

### General Description

The WSF50P04 is the highest performance trench P-Ch MOSFET with extreme high cell density, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications.

The WSF40P04 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

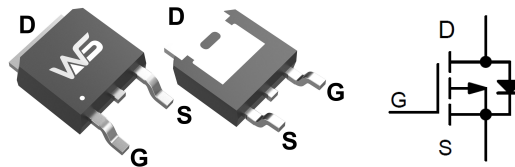
### Product Summary

BVDSS	RDSON	ID
-40V	12mΩ	-40A

### Applications

- High Frequency Point-of-Load Synchronous Buck Converter for MB/NB/UMPC/VGA
- Networking DC-DC Power System
- Load Switch

### TO-252 Pin Configuration



### Absolute Maximum Ratings (Tc=25°C unless otherwise noted)

Symbol	Parameter	Limit	Unit
V <sub>DS</sub>	Drain-Source Voltage	-40	V
V <sub>GS</sub>	Gate-Source Voltage	±20	V
I <sub>D</sub>	Drain Current-Continuous	-40	A
I <sub>D</sub> (100°C)	Drain Current-Continuous(Tc=100°C)	-28	A
I <sub>DM</sub>	Pulsed Drain Current	-160	A
P <sub>D</sub>	Maximum Power Dissipation Tc=25°C	80	W
E <sub>AS</sub>	Single pulse avalanche energy (Note 5)	544	mJ
dv/dt	Drain Source voltage slope, V <sub>DS</sub> ≤ -32 V,	50	V/ns
dv/dt	Reverse diode dv/dt, V <sub>DS</sub> ≤ -32 V, I <sub>SD</sub> < I <sub>D</sub>	15	V/ns
T <sub>J</sub> , T <sub>STG</sub>	Operating Junction and Storage Temperature Range	-55 To 175	°C
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case(Note 2)	1.88	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient(Note 2)	50	°C/W

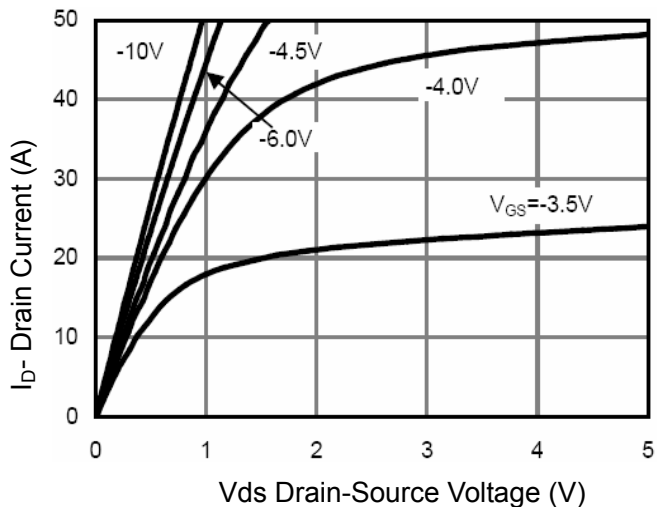
**Electrical Characteristics (T<sub>c</sub>=25°C unless otherwise noted)**

Symbol	Parameter	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V I <sub>D</sub> =-250μA	-40	---	---	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =-40V, V <sub>GS</sub> =0V	---	---	-1	μA
I <sub>GSS</sub>	Gate-Body Leakage Current	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	---	---	±100	nA
<b>On Characteristics (Note 3)</b>						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA	-1.0	-1.5	-3.0	V
R <sub>DS(ON)</sub>	Drain-Source On-State Resistance	V <sub>GS</sub> =-10V, I <sub>D</sub> =-12A	---	12	14	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-12A	---	18.5	24	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =-5V, I <sub>D</sub> =-12A	---	34	---	S
<b>Dynamic Characteristics (Note4)</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =-20V, V <sub>GS</sub> =0V, F=1.0MHz	---	2960	---	PF
C <sub>oss</sub>	Output Capacitance		---	370	---	PF
C <sub>rss</sub>	Reverse Transfer Capacitance		---	310	---	PF
<b>Switching Characteristics (Note 4)</b>						
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>DD</sub> =-20V, I <sub>D</sub> =-12A V <sub>GS</sub> =- 10V, R <sub>G</sub> =3Ω	---	10	---	nS
t <sub>r</sub>	Turn-on Rise Time		---	18	---	nS
t <sub>d(off)</sub>	Turn-Off Delay Time		---	38	---	nS
t <sub>f</sub>	Turn-Off Fall Time		---	24	---	nS
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =-20, I <sub>D</sub> =-12A, V <sub>GS</sub> =- 10V	---	42.2	72	nC
Q <sub>gs</sub>	Gate-Source Charge		---	6.9	---	nC
Q <sub>gd</sub>	Gate-Drain Charge		---	9.7	---	nC
<b>Drain-Source Diode Characteristics</b>						
V <sub>SD</sub>	Diode Forward Voltage (Note 3)	V <sub>GS</sub> =0V, I <sub>S</sub> =-12A	---	---	-1.2	V
I <sub>S</sub>	Diode Forward Current (Note 2)		---	---	-40	A
t <sub>rr</sub>	Reverse Recovery Time	T <sub>J</sub> = 25°C, I <sub>F</sub> =- 12A di/dt = -100A/μs(Notes3)	---	40	---	nS
Q <sub>rr</sub>	Reverse Recovery Charge		---	42	---	nC

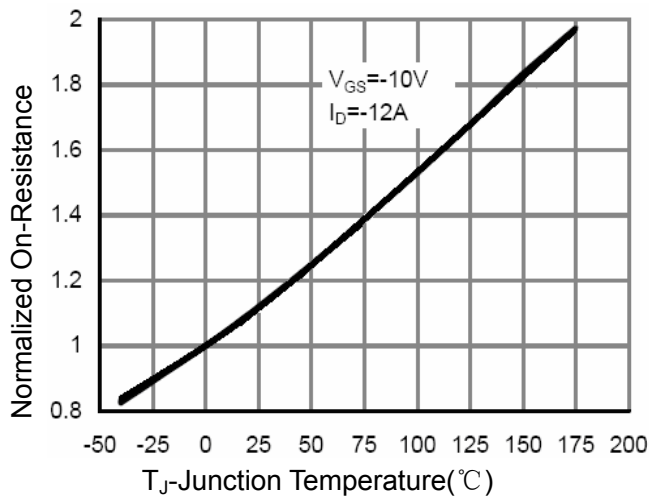
**Notes:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production
5. E<sub>AS</sub> condition: T<sub>J</sub>=25°C, V<sub>DD</sub>=-20V, V<sub>G</sub>=-10V, L=1mH, R<sub>G</sub>=25Ω

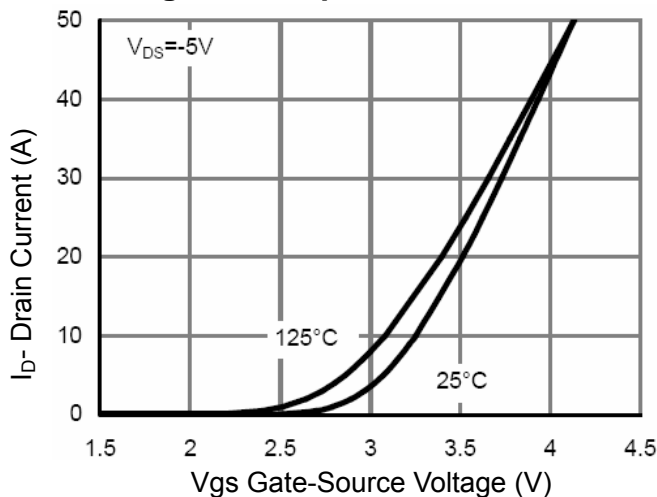
**Typical Electrical and Thermal Characteristics**



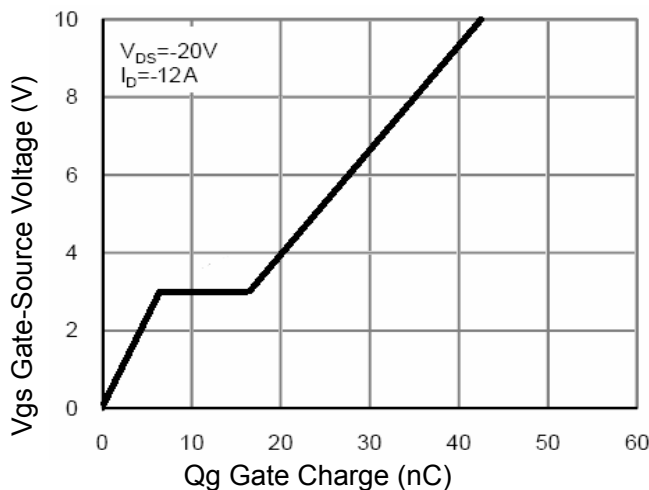
**Figure 1 Output Characteristics**



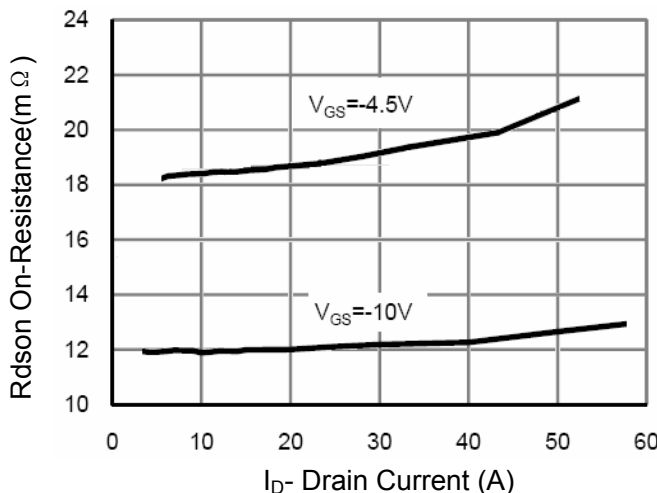
**Figure 4 Rdson-Junction Temperature**



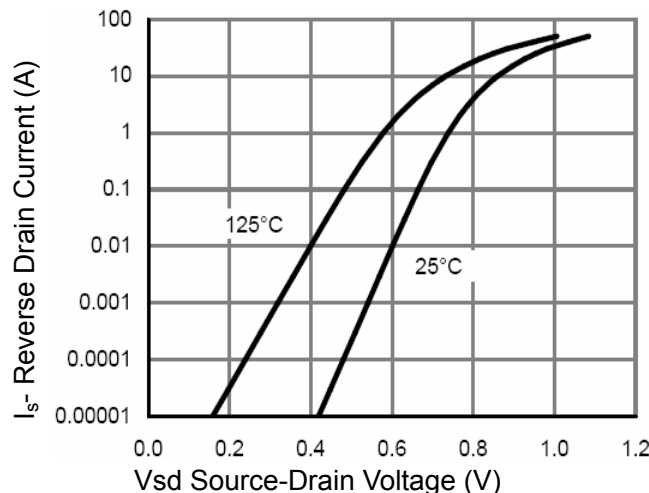
**Figure 2 Transfer Characteristics**



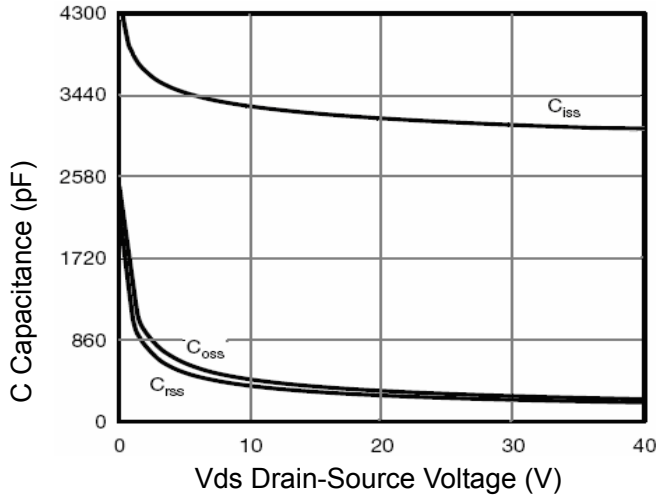
**Figure 5 Gate Charge**



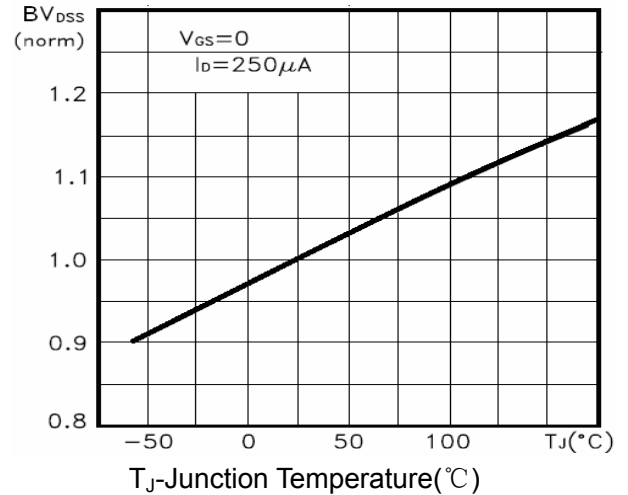
**Figure 3 Rdson- Drain Current**



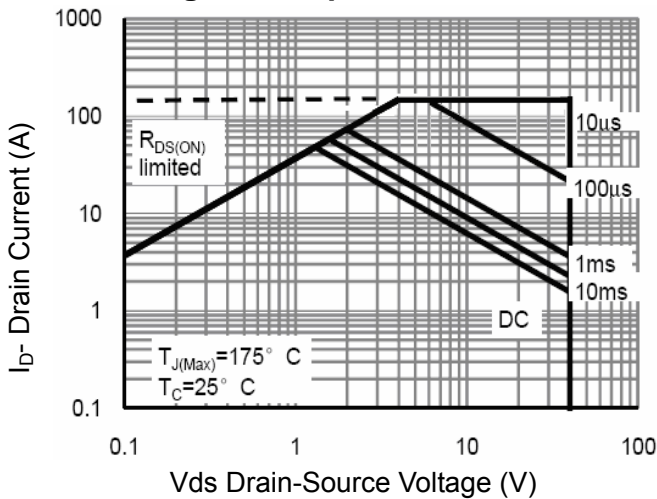
**Figure 6 Source- Drain Diode Forward**



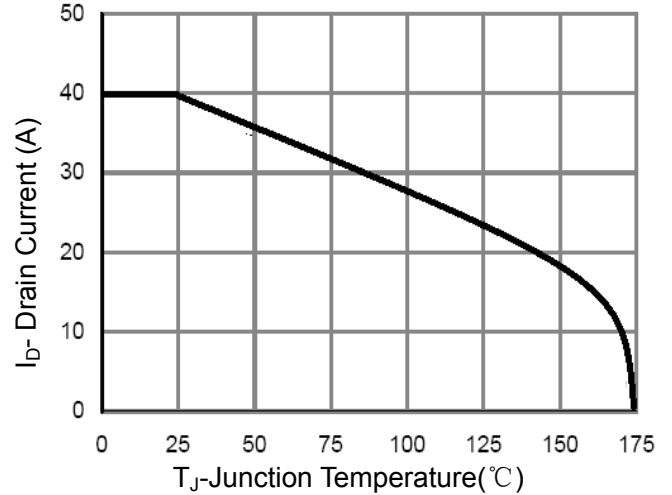
**Figure 7 Capacitance vs Vds**



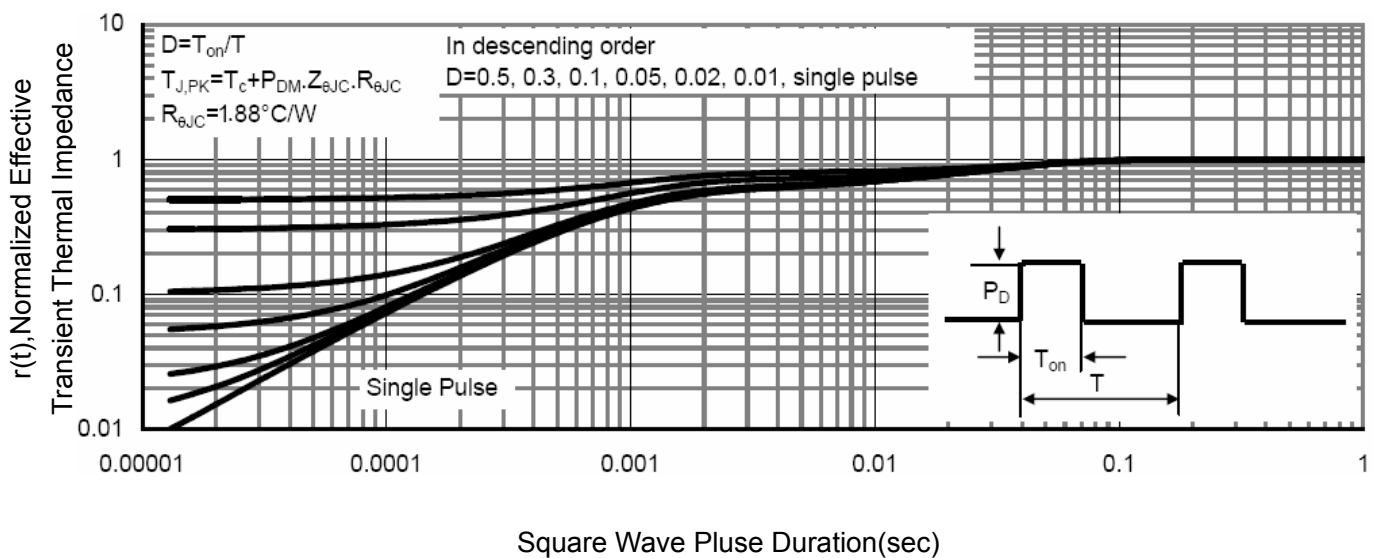
**Figure 9  $BV_{DSS}$  vs Junction Temperature**



**Figure 8 Safe Operation Area**



**Figure 10 ID Current Derating vs Junction Temperature**



**Figure 11 Normalized Maximum Transient Thermal Impedance**



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