



4N60Z-E

Power MOSFET

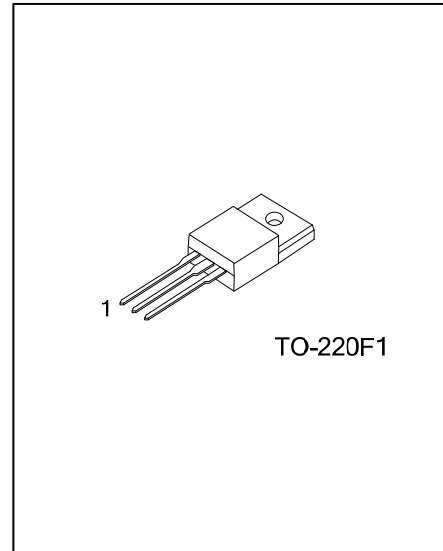
4A, 600V N-CHANNEL POWER MOSFET

DESCRIPTION

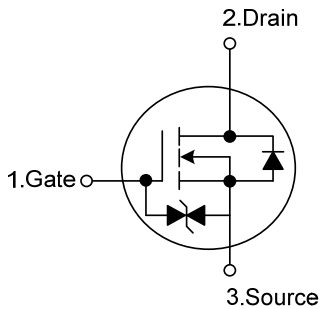
The UTC **4N60Z-E** is a high voltage power MOSFET and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

FEATURES

- * $R_{DS(ON)}=2.5\Omega @ V_{GS}=10V, I_D=2.2A$
- * 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	
4N60ZL-TF1-T	4N60ZG-TF1-T	TO-220F1	G	D	S	Tube

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

<p>4N60ZL-TF1-T</p> <p>(1)Packing Type (2)Package Type (3)Lead Free</p>	<p>(1) T: Tube (2) TF1: TO-220F1 (3) L: Lead Free, G: Halogen Free</p>
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■ ABSOLUTE MAXIMUM RATINGS ($T_C=25^{\circ}\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Drain-Source Voltage	V_{DSS}	600	V
Gate-Source Voltage	V_{GSS}	± 20	V
Avalanche Current (Note 2)	I_{AR}	4.4	A
Drain Current	Continuous	I_D	4.0
	Pulsed (Note 2)	I_{DM}	16
Avalanche Energy Single	Single Pulsed (Note 3)	E_{AS}	200
	Repetitive (Note 2)	E_{AR}	10.6
Peak Diode Recovery dv/dt (Note 4)	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	$^{\circ}\text{C}$

Notes: 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. $L = 30\text{mH}$, $I_{AS} = 3.65\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\ \Omega$, 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	RATINGS	UNIT
Junction to Ambient	θ_{JA}	62.5	$^{\circ}\text{C}/\text{W}$
Junction to Case	θ_{JC}	3.47	$^{\circ}\text{C}/\text{W}$

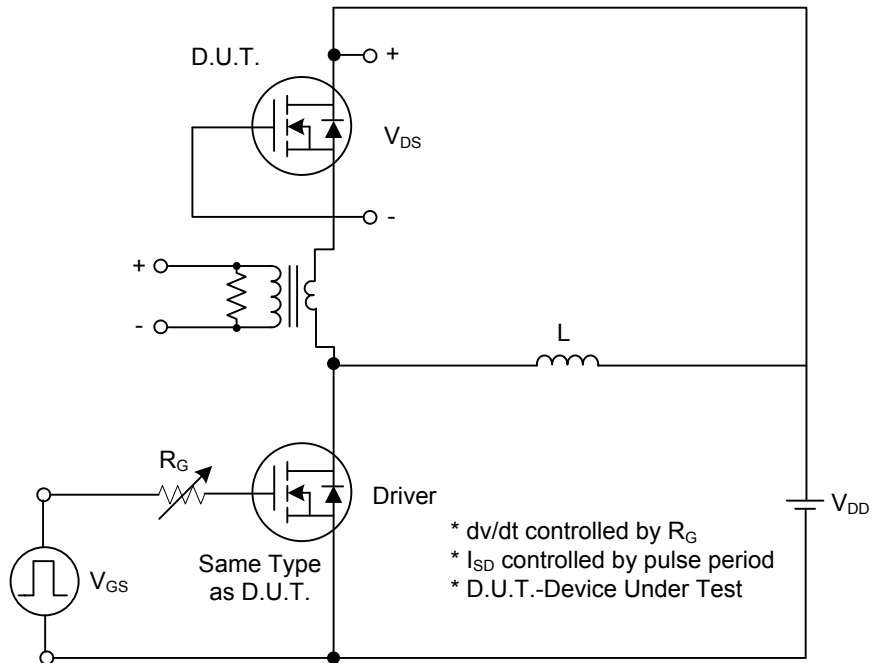
■ ELECTRICAL CHARACTERISTICS (T_C=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} = 0V, I _D = 250μA	600			V
Drain-Source Leakage Current	I _{DSS}	V _{DS} = 600V, V _{GS} = 0V			10	μA
Gate-Source Leakage Current	Forward	I _{GSS}			5	μA
	Reverse				-5	μA
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		2.0	2.5	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C _{ISS}	V _{DS} = 25V, V _{GS} = 0V, f = 1MHz		550	680	pF
Output Capacitance	C _{OSS}			60	80	pF
Reverse Transfer Capacitance	C _{RSS}			12.5	16	pF
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	t _{D(ON)}	V _{DD} =30V, V _{GS} =0~10V, I _D =0.5A R _G = 25Ω (Note 1, 2)		50	70	ns
Turn-On Rise Time	t _R			260	280	ns
Turn-Off Delay Time	t _{D(OFF)}			145	160	ns
Turn-Off Fall Time	t _F			300	320	ns
Total Gate Charge	Q _G	V _{DD} = 50V, V _{DS} =10V, I _D = 1.3A,		60	80	nC
Gate-Source Charge	Q _{GS}	I _G = 100μA, V _{GS} = 10V		15		nC
Gate-Drain Charge	Q _{GD}	(Note 1, 2)		18		nC
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS						
Drain-Source Diode Forward Voltage	V _{SD}	V _{GS} = 0V, I _S = 4.4A			1.4	V
Maximum Continuous Drain-Source Diode Forward Current	I _S				4.4	A
Maximum Pulsed Drain-Source Diode Forward Current	I _{SM}				17.6	A
Reverse Recovery Time	t _{rr}	V _{GS} = 0 V, I _S = 4.4A,		250		ns
Reverse Recovery Charge	Q _{RR}	dI _F /dt = 100 A/μs (Note 1)		1.5		μC

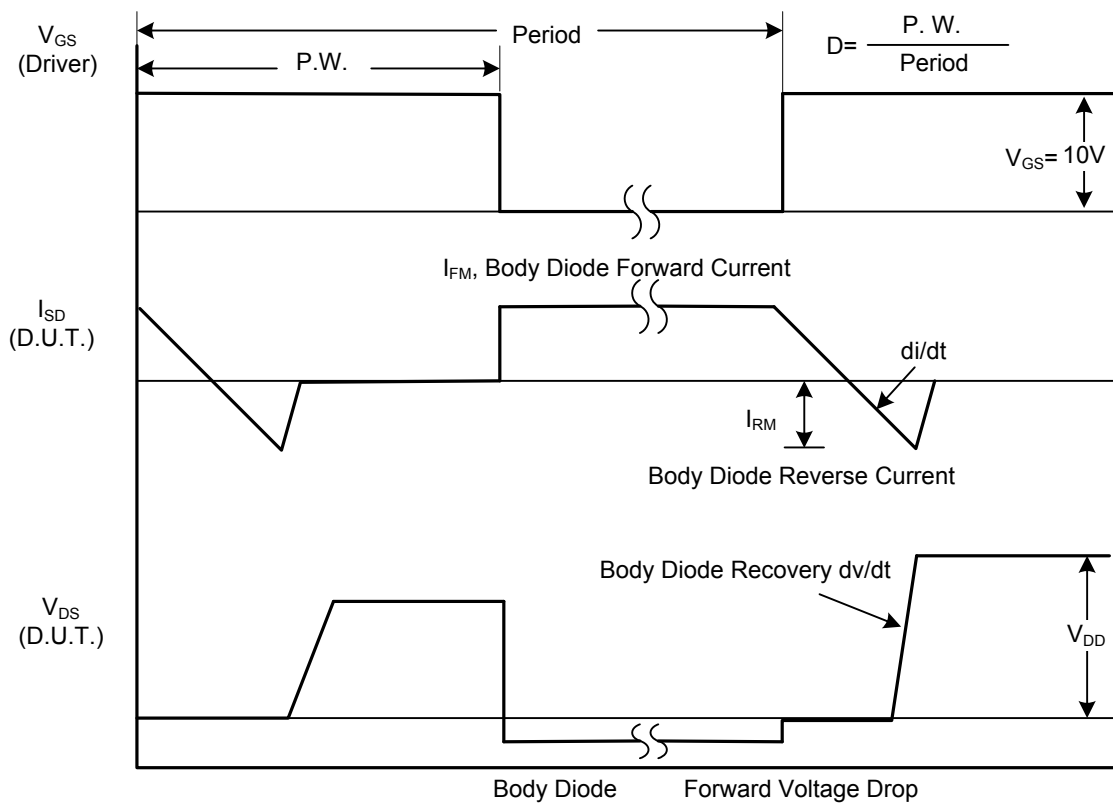
Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%

2. Essentially independent of operating temperature

TEST CIRCUITS AND WAVEFORMS

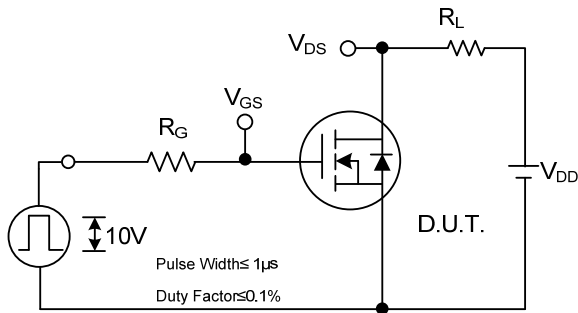


Peak Diode Recovery dv/dt Test Circuit

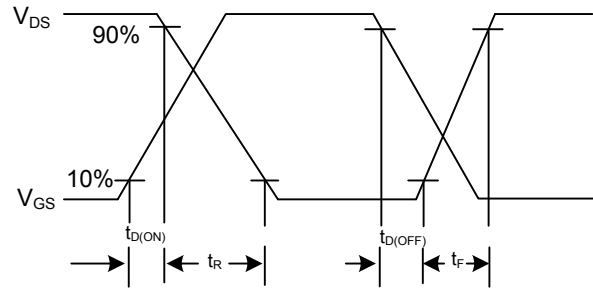


Peak Diode Recovery dv/dt Waveforms

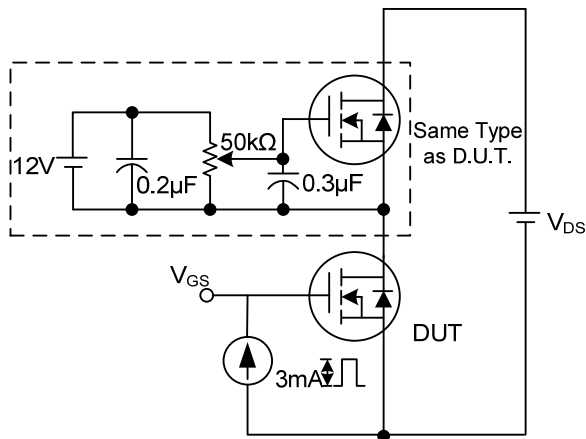
TEST CIRCUITS AND WAVEFORMS (Cont.)



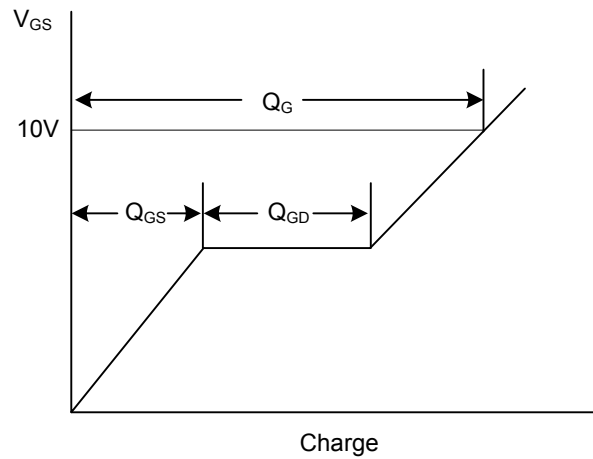
Switching Test Circuit



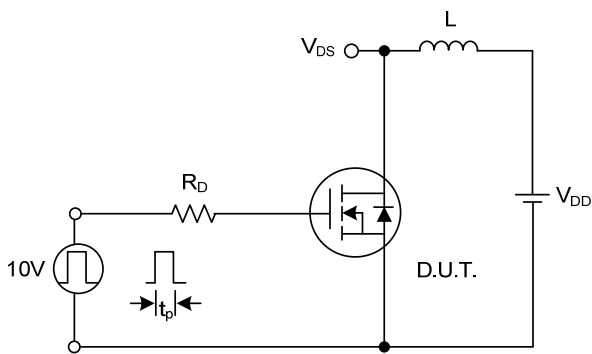
Switching Waveforms



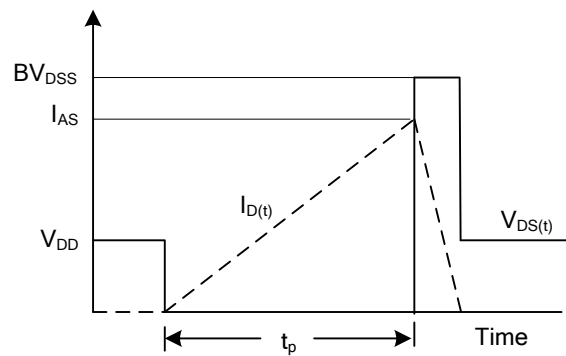
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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