

General Description

The WSF40P04 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

Absolute Maximum Ratings

Symbol	Parameter	Rating	Units
V_{DS}	Drain-Source Voltage	-40	V
V_{GS}	Gate-Source Voltage	± 20	V
$I_D@T_C=25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ -10V^1$	-20	A
$I_D@T_C=100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ -10V^1$	-16	A
I_{DM}	Pulsed Drain Current ²	-28	A
I_{AR}	Avalanche Current	-22	A
EAR	Repetitive avalanche energy $L=0.1\text{mH}$	28	mJ
EAS	Single pulse avalanche energy $L=0.3\text{mH}$	55	mJ
$P_D@T_C=25^\circ\text{C}$	Total Power Dissipation ⁴	45	W
$P_D@T_C=100^\circ\text{C}$	Total Power Dissipation ⁴	20	W
$P_D@T_A=25^\circ\text{C}$	Power Dissipation ^A	2.1	W
$P_D@T_A=70^\circ\text{C}$	Power Dissipation ^A	1.5	W
$T_J \quad T_{STG}$	Junction and Storage Temperature Range	-55 to 175	$^\circ\text{C}$

Thermal Data

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction-Ambient ¹	---	50	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance Junction-Ambient ¹ ($t \leq 10\text{s}$)	---	25	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance Junction-Case ¹	---	2.5	$^\circ\text{C/W}$

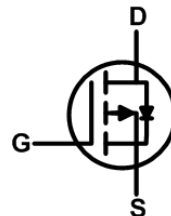
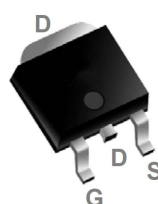
Product Summary

BVDSS	RDSON	ID
-40V	32m Ω	-20A

Applications

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

TO-252-3L(D-PAK) Pin Configuration



Electrical Characteristics ($T_J=25^\circ\text{C}$, unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=-250\mu A$	-40	---	---	V
$\Delta BV_{DSS}/\Delta T_J$	BVDSS Temperature Coefficient	Reference to 25°C , $I_D=-1mA$	---	-0.0232	---	V/ $^\circ\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance ²	$V_{GS}=-10V, I_D=-12A$	---	32	42	m Ω
		$V_{GS}=-4.5V, I_D=-8A$	---	52	58	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=-250\mu A$	-1	-2	-3	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	4.6	---	mV/ $^\circ\text{C}$
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=-32V, V_{GS}=0V, T_J=25^\circ\text{C}$	---	---	-1	μA
		$V_{DS}=-32V, V_{GS}=0V, T_J=55^\circ\text{C}$	---	---	-5	
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	± 100	nA
g_{fs}	Forward Transconductance	$V_{DS}=-5V, I_D=-12A$	---	10	---	S
R_g	Gate Resistance	$V_{DS}=0V, V_{GS}=0V, f=1MHz$	---	6.0	---	Ω
Q_g	Total Gate Charge (-4.5V)	$V_{DS}=-20V, V_{GS}=-10V, I_D=-15A$	---	20	---	nC
Q_{gs}	Gate-Source Charge		---	2.5	---	
Q_{gd}	Gate-Drain Charge		---	4.5	---	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=-20V, V_{GS}=-10V, R_G=1.6\Omega$	---	5	---	ns
T_r	Rise Time		---	12	---	
$T_{d(off)}$	Turn-Off Delay Time		---	20	---	
T_f	Fall Time		---	4.5	---	
C_{iss}	Input Capacitance	$V_{DS}=-25V, V_{GS}=0V, f=1MHz$	---	840	---	pF
C_{oss}	Output Capacitance		---	92	---	
C_{rss}	Reverse Transfer Capacitance		---	60	---	

Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_S	Continuous Source Current ^{1,6}	$V_G=V_D=0V$, Force Current	---	---	-10	A
I_{SM}	Pulsed Source Current ^{2,6}		---	---	-20	A
V_{SD}	Diode Forward Voltage ²	$V_{GS}=0V, I_S=-1A, T_J=25^\circ\text{C}$	---	---	-1	V
t_{rr}	Reverse Recovery Time	$I_F=-12A, dI/dt=100A/\mu s$,	---	20	---	nS
Q_{rr}	Reverse Recovery Charge		---	16	---	nC

Note :

- 1.The data tested by surface mounted on a 1 inch² FR-4 board with 20Z copper, $t < 10\text{sec}$.
- 2.The data tested by pulsed , pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$
- 3.The EAS data shows Max. rating . The test condition is $V_{DD}=-25V, V_{GS}=-10V, L=0.1mH, I_{AR}=-12A$
- 4.The power dissipation is limited by 150°C 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.

Typical Characteristics

Figure1. Power Dissipation

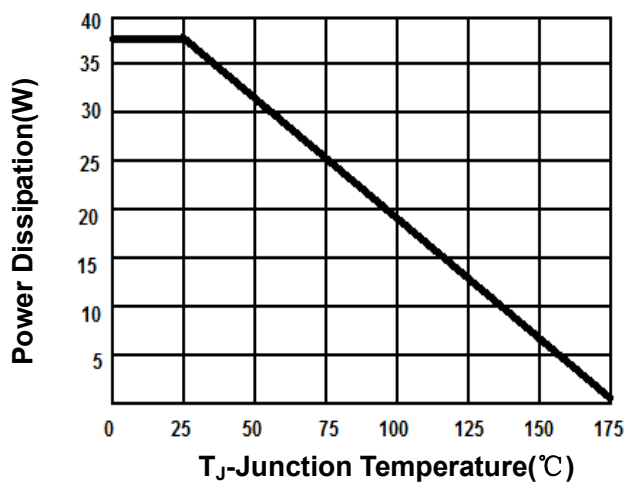


Figure2. Drain Current

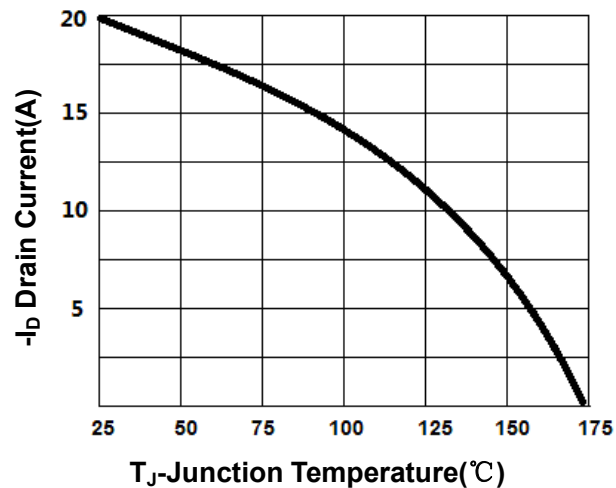


Figure3. Output Characteristics

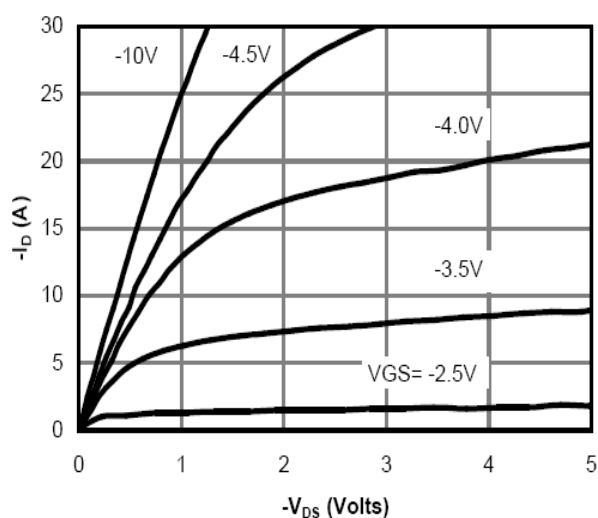
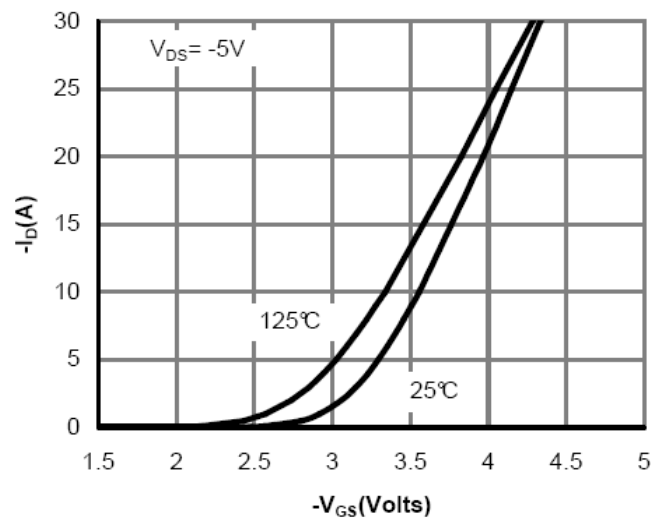


Figure4. Transfer Characteristics



Typical Characteristics

Figure5. Capacitance

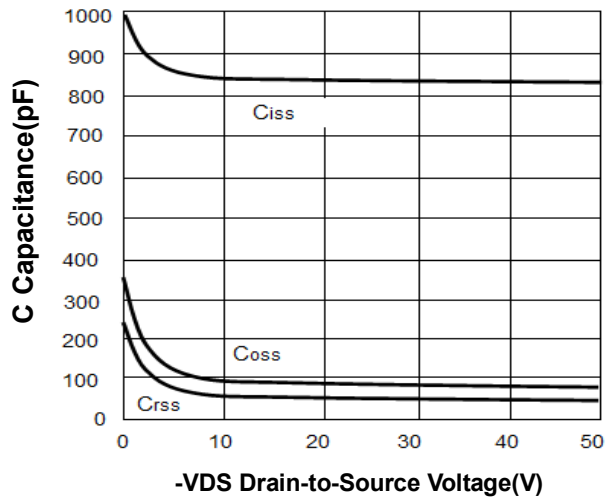


Figure6. $R_{DS(ON)}$ vs Junction Temperature

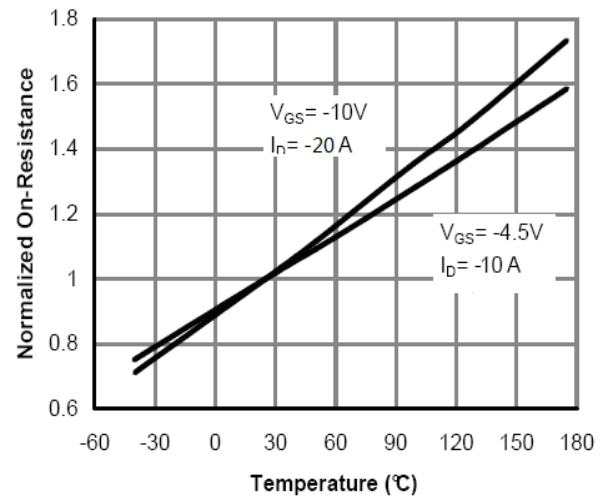


Figure7. $V_{GS(th)}$ vs Junction Temperature

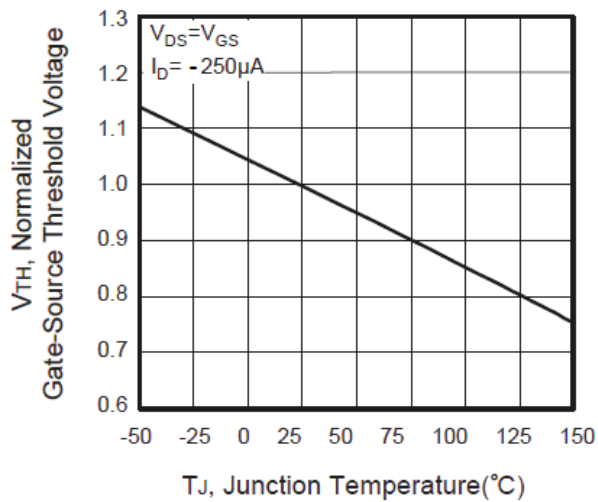
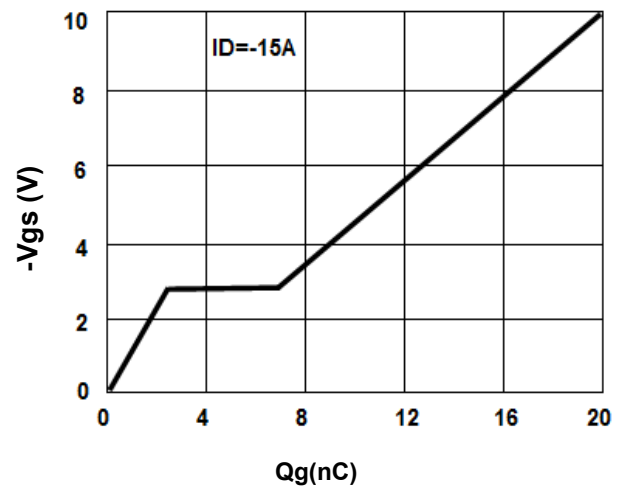
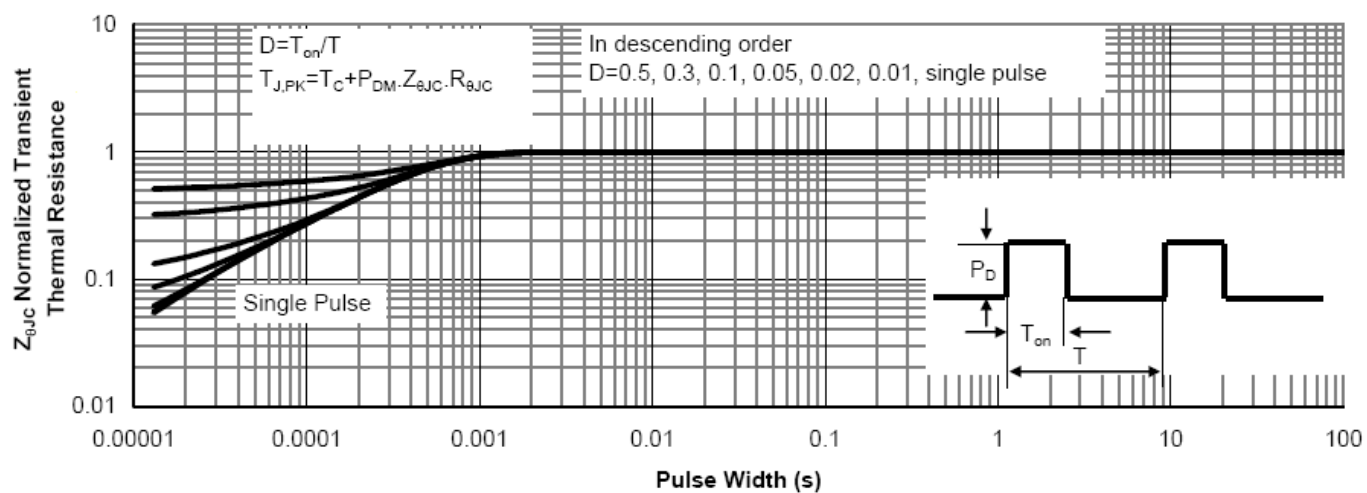


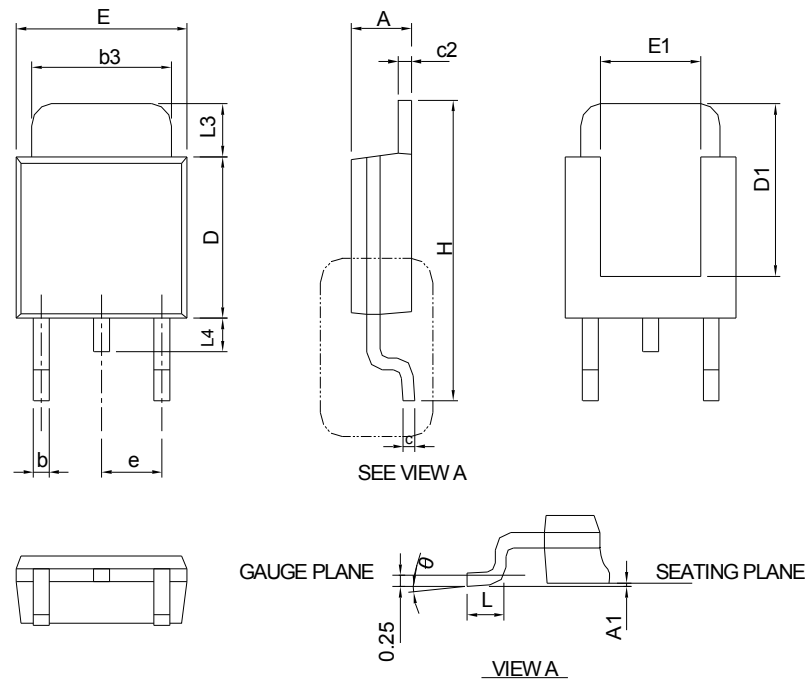
Figure8. Gate Charge Waveforms



Typical Characteristics

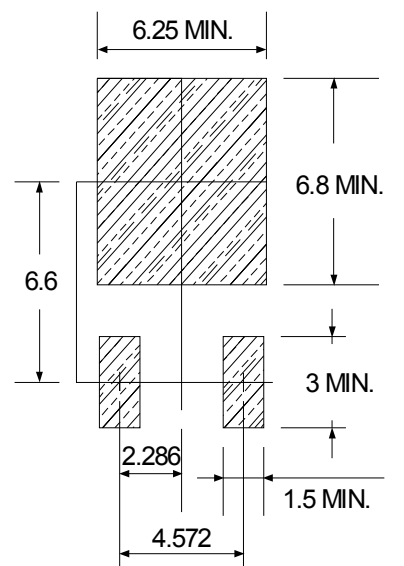
Figure9. Normalized Maximum Transient Thermal Impedance



D-Pak (TO-252AA) (TO-252) (TO-252-3L) Package Outline (Dimensions are shown in millimeters (inches))


SYMBOL	TO-252-3L			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	2.18	2.39	0.086	0.094
A1	-	0.13	-	0.005
b	0.50	0.89	0.020	0.035
b3	4.95	5.46	0.195	0.215
c	0.46	0.61	0.018	0.024
c2	0.46	0.89	0.018	0.035
D	5.33	6.22	0.210	0.245
D1	4.57	6.00	0.180	0.236
E	6.35	6.73	0.250	0.265
E1	3.81	6.00	0.150	0.236
e	2.29 BSC		0.090 BSC	
H	9.40	10.41	0.370	0.410
L	0.90	1.78	0.035	0.070
L3	0.89	2.03	0.035	0.080
L4	-	1.02	-	0.040
θ	0°	8°	0°	8°

Note : Follow JEDEC TO-252 .

RECOMMENDED LAND PATTERN


UNIT: mm

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