



NPS4N65S

N-Channel Enhancement Mode Power MOSFET



VOLTAGE: 650 Volts

CURRENT: 4 Amperes

Package: TO-252

Marking And Polarity

FEATURES

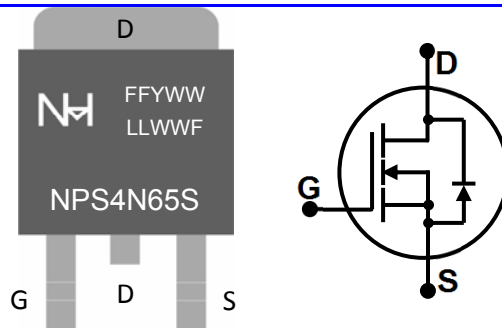
- Low $R_{DS(ON)}$ For High Efficiency
- Low Gate Charge For High Speed Switching
- High EAS For High Reliability
- 100% UIS And RG Tested

TYPICAL APPLICATIONS

- AC/DC converter
- Adaptor and Charger
- LED Drives
- High-Frequency Circuits and Switching Power Supply
- Weight: App. 0.321 Grams (0.01132 Ounce)

PRODUCT SUMMARY

VDS Min.@Tj	650	V
Id Min.@Ta	4	A
RDS(ON) Type@10V	2.30	Ω



Remark:

- NH=Niuhan Trademark
- FF=Product Line Code, According To Actual Changes
YWW=Date Code, According To Actual Changes
LLWWF=Internal Code, According To Actual Changes
- NPS4N65S=Model

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

Parameter	Test Conditions	Symbol	Ratings	Unit
Drain-Source Voltage		V_{DS}	650	V
Gate-Source Voltage		V_{GS}	± 30	V
Continuous Drain Current (Note 1)	Ta= 25 °C	I_D	4	A
	Ta= 100 °C		3	
Drain Current-Pulsed (Note 1)	Tj< 150 °C	I_{DM}	16	A
Maximum Power Dissipation Power Dissipation Derating Factor Above 25°C	Ta= 25 °C	P_D	75	W
	Ta= 100 °C		30	
Derating Factor		D_F	0.60	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= 0.4 mH	I_{AS}	6	A
Single Pulse Avalanche Energy (Note 1) Test Circuit & Waveform See Fig.16	L= 0.4 mH IAS= 6 A, RG= 10 Ω Starting Tj=25 °C, VG = 10 V	E_{AS}	7	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	$R_{\theta JA}$	100.0	°C/W
Thermal Resistance Junction-Case	Device Mounted On 1 in ² FR-4 Board With 2oz	$R_{\theta JC}$	1.7	

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

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Typical Characteristics Curves

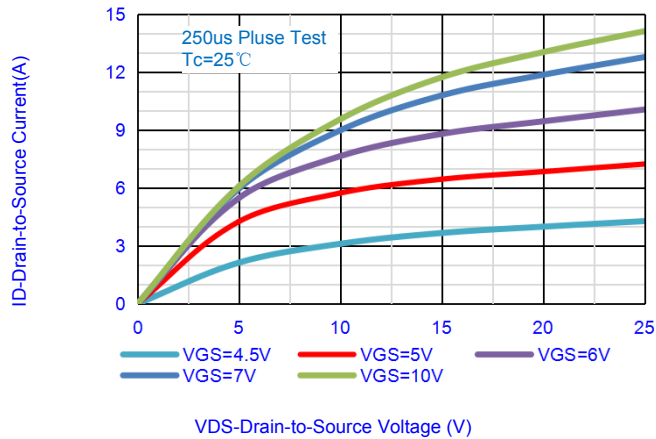


Fig.1-Output Characteristics

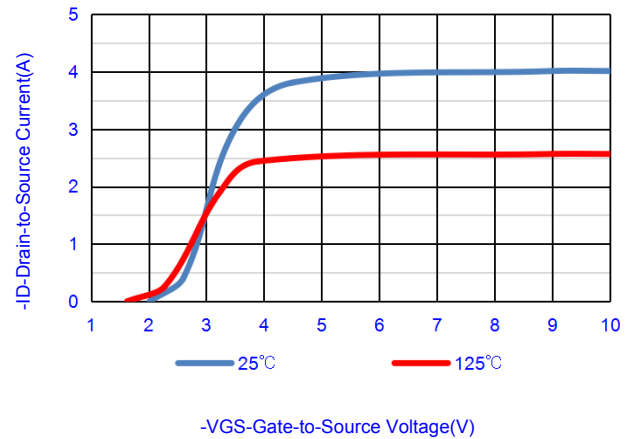


Fig.2- Transfer Characteristics

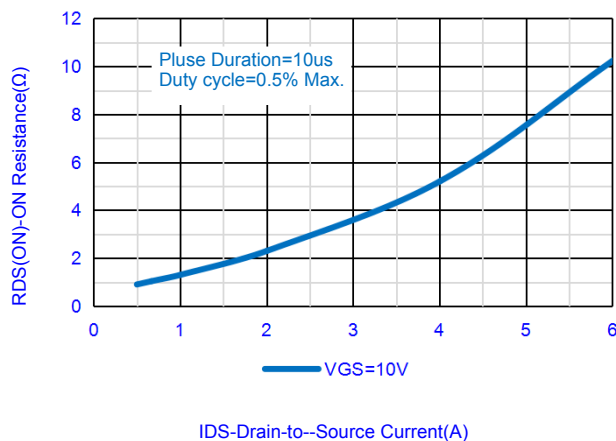


Fig.3- On Resistance vs. Drain Current

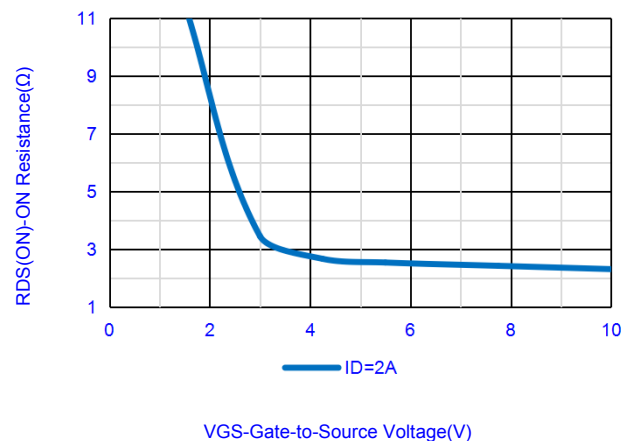


Fig.4- On Resistance vs. Gate Source Voltage

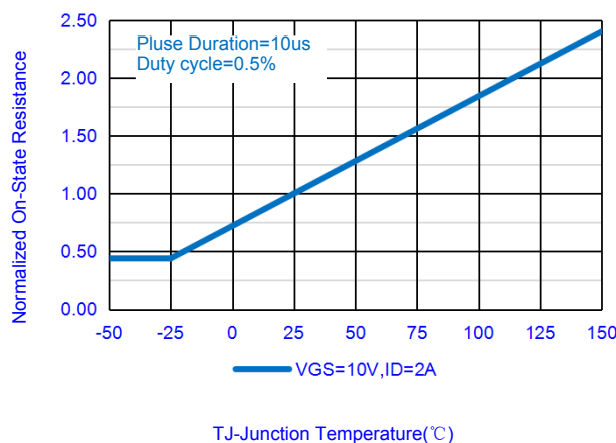


Fig.5- On Resistance vs. Junction Temperature

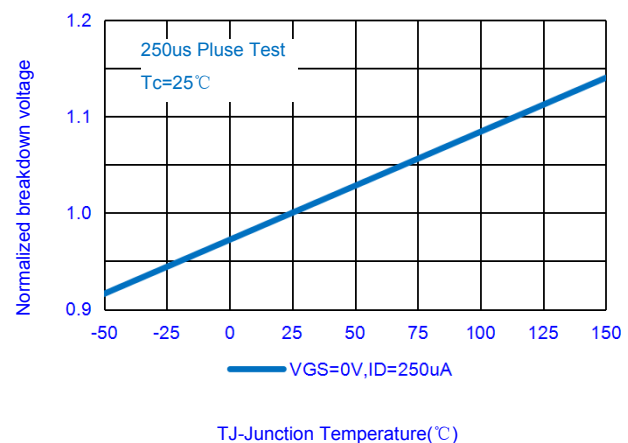


Fig.6- Breakdown Voltage vs. Junction Temperature



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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}	650	--	--	V
Bvdss Temperature Coefficient	ID=250uA,Reference25℃	$\Delta BV_{DSS}/\Delta T_J$	--	0.772	--	V/℃
Drain-Source Leakage Current	VDS= 650 V,VGS=0V	I_{DSS}	--	--	1	uA
Gate-Body Leakage Current	VGS= ±30 V,VDS=0V	I_{GSS}	--	--	±100	nA
Forward Transconductance	ID= 2 A,VDS= 15 V	g_{fs}	--	1.65	--	S
Static on Characteristics						
Gate Threshold Voltage	VGS= VDS ID=250uA	$V_{GS(TH)}$	2.0	3.0	4.0	V
Drain-Source On Resistance	ID= 2 A,VGS= 10 V	$R_{DS(ON)}$	--	2.3	2.8	Ω
	ID= 2 A,VGS= 5.5 V		--	2.5	3.1	
Dynamic Characteristics						
Gate Resistance	VGS=0V,VDS=0V, Freq.=1MHz	R_g	--	3.00	--	Ω
Input Capacitance	VDS= 50 V	C_{iss}	--	571.0	--	pF
Output Capacitance	VGS= 0 V	C_{oss}	--	56.0	--	pF
Reverse Transfer Capacitance	F= 1 MHz	C_{rss}	--	12.0	--	pF
Switching Paramters (Test Circuit & Waveform See Fig.14)						
Turn-On Delay Time	VDS= 325 V	$t_{d(on)}$	--	14.0	--	ns
Turn-On Rise Time	VGS= 10 V	t_r	--	16.0	--	ns
Turn-Off Delay Time	RG= 10 Ω	$t_{d(off)}$	--	32.0	--	ns
Turn-Off Rise Time		t_f	--	11.0	--	ns
Gate Charge Paramters (Test Circuit & Waveform See Fig.15)						
Total Gate Charge	VDS= 325 V	Q_g	--	15.5	--	nC
Gate-Source Charge	VGS= 10 V	Q_{gs}	--	3.0	--	nC
Gate-Drain Charge	ID= 2 A	Q_{gd}	--	6.8	--	nC
Drain-Source Diode Characteristics And Maximum Ratings (Test Circuit & Waveform See Fig.17)						
Max. Diode Forward Cuurent		I_S	--	--	4	A
Max. Pulsed Forward Cuurent		I_{SM}	--	--	14	A
Diode Forward Voltage	ID= 2 A,VGS=0V	V_{SD}	--	0.70	1.0	V
Reverse Recovery Time	ID= 2 A,di/dt= 100 A/us	t_{rr}	--	252	--	ns
Reverse Recovery Charge	VGS= 10 V,VDS= 325 V	Q_{rr}	--	1206.0	--	nC

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Typical Characteristics Curves

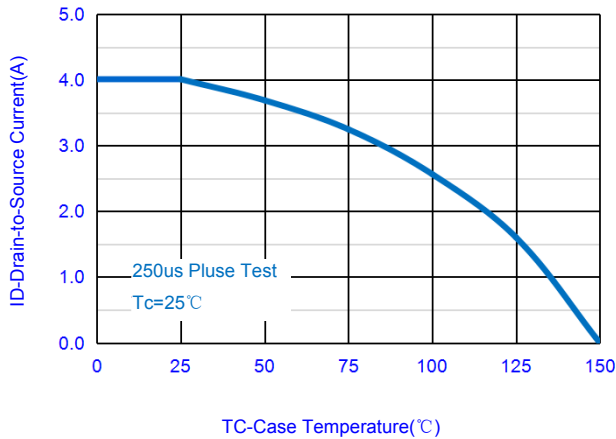


Fig.7-Maximum Continuous Drain Current vs. Case Temperature

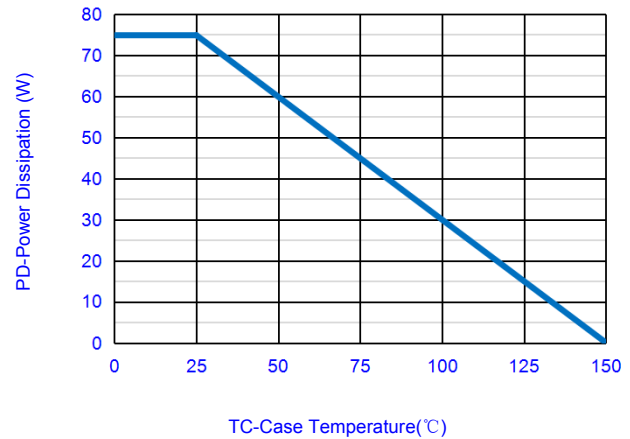


Fig.8-Maximum Power Dissipation vs. Case Temperature

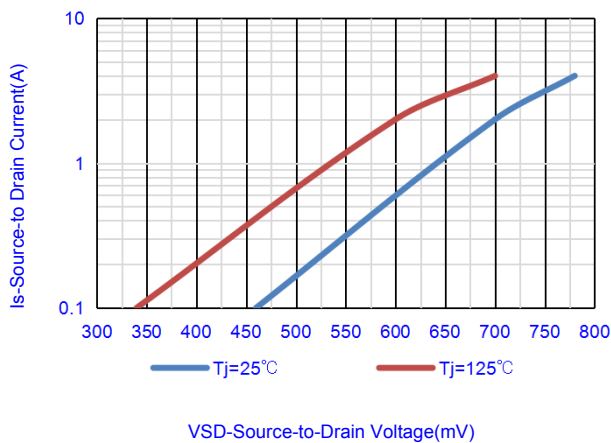


Fig.9- Source-Drain Diode Forward Voltage

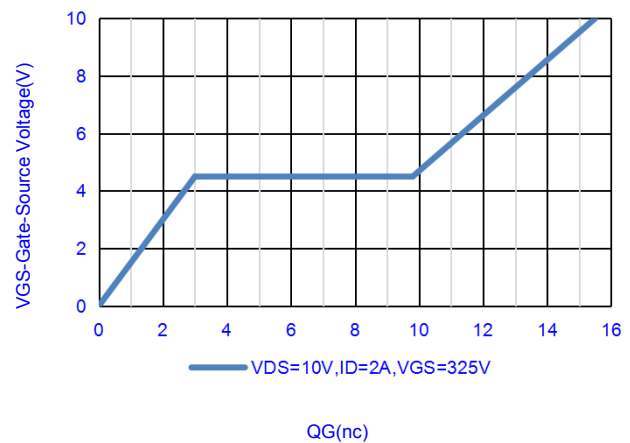


Fig.10-Gate Charge Waveform

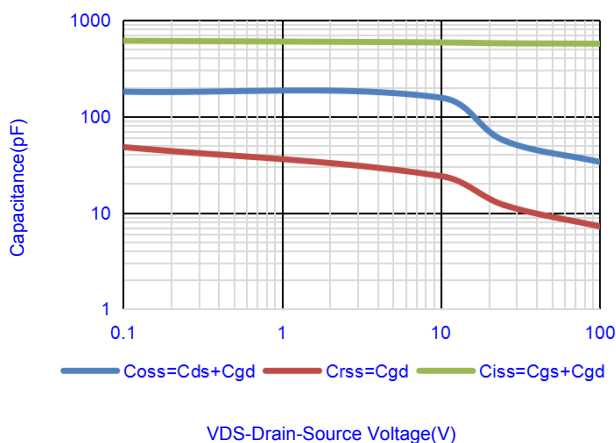


Fig.11- Gate-Source Voltage-VGS(V)

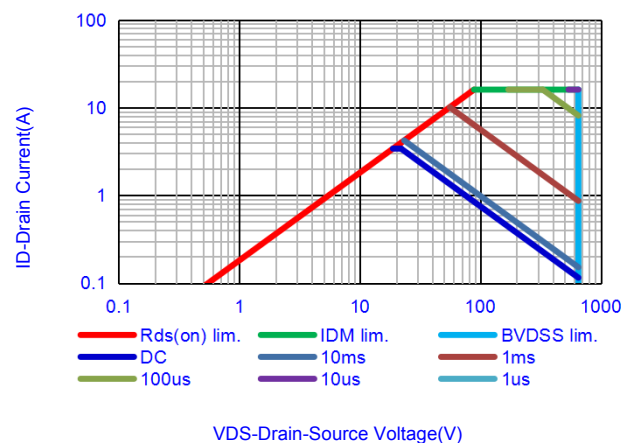


Fig.12-Maximum Safe Operating Area(SOA)

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Typical Characteristics Curves

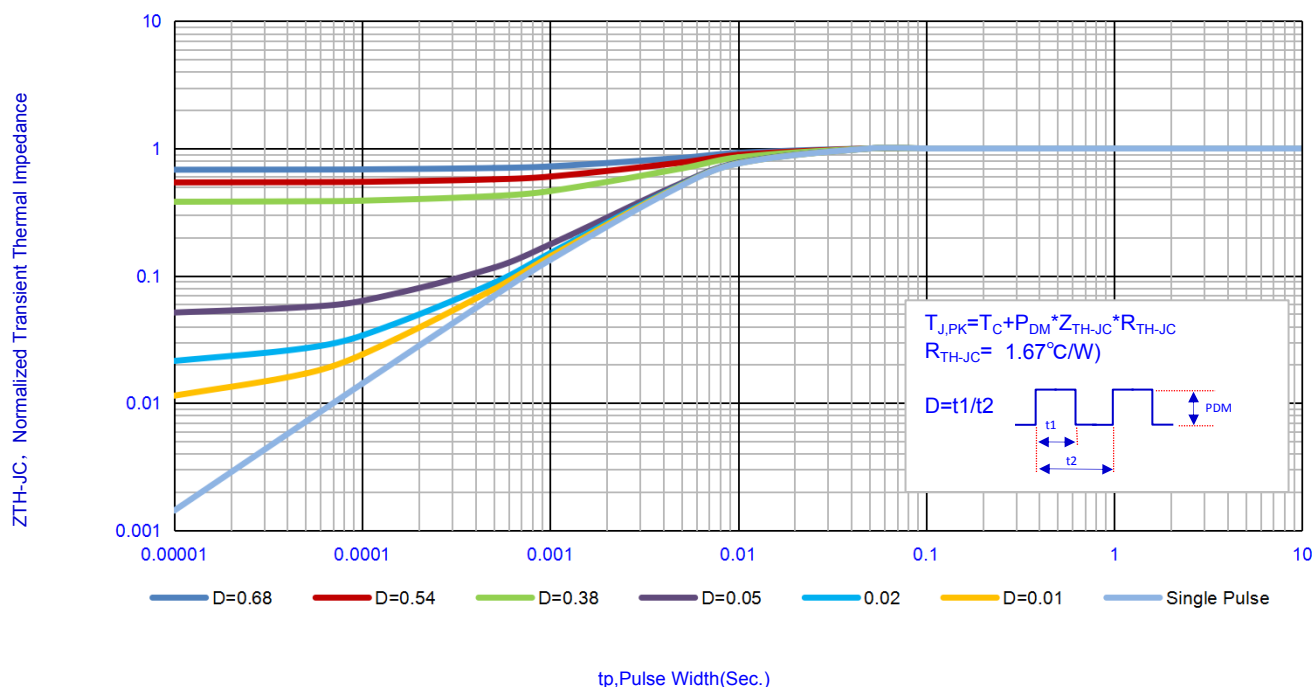


Fig.13- Normalized Maximum Transient Thermal Impedance vs. Pulse Width

Test Circuit & Waveform

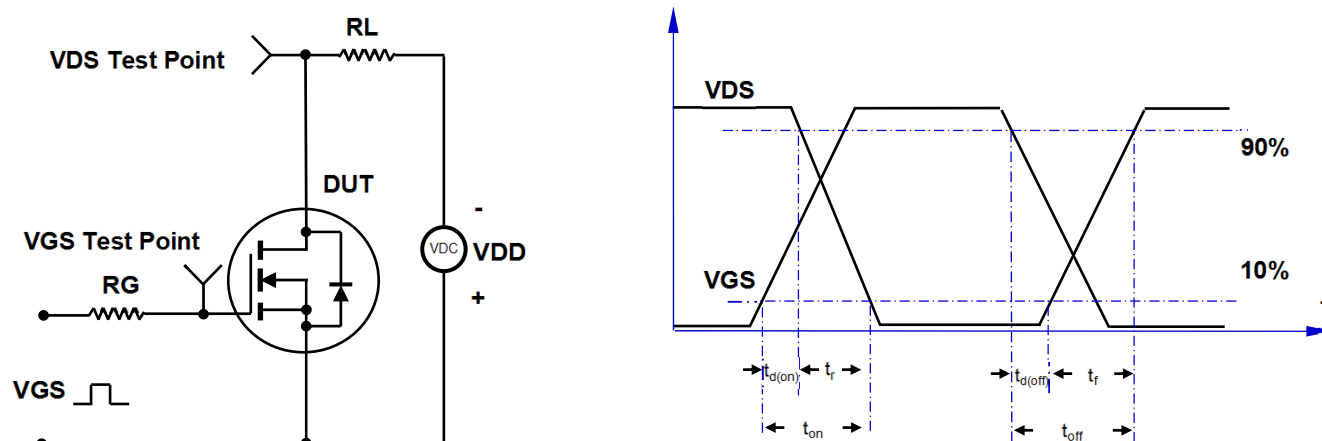


