Dual octal latched transceivers with dual enable (3-State)

MB2543

FEATURES

- Two 8-bit octal transceivers with D-type latch
- Live insertation/extraction permitted
- Power-up 3-State
- Power-up reset
- Multiple V_{CC} and GND pins minimize switching noise
- Back-to-back registers for storage
- Separate controls for data flow in each direction
- Output capability: +64mA/–32mA
- Latch-up protection exceeds 500mA per Jedec JC40.2 Std 17
- ESD protection exceeds 2000V per MIL STD 883 Method 3015 and 200V per Machine Model

DESCRIPTION

The MB2543 high-performance BiCMOS device combines low static and dynamic power dissipation with high speed and high output drive.

The MB2543 dual octal registered transceiver contains two sets of D-type latches for temporary storage of data flowing in either direction. Separate Latch Enable ($n\overline{LEAB}$, $n\overline{LEBA}$) and Output Enable ($n\overline{OEAB}$, $n\overline{OEBA}$) inputs are provided for each register to permit independent control of data transfer in either direction. The outputs are guaranteed to sink 64mA.

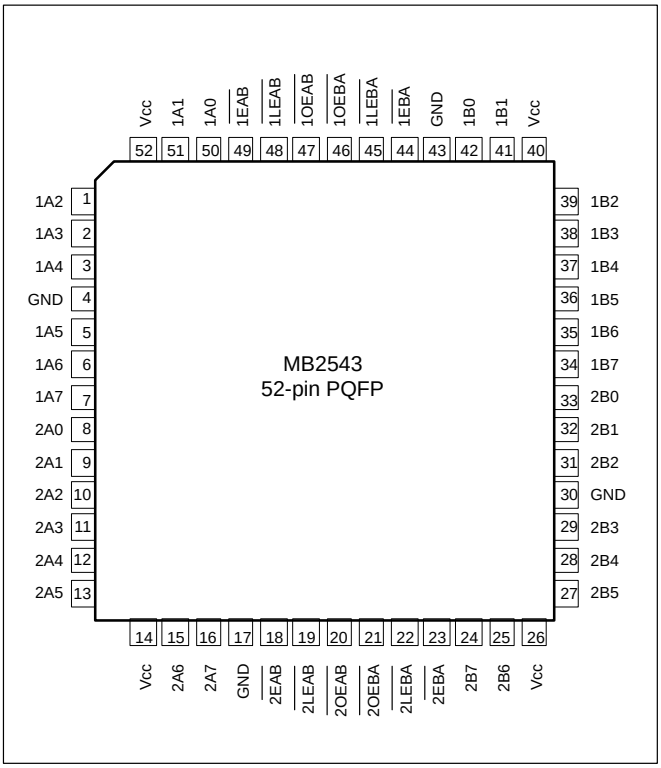
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS T_{amb} = 25°C; GND = 0V	TYPICAL	UNIT
t_{PLH} t_{PHL}	Propagation delay nAx to nBx	C_L = 50pF; V_{CC} = 5V	3.3	ns
C_{IN}	Input capacitance	V_I = 0V or V_{CC}	4	pF
$C_{I/O}$	I/O capacitance	V_O = 0V or $V_{CC;}$ 3-State	7	pF
I_{CCZ}	Total supply current	Outputs disabled; V_{CC} = 5.5V	120	µA

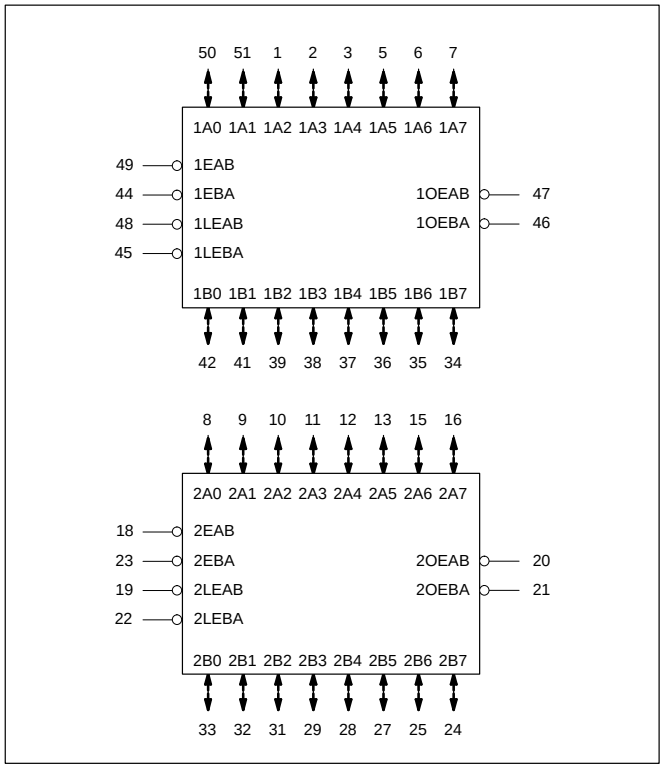
ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	ORDER CODE	DRAWING NUMBER
52-pin plastic Quad Flat Pack	–40°C to +85°C	MB2543BB	1418B

PIN CONFIGURATION



LOGIC SYMBOL



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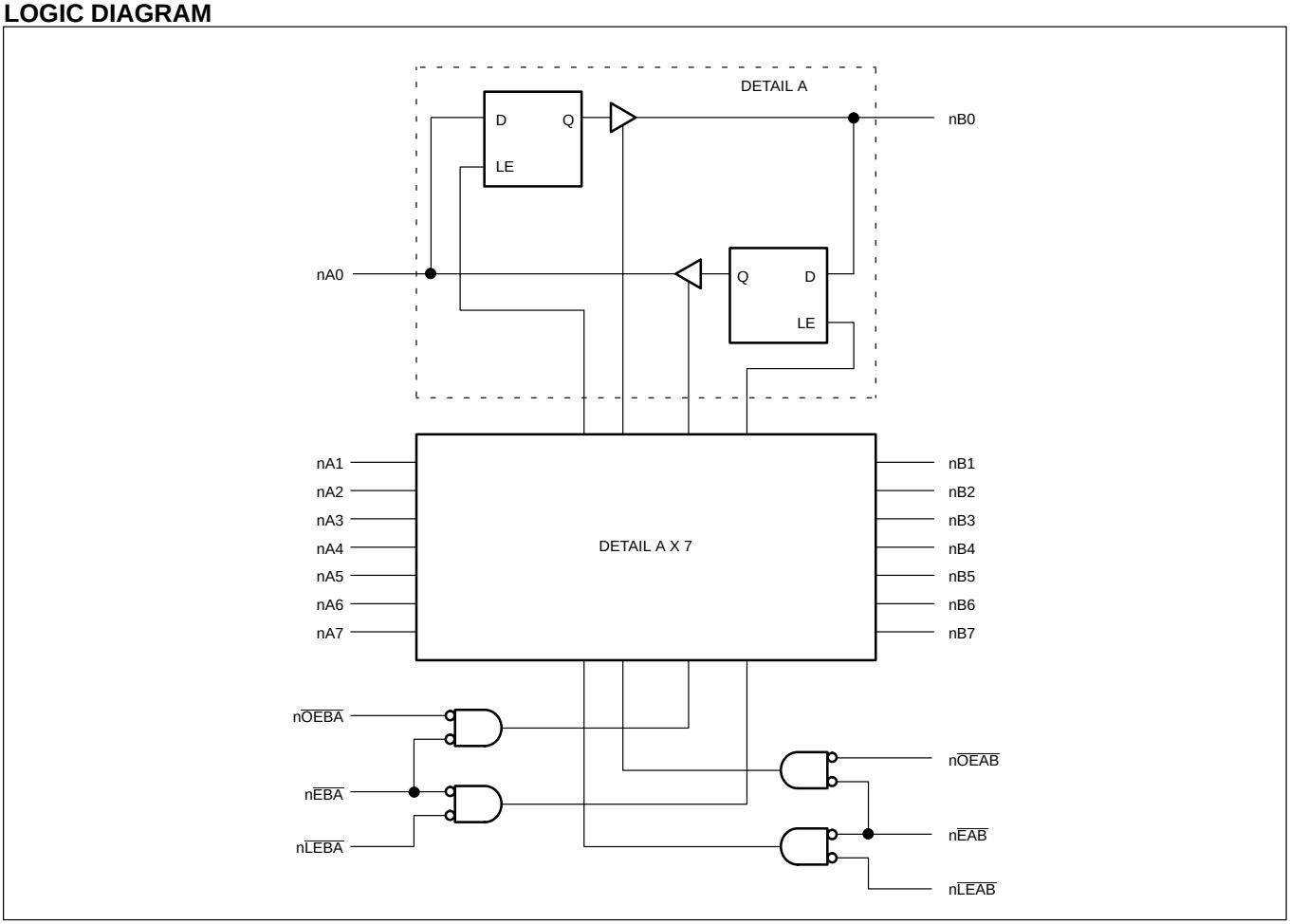
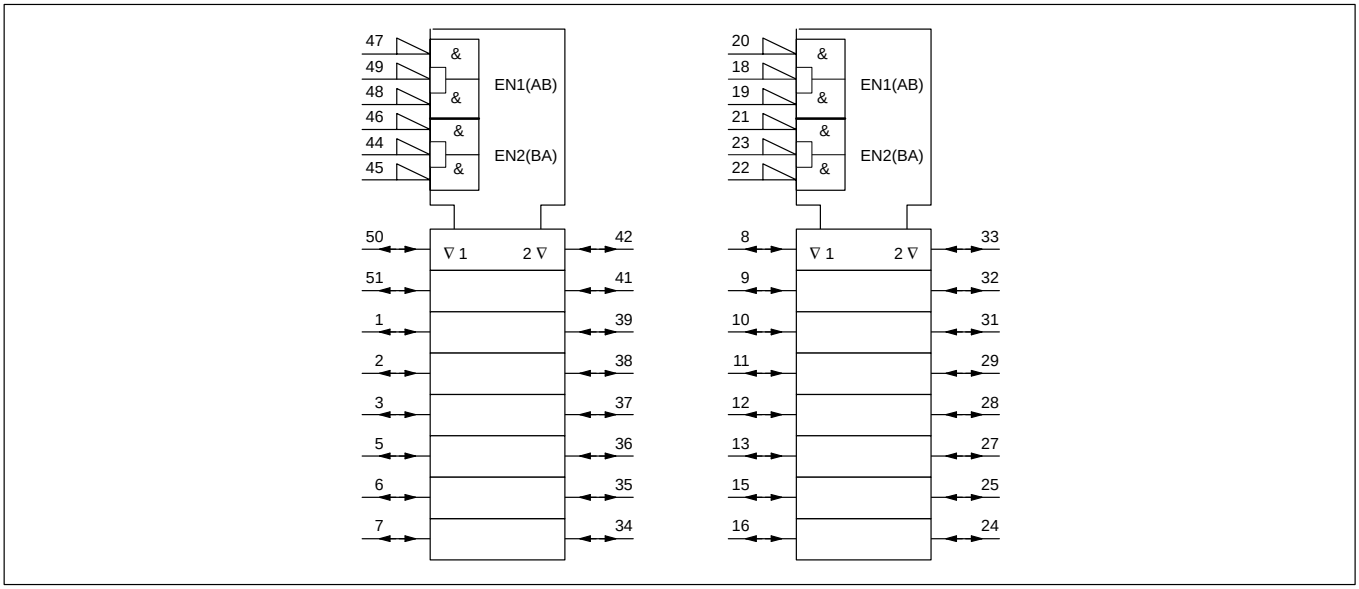
LOGIC DIAGRAM



LOGIC SYMBOL (IEEE/IEC)



FUNCTIONAL DESCRIPTION

The MB2543 contains two sets of eight D-type latches, with separate control pins for each set. Using data flow from A to B as an example, when the A-to-B Enable ($n\overline{EAB}$) input and the A-to-B Latch Enable ($n\overline{LEAB}$) input are Low the A-to-B path is transparent. A subsequent Low-to-High transition of the $n\overline{LEAB}$ signal puts the A data into the latches where it is stored and the B outputs no longer change with the A inputs. With $\overline{EAB}$ and $n\overline{OEAB}$ both Low, the 3-State B output buffers are active and display the data present at the outputs of the A latches.

Control of data flow from B to A is similar, but using the $n\overline{EBA}$, $n\overline{LEBA}$, and $n\overline{OEBA}$ inputs.

PIN DESCRIPTION

PIN NUMBER	SYMBOL	NAME AND FUNCTION
50, 51, 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16	1A0 – 1A7, 2A0 – 2A7	Data inputs/outputs
42, 41, 39, 38, 37, 36, 35, 34, 33, 32, 31, 29, 28, 27, 25, 24	1B0 – 1B7, 2B0 – 2B7	Data inputs/outputs
47, 46, 20, 21	$1\overline{OEAB}$, $1\overline{OEBA}$, $2\overline{OEAB}$, $2\overline{OEBA}$	A to B / B to A Output Enable inputs (active-Low)
49, 44, 18, 23	$1\overline{EAB}$, $1\overline{EBA}$, $2\overline{EAB}$, $2\overline{EBA}$	A to B / B to A Enable inputs (active-Low)
48, 45, 19, 22	$1\overline{LEAB}$, $1\overline{LEBA}$, $2\overline{LEAB}$, $2\overline{LEBA}$	A to B / B to A Latch Enable inputs (active-Low)
4, 17, 30, 43	GND	Ground (0V)
14, 26, 40, 52	V_{CC}	Positive supply voltage

FUNCTION TABLE

INPUTS				OUTPUTS	STATUS
$n\overline{OEXX}$	$n\overline{EXX}$	$n\overline{LEXX}$	nAx or nBx	nBx or nAx	
H	X	X	X	Z	Disabled
X	H	X	X	Z	Disabled
L L	↑ ↑	L L	h l	Z Z	Disabled + Latch
L L	L L	↑ ↑	h l	H L	Latch + Display
L L	L L	L L	H L	H L	Transparent
L	L	H	X	NC	Hold

H = High voltage level
h = High voltage level one set-up time prior to the Low-to-High transition of $n\overline{LEXX}$ or $n\overline{EXX}$ (XX = AB or BA)
L = Low voltage level
l = Low voltage level one set-up time prior to the Low-to-High transition of $n\overline{LEXX}$ or $n\overline{EXX}$ (XX = AB or BA)
X = Don't care
↑ = Low-to-High transition of $n\overline{LEXX}$ or $n\overline{EXX}$ (XX = AB or BA)
NC = No change
Z = High impedance or "off" state

ABSOLUTE MAXIMUM RATINGS[1, 2]

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V_{CC}	DC supply voltage		–0.5 to +7.0	V
I_{IK}	DC input diode current	$V_I < 0$	–18	mA
V_I	DC input voltage[3]		–1.2 to +7.0	V
I_{OK}	DC output diode current	$V_O < 0$	–50	mA
V_{OUT}	DC output voltage[3]	output in Off or High state	–0.5 to +5.5	V
I_{OUT}	DC output current	output in Low state	128	mA
T_{stg}	Storage temperature range		–65 to 150	°C

NOTES:
1 . Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
2 . The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability. The maximum junction temperature of this integrated circuit should not exceed 150°C.
3 . The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS		UNIT
		Min	Max	
V_{CC}	DC supply voltage	4.5	5.5	V
V_I	Input voltage	0	V_{CC}	V
V_{IH}	High-level input voltage	2.0		V
V_{IL}	Low-level Input voltage		0.8	V
I_{OH}	High-level output current		–32	mA
I_{OL}	Low-level output current		64	mA
$\Delta t/\Delta v$	Input transition rise or fall rate	0	10	ns/V
T_{amb}	Operating free-air temperature range	–40	+85	°C

DC ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER		TEST CONDITIONS	LIMITS					UNIT
				T_{amb} = +25°C			T_{amb} = –40°C to +85°C		
				MIN	TYP	MAX	MIN	MAX	
V_{IK}	Input clamp voltage		V_{CC} = 4.5V; I_{IK} = –18mA		–0.9	–1.2		–1.2	V
V_{OH}	High-level output voltage		V_{CC} = 4.5V; I_{OH} = –3mA; V_I = V_{IL} or V_{IH}	2.5	2.9		2.5		V
			V_{CC} = 5.0V; I_{OH} = –3mA; V_I = V_{IL} or V_{IH}	3.0	3.4		3.0		V
			V_{CC} = 4.5V; I_{OH} = –32mA; V_I = V_{IL} or V_{IH}	2.0	2.4		2.0		V
V_{OL}	Low-level output voltage		V_{CC} = 4.5V; I_{OL} = 64mA; V_I = V_{IL} or V_{IH}		0.42	0.55		0.55	V
V_{RST}	Power-up output voltage[3]		V_{CC} = 5.5V; I_O = 1mA; V_I = GND or V_{CC}		0.13	0.55		0.55	V
I_I	Input leakage current	Control pins	V_{CC} = 5.5V; V_I = GND or 5.5V		±0.01	±1.0		±1.0	µA
		Data pins	V_{CC} = 5.5V; V_I = GND or 5.5V		±5	±100		±100	µA
I_{OFF}	Power-off leakage current		V_{CC} = 0.0V; V_O or $V_I \leq$ 4.5V		±5.0	±100		±100	µA
$I_{PU/PD}$	Power-up/down 3-State output current[4]		V_{CC} = 2.1V; V_O = 0.5V; V_I = GND or V_{CC}; V_{OE} = Don't care		±5.0	±50		±50	µA
I_{IH} + I_{OZH}	3-State output High current		V_{CC} = 5.5V; V_O = 2.7V; V_I = V_{IL} or V_{IH}		5.0	50		50	µA
I_{IL} + I_{OZL}	3-State output Low current		V_{CC} = 5.5V; V_O = 0.5V; V_I = V_{IL} or V_{IH}		–5.0	–50		–50	µA
I_{CEX}	Output High leakage current		V_{CC} = 5.5V; V_O = 5.5V; V_I = GND or V_{CC}		5.0	50		50	µA
I_O	Output current[1]		V_{CC} = 5.5V; V_O = 2.5V	–50	–100	–180	–50	–180	mA
I_{CCH}	Quiescent supply current		V_{CC} = 5.5V; Outputs High, V_I = GND or V_{CC}		120	250		250	µA
I_{CCL}			V_{CC} = 5.5V; Outputs Low, V_I = GND or V_{CC}		38	60		60	mA
I_{CCZ}			V_{CC} = 5.5V; Outputs 3-State; V_I = GND or V_{CC}		120	250		250	µA
ΔI_{CC}	Additional supply current per input pin[2]		V_{CC} = 5.5V; one input at 3.4V, other inputs at V_{CC} or GND		0.5	1.5		1.5	mA

NOTES:
1 . Not more than one output should be tested at a time, and the duration of the test should not exceed one second.
2 . This is the increase in supply current for each input at 3.4V.
3 . For valid test results, data must not be loaded into the flip-flops (or latches) after applying the power.
4 . This parameter is valid for any V_{CC} between 0V and 2.1V, with a transition time of up to 10msec. From V_{CC} = 2.1V to V_{CC} = 5V ± 10% a transition time of up to 100µsec is permitted.

AC CHARACTERISTICS

GND = 0V, $t_R = t_F$ = 2.5ns, C_L = 50pF, R_L = 500Ω

SYMBOL	PARAMETER	WAVEFORM	LIMITS					UNIT
			T_{amb} = +25°C, V_{CC} = +5.0V			T_{amb} = -40 to +85°C, V_{CC} = +5.0V ±0.5V		
			MIN	TYP	MAX	MIN	MAX	
t_{PLH} t_{PHL}	Propagation delay nAx to nBx, nBx to nAx	2	1.5 1.6	3.2 3.3	4.6 4.6	1.5 1.6	5.2 5.2	ns
t_{PLH} t_{PHL}	Propagation delay $\overline{LEBA}$ to nAx, $\overline{LEAB}$ to nBx	1, 2	1.9 2.1	3.9 4.1	5.3 5.5	1.9 2.1	6.1 6.2	ns
t_{PZH} t_{PZL}	Output enable time $\overline{OEBA}$ to nAx, $\overline{OEAB}$ to nBx	4 5	1.6 2.3	3.6 4.5	5.0 5.9	1.6 2.3	5.8 6.6	ns
t_{PHZ} t_{PLZ}	Output disable time $\overline{OEBA}$ to nAx, $\overline{OEAB}$ to nBx	4 5	1.0 1.4	3.6 3.2	5.0 4.6	1.0 1.4	5.7 5.2	ns
t_{PZH} t_{PZL}	Output enable time $\overline{EBA}$ to nAx, $\overline{EAB}$ to nBx	4 5	1.6 2.3	3.6 4.5	5.0 5.9	1.6 2.3	5.8 6.6	ns
t_{PHZ} t_{PLZ}	Output disable time $\overline{EBA}$ to nAx, $\overline{EAB}$ to nBx	4 5	1.0 1.4	3.6 3.2	5.0 4.6	1.0 1.4	5.7 5.2	ns

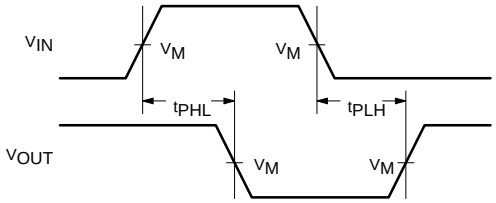
AC SETUP REQUIREMENTS

GND = 0V, $t_R = t_F$ = 2.5ns, C_L = 50pF, R_L = 500Ω

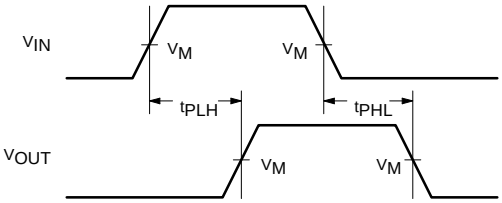
SYMBOL	PARAMETER	WAVEFORM	LIMITS			UNIT
			T_{amb} = +25°C, V_{CC} = +5.0V		T_{amb} = -40 to +85°C, V_{CC} = +5.0V ±0.5V	
			MIN	TYP	MIN	
$t_s(H)$ $t_s(L)$	Setup time nAx to $\overline{LEAB}$, nBx to $\overline{LEBA}$	3	1.0 0.5	0.4 –0.1	1.0 0.5	ns
$t_h(H)$ $t_h(L)$	Hold time nAx to $\overline{LEAB}$, nBx to $\overline{LEBA}$	3	1.0 0.5	0.2 –0.3	1.0 0.5	ns
$t_s(H)$ $t_s(L)$	Setup time nAx to $\overline{EAB}$, nBx to $\overline{EBA}$	3	1.0 0.5	0.2 –0.3	1.0 0.5	ns
$t_h(H)$ $t_h(L)$	Hold time nAx to $\overline{EAB}$, nBx to $\overline{EBA}$	3	1.0 0.5	0.3 –0.2	1.0 0.5	ns
$t_w(L)$	Latch enable pulse width, Low	3	4.0	3.1	4.0	ns

AC WAVEFORMS

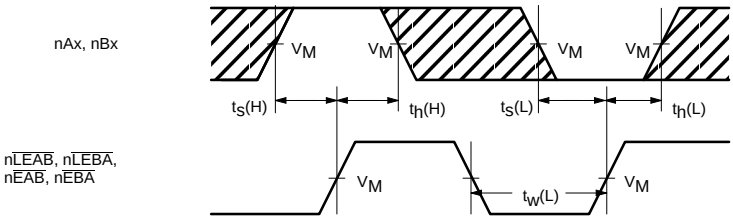
V_M = 1.5V, V_{IN} = GND to 3.0V



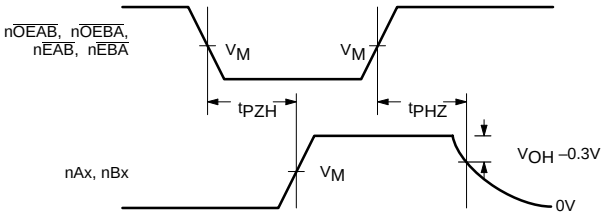
Waveform 1. Propagation Delay For Inverting Output



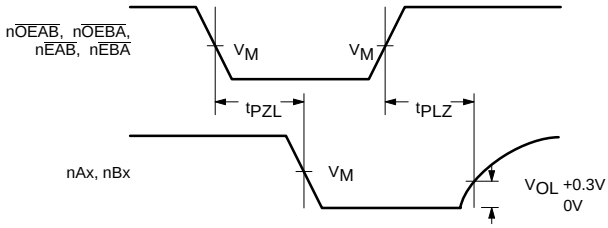
Waveform 2. Propagation Delay For Non-Inverting Output



Waveform 3. Data Setup and Hold Times and Latch Enable Pulse Width



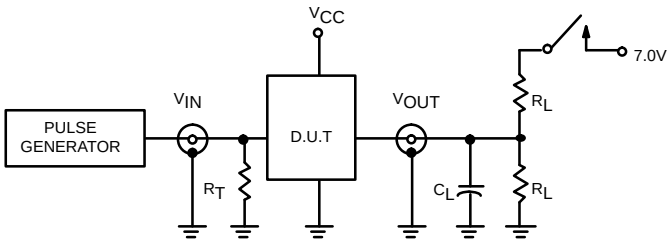
Waveform 4. 3-State Output Enable Time to High Level and Output Disable Time from High Level



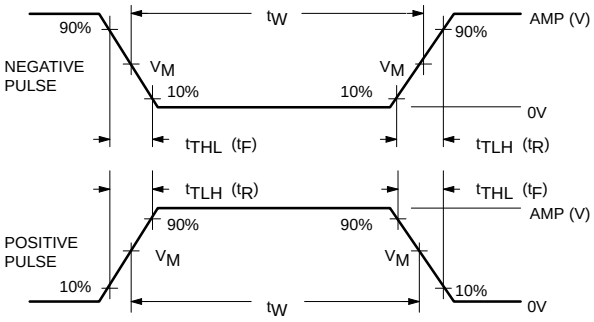
Waveform 5. 3-State Output Enable Time to Low Level and Output Disable Time from Low Level

NOTE: The shaded areas indicate when the input is permitted to change for predictable output performance.

TEST CIRCUIT AND WAVEFORMS



Test Circuit for 3-State Outputs



V_M = 1.5V

Input Pulse Definition

SWITCH POSITION

TEST	SWITCH
t_{PLZ}	closed
t_{PZL}	closed
All other	open

DEFINITIONS

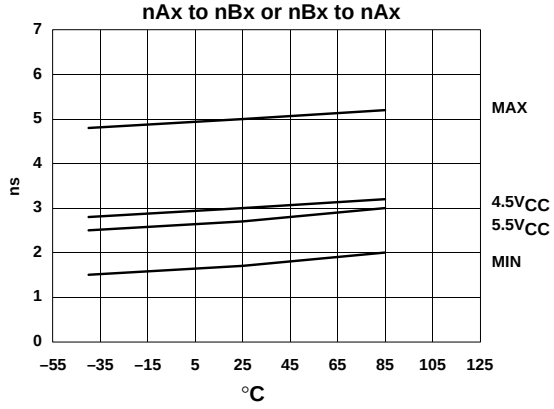
R_L = Load resistor; see AC CHARACTERISTICS for value.

C_L = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.

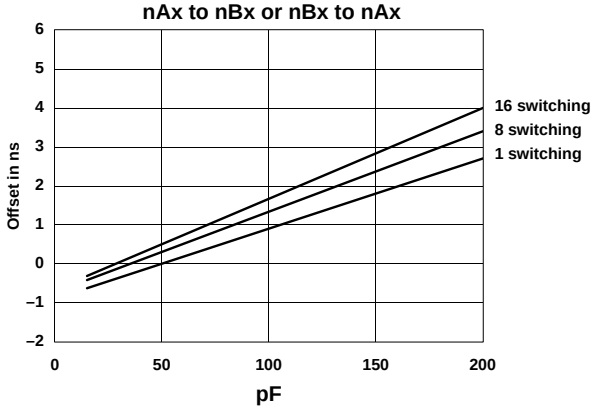
R_T = Termination resistance should be equal to Z_{OUT} of pulse generators.

FAMILY	INPUT PULSE REQUIREMENTS				
	Amplitude	Rep. Rate	t_W	t_R	t_F
MB	3.0V	1MHz	500ns	2.5ns	2.5ns

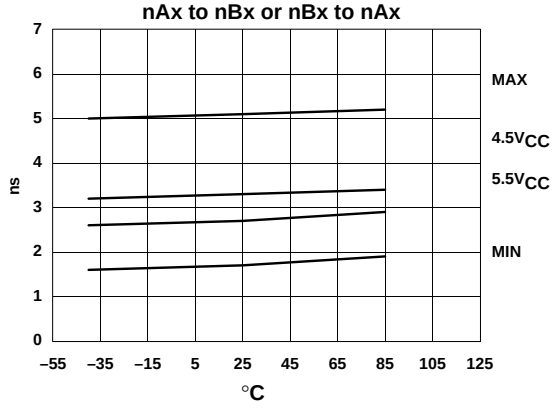
t_{PLH} vs Temperature (T_{amb})
C_L = 50pF, 1 Output Switching
nAx to nBx or nBx to nAx



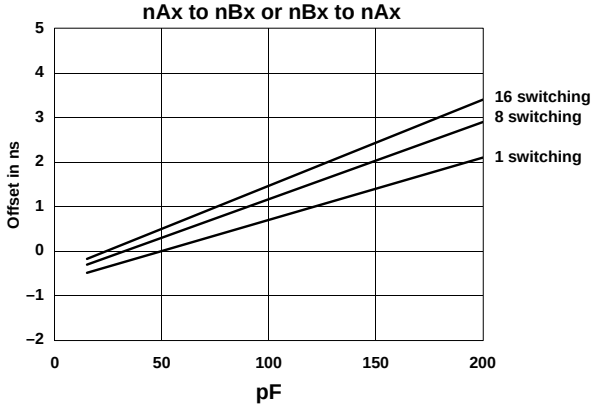
Adjustment of t_{PLH} for
Load Capacitance and # of Outputs Switching
nAx to nBx or nBx to nAx



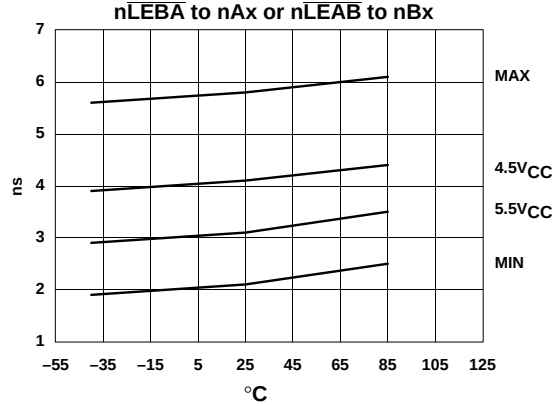
t_{PHL} vs Temperature (T_{amb})
C_L = 50pF, 1 Output Switching
nAx to nBx or nBx to nAx



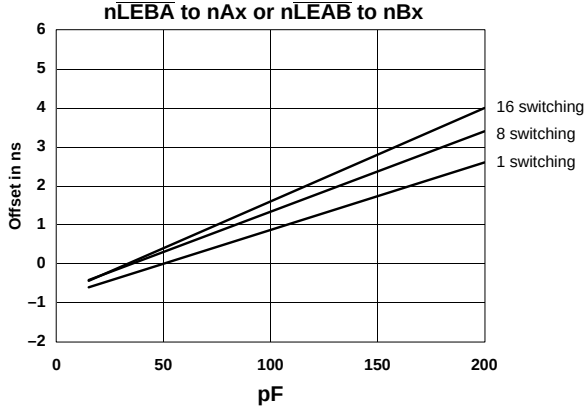
Adjustment of t_{PHL} for
Load Capacitance and # of Outputs Switching
nAx to nBx or nBx to nAx



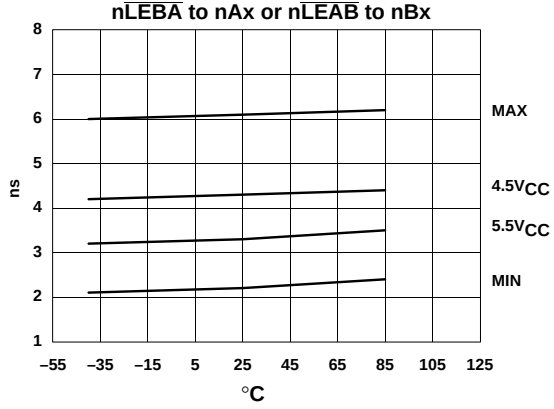
t_{PLH} vs Temperature (T_{amb})
C_L = 50pF, 1 Output Switching
$n\overline{LEBA}$ to nAx or $n\overline{LEAB}$ to nBx



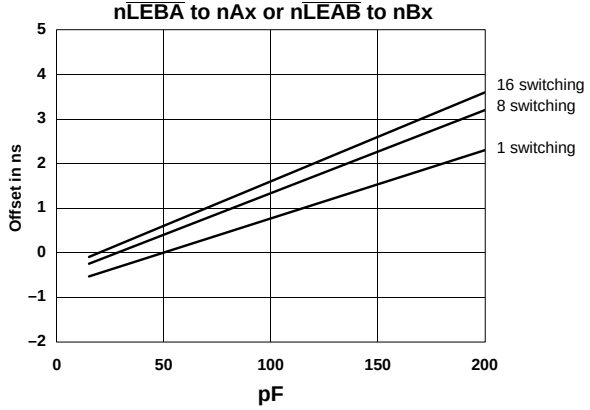
Adjustment of t_{PLH} for
Load Capacitance and # of Outputs Switching
$n\overline{LEBA}$ to nAx or $n\overline{LEAB}$ to nBx



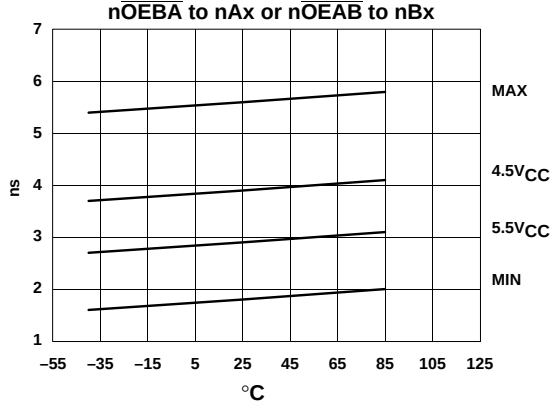
t_{PHL} vs Temperature (T_{amb})
C_L = 50pF, 1 Output Switching
n$\overline{LEBA}$ to nAx or n$\overline{LEAB}$ to nBx



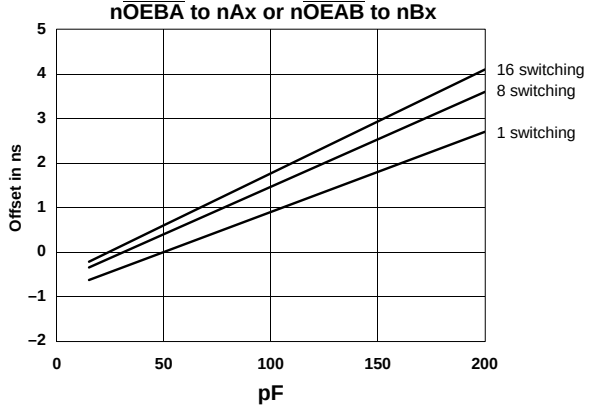
Adjustment of t_{PHL} for
Load Capacitance and # of Outputs Switching
n$\overline{LEBA}$ to nAx or n$\overline{LEAB}$ to nBx



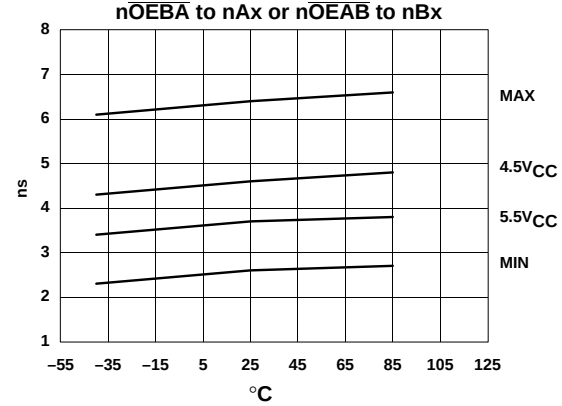
t_{PZH} vs Temperature (T_{amb})
C_L = 50pF, 1 Output Switching
n$\overline{OEBA}$ to nAx or n$\overline{OEAB}$ to nBx



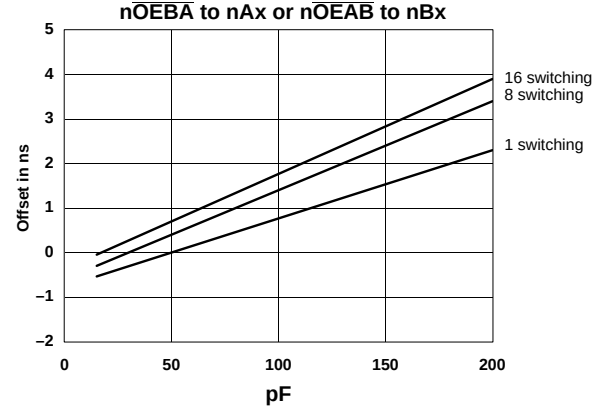
Adjustment of t_{PZH} for
Load Capacitance and # of Outputs Switching
n$\overline{OEBA}$ to nAx or n$\overline{OEAB}$ to nBx



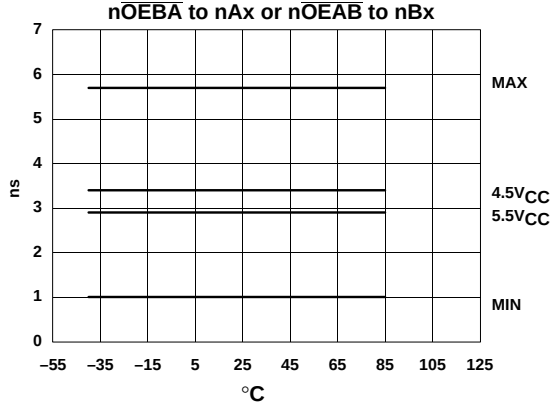
t_{PZL} vs Temperature (T_{amb})
C_L = 50pF, 1 Output Switching
n$\overline{OEBA}$ to nAx or n$\overline{OEAB}$ to nBx



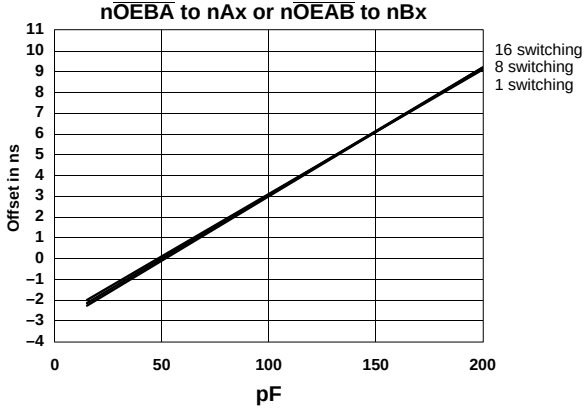
Adjustment of t_{PZL} for
Load Capacitance and # of Outputs Switching
n$\overline{OEBA}$ to nAx or n$\overline{OEAB}$ to nBx



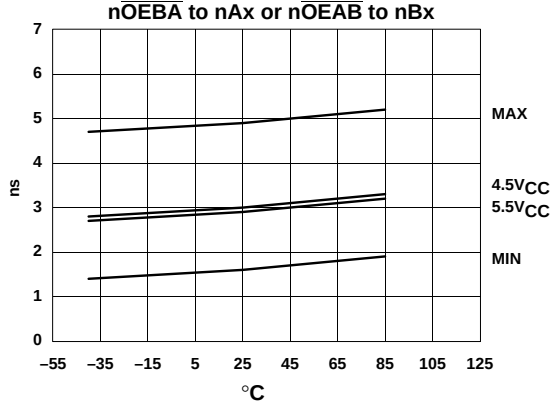
t_{PHZ} vs Temperature (T_{amb})
C_L = 50pF, 1 Output Switching
n$\overline{OEBA}$ to nAx or n$\overline{OEAB}$ to nBx



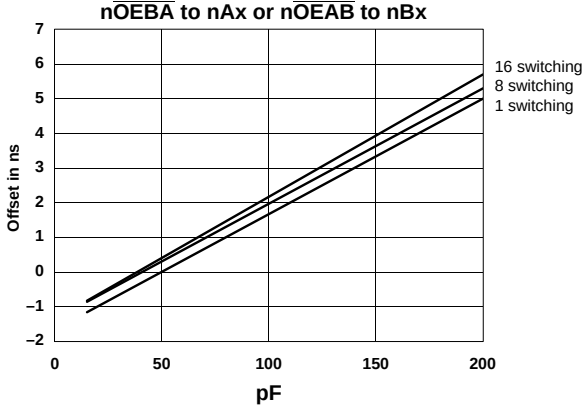
Adjustment of t_{PHZ} for
Load Capacitance and # of Outputs Switching
n$\overline{OEBA}$ to nAx or n$\overline{OEAB}$ to nBx



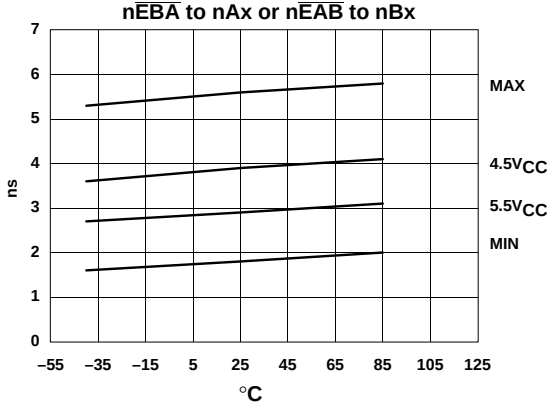
t_{PLZ} vs Temperature (T_{amb})
C_L = 50pF, 1 Output Switching
n$\overline{OEBA}$ to nAx or n$\overline{OEAB}$ to nBx



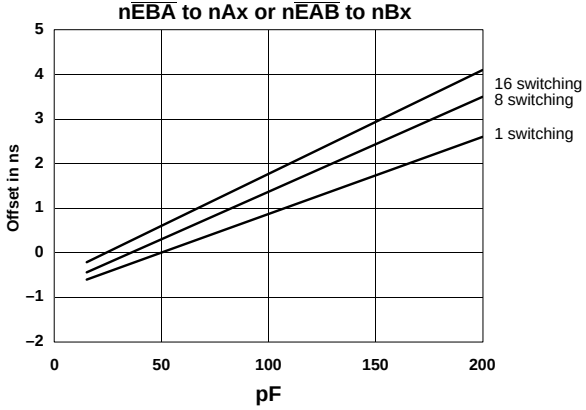
Adjustment of t_{PLZ} for
Load Capacitance and # of Outputs Switching
n$\overline{OEBA}$ to nAx or n$\overline{OEAB}$ to nBx



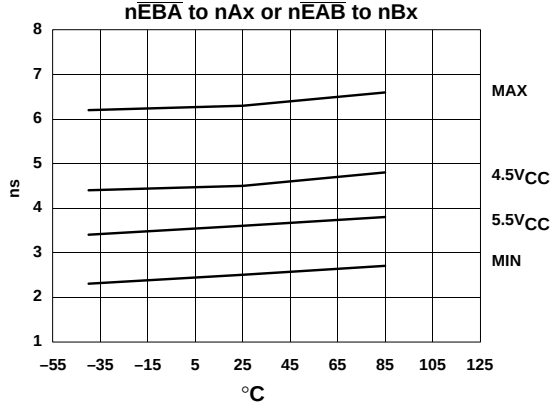
t_{PZH} vs Temperature (T_{amb})
C_L = 50pF, 1 Output Switching
nEBA to nAx or nEAB to nBx



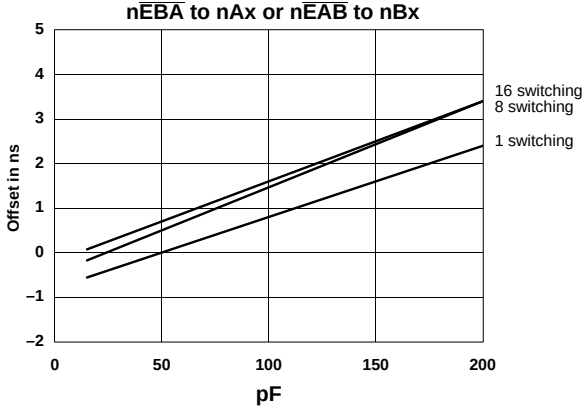
Adjustment of t_{PZH} for
Load Capacitance and # of Outputs Switching
nEBA to nAx or nEAB to nBx



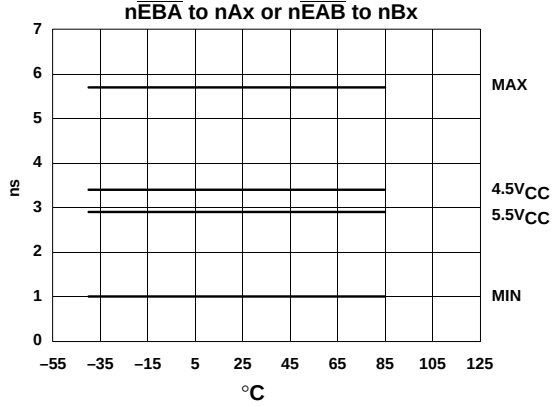
t_{PZL} vs Temperature (T_{amb})
C_L = 50pF, 1 Output Switching
n$\overline{EBA}$ to nAx or n$\overline{EAB}$ to nBx



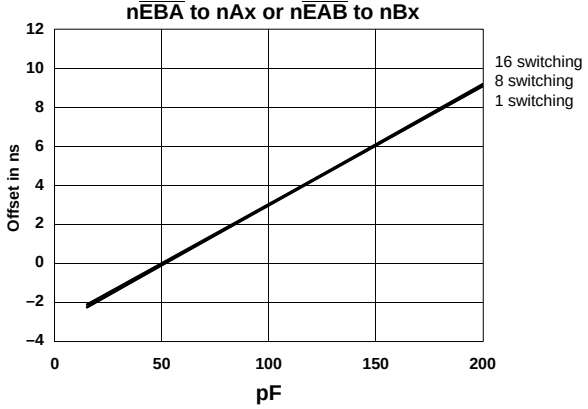
Adjustment of t_{PZL} for
Load Capacitance and # of Outputs Switching
n$\overline{EBA}$ to nAx or n$\overline{EAB}$ to nBx



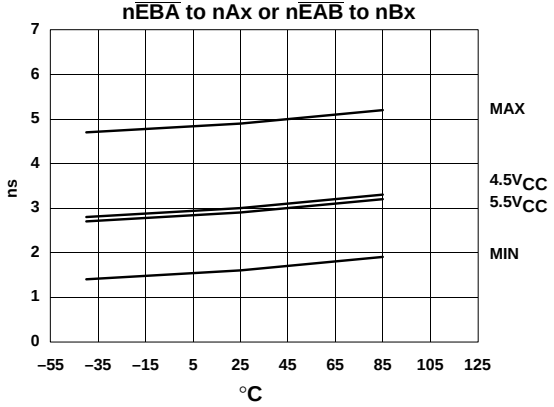
t_{PHZ} vs Temperature (T_{amb})
C_L = 50pF, 1 Output Switching
n$\overline{EBA}$ to nAx or n$\overline{EAB}$ to nBx



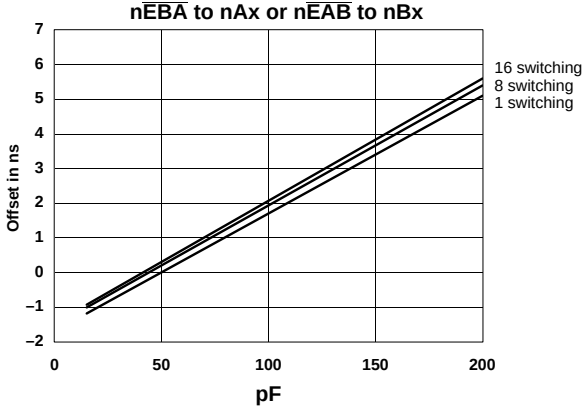
Adjustment of t_{PHZ} for
Load Capacitance and # of Outputs Switching
n$\overline{EBA}$ to nAx or n$\overline{EAB}$ to nBx



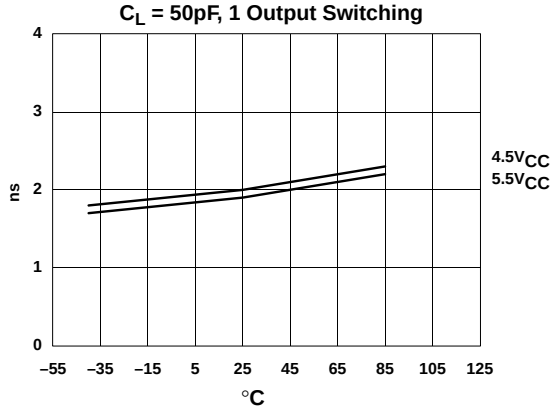
t_{PLZ} vs Temperature (T_{amb})
C_L = 50pF, 1 Output Switching
n$\overline{EBA}$ to nAx or n$\overline{EAB}$ to nBx



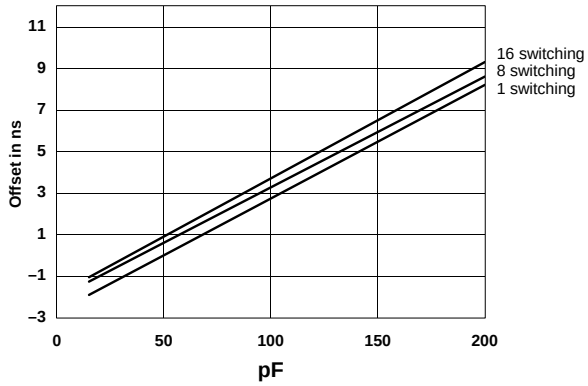
Adjustment of t_{PLZ} for
Load Capacitance and # of Outputs Switching
n$\overline{EBA}$ to nAx or n$\overline{EAB}$ to nBx



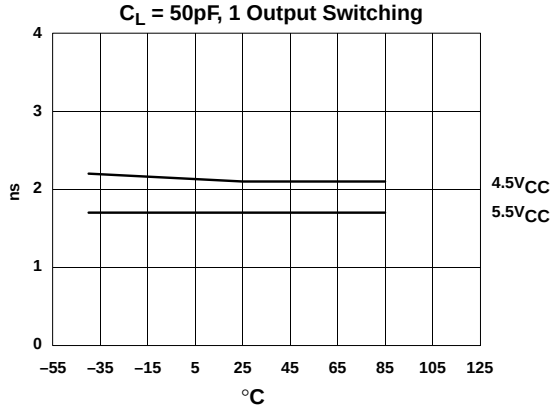
t_{TLH} vs Temperature (T_{amb})
C_L = 50pF, 1 Output Switching



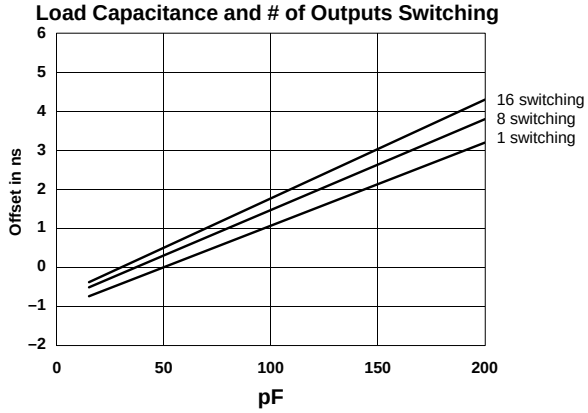
Adjustment of t_{TLH} for Load Capacitance/# of Outputs



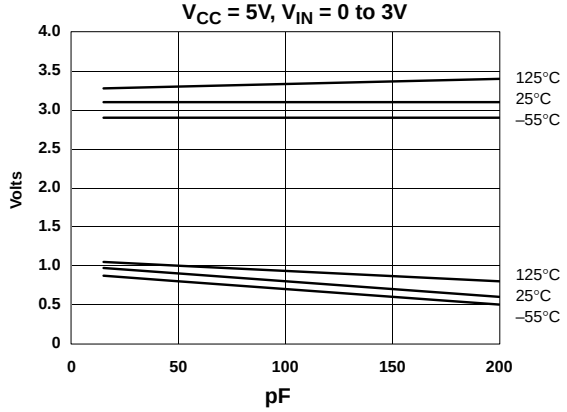
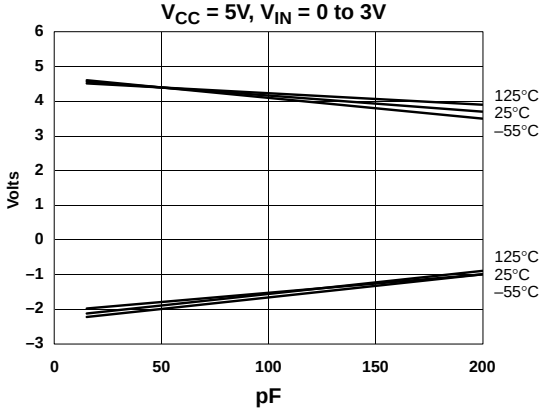
t_{THL} vs Temperature (T_{amb})
C_L = 50pF, 1 Output Switching



Adjustment of t_{THL} for Load Capacitance and # of Outputs Switching



V_{OHV} and V_{OLP} vs Load Capacitance
V_{CC} = 5V, V_{IN} = 0 to 3V



V_{OHP} and V_{OLV} vs Load Capacitance
V_{CC} = 5V, V_{IN} = 0 to 3V