2N7002K

N-Channel Enhancement Mode Power MOSFET

Pb Pb-Free RoHS COMPLIANT

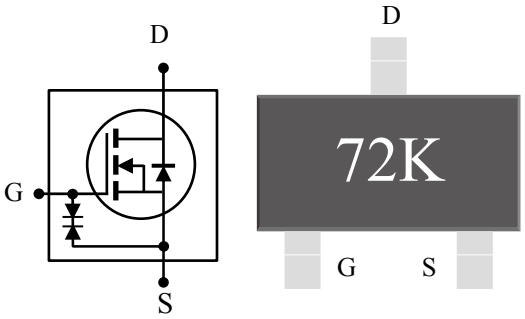
Voltage:	60 Volts	Current:	0.34 Ampers	Polarity And Marking	Package:	SOT-23

Features

- NH'S Advanced Planar DMOS Technology
- Low Rds(on) For Low On-State Loss
- High EAS For High Reliability
- Qualified According To JEDEC Criteria

Typical Applications

- AC/DC Converter
- Adaptor And Charger
- PC Power
- LED Drives And LED Lighting
- Weight:App. 0.008 Grams（0.2038 Ounce)



Remark:

①. 2N7002K=Model

②. 72K=Marking

***100% UIS TESTED**

***100% ΔVDS TESTED**

Product Summary

VDS Min.@T_j	60	V
I_D Min.@Ta	0.34	A
RDS(ON)Typ.@10V	2	Ω

Absolute Maximum Ratings (Ta=25℃ 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 ℃ Ta= 100 ℃	I_D	0.34 0.22	A
Drain Current-Pulse (Note 1)	T_J< 150 ℃	I_{DM}	1.36	A
Maximum Power Dissipation Power Dissipation Derating Factor Above 25℃	Ta= 25 ℃ Ta= 100 ℃	P_D	0.35 0.14	W
Derating Factor		D_F	0.003	W/℃
Avalanche Current,Single Pulse (Note 1)	L= 10.0 mH	I_{AS}	1.5	A
Single Pulse Avalanche Energy (Note 1) Test Circuit & Waveform See Fig.16	L= 10.0 mH IAS= 1.5 A,RG= 10.0 Ω Starting Tj=25 ℃,VG = 10.0 V	E_{AS}	11	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℃	$R_{\theta JA}$	357.0	℃/W

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

2N7002K

N-Channel Enhancement Mode Power MOSFET

Pb Pb-Free RoHS COMPLIANT

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}	60	--	--	V
Bvdss Temperature Coefficient	ID=250uA,Reference25℃	$\Delta BV_{DSS}/\Delta T_J$	--	0.07	--	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= 0.2 A,VDS= 5 V	gfs	--	4.7	--	S
Static On Characteristics						
Gate Threshold Voltage	VGS= VDS ID=250uA	$V_{GS(TH)}$	1.0	1.75	2.5	V
Drain-Source On Resistance	ID= 0.2 A,VGS= 10.0 V ID= 0.2 A,VGS= 4.5 V	$R_{DS(ON)}$	-- --	2.2 2.5	4.0 5.4	Ω
Dynamic Characteristics						
Gate Resistance	VGS=0V,VDS=0V, Freq.=1MHz	R_g	--	2.9	--	Ω
Input Capacitance	VDS= 30 V	C_{iss}	--	40.0	--	pF
Output Capacitance	VGS= 0 V	C_{oss}	--	30.0	--	pF
Reverse Transfer Capacitance	F= 1 MHZ	C_{rss}	--	10.0	--	pF
Switching Paramters (Test Circuit & Waveform See Fig.14)						
Turn-On Delay Time	VDS= 30 V	$t_{d(on)}$	--	10.0	--	ns
Turn-On Rise Time	VGS= 10.0 V	t_r	--	5.3	--	ns
Turn-Off Delay Time	RG= 10.0 Ω	$t_{d(off)}$	--	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	Q_g	--	3.7	--	nC
Gate-Source Charge	VGS= 10.0 V	Q_{gs}	--	1.0	--	nC
Gate-Drain Charge	ID= 0.2 A	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= 0.2 A,VGS=0V	V_{SD}	--	1.00	1.4	V
Reverse Recovery Time	ID= 0.2 A,di/dt= 100 A/us	t_{rr}	--	30.0	--	ns
Reverse Recovery Charge	VGS= 10.0 V,VDD= 30 V	Q_{rr}	--	30.0	--	nC

2N7002K

N-Channel Enhancement Mode Power MOSFET

Pb-Free RoHS COMPLIANT

Typical Characteristics Curves

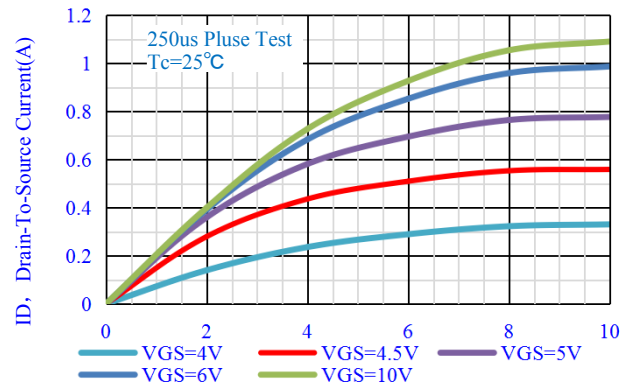


Fig.1-Output Characteritsics

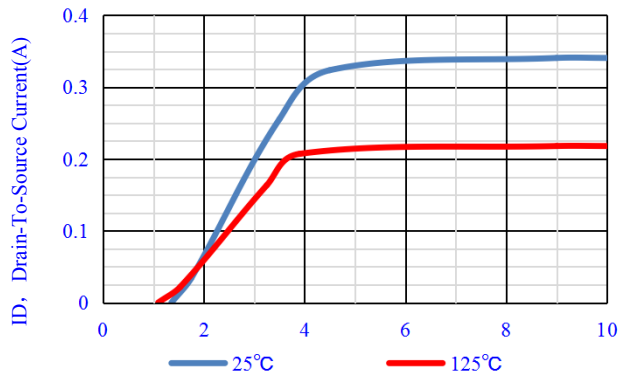


Fig.2- Transfer Characteritsics

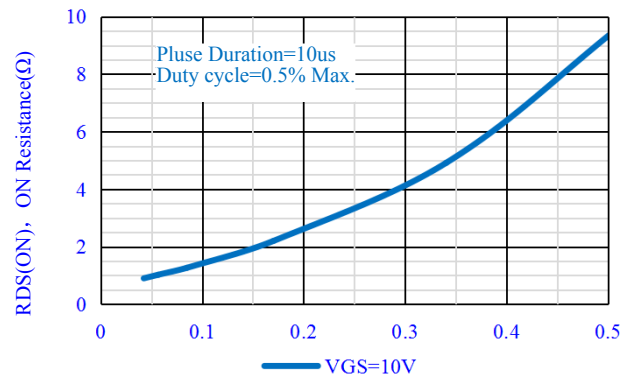


Fig.3- On Resistance vs. Drain Current

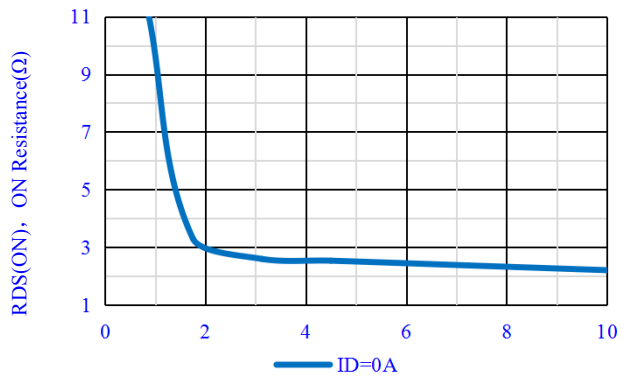


Fig.4- On Resistance vs. Gate Source Voltage

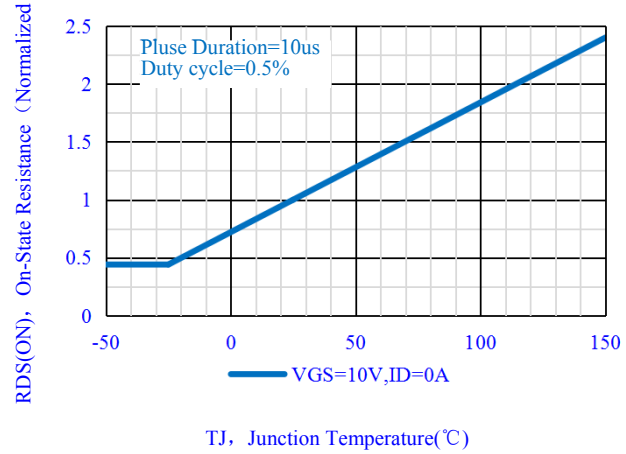


Fig.5-On Resistance vs. Junction Temperature

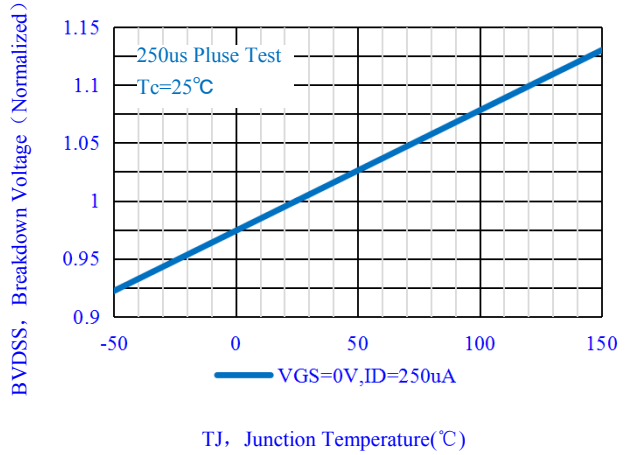


Fig.6- Breakdown Voltage vs. Junction Temperature

2N7002K

N-Channel Enhancement Mode Power MOSFET

Pb-Free RoHS COMPLIANT

Typical Characteristics Curves

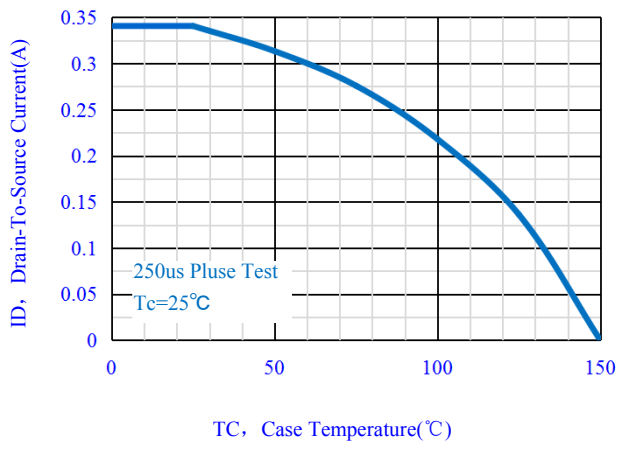


Fig.7-Maximum Continuous Drain Current vs. Case Temperature

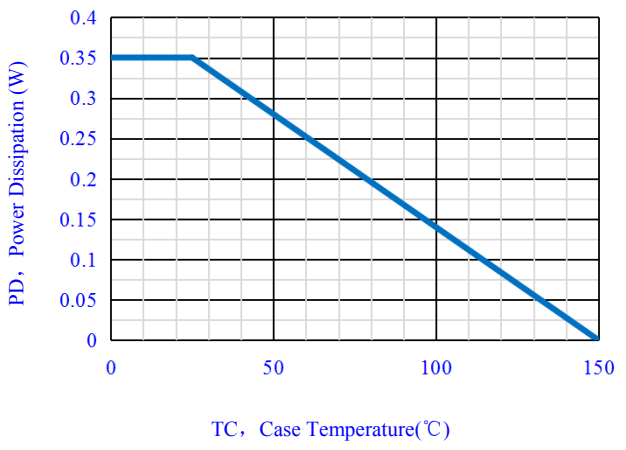


Fig.8-Maximum Power Dissipation vs. Case Temperature

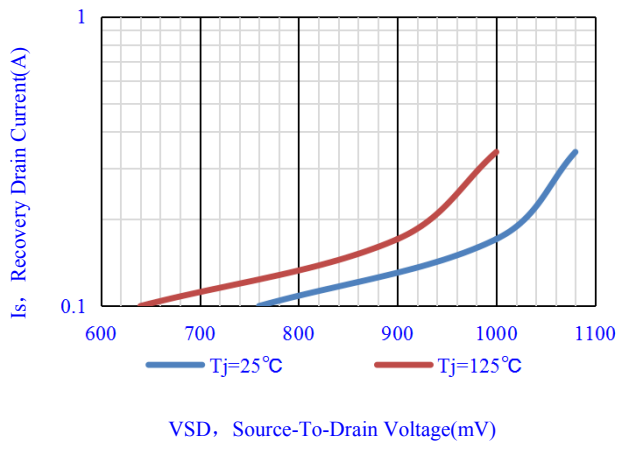


Fig.9- Source-To-Drain Diode Forward Voltage

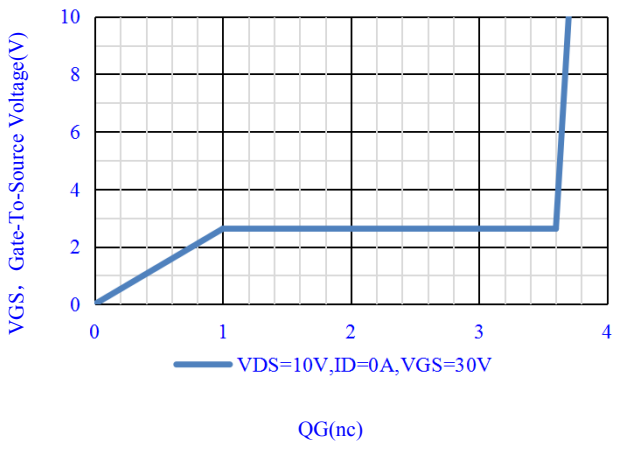


Fig.10-Gate Charge Waveform

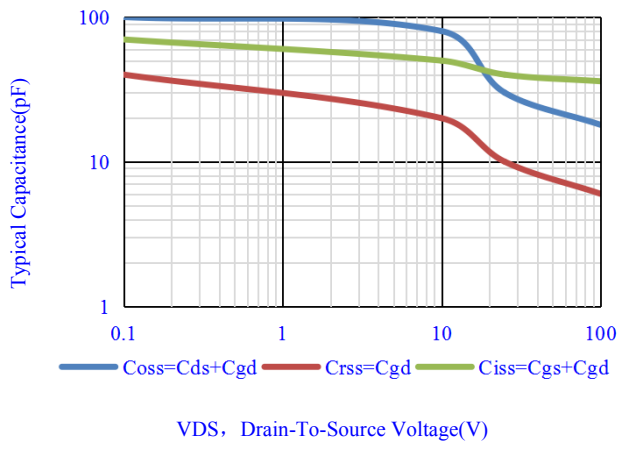


Fig.11-Typical Capacitance vs. Drain-To-Source Voltage

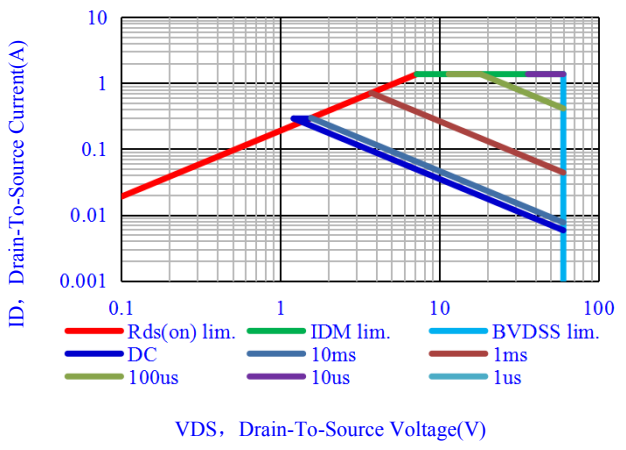


Fig.12-Maximum Safe Operating Area(SOA)

