



15N60

Power MOSFET

15A, 600V N-CHANNEL POWER MOSFET

DESCRIPTION

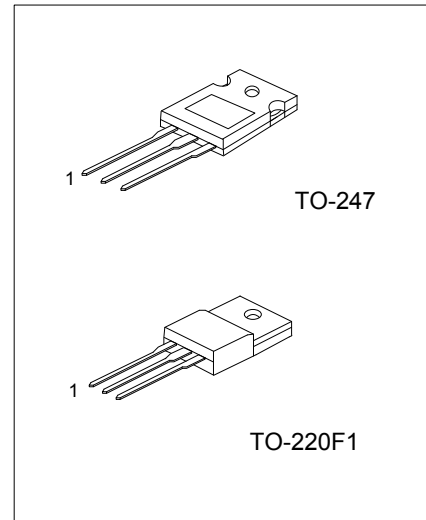
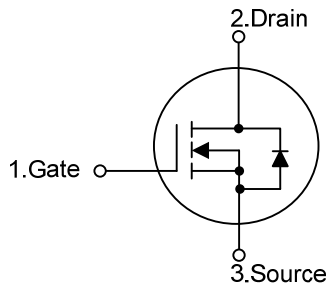
The UTC **15N60** is an N-channel mode power MOSFET using UTC's advanced technology to provide costumers with planar stripe and DMOS technology. This technology is specialized in allowing a minimum on-state resistance and superior switching performance. It also can withstand high energy pulse in the avalanche and commutation mode.

The UTC **15N60** is universally applied in active power factor correction and high efficient switched mode power supplies.

FEATURES

- * $R_{DS(ON)}=0.65\Omega$ @ $V_{GS}=10V$
- * High switching speed
- * Improved dv/dt capability

SYMBOL



ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
15N60L-TF1-T	15N60G-TF1-T	TO-220F1	G	D	S	Tube
15N60L-T47-T	15N60G-T47-T	TO-247	G	D	S	Tube

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

<p>15N60L-TF1-T</p> <ul style="list-style-type: none">(1) Packing Type(2) Package Type(3) Lead Free	<ul style="list-style-type: none">(1) T: Tube(2) TF1: TO-220F1, T47: TO-247(3) G: Halogen Free, L: Lead Free
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■ ABSOLUTE MAXIMUM RATINGS ($T_c=25^\circ\text{C}$, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain to Source Voltage		V_{DSS}	600	V
Gate to Source Voltage		V_{GSS}	± 30	V
Avalanche Current (Note 2)		I_{AR}	15	A
Continuous Drain Current	Continuous	I_D	15	A
	Pulsed (Note 2)	I_{DM}	60	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	637	mJ
	Repetitive (Note 2)	E_{AR}	25.0	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	TO-220F1	P_D	38.5	W
	TO-247		312	
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. $L=5.23\text{mH}$, $I_{AS}=15\text{A}$, $V_{DD}=50\text{V}$, $R_G=25\Omega$, Starting $T_J=25^\circ\text{C}$

4. $I_{SD}\leq 15\text{A}$, $di/dt\leq 200\text{A}/\mu\text{s}$, $V_{DD}\leq BV_{DSS}$, Starting $T_J=25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220F1	θ_{JA}	62.5	$^\circ\text{C/W}$
	TO-247		40	
Junction to Case	TO-220F1	θ_{JC}	3.3	$^\circ\text{C/W}$
	TO-247		0.4	

■ 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, T _J =25°C	600			V
Breakdown Voltage Temperature Coefficient		ΔBV _{DSS} /ΔT _J	I _D =250μA, Referenced to 25°C		0.65		V/°C
Drain-Source Leakage Current		I _{DSS}	V _{DS} =600V, V _{GS} =0V			1	μA
			V _{DS} =520V, 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 _{DS} =V _{GS} , I _D =250μA	2.0		4.0	V
Drain-Source On-State Resistance		R _{DS(ON)}	V _{GS} =10V, I _D =7.5A		0.45	0.65	Ω
DYNAMIC PARAMETERS							
Input Capacitance		C _{ISS}	V _{DS} =25V, V _{GS} =0V, f=1.0MHz		2400	3095	pF
Output Capacitance		C _{OSS}			270	385	pF
Reverse Transfer Capacitance		C _{RSS}			25	35.5	pF
SWITCHING PARAMETERS							
Turn-ON Delay Time		t _{D(ON)}	V _{DD} =325V, I _D =15A, R _G =21.7Ω (Note 1, 2)		100	140	ns
Turn-ON Rise Time		t _R			200	260	ns
Turn-OFF Delay Time		t _{D(OFF)}			500	550	ns
Turn-OFF Fall Time		t _F			210	250	ns
Total Gate Charge		Q _G	V _{DS} =520V, V _{GS} =10V, I _D =15A (Note 1, 2)		270	300	nC
Gate-Source Charge		Q _{GS}			25		nC
Gate-Drain Charge		Q _{GD}			51		nC
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 _S =15A, V _{GS} =0V			1.4	V
Body Diode Reverse Recovery Time		t _{rr}	V _{GS} =0V, I _S =15A,		496		ns
Body Diode Reverse Recovery Charge		Q _{RR}	dl _F /dt=100A/μs (Note 1)		5.69		μC

Notes: 1. Pulse Test : Pulse width ≤ 300μs, Duty cycle ≤ 2%

2. Essentially independent of operating temperature

3. Drain current limited by maximum junction temperature

D.U.T.

V_{DS}

+

-

+

-

L

R_G

Driver

Same Type as D.U.T.

V_{GS}

V_{DD}

- * dv/dt controlled by R_G
- * I_{SD} controlled by pulse period
- * D.U.T.-Device Under Test

The diagram illustrates the switching behavior of a MOSFET's body diode. It consists of three vertically aligned waveforms sharing a common time axis.

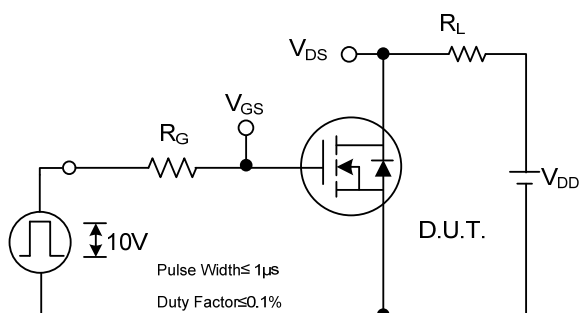
- Top Trace (V_{GS} (Driver)):** A square wave pulse. The pulse width is labeled **P.W.**, and the total duration of one cycle is labeled **Period**. The duty cycle is given by the formula $D = \frac{P.W.}{Period}$. The pulse amplitude is indicated as $V_{GS} = 10V$.
- Middle Trace (I_{SD} (D.U.T.)):** Shows the source-drain current. During the V_{GS} pulse, it represents the **Body Diode Forward Current** (I_{FM}). When V_{GS} is low, the current becomes negative, representing the **Body Diode Reverse Current** (I_{RM}). The reverse current waveform shows a sharp turn-off characterized by di/dt .
- Bottom Trace (V_{DS} (D.U.T.)):** Shows the drain-source voltage. It is low during the V_{GS} pulse and rises to V_{DD} when V_{GS} is low. The rising edge of V_{DS} is labeled **Body Diode Recovery dv/dt** . The voltage level is V_{DD} .

Additional labels at the bottom include **Body Diode** and **Forward Voltage Drop**, which correspond to the negative current and low voltage regions, respectively.

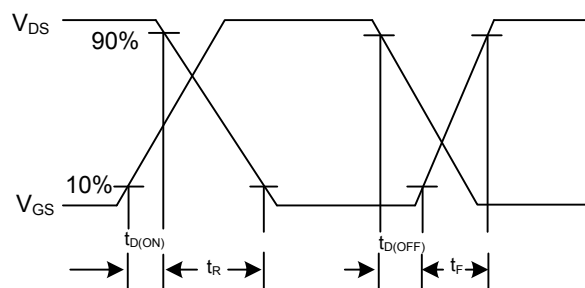
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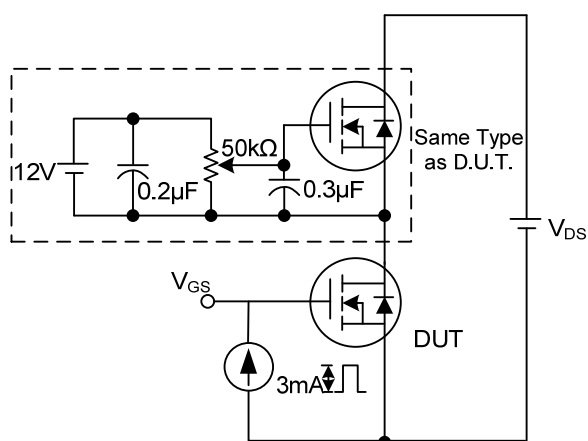
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



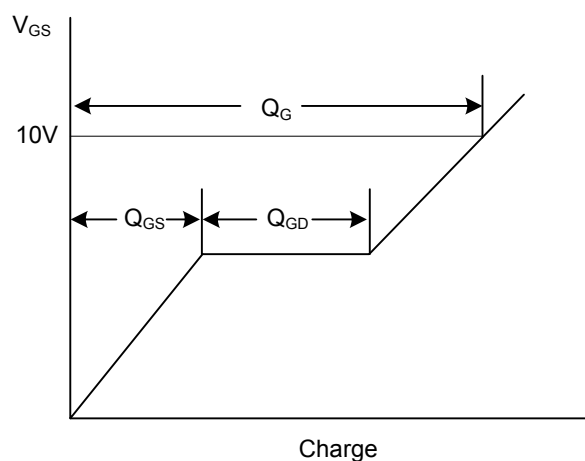
Switching Test Circuit



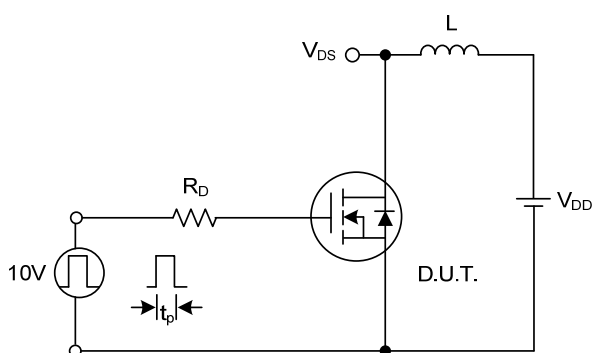
Switching Waveforms



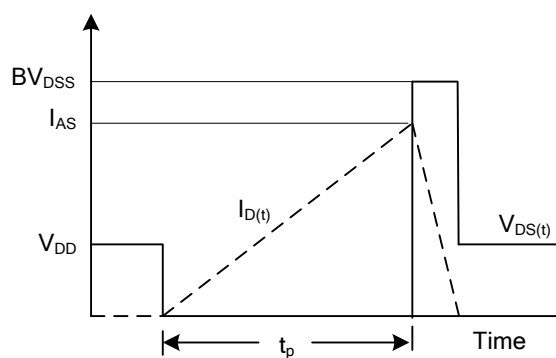
Gate Charge Test Circuit



Gate Charge Waveform

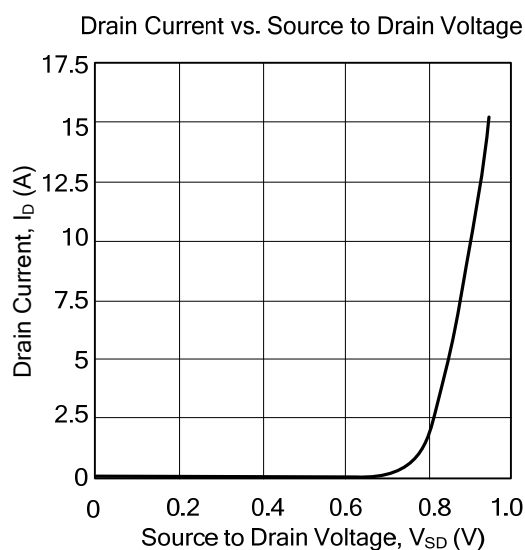
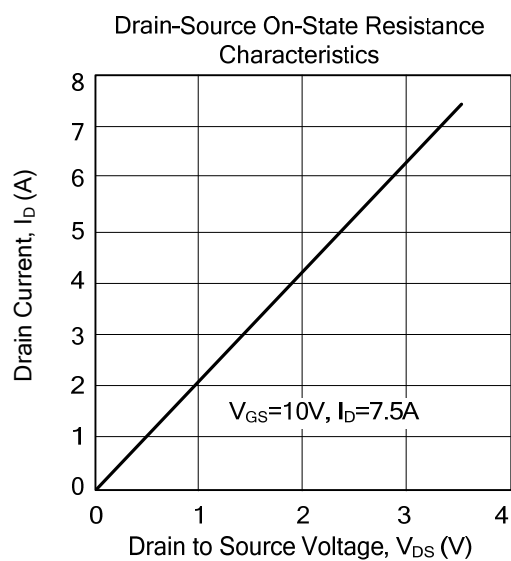
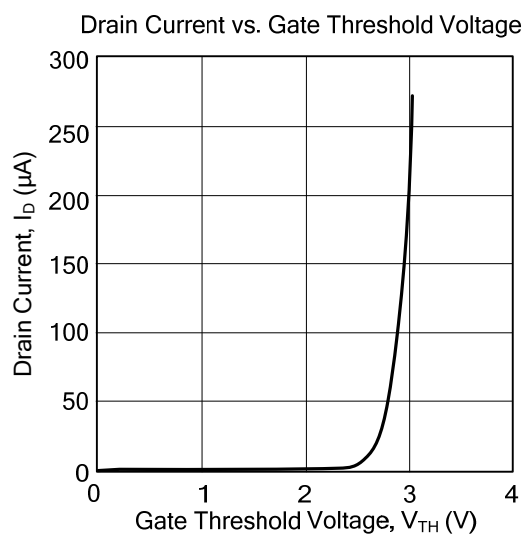
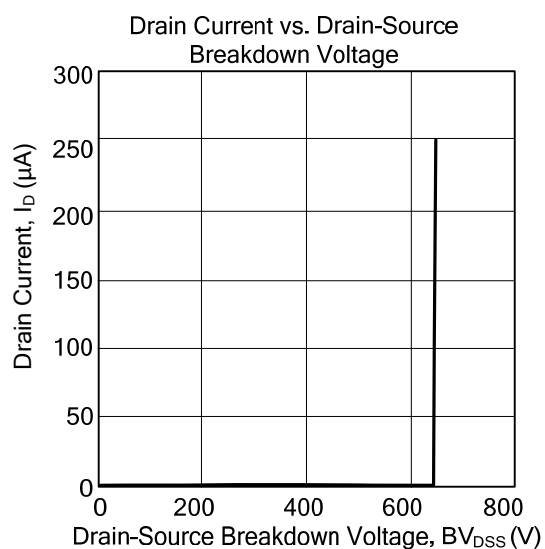


Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS



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