



**4NM45**

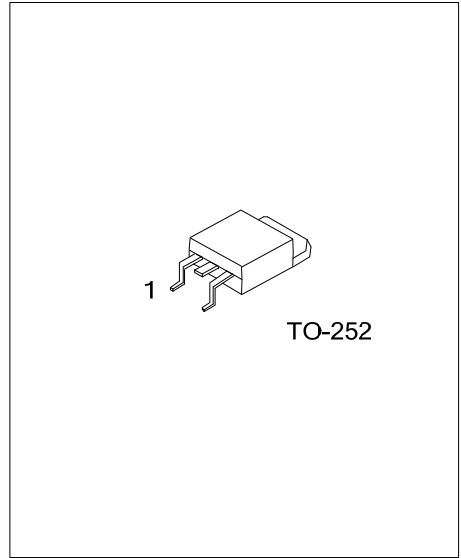
Preliminary

Power MOSFET

**4.0A, 450V N-CHANNEL SUPER-JUNCTION MOSFET**

■ DESCRIPTION

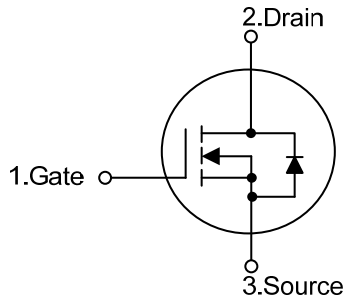
The UTC **4NM45** is a Super Junction MOSFET Structure and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and a high rugged avalanche characteristics. This power MOSFET is usually used at AC-DC converters for power applications.



■ FEATURES

- \*  $R_{DS(ON)} \leq 1.42 \Omega @ V_{GS}=10V, I_D=2.0A$
- \* Low on-resistance
- \* High Switching Speed
- \* 100% Avalanche Tested

■ SYMBOL



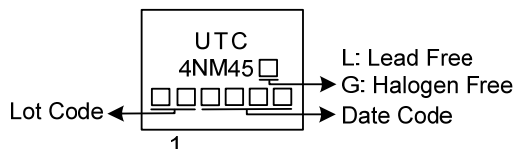
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
4NM45L-TN3-R	4NM45G-TN3-R	TO-252	G	D	S	Tape Reel

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

<p>4NM45G-TN3-R</p> <ul style="list-style-type: none"> <li>(1) Packing Type</li> <li>(2) Package Type</li> <li>(3) Green Package</li> </ul>	<ul style="list-style-type: none"> <li>(1) R: Tape Reel</li> <li>(2) TN3: TO-252</li> <li>(3) G: Halogen Free and Lead Free, L: Lead Free</li> </ul>
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■ MARKING



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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		$V_{DSS}$	450	V
Gate-Source Voltage		$V_{GSS}$	$\pm 30$	V
Drain Current	Continuous	$I_D$	4	A
	Pulsed (Note 2)	$I_{DM}$	12	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	144	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	2.4	V/ns
Power Dissipation		$P_D$	14	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.  $L = 144\text{mH}$ ,  $I_{AS} = 1.4\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD} \leq 4.0\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER	SYMBOL	RATING	UNIT
Junction to Ambient	$\theta_{JA}$	110	$^\circ\text{C}/\text{W}$
Junction to Case	$\theta_{JC}$	8.93	$^\circ\text{C}/\text{W}$

