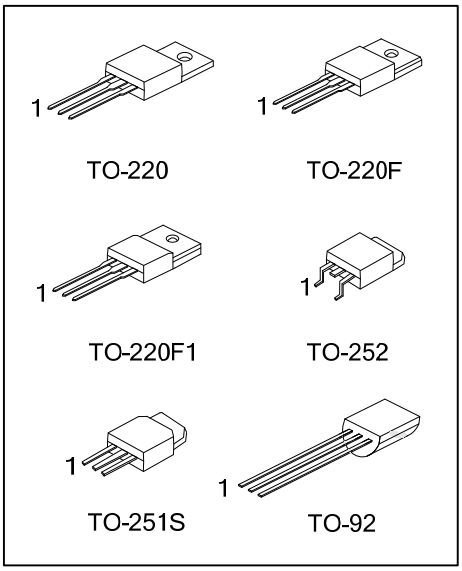
2N60K

Power MOSFET

2A, 600V N-CHANNEL POWER MOSFET



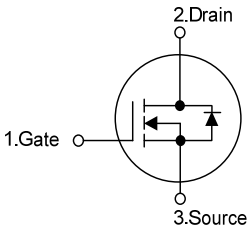
■ DESCRIPTION

The UTC **2N60K** 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

* $R_{DS(ON)}$ < 6.5Ω@V_{GS} = 10V
* Ultra Low gate charge (typical 9.0nC)
* Low reverse transfer capacitance (C_{RSS} = typical 5.0 pF)
* Fast switching capability
* Avalanche energy specified
* Improved dv/dt capability, high ruggedness

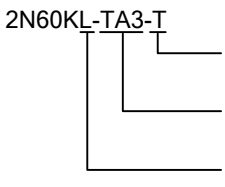
■ SYMBOL



■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
2N60KL-TA3-T	2N60KG-TA3-T	TO-220	G	D	S	Tube
2N60KL-TF3-T	2N60KG-TF3-T	TO-220F	G	D	S	Tube
2N60KL-TF1-T	2N60KG-TF1-T	TO-220F1	G	D	S	Tube
2N60KL-TNS-T	2N60KG-TNS-T	TO-251S	G	D	S	Tube
2N60KL-TN3-T	2N60KG-TN3-T	TO-252	G	D	S	Tube
2N60KL-TN3-R	2N60KG-TN3-R	TO-252	G	D	S	Tape Reel
2N60KL-T92-B	2N60KG-T92-B	TO-92	G	D	S	Tape Box
2N60KL-T92-K	2N60KG-T92-K	TO-92	G	D	S	Bulk
2N60KL-T92-R	2N60KG-T92-R	TO-92	G	D	S	Tape Reel

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



(1) T: Tube, R: Tape Reel, K: Bulk, B: Tape Box
(2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1
TMS: TO-251S, TN3: TO-252, T92: TO-92
(3) L: Lead Free, G: Halogen Free

■ ABSOLUTE MAXIMUM RATINGS (T_C=25°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}	50	mJ
	Repetitive (Note 2)	E_{AR}	4.5	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation (T_C=25°C)	TO-220	P_D	54	W
	TO-220F/TO-220F1		23	W
	TO-251S/TO-252		44	W
	TO-92		2.3	W
Junction Temperature		T_J	+150	°C
Operating Temperature		T_{OPR}	-55 ~ +150	°C
Storage Temperature		T_{STG}	-55 ~ +150	°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=25mH, I_{AS}=2.0A, V_{DD}=50V, R_G=25 Ω, Starting T_J = 25°C
4. I_{SD}≤2.4A, di/dt≤200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C

