

NSH036N12D

N-Channel Enhanced Shielded Gate Trench Power MOSFET



Voltage: 120 Volts

Current: 167 Ampers

Polarity And Marking

Package: TO-263

Features

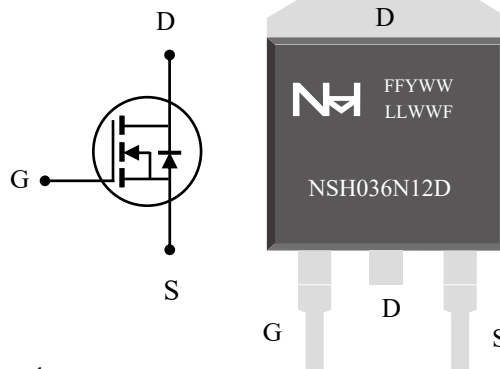
- NH'S Advanced SGT Technology
- Low Reverse Transfer Capacitances
- Low Gate Charge For Low Switching Loss
- Excellent $Q_g \cdot R_{ds(on)}$ Product(FOM)

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. NSH036N12D=Model

***100% UIS TESTED**

***100% ΔV_{DS} TESTED**

Absolute Maximum Ratings (T_a=25°C 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 °C	I _D	167	A
	T _a = 100 °C		133.6	
Drain Current-Pulse (Note 1)	T _j < 175 °C	I _{DM}	668	A
Maximum Power Dissipation Power	T _a = 25 °C	P _D	300	W
	T _a = 100 °C		150	
Derating Factor		D _F	2.00	W/°C
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 °C, V _G = 10.0 V	E _{AS}	540	mJ

Thermal Characteristics (T_a=25°C Unless Otherwise Specified)

Parameter	Test Conditions	Symbol	Typ.	Unit
Junction Temperature		T _J	-55 to 175	°C
Storage Temperature Range		T _{STD}	-55 to 175	°C
Thermal Resistance Junction To Ambient With Steady-State	Still Air Environment With T _a =25 °C	R _{θJA}	60.0	°C/W
Thermal Resistance Junction-Case With Steady-State	Device Mounted On 1 in2 FR-4 Board With 2oz. Copper	R _{θJC}	0.50	

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}	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

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Typical Characteristics Curves

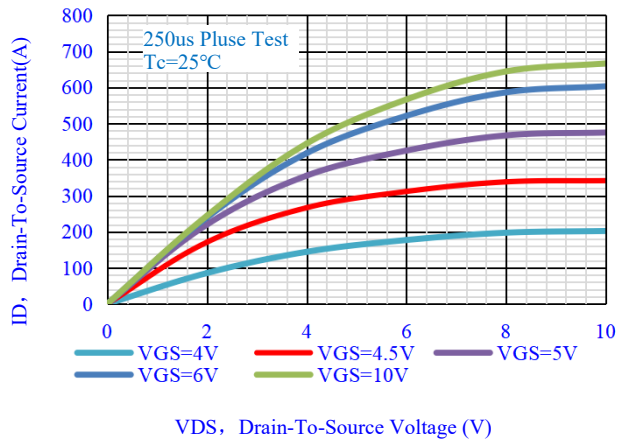


Fig.1-Output Characteristics

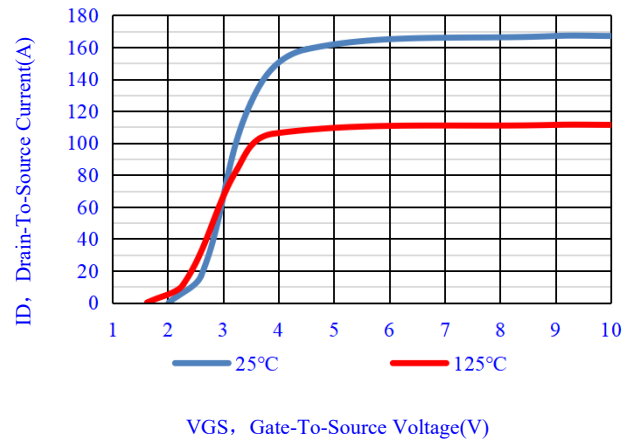


Fig.2- Transfer Characteristics

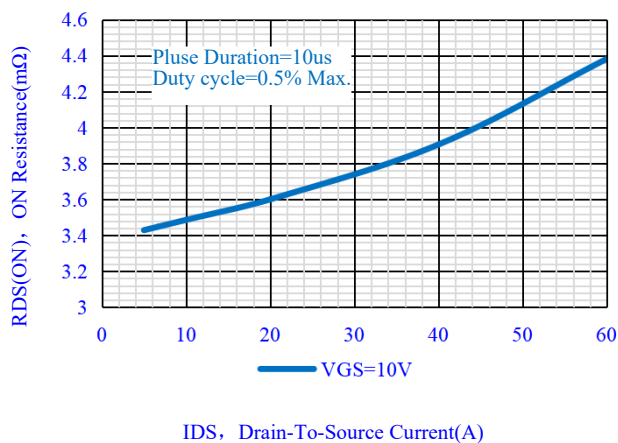


Fig.3- On Resistance vs. Drain Current

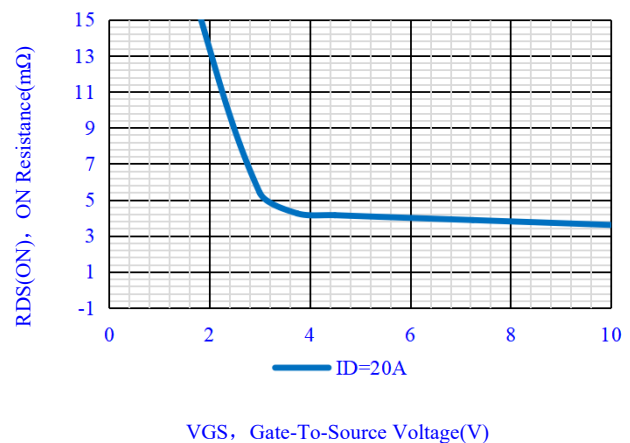


Fig.4- On Resistance vs. Gate Source Voltage

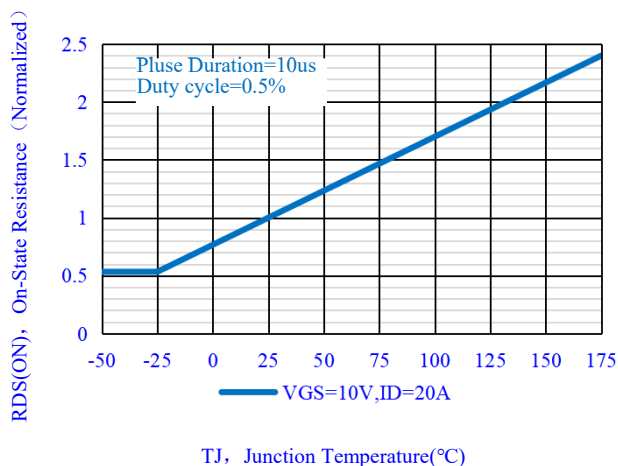


Fig.5- On Resistance vs. Junction Temperature

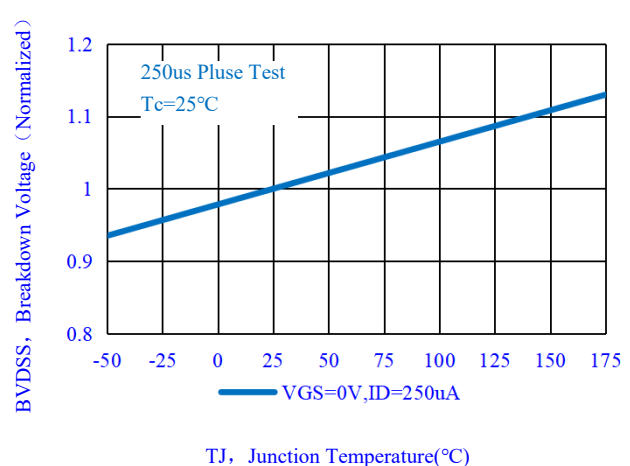


Fig.6- Breakdown Voltage vs. Junction Temperature

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Typical Characteristics Curves

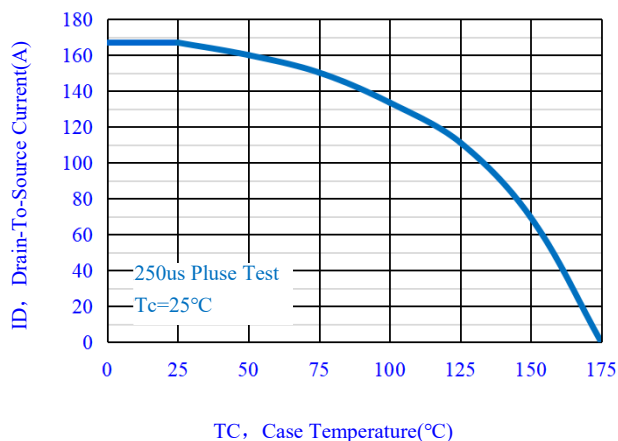


Fig.7-Maximum Continuous Drain Current vs. Case Temperature

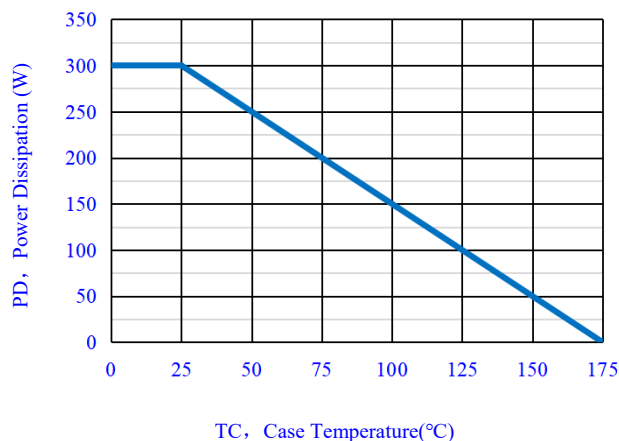


Fig.8-Maximum Power Dissipation vs. Case Temperature

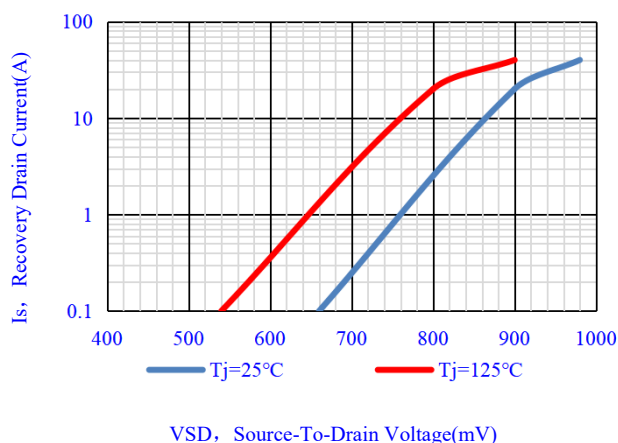


Fig.9- Source-To-Drain Diode Forward Voltage

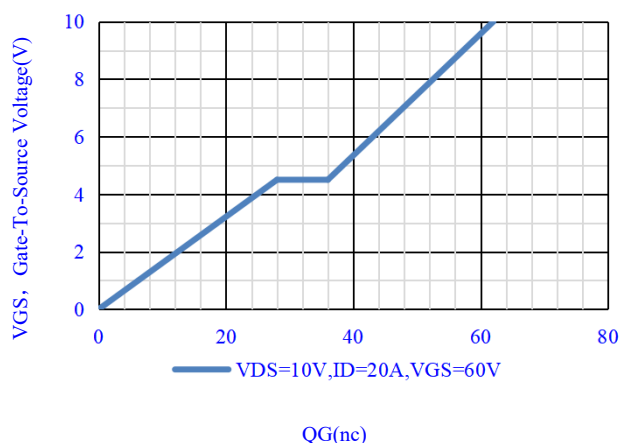


Fig.10-Gate Charge Waveform

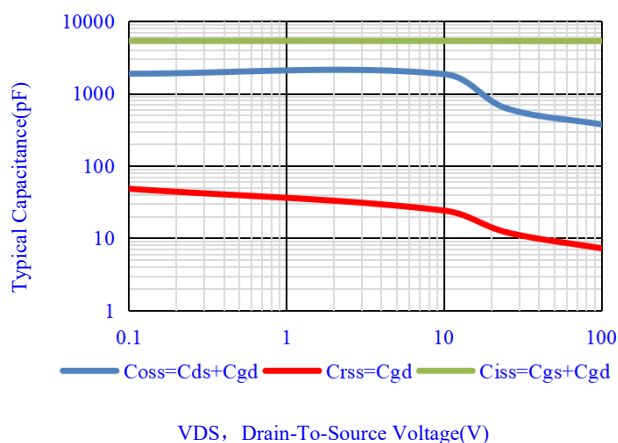


Fig.11-Typical Capacitance vs. Drain-To-Source Voltage

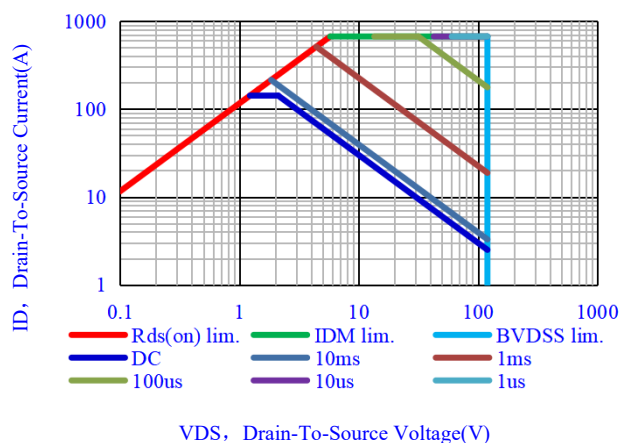


Fig.12-Maximum Safe Operating Area(SOA)

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Typical Characteristics Curves

