



## 2NM65-Q

Power MOSFET

### 2.0A, 650V N-CHANNEL SUPER-JUNCTION MOSFET

#### DESCRIPTION

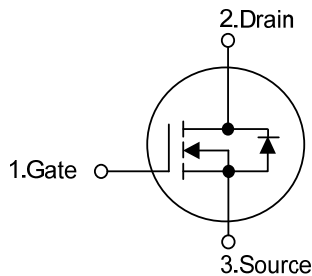
The UTC **2NM65-Q** is an Super Junction MOSFET Structure. It uses UTC advanced planar stripe, DMOS technology to provide customers perfect switching performance, minimal on-state resistance.

The UTC **2NM65-Q** is universally applied in electronic lamp ballasts based on half bridge topology, high efficiency switched mode power supplies, active power factor correction, etc.

#### FEATURES

- \*  $R_{DS(ON)} < 3.1\Omega @ V_{GS} = 10V, I_D = 1.0A$
- \* Fast switching capability
- \* Avalanche energy specified
- \* Improved dv/dt capability, high ruggedness

#### SYMBOL

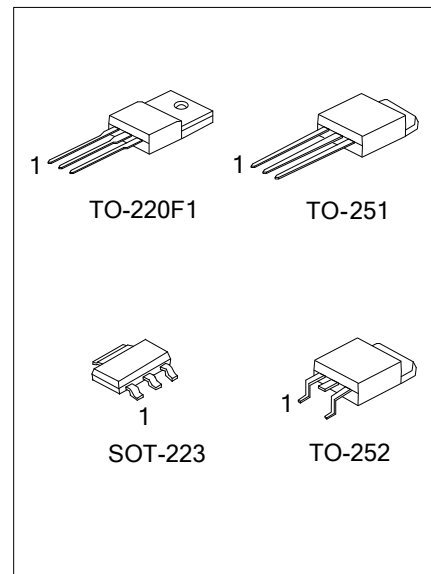


#### ORDERING INFORMATION

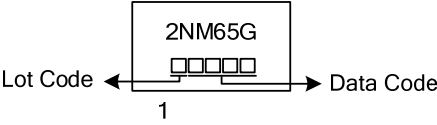
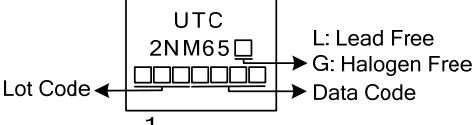
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
-	2NM65G-AA3-R	SOT-223	G	D	S	Tape Reel
2NM65L-TF1-T	2NM65G-TF1-T	TO-220F1	G	D	S	Tube
2NM65L-TM3-T	2NM65G-TM3-T	TO-251	G	D	S	Tube
2NM65L-TN3-R	2NM65G-TN3-R	TO-252	G	D	S	Tape Reel

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

<p>2NM65G-AA3-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) AA3: SOT-223, TF1: TO-220F1, 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	TO-220F1/TO-251/TO-252
 <p>2NM65G</p> <p>Lot Code ← → Data Code</p> <p>1</p>	 <p>UTC</p> <p>2NM65</p> <p>Lot Code ← → Data Code</p> <p>1</p> <p>L: Lead Free G: Halogen Free</p>

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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		$V_{DSS}$	650	V
Gate-Source Voltage		$V_{GSS}$	$\pm 30$	V
Drain Current	Continuous	$I_D$	2.0	A
	Pulsed (Note 2)	$I_{DM}$	8.0	A
Avalanche Current (Note 2)		$I_{AR}$	2.4	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	29	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.0	V/ns
Power Dissipation	SOT-223	$P_D$	3.3	W
	TO-220F1		24	W
	TO-251/TO-252		44	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.  $L=10\text{mH}$ ,  $I_{AS}=2.4\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $R_G=25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD}\leq 2.0\text{A}$ ,  $di/dt\leq 200\text{A}/\mu\text{s}$ ,  $V_{DD}\leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL CHARACTERISTICS

