

**UTC** UNISONIC TECHNOLOGIES CO., LTD

# 3N60-LC

# 3.0A, 600V N-CHANNEL POWER MOSFET

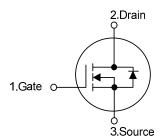
#### DESCRIPTION

The UTC 3N60-LC is a high voltage power MOSFET designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and high rugged avalanche characteristics. This power MOSFET is usually used in high speed switching applications of switching power supplies and adaptors.

#### **FEATURES**

- \*  $R_{DS(ON)} \le 3.0 \ \Omega \ @ V_{GS}=10V, I_D=1.5A$
- \* Fast switching capability
- \* Avalanche energy tested
- \* Improved dv/dt capability, high ruggedness

#### **SYMBOL**

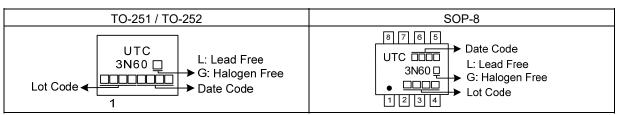


#### ORDERING INFORMATION

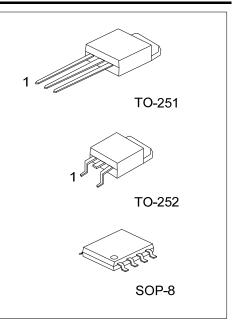
Ordering Number		Deekege	Pin Assignment						Decking		
Lead Free	Halogen Free	Package	1	2	3	4	5	6	7	8	Packing
3N60L-TM3-T	3N60G-TM3-T	TO-251	G	D	S	I	-	I	1	-	Tube
3N60L-TN3-R	3N60G-TN3-R	TO-252	G	D	S	-	-	-	-	-	Tape Reel
3N60L-S08-R	3N60G-S08-R	SOP-8	S	S	S	G	D	D	D	D	Tape Reel
Note: Pin Assignment: G: Gate D: Drain S: Source											

3N60G-TM3-T	(1) T: Tube, R: Tape Reel
(2)Package Type	(2) TM3: TO-251, TN3: TO-252, S08: SOP-8
(3)Green Package	(3) G: Halogen Free and Lead Free, L: Lead Free

#### MARKING



# **Power MOSFET**



### ■ **ABSOLUTE MAXIMUM RATINGS** (Tc=25°C, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V <sub>DSS</sub>	600	V
Gate-Source Voltage		V <sub>GSS</sub>	±30	V
Continuous Drain Current		ID	3	А
Pulsed Drain Current (Note 2)		I <sub>DM</sub>	6	А
Avalanche Energy	Single Pulsed (Note 3)	E <sub>AS</sub>	108	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.4	V/ns
Power Dissipation	TO-251/TO-252		48	W
	SOP-8	PD	2.1	W
Junction Temperature		TJ	+150	°C
Storage Temperature		T <sub>STG</sub>	-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 = 30mH,  $I_{AS}$  = 2.68A,  $V_{DD}$  = 50V,  $R_{G}$  = 25  $\Omega$ , Starting  $T_{J}$  = 25 °C

4.  $I_{SD} \le 3.0A$ , di/dt  $\le 200A/\mu s$ ,  $V_{DD} \le BV_{DSS}$ , Starting  $T_J = 25^{\circ}C$ 

#### THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient (Note)	TO-251/TO-252	0	110	°C/W
	SOP-8	θja	190	°C/W
Junction to Case (Note)	TO-251/TO-252	0	2.6 (Note)	°C/W
	SOP-8	θις	59.5 (Note)	°C/W

Note: Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.



PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, Ι <sub>D</sub> =250μΑ	600			V
Drain-Source Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> =600V, V <sub>GS</sub> =0V			10	μA
Cata Sauraa Laakaga Current Forward		V <sub>GS</sub> =30V, V <sub>DS</sub> =0V			100	nA
Gate- Source Leakage Current Reverse	I <sub>GSS</sub>	V <sub>GS</sub> =-30V, V <sub>DS</sub> =0V			-100	nA
ON CHARACTERISTICS						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250µA	2.0		4.0	V
Static Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =1.5A			3.0	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	CISS			446		рF
Output Capacitance	Coss	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1.0MHz		46		рF
Reverse Transfer Capacitance	C <sub>RSS</sub>			4.5		рF
SWITCHING CHARACTERISTICS						
Total Gate Charge (Note 1)	$Q_G$			15.2		nC
Gate-Source Charge	Q <sub>GS</sub>	V <sub>DS</sub> =100V, V <sub>GS</sub> =10V, I <sub>D</sub> =2.0A I <sub>G</sub> =1mA (Note 1, 2)		5.4		nC
Gate-Drain Charge	$Q_{GD}$	IG-IIIA (NOLE 1, 2)		1.8		nC
Turn-On Delay Time (Note 1)	t <sub>D(ON)</sub>			6.4		ns
Turn-On Rise Time	t <sub>R</sub>	V <sub>DS</sub> =30V, V <sub>GS</sub> =10V, I <sub>D</sub> =0.5A,		16.7		ns
Turn-Off Delay Time	t <sub>D(OFF)</sub>	R <sub>G</sub> =25Ω (Note 1, 2)		39		ns
Turn-Off Fall Time	t <sub>F</sub>			27		ns
DRAIN-SOURCE DIODE CHARACTERISTICS	AND MAXI	MUM RATINGS				
Maximum Continuous Drain-Source Diode	ls				3	А
Forward Current	IS				3	A
Maximum Pulsed Drain-Source Diode Forward	Ism				6	А
Current	ISM				0	A
Drain-Source Diode Forward Voltage (Note 1)	Vsd	Is=3.0A , V <sub>GS</sub> =0V			1.4	V
Reverse Recovery Time (Note 1)	t <sub>rr</sub>	Is=3.0A , V <sub>GS</sub> =0V		220		ns
Reverse Recovery Charge	Qrr	di/dt=100A/µs		3		μC

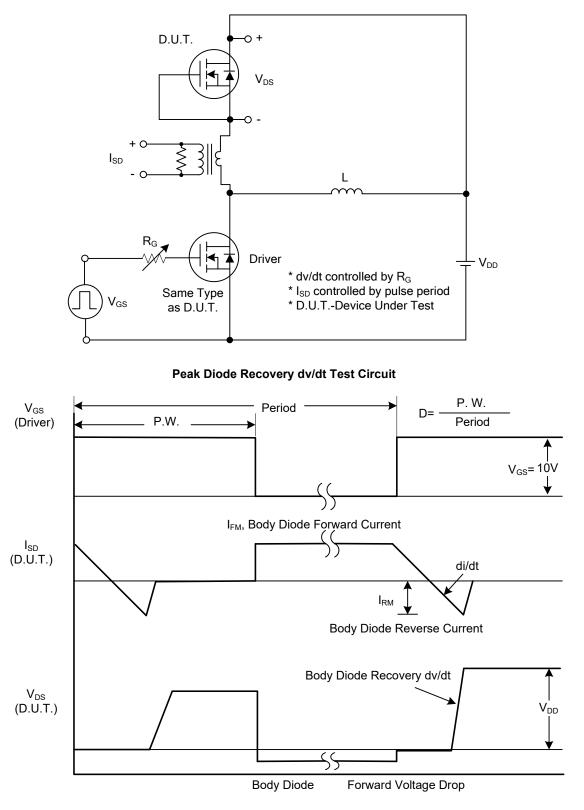
#### ■ ELECTRICAL CHARACTERISTICS (T<sub>J</sub>=25°C, unless otherwise specified)

Notes: 1. Pulse Test: Pulse width  $\leq$  300µs, Duty cycle  $\leq$  2%.

2. Essentially independent of operating temperature.



## TEST CIRCUITS AND WAVEFORMS

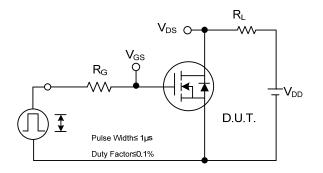




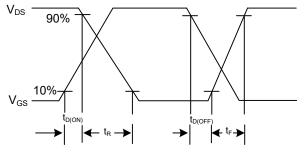


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### ■ TEST CIRCUITS AND WAVEFORMS



Switching Test Circuit



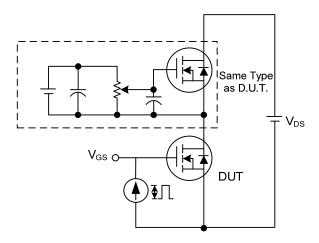
Switching Waveforms

 $\mathsf{Q}_{\mathsf{G}}$ 

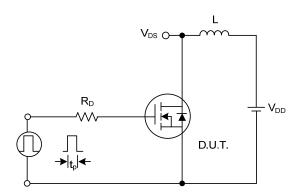
Q<sub>GD</sub>

 $V_{\text{GS}}$ 

Q<sub>GS</sub>-



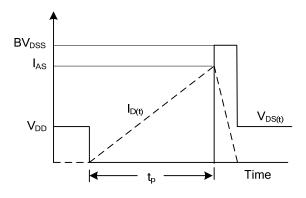
Gate Charge Test Circuit



**Unclamped Inductive Switching Test Circuit** 

Gate Charge Waveform

Charge

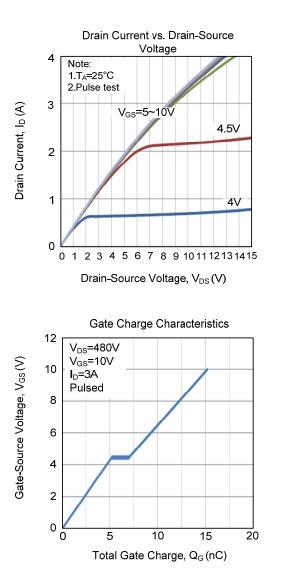


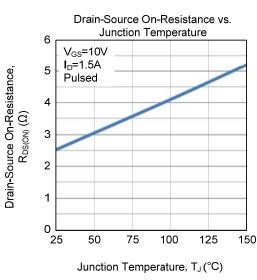
**Unclamped Inductive Switching Waveforms** 

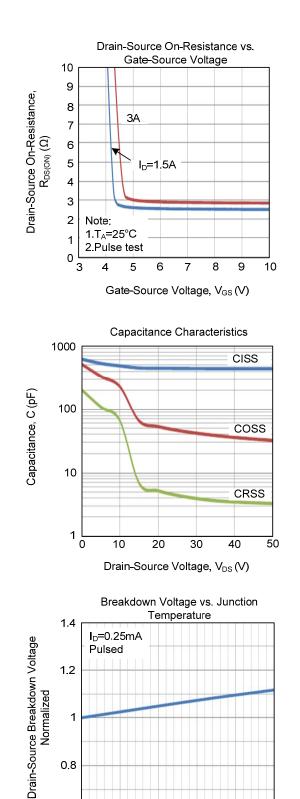


### Power MOSFET

### TYPICAL CHARACTERISTICS







Junction Temperature, T<sub>J</sub>(°C)

100

125

75

0.6

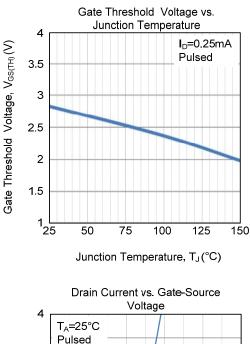
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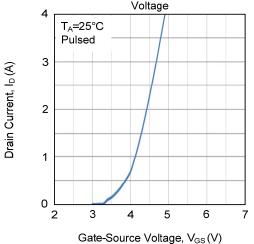
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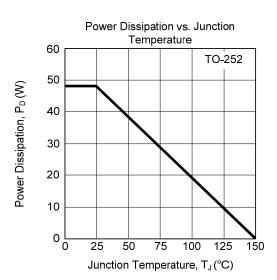


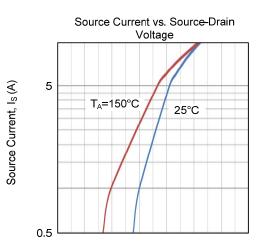
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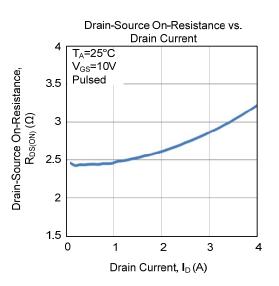


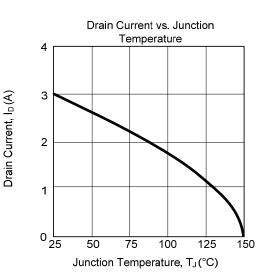






Source-Drain Voltage, V<sub>SD</sub> (V)

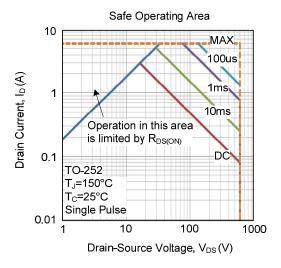






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## ■ TYPICAL CHARACTERISTICS (Cont.)



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