2N7002K

N-Channel Enhancement Mode Power MOSFET

Pb Pb-Free RoHS COMPLIANT

Typical Characteristics Curves

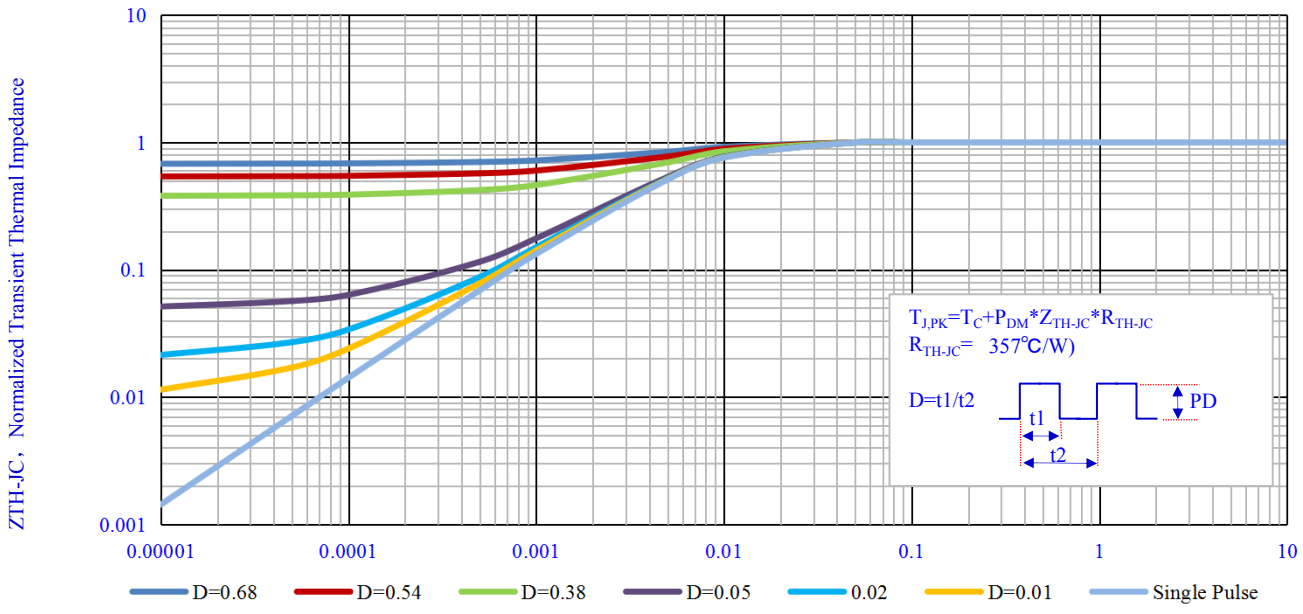
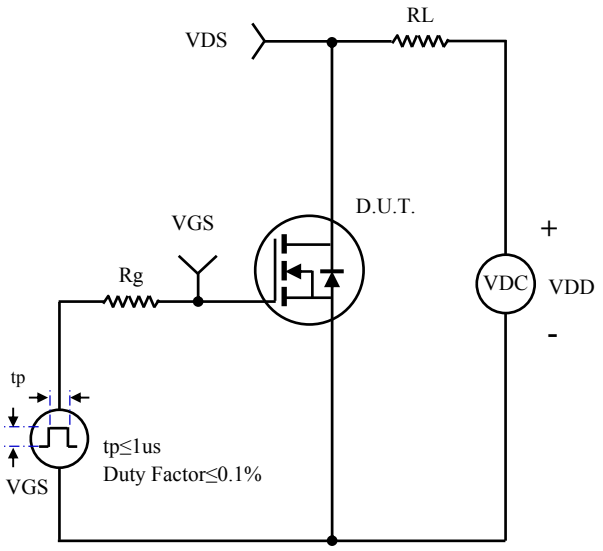


Fig.13- Normalized Maximum Transient Thermal Impedance vs.Pulse Width

Test Circuit & Waveform



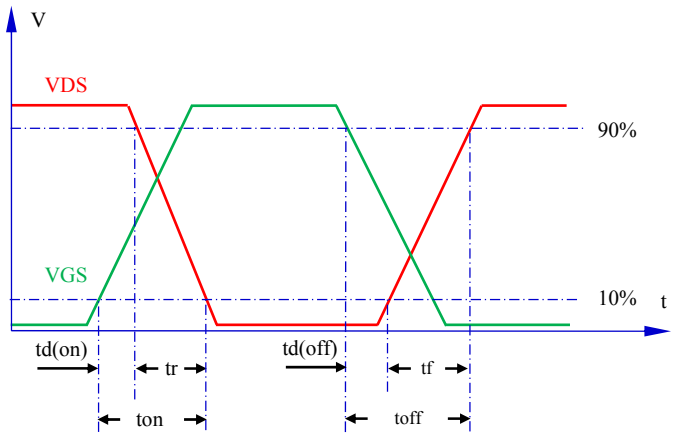


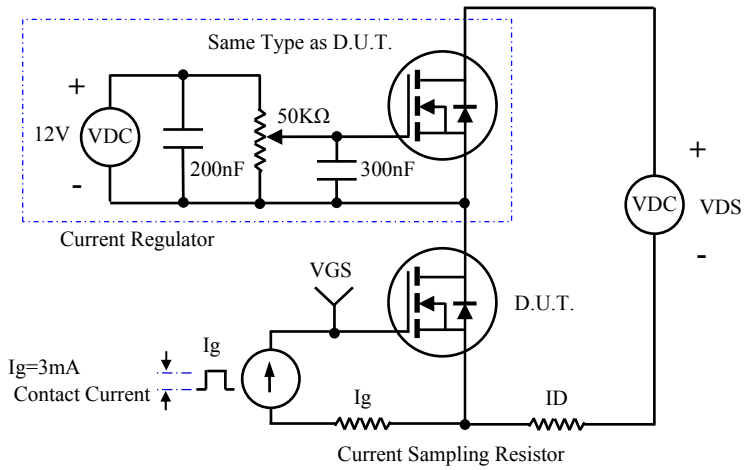
Fig.14- Resistive Switching Test Circuit & Waveform

2N7002K

N-Channel Enhancement Mode Power MOSFET

Pb-Free RoHS COMPLIANT

Test Circuit & Waveform



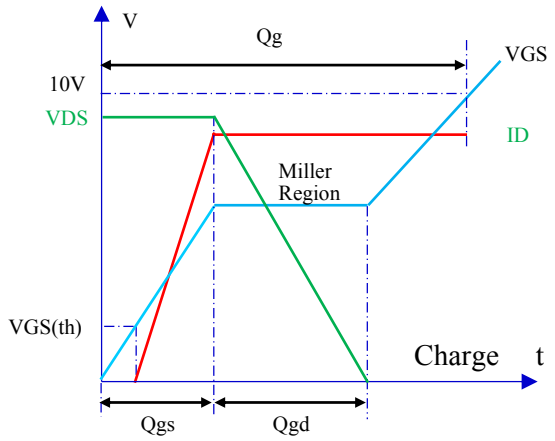
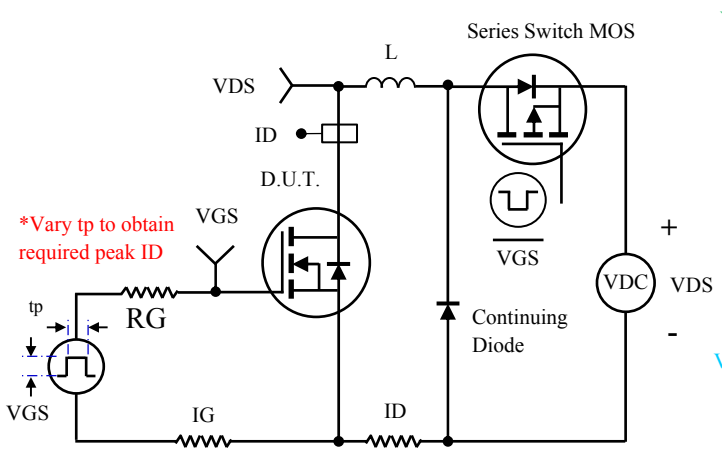


Fig.15-Gate Charge Test Circuit & Waveform



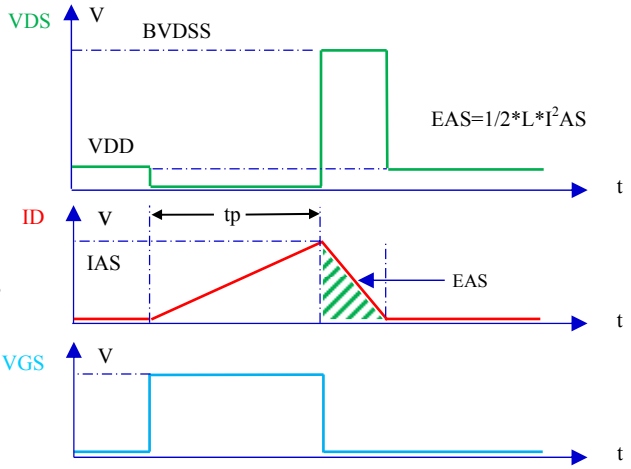
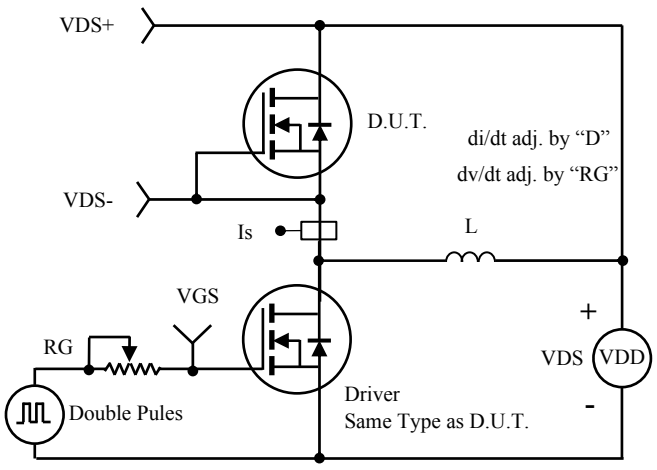


Fig.16- Unclamped Inductive Switching (UIS) Test Circuit & Waveform



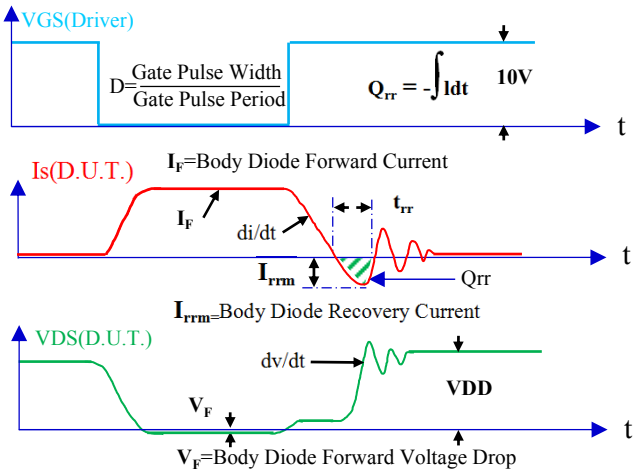


Fig.17- Diode Recovery Test Circuit & Waveform

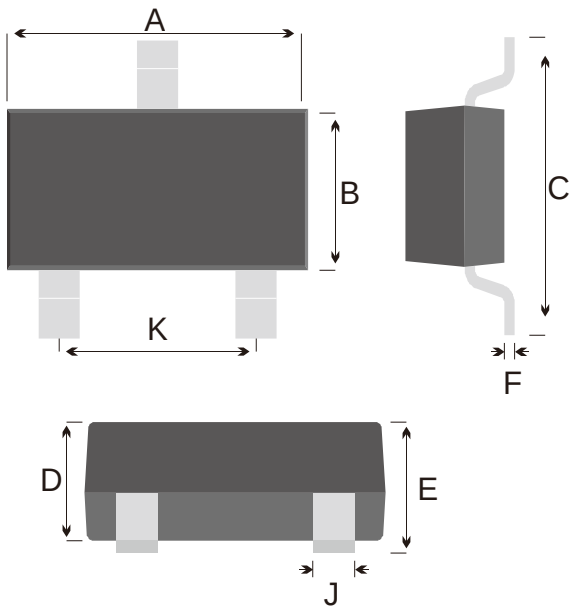
2N7002K

N-Channel Enhancement Mode Power MOSFET

Pb Pb-Free RoHS COMPLIANT

OUTLINE DRAWINGS

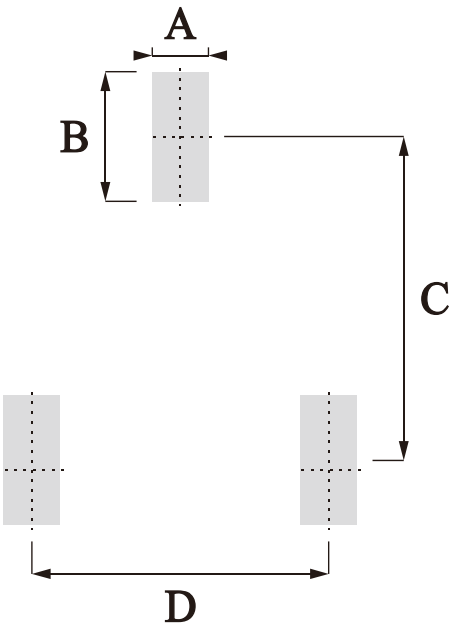
SOT-23



OUTLINE DIMENSIONS						
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.800	-	3.200	0.11	-	0.13
B	1.150	-	1.450	0.05	-	0.06
C	2.250	-	2.650	0.09	-	0.10
D	0.850	-	1.150	0.03	-	0.05
E	0.900	-	1.200	0.04	-	0.05
F	0.080	-	0.180	0.00	-	0.01
J	0.300	-	0.500	0.01	-	0.02
K	1.700	-	2.100	0.07	-	0.08

RECOMMEDNED LAYOUT DRAWINGS

SOT-23



OUTLINE DIMENSIONS						
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	-	0.600	-	-	0.02	-
B	-	0.800	-	-	0.03	-
C	-	2.000	-	-	0.08	-
D	-	1.900	-	-	0.07	-

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

2N7002K

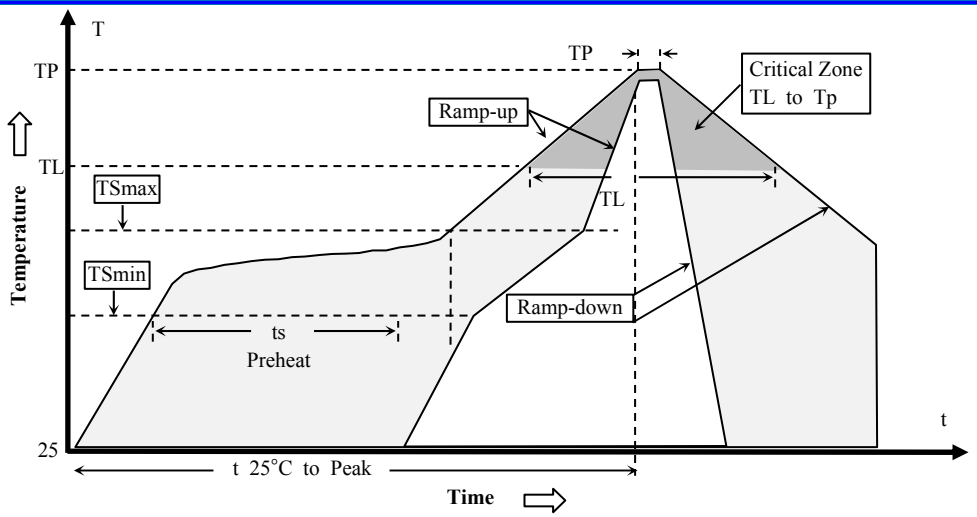
N-Channel Enhancement Mode Power MOSFET

Pb Pb-Free RoHS COMPLIANT

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.

2N7002K

N-Channel Enhancement Mode Power MOSFET

Pb-Free RoHS COMPLIANT

Disclaimer

- Reproducing and modifying informatiom of the document is prohibited without permission from niuhang Electronics Technology co., LTD
- Niuhang Electronics Technology co., LTD. reserves the rights to make changes of the content herein the document anytime without notification.
- Niuhang Electronics Technology co., LTD. disclaims any and all liability arising out of the application or use of any product including damages incidentally and consequentially occurred.
- Niuhang Electronics Technology co., LTD. does not assume any and all implied warranties,including warranties of fitness for particular purpose,non-infringement and merchantability.
- Applications shown on the herein document are examples of standard use and operation.Customers are responsible in comprehending the suitable use in particular applications.niuhang Electronics Technology co., LTD.makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.
- The products shown herein are not designed and authorized for equipments requiring high level of reliability or relating to human life and for any applications concerning life-saving or life-sustaining,such as medical instruments.transportation equipment,aerospae machinery et cetera.Customers usin or selling these products for use in such applications do so at their
own rish and agree to fully indemnify niuhang Electronics Technology co., LTD.for any damages resulting resulting from such improper use or sale.
- When the appearance of the product and chip size does not change, in order to product the customer. quality, change the internal structure and the production process Niuhang can not notify