

This databook provides device data of Philips Semiconductors Low Voltage CMOS logic families. The following families were introduced for the low voltage market: LV, LVC, and ALVC. All families are complete new designs for 3.3V or sub-3V operations.

### ABOUT THE LVC (LOW VOLTAGE CMOS)

The LVC family has become a logic industry standard for 3.3V applications both in the telecom and EDP market segment. Manufactured in a CMOS process it offers direct interface with LVTTTL levels. It is specified and guaranteed for industrial operating temperatures. The LVCs provide 4.5 – 5ns speeds and 24mA drive capability while operating at 3V with very low static and dynamic power consumption. The family supports live insertion. Its 5V tolerance capabilities makes it extremely attractive for mixed 5V/3V systems. The LVC devices offer both non-bus hold and bus hold options with or without damping resistor features. With bus hold, the need for pull-up and pull-down resistors for floating inputs is eliminated. Series damping resistors help prevent signal undershoots and overshoots. The family product offering ranges from standard gates, octals to complex 16-bit bus interface functions used for buffering, multiplexing and interfacing in mixed 5V/3V systems. The broad portfolio and feature set of the LVC family provide designers with the flexibility and reliability necessary to minimize manufacturing costs, eliminate floating inputs and design “worry-free” systems.

### ABOUT THE ALVC (ADVANCED LOW VOLTAGE CMOS)

One of the fastest low voltage CMOS family, the ALVC family is widely used in supporting memory interfacing and multiplexing. ALVC offers direct interface with LVTTTL levels. Industrial operating temperature is from –40°C to +85°C. ALVC features flow-through standard pin-out architecture and low inductance, noise and ground bounce properties. ALVC devices offer both non-bus hold and bus hold operation, with or without “damping resistor” features, indicating a large variety of bus interface functions. With bus hold, the need for pull-up or pull-down resistors for floating inputs is eliminated. Series damping resistors help prevent signal undershoots and overshoots. ALVC devices are widely used in memory buffering, multiplexing and interfacing to 3.3V synchronous DRAMs, demonstrating typical propagation delays of less than 3ns. With a standard 24mA drive capability at 3.3V and static power consumption of 40μ or less, ALVC is ideal for all types of low-voltage applications. Philips ALVC supports products that fulfill the PC100 logic interface requirements necessary to support next generation PC systems.

In Table 1, the nomenclature for the LVC and the ALVC families is summarized.

**Table 1. Guidelines of the Philips nomenclature for the LVC and the ALVC families**

OPTIONS	COMMENT	PHILIPS LVC	PHILIPS ALVC
Non-bus hold	In 8-bits In 16-bits	74LVCxxx 74LVC16XXX	– 74ALVC16xxx
Bus hold	In 8-bits	74LVCHxxx	–
Bus hold	In 16-bits	74LVCH16XXX	74ALVCH16xxx
Damping Resistor	In 8-bits In 16-bits	74LVC2xxx 74LVC162XXX	– 74ALVC162xxx
Bus hold + Damping Resistor	In 16-bits	74LVCH162XXX	74ALVCH162xxx

## ORDERING INFORMATION

All datasheets have an ordering information table which is for Philips Internal Use Only.

All customers worldwide should use the **part name** as the **ordering part number**.

**Only exception:** For North American Distribution Customers, please use the **Disti-Price Book** part name.

**FEATURE SUMMARY**

In table 2, the major characteristics of the three low voltage families are summarized:

**Table 2. Feature Summary**

KEY PARAMETERS	LV	LVC	ALVC
Minimum $V_{CC}$ V	1.0	1.2	1.2
Maximum $V_{CC}$ V	5.5	3.6	3.6
Output current mA	$\pm 6$	$\pm 24$	$\pm 24$
Quiescent current $\mu A$	20	10 <sup>1</sup>	40
'244 delay times			
$T_{PD}$ typ. ns	9	3.5	1.9
$T_{PD}$ max. ns	14	5.8	3.0
Maximum ground bounce V	0.4	0.8	0.7
<b>FEATURES</b>			
Full CMOS	✓	✓	✓
Drive capability: 130 $\Omega$ 50 $\Omega$	✓	✓	✓
Feature size: 2.0 $\mu m$ 0.7 $\mu m$ 0.45 $\mu m$	✓	✓	✓
Corner supply pins Multiple $V_{CC}/GND$ pins	✓	✓ <sup>2</sup>	✓
TTL level input TTL level output 5V Input capability 5V Output capability Live insertion Input bus hold option Damping resistor option	✓ ✓	✓ ✓ ✓ ✓ ✓ <sup>4</sup> ✓ ✓	✓ ✓ ✓ <sup>3</sup>
Packages: DIL SO SSOP TSSOP	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓	✓ ✓

**NOTES:**

1. 20  $\mu A$  for 16-bits.
2. For 16-bit products.
3. For control pins only and for non-bus hold types; For bus hold input and output pins:  $V_{IN\ max} = V_{CC} + 0.5V$ .
4. With pull-up resistor connected to  $\overline{OE}$ .

**DESIGNERS' GUIDE****Electrical Characteristics**

The following pages cover a number of electrical characteristics of the LVC and ALVC families. The parts chosen to be plotted are the 74LVC245A, 74LVC16245A, and the 74ALVC16245.

**I. Propagation Delay versus Temperature**

The effect of temperature on the propagation delay are plotted. The measurements were done under the following conditions:

- $C_L = 50\text{pF}$
- One output switching
- $V_{CC}$  in the range of 2.7V – 3.6V

**II. Propagation Delay versus  $C_L$** 

The effect of the output load on the propagation delay are plotted for different switching conditions (i.e. one output switching or multiple outputs switching). The measurements were done under the following conditions:

- Temperature = 25°C
- $V_{CC} = 3.3\text{V}$
- $R_L = 500\Omega$

**III. Supply Current versus Frequency**

The supply current is plotted for a frequency range of 10MHz – 100MHz. The results are based on the following conditions:

- $C_L = 50\text{pF}$
- All outputs switching
- Temperature = 25°C
- $V_{CC} = 3.3\text{V}$
- $R_L = 500\Omega$

**IV.  $V_{OLP}$ ,  $V_{OLV}$ ,  $V_{OHV}$ ,  $V_{OHV}$  versus Load Capacitance**

Ground bounce versus load capacitance

**V.  $V_{OL}$  versus  $I_{OL}$** 

The output low voltage is plotted versus the output low current.

**VI.  $V_{OH}$  versus  $I_{OH}$** 

The output high voltage is plotted versus the output high current.

**VII. Pin Skew**

The propagation delay skew is presented for all three devices.

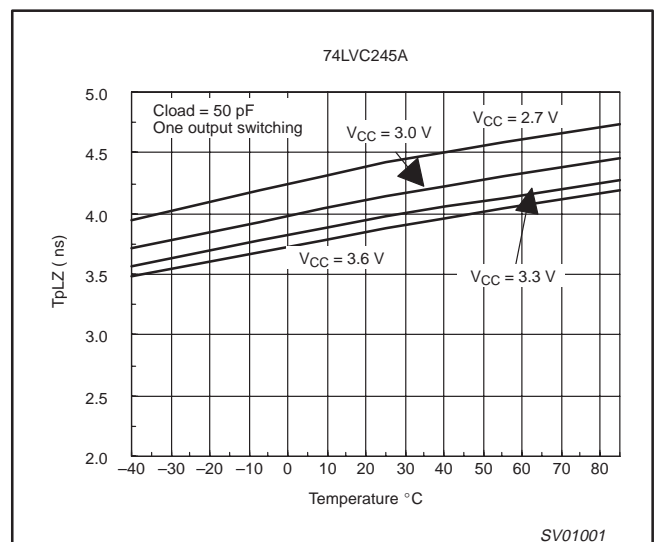
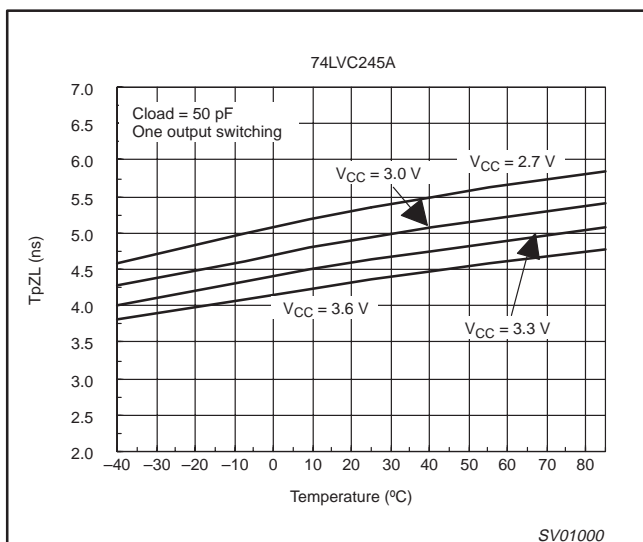
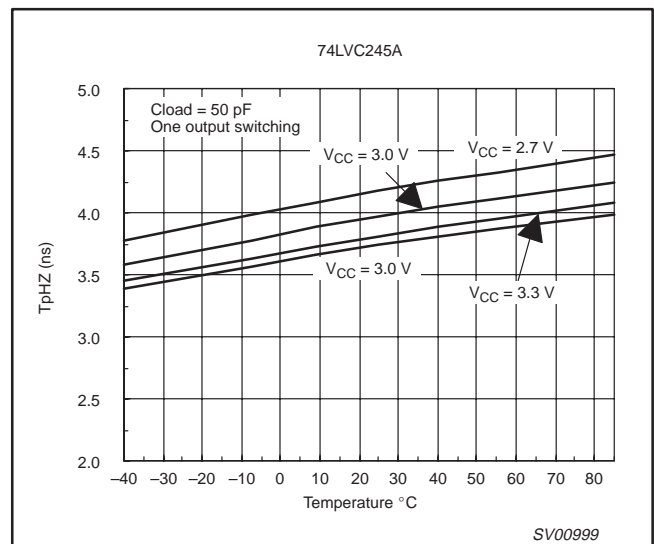
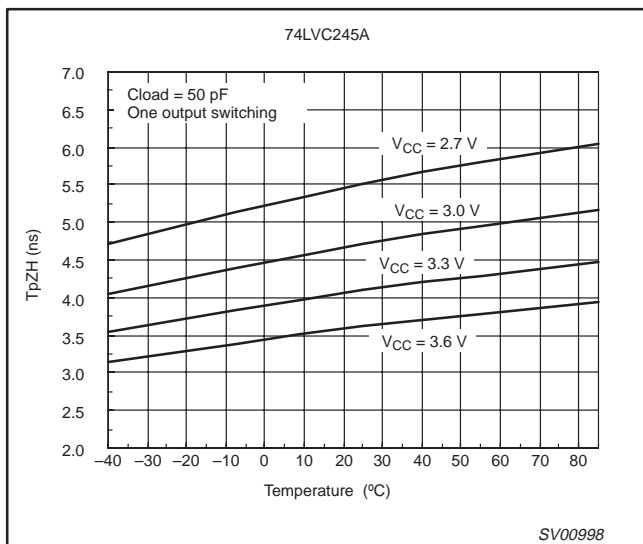
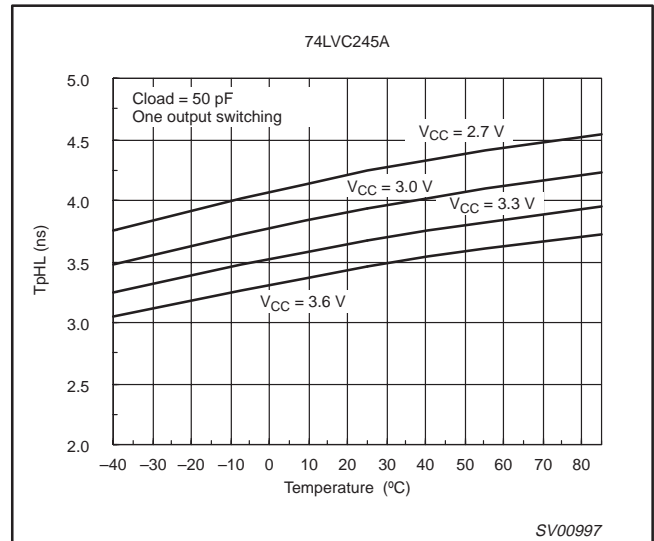
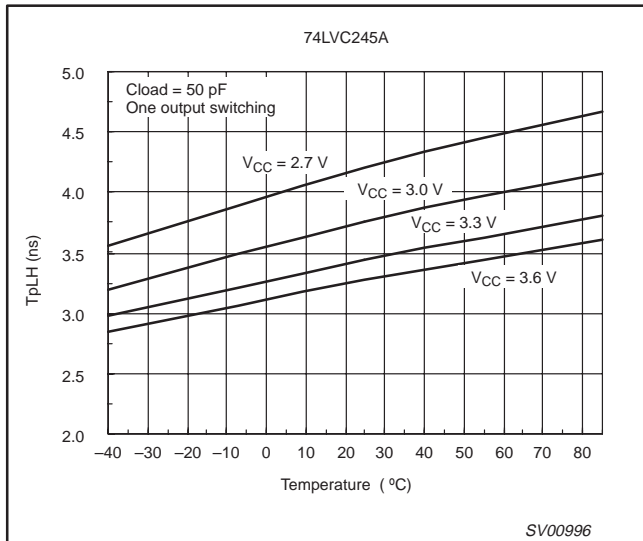
**VIII.  $I_{INP}$  versus  $V_{INP}$** 

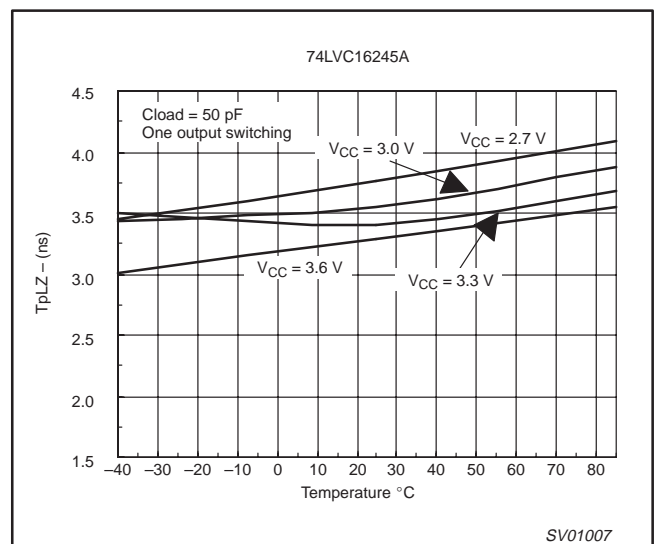
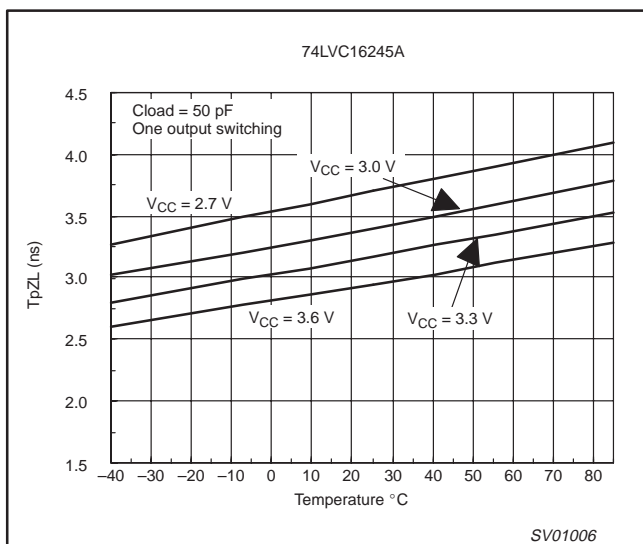
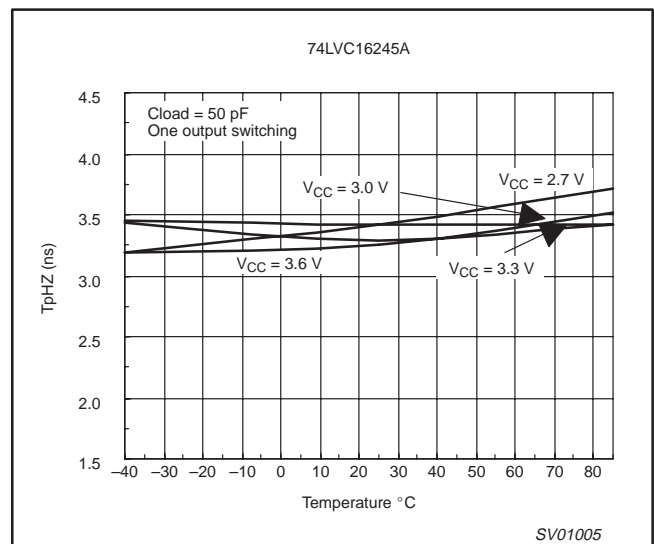
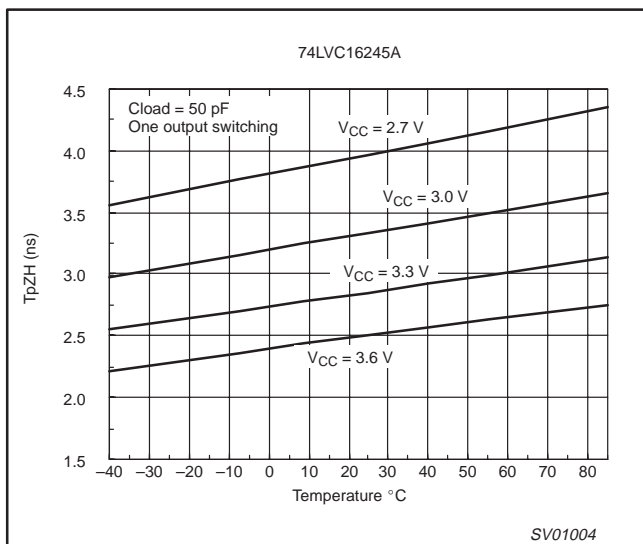
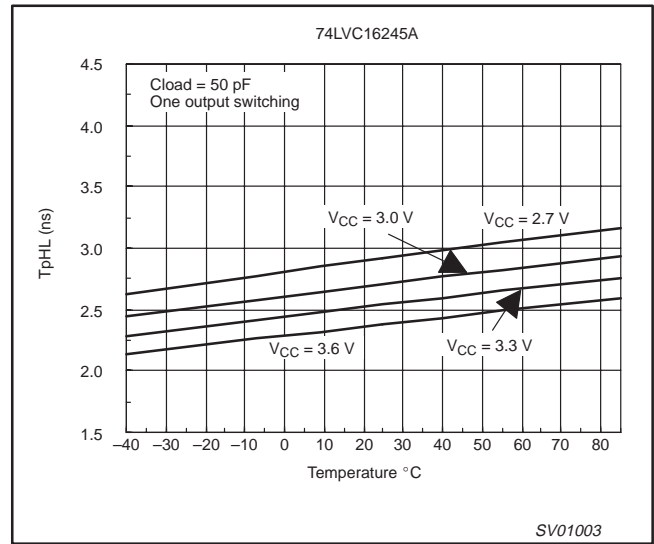
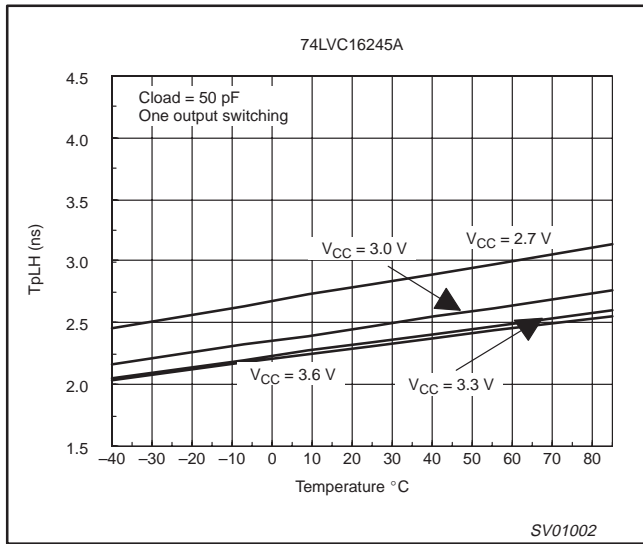
The input current is plotted versus the input voltage.

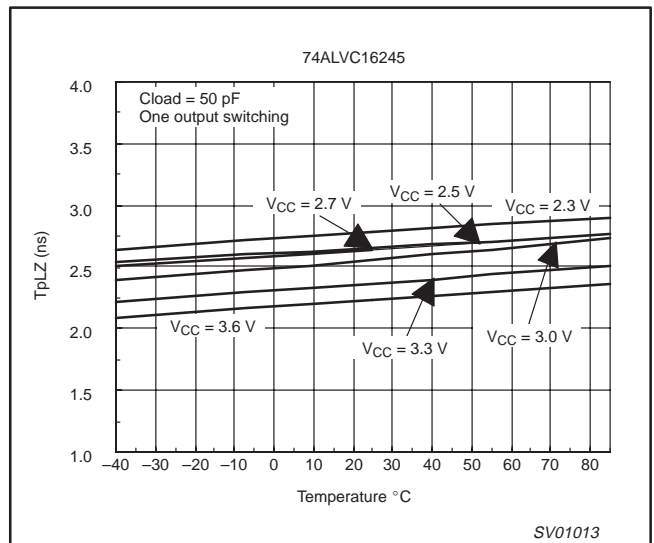
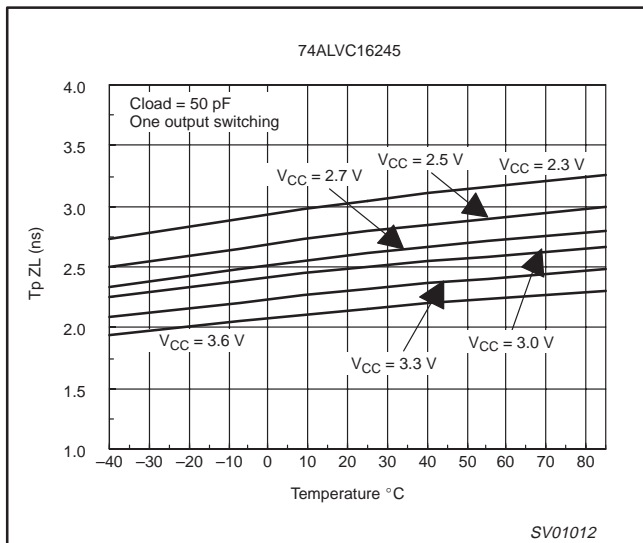
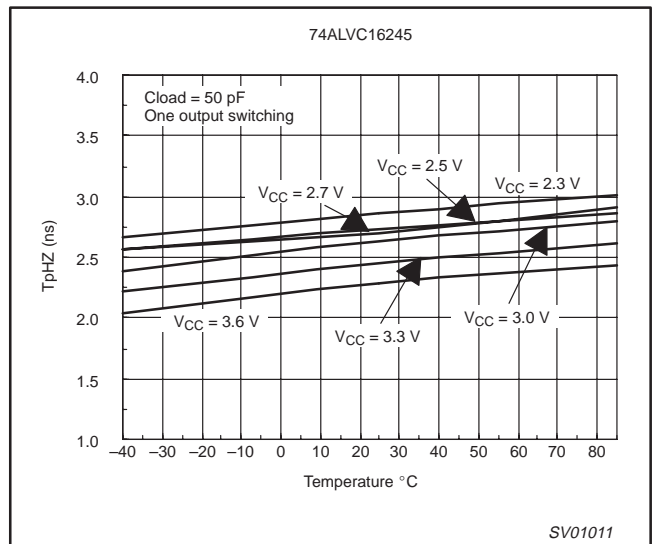
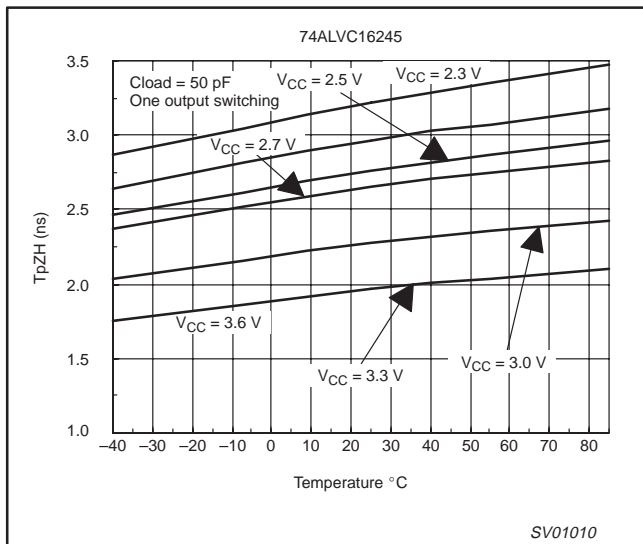
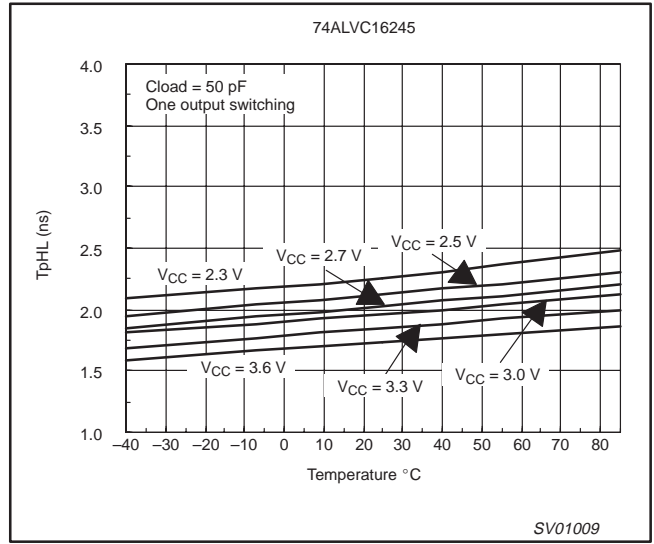
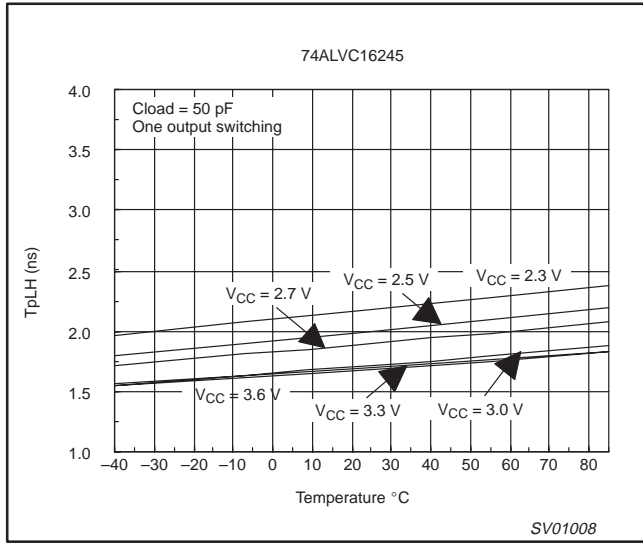
**IX.  $I_{CC}$  versus  $V_{INP}$** 

The input leakage current is plotted versus the input voltage.

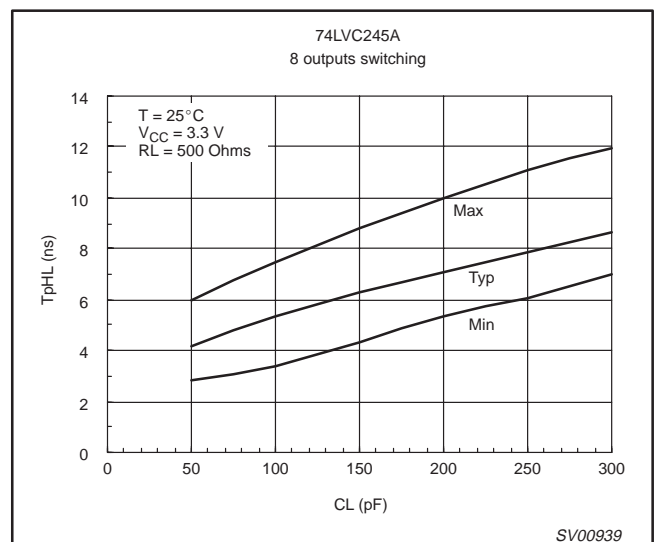
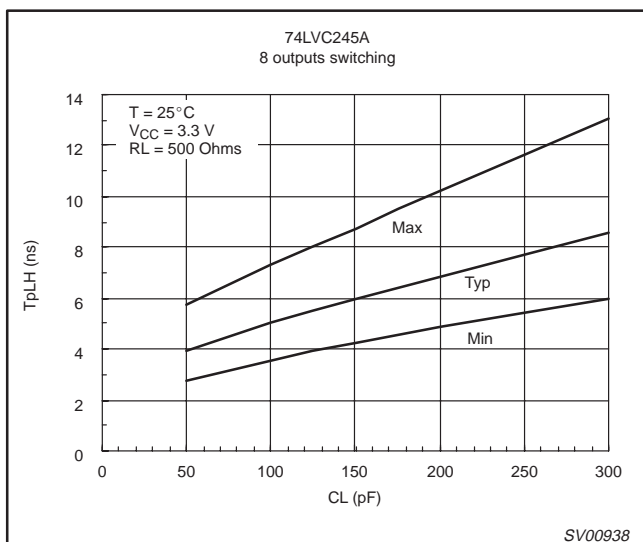
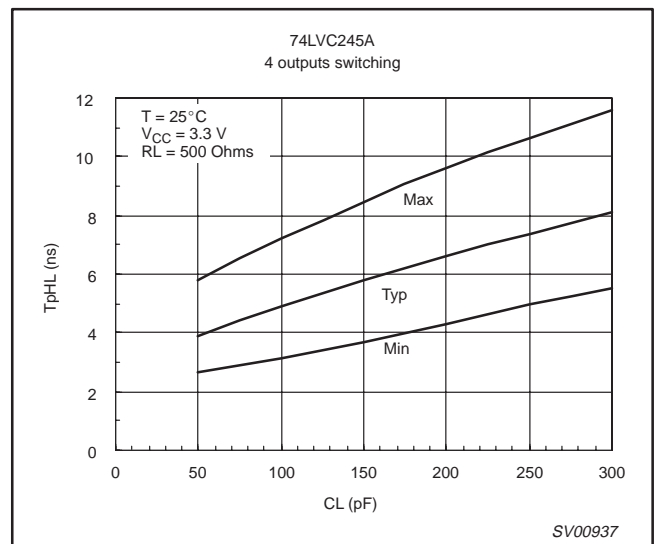
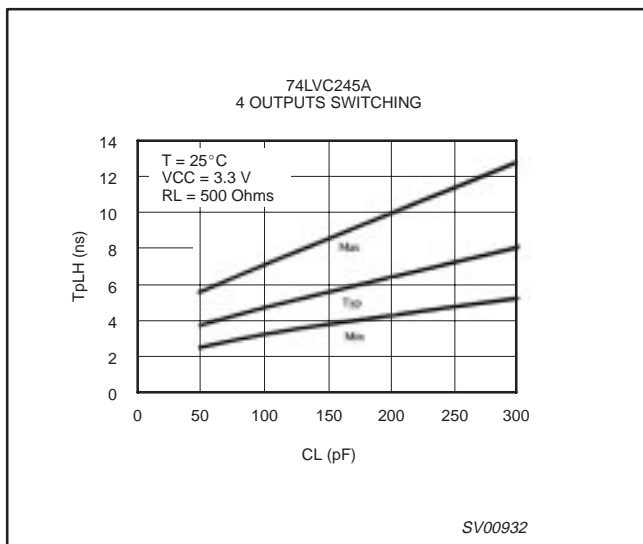
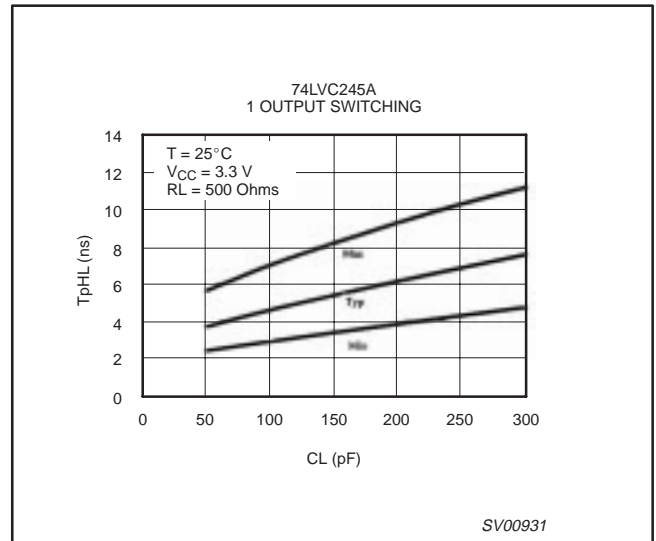
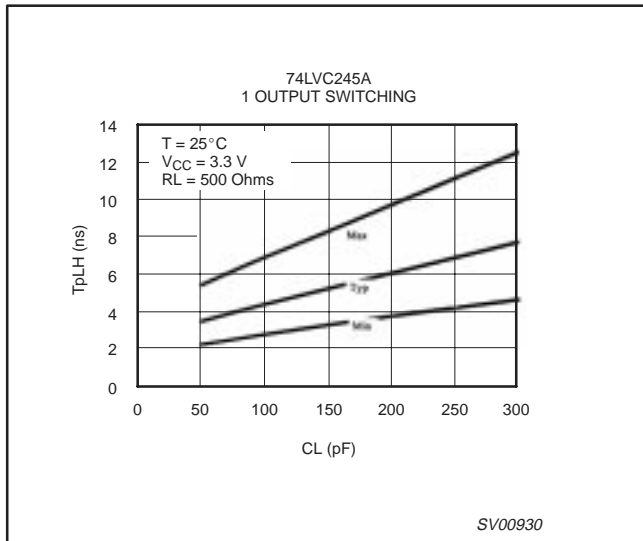
I. PROPAGATION DELAY VERSUS TEMPERATURE

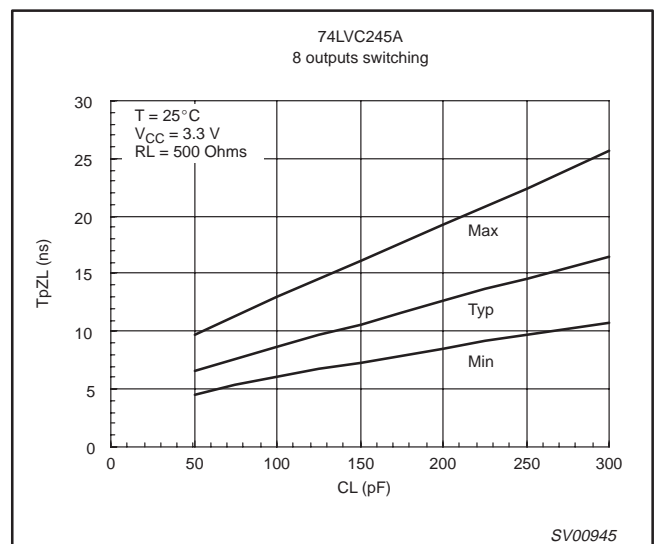
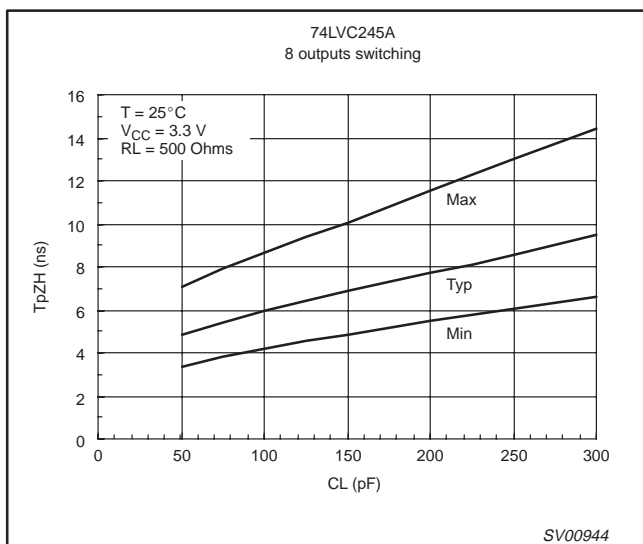
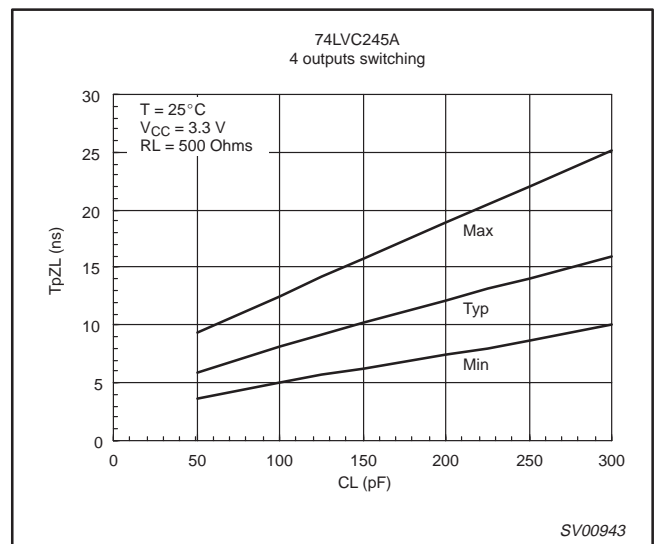
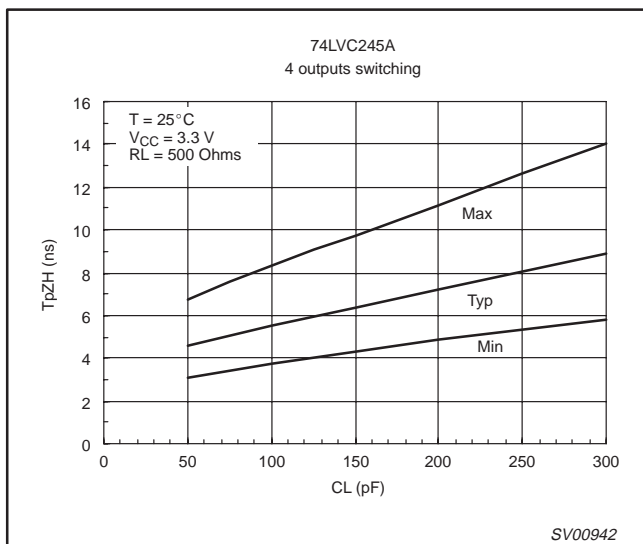
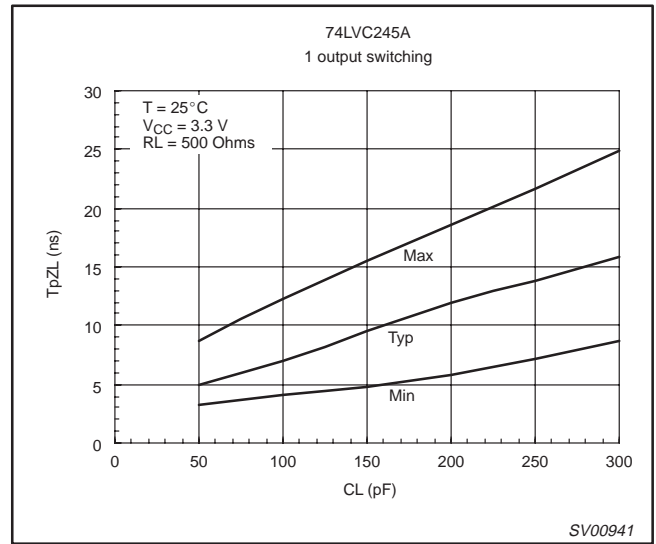
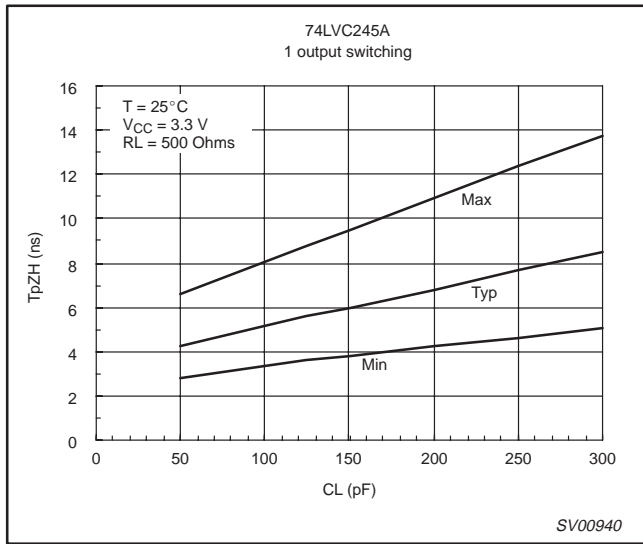


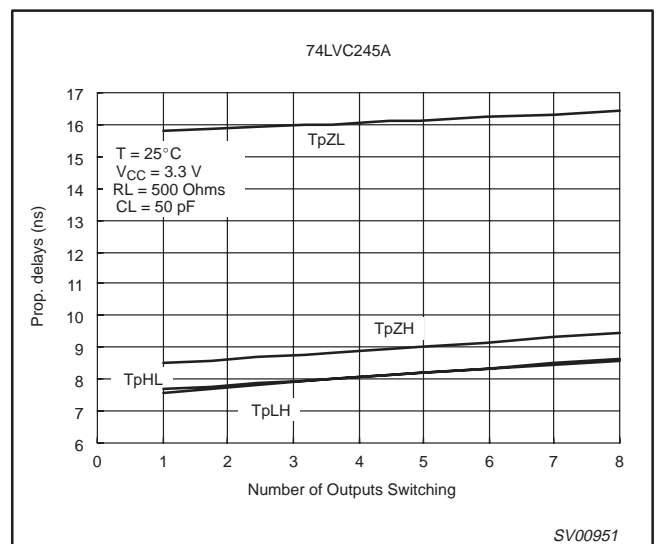
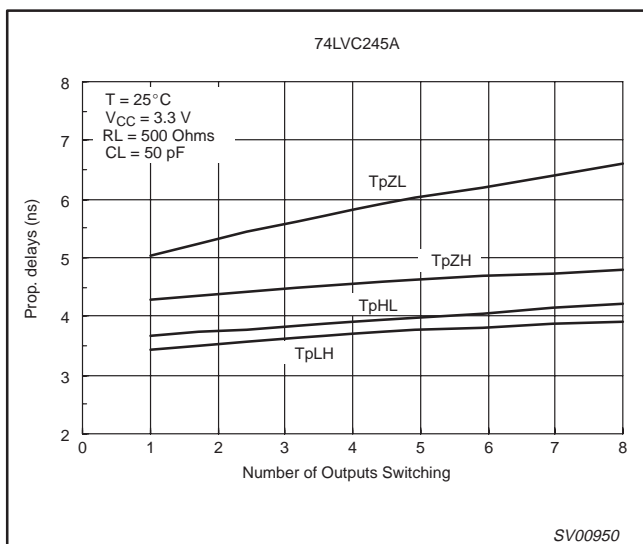
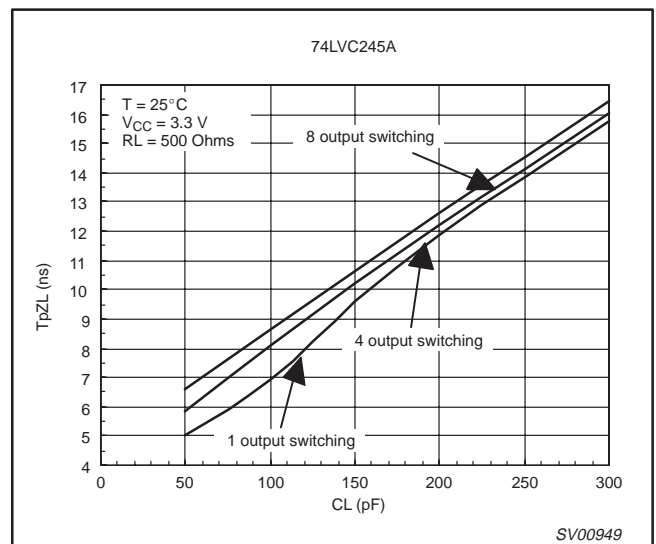
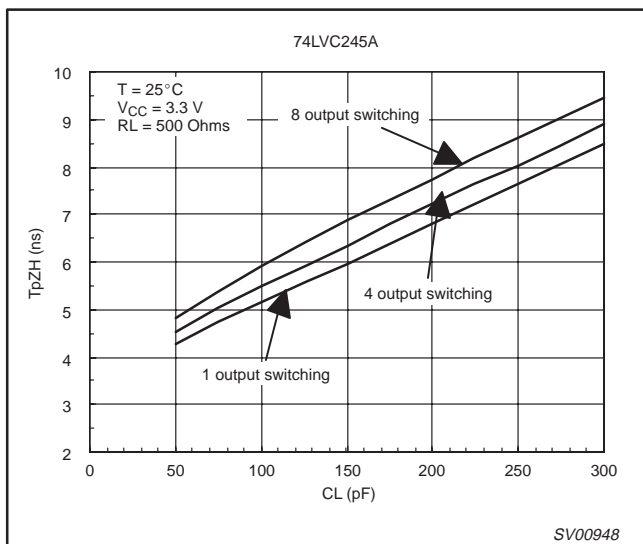
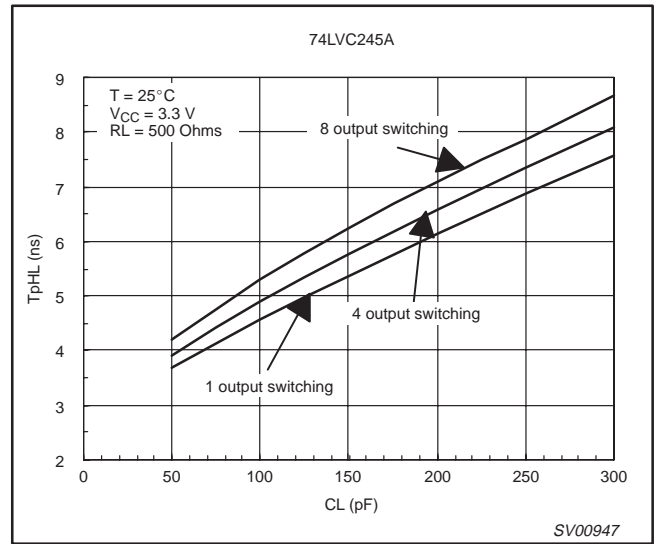
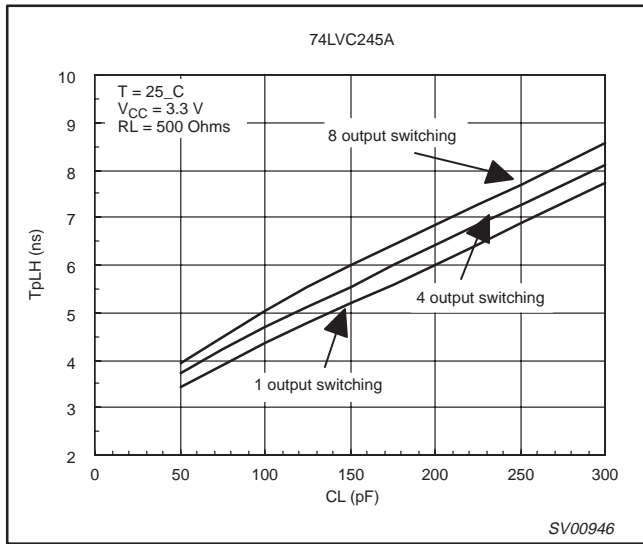


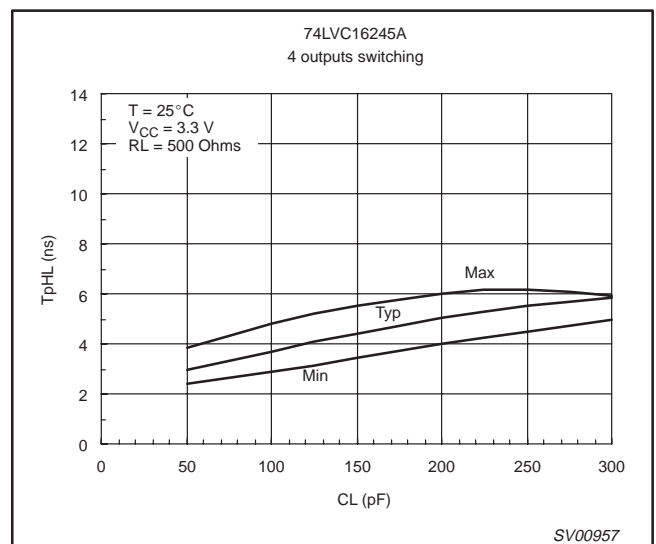
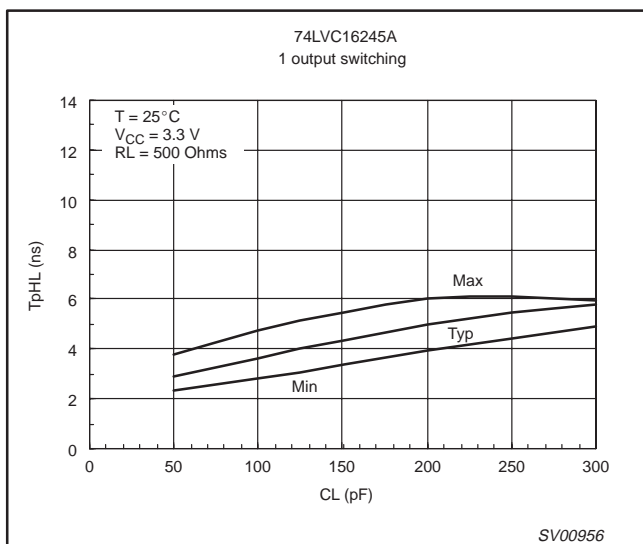
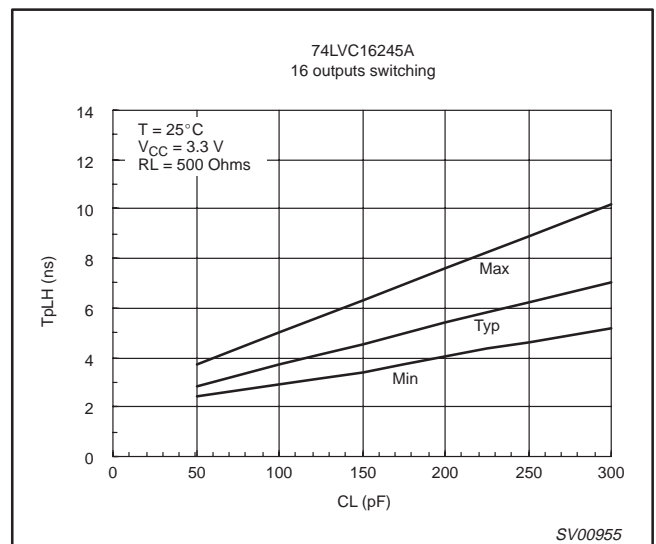
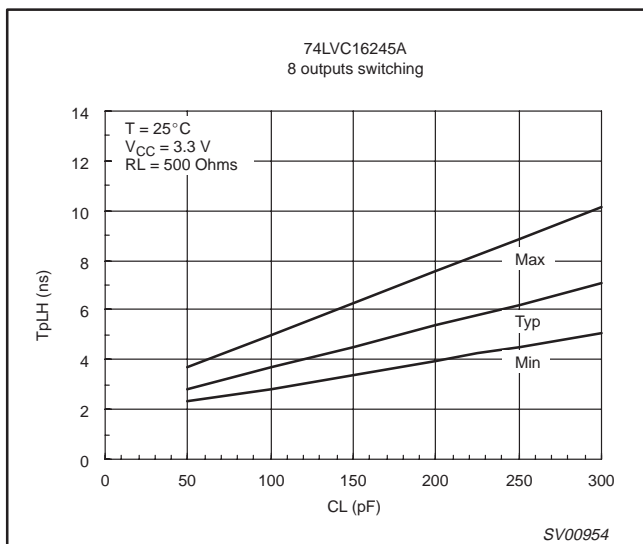
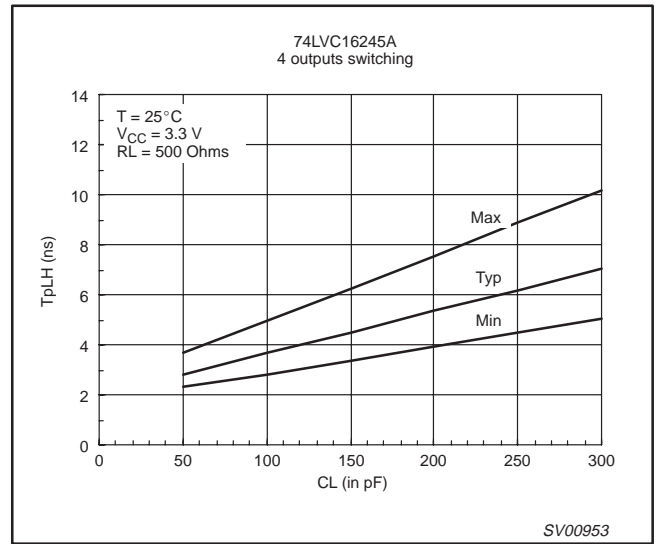
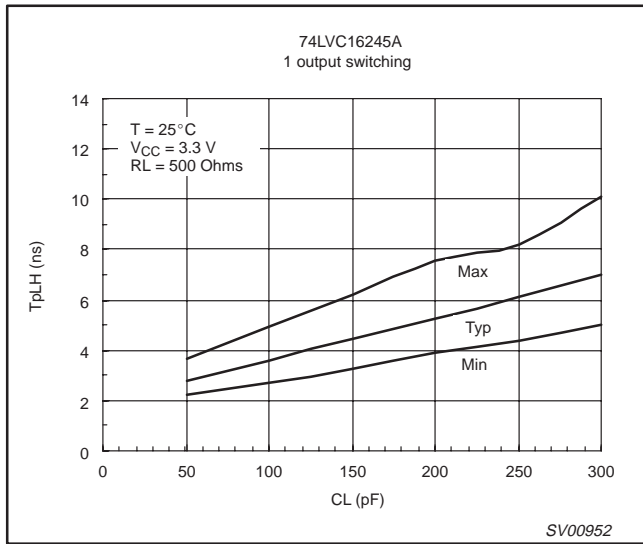


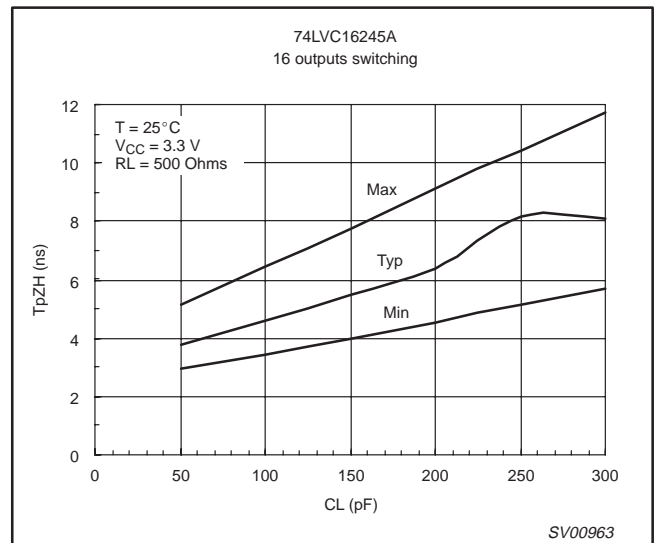
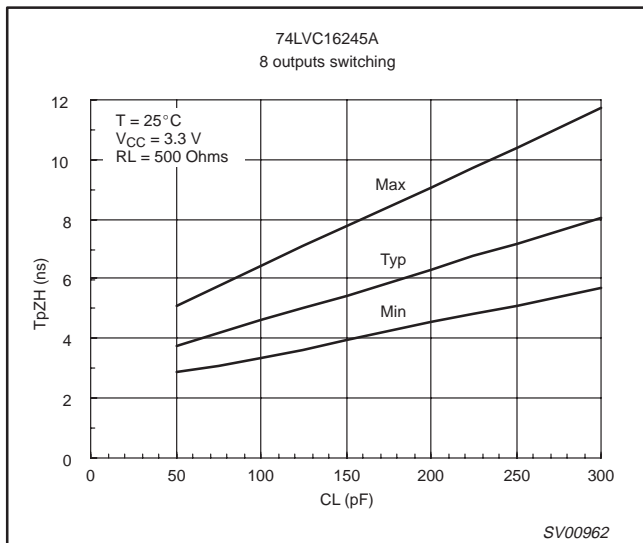
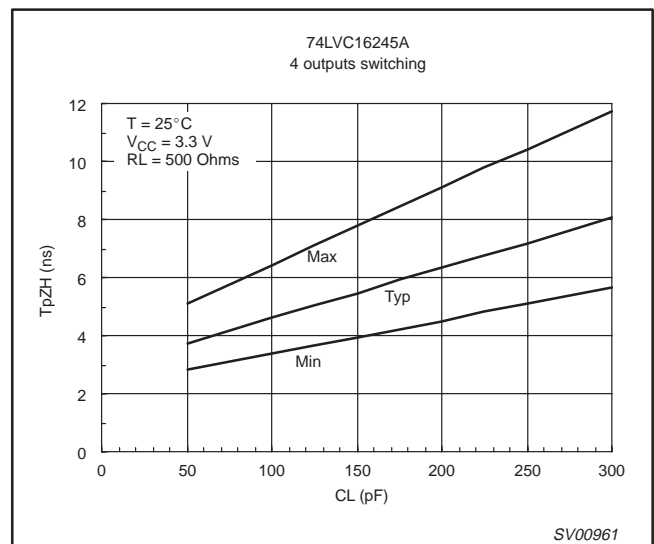
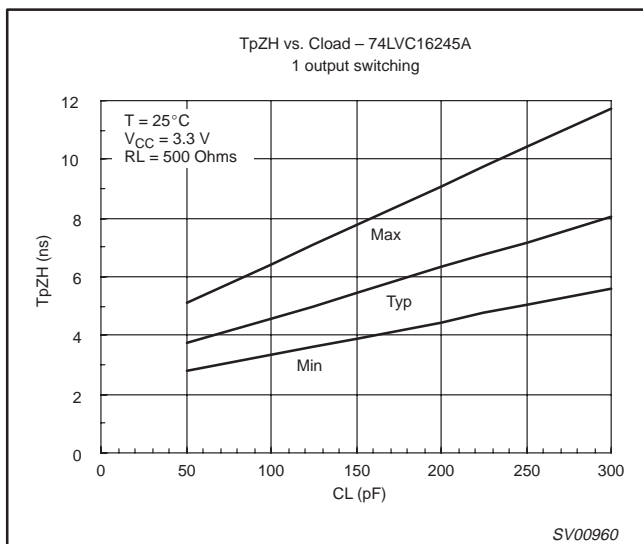
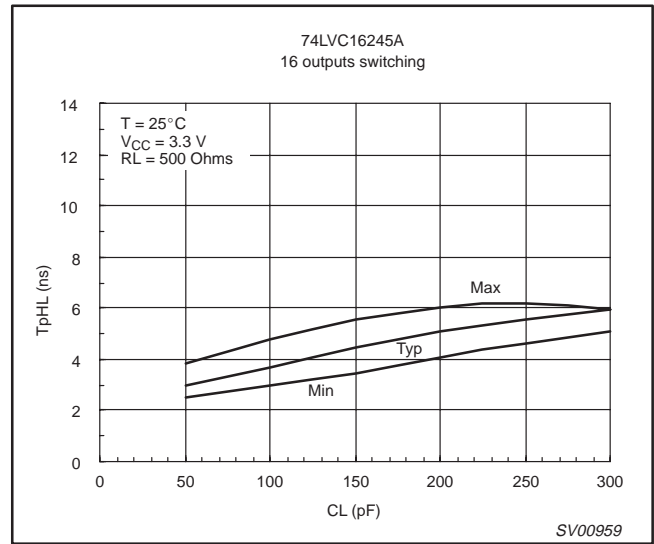
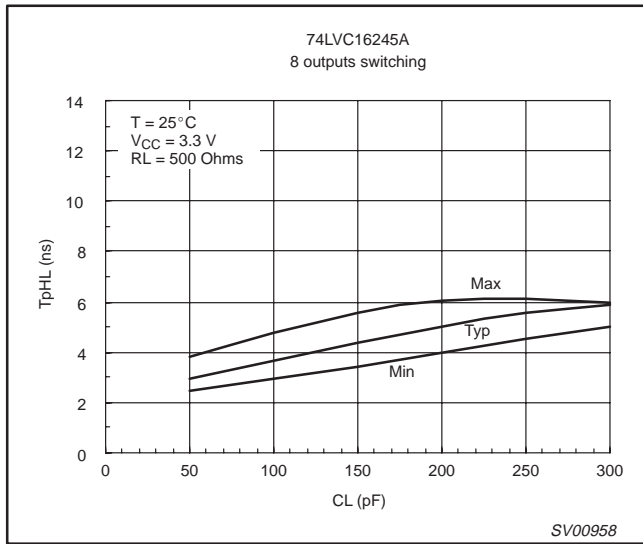
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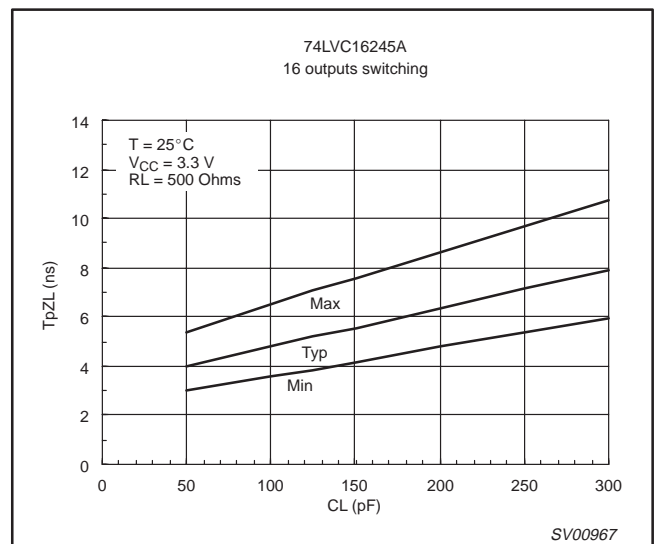
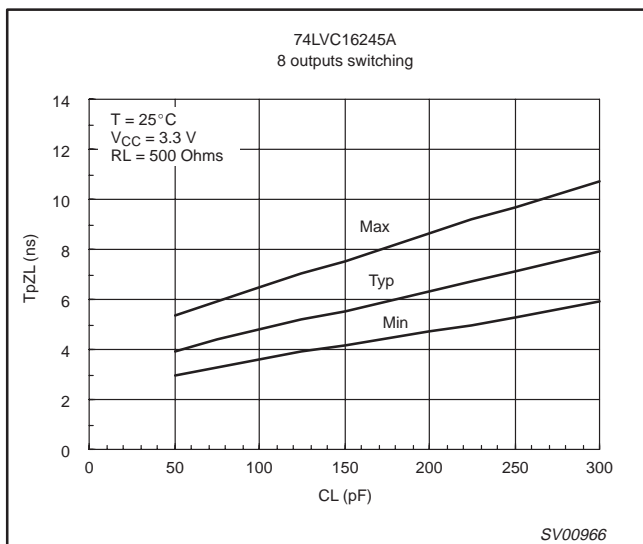
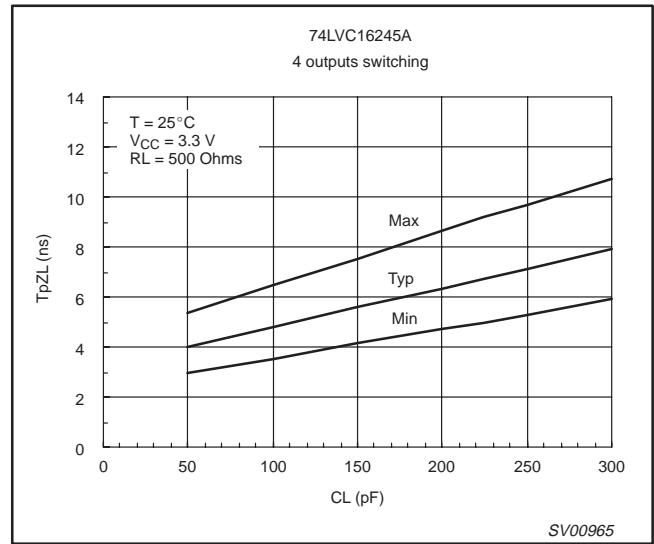
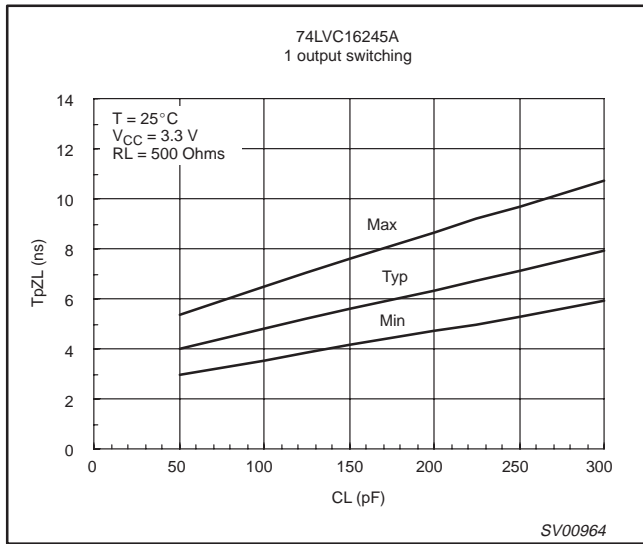


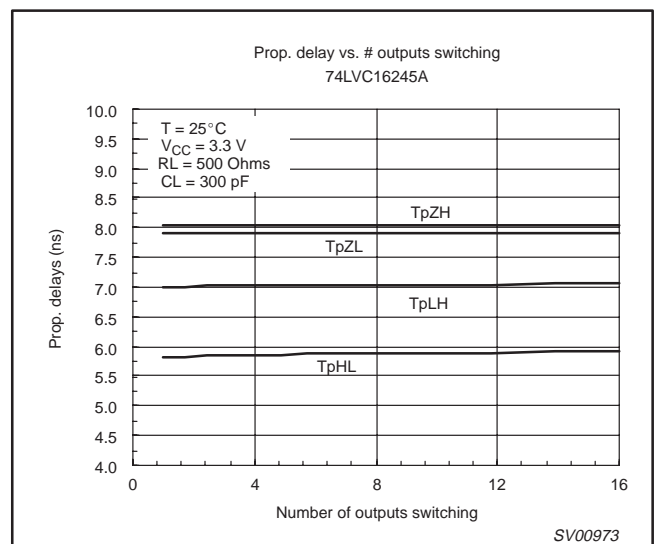
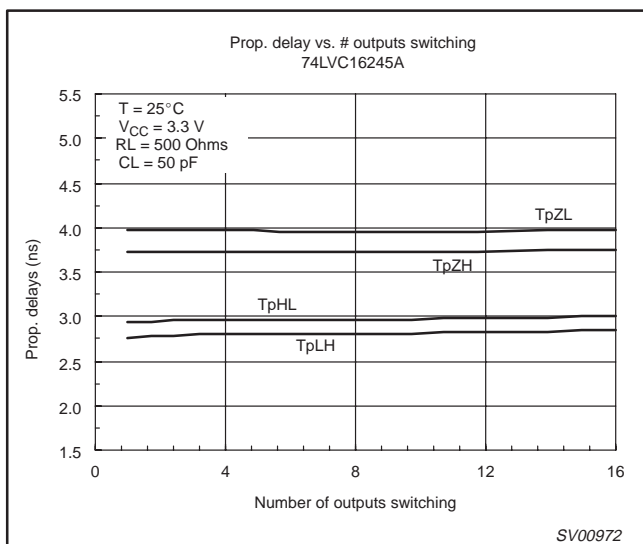
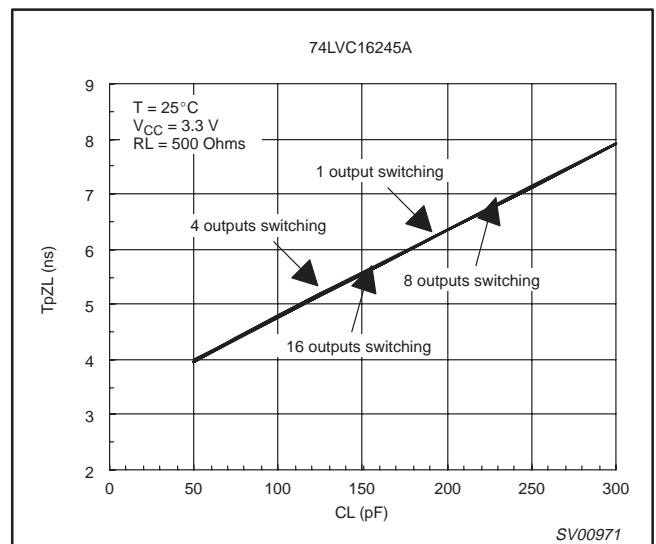
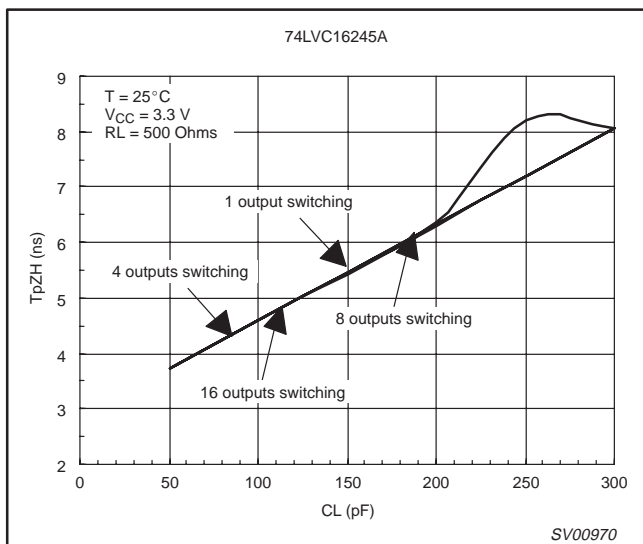
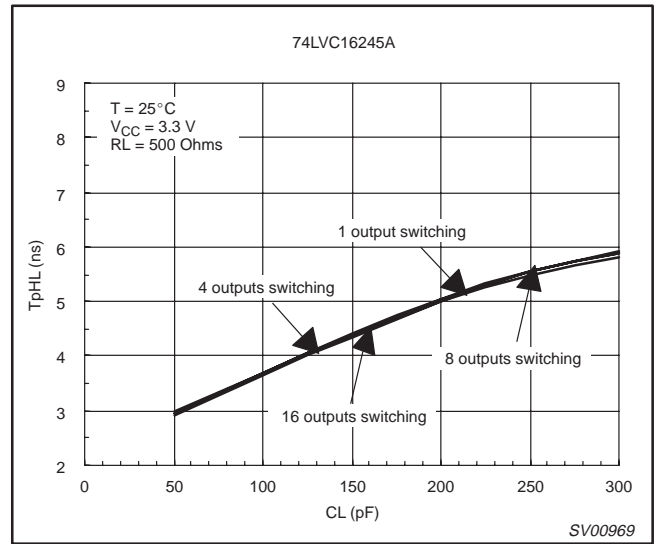
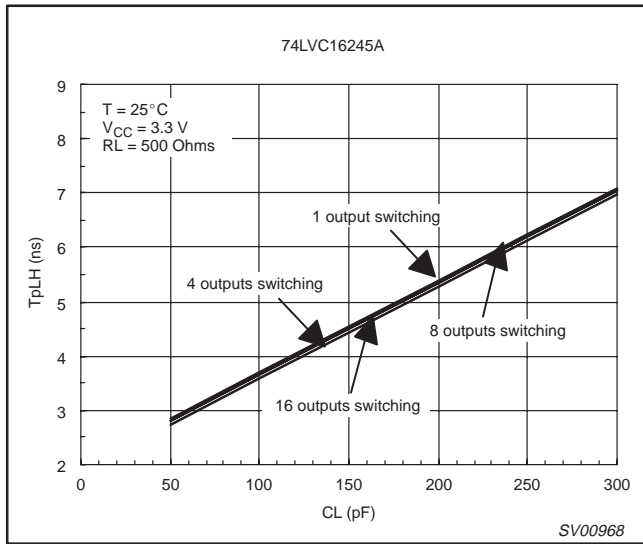


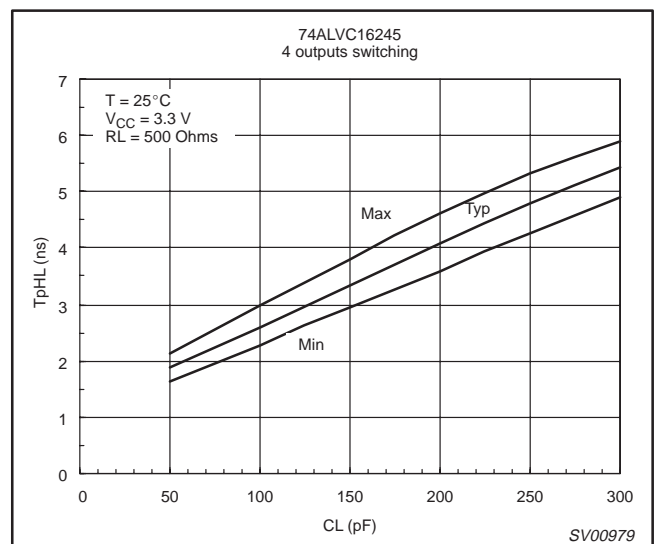
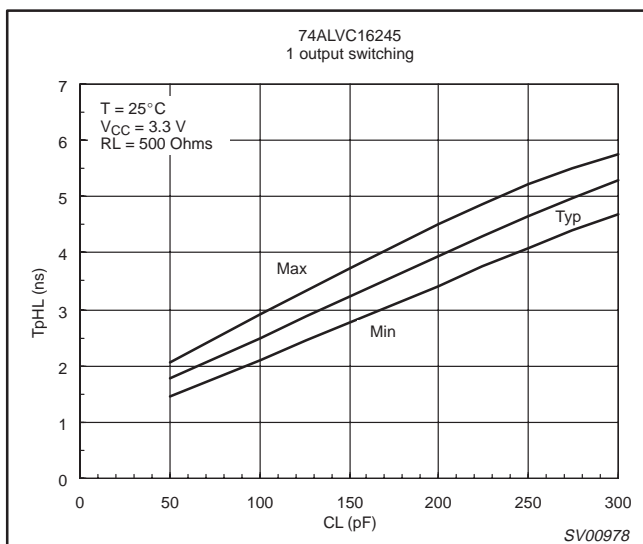
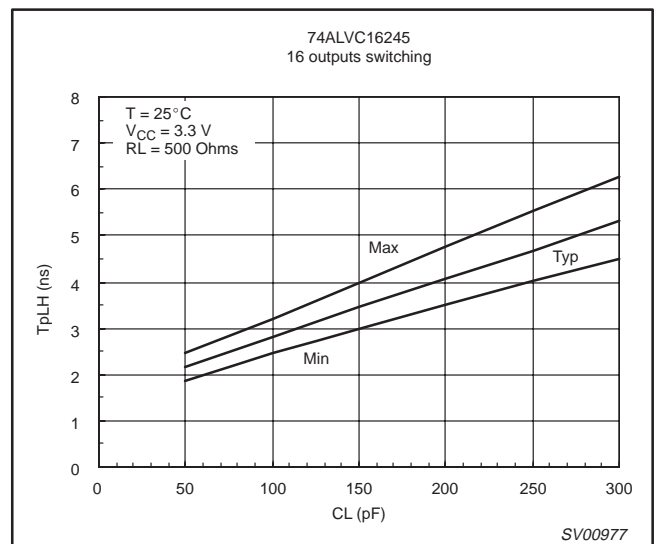
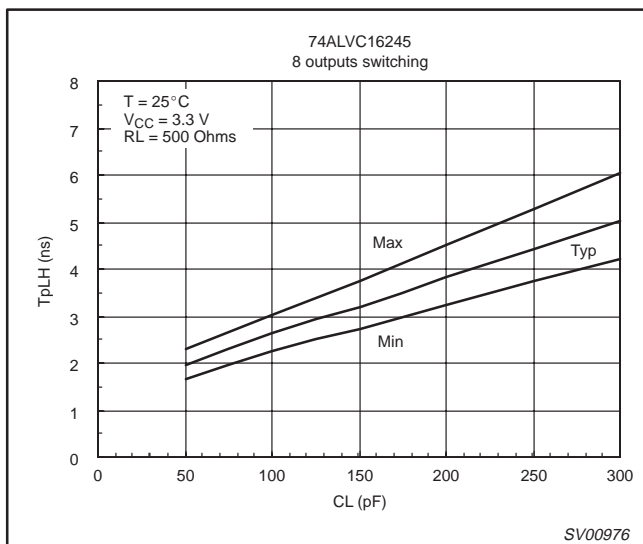
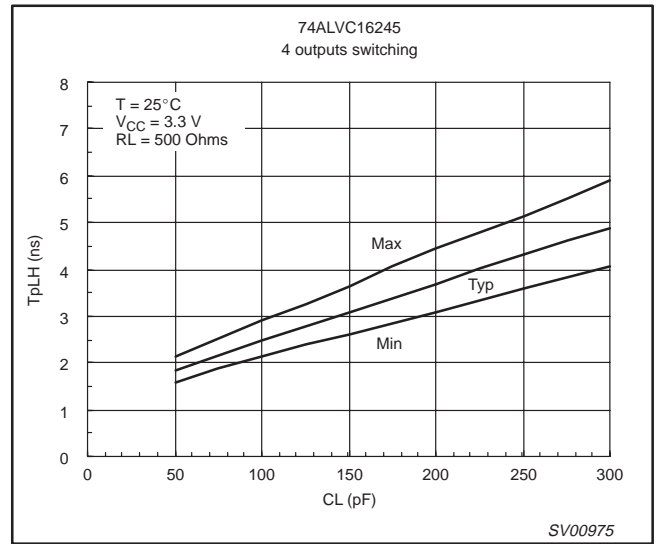
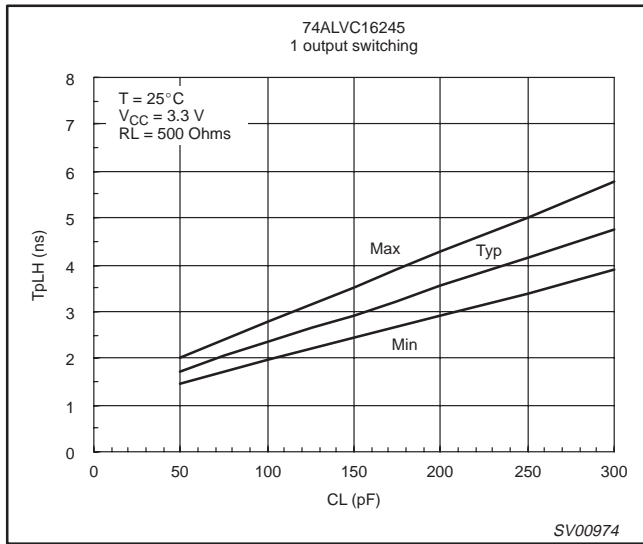


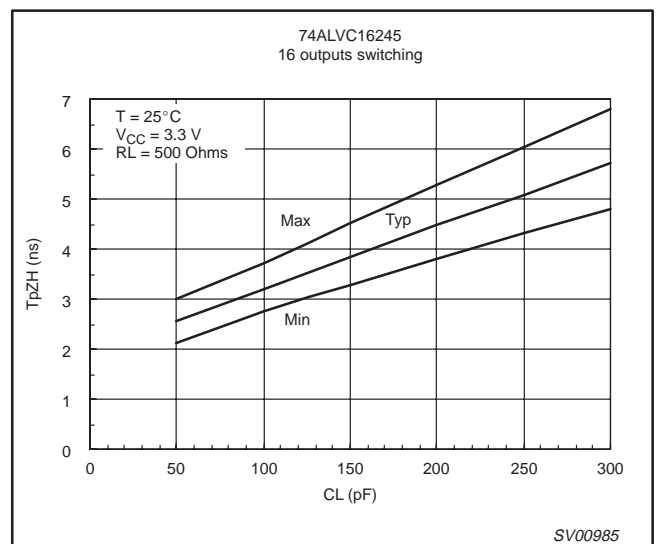
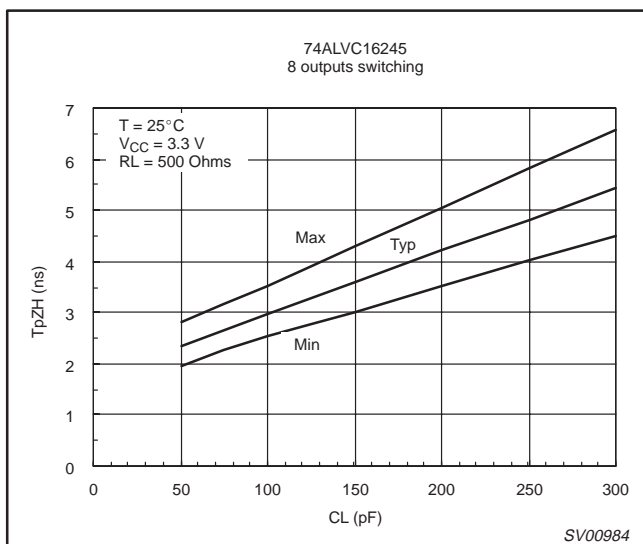
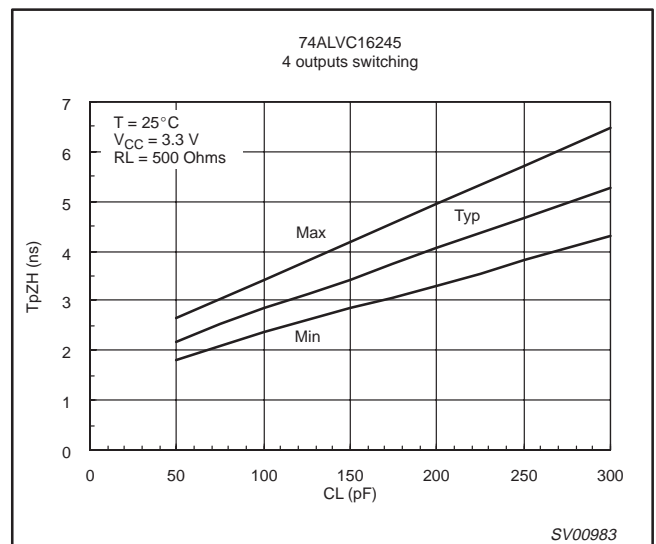
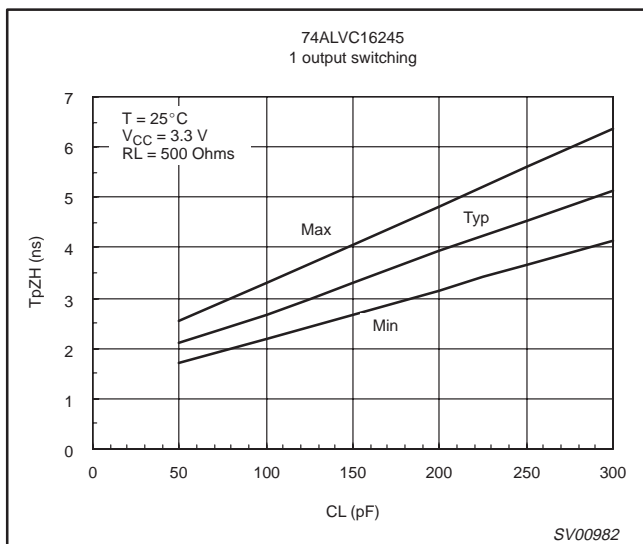
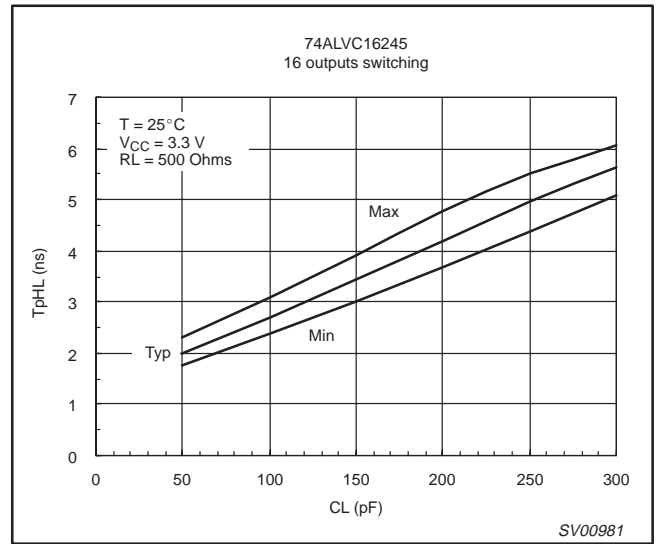
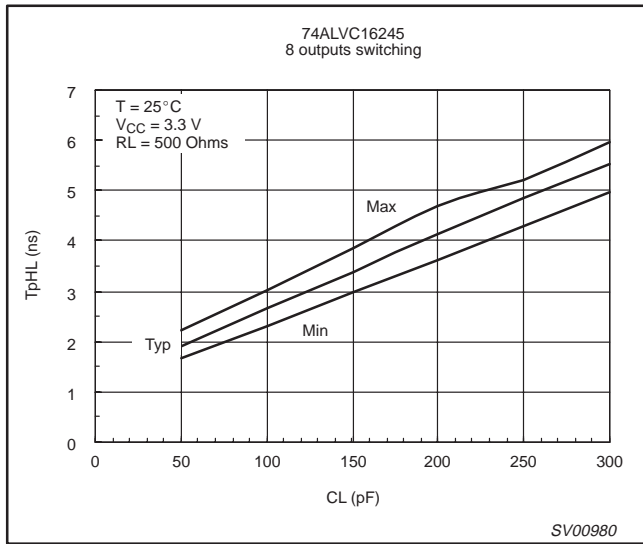


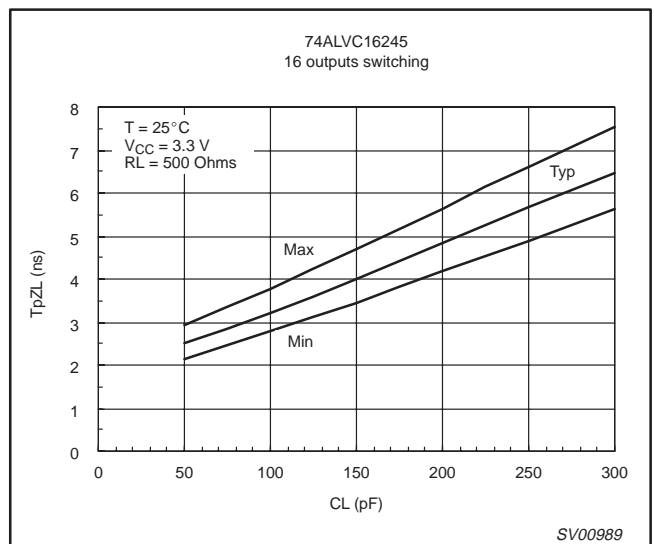
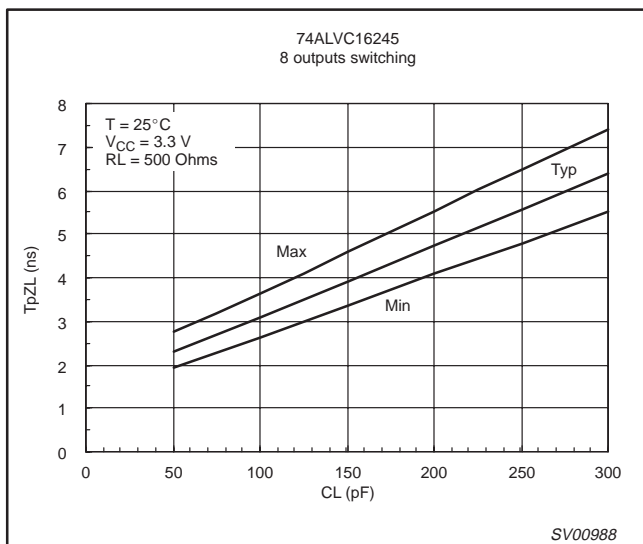
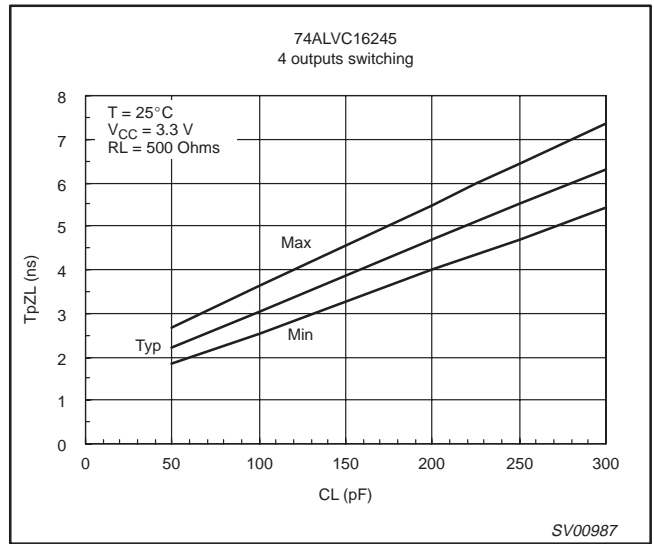
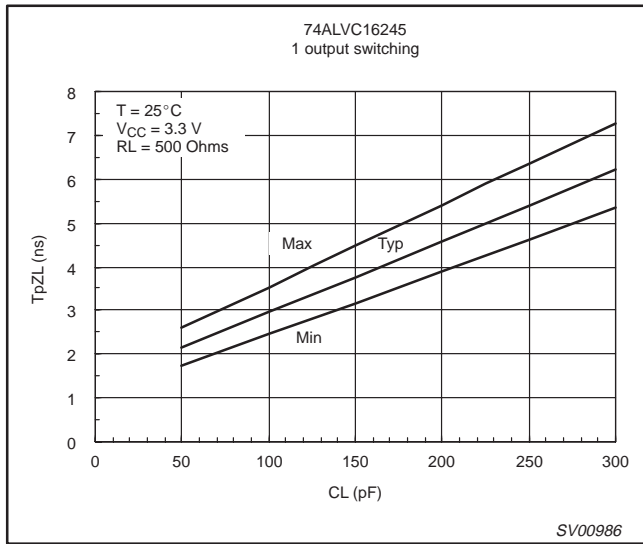


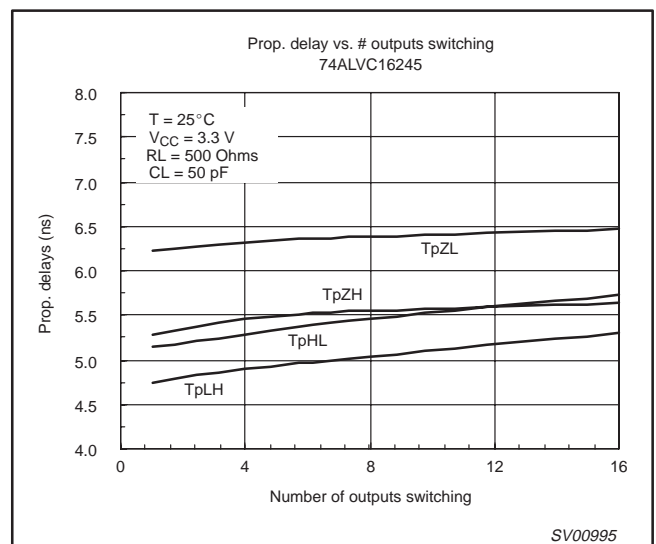
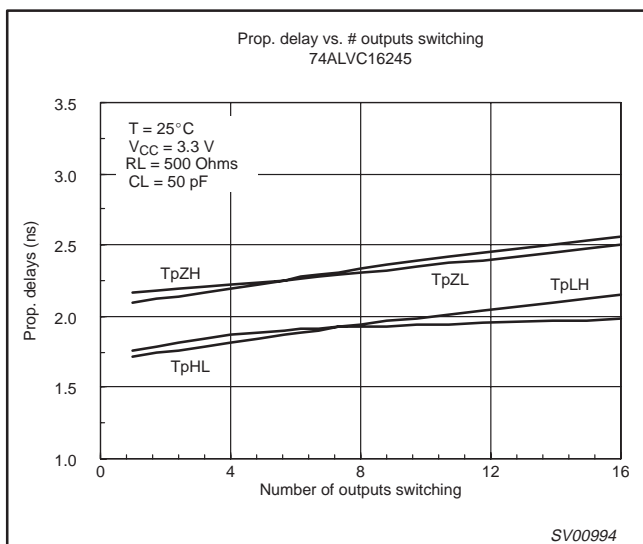
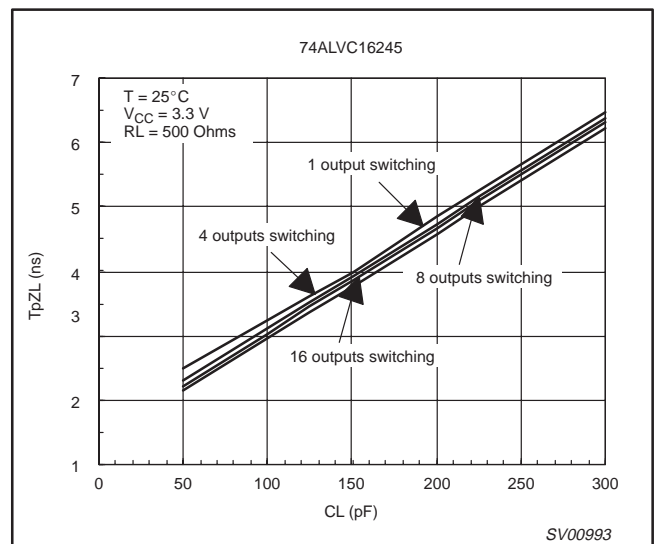
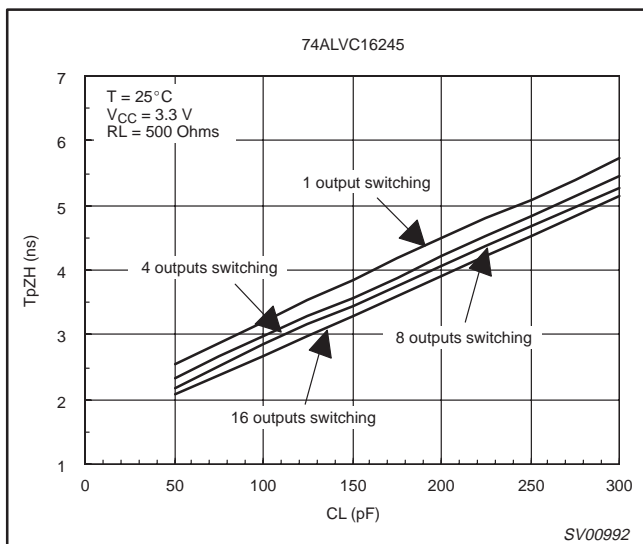
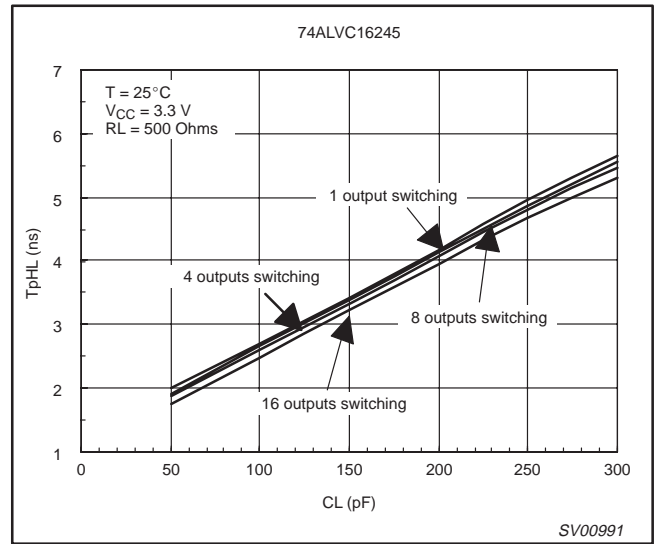
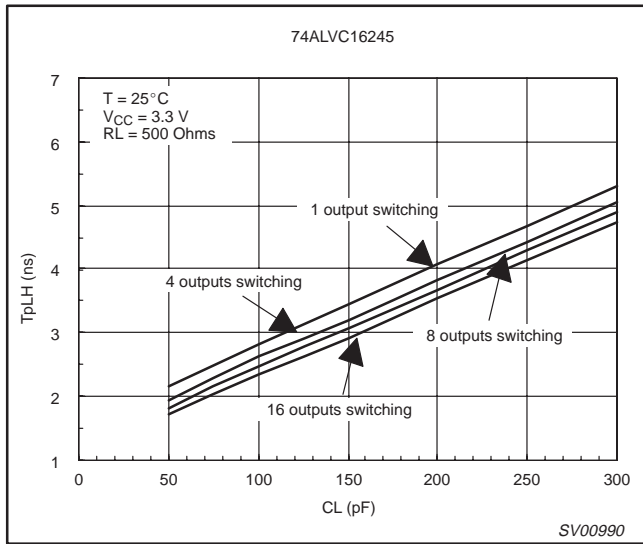




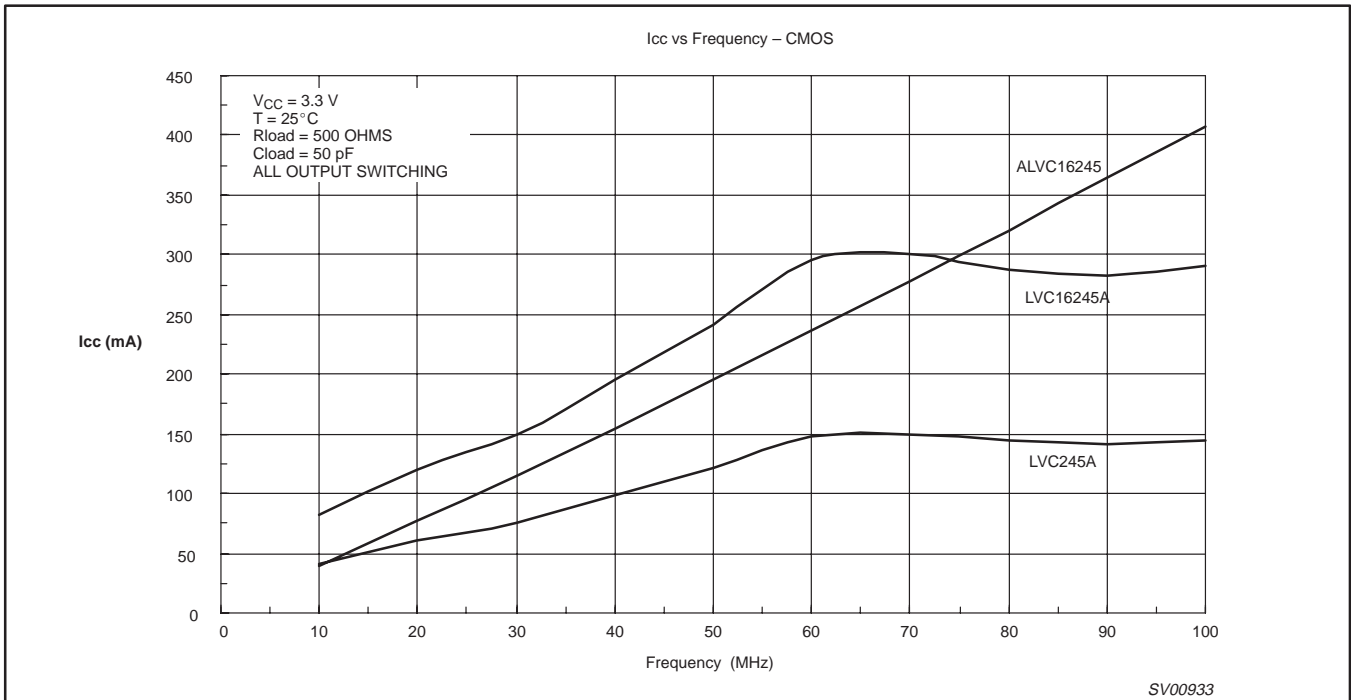








III. SUPPLY CURRENT VERSUS FREQUENCY



IV.  $V_{OLP}$ ,  $V_{OLV}$ ,  $V_{OHV}$ ,  $V_{OHP}$  VERSUS  $C_{LOAD}$  ( $C_L$ )

## 74LVC245A

General conditions

- $T_{amb} = 25^{\circ}\text{C}$
- One output quiet, 7 outputs are switching same time.
- Package: SSOP

**NOTE:** The values are typical. $V_{CC} = 3.3$  Volt

$C_L$ (pF)	50	100	150	200	250	300
$V_{OLP}$ (V)	0.628	0.577	0.518	0.467	0.425	0.390
$V_{OLV}$ (V)	-0.87	-0.636	-0.501	-0.409	-0.320	-0.213
$V_{OHV}$ (V)	2.664	2.788	2.869	2.924	2.963	2.993
$V_{OHP}$ (V)	3.674	3.503	3.413	3.354	3.298	3.248

 $V_{CC} = 2.7$  Volt

$C_L$ (pF)	50	100	150	200	250	300
$V_{OLP}$ (V)	0.357	0.340	0.312	0.91	0.272	0.253
$V_{OLV}$ (V)	-0.542	-0.414	0.318	-0.242	-0.146	-0.055
$V_{OHV}$ (V)	2.270	2.351	2.403	2.439	2.464	2.481
$V_{OHP}$ (V)	2.902	2.789	2.726	2.684	2.642	2.625

 $V_{CC} = 2.5$  Volt

$C_L$ (pF)	50	100	150	200	250	300
$V_{OLP}$ (V)	0.269	0.267	0.257	0.242	0.226	0.211
$V_{OLV}$ (V)	-0.450	-0.345	-0.262	-0.182	-0.086	-0.013
$V_{OHV}$ (V)	2.134	2.201	2.244	2.273	2.294	2.305
$V_{OHP}$ (V)	2.646	2.553	0.502	2.461	2.426	2.425

**74LVC16245A**

General conditions

- $T_{amb} = 25^{\circ}\text{C}$
- One output quiet, 15 outputs are switching same time.
- Package: SSOP

**NOTE:** The values are typical. **$V_{CC} = 3.3$  Volt**

$C_L$ (pF)	50	100	150	200	250	300
$V_{OHV}$ (V)	2.79	2.94	3.01	3.05	3.08	3.10
$V_{OHP}$ (V)	3.34	3.28	3.26	3.25	3.23	3.22

 **$V_{CC} = 2.7$  Volt**

$C_L$ (pF)	50	100	150	200	250	300
$V_{OHV}$ (V)	2.36	2.45	2.49	2.52	2.54	2.55
$V_{OHP}$ (V)	2.69	2.65	2.64	2.63	2.62	2.62

**74ALVC16245**

General conditions

- $T_{amb} = 25^{\circ}\text{C}$
- One output quiet, 15 outputs are switching same time.
- Package: SSOP

**NOTE:** The values are typical. **$V_{CC} = 3.3$  Volt**

$C_L$ (pF)	50	100	150	200	250	300
$V_{OLP}$ (mV)	400	275	210	169	142	122
$V_{OLV}$ (mV)	-385	-177	-94	-66	-48	-36
$V_{OHV}$ (V)	2.84	2.94	2.99	3.03	3.06	3.08
$V_{OHP}$ (V)	3.58	3.42	3.36	3.32	3.30	3.28

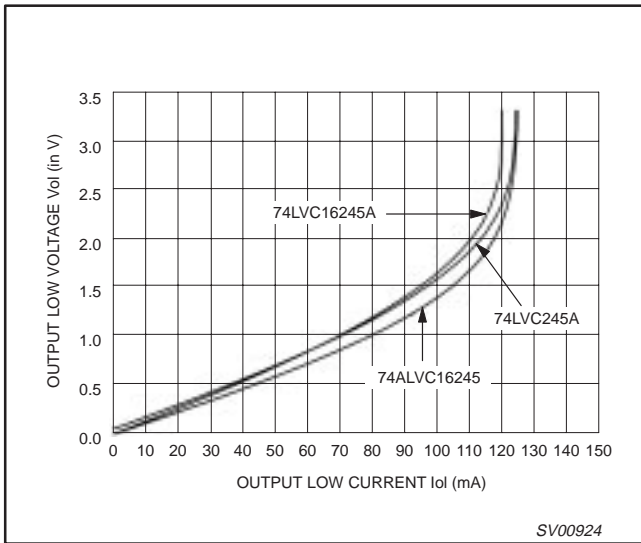
 **$V_{CC} = 2.7$  Volt**

$C_L$ (pF)	50	100	150	200	250	300
$V_{OLP}$ (mV)	261	181	138	111	93	80
$V_{OLV}$ (mV)	-246	-112	-57	-42	-30	-21
$V_{OHV}$ (V)	2.37	2.44	2.49	2.51	2.53	2.54
$V_{OHP}$ (V)	2.86	2.75	2.71	2.68	2.67	2.65

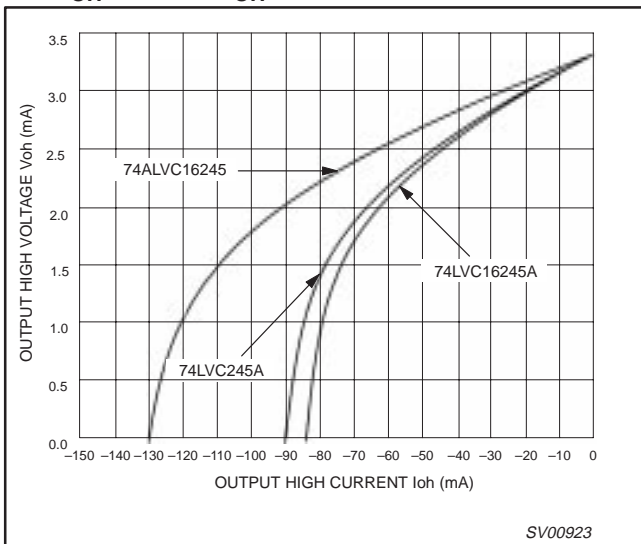
 **$V_{CC} = 1.8$  Volt**

$C_L$ (pF)	50	100	150	200	250	300
$V_{OLP}$ (mV)	77	56	47	39	33	30
$V_{OLV}$ (mV)	-73	-33	-19	-9	-4	-1
$V_{OHV}$ (V)	1.65	1.68	1.69	1.70	1.70	1.71
$V_{OHP}$ (V)	1.80	1.77	1.75	1.74	1.74	1.74

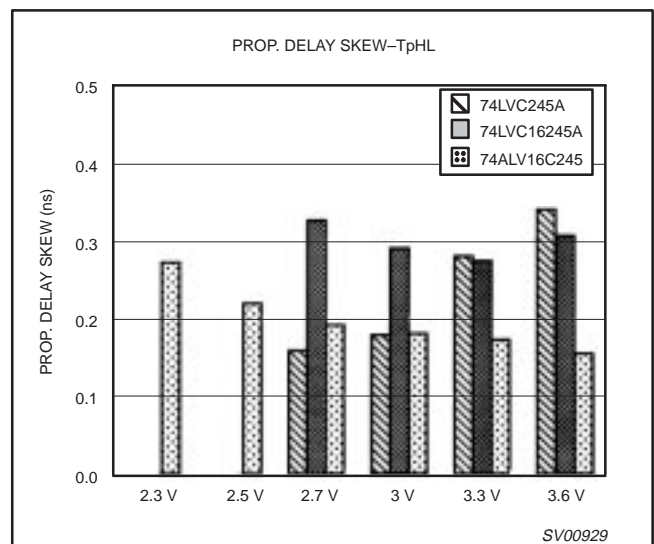
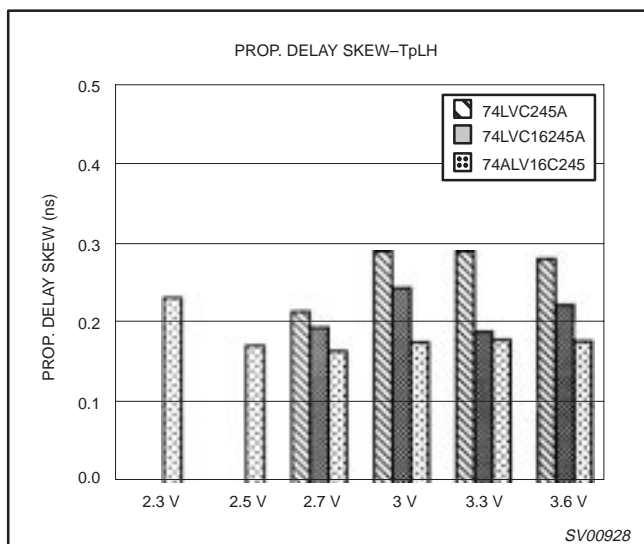
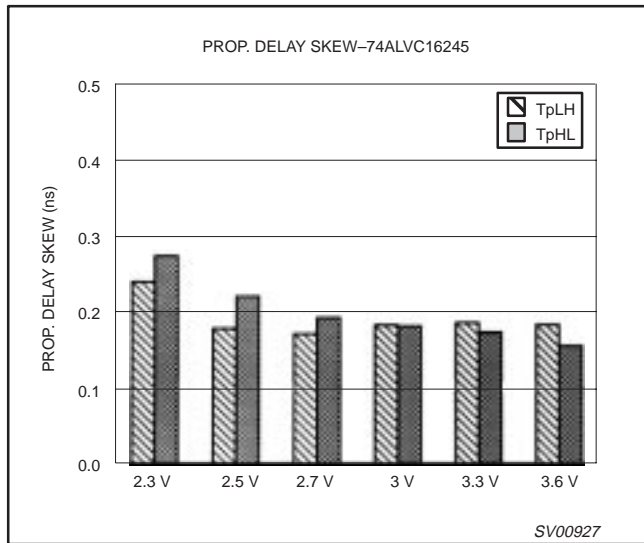
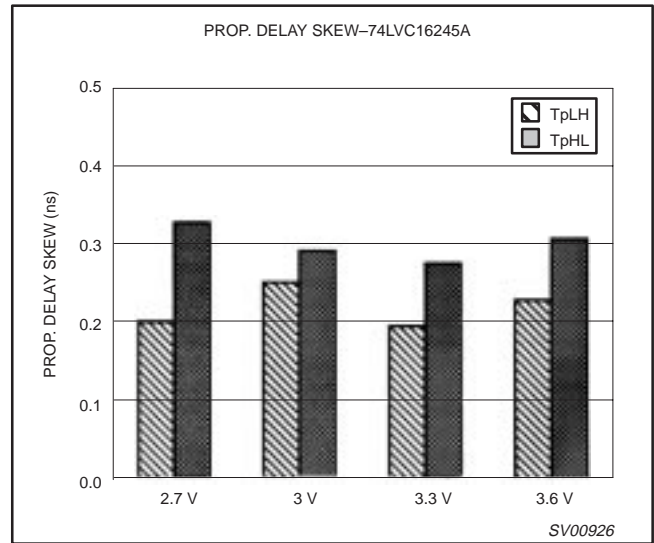
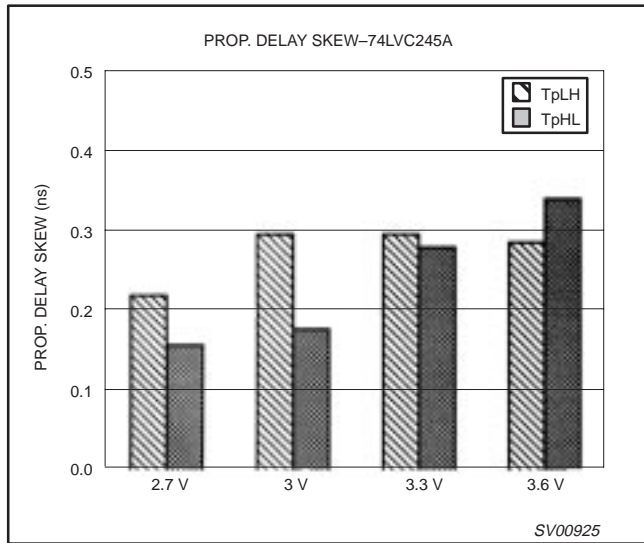
V.  $V_{OL}$  VERSUS  $I_{OL}$



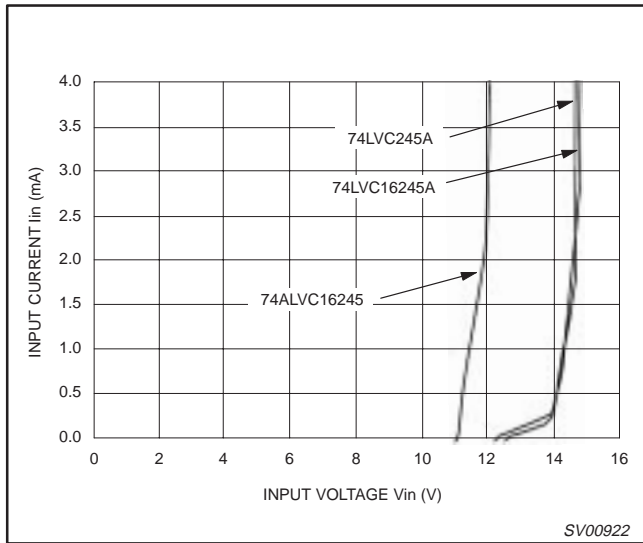
VI.  $V_{OH}$  VERSUS  $I_{OH}$



VII. PIN SKEW



VIII  $I_{INP}$  VERSUS  $V_{INP}$



IX.  $I_{CC}$  VERSUS  $V_{INP}$