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

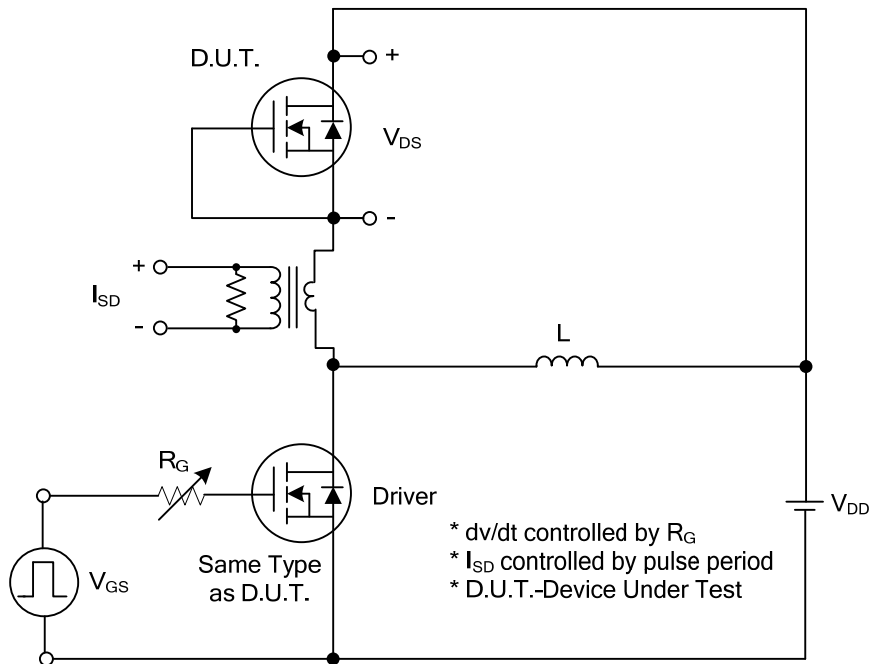
■ ELECTRICAL CHARACTERISTICS ( $T_J=25^\circ\text{C}$ , unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0\text{V}$ , $I_D=250\mu\text{A}$	450			V
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS}=450\text{V}$ , $V_{GS}=0\text{V}$			10	$\mu\text{A}$
Gate-Source Leakage Current	$I_{GSS}$	$V_{GS}=\pm 30\text{V}$ , $V_{DS}=0\text{V}$			$\pm 100$	nA
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}$ , $I_D=250\mu\text{A}$	2.5		4.5	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10\text{V}$ , $I_D=2.0\text{A}$			1.42	$\Omega$
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	$C_{ISS}$	$V_{DS}=50\text{V}$ , $V_{GS}=0\text{V}$ , $f=1\text{MHz}$		142		pF
Output Capacitance	$C_{OSS}$			89		pF
Reverse Transfer Capacitance	$C_{RSS}$			10		pF
<b>SWITCHING CHARACTERISTICS</b>						
Total Gate Charge (Note 1)	$Q_G$	$V_{DS}=50\text{V}$ , $V_{GS}=10\text{V}$ , $I_D=2.0\text{A}$ Note 1, 2)		13		nC
Gate-Source Charge	$Q_{GS}$			4		nC
Gate-Drain Charge	$Q_{GD}$			4		nC
Turn-On Delay Time (Note 1)	$t_{D(ON)}$	$V_{DD}=100\text{V}$ , $V_{GS}=10\text{V}$ , $I_D=4.0\text{A}$ , $R_G=25\Omega$ (Note 1, 2)		7		ns
Turn-On Rise Time	$t_R$			20		ns
Turn-Off Delay Time	$t_{D(OFF)}$			21		ns
Turn-Off Fall Time	$t_F$			21		ns
<b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b>						
Maximum Continuous Drain-Source Diode Forward Current	$I_S$				4	A
Maximum Pulsed Drain-Source Diode Forward Current	$I_{SM}$				12	A
Drain-Source Diode Forward Voltage (Note 1)	$V_{SD}$	$I_S=4.0\text{A}$ , $V_{GS}=0\text{V}$			1.4	V
Body Diode Reverse Recovery Time (Note 1)	$t_{rr}$	$I_S=4.0\text{A}$ , $V_{GS}=0\text{V}$ ,		174		nS
Body Diode Reverse Recovery Charge	$Q_{rr}$	$di/dt=100\text{A}/\mu\text{s}$		1.1		$\mu\text{C}$

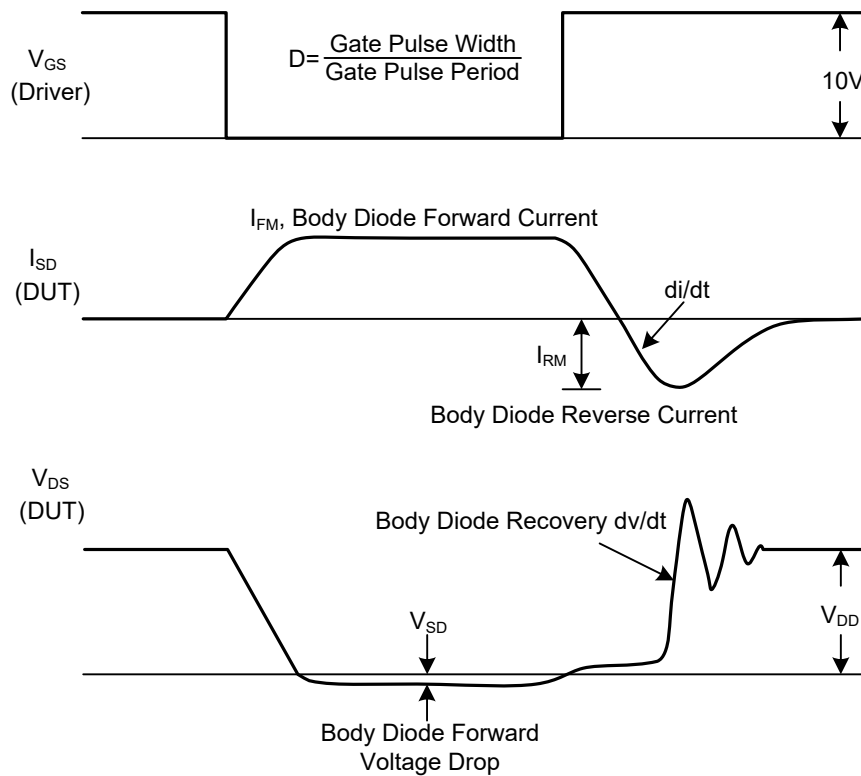
Notes: 1. Pulse Test: Pulse width  $\leq 300\mu\text{s}$ , Duty cycle  $\leq 2\%$ .

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

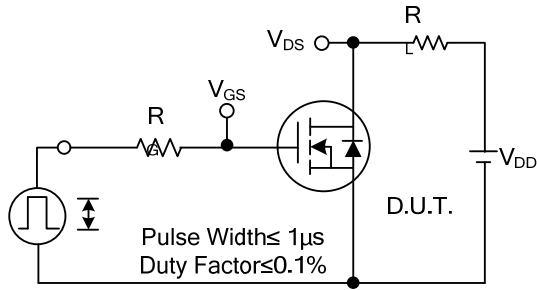


Peak Diode Recovery  $dv/dt$  Test Circuit

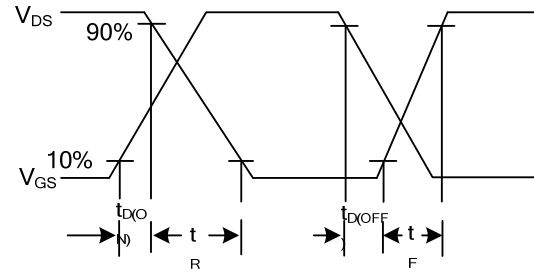


Peak Diode Recovery  $dv/dt$  Waveforms

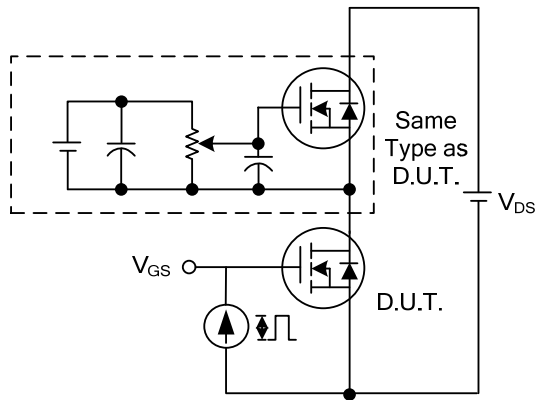
■ TEST CIRCUITS AND WAVEFORMS



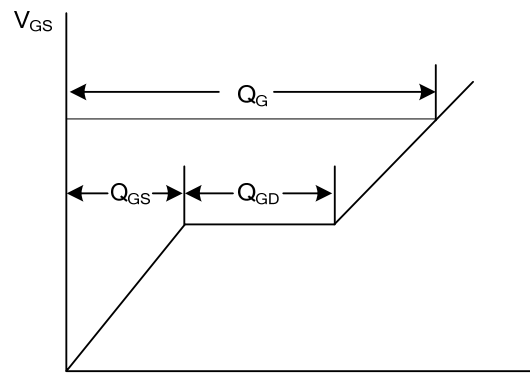
Switching Test Circuit



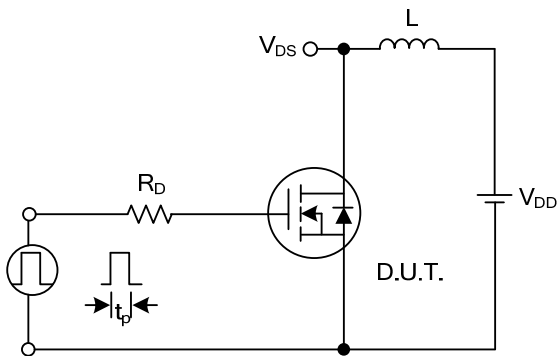
Switching Waveforms



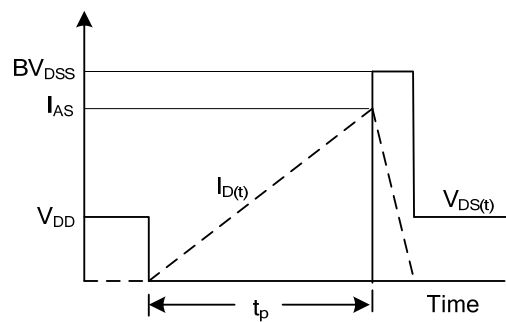
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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