

UNISONIC TECHNOLOGIES CO., LTD

5N60Z **Preliminary Power MOSFET**

5A, 600V N-CHANNEL **POWER MOSFET**

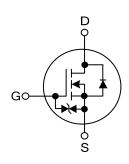
DESCRIPTION

The UTC 5N60Z is a high voltage power MOSFET and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

FEATURES

- * $R_{DS(ON)} = 2.2\Omega @V_{GS} = 10 \text{ V}$
- * Ultra Low Gate Charge (Typical 15 nC)
- * Low Reverse Transfer Capacitance (C_{RSS} = Typical 6.5 pF)
- * Fast Switching Capability
- * Avalanche Energy Specified
- * Improved dv/dt Capability, High Ruggedness

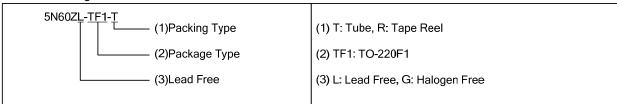




ORDERING INFORMATION

Ordering Number		Dookogo	Pin Assignment			Dealing	
Lead Free	Halogen Free	Package	1	2	3	Packing	
5N60ZL-TF1-T	5N60ZG-TF1-T	TO-220F1	G	D	S	Tube	

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



TO-220F1

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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DSS}	600	V
Gate-Source Voltage		V_{GSS}	±20	V
Avalanche Current (Note 2)		I _{AR}	5	Α
Continuous Drain Current		I_{D}	5	Α
Pulsed Drain Current (Note 2)		I _{DM}	20	Α
Avalanche Energy	Single Pulsed (Note 3)	E _{AS}	210	
	Repetitive (Note 2)	E_{AR}	10	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation		P_{D}	36	W
Junction Temperature		T_J	+150	°C
Operation Temperature		T _{OPR}	-55 ~ +150	°C
Storage Temperature		T _{STG}	-55 ~ +150	°C

Note: 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. Pulse width limited by $T_{J(MAX)}$
- 3. L = 16.8mH, I_{AS} = 5A, V_{DD} = 50V, R_{G} = 25 Ω , Starting T_{J} = 25°C
- 4. $I_{SD} \le 5A$, 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	θ_{JA}	62.5	°C/W		
Junction to Case	$\theta_{ m JC}$	3.47	°C/W		

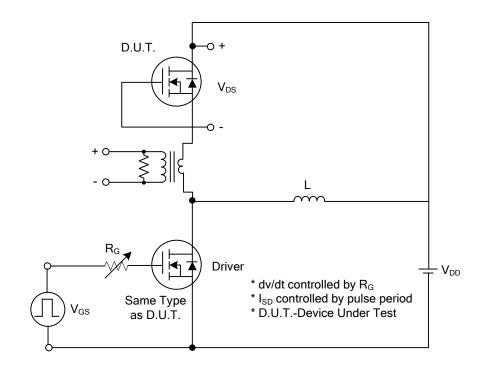
■ **ELECTRICAL CHARACTERISTICS** (T_C = 25°C, unless otherwise specified)

$ \begin{array}{ c c c c c } \hline \textbf{OFF CHARACTERISTICS} \\ \hline \textbf{Drain-Source Breakdown Voltage} & \textbf{BV}_{DSS} & \textbf{V}_{GS} = 0\textbf{V}, \textbf{I}_{D} = 250\mu \textbf{A} & 600 & \textbf{V}_{DS} \\ \hline \textbf{Drain-Source Leakage Current} & \textbf{I}_{DSS} & \textbf{V}_{DS} = 600\textbf{V}, \textbf{V}_{GS} = 0\textbf{V} & 1 & \mu \\ \hline \textbf{Gate-Source Leakage Current} & \textbf{Forward} & \textbf{I}_{GSS} & \textbf{V}_{CS} = 20\textbf{V}, \textbf{V}_{DS} = 0\textbf{V} & +5 & \mu \\ \hline \textbf{Breakdown Voltage Temperature Coefficient} & \textbf{\DeltaBV}_{DSS}/\Delta \textbf{T}_{J} & \textbf{I}_{D} = 250\mu \textbf{A}, \textbf{Referenced to 25°C} & 0.6 & \textbf{V}/ \\ \hline \textbf{ON CHARACTERISTICS} & \textbf{Gate Threshold Voltage} & \textbf{V}_{GS(TH)} & \textbf{V}_{DS} = \textbf{V}_{GS}, \textbf{I}_{D} = 250\mu \textbf{A} & 2.0 & 4.0 & \textbf{V}/ \\ \hline \textbf{Static Drain-Source On-State Resistance} & \textbf{R}_{DS(ON)} & \textbf{V}_{GS} = 10\textbf{V}, \textbf{I}_{D} = 2.5\textbf{A} & 1.8 & 2.2 & \textbf{G}/ \\ \hline \textbf{DYNAMIC CHARACTERISTICS} & \textbf{Input Capacitance} & \textbf{C}_{CSS} & \textbf{V}_{DS} = 25\textbf{V}, \textbf{V}_{GS} = 0\textbf{V}, \\ \hline \textbf{Reverse Transfer Capacitance} & \textbf{C}_{CSS} & \textbf{f} = 1.0 \textbf{MHz} & 5.5 & 7.2 & \textbf{p}/ \\ \hline \textbf{SWITCHING CHARACTERISTICS} & \textbf{Input Characteristics} & I$	PARAMETER		ЛВОL	TEST CONDITIONS	MIN	TVP	MAX	LINIT
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$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	-			· · · · · · · · · · · · · · · · · · ·	000		1	μA
			755				-	μιτ
Breakdown Voltage Temperature Coefficient $\Delta BV_{DSS}/\Delta T_J$ I_D =250μA, Referenced to 25°C0.6V/ON CHARACTERISTICSGate Threshold Voltage $V_{GS(TH)}$ $V_{DS} = V_{GS}$, $I_D = 250\mu A$ 2.04.0V.0Static Drain-Source On-State Resistance $R_{DS(ON)}$ $V_{GS} = 10V$, $I_D = 2.5A$ 1.82.2C.0DYNAMIC CHARACTERISTICSInput Capacitance C_{ISS} $V_{DS} = 25V$, $V_{GS} = 0V$, $I_D = 2.5A$ 515670p.0Output Capacitance C_{OSS} $I_D = 2.5A$ 515670p.0Reverse Transfer Capacitance $I_D = 2.5A$ $I_D = 2.5A$ 515670p.0Reverse Transfer Capacitance $I_D = 2.5A$ $I_D = 2.5A$ $I_D = 2.5A$ 515670p.0SWITCHING CHARACTERISTICS $I_D = 2.5A$ <td< td=""><td>e-Source Leakage Current</td><td><u> </u></td><td>SSS</td><td></td><td></td><td></td><td></td><td>μA</td></td<>	e-Source Leakage Current	<u> </u>	SSS					μA
Gate Threshold Voltage $V_{GS(TH)}$ $V_{DS} = V_{GS}$, $I_D = 250 \mu A$ 2.0 4.0 No Static Drain-Source On-State Resistance $R_{DS(ON)}$ $V_{GS} = 10 V$, $I_D = 2.5 A$ 1.8 2.2 On DYNAMIC CHARACTERISTICS Input Capacitance C_{ISS} $V_{DS} = 25 V$, $V_{GS} = 0 V$, $I_D = 2.5 A$ 5.15 670 produpt Capacitance $I_D = 1.0 MHz$ $I_D = 1.0 $	l l		oss/ΔT _J			0.6		V/°C
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$								
	Gate Threshold Voltage		S(TH)	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$	2.0		4.0	V
	Static Drain-Source On-State Resistance			-		1.8	2.2	Ω
Output Capacitance C_{OSS} $V_{DS} = 25V$, $V_{GS} = 0V$, $f = 1.0MHz$ 55 72 pReverse Transfer Capacitance C_{RSS} $f = 1.0MHz$ 6.5 8.5 pSWITCHING CHARACTERISTICSTurn-On Delay Time $t_{D(ON)}$ 10 30 n	NAMIC CHARACTERISTICS							
	Input Capacitance		iss			515	670	pF
Reverse Transfer Capacitance C_{RSS} $I = 1.0WIT2$ 6.5 8.5 p SWITCHING CHARACTERISTICS Turn-On Delay Time $t_{D(ON)}$ 10 30 n	Output Capacitance					55	72	pF
SWITCHING CHARACTERISTICS Turn-On Delay Time t _{D(ON)} 10 30 n	Reverse Transfer Capacitance					6.5	8.5	рF
5(611)	ITCHING CHARACTERISTICS							
Turn-On Rise Time $t_{\rm P} = 300 \text{V}_{\rm DD} = 300 \text{V}_{\rm DD} = 50 \text{V}_{\rm DD} = 300 \text{V}_{\rm DD} = 50 \text{V}$	n-On Delay Time	t _{D(C}	ON)			10	30	ns
12 00 11 to	Turn-On Rise Time Turn-Off Delay Time		R \	$V_{DD} = 300V, I_D = 5A,$ $R_G = 25\Omega \text{ (Note 1, 2)}$		42	90	ns
Turn-Off Delay Time $t_{D(OFF)}$ $R_G = 25\Omega$ (Note 1, 2) 38 85 n			off)			38	85	ns
Turn-Off Fall Time t_F 46 100 n	Turn-Off Fall Time		F			46	100	ns
Total Gate Charge Q_G $V_{DS} = 480 \text{ V}, I_D = 5A,$ 15 19 n	Total Gate Charge		lg ,	/ - 400 \/ L - 5A		15	19	nC
IGate-Source Charge I ()og I = I I I I I I I I I I I I I I I I I	Gate-Source Charge		00	'- '		2.5		nC
Gate-Drain Charge Q_{GD} $V_{GS} = 10 \text{ V (Note 1, 2)}$ 6.6 n	Gate-Drain Charge		GD	V _{GS} = 10 V (Note 1, 2)		6.6		nC
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS	AIN-SOURCE DIODE CHARACTE	ISTICS AND	IXAM C	MUM RATINGS				
Drain-Source Diode Forward Voltage V_{SD} $V_{GS} = 0 \text{ V}, I_S = 5 \text{A}$ 1.4	Drain-Source Diode Forward Voltage		SD \	$V_{GS} = 0 \text{ V}, I_{S} = 5\text{A}$			1.4	V
Maximum Continuous Drain-Source Diode	Maximum Continuous Drain-Source Diode						_	
Forward Current Is	Forward Current		S					Α
Maximum Pulsed Drain-Source Diode	Maximum Pulsed Drain-Source Diode						20	Α
Forward Current ISM 20 7	Forward Current		I _{SM}				20	Α
Reverse Recovery Time t_{rr} $V_{GS} = 0 \text{ V}, I_S = 5\text{A},$ 300 n	Reverse Recovery Time		rr	$V_{GS} = 0 \overline{V, I_S = 5A,}$		300		ns
Reverse Recovery Charge $Q_{RR} = d_{IF} / dt = 100 \text{ A/}\mu\text{s} \text{ (Note 1)}$ 2.2 μ	Reverse Recovery Charge		RR (d _{IF} / dt = 100 A/µs (Note 1)		2.2		μC

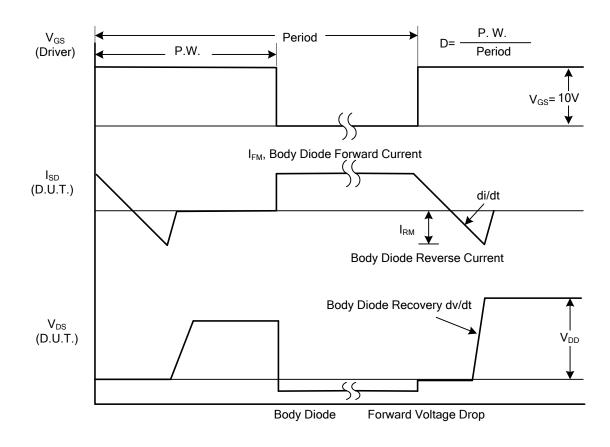
Note 1. Pulse Test: Pulse width ≤ 300µs, Duty cycle ≤ 2%

^{2.} Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

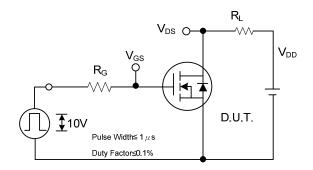


Peak Diode Recovery dv/dt Test Circuit

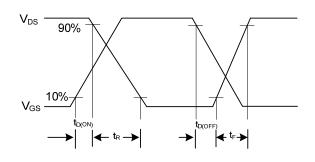


Peak Diode Recovery dv/dt Waveforms

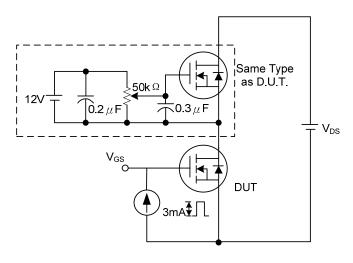
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



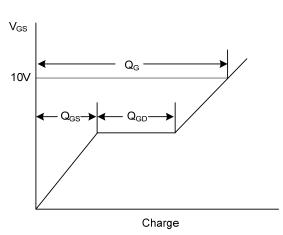
Switching Test Circuit



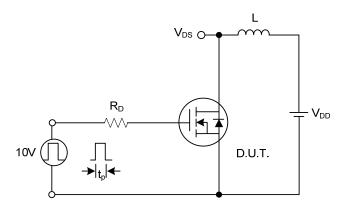
Switching Waveforms



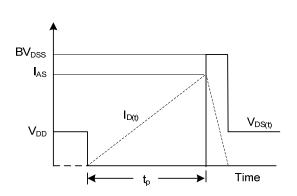
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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