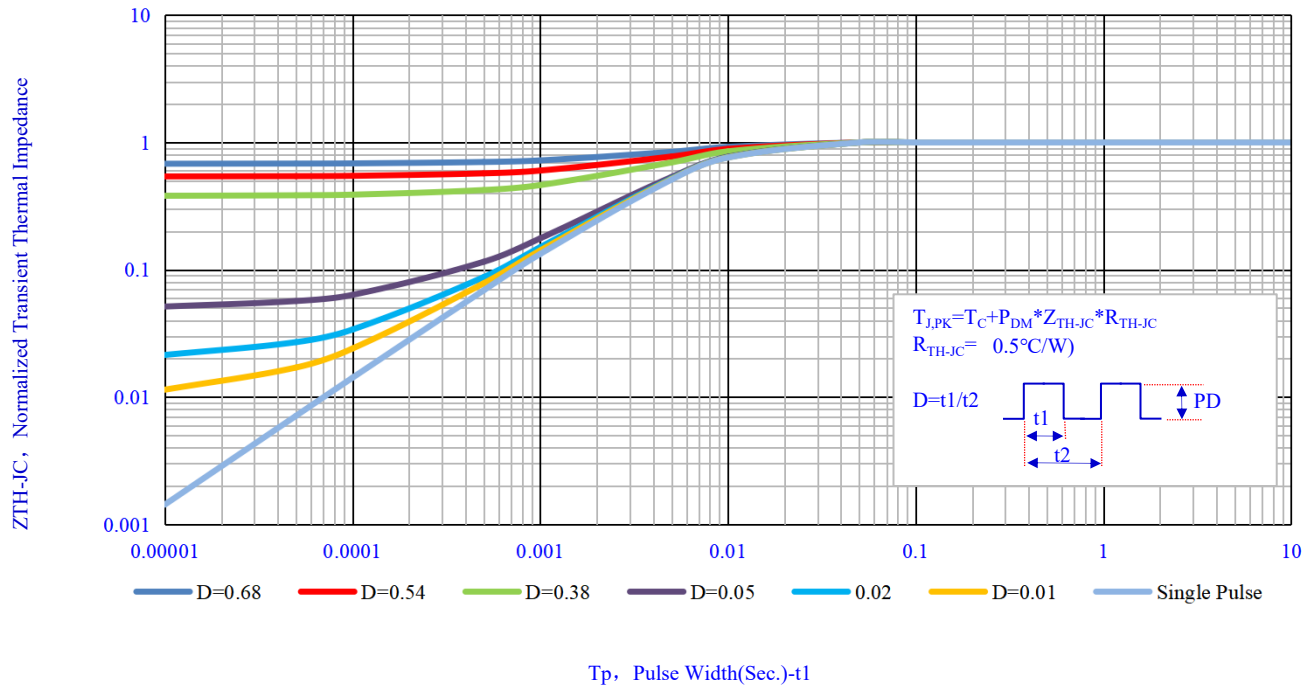


Fig.13- Normalized Maximum Transient Thermal Impedance vs.Pulse Width

Test Circuit & Waveform

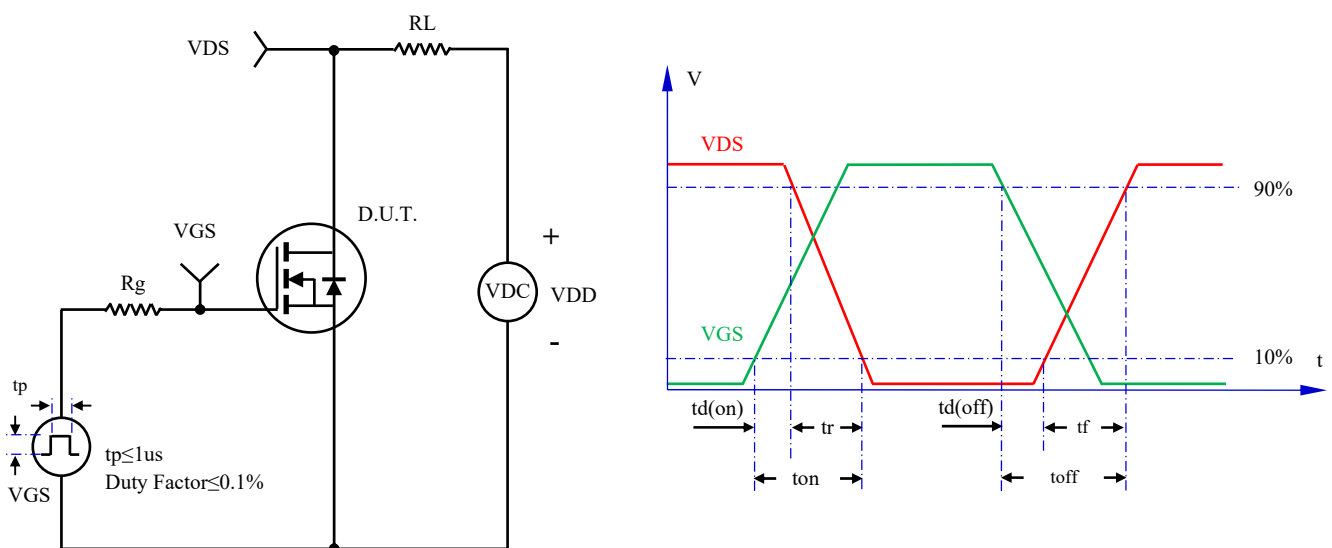


Fig.14- Resistive Switching Test Circuit & Waveform

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Test Circuit & Waveform

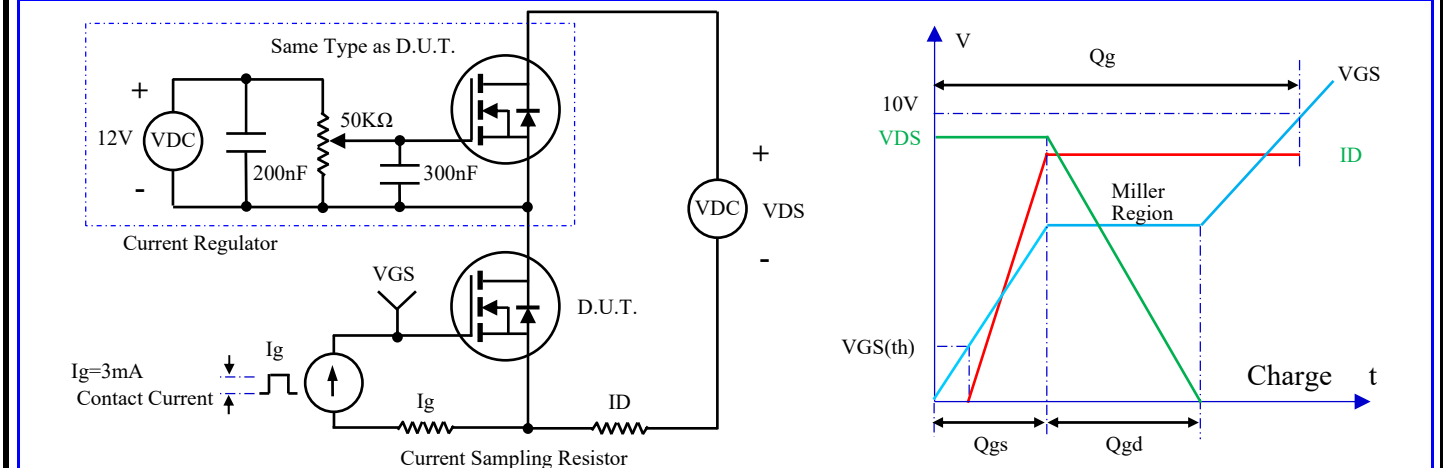


Fig.15-Gate Charge Test Circuit & Waveform

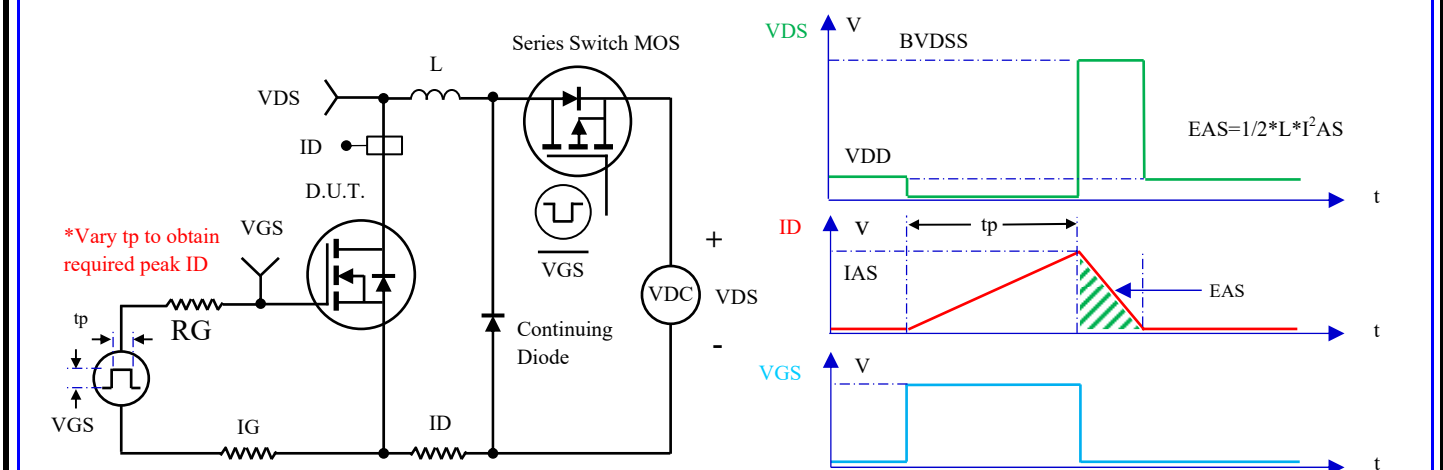


Fig.16- Unclamped Inductive Switching (UIS) Test Circuit & Waveform

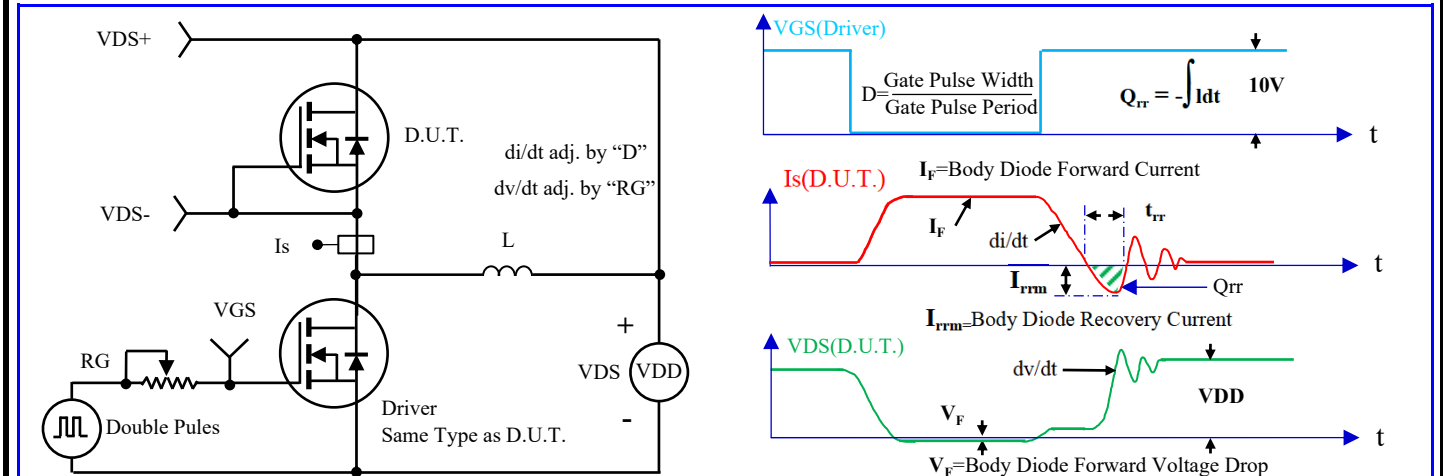


Fig.17- Diode Recovery Test Circuit & Waveform

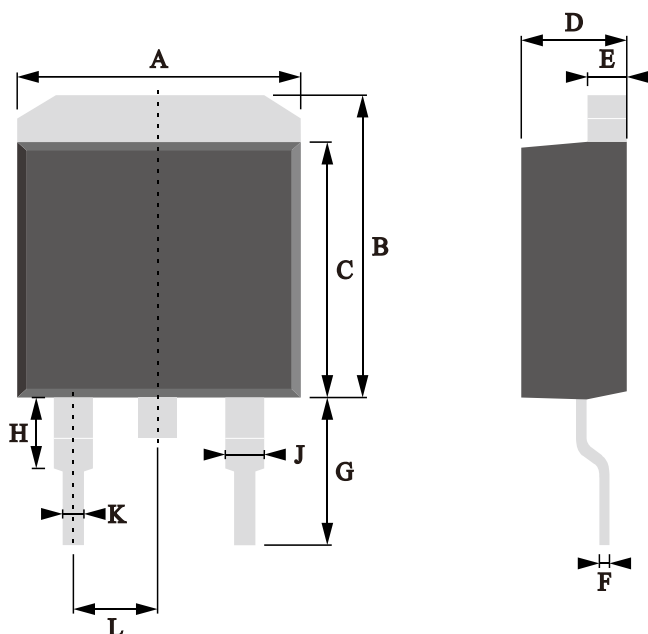
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OUTLINE DRAWINGS

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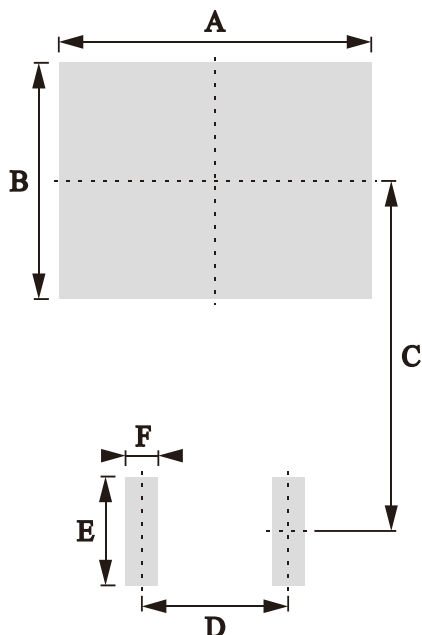


OUTLINE DIMENSIONS

Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	9.30	-	10.50	0.3661	-	0.4134
B	9.60	-	11.60	0.3780	-	0.4567
C	8.20	-	9.50	0.3228	-	0.3740
D	4.00	-	5.00	0.1575	-	0.1969
E	1.00	-	1.70	0.0394	-	0.0669
F	0.20	-	0.70	0.0079	-	0.0276
G	4.45	-	5.25	0.1752	-	0.2067
H	1.25	-	1.85	0.0492	-	0.0728
J	1.00	-	1.60	0.0394	-	0.0630
K	0.60	-	1.00	0.0236	-	0.0394
L	2.25	-	2.80	0.0886	-	0.1102

RECOMMEDNED LAYOUT DRAWINGS

TO-263



OUTLINE DIMENSIONS

Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	-	10.86	-	-	0.4276	-
B	-	7.86	-	-	0.3094	-
C	-	11.64	-	-	0.4583	-
D	-	5.08	-	-	0.2000	-
E	-	3.62	-	-	0.1090	-
F	-	1.14	-	-	0.0560	-

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-263	RL	330	800	340x340x50	800	420x365x360	6400

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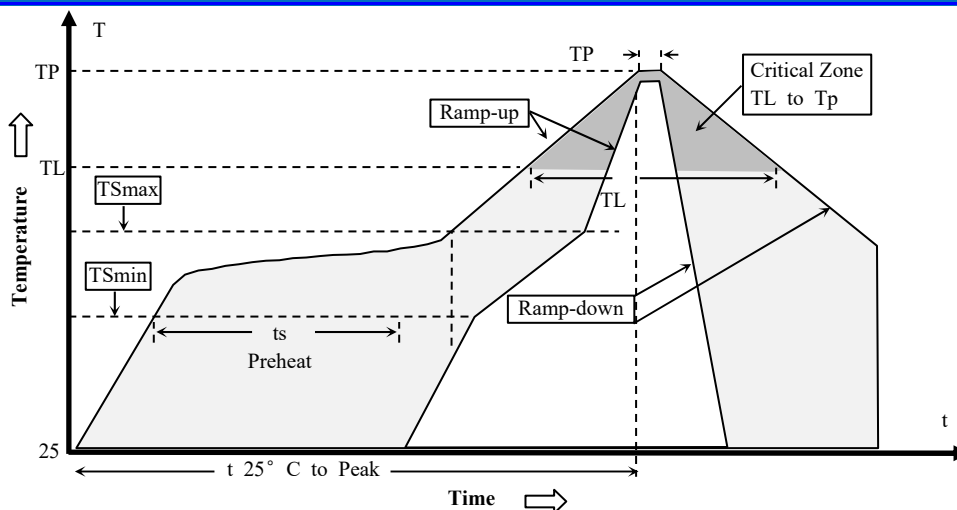
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Recommended wave soldering condition

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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