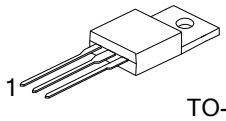
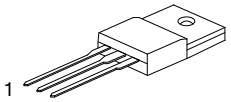
15A, 400V N-CHANNEL POWER MOSFET



TO-220



TO-220F1

■ DESCRIPTION

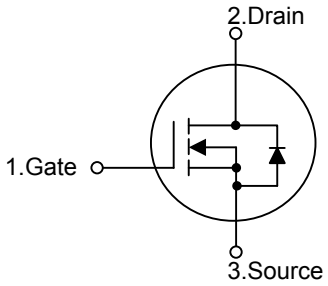
The UTC **15N40** is an N-channel mode power MOSFET using UTC's advanced technology to provide customers with planar stripe and DMOS technology. This technology allows a minimum on-state resistance and superior switching performance. It also can withstand high energy pulse in the avalanche and commutation mode.

The UTC **15N40** is generally applied in high efficiency switch mode power supplies.

■ FEATURES

* $R_{DS(ON)}$=0.35Ω @ V_{GS}=10V,I_D=7.5A
* Low Gate Charge (Typical 28nC)
* Low C_{RSS} (Typical 17pF)
* High Switching Speed

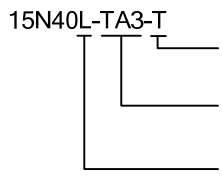
■ SYMBOL



■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
15N40L-TA3-T	15N40G-TA3-T	TO-220	G	D	S	Tube
15N40L-TF1-T	15N40G-TF1-T	TO-220F1	G	D	S	Tube

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



(1) T: Tube

(2) TA3: TO-220, TF1: TO-220F1

(3) G: Halogen Free, L: Lead Free

■ ABSOLUTE MAXIMUM RATINGS (T_C=25°C, unless otherwise specified.) (Note 5)

PARAMETER			SYMBOL	RATINGS	UNIT
Drain to Source Voltage			V_{DSS}	400	V
Gate-Source Voltage			V_{GSS}	±30	V
Drain Current	Continuous	T_C=25°C	I_D	15	A
		T_C=100°C		9	A
	Pulsed (Note 2)		I_{DM}	60	A
Avalanche Current (Note 2)			I_{AR}	15	A
Avalanche Energy	Single Pulsed (Note 3)		E_{AS}	731	mJ
	Repetitive (Note 2)		E_{AR}	17	mJ
Peak Diode Recovery dv/dt (Note 4)			dv/dt	15	V/ns
Power Dissipation (T_C=25°C)			P_D	170	W
Derate above 25°C				1.45	W/°C
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=6.5mH, I_{AS}=15A. V_{DD}=50V, R_G=25Ω, Starting T_J=25°C
4. I_{SD}≤15A, di/dt≤200A/μs, V_{DD}≤BV_{DSS}, Starting T_J=25°C
5. Drain current limited by maximum junction temperature

■ THERMAL CHARACTERISTICS

PARAMETER	SYMBOL	RATINGS	UNIT
Junction to Ambient	θ_{JA}	62.5	°C/W
Junction to Case	θ_{JC}	0.7	°C/W

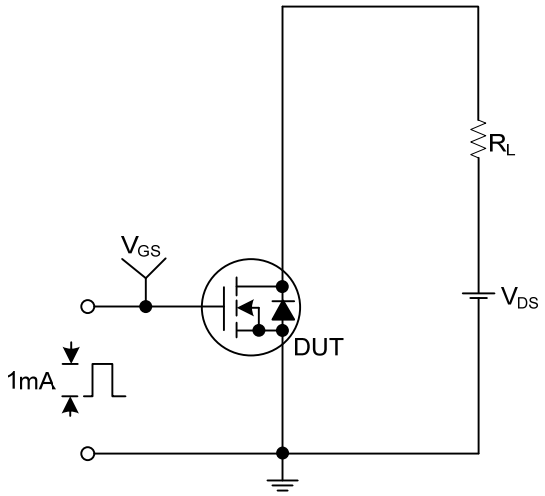
■ ELECTRICAL CHARACTERISTICS

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	I_D=250μA, V_{GS}=0V, T_J=25°C	400			V
Breakdown Voltage Temperature Coefficient		$\Delta BV_{DSS}/\Delta T_J$	Reference to 25°C, I_D=250μA		0.5		V/°C
Drain-Source Leakage Current		I_{DSS}	V_{DS}=400V, V_{GS}=0V,			1	μA
			V_{DS}=320V, T_C=125°C			10	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_{GS}=V_{DS}, I_D=250μA	2.0		4.0	V
Static Drain-Source On-State Resistance		$R_{DS(ON)}$	V_{GS}=10V, I_D=7.5A		0.26	0.35	Ω
DYNAMIC PARAMETERS							
Input Capacitance		C_{ISS}	V_{DS}=25V, V_{GS}=0V, f=1.0MHz		1310	1750	pF
Output Capacitance		C_{OSS}			210	280	pF
Reverse Transfer Capacitance		C_{RSS}			17	25	pF
SWITCHING PARAMETERS							
Total Gate Charge		Q_G	V_{DS}=320V, V_{GS}=10V, I_D=15A (Note 1, 2)		28	36	nC
Gate to Source Charge		Q_{GS}			8		nC
Gate to Drain ("Miller") Charge		Q_{GD}			12		nC
Turn-ON Delay Time		$t_{D(ON)}$	V_{DD}=200V, I_D=15A, R_G=25Ω (Note 1, 2)		26	62	ns
Rise Time		t_R			55	120	ns
Turn-OFF Delay Time		$t_{D(OFF)}$			72	154	ns
Fall-Time		t_F			40	90	ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Body-Diode Continuous Current		I_S				15	A
Maximum Body-Diode Pulsed Current		I_{SM}				60	A
Drain-Source Diode Forward Voltage		V_{SD}	I_{SD}=15A, V_{GS}=0V			1.4	V
Body Diode Reverse Recovery Time		t_{rr}	I_{SD}=15A, V_{GS}=0V, dI_F/dt=100A/μs (Note 1)		333		ns
Body Diode Reverse Recovery Charge		Q_{RR}			3.24		μC