Fig.14- Resistive Switching Test Circuit & Waveform

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Test Circuit & Waveform

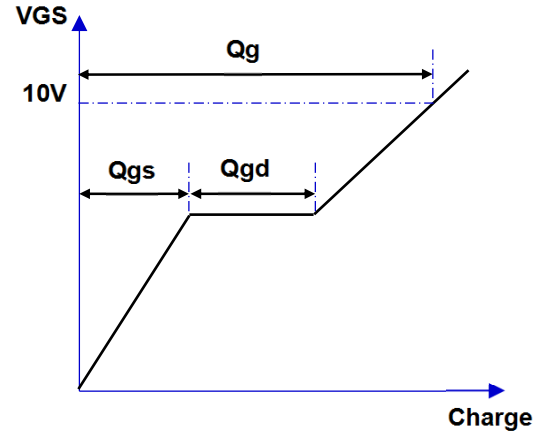
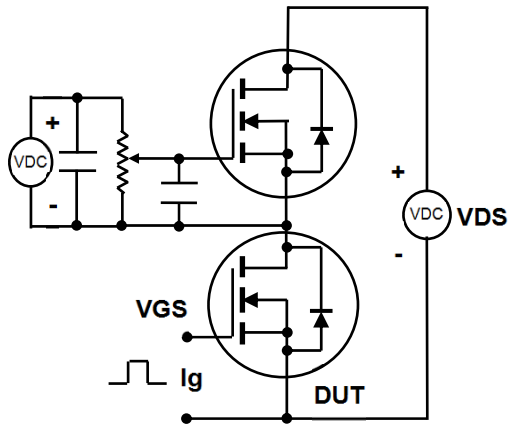


Fig.15- Gate Charge Test Circuit & Waveform

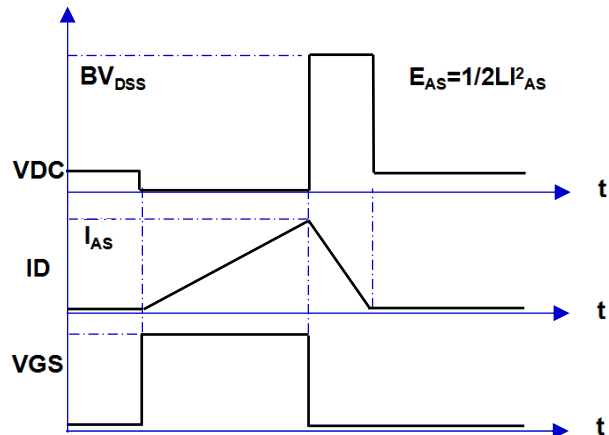
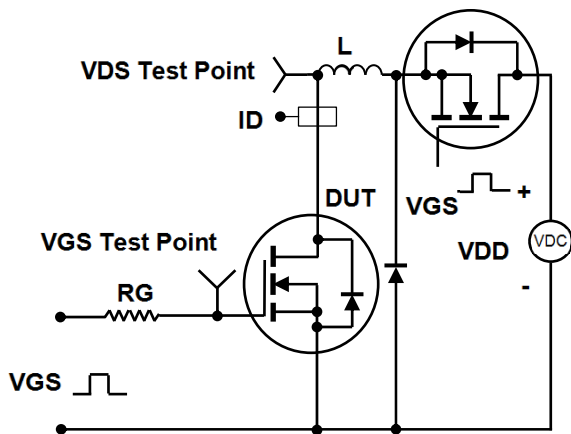


Fig.16- EAS Test Circuit & Waveform

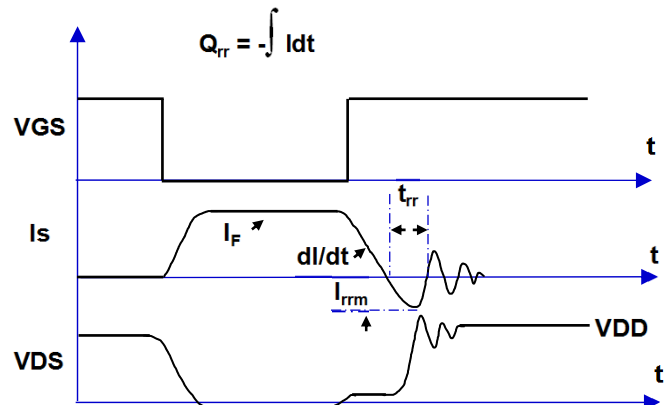
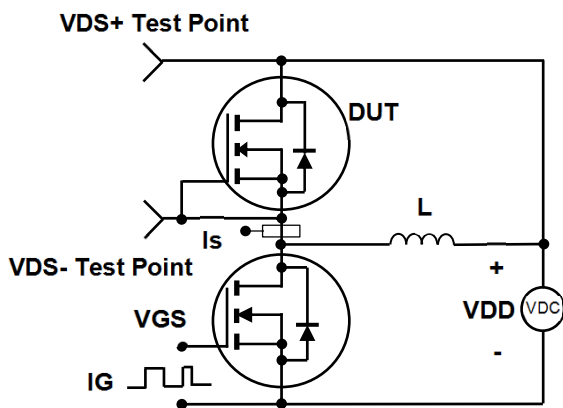


Fig.17- Diode Recovery Test Circuit & Waveform

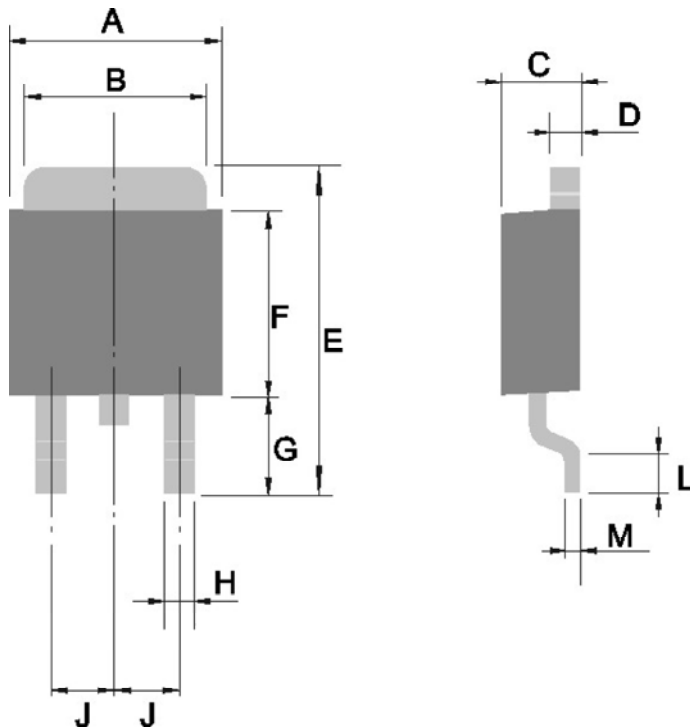
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OUTLINE DRAWINGS

