NH2399

P-Channel Enhancement Mode Trench Power MOSFET

Pb-Free RoHS COMPLIANT

Voltage:	-20	Volts	**Current:**	-6	Amperes	**Package:**	SOT-23

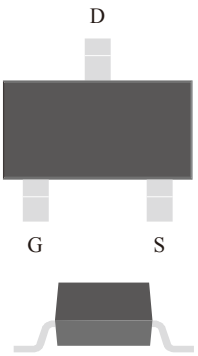
Features

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

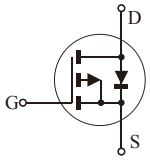
Typical Applications

- 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	-6	**A**
RDS(ON)(TYP)@-10V	28	**mΩ**

Mark
S99

***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}	±12	V
Continuous Drain Current (Note 1)	Ta= 25 ℃ Ta= 100 ℃	I_D	-6 -4	A
Drain Current-Pulse (Note 1)	T_J< 150 ℃	I_{DM}	-24	A
Maximum Power Dissipation Power Dissipation Derating Factor Above 25℃	Ta= 25 ℃ Ta= 100 ℃	P_D	2.5 1.0	W
Derating Factor		D_F	0.02	W/℃

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℃	$R_{\theta JA}$	100	℃/W

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

NH2399

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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= -20 V,VGS=0V	I_{DSS}	--	--	-1	uA
Gate-Body Leakage Current	VGS= ±12 V,VDS=0V	I_{GSS}	--	--	±100	nA
Static On Characteristics						
Gate Threshold Voltage	VGS= VDS ID=-250uA	$V_{GS(TH)}$	-0.6	-1	-1.5	V
Drain-Source On Resistance	ID= -3.0 A,VGS= -10.0 V ID= -3.0 A,VGS= -5.0 V	$R_{DS(ON)}$	-- --	28 41	34 51	mΩ
Dynamic Characteristics						
Input Capacitance	VDS= -10 V VGS= 0 V F= 1 MHZ	C_{iss}	--	1600	--	pF
Output Capacitance		C_{oss}	--	350	--	pF
Reverse Transfer Capacitance		C_{rss}	--	300	--	pF
Switching Paramters With Inductive Load(Test Circuit & Waveform See Fig.15)						
Turn-On Delay Time	VDS= -10 V VGS= -10.0 V RG= 10.0 Ω	$t_{d(on)}$	--	23	--	ns
Turn-On Rise Time		t_r	--	22	--	ns
Turn-Off Delay Time		$t_{d(off)}$	--	30	--	ns
Turn-Off Rise Time		t_f	--	10	--	ns
Gate Charge Paramters (Test Circuit & Waveform See Fig.16)						
Total Gate Charge	VDS= -10 V VGS= -10.0 V ID= -6.0 A	Q_g	--	7	--	nC
Gate-Source Charge		Q_{gs}	--	2	--	nC
Gate-Drain Charge		Q_{gd}	--	3.5	--	nC
Drain-Source Diode Characteristics And Maximum Ratings (Test Circuit & Waveform See Fig.18)						
Max. Diode Forward Current		I_S	--	--	-6.0	A
Max. Pulsed Forward Current		I_{SM}	--	--	-24	A
Diode Forward Voltage	ID= -3.0 A,VGS=0V	V_{SD}	--	-0.7	-1.2	V

