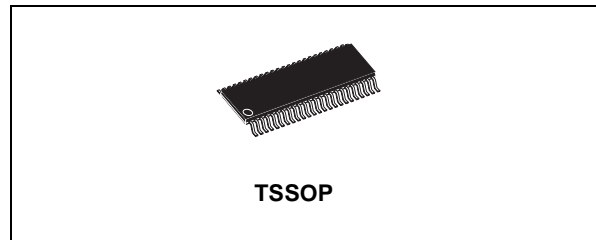




# 74VHCT16245A

## 16-BIT BUS TRANSCEIVER WITH 3-STATE OUTPUTS (NON INVERTED)

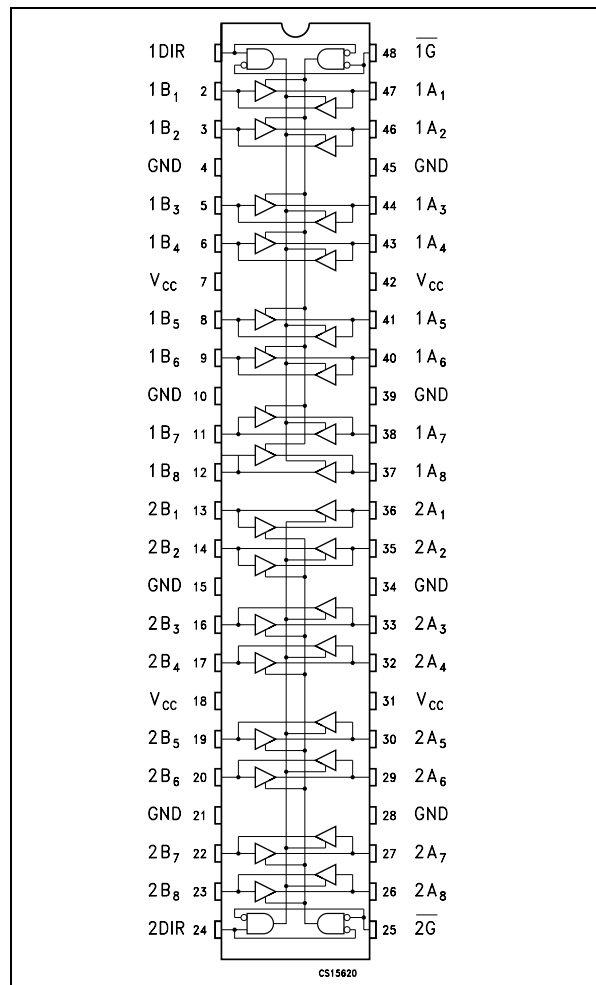
- HIGH SPEED:  $t_{PD} = 4.5 \text{ ns}$  (TYP.) at  $V_{CC} = 5V$
- LOW POWER DISSIPATION:  
 $I_{CC} = 4 \mu\text{A}$  (MAX.) at  $T_A = 25^\circ\text{C}$
- COMPATIBLE WITH TTL OUTPUTS:  
 $V_{IH} = 2V$  (MIN.),  $V_{IL} = 0.8V$  (MAX)
- POWER DOWN PROTECTION ON INPUTS & OUTPUTS
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 8 \text{ mA}$  (MIN)
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \cong t_{PHL}$
- OPERATING VOLTAGE RANGE:  
 $V_{CC}(\text{OPR}) = 4.5V \text{ to } 5.5V$
- IMPROVED LATCH-UP IMMUNITY
- LOW NOISE:  $V_{OLP} = 0.9V$  (MAX.)



### ORDER CODES

PACKAGE	TUBE	T & R
TSSOP		74VHCT16245ATTR

### PIN CONNECTION



### DESCRIPTION

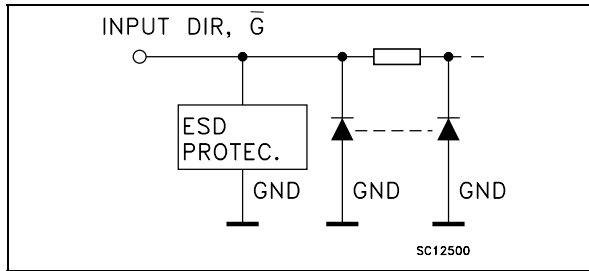
The 74VHCT16245A is an advanced high-speed CMOS 16-BIT BUS TRANSCEIVER (3-STATE) fabricated with sub-micron silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology.

This IC is intended for two-way asynchronous communication between data busses; the direction of data transmission is determined by DIR input. The enable input  $\overline{G}$  can be used to disable the device so that the busses are effectively isolated.

All inputs and outputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess voltage.

All floating bus terminals during High Z State must be held HIGH or LOW.

INPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

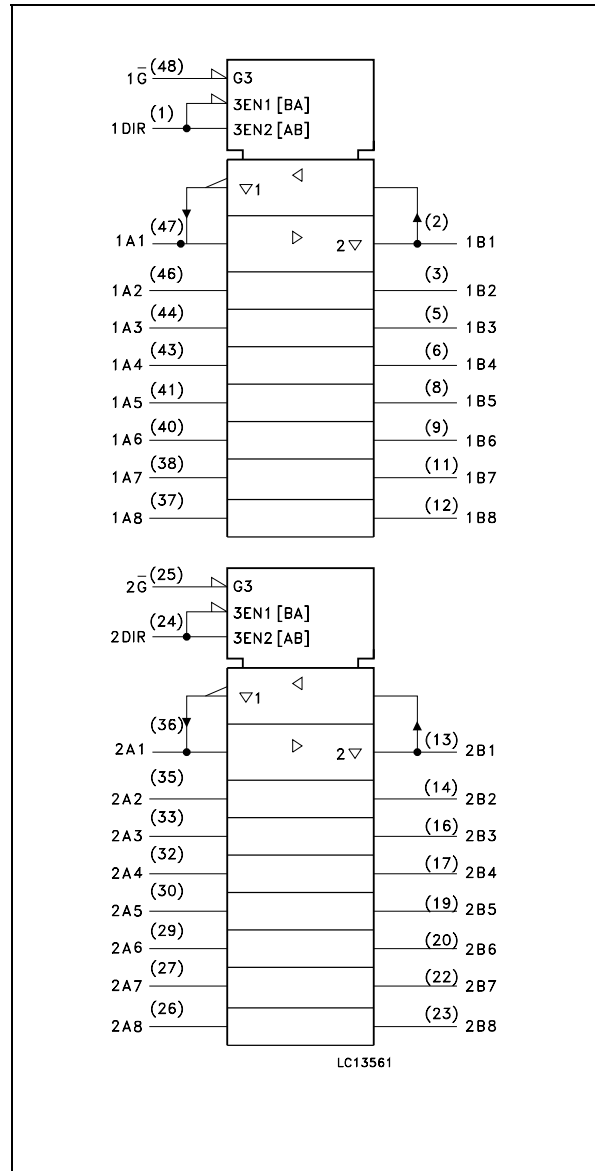
PIN No	SYMBOL	NAME AND FUNCTION
1	1DIR	Directional Control
2, 3, 5, 6, 8, 9, 11, 12	1B1 to 1B8	Data Inputs/Outputs
13, 14, 16, 17, 19, 20, 22, 23	2B1 to 2B8	Data Inputs/Outputs
24	2DIR	Directional Control
25	2G	Output Enable Input
36, 35, 33, 32, 30, 29, 27, 26	2A1 to 2A8	Data Inputs/Outputs
47, 46, 44, 43, 41, 40, 38, 38	1A1 to 1A8	Data Inputs/Outputs
48	1G	Output Enable Input
4, 10, 15, 21, 28, 34, 39, 45	GND	Ground (0V)
7, 18, 31, 42	V <sub>CC</sub>	Positive Supply Voltage

TRUTH TABLE

INPUTS		FUNCTION		OUTPUT
G-bar	DIR	A BUS	B BUS	Y <sub>n</sub>
L	L	OUTPUT	INPUT	A = B
L	H	INPUT	OUTPUT	B = A
H	X	Z	Z	Z

X : Don't Care  
Z : High Impedance

IEC LOGIC SYMBOLS



**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage	-0.5 to +7.0	V
$V_I$	DC Input Voltage (DIR, $\bar{G}$ )	-0.5 to +7.0	V
$V_{I/O}$	DC BUS I/O Voltage (see note 1)	-0.5 to +7.0	V
$V_{I/O}$	DC BUS I/O Voltage (see note 2)	-0.5 to $V_{CC} + 0.5$	V
$I_{IK}$	DC Input Diode Current	- 20	mA
$I_{OK}$	DC Output Diode Current	$\pm 20$	mA
$I_O$	DC Output Current	$\pm 25$	mA
$I_{CC}$ or $I_{GND}$	DC $V_{CC}$ or Ground Current	$\pm 75$	mA
$T_{stg}$	Storage Temperature	-65 to +150	$^{\circ}\text{C}$
$T_L$	Lead Temperature (10 sec)	300	$^{\circ}\text{C}$

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied

- 1) Output in OFF State
- 2) High or Low State

**RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage	4.5 to 5.5	V
$V_I$	Input Voltage	0 to 5.5	V
$V_{I/O}$	BUS I/O Voltage (see note 1)	0 to 5.5	V
$V_{I/O}$	BUS I/O Voltage (see note 2)	0 to $V_{CC}$	V
$T_{op}$	Operating Temperature	-55 to 125	$^{\circ}\text{C}$
dt/dv	Input Rise and Fall Time (see note 3) ( $V_{CC} = 5.0 \pm 0.5\text{V}$ )	0 to 20	ns/V

- 1) Output in OFF State
- 2) High or Low State
- 3) VIN from 0.8V to 2V

## DC SPECIFICATIONS

Symbol	Parameter	Test Condition		Value						Unit	
		V <sub>CC</sub> (V)		T <sub>A</sub> = 25°C			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
V <sub>IH</sub>	High Level Input Voltage	4.5 to 5.5		2			2		2		V
V <sub>IL</sub>	Low Level Input Voltage	4.5 to 5.5				0.8		0.8		0.8	V
V <sub>OH</sub>	High Level Output Voltage	4.5	I <sub>O</sub> =-50 μA	4.4	4.5		4.4		4.4		V
		4.5	I <sub>O</sub> =-8 mA	3.94			3.8		3.7		
V <sub>OL</sub>	Low Level Output Voltage	4.5	I <sub>O</sub> =50 μA		0.0	0.1		0.1		0.1	V
		4.5	I <sub>O</sub> =8 mA			0.36		0.44		0.55	
I <sub>oz</sub>	High Impedance Output Leakage Current	5.5	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> V <sub>O</sub> = 0V to 5.5V			±0.25		± 2.5		± 2.5	μA
I <sub>I</sub>	Input Leakage Current	0 to 5.5	V <sub>I</sub> = 5.5V or GND			± 0.1		± 1.0		± 1.0	μA
I <sub>CC</sub>	Quiescent Supply Current	5.5	V <sub>I</sub> = V <sub>CC</sub> or GND			4		40		40	μA
ΔI <sub>CC</sub>	Additional Worst Case Supply Current	5.5	One Input at 3.4V, other input at V <sub>CC</sub> or GND			1.35		1.5		1.5	mA
I <sub>OPD</sub>	Output Leakage Current	0	V <sub>OUT</sub> = 5.5V			0.5		5.0		5.0	μA

AC ELECTRICAL CHARACTERISTICS (Input t<sub>r</sub> = t<sub>f</sub> = 3ns)

Symbol	Parameter	Test Condition		Value						Unit	
		V <sub>CC</sub> <sup>(*)</sup> (V)	C <sub>L</sub> (pF)	T <sub>A</sub> = 25°C			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay Time	5.0	15		4.5	7.5	1.0	8.5	1.0	10.0	ns
		5.0	50		5.3	8.7	1.0	9.5	1.0	11.0	
t <sub>PZL</sub> t <sub>PZH</sub>	Output Enable Time	5.0	15	RL = 1KΩ	9.0	13.8	1.0	15.0	1.0	16.0	ns
		5.0	50		9.7	14.8	1.0	16.0	1.0	17.0	
t <sub>PLZ</sub> t <sub>PHZ</sub>	Output Disable Time	5.0	50	RL = 1KΩ	10.0	15.4	1.0	16.5	1.0	17.5	ns
t <sub>OSLH</sub> t <sub>OSHL</sub>	Output to Output Skew Time (note 1)	5.0	50			1.0		1.0		1.0	ns

(\*) Voltage range is 5.0V ± 0.5V

Note 1: Parameter guaranteed by design. t<sub>soLH</sub> = |t<sub>pLHm</sub> - t<sub>pLHn</sub>|; t<sub>soHL</sub> = |t<sub>pHLm</sub> - t<sub>pHLn</sub>|

## CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Test Condition	Value						Unit	
			T <sub>A</sub> = 25°C			-40 to 85°C		-55 to 125°C		
			Min.	Typ.	Max.	Min.	Max.	Min.		Max.
C <sub>IN</sub>	Input Capacitance			6	10			10		pF
C <sub>I/O</sub>	Bus Input Capacitance			8						pF
C <sub>PD</sub>	Power Dissipation Capacitance (note 1)			18						pF

1) C<sub>PD</sub> is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation.  $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/8$  (per circuit)

## DYNAMIC SWITCHING CHARACTERISTICS

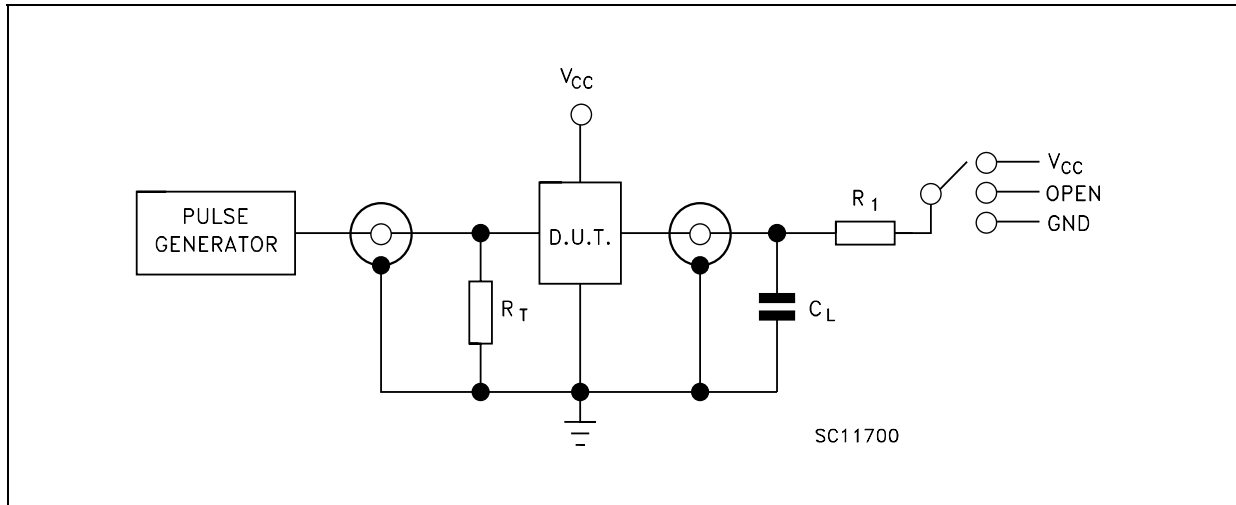
Symbol	Parameter	V <sub>CC</sub> (V)	Test Condition	Value						Unit	
				T <sub>A</sub> = 25°C			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
V <sub>OLP</sub>	Dynamic Low Voltage Quiet Output (note 1, 2)	5.0	C <sub>L</sub> = 50 pF		0.6	0.9					V
V <sub>OLV</sub>				-0.9	-0.6						
V <sub>IHD</sub>	Dynamic High Voltage Input (note 1, 3)	5.0		2.0							
V <sub>ILD</sub>	Dynamic Low Voltage Input (note 1, 3)	5.0				0.8					

1) Worst case package.

2) Max number of outputs defined as (n). Data inputs are driven 0V to 3.0V, (n-1) outputs switching and one output at GND.

3) Max number of data inputs (n) switching. (n-1) switching 0V to 3.0V. Inputs under test switching: 3.0V to threshold (V<sub>ILD</sub>), 0V to threshold (V<sub>IHD</sub>), f=1MHz.

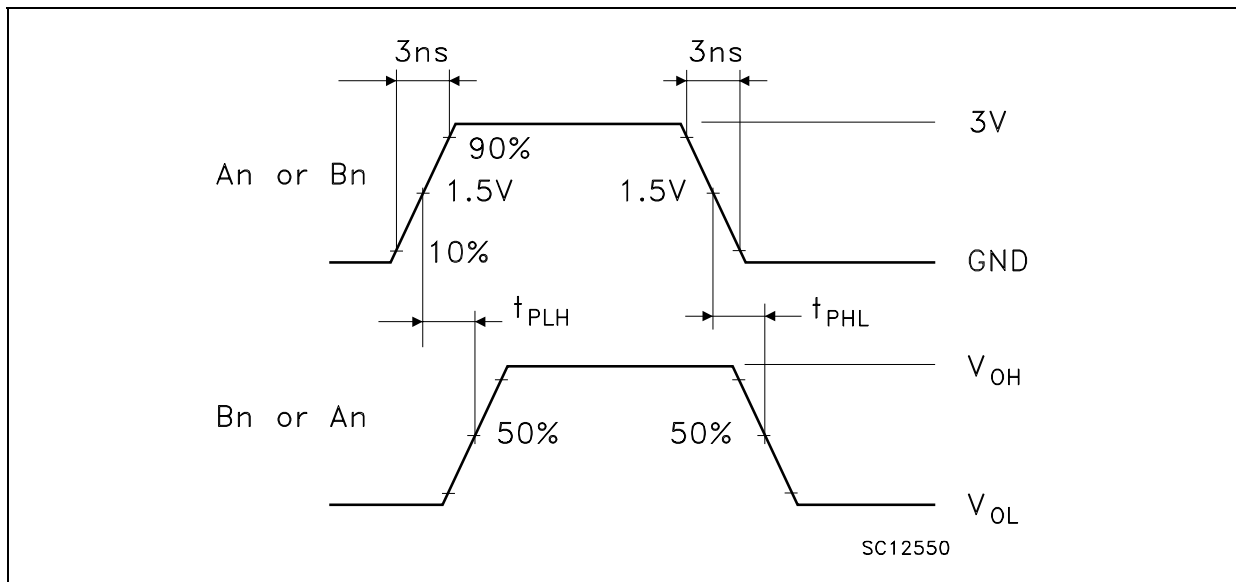
TEST CIRCUIT



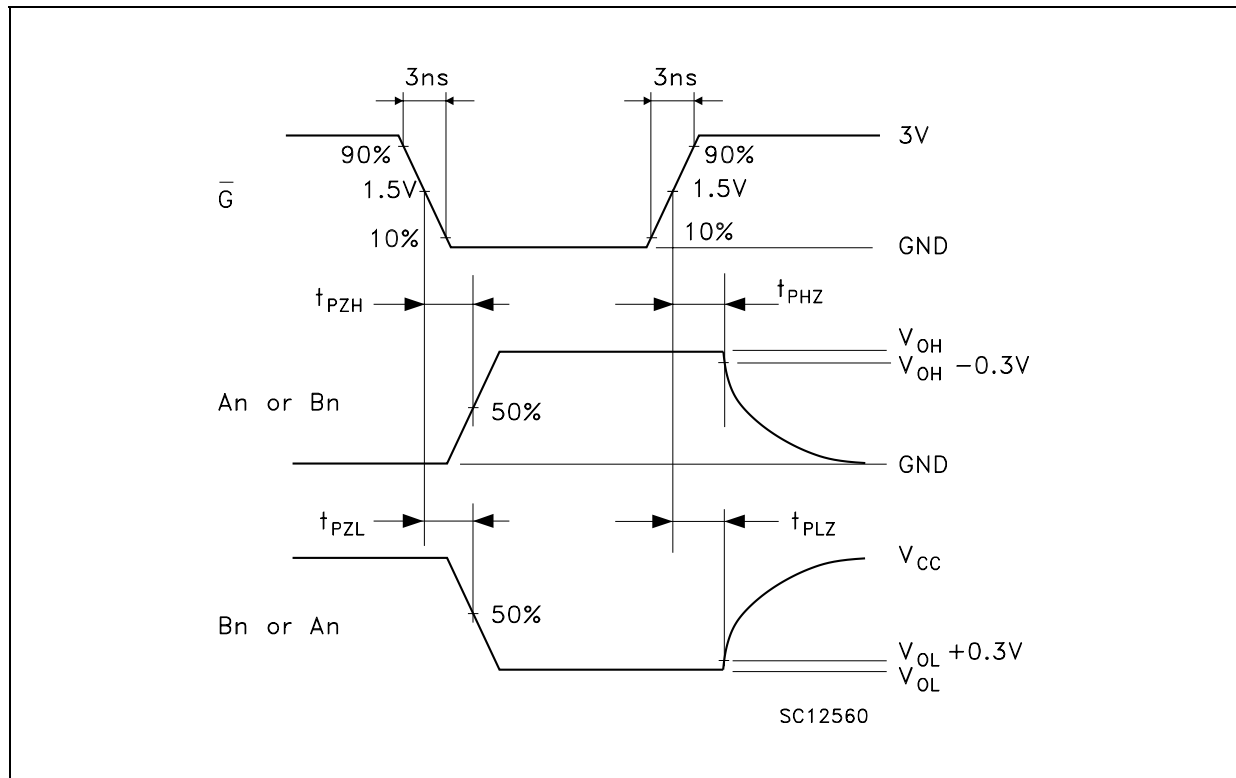
TEST	SWITCH
$t_{PLH}$ , $t_{PHL}$	Open
$t_{PZL}$ , $t_{PLZ}$	$V_{CC}$
$t_{PZH}$ , $t_{PHZ}$	GND

$C_L = 15/50\text{pF}$  or equivalent (includes jig and probe capacitance)  
 $R_L = R_1 = 1\text{K}\Omega$  or equivalent  
 $R_T = Z_{OUT}$  of pulse generator (typically  $50\Omega$ )

WAVEFORM 1: PROPAGATION DELAYS (f=1MHz; 50% duty cycle)



WAVEFORM 2: OUTPUT ENABLE AND DISABLE TIME (f=1MHz; 50% duty cycle)



## TSSOP48 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.2			0.047
A1	0.05		0.15	0.002		0.006
A2		0.9			0.035	
b	0.17		0.27	0.0067		0.011
c	0.09		0.20	0.0035		0.0079
D	12.4		12.6	0.488		0.496
E		8.1 BSC			0.318 BSC	
E1	6.0		6.2	0.236		0.244
e		0.5 BSC			0.0197 BSC	
K	0°		8°	0°		8°
L	0.50		0.75	0.020		0.030





## Tape &amp; Reel TSSOP48 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			330			12.992
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			30.4			1.197
Ao	8.7		8.9	0.343		0.350
Bo	13.1		13.3	0.516		0.524
Ko	1.5		1.7	0.059		0.067
Po	3.9		4.1	0.153		0.161
P	11.9		12.1	0.468		0.476



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