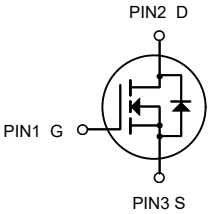
Description

The 4N65F can be used in various power swithching circuit for system miniaturization and higher efficiency.The package form is TO-220/ TO-220F, which accords with the RoHS standard.

TO-220F



N-Channel MOSFET

General Features

V_{DS} = 650V,I_D =20A
$R_{DS(ON)}$ < 0.3Ω@ V_{GS}=10V

Application

● Power switch circuit of adaptor and charger.

Package Marking and Ordering Information

Product ID	Pack	Marking	Units Tube
4N65F	TO-220F	4N65 XXX YYYY	50

Absolute Maximum Ratings@T =25°C(unless otherwise specified)

Symbol	Parameter	Limit	Unit
V_{DSS}	Drain-to-Source Voltage[1]	650	V
V_{GSS}	Gate-to-Source Voltage	±30	
I_D	Continuous Drain Current	4	A
$I_{D\ @\ Tc=100℃}$	Continuous Drain Current @ Tc=100℃	3	
I_{DM}	Pulsed Drain Current at V_{GS}=10V[2]	16	
E_{AS}	Single Pulse Avalanche Energy	125	mJ
P_D	Power Dissipation	27	W
T_L T_{PAK}	Maximum Temperature for Soldering Leads at 0.063in (1.6mm) from Case for 10 seconds, Package Body for 10 seconds	300 260	℃
T_J& T_{STG}	Operating and Storage Temperature Range	-55 to 150	
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	4.7	℃/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	

Caution: Stresses greater than those listed in the "Absolute Maximum Ratings" may cause permanent damage to the device.

Electrical Characteristics T_J =25℃ unless otherwise specified

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	I_D = 250μA, V_{GS} = 0V	650	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 650V, V_{GS} = 0V	-	-	1.0	μA
I_{GSS}	Gate-Body Leakage Current	V_{DS} = 0V, V_{GS} = ±30V	-	-	±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250μA	2	3	4	V
$R_{DS(ON)}$	Static Drain-Source ON-Resistance(4)	V_{GS} = 10V, I_D = 2A	-	2.22	2.64	Ω
C_{iss}	Input Capacitance	V_{GS} = 0V, V_{DS} = 25V, f = 1MHz	-	587	-	pF
C_{oss}	Output Capacitance		-	59	-	pF
C_{rss}	Reverse Transfer Capacitance		-	10	-	pF
Q_g	Total Gate Charge	V_{GS} = 0 to 10V V_{DS} = 520V, I_D = 4A	-	15	-	nC
Q_{gs}	Gate Source Charge		-	3.5	-	nC
Q_{gd}	Gate Drain("Miller") Charge		-	6	-	nC
$t_{d(on)}$	Turn-On DelayTime	V_{GS} = 10V, V_{DD} = 320V I_D= 4A, R_{GEN} = 24Ω	-	13	-	ns
t_r	Turn-On Rise Time		-	22	-	ns
$t_{d(off)}$	Turn-Off DelayTime		-	43	-	ns
t_f	Turn-Off Fall Time		-	27	-	ns
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	4	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	16	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0V, I_S = 4A	-	-	1.2	V
trr	Body Diode Reverse Recovery Time	I_F = 4A, di/dt = 100A/us	-	280	-	ns
Qrr	Body Diode Reverse Recovery Charge		-	2	-	μC

Notes:

1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.
2. E_{AS} condition: Starting T_J=25C, V_{DD}=50V, V_G=10V, R_G=25ohm, L=10mH, I_{AS}=5A
3. $R_{\theta JA}$ is measured with the device mounted on a minimum recommended pad of 2oz copper FR4 PCB
4. Pulse Test: Pulse Width≤300μs, Duty Cycle≤0.5%.

