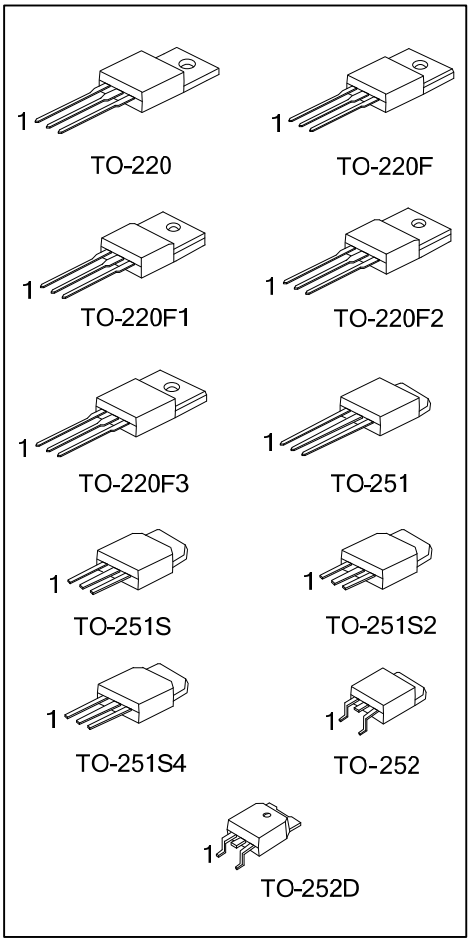
5N50K-MT

Power MOSFET

5A, 500V N-CHANNEL POWER MOSFET



■ DESCRIPTION

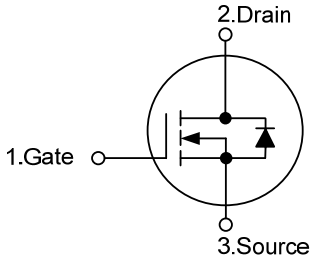
The UTC **5N50K-MT** is an N-channel power MOSFET adopting UTC's advanced technology to provide customers with DMOS, planar stripe technology. This technology is designed to meet the requirements of the minimum on-state resistance and perfect switching performance. It also can withstand high energy pulse in the avalanche and communication mode.

The UTC **5N50K-MT** can be used in applications, such as active power factor correction, high efficiency switched mode power supplies, electronic lamp ballasts based on half bridge topology.

■ FEATURES

* $R_{DS(ON)}$ < 1.4Ω @ V_{GS}=10V, I_D=2.5A
* 100% avalanche tested
* High switching speed

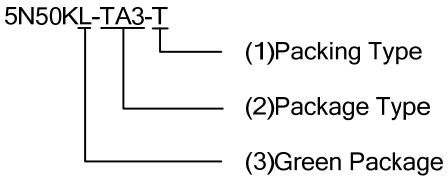
■ SYMBOL



■ ORDERING INFORMATION

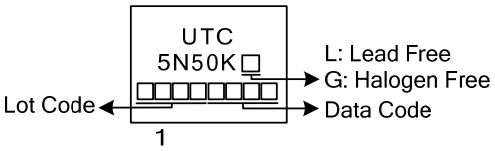
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
5N50KL-TA3-T	5N50KG-TA3-T	TO-220	G	D	S	Tube
5N50KL-TF3-T	5N50KG-TF3-T	TO-220F	G	D	S	Tube
5N50KL-TF1-T	5N50KG-TF1-T	TO-220F1	G	D	S	Tube
5N50KL-TF2-T	5N50KG-TF2-T	TO-220F2	G	D	S	Tube
5N50KL-TF3-T	5N50KG-TF3-T	TO-220F3	G	D	S	Tube
5N50KL-TM3-T	5N50KG-TM3-T	TO-251	G	D	S	Tube
5N50KL-TMS-T	5N50KG-TMS-T	TO-251S	G	D	S	Tube
5N50KL-TMS2-T	5N50KG-TMS2-T	TO-251S2	G	D	S	Tube
5N50KL-TMS4-T	5N50KG-TMS4-T	TO-251S4	G	D	S	Tube
5N50KL-TN3-R	5N50KG-TN3-R	TO-252	G	D	S	Tape Reel
5N50KL-TND-R	5N50KG-TND-R	TO-252D	G	D	S	Tape Reel

