

NDF04N60ZH

Product Preview

N-Channel Power MOSFET 600 V, 2.0 Ω

Features

- Low ON Resistance
- Low Gate Charge
- 100% Avalanche Tested
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

ABSOLUTE MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Typ	Unit
Drain-to-Source Voltage	V_{DS}	600	V
Continuous Drain Current $R_{\theta JC}$	I_D	4.4 (Note 2)	A
Continuous Drain Current $R_{\theta JC}$, $T_A = 100^\circ\text{C}$	I_D	2.8 (Note 2)	A
Pulsed Drain Current, $V_{GS} @ 10\text{ V}$	I_{DM}	18 (Note 2)	A
Power Dissipation $R_{\theta JC}$ (Note 1)	P_D	28	W
Gate-to-Source Voltage	V_{GS}	± 30	V
Single Pulse Avalanche Energy, $I_D = 4.0\text{ A}$	E_{AS}	120	mJ
ESD (HBM) (JESD22-A114)	V_{ESD}	3000	V
RMS Isolation Voltage ($t = 0.3\text{ sec.}$, R.H. $\leq 30\%$, $T_A = 25^\circ\text{C}$) (Figure 14)	V_{ISO}	4500	V
Peak Diode Recovery	dv/dt	4.5 (Note 3)	V/ns
Continuous Source Current (Body Diode)	I_S	4.0	A
Maximum Temperature for Soldering Leads	T_L	260	$^\circ\text{C}$
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55 to 150	$^\circ\text{C}$

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Surface mounted on FR4 board using 1" sq. pad size (Cu area = 1.127 in sq [2 oz] including traces).
2. Limited by maximum junction temperature
3. $I_{SD} = 4.0\text{ A}$, $di/dt \leq 100\text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, $T_J = +150^\circ\text{C}$

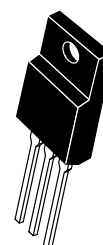
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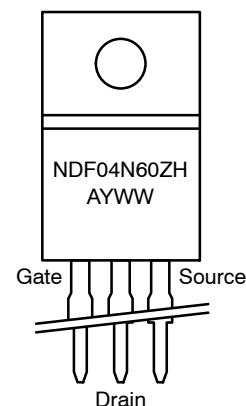
<http://onsemi.com>

V_{DSS}	$R_{DS(ON)} (MAX) @ 2\text{ A}$
600 V	2.0 Ω



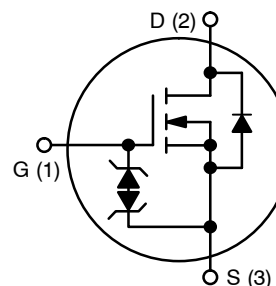
TO-220FP
CASE 221AH

MARKING DIAGRAM



A = Location Code
Y = Year
WW = Work Week
H = Halogen Free Package

N-Channel



ORDERING INFORMATION

Device	Package	Shipping
NDF04N60ZH	TO-220FP	50 Units / Rail (In Development)

NDF04N60ZH

THERMAL RESISTANCE

Parameter	Symbol	Value	Unit
Junction-to-Case (Drain)	$R_{\theta JC}$	4.4	°C/W
Junction-to-Ambient Steady State (Note 4)	$R_{\theta JA}$	50	

ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Test Conditions	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	BV_{DSS}	600			V
Breakdown Voltage Temperature Coefficient	Reference to 25°C , $I_D = 1\text{ mA}$	$\Delta BV_{DSS} / \Delta T_J$		0.6		V/°C
Drain-to-Source Leakage Current	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$	I_{DSS}	25°C		1	μA
			125°C		50	
Gate-to-Source Forward Leakage	$V_{GS} = \pm 20\text{ V}$	I_{GSS}			±10	μA

ON CHARACTERISTICS (Note 5)

Static Drain-to-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 2.0\text{ A}$	$R_{DS(on)}$		1.8	2.0	Ω
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 50\text{ μA}$	$V_{GS(th)}$	3.0		4.5	V
Forward Transconductance	$V_{DS} = 15\text{ V}, I_D = 2.0\text{ A}$	g_{FS}		3.3		S

DYNAMIC CHARACTERISTICS

Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	C_{iss}		535		pF
Output Capacitance		C_{oss}		62		
Reverse Transfer Capacitance		C_{rss}		14		
Total Gate Charge	$V_{DD} = 300\text{ V}, I_D = 4.0\text{ A},$ $V_{GS} = 10\text{ V}$	Q_g		19		nC
Gate-to-Source Charge		Q_{gs}		3.9		
Gate-to-Drain ("Miller") Charge		Q_{gd}		10		
Plateau Voltage		V_{GP}		6.3		V
Gate Resistance		R_g		4.7		Ω

RESISTIVE SWITCHING CHARACTERISTICS

Turn-On Delay Time	$V_{DD} = 300\text{ V}, I_D = 4.0\text{ A},$ $V_{GS} = 10\text{ V}, R_G = 5\text{ Ω}$	$t_{d(on)}$		13		ns
Rise Time		t_r		9.0		
Turn-Off Delay Time		$t_{d(off)}$		24		
Fall Time		t_f		15		

SOURCE-DRAIN DIODE CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Diode Forward Voltage	$I_S = 4.0\text{ A}, V_{GS} = 0\text{ V}$	V_{SD}			1.6	V
Reverse Recovery Time	$V_{GS} = 0\text{ V}, V_{DD} = 30\text{ V}$ $I_S = 4.0\text{ A}, di/dt = 100\text{ A/μs}$	t_{rr}		285		ns
Reverse Recovery Charge		Q_{rr}		1.3		μC

4. Insertion mounted

5. Pulse Width ≤ 380 μs, Duty Cycle ≤ 2%.

TYPICAL CHARACTERISTICS

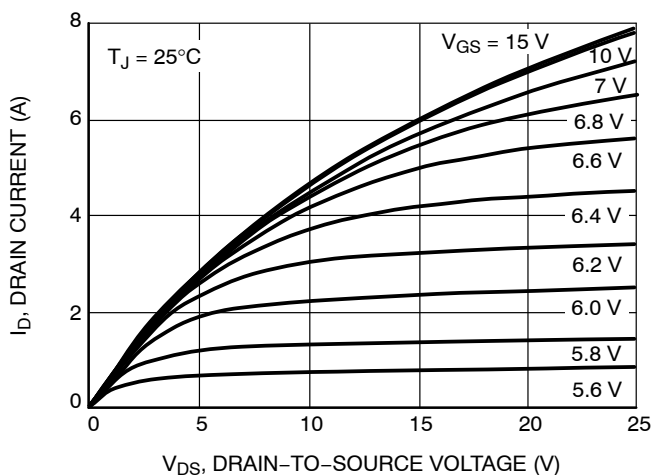


Figure 1. On-Region Characteristics

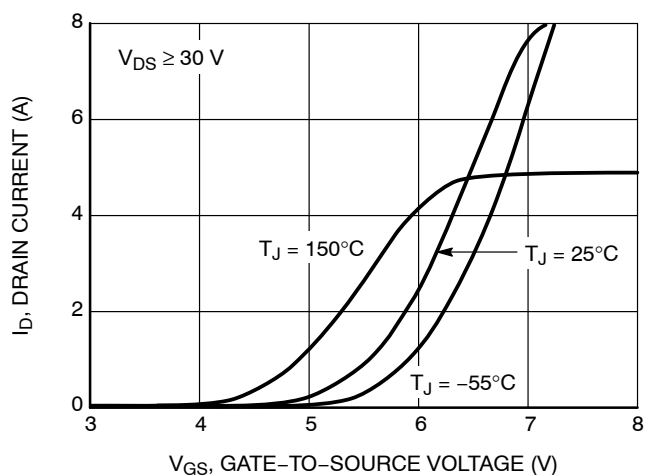


Figure 2. Transfer Characteristics

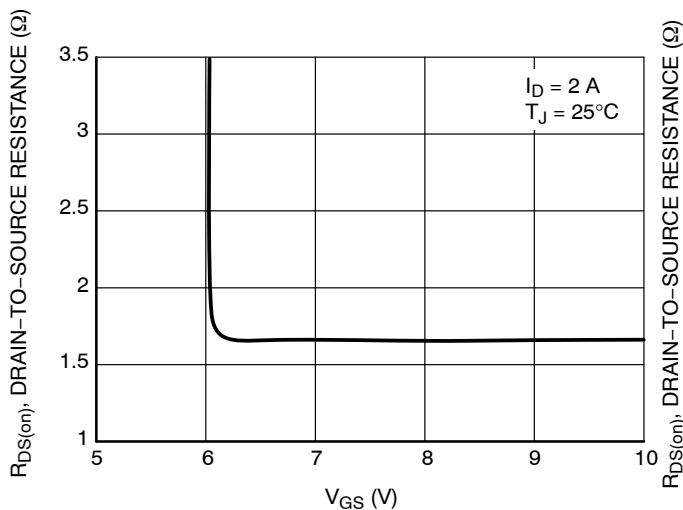


Figure 3. On-Resistance vs. Gate Voltage

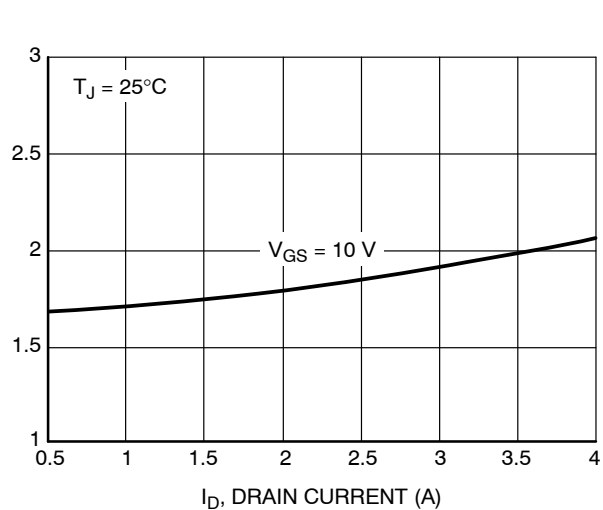


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

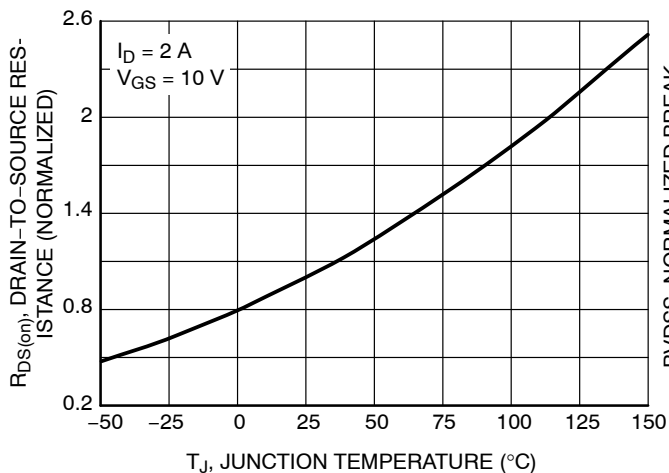


Figure 5. On-Resistance Variation with Temperature

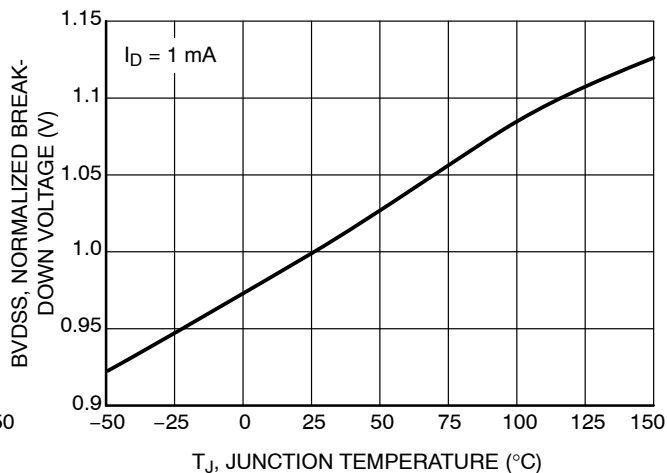


Figure 6. BVDSS Variation with Temperature