NH2399

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Pb-Free RoHS COMPLIANT

Typical Characteristics Curves

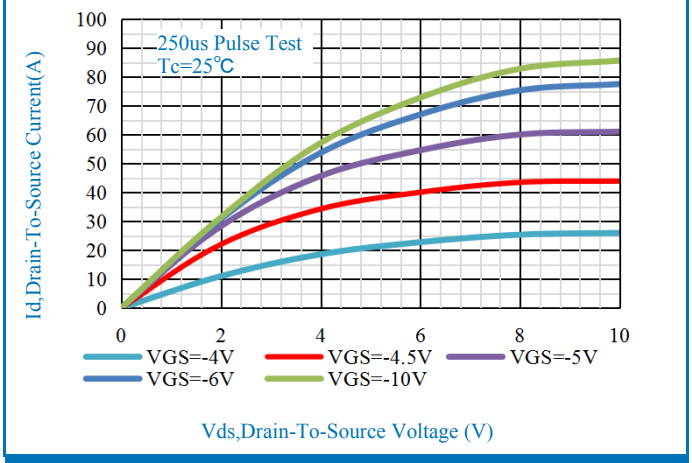


Fig.1-Output Characteristic

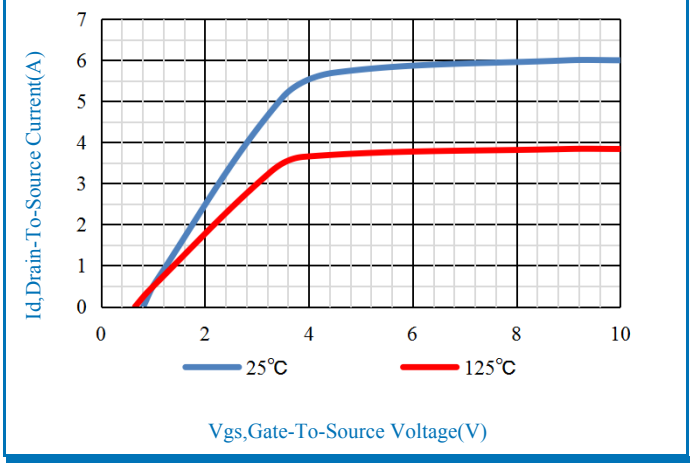


Fig.2-Transfer Characteristic

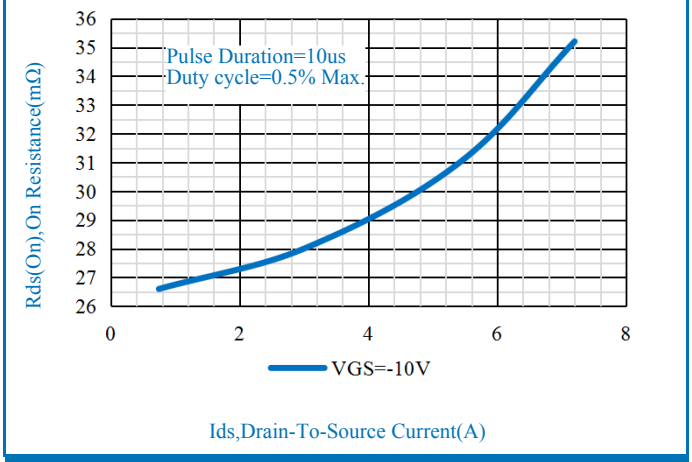


Fig.3-On Resistance Vs. Drain Current

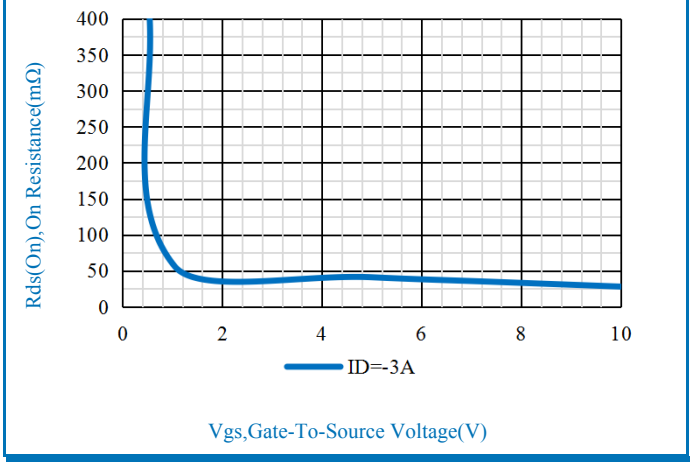


Fig.4-On Resistance Vs. Gate Source Voltage

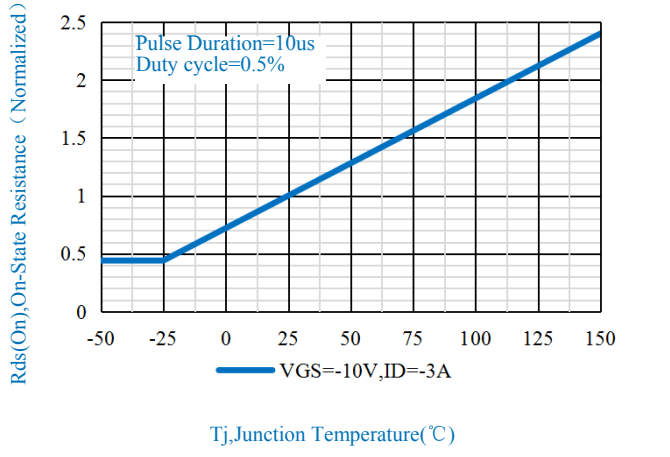


Fig.5-On Resistance Vs. Junction Temperature

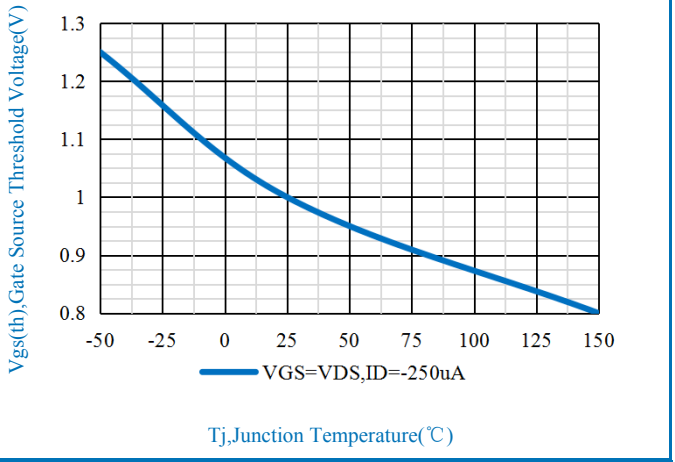


Fig.6-Gate Source Threshold Voltage Vs. Junction Temperature

NH2399

P-Channel Enhancement Mode Trench Power MOSFET

Pb-Free RoHS COMPLIANT

Typical Characteristics Curves

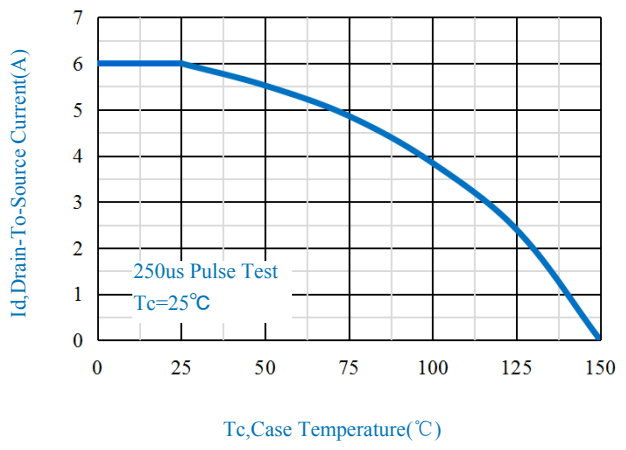


