



USG06R024M

Preliminary

Power MOSFET

N-CHANNEL SGT ENHANCEMENT POWER MOSFET

DESCRIPTION

The UTC **USG06R024M** is a N-channel Power MOSFET, it uses UTC's advanced technology to provide the customers with high switching speed and low gate charge, etc.

The UTC **USG06R024M** applies to primary side switch, synchronous rectifier, Motor Drives, etc.

FEATURES

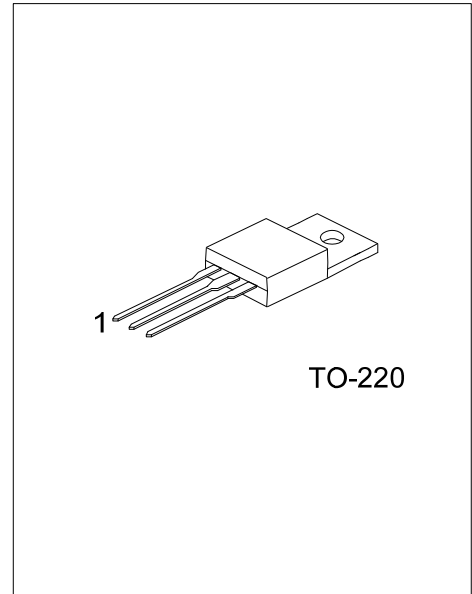
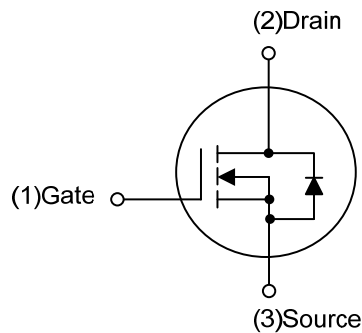
* $R_{DS(ON)} \leq 2.4 \text{ m}\Omega$ @ $V_{GS}=10\text{V}$, $I_D=50\text{A}$

$R_{DS(ON)} \leq 3.4 \text{ m}\Omega$ @ $V_{GS}=4.5\text{V}$, $I_D=50\text{A}$

* High Cell Density Trench Technology

* High Power and Current Handling Capability

SYMBOL



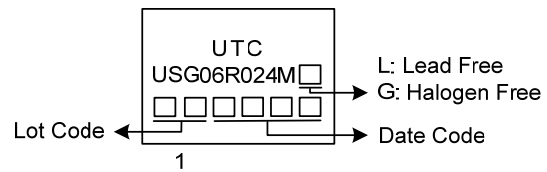
ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
USG06R024ML-TA3-T	USG06R024MG-TA3-T	TO-220	G	D	S	Tube

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

USG06R024MG-TA3-T	(1)Packing Type	(1) T: Tube
	(2)Package Type	(2) TA3: TO-220
	(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_{DS}	60	V
Gate-Source Voltage		V_{GS}	± 20	V
Drain Current	Continuous	I_D	130	A
	Pulsed (Note 2)	I_{DM}	260	A
Single Pulsed Avalanche Energy (Note 3)		E_{AS}	533	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	1.5	V/ns
Power Dissipation		P_D	195	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. $L = 0.1\text{mH}$, $I_{AS} = 103.2\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$

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

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient		θ_{JA}	62.5	$^\circ\text{C}/\text{W}$
Junction to Case (Note)		θ_{JC}	0.64	$^\circ\text{C}/\text{W}$

■ 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	60			V
Drain-Source Leakage Current		I _{DSS}	V _{DS} =60V, V _{GS} =0V			1	μA
Gate-Source Leakage Current	Forward	I _{GSS}	V _{GS} =+20V, V _{DS} =0V			+100	nA
	Reverse		V _{GS} =-20V, V _{DS} =0V			-100	nA
ON CHARACTERISTICS							
Gate Threshold Voltage		V _{GS(TH)}	V _{DS} =V _{GS} , I _D =250μA	1.0		2.5	V
Static Drain-Source On-State Resistance		R _{DS(ON)}	V _{GS} =10V, I _D =50A			2.4	mΩ
			V _{GS} =4.5V, I _D =50A			3.4	mΩ
DYNAMIC PARAMETERS							
Input Capacitance		C _{ISS}	V _{DS} =25V, V _{GS} =0V, f=1.0MHz		8119		pF
Output Capacitance		C _{OSS}			2196		pF
Reverse Transfer Capacitance		C _{RSS}			584		pF
SWITCHING PARAMETERS							
Total Gate Charge		Q _G	V _{DS} =48V, V _{GS} =4.5V, I _D =65A		99		nC
		Q _G			281		nC
Gate to Source Charge		Q _{GS}	V _{DS} =48V, V _{GS} =10V, I _D =65A		29		nC
Gate to Drain Charge		Q _{GD}			102		nC
Turn-ON Delay Time		t _{D(ON)}	V _{DD} =30V, V _{GS} =10V, I _D =65A, R _G =3Ω		18		ns
Rise Time		t _R			25		ns
Turn-OFF Delay Time		t _{D(OFF)}			137		ns
Fall-Time		t _F			72		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Body-Diode Continuous Current		I _S				130	A
Drain-Source Diode Forward Voltage		V _{SD}	I _F =130A, V _{GS} =0V			1.4	V
Body Diode Reverse Recovery Time		t _{rr}	I _S =30A, dI/dt=100A/μs		113		ns
Body Diode Reverse Recovery Charge		Q _{rr}			277		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

R_G

Driver

V_{GS}

Same Type as D.U.T.

V_{DD}

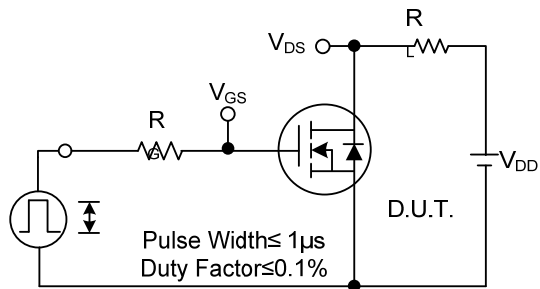
- * dv/dt controlled by R_G
- * I_{SD} controlled by pulse period
- * D.U.T.-Device Under Test

The diagram consists of three vertically aligned waveforms:

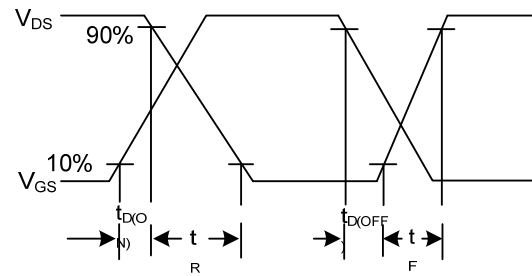
- Top waveform:** V_{GS} (Driver). It shows a rectangular pulse. The duty cycle is defined as $D = \frac{\text{Gate Pulse Width}}{\text{Gate Pulse Period}}$. The pulse height is $10V$.
- Middle waveform:** I_{SD} (DUT). It shows the drain current. During the MOSFET's on-state, it is a constant positive current I_{FM} (Body Diode Forward Current). When the MOSFET turns off, the current reverses to a negative value I_{RM} (Body Diode Reverse Current). The transition from forward to reverse current is labeled di/dt .
- Bottom waveform:** V_{DS} (DUT). It shows the drain-source voltage. During the MOSFET's on-state, it is a constant negative voltage V_{SD} (Body Diode Forward Voltage Drop). When the MOSFET turns off, the voltage rises sharply, showing a peak and subsequent ringing, labeled "Body Diode Recovery dv/dt ". The peak voltage is V_{DD} .

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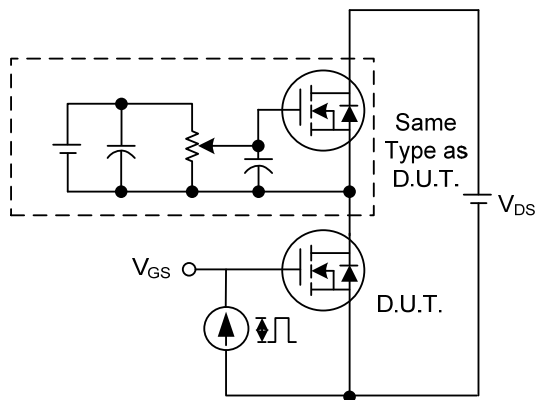
■ TEST CIRCUITS AND WAVEFORMS



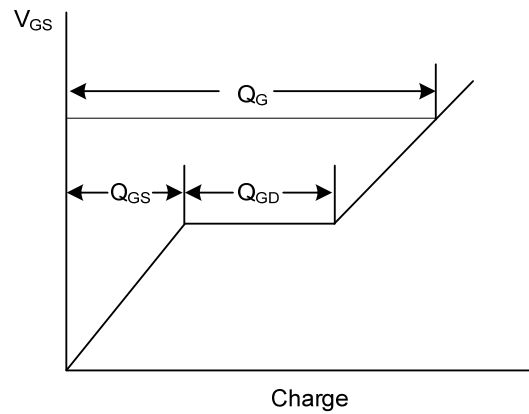
Switching Test Circuit



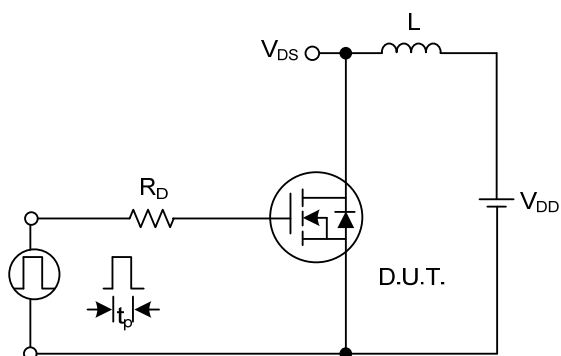
Switching Waveforms



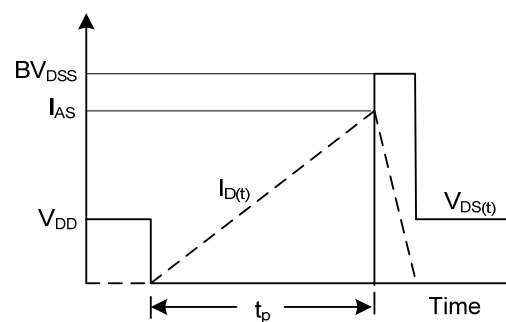
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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