

## General Description

The WSD20L120DN56 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 WSD20L120DN56 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

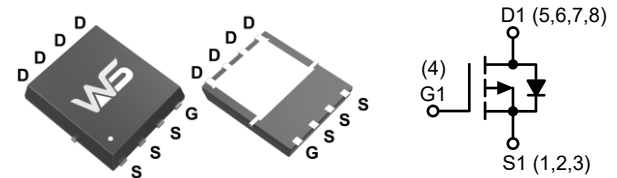
## Product Summary

$BV_{DSS}$	$R_{DS(ON)}$	$I_D$
-20V	2.1m $\Omega$	-120A

## Applications

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

## DFN5X6-8L Pin Configuration



## Absolute Maximum Ratings

Symbol	Parameter	Rating		Units
		10s	Steady State	
$V_{DS}$	Drain-Source Voltage	-20		V
$V_{GS}$	Gate-Source Voltage	$\pm 10$		
$I_D@T_C=25^\circ C$	Continuous Drain Current, $V_{GS} @ -10V$ <sup>1</sup>	-120		A
$I_D@T_C=100^\circ C$	Continuous Drain Current, $V_{GS} @ -10V$ <sup>1</sup>	-69.5		
$I_D@T_A=25^\circ C$	Continuous Drain Current, $V_{GS} @ -10V$ <sup>1</sup>	-25	-22	
$I_D@T_A=70^\circ C$	Continuous Drain Current, $V_{GS} @ -10V$ <sup>1</sup>	-24	-18	
$I_{DM}$	Pulsed Drain Current <sup>2</sup>	-340		
$E_{AS}$	Single Pulse Avalanche Energy <sup>3</sup>	300		mJ
$I_{AS}$	Avalanche Current	-36		A
$P_D@T_C=25^\circ C$	Total Power Dissipation <sup>4</sup>	130		W
$P_D@T_A=25^\circ C$	Total Power Dissipation <sup>4</sup>	6.8	6.25	
$T_{STG}$	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 <sup>1</sup>	---	54	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient <sup>1</sup> ( $t \leq 10s$ )	---	18	
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case <sup>1</sup>	---	1.6	

**Electrical Characteristics (T<sub>J</sub>=25°C, Unless Otherwise Noted)**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =-250μA	-20	---	---	V
ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	BV <sub>DSS</sub> Temperature Coefficient	Reference to 25°C, I <sub>D</sub> =-1mA	---	-0.0212	---	V/°C
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance <sup>2</sup>	V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-20A	---	2.1	2.7	mΩ
		V <sub>GS</sub> =-2.5V, I <sub>D</sub> =-20A	---	2.8	3.7	
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =-250μA	-0.4	-0.6	-1.0	V
ΔV <sub>GS(th)</sub>	V <sub>GS(th)</sub> Temperature Coefficient		---	4.8	---	mV/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =-20V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C	---	---	-1.0	μA
		V <sub>DS</sub> =-20V, V <sub>GS</sub> =0V, T <sub>J</sub> =55°C	---	---	-6.0	
I <sub>GSS</sub>	Gate-Body Leakage Current	V <sub>GS</sub> =±10V, V <sub>DS</sub> =0V	---	---	±100	nA
g <sub>fs</sub>	Forward Transconductance	V <sub>DS</sub> =-5V, I <sub>D</sub> =-20A	---	100	---	S
R <sub>g</sub>	Gate Resistance	V <sub>DS</sub> =0V, V <sub>GS</sub> =0V, f = 1.0MHz	---	2.0	5.0	Ω
Q <sub>g</sub>	Total Gate Charge(-4.5)	V <sub>DS</sub> =-10V, V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-20A	---	100	---	nC
Q <sub>gs</sub>	Gate-Source Charge		---	21	---	
Q <sub>gd</sub>	Gate-Drain Charge		---	32	---	
T <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> =-10V, V <sub>GEN</sub> =-4.5V, R <sub>G</sub> =3Ω, I <sub>D</sub> =-1A, R <sub>L</sub> =0.5Ω	---	20	---	ns
T <sub>r</sub>	Rise Time		---	50	---	
T <sub>d(off)</sub>	Turn-Off Delay Time		---	100	---	
T <sub>f</sub>	Fall Time		---	40	---	
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =-10V, V <sub>GS</sub> =0V, f = 1.0MHz	---	4950	---	pF
C <sub>oss</sub>	Output Capacitance		---	380	---	
C <sub>rss</sub>	Reverse Transfer Capacitance		---	290	---	

**Guaranteed Avalanche Characteristics**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
E <sub>AS</sub>	Single Pulse Avalanche Energy <sup>5</sup>	V <sub>DD</sub> =-25V, L=0.5mH, I <sub>AS</sub> =-36A	300	---	---	mJ

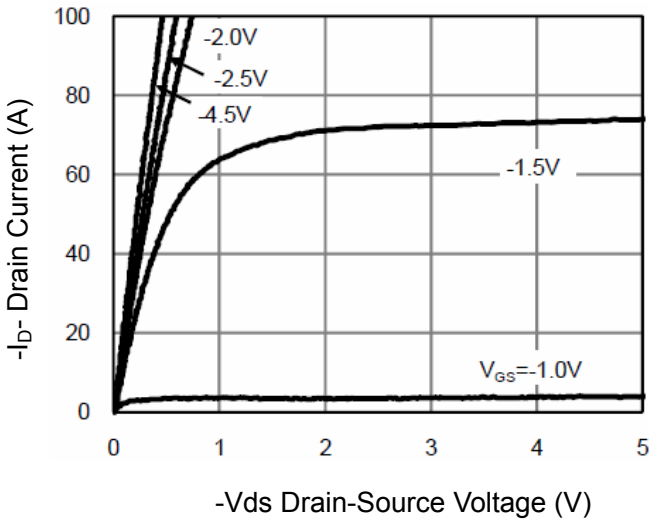
**Diode Characteristics**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
I <sub>S</sub>	Continuous Source Current <sup>1,6</sup>	V <sub>G</sub> =V <sub>D</sub> =0V, Force Current	---	---	-70	A
I <sub>SM</sub>	Pulsed Source Current <sup>2,6</sup>		---	---	-280	
V <sub>SD</sub>	Diode Forward Voltage <sup>2</sup>	V <sub>GS</sub> =0V, I <sub>S</sub> =-1A, T <sub>J</sub> =25°C	---	---	-1.2	V
t <sub>rr</sub>	Reverse Recovery Time	I <sub>F</sub> =-15A, dI/dt=100A/μs, T <sub>J</sub> =25°C	---	48	---	ns
Q <sub>rr</sub>	Reverse Recovery Charge		---	55	---	nC

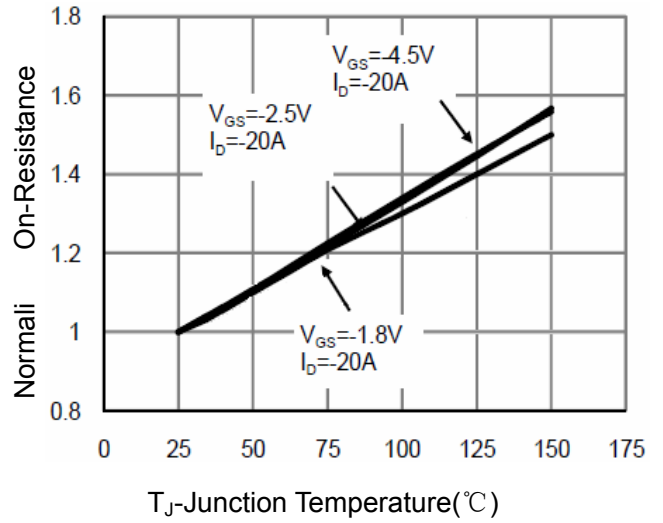
**Note:**

- The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 20Z copper, t<sub>s</sub>≤10sec.
- The data tested by pulsed, pulse width ≤ 300μs, duty cycle ≤ 2%
- The E<sub>AS</sub> data shows Max. rating. The test condition is V<sub>DD</sub>=-25V, V<sub>GS</sub>=-10V, L=0.5mH, I<sub>AS</sub>=-36A
- The power dissipation is limited by 150°C junction temperature.
- The Min. value is 100% E<sub>AS</sub> tested guarantee.
- The data is theoretically the same as I<sub>D</sub> and I<sub>DM</sub>, in real applications, should be limited by total power dissipation.

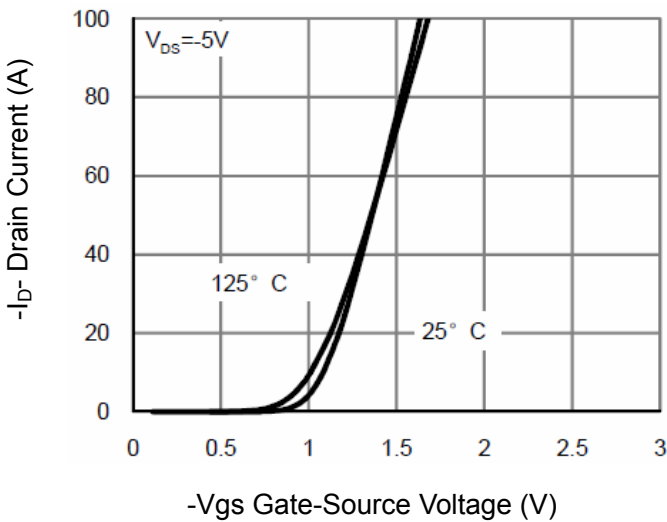
**Typical Characteristics**



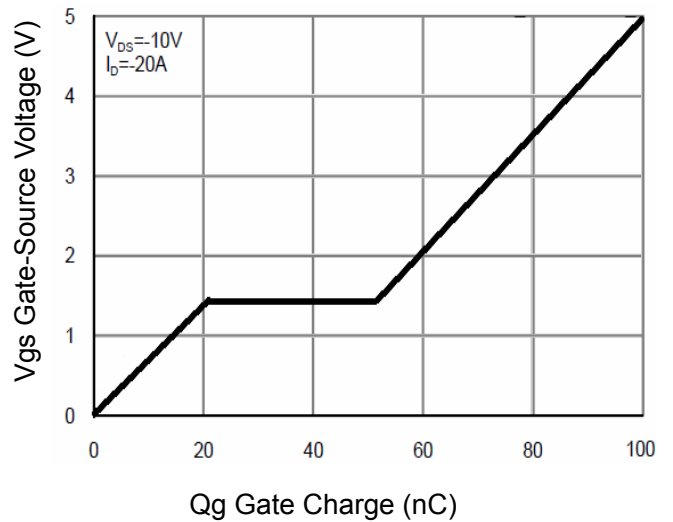
**Figure 1 Output Characteristics**



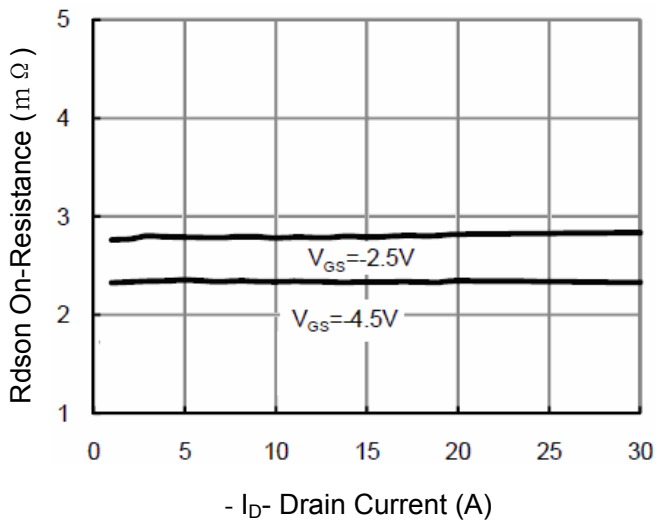
**Figure 4 Rdson-Junction Temperature**



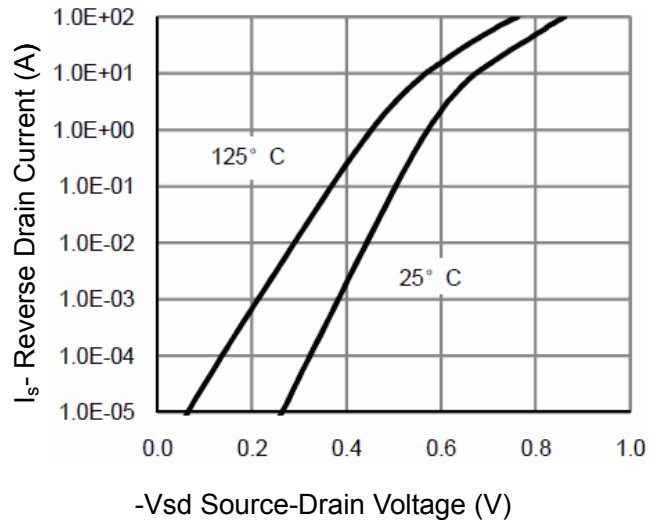
**Figure 2 Transfer Characteristics**



**Figure 5 Gate Charge**

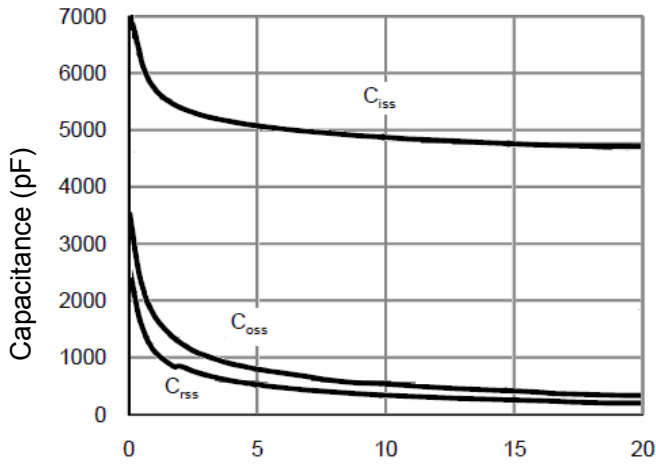


**Figure 3 Rdson- Drain Current**

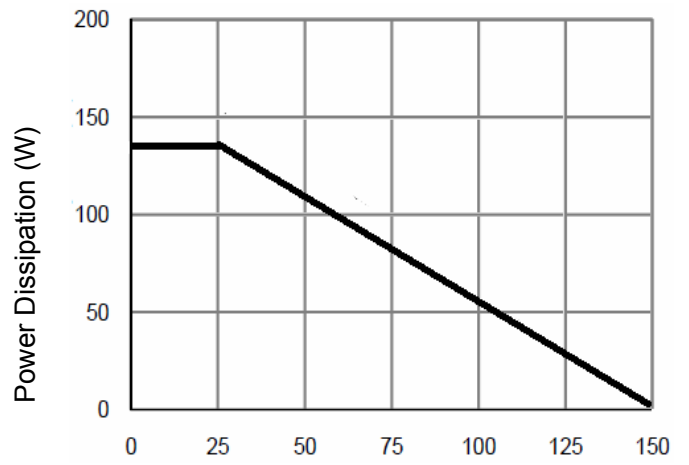


**Figure 6 Source- Drain Diode Forward**

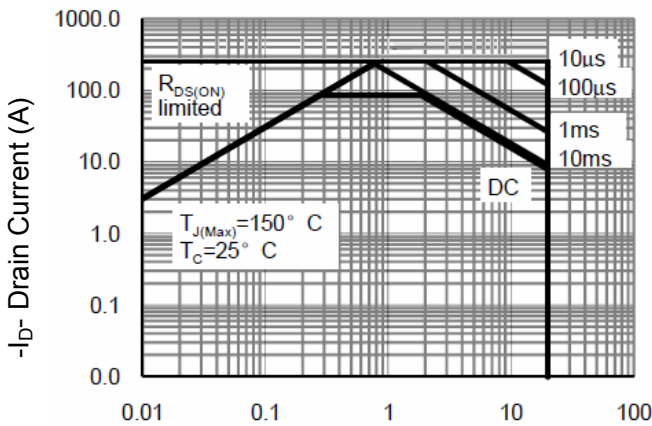
**Typical Characteristics (Cont.)**



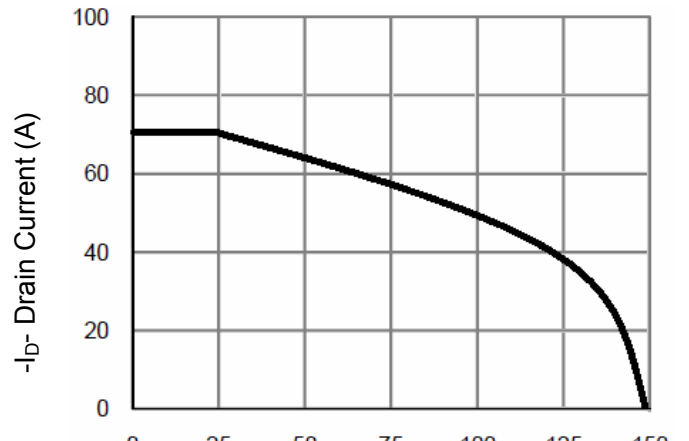
-Vds Drain-Source Voltage (V)  
**Figure 7 Capacitance vs Vds**



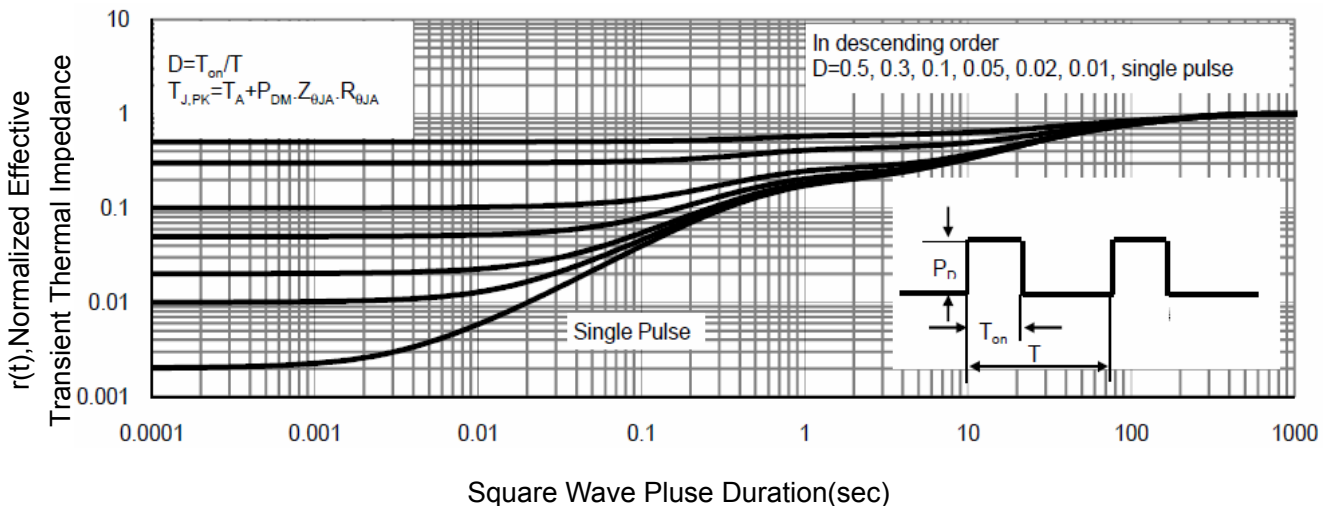
T<sub>J</sub>-Junction Temperature(°C)  
**Figure 9 Power De-rating**



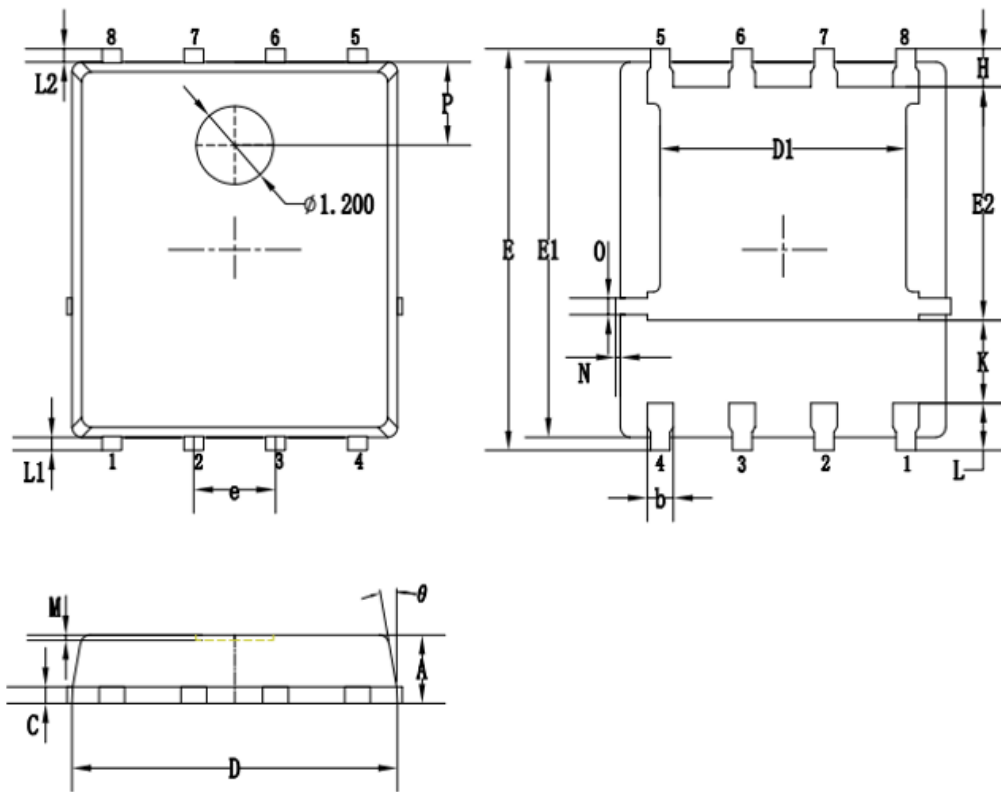
-Vds Drain-Source Voltage (V)  
**Figure 8 Safe Operation Area**



T<sub>J</sub>-Junction Temperature(°C)  
**Figure 10 -Current De-rating**



**Figure 11 Normalized Maximum Transient Thermal Impedance**

**Packaging information**


SYMBOLS	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.05	1.20
b	0.35	0.40	0.50
C	0.20	0.25	0.35
D	4.90	5.05	5.20
D1	3.72	3.82	3.92
E	6.00	6.15	6.30
E1	5.60	5.75	5.90
E2	3.47	3.57	3.67
e	1.27 BSC.		
H	0.48	0.58	0.68
K	1.17	1.27	1.37
L	0.64	0.74	0.84
L1/L2	0.20 REF.		
$\theta$	8°	10°	12°
M	0.08 REF.		
N	0	-	0.15
O	0.25 REF.		
P	1.28 REF.		

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