

General Description

The WSD20L70DN33 is the highest performance trench P-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 WSD20L70DN33 meet the RoHS and Green Product requirement 100% E_{AS} guaranteed with full function reliability approved.

Features

- Advanced high cell density Trench technology
- Super Low Gate Charge
- Excellent CdV/dt effect decline
- 100% E_{AS} Guaranteed
- Green Device Available

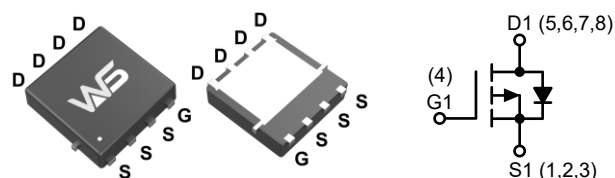
Product Summary

BV_{DSS}	$R_{DS(ON)}$	I_D
-20V	6.7m Ω	-70A

Applications

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

DFN3X3-8L Pin Configuration



Absolute Maximum Ratings

Symbol	Parameter	Rating		Units
		10s	Steady State	
V_{DS}	Drain-Source Voltage	-20		V
V_{GS}	Gate-Source Voltage	± 8		
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ -10V$ ¹	-70		A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ -10V$ ¹	-45		
$I_D @ T_A = 25^\circ C$	Continuous Drain Current, $V_{GS} @ -10V$ ¹	-36	-30	
$I_D @ T_A = 70^\circ C$	Continuous Drain Current, $V_{GS} @ -10V$ ¹	-28	-23	
I_{DM}	Pulsed Drain Current ²	-200		
E_{AS}	Single Pulse Avalanche Energy ³	180		mJ
I_{AS}	Avalanche Current	-60		A
$P_D @ T_C = 25^\circ C$	Total Power Dissipation ⁴	83		W
$P_D @ T_A = 25^\circ C$	Total Power Dissipation ⁴	5.2	4.0	
T_{STG}	Storage Temperature Range	-55 to 150		$^\circ C$
T_J	Operating Junction Temperature Range	-55 to 150		

Thermal Data

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient ¹	---	55	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient ¹ ($t \leq 10s$)	---	20	
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case ¹	---	1.5	

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0\text{V}$, $I_D=-250\mu\text{A}$	-20	---	---	V
$\Delta BV_{DSS}/\Delta T_J$	BV_{DSS} Temperature Coefficient	Reference to 25°C , $I_D=-1\text{mA}$	---	-0.0232	---	V/ $^{\circ}\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance ²	$V_{GS}=-4.5\text{V}$, $I_D=-16\text{A}$	---	6.7	7.9	m Ω
		$V_{GS}=-2.5\text{V}$, $I_D=-12\text{A}$	---	8.4	9.8	
		$V_{GS}=-1.8\text{V}$, $I_D=-9\text{A}$	---	10.3	12.2	
		$V_{GS}=-1.5\text{V}$, $I_D=-8\text{A}$	---	12.3	15.5	
		$V_{GS}=-1.2\text{V}$, $I_D=-5\text{A}$	---	17.6	19.5	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}$, $I_D=-250\mu\text{A}$	-0.2	-0.6	-0.9	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	4.6	---	mV/ $^{\circ}\text{C}$
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=-20\text{V}$, $V_{GS}=0\text{V}$, $T_J=25^{\circ}\text{C}$	---	---	-1.0	μA
		$V_{DS}=-20\text{V}$, $V_{GS}=0\text{V}$, $T_J=55^{\circ}\text{C}$	---	---	-5.0	
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=\pm 8\text{V}$, $V_{DS}=0\text{V}$	---	---	± 100	nA
g_{fs}	Forward Transconductance	$V_{DS}=-5\text{V}$, $I_D=-20\text{A}$	---	110	---	S
R_g	Gate Resistance	$V_{DS}=0\text{V}$, $V_{GS}=0\text{V}$, $f = 1.0\text{MHz}$	---	3	---	Ω
Q_g	Total Gate Charge (-4.5V)	$V_{DS}=-10\text{V}$, $V_{GS}=-4.5\text{V}$, $I_D=-16\text{A}$	---	70	100	nC
Q_{gs}	Gate-Source Charge		---	9.2	---	
Q_{gd}	Gate-Drain Charge		---	18.4	---	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=-10\text{V}$, $V_{GS}=-4.5\text{V}$, $R_G=3\Omega$, $I_D=-1\text{A}$, $R_L=0.5\Omega$	---	18	---	ns
T_r	Rise Time		---	52	---	
$T_{d(off)}$	Turn-Off Delay Time		---	285	---	
T_f	Fall Time		---	123	---	
C_{iss}	Input Capacitance	$V_{DS}=-15\text{V}$, $V_{GS}=0\text{V}$, $f = 1.0\text{MHz}$	---	5625	---	pF
C_{oss}	Output Capacitance		---	927	---	
C_{rss}	Reverse Transfer Capacitance		---	716	---	

Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
I_S	Continuous Source Current ^{1,6}	$V_G=V_D=0\text{V}$, Force Current	---	---	-10	A
I_{SM}	Pulsed Source Current ^{2,6}		---	---	-100	
V_{SD}	Diode Forward Voltage ²	$V_{GS}=0\text{V}$, $I_S=-1\text{A}$, $T_J=25^{\circ}\text{C}$	---	---	-1.0	V
t_{rr}	Reverse Recovery Time	$I_F=-16\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$, $T_J=25^{\circ}\text{C}$	---	78	---	ns
Q_{rr}	Reverse Recovery Charge		---	495	---	nC

Note:

1. The data tested by surface mounted on a 1 inch² FR-4 board with 20Z copper, $t \leq 10\text{sec}$.
2. The data tested by pulsed, pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$
3. The E_{AS} data shows Max. rating. The test condition is $V_{DD}=-10\text{V}$, $V_{GS}=-10\text{V}$, $L=0.1\text{mH}$, $I_{AS}=-60\text{A}$
4. The power dissipation is limited by 150°C junction temperature.
5. The Min. value is 100% E_{AS} 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

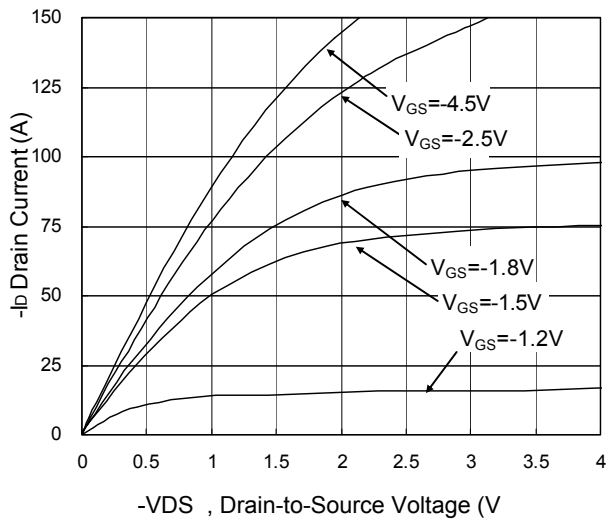


Fig.1 Typical Output Characteristics

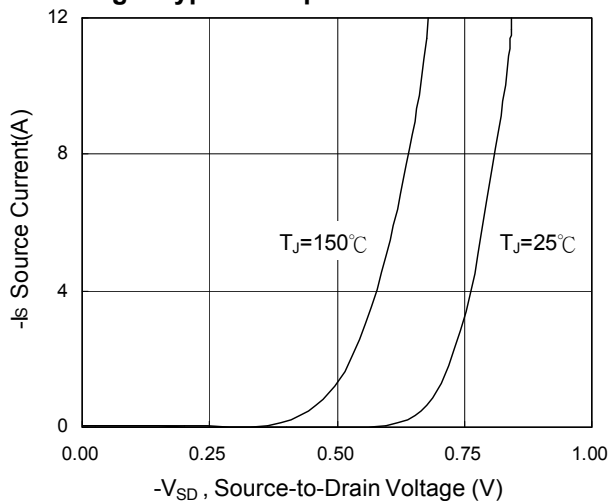


Fig.3 Forward Characteristics of Reverse

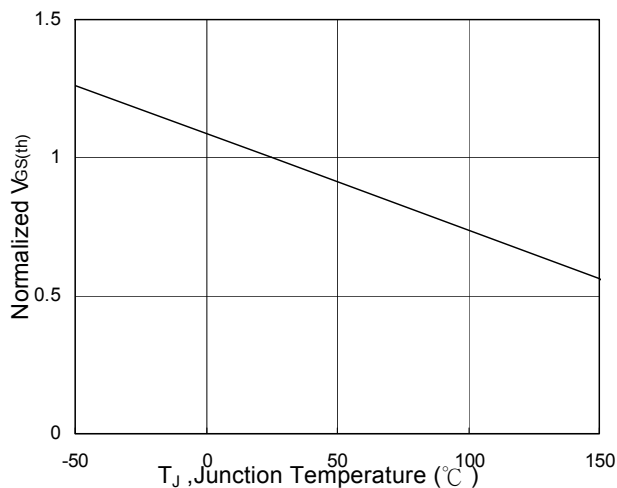


Fig.5 Normalized $V_{GS(th)}$ vs. T_J

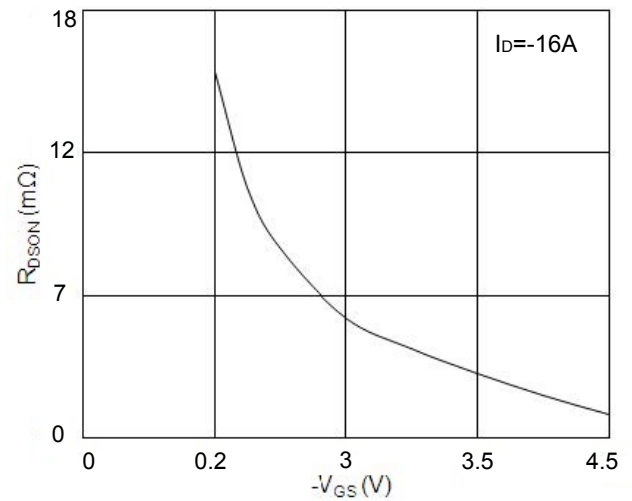


Fig.2 On-Resistance vs. G-S Voltage

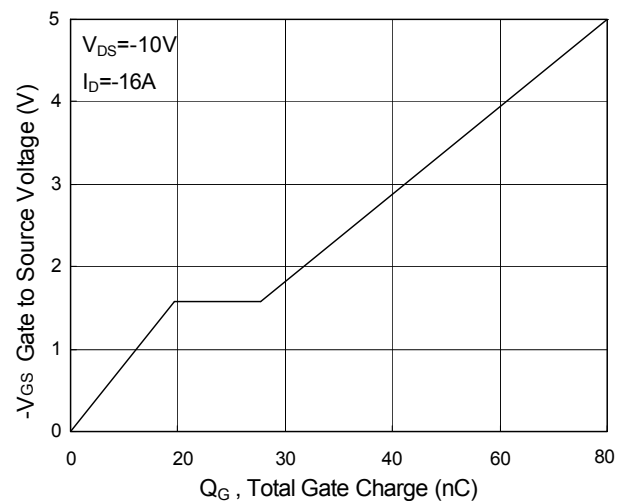


Fig.4 Gate-Charge Characteristics

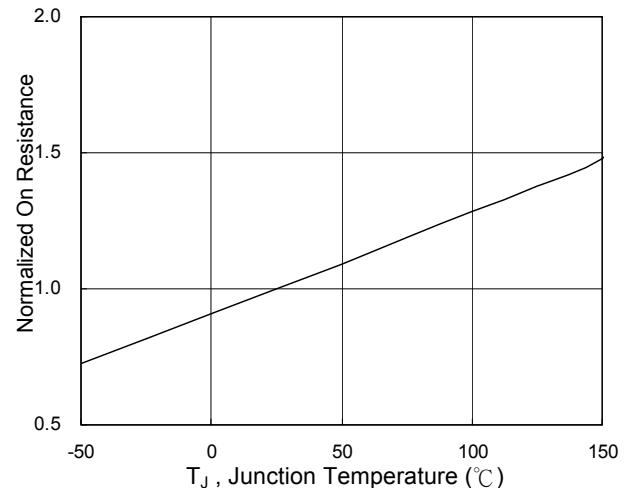
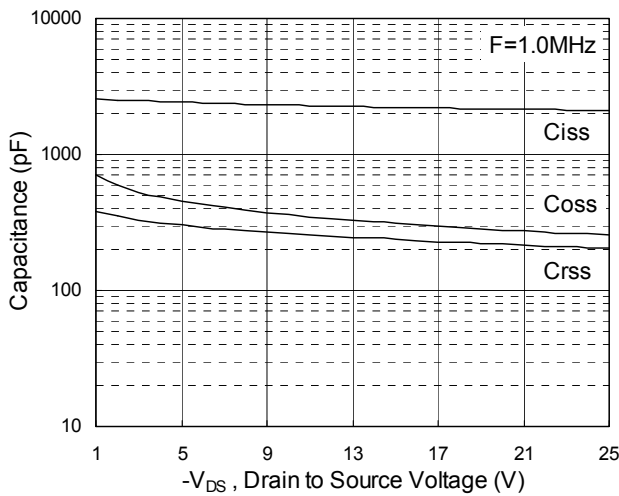
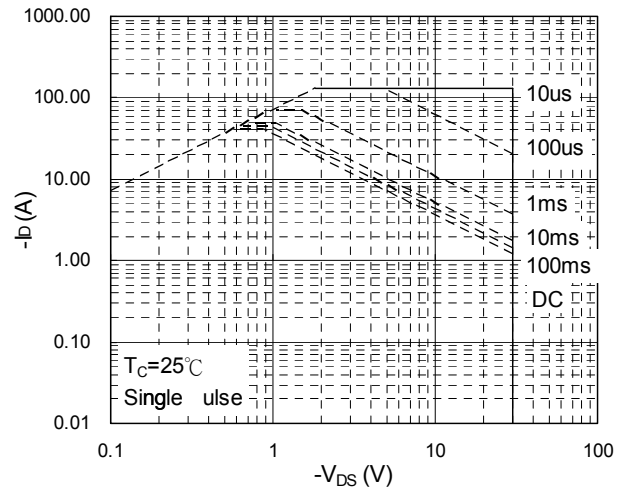
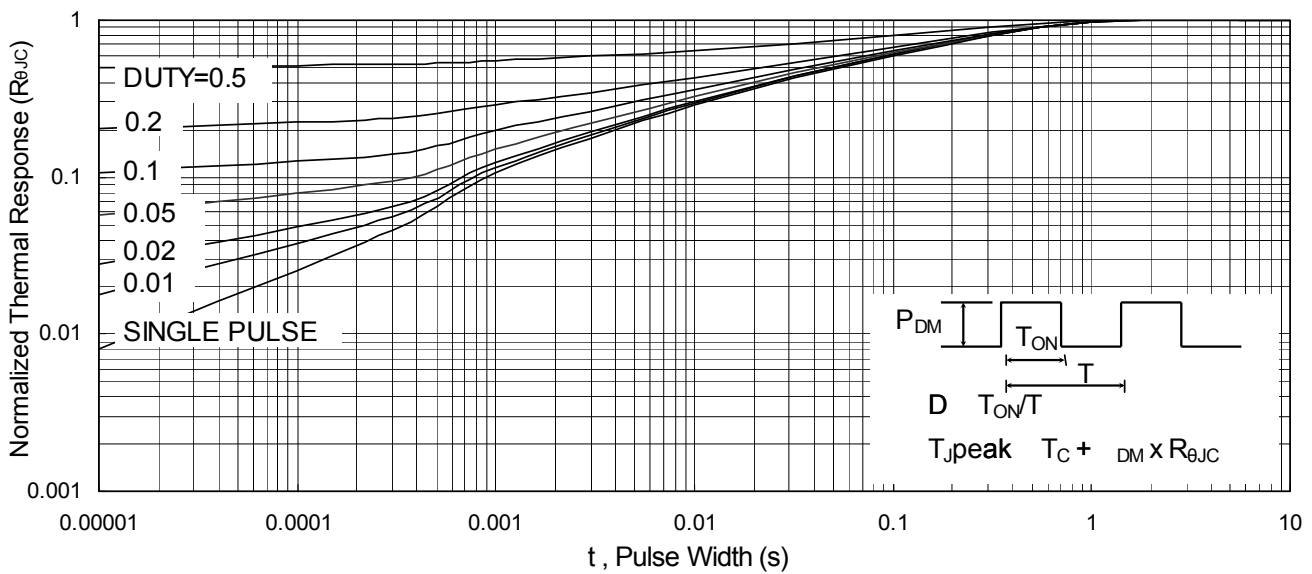
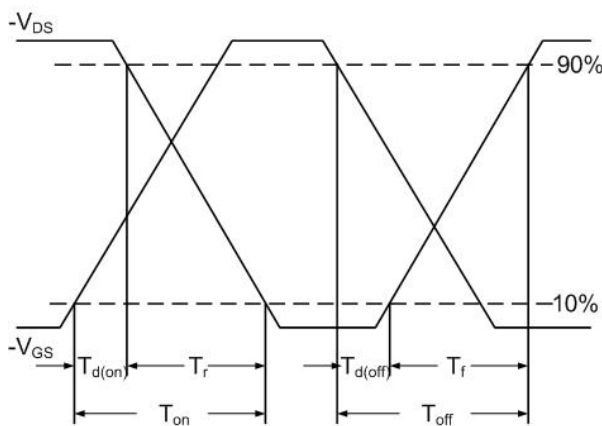
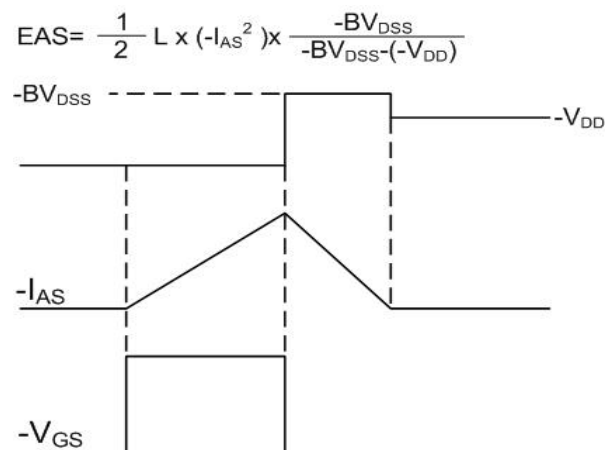
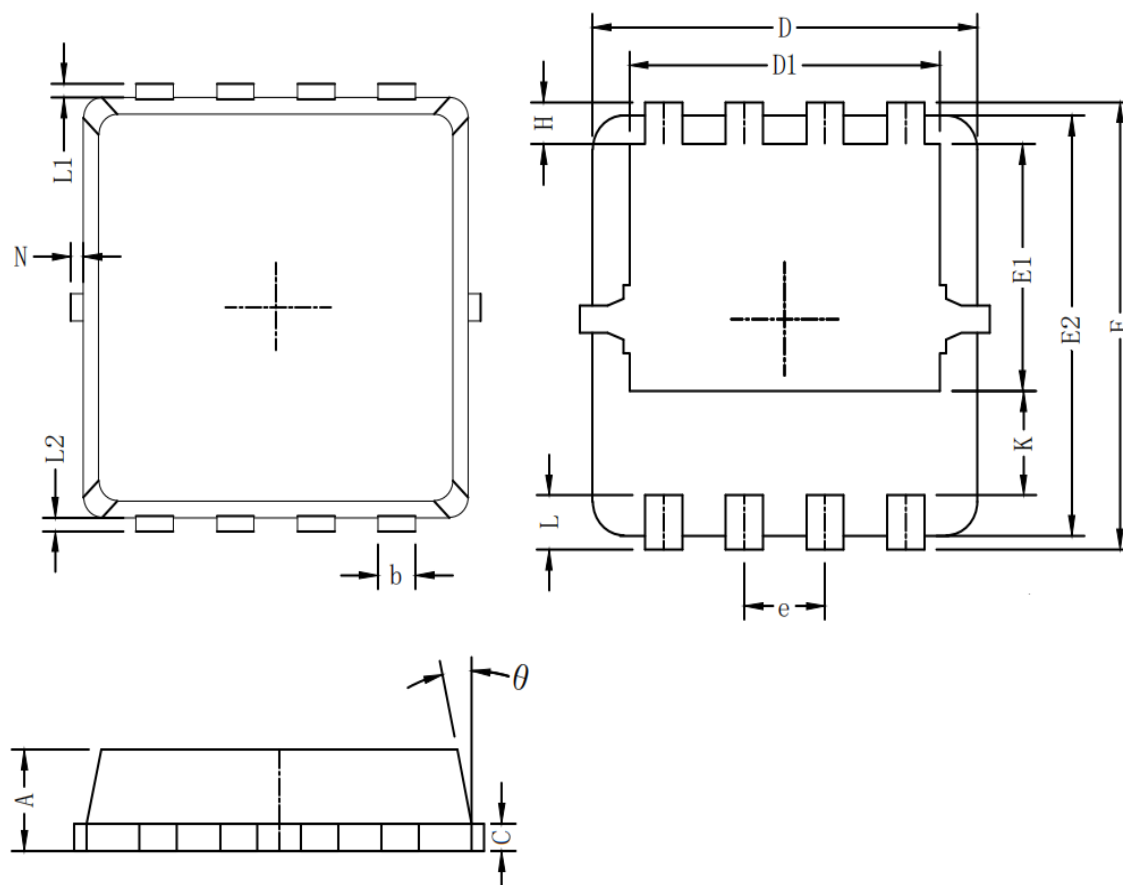


Fig.6 Normalized $R_{DS(on)}$ vs. T_J

Typical Characteristics (Cont.)

Fig.7 Capacitance

Fig.8 Safe Operating Area

Fig.9 Normalized Maximum Transient Thermal Impedance

Fig.10 Switching Time Waveform

Fig.11 Unclamped Inductive Switching Waveform

Packaging information



Symbol	Dim in mm		
	min	typ	max
A	0.6	0.75	0.9
b	0.2	0.3	0.4
C	0.15	0.2	0.25
D	3	3.1	3.2
D1	2.3	2.45	2.6
E	3.15	3.3	3.45
E1	1.43	1.73	1.93
E2	2.9	3.05	3.2
e	0.65BSC		
H	0.2	0.35	0.5
K	0.57	0.77	0.87
L	0.3	0.4	0.5
L1/L2	0.1REF		
θ	8°	10°	13°
N	0		0.15

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