



## 3NM65

Power MOSFET

### 3A, 650V N-CHANNEL SUPER-JUNCTION MOSFET

#### DESCRIPTION

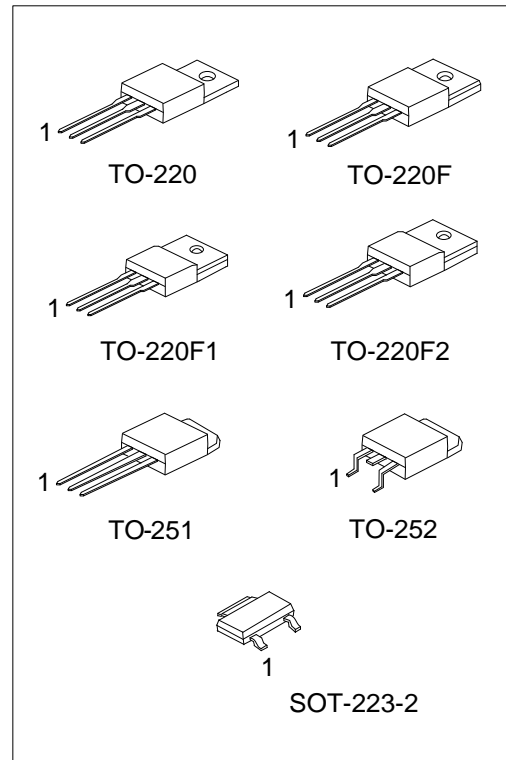
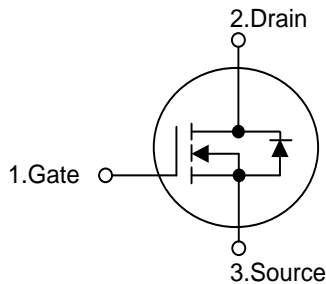
The UTC **3NM65** is a Super Junction MOSFET Structure. It uses UTC advanced planar stripe, DMOS technology to provide customers perfect switching performance, minimal on-state resistance.

The UTC **3NM65** is universally applied in electronic lamp ballasts based on half bridge topology, high efficiency switched mode power supplies, active power factor correction, etc.

#### FEATURES

- \*  $R_{DS(ON)} \leq 2.15 \Omega @ V_{GS}=10V, I_D=1.5A$
- \* Fast switching capability
- \* Avalanche energy specified
- \* Improved dv/dt capability, high ruggedness

#### SYMBOL



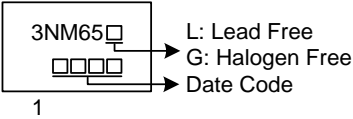
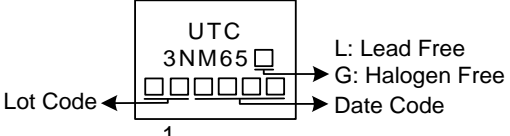
#### ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
3NM65L-AA2-R	3NM65G-AA2-R	SOT-223-2	G	D	S	Tape Reel
3NM65L-TA3-T	3NM65G-TA3-T	TO-220	G	D	S	Tube
3NM65L-TF1-T	3NM65G-TF1-T	TO-220F1	G	D	S	Tube
3NM65L-TF2-T	3NM65G-TF2-T	TO-220F2	G	D	S	Tube
3NM65L-TF3-T	3NM65G-TF3-T	TO-220F	G	D	S	Tube
3NM65L-TM3-T	3NM65G-TM3-T	TO-251	G	D	S	Tube
3NM65L-TN3-R	3NM65G-TN3-R	TO-252	G	D	S	Tape Reel

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

<p>3NM65G-AA2-R</p> <p>(1) Packing Type</p> <p>(2) Package Type</p> <p>(3) Green Package</p>	<p>(1) R: Tape Reel, T: Tube</p> <p>(2) AA2: SOT-223-2, TA3: TO-220, TF3: TO-220F, TF1: TO-220F1, TF2: TO-220F2, TM3: TO-251, TN3: TO-252</p> <p>(3) G: Halogen Free and Lead Free, L: Lead Free</p>
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■ **MARKING**

SOT-223-2	TO-220 / TO-220F / TO-220F1 TO-220F2 / TO-251 / TO-252
 <p>3NM65□ □□□□</p> <p>1</p> <p>L: Lead Free G: Halogen Free Date Code</p>	 <p>UTC 3NM65□ □□□□□□</p> <p>1</p> <p>Lot Code ← L: Lead Free G: Halogen Free Date Code</p>

### ■ ABSOLUTE MAXIMUM RATINGS (T<sub>C</sub> = 25°C, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V <sub>DSS</sub>	650	V
Gate-Source Voltage		V <sub>GSS</sub>	±30	V
Drain Current	Continuous	I <sub>D</sub>	3	A
	Pulsed (Note 2)	I <sub>DM</sub>	9	A
Avalanche Energy	Single Pulsed (Note 3)	E <sub>AS</sub>	104	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	SOT-223-2	P <sub>D</sub>	3	W
	TO-220		60	W
	TO-220F/TO-220F1		24	W
	TO-220F2		25	W
	TO-251/TO-252		44	W
Junction Temperature		T <sub>J</sub>	+150	°C
Storage Temperature		T <sub>STG</sub>	-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=144mH, I<sub>AS</sub>=1.2A, V<sub>DD</sub>=50V, R<sub>G</sub>=25 Ω, Starting T<sub>J</sub> = 25°C

4. I<sub>SD</sub>≤3.0A, di/dt≤200A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25°C

### ■ THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	SOT-223-2	θ <sub>JA</sub>	250	°C/W
	TO-220/TO-220F		62.5	
	TO-220F1/TO-220F2			
	TO-251/TO-252		110	
Junction to Case	SOT-223-2	θ <sub>JC</sub>	41.6	°C/W
	TO-220		2.08	
	TO-220F/TO-220F1		5.2	
	TO-220F2		5.1	
	TO-251/TO-252		2.84	

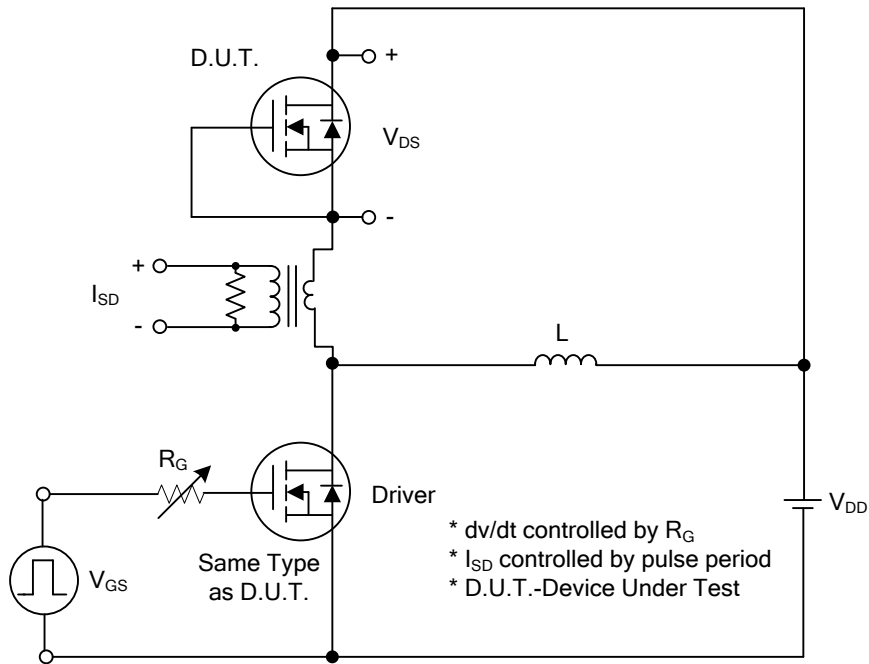
■ **ELECTRICAL CHARACTERISTICS** ( $T_J=25^{\circ}\text{C}$ , unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	650			V
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS}=650V, V_{GS}=0V$			10	$\mu A$
Gate-Source Leakage Current	Forward	$I_{GSS}$			100	nA
	Reverse					
		$V_{GS}=-30V, V_{DS}=0V$			-100	nA
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.5		4.5	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=1.5A$			2.15	$\Omega$
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	$C_{ISS}$	$V_{GS}=0V, V_{DS}=25V, f=1\text{MHz}$		210		pF
Output Capacitance	$C_{OSS}$			160		pF
Reverse Transfer Capacitance	$C_{RSS}$			16		pF
<b>SWITCHING CHARACTERISTICS</b>						
Total Gate Charge (Note 1)	$Q_G$	$V_{DS}=300V, V_{GS}=10V, I_D=3.0A, I_G=5\text{mA}$ (Note 1, 2)		15.5		nC
Gate-Source Charge	$Q_{GS}$			5.4		nC
Gate-Drain Charge	$Q_{GD}$			6.0		nC
Turn-On Delay Time (Note 1)	$t_{D(ON)}$	$V_{DD}=200V, V_{GS}=10V, I_D=3.0A, R_G=25\Omega$ (Note 1, 2)		7.2		ns
Turn-On Rise Time	$t_R$			16.5		ns
Turn-Off Delay Time	$t_{D(OFF)}$			30		ns
Turn-Off Fall Time	$t_F$			24		ns
<b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b>						
Maximum Continuous Drain-Source Diode Forward Current	$I_S$				3	A
Maximum Pulsed Drain-Source Diode Forward Current	$I_{SM}$				9	A
Drain-Source Diode Forward Voltage (Note 1)	$V_{SD}$	$V_{GS}=0V, I_S=3.0A$			1.4	V
Body Diode Reverse Recovery Time (Note 1)	$t_{rr}$	$V_{GS}=0V, I_S=3.0A, dI_F/dt=100A/\mu s$		236		ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			1.5		nC

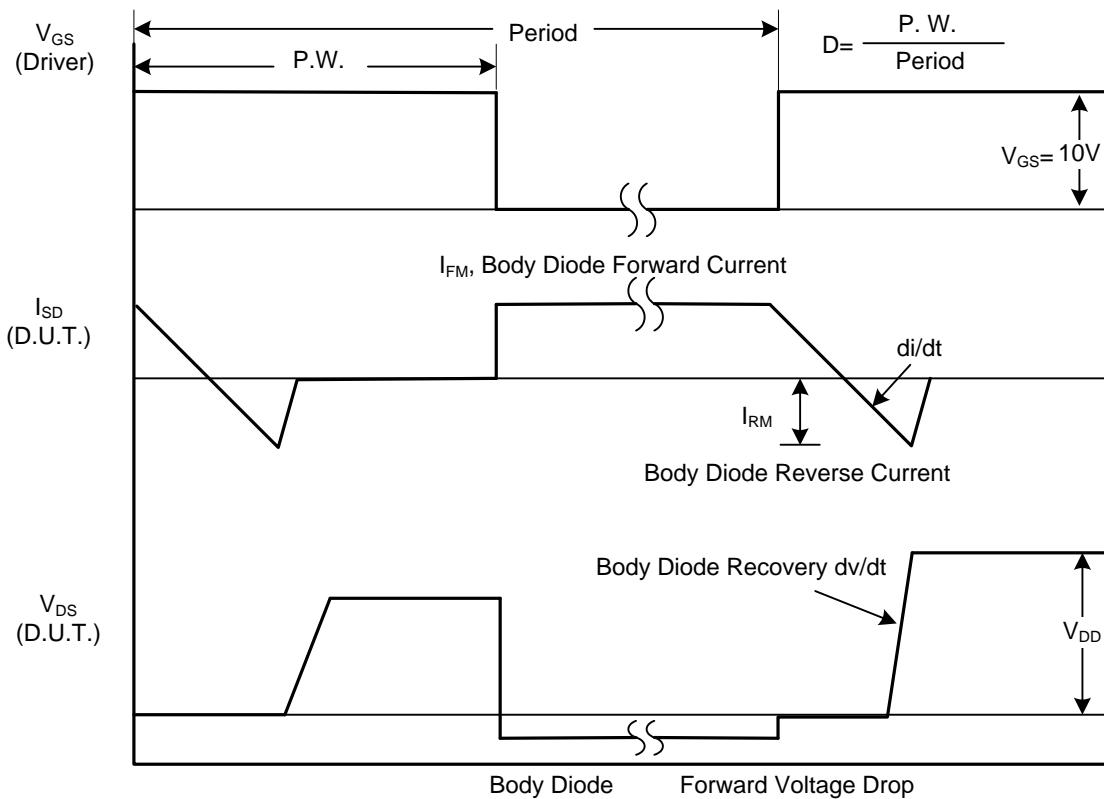
Notes: 1. Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$

2. Essentially independent of operating temperature

## TEST CIRCUITS AND WAVEFORMS

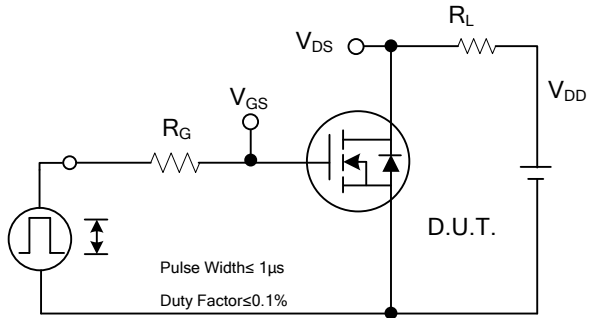


**Peak Diode Recovery dv/dt Test Circuit**

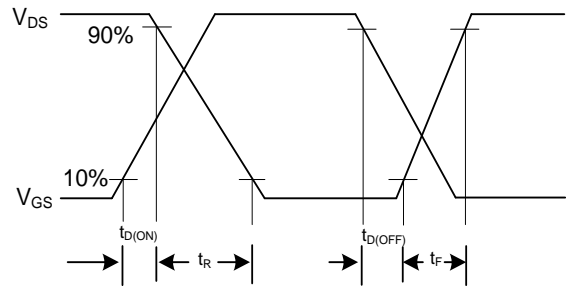


**Peak Diode Recovery dv/dt Waveforms**

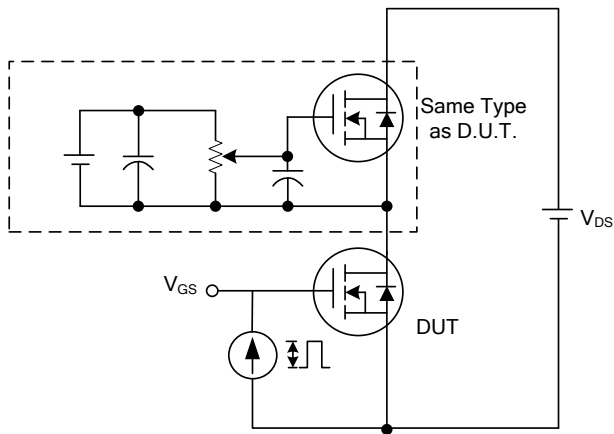
## ■ TEST CIRCUITS AND WAVEFORMS



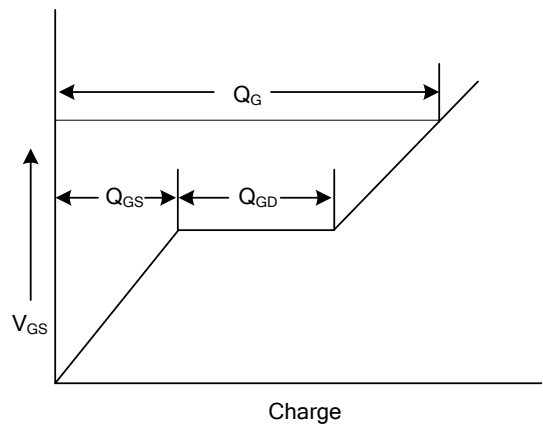
**Switching Test Circuit**



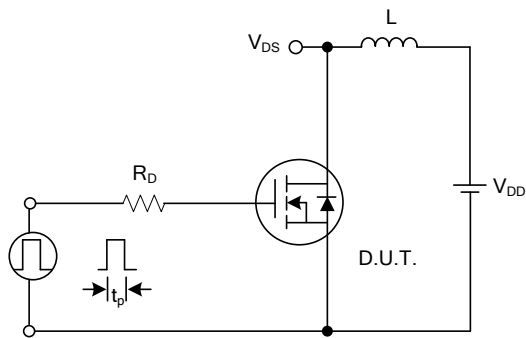
**Switching Waveforms**



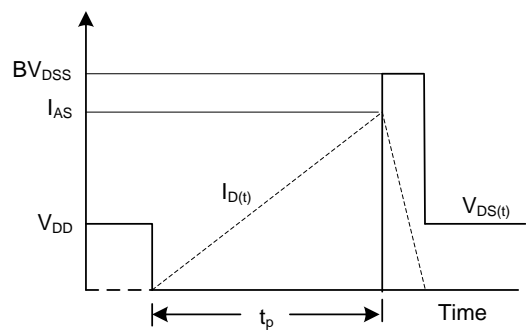
**Gate Charge Test Circuit**



**Gate Charge Waveform**

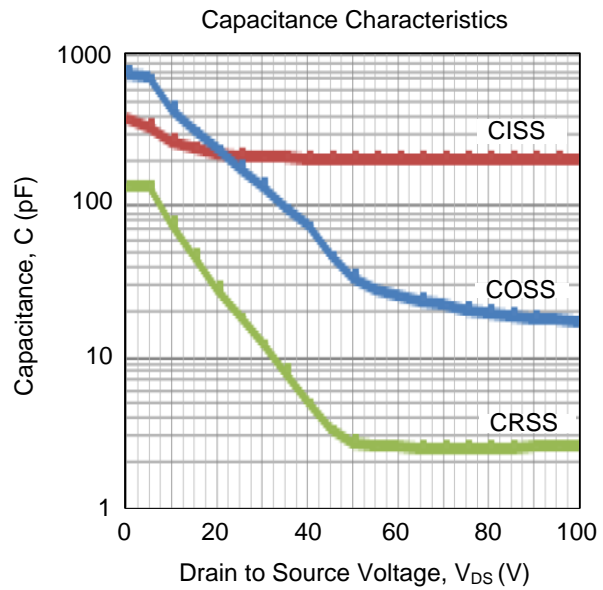
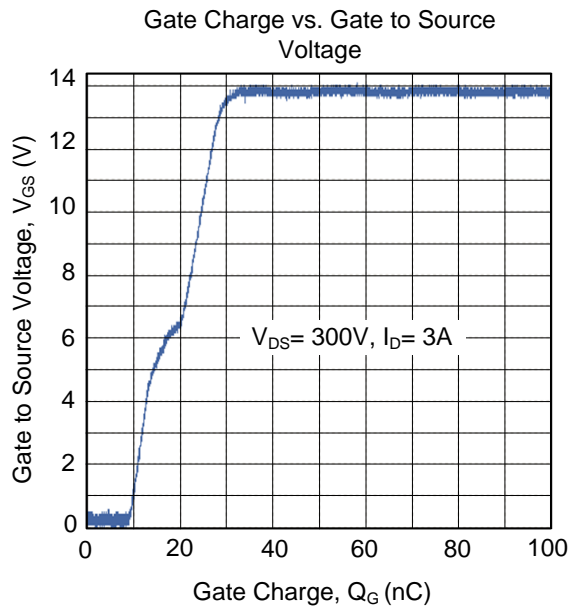


**Unclamped Inductive Switching Test Circuit**



**Unclamped Inductive Switching Waveforms**

## ■ TYPICAL CHARACTERISTICS



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