TYPICAL CHARACTERISTICS

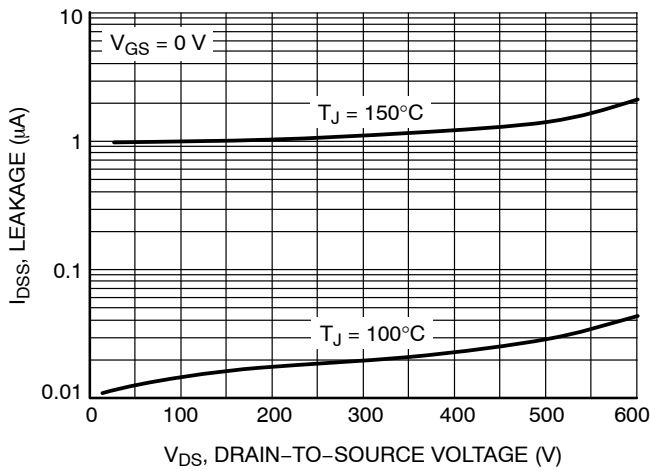


Figure 7. Drain-to-Source Leakage Current vs. Voltage

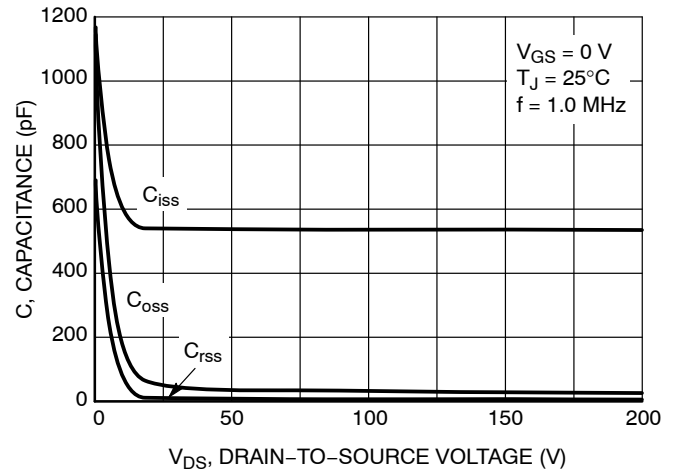


Figure 8. Capacitance Variation

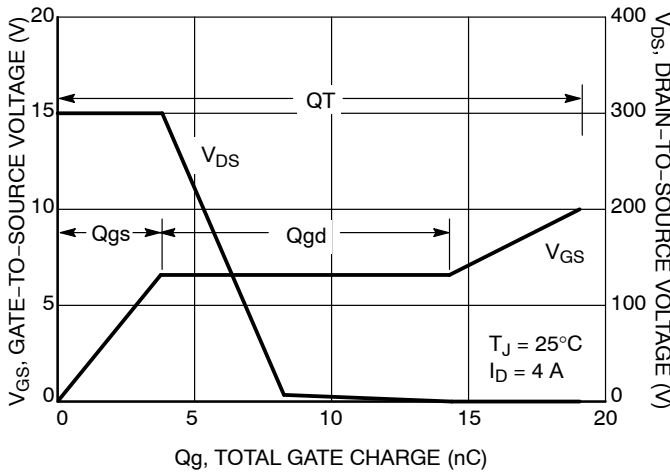


Figure 9. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

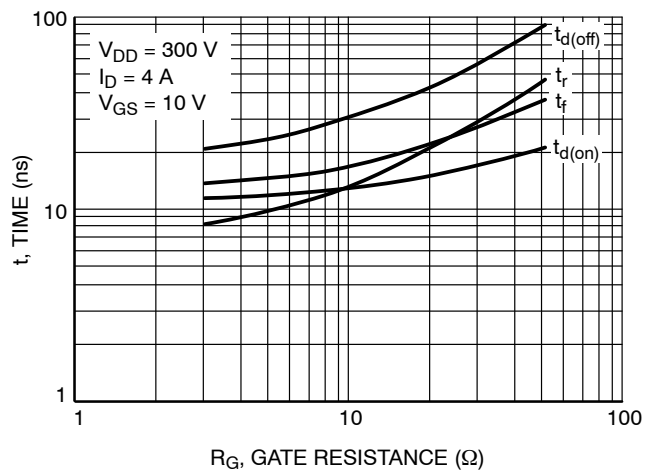


Figure 10. Resistive Switching Time Variation vs. Gate Resistance

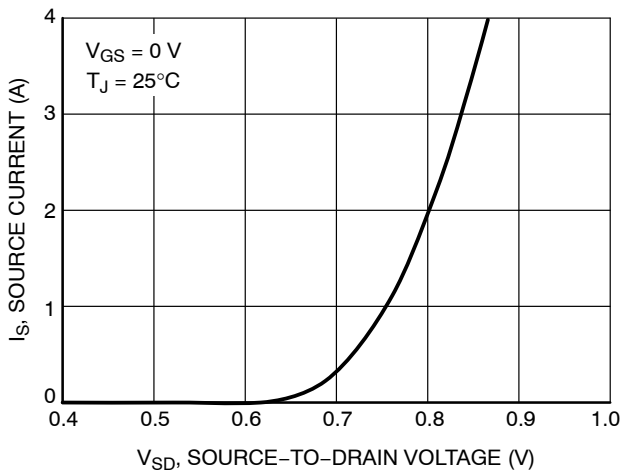


Figure 11. Diode Forward Voltage vs. Current

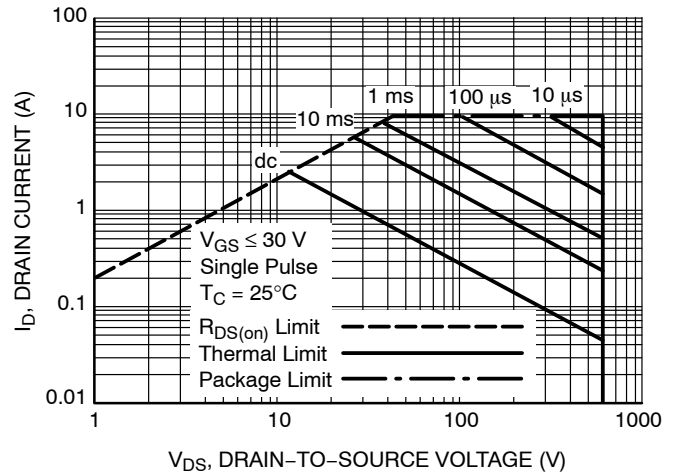


Figure 12. Maximum Rated Forward Biased Safe Operating Area

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TYPICAL CHARACTERISTICS

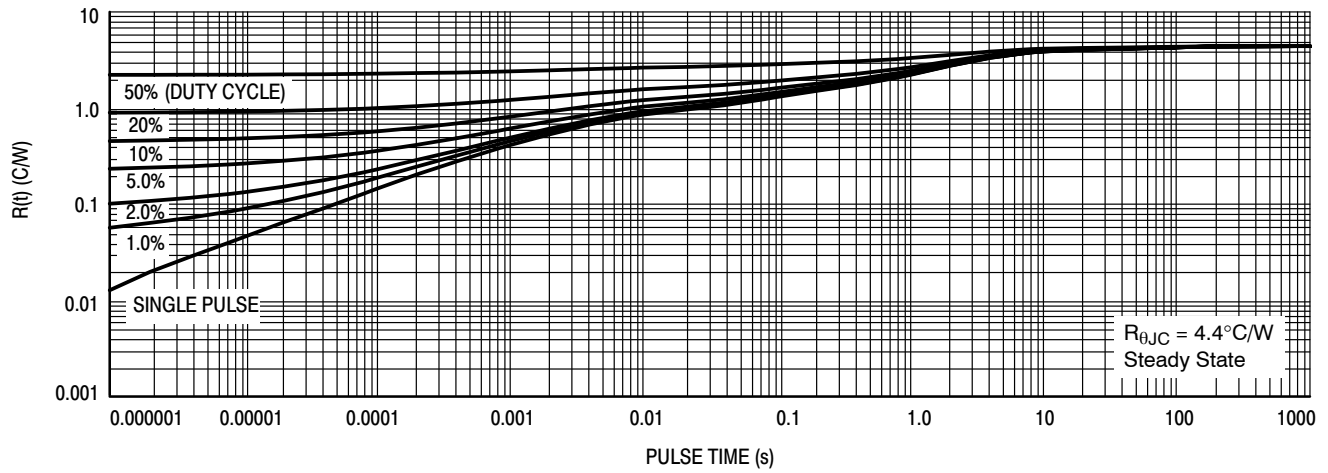


Figure 13. Thermal Impedance (Junction-to-Case)

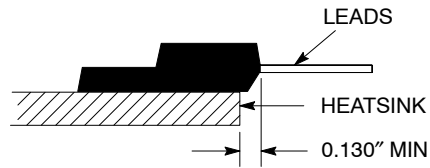


Figure 14. Mounting Position for Isolation Test

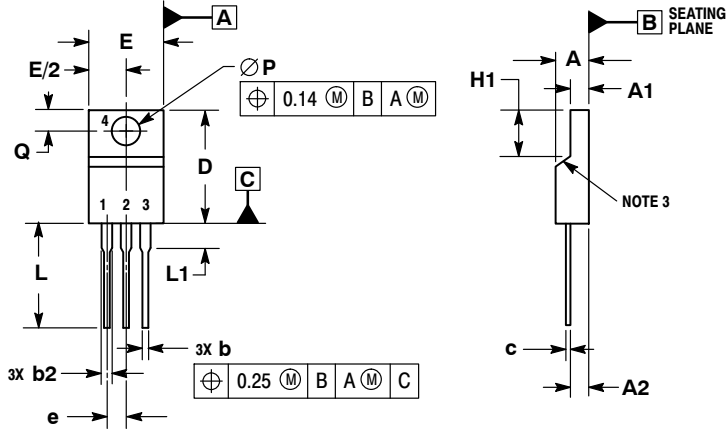
Measurement made between leads and heatsink with all leads shorted together.

*For additional mounting information, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

NDF04N60ZH

PACKAGE DIMENSIONS

TO-220 FULLPACK, 3-LEAD CASE 221AH-01 ISSUE O



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. CONTOUR UNCONTROLLED IN THIS AREA.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH AND GATE PROTRUSIONS. MOLD FLASH AND GATE PROTRUSIONS NOT TO EXCEED 0.13 PER SIDE. THESE DIMENSIONS ARE TO BE MEASURED AT OUTERMOST EXTREME OF THE PLASTIC BODY.
5. DIMENSION b2 DOES NOT INCLUDE DAMBAR PROTRUSION. LEAD WIDTH INCLUDING PROTRUSION SHALL NOT EXCEED 2.00.

MILLIMETERS		
DIM	MIN	MAX
A	4.30	4.70
A1	2.50	2.90
A2	2.50	2.70
b	0.54	0.84
b2	1.10	1.40
c	0.49	0.79
D	14.22	15.88
E	9.65	10.67
e	2.54 BSC	
H1	5.97	6.48
L	12.70	14.73
L1	---	2.80
P	3.00	3.40
Q	2.80	3.20

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