

**18NM60Z-U3**

Advance

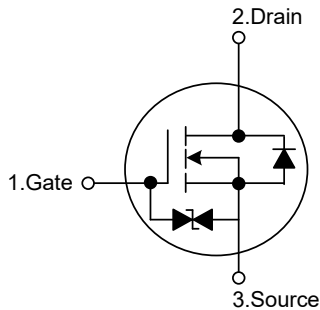
Power MOSFET

**18A, 600V N-CHANNEL
SUPER-JUNCTION MOSFET****DESCRIPTION**

The **UTC 18NM60Z-U3** is a Super Junction MOSFET Structure and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and a high rugged avalanche characteristics. This power MOSFET is usually used at AC-DC converters for power applications.

FEATURES

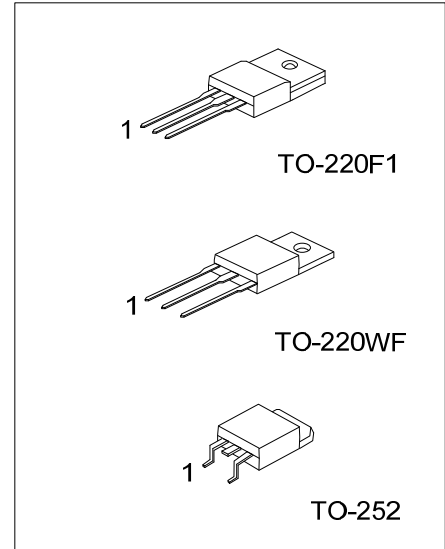
- * $R_{DS(ON)} \leq 0.35 \Omega$ @ $V_{GS}=10V$, $I_D=6.5A$
- * Fast switching capability
- * Avalanche energy tested
- * Improved dv/dt capability, high ruggedness
- * With ESD protection

SYMBOL**ORDERING INFORMATION**

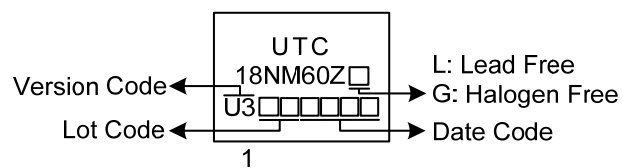
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
18NM60ZL-U3-TF1-T	18NM60ZG-U3-TF1-T	TO-220F1	G	D	S	Tube
18NM60ZL-U3-TW1-T	18NM60ZG-U3-TW1-T	TO-220WF	G	D	S	Tube
18NM60ZL-U3-TN3-R	18NM60ZG-U3-TN3-R	TO-252	G	D	S	Tape Reel

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

18NM60ZG-U3-TF1-T		(1) Packing Type	(1) T: Tube, R: Tape Reel
		(2) Package Type	(2) TF1: TO-220F1, TW1: TO-220WF, TN3: TO-252
		(3) Version Code	(3) Version U3
		(4) Green Package	(4) G: Halogen Free and Lead Free, L: Lead Free



■ MARKING



■ **ABSOLUTE MAXIMUM RATINGS** ($T_C = 25^\circ\text{C}$, unless otherwise specified)

PARAMETER			SYMBOL	RATINGS	UNIT
Drain-Source Voltage			V _{DSS}	600	V
Gate-Source Voltage			V _{GSS}	±20	V
Drain Current	Continuous	T _C =25°C	I _D	18	A
					A
	Pulsed (Note 2)		I _{DM}	54	A
Avalanche Energy	Single Pulsed (Note 3)		E _{AS}	156	mJ
Peak Diode Recovery dv/dt (Note 4)			dv/dt	1.4	V/ns
Power Dissipation	TO-220F1/TO-220WF		P _D	30	W
	TO-252			60	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. $L = 100\text{mH}$, $I_{AS} = 1.8\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\Omega$ Starting $T_J = 25^\circ\text{C}$

4. $I_{SD} \leq 18\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

■ **THERMAL DATA**

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220F1/TO-220WF	θ_{JA}	62.5	$^\circ\text{C}/\text{W}$
	TO-252		110	$^\circ\text{C}/\text{W}$
Junction to Case	TO-220F1/TO-220WF	θ_{JC}	4.16	$^\circ\text{C}/\text{W}$
	TO-252		2.08 (Note)	$^\circ\text{C}/\text{W}$

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

■ **ELECTRICAL CHARACTERISTICS** ($T_J = 25^\circ\text{C}$, 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	600			V
Drain-Source Leakage Current	I _{DSS}	V _{DS} =600V, V _{GS} =0V			10	μA
Gate-Source Leakage Current	I _{GSS}	V _{GS} =±20V, V _{DS} =0V			±10	μA
ON CHARACTERISTICS						
Gate Threshold Voltage	V _{GS(TH)}	V _{DS} =V _{GS} , I _D =250μA	2.5		4.5	V
Static Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _D =6.5A			0.35	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C _{ISS}	V _{GS} =0V, V _{DS} =50V, f=1MHz		1055		pF
Output Capacitance	C _{OSS}			157		pF
Reverse Transfer Capacitance	C _{RSS}			4		pF
SWITCHING CHARACTERISTICS						
Total Gate Charge (Note 1)	Q _G	V _{DS} =480V, V _{GS} =10V, I _D =1.0A (Note 1, 2)		36		nC
Gate-Source Charge	Q _{GS}			7		nC
Gate-Drain Charge	Q _{DD}			10		nC
Turn-On Delay Time (Note 1)	t _{D(ON)}	V _{DD} =100V, V _{GS} =10V, I _D =9.0A, R _G =25Ω (Note 1, 2)		13		ns
Turn-On Rise Time	t _r			23		ns
Turn-Off Delay Time	t _{D(OFF)}			96		ns
Turn-Off Fall Time	t _f			54		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS						
Maximum Continuous Drain-Source Diode Forward Current	I _S				18	A
Drain-Source Diode Forward Voltage (Note 1)	V _{SD}	I _S =18A, V _{GS} =0V			1.4	V
Body Diode Reverse Recovery Time (Note 1)	t _{rr}	I _S =18A, V _{GS} =0V, dI _F /dt=100A/μs		316		nS
Body Diode Reverse Recovery Charge	Q _{rr}			3572		nC

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

2. Essentially independent of operating temperature.

D.U.T.

V_{DS}

I_{SD}

L

V_{DD}

R_G

Driver

V_{GS}

Same Type as D.U.T.

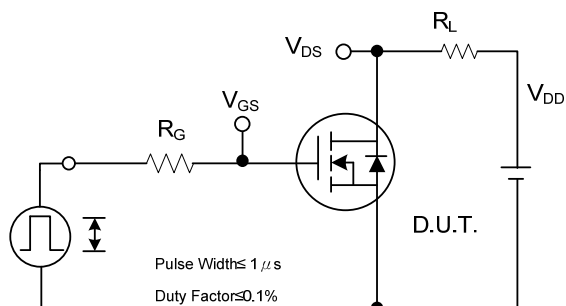
- * dv/dt controlled by R_G
- * I_{SD} controlled by pulse period
- * D.U.T.-Device Under Test

The diagram illustrates the timing relationships for a MOSFET body diode test. It consists of three vertically stacked waveforms:

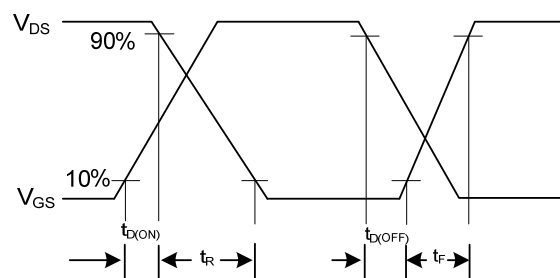
- Top Trace:** V_{GS} (Driver). This is a rectangular pulse. The pulse width is defined as $D = \frac{\text{Gate Pulse Width}}{\text{Gate Pulse Period}}$. The pulse amplitude is $10V$.
- Middle Trace:** I_{SD} (DUT). This trace shows the source-drain current. During the V_{GS} pulse, it shows a forward current I_{FM} (Body Diode Forward Current). When V_{GS} turns off, the current reverses, showing a reverse current I_{RM} (Body Diode Reverse Current). The rate of change of current is labeled di/dt .
- Bottom Trace:** V_{DS} (DUT). This trace shows the drain-source voltage. During the forward current phase, it shows a voltage drop V_{SD} (Body Diode Forward Voltage Drop). When the current reverses, it shows a recovery transient labeled "Body Diode Recovery dv/dt ". The final steady-state voltage is V_{DD} .

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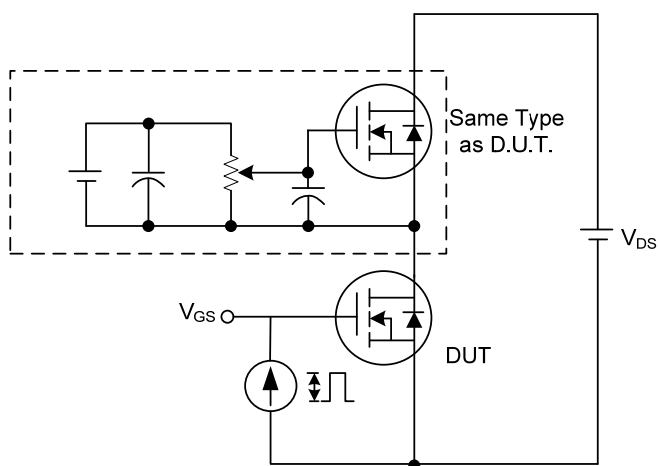
■ TEST CIRCUITS AND WAVEFORMS



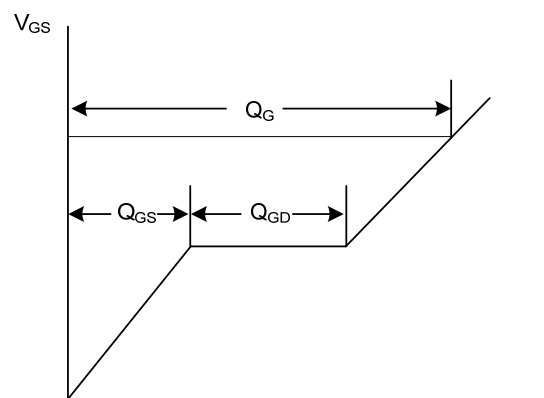
Switching Test Circuit



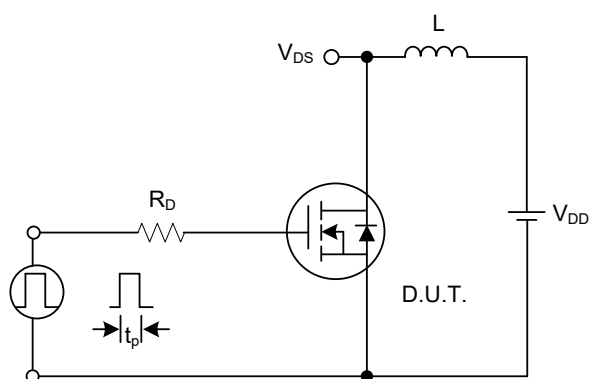
Switching Waveforms



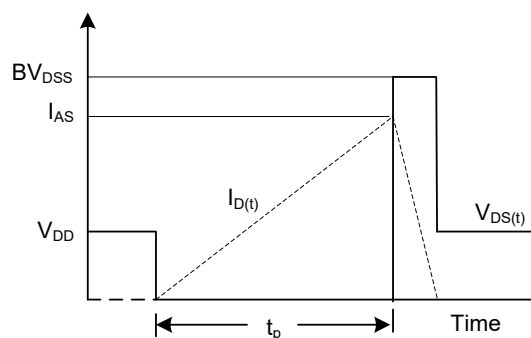
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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