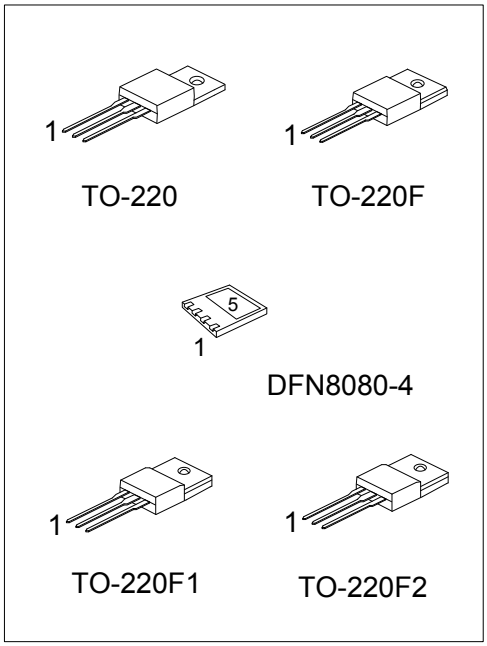
F21NM65

Preliminary | ***Power MOSFET***

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



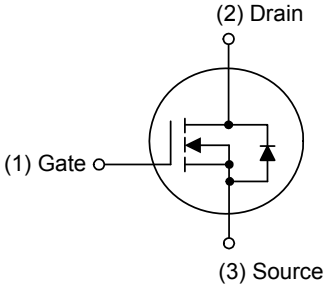
■ DESCRIPTION

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.

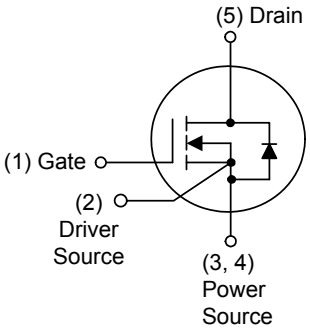
■ FEATURES

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

■ SYMBOL



TO-220 / TO-220F
TO-220F1 / TO-220F2



DFN8080-4

■ ORDERING INFORMATION

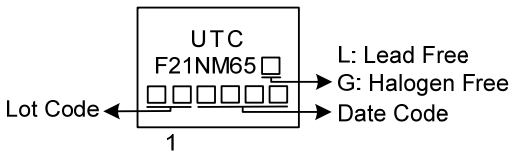
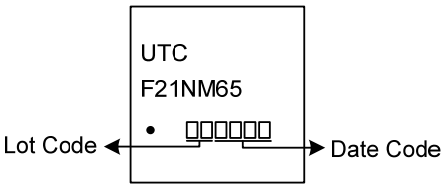
Ordering Number		Package	Pin Assignment					Packing
Lead Free	Halogen Free		1	2	3	4	5	
F21NM65L-TA3-T	F21NM65G-TA3-T	TO-220	G	D	S	-	-	Tube
F21NM65L-TF1-T	F21NM65G-TF1-T	TO-220F1	G	D	S	-	-	Tube
F21NM65L-TF2-T	F21NM65G-TF2-T	TO-220F2	G	D	S	-	-	Tube
F21NM65L-TF3-T	F21NM65G-TF3-T	TO-220F	G	D	S	-	-	Tube
F21NM65L-K04-8080-R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

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

F21NM65G-TA3-T
(1)Packing Type
(2)Package Type
(3)Green Package

(1) T: Tube, R: Tape Reel
(2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1, TF2: TO-220F2, K04-8080: DFN8080-4
(3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING

TO-220 / TO-220F / TO-220F1 / TO-220F2	DFN8080-4
	

■ 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
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 TO-220F2		34	W
	DFN8080-4		65	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 = 30mH, I_{AS} = 4.3A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
4. I_{SD} ≤ 21A, di/dt ≤200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C

■ THERMAL DATA

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

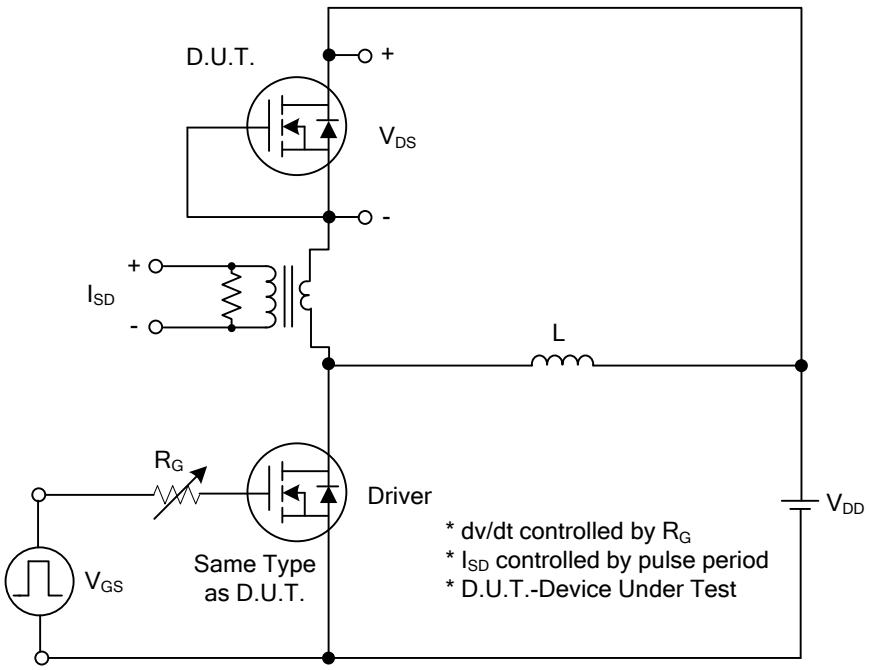
Note: Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.

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

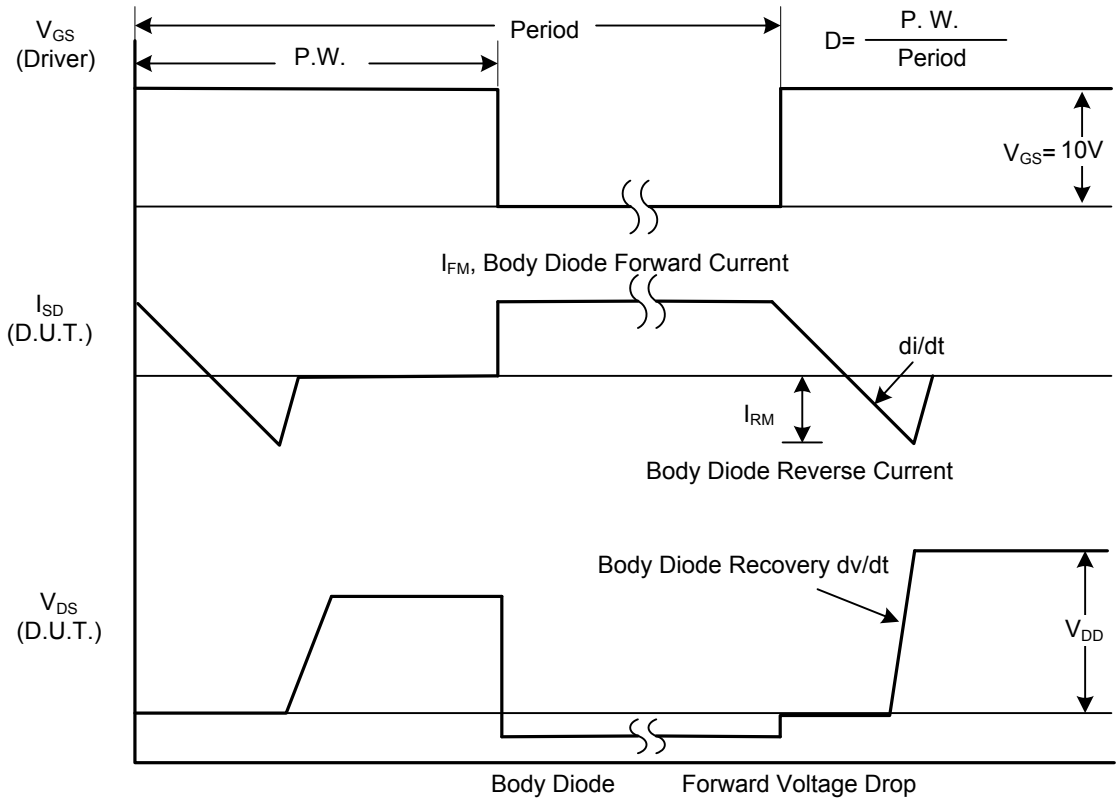
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS}=0V, I_D=250μA	650			V
Drain-Source Leakage Current		I_{DSS}	V_{DS}=650V, V_{GS}=0V			10	μA
Gate- Source Leakage Current	Forward	I_{GSS}	V_{GS}=30V, V_{DS}=0V			100	nA
	Reverse		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 di/dt=100A/μs		170		ns
Reverse Recovery Charge		Q_{rr}			2.4		μC

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

■ TEST CIRCUITS AND WAVEFORMS

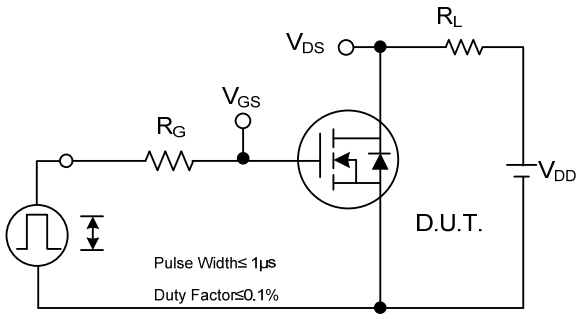


Peak Diode Recovery dv/dt Test Circuit

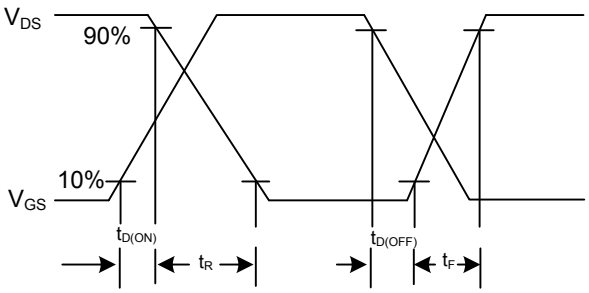


Peak Diode Recovery dv/dt Waveforms

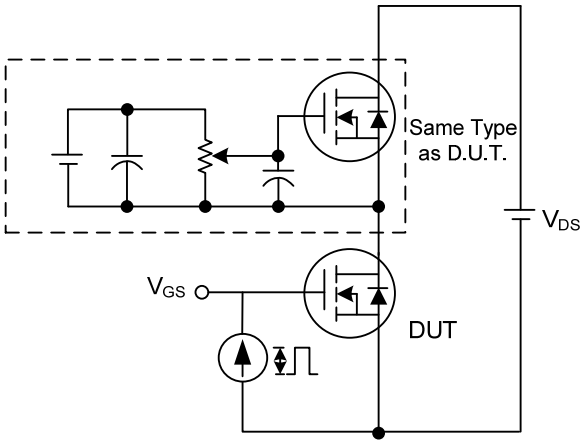
■ TEST CIRCUITS AND WAVEFORMS



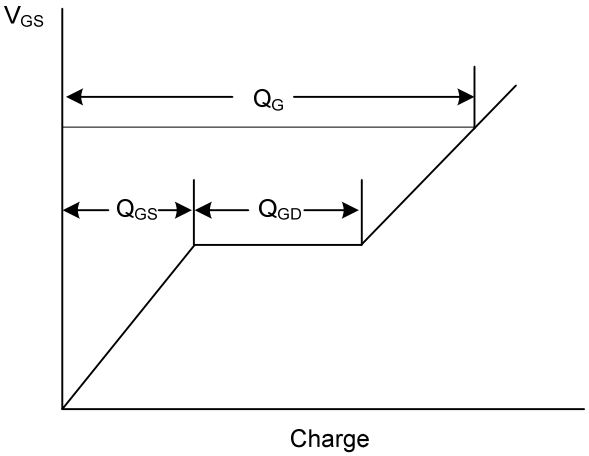
Switching Test Circuit



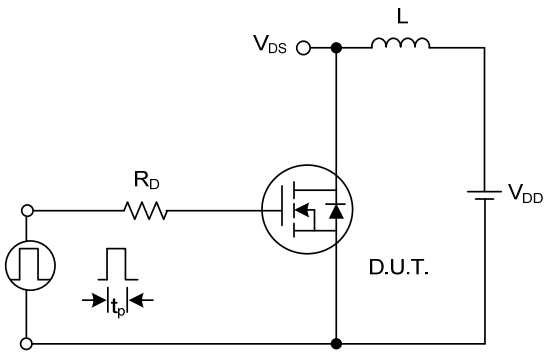
Switching Waveforms



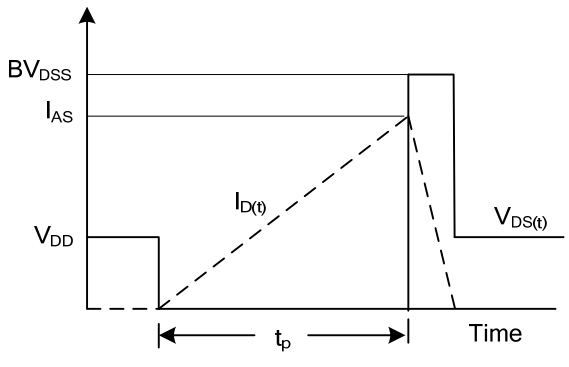
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms