



F21NM65

Preliminary

Power MOSFET

21A, 650V N-CHANNEL SUPER-JUNCTION MOSFET

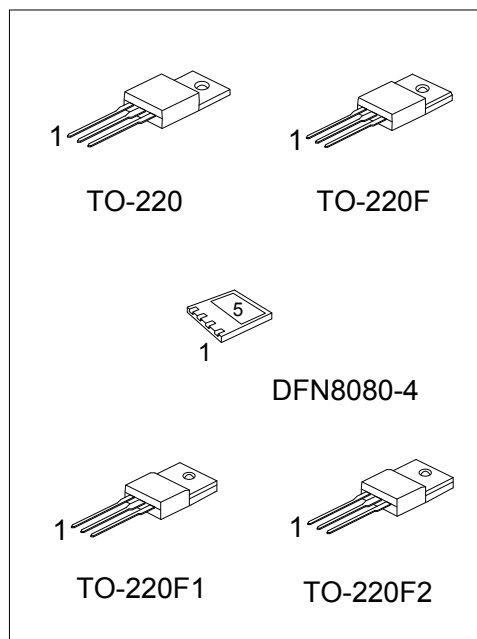
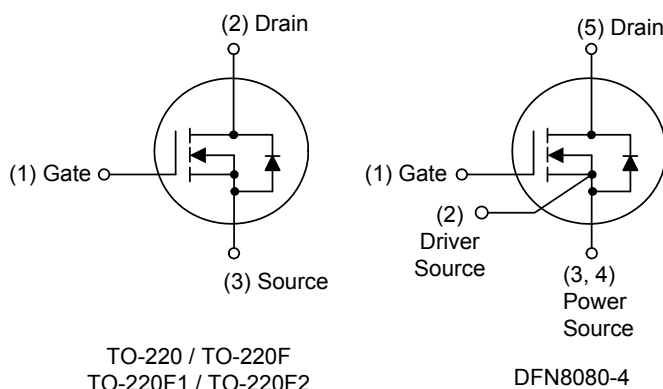
DESCRIPTION

The **UTC F21NM65** is a N-Channel enhancement mode silicon gate super junction power MOSFET with fast body diode 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

- * $R_{DS(ON)} \leq 0.22 \Omega @ V_{GS}=10V, I_D=10.5A$
- * Fast body diode MOSFET technology
- * High Switching Speed
- * 100% Avalanche Tested

SYMBOL



ORDERING INFORMATION

Ordering Number		Package	Pin Assignment					Packing
Lead Free	Halogen Free		1	2	3	4	5	
F21NM65L-TA3-T	F21NM65G-TA3-T	TO-220	G	D	S	-	-	Tube
F21NM65L-TF1-T	F21NM65G-TF1-T	TO-220F1	G	D	S	-	-	Tube
F21NM65L-TF2-T	F21NM65G-TF2-T	TO-220F2	G	D	S	-	-	Tube
F21NM65L-TF3-T	F21NM65G-TF3-T	TO-220F	G	D	S	-	-	Tube
F21NM65L-K04-8080-R	F21NM65G-K04-8080-R	DFN8080-4	G	S	S	S	D	Tape Reel

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

<p>F21NM65G-TA3-T</p> <p>(1) Packing Type</p> <p>(2) Package Type</p> <p>(3) Green Package</p>		<p>(1) T: Tube, R: Tape Reel</p> <p>(2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1, TF2: TO-220F2, K04-8080: DFN8080-4</p> <p>(3) G: Halogen Free and Lead Free, L: Lead Free</p>
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■ MARKING

TO-220 / TO-220F / TO-220F1 / TO-220F2	DFN8080-4
<p>UTC F21NM65 Lot Code → L: Lead Free G: Halogen Free Date Code 1</p>	<p>UTC F21NM65 Lot Code → • Date Code</p>

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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DS}	650	V
Gate-Source Voltage		V_{GS}	± 30	V
Continuous Drain Current		I_D	21	A
Pulsed Drain Current (Note 2)		I_{DM}	42	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	277	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	12.5	V/ns
Power Dissipation	TO-220	P_D	125	W
	TO-220F/TO-220F1		34	W
	TO-220F2			
	DFN8080-4		65	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. $L = 30\text{mH}$, $I_{AS} = 4.3\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\ \Omega$, Starting $T_J = 25^{\circ}\text{C}$

4. $I_{SD} \leq 21\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^{\circ}\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F/ TO-220F1/TO-220F2	θ_{JA}	62.5	$^{\circ}\text{C}/\text{W}$
	DFN8080-4		35 (Note)	$^{\circ}\text{C}/\text{W}$
Junction to Case	TO-220	θ_{JC}	1	$^{\circ}\text{C}/\text{W}$
	TO-220F/TO-220F1		3.67	$^{\circ}\text{C}/\text{W}$
	TO-220F2			
	DFN8080-4		1.92 (Note)	$^{\circ}\text{C}/\text{W}$

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

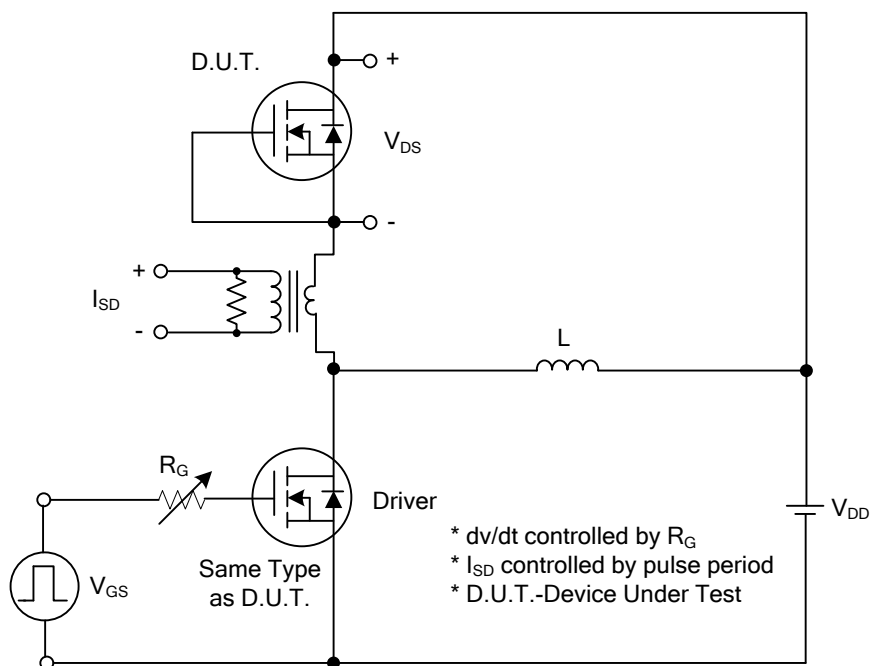
■ ELECTRICAL CHARACTERISTICS (T_J=25°C, unless otherwise specified)

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	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 =10.5A			0.22	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C _{ISS}	V _{DS} =25V, V _{GS} =0V, f=1.0MHz		1570		pF
Output Capacitance		C _{OSS}			965		pF
Reverse Transfer Capacitance		C _{RSS}			96		pF
SWITCHING CHARACTERISTICS							
Total Gate Charge (Note 1)		Q _G	V _{DS} =520V, V _{GS} =10V, I _D =21A I _G =1mA (Note 1, 2)		55.7		nC
Gate-Source Charge		Q _{GS}			12		nC
Gate-Drain Charge		Q _{GD}			24		nC
Turn-On Delay Time (Note 1)		t _{D(ON)}	V _{DS} =100V, V _{GS} =10V, I _D =21A, R _G =25Ω (Note 1, 2)		25		ns
Turn-On Rise Time		t _R			35		ns
Turn-Off Delay Time		t _{D(OFF)}			180		ns
Turn-Off Fall Time		t _F			82		ns
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS							
Maximum Continuous Drain-Source Diode Forward Current		I _S				21	A
Maximum Pulsed Drain-Source Diode Forward Current		I _{SM}				42	A
Drain-Source Diode Forward Voltage (Note 1)		V _{SD}	I _S =21A , V _{GS} =0V			1.4	V
Reverse Recovery Time (Note 1)		t _{rr}	I _S =21A , V _{GS} =0V		170		ns
Reverse Recovery Charge		Q _{rr}	di/dt=100A/μs		2.4		μC

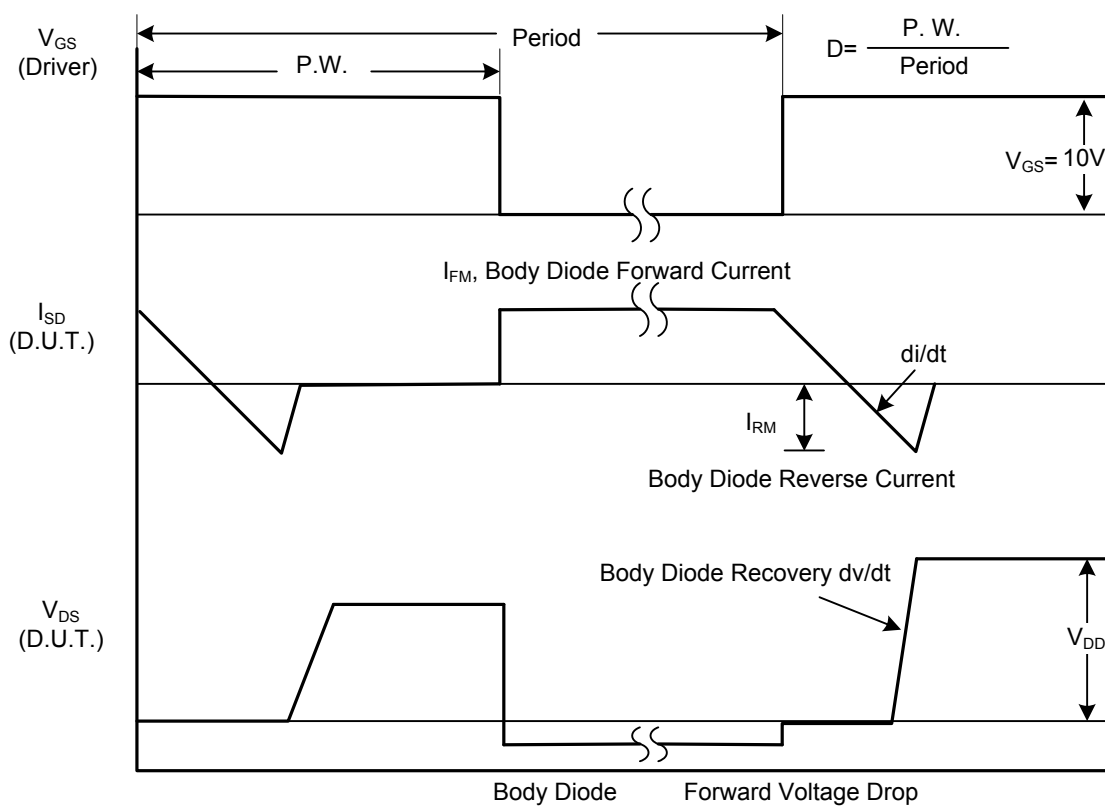
Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

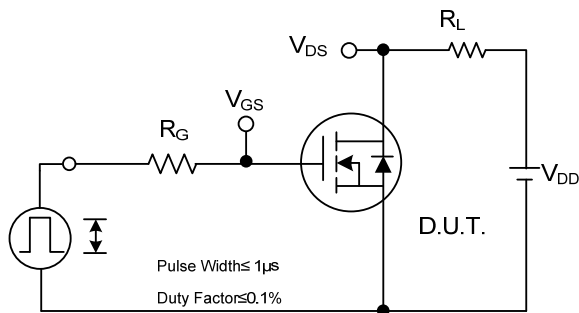


Peak Diode Recovery dv/dt Test Circuit

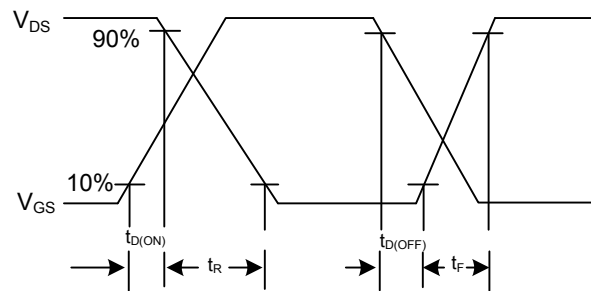


Peak Diode Recovery dv/dt Waveforms

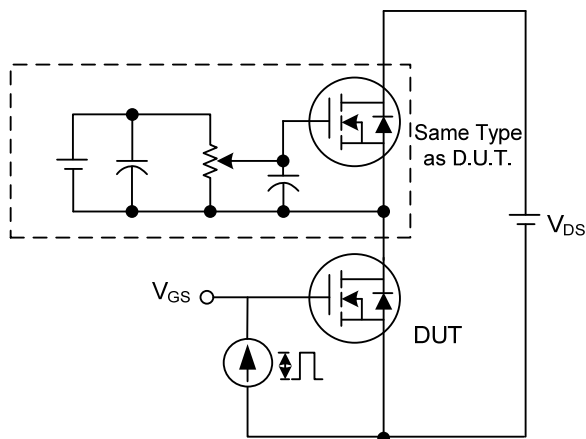
■ TEST CIRCUITS AND WAVEFORMS



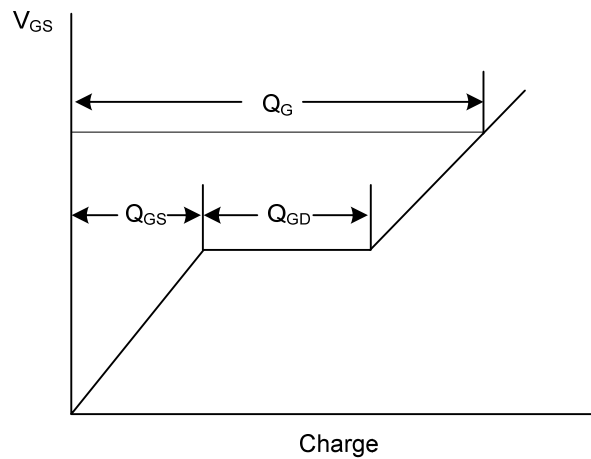
Switching Test Circuit



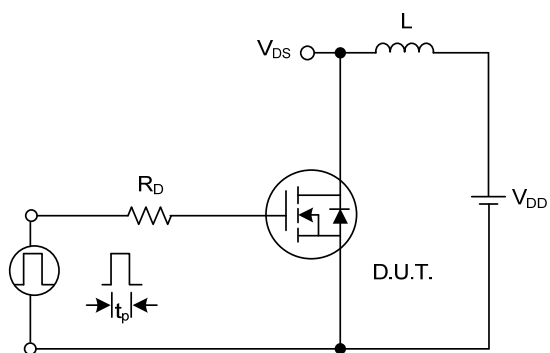
Switching Waveforms



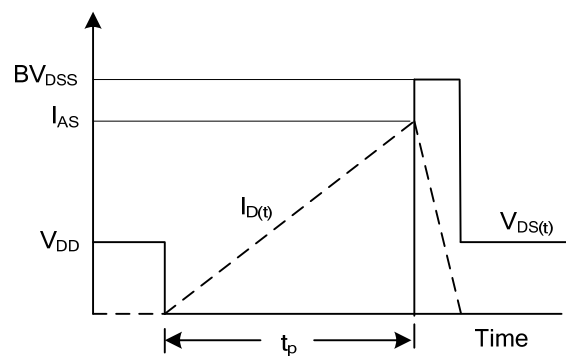
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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