

NTS3012T03S4

N+P-Channel Enhancement Mode Trench Power MOSFET



Voltage: ±30 Volts

Current: +38/-18 Ampers

Package: TO-252-4L

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

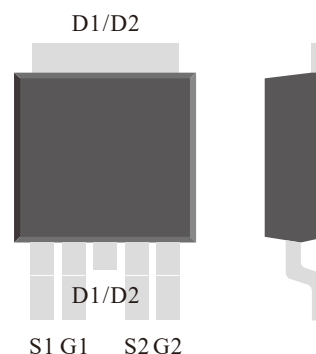
Typical Applications

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

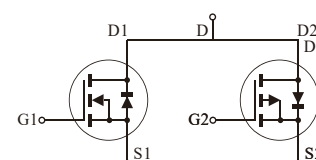
Product Summary

Types of MOS	N	P	Unit
VDS Min.@Tj	30	-30	V
N-ID Min.@Ta	38	-18	A
N-RDS(ON) Type@10V	12	30	mΩ

Diagram:



Polarity:



***100% UIS TESTED**

***100% ΔVDS TESTED**

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

Parameter	Test Conditions	Symbol	N-Ch Ratings	P-Ch Ratings	Unit
Drain-Source Voltage		V_{DS}	30	-30	V
Gate-Source Voltage		V_{GS}	±20	±20	V
Continuous Drain Current (Note 1)	Ta= 25 °C	I_D	38	-18	A
	Ta= 100 °C		24	-12	
Drain Current-Pulsed (Note 1)	Tj< 150 °C	I_{DM}	152	-72	A
Maximum Power Dissipation Power	Ta= 25 °C	P_D	27.2	26.6	W
	Ta= 100 °C		10.9	10.6	
Derating Factor		D_F	0.22	0.21	W/°C
Avalanche Current,Single Pulse (Note 1)	L= 0.5 mH	I_{AS}	12.0	-11.0	A
Single Pulse Avalanche Energy (Note 1) Test Circuit & Waveform See Fig.16	L= 0.5 mH IAS= N/P A,RG= 10 Ω Starting Tj=25 °C,VG = 10 V	E_{AS}	36	30	mJ

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

Parameter	Test Conditions	Symbol	N-Ch Ratings	P-Ch Ratings	Unit
Junction Temperature		T_J	-55 to 150	-55 to 150	°C
Storage Temperature Range		T_{STD}	-55 to 150	-55 to 150	°C
Thermal Resistance Junction To Ambient With Steady-State	Still Air Environment With Ta=25°C	$R_{θJA}$	60.0	60.0	°C/W
Thermal Resistance Junction-Case With Steady-State	FALSE	$R_{θJC}$	4.6	4.7	

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

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N-Channel 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}	30	--	--	V
Bvdss Temperature Coefficient	ID=250uA,Reference25℃	$\Delta BV_{DSS}/\Delta T_J$	--	0.034	--	V/℃
Drain-Source Leakage Current	VDS= 24 V,VGS=0V	I_{DSS}	--	--	1	uA
Gate-Body Leakage Current	VGS= ±20 V,VDS=0V	I_{GSS}	--	--	±100	nA
Forward Transconductance	ID= 19 A,VDS= 5 V	g_{fs}	--	6	--	S
Static on Characteristics						
Gate Threshold Voltage	VGS= VDS ID=250uA	$V_{GS(TH)}$	1.2	2.0	2.5	V
Drain-Source On Resistance	ID= 19 A,VGS= 10 V	$R_{DS(ON)}$	--	12	16	mΩ
	ID= 19 A,VGS= 4.5 V		--	18	24	
Dynamic Characteristics						
Input Capacitance	VDS= 15 V VGS= 0 V F= 1 MHZ	C_{iss}	--	600.0	--	pF
Output Capacitance		C_{oss}	--	75.0	--	pF
Reverse Transfer Capacitance		C_{rss}	--	60.0	--	pF
Gate Resistance	VGS=0V,VDS=0V, Freq.=1MHz	R_g	--	1.2	--	Ω
Switching Paramters (Test Circuit & Waveform See Fig.14)						
Turn-On Delay Time	VDS= 15 V VGS= 10 V RG= 10 Ω	$t_{d(on)}$	--	4.5	--	ns
Turn-On Rise Time		t_r	--	2.5	--	ns
Turn-Off Delay Time		$t_{d(off)}$	--	14.5	--	ns
Turn-Off Rise Time		t_f	--	3.5	--	ns
Gate Charge Paramters (Test Circuit & Waveform See Fig.15)						
Total Gate Charge	VDS= 15 V VGS= 10 V ID= 19 A	Q_g	--	14.0	--	nC
Gate-Source Charge		Q_{gs}	--	2.0	--	nC
Gate-Drain Charge		Q_{gd}	--	3.0	--	nC
Drain-Source Diode Characteristics And Maximum Ratings (Test Circuit & Waveform See Fig.17)						
Max. Diode Forward Cuurent		I_S	--	--	38.1	A
Max. Pulsed Forward Cuurent		I_{SM}	--	--	133	A
Diode Forward Voltage	ID= 19 A,VGS=0V	V_{SD}	--	0.86	1.2	V
Reverse Recovery Time	ID= 19 A,di/dt= 100 A/us	t_{rr}	--	10	--	ns
Reverse Recovery Charge	VGS= 10 V,VDS= 12 V	Q_{rr}	--	5.0	--	nC
Reverse Recovery Current		I_{RRM}	--	1.0	--	A

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P-Channel 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}	-30	--	--	V
Bvdss Temperature Coefficient	ID=-250uA,Reference 25℃	$\Delta BV_{DSS}/\Delta T_J$	--	0.034	--	V/℃
Drain-Source Leakage Current	VDS= -24 V,VGS=0V	I_{DSS}	--	--	-1	uA
Gate-Body Leakage Current	VGS= ±20 V,VDS=0V	I_{GSS}	--	--	±100	nA
Forward Transconductance	ID= -9 A,VDS= -5 V	g_{fs}	--	4.8	--	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= -9 A,VGS= -10 V	$R_{DS(ON)}$	--	30	38	mΩ
	ID= -9 A,VGS= -4.5 V		--	45	57	
Dynamic Characteristics						
Input Capacitance	VDS= -15 V	C_{iss}	--	620.0	--	pF
Output Capacitance	VGS= 0 V	C_{oss}	--	79.0	--	pF
Reverse Transfer Capacitance	F= 1 MHZ	C_{rss}	--	63.0	--	pF
Gate Resistance	VGS=0V,VDS=0V, Freq.=1MHz	R_g	--	6.5	--	Ω
Switching Paramters (Test Circuit & Waveform See Fig.31)						
Turn-On Delay Time	VDS= -15 V	$t_{d(on)}$	--	7.5	--	ns
Turn-On Rise Time	VGS= -10 V	t_r	--	5.5	--	ns
Turn-Off Delay Time	RG= 10 Ω	$t_{d(off)}$	--	19.0	--	ns
Turn-Off Rise Time		t_f	--	7.0	--	ns
Gate Charge Paramters (Test Circuit & Waveform See Fig.32)						
Total Gate Charge	VDS= -15 V	Q_g	--	16.0	--	nC
Gate-Source Charge	VGS= -10 V	Q_{gs}	--	2.0	--	nC
Gate-Drain Charge	ID= -9 A	Q_{gd}	--	4.0	--	nC
Drain-Source Diode Characteristics And Maximum Ratings (Test Circuit & Waveform See Fig.34)						
Max. Diode Forward Cuurent		I_S	--	--	-18	A
Max. Pulsed Forward Cuurent		I_{SM}	--	--	-63	A
Diode Forward Voltage	ID= -9 A,VGS=0V	V_{SD}	--	-0.8	-1.2	V
Reverse Recovery Time	ID= -9 A,di/dt= 100 A/us	t_{rr}	--	15	--	ns
Reverse Recovery Charge	VGS= -10 V,VDS= -12 V	Q_{rr}	--	10	--	nC
Reverse Recovery Current		I_{RRM}	--	1.0	--	A

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N-Channel Typical Characteristics Curves

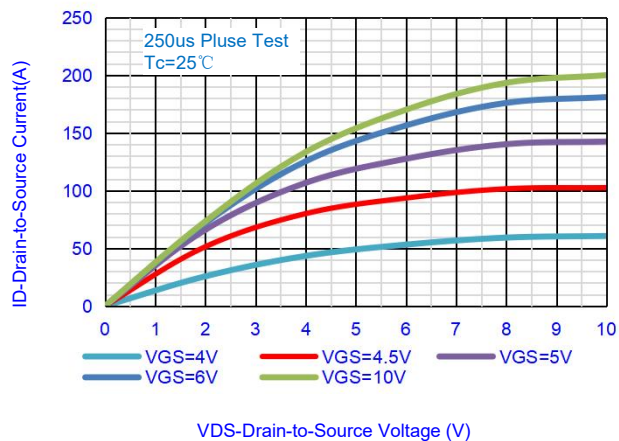


Fig.1-Output Characteristics

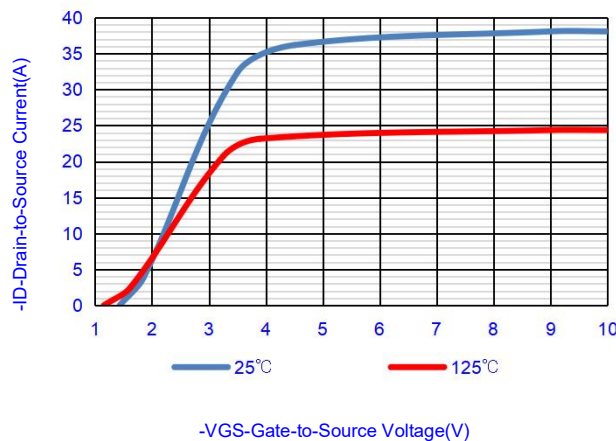


Fig.2- Transfer Characteristics

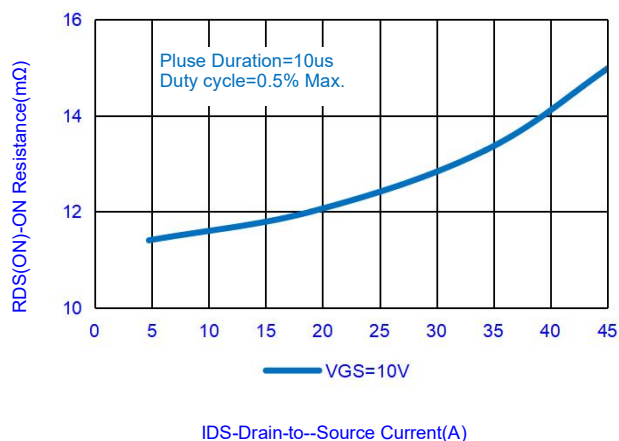


Fig.3- On Resistance vs. Drain Current

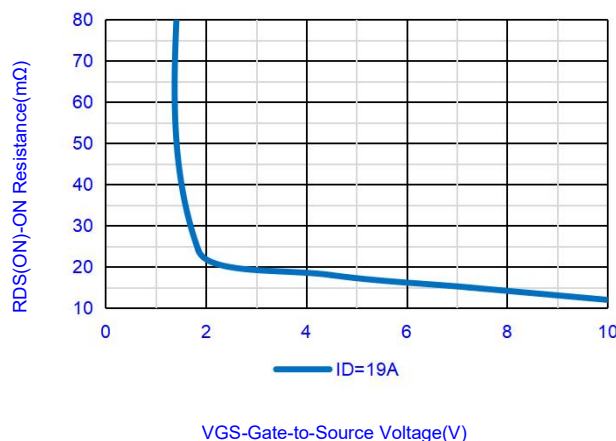


Fig.4- On Resistance vs. Gate Source Voltage

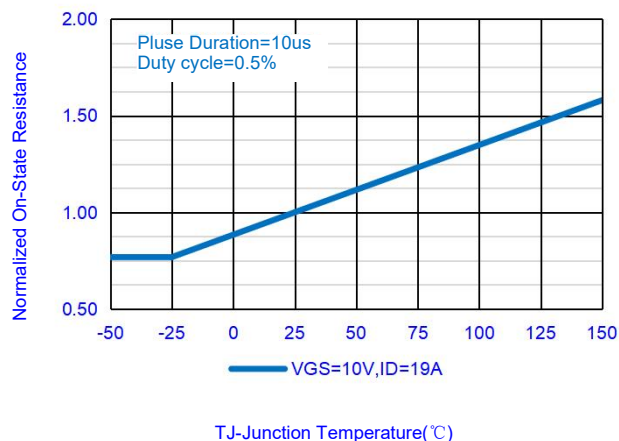


Fig.5- On Resistance vs. Junction Temperature

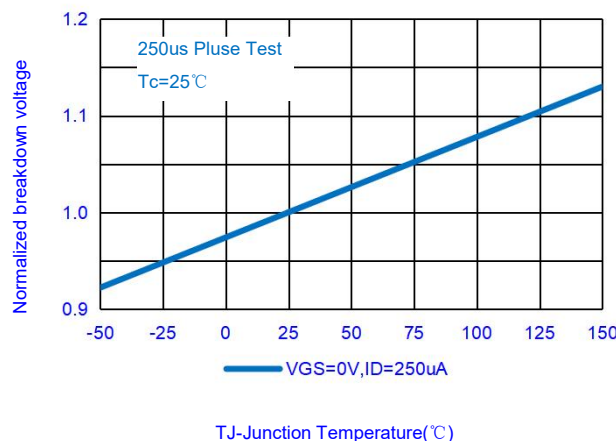


Fig.6- Breakdown Voltage vs. Junction Temperature

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N-Channel Typical Characteristics Curves

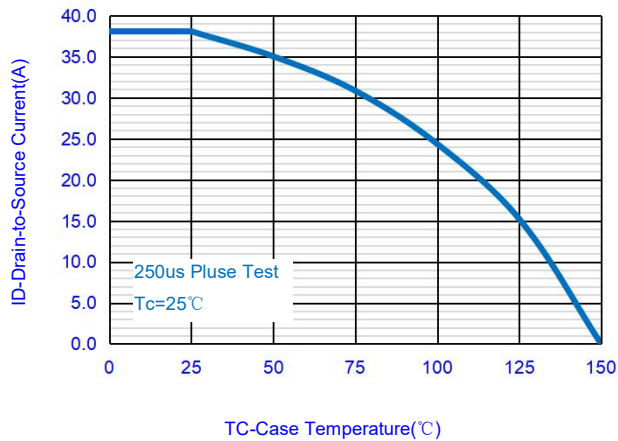


Fig.7-Maximum Continuous Drain Current vs. Case Temperature

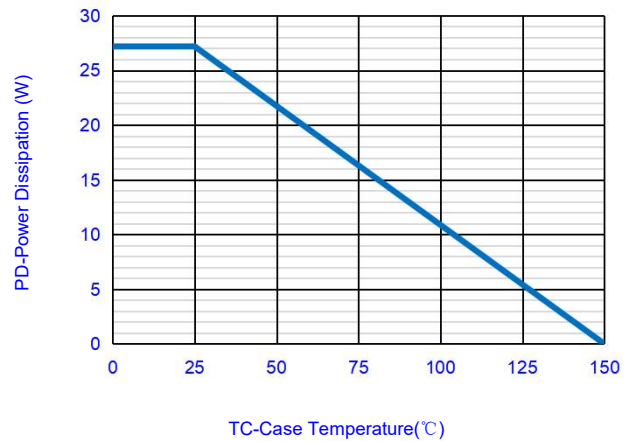


Fig.8-Maximum Power Dissipation vs. Case Temperature

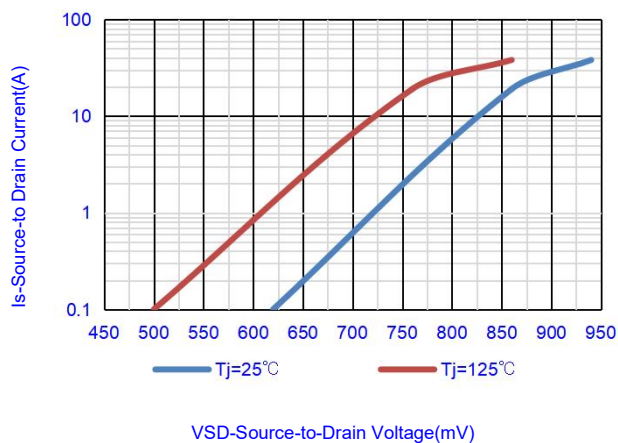


Fig.9- Source-Drain Diode Forward Voltage

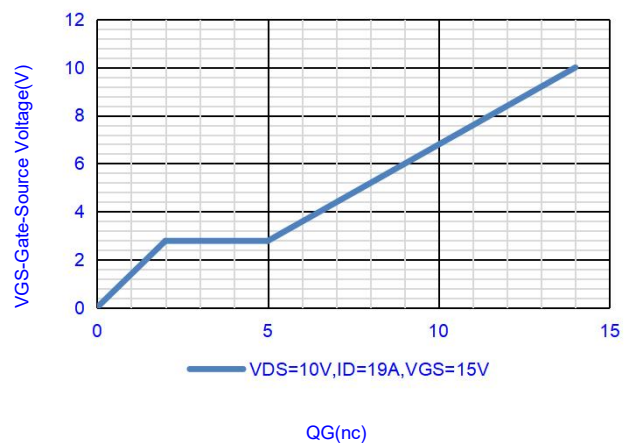


Fig.10-Gate Charge Waveform

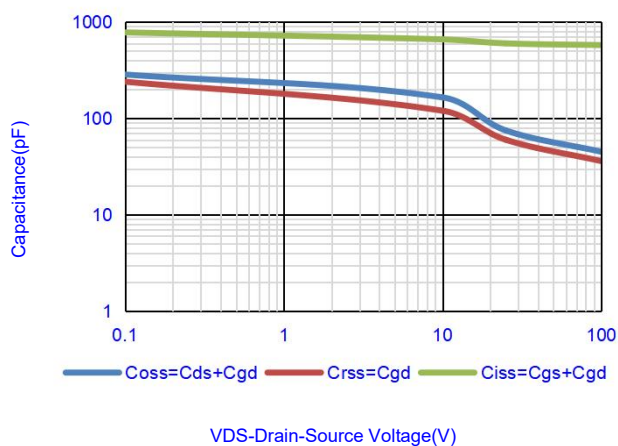


Fig.11- Gate-Source Voltage-VGS(V)

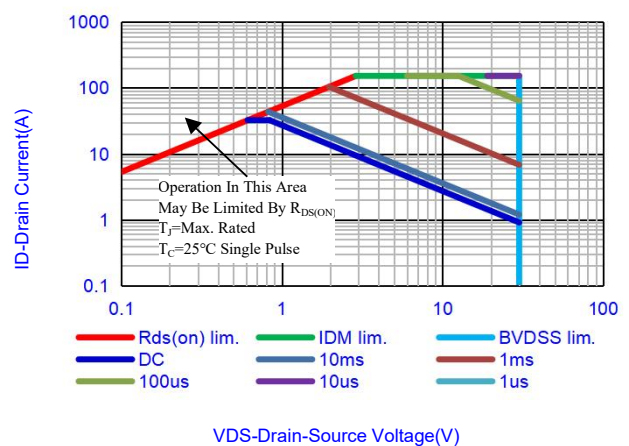


Fig.12-Maximum Safe Operating Area(SOA)

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N-Channel Typical Characteristics Curves

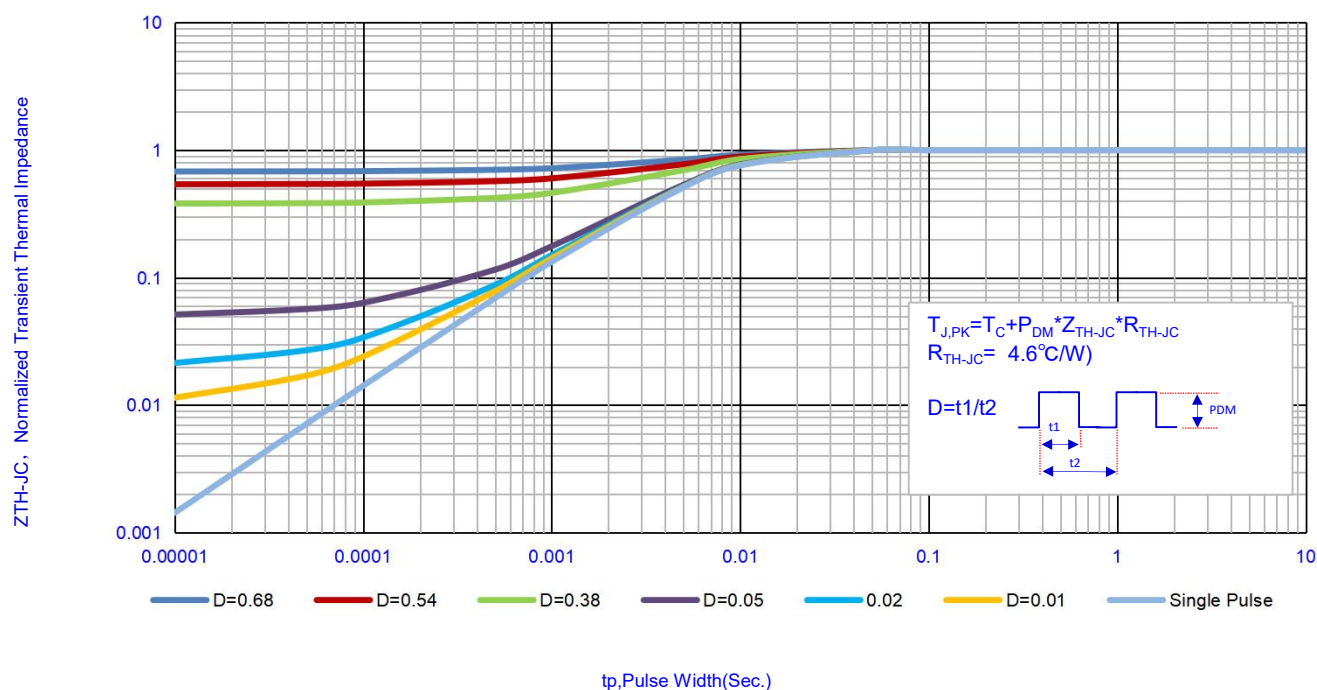


Fig.13- Normalized Maximum Transient Thermal Impedance vs.Pulse Width

N-Channel Test Circuit & Waveform

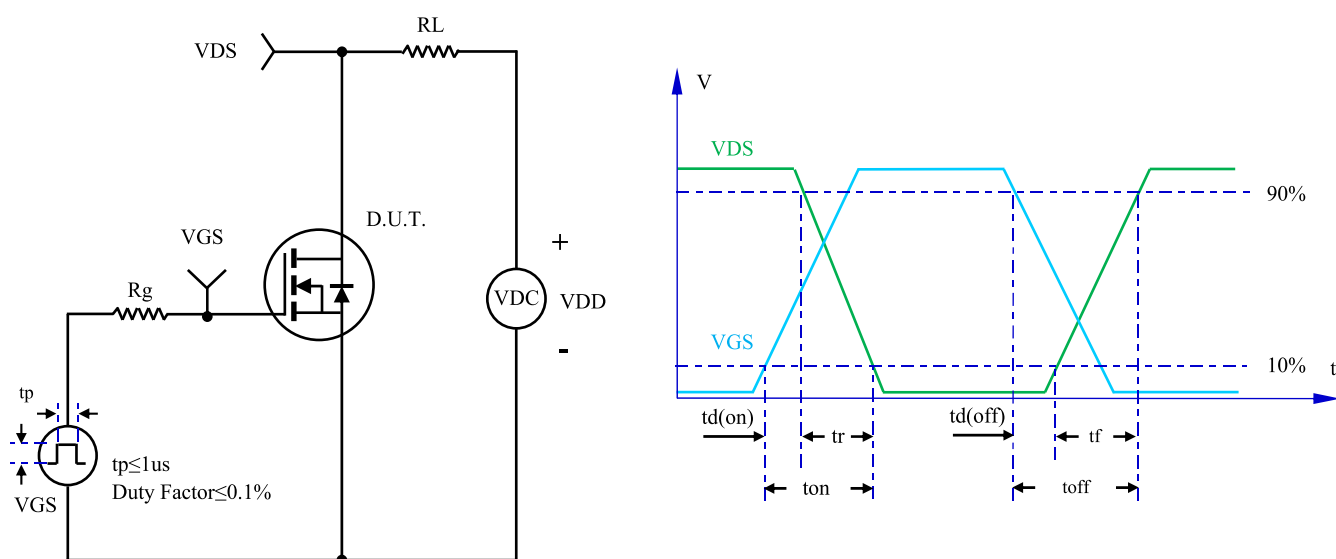


Fig.14- Resistive Switching Test Circuit & Waveform

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N-Channel Test Circuit & Waveform

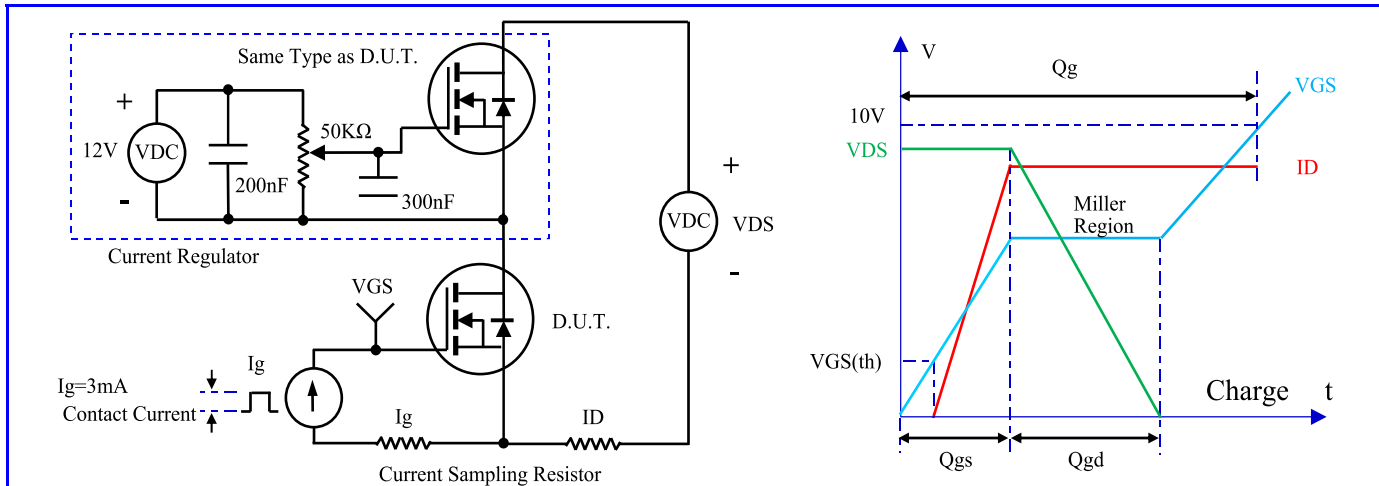


Fig.15-Gate Charge Test Circuit & Waveform

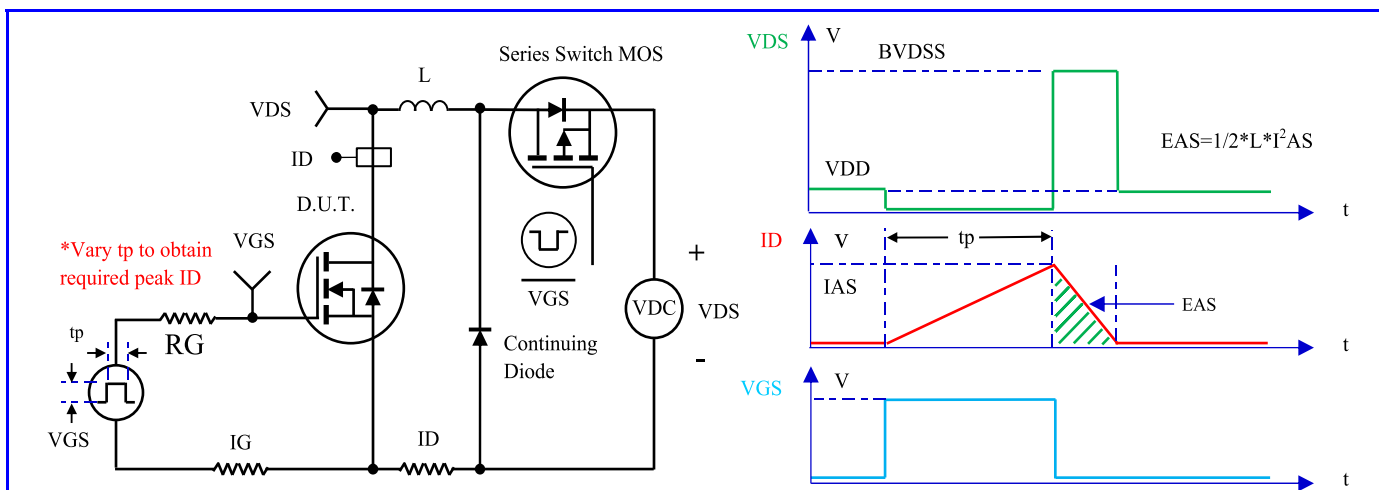


Fig.16- EAS Test Circuit & Waveform

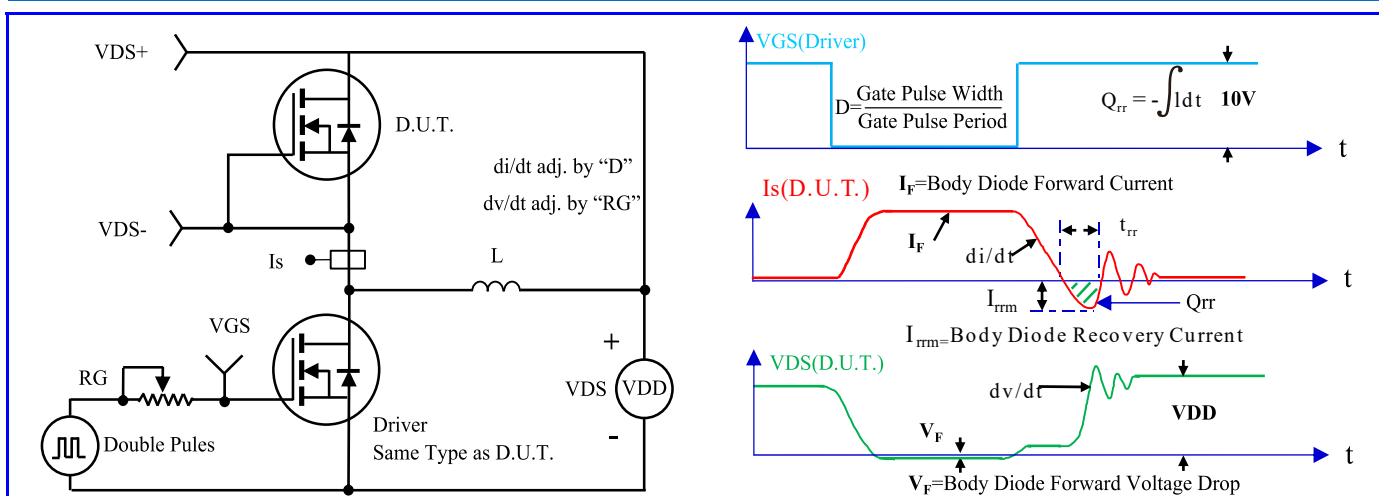


Fig.17- Diode Recovery Test Circuit & Waveform

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P-Channel Typical Characteristics Curves

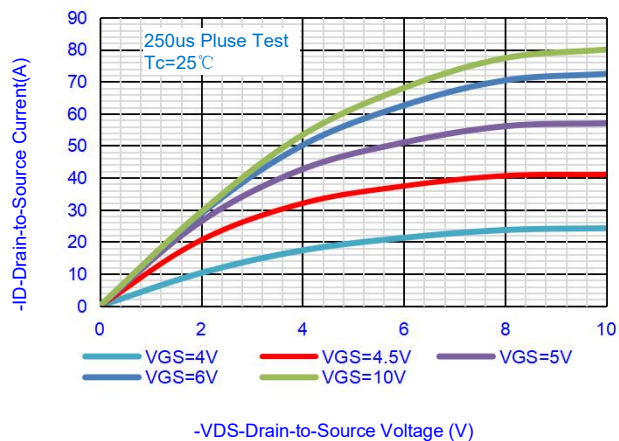


Fig.18-Output Characteristics

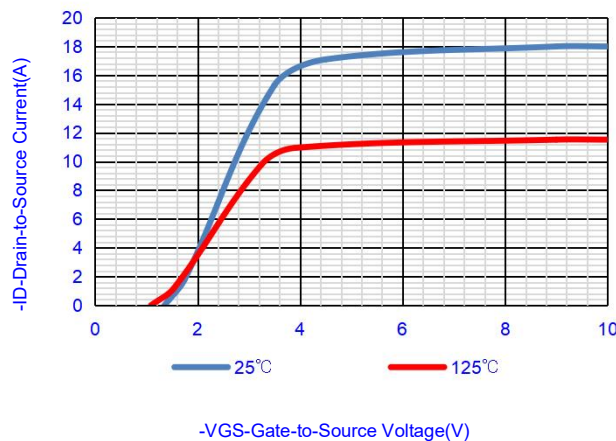


Fig.19- Transfer Characteristics

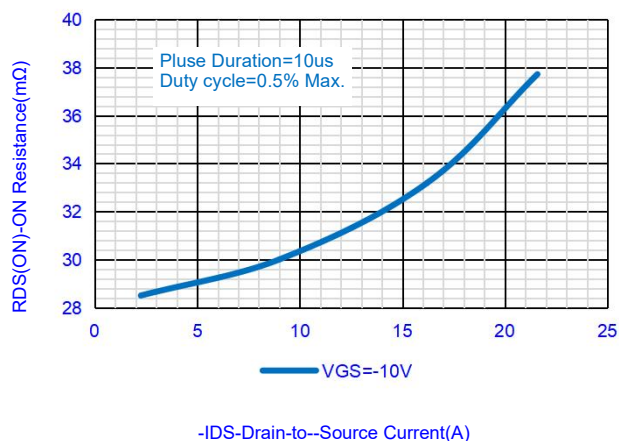


Fig.20- On Resistance vs. Drain Current

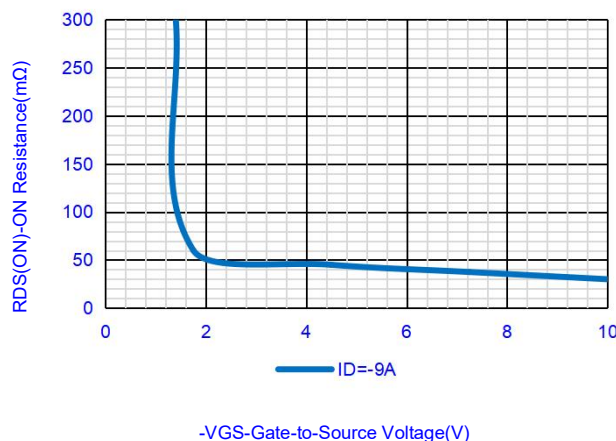


Fig.21- On Resistance vs. Gate Source Voltage

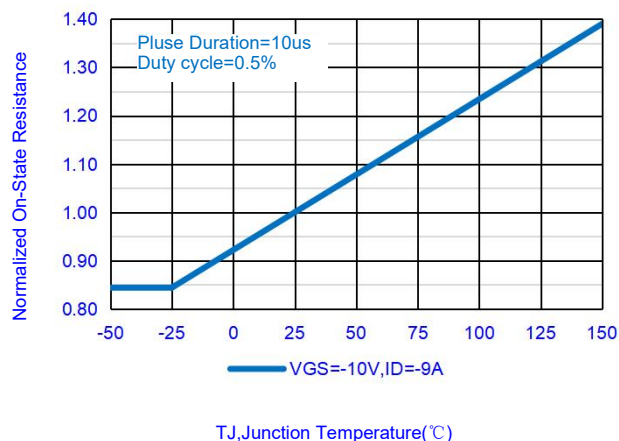


Fig.22- On Resistance vs. Junction Temperature

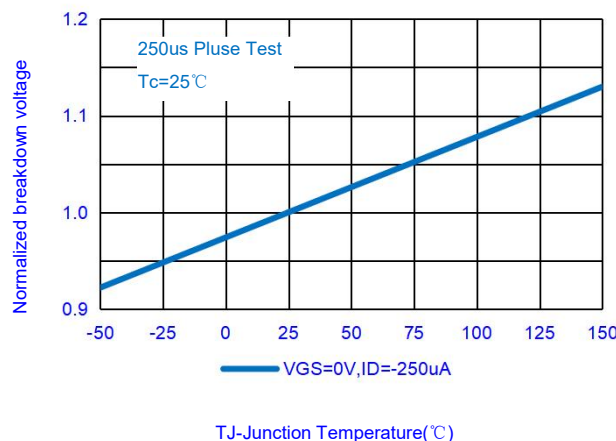


Fig.23- Breakdown Voltage vs. Junction Temperature

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P-Channel Typical Characteristics Curves

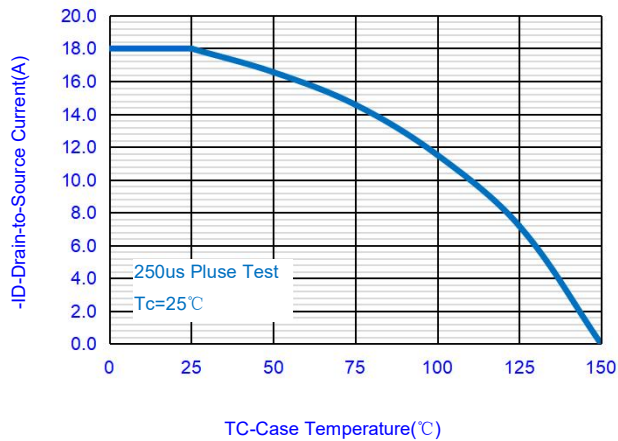


Fig.24-Maximum Continuous Drain Current vs. Case Temperature

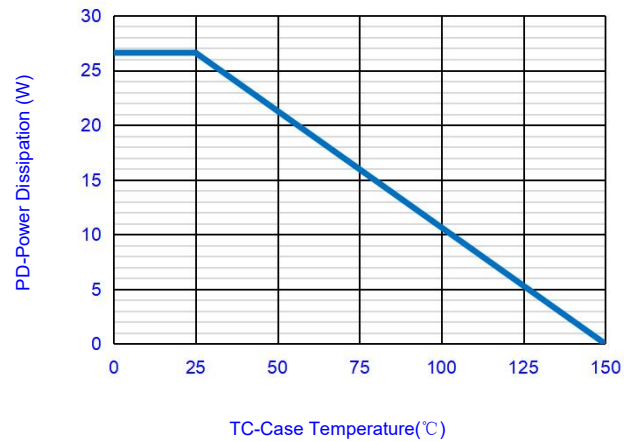


Fig.25-Maximum Power Dissipation vs. Case Temperature

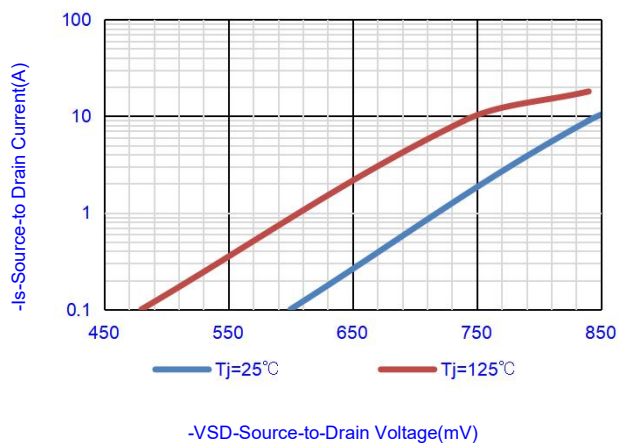


Fig.26- Source-Drain Diode Forward Voltage

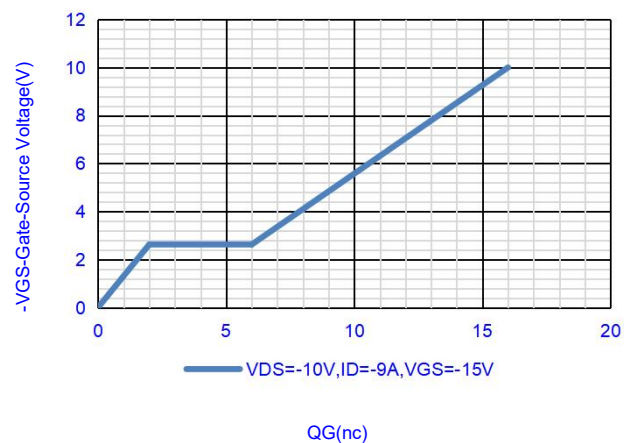


Fig.27-Gate Charge Waveform

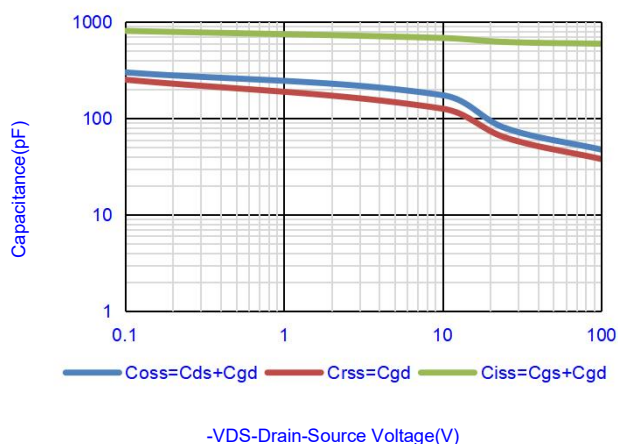


Fig.28- Gate-Source Voltage-VGS(V)

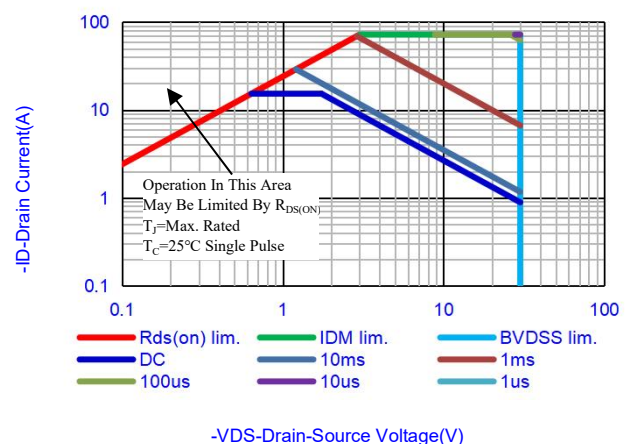


Fig.29-Maximum Safe Operating Area(SOA)

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P-Channel Typical Characteristics Curves

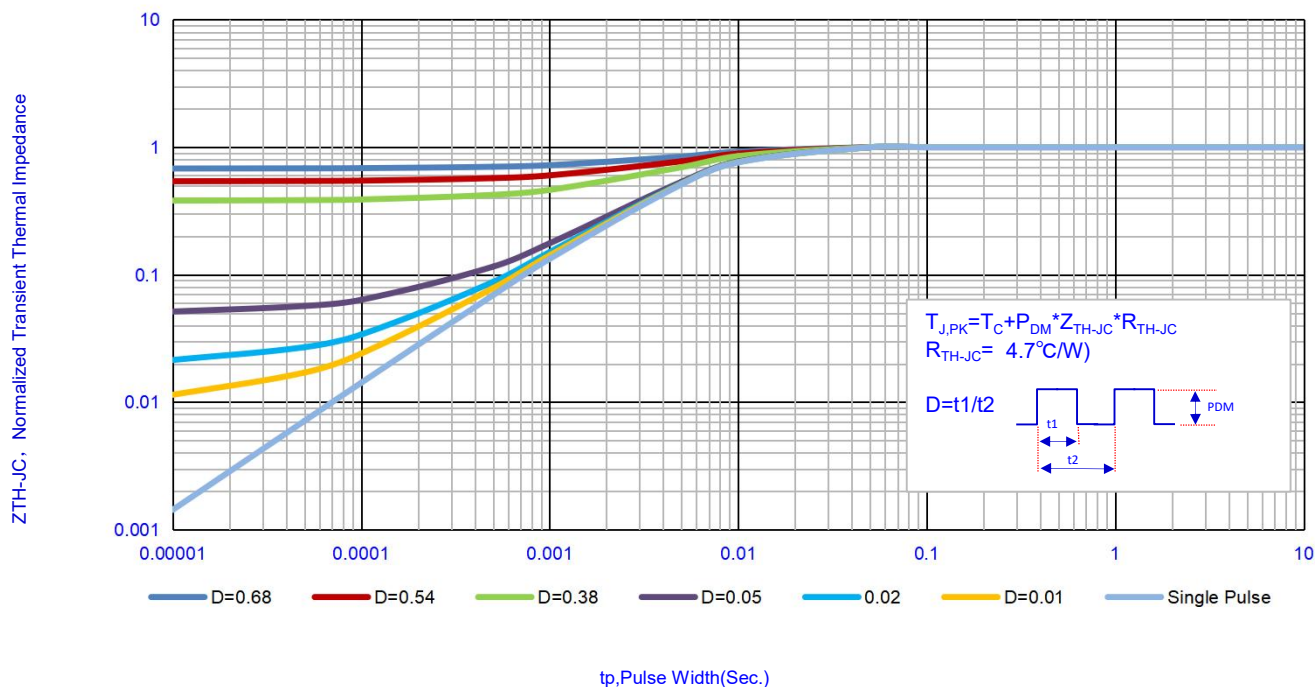


Fig.30- Normalized Maximum Transient Thermal Impedance vs.Pulse Width

P-Channel Test Circuit & Waveform

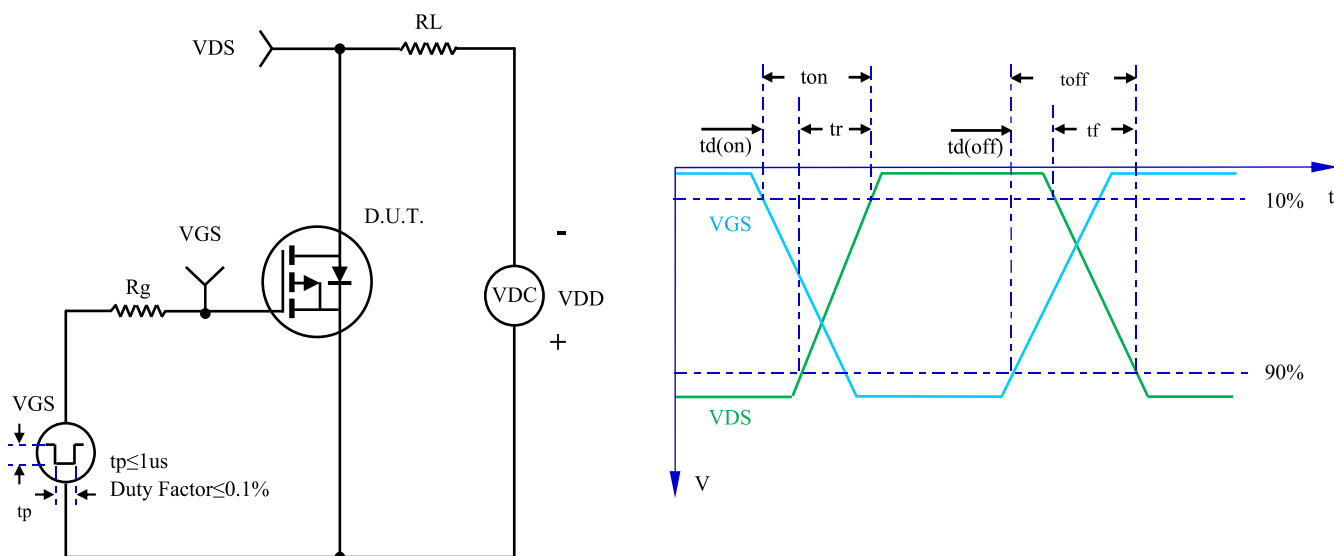


Fig.31- Resistive Switching Test Circuit & Waveform

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P-Channel Test Circuit & Waveform

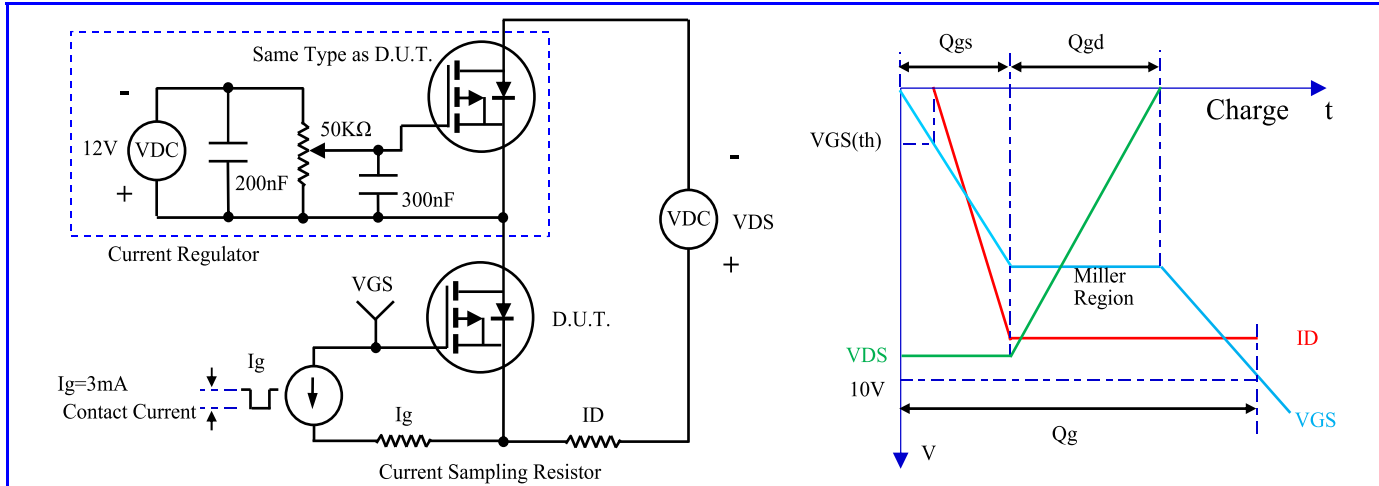


Fig.32-Gate Charge Test Circuit & Waveform

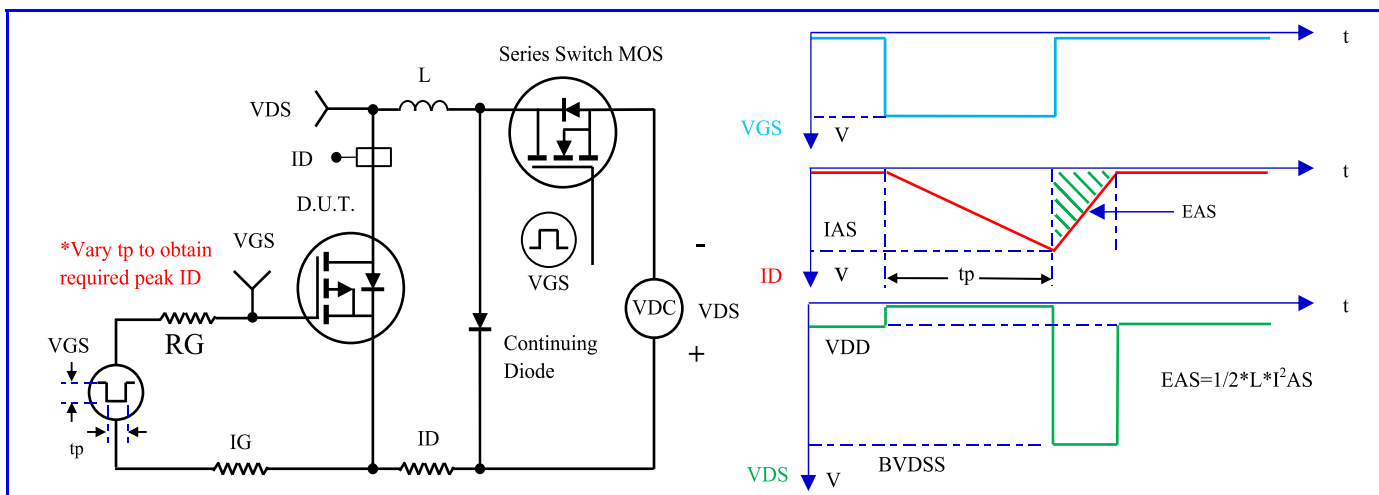


Fig.33- EAS Test Circuit & Waveform

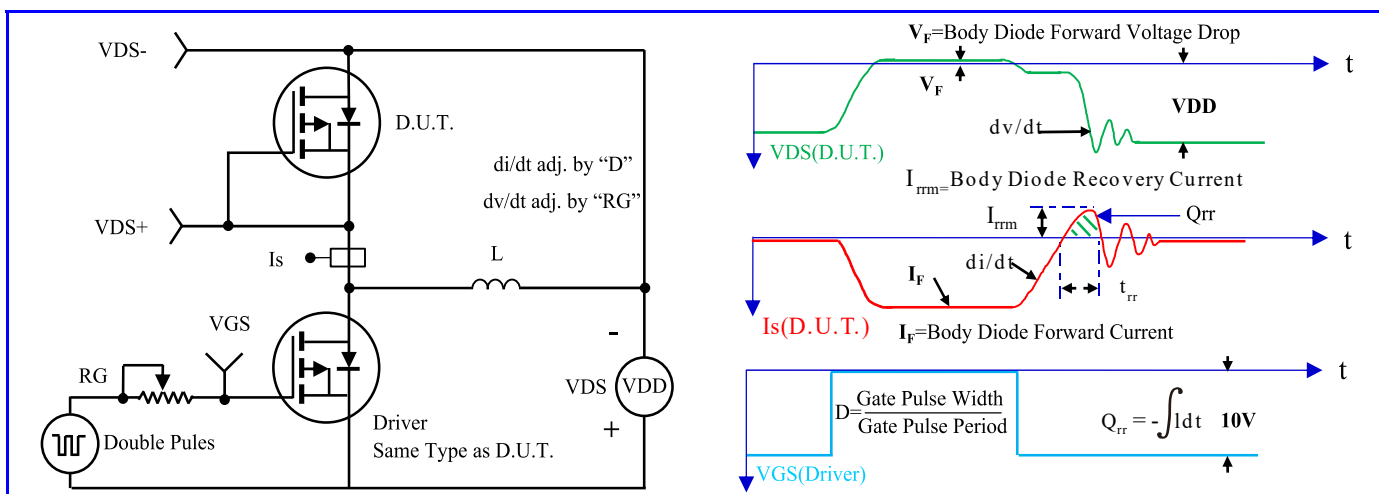


Fig.34- Diode Recovery Test Circuit & Waveform

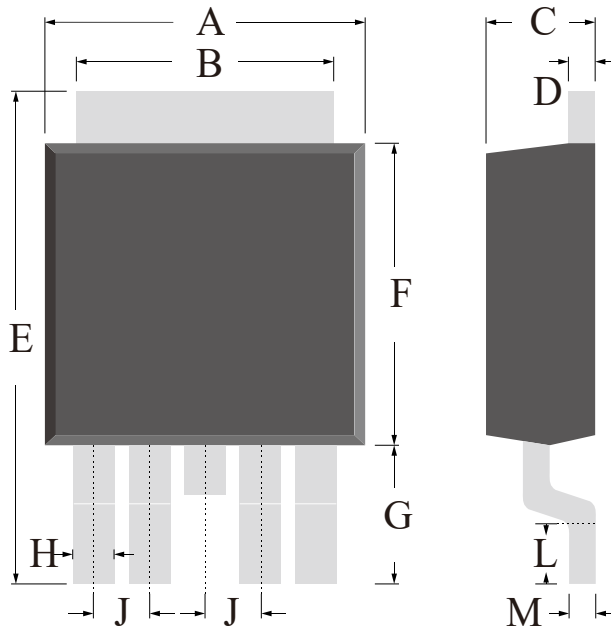
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OUTLINE DRAWINGS

TO-252-4L

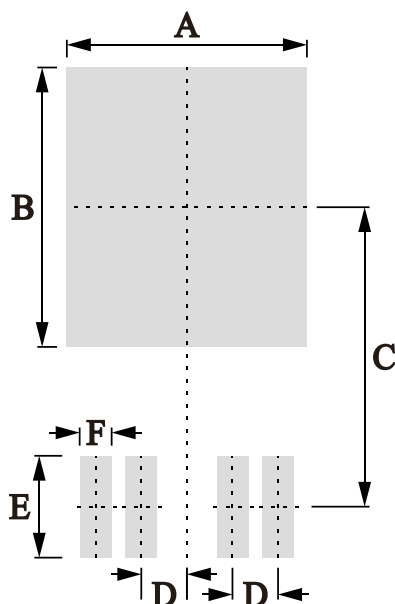


OUTLINE DIMENSIONS

Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	6.10	-	7.10	0.2402	-	0.2795
B	4.80	-	5.80	0.1890	-	0.2283
C	1.95	-	2.55	0.0768	-	0.1004
D	0.35	-	0.75	0.0138	-	0.0295
E	9.25	-	10.75	0.3642	-	0.4232
F	5.60	-	6.60	0.2205	-	0.2598
G	2.50	-	3.10	0.0984	-	0.1220
H	0.55	-	0.85	0.0217	-	0.0335
J	1.00	-	1.28	0.0394	-	0.0504
L	1.00	-	1.40	0.0394	-	0.0551
M	0.35	-	0.75	0.0138	-	0.0295

RECOMMEDNED LAYOUT DRAWINGS

TO-252-4L



OUTLINE DIMENSIONS

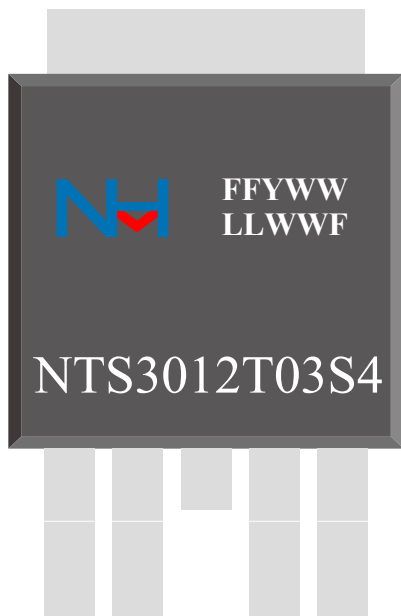
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	-	6.09	-	-	0.2398	-
B	-	7.57	-	-	0.2980	-
C	-	6.64	-	-	0.2614	-
D	-	1.14	-	-	0.0449	-
E	-	2.76	-	-	0.1087	-
F	-	0.80	-	-	0.0315	-

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MARKING INFORMATION

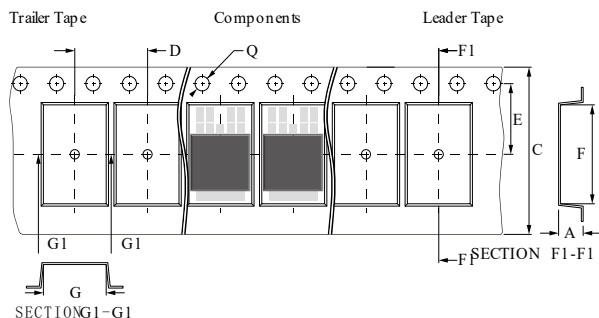


MARKING INSTRUCTIONS

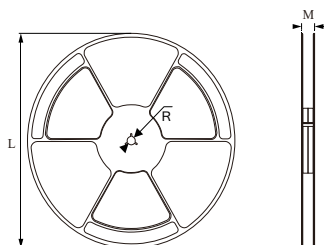
NH=Niuhang Trademark
FF=Product Line Code,According To Actual Changes
YWW=Date Code,According To Actual Changes
LLWWF=Internal Code,According To Actual Changes
NTS3012T03S4=Model

PACKAGING

TAPE



REEL



TO-252-4L

OUTLINE DIMENSIONS

Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
TAPE						
A	2.60	-	2.80	0.1024	-	0.1102
C	15.60	-	16.40	0.6142	-	0.6457
D	7.70	-	8.30	0.3031	-	0.3268
E	7.30	-	7.70	0.2874	-	0.3031
F	10.20	-	10.80	0.4016	-	0.4252
G	6.70	-	7.10	0.2638	-	0.2795
Q Φ	1.40	-	1.60	0.0551	-	0.0630
REEL						
L	328.00	-	332.00	12.913	-	13.071
R	12.00	-	14.00	0.4724	-	0.5512
M	19.40	-	23.40	0.7638	-	0.9213

PACKING INFORMATION

Package Type	Package Code	Product Weight Approx(g/Pcs)	Package Method	Quantity (Pcs/Min. Pack.)	Quantity (Pcs/Inner Box)	Quantity (Pcs/Carton)
TO-252-4L	P1	0.325	13" Reel	2500	5000	30000
TO-252-4L	P2	0.325	13" Reel	2500	2500	25000

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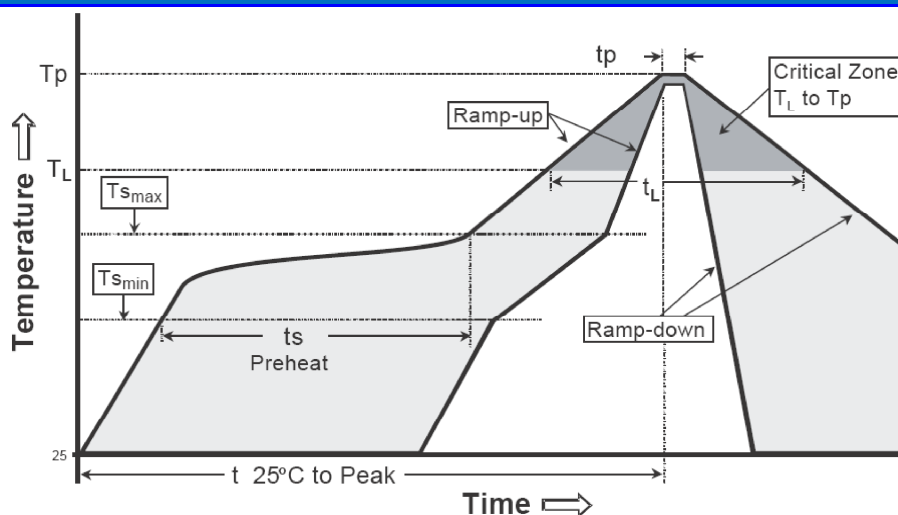
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Recommended wave soldering condition

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 (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.

NTS3012T03S4

N+P-Channel Enhancement Mode Trench Power MOSFET

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