NTS170N06F

N-Channel Enhancement Mode Trench Power MOSFET

Pb Pb-Free RoHS COMPLIANT

Voltage:	60	Volts	**Current:**	50	Amperes	**Package:**	TO-220FP

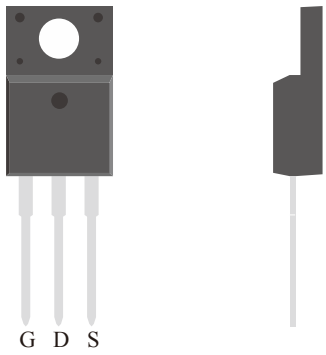
Features

- NH'S Advanced Trench Technology
- Low Rds(on) For Low On-State Loss
- High EAS For High Reliability
- Excellent Qg*Rds(on) Product(FOM）

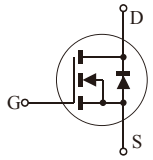
Typical Applications

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

Diagram:



Polarity:



Product Summary

VDS Min.@T_j	60	**V**
I_D Min.@Ta	50	**A**
RDS(ON)(TYP)@10V	12.6	**mΩ**

***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}	60	V
Gate-Source Voltage		V_{GS}	±20	V
Continuous Drain Current (Note 1)	Ta= 25 ℃ Ta= 100 ℃	I_D	50 45	A
Drain Current-Pulse (Note 1)	T_J< 175 ℃	I_{DM}	200	A
Maximum Power Dissipation Power Dissipation Derating Factor Above 25℃	Ta= 25 ℃ Ta= 100 ℃	P_D	48 24	W
Derating Factor		D_F	0.32	W/℃
Avalanche Current,Single Pulse (Note 1)	L= 0.5 mH	I_{AS}	19	A
Single Pulse Avalanche Energy (Note 1) Test Circuit & Waveform See Fig.17	L= 0.5 mH IAS= 19 A,RG= 10.0 Ω Starting Tj=25 ℃,VG = 10.0 V	E_{AS}	90	mJ

Thermal Characteristcs (Ta=25℃ Unless Otherwise Specified)

Parameter	Test Conditions	Symbol	Typ.	Unit
Junction Temperature		T_J	-55 to 175	℃
Storage Temperature Range		T_{STD}	-55 to 175	℃
Thermal Resistance Junction To Ambient With Steady-State	Still Air Environment With Ta=25℃	$R_{\theta JA}$	62.5	℃/W
Thermal Resistance Junction-Case With Steady-State	Device Mounted On 75mm x 45mm x 2.5mm Alu. Heat.	$R_{\theta JC}$	3.1	

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

NTS170N06F

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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℃	$\Delta BV_{DSS}/\Delta T_J$	--	0.06	--	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= 20.0 A,VDS= 5 V	gfs	--	14	--	S
Static On Characteristics						
Gate Threshold Voltage	VGS= VDS ID=250uA	$V_{GS(TH)}$	1	1.5	2	V
Drain-Source On Resistance	ID= 20.0 A,VGS= 10.0 V ID= 20.0 A,VGS= 5.0 V	$R_{DS(ON)}$	-- --	12.6 15.2	17 20.5	mΩ
Dynamic Characteristics						
Gate Resistance	VGS=0V,VDS=0V, Freq.=1MHz	R_g	--	1.15	--	Ω
Input Capacitance	VDS= 30 V	C_{iss}	--	2055	--	pF
Output Capacitance	VGS= 0 V	C_{oss}	--	66	--	pF
Reverse Transfer Capacitance	F= 1 MHZ	C_{rss}	--	76	--	pF
Switching Paramters With Inductive Load(Test Circuit & Waveform See Fig.15)						
Turn-On Delay Time	VDS= 30 V	$t_{d(on)}$	--	10	--	ns
Turn-On Rise Time	VGS= 10.0 V	t_r	--	7.6	--	ns
Turn-Off Delay Time	RG= 10.0 Ω	$t_{d(off)}$	--	44	--	ns
Turn-Off Rise Time	L= 0.5 mH	t_f	--	22	--	ns
Gate Charge Paramters (Test Circuit & Waveform See Fig.16)						
Total Gate Charge	VDS= 30 V	Q_g	--	46	--	nC
Gate-Source Charge	VGS= 10.0 V	Q_{gs}	--	10	--	nC
Gate-Drain Charge	ID= 20.0 A	Q_{gd}	--	6.5	--	nC
Drain-Source Diode Characteristics And Maximum Ratings (Test Circuit & Waveform See Fig.18)						
Max. Diode Forward Current		I_S	--	--	50.0	A
Max. Pulsed Forward Current		I_{SM}	--	--	200	A
Diode Forward Voltage	ID= 20.0 A,VGS=0V	V_{SD}	--	0.7	1.2	V
Reverse Recovery Time	IS= 20.0 A,di/dt= 100 A/us	t_{rr}	--	56	--	ns
Reverse Recovery Charge	VGS= 0.0 V	Q_{rr}	--	42	--	nC
Reverse Recovery Current		I_{RRM}	--	2.0	--	A

NTS170N06F

N-Channel Enhancement Mode Trench Power MOSFET

Pb-Free RoHS COMPLIANT

Typical Characteristics Curves

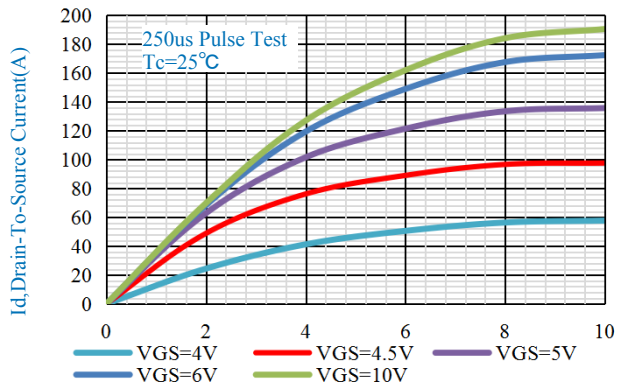


Fig.1-Output Characteristic

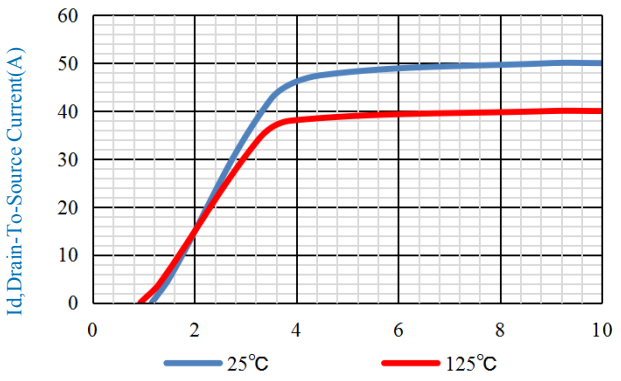


Fig.2-Transfer Characteristic

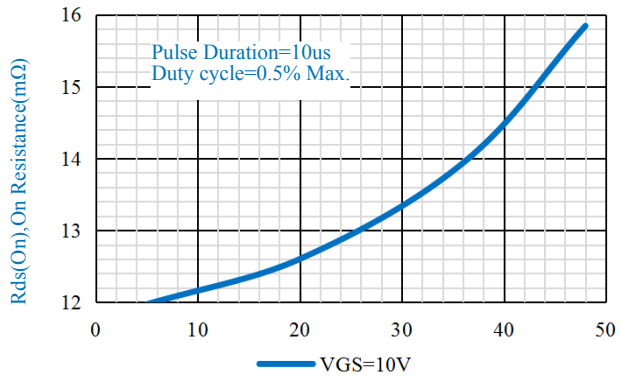


Fig.3-On Resistance Vs. Drain Current

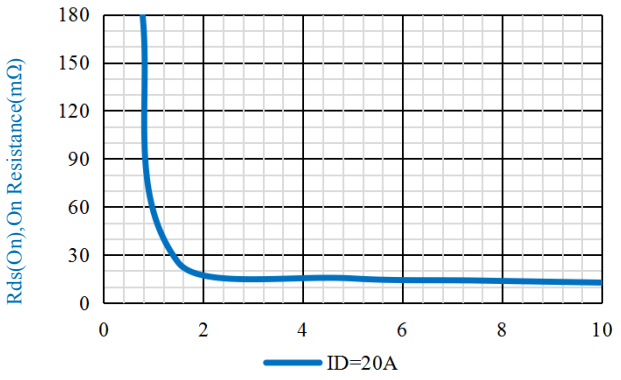


