# 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.These devices are well suited for high efficiency switched mode power supplies, active power factor correction.electronic lamp ballasts based on half bridge topology.

V_{DSS}	$R_{DS(ON)}$	I_D
600V	1.3Ω	7A

TO-220
Not to Scale
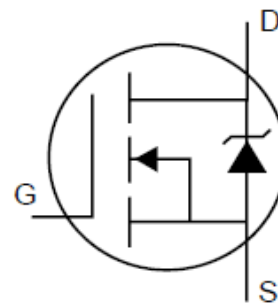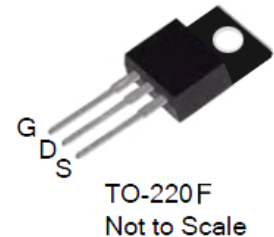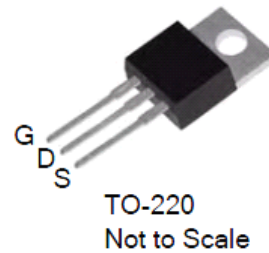
TO-220F
Not to Scale

Features

- 7A, 600V, RDS(on) = 1.3Ω @VGS = 10 V
- Low gate charge (typical   29nC)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

Ordering Information

PART NUMBER	PACKAGE	BRAND
7N60/7N60F	TO−220/220F	0GFD

Absolute Maximum Ratings

TC = 25°Cunless otherwise noted

Symbol	Parameter	7N60	7N60F	Units
V$_{DSS}$	Drain-Source Voltage	600		V
I$_D$	Drain Current - Continuous (TC = 25°C)	7.0	7.0	A
	- Continuous (TC = 100°C)	4.2	4.2	A
I$_{DM}$	Drain Current- Pulsed (Note 1)	28	28	A
V$_{GSS}$	Gate-Source Voltage	± 30		V
E$_{AS}$	Single Pulsed Avalanche Energy (Note 2)	245		mJ
E$_{AR}$	Repetitive Avalanche Energy (Note 1)	14.7		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5		V/ns
P$_D$	Power Dissipation (TC = 25°C)	147	48	W
	Derate above 25°C	1.17	0.38	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	7N60	7N60F	Units
R$_{θJC}$	Thermal Resistance, Junction-to-Case	0.85	2.6	°C/W
R$_{θCS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	--	°C/W
R$_{θJA}$	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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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	--	0.7	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 600$ V, $V_{GS} = 0$ V	--	--	1	µA
		$V_{DS} = 480$ V, $T_C = 125$°C	--	--	10	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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 250$ µA	2.0	--	4.5	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10$ V, $I_D = 3.5$ A	--	1.05	1.3	Ω

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
C_{iss}	Input Capacitance	$V_{DS} = 25$ V, $V_{GS} = 0$ V, $f = 1.0$ MHz	--	1000	--	pF
C_{oss}	Output Capacitance		--	110	--	pF
C_{rss}	Reverse Transfer Capacitance		--	12.6	--	pF

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 300 V, I_D = 7 A, R_G = 25 Ω	--	20	--	ns
t_r	Turn-On Rise Time		--	50	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	80	--	ns
t_f	Turn-Off Fall Time	(Note 4, 5)	--	70	--	ns
Q_g	Total Gate Charge	V_{DS} = 480 V, I_D = 7 A, V_{GS} = 10 V	--	29	--	nC
Q_{gs}	Gate-Source Charge		--	4.7	--	nC
Q_{gd}	Gate-Drain Charge	(Note 4, 5)	--	12.5	--	nC

Drain-Source Diode Characteristics and Maximum Ratings

I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	7.0	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	28	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 7 A	--	--	1.5	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 7 A, d_{IF} / dt = 100 A/μs	--	320	--	ns
Q_{rr}	Reverse Recovery Charge	(Note 4)	--	3.0	--	μC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature

2. L = 10 mH, I_{AS} = 7 A, VDD = 50V, R_G = 25 Ω, Starting T_J = 25°C

3. ISD ≤ 7 A, di/dt ≤ 200A/μs, VDD ≤ BVDSS, Starting T_J = 25°C

4. Pulse Test : Pulse width ≤ 300μs, Duty cycle ≤ 2%

5. Essentially independent of operating temperature

Typical Characteristics
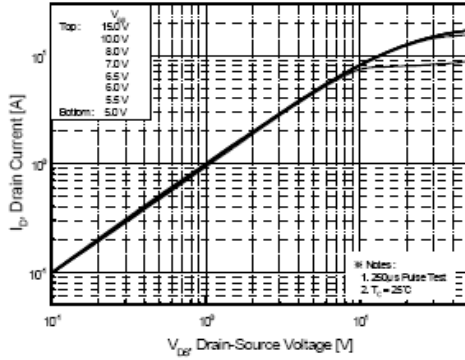
Figure 1. On-Region Characteristics
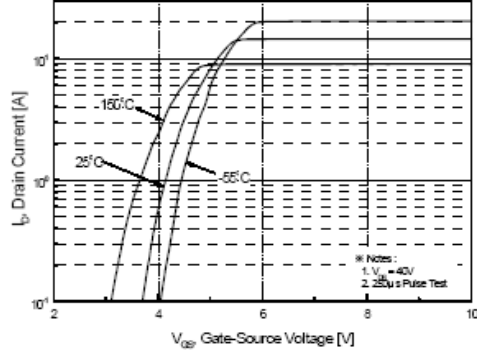
Figure 2. Transfer Characteristics
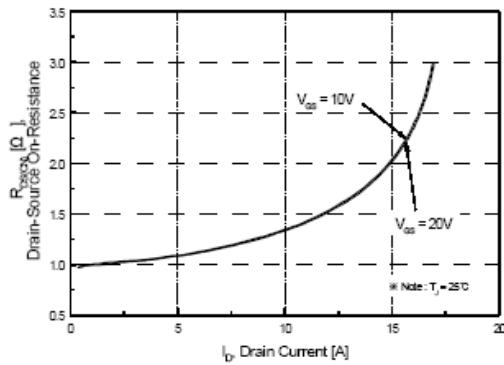
Figure 3. On-Resistance Variation vs
Drain Current and Gate Voltage
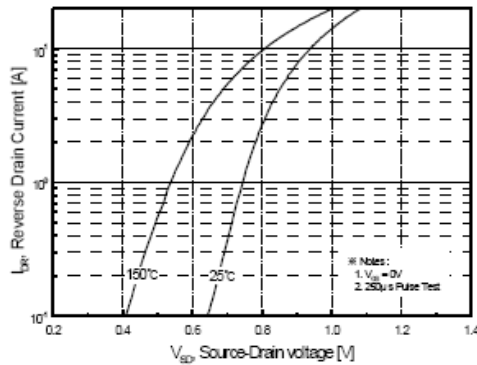
Figure 4. Body Diode Forward Voltage
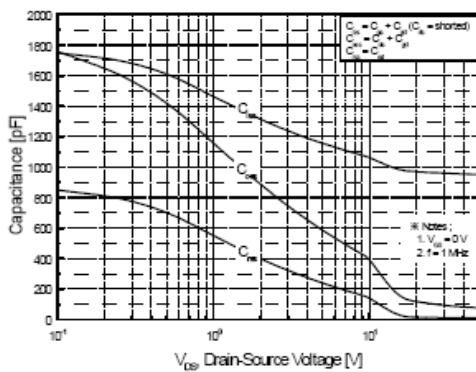Variation with Source Current
and Temperature
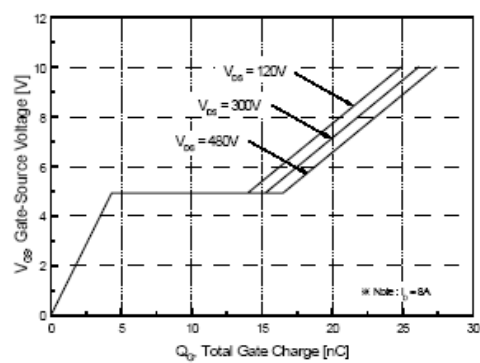
Figure 5. Capacitance Characteristics

Figure 6. Gate Charge Characteristics

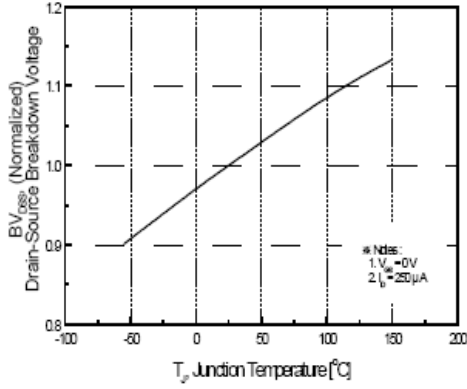## Typical Characteristics (Continued)
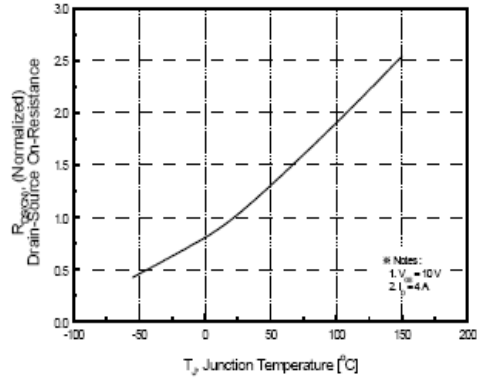

Figure 7. Breakdown Voltage Variation
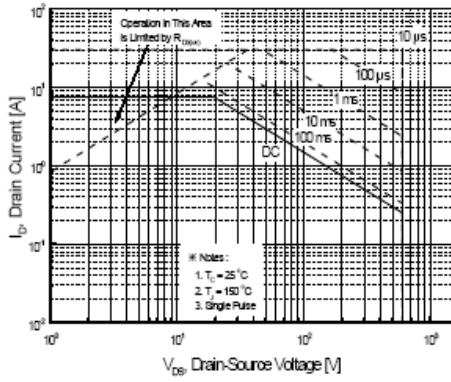vs Temperature

Figure 8. On-Resistance Variation
vs Temperature

Figure 9-1. Maximum Safe Operating Area
for TSP7N60M
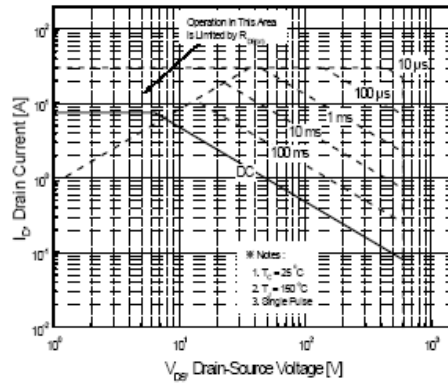
Figure 9-2. Maximum Safe Operating Area
for TSF7N60M
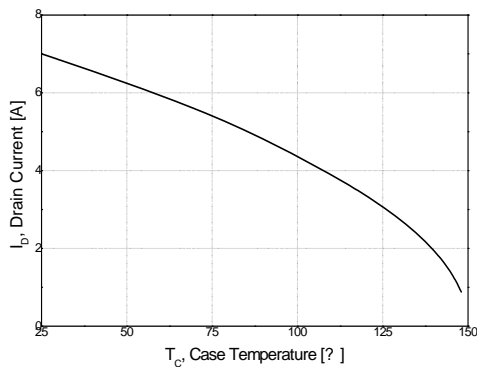
Figure 10. Maximum Drain Current
vs Case Temperature

Typical Characteristics (Continued)
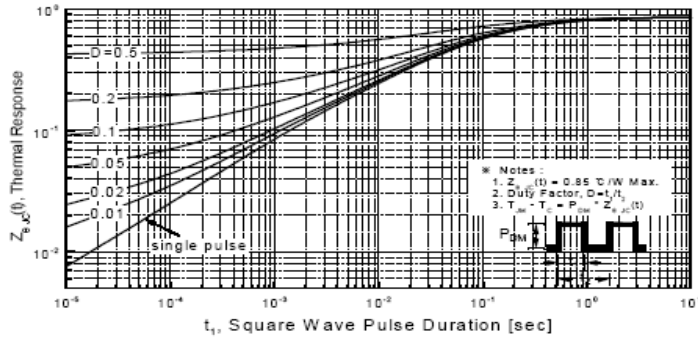
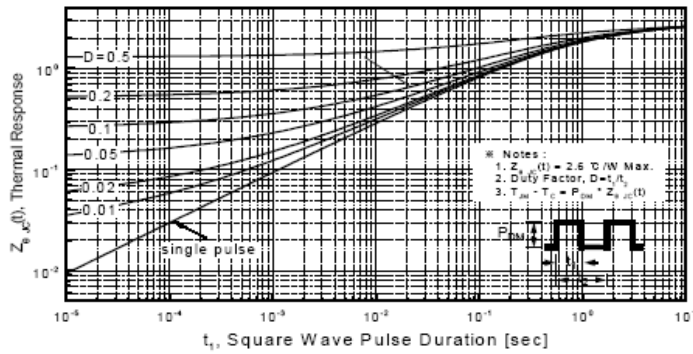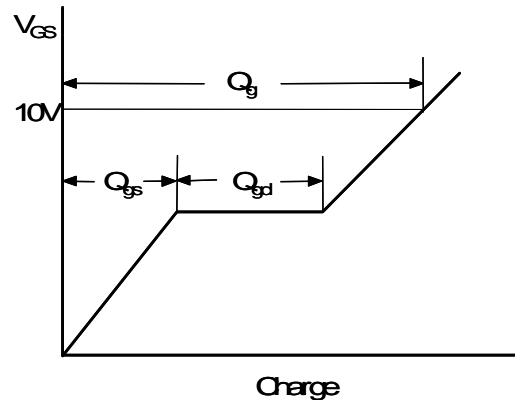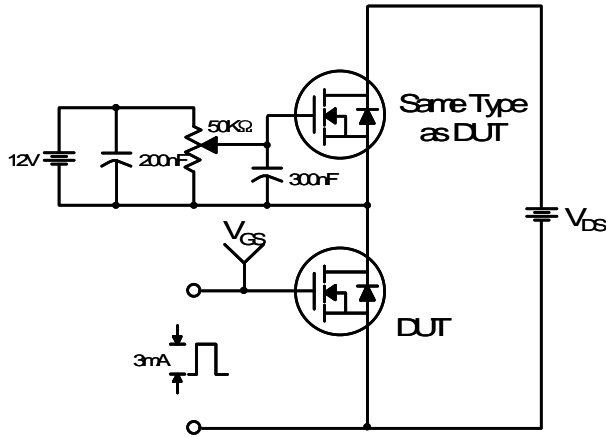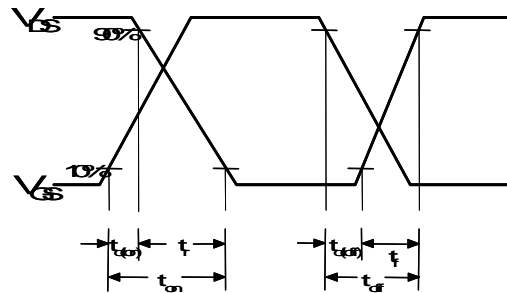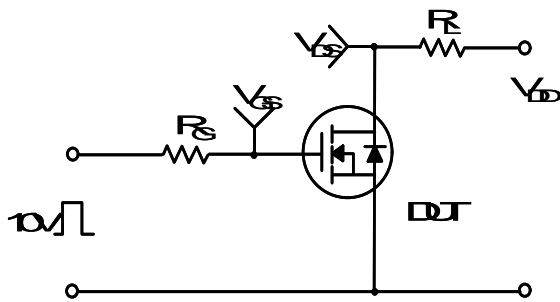**Figure 11-1. Transient Thermal Response Curve for TSP7N60M**

Figure 11-2. Transient Thermal Response Curve for TSF7N60M

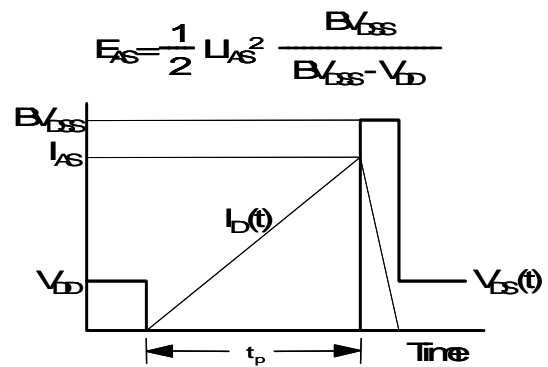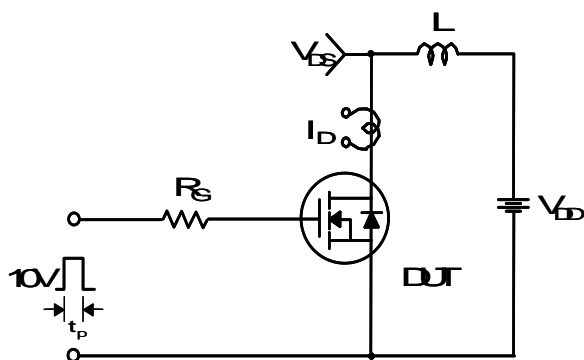**Gate Charge Test Circuit & Waveform**

Resistive Switching Test Circuit & Waveforms

Unclamped Inductive Switching Test Circuit & Waveforms

$$E_{AS} = \frac{1}{2} L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$

Peak Diode Recovery dv/dt Test Circuit & Waveforms