

NH2301



P-Channel Enhancement Mode Trench Power MOSFET

Voltage: -20 Volts

Current: -2.8 Amperes

Package: SOT-23

Features

- NH'S Advanced Trench Technology
- Low $R_{ds(on)}$ For Low On-State Loss
- High EAS For High Reliability
- Excellent $Q_g \cdot R_{ds(on)}$ Product(FOM)

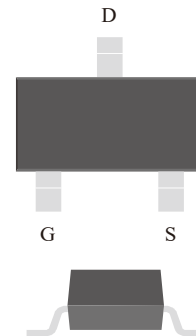
Typical Applications

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

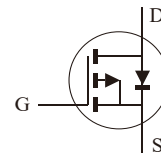
Product Summary

$V_{DS} \text{ Min.}@T_j$	-20	V
$I_D \text{ Min.}@T_a$	-2.8	A
$R_{DS(ON)}(TYP)@-4.5V$	90	m Ω

Diagram:



Polarity:



***100% UIS TESTED**

***100% ΔV_{DS} TESTED**

Absolute Maximum Ratings ($T_a=25^\circ\text{C}$ Unless Otherwise Specified)

Parameter	Test Conditions	Symbol	Ratings	Unit
Drain-Source Voltage		V_{DS}	-20	V
Gate-Source Voltage		V_{GS}	± 10	V
Continuous Drain Current (Note 1)	$T_a = 25^\circ\text{C}$	I_D	-2.8	A
	$T_a = 100^\circ\text{C}$		-1.8	
Drain Current-Pulse (Note 1)	$T_j < 150^\circ\text{C}$	I_{DM}	-11	A
Maximum Power Dissipation Power Dissipation Derating Factor Above 25°C	$T_a = 25^\circ\text{C}$	P_D	900	mW
	$T_a = 100^\circ\text{C}$		360	
Derating Factor		D_F	7.2	mW/ $^\circ\text{C}$

Thermal Characteristics ($T_a=25^\circ\text{C}$ Unless Otherwise Specified)

Parameter	Test Conditions	Symbol	Typ.	Unit
Junction Temperature		T_j	-55 to 150	$^\circ\text{C}$
Storage Temperature Range		T_{STD}	-55 to 150	$^\circ\text{C}$
Thermal Resistance Junction To Ambient With Steady-State	Still Air Environment With $T_a=25^\circ\text{C}$	$R_{\theta JA}$	139	$^\circ\text{C/W}$

Notes: 1.Pulse Width Limited By Max. Junction Temperature. (See Fig. 12).

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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}	-20	--	--	V
Bvdss Temperature Coefficient	ID=-250uA,Reference25℃	ΔBV _{DSS} /ΔT _J	--	0.02	--	V/℃
Drain-Source Leakage Current	VDS= -16 V,VGS=0V	I _{DSS}	--	--	-1	uA
Gate-Body Leakage Current	VGS= ±10 V,VDS=0V	I _{GSS}	--	--	±100	nA
Static On Characteristics						
Gate Threshold Voltage	VGS= VDS ID=-250uA	V _{GS(TH)}	-0.5	-1	-1.5	V
Drain-Source On Resistance	ID= -1.4 A,VGS= -4.5 V	R _{DS(ON)}	--	90	110	mΩ
	ID= -1.4 A,VGS= -2.5 V		--	110	143	
Dynamic Characteristics						
Input Capacitance	VDS= -50 V	C _{iss}	--	600	--	pF
Output Capacitance	VGS= 0 V	C _{oss}	--	120	--	pF
Reverse Transfer Capacitance	F= 1 MHZ	C _{rss}	--	60	--	pF
Switching Paramters (Test Circuit & Waveform See Fig.14)						
Turn-On Delay Time	VDS= -50 V	t _{d(on)}	--	10	--	ns
Turn-On Rise Time	VGS= -4.5 V	t _r	--	35	--	ns
Turn-Off Delay Time	RG= 10.0 Ω	t _{d(off)}	--	30	--	ns
Turn-Off Rise Time		t _f	--	10	--	ns
Gate Charge Paramters (Test Circuit & Waveform See Fig.15)						
Total Gate Charge	VDS= -50 V	Q _g	--	6	--	nC
Gate-Source Charge	VGS= -4.5 V	Q _{gs}	--	0.7	--	nC
Gate-Drain Charge	ID= -1.4 A	Q _{gd}	--	1.2	--	nC
Drain-Source Diode Characteristics And Maximum Ratings (Test Circuit & Waveform See Fig.17)						
Max. Diode Forward Cuurent		I _S	--	--	-2.8	A
Max. Pulsed Forward Cuurent		I _{SM}	--	--	-11.3	A
Diode Forward Voltage	ID= -1.4 A,VGS=0V	V _{SD}	--	-0.8	-1.2	V

Typical Characteristics Curves

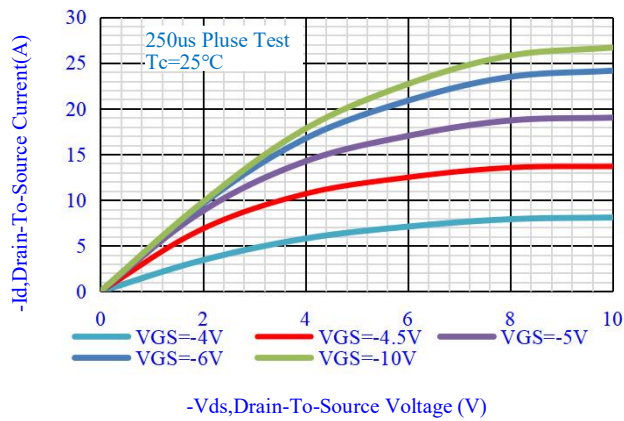


Fig.1-Output Characteristics

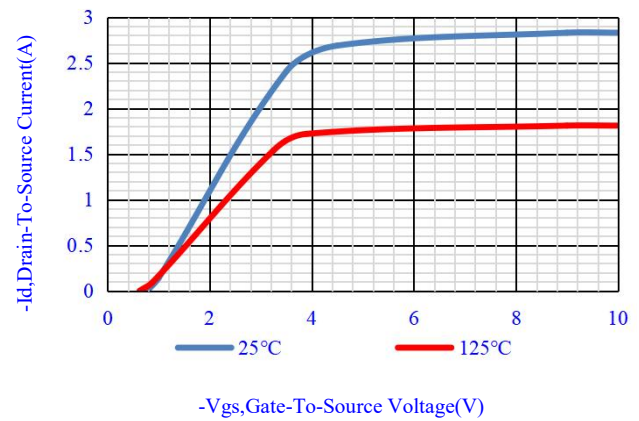


Fig.2-Transfer Characteristics

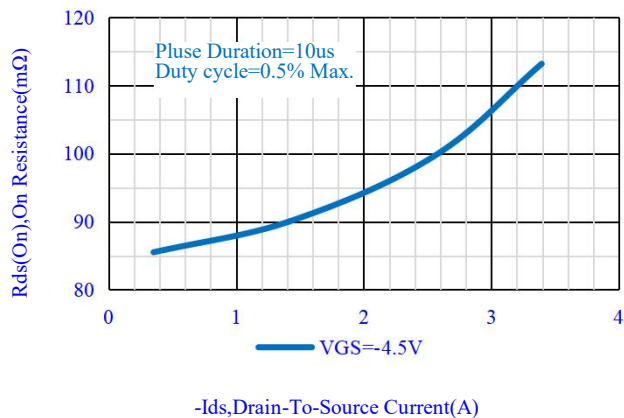


Fig.3-On Resistance Vs. Drain Current

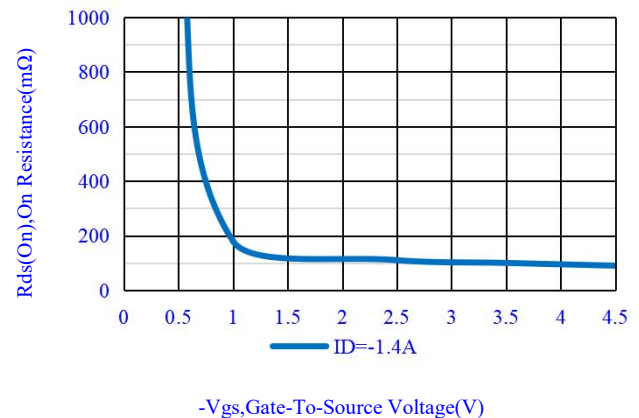


Fig.4-On Resistance Vs. Gate Source Voltage

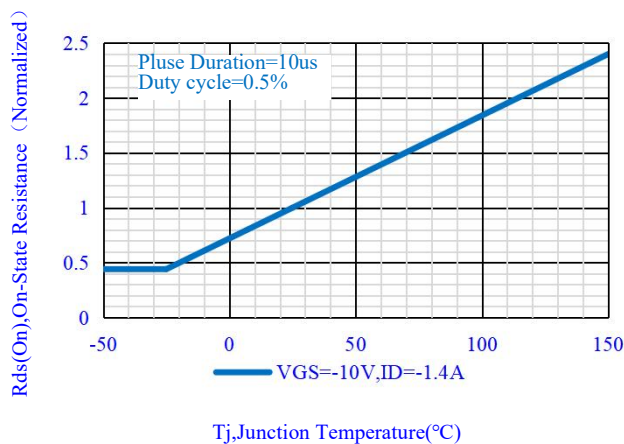


Fig.5-On Resistance Vs. Junction Temperature

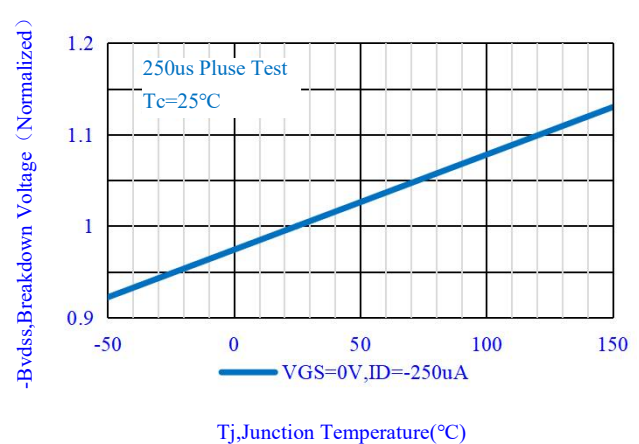


Fig.6-Breakdown Voltage Vs. Junction Temperature

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Typical Characteristics Curves

