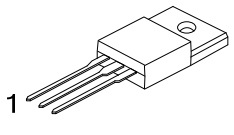
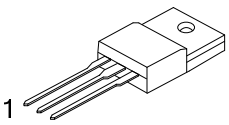
13NM65

Power MOSFET

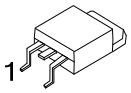
13A, 650V N-CHANNEL SUPER-JUNCTION MOSFET



TO-220F



TO-220F1



TO - 252

■ DESCRIPTION

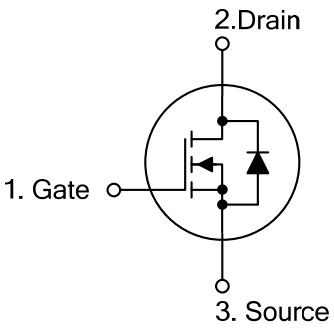
The UTC **13NM65** is a high voltage super junction MOSFET and is designed to have better characteristics.

The UTC **13NM65** Utilizing an advanced charge-balance technology, enhance system efficiency, improve EMI and reliability. such as low gate charge, low on-state resistance and have a high power density and high rugged avalanche characteristics. This super junction MOSFET usually used at AC/DC power conversion, and industrial power applications.

■ FEATURES

* $R_{DS(ON)}$ < 0.5Ω @ V_{GS} = 10V, I_D = 6.5A
* Fast switching capability
* Avalanche energy tested
* Improved dv/dt capability, high ruggedness

■ SYMBOL



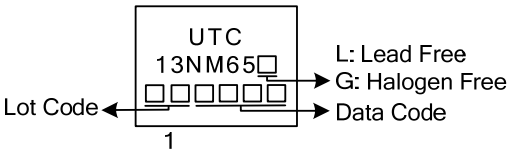
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
13NM65L-TF3-T	13NM65G-TF3-T	TO-220F	G	D	S	Tube
13NM65L-TF1-T	13NM65G-TF1-T	TO-220F1	G	D	S	Tube
13NM65L-TN3-R	13NM65G-TN3-R	TO-252	G	D	S	Tape Reel

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

13NM65L-TF3-T (1) Packing Type (2) Package Type (3) Green Package	(1) T: Tube, R: Tape Reel (2) TF3: TO-220F, TF1: TO-220F1, TN3: TO-252 (3) L: Lead Free, G: Halogen Free and Lead Free

■ MARKING



■ 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	13	A
	Pulsed (Note 2)	I_{DM}	52	A
Avalanche Current (Note 2)		I_{AR}	2.4	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	452	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	TO-220F/TO-220F1	P_D	168	W
	TO-252		48	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 = 157 mH, I_{AS} = 2.4A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
4. I_{SD}≤13A, di/dt≤200A/μs, V_{DD}≤BV_{DSS}, Starting T_J = 25°C

■ THERMAL RESISTANCES CHARACTERISTICS

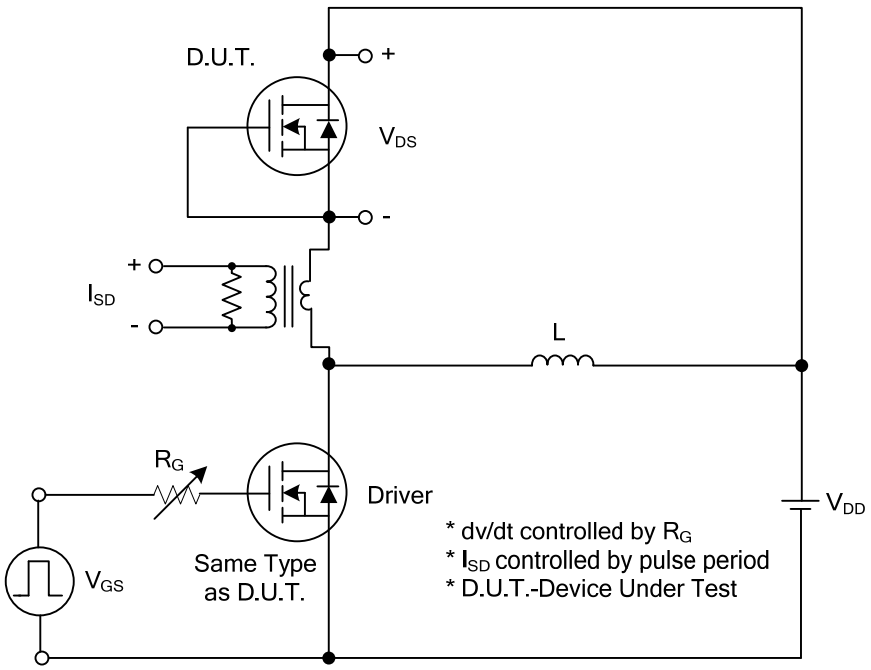
PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	TO-220F/TO-220F1	θ_{JA}	62.5	°C/W
	TO-252		110	°C/W
Junction to Case	TO-220F/TO-220F1	θ_{JC}	0.74	°C/W
	TO-252		1.79	°C/W

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

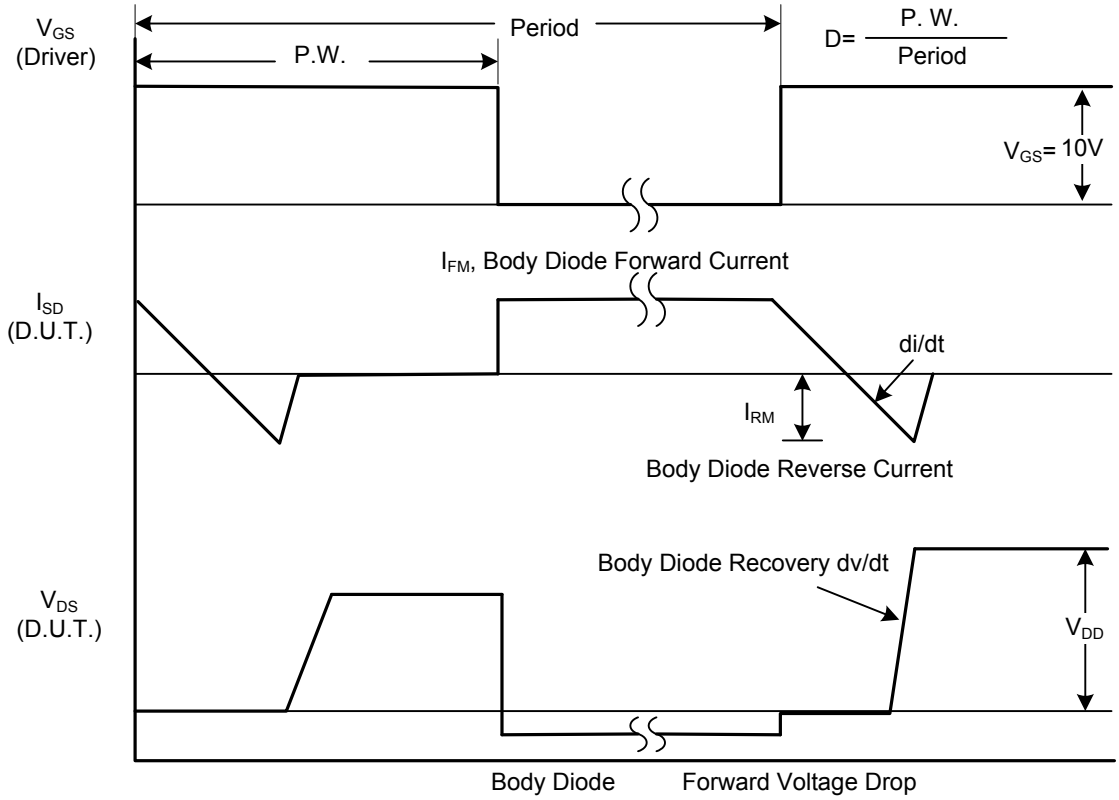
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS} = 0V, I_D = 250μA	650			V
Drain-Source Leakage Current		I_{DSS}	V_{DS} = 650V, V_{GS} = 0V			10	μA
Gate-Source Leakage Current	Forward	I_{GSS}	V_{GS} = 30V, V_{DS} = 0V			100	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 = 6.5A			0.5	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C_{ISS}	V_{GS}=0V, V_{DS}=25V, f=1.0MHz		780		pF
Output Capacitance		C_{OSS}			500		pF
Reverse Transfer Capacitance		C_{RSS}			30		pF
SWITCHING CHARACTERISTICS							
Total Gate Charge (Note 1)		Q_G	V_{DS}=50V, I_D=1.3A, I_G=100μA V_{GS}=10V (Note 1,2)		110		nC
Gate-Source Charge		Q_{GS}			10		nC
Gate-Drain Charge		Q_{GD}			25		nC
Turn-On Delay Time (Note 1)		$t_{D(ON)}$	V_{DD} =30V, I_D =0.5A, R_G =25Ω, V_{GS}=10V (Note 1,2)		58		nS
Turn-On Rise Time		t_R			75		nS
Turn-Off Delay Time		$t_{D(OFF)}$			155		nS
Turn-Off Fall Time		t_F			29		nS
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS							
Maximum Continuous Drain-Source Diode Forward Current		I_S				13	A
Maximum Pulsed Drain-Source Diode Forward Current		I_{SM}				52	A
Drain-Source Diode Forward Voltage (Note 1)		V_{SD}	V_{GS} = 0V, I_S = 13 A			1.4	V
Reverse Recovery Time (Note 1)		t_{rr}	V_{GS} = 0V, I_S = 13A, dI_F / dt =100A/μ		376		nS
Reverse Recovery Charge		Q_{rr}			5.3		μC

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

■ TEST CIRCUITS AND WAVEFORMS

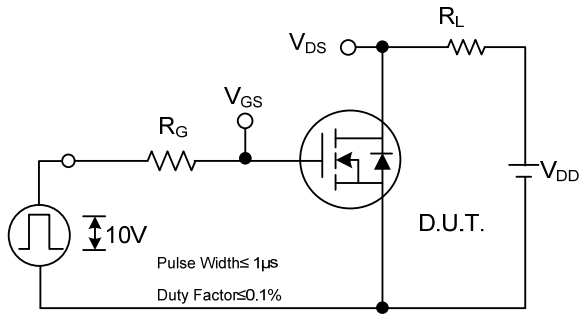


Peak Diode Recovery dv/dt Test Circuit

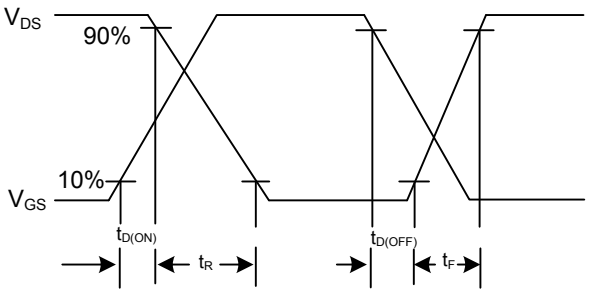


Peak Diode Recovery dv/dt Waveforms

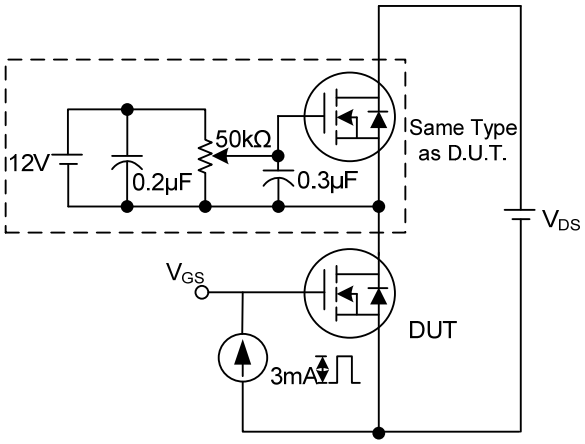
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



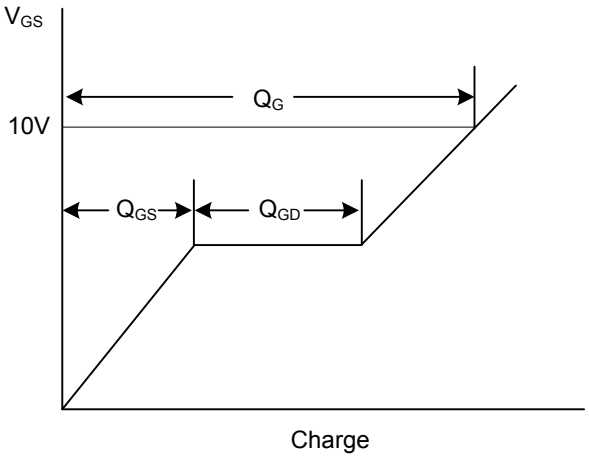
Switching Test Circuit



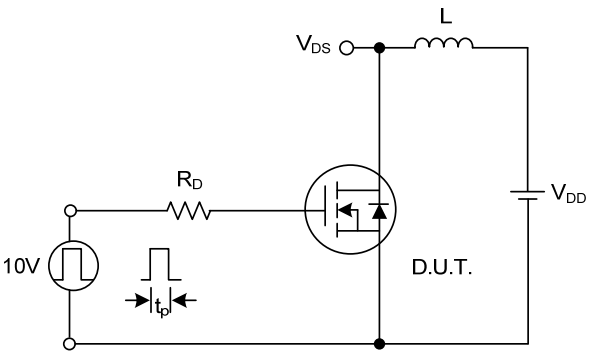
Switching Waveforms



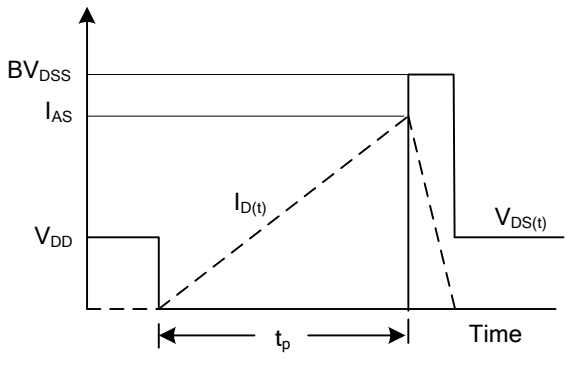
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms