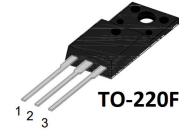
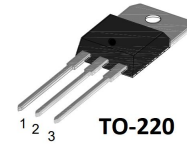


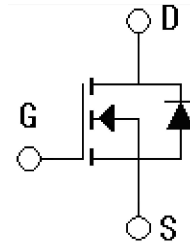
## Features

- Low gate charge (typical 51.5nC)
- Low Crss(typical 16.9pF)
- Fast switchin
- 100% avalanche tested
- Improved dv/dt capability
- RoHS product



## Applications

- LED power supplies
- High frequency switch mode power supplies
- Electronic lamp ballasts based on half bridge



## Absolute Ratings (Tc=25°C)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V <sub>DSS</sub>	600	V
Drain Current-continuous	I <sub>D</sub> T=25°C T=100°C	10*	A
		6.0*	A
Drain Current-pulse (note 1)	I <sub>DM</sub>	40*	A
Gate-Source Voltage	V <sub>GSS</sub>	±30	V
Single pulse avalanche energy (note 2)	E <sub>AS</sub>	1050	mJ
Avalanche Current (note 1)	I <sub>AR</sub>	10	A
Repetitive Avalanche Energy(note 1)	E <sub>AR</sub>	15.6	mJ
Power Dissipation (TO-220F)	PD TC=25°C Derate above 25°C	40	W
		0.32	W/°C
Power Dissipation (TO-220)	PD TC=25°C Derate above 25°C	160	W
		1.28	W/°C
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55~+150	°C
Peak Diode Recovery dv/dt (note 3)	dv/dt	5.0	V/ns
Maximum Lead Temperature for Soldering Purposes	T <sub>L</sub>	300	°C

\*Drain current limited by maximum junction temperature

**Electrical Characteristics**( $T_{CASE}=25^{\circ}C$  unless otherwise specified)

Parameter	Symbol	Tests conditions	Min	Type	Max	Units
Drain-Source Voltage	$BV_{DSS}$	$I_D=250\mu A, V_{GS}=0V$	600	-	-	V
Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	$I_D=250\mu A$ , referenced to $25^{\circ}C$	-	0.6	-	V/ $^{\circ}C$
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=600V, V_{GS}=0V, T_C=25^{\circ}C$	-	-	10	$\mu A$
		$V_{DS}=480V, T_C=125^{\circ}C$	-	-	100	$\mu A$
Gate body leakage current	$I_{GSS}$	$V_{DS}=0V, V_{GS}=\pm 30V$	-	-	$\pm 100$	nA
<b>On-Characteristics</b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.0	-	4.0	V
Static Drain-Source On-Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=5.0A$	-	0.65	0.85	$\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=40V, I_D=5.0A$ (note 4)	-	5.7	-	S
<b>Dynamic Characteristics</b>						
Input capacitance	$C_{iss}$	$V_{DS}=25V, V_{GS}=0V, f=1.0MHz$	-	1435	1800	pF
Output capacitance	$C_{oss}$		-	151.4	200	pF
Reverse transfer capacitance	$C_{rss}$		-	16.9	30	pF

**Electrical Characteristics**( $T_{CASE}=25^{\circ}C$  unless otherwise specified)

Parameter	Symbol	Tests conditions	Min	Type	Max	Units
<b>Switching-Characteristics</b>						
Turn-On delay time	$t_{d(on)}$	$V_{DD}=300V, I_D=10A, R_{GEN}=25\Omega$ (note 4,5)	-	31.2	65	ns
Turn-On rise time	$t_r$		-	57.6	95	ns
Turn-Off delay time	$t_{d(off)}$		-	96	135	ns
Turn-Off rise time	$t_f$		-	52.8	95	ns
Total Gate Charge	$Q_g$	$V_{DS}=480V, I_D=10A, V_{GS}=10V$ (note 4,5)	-	51.5	75	nC
Gate-Source charge	$Q_{gs}$		-	7.3		nC
Gate-Drain charge	$Q_{gd}$		-	18		nC

Drain-Source Diode Characteristics and Maximum Ratings						
Diode Forward Voltage (note 3)	$V_{SD}$	$V_{GS}=0V, I_S=10A$	-	-	1.2	V
Maximum Pulsed Drain-Source Diode Forward Current	$I_{SM}$	-	-	-	40	A
Maximum Continuous Drain Source Diode Forward Current	$I_S$	-	-	-	10	A
Reverse recovery time	$t_{rr}$	$V_{GS}=0V,$ $I_S=10A$	-	405	-	ns
Reverse recovery charge	$Q_{rr}$	$di_F/dt=100A/\mu s$ (note 4)	-	9.0	-	$\mu C$

### Thermal Characteristic

Parameter	Symbol	Value	Unit
Thermal Resistance, junction to Case (TO-220F)	$R_{th(j-C)}$	3.1	$^{\circ}C/W$
Thermal Resistance, Junction to Ambient (TO-220F)	$R_{th(j-A)}$	56	$^{\circ}C/W$
Thermal Resistance, junction to Case (TO-220)	$R_{th(j-C)}$	0.78	$^{\circ}C/W$
Thermal Resistance, Junction to Ambient (TO-220)	$R_{th(j-A)}$	76	$^{\circ}C/W$

### Order Message

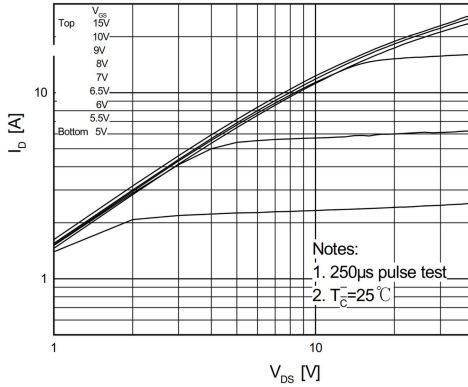
Order codes	Package	Packaging
MS10N60FT	TO-220	Tube
MS10N60FS	TO-220F	Tube

#### Notes:

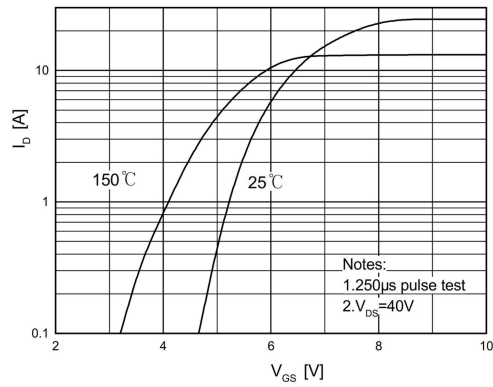
1. Pulse width limited by maximum junction temperature
2.  $L=19mH, I_{AS}=10A, V_{DD}=50V, R_G=25 \Omega, \text{Starting } T_J=25^{\circ}C$
3.  $I_{SD} \leq 10A, di/dt \leq 300A/\mu s, V_{DD} \leq BV_{DSS}, \text{Starting } T_J=25^{\circ}C$
4. Pulse Test: Pulse Width  $\leq 300\mu s, \text{Duty Cycle} \leq 2\%$
5. Essentially independent of operating temperature

## ELECTRICAL CHARACTERISTICS (curves)

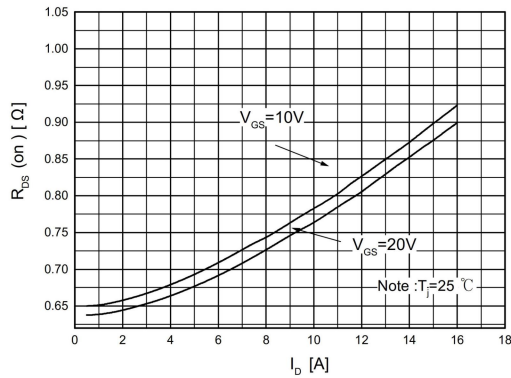
### On-Region Characteristics



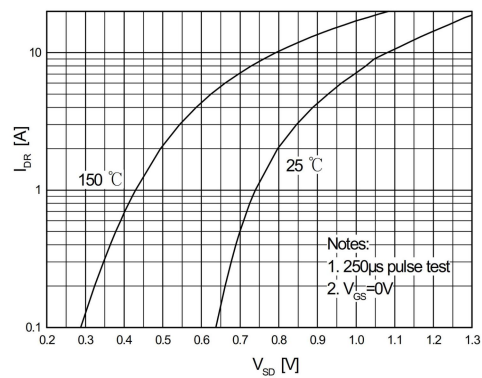
### Transfer Characteristics



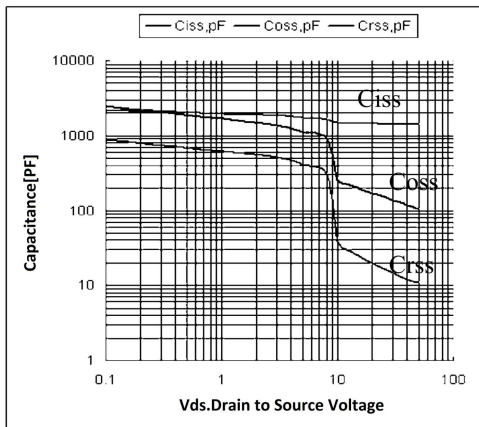
### On-Resistance Variation vs. Drain Current Gate Voltage



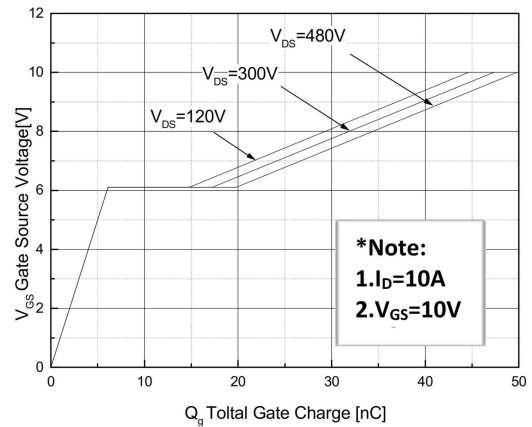
### Body Diode Forward Voltage Variation vs. Source Current and Temperature



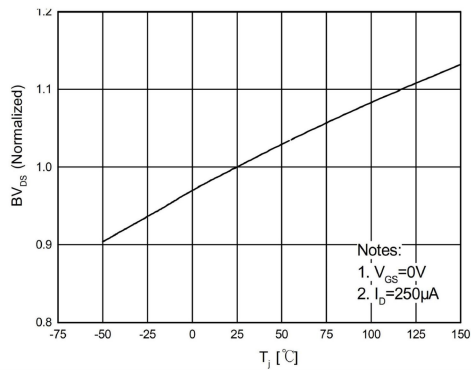
### Capacitance Characteristics



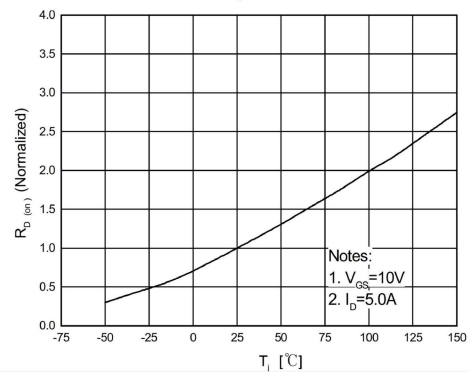
### Gate Charge Characteristics



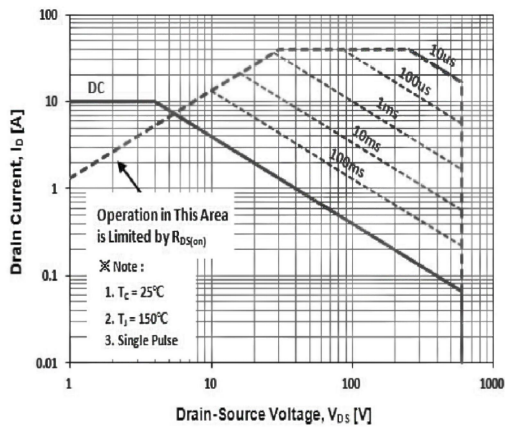
### Breakdown Voltage Variation vs. Temperature



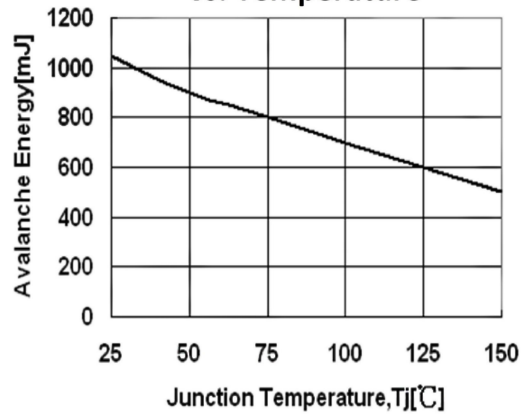
### On-Resistance Variation vs. Temperature



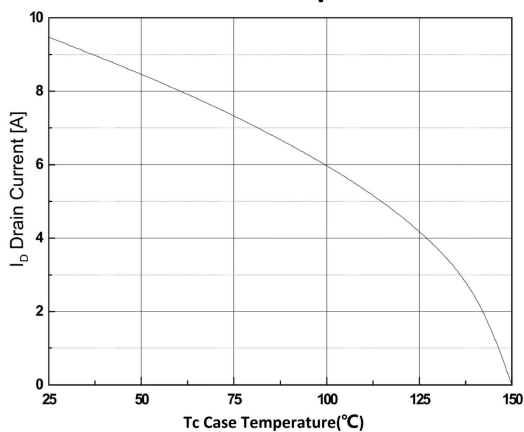
### Maximum Safe Operating Area



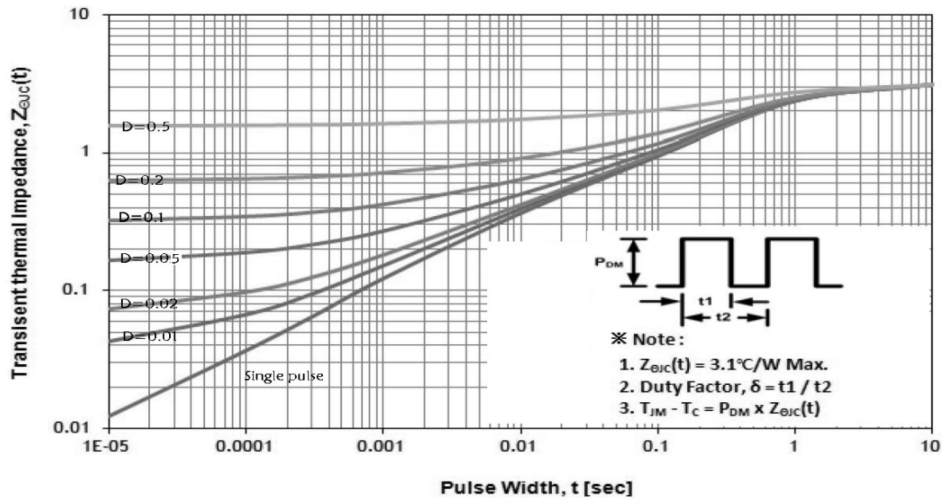
### Avalanche Energy vs. Temperature



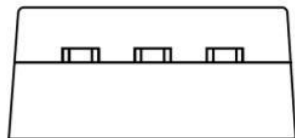
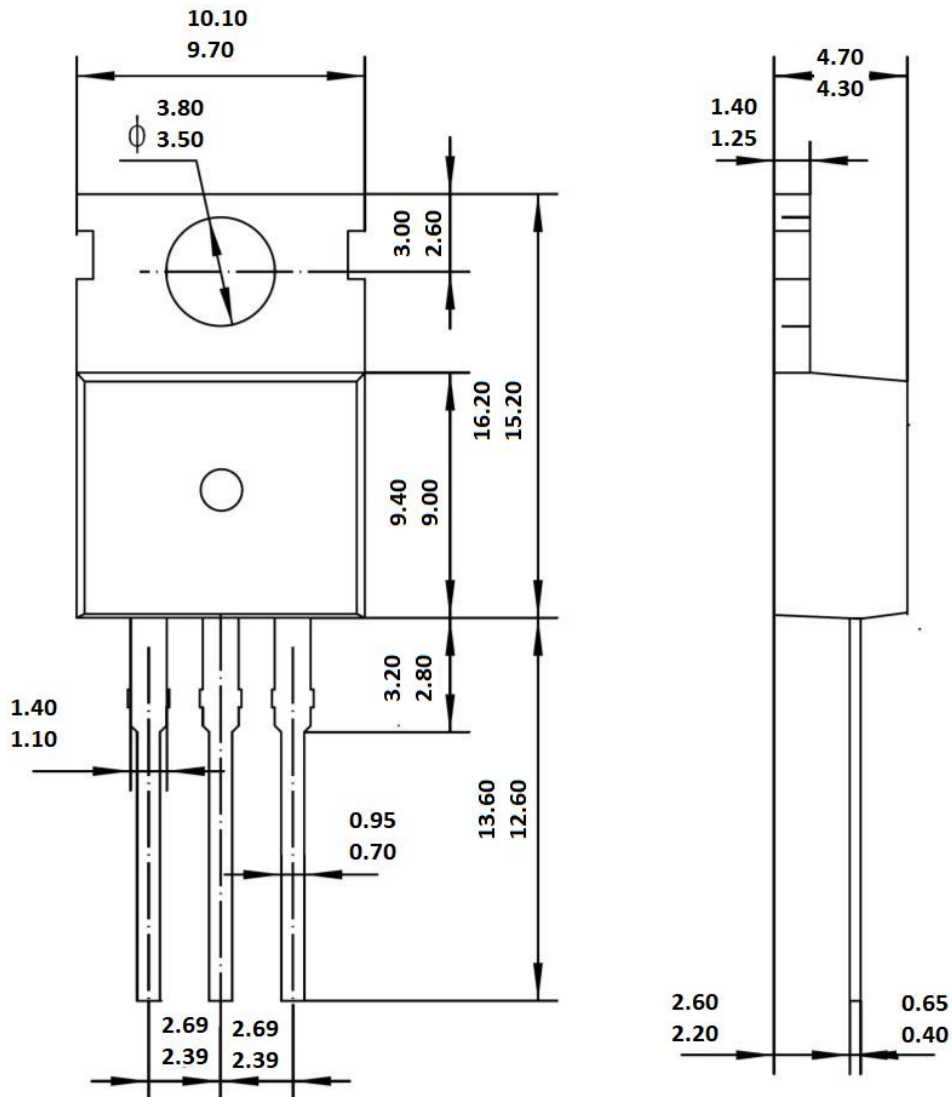
### Maximum Drain Current vs. Case Temperature



## Transient Thermal Response Curve



## PACKAGE MECHANICAL DATA



**TO-220**

**Unit: mm**