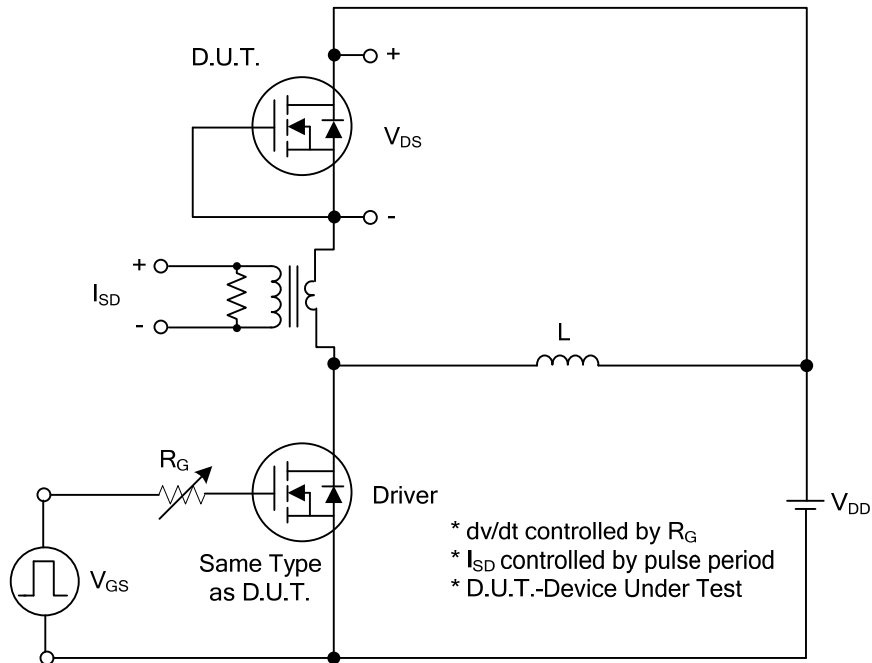
PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	SOT-223	$\theta_{JA}$	150	$^\circ\text{C}/\text{W}$
	TO-220F1		62.5	$^\circ\text{C}/\text{W}$
	TO-251/TO-252		100	$^\circ\text{C}/\text{W}$
Junction to Case	SOT-223	$\theta_{JC}$	38	$^\circ\text{C}/\text{W}$
	TO-220F1		5.2	$^\circ\text{C}/\text{W}$
	TO-251/TO-252		2.8	$^\circ\text{C}/\text{W}$

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

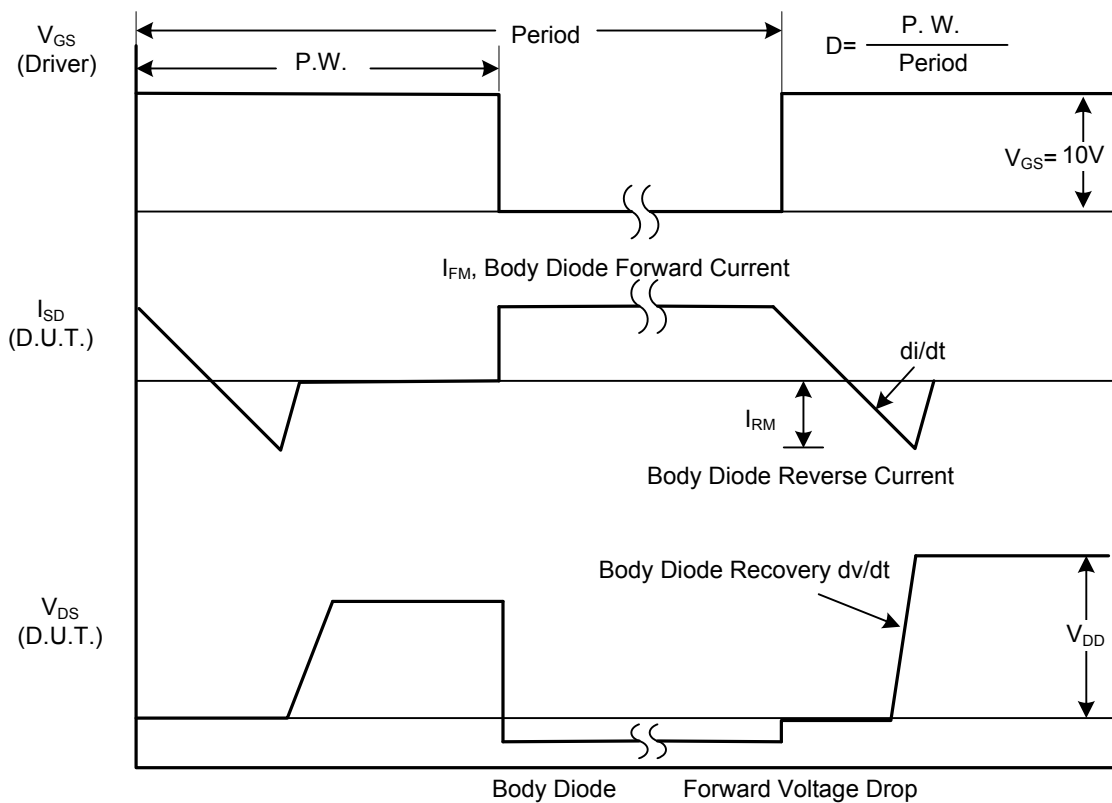
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	650			V
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS} = 650V, V_{GS} = 0V$			10	$\mu A$
Gate-Source Leakage Current	Forward	$V_{GS} = 30V, V_{DS} = 0V$			100	nA
	Reverse		$V_{GS} = -30V, V_{DS} = 0V$			-100
<b>ON CHARACTERISTICS</b>						
Gate Threold Voltage	$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.5		4.5	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 1A$			3.1	$\Omega$
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	$C_{ISS}$	$V_{GS}=0V, V_{DS}=25V, f=1MHz$		135		pF
Output Capacitance	$C_{OSS}$			90		pF
Reverse Transfer Capacitance	$C_{RSS}$			10		pF
<b>SWITCHING CHARACTERISTICS</b>						
Total Gate Charge (Note 1)	$Q_G$	$V_{DS}=50V, V_{GS}=10V, I_D=1.3A$ $I_G=100\mu A$ (Note 1, 2)		26		nC
Gate-Source Charge	$Q_{GS}$			3		nC
Gate-Drain Charge	$Q_{GD}$			4.8		nC
Turn-On Delay Time (Note 1)	$t_{D(ON)}$	$V_{DD}=30V, V_{GS}=10V, I_D=0.5A,$ $R_G=25\Omega$ (Note 1, 2)		34		ns
Turn-On Rise Time	$t_R$			41		ns
Turn-Off Delay Time	$t_{D(OFF)}$			72		ns
Turn-Off Fall Time	$t_F$			26		ns
<b>DRAIN-SOURCE DIODE CHARACTERISTICS</b>						
Continuous Drain-Source Current	$I_S$				2.0	A
Maximum Body-Diode Pulsed Current	$I_{SM}$				8.0	A
Drain-Source Diode Forward Voltage (Note 1)	$V_{SD}$	$I_S=2.0A, V_{GS}=0V$			1.4	V
Body Diode Reverse Recovery Time (Note 1)	$t_{rr}$	$I_S=2.0A, V_{GS}=0V$ $dI/dt=100A/\mu s$		208		nS
Body Diode Reverse Recovery Charge	$Q_{rr}$				1	

Notes: 1. Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$ .  
2. Essentially independent of operating temperature.

## TEST CIRCUITS AND WAVEFORMS

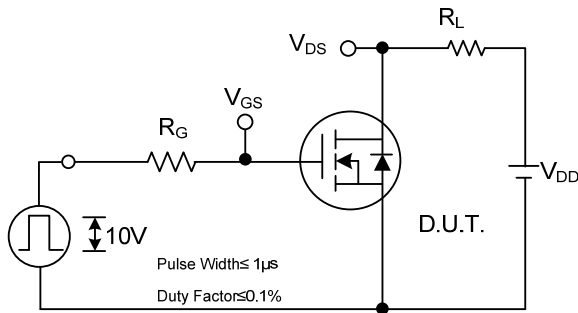


**Peak Diode Recovery dv/dt Test Circuit**

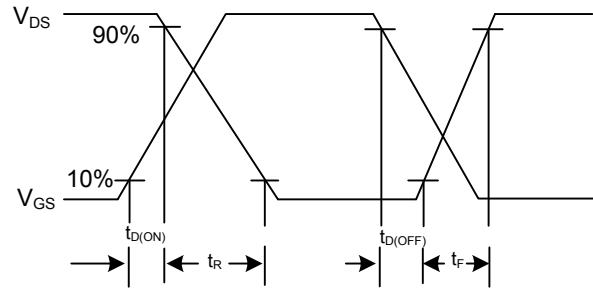


**Peak Diode Recovery dv/dt Waveforms**

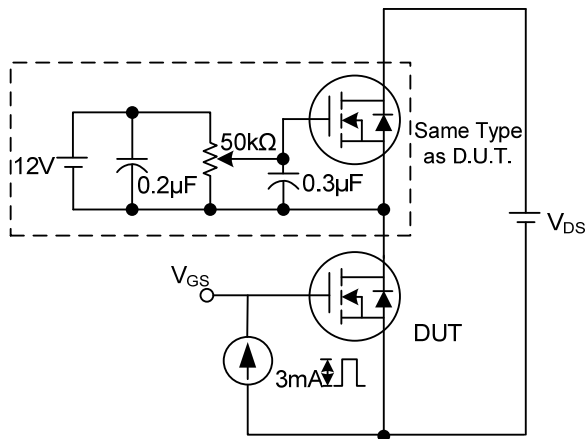
## TEST CIRCUITS AND WAVEFORMS (Cont.)



