



## UTML6401

Preliminary

Power MOSFET

### -4.5A, -12V P-CHANNEL POWER MOSFET

#### DESCRIPTION

The UTC **UTML6401** is a P-channel enhancement power MOSFET using UTC's advanced technology to provide the customers with perfect  $R_{DS(ON)}$  and low gate charge from utilize advanced processing techniques to achieve extremely low on-resistance per silicon area, combined with the fast switching speed and ruggedized device design power MOSFETs are well known for, provides the designer with an extremely efficient and reliable device for use in battery and load management, the thermal resistance and power dissipation are the best available.

#### FEATURES

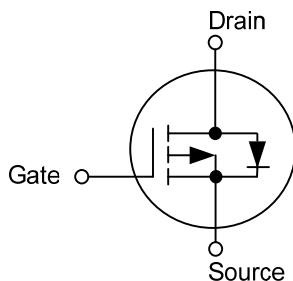
\*  $R_{DS(ON)} \leq 58 \text{ m}\Omega @ V_{GS} = -4.5\text{V}, I_D = -4.3\text{A}$

$R_{DS(ON)} \leq 85 \text{ m}\Omega @ V_{GS} = -2.5\text{V}, I_D = -2.5\text{A}$

$R_{DS(ON)} \leq 145 \text{ m}\Omega @ V_{GS} = -1.8\text{V}, I_D = -2.0\text{A}$

\* Ultra Low On-Resistance

#### SYMBOL

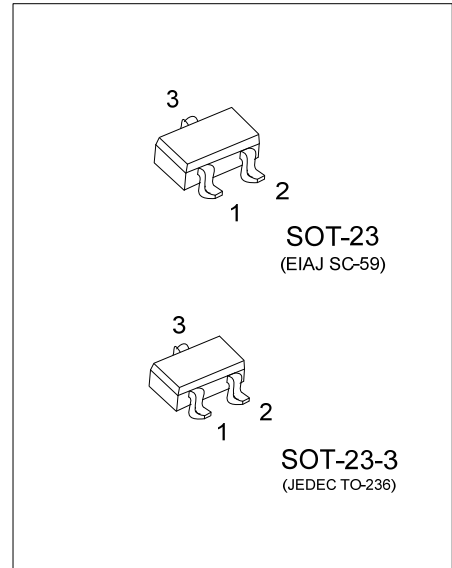


#### ORDERING INFORMATION

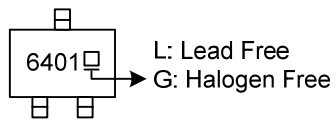
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
UTML6401L-AE2-R	UTML6401G-AE2-R	SOT-23-3	G	S	D	Tape Reel
UTML6401L-AE3-R	UTML6401G-AE3-R	SOT-23	G	S	D	Tape Reel

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

UTML6401G-AE2-R		(1) Packing Type	(1) R: Tape Reel
		(2) Package Type	(2) AE2: SOT-23-3, AE3: SOT-23
		(3) Green Package	(3) G: Halogen Free and Lead Free, L: Lead Free



### ■ MARKING



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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		$V_{DSS}$	-12	V
Gate-Source Voltage		$V_{GSS}$	$\pm 8$	V
Continuous Drain Current	Continuous	$I_D$	-4.5	A
Pulsed Drain Current	Pulsed (Note 2)	$I_{DM}$	-9.0	A
Power Dissipation	SOT-23-3	$P_D$	0.65	W
	SOT-23		0.67	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.

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	SOT-23-3	$\theta_{JA}$	190	$^{\circ}\text{C/W}$
	SOT-23		185	$^{\circ}\text{C/W}$

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

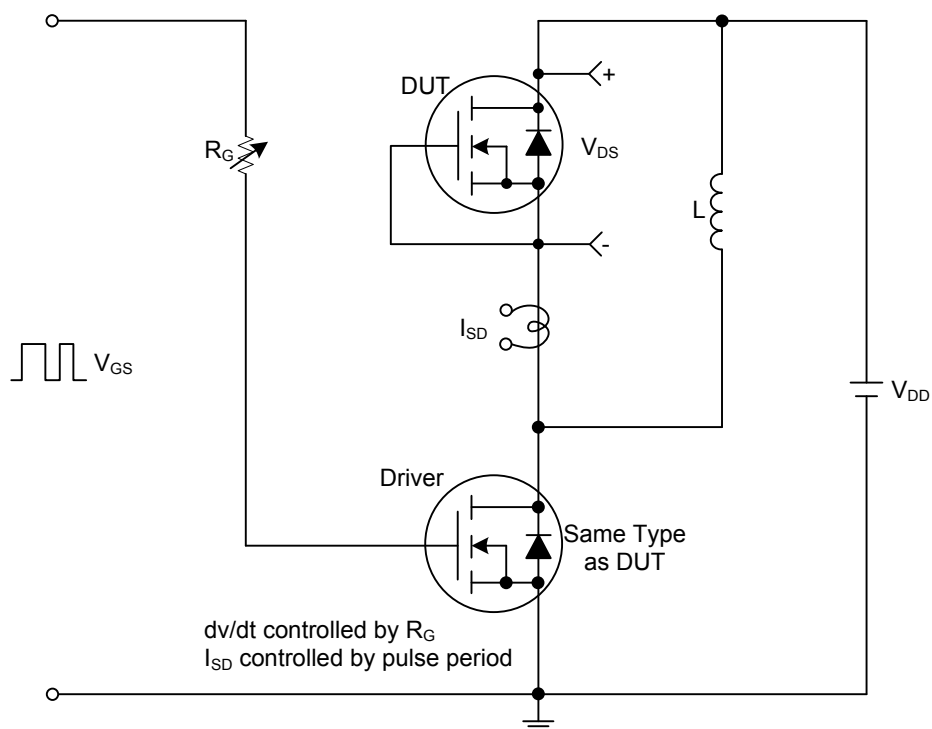
■ ELECTRICAL CHARACTERISTICS ( $T_J=25^{\circ}\text{C}$ , unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV <sub>DSS</sub>	V <sub>GS</sub> =0 V, I <sub>D</sub> =-250μA	-12			V
Drain-Source Leakage Current		I <sub>DSS</sub>	V <sub>DS</sub> =-12V, V <sub>GS</sub> =0V			-1	μA
Gate-Source Leakage Current	Forward	I <sub>GSS</sub>	V <sub>DS</sub> =0V, V <sub>GS</sub> =+8V			100	nA
	Reverse		V <sub>DS</sub> =0V, V <sub>GS</sub> =-8V			-100	nA
ON CHARACTERISTICS							
Gate Threshold Voltage		V <sub>GS(TH)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA	-0.4		-0.95	V
Static Drain-Source On-Resistance		R <sub>DS(ON)</sub>	V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-4.3A			58	mΩ
			V <sub>GS</sub> =-2.5V, I <sub>D</sub> =-2.5A			85	mΩ
			V <sub>GS</sub> =-1.8V, I <sub>D</sub> =-2.0A			145	mΩ
DYNAMIC PARAMETERS							
Input Capacitance		C <sub>ISS</sub>	V <sub>DS</sub> =-6V, V <sub>GS</sub> =0V, f=1.0MHz		810		pF
Output Capacitance		C <sub>OSS</sub>			292		pF
Reverse Transfer Capacitance		C <sub>RSS</sub>			245		pF
SWITCHING PARAMETERS							
Total Gate Charge (Note 1)		Q <sub>G</sub>	V <sub>DS</sub> =-6V, V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-4.5A (Note 1, 2)		9		nC
Gate Source Charge		Q <sub>GS</sub>			1.2		nC
Gate Drain Charge		Q <sub>GD</sub>			2.4		nC
Turn-ON Delay Time (Note 1)		t <sub>D(ON)</sub>	V <sub>DD</sub> =-6V, V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-4.5A, R <sub>G</sub> =3Ω (Note 1, 2)		8		ns
Turn-ON Rise Time		t <sub>R</sub>			17		ns
Turn-OFF Delay Time		t <sub>D(OFF)</sub>			30		ns
Turn-OFF Fall-Time		t <sub>F</sub>			29		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Body-Diode Continuous Current		I <sub>S</sub>				-4.5	A
Maximum Pulsed Drain-Source Diode Forward Current		I <sub>SM</sub>				-9.0	A
Diode Forward Voltage (Note 1)		V <sub>SD</sub>	I <sub>S</sub> =-4.5A, V <sub>GS</sub> =0V			1.4	V

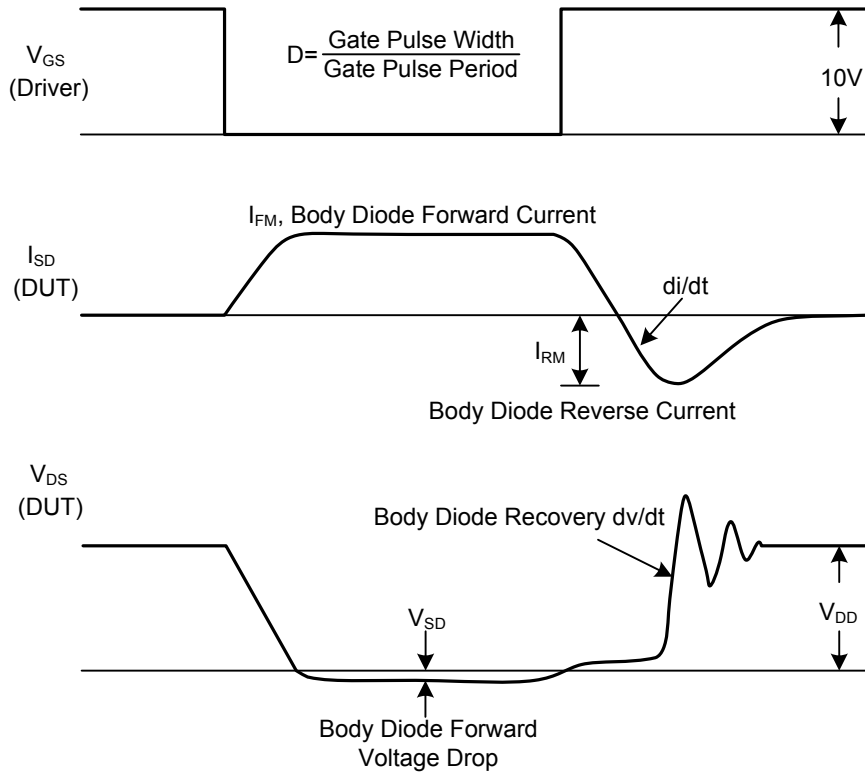
Notes: 1. Pulse Test: Pulse width  $\leq 300\mu\text{s}$ , Duty cycles  $\leq 2\%$ .

2. Essentially independent of operating temperature.

# ■ TEST CIRCUITS AND WAVEFORMS



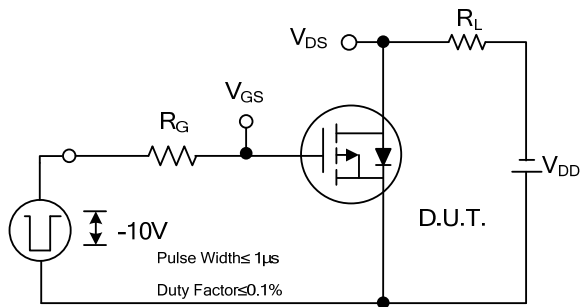
**Peak Diode Recovery dv/dt Test Circuit**



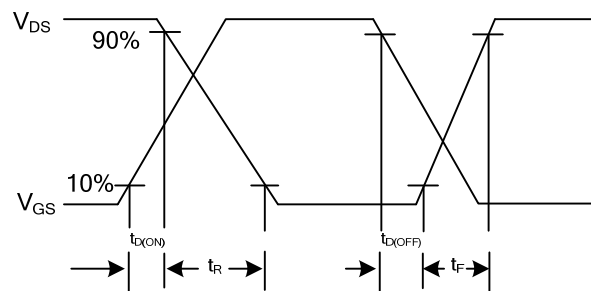
**Peak Diode Recovery dv/dt Test Circuit and Waveforms**

**Peak Diode Recovery dv/dt Waveforms**

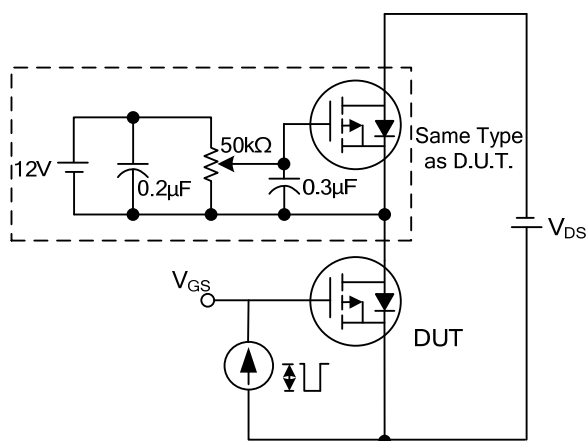
## ■ TEST CIRCUITS AND WAVEFORMS



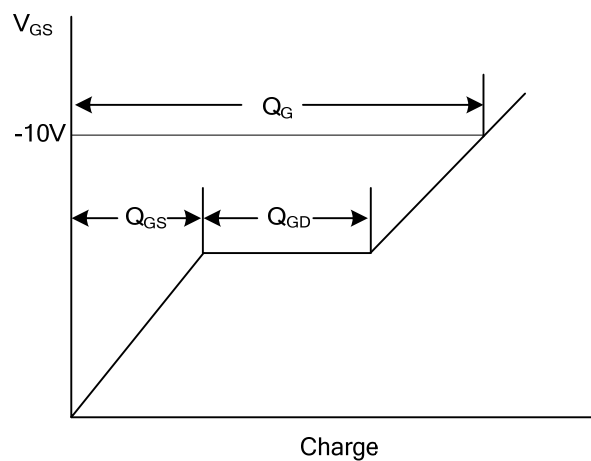
Switching Test Circuit



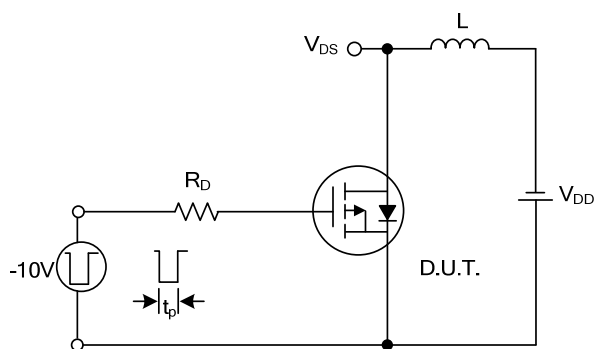
Switching Waveforms



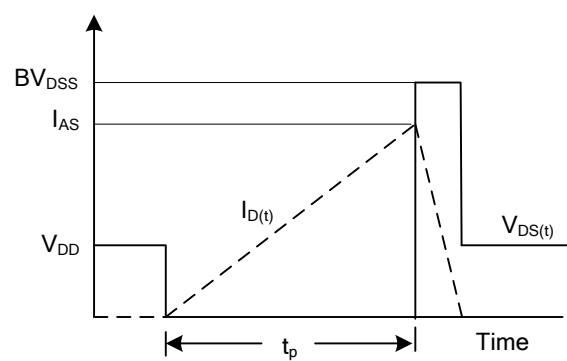
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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