

General Description

The WSF12P04 is the highest performance trench P-Channel MOSFET with extreme high cell density, which provide excellent $R_{DS(ON)}$ and gate charge for most of the synchronous buck converter applications.

The WSF12P04 meet the RoHS and Green Product requirement, 100% E_{AS} guaranteed with full function reliability approved.

Features

- 100% UIS Tested.
- Reliable and Rugged
- Lead Free and Green Devices Available (RoHS Compliant)

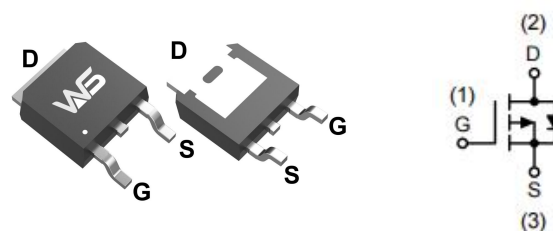
Product Summary

BV_{DSS}	$R_{DS(ON)}$	I_D
-40V	35mΩ	-12A

Applications

- Power Management for Industrial DC/DC Converters
- Ideal for high-frequency switching and synchronous rectification

TO-252-2L Pin Configuration



Absolute Maximum Ratings ($T_A=25^\circ\text{C}$, Unless Otherwise Noted)

Symbol	Parameter		Rating	Units
V_{DS}	Drain-Source Voltage		-40	V
V_{GS}	Gate-Source Voltage		± 20	
I_D ⁷	Continuous Drain Current	$T_C=25^\circ\text{C}$	-12	A
		$T_C=100^\circ\text{C}$	-8	
I_{DM} ³	Pulse Drain Current		-50	
P_D ²	Power Dissipation	$T_C=25^\circ\text{C}$	87	W
I_{AS} ³	Single pulse Avalanche Current		-25	A
E_{AS} ³	Single pulse Avalanche Energy	$L=0.5\text{mH}$	40	mJ
T_{STG}	Storage Temperature Range		-55 to 150	$^\circ\text{C}$
T_J	Operating Junction Temperature Range		-55 to 150	
$R_{\theta JA}$ ^{1,4}	Thermal Resistance-Junction to Ambient	$t \leq 10\text{s}$	31	$^\circ\text{C/W}$
		Steady State	62.5	
$R_{\theta JC}$	Thermal Resistance-Junction to Case		4	

Electrical Characteristics ($T_J=25^{\circ}\text{C}$, Unless Otherwise Noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0V$, $I_D=-250\mu A$	-40	---	---	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=-10V$, $I_D=-20A$	---	35	40	m Ω
		$T_J=125^{\circ}\text{C}$	---	60	---	
		$V_{GS}=-4.5V$, $I_D=-15A$	---	48	65	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}$, $I_D=-250\mu A$	-1.0	-1.5	-2.2	V
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=-40V$, $V_{GS}=0V$	---	---	-1.0	μA
		$T_J=55^{\circ}\text{C}$	---	---	-5.0	
I_{GSS}	Gate-Source Leakage Current	$V_{DS}=0V$, $V_{GS}=\pm 20V$	---	---	± 100	nA
g_{fs}	Forward Transconductance	$V_{DS}=-5V$, $I_D=-18A$	---	13	---	S
R_G	Gate Resistance	$f=1.0\text{MHz}$	---	14	---	Ω
Q_g	Total Gate Charge (10V)	$V_{DS}=-40V$, $V_{GS}=-10V$, $I_D=-20A$	---	10	---	nC
Q_{gs}	Gate-Source Charge		---	3	---	
Q_{gd}	Gate-Drain Charge		---	3.5	---	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=-40V$, $V_{GS}=-10V$, $I_D=-20A$ $R_L=1\Omega$, $R_{GEN}=3\Omega$	---	20	---	ns
T_r	Rise Time		---	13	---	
$T_{d(off)}$	Turn-Off Delay Time		---	50	---	
T_f	Fall Time		---	5	---	
C_{iss}	Input Capacitance	$V_{DS}=-25V$, $V_{GS}=0V$, $f=1.0\text{MHz}$	---	1000	---	pF
C_{oss}	Output Capacitance		---	110	---	
C_{rss}	Reverse Transfer Capacitance		---	85	---	

Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
I_S	Continuous Source Current		---	---	-23	A
V_{SD}	Diode Forward Voltage	$V_{GS}=0V$, $I_S=-1A$	---	---	-1.1	V
t_{rr}	Reverse Recovery Time	$I_F=-20A$, $di/dt=500A/\mu s$	---	31	---	ns
Q_{rr}	Reverse Recovery Charge		---	10	---	nC

Note:

- The value of $R_{\theta JA}$ is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^{\circ}\text{C}$. The Power dissipation P_{DSM} is based on $R_{\theta JA} \leq 10s$ and the maximum allowed junction temperature of 150°C . The value in any given application depends on the user's specific board design.
- The power dissipation P_D is based on $T_{J(MAX)}=150^{\circ}\text{C}$, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.
- Single pulse width limited by junction temperature $T_{J(MAX)}=150^{\circ}\text{C}$.
- The $R_{\theta JA}$ is the sum of the thermal impedance from junction to case $R_{\theta JC}$ and case to ambient.
- The static characteristics in Figures 1 to 6 are obtained using $<300\mu s$ pulses, duty cycle 0.5% max.
- These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of $T_{J(MAX)}=150^{\circ}\text{C}$. The SOA curve provides a single pulse rating.
- The maximum current rating is package limited.
- These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^{\circ}\text{C}$.
- The maximum current rating is silicon limited

Typical Characteristics

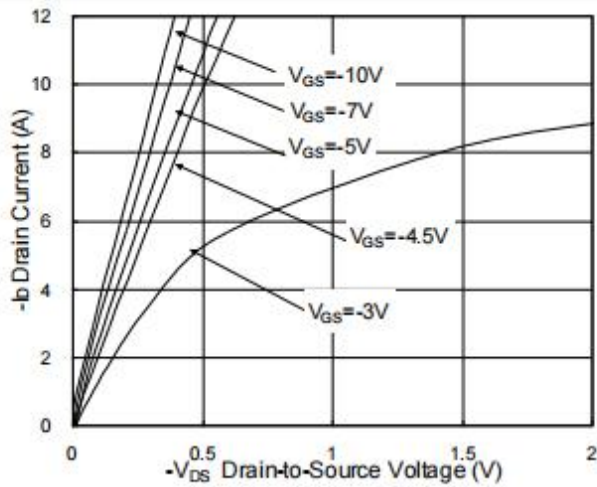


Fig.1 Typical Output Characteristics

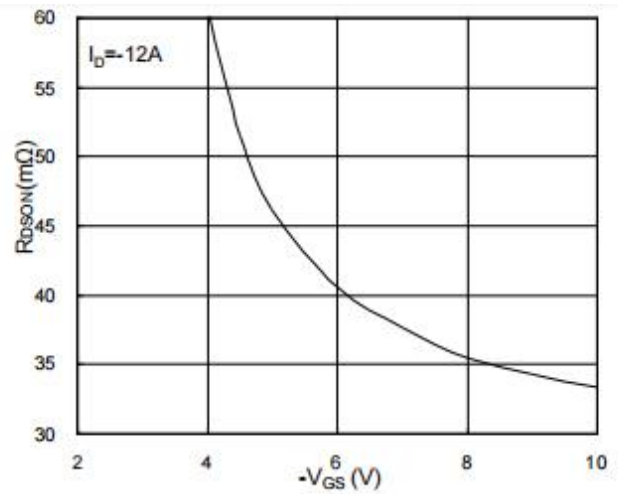


Fig.2 On-Resistance v.s Gate-Source

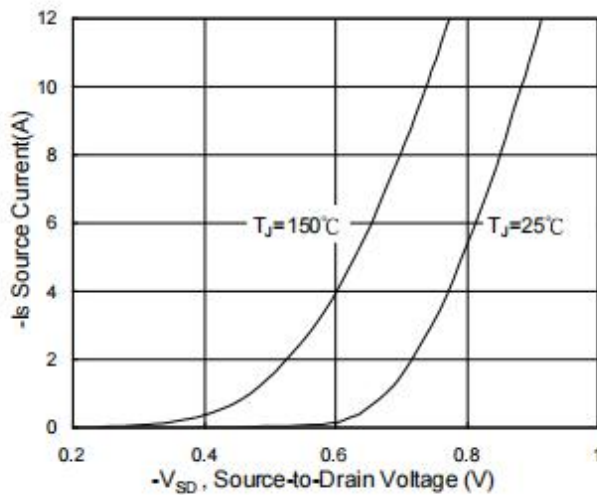


Fig.3 Forward Characteristics of Reverse

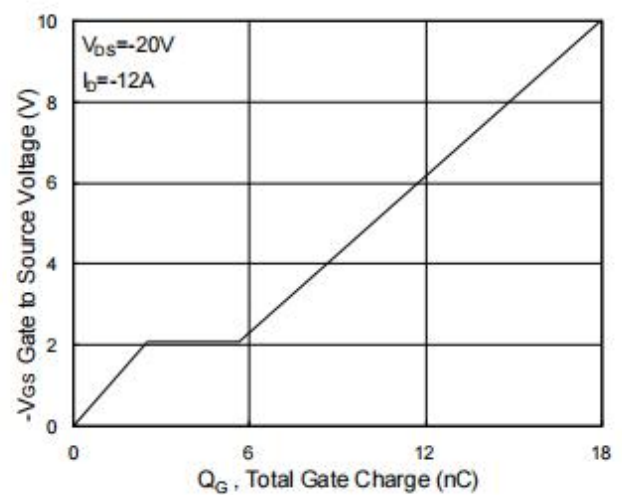


Fig.4 Gate-Charge Characteristics

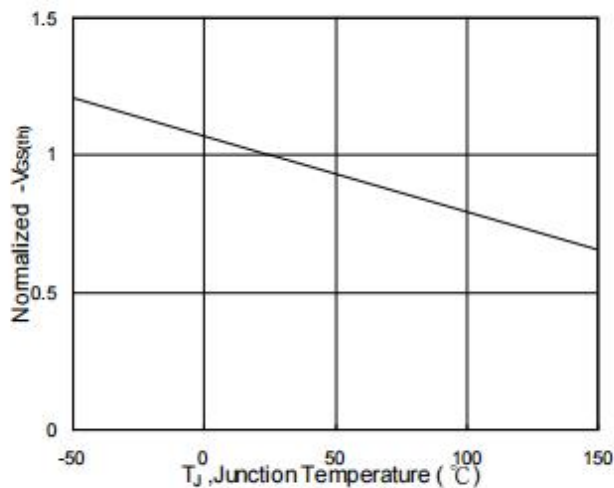


Fig.5 Normalized $V_{GS(th)}$ v.s T_J

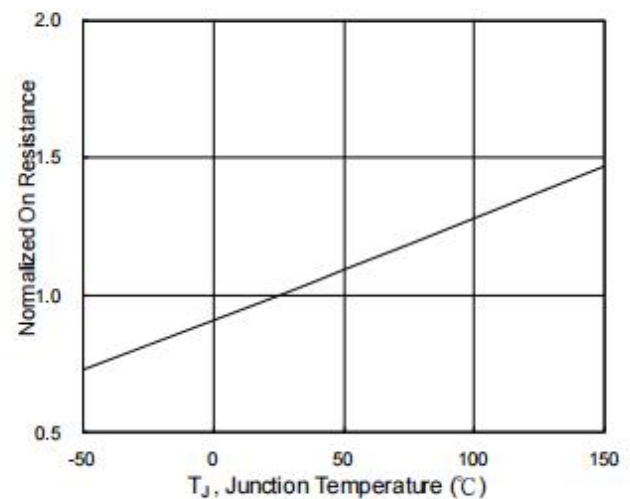


Fig.6 Normalized $R_{DS(on)}$ v.s T_J

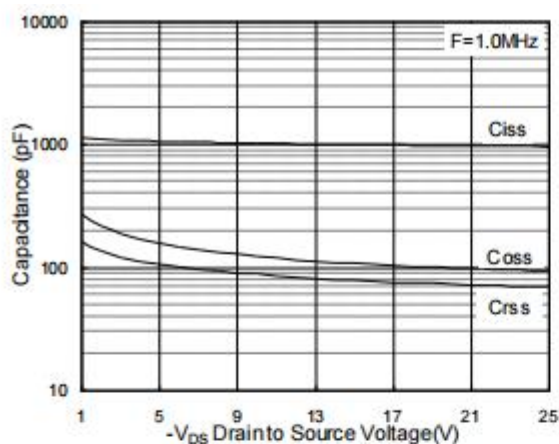


Fig.7 Capacitance

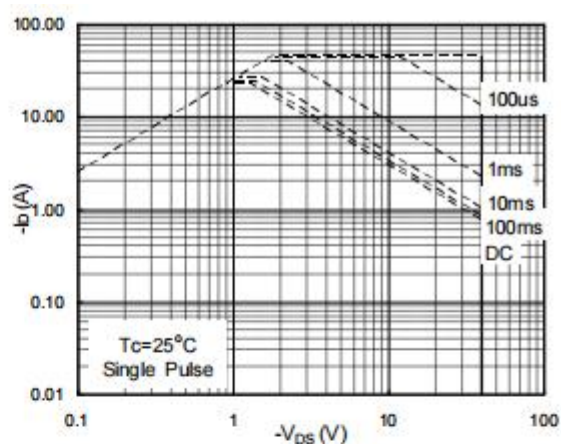


Fig.8 Safe Operating Area

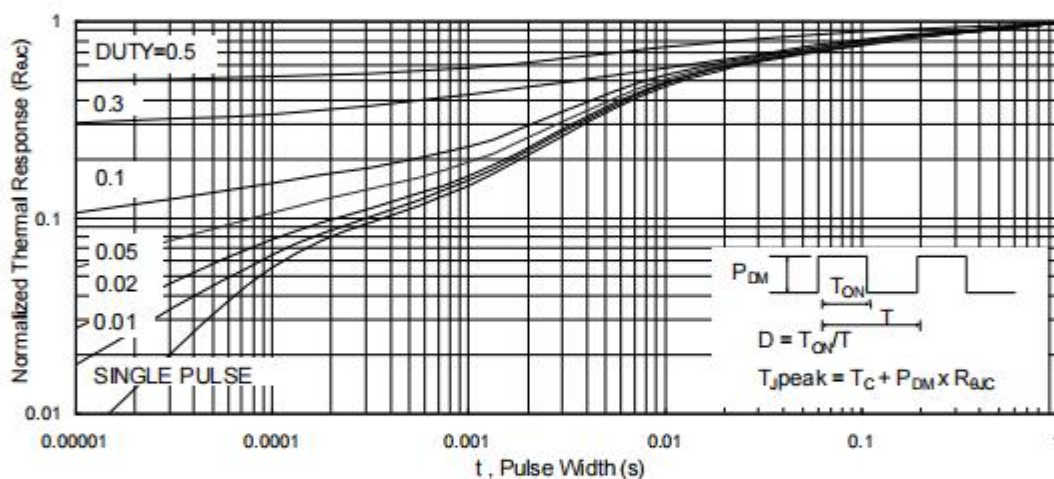


Fig.9 Normalized Maximum Transient Thermal Impedance

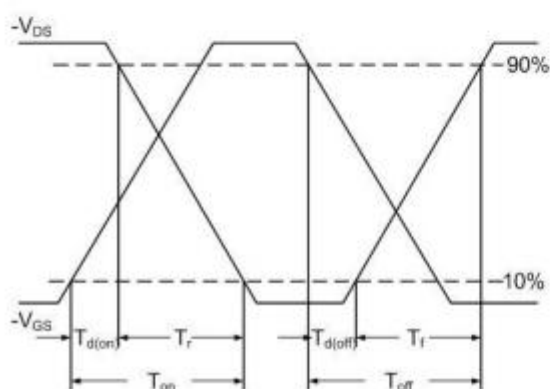


Fig.10 Switching Time Waveform

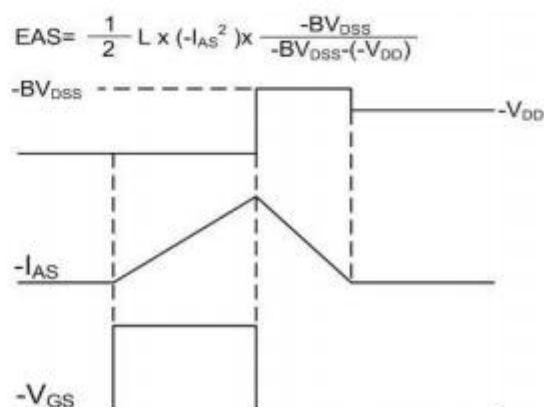
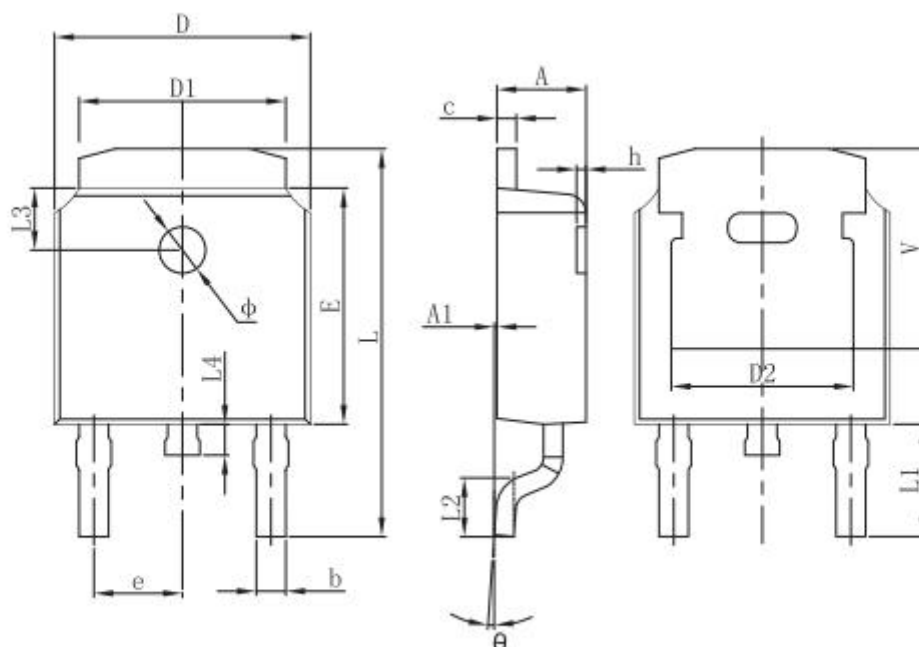


Fig.11 Unclamped Inductive Waveform

Packaging information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
b	0.635	0.770	0.025	0.030
c	0.460	0.580	0.018	0.023
D	6.500	6.700	0.256	0.264
D1	5.100	5.460	0.201	0.215
D2	4.830 REF.		0.190 REF.	
E	6.000	6.200	0.236	0.244
e	2.186	2.386	0.086	0.094
L	9.712	10.312	0.382	0.406
L1	2.900 REF.		0.114 REF.	
L2	1.400	1.700	0.055	0.067
L3	1.600 REF.		0.063 REF.	
L4	0.600	1.000	0.024	0.039
Φ	1.100	1.300	0.043	0.051
θ	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.250 REF.		0.207 REF.	

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