TO-252

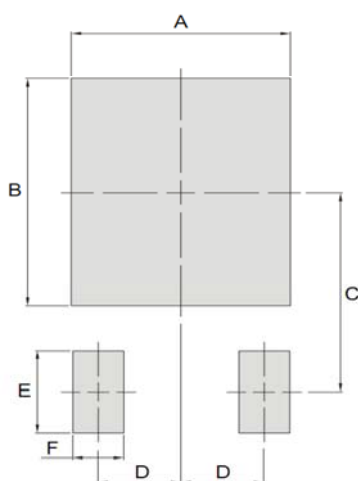


OUTLINE DIMENSIONS

Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	6.100	-	7.100	0.240	-	0.280
B	4.800	-	5.800	0.189	-	0.228
C	1.950	-	2.550	0.077	-	0.100
D	0.350	-	0.750	0.014	-	0.030
E	9.250	-	10.750	0.364	-	0.423
F	5.600	-	6.600	0.220	-	0.260
G	2.500	-	3.100	0.098	-	0.122
H	0.650	-	1.050	0.026	-	0.041
J	2.100	-	2.500	0.083	-	0.098
L	1.000	-	1.400	0.039	-	0.055
M	0.350	-	0.750	0.014	-	0.030

OUTLINE DRAWINGS

TO-252



OUTLINE DIMENSIONS

Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	-	6.09	-	-	0.24	-
B	-	7.57	-	-	0.298	-
C	-	6.64	-	-	0.261	-
D	-	2.3	-	-	0.091	-
E	-	2.76	-	-	0.109	-
F	-	1.42	-	-	0.056	-

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)
TO-252	Tape Reel	340×340×50	5000	360x360x260	25000

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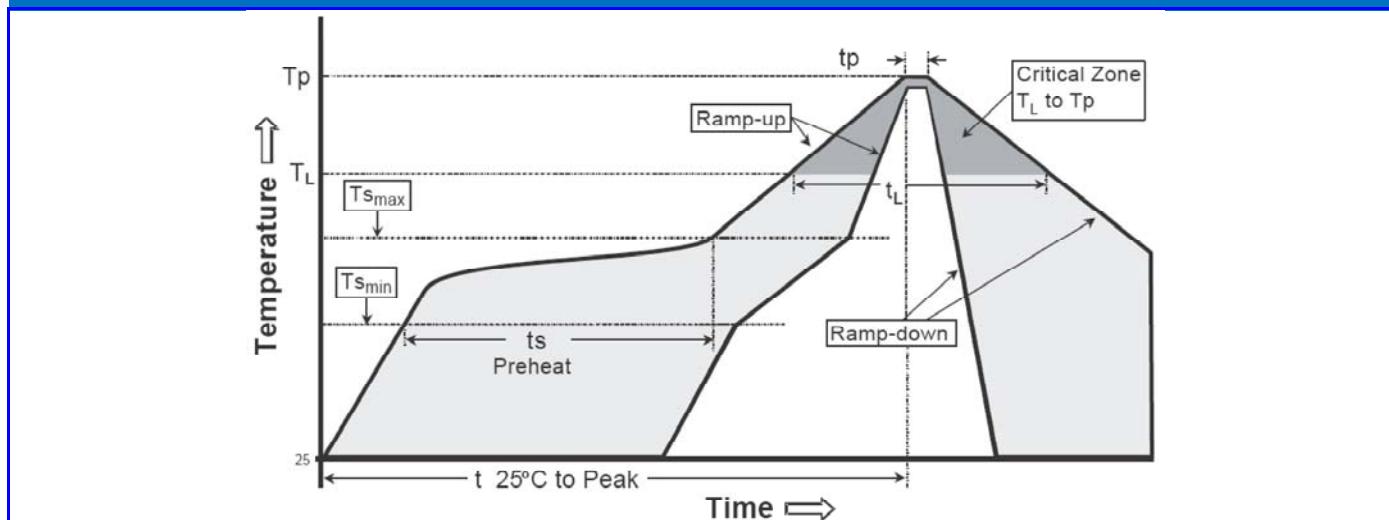
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Recommended wave soldering condition

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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