74VCXH245

Low-Voltage 1.8/2.5/3.3 V 8-Bit Transceiver

(3−State, Non−Inverting with Bushold)

ON Semiconductor®

http://onsemi.com

The 74VCXH245 is an advanced performance, non−inverting 8−bit transceiver. It is designed for very high−speed, very low−power operation in 1.8 V, 2.5 V or 3.3 V systems.

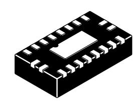
The 74VCXH245 is designed as a byte control. The Transmit/Receive (T/$\overline{R}$n) inputs determine the direction of data flow through the bidirectional transceiver. Transmit (active−HIGH) enables data from A ports to B ports; Receive (active−LOW) enables data from B to A ports. The Output Enable input ($\overline{OE}$), when HIGH, disables both A and B ports by placing them in a HIGH Z condition. The data inputs include active bushold circuitry, eliminating the need for external pullup resistors to hold unused or floating inputs at a valid logic state.

Features

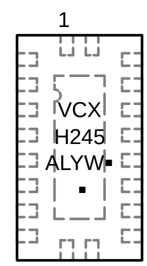
- Designed for Low Voltage Operation: V_{CC} = 1.65−3.6 V
- High Speed Operation: 3.5 ns max for 3.0 to 3.6 V
  4.2 ns max for 2.3 to 2.7 V
  8.4 ns max for 1.65 to 1.95 V
- Static Drive: ±24 mA Drive at 3.0 V
  ±18 mA Drive at 2.3 V
  ±6 mA Drive at 1.65 V
- Includes Active Bushold to Hold Unused or Floating Data Inputs at a Valid Logic State
- Near Zero Static Supply Current in All Three Logic States (20 μA) Substantially Reduces System Power Requirements
- Latchup Performance Exceeds ±200 mA @ 85°C
- ESD Performance:
  Human Body Model >2000 V
  Machine Model >200 V
- Pb−Free Package is Available

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

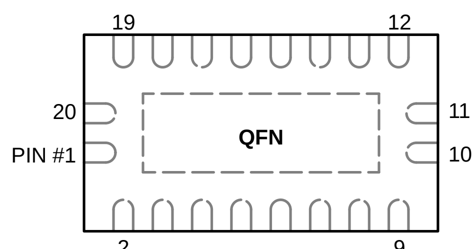
MARKING DIAGRAM



QFN
MNR2 SUFFIX
CASE 485AA



A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
▪ = Pb−Free Package
(Note: Microdot may be in either location)



Pinout (Top View)

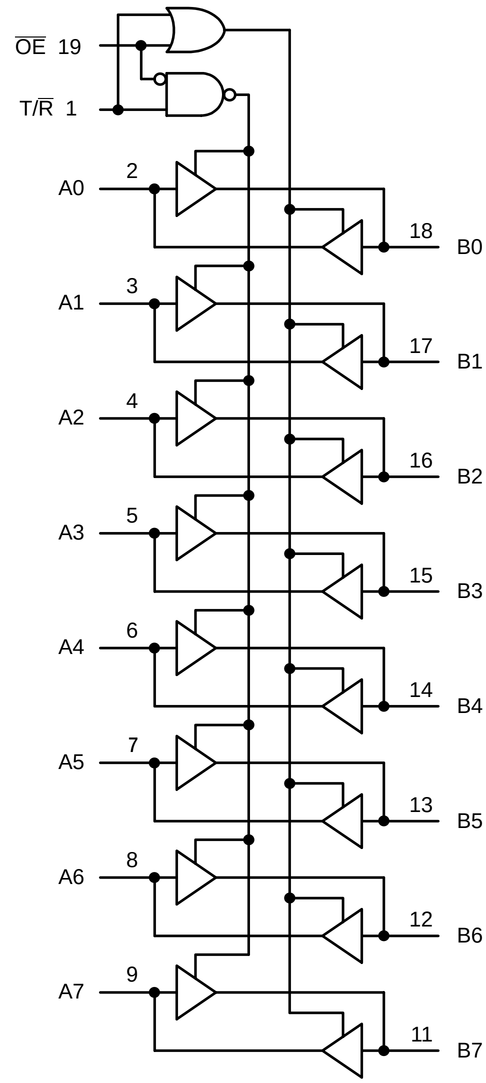
ORDERING INFORMATION

Device	Package	Shipping†
74VCXH245MNR2	QFN	3000/Tape&Reel
74VCXH245MNR2G	QFN (Pb−Free)	3000/Tape&Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

PIN NAMES

PINS	FUNCTION
$\overline{OE}$	Output Enable Input
T/$\overline{R}$	Transmit/Receive Input
A0−A7	Side A Bushold Inputs or 3−State Outputs
B0−B7	Side B Bushold Inputs or 3−State Outputs



V_{CC} = Pin 20
GND = Pin 10

Figure 1. Logic Diagram

TRUTH TABLE

INPUTS		OPERATING MODE Non−Inverting
$\overline{OE}$	T/$\overline{R}$	
L	L	B Data to A Bus
L	H	A Data to B Bus
H	X	Z State

H = High Voltage Level
L = Low Voltage Level
Z = High Impedance State
X = High or Low Voltage Level and Transitions are Acceptable

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Condition	Unit
V_{CC}	DC Supply Voltage	−0.5 to + 4.6		V
V_I	DC Input Voltage	$-0.5 \le V_I \le V_{CC} + 0.5$		V
V_O	DC Output Voltage	$-0.5 \le V_O \le V_{CC} + 0.5$	Note 1	V
I_{IK}	DC Input Diode Current	−50	V_I < GND	mA
I_{OK}	DC Output Diode Current	−50	V_O < GND	mA
		+50	$V_O > V_{CC}$	mA
I_O	DC Output Source/Sink Current	±50		mA
I_{CC}	DC Supply Current Per Supply Pin	±100		mA
I_{GND}	DC Ground Current Per Ground Pin	±100		mA
T_{STG}	Storage Temperature Range	−65 to +150		°C

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.
1. I_O absolute maximum rating must be observed.

RECOMMENDED OPERATING CONDITIONS (Note 2)

Symbol	Parameter	Min	Typ	Max	Unit
V_{CC}	Supply Voltage Operating Data Retention Only	1.65 1.2	3.3 3.3	3.6 3.6	V
V_I	Input Voltage	−0.3		V_{CC}	V
V_O	Output Voltage	0		V_{CC}	V
I_{OH}	HIGH Level Output Current, V_{CC} = 3.0 V − 3.6 V			−24	mA
I_{OL}	LOW Level Output Current, V_{CC} = 3.0 V − 3.6 V			24	mA
I_{OH}	HIGH Level Output Current, V_{CC} = 2.3 V − 2.7 V			−18	mA
I_{OL}	LOW Level Output Current, V_{CC} = 2.3 V − 2.7 V			18	mA
I_{OH}	HIGH Level Output Current, V_{CC} = 1.65 V − 1.95 V			−6	mA
I_{OL}	LOW Level Output Current, V_{CC} = 1.65 V − 1.95 V			6	mA
T_A	Operating Free−Air Temperature	−40		+85	°C
Δt/ΔV	Input Transition Rise or Fall Rate, V_{IN} from 0.8 V to 2.0 V, V_{CC} = 3.0 V	0		10	ns/V

2. Floating or unused control inputs must be held HIGH or LOW.

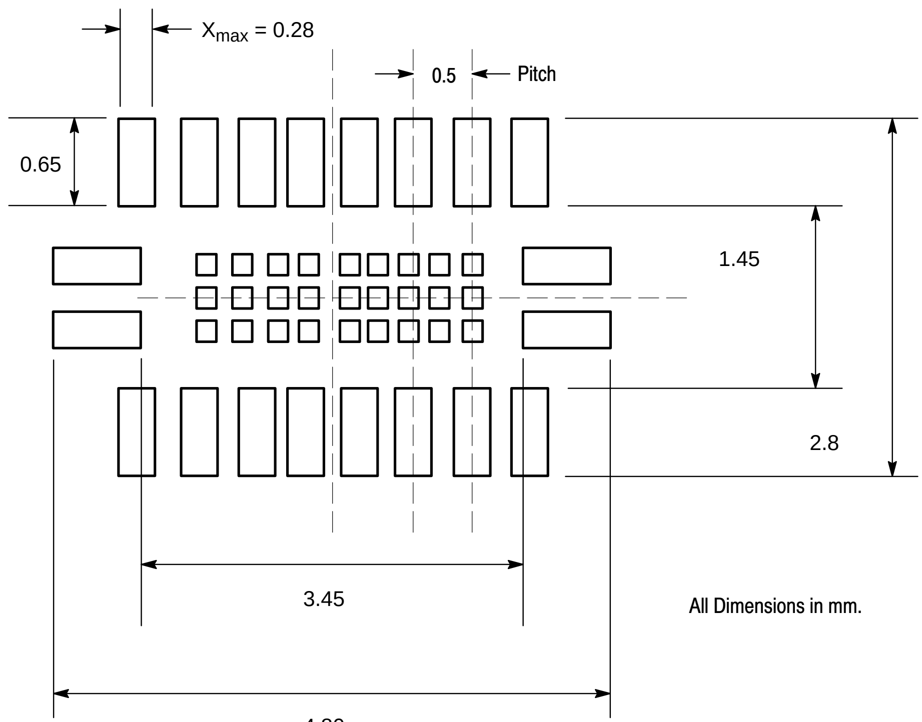


Figure 2. 20 Pad QFN Suggested Board Layout (Bottom View)

DC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic	Condition	T_A = −40°C to +85°C		Unit
			Min	Max	
V_{IH}	HIGH Level Input Voltage (Note 3)	1.65 V ≤ V_{CC} < 1.95 V	0.65 x V_{CC}		V
		2.3 V ≤ V_{CC} ≤ 2.7 V	1.6		
		2.7 V < V_{CC} ≤ 3.6 V	2.0		
V_{IL}	LOW Level Input Voltage (Note 3)	1.65 V ≤ V_{CC} < 1.95 V		0.35 x V_{CC}	V
		2.3 V ≤ V_{CC} ≤ 2.7 V		0.7	
		2.7 V < V_{CC} ≤ 3.6 V		0.8	
V_{OH}	HIGH Level Output Voltage	1.65 V ≤ V_{CC} ≤ 3.6 V; I_{OH} = −100 μA	V_{CC} − 0.2		V
		V_{CC} = 1.65 V; I_{OH} = −6 mA	1.25		
		V_{CC} = 2.3 V; I_{OH} = −6 mA	2.0		
		V_{CC} = 2.3 V; I_{OH} = −12 mA	1.8		
		V_{CC} = 2.3 V; I_{OH} = −18 mA	1.7		
		V_{CC} = 2.7 V; I_{OH} = −12 mA	2.2		
		V_{CC} = 3.0 V; I_{OH} = −18 mA	2.4		
		V_{CC} = 3.0 V; I_{OH} = −24 mA	2.2		
V_{OL}	LOW Level Output Voltage	1.65 V ≤ V_{CC} ≤ 3.6 V; I_{OL} = 100 μA		0.2	V
		V_{CC} = 1.65 V; I_{OL} = 6 mA		0.3	
		V_{CC} = 2.3 V; I_{OL} = 12 mA		0.4	
		V_{CC} = 2.3 V; I_{OL} = 18 mA		0.6	
		V_{CC} = 2.7 V; I_{OL} = 12 mA		0.4	
		V_{CC} = 3.0 V; I_{OL} = 18 mA		0.4	
		V_{CC} = 3.0 V; I_{OL} = 24 mA		0.55	
I_I	Input Leakage Current	V_{IN} = V_{CC} or GND; V_{CC} = 3.6 V		±5.0	μA
$I_{I(HOLD)}$	Minimum Bushold Input Current	V_{CC} = 3.0 V, V_{IN} = 0.8 V	75		μA
		V_{CC} = 3.0 V, V_{IN} = 2.0 V	−75		
		V_{CC} = 2.3 V, V_{IN} = 0.7 V	45		
		V_{CC} = 2.3 V, V_{IN} = 1.6 V	−45		
		V_{CC} = 1.65 V, V_{IN} = 0.57 V	25		
		V_{CC} = 1.65 V, V_{IN} = 1.07 V	−25		
$I_{I(OD)}$	Minimum Bushold Over−Drive Current Needed to Change State	V_{CC} = 3.6 V, (Note 4)	450		μA
		V_{CC} = 3.6 V, (Note 5)	−450		
		V_{CC} = 2.7 V, (Note 4)	300		
		V_{CC} = 2.7 V, (Note 5)	−300		
		V_{CC} = 1.95 V, (Note 4)	200		
		V_{CC} = 1.95 V, (Note 5)	−200		
I_{OZ}	3−State Output Current	V_O = V_{CC} or GND; V_{CC} = 3.6 V; V_I = V_{IH} or V_{IL}		±10	μA
I_{CC}	Quiescent Supply Current (Note 6)	1.65 V ≤ V_{CC} ≤ 3.6 V; V_I = GND or V_{CC}		20	μA
ΔI_{CC}	Increase in I_{CC} per Input	2.7 V < V_{CC} ≤ 3.6 V; V_{IH} = V_{CC} − 0.6 V		750	μA

3. These values of V_I are used to test DC electrical characteristics only.
4. An external driver must source at least the specified current to switch from LOW−to−HIGH.
5. An external driver must sink at least the specified current to switch from HIGH−to−LOW.
6. Outputs disabled or 3−state only.

AC CHARACTERISTICS (Note 7; t_R = t_F = 2.0 ns; C_L = 30 pF; R_L = 500 Ω)

Symbol	Parameter	Waveform	Limits						Unit
			T_A = −40°C to +85°C						
			V_{CC} = 3.0 V to 3.6 V		V_{CC} = 2.3 V to 2.7 V		V_{CC} = 1.65 V to1.95 V		
			Min	Max	Min	Max	Min	Max	
t_{PLH} t_{PHL}	Propagation Delay Input to Output	1	0.6 0.6	3.5 3.5	0.8 0.8	4.2 4.2	1.5 1.5	8.4 8.4	ns
t_{PZH} t_{PZL}	Output Enable Time to High and Low Level	2	0.6 0.6	4.5 4.5	0.8 0.8	5.6 5.6	1.5 1.5	9.8 9.8	ns
t_{PHZ} t_{PLZ}	Output Disable Time From High and Low Level	2	0.6 0.6	3.6 3.6	0.8 0.8	4.0 4.0	1.5 1.5	7.2 7.2	ns
t_{OSHL} t_{OSLH}	Output−to−Output Skew (Note 8)			0.5 0.5		0.5 0.5		0.75 0.75	ns

7. For C_L = 50 pF, add approximately 300 ps to the AC maximum specification.
8. Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH−to−LOW (t_{OSHL}) or LOW−to−HIGH (t_{OSLH}); parameter guaranteed by design.