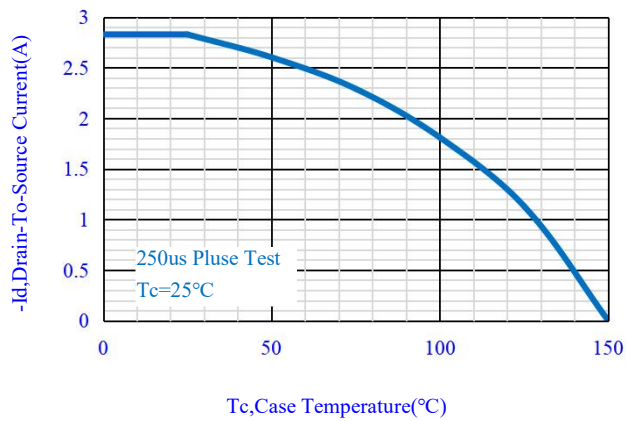


Fig.7-Maximum Continuous Drain Current Vs. Case Temperature

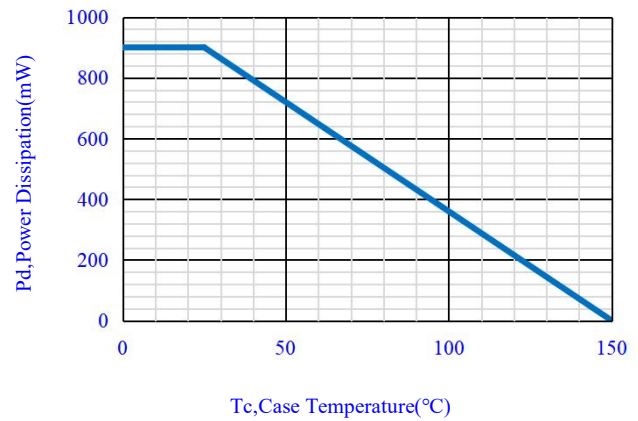


Fig.8-Maximum Power Dissipation Vs. Case Temperature

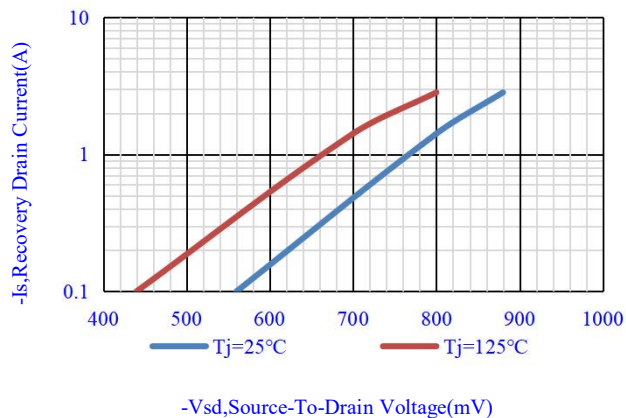


Fig.9-Source-To-Drain Diode Forward Voltage

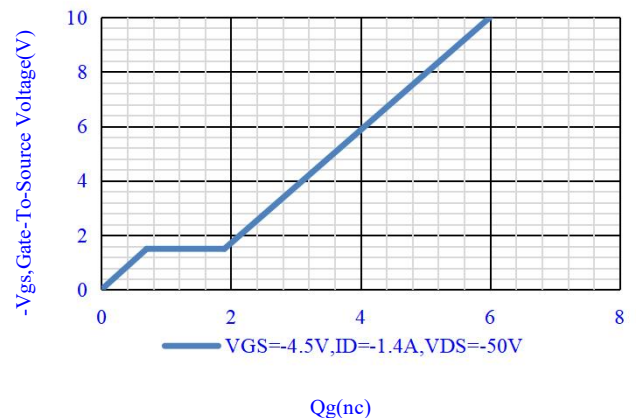


