



10N60K

Power MOSFET

10A, 600V N-CHANNEL POWER MOSFET

■ **DESCRIPTION**

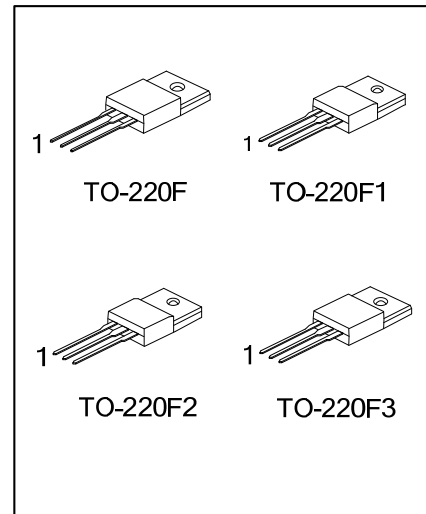
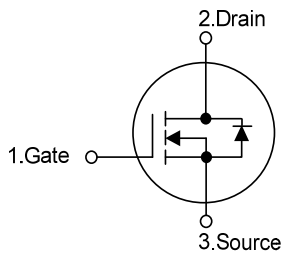
The UTC **10N60K** is an N-channel Power MOSFET using UTC's advanced technology to provide customers a minimum on-state resistance and superior switching performance, etc.

The UTC **10N60K** is generally applied in high efficient DC to DC converters, PWM motor controls and bridge circuits, etc.

■ **FEATURES**

- * $R_{DS(ON)} < 1.2\Omega @ V_{GS} = 10V$
- * Low Gate Charge (Typical 90nC)
- * Low C_{RSS} (typical 18 pF)
- * High Switching Speed
- * Improved dv/dt capability

■ **SYMBOL**



■ **ORDERING INFORMATION**

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
10N60KL-TF3-T	10N60KG-TF3-T	TO-220F	G	D	S	Tube
10N60KL-TF1-T	10N60KG-TF1-T	TO-220F1	G	D	S	Tube
10N60KL-TF2-T	10N60KG-TF2-T	TO-220F2	G	D	S	Tube
10N60KL-TF3T-T	10N60KG-TF3T-T	TO-220F3	G	D	S	Tube

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

<p>10N60KL-TF3-T</p> <p>(1) Packing Type (2) Package Type (3) Lead Free</p>	<p>(1) T: Tube (2) TF3: TO-220F, TF1: TO-220F1, TF2: TO-220F2 TF3T: TO-220F3 (3) L: Lead Free, G: Halogen Free</p>
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■ **MARKING INFORMATION**

PACKAGE	MARKING
TO-220F TO-220F1 TO-220F2 TO-220F3	<p>UTC 10N60K</p> <p>Lot Code ← [] → Data Code</p> <p>L: Lead Free G: Halogen Free</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
Avalanche Current (Note 2)		I_{AR}	10	A
Drain Current	Continuous	I_D	10	A
	Pulsed (Note 2)	I_{DM}	38	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	300	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	TO-220F/TO-220F1	P_D	50	W
	TO-220F3			
	TO-220F2		52	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. $L=6\text{mH}$, $I_{AS}=10\text{A}$, $V_{DD}=50\text{V}$, $R_G=25\ \Omega$, Starting $T_J = 25^\circ\text{C}$

4. $I_{SD}\leq 9.5\text{A}$, $di/dt\leq 200\text{A}/\mu\text{s}$, $V_{DD}\leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

■ THERMAL DATA

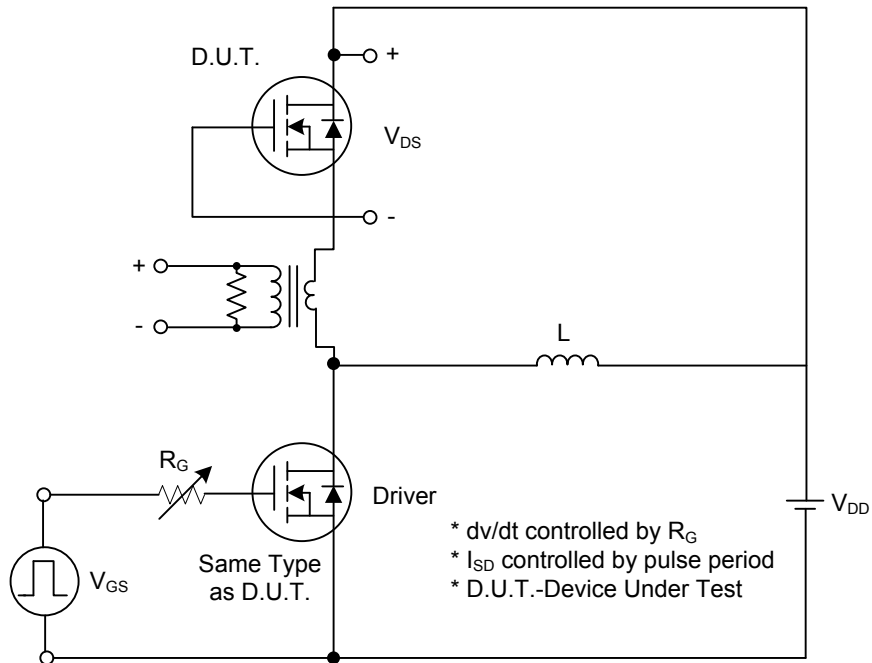
PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient		θ_{JA}	62.5	$^\circ\text{C}/\text{W}$
Junction to Case	TO-220F/TO-220F1	θ_{JC}	2.5	$^\circ\text{C}/\text{W}$
	TO-220F3			
	TO-220F2		2.4	$^\circ\text{C}/\text{W}$

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

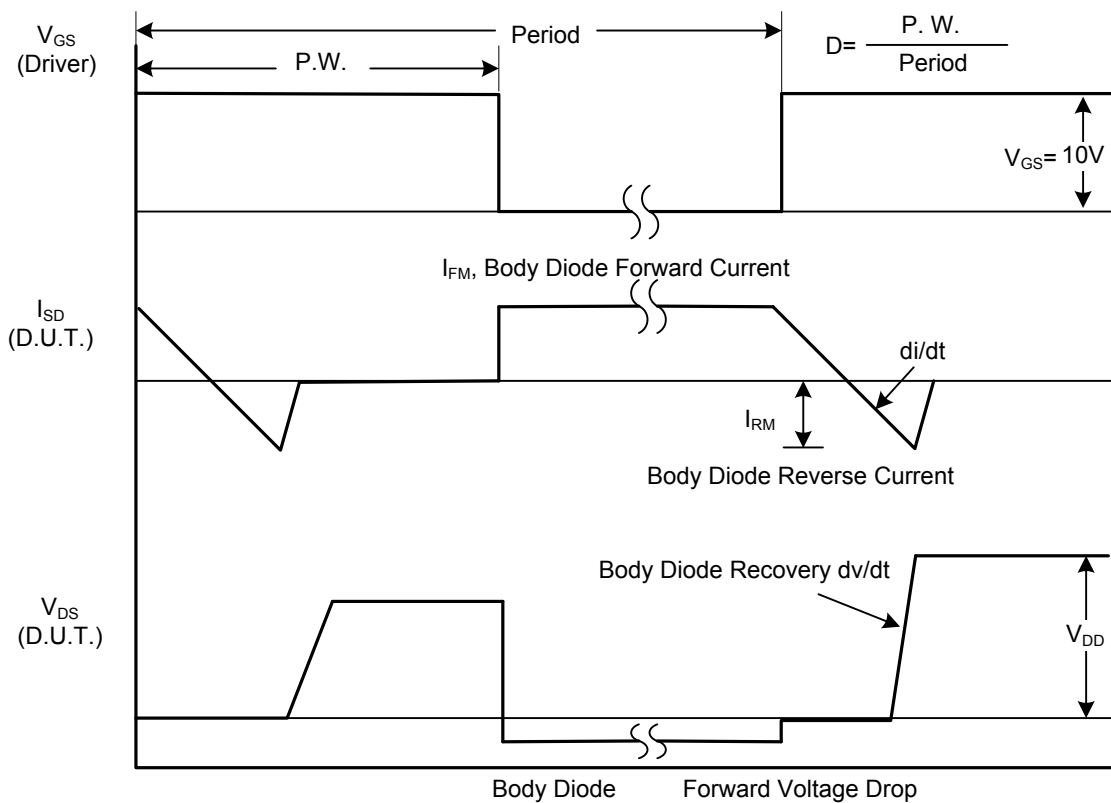
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS} = 0V, I_D = 250\mu A$	600			V
Drain-Source Leakage Current	I_{DSS}	$V_{DS} = 600V, V_{GS} = 0V$			1	μA
		$V_{DS} = 480V, V_{GS} = 0V, T_C=125^\circ\text{C}$			10	μA
Gate-Source 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		0.7		$V/^\circ\text{C}$
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	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 5A$	0.5	0.8	1.2	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{ISS}	$V_{DS}=25V, V_{GS}=0V, f=1.0\text{ MHz}$		1000	2040	pF
Output Capacitance	C_{OSS}			125	215	pF
Reverse Transfer Capacitance	C_{RSS}			18	24	pF
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	$t_{D(ON)}$	$V_{DD}=300V, I_D = 10A, R_G = 25\Omega$ (Note 1, 2)		50	70	ns
Turn-On Rise Time	t_R			69	150	ns
Turn-Off Delay Time	$t_{D(OFF)}$			230	260	ns
Turn-Off Fall Time	t_F			88	105	ns
Total Gate Charge	Q_G	$V_{DS}=480V, I_D=10A, V_{GS}=10V$ (Note 1, 2)		90	120	nC
Gate-Source Charge	Q_{GS}			20		nC
Gate-Drain Charge	Q_{GD}			22		nC
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
Drain-Source Diode Forward Voltage	V_{SD}	$V_{GS} = 0V, I_S = 10A$			1.4	V
Maximum Continuous Drain-Source Diode Forward Current	I_S				10	A
Maximum Pulsed Drain-Source Diode Forward Current	I_{SM}				38	A
Reverse Recovery Time	t_{rr}	$V_{GS} = 0V, I_S = 10A,$		420		ns
Reverse Recovery Charge	Q_{RR}	$di_F / dt = 100\text{ A}/\mu\text{s}$ (Note 1)		4.2		μC

Note: 1. Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$
 2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

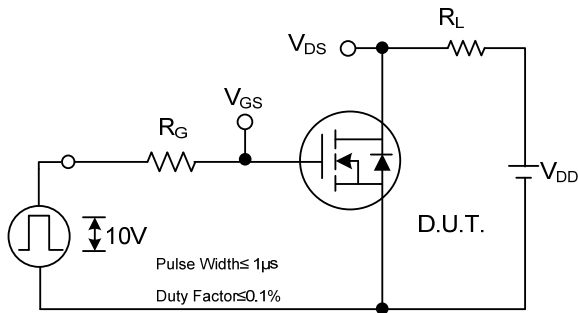


Peak Diode Recovery dv/dt Test Circuit

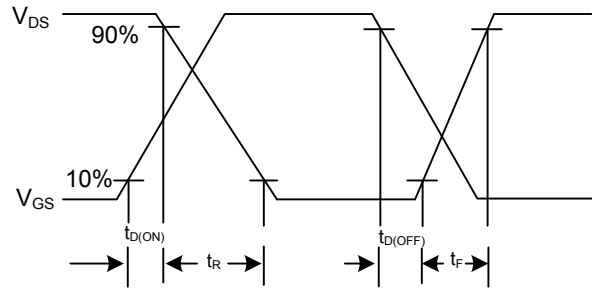


Peak Diode Recovery dv/dt Waveforms

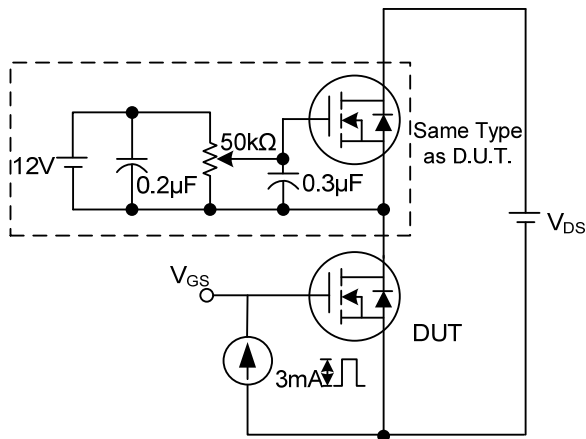
TEST CIRCUITS AND WAVEFORMS (Cont.)



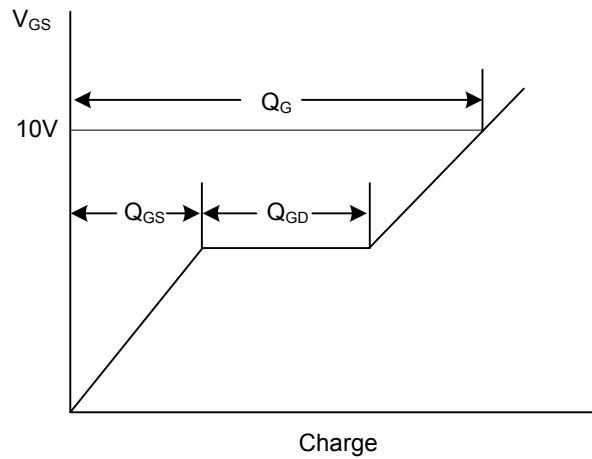
Switching Test Circuit



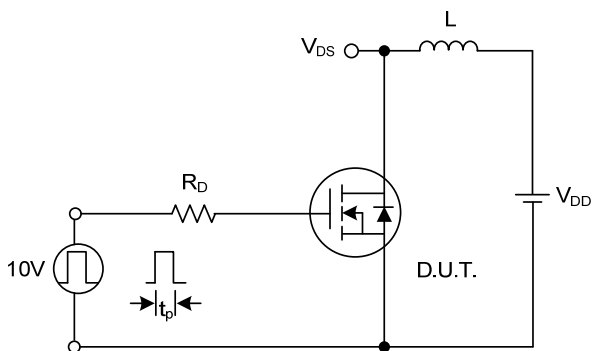
Switching Waveforms



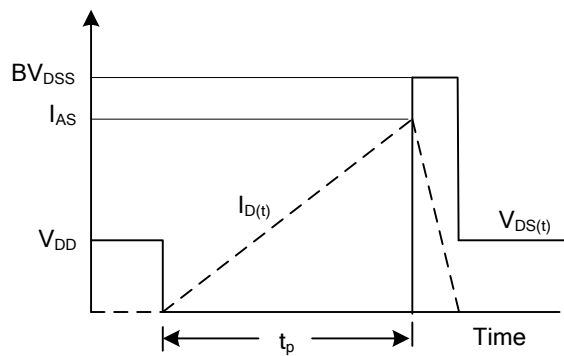
Gate Charge Test Circuit



Gate Charge Waveform

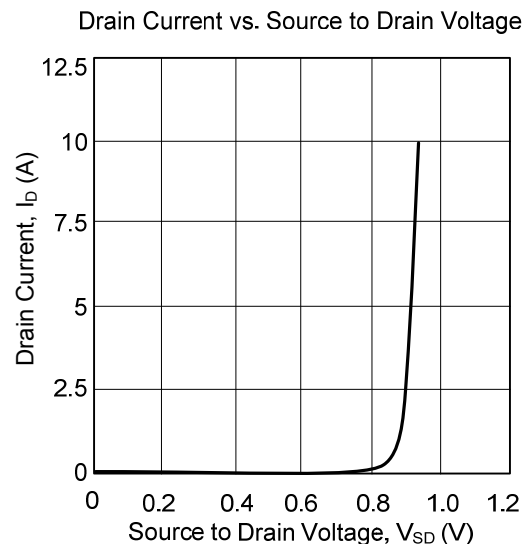
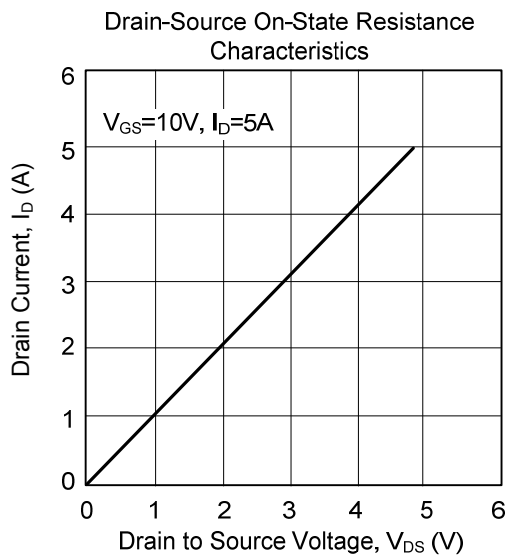
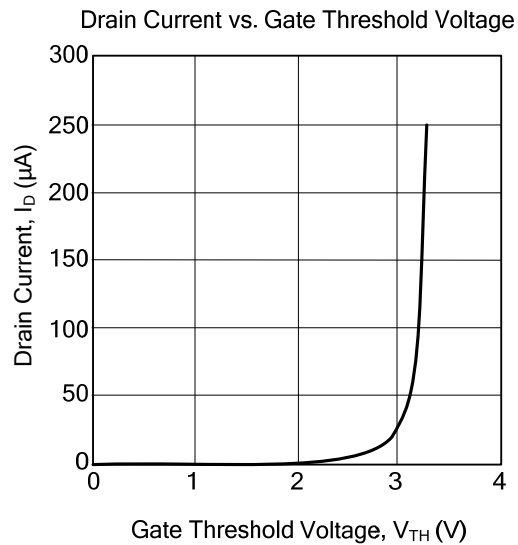
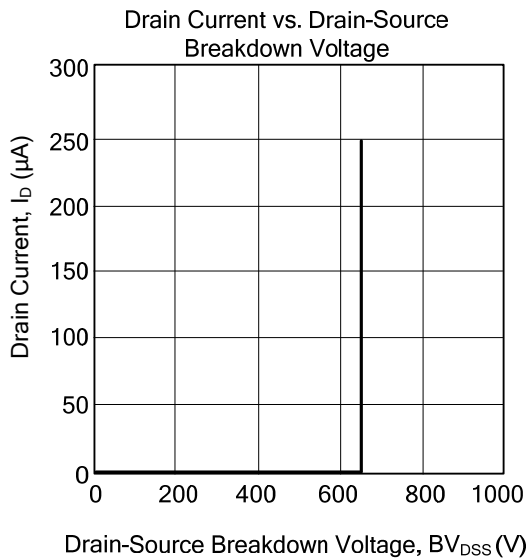


Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

TYPICAL CHARACTERISTICS



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