

### ) HDWXUHV

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

### Product Summary

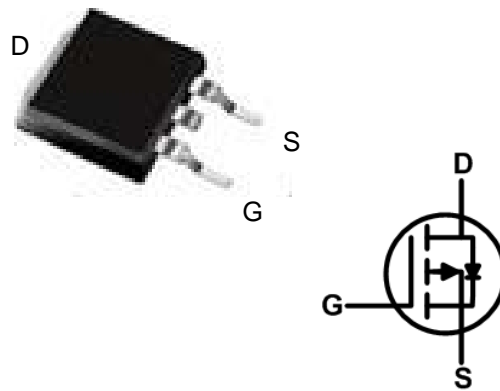
BVDSS	RDSON	ID
-40V	13mΩ	-52A

### Description

The D52P04M is the high cell density trenched P-ch MOSFETs, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications.

The D52P04M meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

### TO-252 Pin Configuration



### Absolute Maximum Ratings

Symbol	Parameter	Rating	Units
$V_{DS}$	Drain-Source Voltage	-40	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	V
$I_D@T_C=25^\circ C$	Continuous Drain Current, $V_{GS} @ -10V^1$	-52	A
$I_D@T_C=100^\circ C$	Continuous Drain Current, $V_{GS} @ -10V^1$	-32	A
$I_D@T_A=25^\circ C$	Continuous Drain Current, $V_{GS} @ -10V^1$	-10	A
$I_D@T_A=70^\circ C$	Continuous Drain Current, $V_{GS} @ -10V^1$	-8	A
$I_{DM}$	Pulsed Drain Current <sup>2</sup>	-105	A
EAS	Single Pulse Avalanche Energy <sup>3</sup>	146	mJ
$I_{AS}$	Avalanche Current	-54	A
$P_D@T_C=25^\circ C$	Total Power Dissipation <sup>4</sup>	52.1	W
$P_D@T_A=25^\circ C$	Total Power Dissipation <sup>4</sup>	2	W
$T_{STG}$	Storage Temperature Range	-55 to 150	$^\circ C$
$T_J$	Operating Junction Temperature Range	-55 to 150	$^\circ C$

### Thermal Data

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction-Ambient <sup>1</sup>	---	62	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance Junction-Case <sup>1</sup>	---	2.4	$^\circ C/W$

# D52P04M

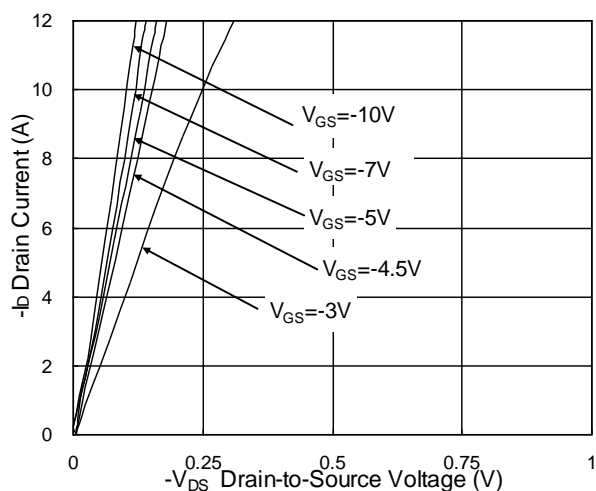
## Electrical Characteristics (T<sub>J</sub>=25 °C, unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =-250uA	-40	---	---	V
ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	BV <sub>DSS</sub> Temperature Coefficient	Reference to 25°C, I <sub>D</sub> =-1mA	---	-0.023	---	V/°C
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance <sup>2</sup>	V <sub>GS</sub> =-10V, I <sub>D</sub> =-18A	---	10.5	13	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-12A	---	15	20	
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =-250uA	-1.0	-1.6	-2.5	V
ΔV <sub>GS(th)</sub>	V <sub>GS(th)</sub> Temperature Coefficient		---	4.74	---	mV/°C
I <sub>DSS</sub>	Drain-Source Leakage Current	V <sub>DS</sub> =-32V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C	---	---	1	uA
		V <sub>DS</sub> =-32V, V <sub>GS</sub> =0V, T <sub>J</sub> =55°C	---	---	5	
I <sub>GSS</sub>	Gate-Source Leakage Current	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	---	---	±100	nA
g <sub>fs</sub>	Forward Transconductance	V <sub>DS</sub> =-5V, I <sub>D</sub> =-18A	---	24	---	S
R <sub>g</sub>	Gate Resistance	V <sub>DS</sub> =0V, V <sub>GS</sub> =0V, f=1MHz	---	7	14	Ω
Q <sub>g</sub>	Total Gate Charge (-4.5V)	V <sub>DS</sub> =-20V, V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-12A	---	27.9	---	nC
Q <sub>gs</sub>	Gate-Source Charge		---	7.7	---	
Q <sub>gd</sub>	Gate-Drain Charge		---	7.5	---	
T <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> =-15V, V <sub>GS</sub> =-10V, R <sub>G</sub> =3.3Ω, I <sub>D</sub> =-1A	---	40	---	ns
T <sub>r</sub>	Rise Time		---	35.2	---	
T <sub>d(off)</sub>	Turn-Off Delay Time		---	100	---	
T <sub>f</sub>	Fall Time		---	9.6	---	
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =-15V, V <sub>GS</sub> =0V, f=1MHz	---	3500	---	pF
C <sub>oss</sub>	Output Capacitance		---	323	---	
C <sub>rss</sub>	Reverse Transfer Capacitance		---	222	---	
<b>Diode Characteristics</b>						
I <sub>S</sub>	Continuous Source Current <sup>1,5</sup>	V <sub>G</sub> =V <sub>D</sub> =0V, Force Current	---	---	-52	A
I <sub>SM</sub>	Pulsed Source Current <sup>2,5</sup>		---	---	-105	A
V <sub>SD</sub>	Diode Forward Voltage <sup>2</sup>	V <sub>GS</sub> =0V, I <sub>S</sub> =-1A, T <sub>J</sub> =25°C	---	---	-1	V

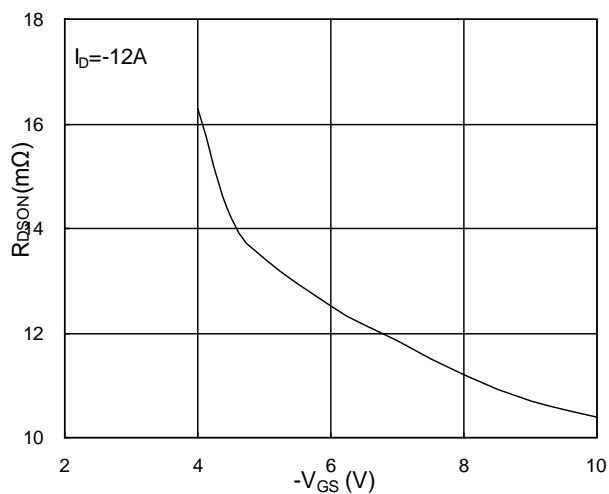
Note :

- 1.The data tested by surface mounted on a 1 inch<sup>2</sup>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<sub>DD</sub>=-25V,V<sub>GS</sub>=-10V,L=0.1mH,I<sub>AS</sub>=-54A
- 4.The power dissipation is limited by 150°C junction temperature
- 5.The data is theoretically the same as I<sub>D</sub> and I<sub>S</sub> , in real applications , should be limited by total power dissipation.

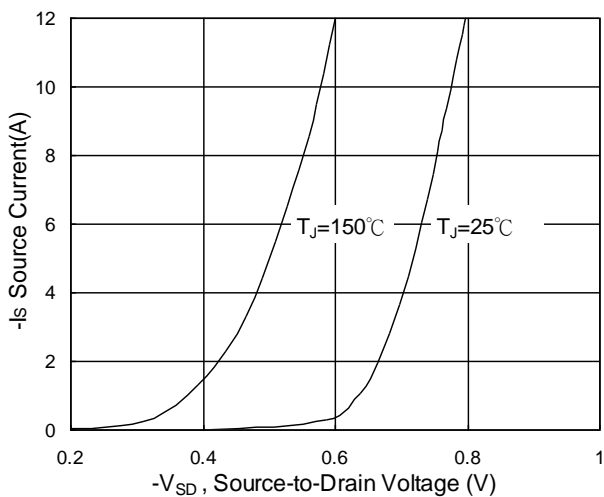
## Typical Characteristics



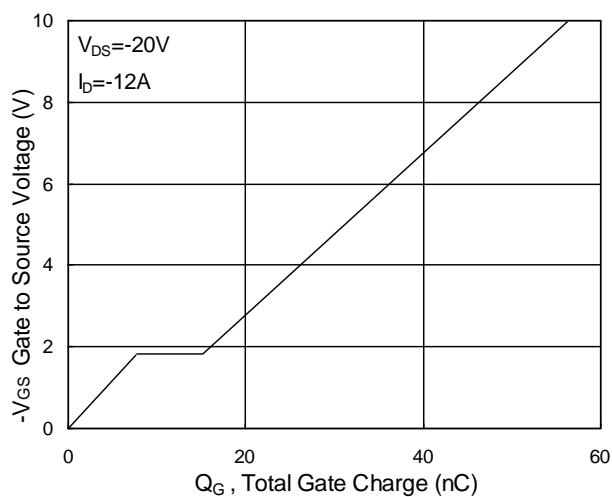
**Fig.1 Typical Output Characteristics**



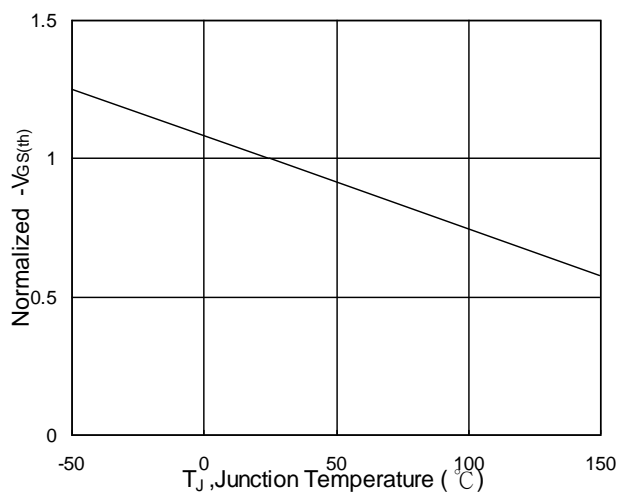
**Fig.2 On-Resistance v.s Gate-Source**



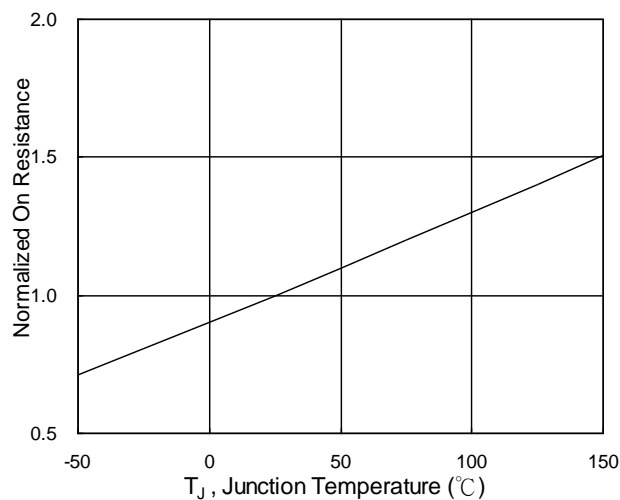
**Fig.3 Forward Characteristics Of Reverse**



**Fig.4 Gate-Charge Characteristics**

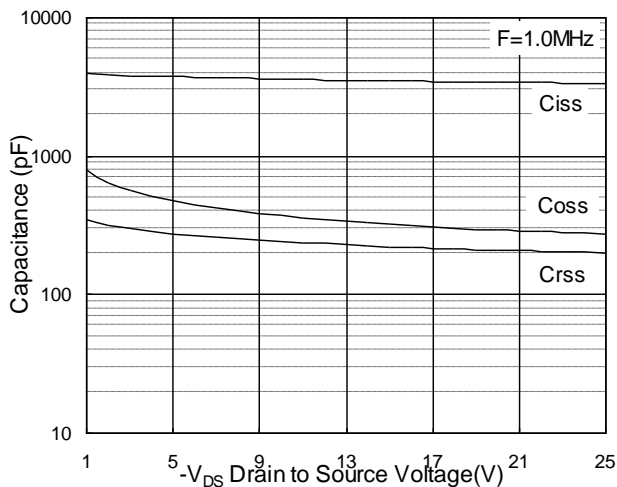


**Fig.5 Normalized  $V_{GS(th)}$  v.s  $T_J$**

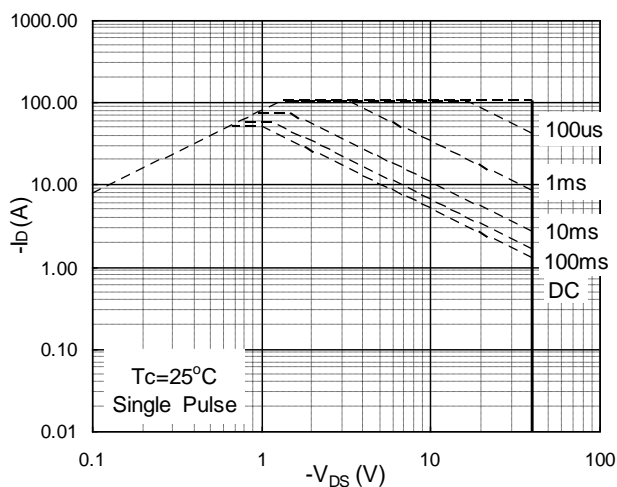


**Fig.6 Normalized  $R_{DS(on)}$  v.s  $T_J$**

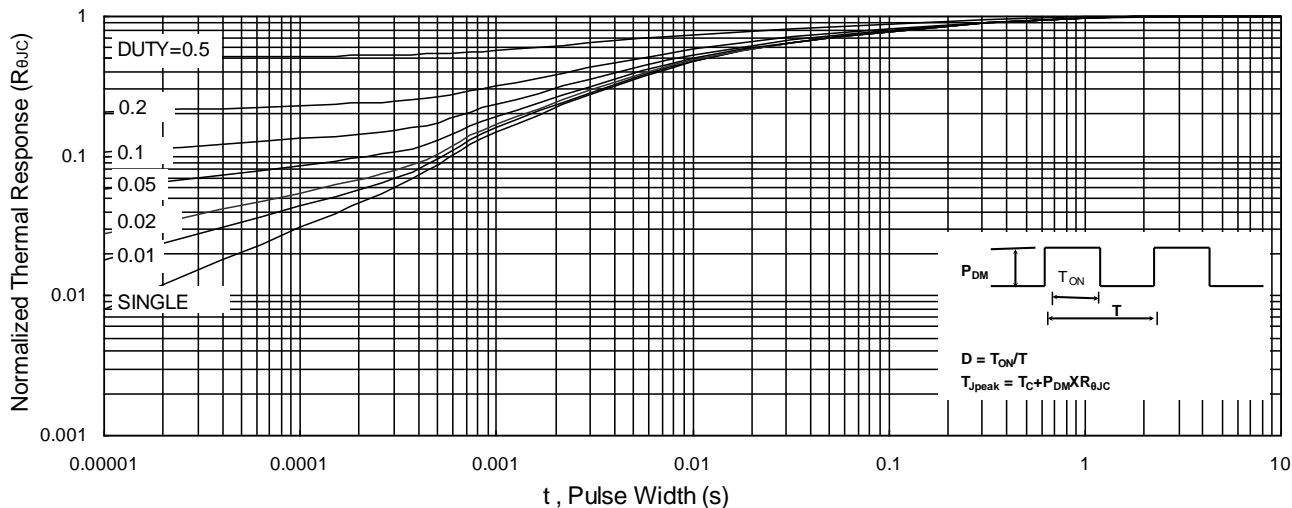
# D52P04M



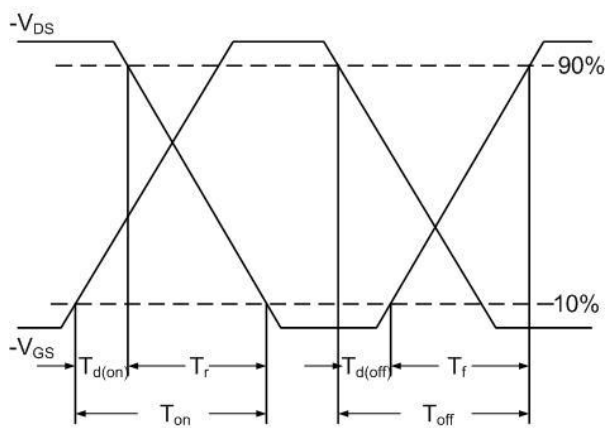
**Fig.7 Capacitance**



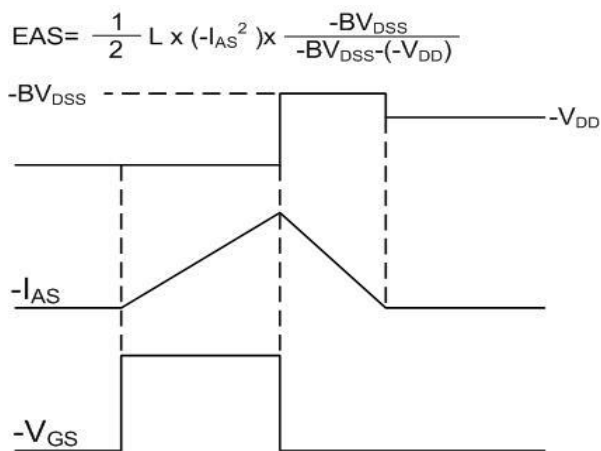
**Fig.8 Safe Operating Area**



**Fig.9 Normalized Maximum Transient Thermal Impedance**



**Fig.10 Switching Time Waveform**



**Fig.11 Unclamped Inductive Waveform**

$$EAS = \frac{1}{2} L \times (-I_{AS}^2) \times \frac{-BV_{DSS}}{-BV_{DSS} - (-V_{DD})}$$



