NH2302A

N-Channel Enhancement Mode Trench Power MOSFET

Pb-Free RoHS COMPLIANT

Voltage:	20 Volts	Current:	3.3 Ampers	Package:	SOT-23

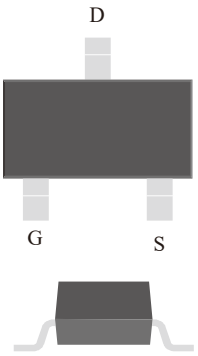
Features

- NH'S Advanced Trench Technology
- Low Rds(on) For Low On-State Loss
- High EAS For High Reliability
- Excellent Qg*Rds(on) Product(FOM）

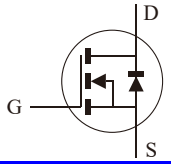
Typical Applications

- DC-DC Converter
- Battery Management System(BMS)
- Printed Circuit Board For Control Circuit
- Uninterrupible Power Supplies(UPS)

Diagram:



Polarity:



Product Summary

VDS Min.@T_j	20	V
I_D Min.@Ta	3.3	A
RDS(ON)(TYP)@4.5V	50.0	**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}	20	V
Gate-Source Voltage		V_{GS}	±8	V
Continuous Drain Current (Note 1)	Ta= 25 ℃ Ta= 100 ℃	I_D	3.3 2.1	A
Drain Current-Pulse (Note 1)	T_J< 150 ℃	I_{DM}	10	A
Maximum Power Dissipation Power Dissipation Derating Factor Above 25℃	Ta= 25 ℃ Ta= 100 ℃	P_D	1000 400	mW
Derating Factor		D_F	8	mW/℃
Avalanche Current,Single Pulse (Note 1)	L= 0.5 mH	I_{AS}	5	A
Single Pulse Avalanche Energy (Note 1) Test Circuit & Waveform See Fig.16	L= 0.5 mH IAS= 5.0 A,RG= 10.0 Ω Starting Tj=25 ℃,VG= 4.5 V	E_{AS}	6	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℃	$R_{\theta JA}$	500	℃/W
Thermal Resistance Junction-Case With Steady-State	Device Mounted On 1 in2 FR-4 Board With 2oz. Copper	$R_{\theta JC}$	125	

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

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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}	20	--	--	V
Bvdss Temperature Coefficient	ID=250uA,Reference25℃	$\Delta BV_{DSS}/\Delta T_J$	--	0.02	--	V/℃
Drain-Source Leakage Current	VDS= 16 V,VGS=0V	I_{DSS}	--	--	1	uA
Gate-Body Leakage Current	VGS= ±8 V,VDS=0V	I_{GSS}	--	--	±100	nA
Forward Transconductance	ID= 1.7 A,VDS= 5 V	gfs	--	8.0	--	S
Static On Characteristics						
Gate Threshold Voltage	VGS= VDS ID=250uA	$V_{GS(TH)}$	0.4	1.0	1.5	V
Drain-Source On Resistance	ID= 1.7 A,VGS= 4.5 V ID= 1.7 A,VGS= 2.5 V	$R_{DS(ON)}$	-- --	50.0 70.0	60.0 80.0	mΩ
Dynamic Characteristics						
Input Capacitance	VDS= 8 V	C_{iss}	--	550.0	--	pF
Output Capacitance	VGS= 0 V	C_{oss}	--	170.0	--	pF
Reverse Transfer Capacitance	F= 1 MHZ	C_{rss}	--	30.0	--	pF
Switching Paramters (Test Circuit & Waveform See Fig.14)						
Turn-On Delay Time	VDS= 8 V	$t_{d(on)}$	--	28.0	--	ns
Turn-On Rise Time	VGS= 4.5 V	t_r	--	12.0	--	ns
Turn-Off Delay Time	RG= 10.0 Ω	$t_{d(off)}$	--	65.0	--	ns
Turn-Off Rise Time		t_f	--	30.0	--	ns
Gate Charge Paramters (Test Circuit & Waveform See Fig.15)						
Total Gate Charge	VDS= 8 V	Q_g	--	4.0	--	nC
Gate-Source Charge	VGS= 4.5 V	Q_{gs}	--	0.6	--	nC
Gate-Drain Charge	ID= 1.7 A	Q_{gd}	--	1.5	--	nC
Drain-Source Diode Characteristics And Maximum Ratings (Test Circuit & Waveform See Fig.17)						
Max. Diode Forward Cuurent		I_S	--	--	3.3	A
Max. Pulsed Forward Cuurent		I_{SM}	--	--	11.7	A
Diode Forward Voltage	ID= 1.7 A,VGS=0V	V_{SD}	--	0.75	1.1	V
Reverse Recovery Time	ID= 1.7 A,di/dt= 100 A/us	t_{rr}	--	8.0	--	ns
Reverse Recovery Charge	VGS= 4.5 V,VDD= 8 V	Q_{rr}	--	19.0	--	nC

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Typical Characteristics Curves

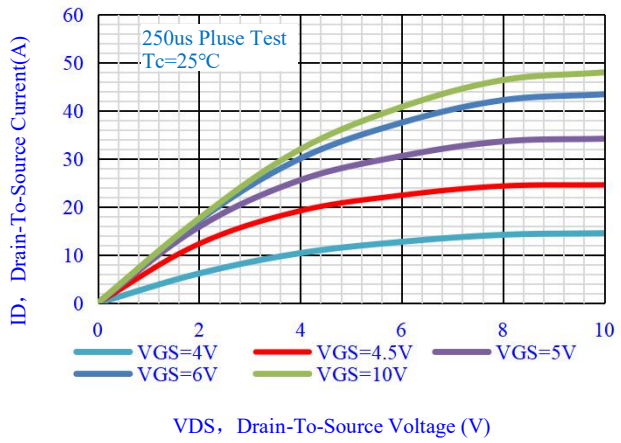

Fig.1-Output Characteritsics

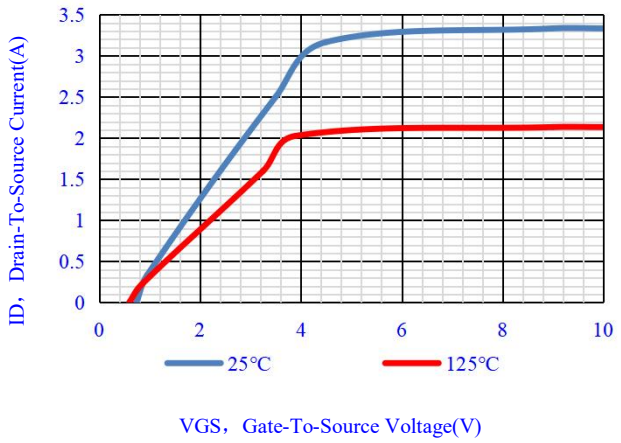

Fig.2- Transfer Characteritsics

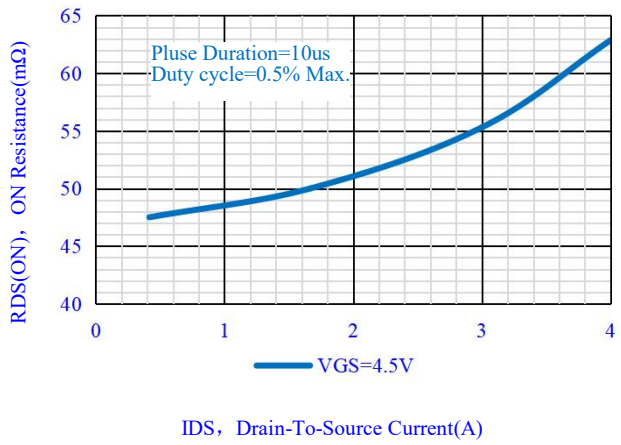

Fig.3- On Resistance vs. Drain Current

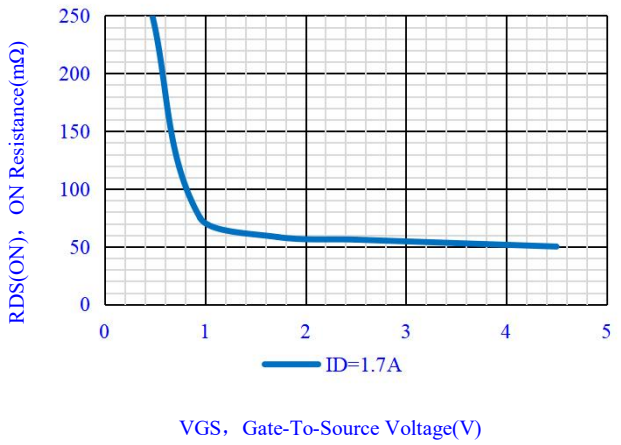

Fig.4- On Resistance vs. Gate Source Voltage

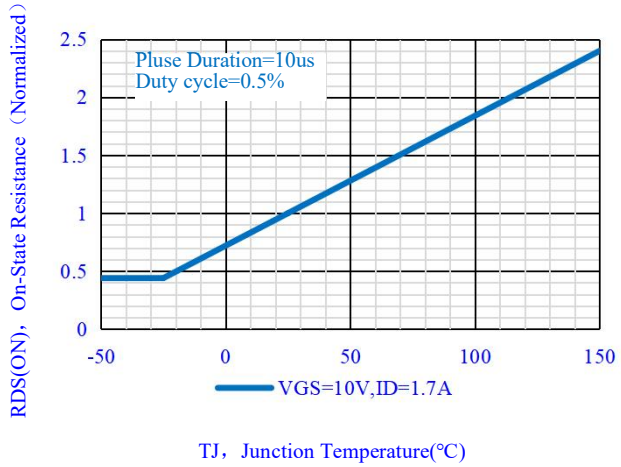

Fig.5-On Resistance vs. Junction Temperature

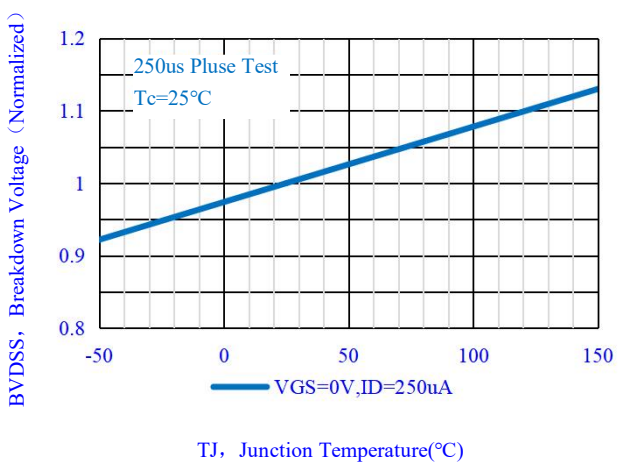

Fig.6- Breakdown Voltage vs. Junction Temperature

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Typical Characteristics Curves

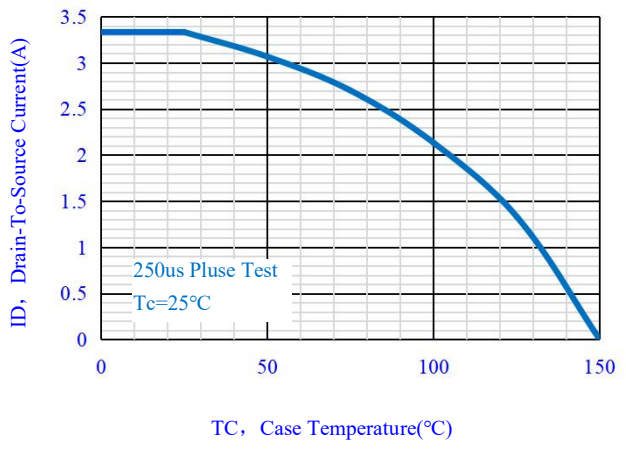

Fig.7-Maximum Continuous Drain Current vs. Case Temperature

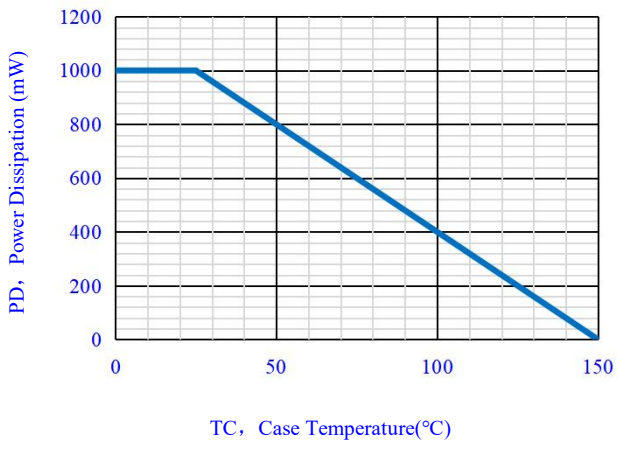

Fig.8-Maximum Power Dissipation vs. Case Temperature

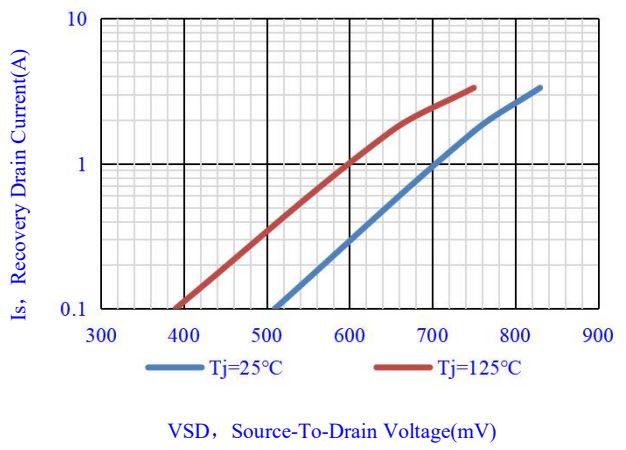

Fig.9- Source-To-Drain Diode Forward Voltage

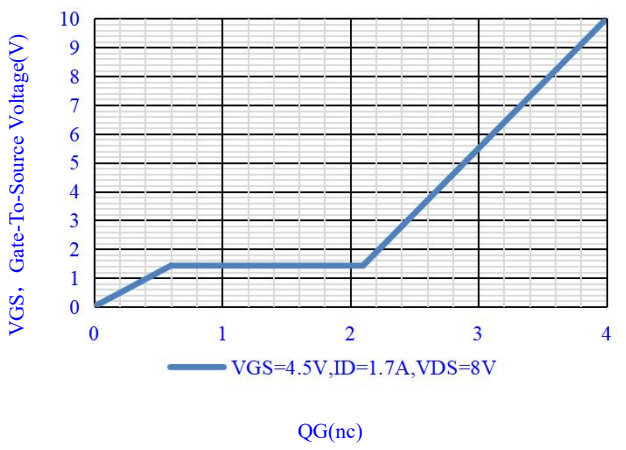

