



## UTT120N04M

Preliminary

Power MOSFET

### 120A, 40V N-CHANNEL POWER MOSFET

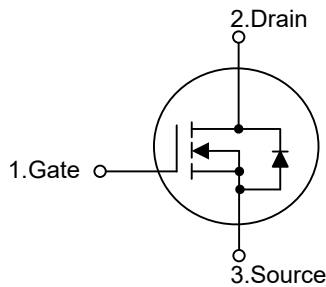
#### DESCRIPTION

The UTC **UTT120N04M** is an N-channel enhancement mode Power FET, it uses UTC's advanced technology to provide customers a minimum on-state resistance and high switching speed.

#### FEATURES

- \*  $R_{DS(ON)} \leq 3.9 \text{ m}\Omega$  @  $V_{GS}=10\text{V}$ ,  $I_D=60\text{A}$   
 $R_{DS(ON)} \leq 7.8 \text{ m}\Omega$  @  $V_{GS}=4.5\text{V}$ ,  $I_D=60\text{A}$
- \* High switching speed
- \* Improved dv/dt capability

#### SYMBOL



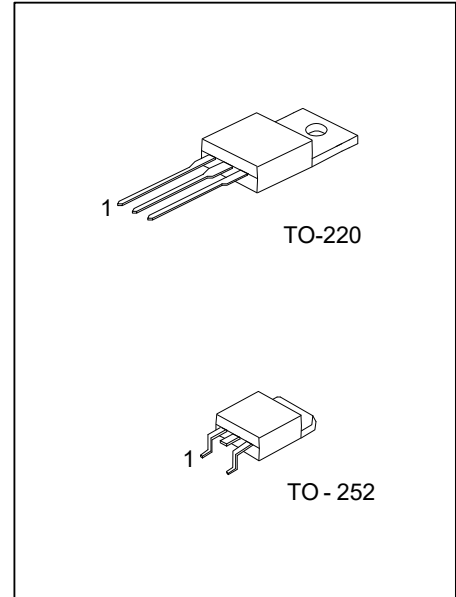
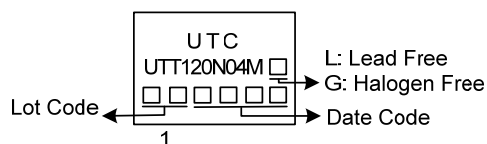
#### ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
UTT120N04ML-TA3-T	UTT120N04MG-TA3-T	TO-220	G	D	S	Tube
UTT120N04ML-TN3-R	UTT120N04MG-TN3-R	TO-252	G	D	S	Tape Reel

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

UTT120N04MG-TA3-T	(1)Packing Type (2)Package Type (3)Green Package	(1) T: Tube, R: Tape Reel (2) TA3: TO-220, TN3: TO-252 (3) G: Halogen Free and Lead Free L: Lead Free
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#### MARKING



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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		$V_{DS}$	40	V
Gate-Source Voltage		$V_{GS}$	$\pm 20$	V
Drain Current	Continuous	$I_D$	120	A
	Pulsed (Note 2)	$I_{DM}$	240	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	186	mJ
Peak Diode Recovery $dv/dt$ (Note 4)		$dv/dt$	1.1	V/ns
Power Dissipation	TO-220	$P_D$	200	W
	TO-252		70	W
Junction Temperature		$T_J$	+150	$^{\circ}\text{C}$
Storage Temperature Range		$T_{STG}$	-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.  $L=0.1\text{mH}$ ,  $I_{AS}=61\text{A}$ ,  $V_{DD}=25\text{V}$ ,  $R_G=25\Omega$ , Starting  $T_J = 25^{\circ}\text{C}$

4.  $I_{SD} \leq 30\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^{\circ}\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	TO-220	$\theta_{JA}$	62.5	$^{\circ}\text{C}/\text{W}$
	TO-252		110	$^{\circ}\text{C}/\text{W}$
Junction to Case	TO-220	$\theta_{JC}$	0.62	$^{\circ}\text{C}/\text{W}$
	TO-252		1.78 (Note)	$^{\circ}\text{C}/\text{W}$

Note: Device mounted on FR-4 substrate  $P_c$  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
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV <sub>DSS</sub>	I <sub>D</sub> =250μA, V <sub>GS</sub> =0V	40			V
Drain-Source Leakage Current		I <sub>DSS</sub>	V <sub>DS</sub> =40V			1	μA
Gate-Source Leakage Current	Forward	I <sub>GSS</sub>	V <sub>GS</sub> =+20V, V <sub>DS</sub> =0V			+100	nA
	Reverse		V <sub>GS</sub> =-20V, V <sub>DS</sub> =0V			-100	nA
ON CHARACTERISTICS							
Gate Threshold Voltage		V <sub>GS(TH)</sub>	I <sub>D</sub> =250μA, V <sub>DS</sub> =V <sub>GS</sub>	1.0		3.0	V
Static Drain-Source On-State Resistance		R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =60A			3.9	mΩ
			V <sub>GS</sub> =4.5V, I <sub>D</sub> =60A			7.8	mΩ
DYNAMIC PARAMETERS							
Input Capacitance		C <sub>ISS</sub>	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1MHz		5578		pF
Output Capacitance		C <sub>OSS</sub>			800		pF
Reverse Transfer Capacitance		C <sub>RSS</sub>			700		pF
SWITCHING PARAMETERS							
Total Gate Charge		Q <sub>G</sub>	V <sub>DD</sub> =32V, V <sub>GS</sub> =10V, I <sub>D</sub> =120A, (Note 1, 2)		145		nC
Gate to Source Charge		Q <sub>GS</sub>			50		nC
Gate to Drain Charge		Q <sub>GD</sub>			46		nC
Turn-ON Delay Time		t <sub>D(ON)</sub>	V <sub>DD</sub> =20V, I <sub>D</sub> =120A, R <sub>G</sub> =3Ω, V <sub>GS</sub> =10V (Note 1, 2)		15		ns
Rise Time		t <sub>R</sub>			20		ns
Turn-OFF Delay Time		t <sub>D(OFF)</sub>			48		ns
Fall-Time		t <sub>F</sub>			22		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Body-Diode Continuous Current		I <sub>S</sub>				120	A
Maximum Body-Diode Pulsed Current		I <sub>SM</sub>				240	A
Drain-Source Diode Forward Voltage		V <sub>SD</sub>	I <sub>S</sub> =120A			1.4	V
Reverse Recovery Time		t <sub>rr</sub>	I <sub>S</sub> =30A, V <sub>GS</sub> =0V		76		nS
Reverse Recovery Charge (Note 1)		Q <sub>rr</sub>	dI <sub>F</sub> /dt=100A/μs		140		nC

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

2. Essentially independent of operating ambient temperature.

D.U.T.

$V_{DS}$

$I_{SD}$

$L$

$V_{DD}$

Driver

$R_G$

$V_{GS}$

Same Type as D.U.T.

- \*  $dv/dt$  controlled by  $R_G$
- \*  $I_{SD}$  controlled by pulse period
- \* D.U.T.-Device Under Test

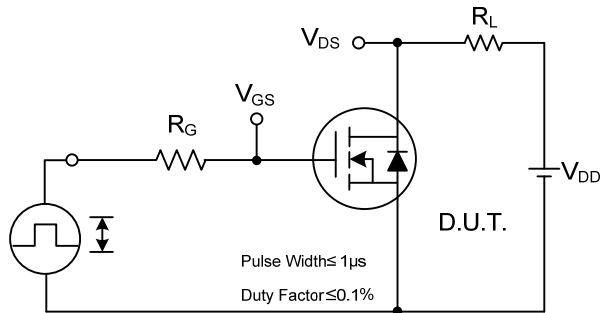
Timing diagram for a MOSFET switching a load inductor. The diagram shows three waveforms:  $V_{GS}$  (Driver),  $I_{SD}$  (D.U.T.), and  $V_{DS}$  (D.U.T.).

- $V_{GS}$  (Driver): A square wave with pulse width (P.W.) and period (Period). The duty cycle is  $D = \frac{P.W.}{Period}$ . The gate voltage is  $V_{GS} = 10V$ .
- $I_{SD}$  (D.U.T.): The source-drain current. It shows the body diode forward current ( $I_{FM}$ ) during the on-state and the body diode reverse current ( $I_{RM}$ ) during the off-state. The reverse current has a slope  $di/dt$ .
- $V_{DS}$  (D.U.T.): The drain-source voltage. It shows the body diode recovery  $dv/dt$  during the off-state. The forward voltage drop is also indicated.

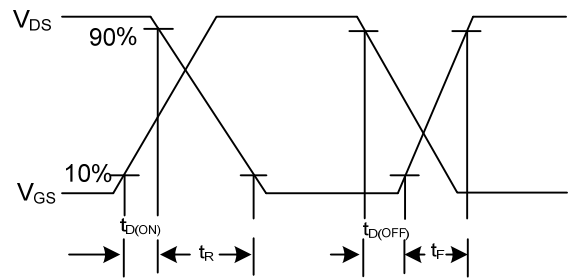
4 of 6

QW-R502-D252.a

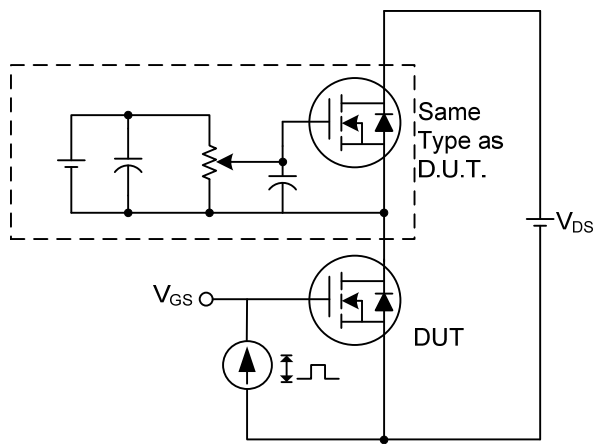
### ■ TEST CIRCUITS AND WAVEFORMS



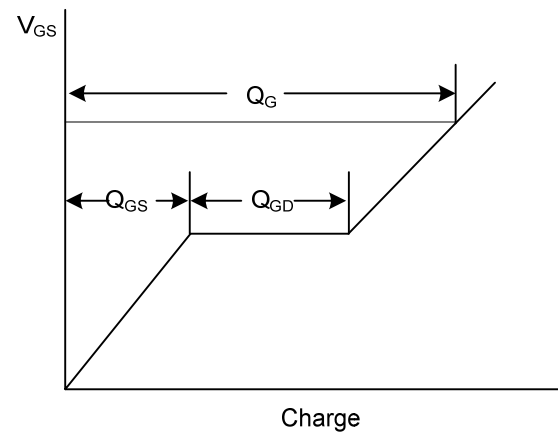
Switching Test Circuit



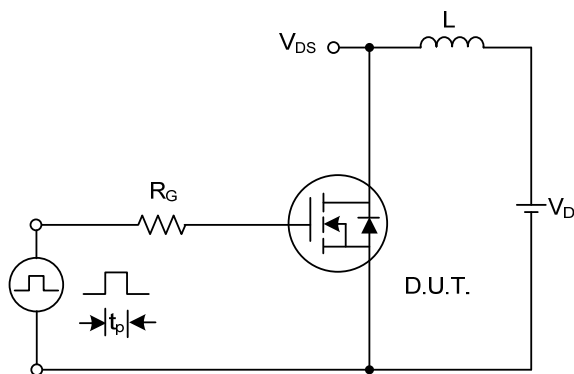
Switching Waveforms



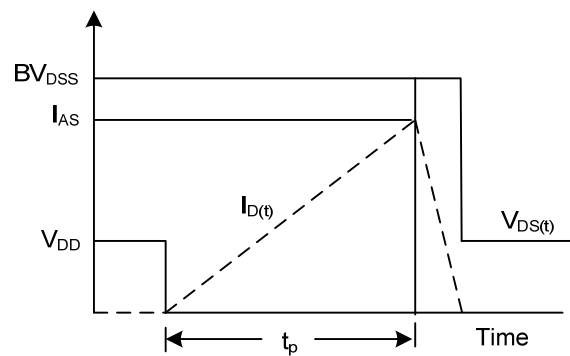
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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