Fig.7-Maximum Continuous Drain Current Vs. Case Temperature

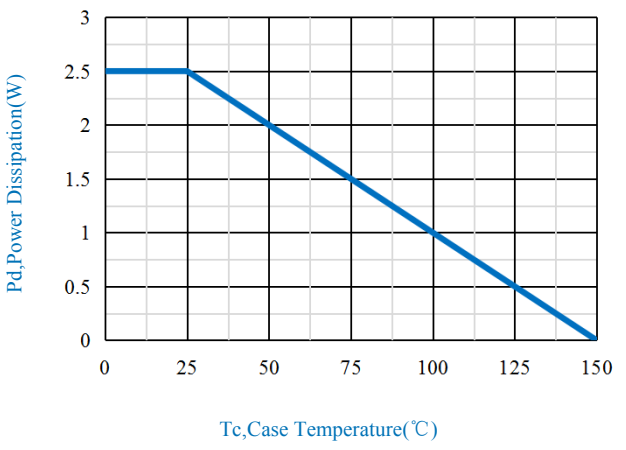


Fig.8-Maximum Power Dissipation Vs. Case Temperature

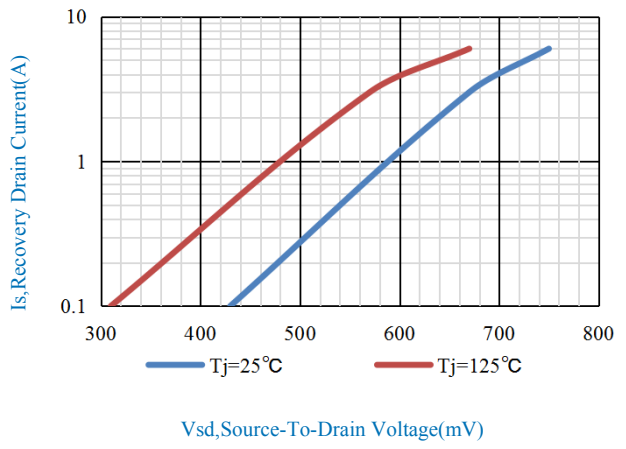


Fig.9-Source-To-Drain Diode Forward Voltage

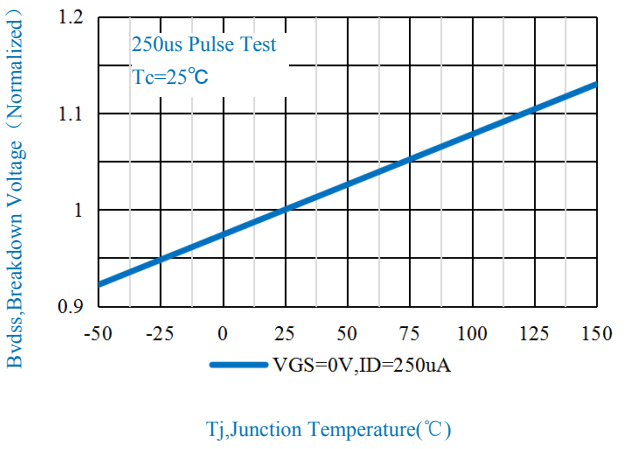


Fig.10-Breakdown Voltage Vs. Junction Temperature

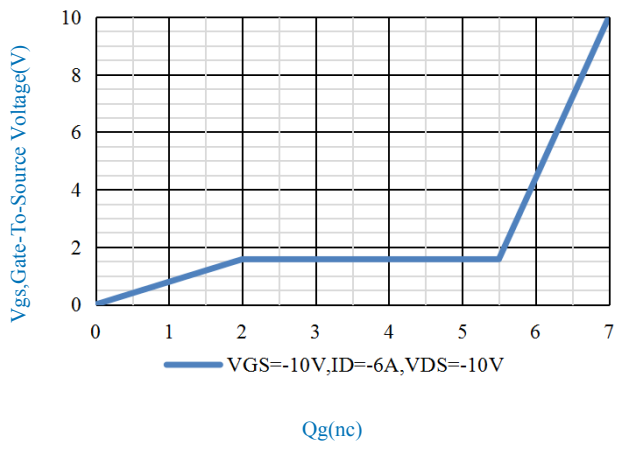


Fig.11-Gate Charge Waveform

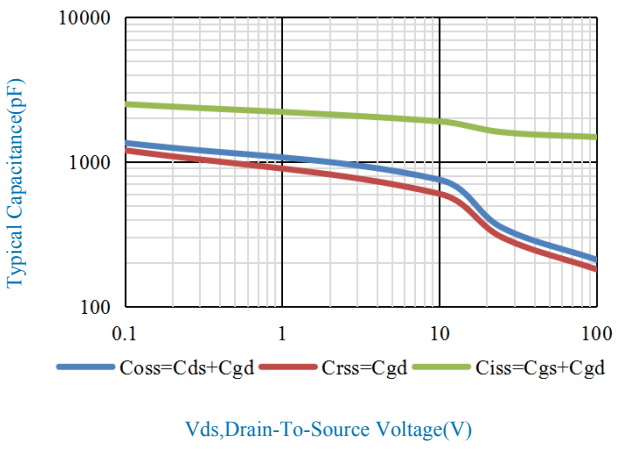


Fig.12-Typical Capacitance Vs. Drain-To-Source Voltage

NH2399

P-Channel Enhancement Mode Trench Power MOSFET

Pb-Free RoHS COMPLIANT

Typical Characteristics Curves

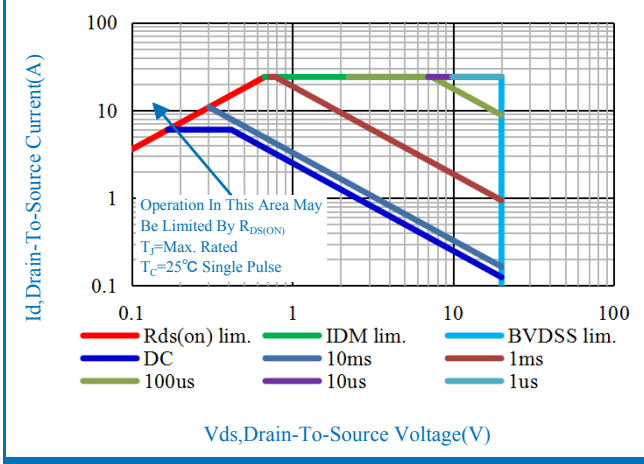


Fig.13-Maximum Safe Operating Area(SOA)

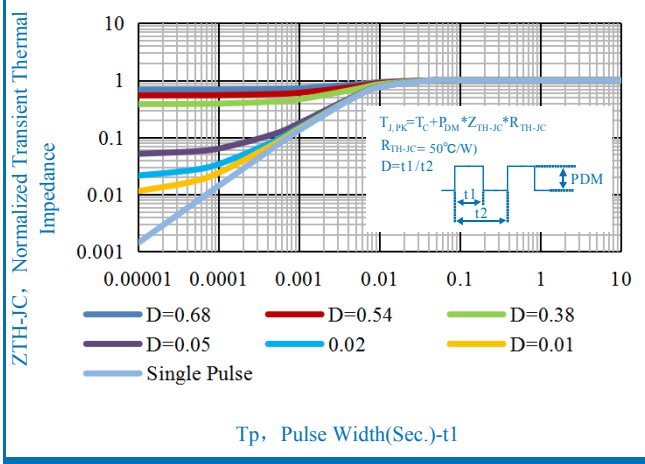
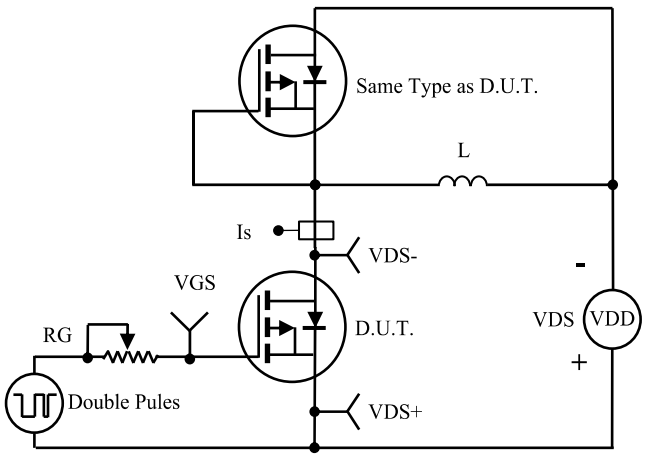


Fig.14- Normalized Maximum Transient Thermal Impedance Vs.Pulse Width

Inductive Load Test Circuit & Waveform



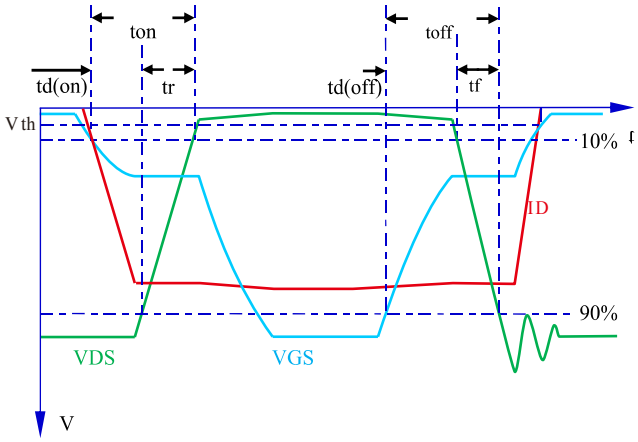


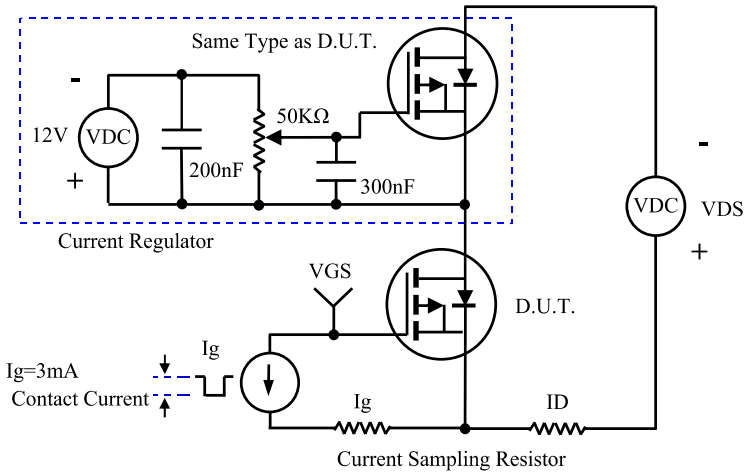
Fig.15- Inductive Switching Test Circuit & Waveform

NH2399

P-Channel Enhancement Mode Trench Power MOSFET

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Test Circuit & Waveform



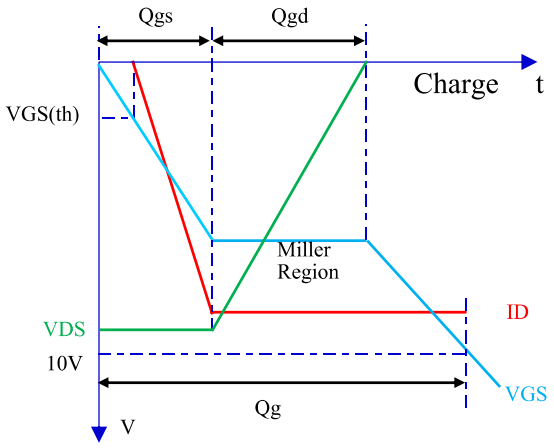
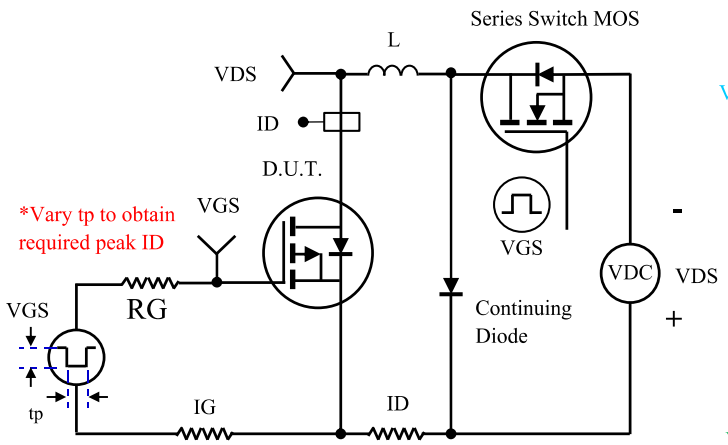


Fig.16-Gate Charge Test Circuit & Waveform



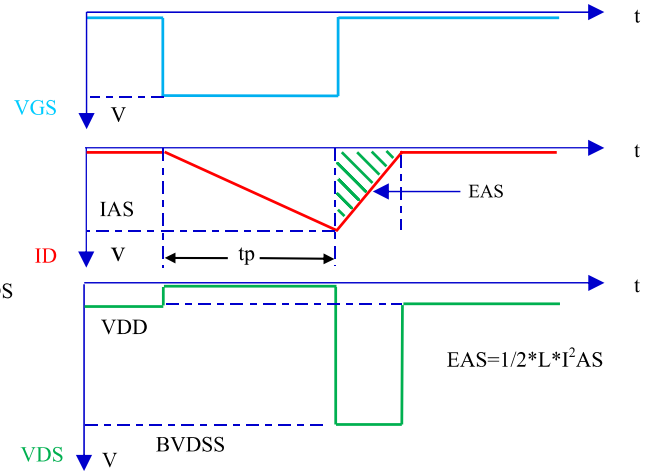
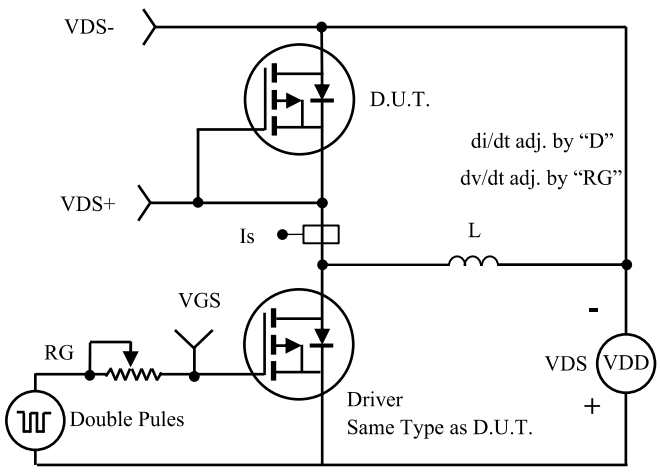


Fig.17- Unclamped Inductive Switching (UIS) Test Circuit & Waveform



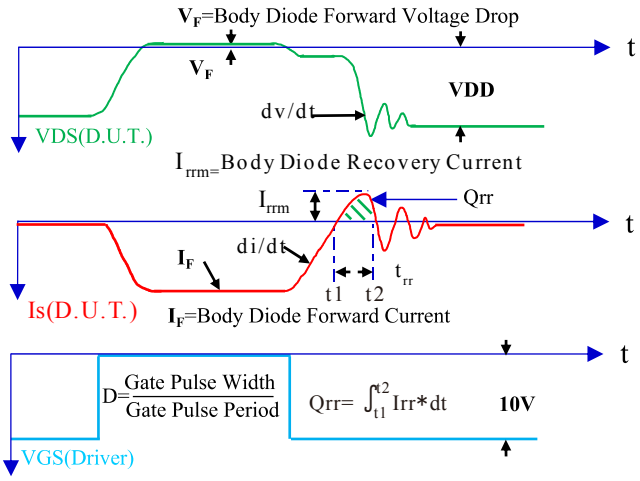


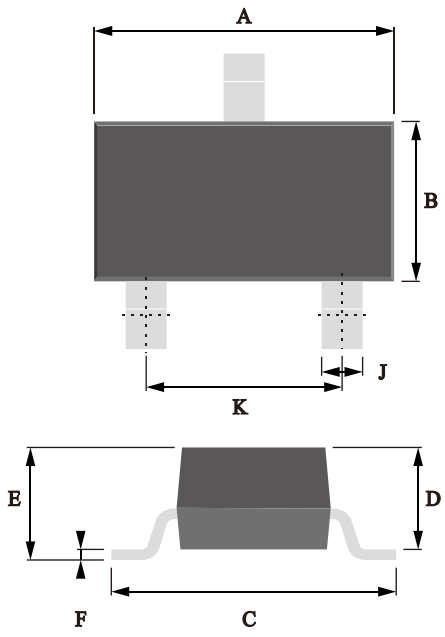
Fig.18- Diode Recovery Test Circuit & Waveform

NH2399

P-Channel Enhancement Mode Trench Power MOSFET

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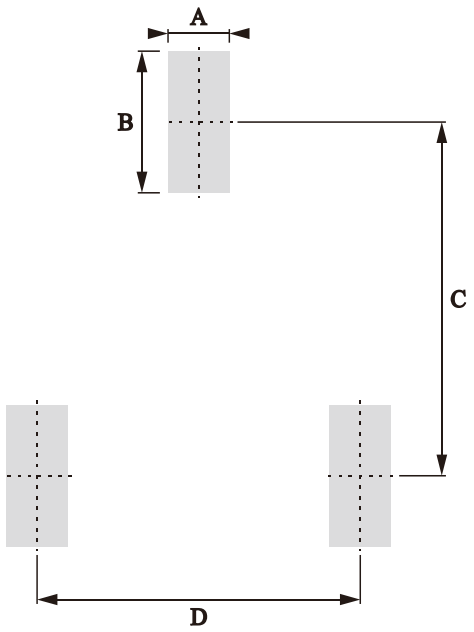
OUTLINE DRAWINGS



SOT-23

OUTLINE DIMENSIONS						
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.80	3.00	3.20	0.1102	-	0.1260
B	1.15	1.30	1.45	0.0453	-	0.0571
C	2.25	2.45	2.65	0.0886	-	0.1043
D	0.85	1.00	1.15	0.0335	-	0.0453
E	0.90	1.05	1.20	0.0354	-	0.0472
F	0.08	0.13	0.18	0.0031	-	0.0071
J	0.30	0.40	0.50	0.0118	-	0.0197
K	1.70	1.90	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	-

NH2399

P-Channel Enhancement Mode Trench Power MOSFET

Pb-Free RoHS COMPLIANT

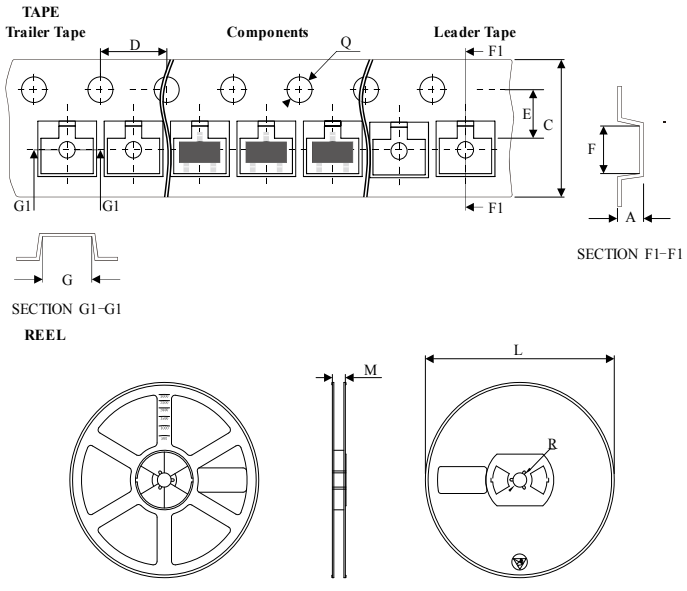
MARKING INFORMATION



MARKING INSTRUCTIONS

S99=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	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

NH2399

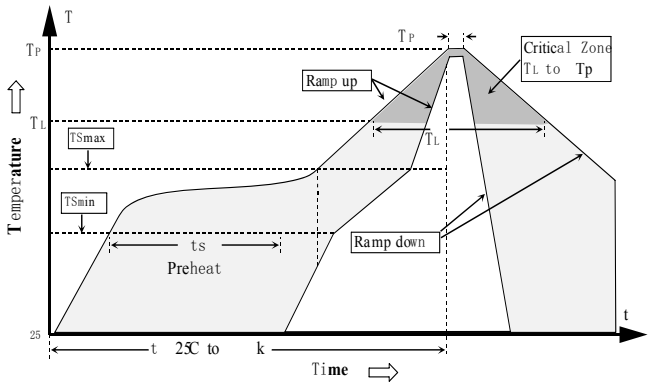
P-Channel Enhancement Mode Trench Power MOSFET

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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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NH2399

P-Channel Enhancement Mode Trench Power MOSFET

Pb Pb-Free RoHS COMPLIANT

Specification Revision History

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

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