

NH3416



N-Channel Enhancement Mode Trench Power MOSFET

Voltage: 20 Volts

Current: 7 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)
- Built-in ESD Protected

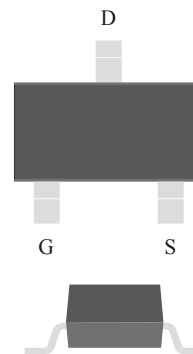
Typical Applications

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

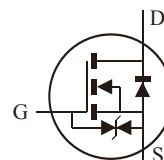
Product Summary

VDS Min.@Tj	20	V
ID Min.@Ta	7	A
RDS(ON)(TYP)@4.5V	13	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}	20	V
Gate-Source Voltage		V _{GS}	±12	V
Continuous Drain Current (Note 1)	Ta= 25 ℃	I _D	7	A
	Ta= 100 ℃		4	
Drain Current-Pulse (Note 1)	Tj< 150 ℃	I _{DM}	28	A
Maximum Power Dissipation Power	Ta= 25 ℃	P _D	1100	mW
Dissipation Derating Factor Above 25℃	Ta= 100 ℃		440	
Derating Factor		D _F	8.80	mW/℃

Thermal Characteristics (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 _{θJA}	125	℃/W

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

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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= 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)}	0.45	0.73	1	V
Drain-Source On Resistance	ID= 3.5 A,VGS= 4.5 V	R _{DS(ON)}	--	13	18	mΩ
	ID= 3.5 A,VGS= 2.5 V		--	19	27	
Dynamic Characteristics						
Input Capacitance	VDS= 10 V VGS= 0 V F= 1 MHZ	C _{iss}	--	610	--	pF
Output Capacitance		C _{oss}	--	130	--	pF
Reverse Transfer Capacitance		C _{rss}	--	110	--	pF
Switching Paramters With Inductive Load(Test Circuit & Waveform See Fig.15)						
Turn-On Delay Time	VDS= 10 V VGS= 4.5 V RG= 10.0 Ω	t _{d(on)}	--	4	--	ns
Turn-On Rise Time		t _r	--	15	--	ns
Turn-Off Delay Time		t _{d(off)}	--	18	--	ns
Turn-Off Rise Time		t _f	--	8	--	ns
Gate Charge Paramters (Test Circuit & Waveform See Fig.16)						
Total Gate Charge	VDS= 10 V VGS= 4.5 V ID= 7.0 A	Q _g	--	12	--	nC
Gate-Source Charge		Q _{gs}	--	2	--	nC
Gate-Drain Charge		Q _{gd}	--	2.5	--	nC
Drain-Source Diode Characteristics And Maximum Ratings (Test Circuit & Waveform See Fig.18)						
Max. Diode Forward Cuurent		I _s	--	--	7.0	A
Max. Pulsed Forward Cuurent		I _{SM}	--	--	28	A
Diode Forward Voltage	ID= 3.5 A,VGS=0V	V _{SD}	--	0.7	1.2	V

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Typical Characteristics Curves

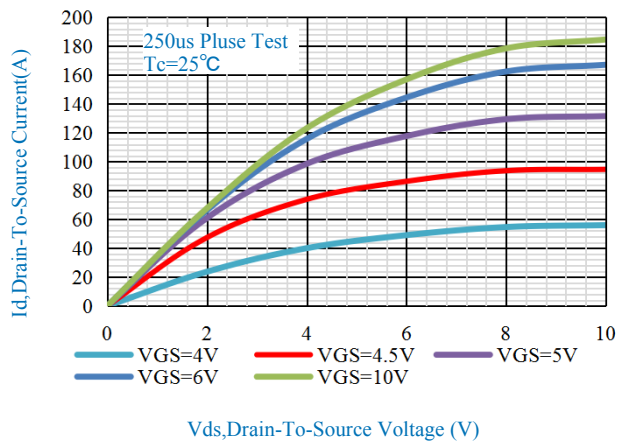


Fig.1-Output Characteristics

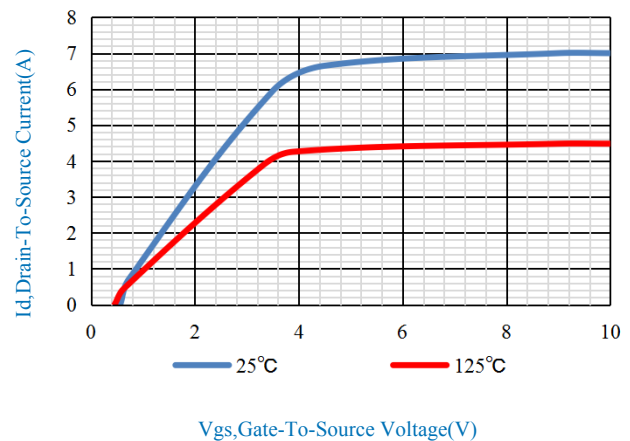


Fig.2-Transfer Characteristics

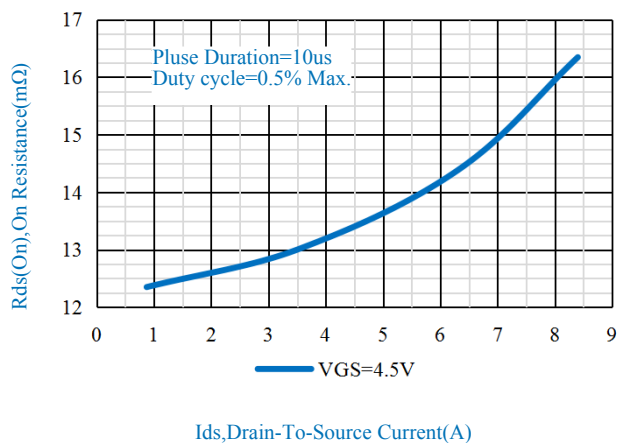


Fig.3-On Resistance Vs. Drain Current

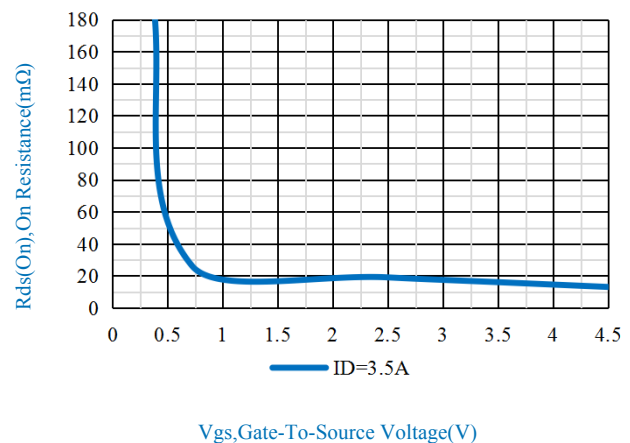


Fig.4-On Resistance Vs. Gate Source Voltage

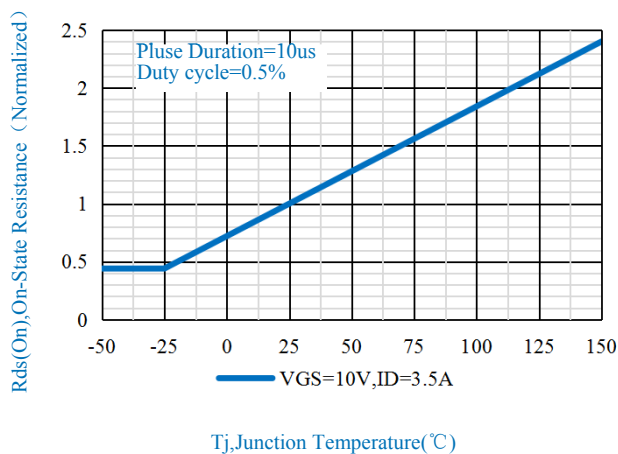


Fig.5-On Resistance Vs. Junction Temperature

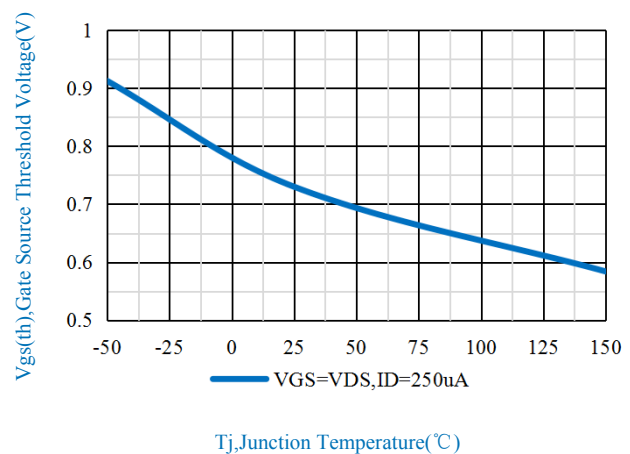


Fig.6-Gate Source Threshold Voltage Vs. Junction Temperature

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Typical Characteristics Curves

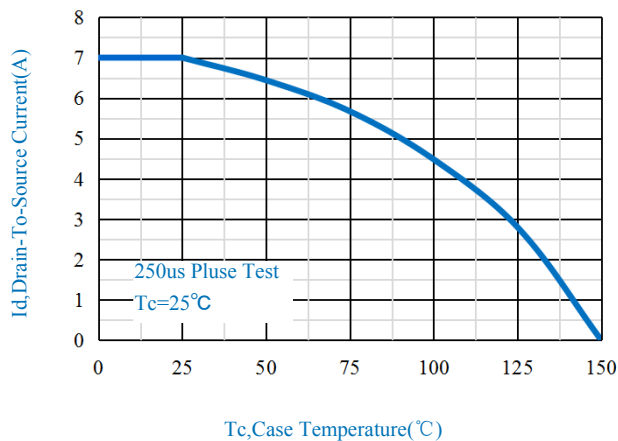


Fig.7-Maximum Continuous Drain Current Vs. Case Temperature

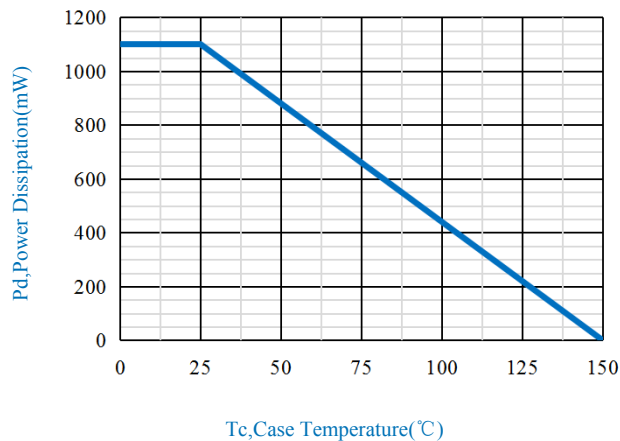


Fig.8-Maximum Power Dissipation Vs. Case Temperature

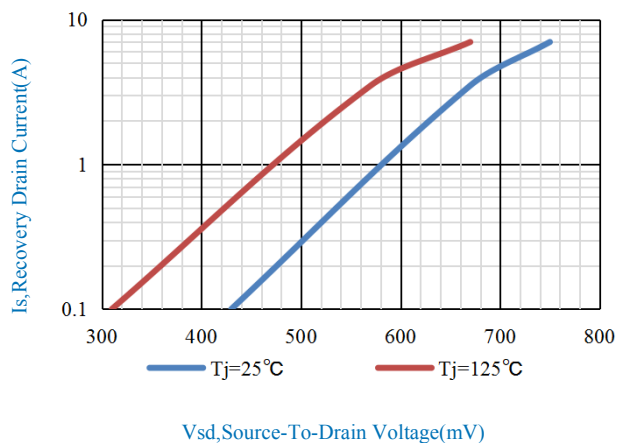


Fig.9-Source-To-Drain Diode Forward Voltage

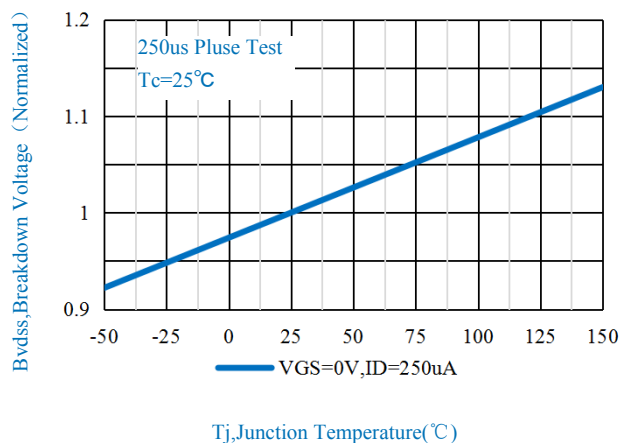


Fig.10-Breakdown Voltage Vs. Junction Temperature

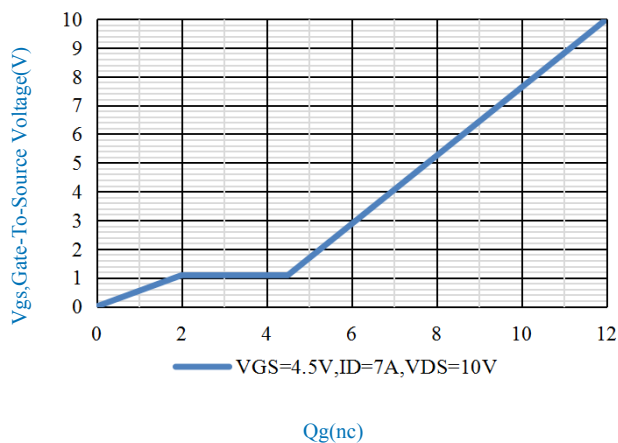


Fig.11-Gate Charge Waveform

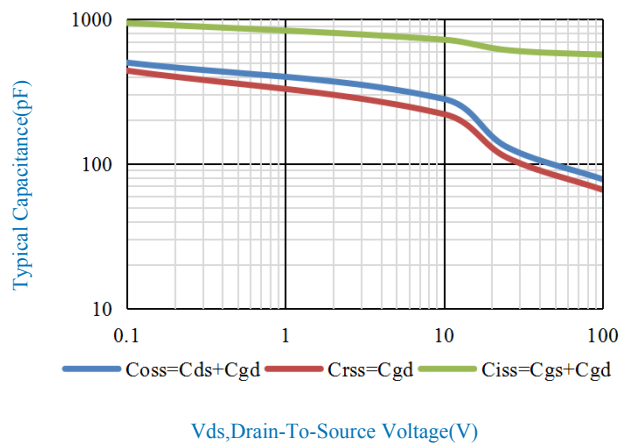


Fig.12-Typical Capacitance Vs. Drain-To-Source Voltage

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Typical Characteristics Curves

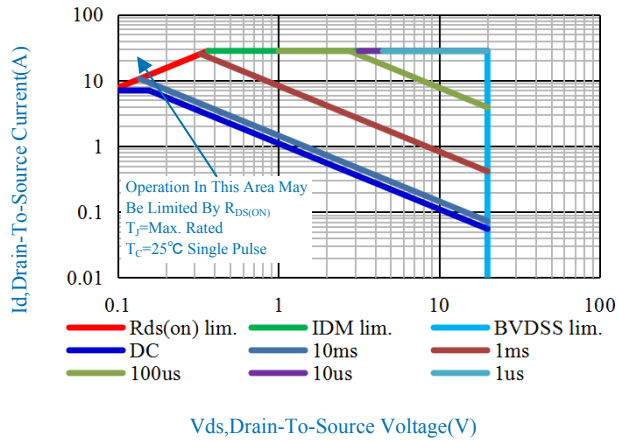


Fig.13-Maximum Safe Operating Area(SOA)

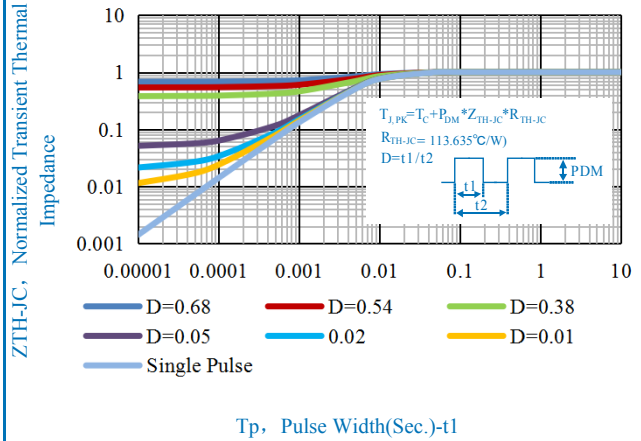


Fig.14- Normalized Maximum Transient Thermal Impedance Vs.Pulse Width

Inductive Load Test Circuit & Waveform

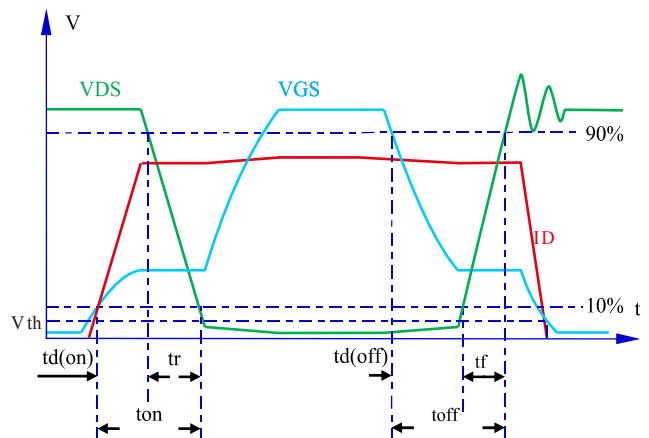
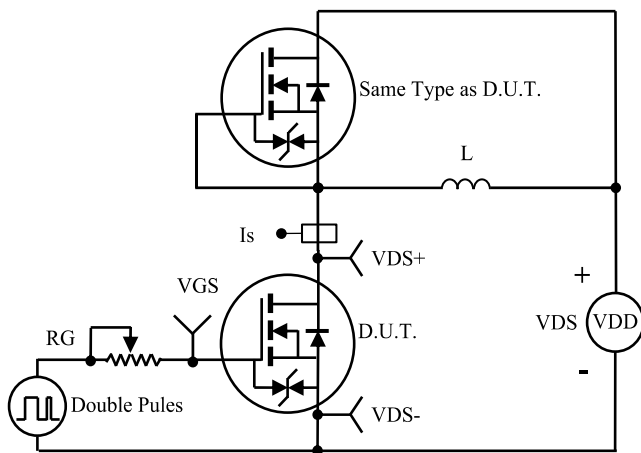


Fig.15- Inductive Switching Test Circuit & Waveform

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Test Circuit & Waveform

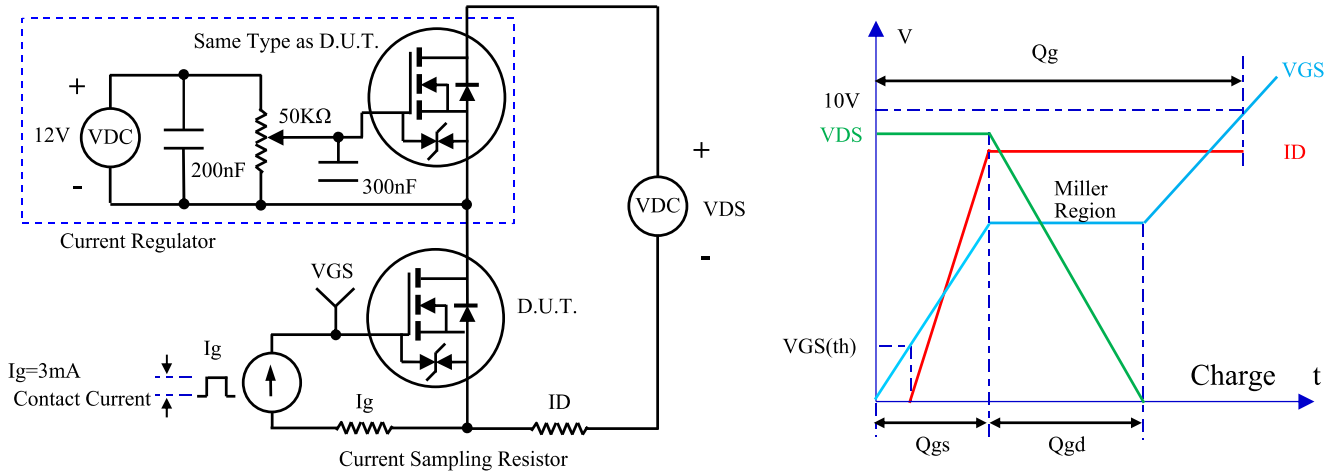


Fig.16- Gate Charge Test Circuit & Waveform

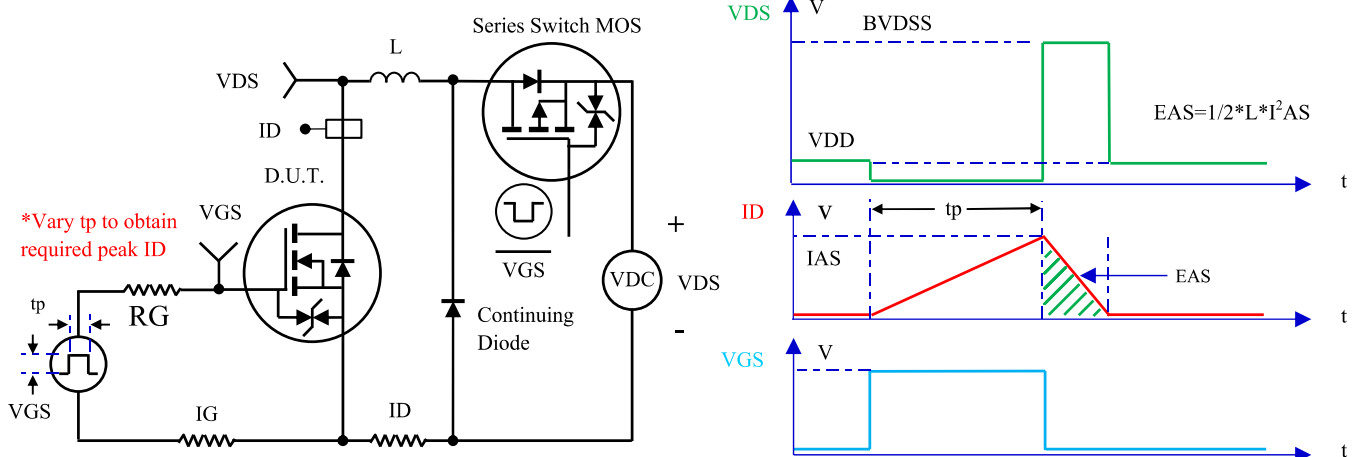


Fig.17- Unclamped Inductive Switching (UIS) Test Circuit & Waveform

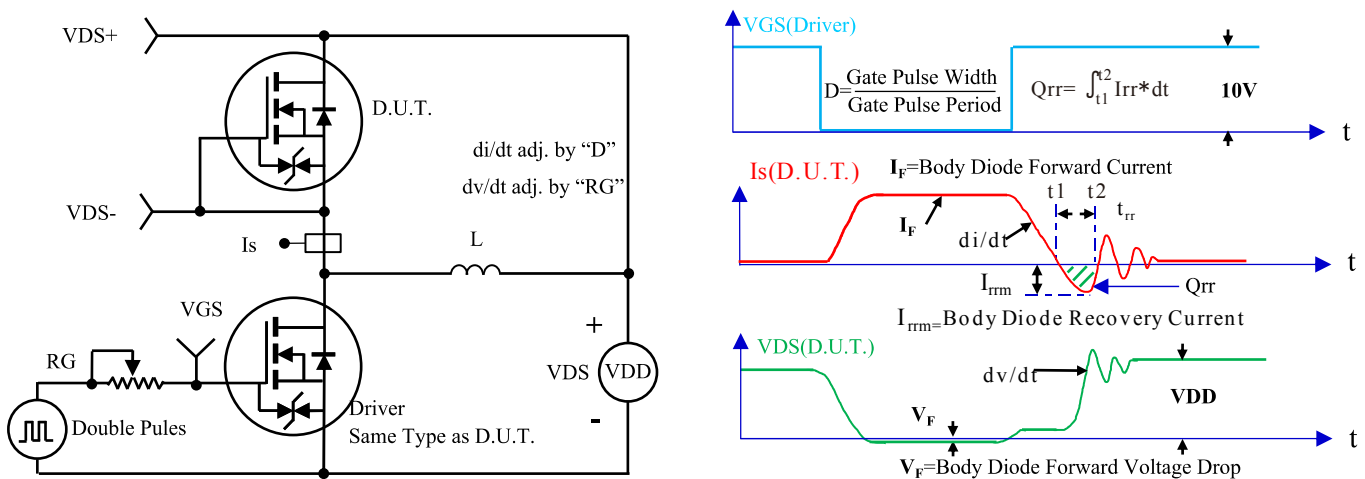


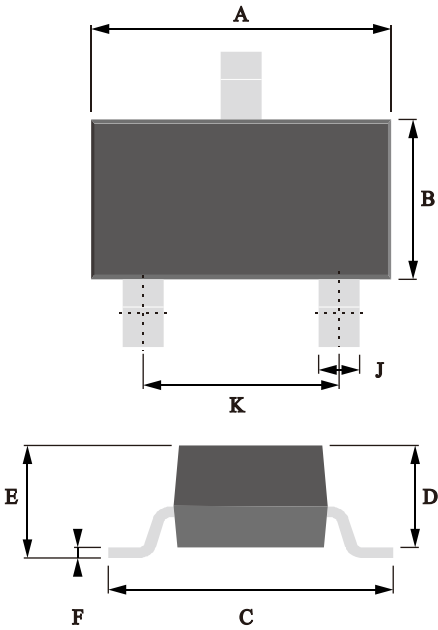
Fig.18- Diode Recovery Test Circuit & Waveform

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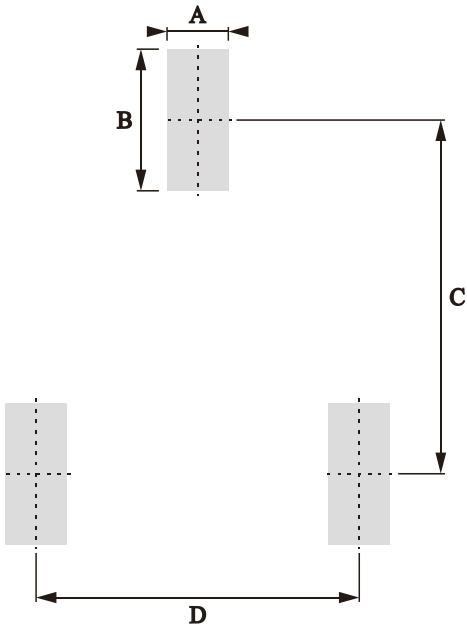
OUTLINE DRAWINGS



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

RECOMMEDND LAYOUT DRAWINGS



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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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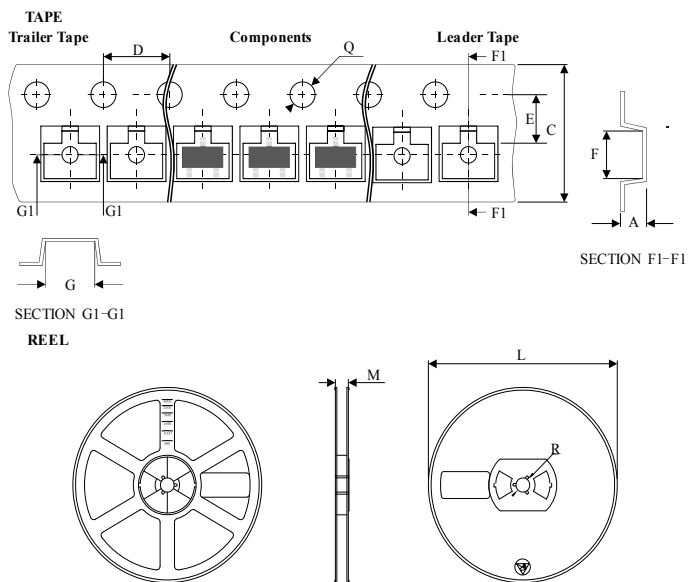
MARKING INFORMATION



MARKING INSTRUCTIONS

3416=Mark

PACKAGING



SOT-23

OUTLINE DIMENSIONS						
Dim.	Millimeters			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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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 (t _p)	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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Specification Revision History

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