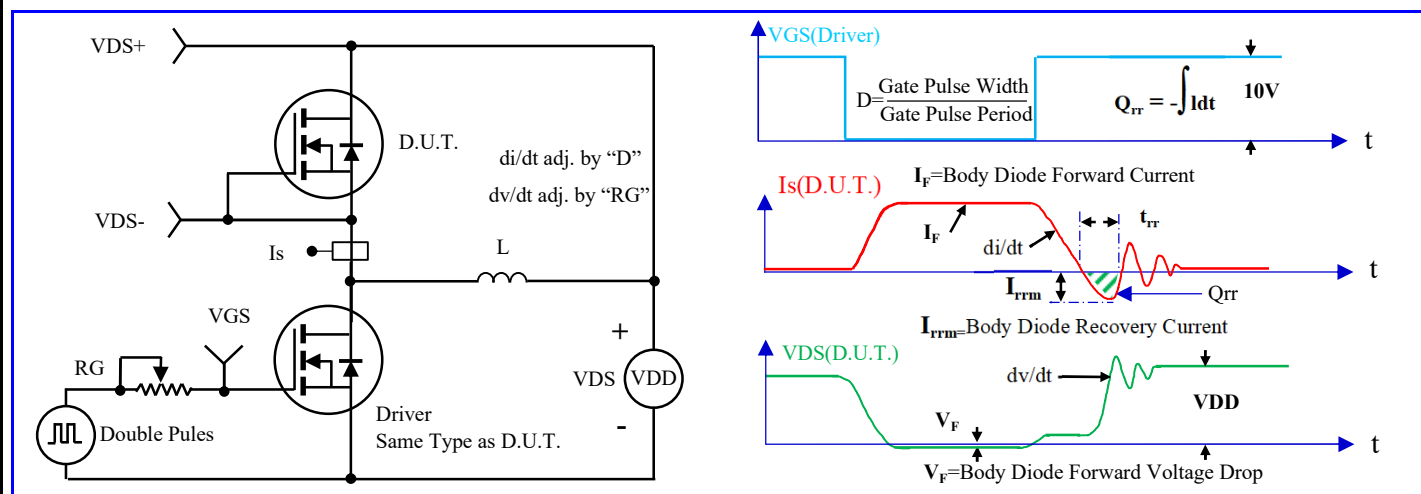


Fig.17- Diode Recovery Test Circuit & Waveform

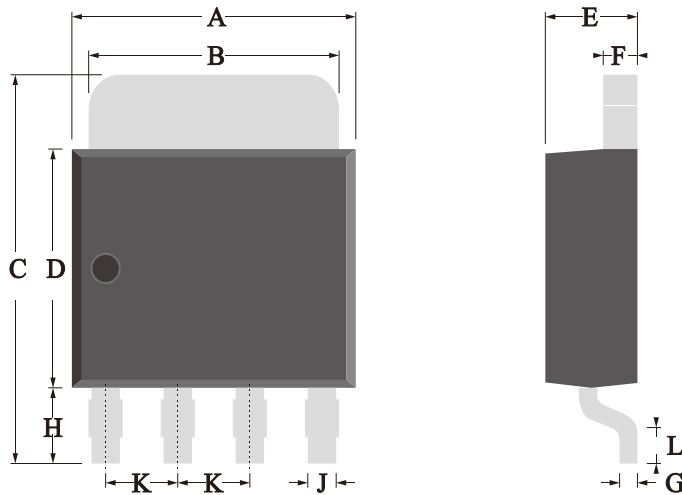
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OUTLINE DRAWINGS

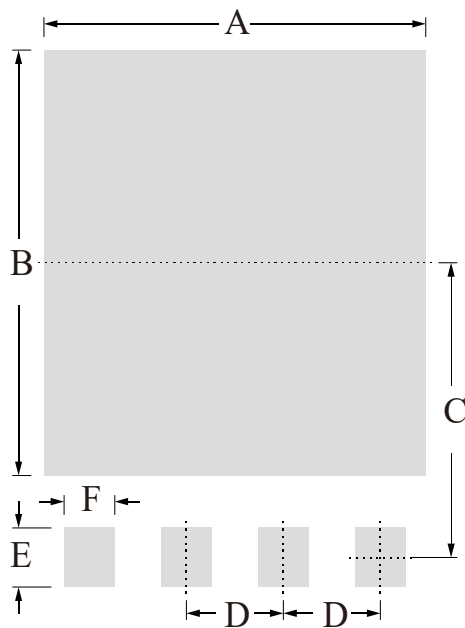
LFPAK5*6



OUTLINE DIMENSIONS						
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.70	-	5.10	0.1850	-	0.2008
B	3.60	-	4.40	0.1417	-	0.1732
C	5.80	-	6.20	0.2283	-	0.2441
D	3.80	-	4.10	0.1496	-	0.1614
E	0.95	-	1.10	0.0374	-	0.0433
F	0.24	-	0.30	0.0094	-	0.0118
G	0.19	-	0.25	0.0075	-	0.0098
H	0.80	-	1.30	0.0315	-	0.0512
J	0.35	-	0.50	0.0138	-	0.0197
K	1.20	-	1.35	0.0472	-	0.0531
L	0.40	-	0.85	0.0157	-	0.0335

RECOMMEDNED LAYOUT DRAWINGS

LFPAK5*6



OUTLINE DIMENSIONS						
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	-	4.70	-	-	0.1850	-
B	-	5.50	-	-	0.2980	-
C	-	3.60	-	-	0.2610	-
D	-	1.27	-	-	0.0910	-
E	-	0.80	-	-	0.1090	-
F	-	1.00	-	-	0.0560	-

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MARKING INFORMATION



MARKING INSTRUCTIONS

NH=Niuhan Trademark
FF=Product Line Code,According To Actual Changes
YWW=Date Code,According To Actual Changes
LLWWF=Internal Code,According To Actual Changes
NSH013N06L5=Model

PACKING INFORMATION

Package Type	Package Code	Product Weight Approx(g/Pcs)	Package Method	Quantity (Pcs/Min. Pack.)	Quantity (Pcs/Inner Box)	Quantity (Pcs/Carton)
LFPAK5*6	P1	0.095	13" Reel	5000	10000	50000

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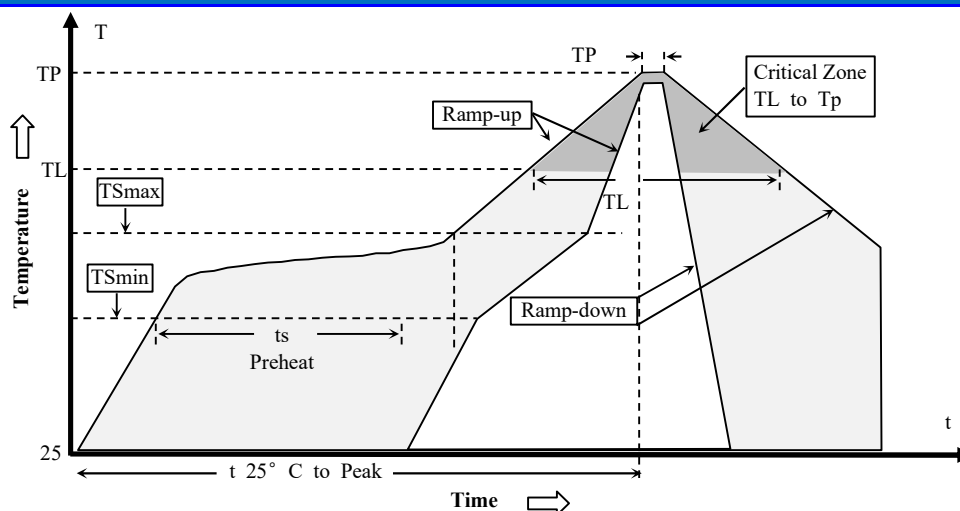
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Recommended wave soldering condition

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 (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.

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