■ THERMAL DATA

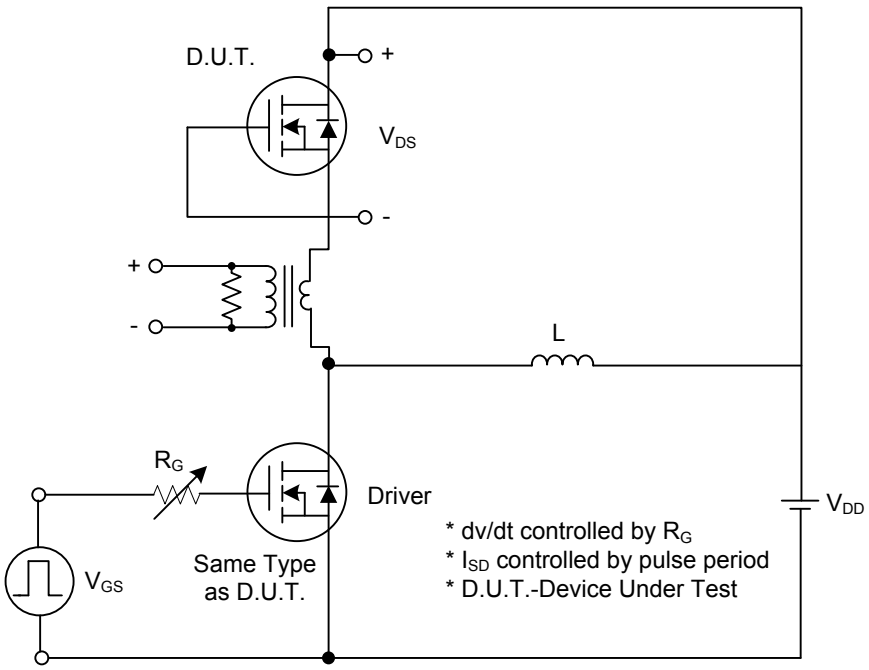
PARAMETER	PACKAGE	SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F TO-220F1	θ_{JA}	62.5	°C/W
	TO-251S/TO-252		100	°C/W
	TO-92		85	°C/W
Junction to Case	TO-220	θ_{Jc}	2.32	°C/W
	TO-220F1/TO-220F		5.5	°C/W
	TO-251S/TO-252		2.87	°C/W
	TO-92		54	°C/W

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

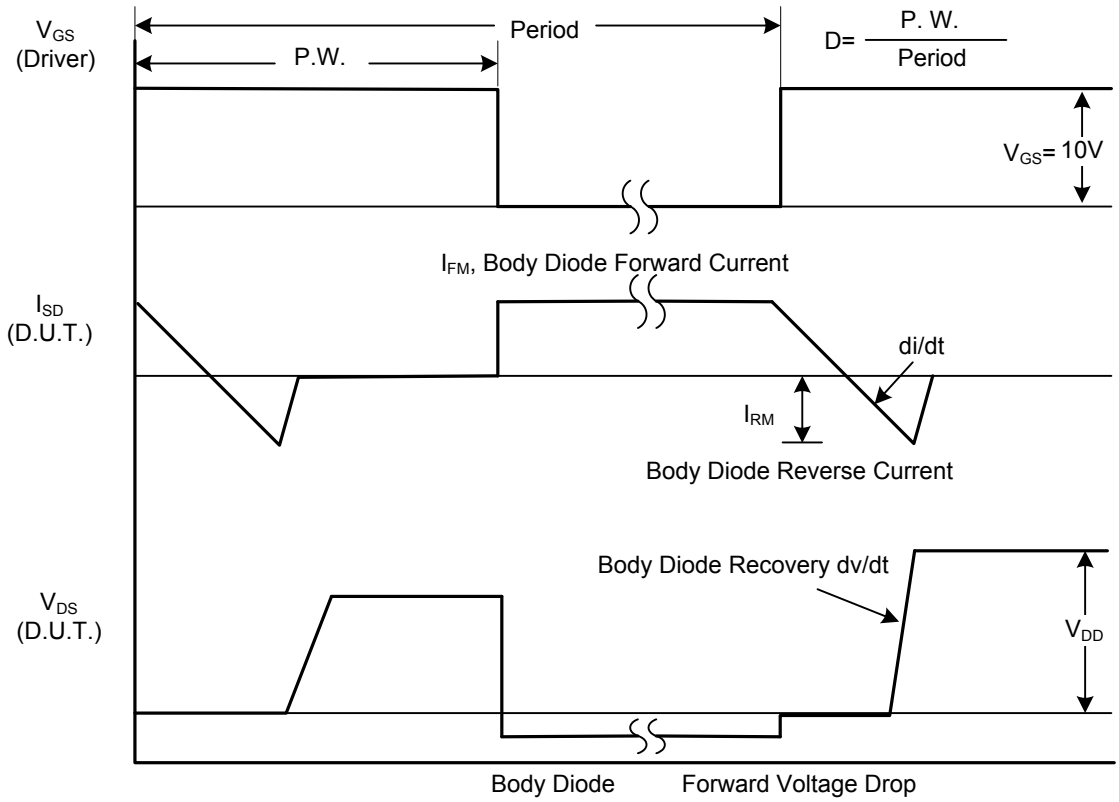
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS} = 0V, I_D = 250μA	600			V
Drain-Source Leakage Current		I_{DSS}	V_{DS} = 600V, V_{GS} = 0V			10	μA
			V_{DS} = 480V, T_C =125°C			100	μA
Gate-Source Leakage Current	Forward	I_{GSS}	V_{GS} = 30V, V_{DS} = 0V			100	nA
	Reverse		V_{GS} = -30V, V_{DS} = 0V			-100	nA
Breakdown Voltage Temperature Coefficient		$\triangle BV_{DSS}/\triangle T_J$	I_D=250μA, Referenced to 25°C		0.4		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} = 10V, I_D =1A		6	6.5	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C_{ISS}	V_{DS} =25V, V_{GS} =0V, f =1MHz		270	350	pF
Output Capacitance		C_{OSS}			40	50	pF
Reverse Transfer Capacitance		C_{RSS}			5	7	pF
SWITCHING CHARACTERISTICS							
Turn-On Delay Time		$t_{D\ (ON)}$	V_{DD} =300V, I_D =2.4A, R_G=25Ω (Note 1, 2)		10	30	ns
Turn-On Rise Time		t_R			25	40	ns
Turn-Off Delay Time		$t_{D(OFF)}$			20	50	ns
Turn-Off Fall Time		t_F			25	40	ns
Total Gate Charge		Q_G	V_{DS}=480V, V_{GS}=10V, I_D=2.4A (Note 1, 2)		9.0	11	nC
Gate-Source Charge		Q_{GS}			4.3		nC
Gate-Drain Charge		Q_{GD}			1.6		nC
DRAIN-SOURCE DIODE CHARACTERISTICS							
Drain-Source Diode Forward Voltage		V_{SD}	V_{GS} = 0 V, I_{SD} = 2.0 A			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} = 0 V, I_{SD} = 2.4A, di/dt = 100 A/μs (Note1)		180		ns
Reverse Recovery Charge		Q_{RR}			0.72		μC

Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle≤2%
2. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

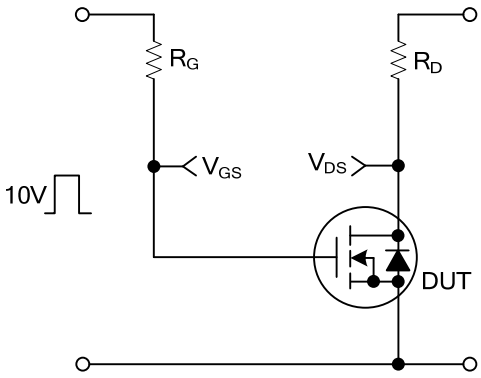


Peak Diode Recovery dv/dt Test Circuit

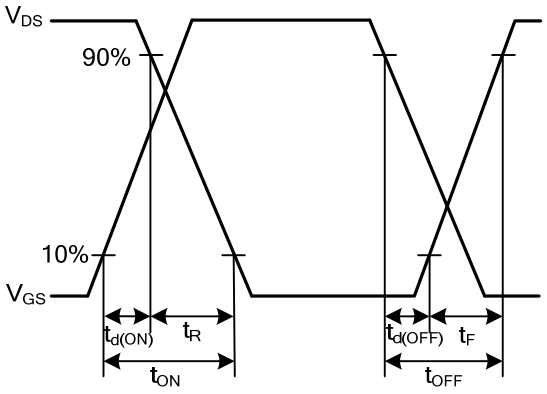


Peak Diode Recovery dv/dt Waveforms

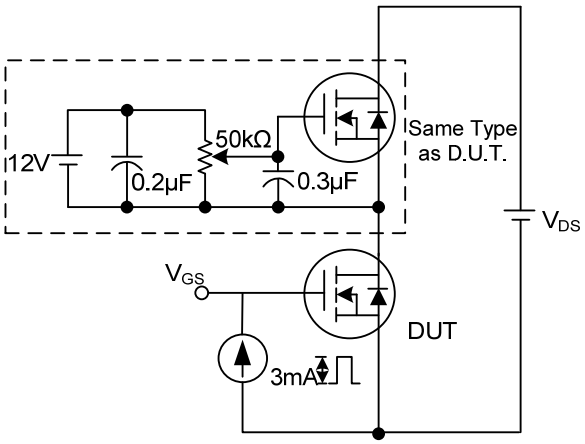
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



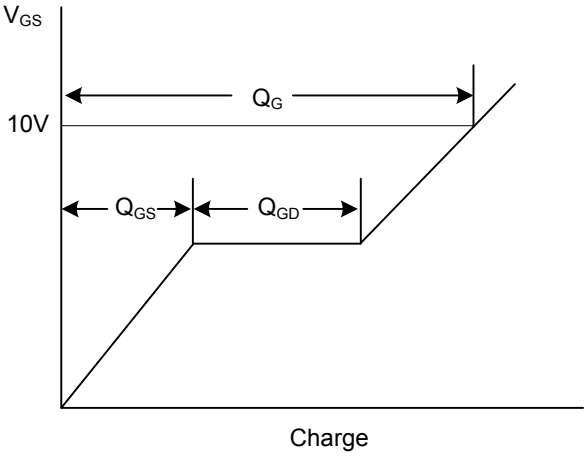
itching Test Circuit



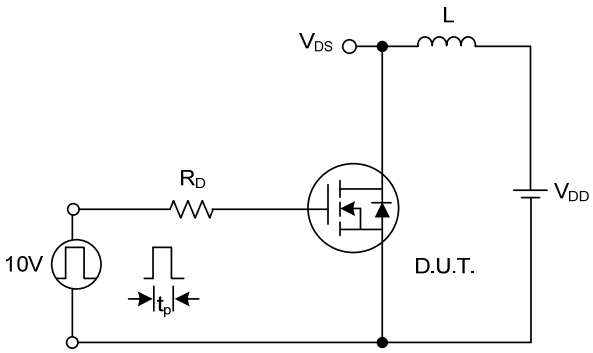
Switching Waveforms



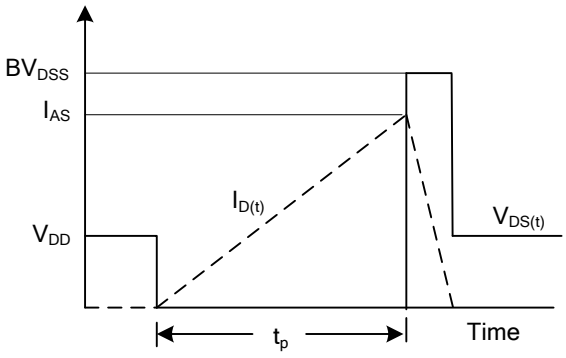
Gate Charge Test Circuit



Gate Charge Waveform



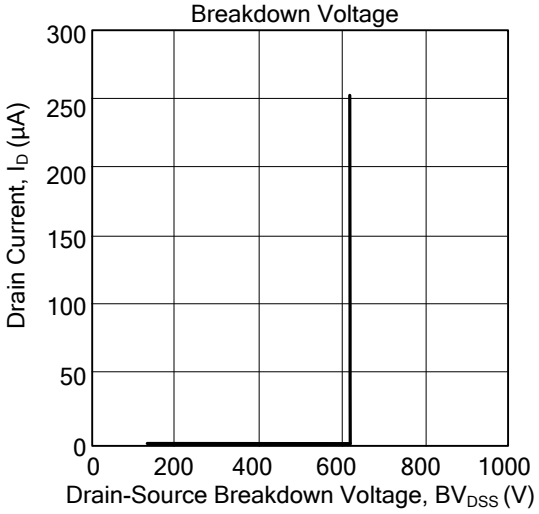
Unclamped Inductive Switching Test Circuit



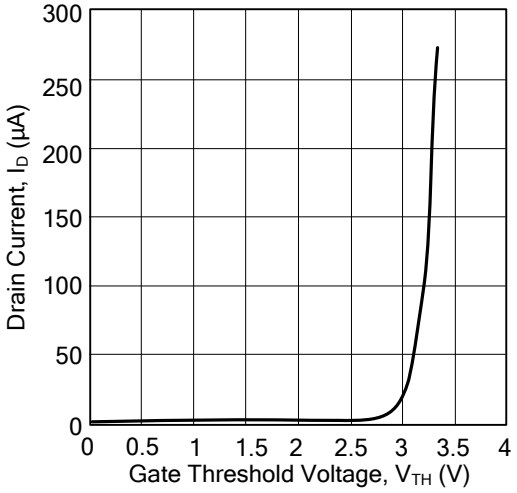
Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS

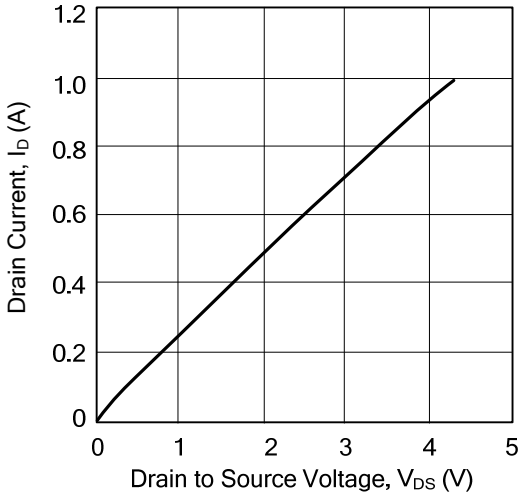
Drain Current vs. Drain-Source Breakdown Voltage



Drain Current vs. Gate Threshold Voltage



Drain-Source On-State Resistance Characteristics



Drain Current vs. Source to Drain Voltage