



4N65-U

Power MOSFET

4A, 650V N-CHANNEL POWER MOSFET

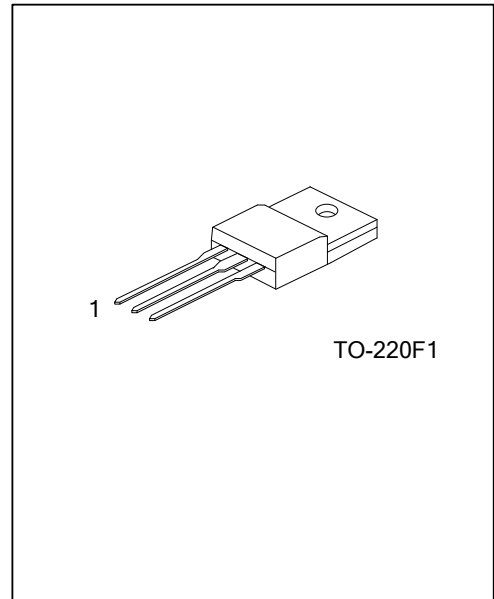
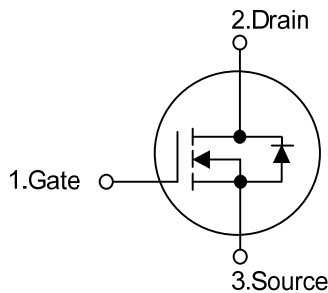
DESCRIPTION

The UTC **4N65-U** 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.

FEATURES

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

SYMBOL



ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
4N65L- TF1-T	4N65G-TF1-T	TO-220F1	G	D	S	Tube

Note: Pin Assignment: G: Gate D: Drain S: Source

<p>4N65L-TF1-T</p> <p>(1)Packing Type</p> <p>(2)Package Type</p> <p>(3)Lead Free</p>	<p>(1) T: Tube</p> <p>(2) TF1: TO-220F1</p> <p>(3) L: Lead Free, G: Halogen Free</p>
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MARKING INFORMATION

PACKAGE	MARKING
TO-220F1	<p>UTC</p> <p>4N65</p> <p>Lot Code</p> <p>1</p> <p>L: Lead Free</p> <p>G: Halogen Free</p> <p>Data Code</p>

■ 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}	240	mJ
	Repetitive (Note2)	E_{AR}	10.6	mJ
Peak Diode Recovery dv/dt (Note4)		dv/dt	4.5	V/ns
Power Dissipation		P_D	36	W
Junction Temperature		T_J	+150	$^\circ\text{C}$
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	SYMBOL	RATING	UNIT
Junction to Ambient	θ_{JA}	62.5	$^\circ\text{C}/\text{W}$
Junction to Case	θ_{JC}	3.47	$^\circ\text{C}/\text{W}$

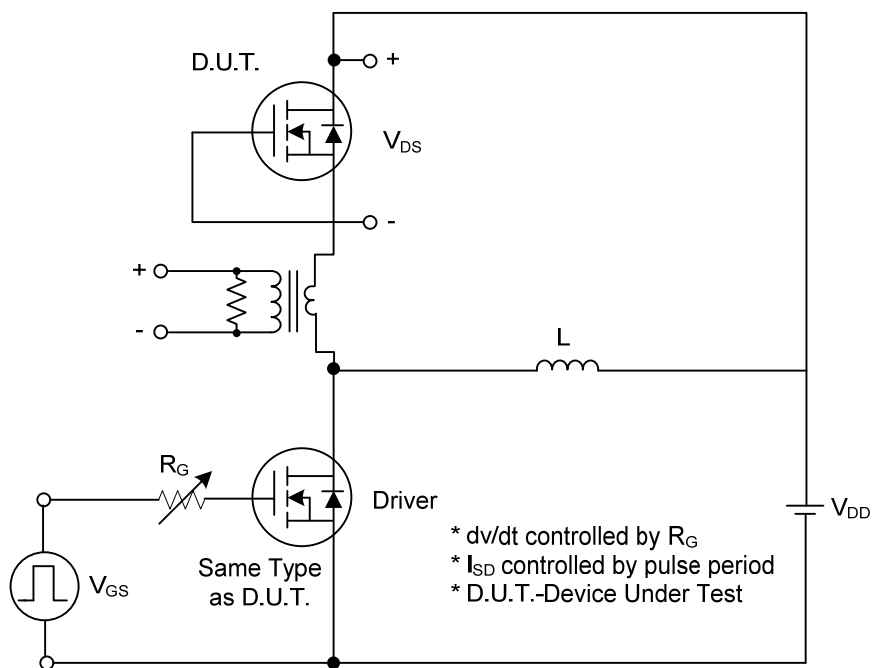
■ ELECTRICAL CHARACTERISTICS (T_C=25°C, unless otherwise specified)

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} = 520 V, T _C =125°C			100	μA
Gate-Source Leakage Current	Forward	I _{GSS}	V _{GS} = 30 V, V _{DS} = 0 V			100	nA
	Reverse		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		980	1120	pF
Output Capacitance		C _{OSS}			55	70	pF
Reverse Transfer Capacitance		C _{RSS}			44	55	pF
SWITCHING CHARACTERISTICS							
Turn-On Delay Time		t _{D(ON)}	V _{DS} = 30V, I _D = 1.0A, R _G = 25Ω (Note 1, 2)		68	108	ns
Turn-On Rise Time		t _R			210	250	ns
Turn-Off Delay Time		t _{D(OFF)}			104	144	ns
Turn-Off Fall Time		t _F			35	80	ns
Total Gate Charge		Q _G	V _{DS} =120V,I _D =4.0A, I _G =3.3mA, V _{GS} =10V (Note 1, 2)		96		nC
Gate-Source Charge		Q _{GS}			11		nC
Gate-Drain Charge		Q _{GD}			45		nC
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Drain-Source Diode Forward Voltage		V _{SD}	V _{GS} = 0 V, I _S = 4A			1.4	V
Maximum Continuous Drain-Source Diode Forward Current		I _S				4	A
Maximum Pulsed Drain-Source Diode Forward Current		I _{SM}				16	A
Reverse Recovery Time		t _{rr}	V _{GS} = 0V, I _S = 4A,		250		ns
Reverse Recovery Charge		Q _{RR}	dl _F /dt = 100 A/μs (Note 1)		1.5		μC

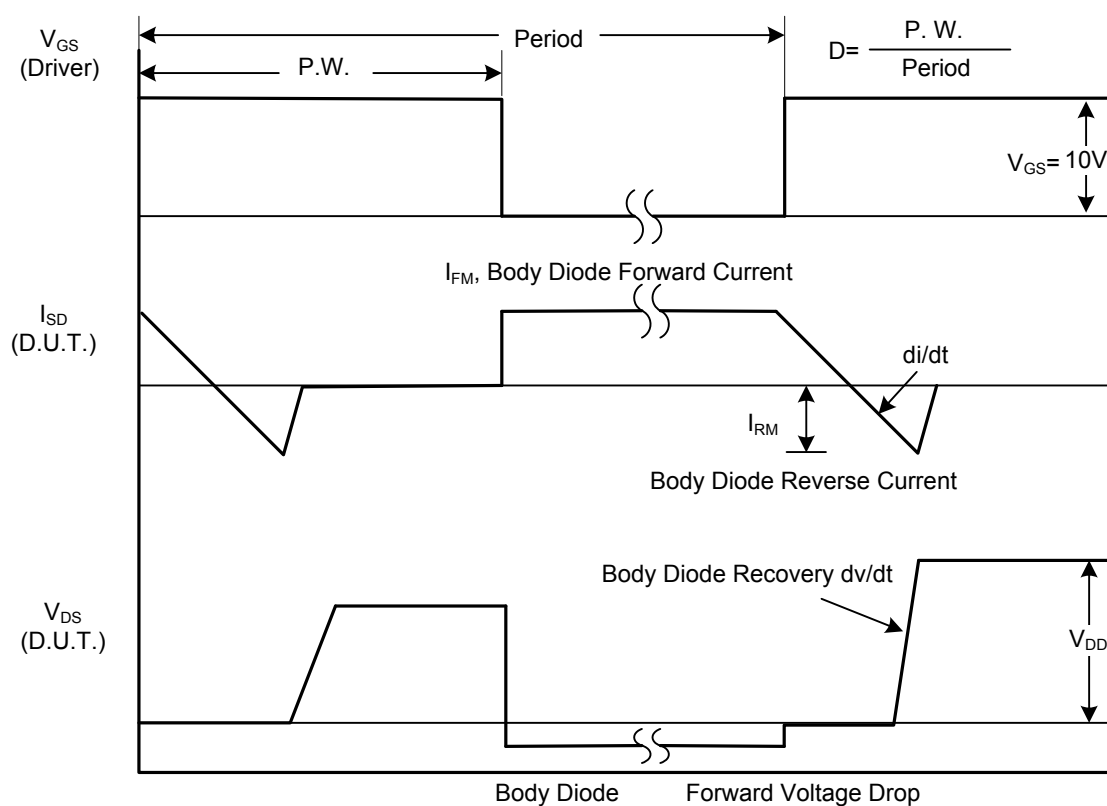
Note: 1. Pulse Test: Pulse width≤300μs, Duty cycle≤2%.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

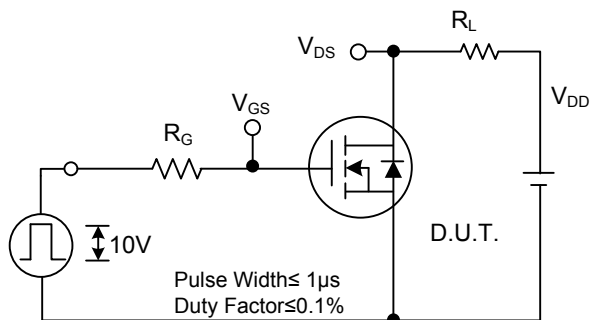


Peak Diode Recovery dv/dt Test Circuit

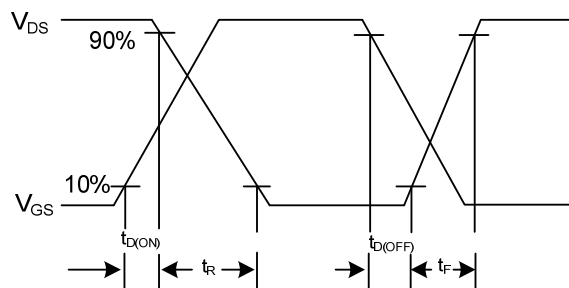


Peak Diode Recovery dv/dt Waveforms

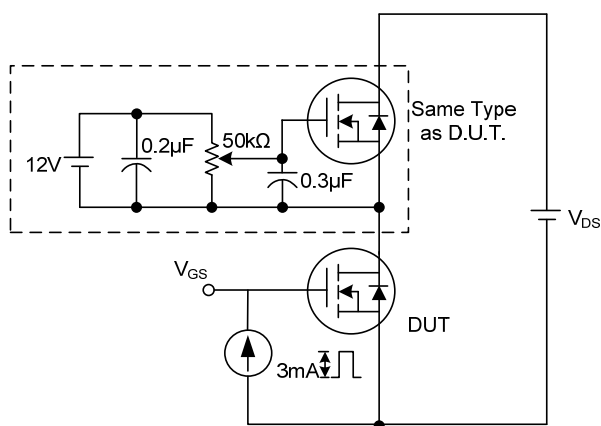
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



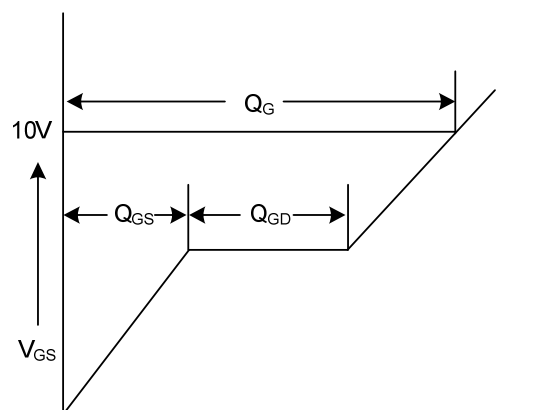
Switching Test Circuit



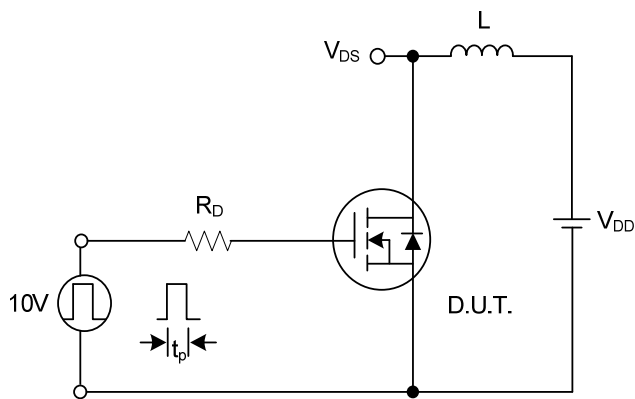
Switching Waveforms



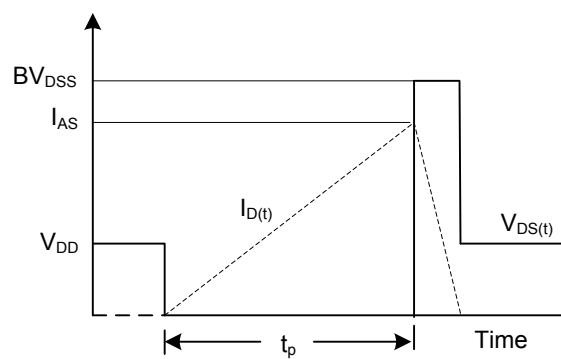
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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