

2N7002K

N-Channel Enhancement Mode Power MOSFET



VOLTAGE: 60 Volts

CURRENT: 0.34 Amperes

Package: SOT-23

Marking And Polarity

FEATURES

- Low $R_{DS(ON)}$ For High Efficiency
- Low Gate Charge For High Speed Switching
- High EAS For High Reliability
- 100% UIS And RG Tested

TYPICAL APPLICATIONS

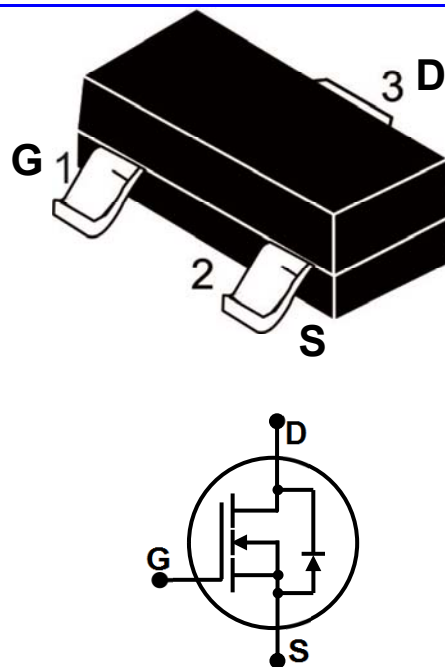
- DC/DC Converter And Synchronous Rectification
- High-Frequency Circuits And Battery Management System(BMS)
- The Motor Drives And Printed Circuit Board Control
- Automotive Electronics And UPS (Uninterruptible Power Supplies)
- **Weight:App. 0.008 grams (0.00028 ounce)**

PRODUCT SUMMARY

VDS Min.@T _j	60	V
I _D Min.@Ta	0.34	A
RDS(ON) Type@10V	2.20	Ω

Marking

72K



Absolute Maximum Ratings (Ta=25°C Unless Otherwise Specified)

Parameter	Test Conditions	Symbol	Ratings	Unit
Drain-Source Voltage		V_{DS}	60	V
Gate-Source Voltage		V_{GS}	±20	V
Continuous Drain Current (Note 1)	Ta= 25 °C	I_D	0.34	A
	Ta= 100 °C		0.22	
Drain Current-Pulsed (Note 1)	T _j < 150 °C	I_{DM}	1.36	A
Maximum Power Dissipation Power	Ta= 25 °C	P_D	8.33	W
Dissipation Derating Factor Above 25°C	Ta= 100 °C		3.33	
Derating Factor		D_F	0.07	W/°C
Junction Temperature		T_J	-55 to 150	°C
Storage Temperature Range		T_{STD}	-55 to 150	°C
Avalanche Current,Single Pulse (Note 1)	L= 0.5 mH	I_{AS}	7	A
Single Pulse Avalanche Energy (Note 1) Test Circuit & Waveform See Fig.16	L= 0.5 mH,VDD= 30 V IAS= 6.7 A,RG= 10 Ω Starting T _j =25 °C,VG = 10 V	E_{AS}	11	mJ

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

Parameter	Test Conditions	Symbol	Typ.	Unit
Thermal Resistance Junction To Ambient	Still Air Environment With Ta =25°C	$R_{\theta JA}$	300.0	°C/W
Thermal Resistance Junction-Case	Device Mounted On 1 in ² FR-4 Board With 2oz	$R_{\theta JC}$	15.0	

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}	60	--	--	V
Bvdss Temperature Coefficient	ID=250uA,Reference25℃	$\Delta BV_{DSS}/\Delta T_J$	--	0.069	--	V/℃
Drain-Source Leakage Current	VDS= 60 V,VGS=0V	I_{DSS}	--	--	1	uA
Gate-Body Leakage Current	VGS= ±20 V,VDS=0V	I_{GSS}	--	--	±100	nA
Forward Transconductance	ID= 0 A,VDS= 5 V	g_{fs}	--	5	--	S
Static on Characteristics						
Gate Threshold Voltage	VGS= VDS ID=250uA	$V_{GS(TH)}$	1.0	1.7	2.5	V
Drain-Source On Resistance	ID= 0 A,VGS= 10 V	$R_{DS(ON)}$	--	2.20	5.00	Ω
	ID= 0 A,VGS= 4.5 V		--	2.53	6.70	
Dynamic Characteristics						
Gate Resistance	VGS=0V,VDS=0V, Freq.=1MHz	R_g	--	2.90	--	Ω
Input Capacitance	VDS= 30 V VGS= 0 V F= 1 MHZ	C_{iss}	--	27.0	--	pF
Output Capacitance		C_{oss}	--	4.0	--	pF
Reverse Transfer Capacitance		C_{rss}	--	2.5	--	pF
Switching Paramters (Test Circuit & Waveform See Fig.14)						
Turn-On Delay Time	VDS= 30 V VGS= 10 V RL= 1.2 Ω RG= 10 Ω	$t_{d(on)}$	--	4.3	--	ns
Turn-On Rise Time		t_r	--	5.3	--	ns
Turn-Off Delay Time		$t_{d(off)}$	--	15.0	--	ns
Turn-Off Rise Time		t_f	--	8.2	--	ns
Gate Charge Paramters (Test Circuit & Waveform See Fig.15)						
Total Gate Charge	VDS= 30 V VGS= 10 V ID= 0 A	Q_g	--	3.7	--	nC
Gate-Source Charge		Q_{gs}	--	1.0	--	nC
Gate-Drain Charge		Q_{gd}	--	2.6	--	nC
Drain-Source Diode Characteristics And Maximum Ratings (Test Circuit & Waveform See Fig.17)						
Max. Diode Forward Cuurent		I_S	--	--	0.34	A
Max. Pulsed Forward Cuurent		I_{SM}	--	--	1.19	A
Diode Forward Voltage	ID= 0 A,VGS=0V	V_{SD}	--	1.00	1.4	V
Reverse Recovery Time	ID= 0 A,di/dt= 100 A/us	t_{rr}	--	30.0	--	ns
Reverse Recovery Charge	VGS= 10 V,VDS= 30 V	Q_{rr}	--	30.0	--	nC

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Typical Characteristics Curves

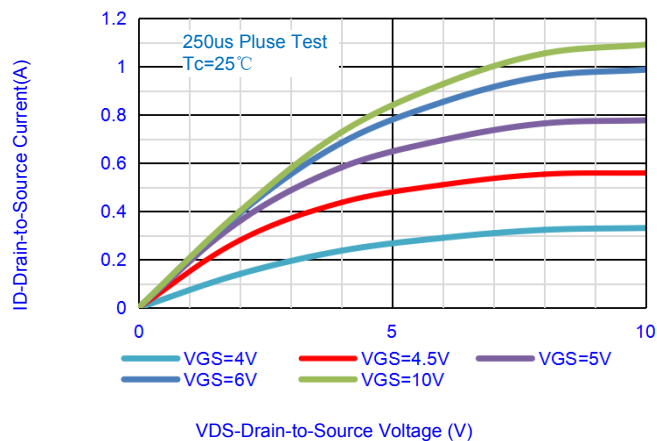


Fig.1-Output Characteristics

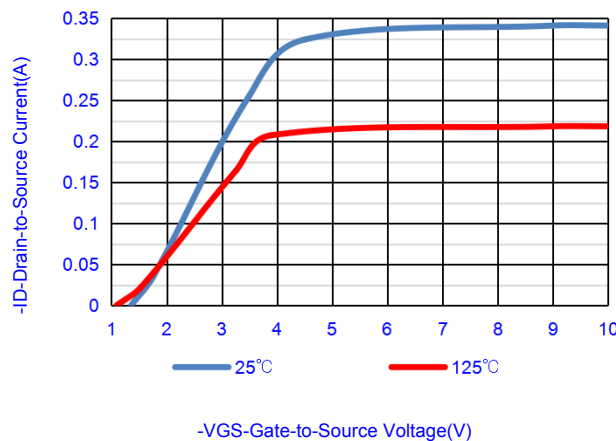


Fig.2- Transfer Characteristics

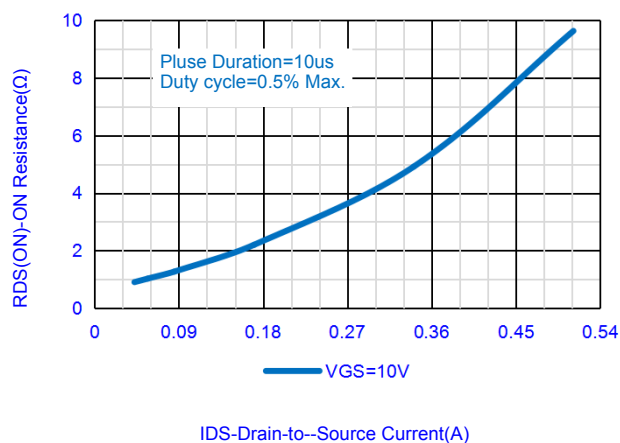


Fig.3- On Resistance vs. Drain Current

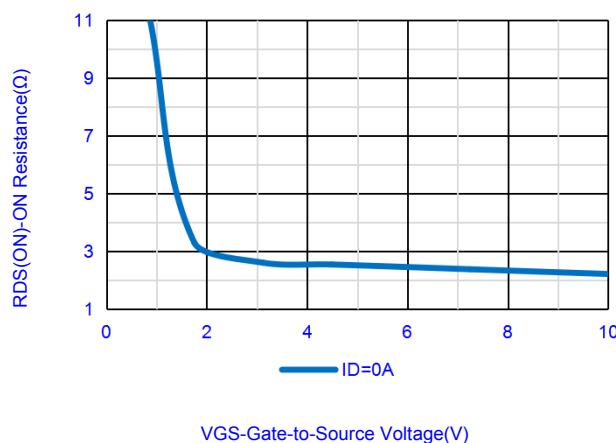


Fig.4- On Resistance vs. Gate Source Voltage

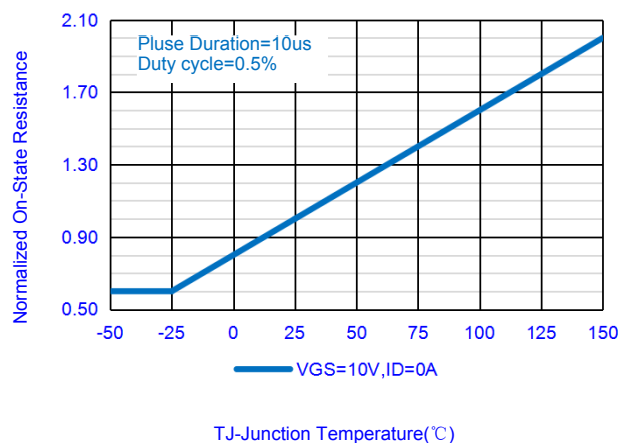


Fig.5- On Resistance vs. Junction Temperature

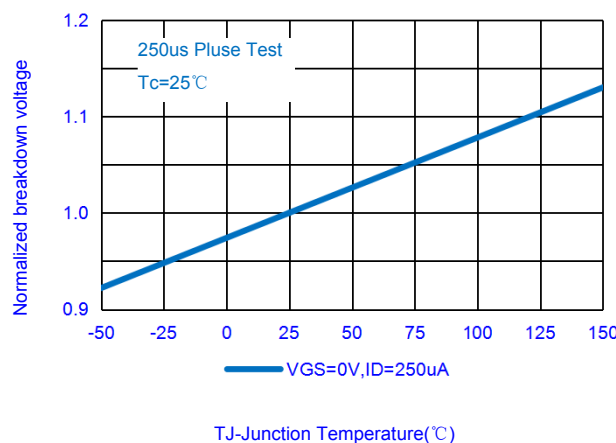


Fig.6- Breakdown Voltage vs. Junction Temperature

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Typical Characteristics Curves

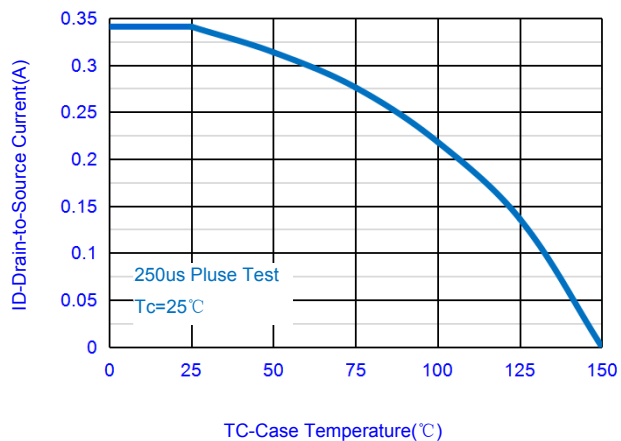


Fig.7-Maximum Continuous Drain Current vs. Case Temperature

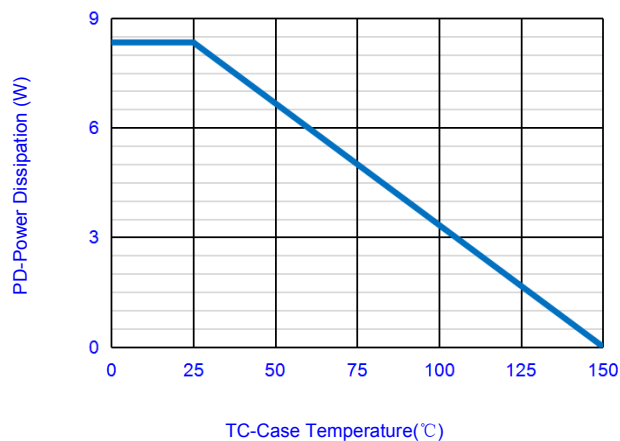


Fig.8-Maximum Power Dissipation vs. Case Temperature

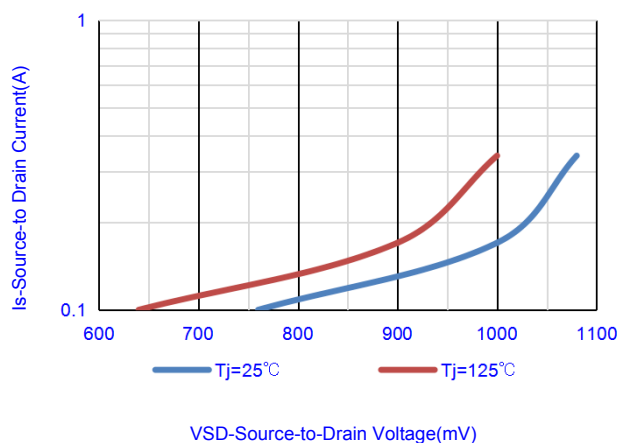


Fig.9- Source-Drain Diode Forward Voltage

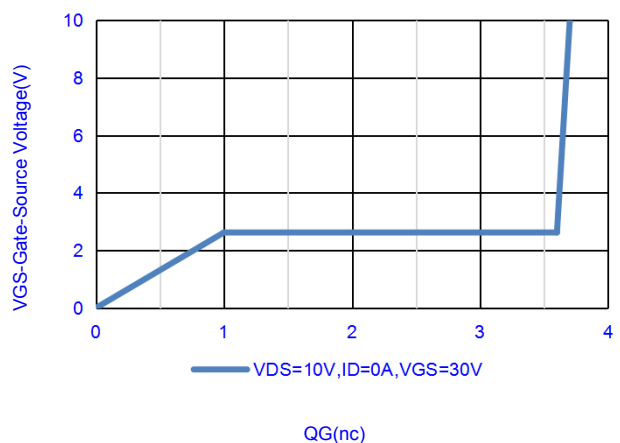


Fig.10-Gate Charge Waveform

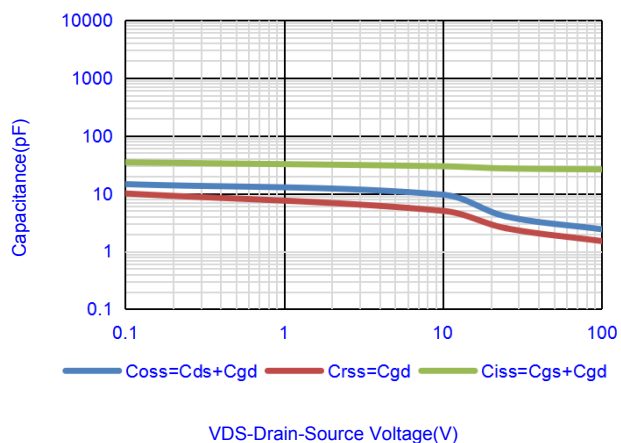


Fig.11- Gate-Source Voltage-VGS(V)

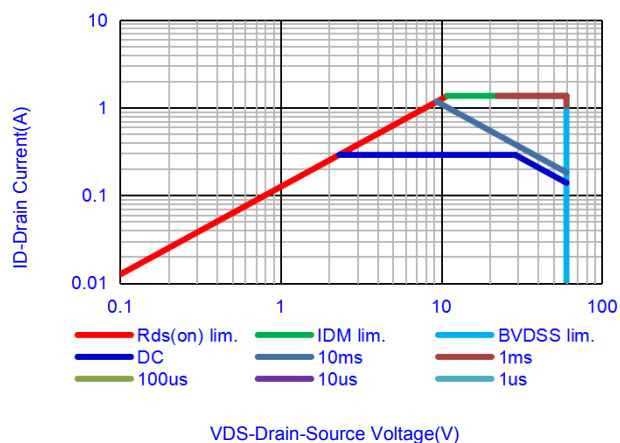


Fig.12-Maximum Safe Operating Area(SOA)

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Typical Characteristics Curves

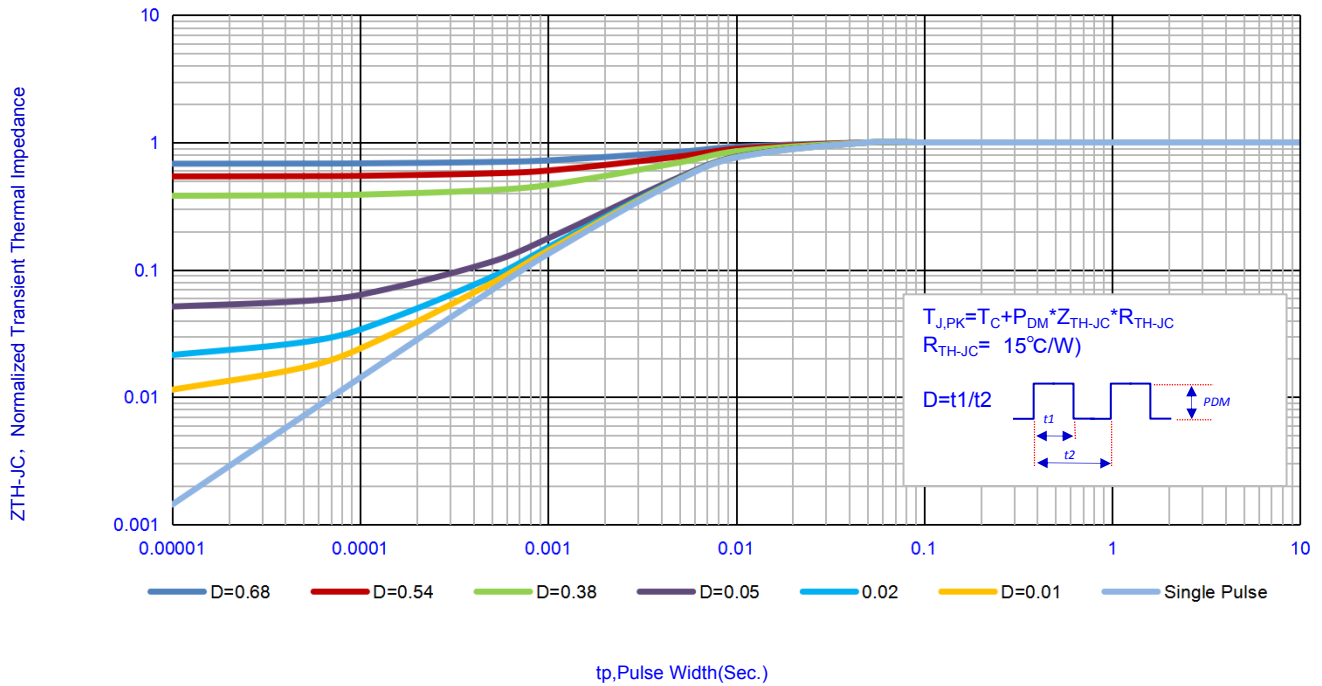


Fig.13- Normalized Maximum Transient Thermal Impedance vs.Pulse Width

Test Circuit & Waveform

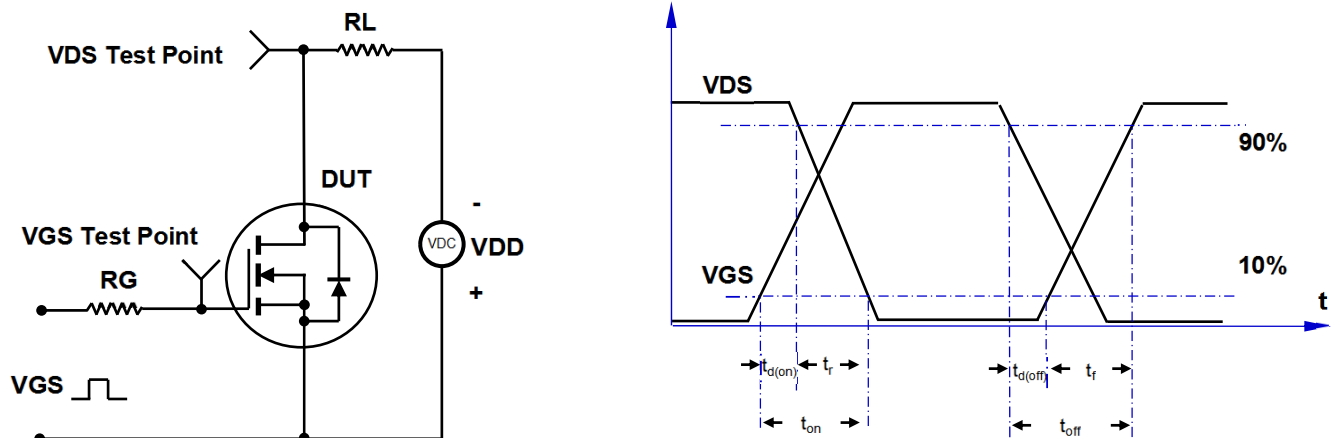


Fig.14- Resistive Switching Test Circuit & Waveform

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Test Circuit & Waveform

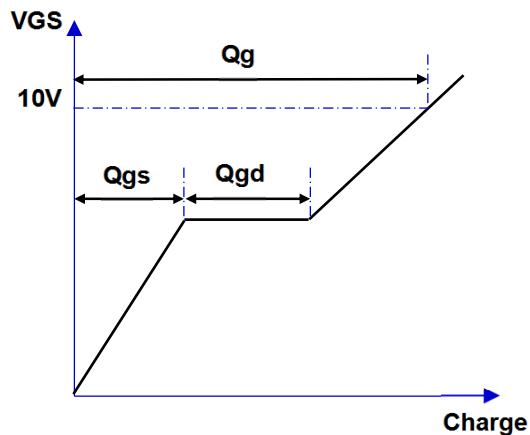
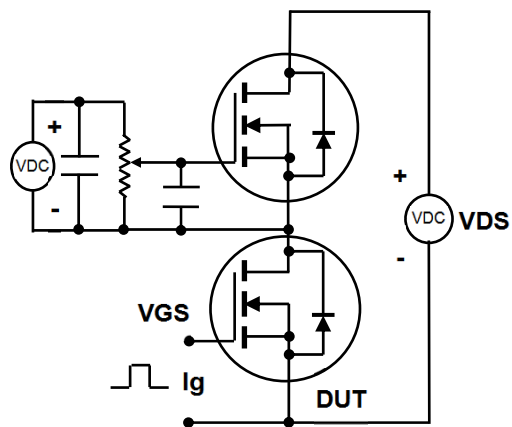


Fig.15- Gate Charge Test Circuit & Waveform

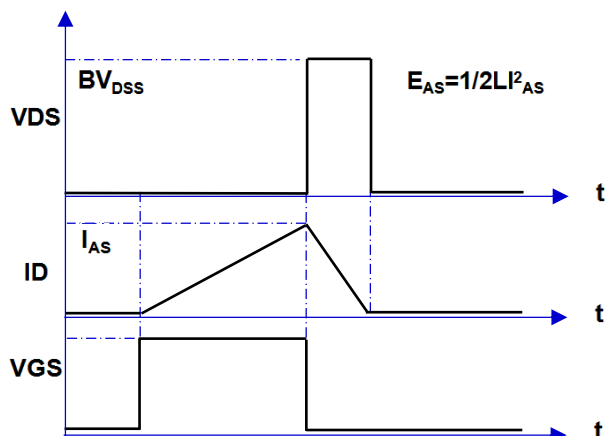
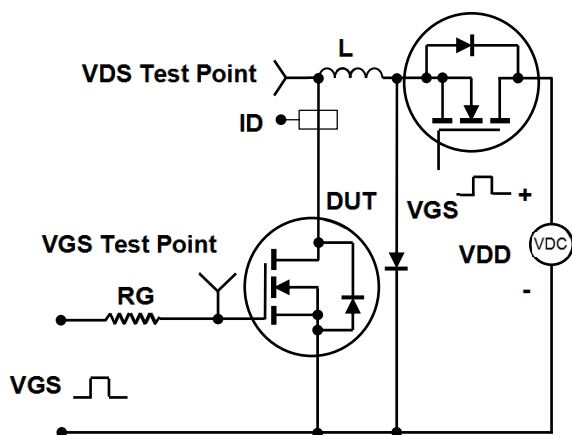


Fig.16- EAS Test Circuit & Waveform

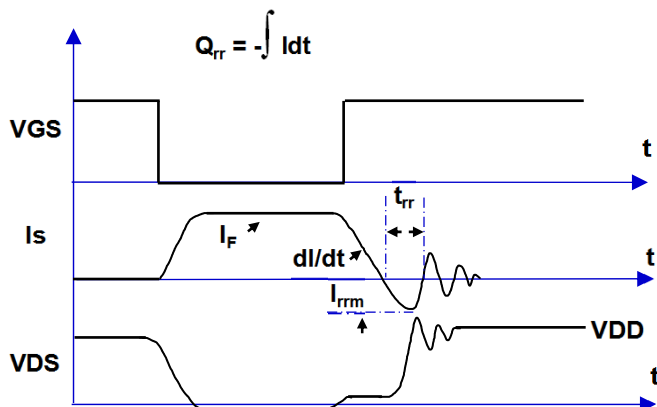
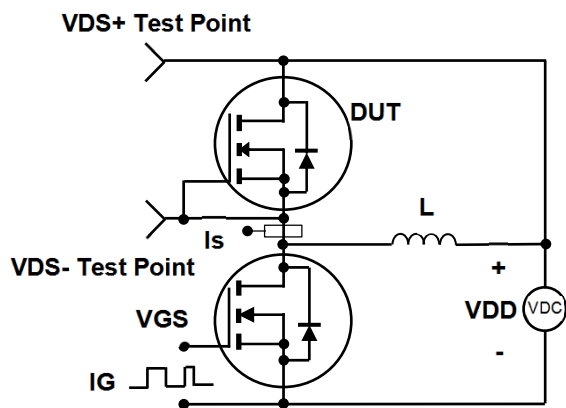


Fig.17- Diode Recovery Test Circuit & Waveform

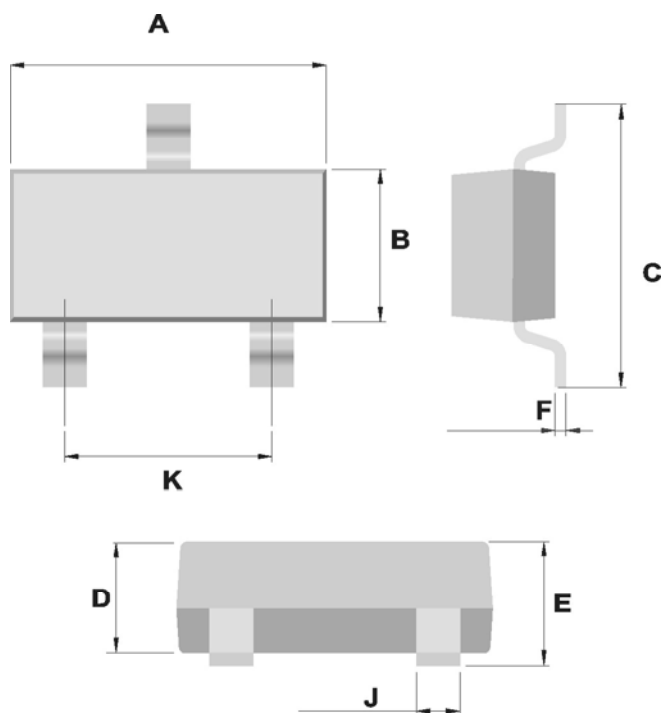
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OUTLINE DRAWINGS

SOT-23

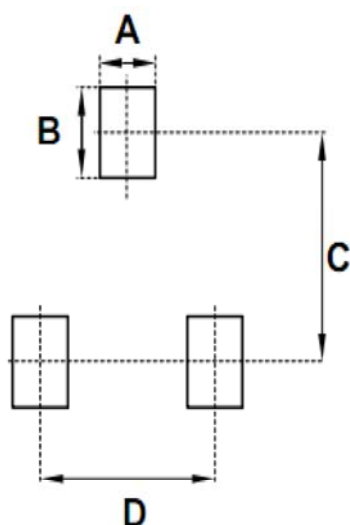


OUTLINE DIMENSIONS

Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.800	-	3.200	0.1102	-	0.1260
B	1.150	-	1.450	0.0453	-	0.0571
C	2.250	-	2.650	0.0886	-	0.1043
D	0.850	-	1.150	0.0335	-	0.0453
E	0.900	-	1.200	0.0354	-	0.0472
F	0.080	-	0.180	0.0031	-	0.0071
J	0.300	-	0.500	0.0118	-	0.0197
K	1.700	-	2.100	0.0669	-	0.0827

OUTLINE DRAWINGS

SOT-23



RECOMMENDED MOUNTING PAD DIMENSIONS

Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	-	0.600	-	-	0.0236	-
B	-	0.800	-	-	0.0315	-
C	-	2.000	-	-	0.0787	-
D	-	1.900	-	-	0.0748	-

PACKING INFORMATION

Package Code	Package Method	Inner Box Size L×W×H(mm)	Quantity (Pcs/Inner Box)	Outer Carton Size L×W×H(mm)	Quantity (Pcs/Carton)
SOT-23	Tape Reel	210X208X203	15000	440X440X230	180000

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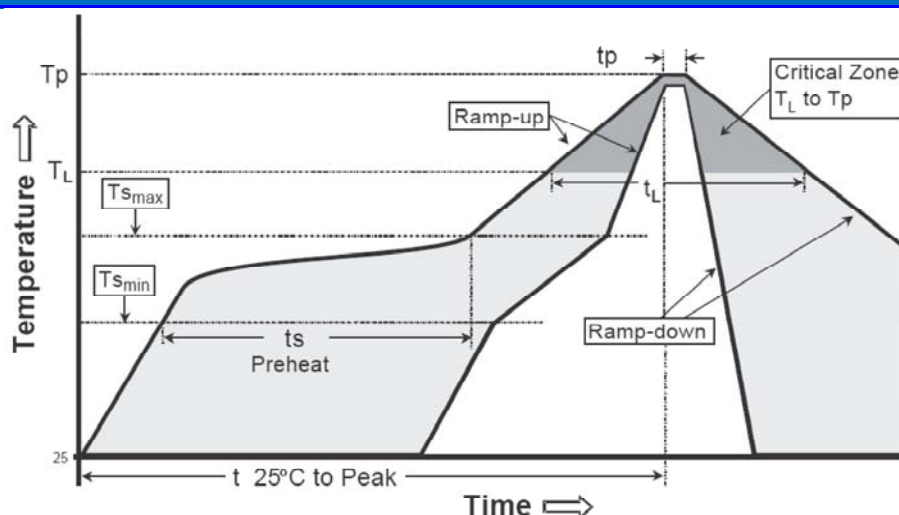
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Recommended wave soldering condition

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 (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(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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