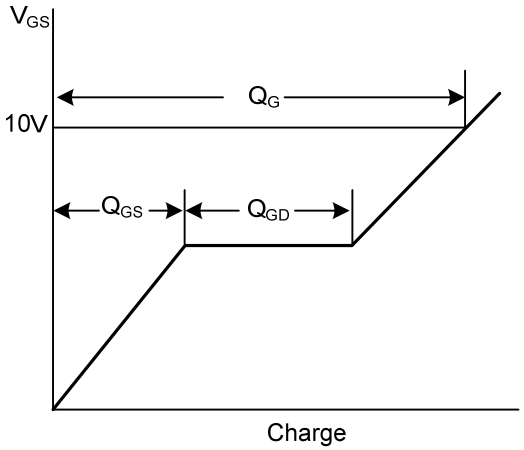
Notes: 1. Pulse Test: Pulse width≤300μs; Duty Cycle≤2%.
2. Essentially Independent of Operating Temperature Typical Characteristics

■ TEST CIRCUITS AND WAVEFORMS

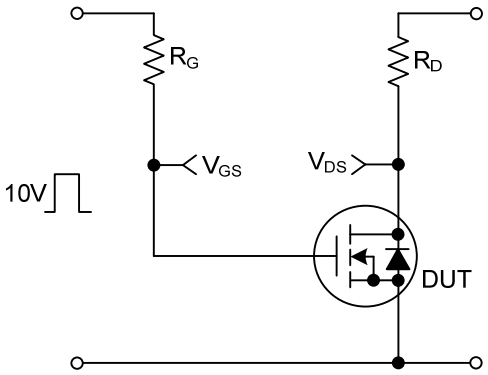
Gate Charge Test Circuit



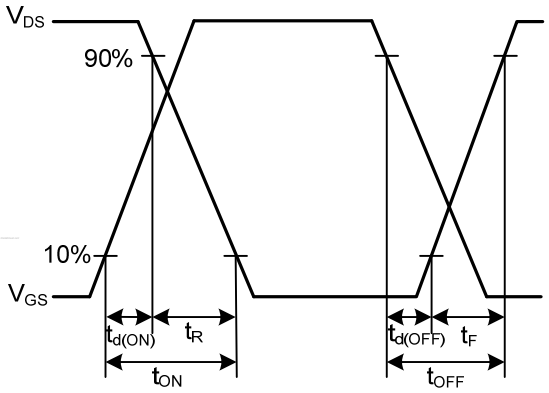
Gate Charge Waveforms



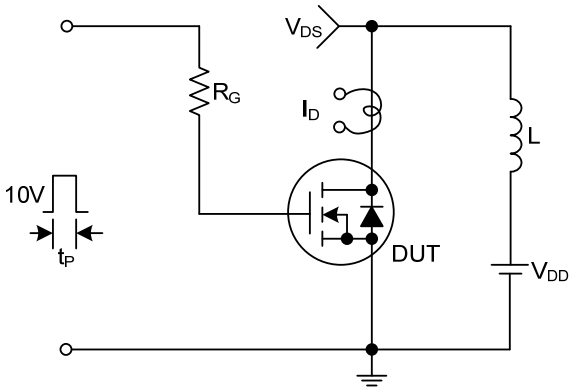
Resistive Switching Test Circuit



Resistive Switching Waveforms

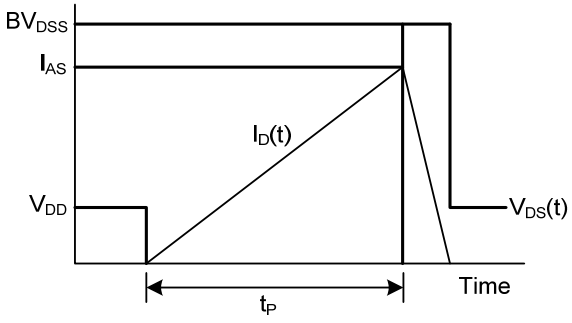


Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

$$E_{AS}=\frac{1}{2}LI_{AS}^{2}\frac{BV_{DSS}}{BV_{DSS}-V_{DD}}$$



■ TEST CIRCUITS AND WAVEFORMS(Cont.)

Peak Diode Recovery dv/dt Test Circuit & Waveforms