Typical Characteristics

Figure 1: Output Characteristics

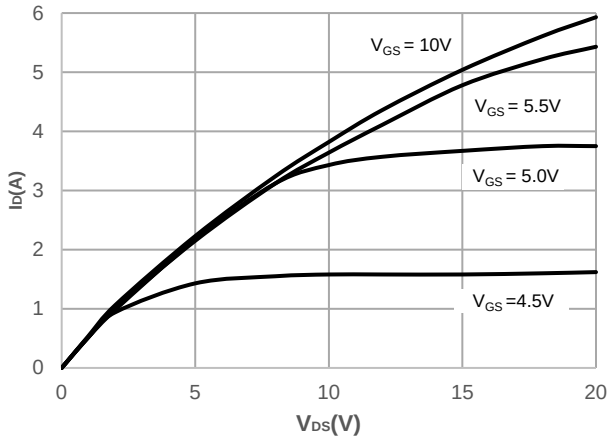


Figure 2: Typical Transfer Characteristics

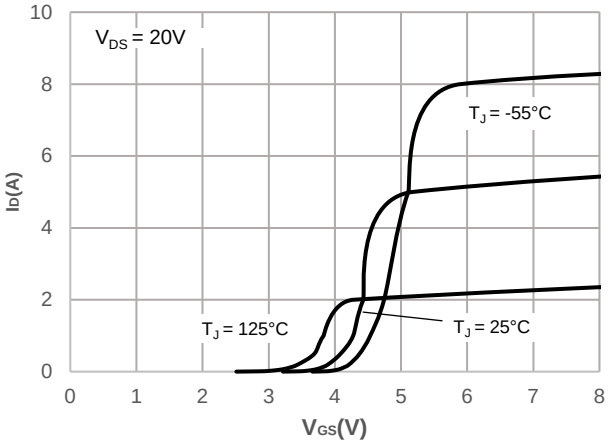


Figure 3: On-resistance vs. Drain Current

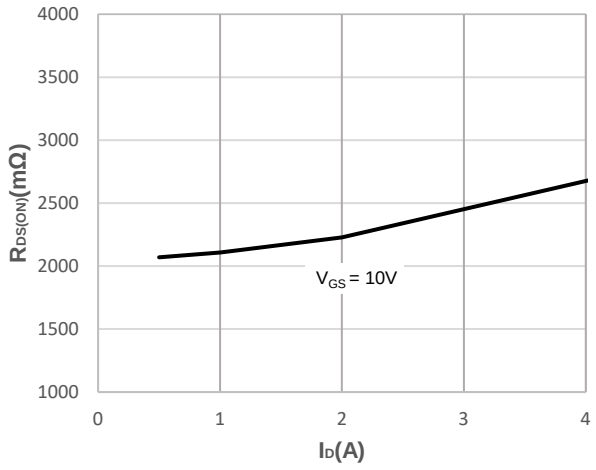


Figure 4: Body Diode Characteristics

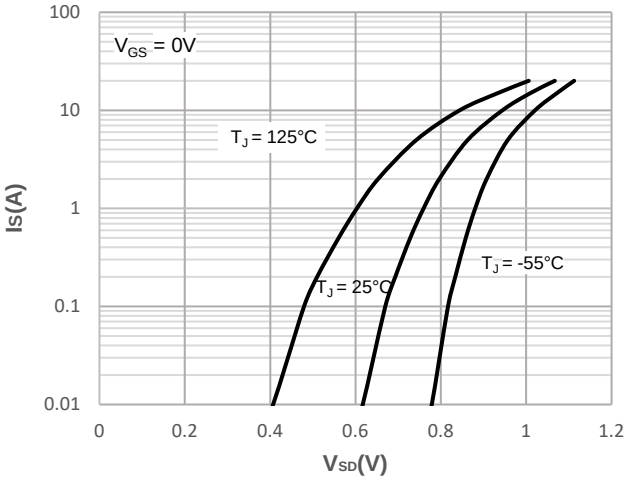


Figure 5: Gate Charge Characteristics

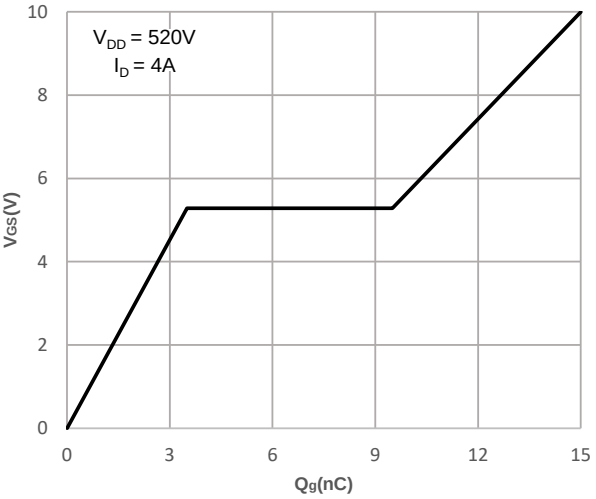


Figure 6: Capacitance Characteristics

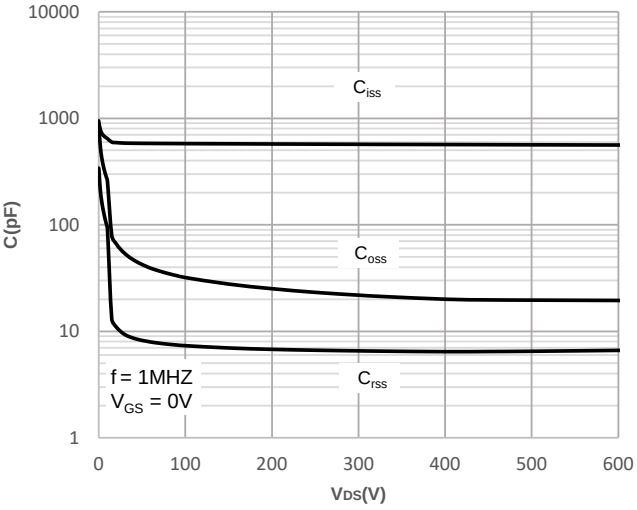


Figure 7: Normalized Breakdown voltage vs. Junction Temperature

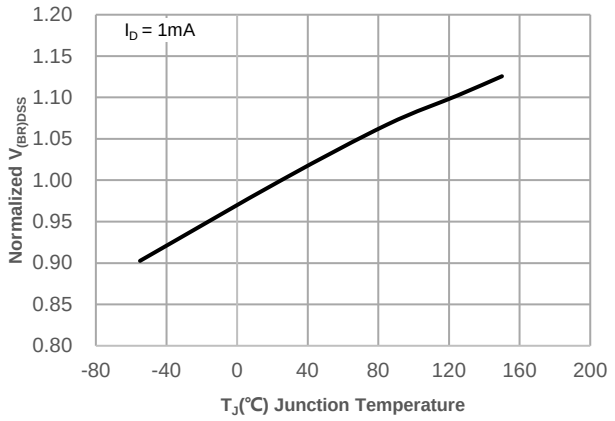


Figure 8: Normalized on Resistance vs. Junction Temperature

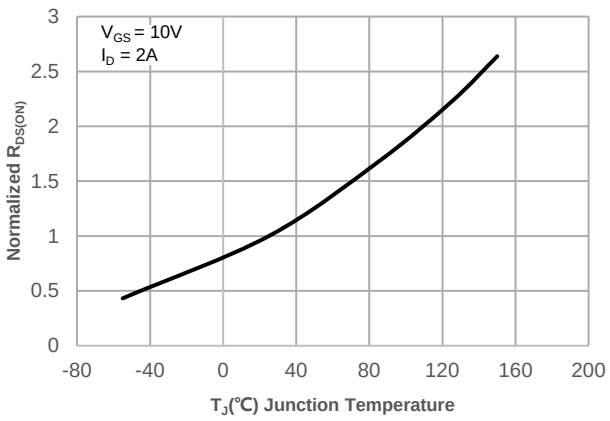


Figure 9: Maximum Safe Operating Area

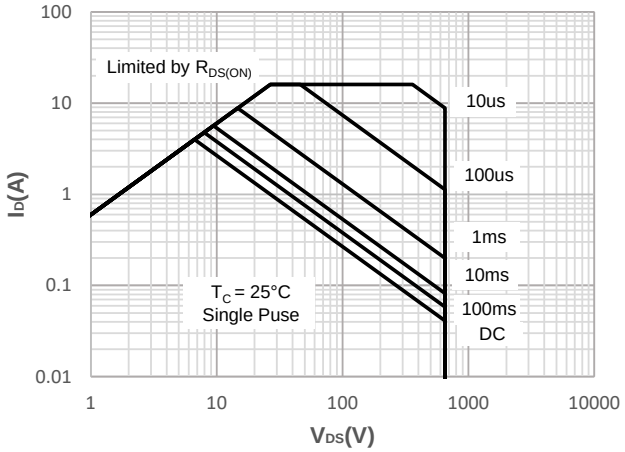


Figure 10: Maximum Continuous Drian Current vs. Case Temperature

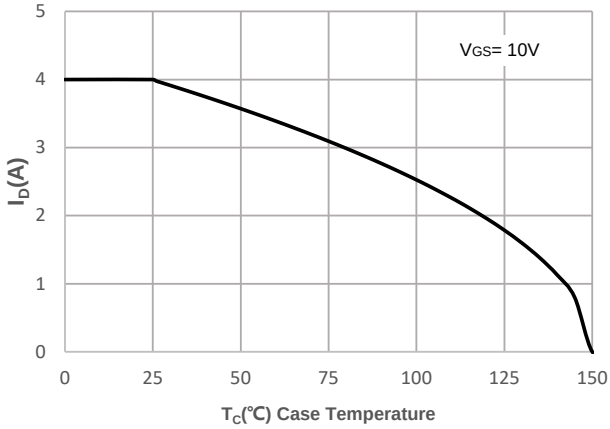


Figure 11: Normalized Maximum Transient Thermal Impedance

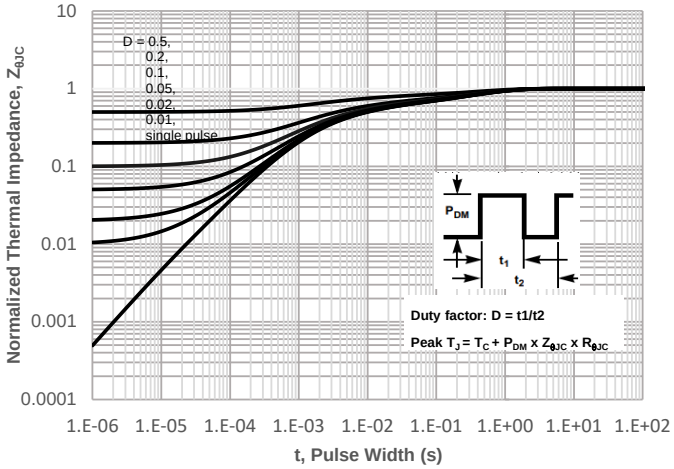
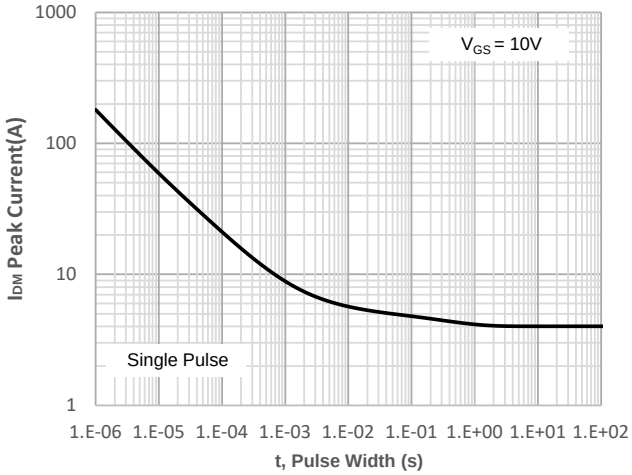


Figure 12: Peak Current Capacity



Test Circuit

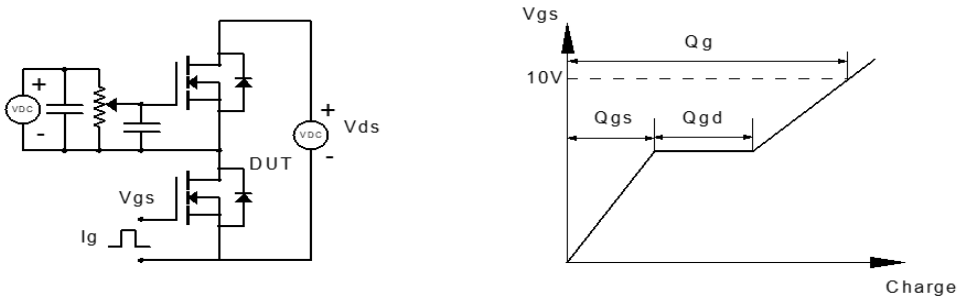


Figure 1: Gate Charge Test Circuit & Waveform

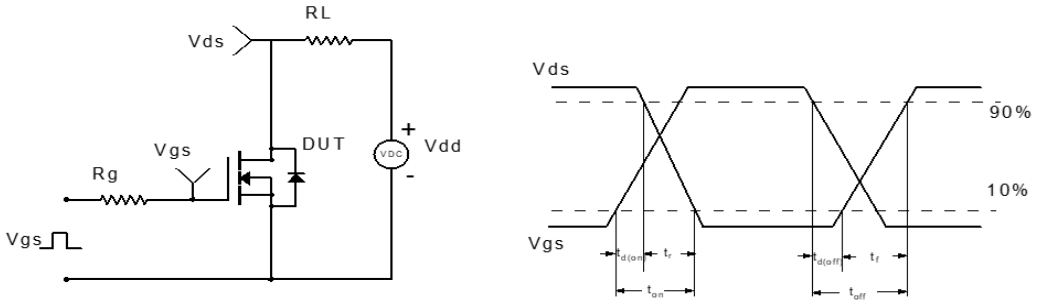


Figure 2: Resistive Switching Test Circuit & Waveform

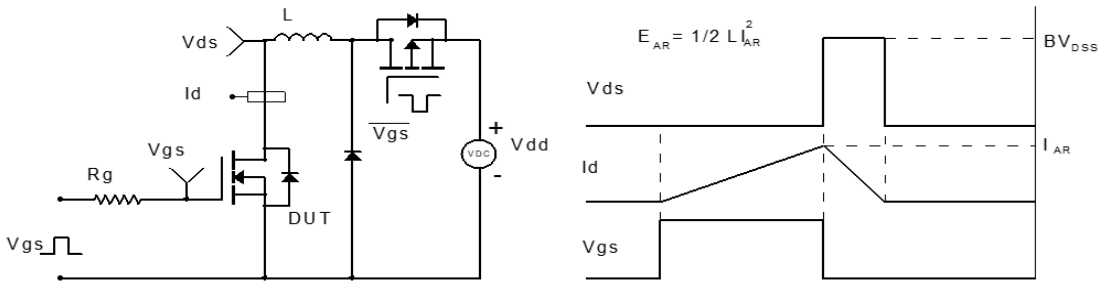


Figure 3: Unclamped Inductive Switching Test Circuit& Waveform

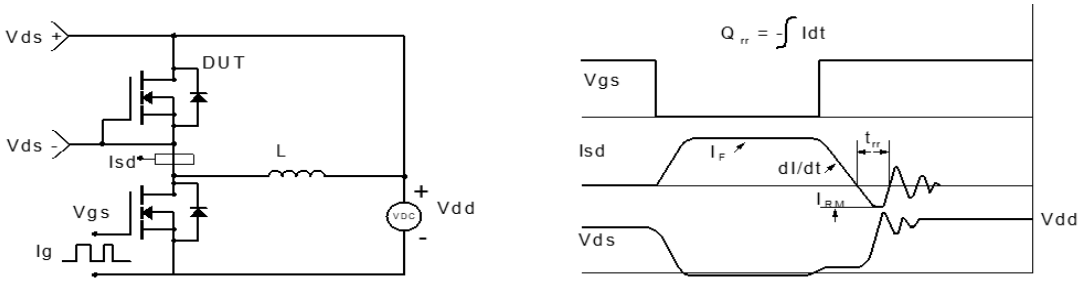
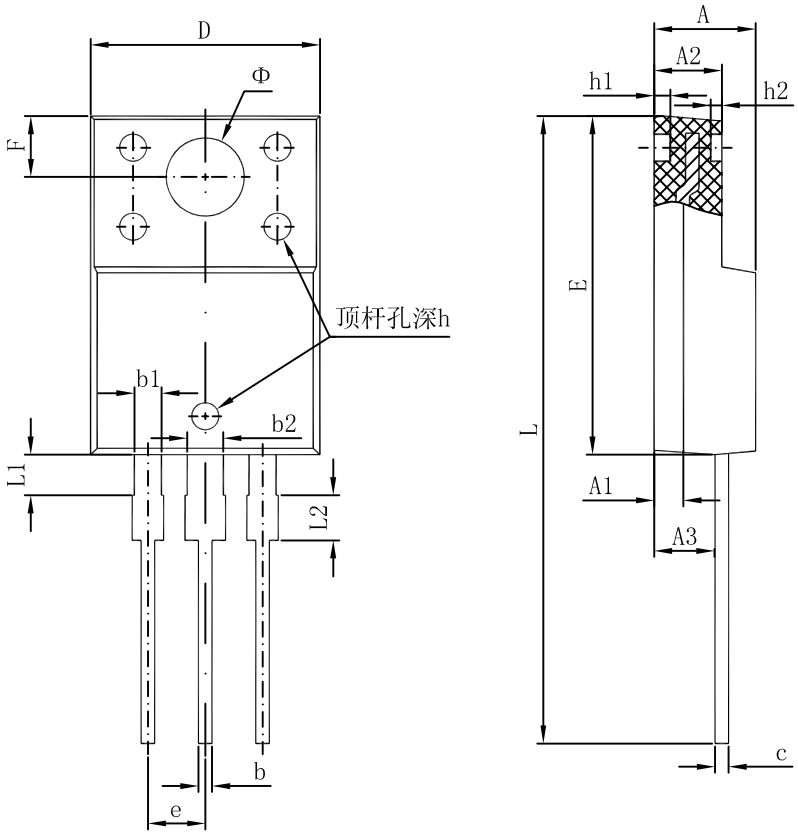


Figure 4: Diode Recovery Test Circuit & Waveform

Package Dimension TO-220F



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	1.900	2.100	0.075	0.083

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