



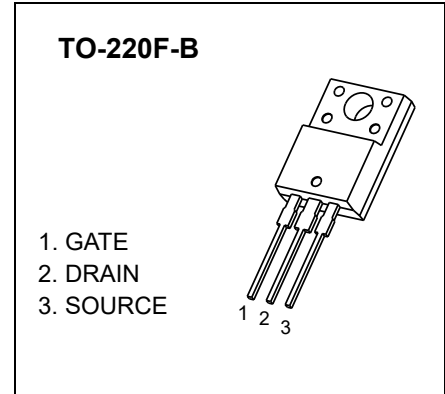
# TO-220F-B Plastic-Encapsulate MOSFETS

## PF12N65M1 N-Channel Power MOSFET

$V_{(BR)DSS}$	$R_{DS(on)TYP}$	$I_D$
650V	0.67Ω@10V	12A

### GENERAL DESCRIPTION

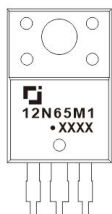
This advanced high voltage MOSFET is designed to stand high energy in the avalanche mode and switch efficiently. This new high energy device also offers a drain-to-source diode fast recovery time. Designed for high voltage, high speed switching applications such as power supplies, converters, power motor controls and bridge circuits.



### FEATURE

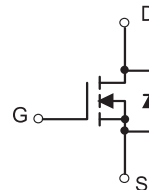
- High Current Rating
- Lower  $R_{DS(on)}$
- Lower Capacitance
- Lower Total Gate Charge
- Tighter  $V_{SD}$  Specifications
- Avalanche Energy Specified
- Fast Switching Capability

### MARKING



12N65M1= Device code.  
 Solid dot = Green molding compound device,  
 if none, the normal device  
 XXXX=Code

### EQUIVALENT CIRCUIT



### Maximum ratings ( $T_J=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	$V_{DS}$	650	V
Gate-Source Voltage	$V_{GS}$	±30	V
Continuous Drain Current	$I_D$ <sup>①</sup>	12	A
Pulsed Drain Current	$I_{DM}$ <sup>②</sup>	48	A
Single Pulsed Avalanche Energy	$E_{AS}$ <sup>③</sup>	400	mJ
Power Dissipation	$P_D$ <sup>①</sup>	74	W
Thermal Resistance from Junction to Ambient	$R_{\theta JA}$ <sup>⑥</sup>	62.5	°C/W
Thermal Resistance from Junction to Case	$R_{\theta JC}$ <sup>①</sup>	1.7	°C/W
Operating and Storage Temperature Range	$T_J, T_{STG}$	-55 ~+150	°C

## MOSFET ELECTRICAL CHARACTERISTICS

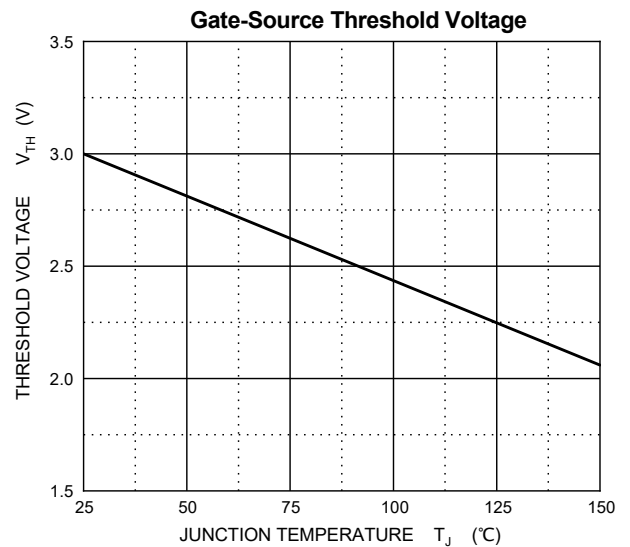
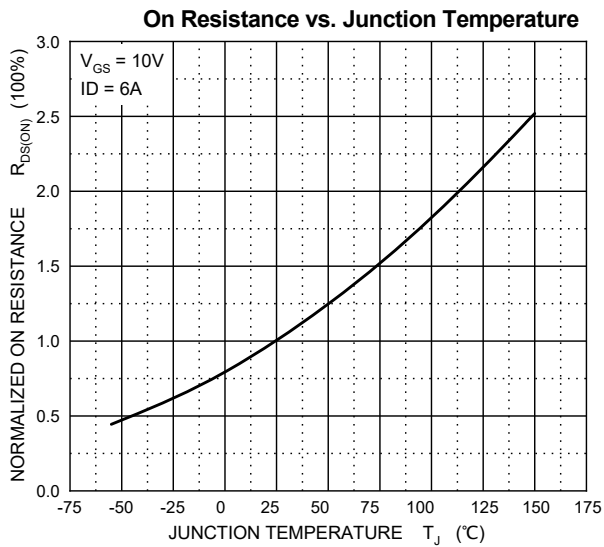
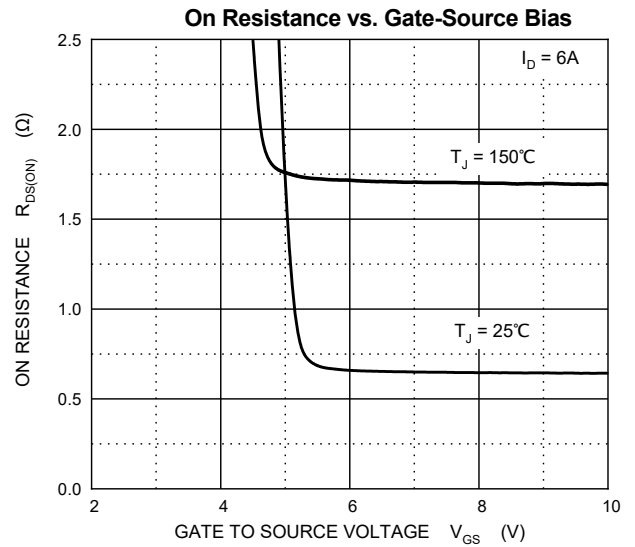
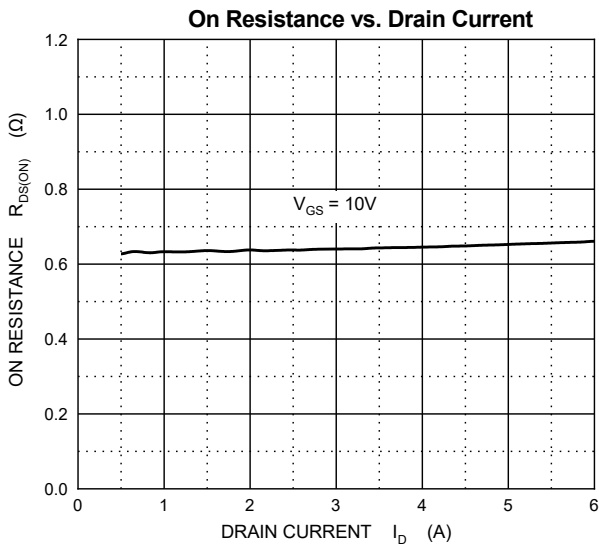
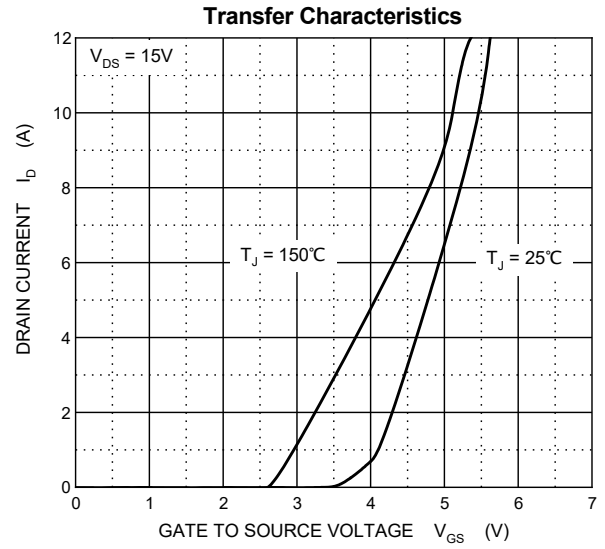
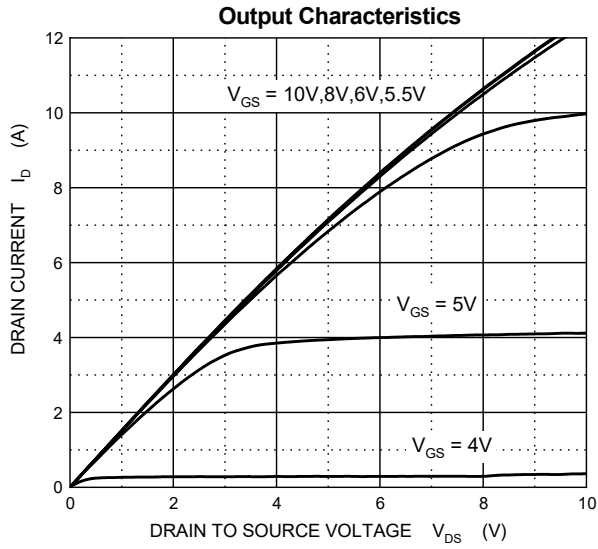
$T_J=25\text{ }^\circ\text{C}$  unless otherwise specified

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>Off characteristics</b>						
Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	650			V
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 650V, V_{GS} = 0V$			1.0	$\mu A$
Gate-body leakage current	$I_{GSS}$	$V_{DS} = 0V, V_{GS} = \pm 30V$			$\pm 100$	nA
<b>On characteristics</b> <sup>④</sup>						
Gate-threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.0	3.0	4.0	V
Static drain-source on-resistance	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 6A$		0.67	0.8	$\Omega$
<b>Dynamic characteristics</b> <sup>⑤</sup>						
Input capacitance	$C_{iss}$	$V_{DS} = 50V, V_{GS} = 0V, f = 100kHz$		1930		pF
Output capacitance	$C_{oss}$			104		
Reverse transfer capacitance	$C_{rss}$			4.8		
<b>Switching characteristics</b> <sup>⑤</sup>						
Total gate charge	$Q_g$	$V_{DS} = 50V, V_{GS} = 10V, I_D = 12A$		30		nC
Gate-source charge	$Q_{gs}$			10.3		
Gate-drain charge	$Q_{gd}$			6.4		
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 24V, V_{GS} = 10V, R_G = 10\Omega, I_D = 12A$		17		ns
Turn-on rise time	$t_r$			5		
Turn-off delay time	$t_{d(off)}$			38		
Turn-off fall time	$t_f$			20		
<b>Drain-Source Diode Characteristics</b>						
Drain-source diode forward voltage	$V_{SD}$ <sup>④</sup>	$V_{GS} = 0V, I_S = 12A$			1.2	V
Maximum continuous drain-source diode forward current	$I_S$ <sup>①</sup>				12	A
Maximum pulsed drain-source diode forward current	$I_{SM}$ <sup>②</sup>				48	A

### Notes :

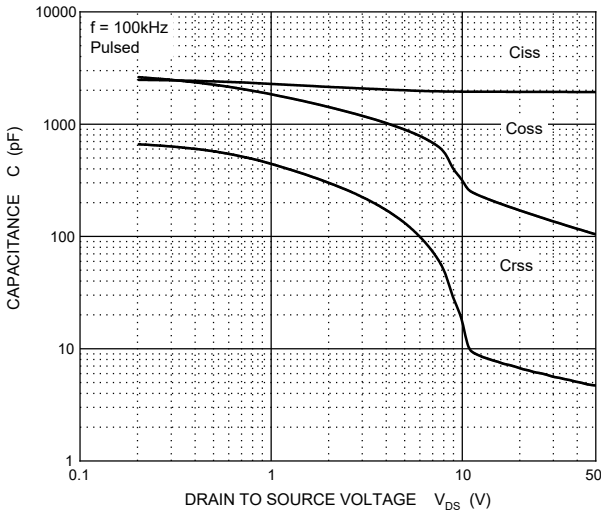
- $T_C=25\text{ }^\circ\text{C}$  Limited only by maximum temperature allowed.
- $P_W \leq 10\mu s$ , Duty cycle  $\leq 1\%$ .
- EAS condition:  $V_{DD}=50V, V_{GS}=10V, L=10mH, R_g=25\Omega$  Starting  $T_J = 25\text{ }^\circ\text{C}$ .
- Pulse Test : Pulse Width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .
- Guaranteed by design, not subject to production.
- The value of R $\theta$ JA is measured with the device in a still air environment with  $T_a=25\text{ }^\circ\text{C}$ .

# Typical Characteristics ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)

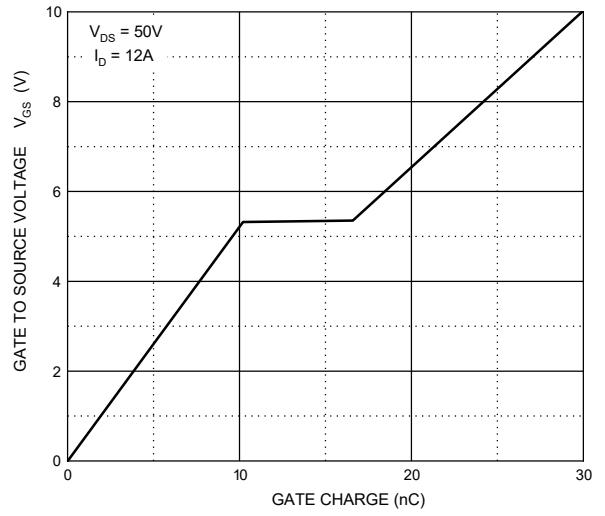


# Typical Characteristics ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)

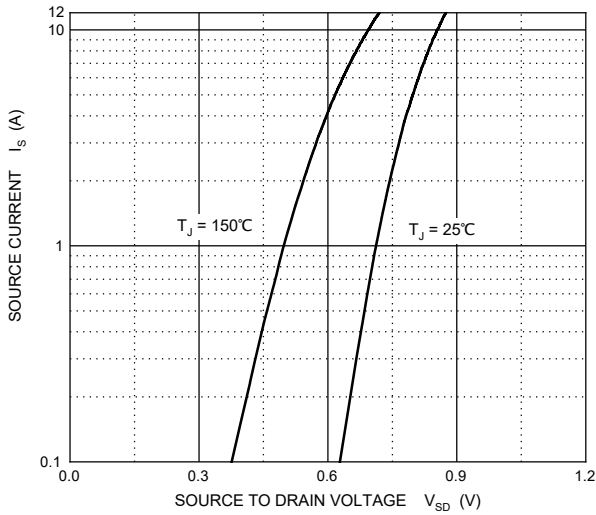
**Typical Capacitances**



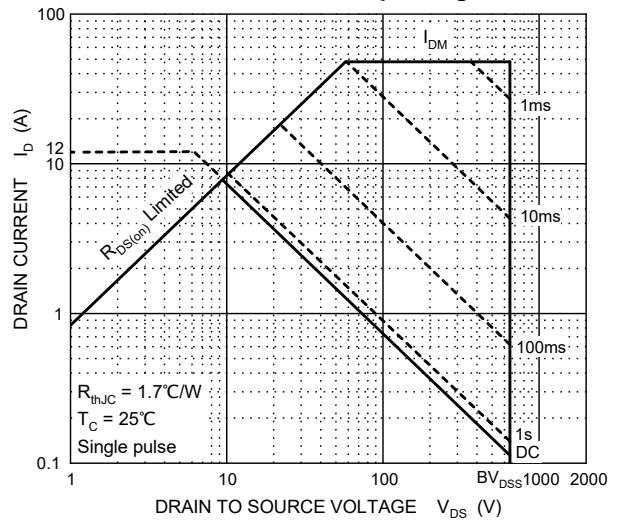
**Gate Charge**



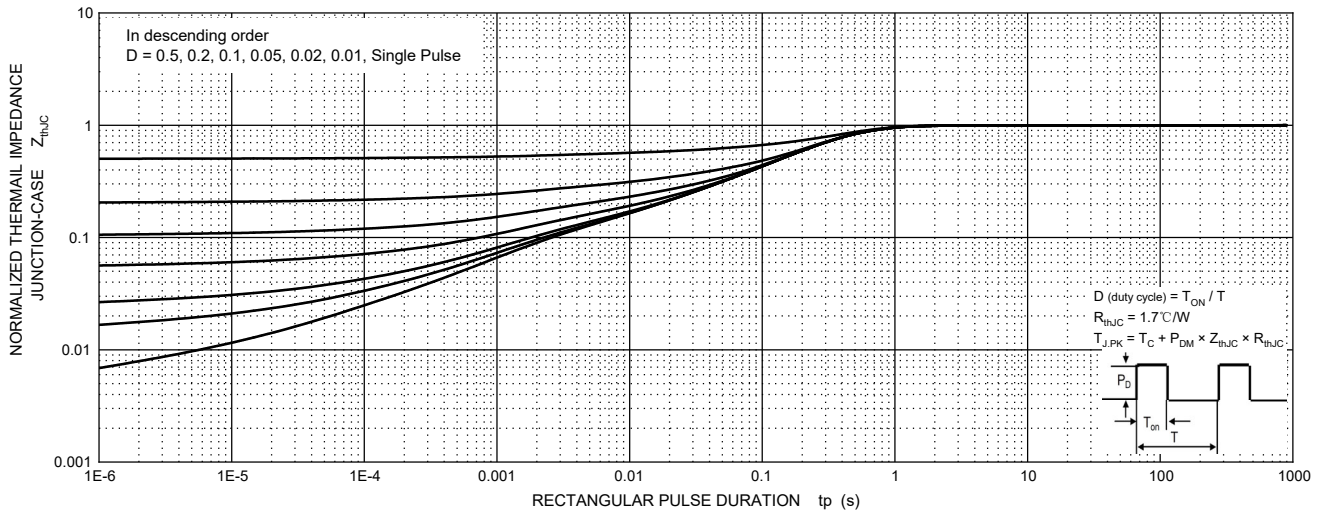
**Source-Drain Diode Forward Characteristics**



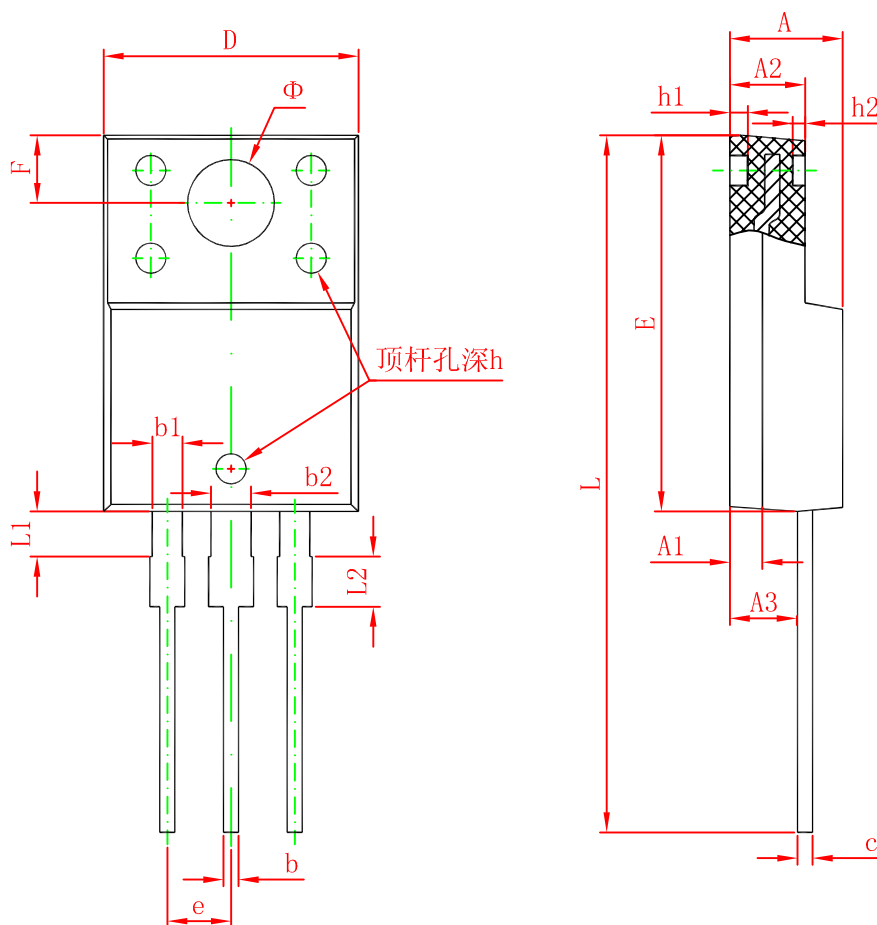
**Maximum Safe Operating Area**



**Transient Thermal Impedance, Junction-Case**



# TO-220F Package Outline Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.300	4.700	0.169	0.185
A1	1.300 REF.		0.051 REF.	
A2	2.800	3.200	0.110	0.126
A3	2.500	2.900	0.098	0.114
b	0.500	0.750	0.020	0.030
b1	1.100	1.350	0.043	0.053
b2	1.500	1.750	0.059	0.069
c	0.500	0.750	0.020	0.030
D	9.960	10.360	0.392	0.408
E	14.800	15.200	0.583	0.598
e	2.540 TYP.		0.100 TYP.	
F	2.700 REF.		0.106 REF.	
Φ	3.500 REF.		0.138 REF.	
h	0.000	0.300	0.000	0.012
h1	0.800 REF.		0.031 REF.	
h2	0.500 REF.		0.020 REF.	
L	28.000	28.400	1.102	1.118
L1	1.700	1.900	0.067	0.075
L2	0.900	1.100	0.075	0.083