



2N60-TC

Power MOSFET

2A, 600V N-CHANNEL POWER MOSFET

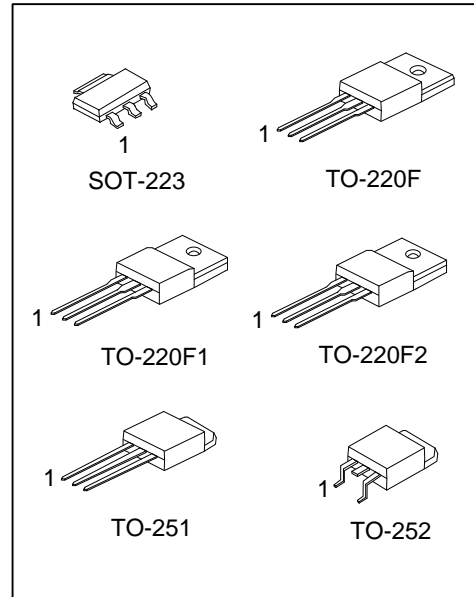
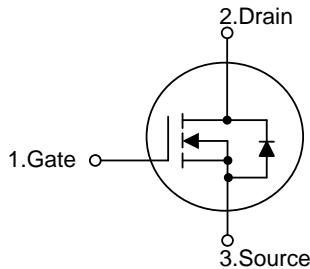
DESCRIPTION

The UTC 2N60-TC 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 AC to DC converters and bridge circuits.

FEATURES

- * $R_{DS(ON)} \leq 4.2 \Omega @ V_{GS}=10V, I_D=1.0A$
- * High Switching Speed

SYMBOL



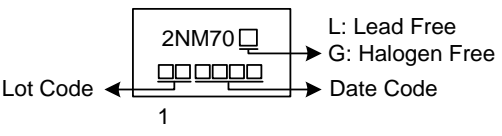
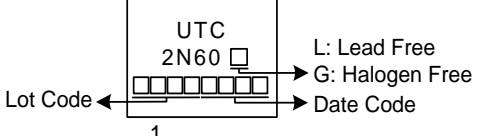
ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
2N60L-AA3-R	2N60G-AA3-R	SOT-223	G	D	S	Tape Reel
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-TF3-T	2N60G-TF3-T	TO-220F	G	D	S	Tube
2N60L-TM3-T	2N60G-TM3-T	TO-251	G	D	S	Tube
2N60L-TN3-R	2N60G-TN3-R	TO-252	G	D	S	Tape Reel

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

<p>2N60G-AA3-R</p> <p>(1)Packing Type</p> <p>(2)Package Type</p> <p>(3)Green Package</p>	<p>(1) R: Tape Reel, T: Tube</p> <p>(2) AA3: SOT-223, TF3: TO-220F, TF1: TO-220F1 TF2: TO-220F2, TM3: TO-251, TN3: TO-252</p> <p>(3) G: Halogen Free and Lead Free, L: Lead Free</p>
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MARKING

SOT-223	TO-220F / TO-220F1 / TO-220F2 / TO-251 / TO-252
 <p>Diagram of SOT-223 marking: A rectangular package with '2NM70' and a small square symbol at the top. Below it are four small squares representing a lot code and four small squares representing a date code. Arrows point from the lot code to 'Lot Code' and from the date code to 'Date Code'. A '1' is at the bottom. To the right, 'L: Lead Free' and 'G: Halogen Free' are listed.</p>	 <p>Diagram of TO-220F marking: A rectangular package with 'UTC' and '2N60' and a small square symbol at the top. Below it are six small squares representing a lot code and four small squares representing a date code. Arrows point from the lot code to 'Lot Code' and from the date code to 'Date Code'. A '1' is at the bottom. To the right, 'L: Lead Free' and 'G: Halogen Free' are listed.</p>

■ **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
Drain Current	Continuous	I_D	2	A
	Pulsed (Note 2)	I_{DM}	4	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	80	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.3	V/ns
Power Dissipation	SOT-223	P_D	2.5	W
	TO-220F/TO-220F1		23	W
	TO-220F2			
	TO-251/TO-252		44	W
Junction Temperature		T_J	+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. $L = 10\text{mH}$, $I_{AS} = 4.0\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\ \Omega$ Starting $T_J = 25^\circ\text{C}$

4. $I_{SD} \leq 2.0\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

■ **THERMAL DATA**

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	SOT-223	θ_{JA}	160	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1		62.5	$^\circ\text{C}/\text{W}$
	TO-220F2			
	TO-251/TO-252		100	$^\circ\text{C}/\text{W}$
Junction to Case	SOT-223	θ_{JC}	50 (Note)	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1		5.5	$^\circ\text{C}/\text{W}$
	TO-220F2			
	TO-251/TO-252		2.87 (Note)	$^\circ\text{C}/\text{W}$

Note: Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.

