

**F65NM65**

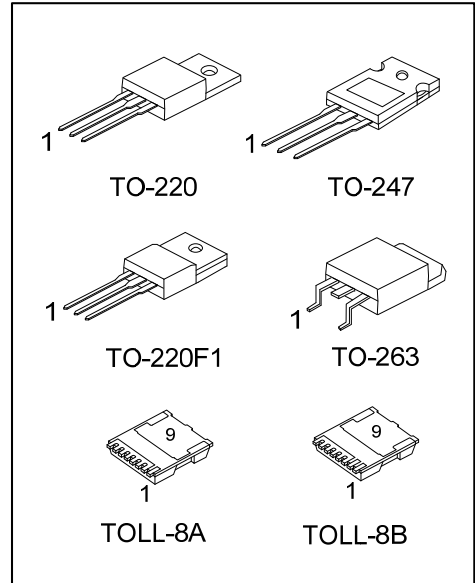
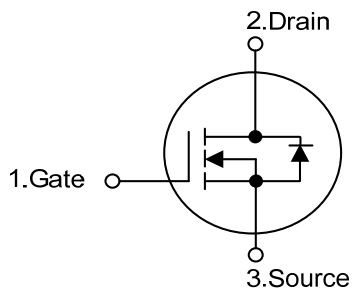
Preliminary

Power MOSFET**65A, 650V N-CHANNEL
SUPER-JUNCTION MOSFET****DESCRIPTION**

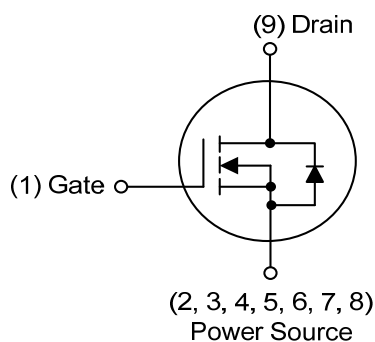
The **UTC F65NM65** is a Super Junction MOSFET Structure and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and a high rugged avalanche characteristics. This power MOSFET is usually used at AC-DC converters for power applications.

FEATURES

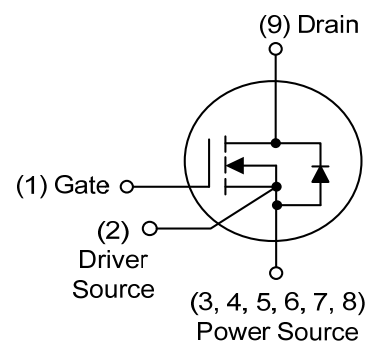
- * $R_{DS(ON)} \leq 60 \text{ m}\Omega$ @ $V_{GS}=10\text{V}$, $I_D=30\text{A}$
- * High Switching Speed
- * 100% Avalanche Tested

**SYMBOL**

TO-220 / TO-220F1
TO-247 / TO-263



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	
F65NM65L-TA3-T	F65NM65G-TA3-T	TO-220	G	D	S	-	-	-	-	-	-	Tube
F65NM65L-TF1-T	F65NM65G-TF1-T	TO-220F1	G	D	S	-	-	-	-	-	-	Tube
F65NM65L-T47-T	F65NM65G-T47-T	TO-247	G	D	S	-	-	-	-	-	-	Tube
F65NM65L-TQ2-T	F65NM65G-TQ2-T	TO-263	G	D	S	-	-	-	-	-	-	Tube
F65NM65L-TQ2-R	F65NM65G-TQ2-R	TO-263	G	D	S	-	-	-	-	-	-	Tape Reel
F65NM65L-T8A-R	F65NM65G-T8A-R	TOLL-8A	G	S	S	S	S	S	S	S	S	Tape Reel
F65NM65L-T8B-R	F65NM65G-T8B-R	TOLL-8B	G	S	S	S	S	S	S	S	D	Tape Reel

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

F65NM65G-TA3-T (1) Packing Type (2) Package Type (3) Green Package	(1) T: Tube, R: Tape Reel (2) TA3: TO-220, TF1: TO-220F1, T47: TO-247 TQ2: TO-263, T8A: TOLL-8A, T8B: TOLL-8B (3) G: Halogen Free and Lead Free, L: Lead Free
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■ MARKING

TO-220 / TO-220F1 / TO-263 / TO-247	TOLL-8A / TOLL-8B
UTC F65NM65 Lot Code → [] [] [] [] → L: Lead Free → G: Halogen Free → Date Code 1	UTC F65NM65 Lot Code → [] [] [] [] → L: Lead Free → G: Halogen Free → Date Code 1

■ **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}	± 30	V
Drain Current	Continuous	I_D	65	A
	Pulsed (Note 2)	I_{DM}	130	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	722	mJ
Peak Diode Recovery dv/dt		dv/dt	14.3	V/ns
Power Dissipation	TO-220/TO-263	P_D	130	W
	TO-220F1		41	W
	TO-247		153	W
	TOLL-8A/TOLL-8B		320	W
Junction Temperature		T_J	+150	$^{\circ}\text{C}$
Storage Temperature		T_{STG}	-55 ~ +150	$^{\circ}\text{C}$

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. $L = 100\text{mH}$, $I_{AS} = 3.8\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\Omega$, Starting $T_J = 25^{\circ}\text{C}$

4. $I_{SD} \leq 30\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^{\circ}\text{C}$

■ **THERMAL DATA**

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F1	θ_{JA}	62.5	$^{\circ}\text{C}/\text{W}$
	TO-263			
	TO-247		40	$^{\circ}\text{C}/\text{W}$
	TOLL-8A/TOLL-8B		35	$^{\circ}\text{C}/\text{W}$
Junction to Case	TO-220/TO-263	θ_{JC}	0.96	$^{\circ}\text{C}/\text{W}$
	TO-220F1		3.04	$^{\circ}\text{C}/\text{W}$
	TO-247		0.81	$^{\circ}\text{C}/\text{W}$
	TOLL-8A/TOLL-8B		0.39 (Note)	$^{\circ}\text{C}/\text{W}$

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

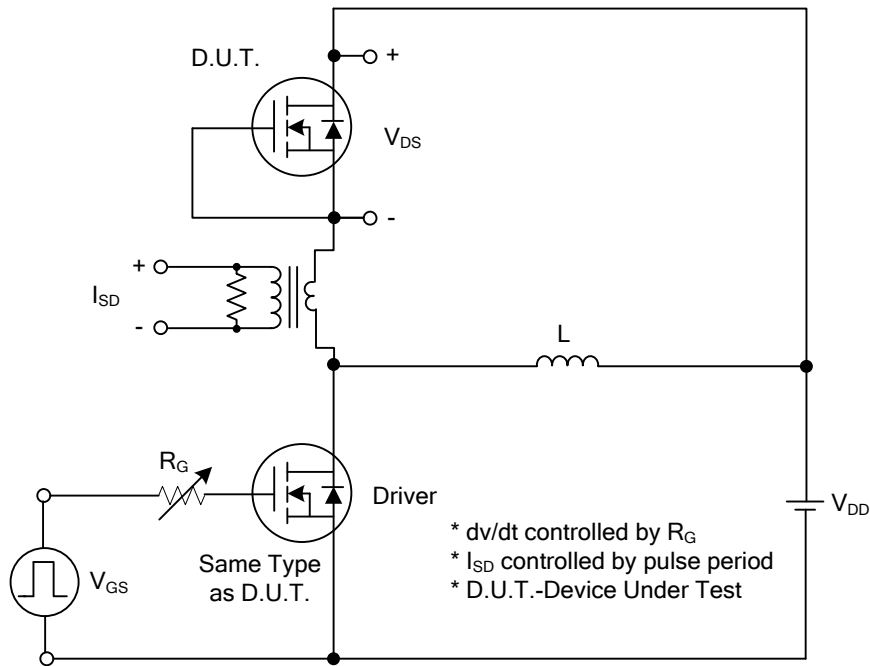
■ **ELECTRICAL CHARACTERISTICS** ($T_J=25^\circ\text{C}$, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV _{DSS}	I _D =250μA, V _{GS} =0V	650			V
Drain-Source Leakage Current		I _{DSS}	V _{DS} =650V, V _{GS} =0V			10	μA
Gate- Source Leakage Current	Forward	I _{GSS}	V _{GS} =+30V, V _{DS} =0V			+100	nA
	Reverse		V _{GS} =-30V, V _{DS} =0V			-100	nA
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 =30A			60	mΩ
DYNAMIC PARAMETERS							
Input Capacitance		C _{ISS}	V _{GS} =0V, V _{DS} =50V, f=1.0MHz		2385		pF
Output Capacitance		C _{OSS}			130		pF
Reverse Transfer Capacitance		C _{RSS}			7.2		pF
SWITCHING PARAMETERS							
Total Gate Charge (Note 1)		Q _G	V _{DS} =520V, V _{GS} =10V, I _D =65A (Note1, 2)		120		nC
Gate to Source Charge		Q _{GS}			36		nC
Gate to Drain Charge		Q _{GD}			45		nC
Turn-ON Delay Time (Note 1)		t _{D(ON)}	V _{DS} =100V, V _{GS} =10V, I _D =65A, R _G =3Ω (Note1, 2)		130		ns
Rise Time		t _R			110		ns
Turn-OFF Delay Time		t _{D(OFF)}			420		ns
Fall-Time		t _F			83		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Body-Diode Continuous Current		I _S				65	A
Maximum Body-Diode Pulsed Current		I _{SM}				130	A
Drain-Source Diode Forward Voltage (Note 1)		V _{SD}	I _S =65A, V _{GS} =0V			1.4	V
Body Diode Reverse Recovery Time (Note 1)		t _{rr}	I _S =30A, V _{GS} =0V,		176		ns
Body Diode Reverse Recovery Charge		Q _{rr}	dl _F /dt=100A/μs (Note 1)		1.2		μC

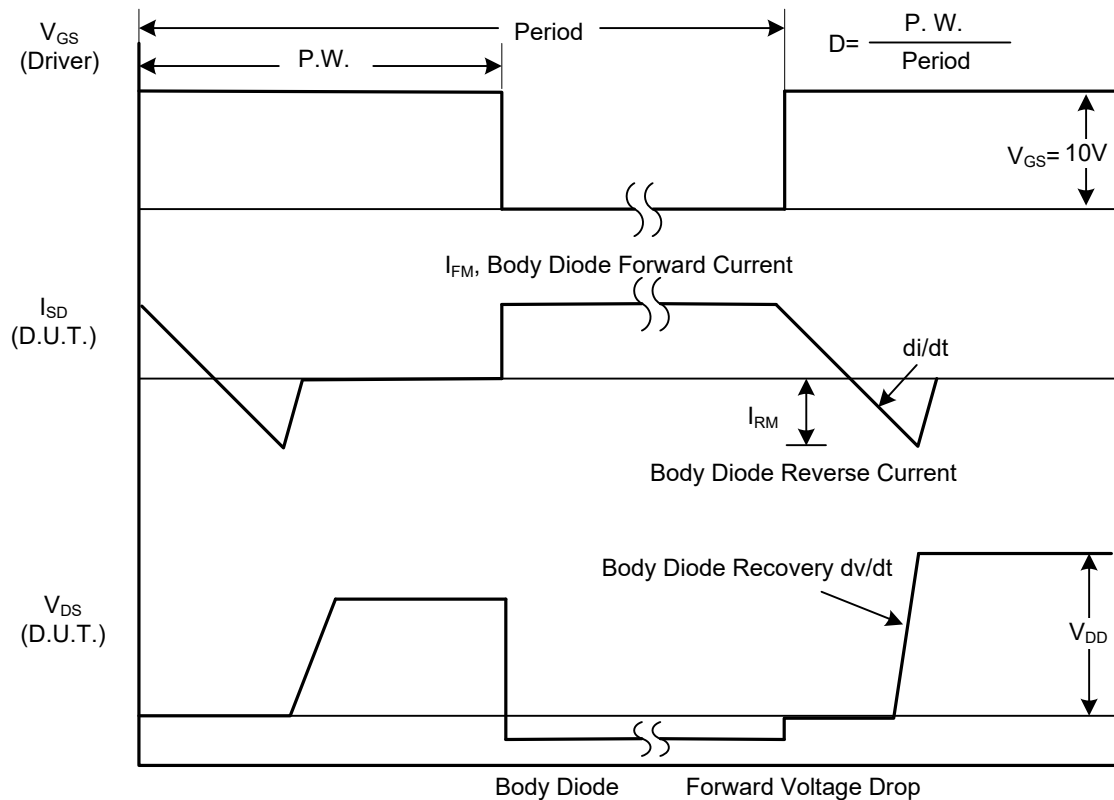
Notes: 1. Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating ambient temperature.

■ TEST CIRCUITS AND WAVEFORMS



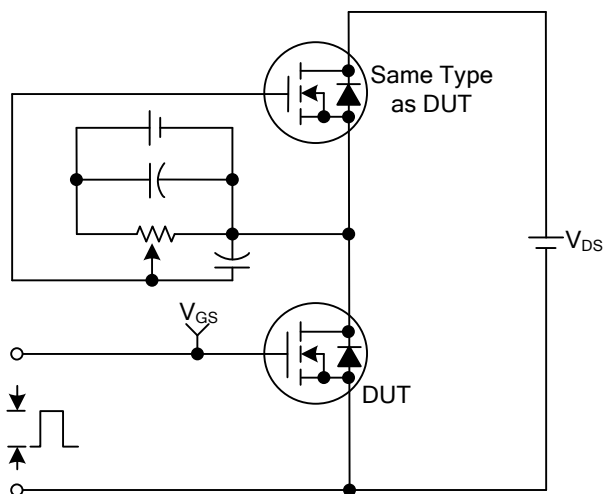
Peak Diode Recovery dv/dt Test Circuit



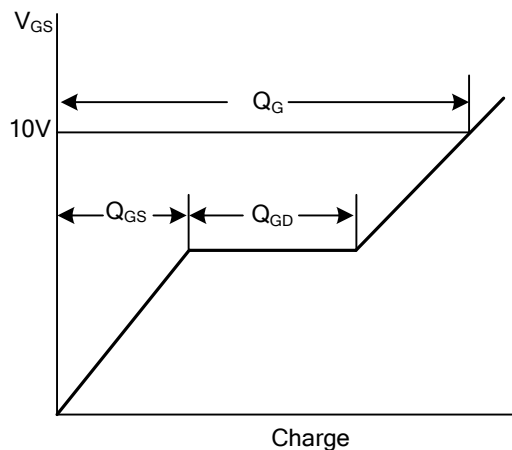
Peak Diode Recovery dv/dt Waveforms

■ TEST CIRCUITS AND WAVEFORMS

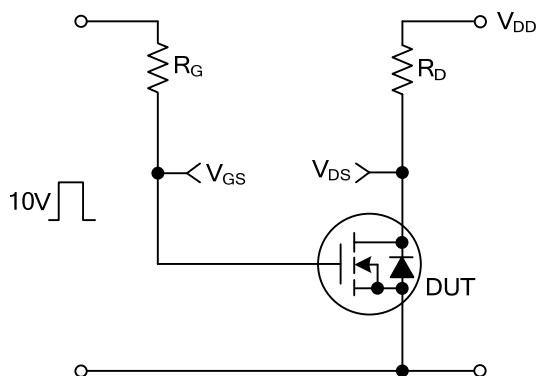
Gate Charge Test Circuit



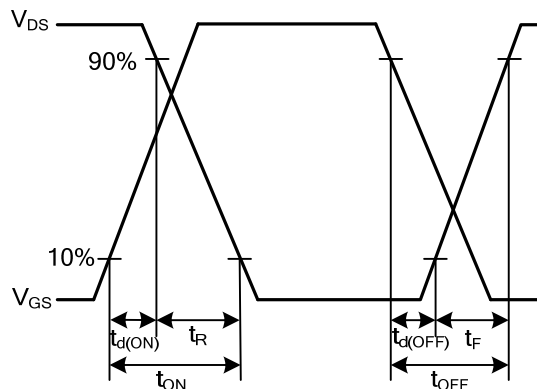
Gate Charge Waveforms



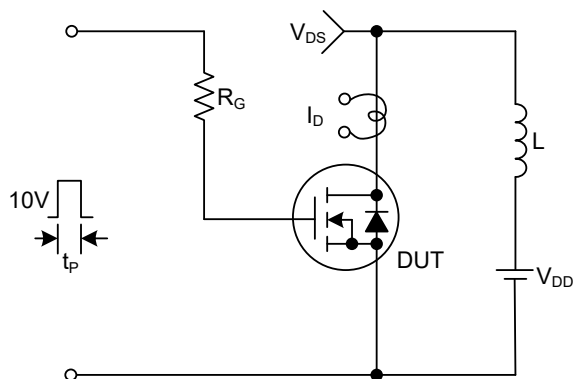
Resistive Switching Test Circuit



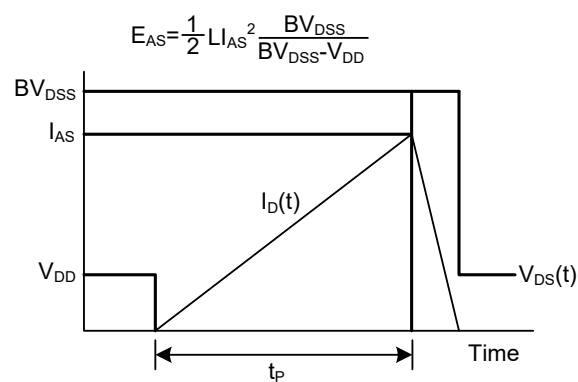
Resistive Switching Waveforms



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms



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