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



(1) T: Tube, R: Tape Reel
(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
(3) L: Lead Free, G: Halogen Free and Lead Free

■ MARKING



■ ABSOLUTE MAXIMUM RATINGS (T_C=25°C, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DSS}	500	V
Gate-Source Voltage		V_{GSS}	±30	V
Drain Current	Continuous	I_D	5	A
	Pulsed (Note 2)	I_{DM}	20	A
Avalanche Current (Note 2)		I_{AR}	5	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	150	mJ
	Repetitive (Note 2)	E_{AR}	7.3	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	TO-220	P_D	78	W
	TO-220F/TO-220F1 TO-220F3		36	W
	TO-220F2		29	W
	TO-251/TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		54	W
Junction Temperature		T_J	+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 maximum junction temperature
3. L = 12mH, I_{AS} = 5A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
4. I_{SD} ≤5A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C

■ THERMAL DATA

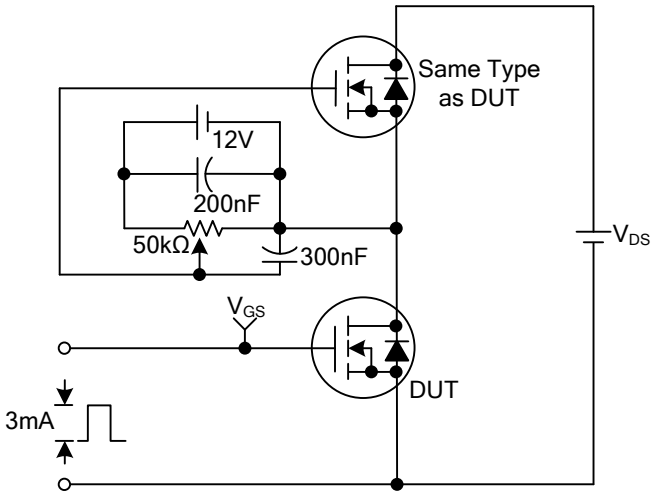
PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F TO-220F1/TO-220F2 TO-220F3	θ_{JA}	62.5	°C/W
	TO-251/TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		110	°C/W
Junction to Case	TO-220	θ_{JC}	1.16	°C/W
	TO-220F/TO-220F1 TO-220F3		4.2	°C/W
	TO-220F2		4.18	°C/W
	TO-251/TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		2.3	°C/W

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

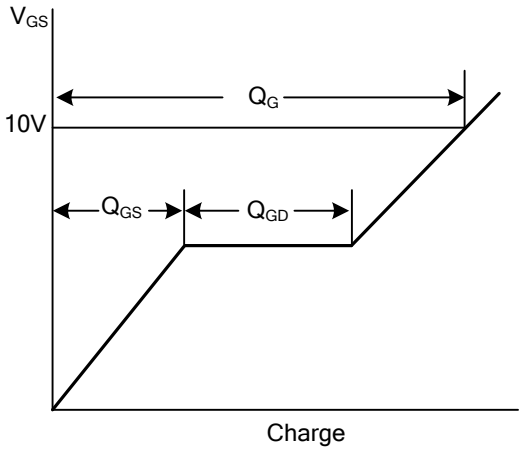
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	I_D=250μA, V_{GS}=0V	500			V
Breakdown Voltage Temperature Coefficient		$\triangle BV_{DSS}/\triangle T_J$	Reference to 25°C, I_D=250μA		0.5		V/°C
Drain-Source Leakage Current		I_{DSS}	V_{DS}=500V, V_{GS}=0V			1	μA
			V_{DS}=400V, T_C=125°C			10	
Gate- Source Leakage Current	Forward	I_{GSS}	V_{GS}=30V, V_{DS}=0V			100	nA
	Reverse		V_{GS}=-30V, V_{DS}=0V			-100	nA
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=2.5A		1.23	1.4	Ω
DYNAMIC PARAMETERS							
Input Capacitance		C_{ISS}	V_{GS}=0V, V_{DS}=25V, f=1.0MHz		525	625	pF
Output Capacitance		C_{OSS}			64	105	pF
Reverse Transfer Capacitance		C_{RSS}			6	20	pF
SWITCHING PARAMETERS							
Turn-ON Delay Time		$t_{D(ON)}$	V_{DD}=30V, I_D=0.5A, R_G=25Ω (Note 1, 2)		46	60	ns
Rise Time		t_R			50	70	ns
Turn-OFF Delay Time		$t_{D(OFF)}$			54	130	ns
Fall-Time		t_F			44	105	ns
Total Gate Charge		Q_G	V_{GS}=10V, V_{DS}=50V, I_D=1.3A (Note 1, 2)		21.6	24	nC
Gate to Source Charge		Q_{GS}			5.6		nC
Gate to Drain Charge		Q_{GD}			5.5		nC
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Continuous Drain-Source Diode Forward Current		I_S				5	A
Maximum Pulsed Drain-Source Diode Forward Current		I_{SM}				20	A
Drain-Source Diode Forward Voltage		V_{SD}	I_S=5A, V_{GS}=0V			1.4	V
Reverse Recovery Time		t_{rr}	I_S=5A, V_{GS}=0V, dI_F/dt=100A/μs (Note 1)		263		ns
Reverse Recovery Charge		Q_{RR}			1.9		μC