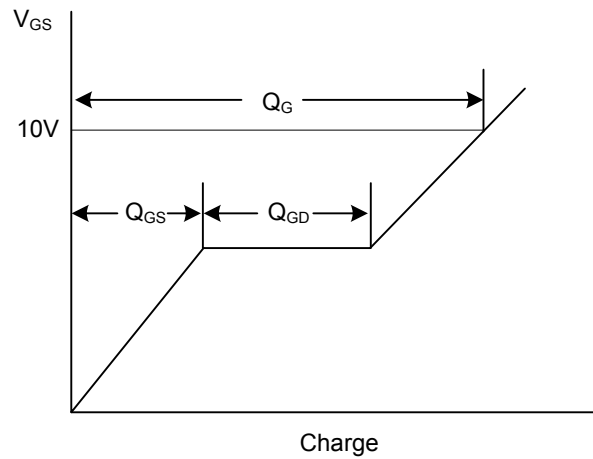
**Switching Test Circuit**



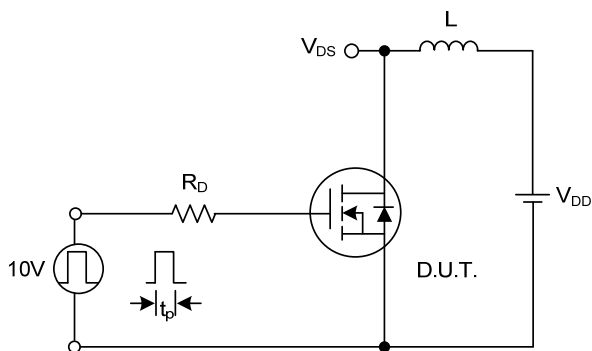
**Switching Waveforms**



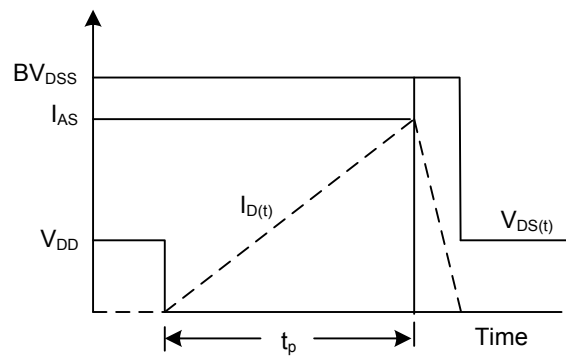
**Gate Charge Test Circuit**



**Gate Charge Waveform**

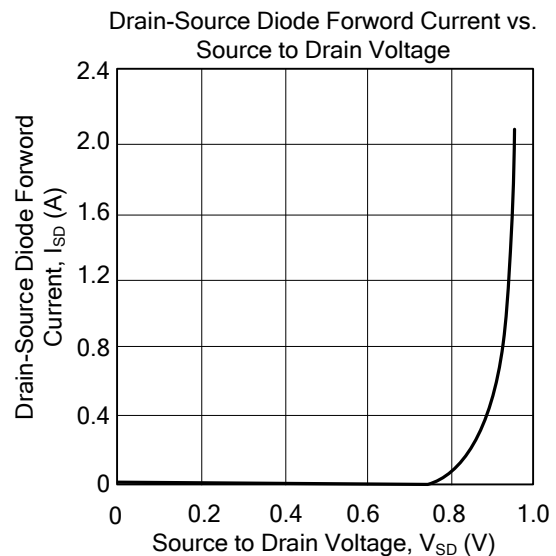
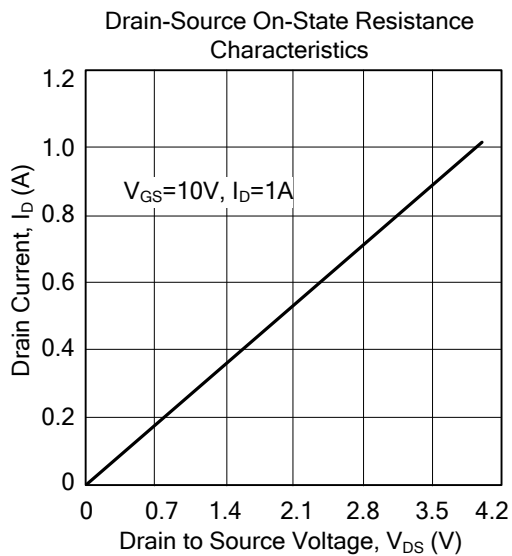
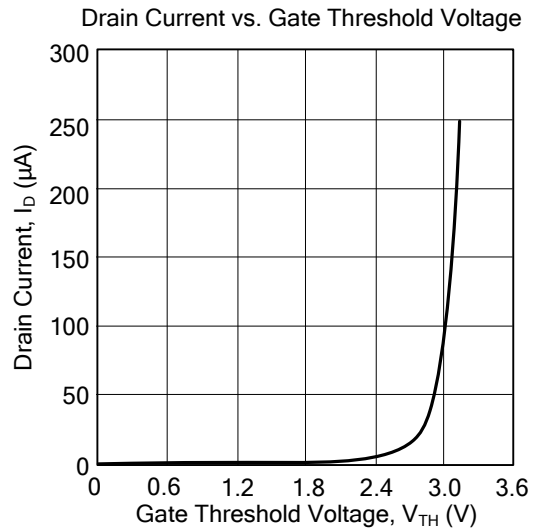
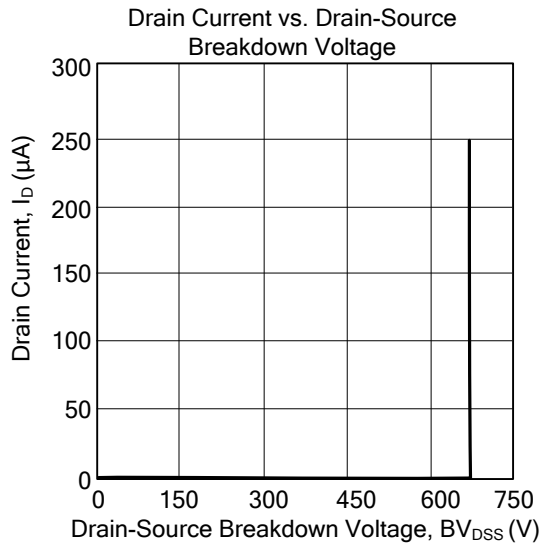


**Unclamped Inductive Switching Test Circuit**



**Unclamped Inductive Switching Waveforms**

## TYPICAL CHARACTERISTICS



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