3.3 V OCTAL BUS TRANSCEIVER WITH 3 STATE OUTPUTS

NEW PRODUCT

Description

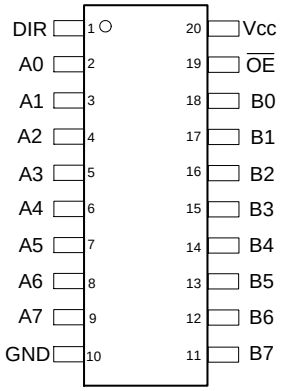
The 74LVT245BB is an octal transceiver designed for asynchronous communication between data buses. The device transmits data from the A bus to the B bus or from the B bus to the A bus, depending on the logic level at the direction-control (DIR) input. The output-enable ($\overline{OE}$) Pin can be used to disable the device so the buses effectively are isolated.

The device is designed for operation with a power supply range of 2.7V to 3.6V.

The inputs are tolerant to 5.5V allowing this device to be used in a mixed voltage environment. The device is fully specified for partial power down applications using I_{OFF}. The I_{OFF} circuitry disables the output preventing damaging current backflow when the device is powered down.

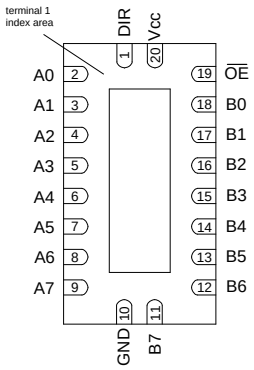
Pin Assignments

(Top View)



TSSOP-20

(Top Transparent View)



QFN-20

Features

- Supply Voltage Range from 2.7V to 3.6V
- Outputs Sink 64mA or Source 32mA
- CMOS Low Power Consumption
- I_{OFF} Supports Partial Power-Down Operation
- Inputs or Outputs Accept Up to 5.5V
- Inputs Include Bus-Hold – No Resistors on Unused Inputs.
- Inputs can be Driven by 3.3V or 5V Allowing for Mixed Voltage Applications
- Schmitt Trigger Action at All Inputs
- Outputs in 3-State During Power Up – Allows for Hot Insertion
- Outputs Have Less than 125µA Leakage when Forced to 5.5V
- ESD Protection Tested per JESD 22
  - Exceeds 200-V Machine Model (A115)
  - Exceeds 2000-V Human Body Model (A114)
  - Exceeds 1000-V Charged Device Model (C101)
- Latch-Up Exceeds 500mA per JESD 78, Class II
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

Applications

- General Purpose Logic
- Bus Driving
- Power Down Signal Isolation
- Wide Array of Products such as:
  - Servers, PCs, Notebooks, Netbooks, Ultrabooks
  - Networking Computer Peripherals, Hard Drives, CD/DVD ROM
  - TVs, DVDs, DVRs, Set Top Boxes

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen and Antimony free, "Green" and Lead-Free.
3. Halogen and Antimony free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

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Ordering Information

74 LVT 245BB xxx -13

Logic Device	Function	Package	Packing
74: Logic Prefix	245BB: Octal Bus Transceiver with 3-state Outputs	T20: TSSOP-20 Q20: QFN-20	**-13: 13" Tape & Reel**

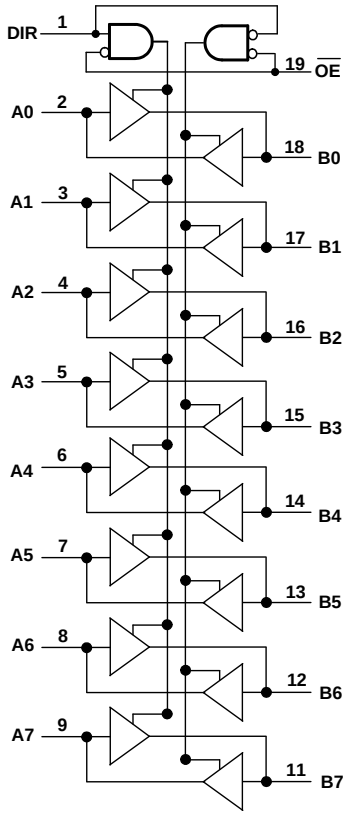
Part Number	Package Code	Package (Note 4 & 5)	Package Size	13" Tape and Reel	
				Quantity	Part Number Suffix
74LVT245BBT20-13	T20	TSSOP-20	6.4mm x 6.5mm x 1.2mm 0.65mm lead pitch	2,500/Tape & Reel	-13
74LVT245BBQ20-13	Q20	V-QFN4525-20	2.5mm x 4.5mm x 0.95mm 0.50mm lead pitch	2,500/Tape & Reel	-13

Notes: 4. Pad layout as shown on Diodes Incorporated's package outline PDFs, which can be found on our website at http://www.diodes.com/package-outlines.html.
5. V-QFN4525-20 is a JEDEC recognized naming convention that specifies the package thickness category as V and the number 4525 describes the package as 4.5mm × 2.5mm.

Pin Descriptions

Pin Number	Pin Name	Description
1	DIR	Direction
2	A0	Data I/O
3	A1	Data I/O
4	A2	Data I/O
5	A3	Data I/O
6	A4	Data I/O
7	A5	Data I/O
8	A6	Data I/O
9	A7	Data I/O
10	GND	Ground
11	B7	Data I/O
12	B6	Data I/O
13	B5	Data I/O
14	B4	Data I/O
15	B3	Data I/O
16	B2	Data I/O
17	B1	Data I/O
18	B0	Data I/O
19	$\overline{OE}$	Output Enable
20	V_{CC}	Supply Voltage

Logic Diagram



Function Table

INPUTS		Operation
$\overline{OE}$	DIR	
L	L	B Data to A Bus
L	H	A Data to B Bus
H	X	Bus Isolation

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Absolute Maximum Ratings (Notes 6 & 7)

Symbol	Description	Rating	Unit
ESD HBM	Human Body Model ESD Protection	2	kV
ESD CDM	Charged Device Model ESD Protection	1	kV
ESD MM	Machine Model ESD Protection	200	V
V_{CC}	Supply Voltage Range	-0.5 to +4.6	V
V_I	Input Voltage Range (Note 7)	-0.5 to +7.0	V
V_O	Output Voltage Range Output in OFF of HIGH State (Note 7)	-0.5 to +7.0	V
I_{IK}	Input Clamp Current V_I< 0V	-50	mA
I_{OK}	Output Clamp Current V_O< 0V	-50	mA
I_{OL}	Output Current – LOW State	128	mA
I_{OH}	Output Current – HIGH State	-64	mA
T_J	Operating Junction Temperature	-40 to +150	°C
T_{STG}	Storage Temperature	-65 to +150	°C
P_{TOT}	Total Power Dissipation	500	mW

Notes: 6. Stresses beyond the absolute maximum may result in immediate failure or reduced reliability. These are stress values and device operation should be within recommend values.
7. Forcing the maximum allowed voltage could cause a condition exceeding the maximum current or conversely forcing the maximum current could cause a condition exceeding the maximum voltage. The ratings of both current and voltage must be maintained within the controlled range.

Recommended Operating Conditions (Note 8)

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	Supply Voltage	—	2.7	3.6	V
V_I	Input Voltage	—	0	5.5	V
V_O	Output Voltage	—	0	5.5	V
I_{OH}	High-Level Output Current	V_{CC} = 3.0V	—	-32	mA
I_{OL}	Low-Level Output Current	V_{CC} = 3.0V	—	32	mA
		V_{CC} = 3.0V (Note 9)	—	64	
Δt/ΔV	Input Transition Rise or Fall Rate	—	—	10	ns/V
T_A	Operating Free-Air Temperature	—	-40	+125	°C

Notes: 8. Unused inputs should be held at V_{CC} or ground.
9. For Iol > 32mA the current duty cycle ≤ 50%, Frequency > 1Khz.

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Electrical Characteristics

Symbol	Parameter	Test Conditions	V_{CC}	T_A = -40°C to +85°C			Unit
				Min	Typical	Max	
V_{IK}	Input Clamping Voltage	I_{IK} = -18mA	2.7V	-1.2	-0.9	—	—
V_{IH}	High-Level Input Voltage	—	2.7V to 3.6V	2.0	—	—	V
V_{IL}	Low-Level input Voltage	—	2.7V to 3.6V	—	—	0.8	V
V_{OH}	High-Level Output Voltage	I_{OH} = -100µA	2.7V to 3.6V	V_{CC} -0.2	V_{CC} -0.1	—	
		I_{OH} = -8mA	2.7V	2.4	2.5	—	V
		I_{OH} = -34mA	3.0V	2.0	2.2	—	
V_{OL}	Low-Level Output Voltage	I_{OL} = 100µA	2.7V to 3.6V	—	0.1	0.2	V
		I_{OL} = 24mA	2.7V	—	0.3	0.5	
		I_{OL} = 16mA	3.0V	—	0.25	0.4	
		I_{OL} = 24mA	3.0V	—	0.3	0.5	
		I_{OL} = 64mA	3.0V	—	0.4	0.55	
I_{OFF}	Power Down Leakage Current	V_I or V_O = 0 to 4.5V	0V	—	±1	±100	µA
$I_{O\text{-}Leakage}$	Output Leakage Current	V_O = 5.5V; Output HIGH	3.6V		60	125	µA
I_{OZPU}	Power-Up I/O Leakage	V_O = 0.5V to 3.0V $\overline{OE}$ = Don't Care	0V to 1.2V	—	15	±100	µA
I_{OZPD}	Power-Down I/O Leakage	V_O = 0.5V to 3.0V $\overline{OE}$ = Don't Care	0V to 1.2 V	—	15	±100	µA
I_I	Input Current Control Pins	V_I = 5.5V	0V or 3.6V	—	1	10	µA
		V_I = V_{CC} or GND	3.6V	—	±0.1	±1	
	Input Current I/O Data Pins	V_I = 5.5V	3.6V	—	1	20	µA
		V_I = V_{CC}	3.6V	—	.1	1	
		V_I = GND	3.6V	-5	-1		
I_{BHL}	Bus Hold LOW Current	V_I = 0.8V	3.0V	75	150	—	µA
I_{BHH}	Bus Hold HIGH Current	V_I = 2.0V	3.0V	-150	-75	—	µA
I_{BHLO}	Bus Hold LOW Overdrive Current	V_I = 3.6V	0V to 3.0V	500	—	—	µA
I_{BHHO}	Bus Hold HIGH Overdrive Current	V_I = 3.6V	0V to 3.0V	—	—	-500	µA
I_{CC}	Supply Current	V_I = GND or V_{CC}, I_O = 0	3.6 V	—	—	—	mA
		Outputs HIGH		—	0.13	0.19	
		Output LOW		—	3	12	
		Outputs Disabled		—	0.13	0.19	
ΔI_{CC}	Additional Supply Current	One Input at V_{CC}-0.6V Others at V_{CC} or Ground Io = 0A	3.0V to 3.6V	—	100	200	µA
C_I	Input Capacitance	Control Pins; V_I = GND or V_{CC}	0V to 3.6V	—	4	—	pF
		I/O Pins; V_I = GND or V_{CC}		—	10	—	

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Switching Characteristics (Figure 1)

Symbol	Parameter	V_{CC}	T_A = -40°C to +85°C			Unit
			Min	Typ	Max	
t_{PLH}	LOW to HIGH Propagation Delay A_N to B_N or B_N to A_N	2.7V	—	—	5.5	ns
		3.3V ± 0.3	1.2	2.4	4.8	
t_{PHL}	HIGH to LOW Propagation Delay A_N to B_N or B_N to A_N	2.7V	—	—	4.7	
		3.3V ± 0.3	1.2	2.4	4.4	
t_{PZH}	Z-State to HIGH Enable Time $\overline{OE}$ to A_N or $\overline{OE}$ to B_N	2.7V	—	—	8.9	ns
		3.3V ± 0.3	1.3	3.3	7.7	
t_{PZL}	Z-State to LOW Enable Time $\overline{OE}$ to A_N or $\overline{OE}$ to B_N	2.7V	—	—	6.9	
		3.3V ± 0.3	1.7	3.2	6.4	
t_{PHZ}	HIGH to Z-State Disable Time $\overline{OE}$ to A_N or $\overline{OE}$ to B_N	2.7V	—	—	6.5	ns
		3.3V ± 0.3	2.2	3.6	6.0	
t_{PLZ}	LOW to Z-State Disable Time $\overline{OE}$ to A_N or $\overline{OE}$ to B_N	2.7V	—	—	5.5	
		3.3V ± 0.3	2.2	3.4	5.5	

Package Characteristics

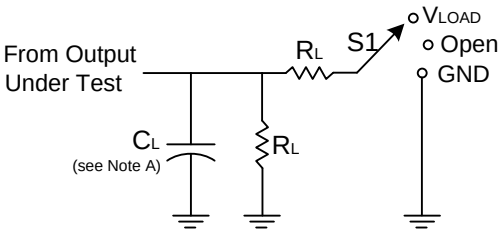
Symbol	Parameter	Package	Test Conditions	Min	Typ.	Max	Unit
θ_{JA}	Thermal Resistance Junction-to-Ambient	TSSOP-20	(Note 10)	—	74	—	°C/W
θ_{JC}	Thermal Resistance Junction-to-Case	TSSOP-20	(Note 10)	—	15	—	°C/W
θ_{JA}	Thermal Resistance Junction-to-Ambient	V-QFN4525-20	(Note 10)	—	67	—	°C/W
θ_{JC}	Thermal Resistance Junction-to-Case	V-QFN4525-20	(Note 10)	—	20	—	°C/W

Note: 10. Test conditions for TSSOP-20 and V-QFN4525-20: Devices mounted on 4 layer FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout per JESD 51-7.

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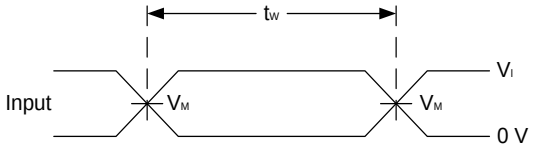
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Parameter Measurement Information

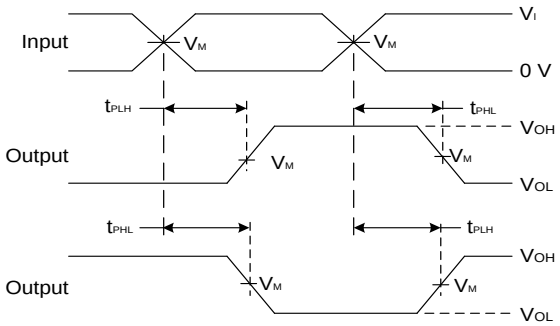


TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	V_{LOAD}
t_{PHZ}/t_{PZH}	GND

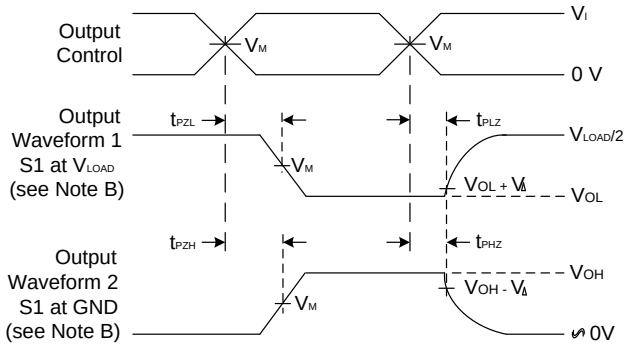
V_{CC}	Inputs		V_M	V_{LOAD}	C_L	R_L	$V\Delta$
	V_I	t_R/t_F					
3.3V±0.3V	2.7V	≤2.5ns	1.5V	6V	50pF	500Ω	0.3V



Voltage Waveform Pulse Duration



Voltage Waveform Propagation Delay Times
Inverting and Non Inverting Outputs



Voltage Waveform Enable and Disable Times
Low and High Level Enabling

Notes: A. Includes test lead and test apparatus capacitance.
B. All pulses are supplied at pulse repetition rate ≤ 10 MHz.
C. Inputs are measured separately one transition per measurement.

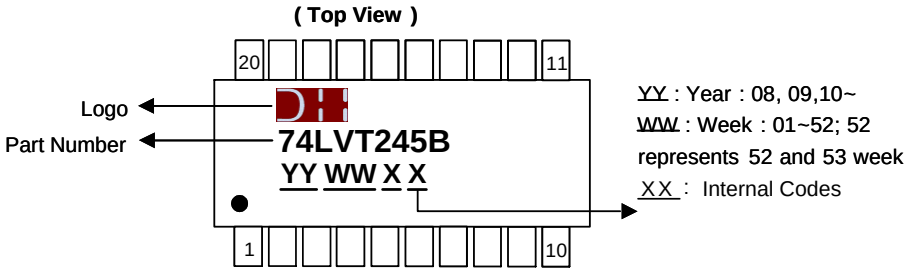
Figure 1 Load Circuit and Voltage Waveforms

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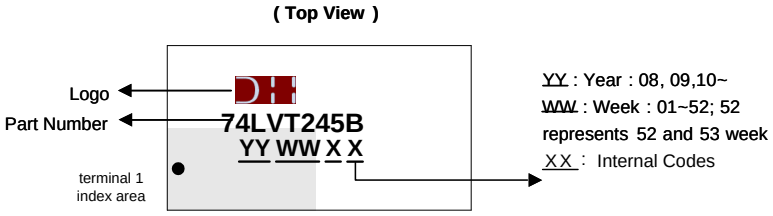
Marking Information

1) TSSOP20



Part Number	Package
74LVT245BBT20-13	TSSOP-20

2) QFN-20 (V-QFN4525-20)



Part Number	Package
74LVT245BBQ20-13	V-QFN4525-20

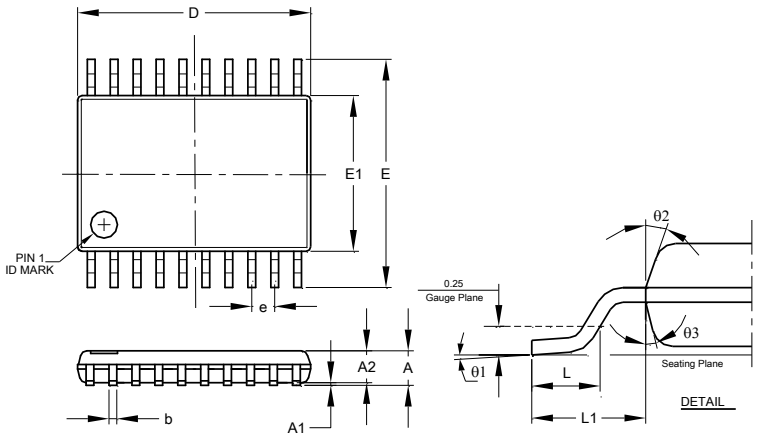
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Package Outline Dimensions

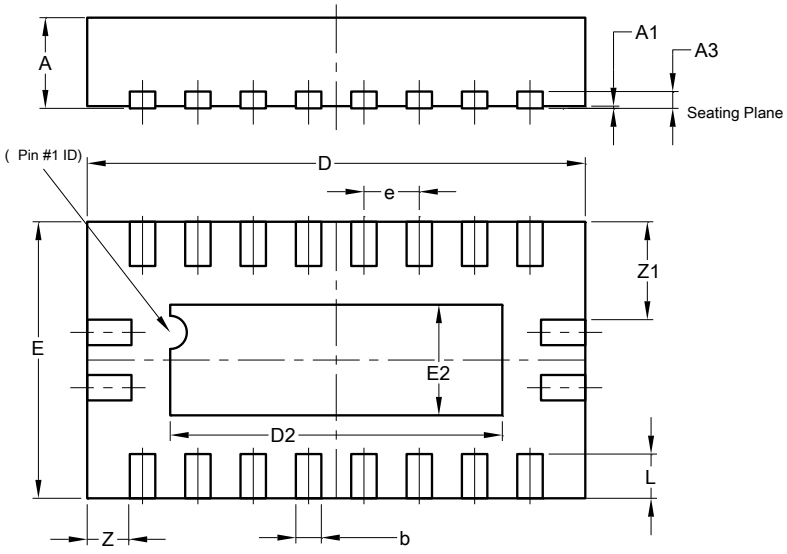
Please see http://www.diodes.com/package-outlines.html for the latest version.

TSSOP-20



TSSOP-20			
Dim	**Min**	**Max**	**Typ**
A	—	1.20	—
A1	0.05	0.15	—
A2	0.80	1.05	—
b	0.19	0.30	—
c	0.09	0.20	—
D	6.40	6.60	6.50
E	6.20	6.60	6.40
E1	4.30	4.50	4.40
e	0.65 BSC		
L	0.45	0.75	0.60
L1	1.0 REF		
θ1	0°	8°	—
θ2	10°	14°	12°
θ3	10°	14°	12°
All Dimensions in mm			

V-QFN4525-20



V-QFN4525-20			
Dim	**Min**	**Max**	**Typ**
A	0.75	0.85	0.80
A1	0.00	0.05	0.02
A3	—	—	0.15
b	0.18	0.30	0.23
D	4.45	4.55	4.50
D2	2.85	3.15	3.00
E	2.45	2.55	2.50
E2	0.85	1.15	1.00
e	0.50BSC		
L	0.30	0.50	0.40
Z	—	—	0.385
Z1	—	—	0.885
All Dimensions in mm			

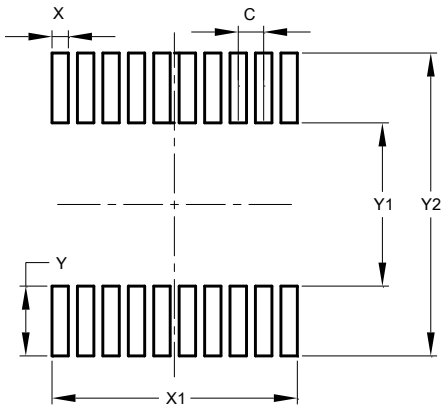
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Suggested Pad Layout

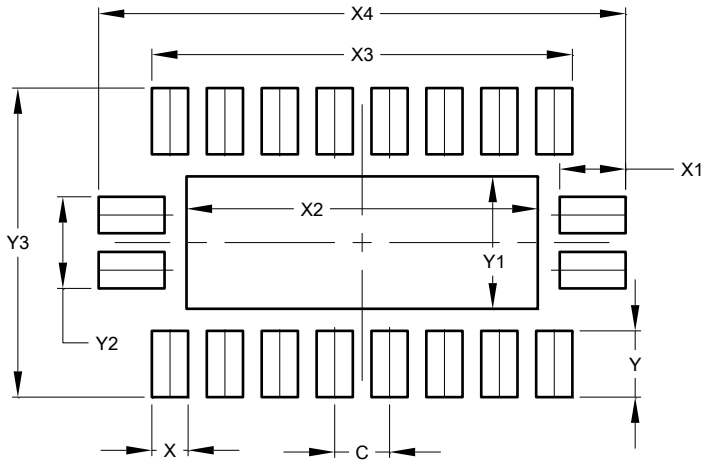
Please see http://www.diodes.com/package-outlines.html for the latest version.

TSSOP-20



Dimensions	Value (in mm)
C	0.650
X	0.420
X1	6.270
Y	1.780
Y1	4.160
Y2	7.720

V-QFN4525-20



Dimensions	Value (in mm)
C	0.500
X	0.330
X1	0.600
X2	3.200
X3	3.830
X4	4.800
Y	0.600
Y1	1.200
Y2	0.830
Y3	2.800

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