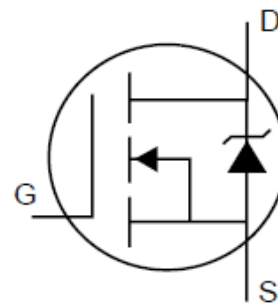
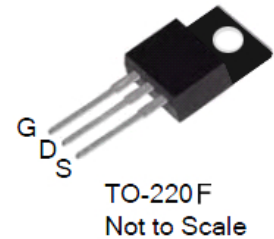
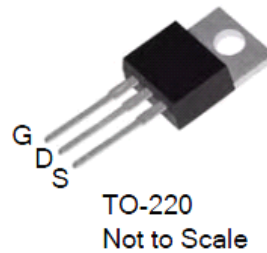


## 600V N-Channel MOSFET GENERAL DESCRIPTION

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	$2.5\Omega$	4.5A



### Features

- 4.5A, 600V,  $R_{DS(on)} = 2.5\Omega$  @  $V_{GS} = 10V$
- 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°C unless otherwise noted

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

**Thermal Characteristics**

Symbol	Parameter	5N60	5N60F	Units
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case	1.25	3.79	°C/W
R <sub>θCS</sub>	Thermal Resistance, Case-to-Sink Typ.	0.5	0.5	°C/W
R <sub>θJA</sub>	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
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**Off Characteristics**

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	600	--	--	V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to 25°C	--	0.4	--	V/°C
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$	--	--	10	$\mu\text{A}$
		$V_{DS} = 480\text{ V}, T_C = 125^\circ\text{C}$	--	--	100	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA

**On Characteristics**

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	2.0	--	4.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 2.25\text{ A}$	--	2.0	2.5	$\Omega$

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$	--	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	$V_{DD} = 300\text{ V}, I_D = 4.5\text{ A},$ $R_G = 25\ \Omega$	--	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		(Note 4, 5)	--	40	90
$Q_g$	Total Gate Charge	$V_{DS} = 480\text{ V}, I_D = 4.5\text{ A},$ $V_{GS} = 10\text{ V}$	--	17	-	nC
$Q_{gs}$	Gate-Source Charge		--	2.8	--	nC
$Q_{gd}$	Gate-Drain Charge		(Note 4, 5)	--	6.2	--

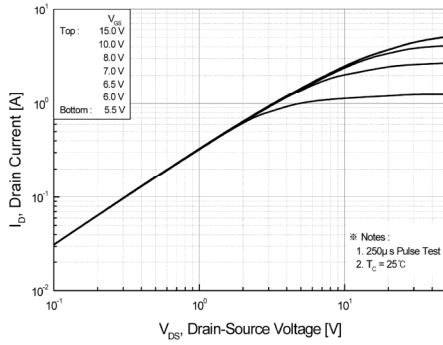
### Drain-Source Diode Characteristics and Maximum Ratings

$I_S$	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	$V_{GS} = 0\text{ V}, I_S = 4.5\text{ A}$	--	--	1.4	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 4.5\text{ A},$ $di_F / dt = 100\text{ A}/\mu\text{s}$	--	300	--	ns
$Q_{rr}$	Reverse Recovery Charge		(Note 4)	--	2.2	--

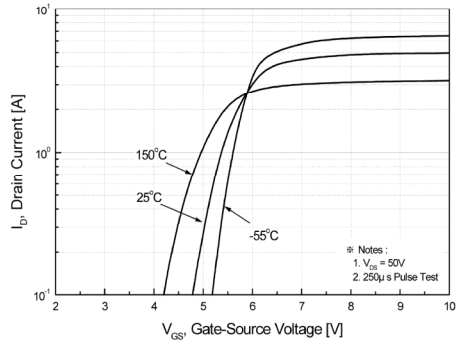
#### Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L = 25\text{ mH}, I_{AS} = 4.5\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega,$  Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 4.5\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BVDSS,$  Starting  $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse width  $\leq 300\ \mu\text{s},$  Duty cycle  $\leq 2\%$
5. Essentially independent of operating temperature

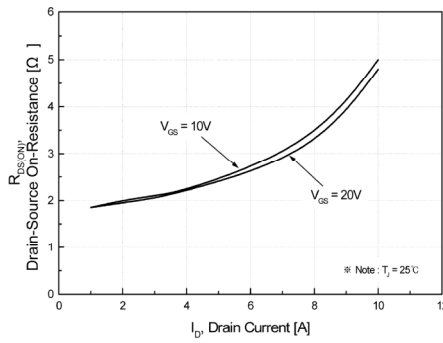
**Fig 1. On-State Characteristics**



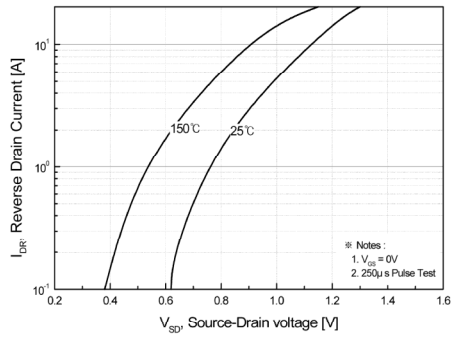
**Fig 2. Transfer Characteristics**



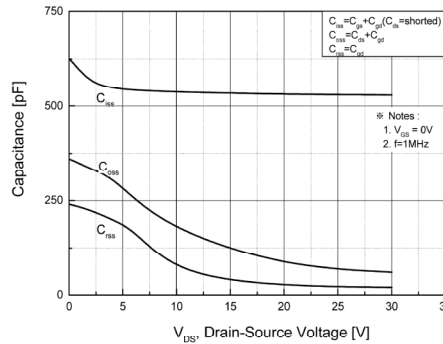
**Fig 3. On Resistance Variation vs. Drain Current and Gate Voltage**



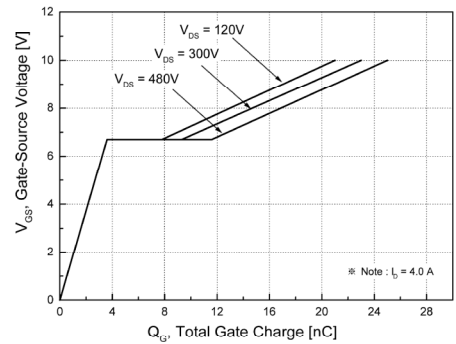
**Fig 4. On State Current vs. Allowable Case Temperature**



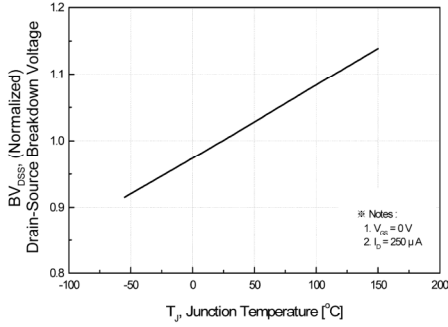
**Fig 5. Capacitance Characteristics (Non-Repetitive)**



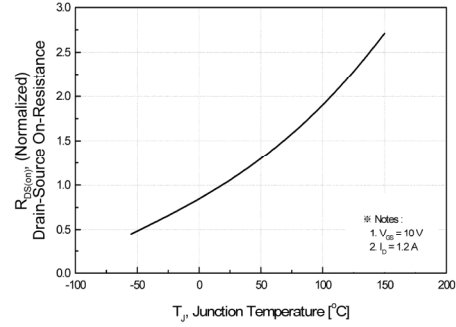
**Fig 6. Gate Charge Characteristics**



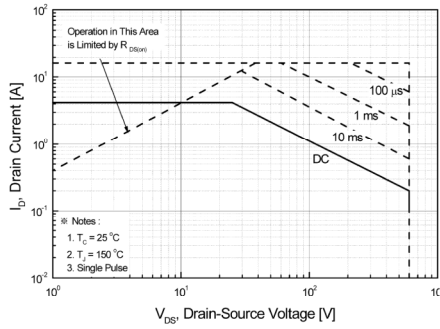
**Fig 7. Breakdown Voltage Variation vs. Junction Temperature**



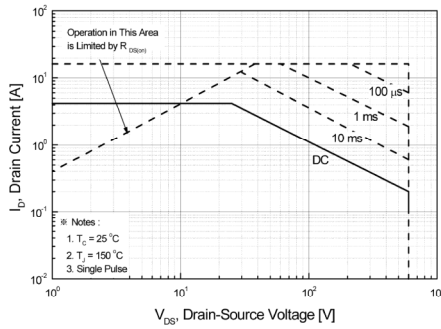
**Fig 8. On-Resistance Variation vs. Junction Temperature**



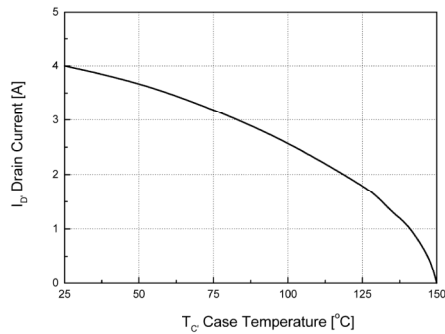
**Fig 9-1. Maximum Safe Operating Area for TSP5N60M**



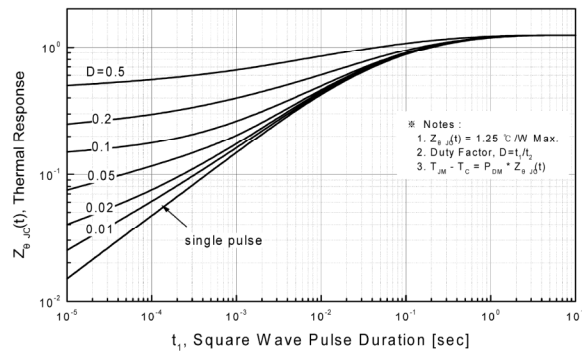
**Fig 9-2. Maximum Safe Operating Area for TSF5N60M**



**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**

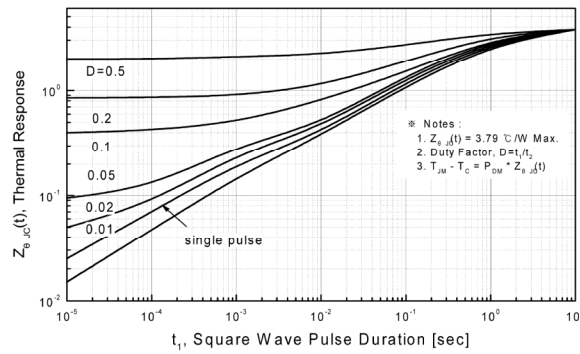


Fig. 12. Gate Charge Test Circuit & Waveforms

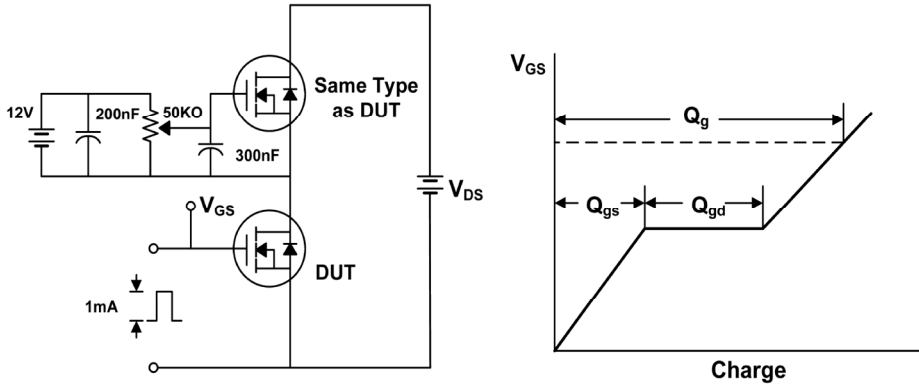


Fig 13. Switching Time Test Circuit & Waveforms

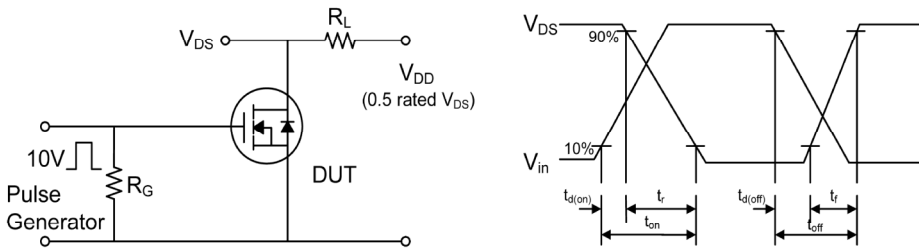


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

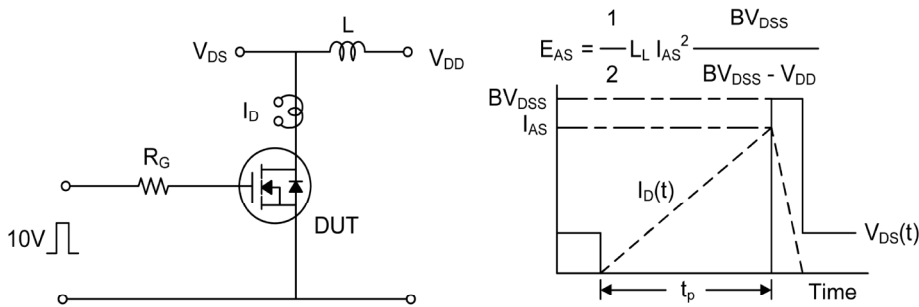




Fig. 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

