

NCH75R190F

N-Channel Silicon Carbide MOSFET



Voltage: 750 Volts

Current: 15.5 Ampers

Package: TO-220FP

Features

- NH'S Advanced Silicon Carbide MOSFET Technology
- High Blocking Voltage And Low Capacitances
- High-Speed Switching For Very Low Switching Losses
- Excellent $Q_g \cdot R_{ds(on)}$ Product(FOM)

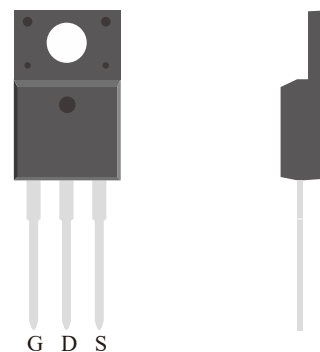
Typical Applications

- High Voltage DC/DC Converters
- Adaptor And Charger
- Battery Chargers And Motor Drives
- LED Drives And LED Lighting

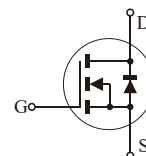
Product Summary

VDS Min.@T _j	750	V
I _D Min.@Ta	15.5	A
RDS(ON)(TYP)@18V,T _j =25°C	190	mΩ

Diagram:



Polarity:



***100% UIS TESTED**

***100% ΔVDS TESTED**

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

Parameter	Test Conditions	Symbol	Ratings	Unit
Drain-Source Voltage		V _{DS}	750	V
Gate-Source Voltage		V _{GS} MAX. V _{GS} O.P.	-10/+22 0/+15 or 18	V
Continuous Drain Current (Note 1)	Ta= 25 °C Ta= 100 °C	I _D	15.5 12.4	A
Drain Current-Pulse (Note 1)	T _j < 175 °C	I _{DM}	27	A
Maximum Power Dissipation Power	Ta= 25 °C	P _D	79	W
Dissipation Derating Factor Above 25 °C	Ta= 100 °C		39	
Derating Factor		D _F	0.53	W/°C
Avalanche Current,Single Pulse (Note 1)	L= 0.5 mH	I _{AS}	10.0	A
Single Pulse Avalanche Energy (Note 1) Test Circuit & Waveform See Fig.22	L= 0.5 mH IAS= 10.0 A,RG= 10.0 Ω Starting T _j =25 °C,VG = 18.0 V	E _{AS}	25	mJ

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

Parameter	Test Conditions	Symbol	Typ.	Unit
Junction Temperature		T _J	-55 to 175	°C
Storage Temperature Range		T _{STD}	-55 to 175	°C
Thermal Resistance Junction To Ambient With Steady-State	Still Air Environment With Ta=25 °C	R _{θJA}	50	°C/W
Thermal Resistance Junction-Case With Steady-State	Device Mounted On 75mm x 45mm x 2.5mm Alu. Heat.	R _{θJC}	1.9	

Notes: 1.Pulse Width Limited By Max. Junction Temperature. (See Fig. 19).

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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=100uA	BV _{DSS}	750	--	--	V		
Zero Gate Voltage Drain Current	VDS= 0 V, VGS=0V, Tj=25°C	I _{DSS}	--	0.1	20	uA		
	VDS= 750 V, VGS=0V, Tj=175°C		--	3	--			
Gate To Source Leakage Current	VGS= 22 V, VDS=0V	I _{GSS}	--	--	250	nA		
Source To Gate Leakage Current	VGS= -10 V, VDS=0V	I _{SGS}	--	--	250	nA		
Forward Transconductance	ID= 4.7 A, VDS= 20 V	g _{fs}	--	3.6	--	S		
Static On Characteristics								
Gate Threshold Voltage	VGS= VDS, ID=10mA ,Tj=25°C	V _{GS(TH)}	3	4.1	5	V		
	VGS= VDS, ID=10mA ,Tj=175°C		--	3.0	--			
Drain-Source On Resistance	ID= 4.7 A, VGS= 18.0 V, Tj=25°C	R _{DS(ON)}	--	190	240	mΩ		
	ID= 4.7 A, VGS= 18.0 V, Tj=175°C		--	209	264			
	ID= 4.7 A, VGS= 15.0 V, Tj=25°C		--	247	360			
	ID= 4.7 A, VGS= 15.0 V, Tj=175°C		--	220	320			
Dynamic Characteristics								
Input Capacitance	VDS= 650 V	C _{iss}	--	294	--	pF		
Output Capacitance	VGS= 0 V		C _{oss}	--	25		--	pF
Reverse Transfer Capacitance	F= 1 MHZ		C _{rss}	--	4		--	
Gate Resistance	VGS=0V, VDS=0V, Freq.=1MHz	R _g	--	25	--	Ω		
Switching Paramters (Test Circuit & Waveform See Fig.20)								
Turn-On Delay Time	VDS= 400 V ID= 4.7 A	Tj=25°C	t _{d(on)}	--	13	--	ns	
		Tj=175°C		--	12.4			--
Turn-On Rise Time	VGS= 0/+18 V RG= 10.0 Ω	Tj=25°C	t _r	--	8.5	--	ns	
		Tj=175°C		--	8.1			--
Turn-Off Delay Time	L= 600 μH	Tj=25°C	t _{d(off)}	--	10	--	ns	
		Tj=175°C		--	9.5			--
Turn-Off Rise Time		Tj=25°C	t _f	--	6	--	ns	
		Tj=175°C		--	5.1			--
Turn-On Switching Loss		Tj=25°C	E _{on}	--	20.0	--	μJ	
		Tj=175°C		--	19.0			--
Turn-Off Switching Loss		Tj=25°C	E _{off}	--	14.9	--	μJ	
		Tj=175°C		--	13.6			--
Total Switching Energy		Tj=25°C	E _{tot}	--	34.9	--	μJ	
		Tj=175°C		--	32.6			--

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

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Gate Charge Paramters (Test Circuit & Waveform See Fig.21)						
Total Gate Charge	VDS= 400 V	Q_g	--	12	--	nC
Gate-Source Charge	VGS= 0/+18 V	Q_{gs}	--	4	--	nC
Gate-Drain Charge	ID= 4.7 A	Q_{gd}	--	1.5	--	nC
Drain-Source Diode Characteristics And Maximum Ratings (Test Circuit & Waveform See Fig.23)						
Max. Diode Forward Cuurent	Tj= 25 °C	I_s	--	--	15.5	A
tp Limited by Tj(max)	Tj= 100 °C		--	--	12.4	
Max. Pulsed Forward Cuurent		I_{SM}	--	--	23	A
Diode Forward Voltage	ID= 2.8 A, VGS=-0V Tj=25°C Tj=175°C	V_{SD}	--	3.3 2.8	--	V
Reverse Recovery Time	IS= 7.8 A di/dt= 1000.0 A/us Tj=25°C Tj=175°C	t_{rr}	--	9.8 11.1	--	ns
Reverse Recovery Charge	VGS= 0.0 V VDS= 400 V Tj=25°C Tj=175°C	Q_{rr}	--	32 36.8	--	nC
Reverse Recovery Current	Tj=25°C Tj=175°C	I_{rrm}	--	7.0 6.6	--	A
Reverse Recovery Energy	Tj=25°C Tj=175°C	E_{rr}	--	13.7 14.6	--	μJ

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Typical Characteristics Curves

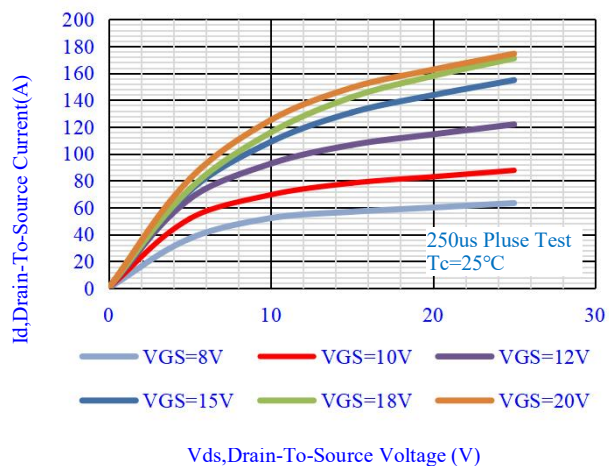


Fig.1-Output Characteristics@ $T_j=25^{\circ}\text{C}$

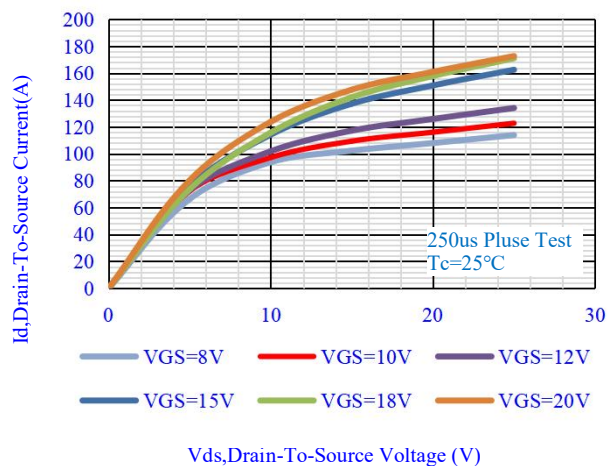


Fig.2-Output Characteristics@ $T_j=175^{\circ}\text{C}$

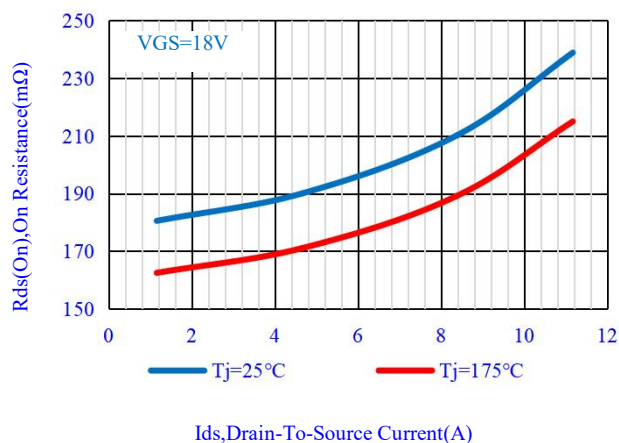


Fig.3-On Resistance Vs. Drain Current

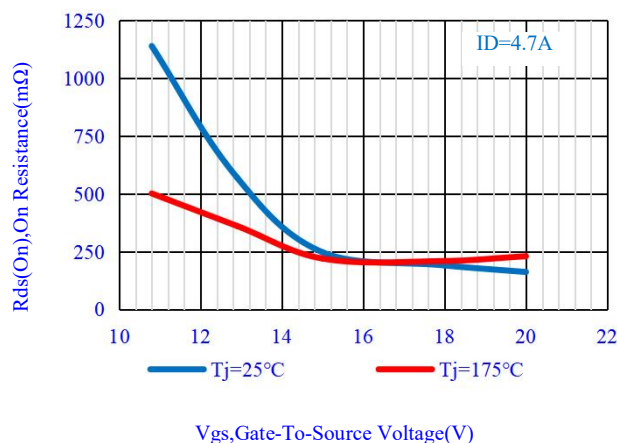


Fig.4-On Resistance Vs. Gate Source Voltage

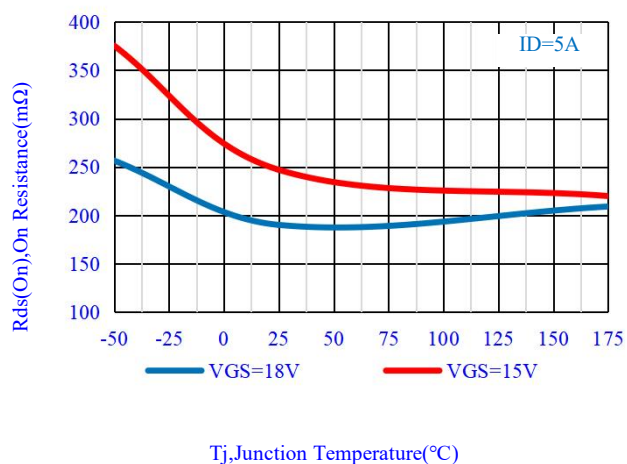


Fig.5-On Resistance Vs. Junction Temperature

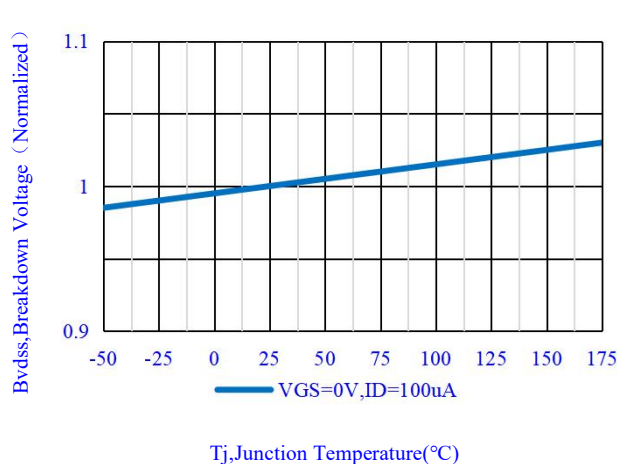


Fig.6-Breakdown Voltage Vs. Junction Temperature

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Typical Characteristics Curves

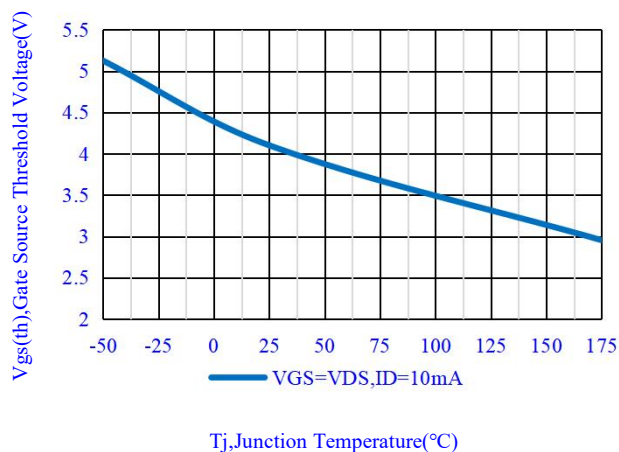


Fig.7-Gate Source Threshold Voltage Vs. Junction Temperature

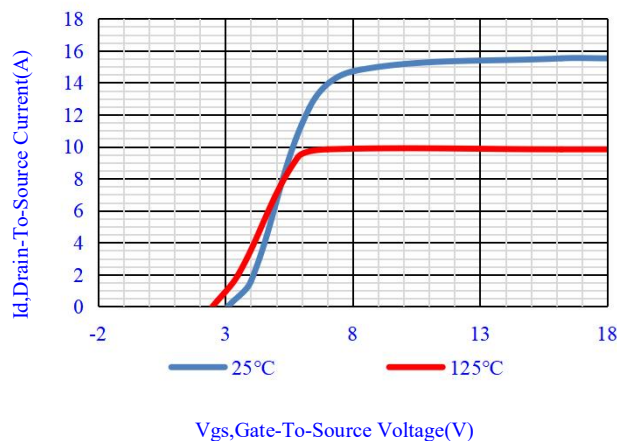


Fig.8-Transfer Characteristics

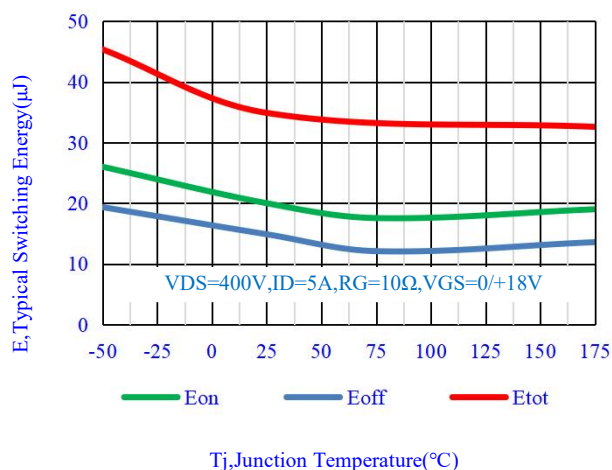


Fig.9-Typical Switching Energy Vs. Junction Temperature

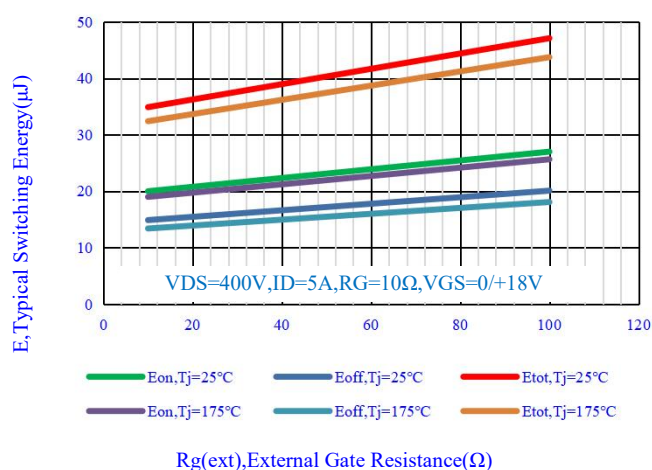


Fig.10-Typical Switching Energy Vs. External Gate Resistance

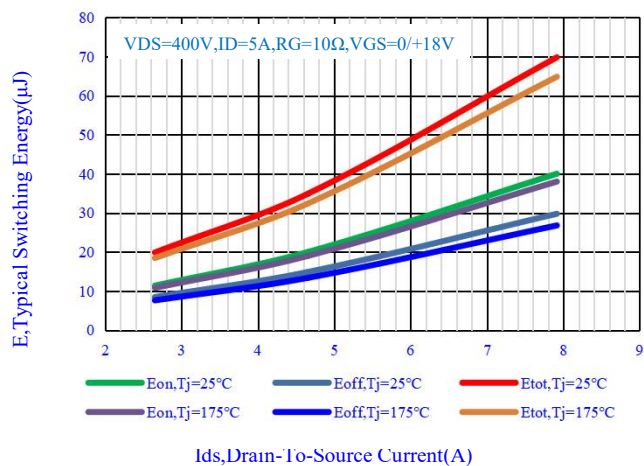


Fig.11-Typical Switching Energy Vs. Drain Source Current

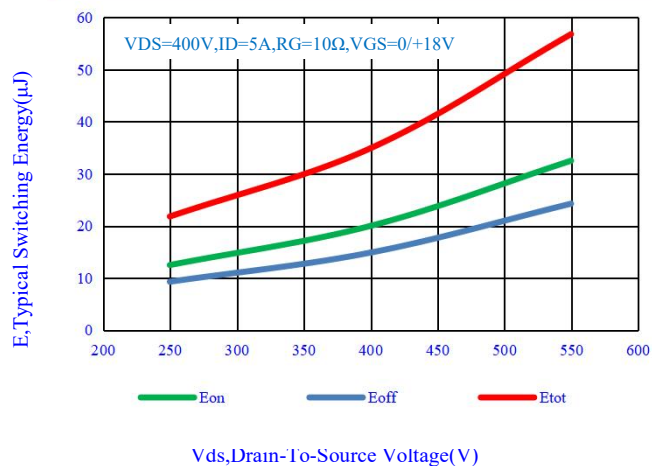


Fig.12-Typical Switching Energy Vs. Drain Source Voltage

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Typical Characteristics Curves

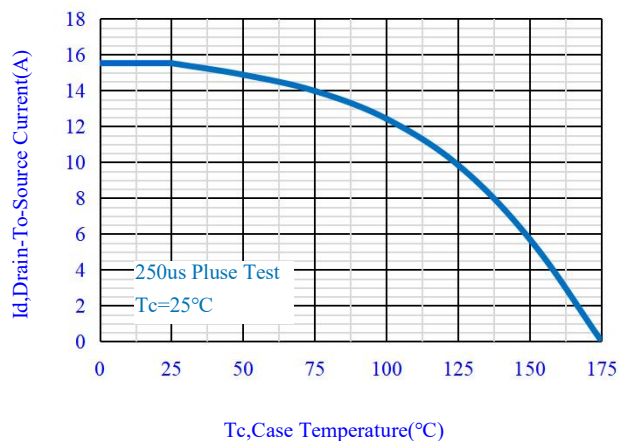


Fig.13-Maximum Continuous Drain Current Vs. Case Temperature

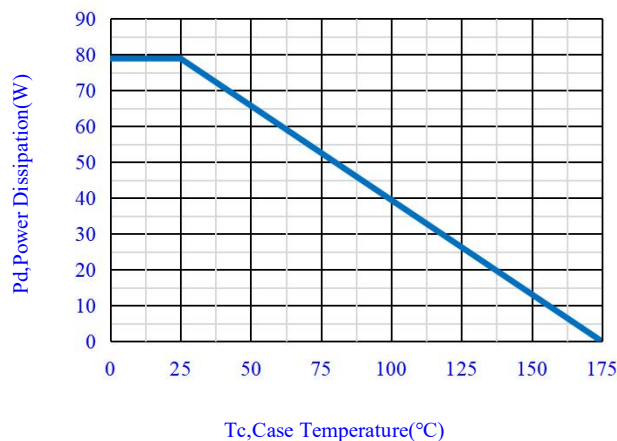


Fig.14-Maximum Power Dissipation Vs. Case Temperature

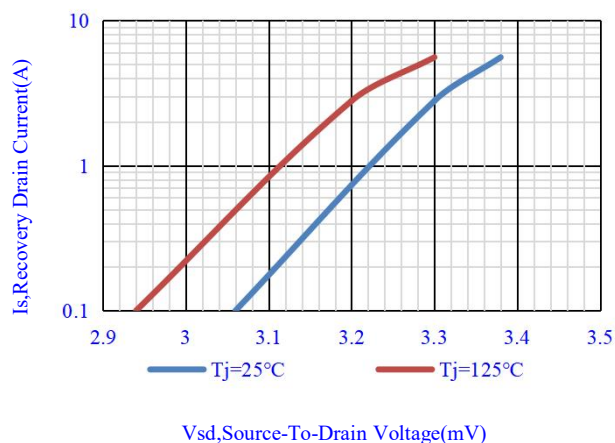


Fig.15-Source-To-Drain Diode Forward Voltage

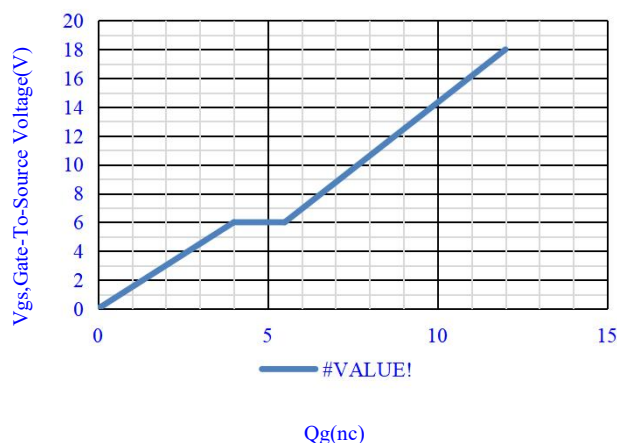


Fig.16-Gate Charge Waveform

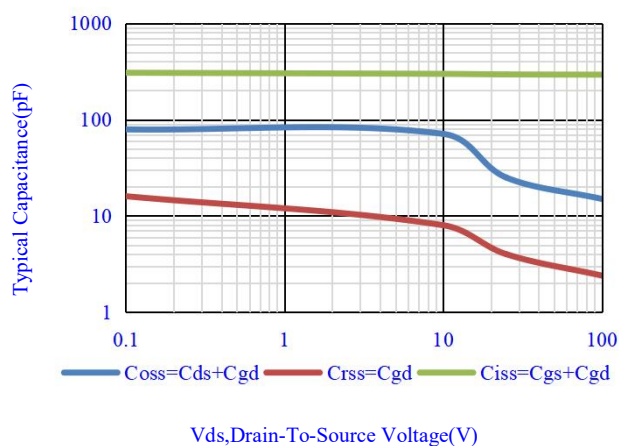


Fig.17-Typical Capacitance Vs. Drain-To-Source Voltage

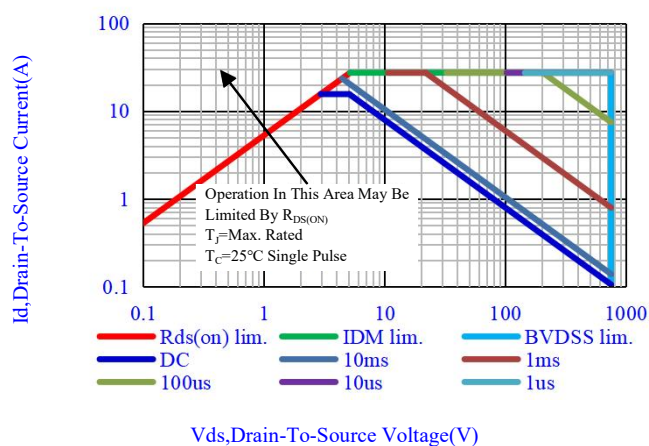


Fig.18-Maximum Safe Operating Area(SOA)

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Typical Characteristics Curves

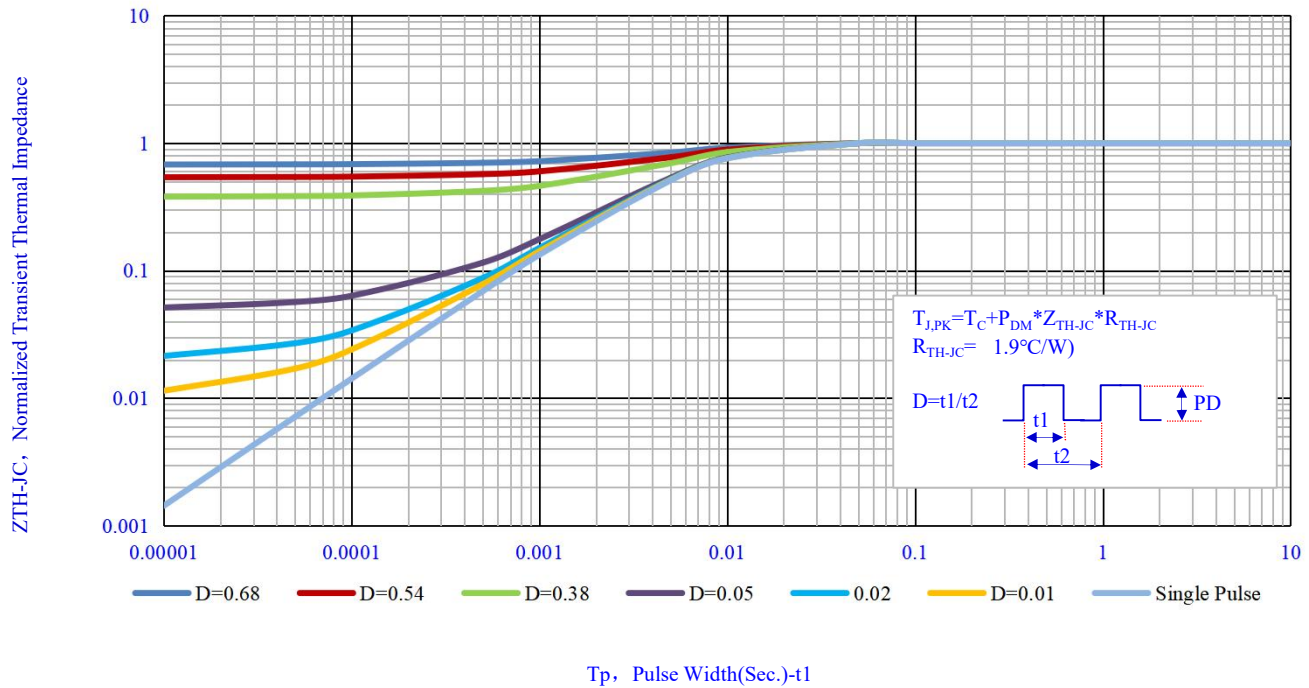


Fig.19- Normalized Maximum Transient Thermal Impedance Vs.Pulse Width

Test Circuit & Waveform

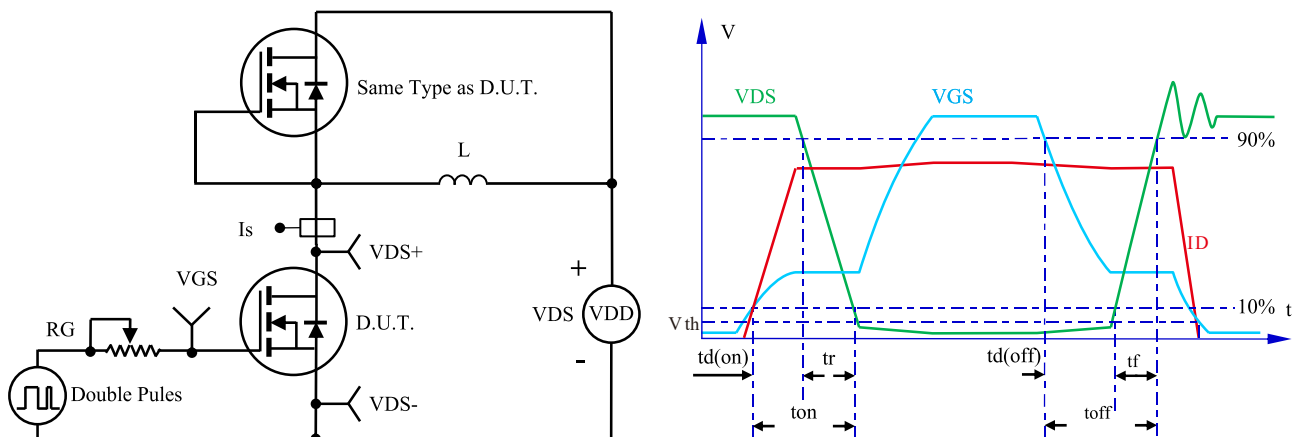


Fig.20- Inductive Switching Test Circuit & Waveform

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Test Circuit & Waveform

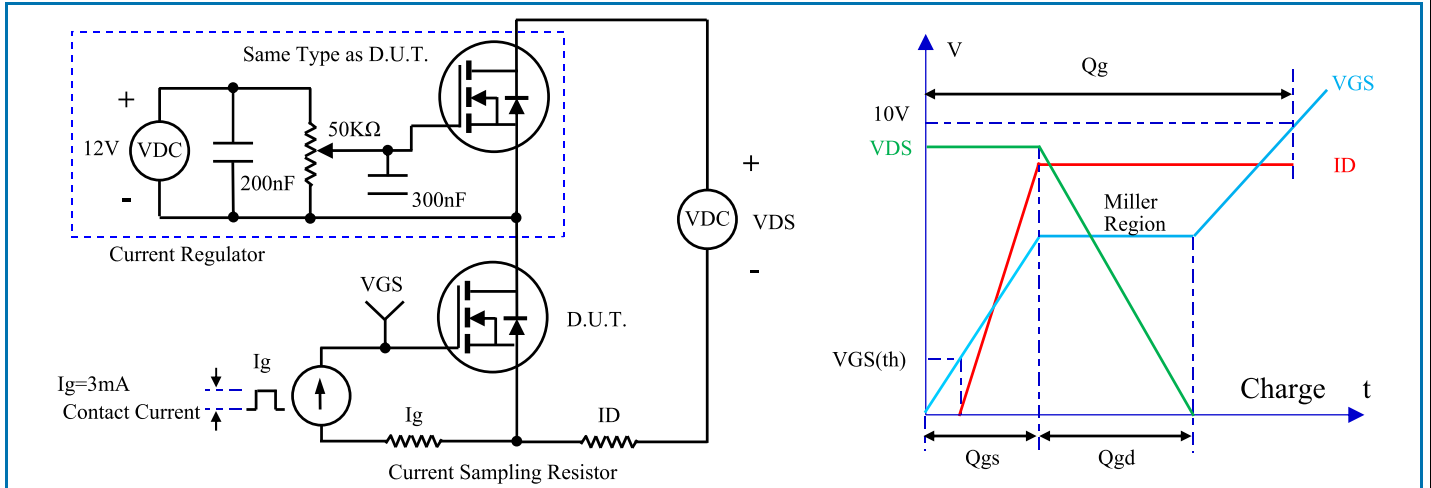


Fig.21-Gate Charge Test Circuit & Waveform

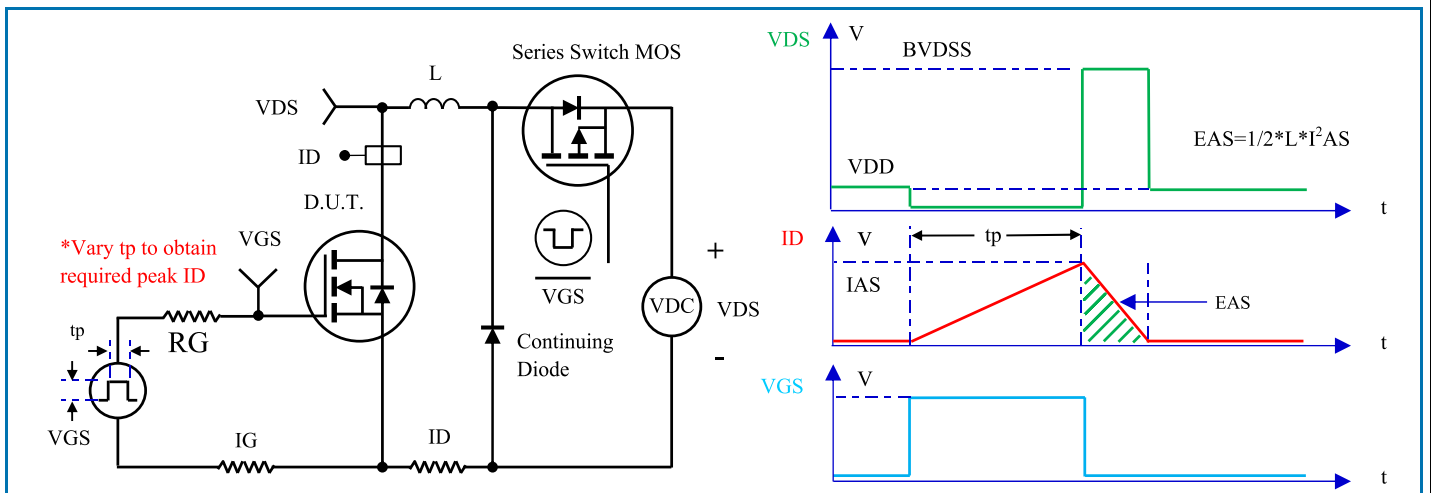


Fig.22- Unclamped Inductive Switching (UIS) Test Circuit & Waveform

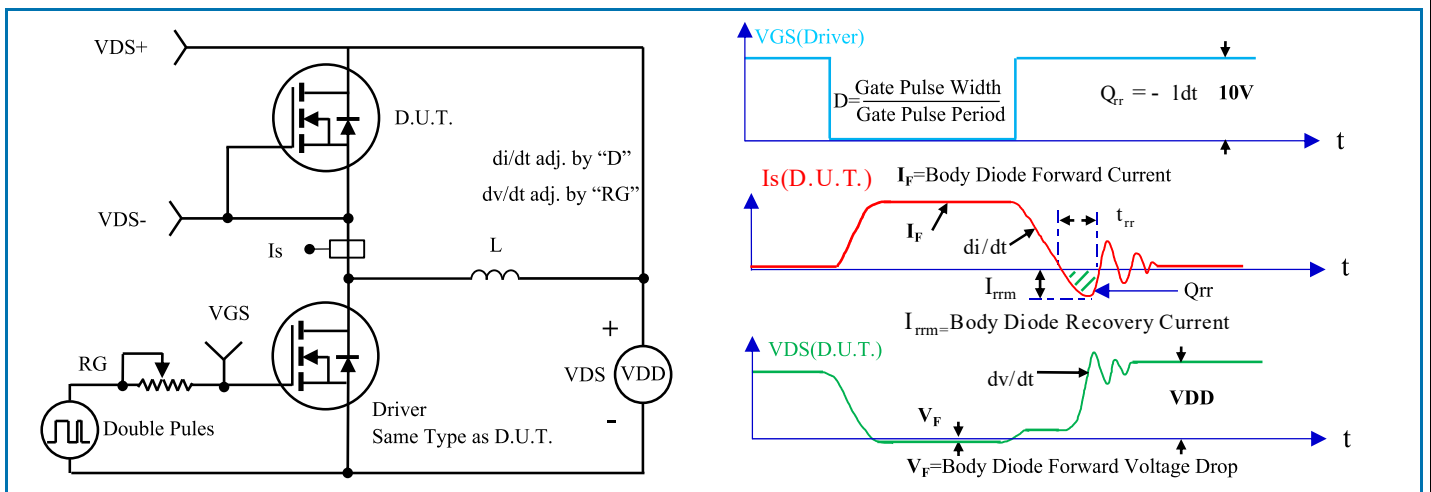


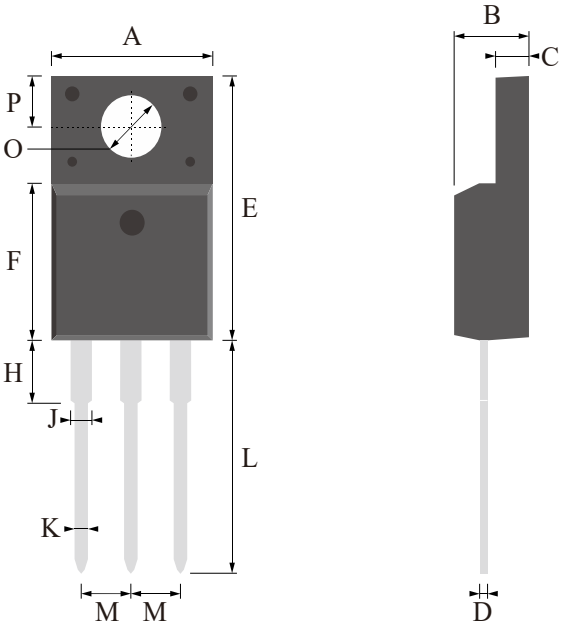
Fig.23- Diode Recovery Test Circuit & Waveform

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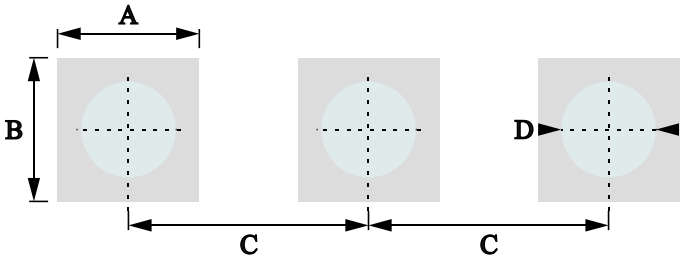
OUTLINE DRAWINGS



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	-	3.30	0.1024	-	0.1299
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	3.20	-	3.80	0.1260	-	0.1496

RECOMMEDND 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	-

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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=Inernal Code,According To Actual Changes
NCH75R190F=Model

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-220FP	P1	2.048	Tube	50	1000	5000

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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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Specification Revision History

Rev.	Date	Changed Items	Pre-Changed Content	Changed Content
A/1	2025-10-20	First Issue		
		Blank Below		