



UT45N04

Preliminary

Power MOSFET

**45A, 40V N-CHANNEL
POWER MOSFET****DESCRIPTION**

The UTC **UT45N04** is a N-channel power MOSFET providing very low on-resistance. It has high efficiency and perfect cost-effectiveness. This device is ideal for load switch and battery protection applications. For example in applications such as switching regulators, switching converters, motor drivers and relay drivers.

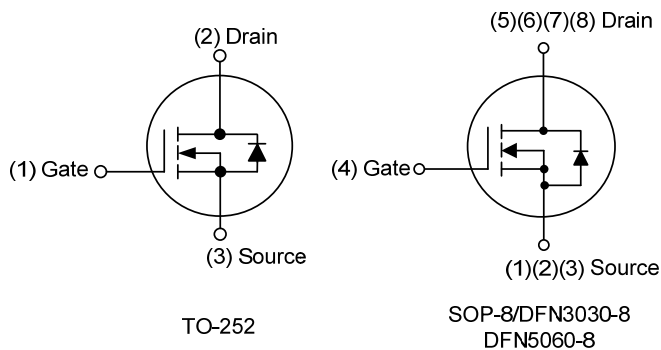
These transistors can be operated directly from integrated circuits, applied in the commercial and industrial fields.

FEATURES

* $R_{DS(on)} \leq 8.5 \text{ m}\Omega$ @ $V_{GS}=10\text{V}$, $I_D=20\text{A}$

$R_{DS(on)} \leq 12 \text{ m}\Omega$ @ $V_{GS}=4.5\text{V}$, $I_D=20\text{A}$

* High breakdown voltage

SYMBOL**ORDERING INFORMATION**

Ordering Number		Package	Pin Assignment								Packing
Lead Free	Halogen Free		1	2	3	4	5	6	7	8	
UT45N04L-TN3-R	UT45N04G-TN3-R	TO-252	G	D	S	-	-	-	-	-	Tape Reel
UT45N04L-S08-R	UT45N04G-S08-R	SOP-8	S	S	S	G	D	D	D	D	Tape Reel
UT45N04L-P3030-R	UT45N04G-P3030-R	PDFN3×3	S	S	S	G	D	D	D	D	Tape Reel
UT45N04L-P5060-R	UT45N04G-P5080-R	PDFN5×6	S	S	S	G	D	D	D	D	Tape Reel

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

UT45N04G-TN3-R		(1) Packing Type	(1) R: Tape Reel
		(2) Package Type	(2) TN3: TO-252, S08: SOP-8, P3030: PDFN3×3 P5060: PDFN5×6
		(3) Green Package	(3) G: Halogen Free and Lead Free, K: Lead Free

MARKING

TO-252	SOP-8
UTC UT45N04 Lot Code → [] [] [] [] [] → Date Code 1 L: Lead Free G: Halogen Free	UTC [] [] [] [] [] UT45N04 • [] [] [] [] [] 1 2 3 4 → Date Code → K: Lead Free → G: Halogen Free → Lot Code
PDFN3×3	PDFN5×6
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■ **ABSOLUTE MAXIMUM RATINGS** ($T_C=25^{\circ}\text{C}$, unless otherwise specified)

