

**20NM60Z-U3**

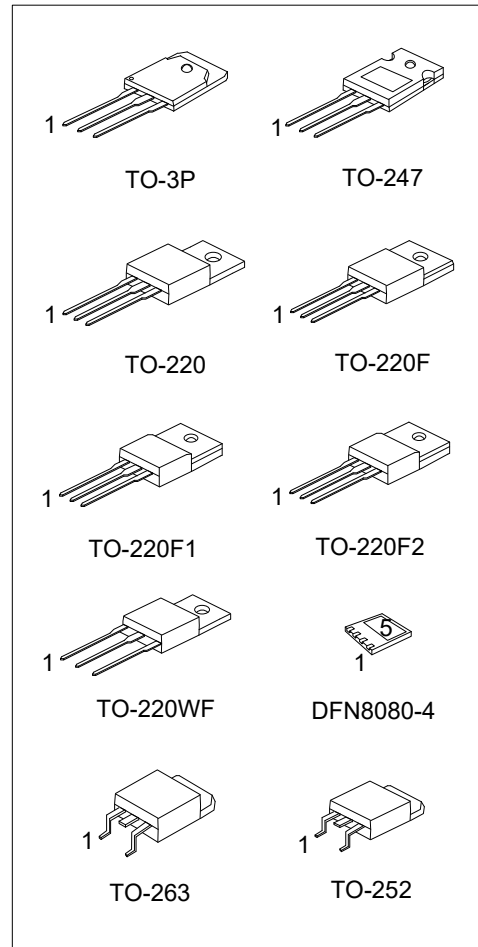
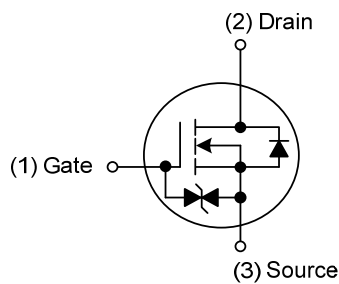
Preliminary

Power MOSFET**20A, 600V N-CHANNEL
SUPER-JUNCTION MOSFET****DESCRIPTION**

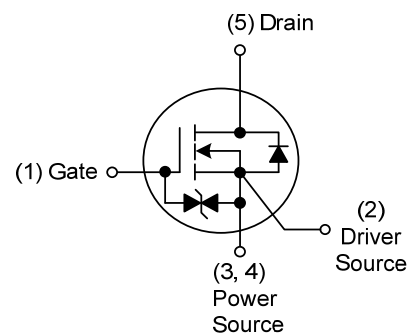
The **UTC 20NM60Z-U3** is a Super Junction MOSFET Structure and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and a high rugged avalanche characteristics. This power MOSFET is usually used at AC-DC converters for power applications.

FEATURES

- * $R_{DS(ON)} \leq 0.19 \Omega$ @ $V_{GS}=10V$, $I_D=5.0A$
- * Fast switching capability
- * Avalanche energy tested
- * Improved dv/dt capability, high ruggedness
- * With ESD Protected: HBM=2KV

**SYMBOL**

TO-220 / TO-220F / TO-220F1
TO-220F2 / TO-220WF / TO-252
TO-263 / TO-3P / TO-247

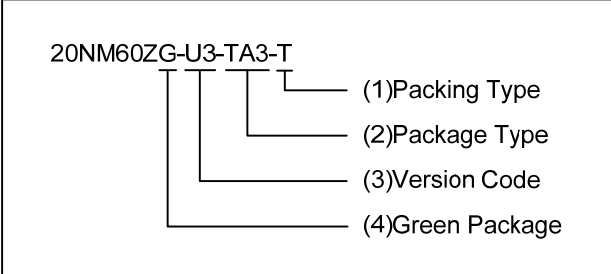


DFN8080-4

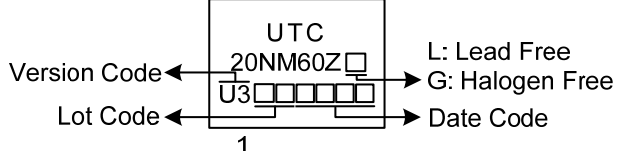
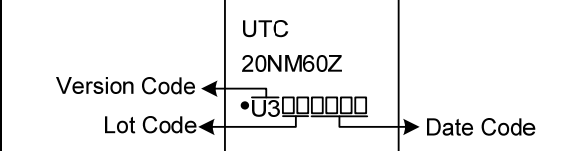
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment					Packing
Lead Free	Halogen Free		1	2	3	4	5	
20NM60ZL-U3-TA3-T	20NM60ZG-U3-TA3-T	TO-220	G	D	S	-	-	Tube
20NM60ZL-U3-TF1-T	20NM60ZG-U3-TF1-T	TO-220F1	G	D	S	-	-	Tube
20NM60ZL-U3-TF2-T	20NM60ZG-U3-TF2-T	TO-220F2	G	D	S	-	-	Tube
20NM60ZL-U3-TF3-T	20NM60ZG-U3-TF3-T	TO-220F	G	D	S	-	-	Tube
20NM60ZL-U3-TW1-T	20NM60ZG-U3-TW1-T	TO-220WF	G	D	S	-	-	Tube
20NM60ZL-U3-TN3-R	20NM60ZG-U3-TN3-R	TO-252	G	D	S	-	-	Tape Reel
20NM60ZL-U3-TQ2-T	20NM60ZG-U3-TQ2-T	TO-263	G	D	S	-	-	Tube
20NM60ZL-U3-TQ2-R	20NM60ZG-U3-TQ2-R	TO-263	G	D	S	-	-	Tape Reel
20NM60ZL-U3-T3P-T	20NM60ZG-U3-T3P-T	TO-3P	G	D	S	-	-	Tube
20NM60ZL-U3-T47-T	20NM60ZG-U3-T47-T	TO-247	G	D	S	-	-	Tube
20NM60ZL-U3-K04-8080-R	20NM60ZG-U3-K04-8080-R	DFN8080-4	G	S	S	S	D	Tape Reel

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

	(1) T: Tube, R: Tape Reel
	(2) TA3: TO-220, TF1: TO-220F1, TF2: TO-220F2 TF3: TO-220F, TW1: TO-220WF, TN3: TO-252, TQ2: TO-263, T3P: TO-3P, T47: TO-247 K04-8080: DFN8080-4
	(3) Version U3
	(4) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING

TO-220 / TO-220F / TO-220F1 / TO-220F2 TO-220WF / TO-252 / TO-263 / TO-3P / TO-247	DFN8080-4
	

■ **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}	±25	V
Drain Current	Continuous	T _C =25°C	I _D	20	A
		T _C =100°C		12	A
	Pulsed (Note 2)		I _{DM}	60	A
Avalanche Energy	Single Pulsed (Note 3)		E _{AS}	90	mJ
Peak Diode Recovery dv/dt (Note 4)			dv/dt	1.2	V/ns
Power Dissipation	TO-220/TO-263		P _D	110	W
	TO-220F/TO-220F1			33	W
	TO-220F2/TO-220WF				
	TO-252			64	W
	TO-3P			130	W
	TO-247			120	W
	DFN8080-4			62	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. $L = 10\text{mH}$, $I_{AS} = 4.2\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\Omega$ Starting $T_J = 25^{\circ}\text{C}$

4. $I_{SD} \leq 20\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^{\circ}\text{C}$

■ **THERMAL DATA**

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F TO-220F1/TO-220F2 TO-220WF/TO-263	θ_{JA}	62.5	$^{\circ}\text{C}/\text{W}$
	TO-252		110	$^{\circ}\text{C}/\text{W}$
	TO-3P		30	$^{\circ}\text{C}/\text{W}$
	TO-247		40	$^{\circ}\text{C}/\text{W}$
	DFN8080-4		35 (Note)	$^{\circ}\text{C}/\text{W}$
Junction to Case	TO-220/TO-263	θ_{JC}	1.14 (Note)	$^{\circ}\text{C}/\text{W}$
	TO-220F/TO-220F1 TO-220F2/TO-220WF		3.78	$^{\circ}\text{C}/\text{W}$
	TO-252		1.95 (Note)	$^{\circ}\text{C}/\text{W}$
	TO-3P		0.96	$^{\circ}\text{C}/\text{W}$
	TO-247		1.04	$^{\circ}\text{C}/\text{W}$
	DFN8080-4		2.01 (Note)	$^{\circ}\text{C}/\text{W}$

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

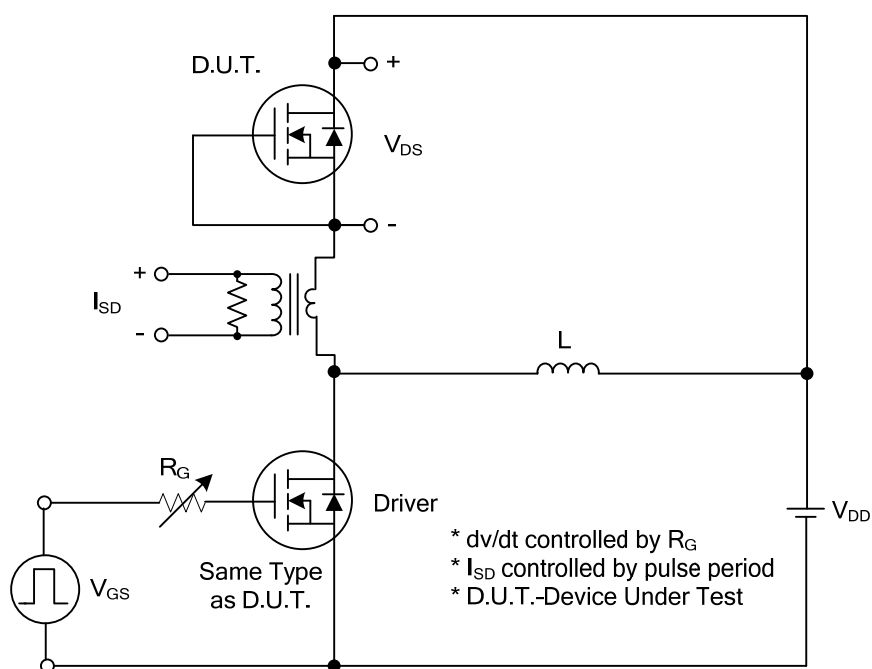
■ **ELECTRICAL CHARACTERISTICS** ($T_J=25^\circ\text{C}$, unless otherwise specified)

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 =5.0A		0.16	0.19	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C _{ISS}	V _{GS} =0V, V _{DS} =50V, f=1MHz		1207		pF
Output Capacitance	C _{OSS}			385		pF
Reverse Transfer Capacitance	C _{RSS}			13		pF
SWITCHING CHARACTERISTICS						
Total Gate Charge (Note 1)	Q _G	V _{DS} =480V, V _{GS} =10V, I _D =10A (Note 1, 2)		51		nC
Gate-Source Charge	Q _{GS}			23		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 =10A, R _G =25Ω (Note 1, 2)		18		ns
Turn-On Rise Time	t _R			32		ns
Turn-Off Delay Time	t _{D(OFF)}			167		ns
Turn-Off Fall Time	t _F			67		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS						
Maximum Continuous Drain-Source Diode Forward Current	I _S				20	A
Maximum Pulsed Drain-Source Diode Forward Current	I _{SM}				60	A
Drain-Source Diode Forward Voltage (Note 1)	V _{SD}	I _S =20A, V _{GS} =0V			1.4	V
Body Diode Reverse Recovery Time (Note 1)	t _{rr}	I _S =20A, V _{GS} =0V, dI _F /dt=100A/μs		392		ns
Body Diode Reverse Recovery Charge	Q _{rr}			5687		nC

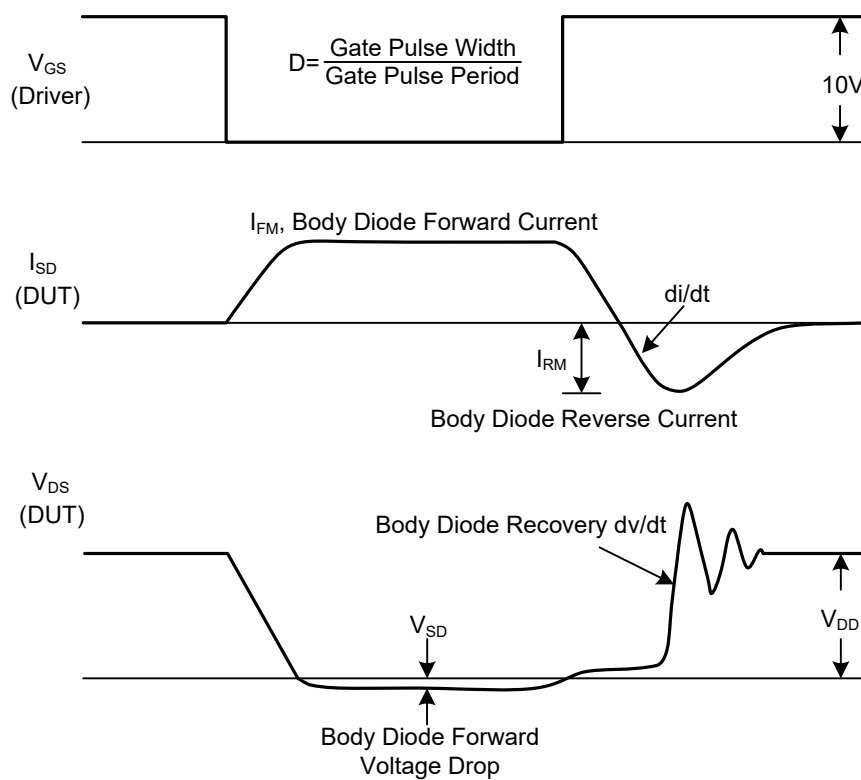
Notes: 1. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

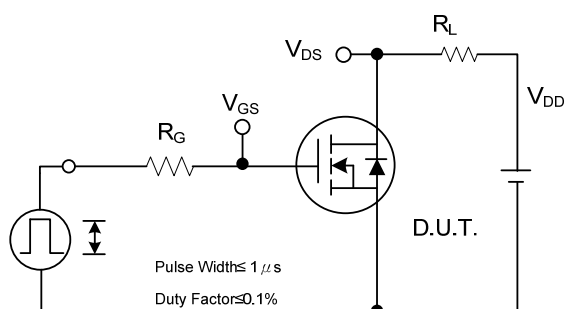


Peak Diode Recovery dv/dt Test Circuit

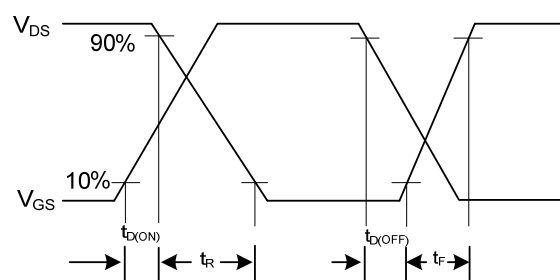


Peak Diode Recovery dv/dt Waveforms

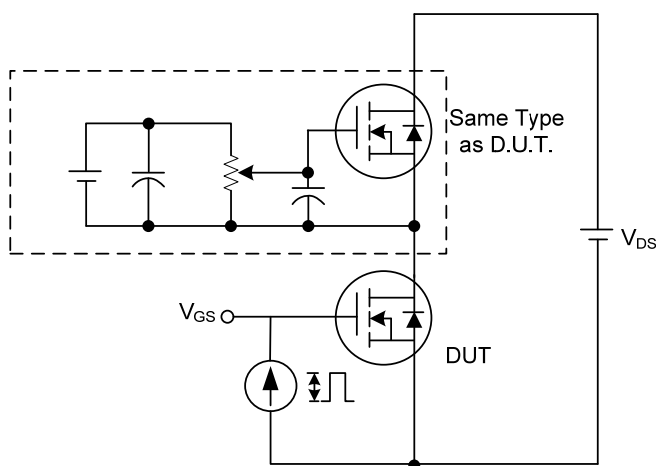
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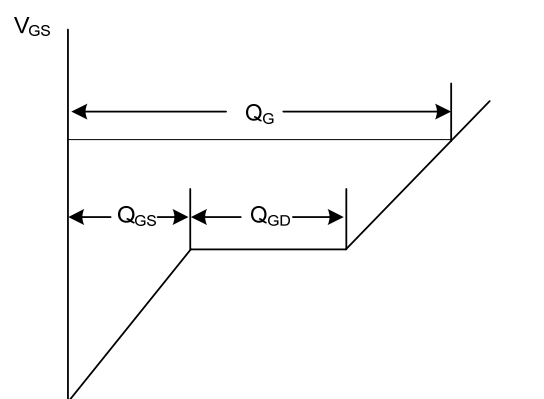
Switching Test Circuit



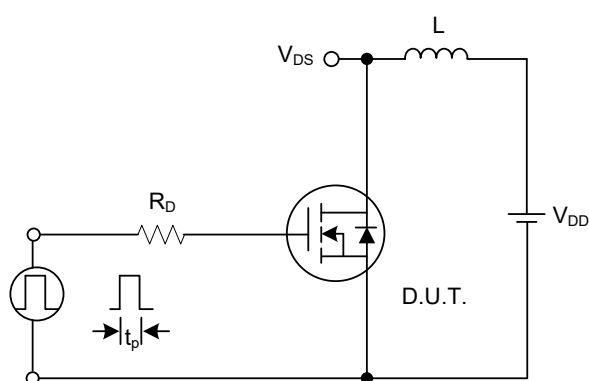
Switching Waveforms



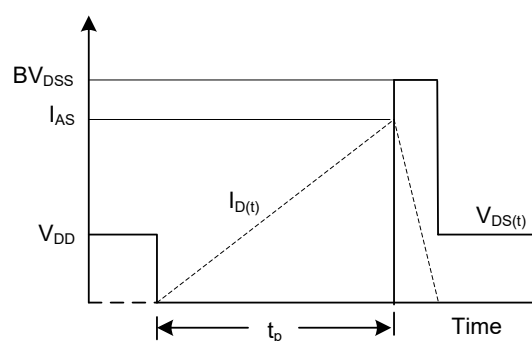
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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