

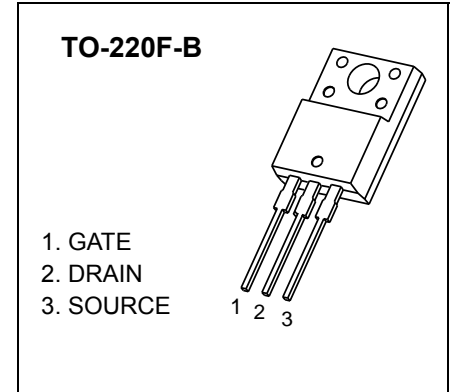
## TO-220F-B Plastic-Encapsulate MOSFETS

### CJPF04N65M1 N-Channel Power MOSFET

$V_{(BR)DSS}$	$R_{DS(on)TYP}$	$I_D$
650V	2.1Ω@10V	4A

#### GENERAL DESCRIPTION

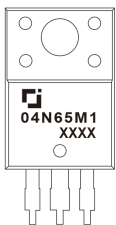
This advanced high voltage MOSFET is designed to stand high energy in the avalanche mode and switch efficiently. This new high energy device also offers a drain-to-source diode fast recovery time. Designed for high voltage, high speed switching applications such as power supplies, converters, power motor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



#### FEATURE

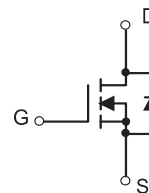
- High Current Rating
- Low Gate Charge
- Low Reverse Transfer Capacitance
- Fast Switching Capability
- Tighter  $V_{SD}$  Specifications
- Avalanche Energy Specified

#### MARKING



04N65M1= 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	Limit	Unit
Drain-Source Voltage	$V_{DS}$	650	V
Gate-Source Voltage	$V_{GS}$	±30	V
Continuous Drain Current	$I_D$ ①	4	A
Pulsed Drain Current	$I_{DM}$ ①②	16	A
Single Pulsed Avalanche Energy	$E_{AS}$ ③	265	mJ
Power Dissipation	$P_D$ ①	83	W
Thermal Resistance from Junction to Ambient	$R_{\theta JA}$ ⑥	34	$^\circ\text{C/W}$
Thermal Resistance from Junction to Case	$R_{\theta JC}$ ①	1.5	$^\circ\text{C/W}$
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55~+150	$^\circ\text{C}$

# MOSFET ELECTRICAL CHARACTERISTICS

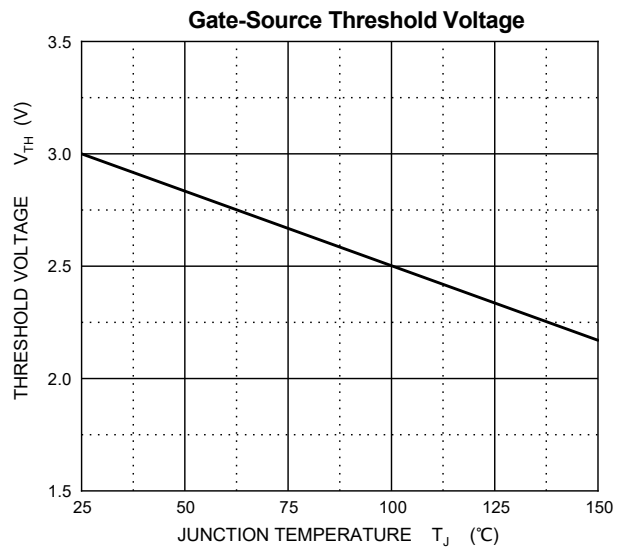
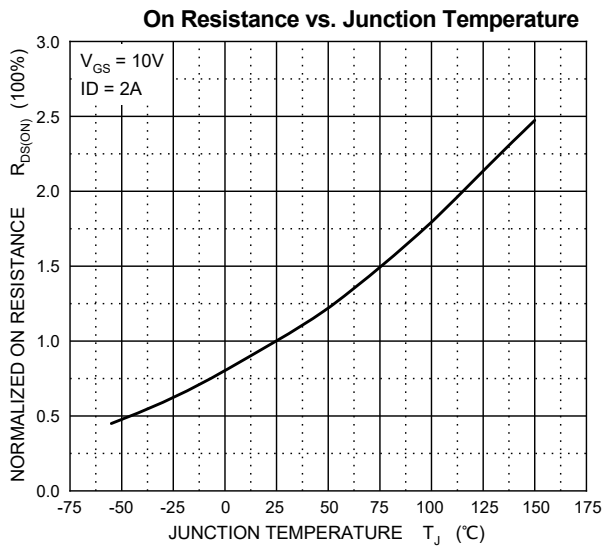
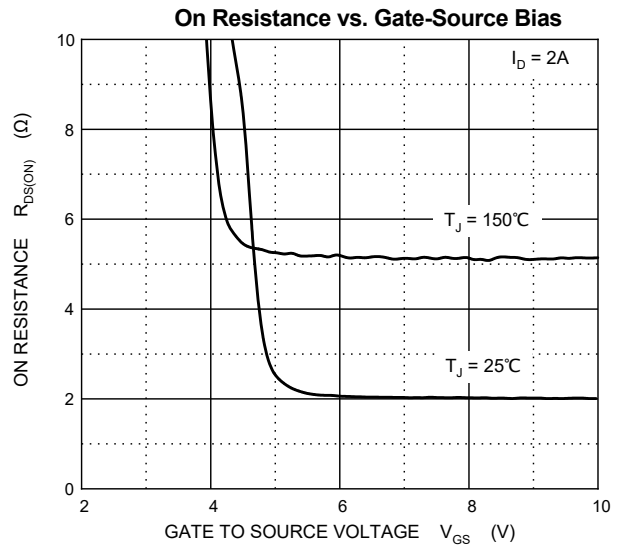
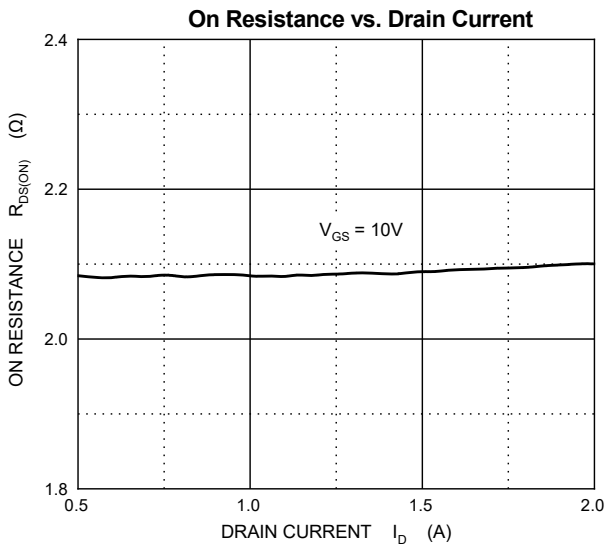
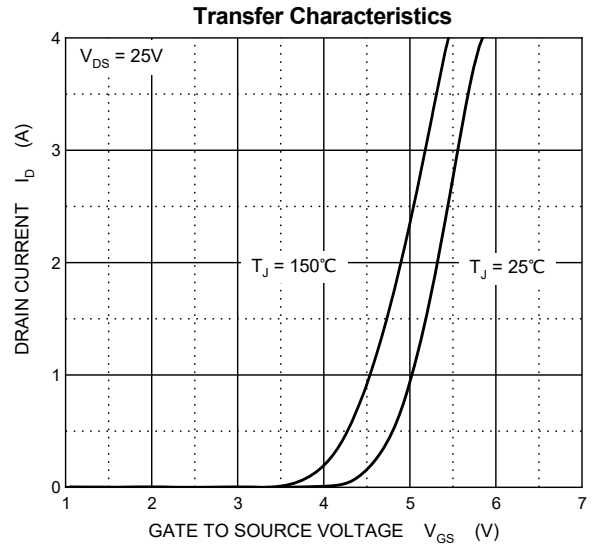
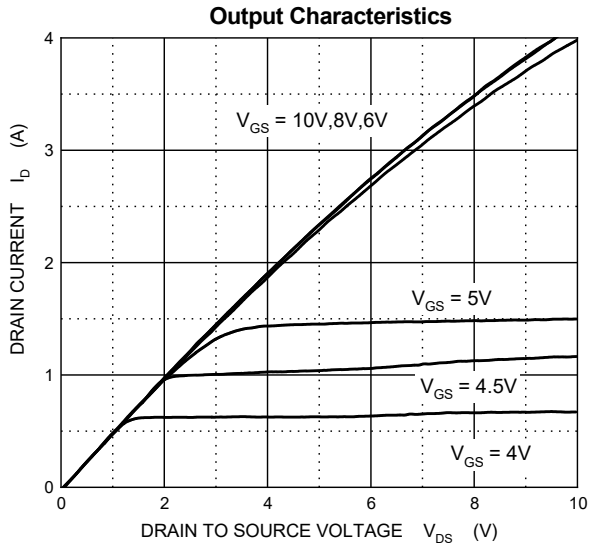
$T_J=25^{\circ}\text{C}$  unless otherwise specified

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	$I_{DSS}$	$V_{DS}=650V, V_{GS}=0V$	$T_J=25^{\circ}\text{C}$		1.0	$\mu A$
			$T_J=125^{\circ}\text{C}$		100	
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	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 2A$		2.1	2.6	$\Omega$
<b>Dynamic characteristics</b> <sup>⑤</sup>						
Input capacitance	$C_{iss}$	$V_{DS} = 50V, V_{GS} = 0V, f = 1\text{MHz}$		624		pF
Output capacitance	$C_{oss}$			36		
Reverse transfer capacitance	$C_{rss}$			3		
Gate resistance	$R_g$	$f = 1\text{MHz}$		3		$\Omega$
<b>Switching characteristics</b> <sup>⑤</sup>						
Total gate charge	$Q_g$	$V_{DS} = 520V, V_{GS} = 10V, I_D = 4A$		10.4		nC
Gate-source charge	$Q_{gs}$			3.5		
Gate-drain charge	$Q_{gd}$			2.8		
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 50V, V_{GS} = 10V, R_G = 10\Omega, R_L = 50\Omega$		7.0		ns
Turn-on rise time	$t_r$			3.3		
Turn-off delay time	$t_{d(off)}$			15		
Turn-off fall time	$t_f$			7.6		
<b>Drain-Source Diode Characteristics</b>						
Drain-source diode forward voltage	$V_{SD}$ <sup>④</sup>	$V_{GS} = 0V, I_S = 4A$			1.2	V
Maximum continuous drain-source diode forward current	$I_S$ <sup>①</sup>				4	A
Maximum pulsed drain-source diode forward current	$I_{SM}$ <sup>①②</sup>				16	A
Reverse recovery time	$t_{rr}$	$dI_F/dt = 100A/\mu s, I_S = 4A, V_{DD} = 50V$		272		ns
Reverse recovery charge	$Q_{rr}$				1679	

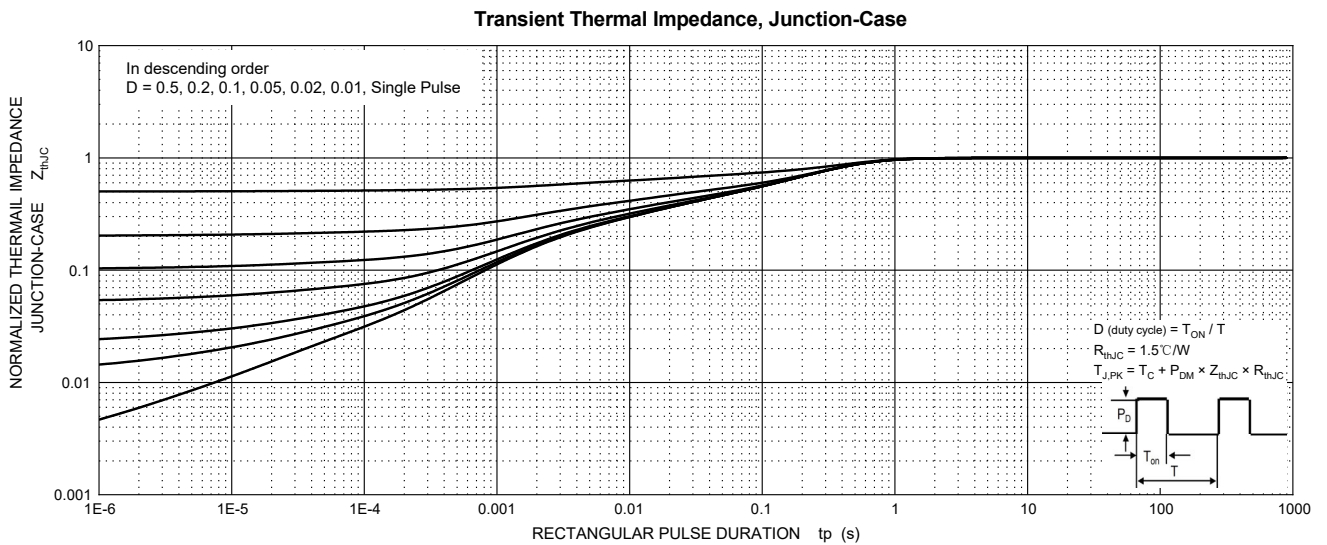
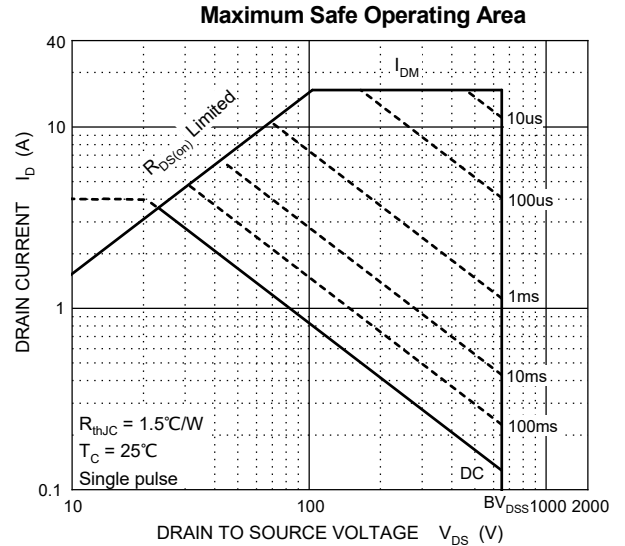
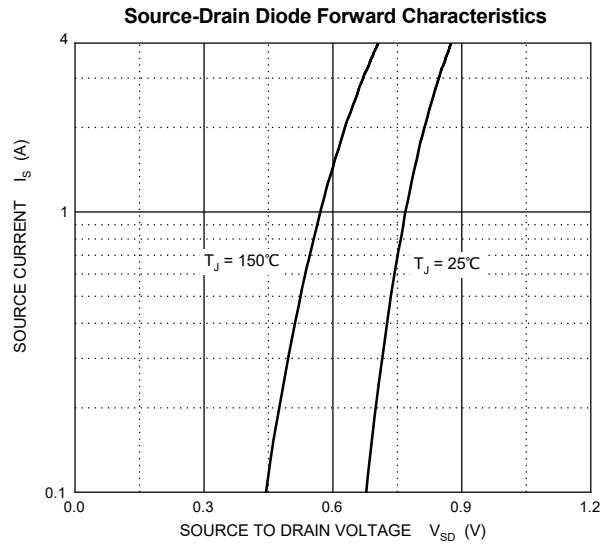
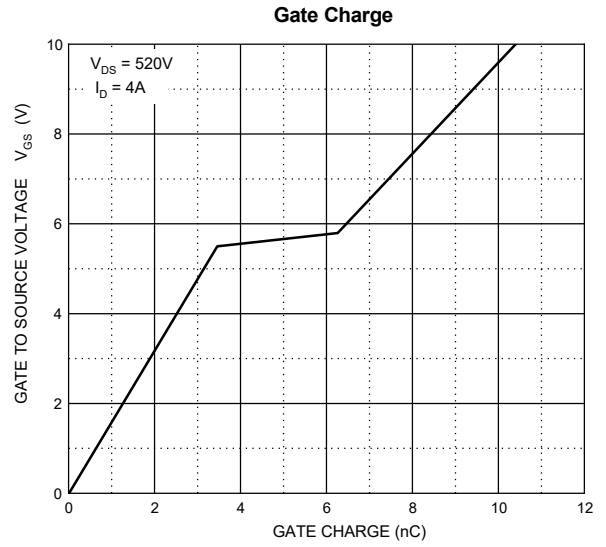
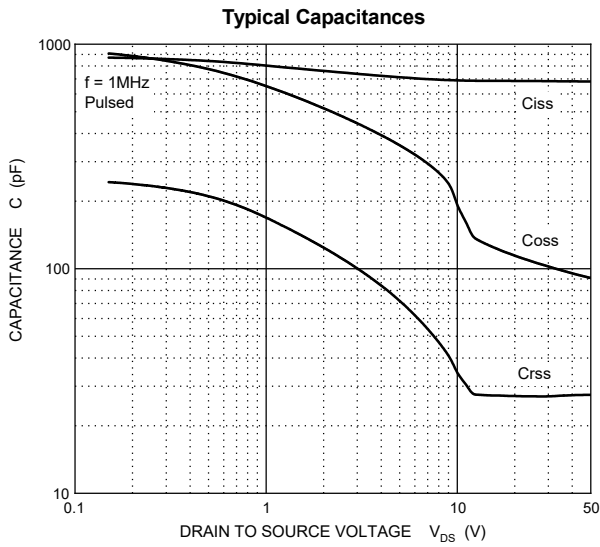
## Notes :

- $T_C=25^{\circ}\text{C}$  Limited only by maximum temperature allowed.
- $P_W \leq 10\mu s$ , Duty cycle  $\leq 1\%$ .
- EAS condition:  $V_{DD}=100V, V_{GS}=10V, L=10mH, R_g=25\Omega$  Starting  $T_J = 25^{\circ}\text{C}$ .
- 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  $T_a=25^{\circ}\text{C}$ .

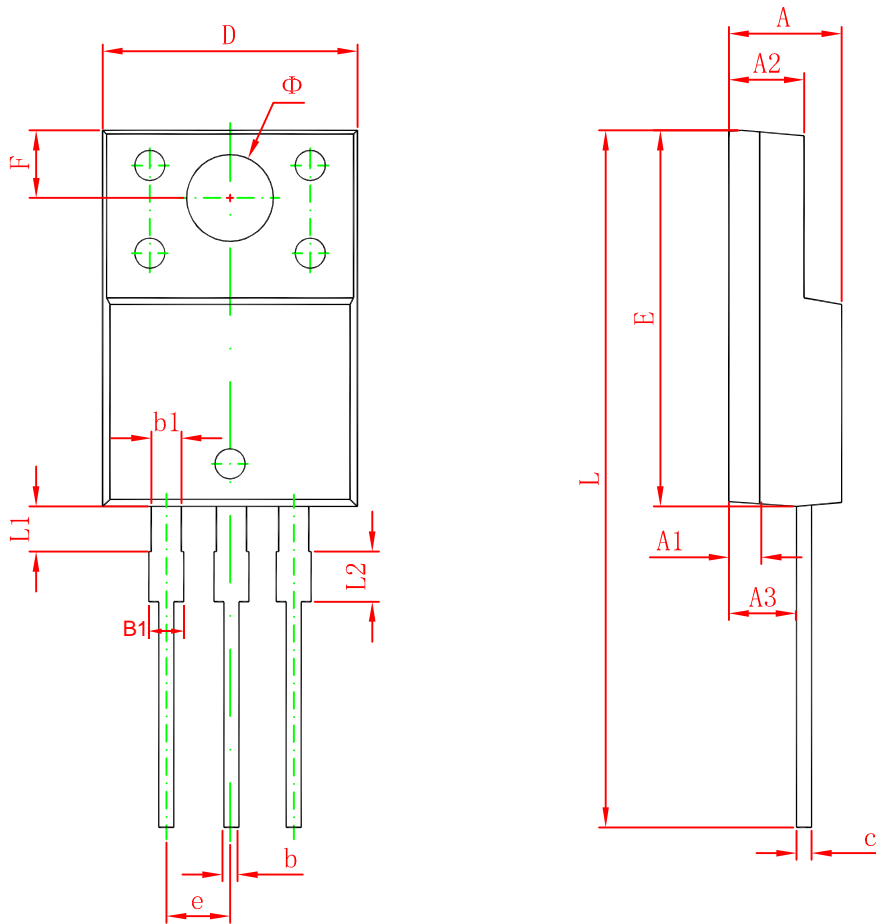
# Typical Characteristics ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)



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# TO-220F-B Package Outline Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.300	4.700	0.169	0.185
A1	1.200 REF.		0.047 REF.	
A2	2.800	3.200	0.110	0.126
A3	2.500	2.900	0.098	0.114
b	0.710	0.910	0.028	0.036
b1	1.100	1.350	0.043	0.053
B1	1.150	1.400	0.045	0.055
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.	
$\Phi$	3.300	3.700	0.130	0.146
L	28.000	28.400	1.102	1.118
L1	2.100	2.400	0.082	0.094
L2	1.300	1.700	0.051	0.066