

## 40V N-Channel MOSFET

### RCQ5402

#### General Description

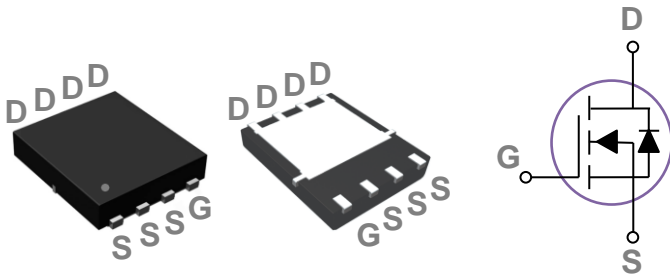
These N-Channel enhancement mode power field effect transistors are using trench DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency fast switching applications.

BVDSS	RDSON	ID
40V	2.2mΩ	140A

#### Features

- 40V, 140A,  $R_{DS(ON)} = 2.2m\Omega @ V_{GS} = 10V$
- Improved  $dv/dt$  capability
- Fast switching
- Green Device Available

#### DFN5X6 Pin Configuration



#### Applications

- PowerTools
- Load Switch
- LED applications
- Motor Drive Applications

#### Absolute Maximum Ratings $T_c=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Rating	Units
$V_{DS}$	Drain-Source Voltage	40	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	V
$I_D$	Drain Current – Continuous ( $T_c=25^\circ\text{C}$ ) (Chip Limitation)	140	A
	Drain Current – Continuous ( $T_c=100^\circ\text{C}$ ) (Chip Limitation)	88	A
$I_{DM}$	Drain Current – Pulsed <sup>1</sup>	560	A
EAS	Single Pulse Avalanche Energy <sup>2</sup>	360	mJ
IAS	Single Pulse Avalanche Current <sup>2</sup>	85	A
$P_D$	Power Dissipation ( $T_c=25^\circ\text{C}$ )	142	W
	Power Dissipation – Derate above $25^\circ\text{C}$	1.14	W/ $^\circ\text{C}$
$T_{STG}$	Storage Temperature Range	-55 to 150	$^\circ\text{C}$
$T_J$	Operating Junction Temperature Range	-55 to 150	$^\circ\text{C}$

#### Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction to ambient	---	62	$^\circ\text{C}/\text{W}$
$R_{\theta JC}$	Thermal Resistance Junction to Case	---	0.88	$^\circ\text{C}/\text{W}$

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#### Electrical Characteristics (T<sub>J</sub>=25 °C, unless otherwise noted)

##### Off Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I <sub>DSS</sub>	Drain-Source Leakage Current					
I <sub>GSS</sub>	Gate-Source Leakage Current					

##### On Characteristics

R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =30A	---	1.9	2.2	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =20A	'---	2.5	3	mΩ
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =250uA	1	1.6	2.5	V
g <sub>fs</sub>	Forward Transconductance	V <sub>DS</sub> =10V, I <sub>D</sub> =10A	---	45	---	S

##### Dynamic and switching Characteristics

Q <sub>g</sub>	Total Gate Charge <sup>3,4</sup>	V <sub>DS</sub> =20V, V <sub>GS</sub> =4.5V, I <sub>D</sub> =10A	---	70	140	nC
Q <sub>gs</sub>	Gate-Source Charge <sup>3,4</sup>		---	15	32	
Q <sub>gd</sub>	Gate-Drain Charge <sup>3,4</sup>		---	40	80	
T <sub>d(on)</sub>	Turn-On Delay Time <sup>3,4</sup>	V <sub>DD</sub> =20V, V <sub>GS</sub> =10V, R <sub>G</sub> =10Ω I <sub>D</sub> =10A	---	24.6	48	ns
T <sub>r</sub>	Rise Time <sup>3,4</sup>		---	62.8	120	
T <sub>d(off)</sub>	Turn-Off Delay Time <sup>3,4</sup>		---	224	440	
T <sub>f</sub>	Fall Time <sup>3,4</sup>		---	162	320	
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, F=1MHz	---	8000	12000	pF
C <sub>oss</sub>	Output Capacitance		---	550	1000	
C <sub>rss</sub>	Reverse Transfer Capacitance		---	420	800	
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, F=1MHz	---	1.2	2.4	Ω

##### Drain-Source Diode Characteristics and Maximum Ratings

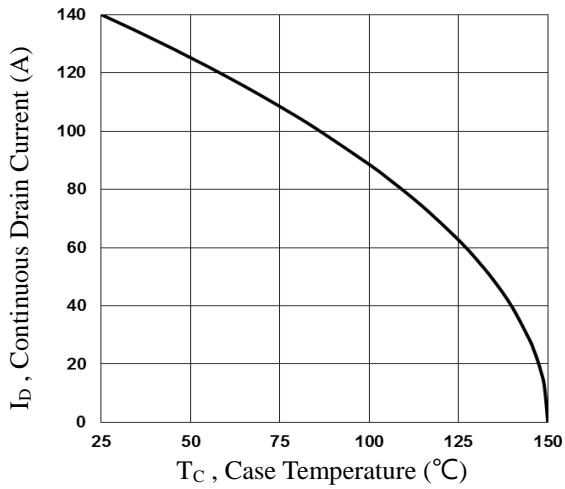
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I <sub>S</sub>	Continuous Source Current	V <sub>G</sub> =V <sub>D</sub> =0V, Force Current	---	---	140	A
I <sub>SM</sub>	Pulsed Source Current		---	---	280	A
V <sub>SD</sub>	Diode Forward Voltage	V <sub>GS</sub> =0V, I <sub>S</sub> =1A, T <sub>J</sub> =25°C	---	---	1	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> =0V, I <sub>S</sub> =20A, di/dt=100A/μs T <sub>J</sub> =25°C	---	32	---	ns
Q <sub>rr</sub>	Reverse Recovery Charge		---	19	---	nC

Note :

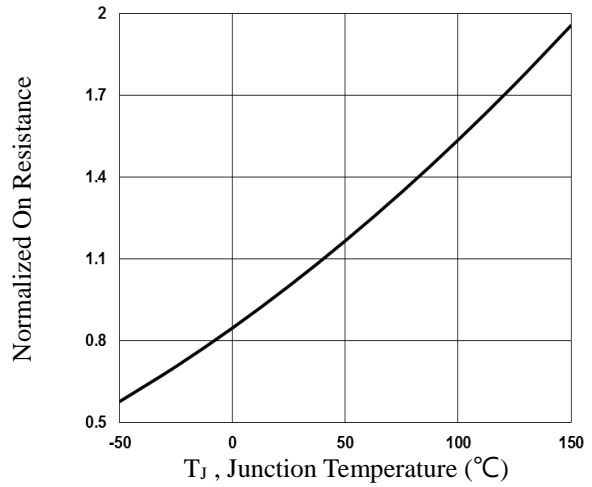
1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2. V<sub>DD</sub>=25V, V<sub>GS</sub>=10V, L=0.1mH, I<sub>AS</sub>=85A., Starting T<sub>J</sub>=25°C
3. The data tested by pulsed, pulse width ≤ 300us, duty cycle ≤ 2%.
4. Essentially independent of operating temperature.

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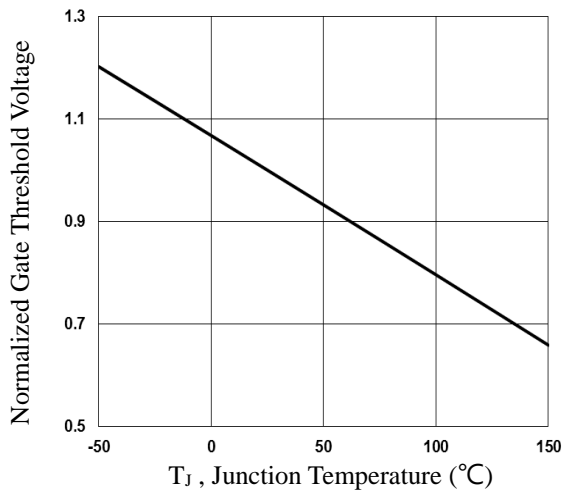
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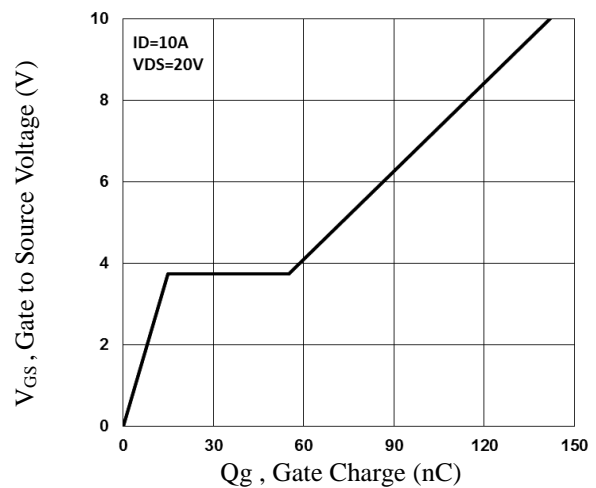
**Fig.1 Continuous Drain Current vs.  $T_c$**



