QM6020AP

N-Ch 60V Fast Switching MOSFETs

General Description

The QM6020AP is the highest performance trench N-ch MOSFETs with extreme high cell density , which provide excellent RDSON and gate charge for most of the synchronous buck converter applications .

The QM6020AP meet the RoHS and Green Product requirement , 100% EAS guaranteed with full function reliability approved.

Features

- Advanced high cell density Trench technology
- Super Low Gate Charge
- Excellent CdV/dt effect decline
- 100% EAS Guaranteed
- Green Device Available

Product Summery

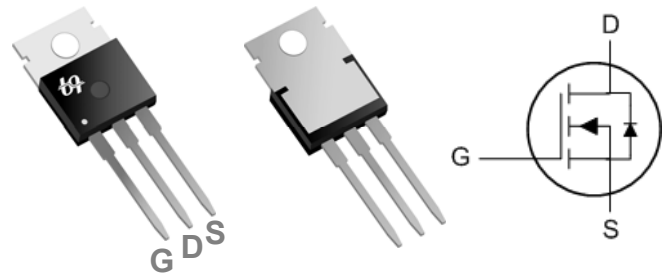| BVDSS	RDSON	ID
60V	3.8mΩ	198A

Applications

- High Frequency Point-of-Load Synchronous Buck Converter
- Networking DC-DC Power System
- Power Tool Application

TO220 Pin Configuration

Absolute Maximum Ratings

Symbol	Parameter	Rating	Units
V_{DS}	Drain-Source Voltage	60	V
V_{GS}	Gate-Source Voltage	±20	V
I_D@T_C=25℃	Continuous Drain Current, V_{GS} @ 10V[1,7]	198	A
I_D@T_C=100℃	Continuous Drain Current, V_{GS} @ 10V[1,7]	125	A
I_D@T_A=25℃	Continuous Drain Current, V_{GS} @ 10V[1]	17.5	A
I_D@T_A=70℃	Continuous Drain Current, V_{GS} @ 10V[1]	14	A
I_{DM}	Pulsed Drain Current[2]	350	A
EAS	Single Pulse Avalanche Energy[3]	977	mJ
I_{AS}	Avalanche Current	107	A
P_D@T_C=25℃	Total Power Dissipation[4]	260	W
P_D@T_A=25℃	Total Power Dissipation[4]	2.02	W
T_{STG}	Storage Temperature Range	-55 to 150	℃
T_J	Operating Junction Temperature Range	-55 to 150	℃

Thermal Data

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction-Ambient [1]	---	62	℃/W
$R_{\theta JC}$	Thermal Resistance Junction-Case[1]	---	0.48	℃/W

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Electrical Characteristics (T$_J$=25 ℃, unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV$_{DSS}$	Drain-Source Breakdown Voltage	V$_{GS}$=0V , I$_D$=250uA	60	---	---	V
△BV$_{DSS}$/△T$_J$	BV$_{DSS}$ Temperature Coefficient	Reference to 25℃ , I$_D$=1mA	---	0.058	---	V/℃
R$_{DS(ON)}$	Static Drain-Source On-Resistance[2]	V$_{GS}$=10V , I$_D$=30A	---	3	3.8	mΩ
V$_{GS(th)}$	Gate Threshold Voltage	V$_{GS}$=V$_{DS}$, I$_D$ =250uA	2.5	---	4.5	V
△V$_{GS(th)}$	V$_{GS(th)}$ Temperature Coefficient		---	-7.8	---	mV/℃
I$_{DSS}$	Drain-Source Leakage Current	V$_{DS}$=48V , V$_{GS}$=0V , T$_J$=25℃	---	---	1	uA
		V$_{DS}$=48V , V$_{GS}$=0V , T$_J$=55℃	---	---	5	
I$_{GSS}$	Gate-Source Leakage Current	V$_{GS}$=±20V , V$_{DS}$=0V	---	---	±100	nA
gfs	Forward Transconductance	V$_{DS}$=5V , I$_D$=30A	---	95	---	S
R$_g$	Gate Resistance	V$_{DS}$=0V , V$_{GS}$=0V , f=1MHz	---	2.8	5.6	Ω
Q$_g$	Total Gate Charge (10V)	V$_{DS}$=48V , V$_{GS}$=10V , I$_D$=15A	---	89	124.6	nC
Q$_{gs}$	Gate-Source Charge		---	32	44.8	
Q$_{gd}$	Gate-Drain Charge		---	18	25.2	
T$_{d(on)}$	Turn-On Delay Time	V$_{DD}$=30V , V$_{GS}$=10V , R$_G$=3.3Ω, I$_D$=48A	---	33.6	67.2	ns
T$_r$	Rise Time		---	40.6	73	
T$_{d(off)}$	Turn-Off Delay Time		---	59	118	
T$_f$	Fall Time		---	26.8	53.6	
C$_{iss}$	Input Capacitance	V$_{DS}$=15V , V$_{GS}$=0V , f=1MHz	---	6655	9317	pF
C$_{oss}$	Output Capacitance		---	1565	2191	
C$_{rss}$	Reverse Transfer Capacitance		---	340	476	

Guaranteed Avalanche Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
EAS	Single Pulse Avalanche Energy[5]	V$_{DD}$=50V , L=0.1mH , I$_{AS}$=30A	78	---	---	mJ

Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I$_S$	Continuous Source Current[1,6]	V$_G$=V$_D$=0V , Force Current	---	---	198	A
I$_{SM}$	Pulsed Source Current[2,6]		---	---	350	A
V$_{SD}$	Diode Forward Voltage[2]	V$_{GS}$=0V , I$_S$=A , T$_J$=25℃	---	---	1.2	V
t$_{rr}$	Reverse Recovery Time	I$_F$=30A , dI/dt=100A/μs , T$_J$=25℃	---	46	---	nS
Q$_{rr}$	Reverse Recovery Charge		---	52	---	nC

Note :

1. The data tested by surface mounted on a 1 inch^2 FR-4 board with 2OZ copper.

2. The data tested by pulsed , pulse width ≦ 300us , duty cycle ≦ 2%

3. The EAS data shows Max. rating . The test condition is V$_{DD}$=50V,V$_{GS}$=10V,L=0.1mH,I$_{AS}$=107A

4. The power dissipation is limited by 150℃ junction temperature.

5. The Min. value is 100% EAS tested guarantee.

6. The data is theoretically the same as I$_D$ and I$_{DM}$, in real applications , should be limited by total power dissipation.

7. Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 120A.

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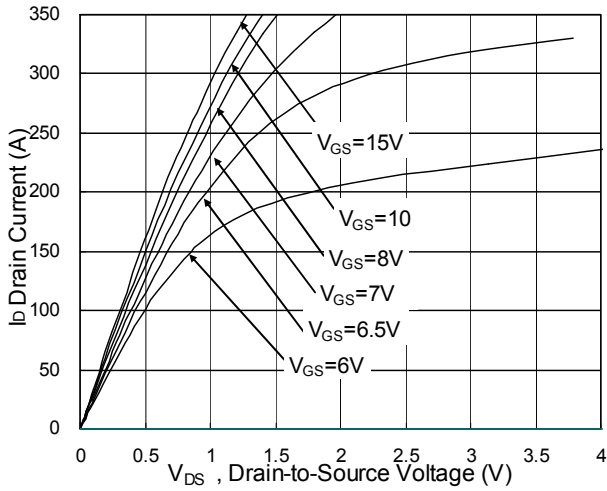## Typical Characteristics

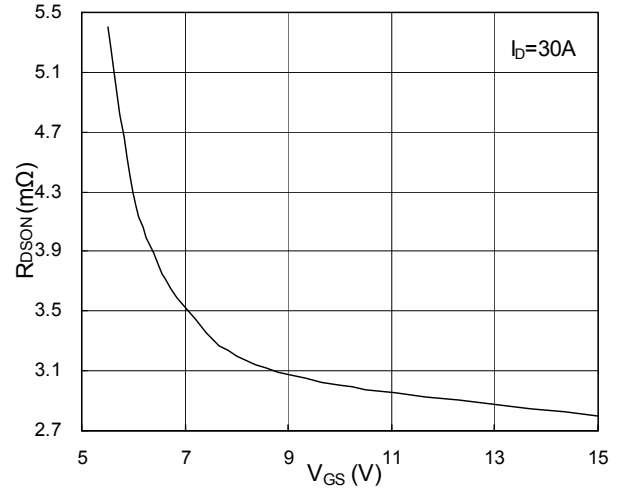**Fig.1 Typical Output Characteristics**
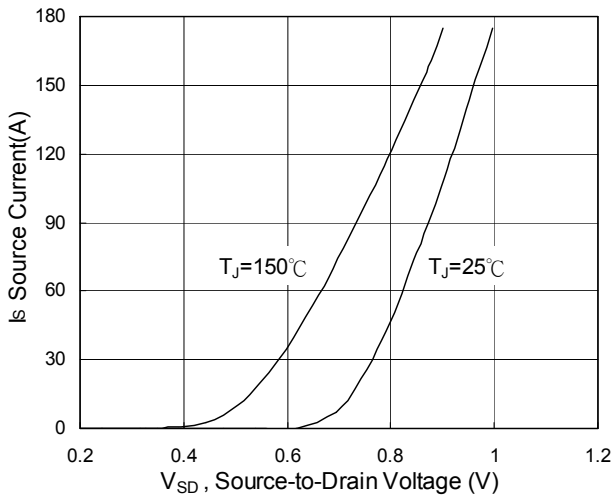

Fig.2 On-Resistance v.s Gate-Source

Fig.3 Forward Characteristics of Reverse
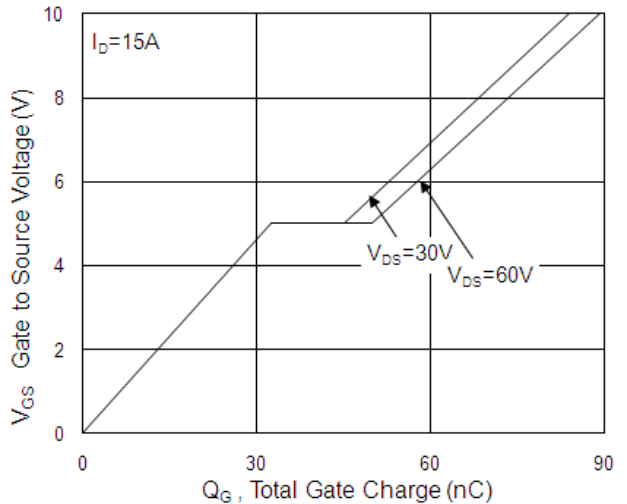
Fig.4 Gate-Charge Characteristics
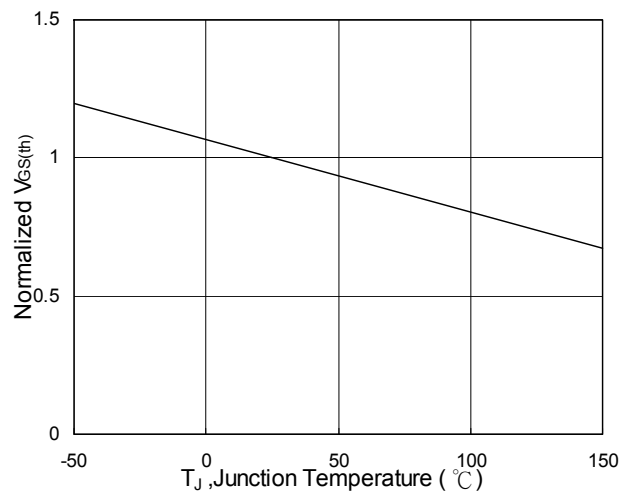
Fig.5 Normalized $V_{GS(th)}$ v.s T_J
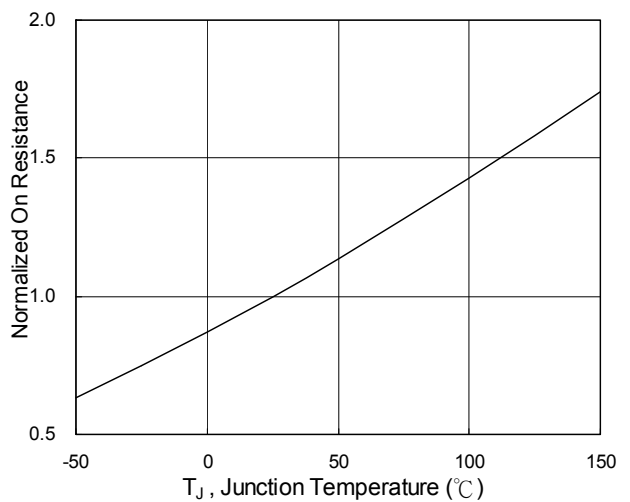
Fig.6 Normalized R_{DSON} v.s T_J

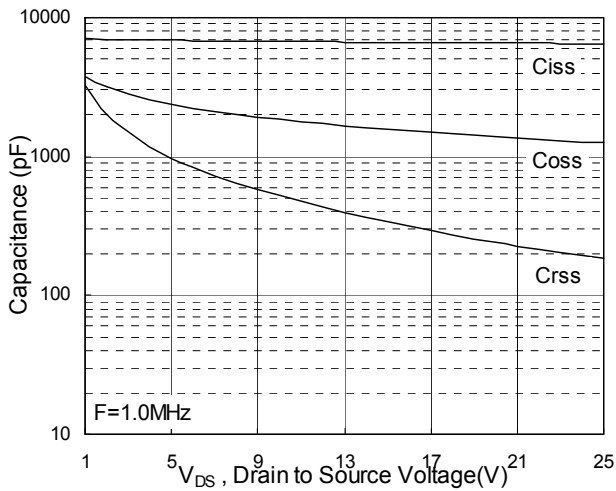www.ubiq-semi.com

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Fig.7 Capacitance
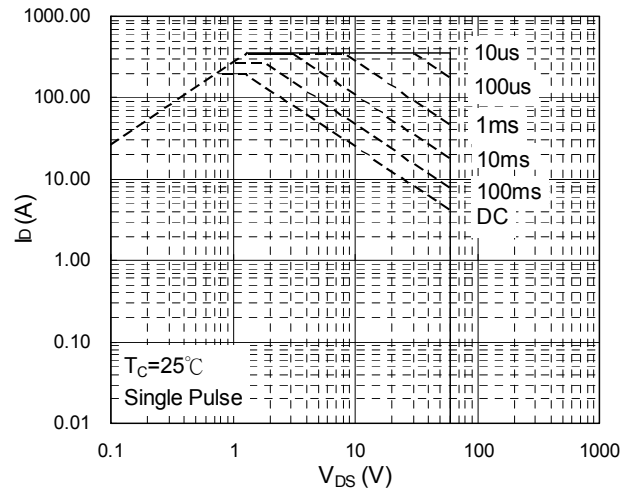
Fig.8 Safe Operating Area
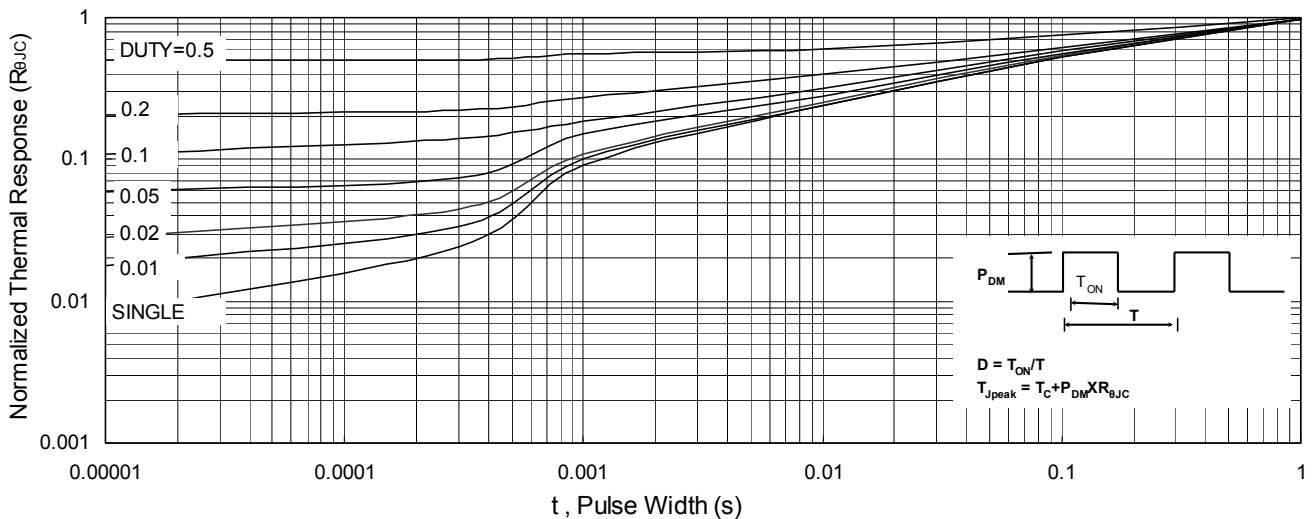
Fig.9 Normalized Maximum Transient Thermal Impedance

$$D = T_{ON}/T$$
$$T_{Jpeak} = T_C + P_{DM} X R_{\theta JC}$$

$$EAS = \frac{1}{2} L \times I_{AS}^2 \times \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$
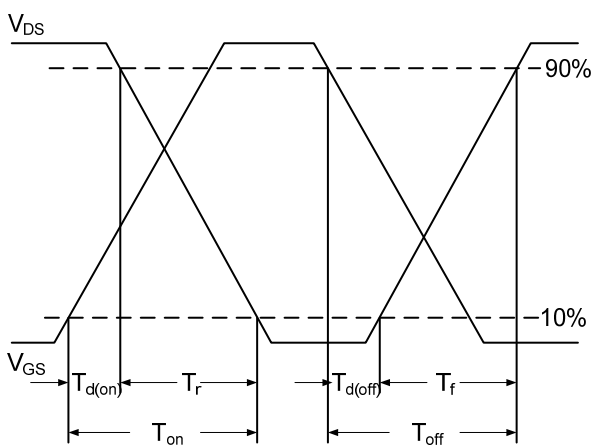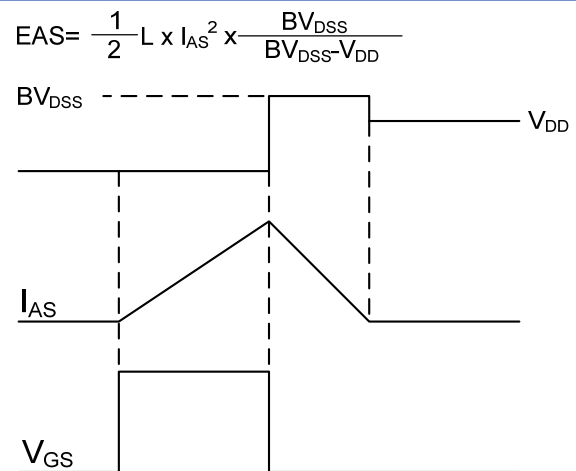
Fig.10 Switching Time Waveform

Fig.11 Unclamped Inductive Switching Waveform

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