



5N40K-MT

Power MOSFET

5A, 400V N-CHANNEL POWER MOSFET

■ DESCRIPTION

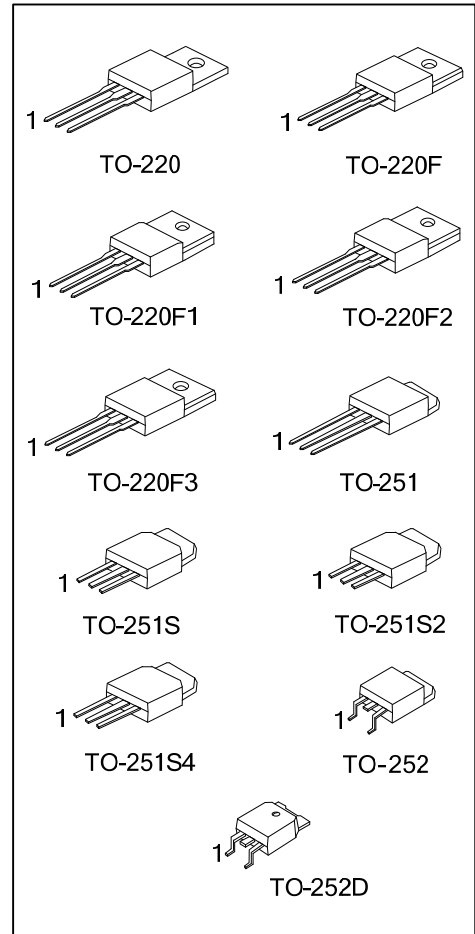
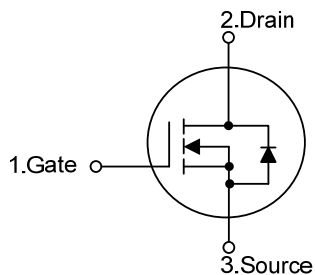
The UTC **5N40K-MT** is an N-channel mode power MOSFET using UTC's advanced technology to provide customers with planar stripe and DMOS technology. This technology specializes in allowing a minimum on-state resistance and superior switching performance. It also can withstand high energy pulse in the avalanche and commutation mode.

The UTC **5N40K-MT** is universally applied in electronic lamp ballast based on half bridge topology and high efficient switched mode power supply.

■ FEATURES

- * $R_{DS(ON)} < 1.2\Omega$ @ $V_{GS}=10V$, $I_D=2.5A$
- * High switching speed
- * 100% avalanche tested

■ SYMBOL



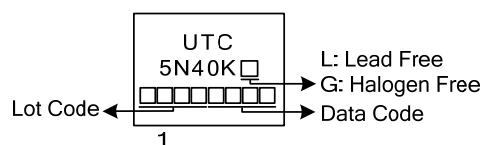
ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
5N40KL-TA3-T	5N40KG-TA3-T	TO-220	G	D	S	Tube
5N40KL-TF3-T	5N40KG-TF3-T	TO-220F	G	D	S	Tube
5N40KL-TF1-T	5N40KG-TF1-T	TO-220F1	G	D	S	Tube
5N40KL-TF2-T	5N40KG-TF2-T	TO-220F2	G	D	S	Tube
5N40KL-TF3-T	5N40KG-TF3-T	TO-220F3	G	D	S	Tube
5N40KL-TM3-T	5N40KG-TM3-T	TO-251	G	D	S	Tube
5N40KL-TMS-T	5N40KG-TMS-T	TO-251S	G	D	S	Tube
5N40KL-TMS2-T	5N40KG-TMS2-T	TO-251S2	G	D	S	Tube
5N40KL-TMS4-T	5N40KG-TMS4-T	TO-251S4	G	D	S	Tube
5N40KL-TN3-R	5N40KG-TN3-R	TO-252	G	D	S	Tape Reel
5N40KL-TND-R	5N40KG-TND-R	TO-252D	G	D	S	Tape Reel

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

5N40KL-TA3-T (1) Packing Type (2) Package Type (3) Green Package	(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
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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}	400	V
Gate-Source Voltage		V_{GSS}	± 30	V
Drain Current	Continuous ($T_C=25^{\circ}\text{C}$)	I_{D}	5	A
	Pulsed (Note 2)	I_{DM}	20	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	210	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	TO-220	P_{D}	69	W
	TO-220F/TO-220F1		38	W
	TO-220F3			
	TO-220F2		39	W
	TO-251/TO-251S		58	W
	TO-251S2/TO-251S4 TO-252/TO-252D			
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. $L = 16.8\text{mH}$, $I_{\text{AS}} = 5\text{A}$, $V_{\text{DD}} = 50\text{V}$, $R_{\text{G}} = 25\Omega$, Starting $T_{\text{J}} = 25^{\circ}\text{C}$

4. $I_{\text{SD}} \leq 5\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{\text{DD}} \leq BV_{\text{DSS}}$, Starting $T_{\text{J}} = 25^{\circ}\text{C}$

■ **THERMAL DATA**

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F	θ_{JA}	62.5	$^{\circ}\text{C}/\text{W}$
	TO-220F1/TO-220F2			
	TO-220F3			
	TO-251/TO-251S		110	$^{\circ}\text{C}/\text{W}$
Junction to Case	TO-251S2/TO-251S4	θ_{JC}	1.8	$^{\circ}\text{C}/\text{W}$
	TO-252/TO-252D			
	TO-220		3.25	$^{\circ}\text{C}/\text{W}$
	TO-220F/TO-220F1			
	TO-220F3		3.15	$^{\circ}\text{C}/\text{W}$
	TO-220F2			
	TO-251/TO-251S		2.13	$^{\circ}\text{C}/\text{W}$
	TO-251S2/TO-251S4 TO-252/TO-252D			

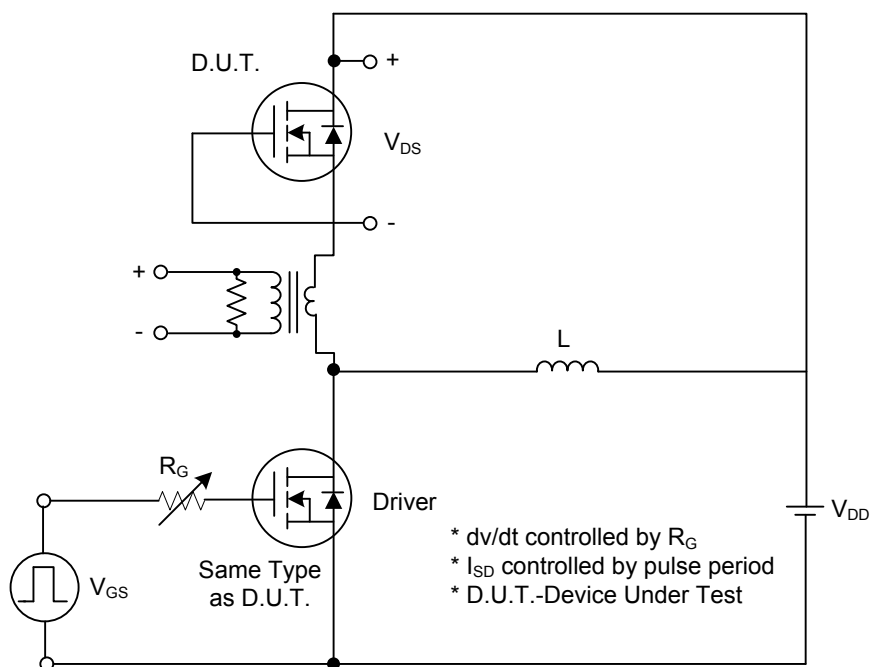
■ **ELECTRICAL CHARACTERISTICS** ($T_C=25^\circ\text{C}$, unless otherwise noted)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV _{DSS}	I _D =250μA, V _{GS} =0V	400			V
Breakdown Voltage Temperature Coefficient		ΔBV _{DSS} /ΔT _J	Reference to 25°C, I _D =250μA		0.4		V/°C
Drain-Source Leakage Current		I _{DSS}	V _{DS} =400V, V _{GS} =0V			1	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
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		0.65	1.2	Ω
DYNAMIC PARAMETERS							
Input Capacitance		C _{ISS}	V _{GS} =0V, V _{DS} =25V, f=1.0MHz		710	910	pF
Output Capacitance		C _{OSS}			88	118	pF
Reverse Transfer Capacitance		C _{RSS}			65	75	pF
SWITCHING PARAMETERS							
Turn-ON Delay Time		t _{D(ON)}	V _{DD} = 30V, I _D = 0.5A, R _G = 25Ω (Note 1, 2)		48	60	ns
Rise Time		t _R			54	100	ns
Turn-OFF Delay Time		t _{D(OFF)}			135	110	ns
Fall-Time		t _F			48	105	ns
Total Gate Charge		Q _G	V _{DS} = 50V, I _D = 1.3A, V _{GS} = 10 V (Note 1, 2)		22	26	nC
Gate to Source Charge		Q _{GS}			8		nC
Gate to Drain Charge		Q _{GD}			6		nC
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Body-Diode Continuous Current		I _S				5	A
Maximum Body-Diode Pulsed Current		I _{SM}				20	A
Drain-Source Diode Forward Voltage		V _{SD}	I _S =5A, V _{GS} =0V			1.4	V

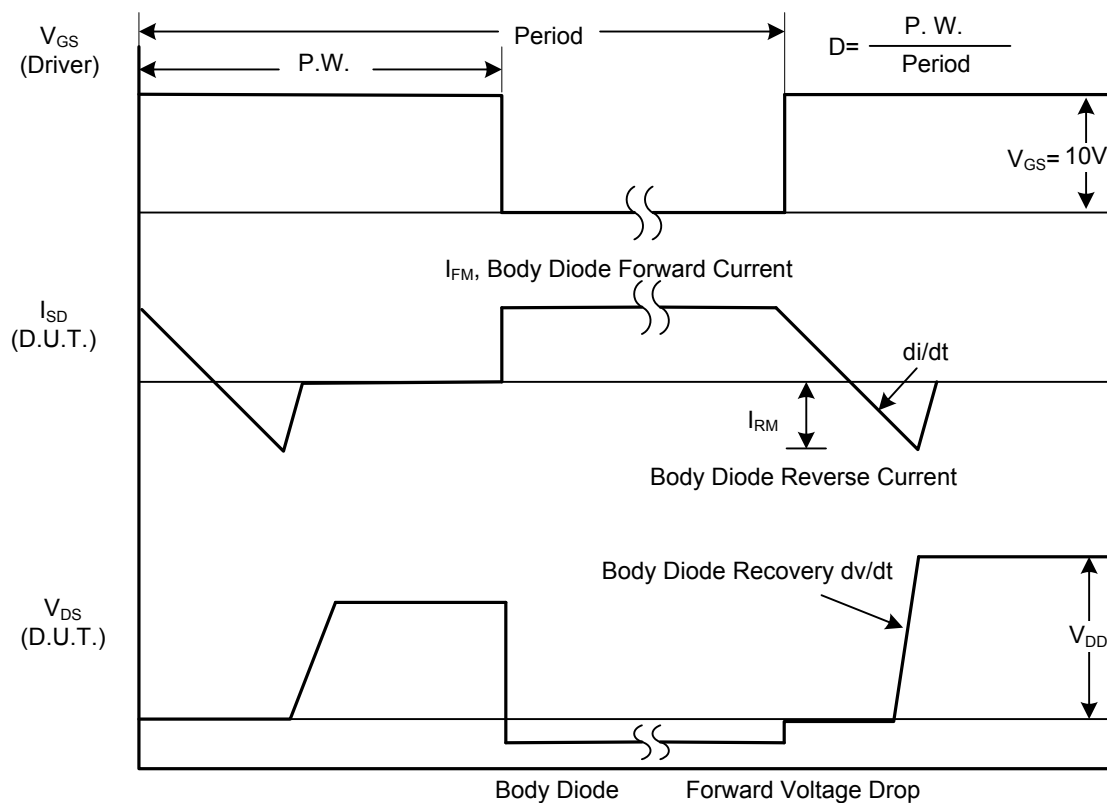
Notes: 1. Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$

2. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

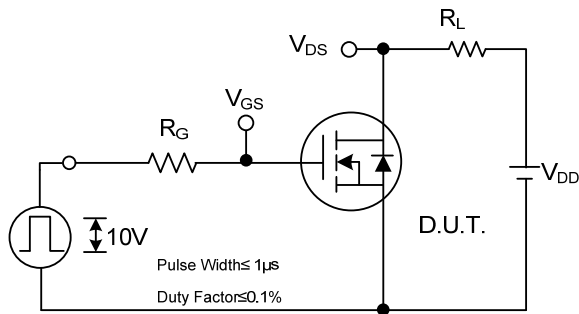


Peak Diode Recovery dv/dt Test Circuit

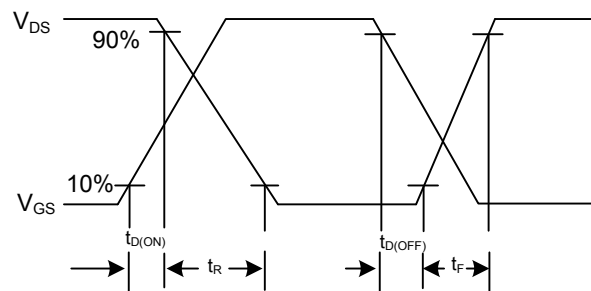


Peak Diode Recovery dv/dt Waveforms

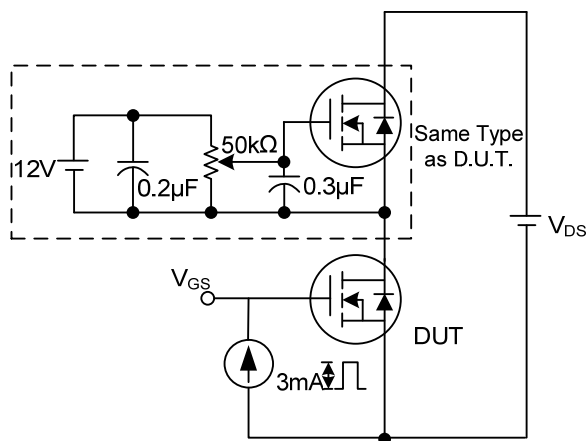
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



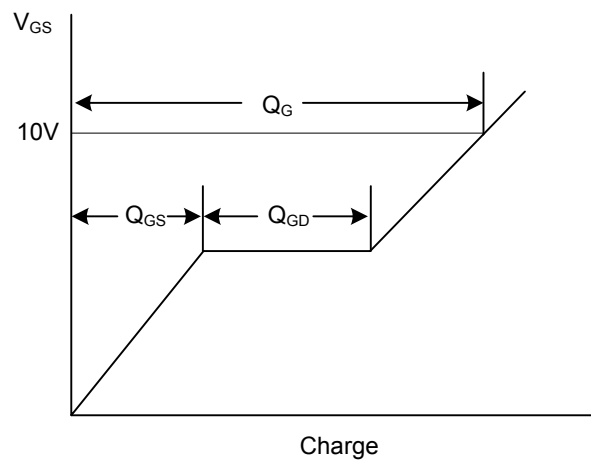
Switching Test Circuit



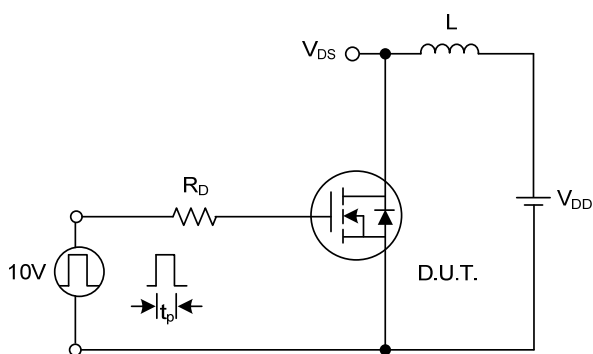
Switching Waveforms



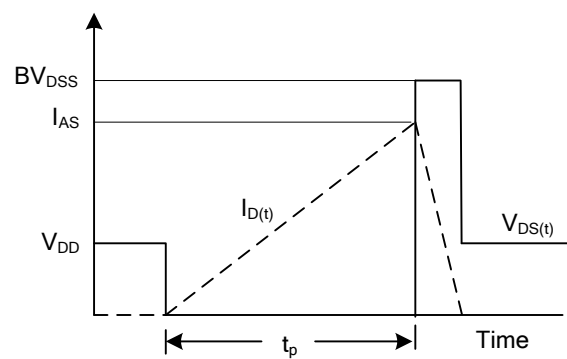
Gate Charge Test Circuit



Gate Charge Waveform

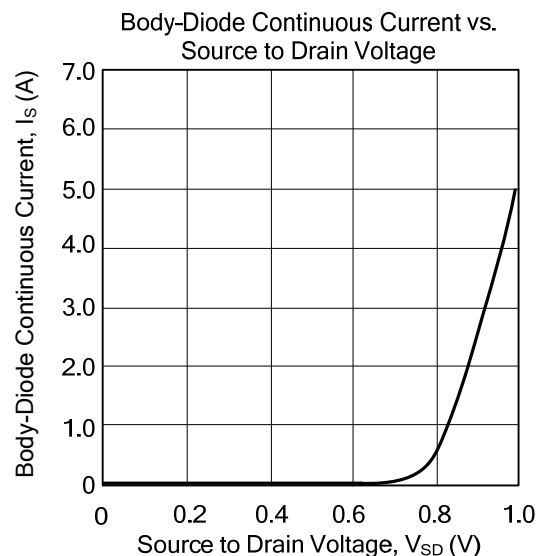
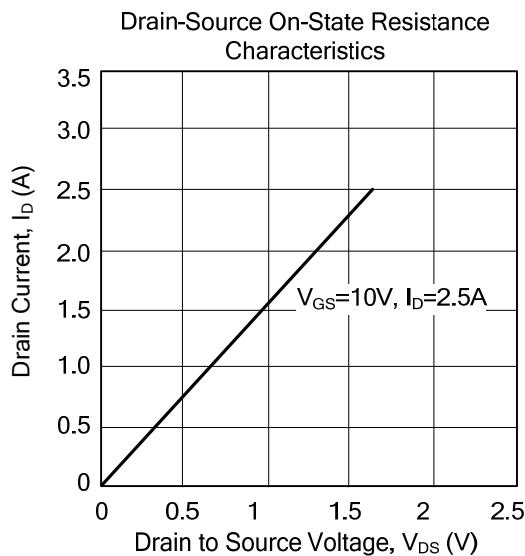
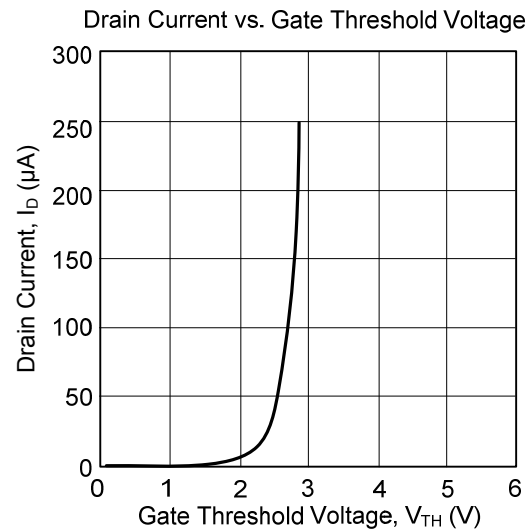
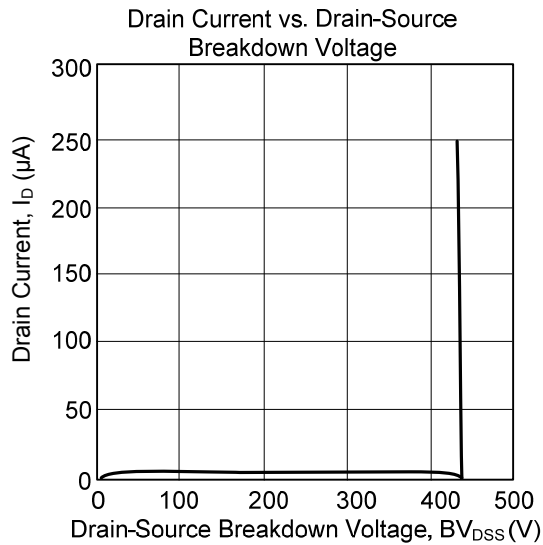


Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

TYPICAL CHARACTERISTICS



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