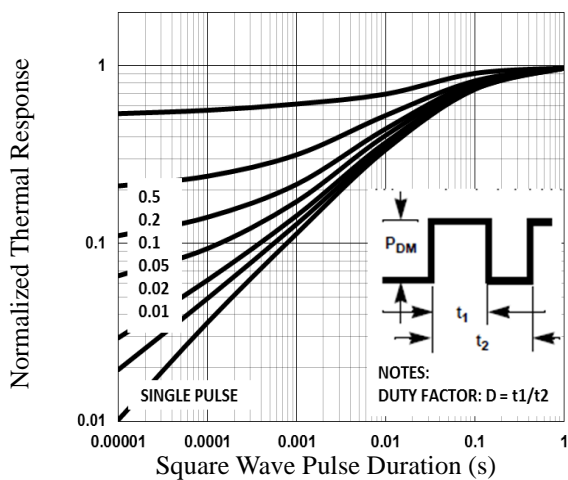
**Fig.2 Normalized  $R_{DS(on)}$  vs.  $T_j$**



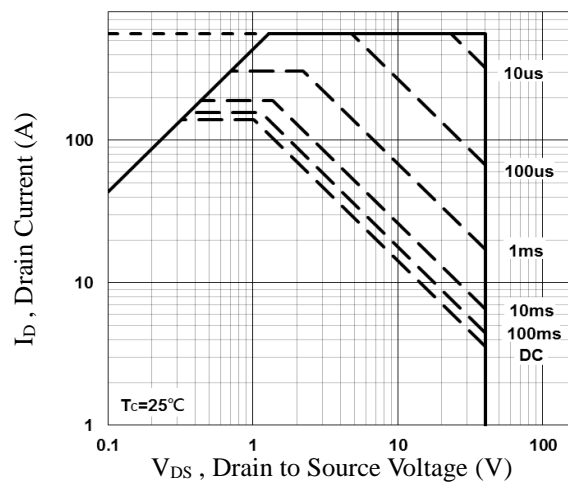
**Fig.3 Normalized  $V_{th}$  vs.  $T_j$**



**Fig.4 Gate Charge Characteristics**

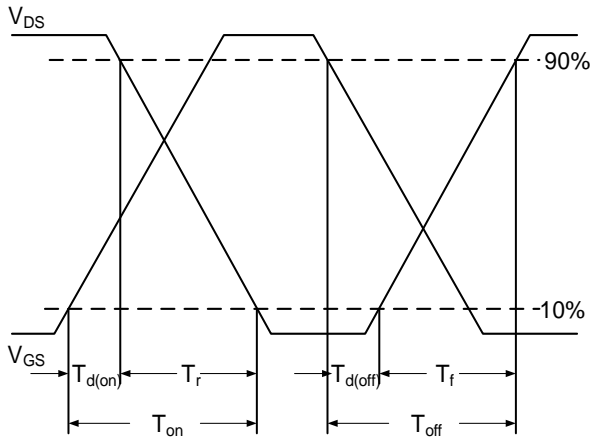


**Fig.5 Normalized Transient Impedance**

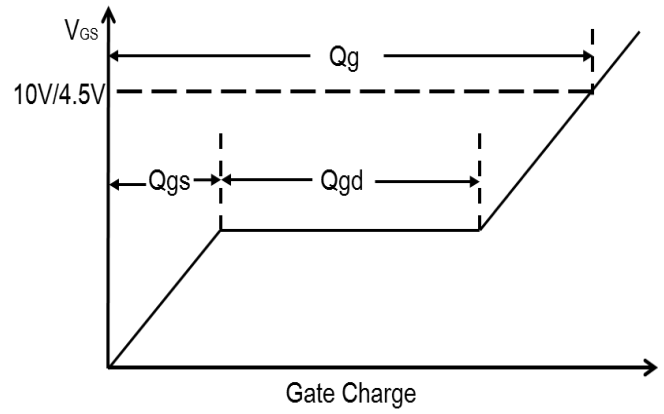


**Fig.6 Maximum Safe Operation Area**

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**Fig.7 Switching Time Waveform**

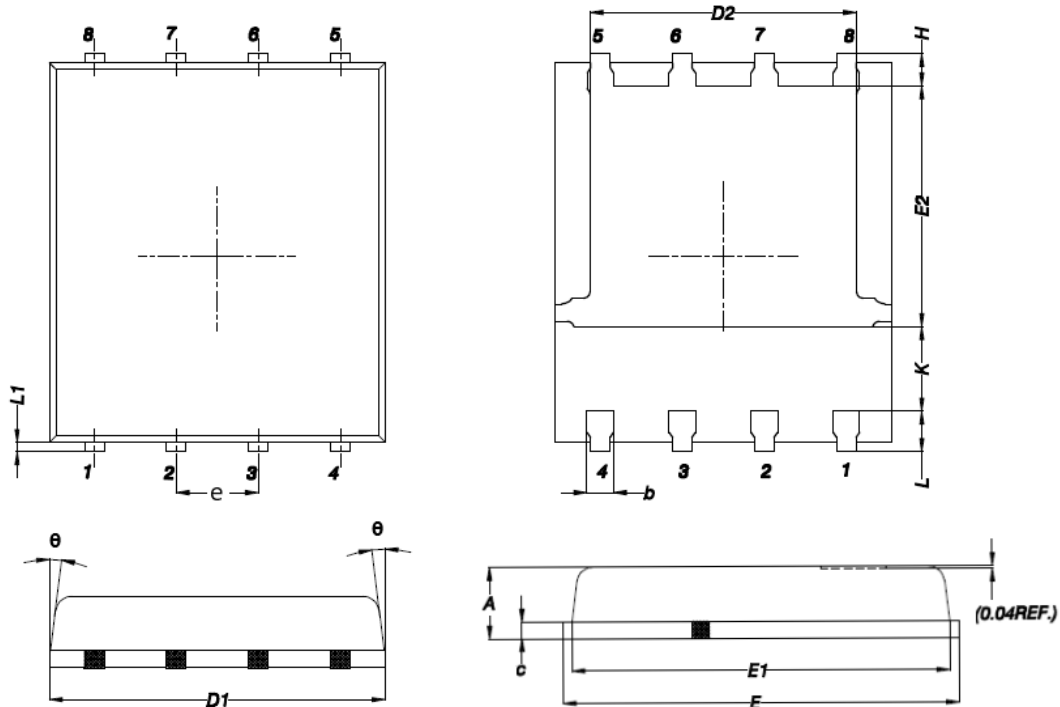


**Fig.8 Gate Charge Waveform**

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### DFN5x6 PACKAGE INFORMATION



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MAX	MIN	MAX	MIN
A	1.200	0.850	0.047	0.031
b	0.510	0.300	0.020	0.012
C	0.300	0.200	0.012	0.008
D1	5.400	4.800	0.212	0.189
D2	4.310	3.610	0.170	0.142
E	6.300	5.850	0.248	0.230
E1	5.960	5.450	0.235	0.215
E2	3.920	3.300	0.154	0.130
e	1.27BSC		0.05BSC	
H	0.650	0.380	0.026	0.015
K	---	1.100	---	0.043
L	0.710	0.380	0.028	0.015
L1	0.250	0.050	0.009	0.002
θ	12°	0°	12°	0°