

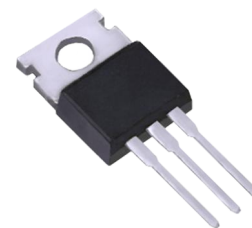
4N65

Power MOSFET

4A, 650V N-CHANNEL POWER MOSFET

■ DESCRIPTION

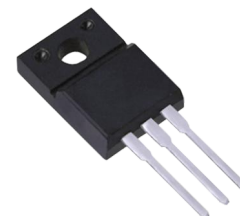
The UTC **4N65** is a high voltage power MOSFET designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristic. This power MOSFET is usually used in high speed switching applications including power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.



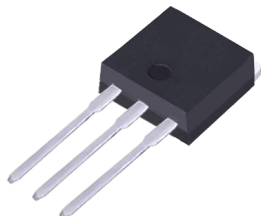
TO-220

■ FEATURES

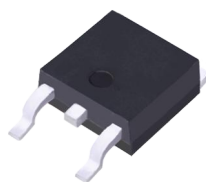
- * $R_{DS(ON)} < 2.5\Omega$ @ $V_{GS} = 10\text{ V}$, $I_D = 2.2\text{ A}$
- * Fast Switching Capability
- * Avalanche Energy Specified
- * Improved dv/dt Capability, High Ruggedness



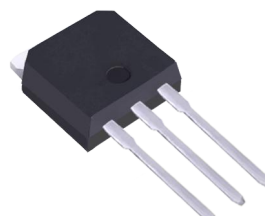
TO-220F



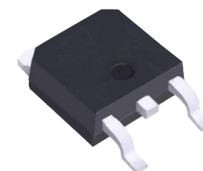
TO-262



TO-263



TO-251



TO-252

■ ABSOLUTE MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DSS}	650	V
Gate-Source Voltage		V_{GSS}	± 30	V
Avalanche Current (Note2)		I_{AR}	4.4	A
Drain Current	Continuous	I_D	4.0	A
	Pulsed (Note2)	I_{DM}	16	A
Avalanche Energy	Single Pulsed (Note3)	E_{AS}	260	mJ
	Repetitive (Note2)	E_{AR}	10.6	mJ
Peak Diode Recovery dv/dt (Note4)		dv/dt	4.5	V/ns
Power Dissipation	TO-220/TO-262/TO-263	P_D	106	W
	TO-220F/TO-220F1 TO-220F3		35	W
	TO-220F2		36	W
	TO-251/ TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		50	W
	DFN5060-8		30	W
	Junction Temperature		T_J	+150
Operating Temperature		T_{OPR}	-55 ~ +150	$^\circ\text{C}$
Storage Temperature		T_{STG}	-55 ~ +150	$^\circ\text{C}$

Note: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2. Repetitive Rating: Pulse width limited by maximum junction temperature.

3. $L = 30\text{mH}$, $I_{AS} = 4\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\ \Omega$, Starting $T_J = 25^\circ\text{C}$

4. $I_{SD} \leq 4.4\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER	PACKAGE	SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-262/TO-263 TO-220F/TO-220F1 TO-220F2/TO-220F3	θ_{JA}	62.5	$^\circ\text{C}/\text{W}$
	TO-251/ TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		110	$^\circ\text{C}/\text{W}$
	DFN5060-8		75	$^\circ\text{C}/\text{W}$
	Junction to Case		θ_{JC}	1.18
TO-220/TO-262/TO-263	3.5	$^\circ\text{C}/\text{W}$		
TO-220F/TO-220F1 TO-220F3	3.4	$^\circ\text{C}/\text{W}$		
TO-220F2	2.5	$^\circ\text{C}/\text{W}$		
TO-251/ TO-251S TO-251S2/TO-251S4 TO-252/TO-252D	4.17	$^\circ\text{C}/\text{W}$		
DFN5060-8				

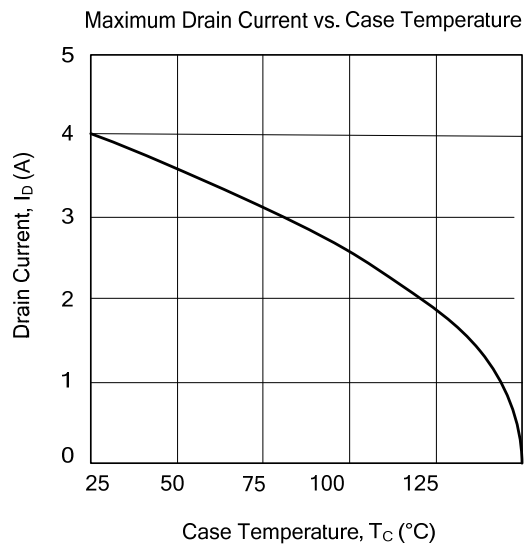
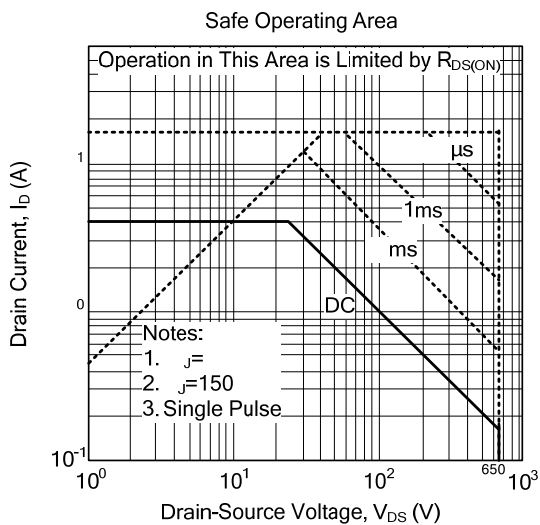
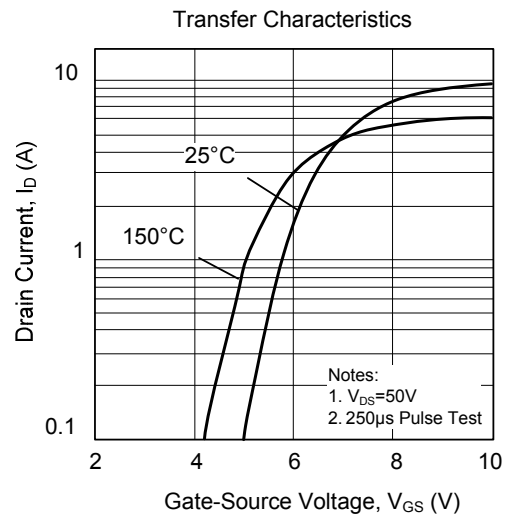
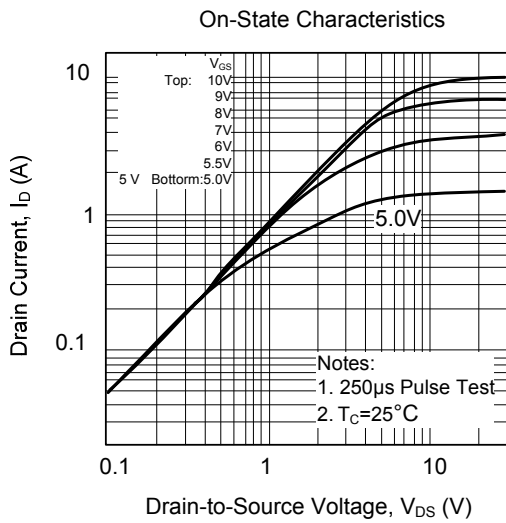
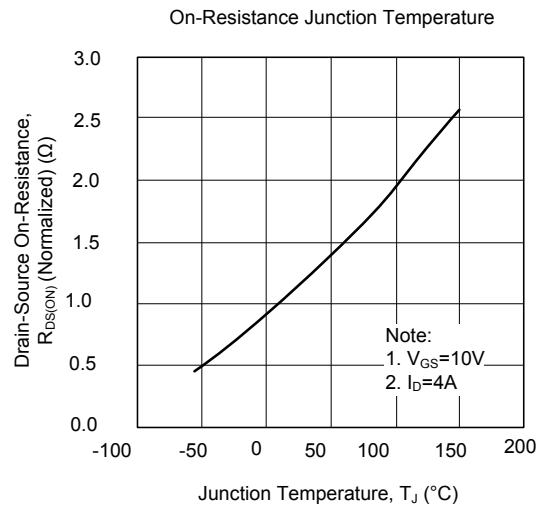
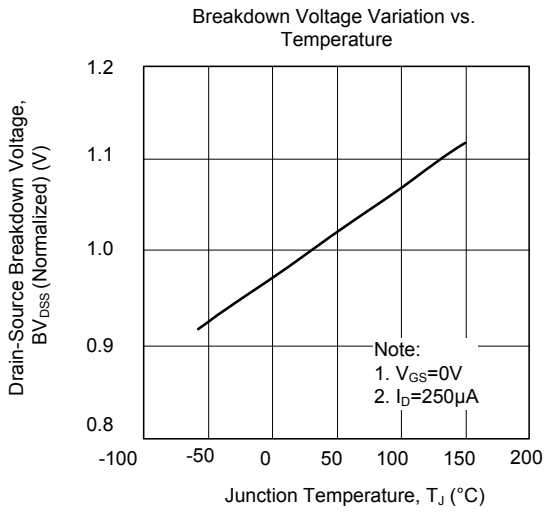
■ ELECTRICAL CHARACTERISTICS (T_C=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} = 0 V, I _D = 250μA	650			V	
Drain-Source Leakage Current	I _{DSS}	V _{DS} = 650 V, V _{GS} = 0 V			10	μA	
		V _{DS} = 480 V, T _C = 125°C			100	μA	
Gate-Source Leakage Current	I _{GSS}	V _{GS} = 30 V, V _{DS} = 0 V			100	nA	
		V _{GS} = -30 V, V _{DS} = 0 V			-100	nA	
Breakdown Voltage Temperature Coefficient	ΔBV _{DSS} /ΔT _J	I _D =250μA, Referenced to 25°C		0.6		V/°C	
ON CHARACTERISTICS							
Gate Threshold Voltage	V _{GS(TH)}	V _{DS} = V _{GS} , I _D = 250μA	2.0		4.0	V	
Static Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} = 10 V, I _D = 2.2A		2.4	2.5	Ω	
DYNAMIC CHARACTERISTICS							
Input Capacitance	C _{ISS}	V _{DS} = 25 V, V _{GS} = 0V, f = 1MHz		670	750	pF	
Output Capacitance	C _{OSS}				70	90	pF
Reverse Transfer Capacitance	C _{RSS}				23	26	pF
SWITCHING CHARACTERISTICS							
Total Gate Charge	Q _G	V _{DS} = 520V, I _D = 4.0A, V _{GS} = 10V (Note 1, 2)		100	120	nC	
Gate-Source Charge	Q _{GS}				17	19	nC
Gate-Drain Charge	Q _{GD}				20	26	nC
Turn-On Delay Time	t _{D(ON)}	V _{DS} = 325V, I _D = 4.0A, R _G = 25Ω (Note 1, 2)		45	85	ns	
Turn-On Rise Time	t _R				100	140	ns
Turn-Off Delay Time	t _{D(OFF)}				200	240	ns
Turn-Off Fall Time	t _F				130	150	ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Continuous Drain-Source Diode Forward Current	I _S				4.4	A	
Maximum Pulsed Drain-Source Diode Forward Current	I _{SM}				17.6	A	
Drain-Source Diode Forward Voltage	V _{SD}	V _{GS} = 0 V, I _S = 4.4A			1.4	V	
Reverse Recovery Time	t _{rr}	V _{GS} = 0V, I _S = 4.4A,		250		ns	
Reverse Recovery Charge	Q _{rr}	di _F /dt = 100 A/μs (Note 1)		1.5		μC	

Note: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.

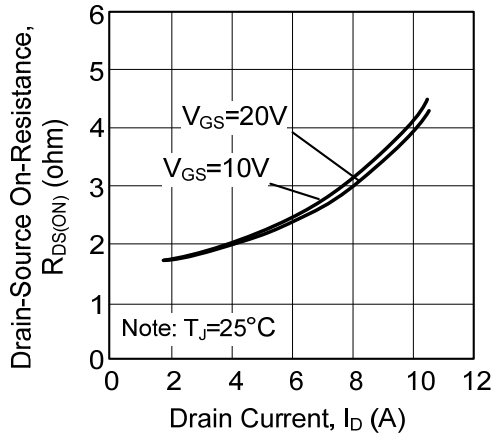
2. Essentially independent of operating temperature.

TYPICAL CHARACTERISTICS

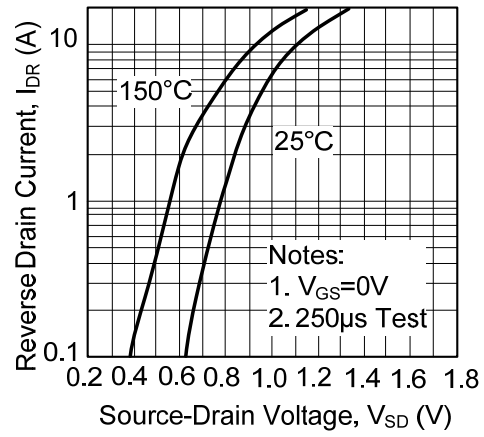


■ TYPICAL CHARACTERISTICS(Cont.)

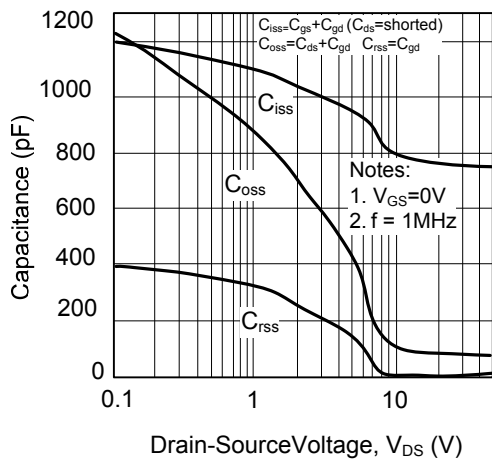
On-Resistance Variation vs. Drain Current and Gate Voltage



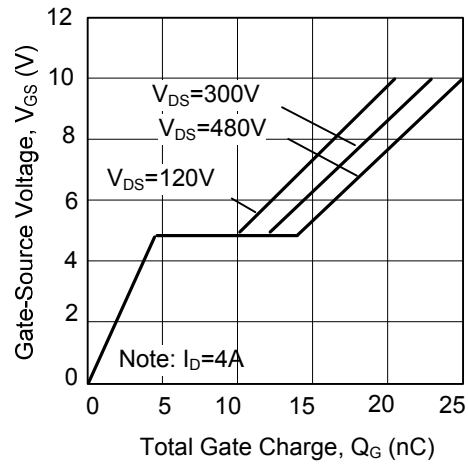
On State Current vs. Allowable Case Temperature



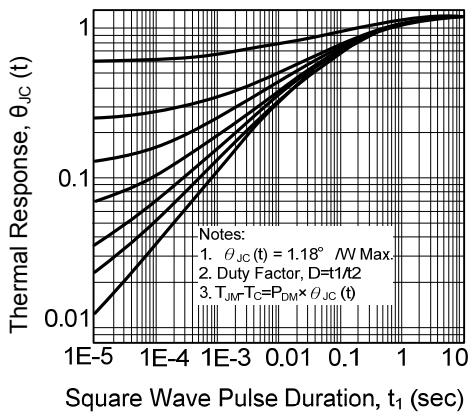
Capacitance Characteristics (Non-Repetitive)



Gate Charge Characteristics



Transient Thermal Response Curve



Power Dissipation

