

## General Description

The WSF40N04 is the highest performance trench N-Channel MOSFETs with extreme high cell density, which provide excellent  $R_{DS(ON)}$  and gate charge for most of the synchronous buck converter applications.

The WSF40N04 meet the RoHS and Green Product requirement 100%  $E_{AS}$  guaranteed with full function reliability approved.

## Features

- Reliable and Rugged
- Lead Free and Green Devices Available (RoHS Compliant)

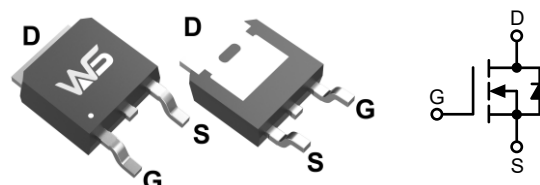
## Product Summary

$BV_{DSS}$	$R_{DS(ON)}$	$I_D$
40V	13mΩ	40A

## Applications

- Power Management in Desktop Computer or DC/DC Converters.

## 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	$\pm 20$	
$I_S$	Diode Continuous Forward Current	$T_C=25^{\circ}\text{C}$	A
$I_D$	Continuous Drain Current	$T_C=25^{\circ}\text{C}$	
		$T_C=100^{\circ}\text{C}$	
$I_{DM}^1$	Pulsed Drain Current	$T_C=25^{\circ}\text{C}$	120
$P_D$	Maximum Power Dissipation	$T_C=25^{\circ}\text{C}$	41.7
		$T_C=100^{\circ}\text{C}$	16.7
$R_{\theta JC}$	Thermal Resistance-Junction to Case	Steady State	3
$I_D$	Continuous Drain Current	$T_A=25^{\circ}\text{C}$	12.7
		$T_A=70^{\circ}\text{C}$	10.2
$P_D$	Maximum Power Dissipation	$T_A=25^{\circ}\text{C}$	2.8
		$T_A=70^{\circ}\text{C}$	1.8
$R_{\theta JA}$	Thermal Resistance-Junction to Ambient	$t \leq 10s$	20
		Steady State	45
$I_{AS}^2$	Avalanche Current, Single pulse	$L=0.1mH$	35
$E_{AS}^2$	Avalanche Energy, Single pulse	$L=0.1mH$	61
$T_{STG}$	Storage Temperature Range	-55 to 150	$^{\circ}\text{C}$
$T_J$	Maximum Junction Temperature	150	

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

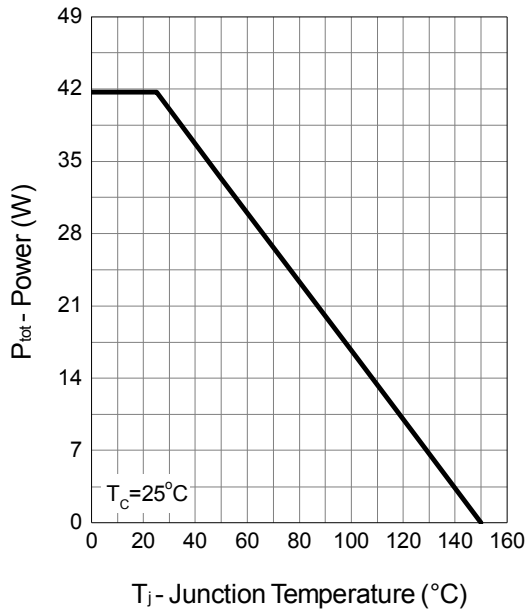
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
Static Characteristics						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V , I <sub>DS</sub> =250μA	40	---	---	V
R <sub>DS(ON)</sub> <sup>3</sup>	Drain-Source On-state Resistance	V <sub>GS</sub> =10V , I <sub>DS</sub> =30A	---	13	17	mΩ
		T <sub>J</sub> =125°C	---	17.2	---	
		V <sub>GS</sub> =4.5V , I <sub>DS</sub> =15A	---	17	21.5	
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>DS</sub> =250μA	1.5	1.8	2.5	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =32V , V <sub>GS</sub> =0V	---	---	1.0	μA
		T <sub>J</sub> =85°C	---	---	30	
I <sub>GSS</sub>	Gate 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>DS</sub> =15A	---	30	---	S
Gate Charge Characteristics						
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =20V , V <sub>GS</sub> =4.5V , I <sub>DS</sub> =30A	---	9.4	11.2	nC
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =20V , V <sub>GS</sub> =10V , I <sub>DS</sub> =30A	---	20	24	
Q <sub>gth</sub>	Threshold Gate Charge		---	1.4	---	
Q <sub>gs</sub>	Gate-Source Charge		---	3.1	---	
Q <sub>gd</sub>	Gate-Drain Charge		---	5.0	---	
Dynamic Characteristics						
R <sub>G</sub>	Gate Resistance	V <sub>GS</sub> =0V , V <sub>DS</sub> =0V , F=1.0MHz	0.7	1.1	1.8	Ω
T <sub>d(ON)</sub>	Turn-On Delay Time	V <sub>DD</sub> =20V , R <sub>L</sub> =20Ω , I <sub>DS</sub> =1A , V <sub>GEN</sub> =10V , R <sub>G</sub> =1Ω	---	12.8	---	ns
T <sub>r</sub>	Turn-On Rise Time		---	10.4	---	
T <sub>d(OFF)</sub>	Turn-Off Delay Time		---	24	---	
T <sub>f</sub>	Turn-Off Fall Time		---	5.6	---	
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V , V <sub>DS</sub> =20V , Frequency = 1.0MHz	---	1120	---	pF
C <sub>oss</sub>	Output Capacitance		---	132	---	
C <sub>rss</sub>	Reverse Transfer Capacitance		---	75	---	
Diode Characteristics						
V <sub>SD</sub> <sup>3</sup>	Diode Forward Voltage	I <sub>SD</sub> =10A , V <sub>GS</sub> =0V	---	0.9	1.1	V
t <sub>rr</sub>	Reverse Recovery Time	I <sub>SD</sub> =10A , dl <sub>SD</sub> /dt=100A/μs	---	13.8	---	ns
t <sub>a</sub>	Charge Time		---	9.8	---	
t <sub>b</sub>	Discharge Time		---	4.0	---	
Q <sub>rr</sub>	Reverse Recovery Charge			---	8.0	---

Note:

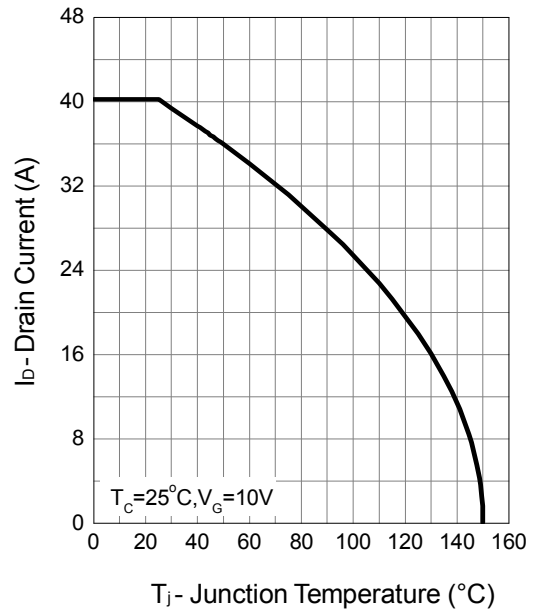
1. Max. current is limited by bonding wire.
2. UIS tested and pulse width limited by maximum junction temperature  $150^{\circ}\text{C}$  (initial temperature  $T_J=25^{\circ}\text{C}$ ).
3. Pulse test ; pulse widths $\leq 300\text{ms}$ , duty cycle $\leq 2\%$ .

## Typical Characteristics

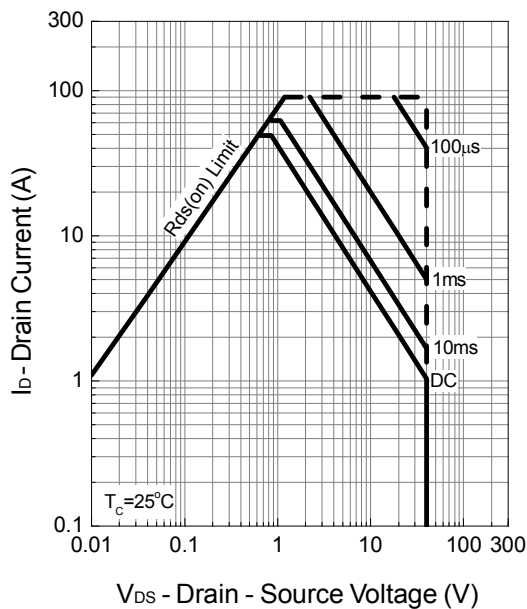
**Power Dissipation**



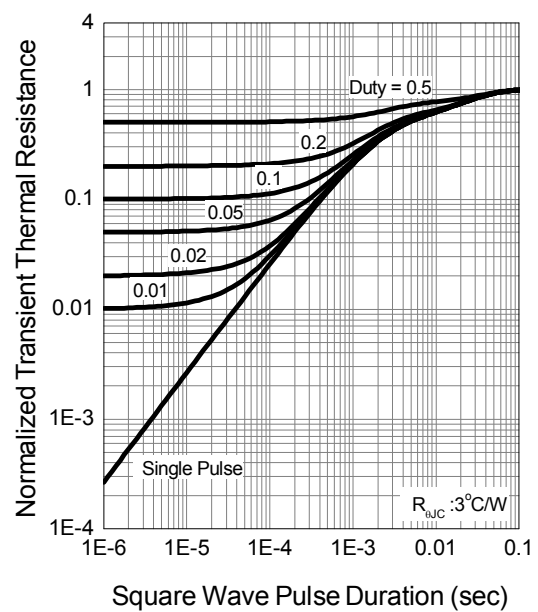
**Drain Current**

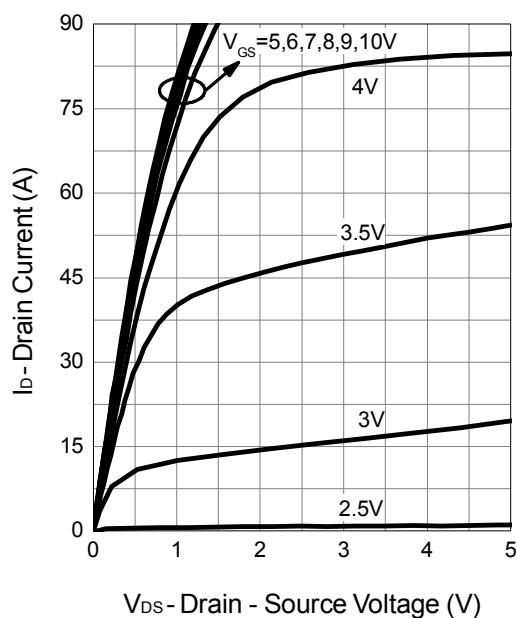
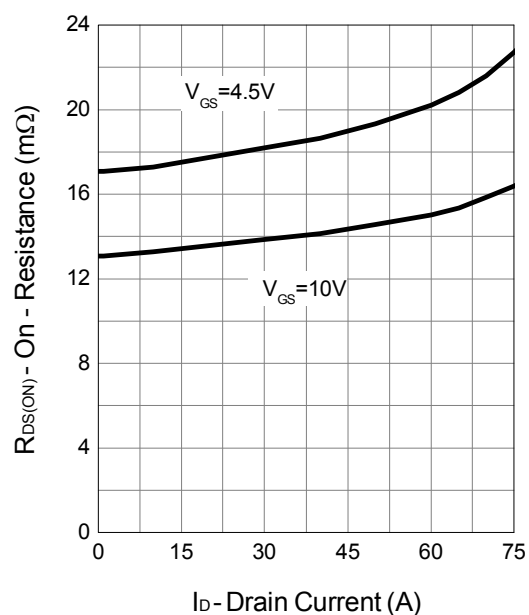
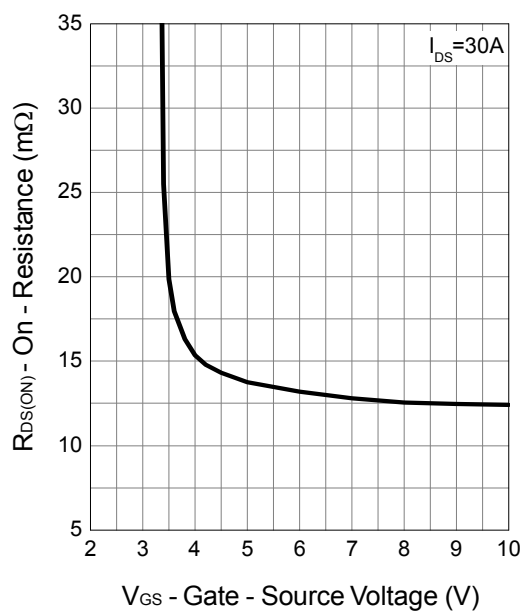
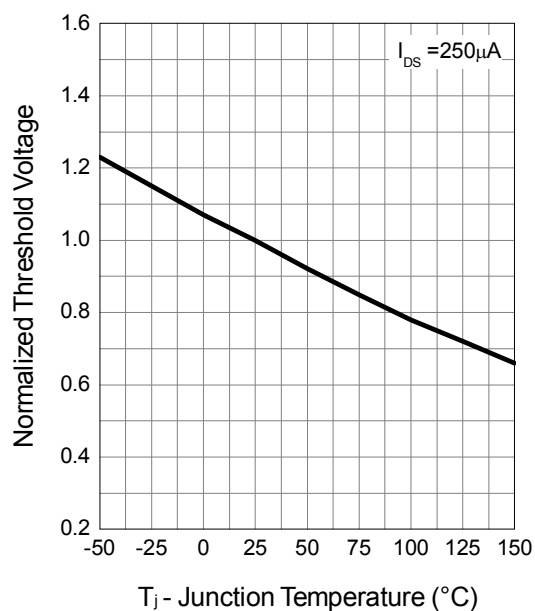


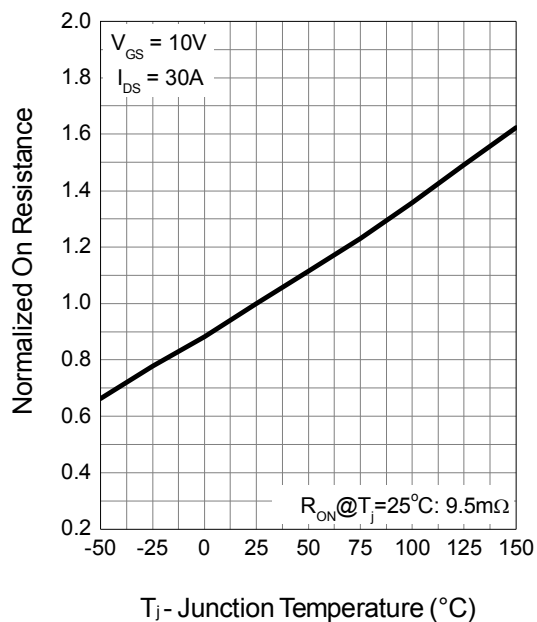
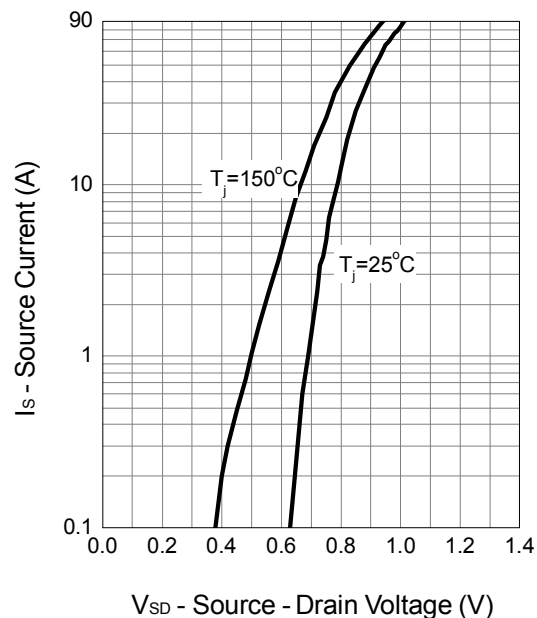
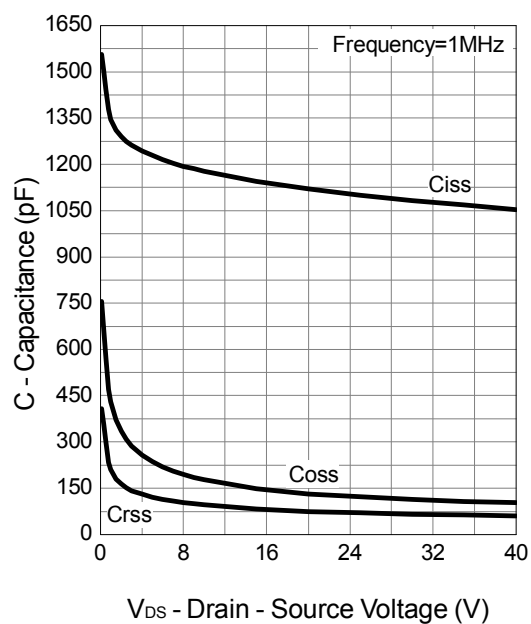
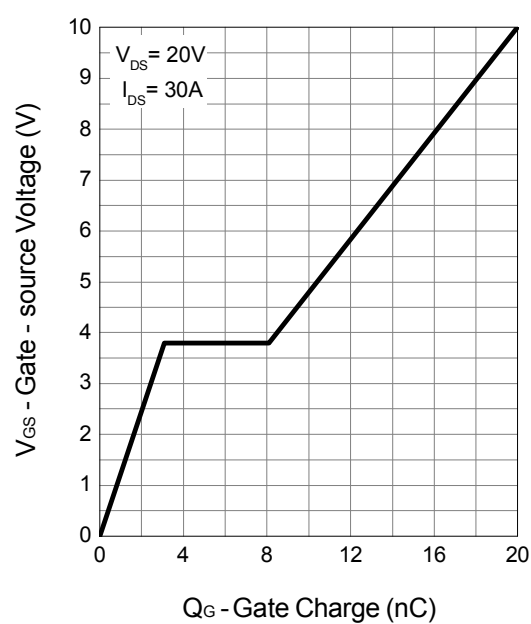
**Safe Operation Area**



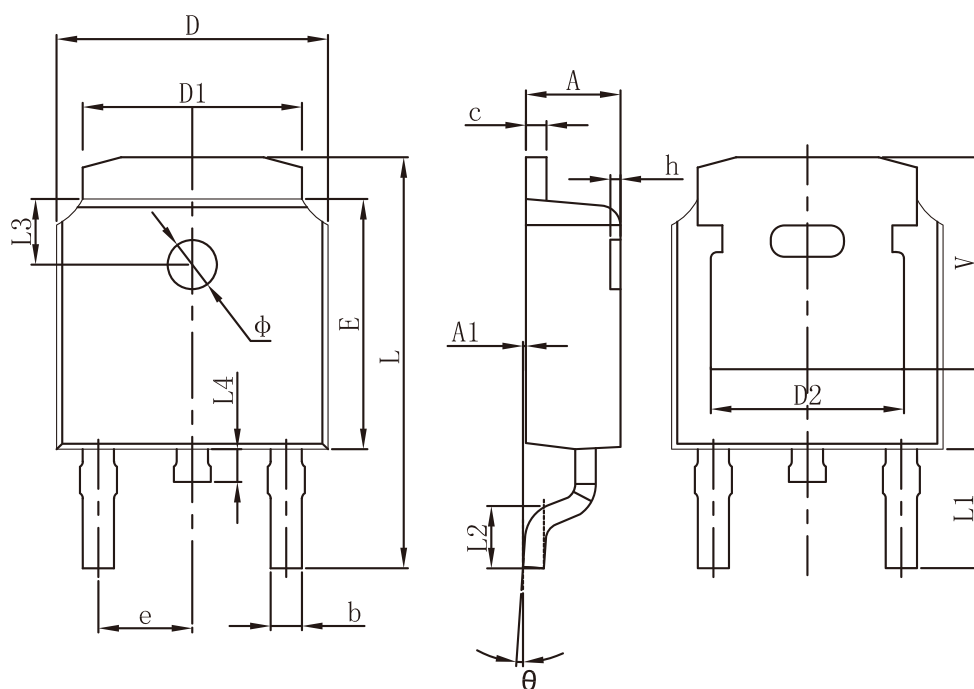
**Thermal Transient Impedance**



**Typical Characteristics (Cont.)**
**Output Characteristics**

**Drain-Source On Resistance**

**Gate-Source On Resistance**

**Gate Threshold Voltage**


**Typical Characteristics (Cont.)**
**Drain-Source On Resistance**

**Source-Drain Diode Forward**

**Capacitance**

**Gate Charge**


## Packaging information



SYMBOL	MILLIMETERS		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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