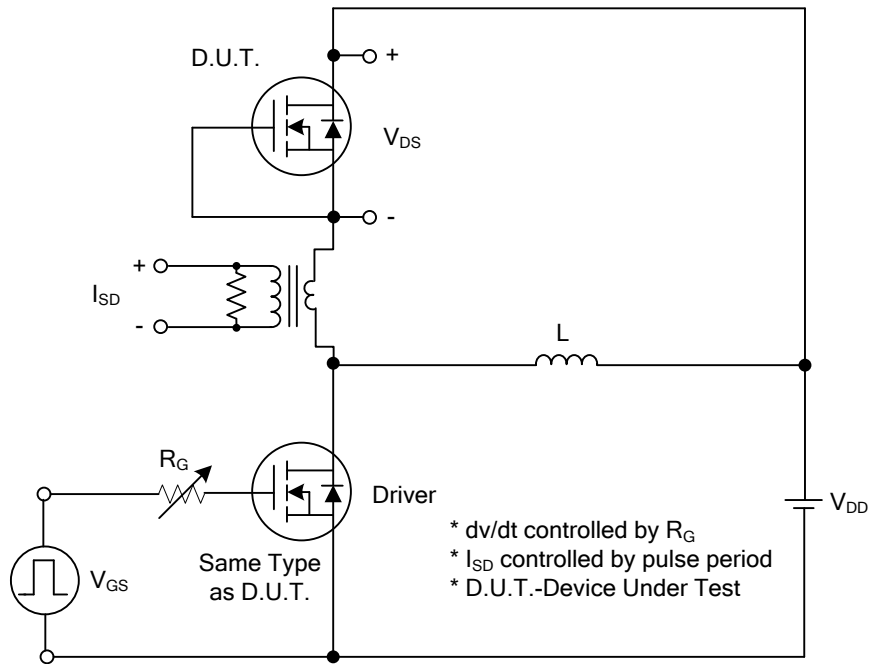
■ **ELECTRICAL CHARACTERISTICS** ($T_J = 25^\circ\text{C}$, unless otherwise specified)

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
Gate-Source Leakage Current	Forward	I_{GSS}			100	nA
	Reverse				-100	nA
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	$R_{DS(ON)}$	$V_{GS}=10V, I_D=1.0A$			4.2	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{ISS}	$V_{GS}=0V, V_{DS}=25V, f=1.0\text{ MHz}$		300		pF
Output Capacitance	C_{OSS}			40		pF
Reverse Transfer Capacitance	C_{RSS}			2.5		pF
SWITCHING CHARACTERISTICS						
Total Gate Charge (Note 1)	Q_G	$V_{DS}=100V, V_{GS}=10V, I_D=1.0A$ $I_G=1\text{ mA}$ (Note 1, 2)		8.6		nC
Gate-source Charge	Q_{GS}			4		nC
Gate-Drain Charge	Q_{GD}			1.5		nC
Turn-on Delay Time (Note 1)	$t_{D(ON)}$	$V_{DS}=300V, V_{GS}=10V, I_D=2.0A,$ $R_G=25\Omega$ (Note 1, 2)		5		ns
Rise Time	t_R			17		ns
Turn-off Delay Time	$t_{D(OFF)}$			20		ns
Fall-Time	t_F			20		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS						
Maximum Body-Diode Continuous Current	I_S				2	A
Maximum Body-Diode Pulsed Current	I_{SM}				8	A
Drain-Source Diode Forward Voltage (Note 1)	V_{SD}	$V_{GS}=0V, I_S=2.0A$			1.4	V
Reverse Recovery Time (Note 1)	t_{rr}	$V_{GS}=0V, I_S=2.0A,$		216		ns
Reverse Recovery Charge	Q_{rr}	$dI_F/dt=100A/\mu s$ (Note1)		1.1		μC

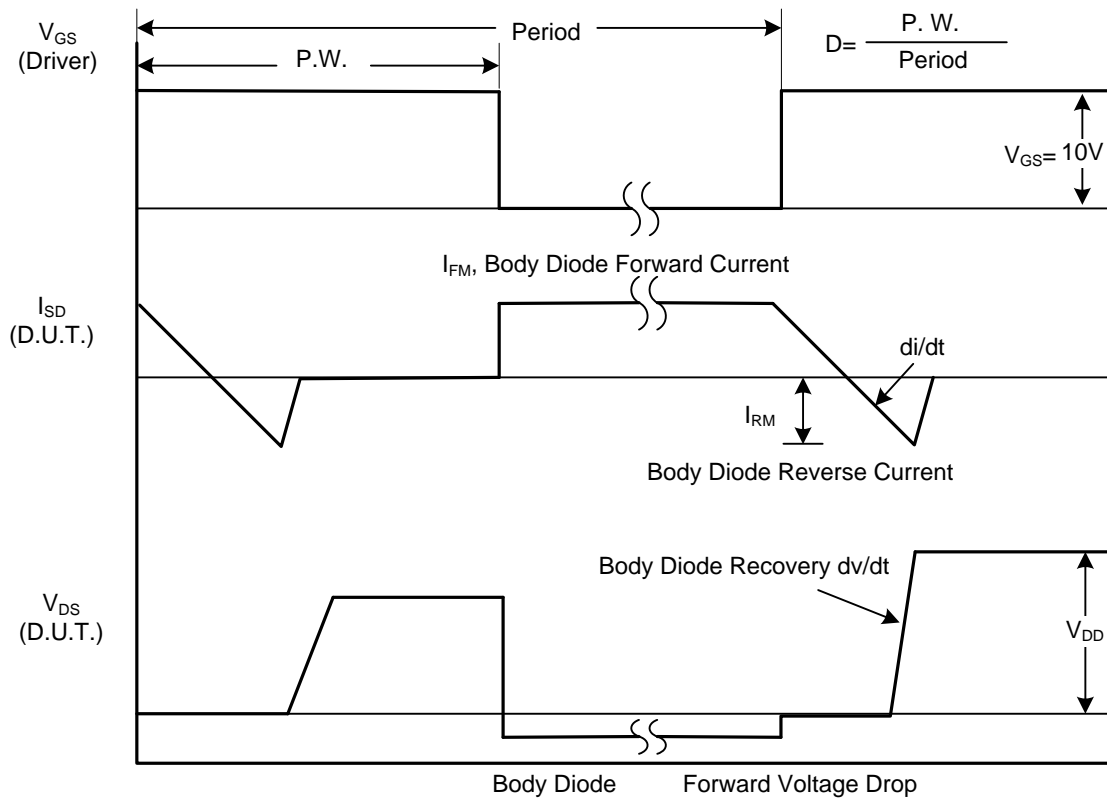
Notes: 1. Pulse Test : Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

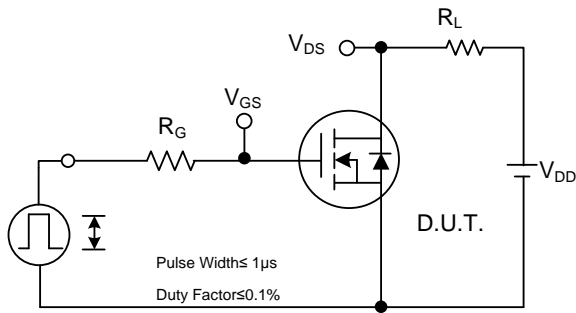


Peak Diode Recovery dv/dt Test Circuit

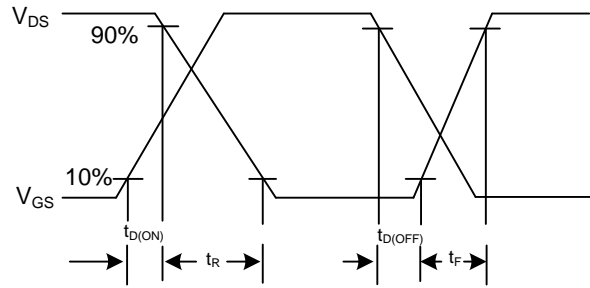


Peak Diode Recovery dv/dt Waveforms

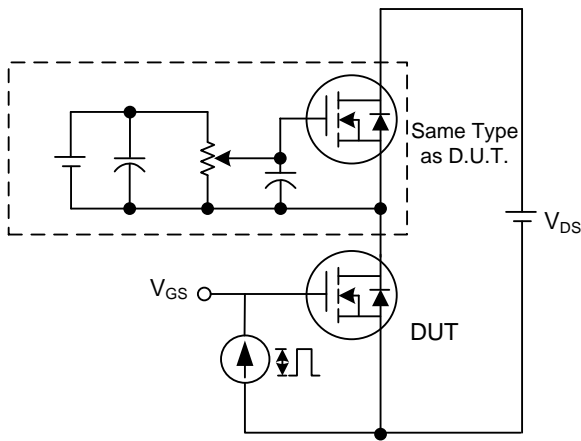
■ TEST CIRCUITS AND WAVEFORMS



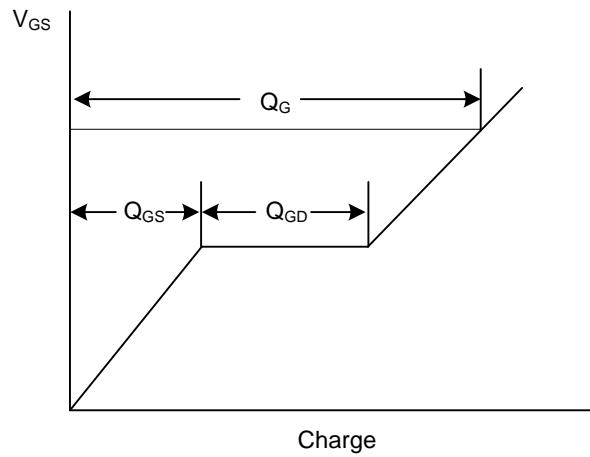
Switching Test Circuit



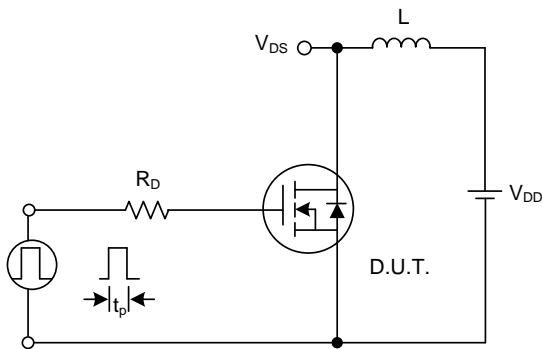
Switching Waveforms



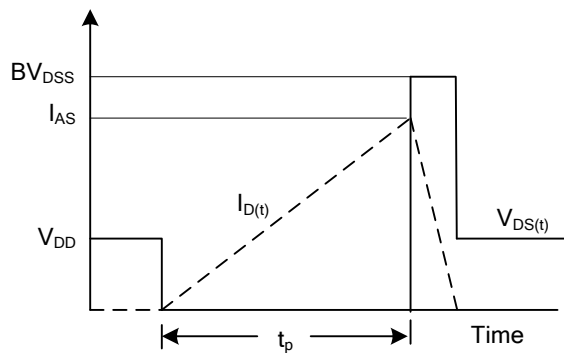
Gate Charge Test Circuit



Gate Charge Waveform

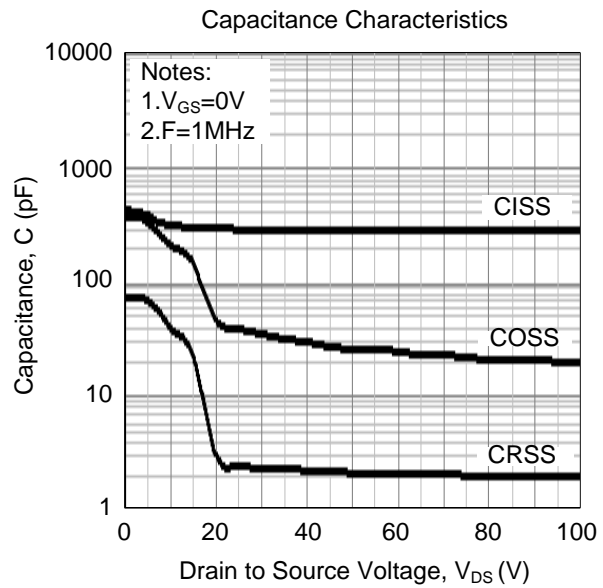
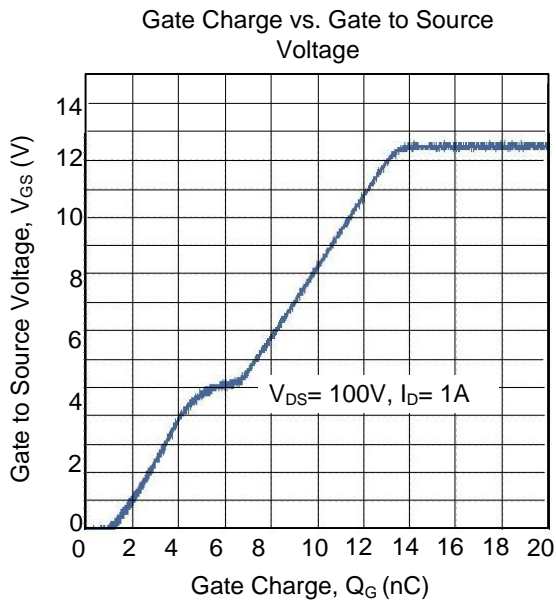


Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS



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