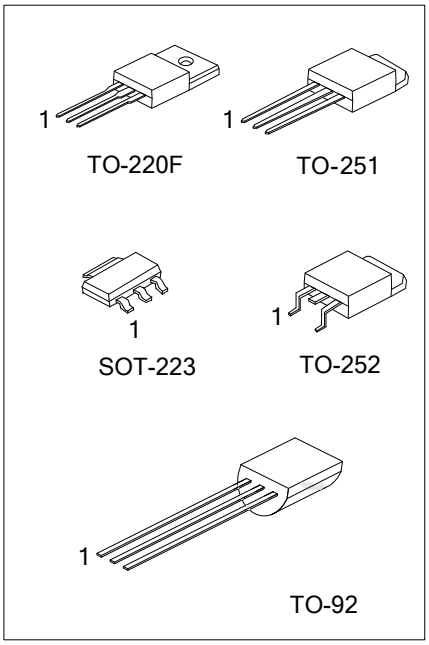
1.0A, 400V N-CHANNEL POWER MOSFET



■ DESCRIPTION

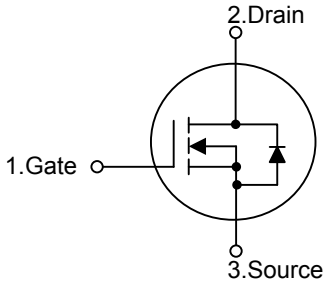
The UTC **1N40** is a N-channel mode power MOSFET using UTC's advanced technology to provide customers with planar stripe and DMOS technology. This technology specializes in allowing a minimum on-state resistance and superior switching performance. It also can withstand high energy pulse in the avalanche and commutation mode.

The UTC **1N40** is universally applied in electronic lamp ballast based on half bridge topology and high efficient switched mode power supply.

■ FEATURES

* $R_{DS(ON)}$ < 4.0Ω @ V_{GS} = 10V, I_D = 0.5A
* High Switching Speed
* 100% Avalanche Tested

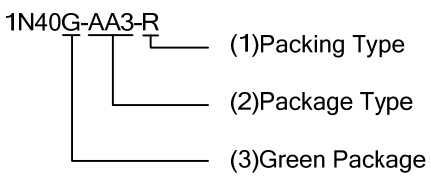
■ SYMBOL



■ ORDERING INFORMATION

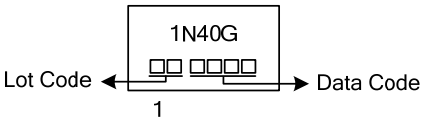
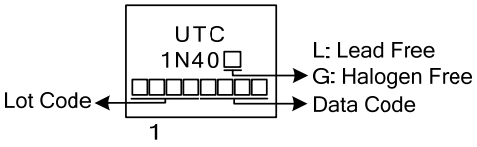
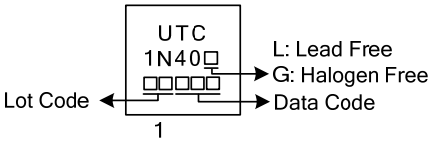
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
-	1N40G-AA3-R	SOT-223	G	D	S	Tape Reel
1N40L-TF3-T	1N40G-TF3-T	TO-220F	G	D	S	Tube
1N40L-TM3-T	1N40G-TM3-T	TO-251	G	D	S	Tube
1N40L-TN3-R	1N40G-TN3-R	TO-252	G	D	S	Tape Reel
1N40L-T92-B	1N40G-T92-B	TO-92	G	D	S	Tape Box
1N40L-T92-K	1N40G-T92-K	TO-92	G	D	S	Bulk

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



(1) R: Tape Reel, T: Tube, B: Tape Box, K: Bulk
(2) AA3: SOT-223, TF3: TO-220F, TM3: TO-251
TN3: TO-252, T92: TO-92
(3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING

Package	Marking
SOT-223	
TO-220F / TO-251 / TO-252	
TO-92	

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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DSS}	400	V
Gate-Source Voltage		V_{GSS}	±30	V
Drain Current (T_C=25°C)	Continuous	I_D	1	A
	Pulsed (Note 2)	I_{DM}	4	A
Avalanche Current (Note 2)		I_{AR}	1.5	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	15	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	5	V/ns
Power Dissipation (T_C=25°C)	TO-223	P_D	1	W
	TO-220F		15	W
	TO-251/TO-252		25	W
	TO-92		1	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 = 13 mH, I_{AS} = 1.5A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
4. I_{SD} ≤ 1.0A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C

■ THERMAL DATA

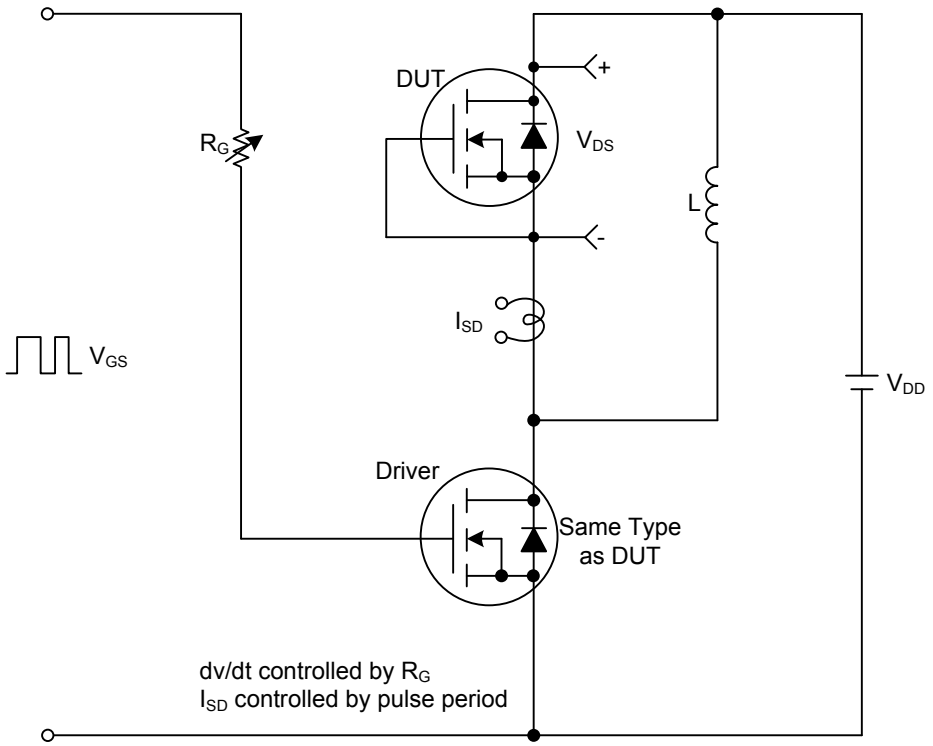
PARAMETER	PACKAGE	SYMBOL	RATINGS	UNIT
Junction to Ambient	SOT-223	θ_{JA}	150	°C/W
	TO-220F		62.5	°C/W
	TO-251/TO-252		110	°C/W
	TO-92		160	°C/W
Junction to Case	SOT-223	θ_{JC}	125	°C/W
	TO-220F		8.3	°C/W
	TO-251/TO-252		5	°C/W
	TO-92		125	°C/W

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

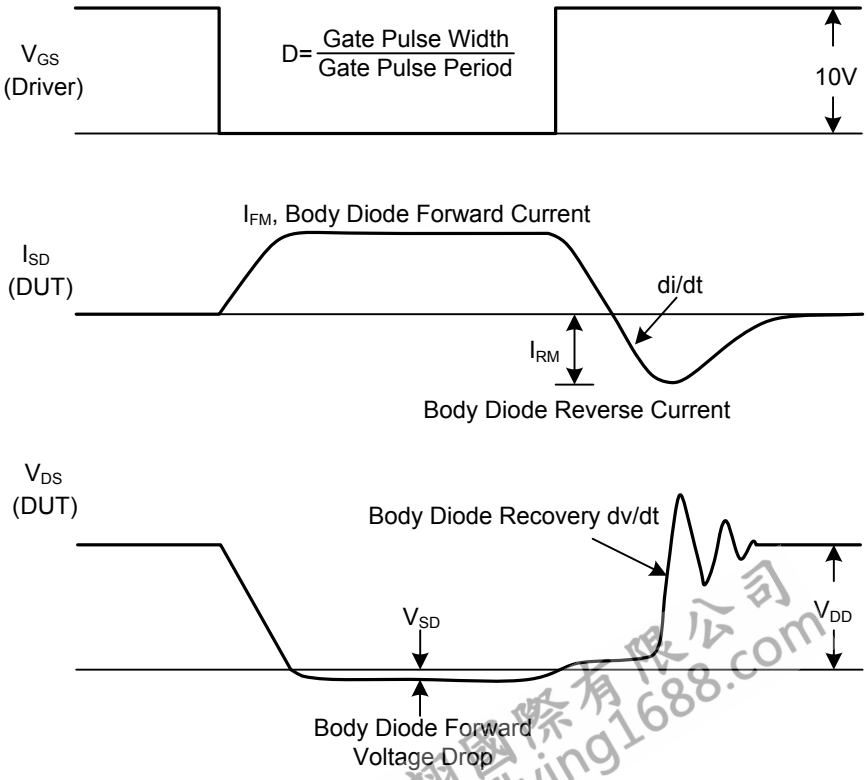
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	I_D=250μA, V_{GS}=0V	400			V
Drain-Source Leakage Current		I_{DSS}	V_{DS}=400V, V_{GS}=0V			1	μA
Gate- Source Leakage Current	Forward	I_{GSS}	V_{GS}=+30V, V_{DS}=0V			+100	nA
	Reverse		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=0.5A			4.0	Ω
DYNAMIC PARAMETERS							
Input Capacitance		C_{ISS}	V_{GS}=0V, V_{DS}=25V, f=1.0MHz		165		pF
Output Capacitance		C_{OSS}			35		pF
Reverse Transfer Capacitance		C_{RSS}			20		pF
SWITCHING PARAMETERS							
Total Gate Charge		Q_G	V_{DS}=50V, V_{GS}=10V, I_D=1.3A , I_G=100μA (Note 1, 2)		13.5		nC
Gate to Source Charge		Q_{GS}			1.5		nC
Gate to Drain Charge		Q_{GD}			1.5		nC
Turn-ON Delay Time		$t_{D(ON)}$	V_{DD}=30V, V_{GS}=10V, I_D=0.5A, R_G=25Ω (Note 1, 2)		30		ns
Rise Time		t_R			20		ns
Turn-OFF Delay Time		$t_{D(OFF)}$			60		ns
Fall-Time		t_F			13		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Body-Diode Continuous Current		I_S				1	A
Maximum Body-Diode Pulsed Current		I_{SM}				4	A
Drain-Source Diode Forward Voltage		V_{SD}	V_{GS}=0V, I_S=1.0A			1.4	V
Reverse Recovery Time		t_{rr}	V_{GS}=0V, I_S=1.0A dI$_F$/dt=100A/μs (Note 1)		160		ns
Reverse Recovery Charge		Q_{rr}			0.28		μC

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

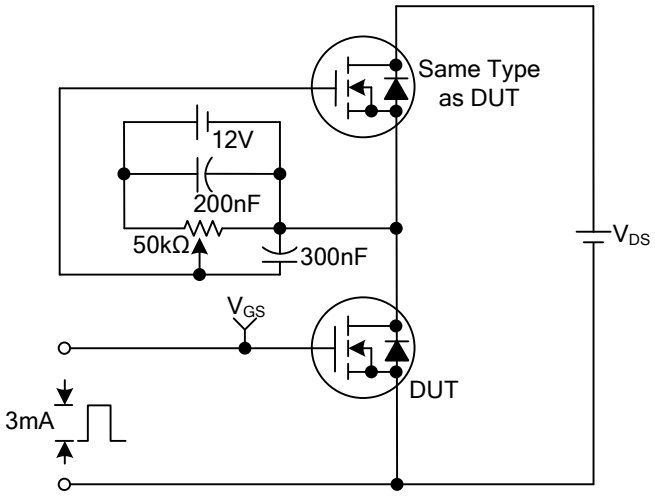
■ TEST CIRCUITS AND WAVEFORMS



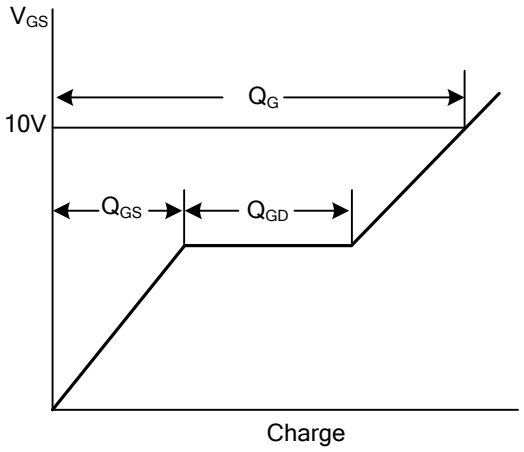
Peak Diode Recovery dv/dt Test Circuit & Waveforms



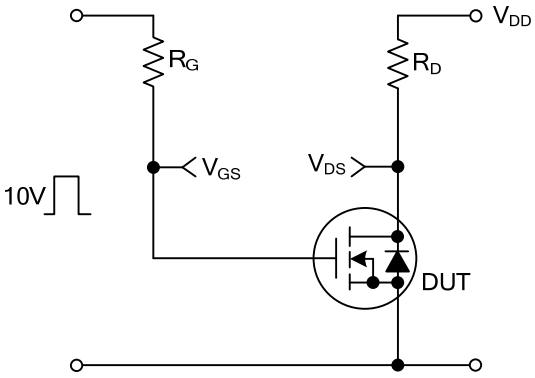
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



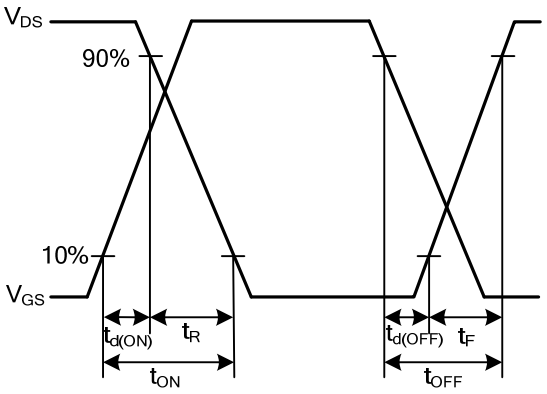
Gate Charge Test Circuit



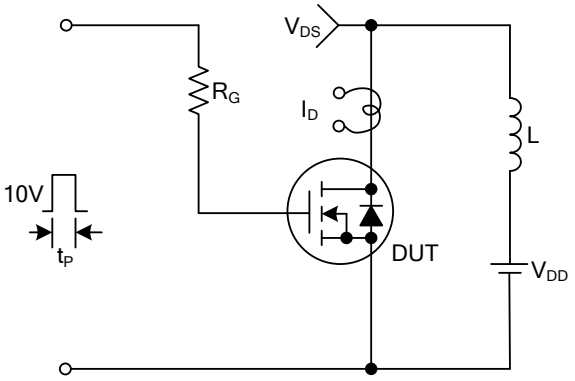
Gate Charge Waveforms



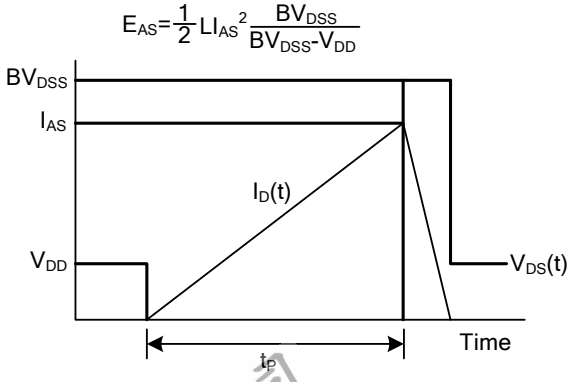
Resistive Switching Test Circuit



Resistive Switching Waveforms



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms