

**33NM65Z-U3**

Preliminary

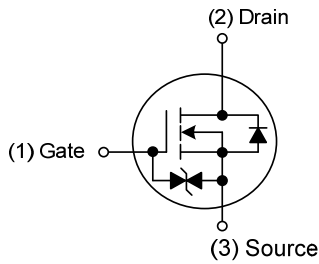
Power MOSFET

**33A, 650V N-CHANNEL
SUPER-JUNCTION MOSFET****DESCRIPTION**

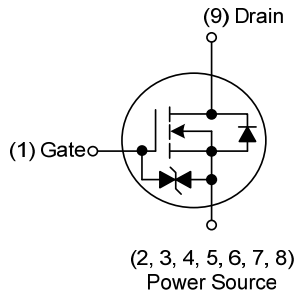
The **UTC 33NM65Z-U3** is a Super Junction MOSFET Structure and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and a high rugged avalanche characteristics. This power MOSFET is usually used at AC-DC converters for power applications.

FEATURES

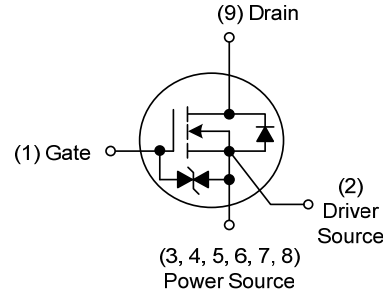
- * $R_{DS(ON)} \leq 0.13 \Omega$ @ $V_{GS}=10V$, $I_D=16A$
- * Fast switching capability
- * Avalanche energy tested
- * Improved dv/dt capability, high ruggedness
- * With ESD Protected: HBM=2KV

SYMBOL

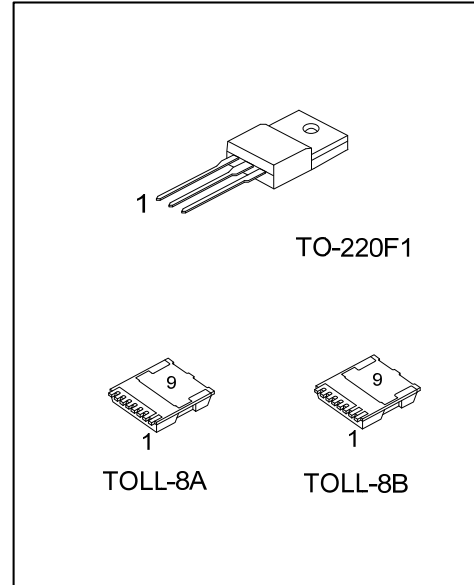
TO-220F1



TOLL-8A



TOLL-8B

**ORDERING INFORMATION**

Ordering Number		Package	Pin Assignment									Packing
Lead Free	Halogen Free		1	2	3	4	5	6	7	8	9	
33NM65ZL-U3-TF1-T	33NM65ZG-U3-TF1-T	TO-220F1	G	D	S	-	-	-	-	-	-	Tube
33NM65ZL-U3-T8A-R	33NM65ZG-U3-T8A-R	TOLL-8A	G	S	S	S	S	S	S	S	D	Tape Reel
33NM65ZL-U3-T8B-R	33NM65ZG-U3-T8B-R	TOLL-8B	G	S	S	S	S	S	S	S	D	Tape Reel

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

33NM65ZG-U3-TF1-T		(1)Packing Type	(1) T: Tube, R: Tape Reel
		(2)Package Type	(2) TF1: TO-220F1, T8A: TOLL-8A, T8B: TOLL-8B
		(3)Version Code	(3) Version U3
		(4)Green Package	(4) G: Halogen Free and Lead Free, L: Lead Free

MARKING

TO-220F1	TOLL-8A / TOLL-8A
UTC 33NM65Z U3 1 Version Code Lot Code L: Lead Free G: Halogen Free Date Code	UTC 33NM65Z U3 1 Version Code Lot Code L: Lead Free G: Halogen Free Date Code

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

PARAMETER			SYMBOL	RATINGS	UNIT
Drain-Source Voltage			V _{DSS}	650	V
Gate-Source Voltage			V _{GSS}	±20	V
Drain Current	Continuous	T _C =25°C	I _D	33	A
		T _C =100°C		19.8	A
	Pulsed (Note 2)		I _{DM}	99	A
Avalanche Energy	Single Pulsed (Note 3)		E _{AS}	22.5	mJ
Peak Diode Recovery dv/dt (Note 4)			dv/dt	1.3	V/ns
Power Dissipation	TO-220F1		P _D	41	W
	TOLL-8A/TOLL-8B			220	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. $L = 10\text{mH}$, $I_{AS} = 2.1\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\Omega$ Starting $T_J = 25^{\circ}\text{C}$

4. $I_{SD} \leq 33\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^{\circ}\text{C}$

■ **THERMAL DATA**

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220F1	θ_{JA}	62.5	$^{\circ}\text{C}/\text{W}$
	TOLL-8A/TOLL-8B		35 (Note)	$^{\circ}\text{C}/\text{W}$
Junction to Case	TO-220F1	θ_{JC}	3.05	$^{\circ}\text{C}/\text{W}$
	TOLL-8A/TOLL-8B		0.56 (Note)	$^{\circ}\text{C}/\text{W}$

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

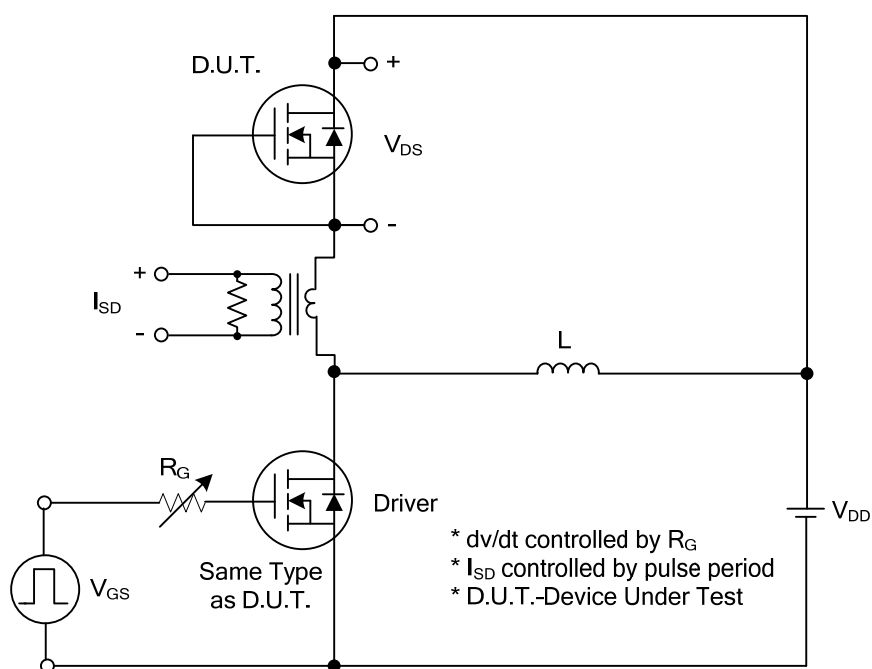
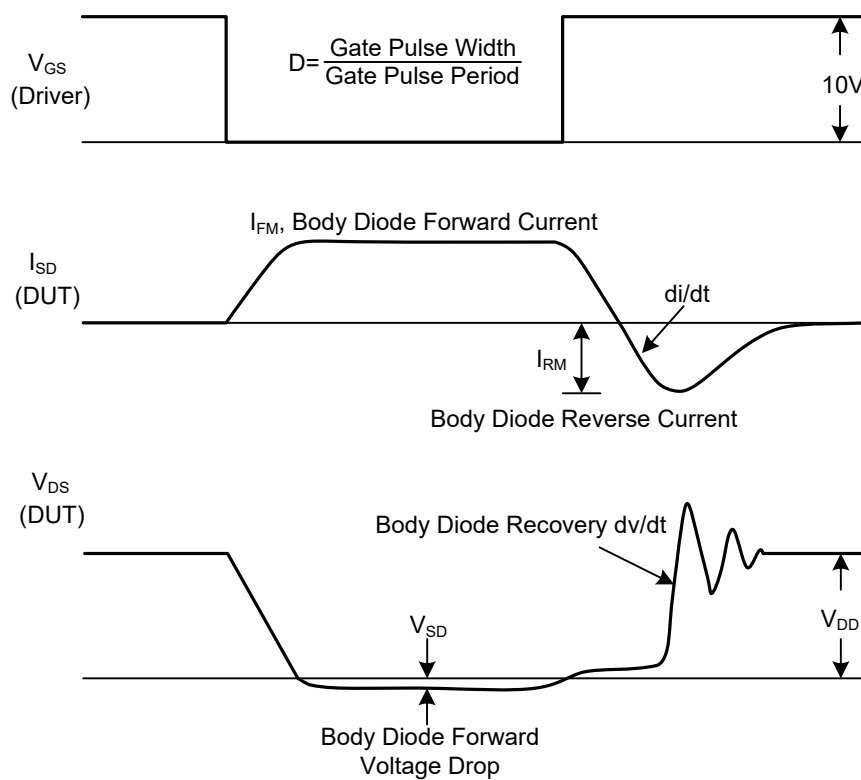
■ **ELECTRICAL CHARACTERISTICS** ($T_J=25^{\circ}\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V, I _D =250μA	650			V
Drain-Source Leakage Current	I _{DSS}	V _{DS} =650V, 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 =16A			0.13	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C _{ISS}	V _{GS} =0V, V _{DS} =50V, f=1MHz		1767		pF
Output Capacitance	C _{OSS}			540		pF
Reverse Transfer Capacitance	C _{RSS}			19		pF
SWITCHING CHARACTERISTICS						
Total Gate Charge (Note 1)	Q _G	V _{DS} =520V, V _{GS} =10V, I _D =33A (Note 1, 2)		71		nC
Gate-Source Charge	Q _{GS}			12		nC
Gate-Drain Charge	Q _{DD}			36		nC
Turn-On Delay Time (Note 1)	t _{D(ON)}	V _{DD} =100V, V _{GS} =10V, I _D =33A, R _G =25Ω (Note 1, 2)		28		ns
Turn-On Rise Time	t _r			36		ns
Turn-Off Delay Time	t _{D(OFF)}			218		ns
Turn-Off Fall Time	t _f			118		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS						
Maximum Continuous Drain-Source Diode Forward Current	I _S				33	A
Maximum Pulsed Drain-Source Diode Forward Current	I _{SM}				99	A
Drain-Source Diode Forward Voltage (Note 1)	V _{SD}	I _S =33A, V _{GS} =0V			1.4	V
Body Diode Reverse Recovery Time (Note 1)	t _{rr}	I _S =33A, V _{GS} =0V, dI _F /dt=100A/μs		448		nS
Body Diode Reverse Recovery Charge	Q _{rr}			7548		nC

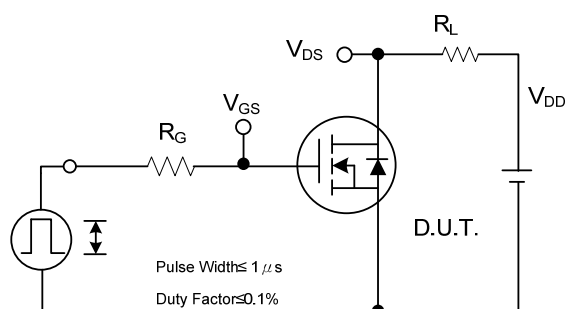
Notes: 1. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating temperature.

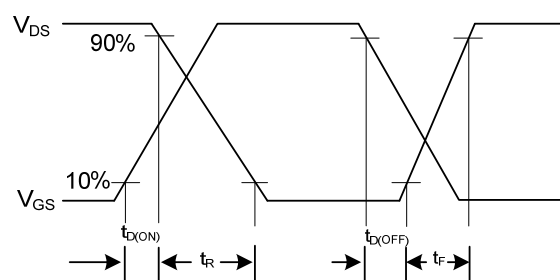
■ TEST CIRCUITS AND WAVEFORMS

Peak Diode Recovery dv/dt Test CircuitPeak Diode Recovery dv/dt Waveforms

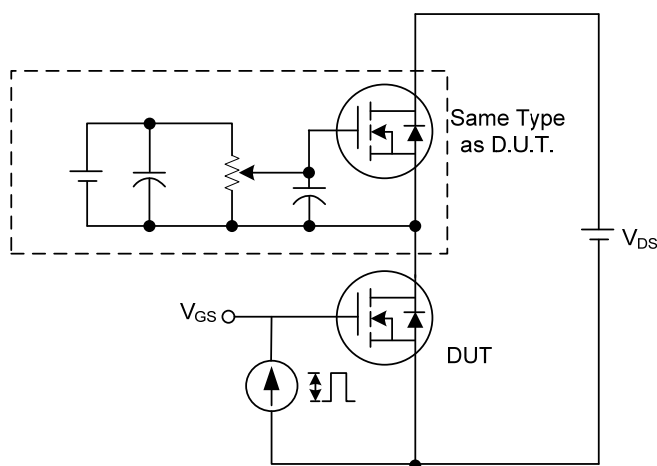
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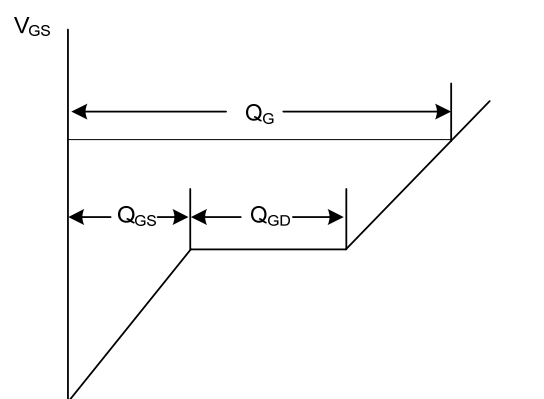
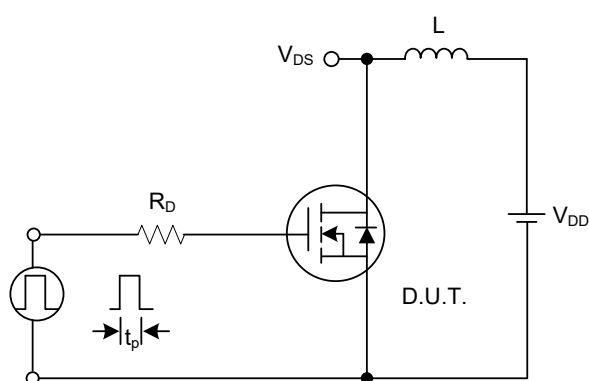
Switching Test Circuit



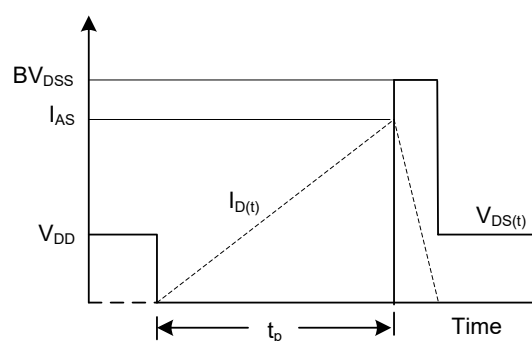
Switching Waveforms



Gate Charge Test Circuit

Charge
Gate Charge Waveform

Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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