Fig.4-On Resistance Vs. Gate Source Voltage

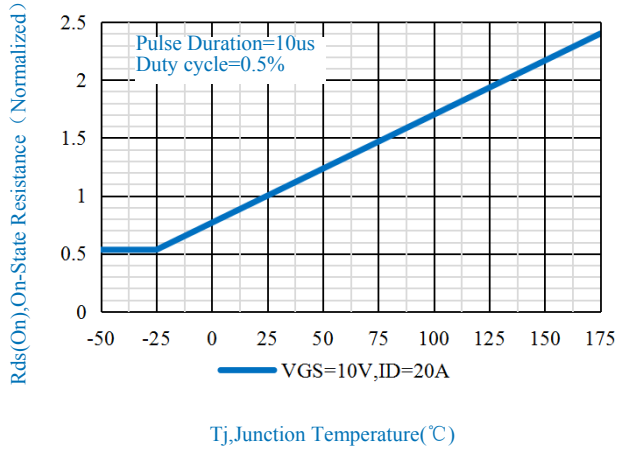


Fig.5-On Resistance Vs. Junction Temperature

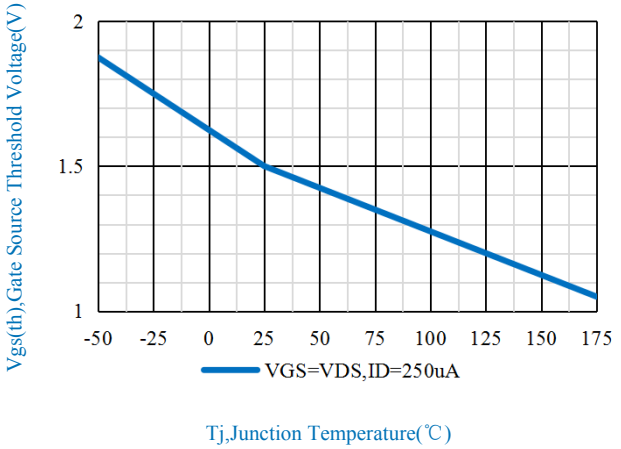


Fig.6-Gate Source Threshold Voltage Vs. Junction Temperature

NTS170N06F

N-Channel Enhancement Mode Trench Power MOSFET

Pb-Free RoHS COMPLIANT

Typical Characteristics Curves

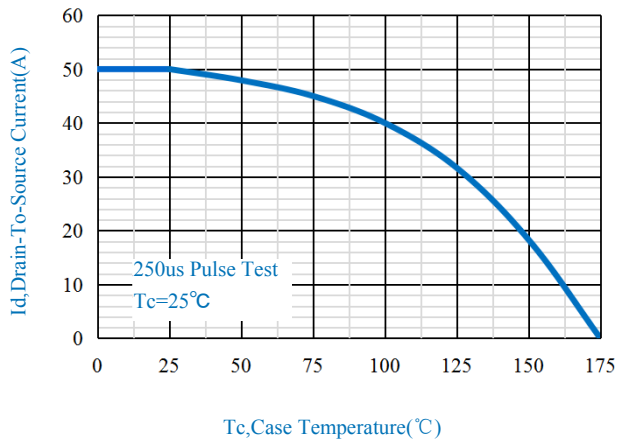


Fig.7-Maximum Continuous Drain Current Vs. Case Temperature

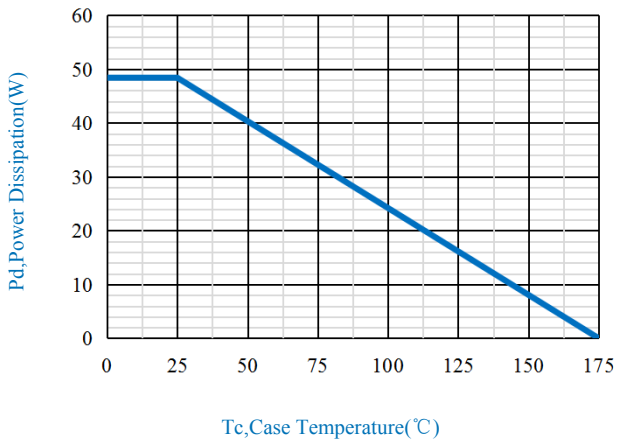


Fig.8-Maximum Power Dissipation Vs. Case Temperature

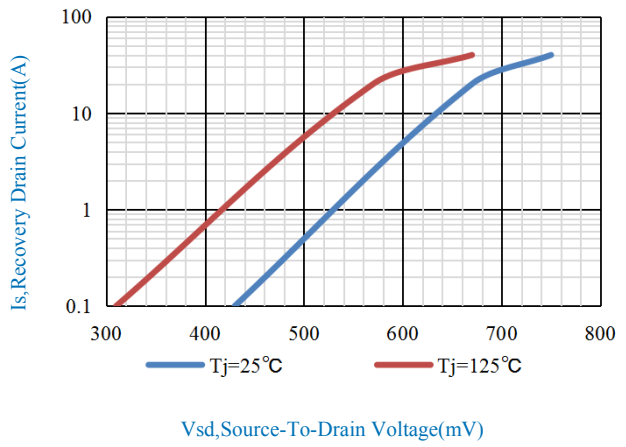


Fig.9-Source-To-Drain Diode Forward Voltage

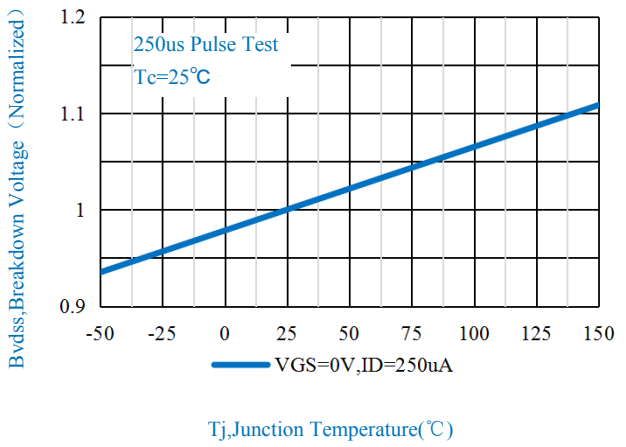


Fig.10-Breakdown Voltage Vs. Junction Temperature

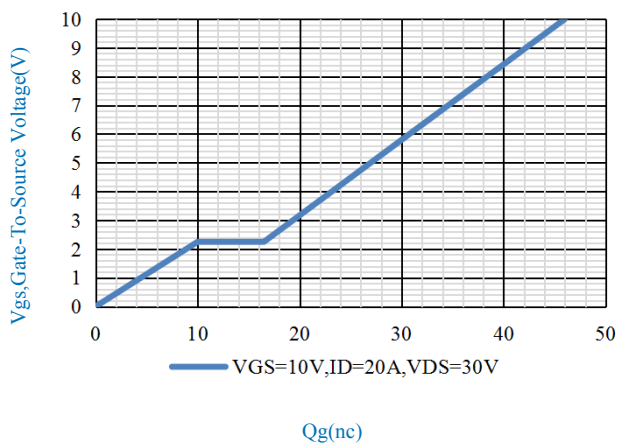


Fig.11-Gate Charge Waveform

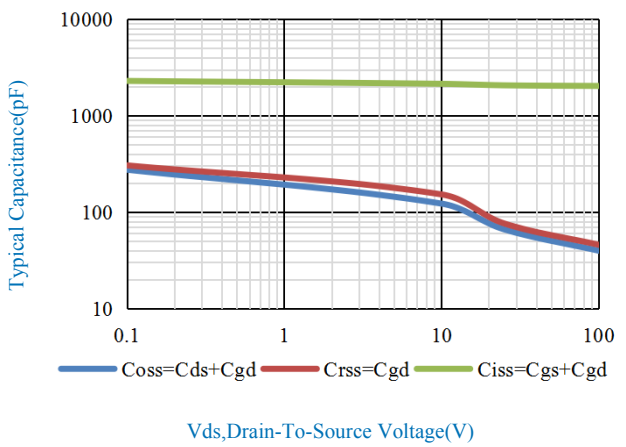


Fig.12-Typical Capacitance Vs. Drain-To-Source Voltage

NTS170N06F

N-Channel Enhancement Mode Trench Power MOSFET

Pb-Free RoHS COMPLIANT

Typical Characteristics Curves

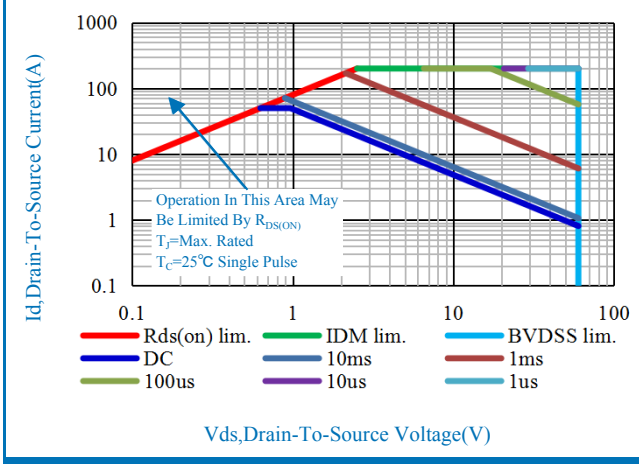


Fig.13-Maximum Safe Operating Area(SOA)

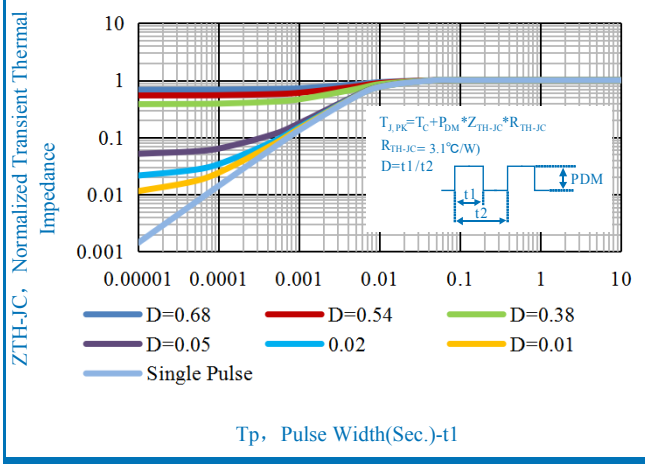
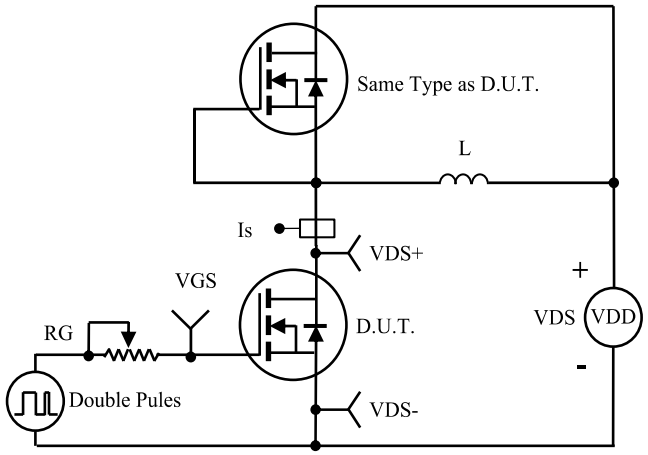


Fig.14- Normalized Maximum Transient Thermal Impedance Vs.Pulse Width

Inductive Load Test Circuit & Waveform



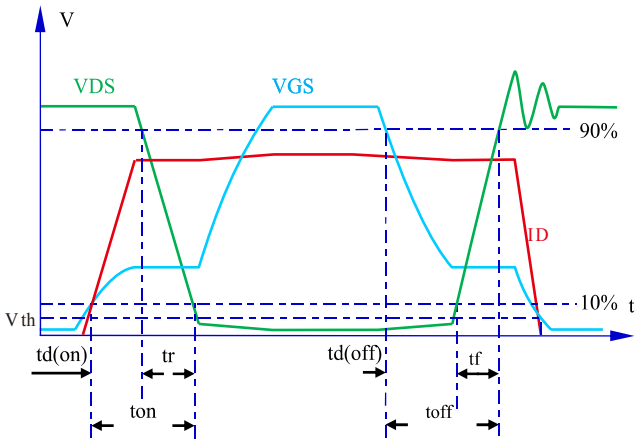


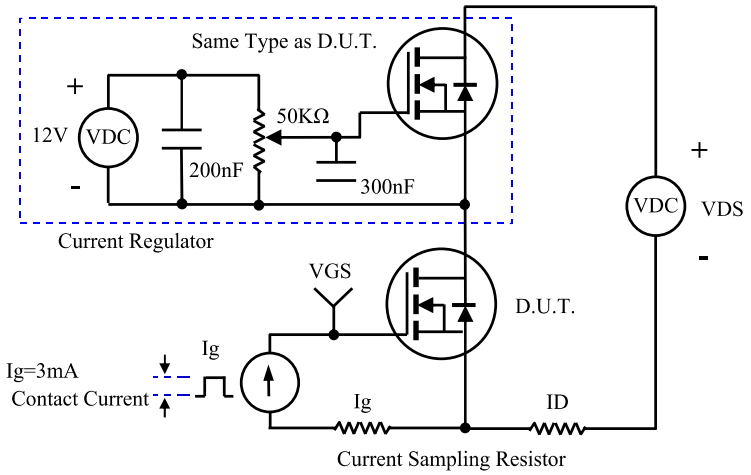
Fig.15- Inductive Switching Test Circuit & Waveform

NTS170N06F

N-Channel Enhancement Mode Trench Power MOSFET

Pb-Free RoHS COMPLIANT

Test Circuit & Waveform



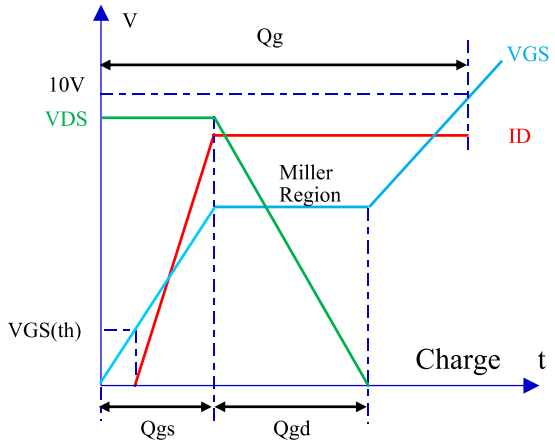
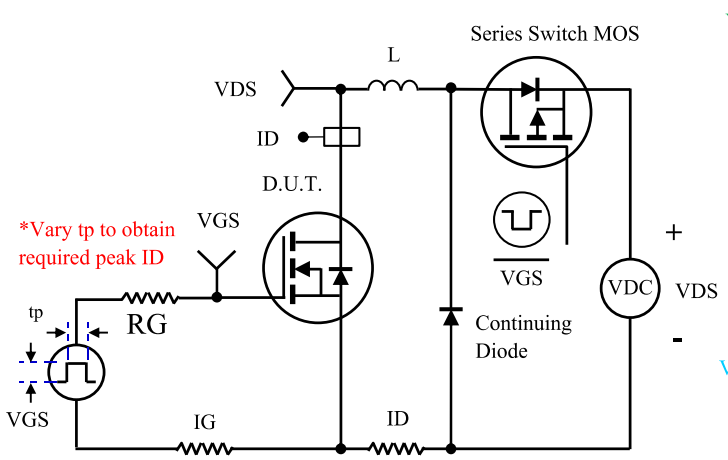


Fig.16-Gate Charge Test Circuit & Waveform



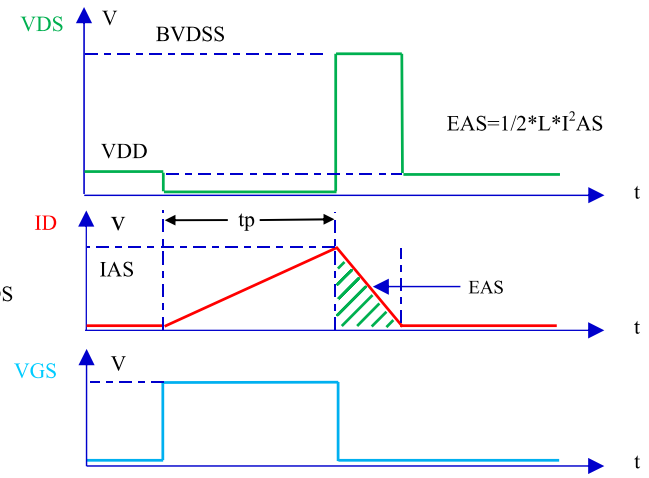
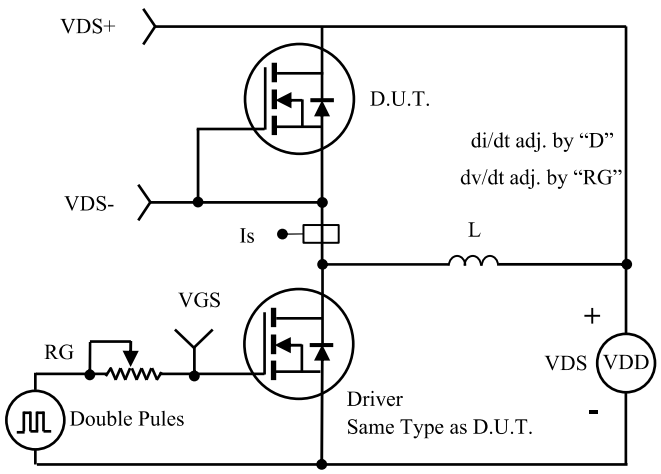


Fig.17- Unclamped Inductive Switching (UIS) Test Circuit & Waveform



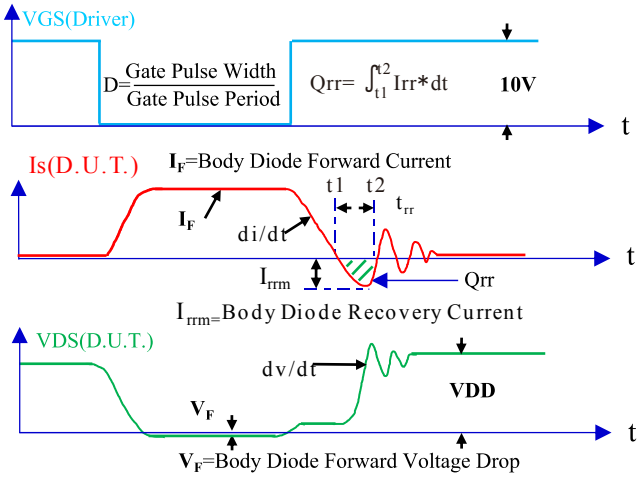


Fig.18- Diode Recovery Test Circuit & Waveform

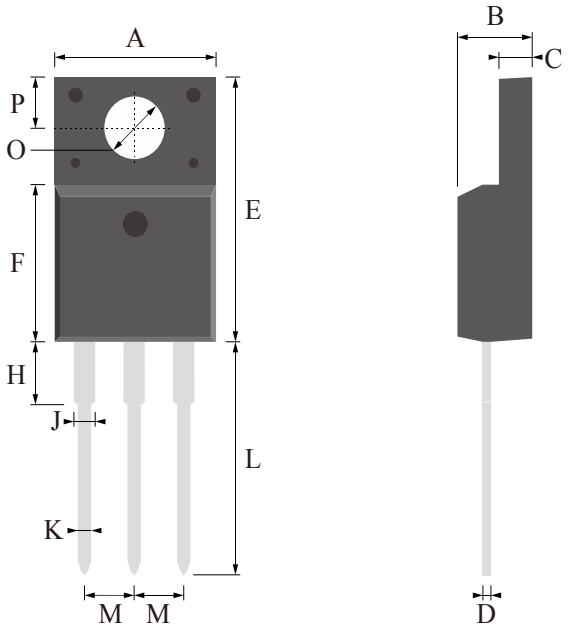
NTS170N06F

N-Channel Enhancement Mode Trench Power MOSFET

Pb-Free RoHS COMPLIANT

OUTLINE DRAWINGS

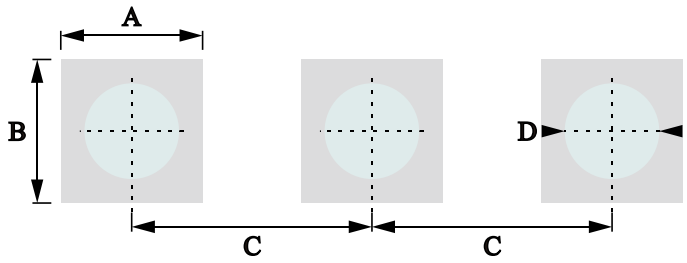
TO-220FP



OUTLINE DIMENSIONS						
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	9.25	-	10.75	0.3642	-	0.4232
B	4.20	-	5.20	0.1654	-	0.2047
C	2.30	-	2.90	0.0906	-	0.1142
D	0.35	-	0.75	0.0138	-	0.0295
E	14.80	-	16.80	0.5827	-	0.6614
F	8.25	-	9.75	0.3248	-	0.3839
L	12.15	-	14.15	0.4783	-	0.5571
H	2.60	-	3.80	0.1024	-	0.1496
J	1.10	-	1.60	0.0433	-	0.0630
K	0.60	-	1.00	0.0236	-	0.0394
M	2.20	-	3.00	0.0866	-	0.1181
O	2.70	-	3.50	0.1063	-	0.1378
P	3.10	-	3.80	0.1220	-	0.1496

RECOMMEDNED LAYOUT DRAWINGS

TO-220FP



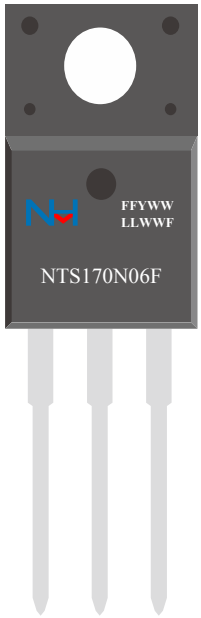
OUTLINE DIMENSIONS						
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	-	1.60	-	-	0.0630	-
B	-	1.60	-	-	0.0630	-
C	-	2.54	-	-	0.1000	-
D	-	1.00	-	-	0.0394	-

NTS170N06F

N-Channel Enhancement Mode Trench Power MOSFET

Pb-Free RoHS COMPLIANT

MARKING INFORMATION



MARKING INSTRUCTIONS

NH=Niuhang Trademark

FF=Product Line Code,According To Actual Changes

YWW=Date Code,According To Actual Changes

LLWWF=Inernal Code,According To Actual Changes

NTS170N06F=Model

PACKING INFORMATION

Package Type	Package Code	Productor Weight Approx(g/Pcs)	Package Method	Quantity (Pcs/Min. Pack.)	Quantity (Pcs/Inner Box)	Quantity (Pcs/Carton)
TO-220FP	P1	2.048	Tube	50	1000	5000

NTS170N06F

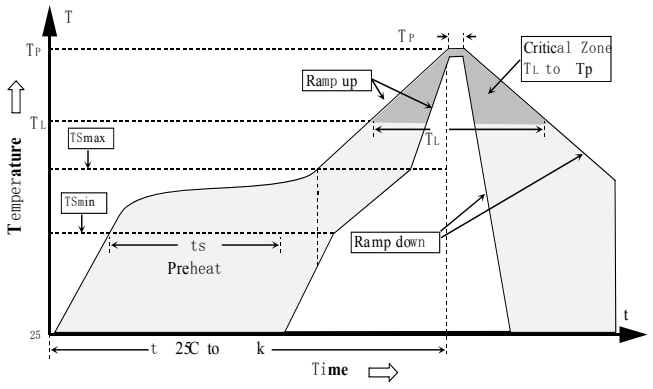
N-Channel Enhancement Mode Trench Power MOSFET

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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.

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NTS170N06F

N-Channel Enhancement Mode Trench Power MOSFET

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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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