Fig.10-Gate Charge Waveform

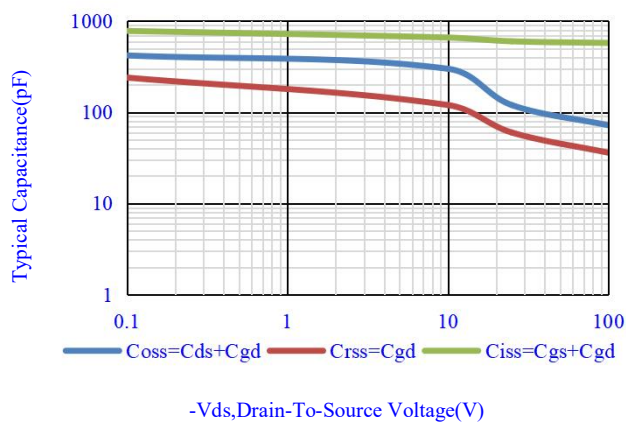


Fig.11-Typical Capacitance Vs. Drain-To-Source Voltage

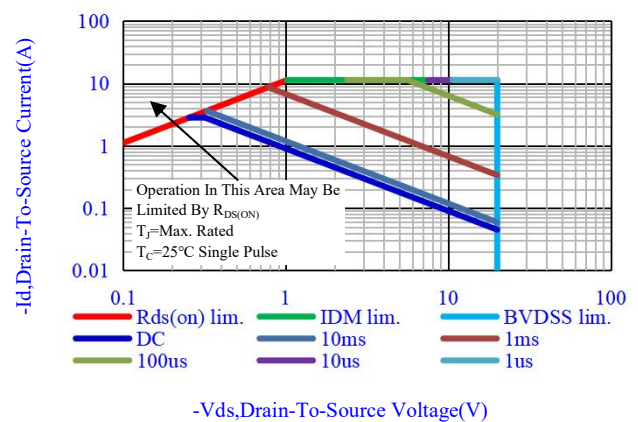


Fig.12-Maximum Safe Operating Area(SOA)

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Typical Characteristics Curves

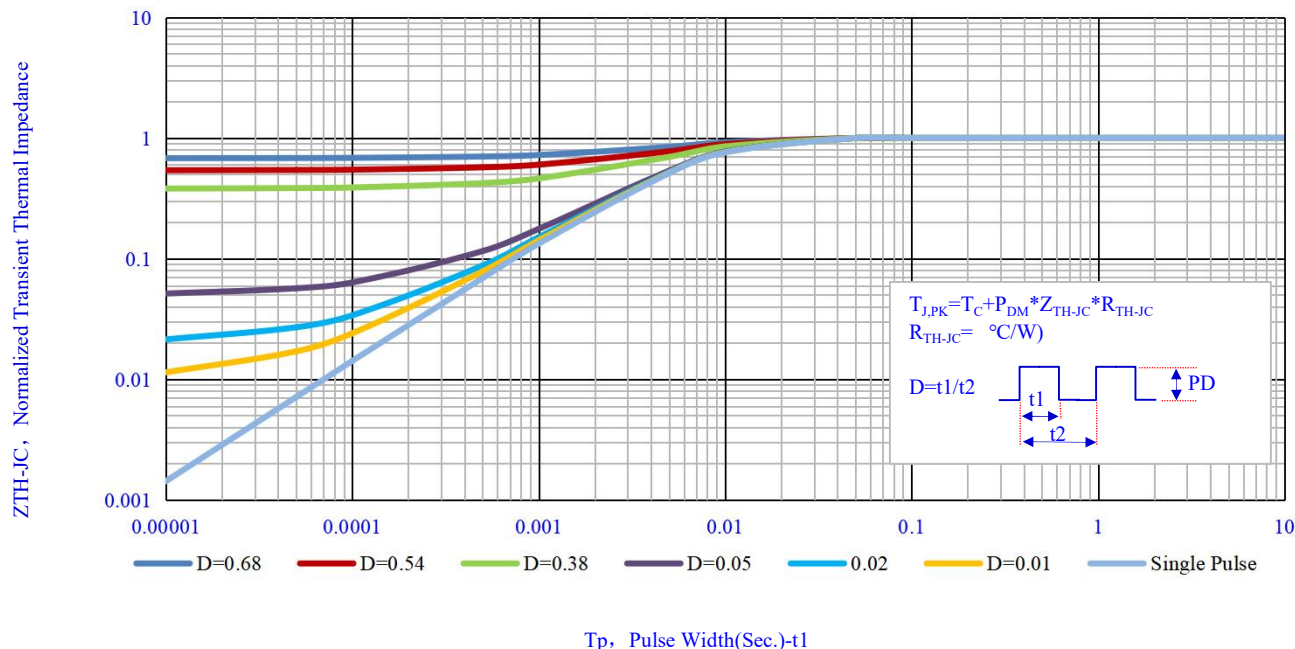


Fig.12- Normalized Maximum Transient Thermal Impedance Vs.Pulse Width

Test Circuit & Waveform

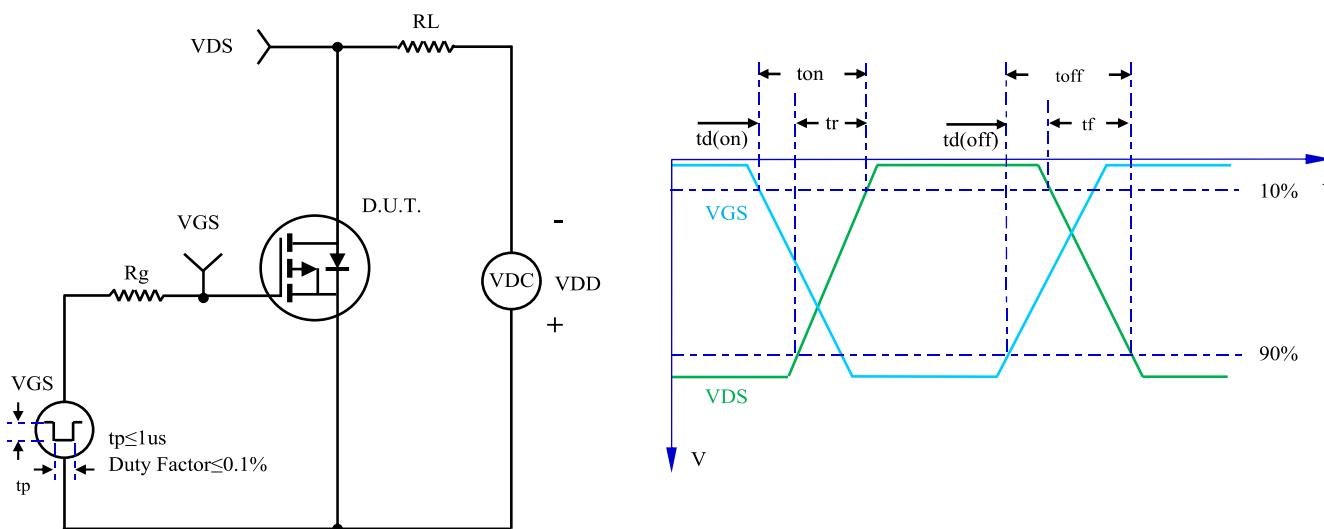


Fig.13- Resistive Switching Test Circuit & Waveform

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Test Circuit & Waveform

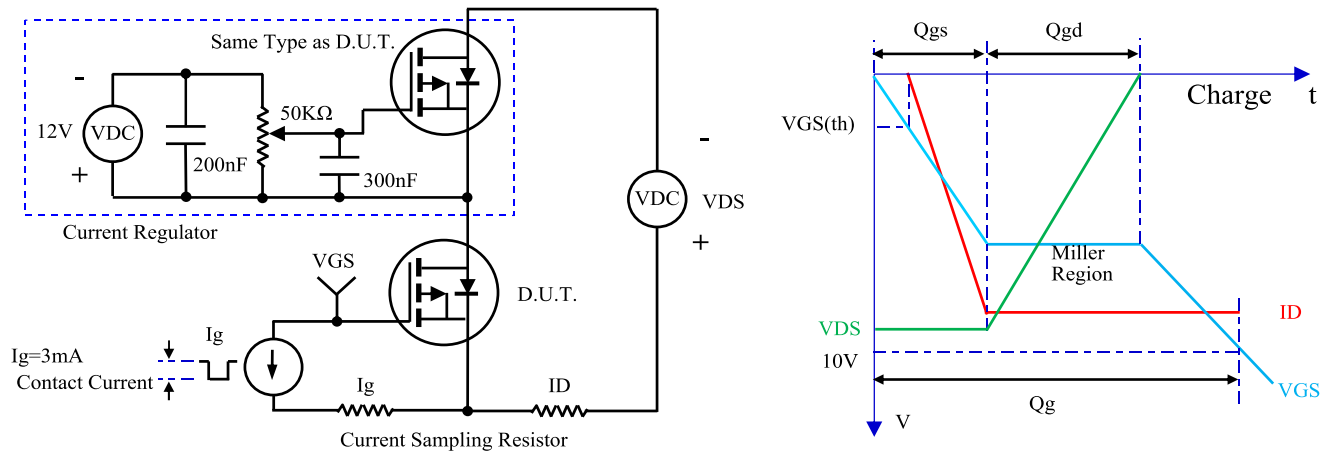


Fig.14-Gate Charge Test Circuit & Waveform

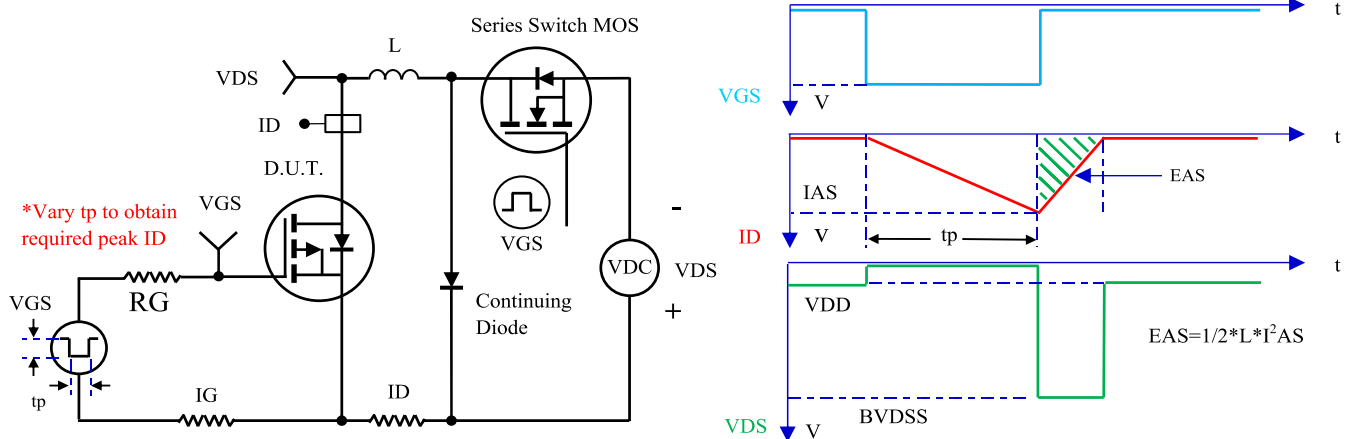


Fig.15- Unclamped Inductive Switching (UIS) Test Circuit & Waveform

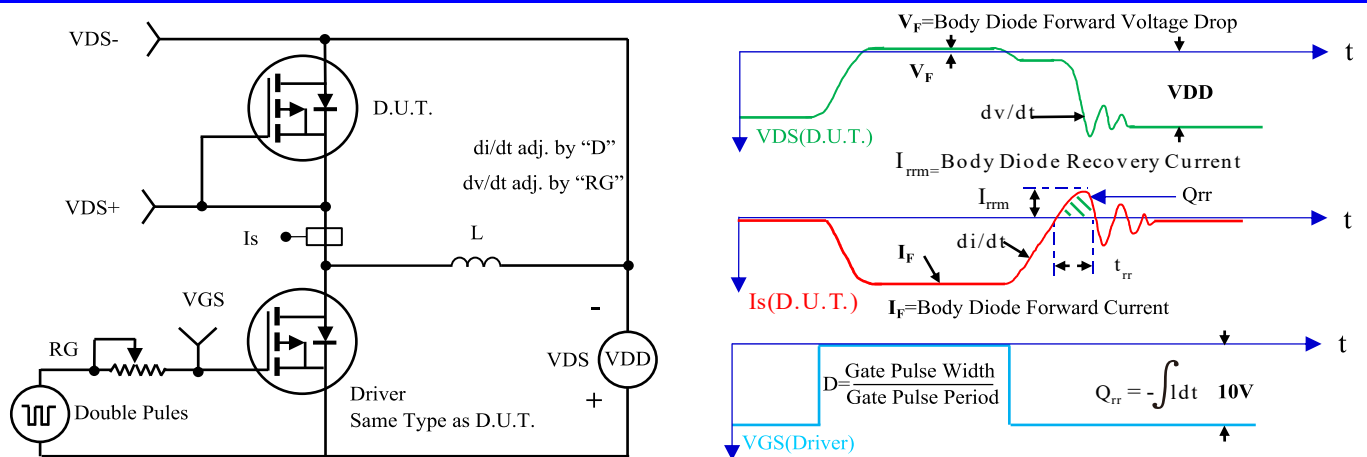


Fig.16- Diode Recovery Test Circuit & Waveform

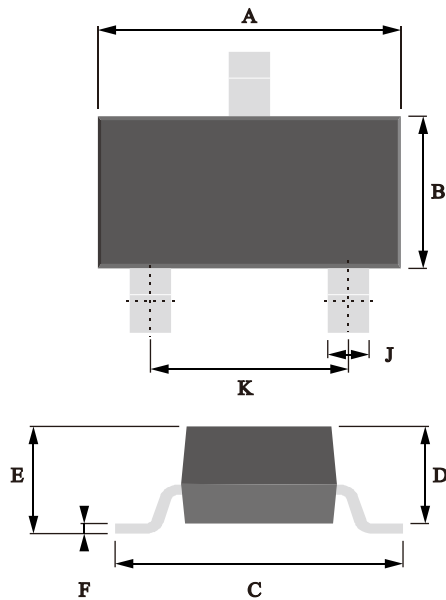
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OUTLINE DRAWINGS

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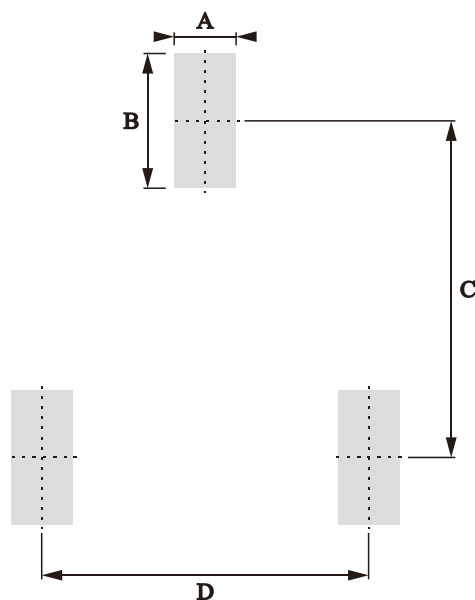


OUTLINE DIMENSIONS

Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	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

RECOMMENDED LAYOUT DRAWINGS

SOT-23



OUTLINE DIMENSIONS

Dim.	Millimeters			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	-

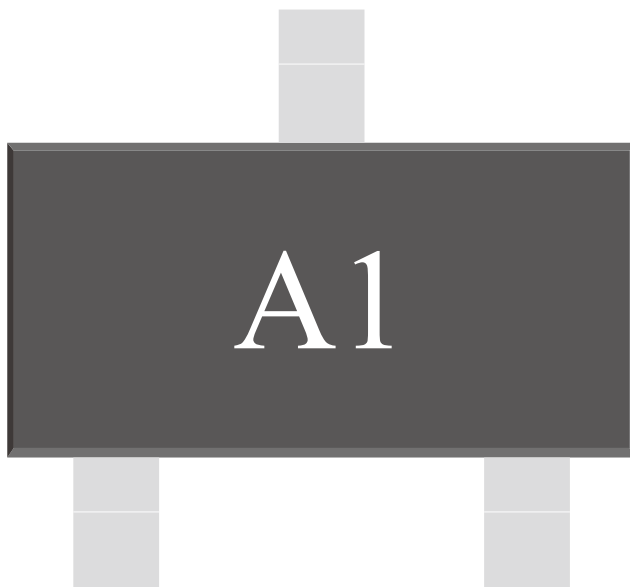
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MARKING INFORMATION

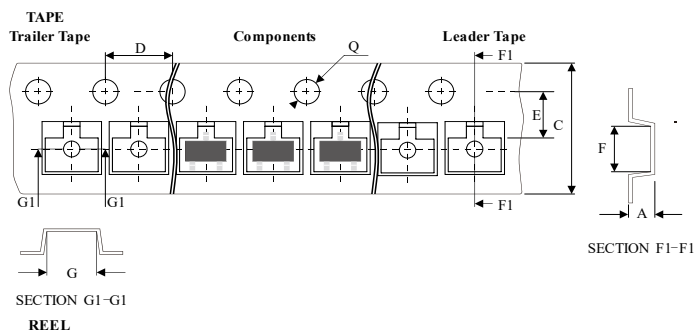
MARKING INSTRUCTIONS



A1=Mark

PACKAGING

SOT-23



OUTLINE DIMENSIONS

Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
TAPE						
A	1.12	-	1.32	0.0441	-	0.0520
C	7.90	-	8.10	0.3110	-	0.3189
D	3.70	-	4.30	0.1457	-	0.1693
E	3.40	-	3.60	0.1339	-	0.1417
F	2.67	-	2.87	0.1051	-	0.1130
G	3.05	-	3.25	0.1201	-	0.1280
Q Φ	1.40	-	1.60	0.0551	-	0.0630
REEL						
L Φ	176.00	-	180.00	6.929	-	7.087
R	12.00	-	14.00	0.4724	-	0.5512
M	11.00	-	13.00	0.4331	-	0.5118

PACKING INFORMATION

Package Type	Package Code	Product 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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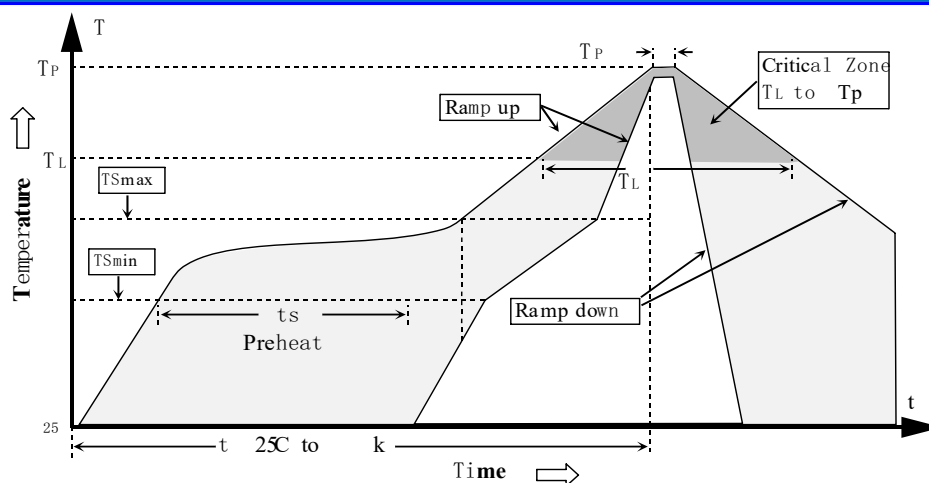


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Recommended wave soldering condition

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 (Tsmx 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.

P-Channel Enhancement Mode Trench Power MOSFET**Disclaimer**

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