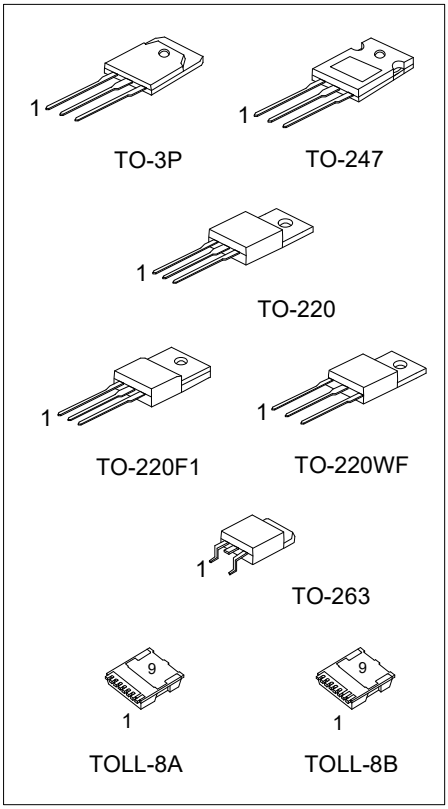
38A, 650V N-CHANNEL SUPER-JUNCTION MOSFET



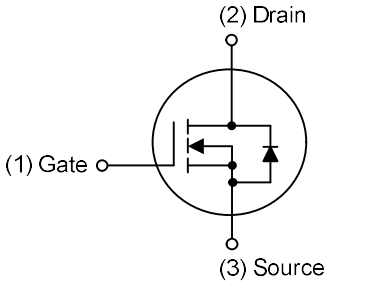
■ DESCRIPTION

The **UTC 38NM65-U2** 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.

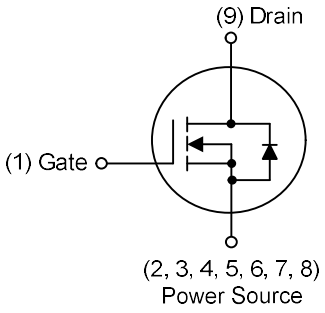
■ FEATURES

* $R_{DS(ON)} \leq 99\ m\Omega$ @ $V_{GS} = 10V$, $I_D = 9.5A$
* Fast switching capability
* Avalanche energy tested
* Improved dv/dt capability, high ruggedness
* Green Product

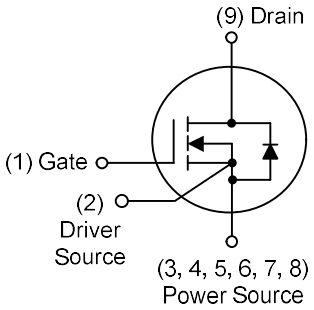
■ SYMBOL



TO-220 / TO-220F1 / TO-220WF
TO-247 / TO-263 / TO-3P



TOLL-8A



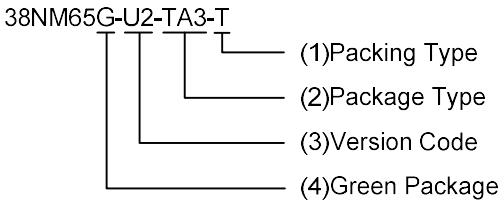
TOLL-8B

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■ ORDERING INFORMATION

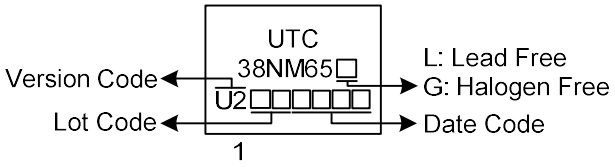
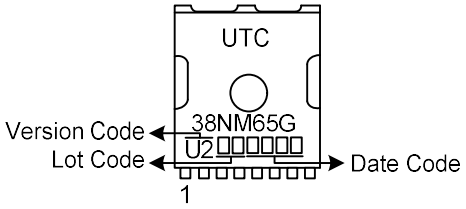
Ordering Number		Package	Pin Assignment									Packing
Lead Free	Halogen Free		1	2	3	4	5	6	7	8	9	
-	38NM65G-U2-TA3-T	TO-220	G	D	S	-	-	-	-	-	-	Tube
38NM65L-U2-TF1-T	38NM65G-U2-TF1-T	TO-220F1	G	D	S	-	-	-	-	-	-	Tube
-	38NM65G-U2-TW1-T	TO-220WF	G	D	S	-	-	-	-	-	-	Tube
-	38NM65G-U2-TQ2-T	TO-263	G	D	S	-	-	-	-	-	-	Tube
-	38NM65G-U2-TQ2-R	TO-263	G	D	S	-	-	-	-	-	-	Tape Reel
-	38NM65G-U2-T3P-T	TO-3P	G	D	S	-	-	-	-	-	-	Tube
-	38NM65G-U2-T47-T	TO-247	G	D	S	-	-	-	-	-	-	Tube
-	38NM65G-U2-T8A-R	TOLL-8A	G	S	S	S	S	S	S	S	D	Tape Reel
-	38NM65G-U2-T8B-R	TOLL-8B	G	S	S	S	S	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, TWF: TO-220WF, TQ2: TO-263, T3P: TO-3P, T47: TO-247 T8A: TOLL-8A, T8B: TOLL-8B
(3) Version U2
(4) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING

TO-220 / TO-220F1 / TO-220WF TO-263 / TO-3P / TO-247	TOLL-8A / TOLL-8B
	

■ 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}	±30	V
Drain Current	Continuous	I_D	38	A
	Pulsed (Note 2)	I_{DM}	114	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	1600	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	8.2	V/ns
Power Dissipation	TO-220/ TO-263	P_D	130	W
	TO-220F1/TO-220WF		40	W
	TO-247		151	W
	TO-3P		160	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 = 100mH, I_{AS} = 5.7A, V_{DD} = 90V, R_G = 25Ω, Starting T_J = 25°C
4. I_{SD} ≤ 30A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C

■ THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	TO-220/TO-220F1 TO-220WF/TO-263	θ_{JA}	62.5	°C/W
	TO-247		40	°C/W
	TO-3P		30	°C/W
	TOLL-8A/TOLL-8B		35 (Note)	°C/W
Junction to Case	TO-220/ TO-263	θ_{JC}	0.96	°C/W
	TO-220F1/TO-220WF		3.125	°C/W
	TO-247		0.83	°C/W
	TO-3P		0.78	°C/W
	TOLL-8A/TOLL-8B		0.57 (Note)	°C/W

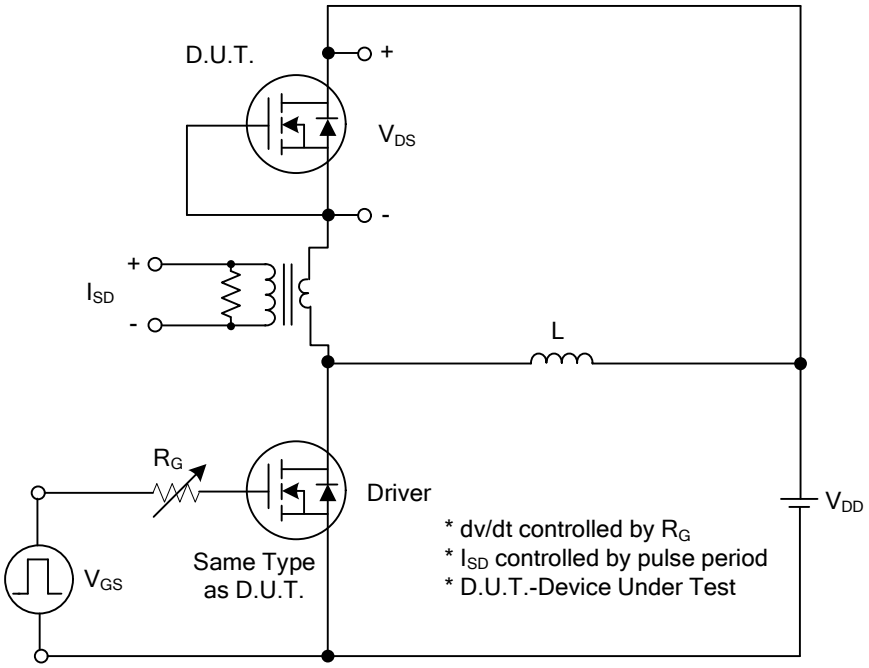
Note: Device mounted on FR-4 substrate P_C board, 2oz copper, with 1inch square copper plate.

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

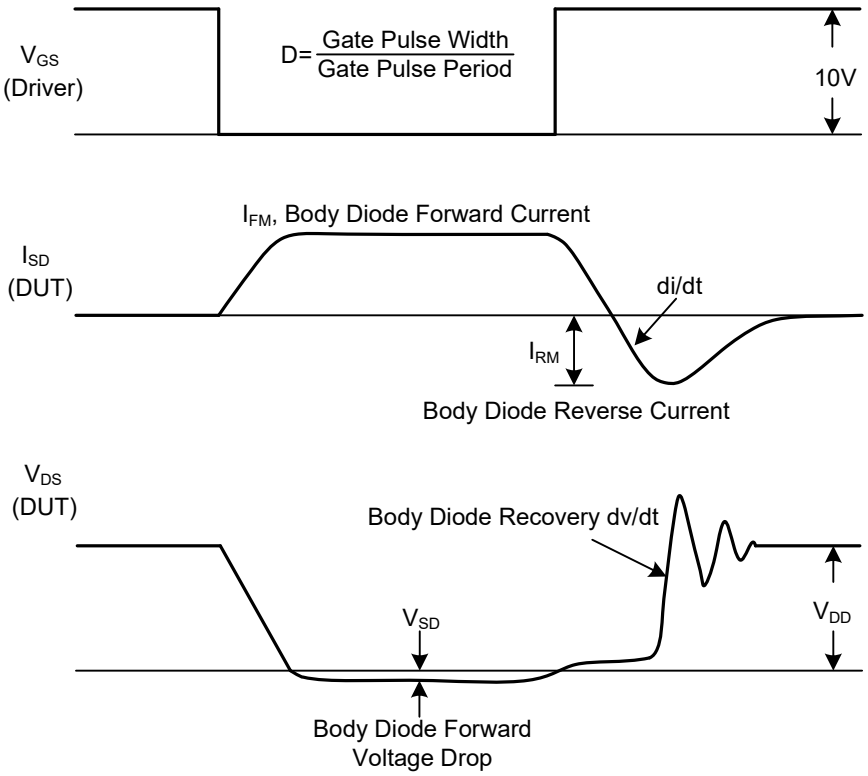
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V, I_D=250μA	650			V
Drain-Source Leakage Current	I_{DSS}	V_{DS}=650V, V_{GS}=0V			10	μA
Gate-Source Leakage Current	I_{GSS}	V_{GS}=±30V, V_{DS}=0V			±100	nA
ON CHARACTERISTICS						
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=9.5A			99	mΩ
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{ISS}	V_{GS}=0V, V_{DS}=50V, f=1MHz		2328		pF
Output Capacitance	C_{OSS}			787		pF
Reverse Transfer Capacitance	C_{RSS}			76		pF
SWITCHING CHARACTERISTICS						
Total Gate Charge	Q_G	V_{DS}=520V, V_{GS}=10V, I_D=38A (Note 1, 2)		115		nC
Gate-Source Charge	Q_{GS}			20		nC
Gate-Drain Charge	Q_{DD}			74		nC
Turn-On Delay Time	$t_{D(ON)}$	V_{DD}=100V, V_{GS}=10V, I_D=38A, R_G =25Ω (Note 1, 2)		44		ns
Turn-On Rise Time	t_R			98		ns
Turn-Off Delay Time	$t_{D(OFF)}$			202		ns
Turn-Off Fall Time	t_F			35		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS						
Maximum Continuous Drain-Source Diode Forward Current	I_S				38	A
Maximum Pulsed Drain-Source Diode Forward Current	I_{SM}				114	A
Drain-Source Diode Forward Voltage	V_{SD}	I_S=30A, V_{GS}=0V			1.4	V
Body Diode Reverse Recovery Time	t_{rr}	I_S=30A, V_{GS}=0V, dI_F/dt=100A/μs		596		nS
Body Diode Reverse Recovery Charge	Q_{rr}			12.4		μC

Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.
2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

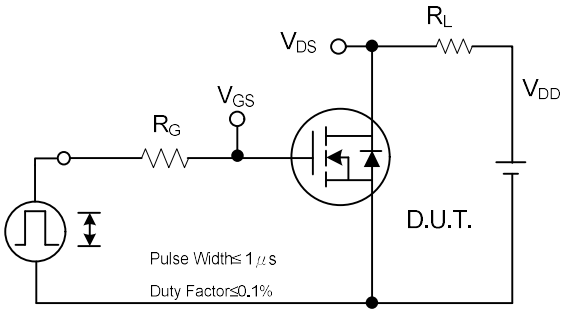


Peak Diode Recovery dv/dt Test Circuit

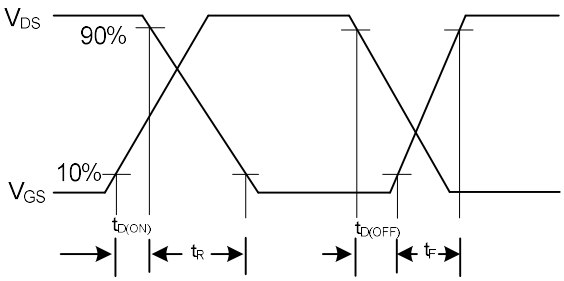


Peak Diode Recovery dv/dt Waveforms

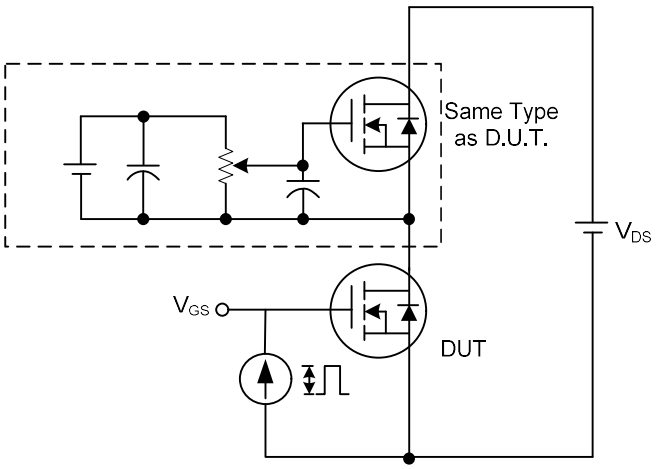
■ TEST CIRCUITS AND WAVEFORMS



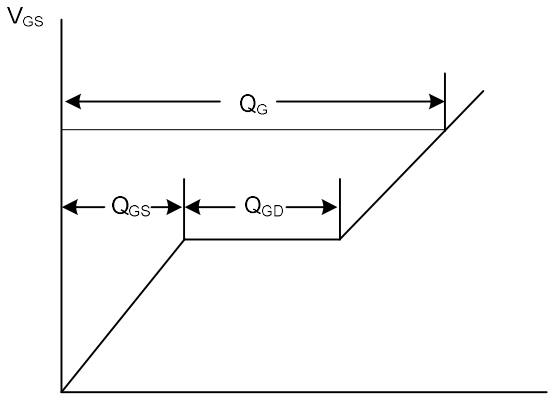
Switching Test Circuit



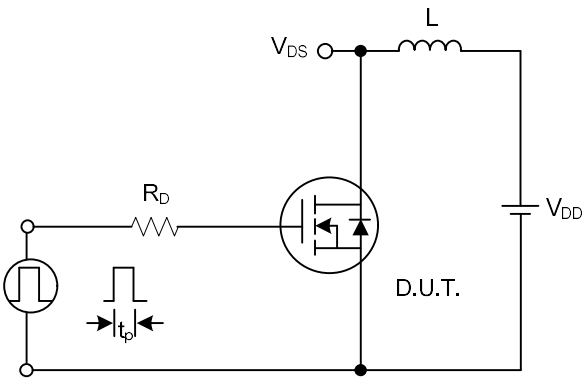
Switching Waveforms



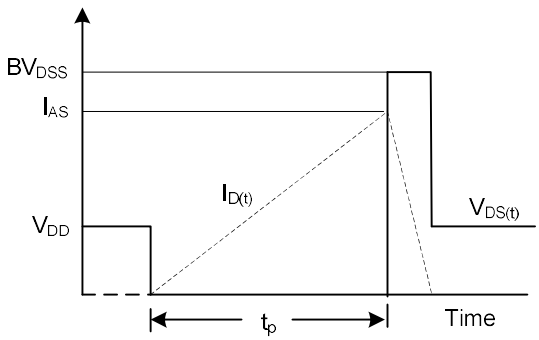
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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