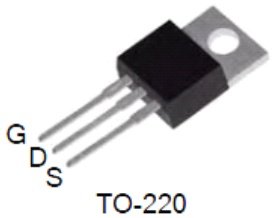
600V N-Channel MOSFET

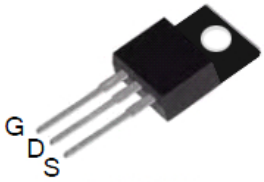
GENERAL DESCRIPTION

This Power MOSFET is produced using advanced planar stripe, DMOS technology.This latest technology has been especially designed to minimize on-state resistance, have a high rugged avalanche characteristics, such as fast switching time,low on resistance.low gate charge and especially excellent avalanche characteristics. This power MOSFET is usually used at AC adaptors, on the battery charger and SMPS

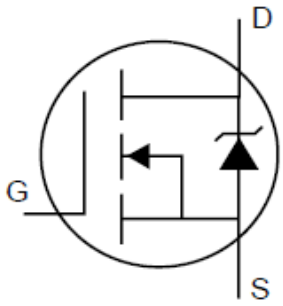
V_{DSS}	$R_{DS(ON)}$	I_D
600V	2.5Ω	4.5A



TO-220
Not to Scale



TO-220F
Not to Scale



Features

- 4.5A, 600V, RDS(on) = 2.5Ω @VGS = 10 V
- Low gate charge (typical 17nC)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

Ordering Information

PART NUMBER	PACKAGE	BRAND
5N60/5N60F	TO-220/220F	0GFD

Absolute Maximum Ratings

TC = 25°Cunless otherwise noted

Symbol	Parameter	5N60	5N60F	Units
V_{DSS}	Drain-Source Voltage	600		V
I_D	Drain Current - Continuous (TC = 25°C)	4.5	4.5	A
	- Continuous (TC = 100°C)	2.7	2.7	A
I_{DM}	Drain Current- Pulsed (Note 1)	18	18	A
V_{GSS}	Gate-Source Voltage	± 30		V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	280		mJ
E_{AR}	Repetitive Avalanche Energy (Note 1)	13		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5		V/ns
P_D	Power Dissipation (TC = 25°C)	120	45	W
	Derate above 25°C	0.8	0.5	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150		°C
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300		°C

Thermal Characteristics

Symbol	Parameter	5N60	5N60F	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.25	3.79	°C/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	0.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	62.5	°C/W

Electrical Characteristics

TC = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	600	--	--	V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	--	0.4	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 600 V, V_{GS} = 0 V	--	--	10	μA
		V_{DS} = 480 V, T_C = 125°C	--	--	100	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS} = 30 V, V_{DS} = 0 V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	V_{GS} = -30 V, V_{DS} = 0 V	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D= 250 μA	2.0	--	4.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 2.25A	--	2.0	2.5	Ω
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	545	780	pF
C_{oss}	Output Capacitance		--	60	80	pF
C_{rss}	Reverse Transfer Capacitance		--	8	11	pF

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 300 V, I_D = 4.5A, R_G = 25 Ω (Note 4, 5)	--	10	30	ns
t_r	Turn-On Rise Time		--	35	80	ns
$t_{d(off)}$	Turn-Off Delay Time		--	45	100	ns
t_f	Turn-Off Fall Time		--	40	90	ns
Q_g	Total Gate Charge	V_{DS} = 480 V, I_D = 4.5 A, V_{GS} = 10 V (Note 4, 5)	--	17	-	nC
Q_{gs}	Gate-Source Charge		--	2.8	--	nC
Q_{gd}	Gate-Drain Charge		--	6.2	--	nC

Drain-Source Diode Characteristics and Maximum Ratings

I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	4.5	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	18	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 4.5 A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 4.5 A, dI_F / dt = 100 A/μs (Note 4)	--	300	--	ns
Q_{rr}	Reverse Recovery Charge		--	2.2	--	μC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 25 mH, IAS = 4.5 A, VDD = 50V, RG = 25 Ω, Starting TJ = 25°C
3. ISD ≤ 4.5 A, di/dt ≤ 200A/μs, VDD ≤ BVDSS, Starting TJ = 25°C
4. Pulse Test : Pulse width ≤ 300μs, Duty cycle ≤ 2%
5. Essentially independent of operating temperature

Fig 1. On-State Characteristics

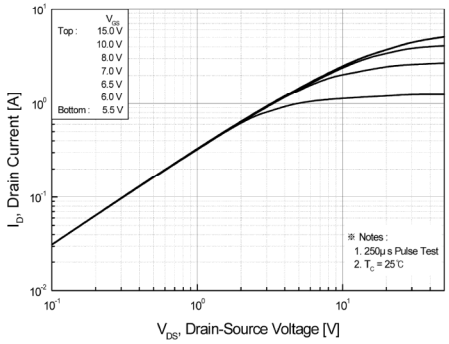


Fig 2. Transfer Characteristics

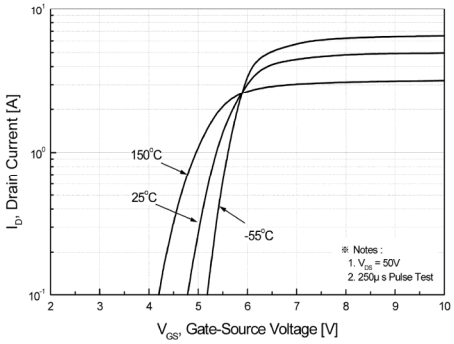


Fig 3. On Resistance Variation vs. Drain Current and Gate Voltage

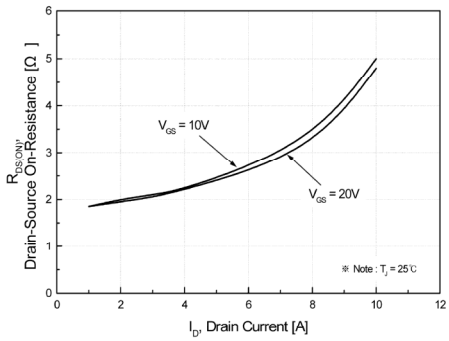


Fig 4. On State Current vs. Allowable Case Temperature

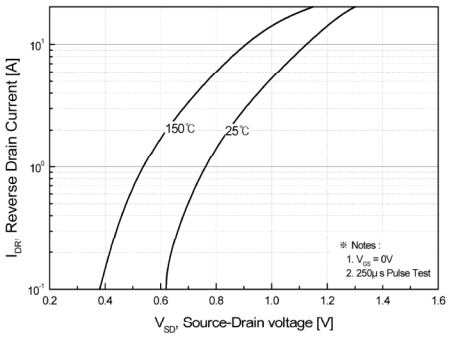


Fig 5. Capacitance Characteristics (Non-Repetitive)

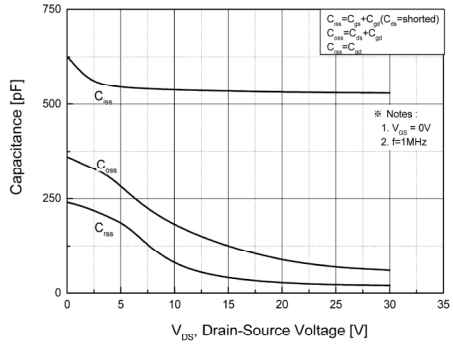


Fig 6. Gate Charge Characteristics

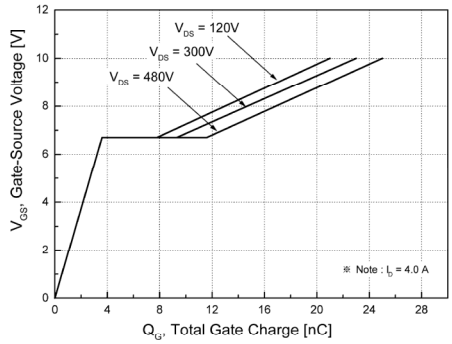


Fig 7. Breakdown Voltage Variation vs. Junction Temperature

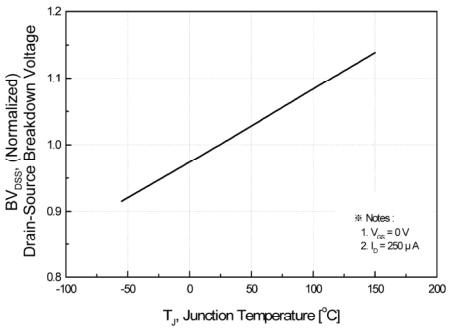


Fig 8. On-Resistance Variation vs. Junction Temperature

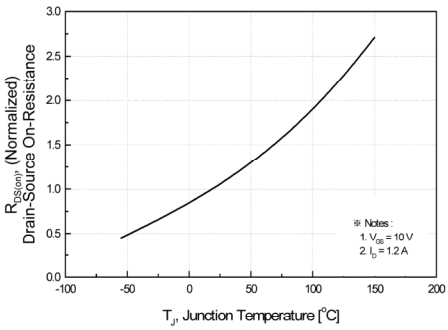


Fig 9-1. Maximum Safe Operating Area for TSP5N60M

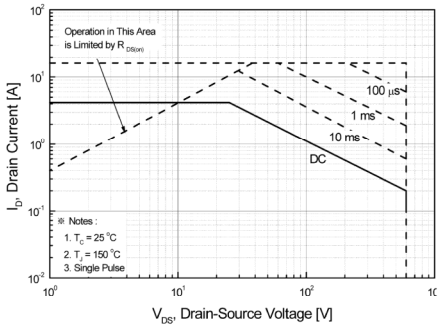


Fig 9-2. Maximum Safe Operating Area for TSF5N60M

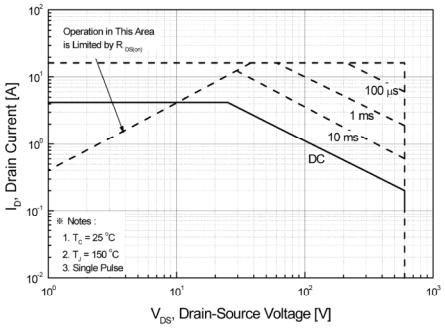


Fig 10. Maximum Drain Current vs. Case Temperature

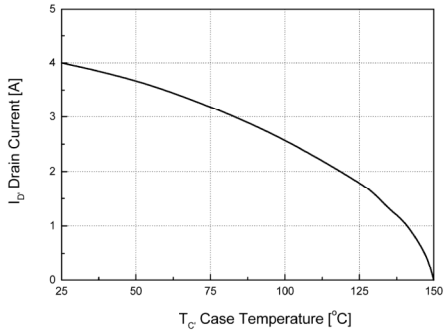


Fig 11 -1 . Transient Thermal Response Curve for TSP5N60M

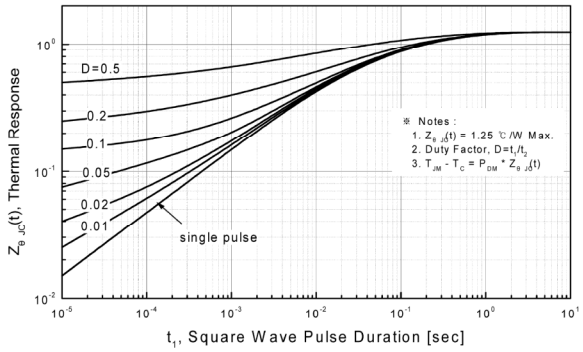


Fig 11-2 . Transient Thermal Response Curve for TSF5N60M

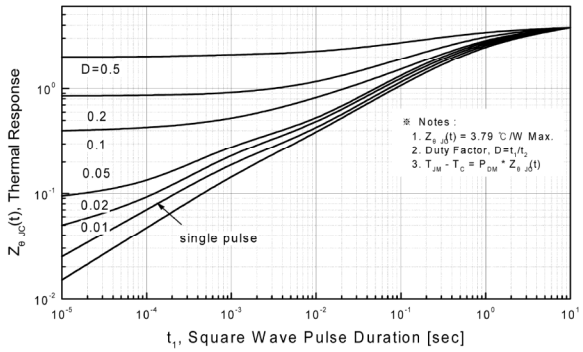


Fig. 12. Gate Charge Test Circuit & Waveforms

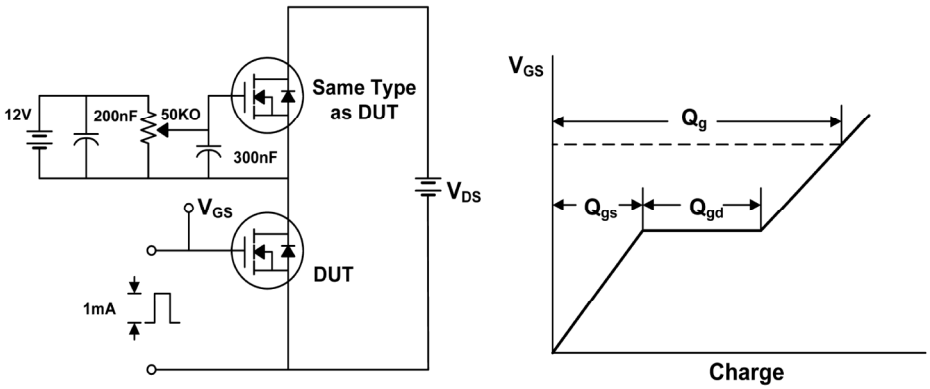


Fig 13. Switching Time Test Circuit & Waveforms

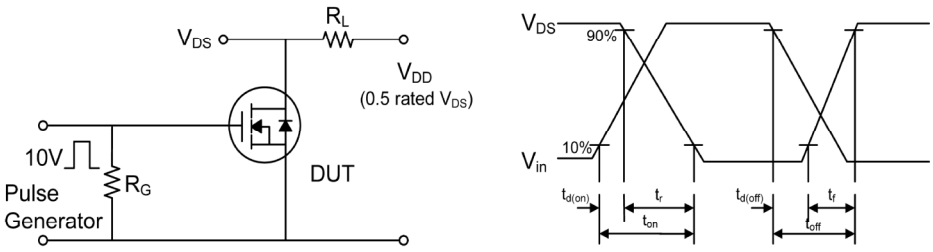


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

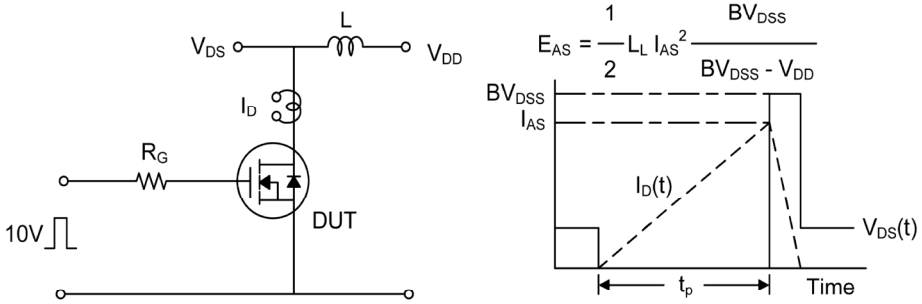


Fig. 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms