



2N60-C

Power MOSFET

2A, 600V N-CHANNEL POWER MOSFET

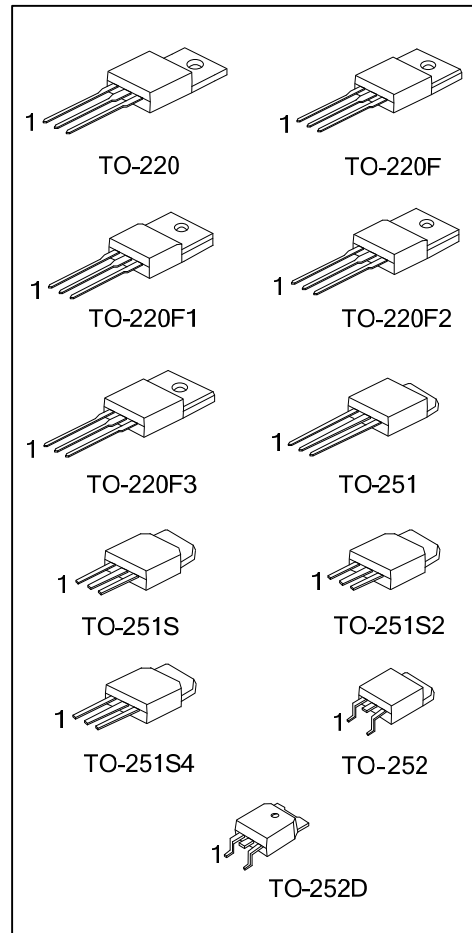
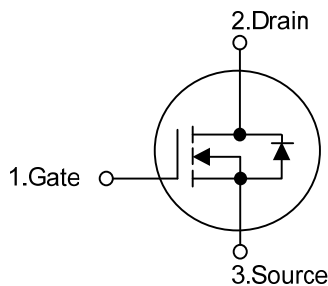
DESCRIPTION

The UTC **2N60-C** 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

- * $R_{DS(ON)} < 4.6 \Omega @ V_{GS} = 10V, I_D = 1A$
- * Fast switching capability
- * Avalanche energy specified
- * Improved dv/dt capability, high ruggedness

SYMBOL



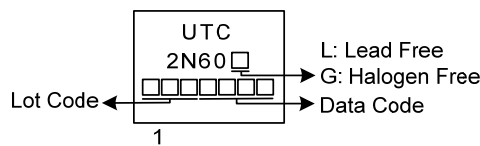
ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
2N60L-TA3-T	2N60G-TA3-T	TO-220	G	D	S	Tube
2N60L-TF3-T	2N60G-TF3-T	TO-220F	G	D	S	Tube
2N60L-TF1-T	2N60G-TF1-T	TO-220F1	G	D	S	Tube
2N60L-TF2-T	2N60G-TF2-T	TO-220F2	G	D	S	Tube
2N60L-TF3T-T	2N60G-TF3T-T	TO-220F3	G	D	S	Tube
2N60L-TM3-T	2N60G-TM3-T	TO-251	G	D	S	Tube
2N60L-TMS-T	2N60G-TMS-T	TO-251S	G	D	S	Tube
2N60L-TMS2-T	2N60G-TMS2-T	TO-251S2	G	D	S	Tube
2N60L-TMS4-T	2N60G-TMS4-T	TO-251S4	G	D	S	Tube
2N60L-TN3-R	2N60G-TN3-R	TO-252	G	D	S	Tape Reel
2N60L-TND-R	2N60G-TND-R	TO-252D	G	D	S	Tape Reel

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

<p>2N60L-TA3-T</p> <p>(1) Packing Type</p> <p>(2) Package Type</p> <p>(3) Green Package</p>	<p>(1) T: Tube, R: Tape Reel</p> <p>(2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1, TF2: TO-220F2, TF3: TO-220F3, TM3: TO-251, TMS: TO-251S, TMS2: TO-251S2, TMS4: TO-251S4, TN3: TO-252, TND: TO-252D</p> <p>(3) L: Lead Free, G: Halogen Free and Lead Free</p>
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MARKING



■ 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}	± 30	V
Avalanche Current (Note 2)		I_{AR}	2.0	A
Drain Current	Continuous	I_D	2.0	A
	Pulsed (Note 2)	I_{DM}	8.0	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	140	mJ
	Repetitive (Note 2)	E_{AR}	4.5	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	3.7	V/ns
Power Dissipation	TO-220	P_D	54	W
	TO-220F/TO-220F1		23	
	TO-220F3			
	TO-220F2		24	
	TO-251/TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		44	
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 T_J

3. $L=70\text{mH}$, $I_{AS}=2.0\text{A}$, $V_{DD}=50\text{V}$, $R_G=25\ \Omega$, Starting $T_J = 25^\circ\text{C}$

4. $I_{SD} \leq 2\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	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		100	
Junction to Case	TO-220F/TO-220F1 TO-220F3	θ_{JC}	5.5	$^\circ\text{C}/\text{W}$
	TO-220F2		5.43	
	TO-251/TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		2.87	

■ ELECTRICAL CHARACTERISTICS ($T_J=25^\circ\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS} = 0V, I_D = 250\mu A$	600			V
Drain-Source Leakage Current	I_{DSS}	$V_{DS} = 600V, V_{GS} = 0V$			10	μA
		$V_{DS} = 480V, T_C = 125^\circ\text{C}$			100	μA
Gate-Source Leakage Current	Forward	I_{GSS}			100	nA
	Reverse					
		$V_{GS} = -30V, V_{DS} = 0V$			-100	nA
Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	$I_D=250\mu A$, Referenced to 25°C		0.4		$V/^\circ\text{C}$
ON CHARACTERISTICS						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.0		4.0	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 1A$			4.6	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{ISS}	$V_{DS}=25V, V_{GS}=0V, f=1\text{MHz}$		300	350	pF
Output Capacitance	C_{OSS}			45	50	pF
Reverse Transfer Capacitance	C_{RSS}			10	13	pF
SWITCHING CHARACTERISTICS						
Total Gate Charge	Q_G	$V_{DS}=50V, V_{GS}=10V, I_D=1.3A$ $I_G = 100\mu A$ (Note 1, 2)		35		nC
Gate-Source Charge	Q_{GS}			3.5		nC
Gate-Drain Charge	Q_{GD}			2.5		nC
Turn-On Delay Time	$t_{D(ON)}$	$V_{DD}=30V, I_D=0.5A, R_G=25\Omega,$ $V_{GS}=10V$ (Note 1, 2)		30		ns
Turn-On Rise Time	t_R			25		ns
Turn-Off Delay Time	$t_{D(OFF)}$			90		ns
Turn-Off Fall Time	t_F			25		ns
DRAIN-SOURCE DIODE CHARACTERISTICS						
Drain-Source Diode Forward Voltage	V_{SD}	$V_{GS} = 0V, I_{SD} = 2.0A$			1.4	V
Continuous Drain-Source Current	I_{SD}				2.0	A
Pulsed Drain-Source Current	I_{SM}				8.0	A
Reverse Recovery Time	t_{rr}	$V_{GS} = 0V, I_{SD} = 2A,$ $di/dt = 100A/\mu s$ (Note 1)		275		ns
Reverse Recovery Charge	Q_{RR}			1.1		μC

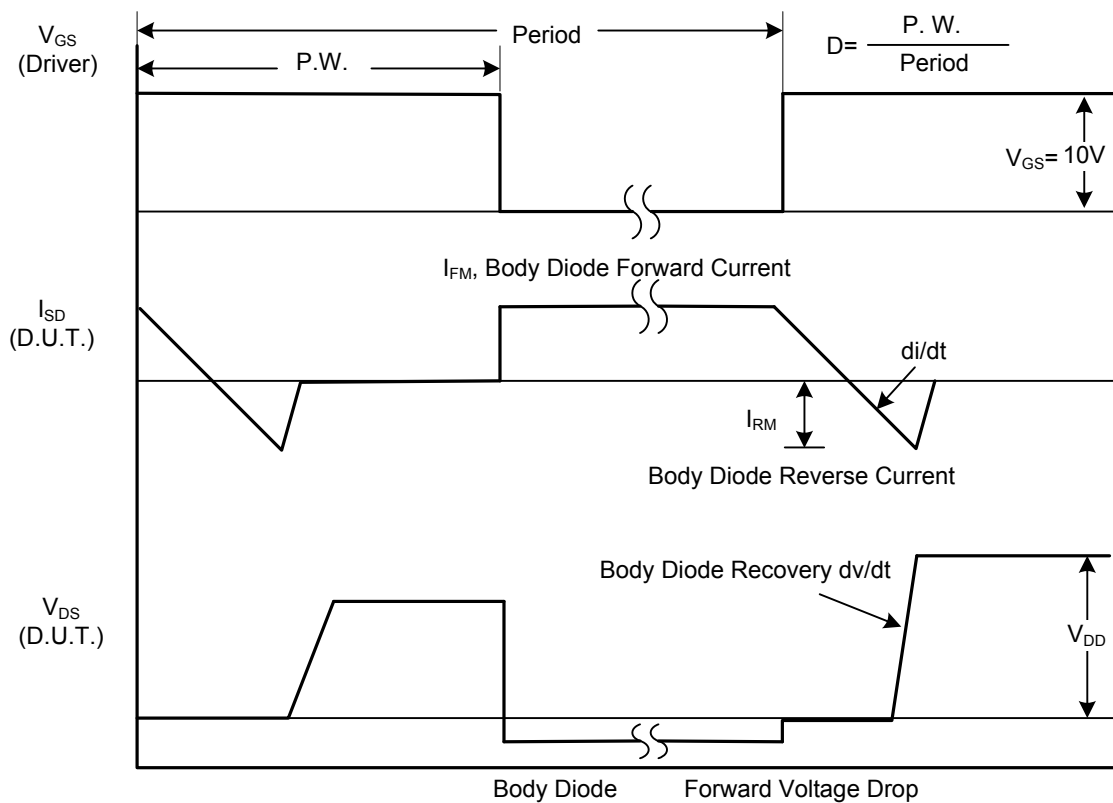
Notes: 1. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS



Peak Diode Recovery dv/dt Test Circuit

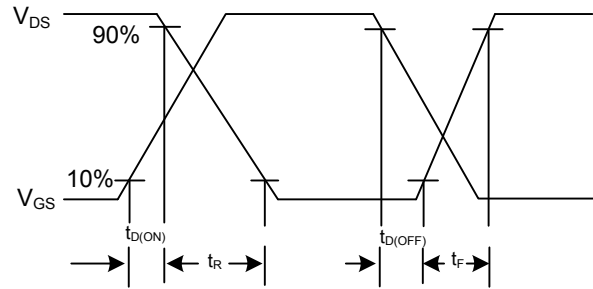


Peak Diode Recovery dv/dt Waveforms

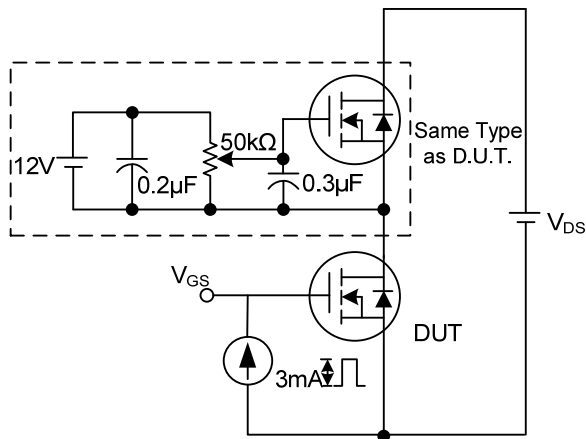
TEST CIRCUITS AND WAVEFORMS (Cont.)



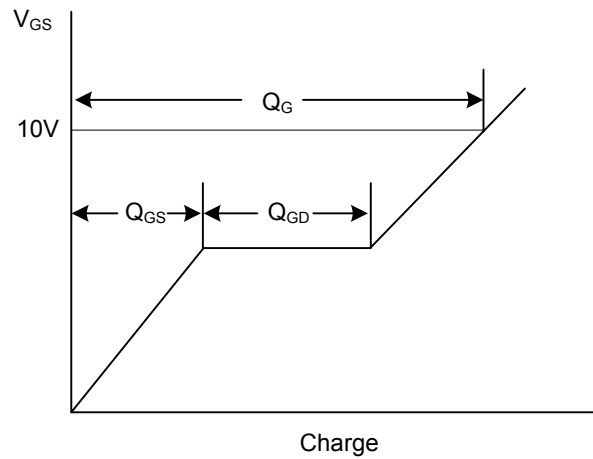
Switching Test Circuit



Switching Waveforms



Gate Charge Test Circuit



Gate Charge Waveform

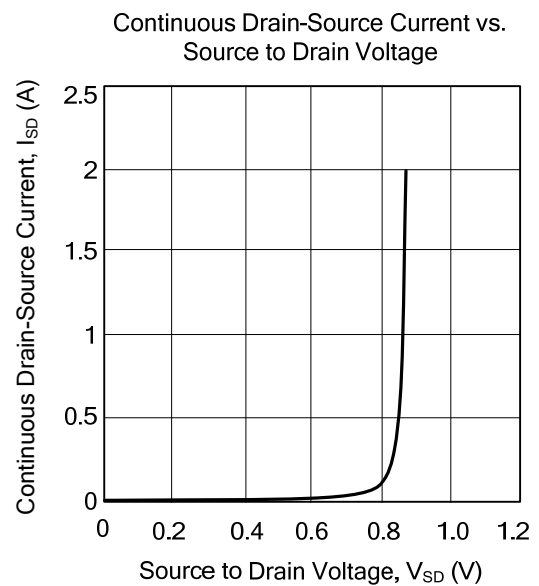
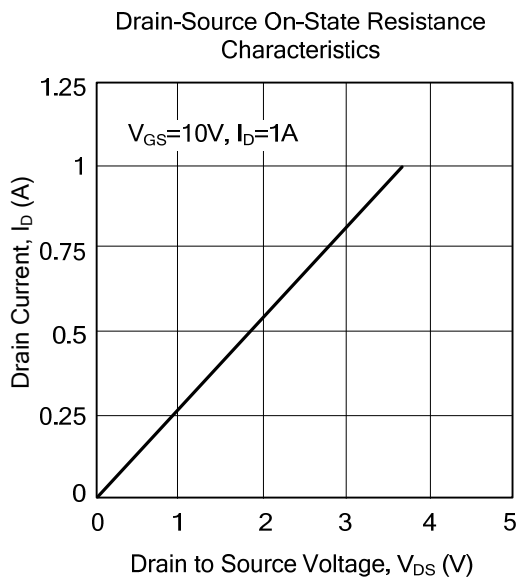
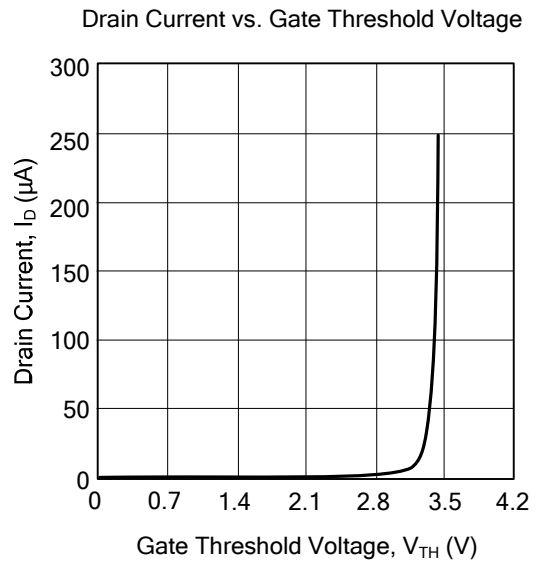
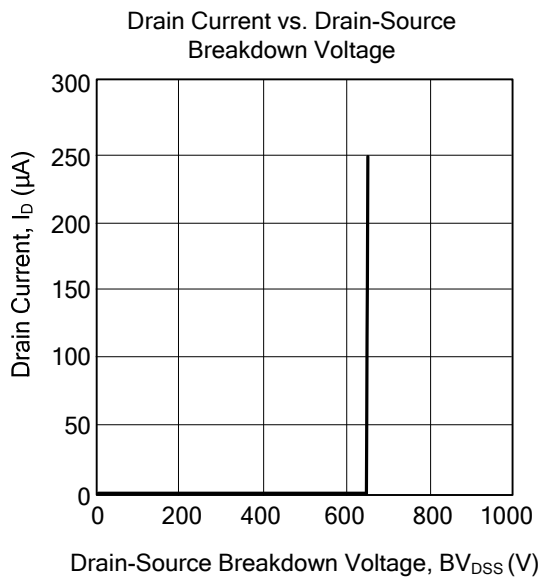


Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

TYPICAL CHARACTERISTICS



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