DYNAMIC SWITCHING CHARACTERISTICS

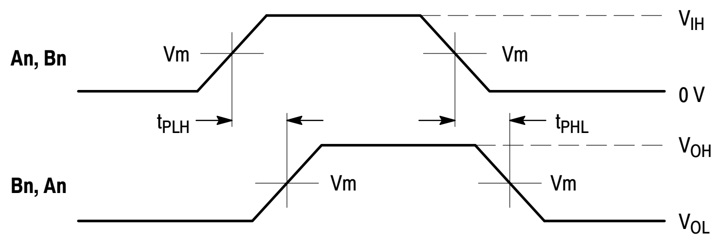
Symbol	Characteristic	Condition	T_A = +25°C Typ	Unit
V_{OLP}	Dynamic LOW Peak Voltage (Note 9)	V_{CC} = 1.8 V, C_L = 30 pF, V_{IH} = V_{CC}, V_{IL} = 0 V	0.3	V
		V_{CC} = 2.5 V, C_L = 30 pF, V_{IH} = V_{CC}, V_{IL} = 0 V	0.7	
		V_{CC} = 3.3 V, C_L = 30 pF, V_{IH} = V_{CC}, V_{IL} = 0 V	1.0	
V_{OLV}	Dynamic LOW Valley Voltage (Note 9)	V_{CC} = 1.8 V, C_L = 30 pF, V_{IH} = V_{CC}, V_{IL} = 0 V	−0.3	V
		V_{CC} = 2.5 V, C_L = 30 pF, V_{IH} = V_{CC}, V_{IL} = 0 V	−0.7	
		V_{CC} = 3.3 V, C_L = 30 pF, V_{IH} = V_{CC}, V_{IL} = 0 V	−1.0	
V_{OHV}	Dynamic HIGH Valley Voltage (Note 10)	V_{CC} = 1.8 V, C_L = 30 pF, V_{IH} = V_{CC}, V_{IL} = 0 V	1.3	V
		V_{CC} = 2.5 V, C_L = 30 pF, V_{IH} = V_{CC}, V_{IL} = 0 V	1.7	
		V_{CC} = 3.3 V, C_L = 30 pF, V_{IH} = V_{CC}, V_{IL} = 0 V	2.0	

9. Number of outputs defined as “n”. Measured with “n−1” outputs switching from HIGH−to−LOW or LOW−to−HIGH. The remaining output is measured in the LOW state.
10. Number of outputs defined as “n”. Measured with “n−1” outputs switching from HIGH−to−LOW or LOW−to−HIGH. The remaining output is measured in the HIGH state.

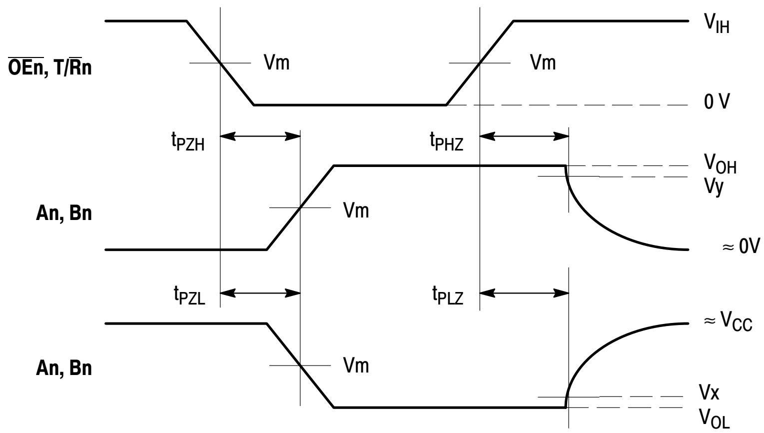
CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Condition	Typical	Unit
C_{IN}	Input Capacitance	Note 11	6	pF
C_{OUT}	Output Capacitance	Note 11	7	pF
C_{PD}	Power Dissipation Capacitance	Note 11, 10 MHz	20	pF

11. V_{CC} = 1.8, 2.5 or 3.3 V; V_I = 0 V or V_{CC}.



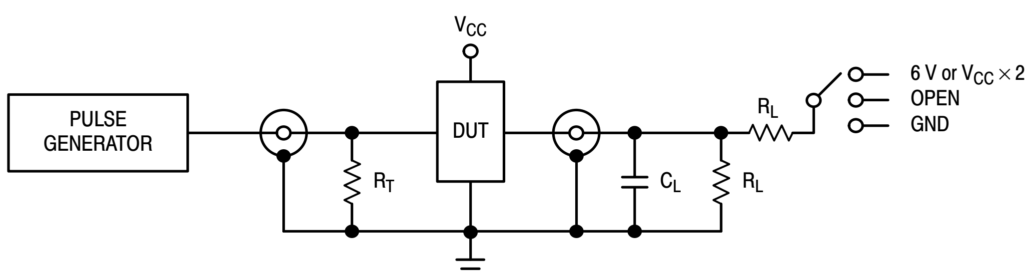
WAVEFORM 1 – PROPAGATION DELAYS
$t_R = t_F = 2.0$ ns, 10% to 90%; f = 1 MHz; $t_W = 500$ ns



WAVEFORM 2 – OUTPUT ENABLE AND DISABLE TIMES
$t_R = t_F = 2.0$ ns, 10% to 90%; f = 1 MHz; $t_W = 500$ ns

Figure 3. AC Waveforms

Symbol	V_{CC}		
	3.3 V ± 0.3 V	**2.5 V ± 0.2 V**	**1.8 V ± 0.15 V**
V_{IH}	2.7 V	V_{CC}	V_{CC}
V_m	1.5 V	$V_{CC}/2$	$V_{CC}/2$
V_x	V_{OL} + 0.3 V	V_{OL} + 0.15 V	V_{OL} + 0.15 V
V_y	V_{OH} − 0.3 V	V_{OH} − 0.15 V	V_{OH} − 0.15 V



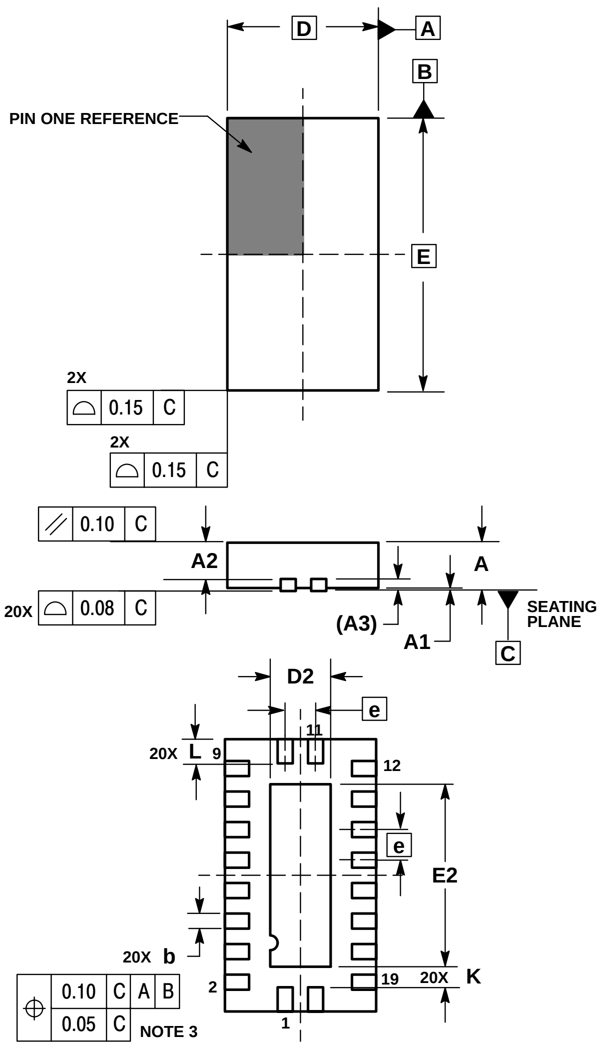
TEST	SWITCH
t_{PLH}, t_{PHL}	Open
t_{PZL}, t_{PLZ}	6 V at V_{CC} = 3.3 ± 0.3 V; $V_{CC} \times 2$ at V_{CC} = 2.5 ± 0.2 V; 1.8 V ± 0.15 V
t_{PZH}, t_{PHZ}	GND

C_L = 30 pF or equivalent (Includes jig and probe capacitance)
R_L = 500 Ω or equivalent
$R_T = Z_{OUT}$ of pulse generator (typically 50 Ω)

Figure 4. Test Circuit

PACKAGE DIMENSIONS

QFN
MNR2 SUFFIX
CASE 485AA−01
ISSUE A



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30 MM FROM TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

	MILLIMETERS	
DIM	MIN	MAX
A	0.80	1.00
A1	0.00	0.05
A2	0.65	0.75
A3	0.20 REF	
b	0.20	0.30
D	2.50 BSC	
D2	0.85	1.15
E	4.50 BSC	
E2	2.85	3.15
e	0.50 BSC	
K	0.20	---
L	0.35	0.45

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