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

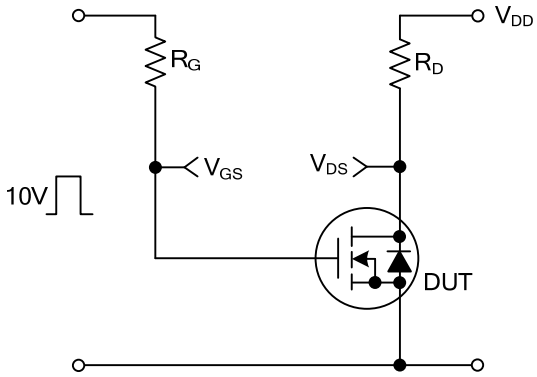
■ TEST CIRCUITS AND WAVEFORMS



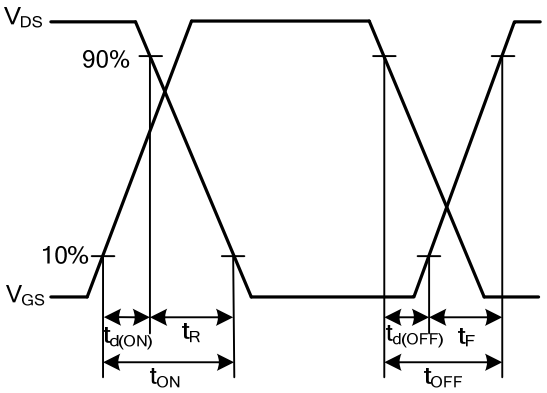
Gate Charge Test Circuit



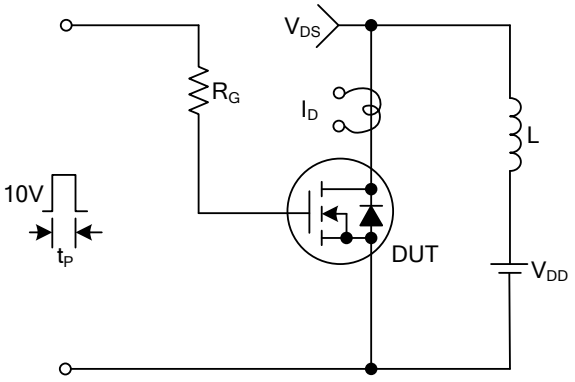
Gate Charge Waveforms



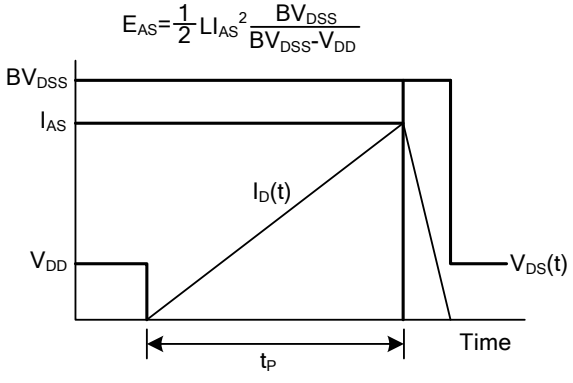
Resistive Switching Test Circuit



Resistive Switching Waveforms

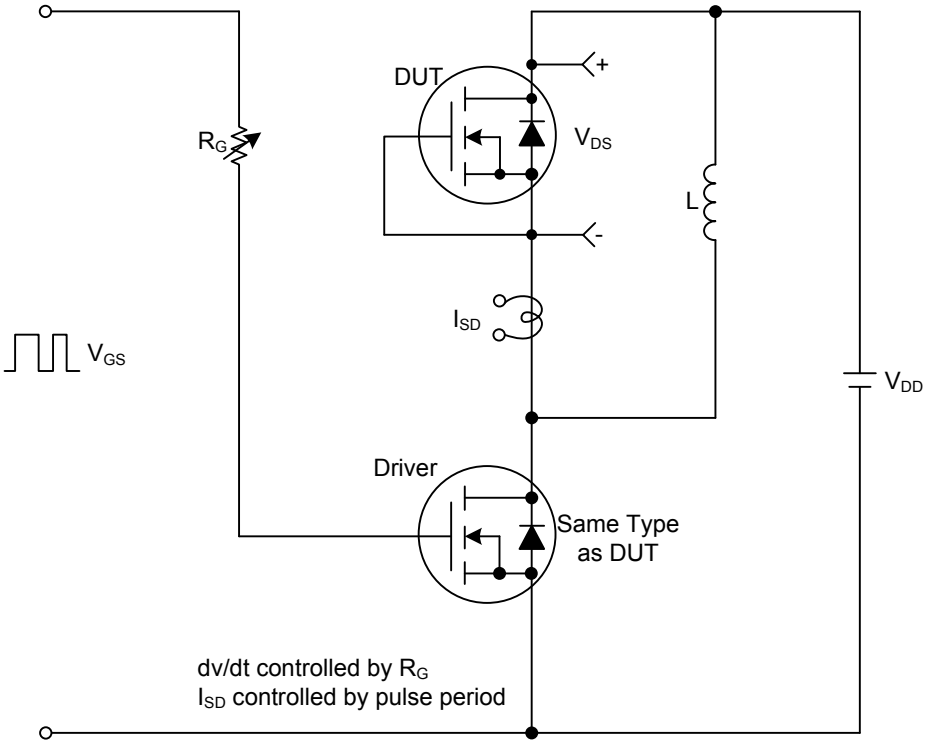


Unclamped Inductive Switching Test Circuit

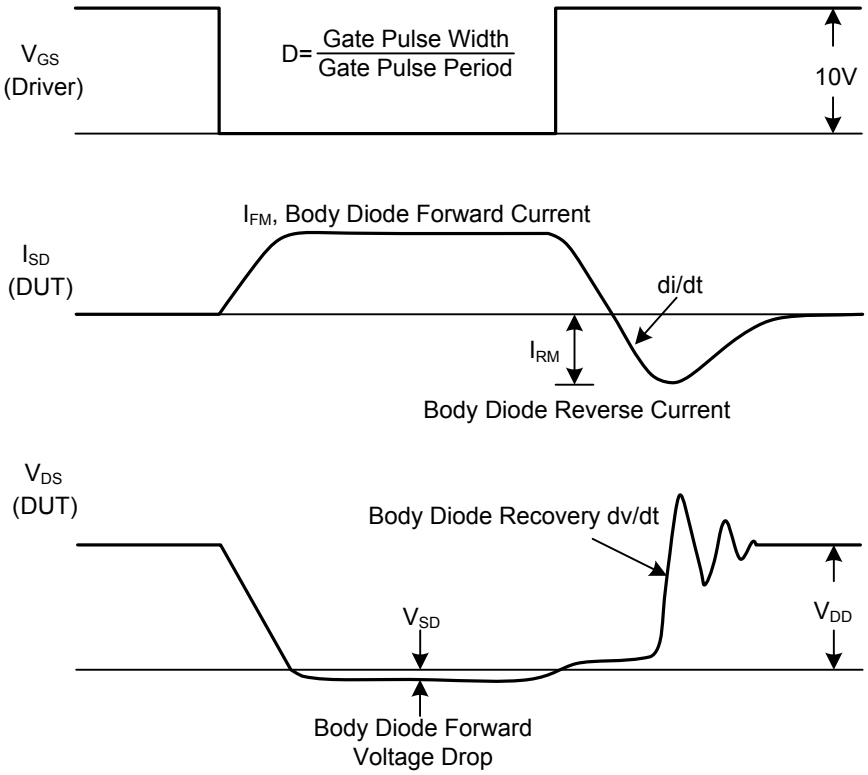


Unclamped Inductive Switching Waveforms

■ TEST CIRCUITS AND WAVEFORMS(Cont.)

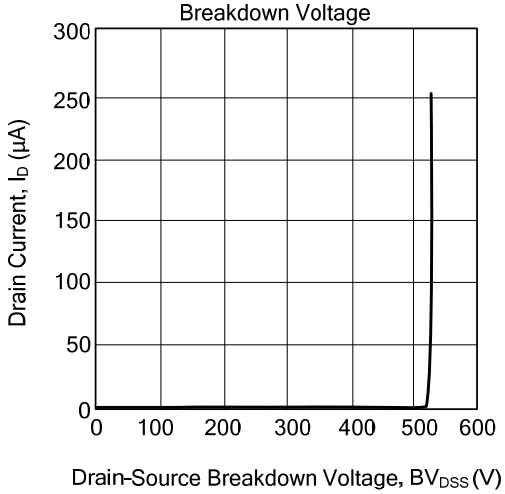


Peak Diode Recovery dv/dt Test Circuit & Waveforms

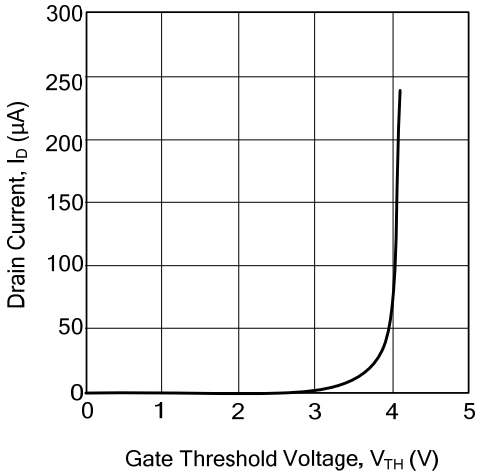


■ TYPICAL CHARACTERISTICS

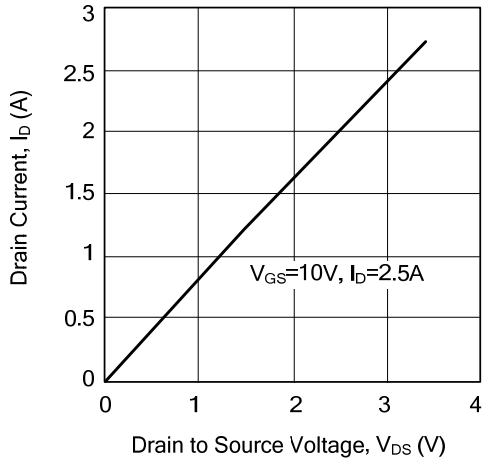
Drain Current vs. Drain-Source Breakdown Voltage



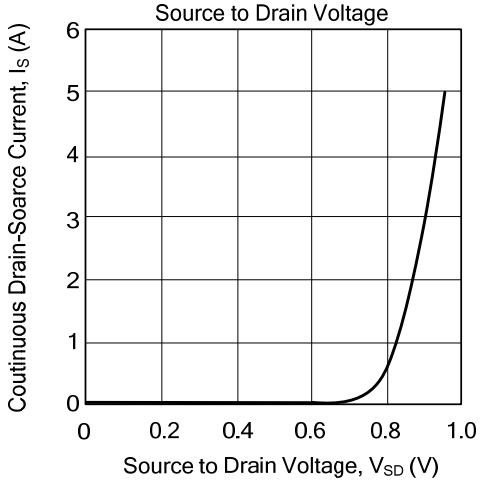
Drain Current vs. Gate Threshold Voltage



Drain-Source On-State Resistance Characteristics



Coutinuous Drain-Soarce Current vs. Source to Drain Voltage



Maximum Safe Operating Area