PARAMETER			SYMBOL	RATINGS	UNIT
Drain-Source Voltage			V _{DSS}	40	V
Gate-Source Voltage			V _{GSS}	±20	V
Drain Current	Continuous	TO-252 PDFN5×6 PDFN3×3	I _D	45	A
		SOP-8		15	A
	Pulsed		I _{DM}	135	A
Single Pulsed Avalanche Energy (Note 3)			E _{AS}	31	mJ
Peak Diode Recovery dv/dt (Note 4)			dv/dt	2.1	V/ns
Power Dissipation	TO-252		P _D	45	W
	SOP-8			5	W
	PDFN3×3			31	W
	PDFN5×6			40	W
Junction Temperature			T _J	+150	°C
Storage Temperature Range			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. $L=0.1\text{mH}$, $I_{AS}=25\text{A}$, $V_{DD}=20\text{V}$, $R_G=25\ \Omega$, 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	RATINGS	UNIT
Junction to Ambient	TO-252	θ_{JA}	50	$^{\circ}\text{C}/\text{W}$
	PDFN3×3		75	$^{\circ}\text{C}/\text{W}$
	SOP-8		125	$^{\circ}\text{C}/\text{W}$
	PDFN5×6		65	$^{\circ}\text{C}/\text{W}$
Junction to Case	TO-252	θ_{JC}	2.7	$^{\circ}\text{C}/\text{W}$
	SOP-8		25	$^{\circ}\text{C}/\text{W}$
	PDFN3×3		4.03	$^{\circ}\text{C}/\text{W}$
	PDFN5×6		3.125	$^{\circ}\text{C}/\text{W}$

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 _{DSS}	I _D =250μA, V _{GS} =0V	40			V
Drain-Source Leakage Current		I _{DSS}	V _{DS} =40V, V _{GS} =0V			1	μA
Gate-Source Leakage Current	Forward	I _{GSS}	V _{GS} =+10V, V _{DS} =0V			+100	nA
	Reverse		V _{GS} =-10V, V _{DS} =0V			-100	nA
ON CHARACTERISTICS							
Gate Threshold Voltage		V _{GS(TH)}	V _{DS} =V _{GS} , I _D =250μA	1.0		3.0	V
Static Drain-Source On-State Resistance		R _{DS(ON)}	V _{GS} =10V, I _D =20A			8.5	mΩ
			V _{GS} =4.5V, I _D =20A			12	mΩ
DYNAMIC PARAMETERS							
Input Capacitance		C _{ISS}	V _{GS} =0V, V _{DS} =25V, f=1.0MHz		1520		pF
Output Capacitance		C _{OSS}			185		pF
Reverse Transfer Capacitance		C _{RSS}			155		pF
SWITCHING PARAMETERS							
Total Gate Charge		Q _G	V _{DS} =32V, V _{GS} =4.5V, I _D =45A (Note 1, 2)		26		nC
Gate to Source Charge		Q _{GS}			5		nC
Gate to Drain Charge		Q _{GD}			11		nC
Turn-ON Delay Time		t _{D(ON)}	V _{DS} =20V, V _{GS} =4.5V, I _D =45A, R _G =3.3Ω (Note 1, 2)		13		ns
Rise Time		t _R			20		ns
Turn-OFF Delay Time		t _{D(OFF)}			36		ns
Fall-Time		t _F			25		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Body-Diode Continuous Current		I _S				45	A
Maximum Body-Diode Pulsed Current		I _{SM}				90	A
Drain-Source Diode Forward Voltage		V _{SD}	I _S =45A, V _{GS} =0V			1.4	V
Reverse Recovery Time (Note 1)		t _{rr}	I _S =30A , V _{GS} =0V, di/dt=100A/μs		30		ns
Reverse Recovery Charge		Q _{rr}			12		nC

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

2. Essentially independent of operating temperature.

D.U.T.

V_{DS}

I_{SD}

L

V_{DD}

R_G

Driver

Same Type as D.U.T.

V_{GS}

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

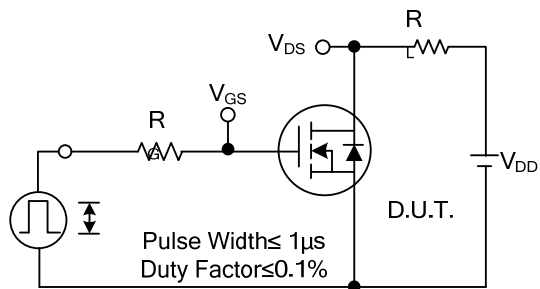
The diagram shows three waveforms over time:

- V_{GS} (Driver):** A square wave with pulse width (P.W.) and period (Period). The duty cycle is $D = \frac{P.W.}{Period}$. The peak voltage is $V_{GS} = 10V$.
- I_{SD} (D.U.T.):** The source-drain current. It shows a negative peak during the MOSFET's on-state (forward current I_{FM}) and a positive peak during the off-state (reverse current I_{RM}). The reverse current is labeled "Body Diode Reverse Current". The slope of the reverse current is labeled di/dt .
- V_{DS} (D.U.T.):** The drain-source voltage. It shows a trapezoidal waveform. The rising edge is labeled "Body Diode Recovery dv/dt ". The peak voltage is V_{DD} .

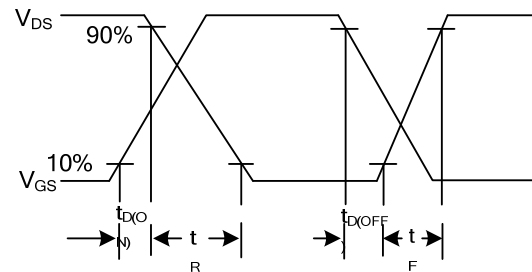
Labels at the bottom indicate the "Body Diode" and "Forward Voltage Drop" regions.

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QW-R209-421.b

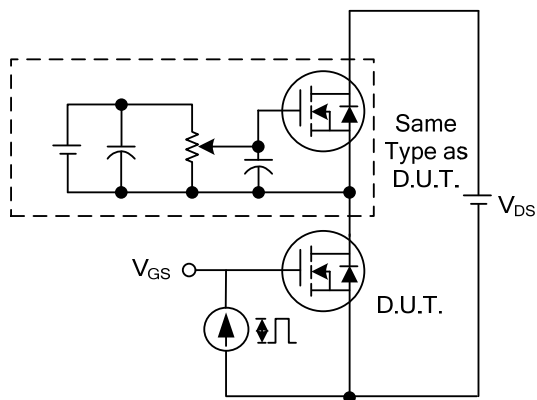
■ TEST CIRCUITS AND WAVEFORMS



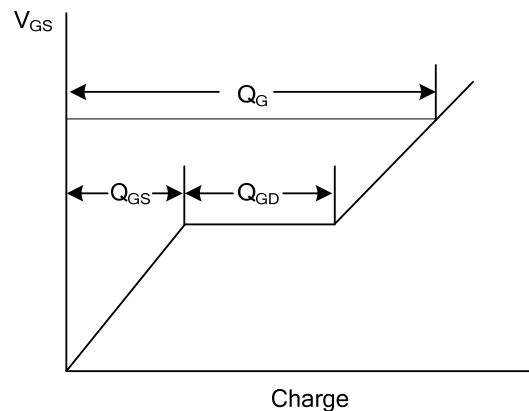
Switching Test Circuit



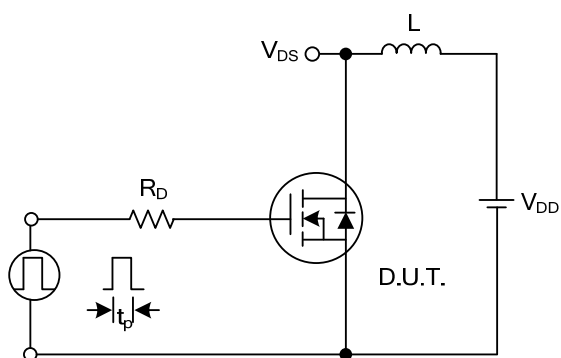
Switching Waveforms



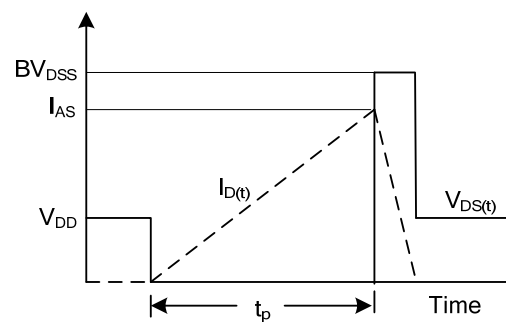
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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