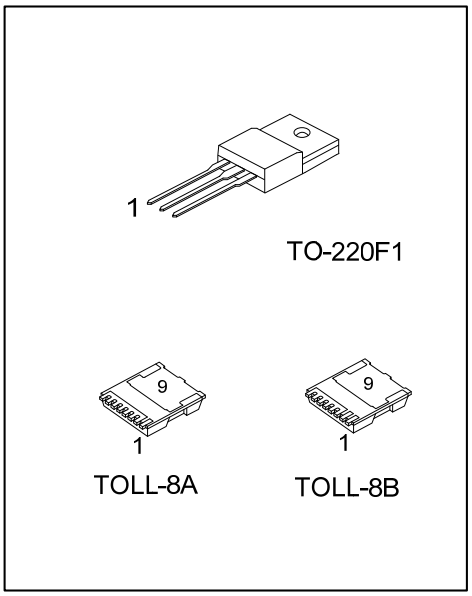
33A, 650V N-CHANNEL SUPER-JUNCTION MOSFET



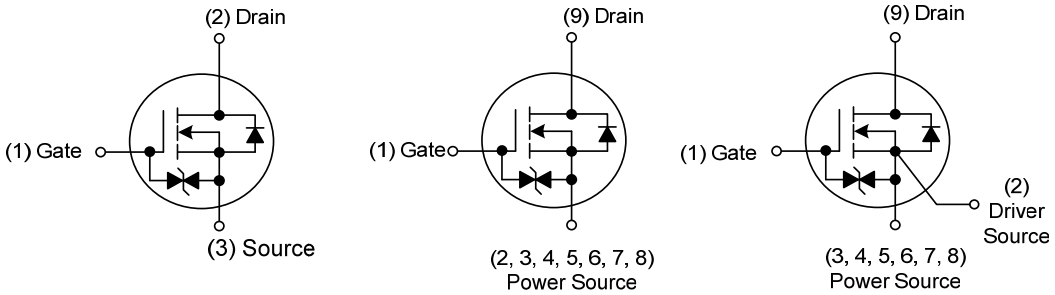
■ DESCRIPTION

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

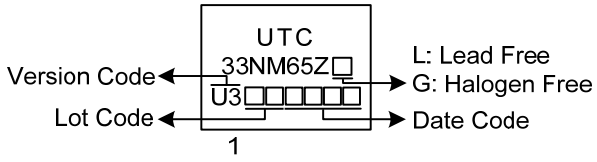
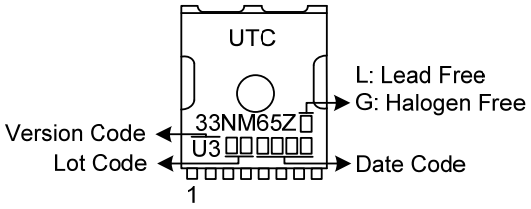
Ordering Number		Package	Pin Assignment								Packing
Lead Free	Halogen Free		1	2	3	4	5	6	7	8	9	
33NM65ZL-U3-TF1-T	33NM65ZG-U3-TF1-T	TO-220F1	G	D	S	-	-	-	-	-	-	Tube
33NM65ZL-U3-T8A-R	33NM65ZG-U3-T8A-R	TOLL-8A	G	S	S	S	S	S	S	S	D	Tape Reel
33NM65ZL-U3-T8B-R	33NM65ZG-U3-T8B-R	TOLL-8B	G	S	S	S	S	S	S	S	D	Tape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

■ ABSOLUTE MAXIMUM RATINGS (T_C=25°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 = 10mH, I_{AS} = 2.1A, V_{DD} = 50V, R_G = 25Ω Starting T_J = 25°C
4. I_{SD} ≤ 33A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C