Fig.10-Gate Charge Waveform

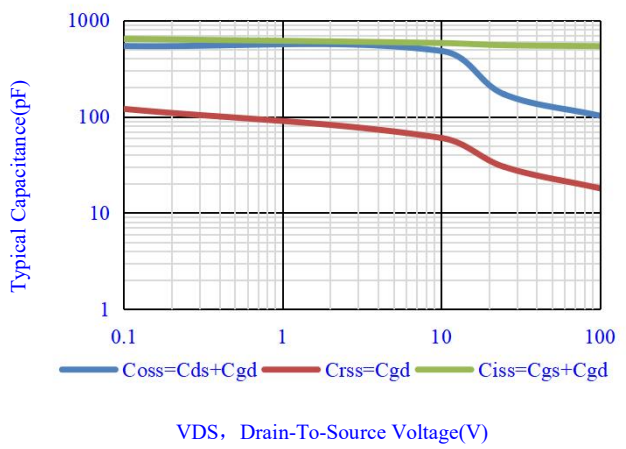

Fig.11-Typical Capacitance vs. Drain-To-Source Voltage

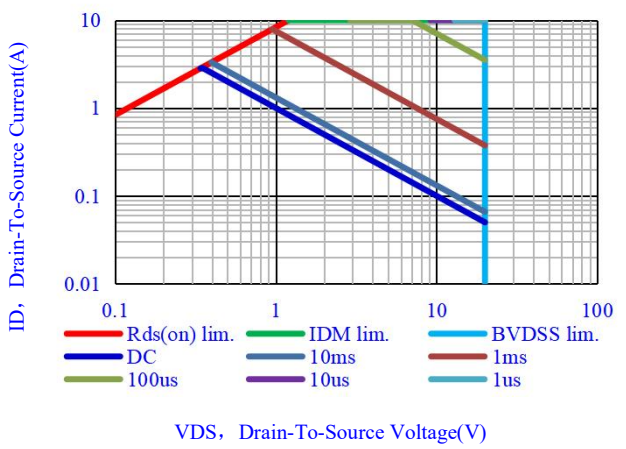

Fig.12-Maximum Safe Operating Area(SOA)

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Typical Characteristics Curves

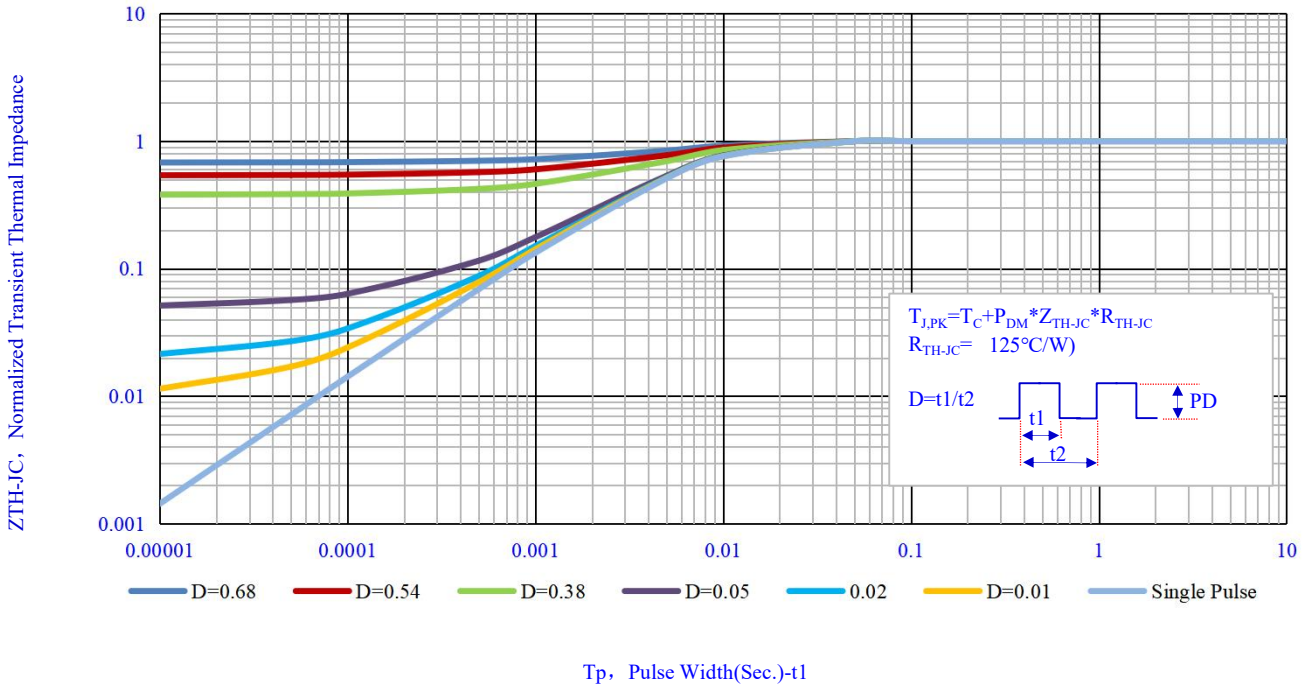

Fig.13- Normalized Maximum Transient Thermal Impedance vs.Pulse Width

Test Circuit & Waveform

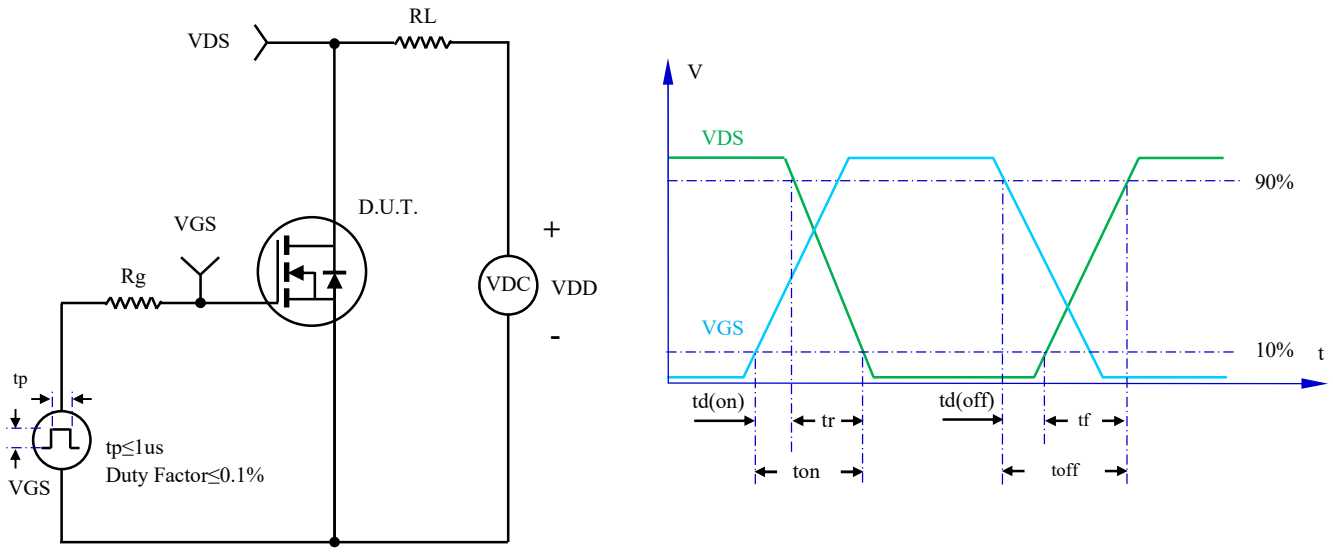

Fig.14- Resistive Switching Test Circuit & Waveform

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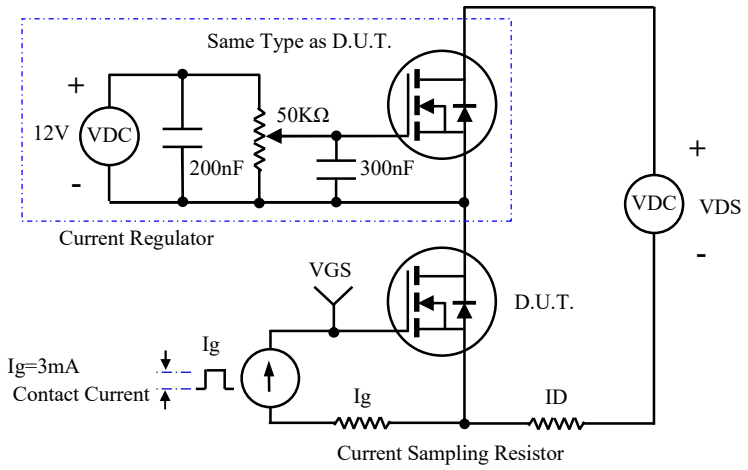
Test Circuit & Waveform



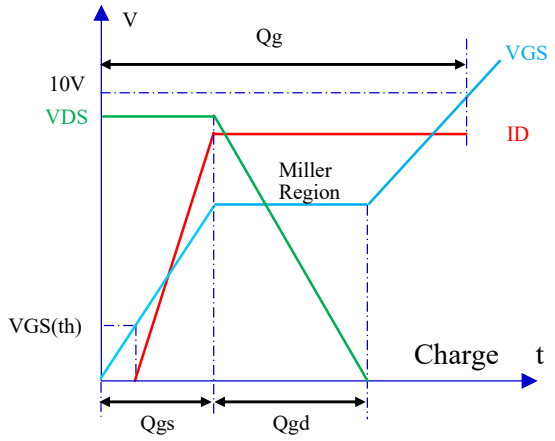
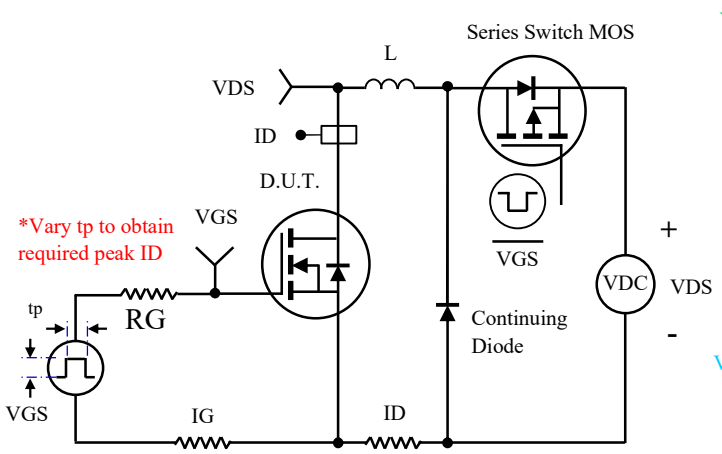


Fig.15-Gate Charge Test Circuit & Waveform



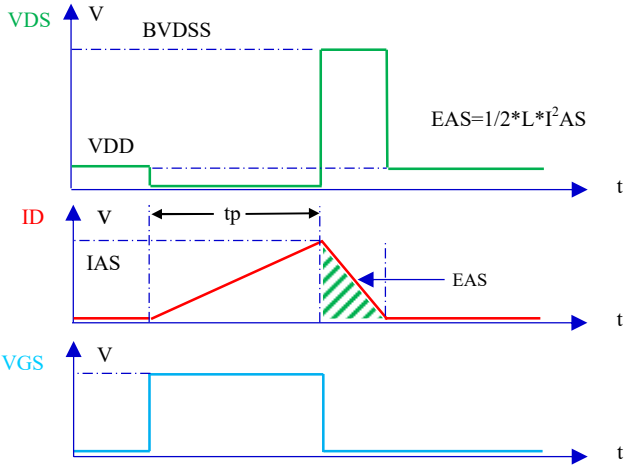
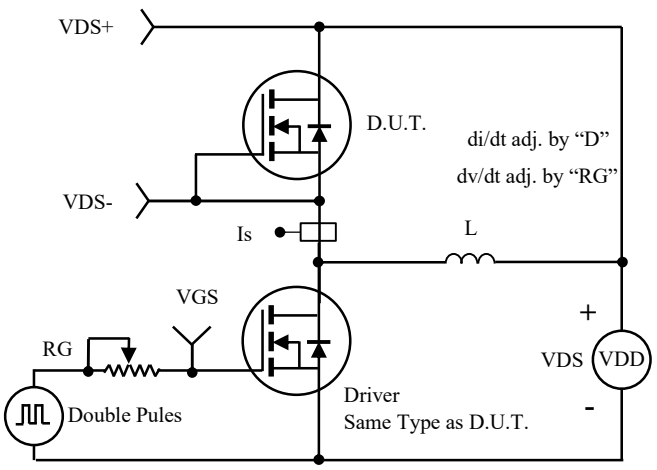


Fig.16- Unclamped Inductive Switching (UIS) Test Circuit & Waveform



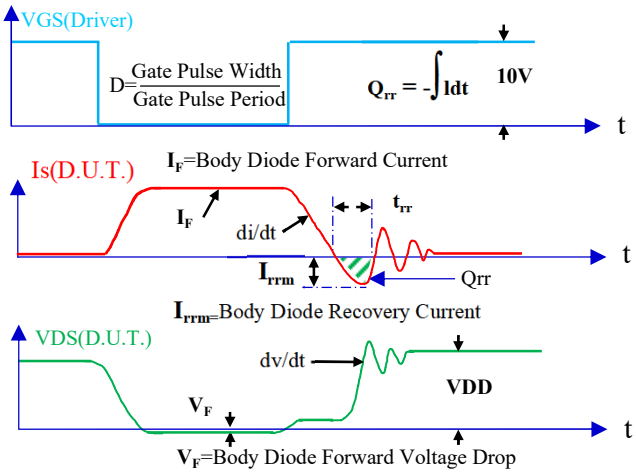


Fig.17- Diode Recovery Test Circuit & Waveform

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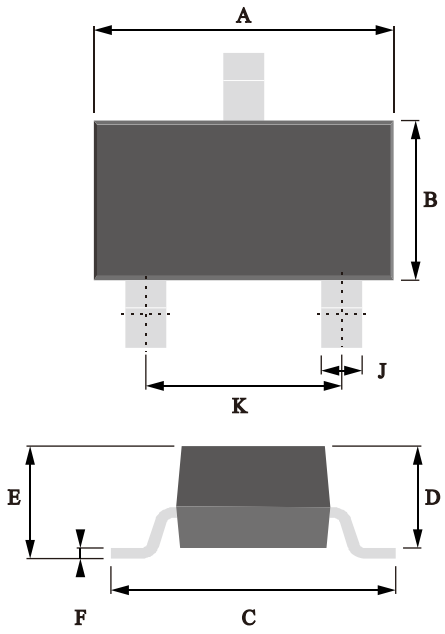
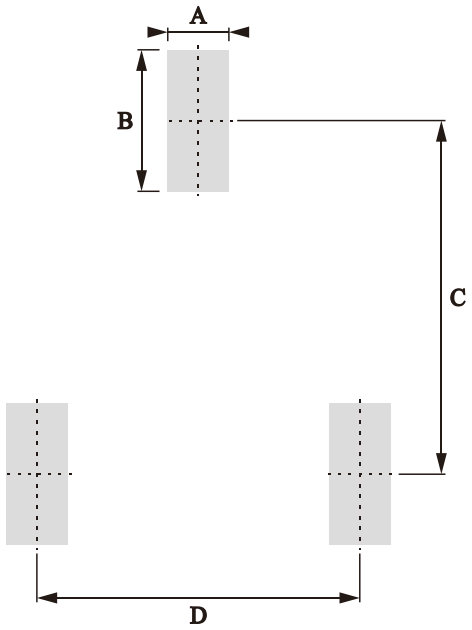
OUTLINE DRAWINGS



SOT-23

OUTLINE DIMENSIONS						
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.80	-	3.20	0.1102	-	0.1260
B	1.15	-	1.45	0.0453	-	0.0571
C	2.25	-	2.65	0.0886	-	0.1043
D	0.85	-	1.15	0.0335	-	0.0453
E	0.90	-	1.20	0.0354	-	0.0472
F	0.08	-	0.18	0.0031	-	0.0071
J	0.30	-	0.50	0.0118	-	0.0197
K	1.70	-	2.10	0.0669	-	0.0827

RECOMMEDNED LAYOUT DRAWINGS



SOT-23

OUTLINE DIMENSIONS						
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	-	0.60	-	-	0.0000	-
B	-	0.80	-	-	0.0315	-
C	-	2.00	-	-	0.0787	-
D	-	1.90	-	-	0.0748	-

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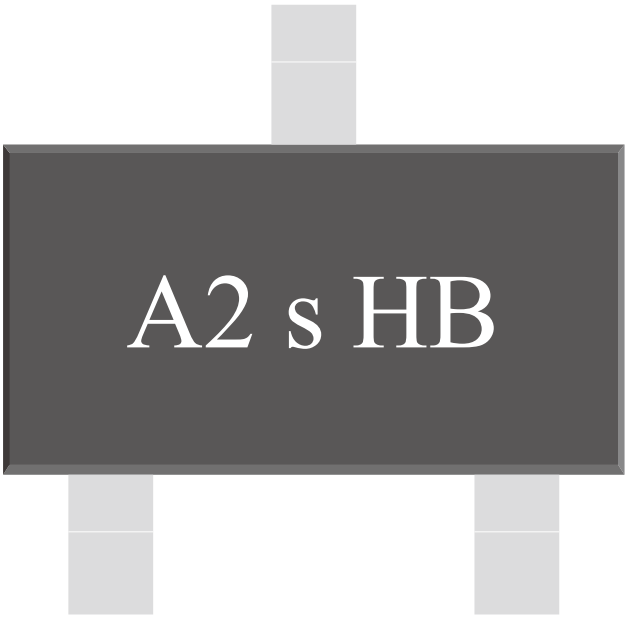
MARKING INFORMATION



MARKING INSTRUCTIONS

A2 s HB=Marking

PACKING INFORMATION

Package Type	Package Code	Productor Weight Approx(g/Pcs)	Package Method	Quantity (Pcs/Min. Pack.)	Quantity (Pcs/Inner Box)	Quantity (Pcs/Carton)
SOT-23	P1	0.008	7" Reel	3000	45000	180000

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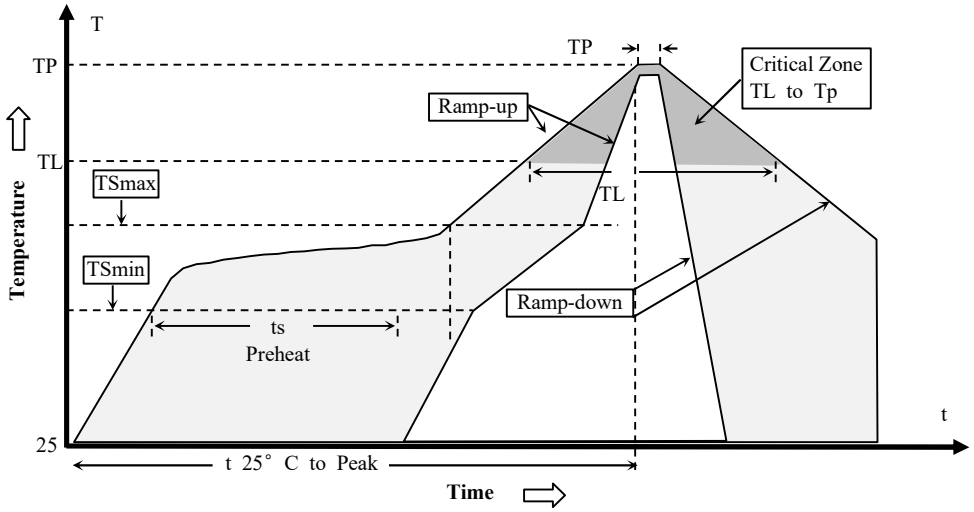
Recommended wave soldering condition

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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