

NTS170N06S

60V N-Channel Enhancement Mode Power MOSFET



VOLTAGE: 60 Volts

CURRENT: 36.0 Amperes

TO-252

Marking and Polarity

FEATURES

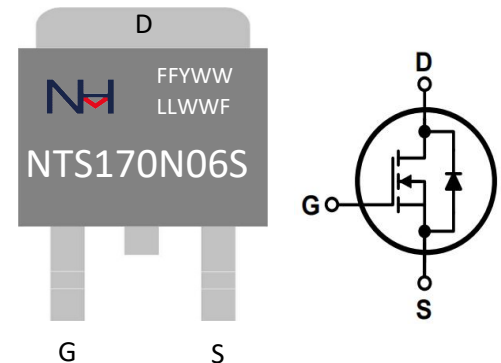
- Low RDS(ON)
- Ultra Low Gate Charge
- RoHS Compliant
- 100% UIS and RG Tested

TYPICAL APPLICATIONS

- Adapter, PC, PD, Charger, LED Driver
- Switched mode power supplies (SMPS)
- Uninterruptible Power Supply (UPS)

PRODUCT SUMMARY

VDS@TjMAX.	60	V
ID	36	A
RDS(ON) , Typ. @10V	12.6	mΩ



Remark:

- NH=niu hang trademark;
- FF=Product line code, According to actual changes
YWW=Date code, According to actual changes
LLWWF=Internal code, According to actual changes
- NTS170N06S=Module.

Absolute Maximum Ratings (Ratings at 25°C ambient temperature 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	Ta= 25 °C	I_D	36	A
	Ta= 100 °C		23.0	
Drain Current-Pulsed	Tj< 175 °C	I_{DM}	144	A
Maximum Power Dissipation	Ta= 25 °C	P_D	48	W
Power Dissipation Derating Factor above 25°C	Ta= 100 °C		24	
Derating Factor		D_F	0.32	W/°C
Junction Temperature		T_J	-55 to 175	°C
Storage temperature range		T_{STD}	-55 to 175	°C
Avalanche Current, Single pulse	L= 0.5 mH	I_{AS}	20	A
Single Pulse Avalanche Energy	L= 0.5 mH, VDD=40V IAS= 20 A, RG=25Ω Starting TJ =25°C	E_{AS}	100	mJ

Thermal Characteristics (Ratings at 25°C ambient temperature unless otherwise specified)

Parameter	Test Conditions	Symbol	Max	Unit
Thermal Resistance Junction to Ambient	1. still air environment with TA =25° C.	$R_{\theta JA}$	100	°C/W
Thermal Resistance Junction-Case	2. device mounted on 1 in ² FR-4 board with 2oz	$R_{\theta JC}$	3.1	



NTS170N06S

60V N-Channel Enhancement Mode Power MOSFET



Electrical Characteristics (Ratings at 25°C ambient temperature 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, Reference 25°C	$\Delta BV_{DSS}/\Delta T_J$	-	0.23	-	V/°C
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
Static on Characteristics						
Gate Threshold Voltage	VGS= VDS ID=250uA	$V_{GS(TH)}$	1.0	1.5	2.0	V
Drain-Source On Resistance	ID= 20 A, VGS=10V	$R_{DS(ON)}$	-	12.6	17.0	mΩ
Dynamic Characteristics						
Gate Resistance	VGS=0V, VDS=0V, Freq.=1MHz	R_g	-	1.30	-	Ω
Input Capacitance	VDS= 30 V	C_{iss}	-	2098	-	pF
Output Capacitance	VGS= 0 V	C_{oss}	-	103	-	pF
Reverse Transfer Capacitance	F= 1 MHZ	C_{rss}	-	93	-	pF
Switching Paramters						
Turn-On Delay Time	VDS= 30 V	$t_{d(on)}$	-	10.0	-	ns
Turn-On Rise Time	R _L 3 Ω	t_r	-	7.6	-	ns
Turn-Off Delay Time	VGS= 10 V	$t_{d(off)}$	-	56.4	-	ns
Turn-Off Rise Time	RG= 6 Ω	t_f	-	13.2	-	ns
Total Gate Charge	VDS= 30 V	Q_g	-	45.4	-	nC
Gate-Source Charge	ID= 10 A	Q_{gs}	-	9.6	-	nC
Gate-Drain Charge	VGS= 10 V	Q_{gd}	-	6	-	nc
Drain-Source Diode Characteristics and Maximum Ratings						
Max. Diode Forward Cuurent		I_S	-	-	36	A
Max. Pulsed Forward Cuurent		I_{SM}	-	-	144	A
Diode Forward Voltage	ID= 20 A, VGS=0V	V_{SD}	-	0.86	1.2	V
Reverse Recovery Time	ID= 10 A, VGS=0V	t_{rr}	-	20	-	ns
Reverse Recovery Charge	di/dt= 100 A/us	Q_{rr}	-	19.8	-	nC

NTS170N06S

60V N-Channel Enhancement Mode Power MOSFET



Typical Characteristics Curves

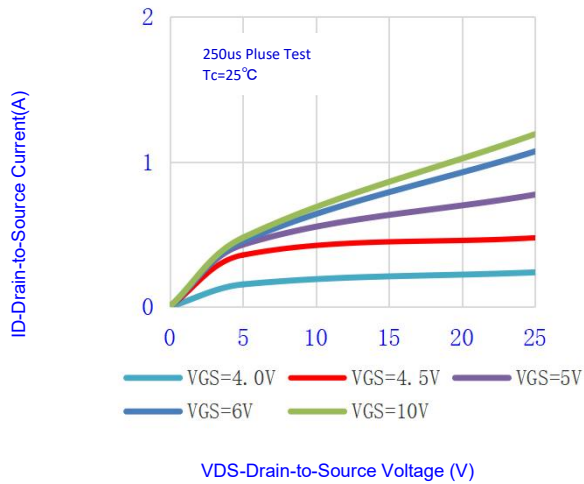


Fig.1-Output Characteristics

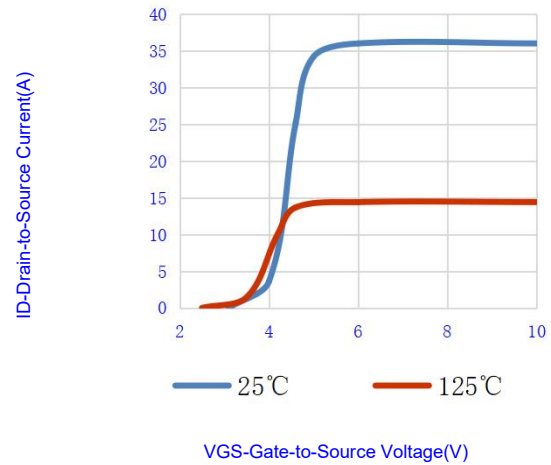


Fig.2- Transfer Characteristics

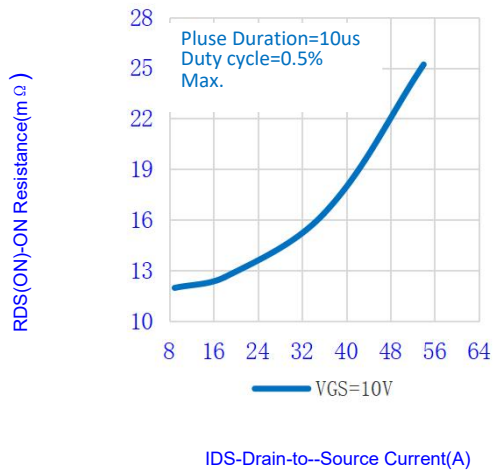


Fig.3- On Resistance vs. Drain Current

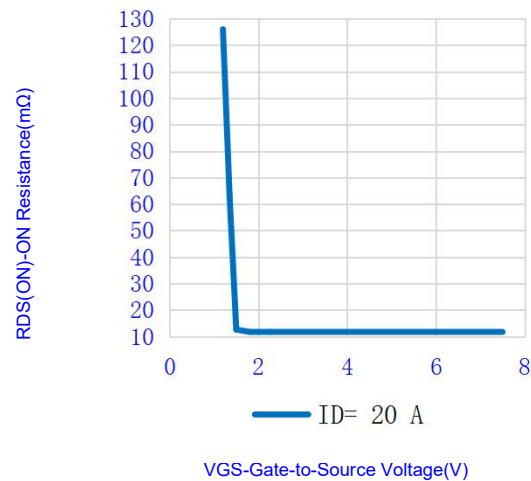


Fig.4- On Resistance vs. Gate Source Voltage

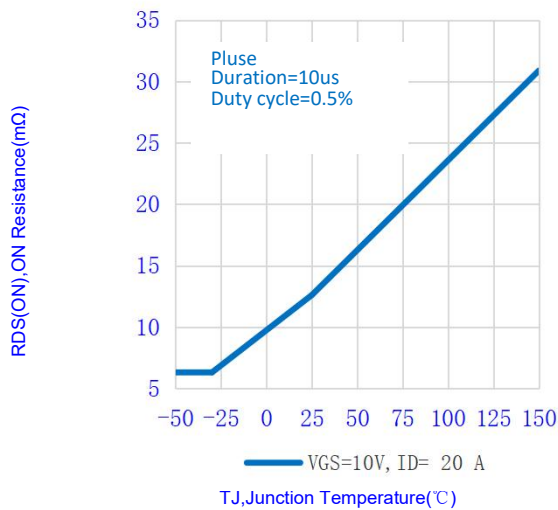


Fig.5- On Resistance vs. Junction Temperature

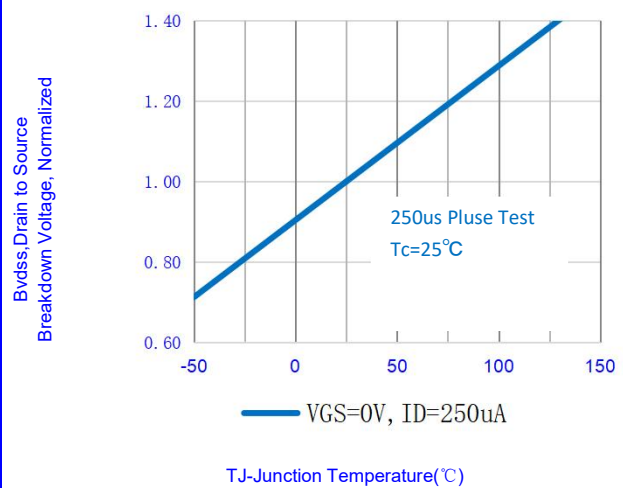


Fig.6- Breakdown Voltage vs. Junction Temperature

NTS170N06S

60V N-Channel Enhancement Mode Power MOSFET



Typical Characteristics Curves

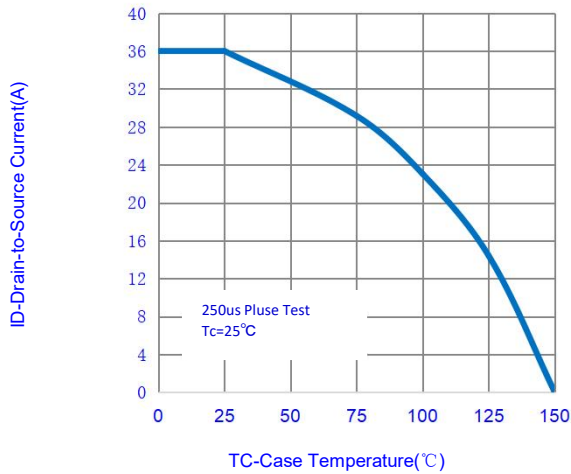


Fig.7-Maximum Continuous Drain Current vs. Case Temperature

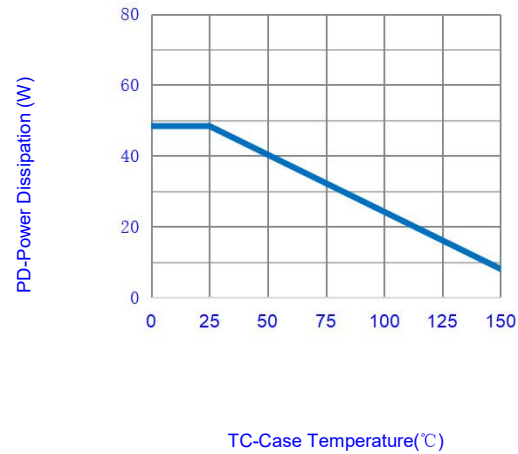


Fig.8-Maximum Power Dissipation vs. Case Temperature

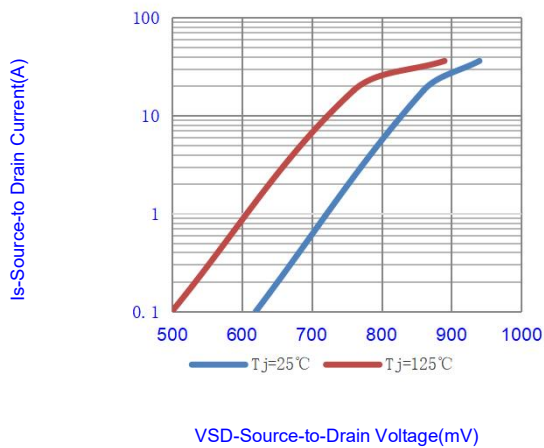


Fig.9- Source-Drain Diode Forward Voltage

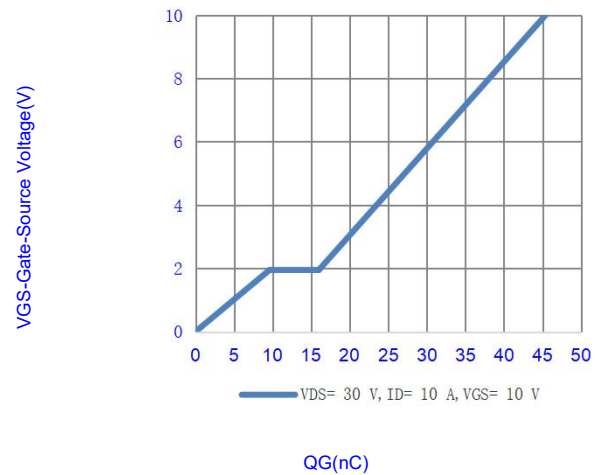


Fig.10-Gate Charge Waveform

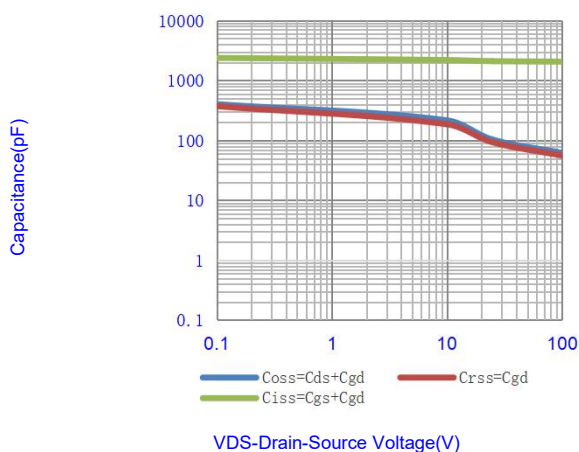


Fig.11- Gate-Source Voltage-VGS(V)

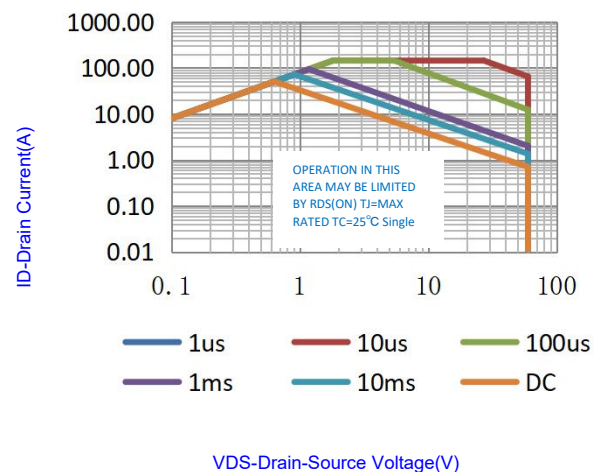


Fig.12-Maximum Safe Operating Area(SOA)

NTS170N06S

60V N-Channel Enhancement Mode Power MOSFET



Typical Characteristics Curves

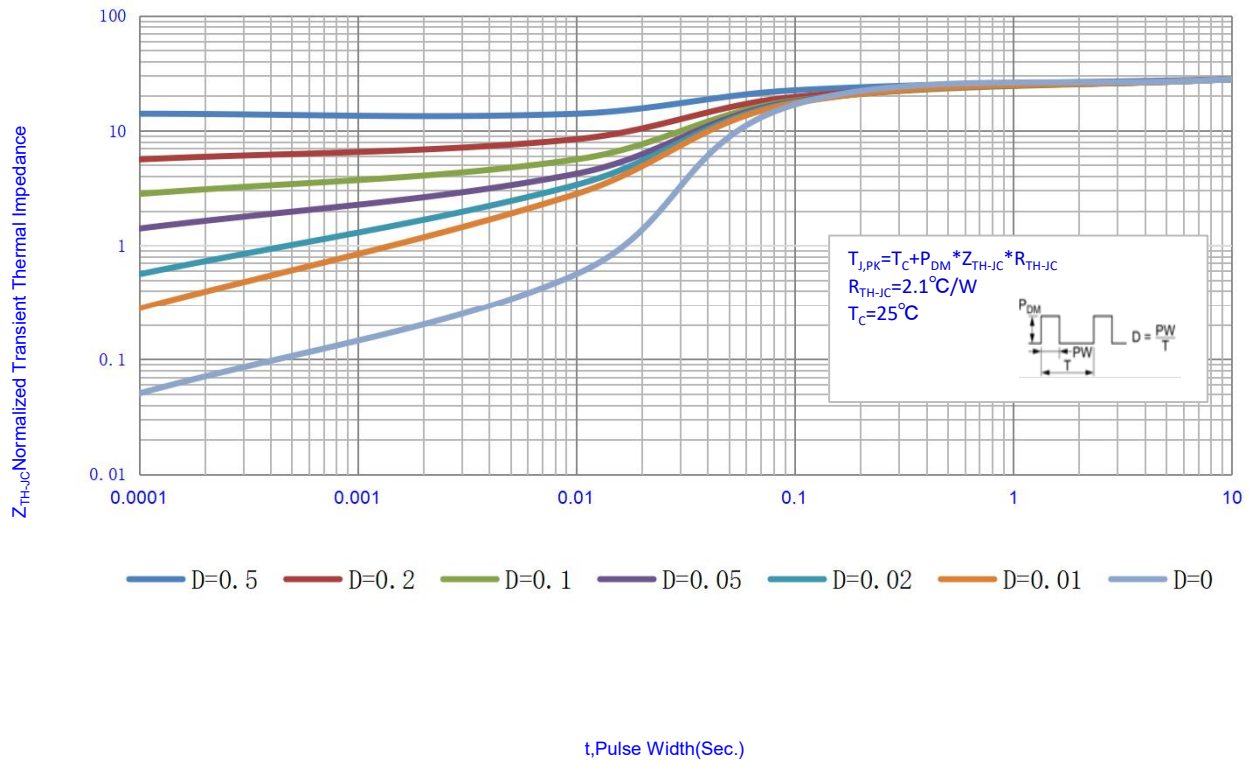


Fig.13- Normalized Transient Thermal Impedance vs. Pulse Width

Test Circuit & Waveform

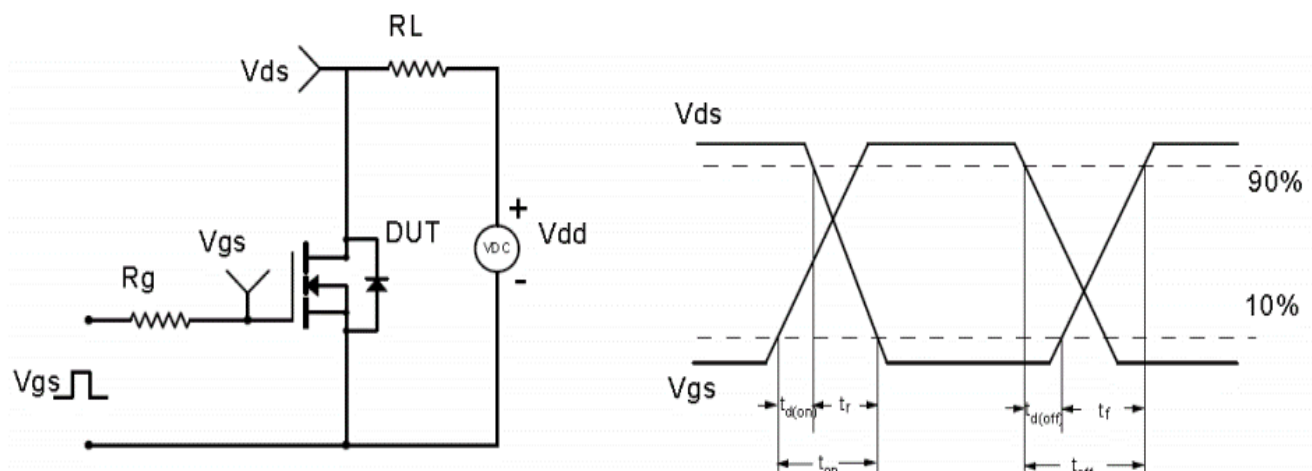


Fig.14- Resistive Switching Test Circuit & Waveform

NTS170N06S

60V N-Channel Enhancement Mode Power MOSFET



Test Circuit & Waveform

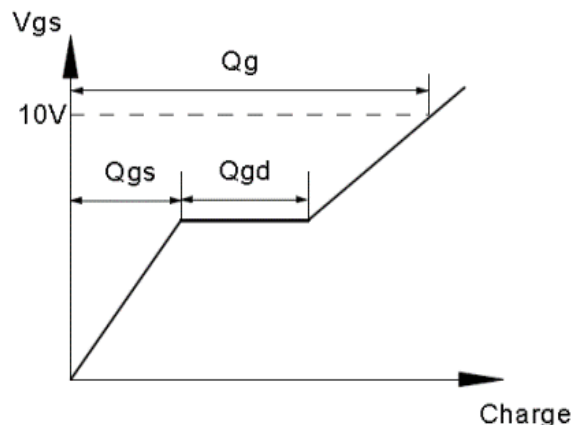
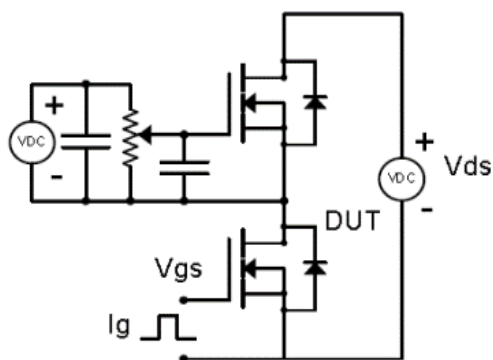


Fig.15- Gate Charge Test Circuit & Waveform

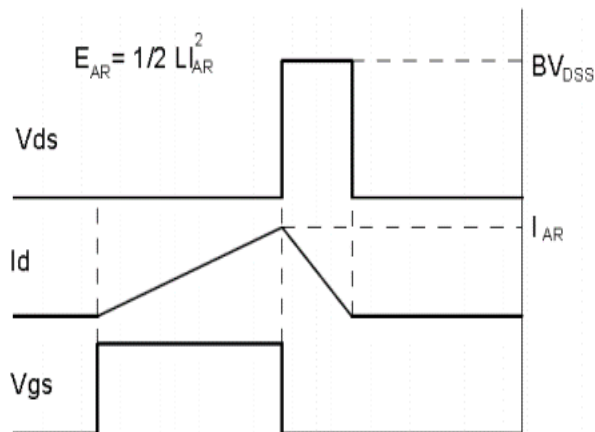
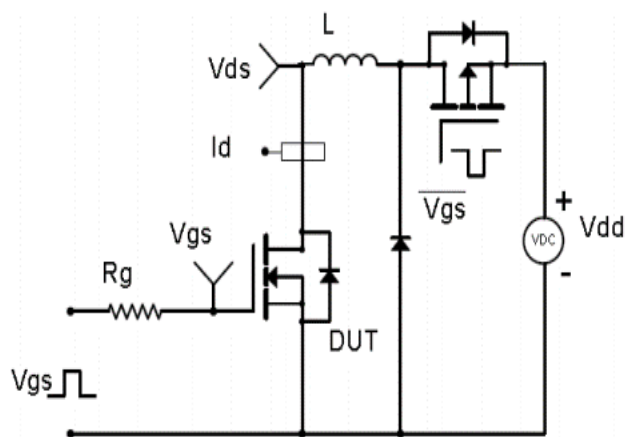


Fig.16- EAS Test Circuit & Waveform

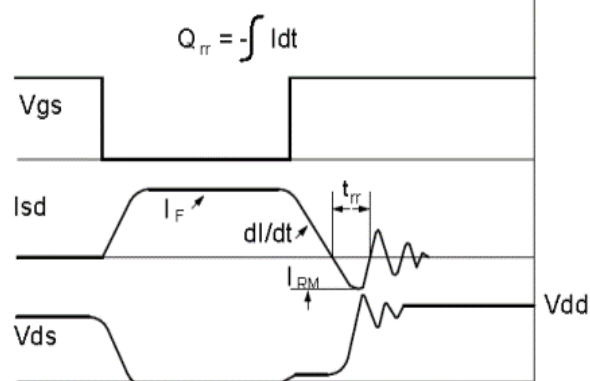
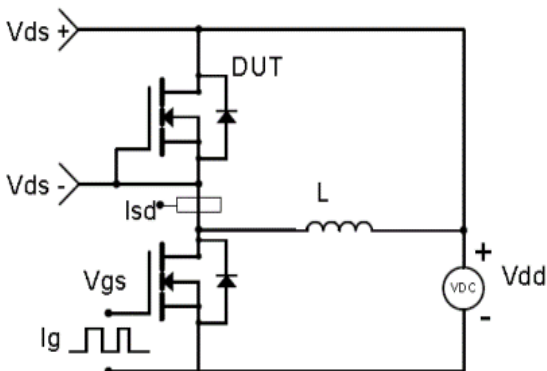


Fig.16- Diode Recovery Test Circuit & Waveform

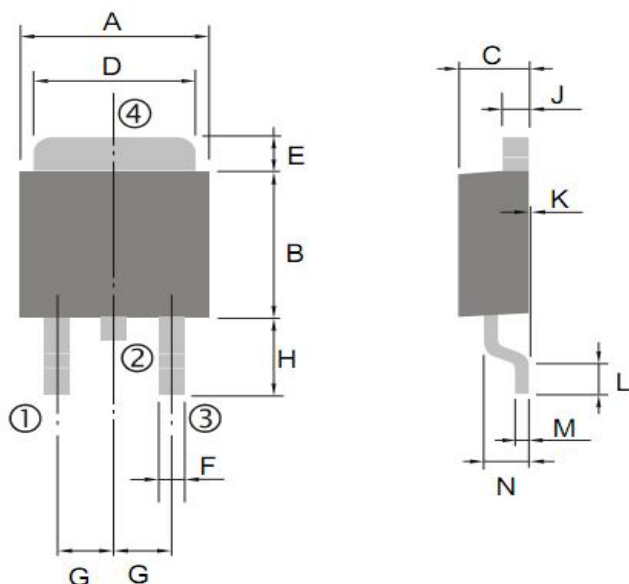
NTS170N06S

60V N-Channel Enhancement Mode Power MOSFET



OUTLINE DRAWINGS

TO-252

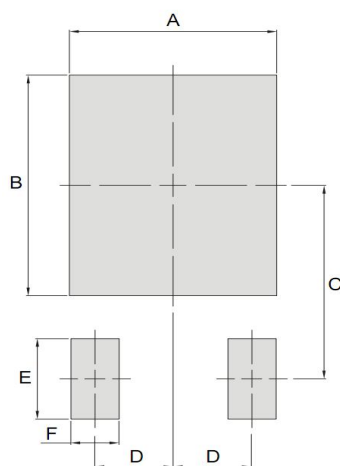


OUTLINE DIMENSIONS

Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	6.400	-	6.800	0.252	-	0.268
B	5.200	-	6.200	0.205	-	0.244
C	2.100	-	2.500	0.083	-	0.098
D	4.800	-	5.500	0.189	-	0.217
E	1.000	-	1.600	0.039	-	0.063
F	0.500	-	1.000	0.020	-	0.039
G	2.100	-	2.500	0.083	-	0.098
H	2.800	-	3.500	0.110	-	0.138
J	0.400	-	0.600	0.016	-	0.024
K	-	0.080	-	-	0.003	-
L	0.900	-	1.400	0.035	-	0.055
M	-	0.500	-	-	0.020	-
N	1.300	-	1.800	0.051	-	0.071

RECOMMENDED LAYOUT DRAWINGS

TO-252



RECOMMENDED LAYOUT DIMENSIONS

Dim.	Millimeters			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

TO-252

Package Method	Reel Size (mm)	Quantity (pcs/reel)	Inner Box Size L×W×H(mm)	Quantity (pcs/Inner Box)	Outer Carton Size L×W×H(mm)	Quantity (pcs/carton)
Tape Reel	Φ330	2500	340×340×50	5000	360×360×260	25000

NTS170N06S

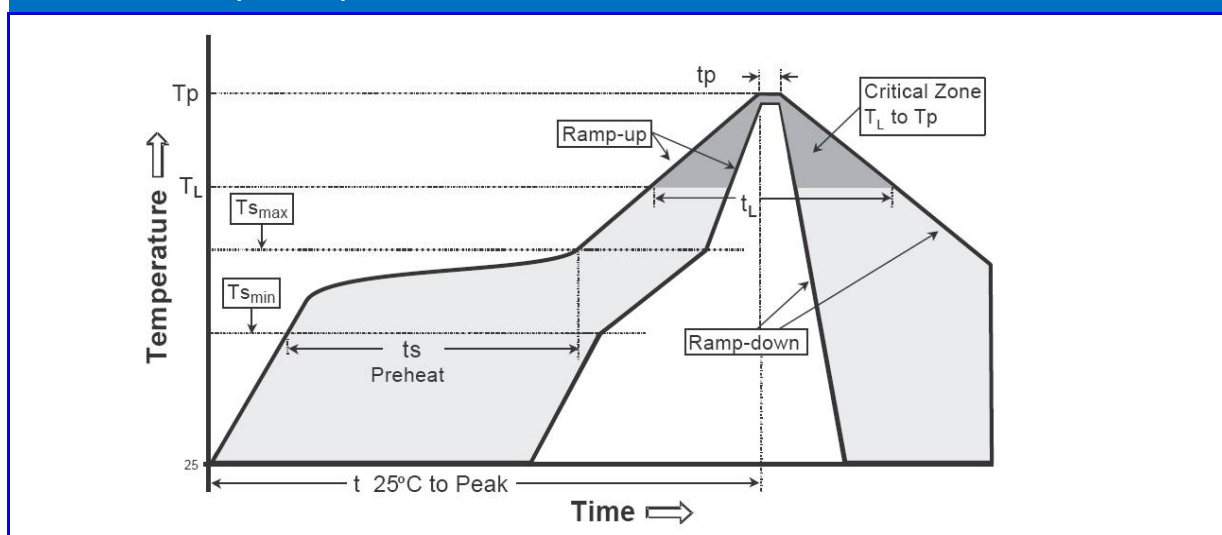
60V N-Channel Enhancement Mode Power MOSFET



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.

NTS170N06S

60V N-Channel Enhancement Mode Power MOSFET

**Disclaimer**

- Reproducing and modifying information of the document is prohibited without permission from niuhang Electronics co., LTD
- Niuhan Electronics co., LTD. reserves the rights to make changes of the content herein the document anytime without notification.
- Niuhan Electronics co., LTD. disclaims any and all liability arising out of the application or use of any product including damages incidentally and consequentially occurred.
- Niuhan Electronics 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. Niuhan Electronics 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, aerospace machinery et cetera. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Niuhan Electronics co., LTD. for any damages 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 Niuhan can not notify