■ THERMAL DATA

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

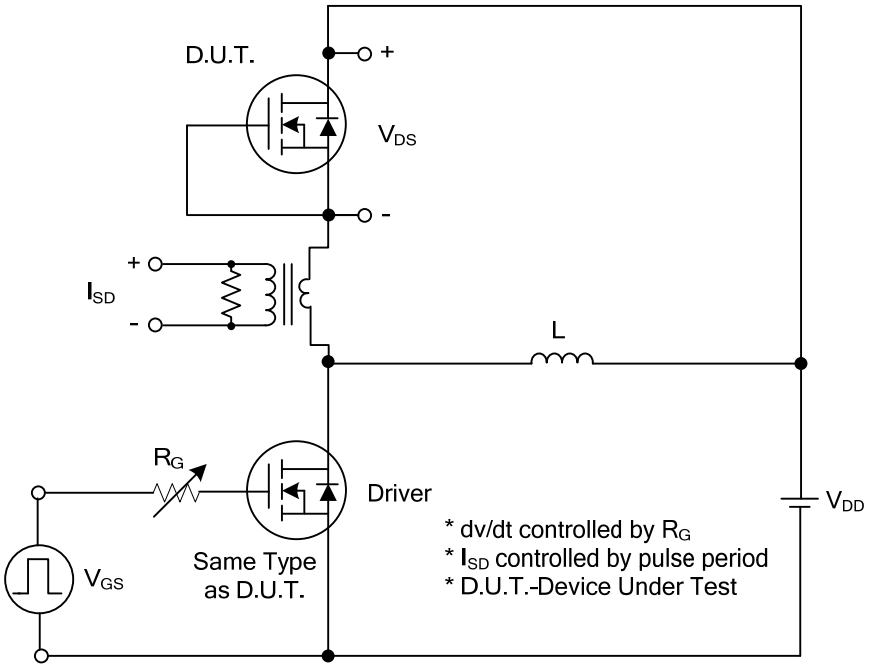
Note: Device mounted on FR-4 substrate P_C board, 2oz copper, with 1inch square copper plate.

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

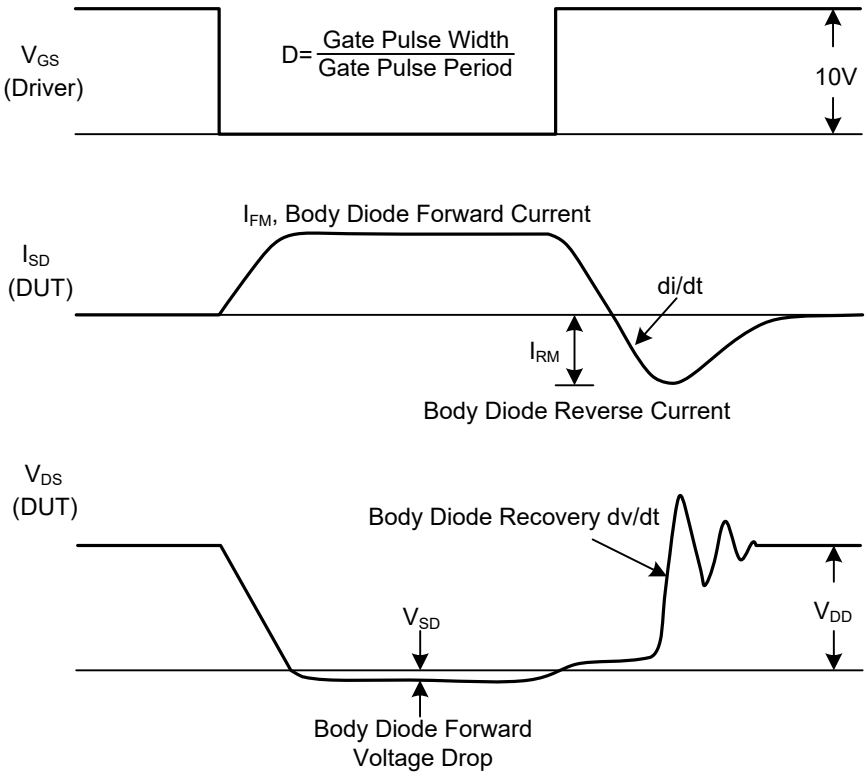
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V, I_D=250μA	650			V
Drain-Source Leakage Current	I_{DSS}	V_{DS}=650V, V_{GS}=0V			10	μA
Gate-Source Leakage Current	I_{GSS}	V_{GS}=±20V, V_{DS}=0V			±10	μA
ON CHARACTERISTICS						
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 ≤ 300μs, Duty cycle ≤ 2%.
2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

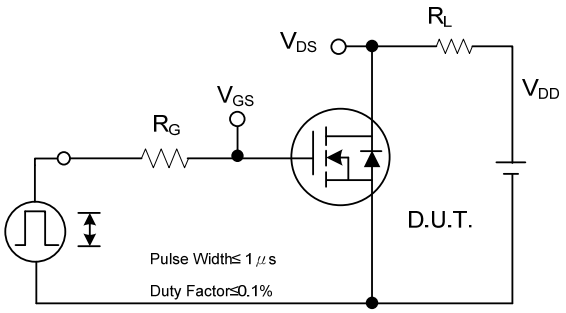


Peak Diode Recovery dv/dt Test Circuit

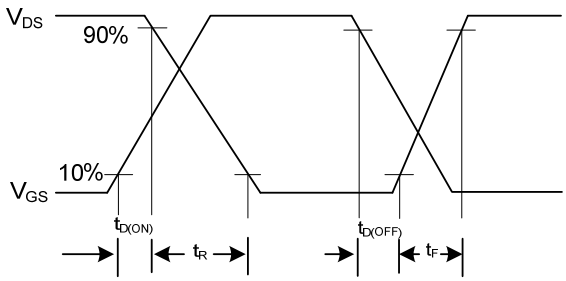


Peak Diode Recovery dv/dt Waveforms

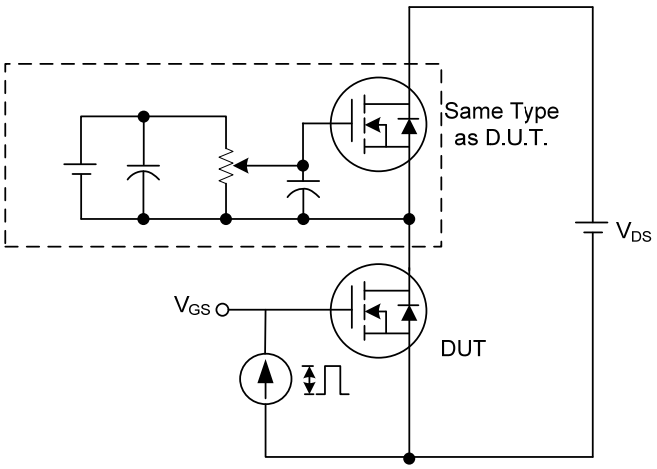
■ TEST CIRCUITS AND WAVEFORMS



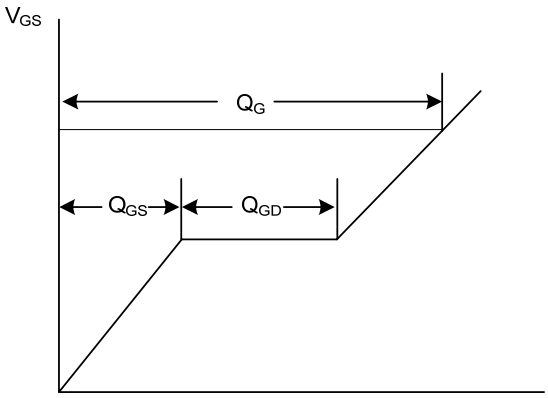
Switching Test Circuit



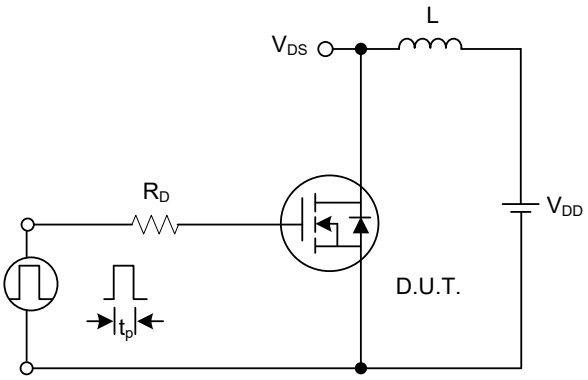
Switching Waveforms



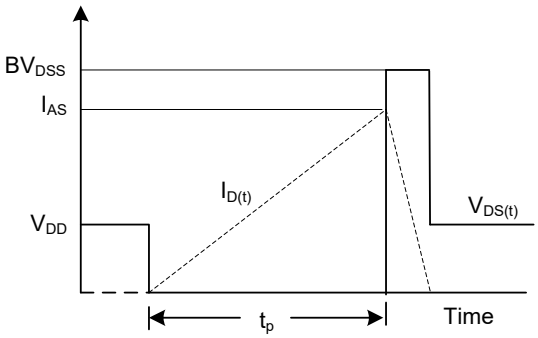
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms