650V,2.25Ω, 4A, N-Channel MOSFET

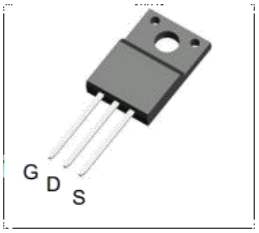
1. Features

- New technology for high voltage device
- Low on-resistance and low conduction losses
- Ultra Low Gate Charge cause lower driving requirements

V_{DS} Typ.	$R_{DS(on)}$ Typ.	I_D Max.
650V	2.25Ω @ 10V	4A

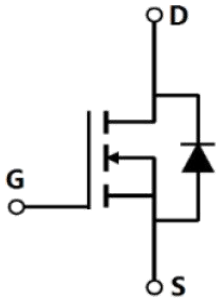
2. Applications

- Power factor correction
- Switched mode power supplies
- Uninterruptible Power Supply



Pin Description

TO-220F



Schematic Diagram

3. Package Marking and Ordering Information

Part no.	Marking	Package	PCS/Tube	PCS/CTN.
ZX 4N65FF	*	TO-220F	50	5,000

4. Absolute Max Ratings at Ta=25℃ (Note1)

Parameter	Symbol	Maximum	Units
Drain to Source Voltage	V_{DSS}	650	V
Gate to Source Voltage	V_{GSS}	±30	V
Drain Current-Continuous	I_D	4	A
Drain Current (Pulse)	I_{DM}	16	A
Single Pulsed Avalanche Energy	E_{AS}	210	mJ
Maximum Power Dissipation	P_D	28.4	W
Operating Junction and Storage Temperature Range	T_j, T_{stg}	-55 to +160	℃

Note 1: Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

5. Thermal Resistance Ratings (Note 2)

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	4.4	℃/W

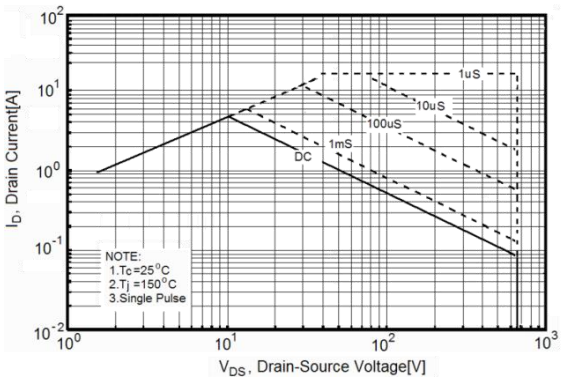
Note 2: When mounted on 1 inch square copper board t ≤ 10sec The value in any given application depends on the user's specific board design.

6. Electrical Characteristics at Ta=25℃ (Note 3)

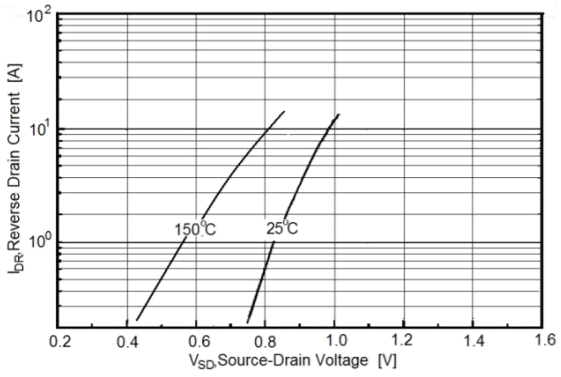
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Drain to Source Breakdown Voltage	$V_{(BR)DSS}$	I_D = 250μA, V_{GS} = 0V	650	700		V
Zero-Gate Voltage Drain Current	I_{DSS}	V_{DS} = 650V, V_{GS} = 0V			1	μA
Gate-Body Leakage Current	I_{GSS}	V_{GS} = ±20V, V_{DS} = 0V			±100	nA
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_{DS}=250μA	2	3	4	V
Drain to Source On-State Resistance	$R_{DS(on)}$	I_D = 2A, V_{GS} = 10V		2.25	2.5	Ω
Input Capacitance	C_{iss}	V_{GS}=0V, V_{DS}=50V, Frequency=1.0MHz		304		pF
Output Capacitance	C_{oss}			18		pF
Reverse Transfer Capacitance	C_{rss}			0.6		pF
Turn-ON Delay Time	$t_{d(on)}$	V_{DD} = 380V, V_{GS} = 10V, R_{GEN} = 5Ω, I_D = 2.5A		8		ns
Turn-ON Rise Time	t_r			4		ns
Turn-OFF Delay Time	$t_{d(off)}$			52		ns
Turn-ON Fall Time	t_f			9		ns
Total Gate Charge	Q_g	V_{DS} = 480V, V_{GS} = 10V, I_D = 4A		8.8		nC
Gate-Source Charge	Q_{gs}			2.3		nC
Gate-Drain Charge	Q_{gd}			4		nC
Diode Forward Voltage	V_{SD}	I_S = 4A, V_{GS} = 0V	0.5	0.8	1.1	V
Maximum Continuous Drain to Source Diode Forward Curren	I_S	-	-	-	4	A
Maximum Pulsed Drain to Source Diode Forward Current	I_{SM}	-	-	-	16	A
Body Diode Reverse Recovery Time	t_{rr}	I_F=2A, di/dt=100A/μs	-	200	-	nS
Body Diode Reverse Recovery Charg	Q_{rr}		-	0.6	-	nC

Note 3: Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

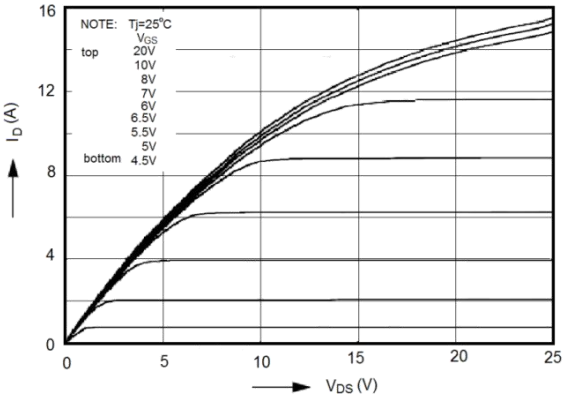
7. Typical electrical and thermal characteristics



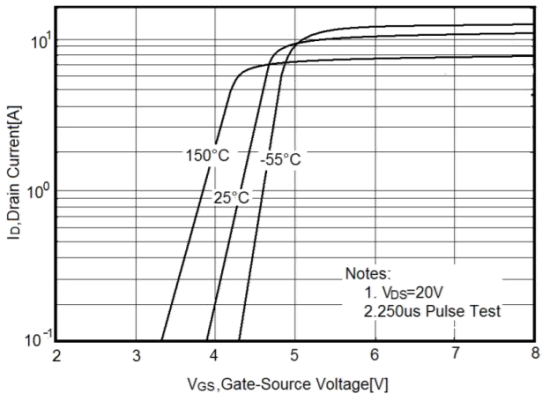
Safe operating area



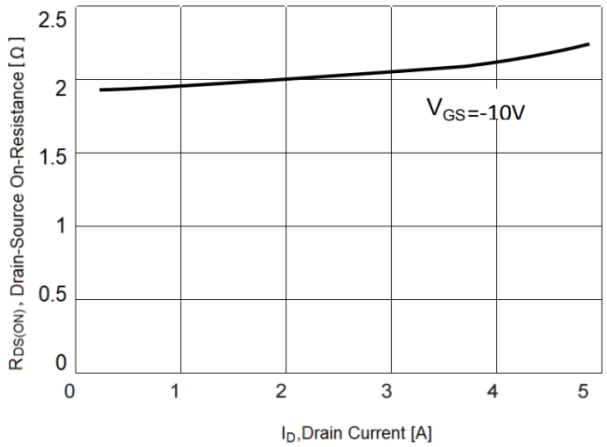
Source-Drain Diode Forward Voltage



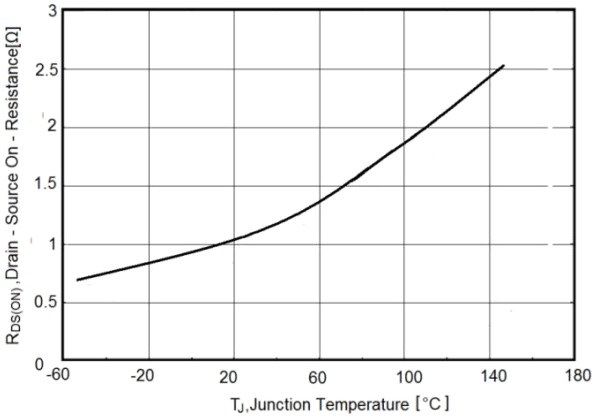
Output Characteristics



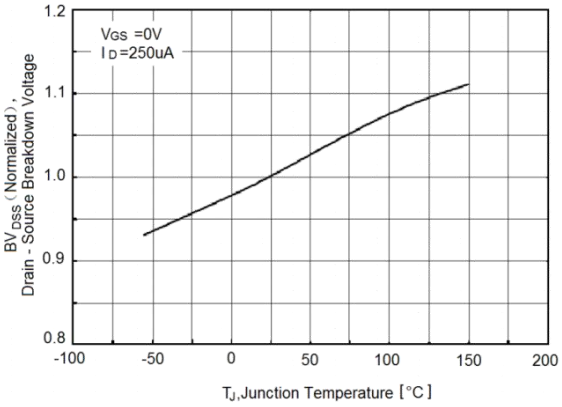
Typical Transfer Characteristics



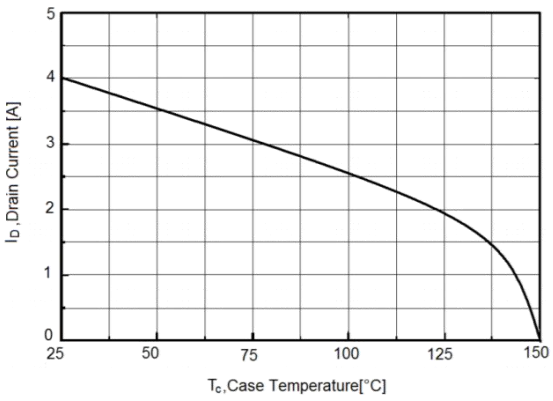
Static drain-source on resistance



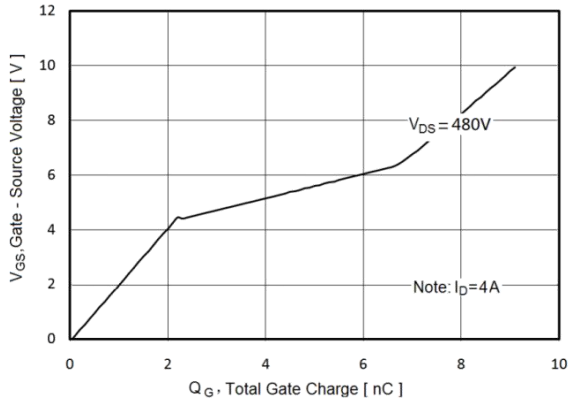
$R_{DS(on)}$ vs Junction Temperature



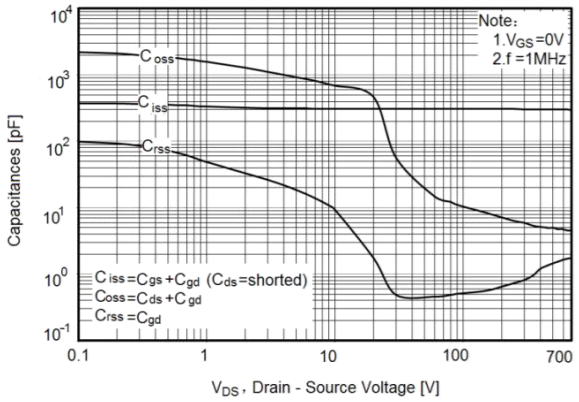
BV_{DSS} vs Junction Temperature



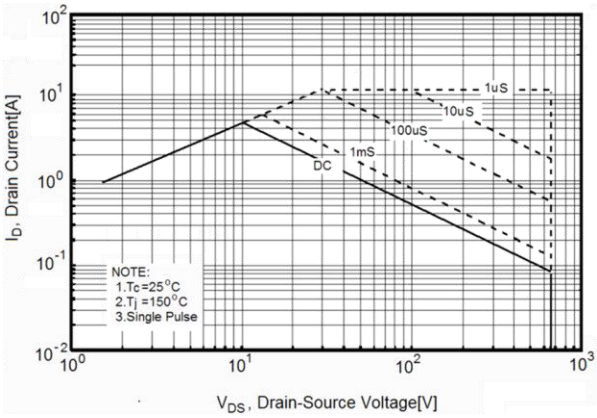
Maximum Id vs Junction Temperature



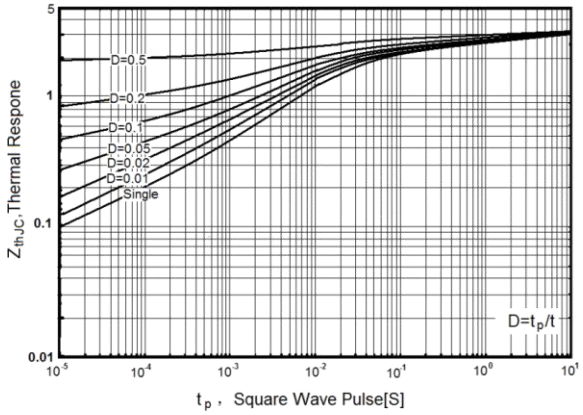
Gate charge waveforms



Capacitance

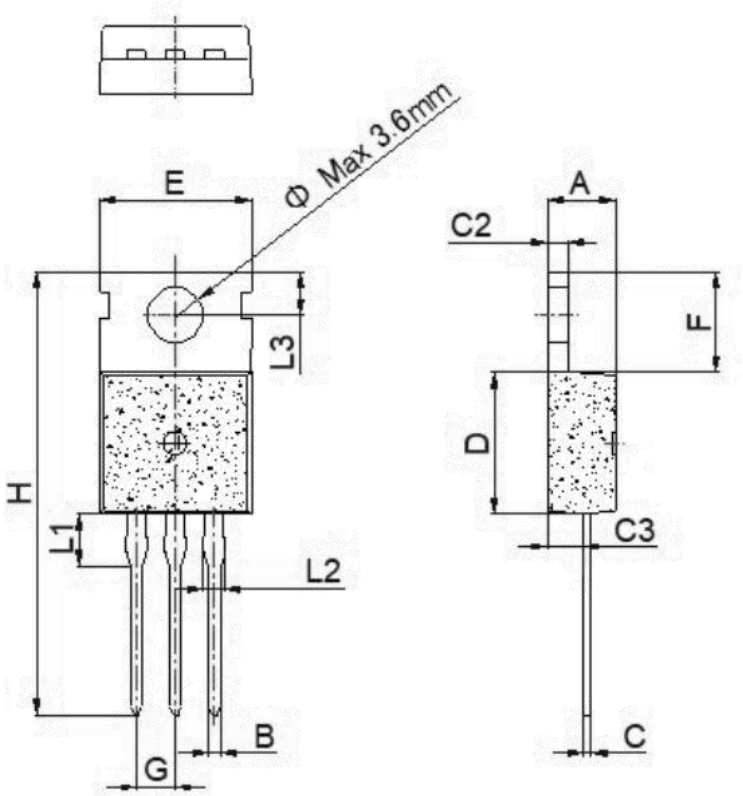


Safe operating area



Transient Thermal Impedance

8. Package Dimensions



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.40		4.60	0.173		0.181
B	0.70		0.90	0.028		0.035
C	0.45		0.60	0.018		0.024
C2	1.23		1.32	0.048		0.052
C3	2.20		2.60	0.087		0.102
D	8.90		9.90	0.350		0.390
E	9.90		10.3	0.390		0.406
F	6.30		6.90	0.248		0.272
G		2.54			0.1	
H	28.0		29.8	1.102		1.173
L1		3.39			0.133	
L2	1.14		1.70	0.045		0.067
L3	2.65		2.95	0.104		0.116
Φ		3.6			0.142	