TOSHIBA Digital Integrated Circuit Silicon Monolithic

TC7MPH3245FTG

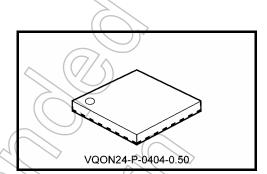
Low Voltage/Low Power 4-Bit × 2 Dual Supply Bus Transceiver with Bushold

The TC7MP3245FTG is a dual supply, advanced high-speed CMOS 8-bit dual supply voltage interface bus transceiver fabricated with silicon gate CMOS technology.

Designed for use as an interface between a 1.2-V, 1.5-V, 1.8-V, or 2.5-V bus and a 1.8-V, 2.5-V or 3.6-V bus in mixed 1.2-V, 1.5-V, 1.8-V or 2.5-V/1.8-V, 2.5-V or 3.6-V supply systems.

The A-port interfaces with the 1.2-V, 1.5-V, 1.8-V or 2.5-V bus, the B-port with the 1.8-V, 2.5-V, 3.3-V bus.

The direction of data transmission is determined by the level of the DIR input. The enable input (\overline{OE}) can be used to disable the device so that the buses are effectively isolated. The bus of a B bus side at floating state is maintained in an appropriate logic



Weight: 0.03 g (typ.)

level due to a bushold circuit to a B bus. Moreover, the bushold circuit which is added to a B bus is off when OE is low.

All inputs are equipped with protection circuits against static discharge or transient excess voltage.

Features

- Bidirectional interface between 1.2-V and 1.8-V, 1.2-V and 2.5-V, 1.2-V and 3.3-V, 1.5-V and 2.5-V, 1.5-V and 3.3-V, 1.8-V and 2.5-V, 1.8-V and 3.3-V or 2.5-V and 3.3-V buses.
- High-speed operation: $t_{pd} = 6.8 \text{ ns (max)} (V_{CCA} = 2.5 \pm 0.2 \text{ V}, V_{CCB} = 3.3 \pm 0.3 \text{ V})$

 $t_{pd} = 8.9 \text{ ns (max)} (V_{CCA} = 1.8 \pm 0.15 \text{ V}, V_{CCB} = 3.3 \pm 0.3 \text{ V})$

 $t_{pd} = 10.3 \text{ ns (max) (VCCA} = 1.5 \pm 0.1 \text{ V, VCCB} = 3.3 \pm 0.3 \text{ V)}$

 $t_{pd} = 61 \text{ ns (max)} (V_{CCA} = 1.2 \pm 0.1 \text{ V}, V_{CCB} = 3.3 \pm 0.3 \text{ V})$

 $t_{pd} = 9.5 \text{ ns (max)} (V_{CCA} = 1.8 \pm 0.15 \text{ V}, V_{CCB} = 2.5 \pm 0.2 \text{ V})$

 $t_{pd} = 10.8 \text{ ns (max)} (V_{CCA} = 1.5 \pm 0.1 \text{ V}, V_{CCB} = 2.5 \pm 0.2 \text{ V})$

 $t_{pd} = 60 \text{ ns (max)} (V_{CCA} = 1.2 \pm 0.1 \text{ V}, V_{CCB} = 2.5 \pm 0.2 \text{ V})$

 $t_{pd} = 58 \text{ ns (max)} (V_{CCA} = 1.2 \pm 0.1 \text{ V}, V_{CCB} = 1.5 \pm 0.1 \text{ V})$

• Output current: $IOH/IOL = \pm 12 \text{ mA (min)} (VCC = 3.0 \text{ V})$

 $I_{OH}/I_{OL} = \pm 9 \text{ mA (min) (V}_{CC} = 2.3 \text{ V)}$

 $I_{OH}/I_{OL} = \pm 3 \text{ mA (min)} (V_{CC} = 1.65 \text{ V})$

 $I_{OH}/I_{OL} = \pm 1 \text{ mA (min) (V}_{CC} = 1.4 \text{ V)}$

- Latch-up performance: ±300 mA
- ESD performance: Machine model ≥ ±200 V

Human body model ≥ ±2000 V

- Ultra-small package: VQON24
- Bushold circuit is build in only the B bus side. (Only in $\overline{OE} = \text{"H"}$, a former state is maintained.)
- Low current consumption: Using the new circuit significantly reduces current consumption when $\overline{OE}=$ "H". Suitable for battery-driven applications such as PDAs and cellular phones.
- Floating A-bus and B-bus are permitted. (when $\overline{OE} = \text{"H"}$)
- 3.6-V tolerant function provided on A-bus terminal, DIR and \overline{OE} terminal.

Note 1: Do not apply a signal to any bus pins when it is in the output mode. Damage may result.

Note: When mounting VQON package, the type of recommended flux is RA or RMA.

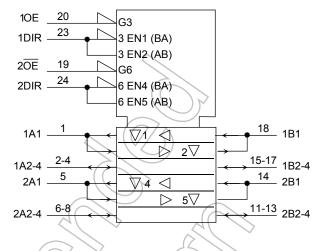
Start of commercial production 2004-12

Pin Assignment (top view)

2DIR 1DIR V_{CCA} GND 1OE 2OE 23 22 21 20 19 1A1 1 1B1 18 1A2 2 17 1B2 1A3 3 16 1B3 15 1B4 1A4 4 2B1 2A1 5 14 2A2 6 13 2B2 10 12 8 9 11

2A3 2A4 GND V_{CCB} 2B4 2B3

IEC Logic Symbol



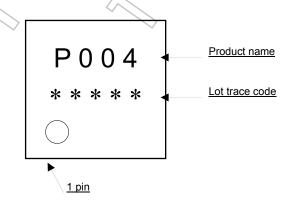
Truth Table

Inp	uts	Fund	ction		Bushold Circuit
1OE	1DIR	Bus 1A1-1A4	Bus 1B1-1B4	Outputs	(B bus)
L	L	Output	Input	A = B	OFF
L	Н	Input	Output) B = A	OFF
Н	Х	2		z	ON*

Inp	uts	Fun	ction		Bushold Circuit
2OE	2DIR	Bus 2A1-2A4	Bus 2B1-2B4	Outputs	(B bus)
L	L //	Output	Input	(A ≠ B)	OFF
L	Н	Input	Output	B=A	OFF
Н	Х		7	Z	ON*

- X: Don't care
- Z: High impedance
- *: Logic state just before becoming disable is maintained.

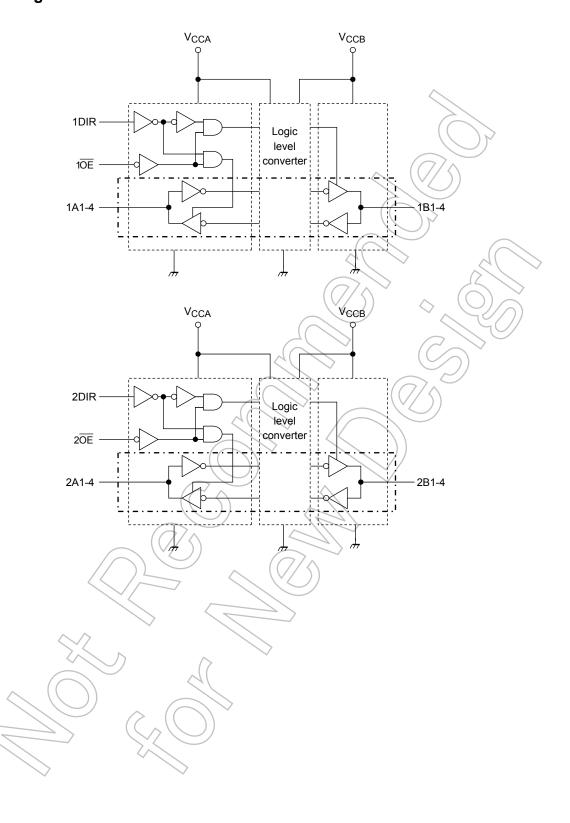
Marking



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Block Diagram



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Absolute Maximum Ratings (Note 1)

Characteristics		Symbol	Rating	Unit
Power supply voltage (N	lote 2)	V_{CCA}	-0.5 to 4.6	V
rower suppry voltage (N	lote 2)	V _{CCB}	-0.5 to 4.6	V
DC input voltage (DIR, $\overline{\text{OE}}$)		V _{IN}	-0.5 to 4.6	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
		Viva	-0.5 to 4.6 (Note 3)	(
DC bus I/O voltage		V _{I/OA}	-0.5 to V _{CCA} + 0.5 (Note 4)	N
		V _{I/OB}	-0.5 to V _{CCB} + 0.5 (Note 4)	
Input diode current		I _{IK}	-50	mA
Output diode current		I _{I/OK}	±50 (Note 5)	mA
DC output current		I _{OUTA}	±25	mA
BO output current		loutb	±25	, mix
DC V _{CC} /ground current per supp	alv nin	I _{CCA}	±50	mA.
DO VOCAGIONINA CUITEIR PEI SUPP	лу ріп	I _{CCB}	±50	
Power dissipation		P_{D}	180	mW
Storage temperature		T _{stg}	-65 to 150	°¢ (

Note 1: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 2: Don't supply a voltage to V_{CCB} pin when V_{CCA} is in the OFF state.

Note 3: Output in OFF state

Note 4: High or Low stats. Jour absolute maximum rating must be observed.

Note 5: Vout < GND, Vout > Vcc



Operating Ranges (Note 1)

Characteristics		Symbol	Rating	Unit	
Power supply voltage		V_{CCA}	1.1 to 2.7	V	
	(Note 2)	V _{CCB}	1.65 to 3.6	v	
Input voltage $(DIR,\ \overline{OE})$		V_{IN}	0 to 3.6	< <	
		V	0 to 3.6 (Note 3)		
Bus I/O voltage		V _{I/OA}	0 to V _{CCA} (Note 4)	N	· · · · · · · · · · · · · · · · · · ·
		V _{I/OB}	0 to V _{CCB} (Note 4)))
			±9 (Note 5)		
		I _{OUTA}	±3 (Note 6)	\mathcal{C}	
Output current			±1 (Note 7)	mA	
Output current			±12 (Note 8)		
		I _{OUTB}	±9 (Note 9)	·	
			±3 (Note 10)	\Diamond	
Operating temperature		T _{opr}	-40 to 85	°C	90
Input rise and fall time		dt/dv	0 to 10 (Note 11)	ns/V	

Note 1: The operating ranges must be maintained to ensure the normal operation of the device. Unused inputs and bus inputs must be tied to either V_{CC} or GND. Please connect both bus inputs and the bus outputs with V_{CC} or GND when the I/O of the bus terminal changes by the function. In this case, please note that the output is not short-circuited.

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- Note 2: Don't use in $V_{CCA} > V_{CCB}$
- Note 3: Output in OFF state
- Note 4: High or low state
- Note 5: V_{CCB}= 2.3 to 2.7 V
- Note 6: $V_{CCB} = 1.65 \text{ to } 1.95 \text{ V}$
- Note 7: $V_{CCB} = 1.4 \text{ to } 1.6 \text{ V}$
- Note 8: $V_{CCA} = 3.0 \text{ to } 3.6 \text{ V}$
- Note 9: $V_{CCA} = 2.3 \text{ to } 2.7 \text{ V}$
- Note 10: V_{CCA} = 1.65 to 1.95 V
- Note 11: $V_{IN} = 0.8$ to 2.0 V, $V_{CCA} = 2.5$ V, $V_{CCB} = 3.0$ V

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Electrical Characteristics

DC Characteristics (2.3 V \leq V_{CCA} \leq 2.7 V, 2.7 V < V_{CCB} \leq 3.6 V)

Characteristics	Symbol	Test Co	ondition	V _{CCA} (V)	V _{CCB} (V)	Ta = -40	to 85°C	Unit
Ondradichonos	Cymbol	1001 01	ondition	VCCA (V)	VCCB (V)	Min	Max	Onic
H-level input voltage	V_{IHA}	DIR, OE, An		2.3 to 2.7	2.7 to 3.6	1.6	_	V
Triovol input voltago	V_{IHB}	Bn		2.3 to 2.7	2.7 to 3.6	2.0	_	•
L-level input voltage	V_{ILA}	DIR, \overline{OE} , An		2.3 to 2.7	2.7 to 3.6)) <u>~</u>	0.7	V
L-level input voltage	V_{ILB}	Bn		2.3 to 2.7	2.7 to 3.6	_	8.0	V
	V _{OHA}		$I_{OHA} = -100 \mu A$	2.3 to 2.7	2.7 to 3.6	V _{CCA} - 0.2	_	
H-level output voltage		V _{IN} = V _{IH} or V _{IL}	$I_{OHA} = -9 \text{ mA}$	2.3	2.7 to 3.6	1.7	_	V
Ti-level output voltage	V _{OHB}	VIN - VIH OI VIL	I _{OHB} = -100 μA	2.3 to 2.7	2.7 to 3.6	V _{CCB} - 0.2		V
			$I_{OHB} = -12 \text{ mA}$	2.3 to 2.7	3.0	2.2		
	V _{OLA}		$I_{OLA} = 100 \mu\text{A}$	2.3 to 2.7	2.7 to 3.6	2	0.2	
L-level output voltage	VOLA	V _{IN} = V _{IH} or V _{IL}	I _{OLA} = 9 mA	2.3	2.7 to 3.6	(4)	0.6	V
L-level output voltage	V _{OLB}	AIM - AIH OL AIF	$I_{OLB} = 100 \mu A$	2.3 to 2.7	2.7 to 3.6		0.2	V
	VOLB	4	$I_{OLB} = 12 \text{ mA}$	2.3 to 2.7	(3.0	_	0.55	
2 state output OFF state ourrent	I _{OZA}	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $V_{OUT} = 0 \text{ to } 3.6$		2.3 to 2.7	2.7 to 3.6	_	±5.0	^
3-state output OFF state current	I _{OZB}	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = 0$ to 3.6		2.3 to 2.7	2.7 to 3.6	_	±5.0	μА
Input leakage current	I _{IN}	V _{IN} (DIR, OE)	= 0 to 3.6 V	2.3 to 2.7	2.7 to 3.6	_	±5.0	μΑ
Bushold input minimum drive hold		V _{IN} = 0.8 V		2.3 to 2.7	3.0	75	_	^
current	IHOLD	V _{IN} ≜ 2.0 V		2.3 to 2.7	3.0	-75	_	μΑ
Bushold input over-drive current	l.aa	V _{IN} = "L"→"H"		2.3 to 2.7	3.6	_	550	^
to change state (Note)	HOD	V _{IN} = "H"→"L"		2.3 to 2.7	3.6	_	-550	μΑ
	VQFF1) (0	0	_	5.0	
Power-off leakage current	lOFF2	V _{IN} , V _{OUT} = 0 to	3,6 V	2.3 to 2.7	0	_	5.0	μΑ
	I _{OFF3}			2.3 to 2.7	Open	_	5.0	
	ICCA	VINA = VCCA or GND VINB = VCCB or GND		2.3 to 2.7	2.7 to 3.6		5.0	4
Quiescent supply current	I _{CCB}	$V_{INA} = V_{CCA}$ or GND $V_{INB} = V_{CCB}$ or GND		2.3 to 2.7	2.7 to 3.6	_	5.0	μА
	ICCA			2.3 to 2.7	2.7 to 3.6	_	±5.0	^
	I¢¢B	V _{CCB} ≤ (V _{IN} , V _C	_{UT}) ≤ 3.6 V	2.3 to 2.7	2.7 to 3.6	_	±5.0	μΑ
	Ісств	VINA = VCCB - 0	.6 V per input	2.3 to 2.7	2.7 to 3.6	_	750.0	μА



DC Characteristics (1.65 V \leq V_{CCA} < 2.3 V, 2.7 V < V_{CCB} \leq 3.6 V)

Characteristics	Symbol	Test Co	ondition	V _{CCA} (V)	V _{CCB} (V)	Ta = -40 Min	to 85°C Max	Unit
H-level input voltage	V _{IHA}	DIR, \overline{OE} , An		1.65 to 2.3	2.7 to 3.6	0.65 × V _{CCA}		V
Triever input voltage	V _{IHB}	Bn		1.65 to 2.3	2.7 to 3.6	2.0	_	v
L-level input voltage	V _{ILA}	DIR, \overline{OE} , An		1.65 to 2.3	2.7 to 3.6	7	0.35 × V _{CCA}	V
1 0	V _{ILB}	Bn		1.65 to 2.3	2.7 to 3.6)_	0.8	
	V _{OHA}		I _{OHA} = -100 μA	1.65 to 2.3	2.7 to 3.6	V _{CCA} - 0.2	_	
H-level output voltage		V _{IN} = V _{IH} or V _{IL}	$I_{OHA} = -3 \text{ mA}$	1.65	2.7 to 3.6	1.25	_	V
Thevel output voltage	V _{OHB}	VIN - VIH OI VIL	I _{OHB} = -100 μA	1.65 to 2.3	2.7 to 3.6	V _{CCB} - 0.2	_	V
			I _{OHB} = -12 mA	1.65 to 2.3	3.0	2.2	\rightarrow	
	V _{OLA}		$I_{OLA} = 100 \mu A$	1.65 to 2.3	2.7 to 3.6	$\langle - \rangle$	0.2	
L-level output voltage	VOLA	V _{IN} = V _{IH} or V _{IL}	I _{OLA} = 3 mA)) 1.65	2.7 to 3.6	2)45	0.3	V
L-icver output voltage	V _{OLB}	AIM — AIH OI AIL	I _{OLB} = 100 μA	1.65 to 2.3	2.7 to 3.6	4	0.2	V
	VOLB		I _{OLB} = 12 mA	1.65 to 2.3	3.0	>_	0.55	
2 state output OFF state ourset	I _{OZA}	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $V_{OUT} = 0 \text{ to } 3.6$	v V	1.65 to 2.3	2.7 to 3.6	_	±5.0	٨
3-state output OFF state current	I _{OZB}	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $V_{OUT} = 0 \text{ to } 3.6$		1.65 to 2.3	2.7 to 3.6	_	±5.0	μА
Input leakage current	I _{IN}	V _{IN} (DIR, OE)	= 0 to 3.6 V	1.65 to 2.3	2.7 to 3.6	_	±2.0	μА
Bushold input minimum drive hold		V _{IN} = 0.8 V		1.65 to 2.3	3.0	75	_	
current	IHOLD	V _{IN} = 2.0 V	^	1.65 to 2.3	3.0	-75	_	μА
Bushold input over-drive current	. ((V _{IN} = "L"→"H"		1.65 to 2.3	3.6	_	550	^
to change state (Note)	lod	V _{IN} = "H"→"L"	1/2	1.65 to 2.3	3.6	_	-550	μΑ
	logf1			0	0	_	5.0	
Power-off leakage current	l _{OFF2}	V_{IN} , $V_{OUT} = 0$ to	3.6 V	1.65 to 2.3	0	_	5.0	μΑ
	I _{OFF3}			1.65 to 2.3	Open	_	5.0	
	> I _{CCA}	V _{INA} = V _{CCA} or GND V _{INB} = V _{CCB} or GND		1.65 to 2.3	2.7 to 3.6	_	5.0	
Quiescent supply current	I _{CCB}	VINIA = VCCA OF GND		1.65 to 2.3	2.7 to 3.6	_	5.0	μА
	I _{CCA}	$V_{CCA} \le (V_{IN}, V_{O})$	$V_{CCA} \le (V_{IN}, V_{OUT}) \le 3.6 \text{ V}$		2.7 to 3.6	_	±5.0	^
	ICCB	V _{CCB} ≤ (V _{IN} , V _O	UT) ≤ 3.6 V	1.65 to 2.3	2.7 to 3.6	_	±5.0	μА
	Ісств	V _{INB} = V _{CCB} - 0	.6 V per input	1.65 to 2.3	2.7 to 3.6	_	750.0	μΑ



DC Characteristics (1.4 V \leq V_{CCA} < 1.65 V, 2.7 V < V_{CCB} \leq 3.6 V)

Characteristics	Symbol	Test Co	andition	V _{CCA} (V)	V _{CCB} (V)	Ta = -40	to 85°C	Unit
Gharacteristics	Cymbol	1031 00	Test Condition			Min	Max	Onit
H-level input voltage	V_{IHA}	DIR, \overline{OE} , An		1.4 to 1.65	2.7 to 3.6	0.65 × V _{CCA}	_	V
	V_{IHB}	Bn		1.4 to 1.65	2.7 to 3.6	2.0	_	
L-level input voltage	V_{ILA}	DIR, \overline{OE} , An		1.4 to 1.65	2.7 to 3.6	b	$\begin{array}{c} 0.30 \times \\ V_{CCA} \end{array}$	V
	V_{ILB}	Bn		1.4 to 1.65	2.7 to 3.6	ン <u>_</u>	8.0	
	V _{OHA}		I _{OHA} = -100 μA	1.4 to 1.65	2.7 to 3.6	V _{CCA} - 0.2	_	
H-level output voltage		V _{IN} = V _{IH} or V _{IL}	$I_{OHA} = -1 \text{ mA}$	14	2.7 to 3.6	1.05	_	V
The level output voltage	V _{OHB}	VIII — VIII OI VIL	I _{OHB} = -100 μA	1.4 to 1.65	2.7 to 3.6	V _{CCB} - 0.2	_	•
			I _{OHB} = -12 mA	1.4 to 1.65	3.0	2.2	\rightarrow	
	V_{OLA}		$I_{OLA} = 100 \mu A$	1.4 to 1.65	2.7 to 3.6	$\langle - \rangle$	0.2	
L-level output voltage	VOLA	V _{IN} = V _{IH} or V _{IL}	I _{OLA} = 1 mA)) 1.4	2.7 to 3.6	2/5	0.35	V
L lover output voltage	V _{OLB}	VIIV — VIH OI VIL	$I_{OLB} = 100 \mu A$	1.4 to 1.65	2.7 to 3.6	4	0.2	•
	VOLB		I _{OLB} = 12 mA	1.4 to 1.65	3.0	>_	0.55	
2 state output OEE state ourrent	I _{OZA}	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = 0$ to 3.6	v v	1.4 to 1.65	2.7 to 3.6	_	±5.0	^
3-state output OFF state current	I _{OZB}	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $V_{OUT} = 0 \text{ to } 3.6$		1.4 to 1.65	2.7 to 3.6	_	±5.0	μА
Input leakage current	I _{IN}	V _{IN} (DIR, OE) =	= 0 to 3.6 V	1.4 to 1.65	2.7 to 3.6	_	±2.0	μА
Bushold input minimum drive hold	1	V _{IN} = 0.8 V		1.4 to 1.65	3.0	75	_	^
current	IHOLD	V _{IN} = 2.0 V	\wedge	1.4 to 1.65	3.0	-75	_	μА
Bushold input over-drive current	1	V _{IN} = "L"→"H"		1.4 to 1.65	3.6	_	550	^
to change state (Note)	lod	V _{IN} = "H"→"L"	7/2	1.4 to 1.65	3.6	_	-550	μΑ
	loff1			0	0	_	5.0	
Power-off leakage current	I _{OFF2}	V_{IN} , $V_{OUT} = 0$ to	3.6 V	1.4 to 1.65	0	_	5.0	μΑ
	I _{OFF3}			1.4 to 1.65	Open	_	5.0	
	CCA	V _{INA} = V _{CCA} or GND V _{INB} = V _{CCB} or GND		1.4 to 1.65	2.7 to 3.6	_	5.0	^
Quiescent supply current	I _{CCB}	VINA = VCCA OF GND		1.4 to 1.65	2.7 to 3.6	_	5.0	μА
	ICCA	$V_{CCA} \le (V_{IN}, V_{O})$	UT) ≤ 3.6 V	1.4 to 1.65	2.7 to 3.6	_	±5.0	^
	IÇCB	V _{CCB} ≤ (V _{IN} , V _O	UT) ≤ 3.6 V	1.4 to 1.65	2.7 to 3.6	_	±5.0	μА
	Ісств	V _{INB} = V _{CCB} - 0	.6 V per input	1.4 to 1.65	2.7 to 3.6	_	750.0	μА

DC Characteristics (1.1 V \leq V_{CCA} < 1.4 V, 2.7 V < V_{CCB} \leq 3.6 V)

Characteristics	Symbol	Test Co	ondition	V _{CCA} (V)	V _{CCB} (V)	Ta = -40		Unit
						Min	Max	
H-level input voltage	V_{IHA}	DIR, \overline{OE} , An	DIR, OE, An		2.7 to 3.6	0.65 × V _{CCA}	_	V
	V_{IHB}	Bn	3n 1		2.7 to 3.6	2.0	_	
L-level input voltage	V _{ILA}	DIR, OE, An		1.1 to 1.4	2.7 to 3.6	7	0.30 × V _{CCA}	V
	V _{ILB}	Bn		1.1 to 1.4	2.7 to 3.6	7_	8.0	
	V _{OHA}		I _{OHA} = -100 μA	1.1 to 1.4	2.7 to 3.6	V _{CCA} - 0.2	_	
H-level output voltage	V _{OHB}	$V_{IN} = V_{IH}$ or V_{IL}	I _{OHB} = -100 μA	1.1 to 1.4	2.7 to 3.6	V _{CCB} – 0.2	_	V
			$I_{OHB} = -12 \text{ mA}$	1.1 to 1.4	3.0	2.2	_	
	V _{OLA}		I _{OLA} = 100 μA	1.1 to 1.4	2.7 to 3.6	4	0.2	
L-level output voltage	V/	$V_{IN} = V_{IH}$ or V_{IL}	I _{OLB} = 100 μA	1.1 to 1.4	2.7 to 3.6		0.2	V
	V _{OLB}		I _{OLB} = 12 mA	1.1 to 1.4	♦ 3.0		0.55	
	I _{OZA}	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $V_{OUT} = 0 \text{ to } 3.6 \text{ N}$			2.7 to 3.6	CC	±5.0	
3-state output OFF state current	I _{OZB}	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = 0$ to 3.6		1.1 to 1.4	2.7 to 3.6	_	±5.0	μА
Input leakage current	I _{IN}	V _{IN} (DIR, OE)	= 0 to 3.6 V	1.1 to 1.4/	2,7 to 3.6	_	±2.0	μΑ
Bushold input minimum drive hold		V _{IN} = 0.8 V	> /	1.1 to 1.4	3.0	75	_	•
current	IHOLD	V _{IN} = 2.0 V		1.1 to 1.4	3.0	-75	_	μА
Bushold input over-drive current		V _{IN} = "L"→"H"		1.1 to 1.4	3.6	_	550	^
to change state (Note)	liod	V _{IN} = "H"→"L"	^	1.1 to 1.4	3.6	_	-550	μΑ
	I _{OFF} 1	())		0	0	_	5.0	
Power-off leakage current	IOFF2	V _{IN} , V _{OUT} = 0 to	3.6 V	1.1 to 1.4	0	_	5.0	μΑ
	l _{OFF3}			1.1 to 1.4	Open	_	5.0	
	IGGA	V _{INA} = V _{CCA} or GND V _{INB} = V _{CCB} or GND		1.1 to 1.4	2.7 to 3.6	_	5.0	4
Quiescent supply current) I _{CCB}	V _{INA} = V _{CCA} or GND V _{INB} = V _{CCB} or GND		1.1 to 1.4	2.7 to 3.6	_	5.0	μА
Ico		$V_{CCA} \le (V_{IN}, V_O)$	UT) ≤ 3.6 V	1.1 to 1.4	2.7 to 3.6	_	±5.0	
	I _{CCB}	$V_{CCB} \le (V_{IN}, V_{O})$	UT) ≤ 3.6 V	1.1 to 1.4	2.7 to 3.6	_	±5.0	μА
	ICCTB	V _{INB} = V _{CCA} - 0	.6 V per input	1.1 to 1.4	2.7 to 3.6	_	750.0	

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Note: It is a necessary electric current to change the input in "L" or "H".

2014-03-01



DC Characteristics (1.65 V \leq V_{CCA} < 2.3 V, 2.3 V \leq V_{CCB} \leq 2.7 V)

H-level input voltage ViHA DIR, □E, An 1.65 to 2.3 2.3 to 2.7 0.65 × VCCA ViHA ViHB Bn 1.65 to 2.3 2.3 to 2.7 1.6 C-2 ViHA ViHB Bn 1.65 to 2.3 2.3 to 2.7 ViHB	Characteristics	Symbol	Test Co	ondition	V _{CCA} (V)	V _{CCB} (V)	Ta = -40	to 85°C	Unit
Helevel input voltage							Min	Max	
L-level input voltage VILA DIR, OE, An 1.65 to 2.3 2.3 to 2.7 VCCA VCCCA VCCCCA VCCCCCA VCCCCCCCCCC	H-level input voltage	V_{IHA}	DIR, \overline{OE} , An	DIR, \overline{OE} , An		2.3 to 2.7		_	V
L-level input voltage VILA V		V_{IHB}	Bn		1.65 to 2.3	2.3 to 2.7	1.6	_	
No	L-level input voltage	V _{ILA}	DIR, OE, An		1.65 to 2.3	2.3 to 2.7	4		V
H-level output voltage VoHa Vo		V_{ILB}	Bn		1.65 to 2.3	2.3 to 2.7)_	0.7	
H-level output voltage VoHB VoHB VoHB VoHB VoHB VoHB Volta		V _{OHA}		$I_{OHA} = -100 \mu A$	1.65 to 2.3	2.3 to 2.7		_	
Voha	H lovel output voltage		Mar Mar or Ma	$I_{OHA} = -3 \text{ mA}$	1.65	2.3 to 2.7	1.25	_	\/
L-level output voltage	H-level output voltage	V _{OHB}	AIN = AIH OL AIL	I _{OHB} = -100 μA	1.65 to 2.3	2.3 to 2.7			V
L-level output voltage Vol.a Vin = Vih or Vil. Vol.b Vin = Vih or Vil. Vol.b Vin = Vih or Vil. Vol.cb = 9mA 1.65 to 2.3 2.3 to 2.7 0.2 1.65 to 2.3 2.3 to 2.7 0.66 Vin = Vih or Vil. Vol.cb = 9mA 1.65 to 2.3 2.3 to 2.7 1.65 to 2.3 1.65 to 2.3 2.3 to 2.7 2.7 2.7 2.8 2.8 2.8 2.8 2.8		02		I _{OHB} = -9 mA	1.65 to 2.3	2.3	7.17	\rightarrow	
L-level output voltage Volta		\/		I _{OLA} = 100 μA	1.65 to 2.3	2.3 to 2.7		0.2	
Volb	L level entent veltere	VOLA	N N N	I _{OLA} = 3 mA)) 1.65	2.3 to 2.7)	0.3	
Ioza ViN = ViH or ViL VoUT = 0 to 3.6 V 1.65 to 2.3 2.3 to 2.7 ±5.0 μA	L-level output voltage		$AIM = AIH \text{ or } AI\Gamma$	I _{OLB} = 100 μA	1.65 to 2.3	2.3 to 2.7	4	0.2	V
OZA VOUT = 0 to 3.6 V 1.65 to 2.3 2.3 to 2.7 ±5.0 μA		VOLB		I _{OLB} = 9mA	1.65 to 2.3	2.3	>_	0.6	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		I _{OZA}		V	1.65 to 2.3	2.3 to 2.7	_	±5.0	
Bushold input minimum drive hold current I HOLD VIN = 0.7 V 1.65 to 2.3 2.3 45	3-state output OFF state current	I _{OZB}			1.65 to 2.3	2.3 to 2.7	_	±5.0	μΑ
Current current current to change state IHOLD VIN = 1.6 V 1.65 to 2.3 2.3 -45 — μΑ Bushold input over-drive current to change state (Note) $VIN = "H" → "L"$ 1.65 to 2.3 2.7 — 450 μΑ Vone "H" → "L" 1.65 to 2.3 2.7 — -450 μΑ Power-off leakage current IOFF1 VIN, VOUT = 0 to 3.6 V 1.65 to 2.3 0 — 5.0 μΑ IOFF3 ICCA VINA = VCCA or GND VINB = VCCB or GND 1.65 to 2.3 2.3 to 2.7 — 5.0 μΑ Quiescent supply current ICCA VINA = VCCA or GND VINB = VCCB or GND 1.65 to 2.3 2.3 to 2.7 — 5.0 μΑ ICCA VCCA = (VIN, VOUT) ≤ 3.6 V 1.65 to 2.3 2.3 to 2.7 — 5.0 μΑ	Input leakage current	I _{IN}	V _{IN} (DIR, OE)	= 0 to 3.6 V	1.65 to 2.3	2.3 to 2.7	_	±2.0	μА
Current $V_{IN} = 1.6 \text{ V}$ $V_{IN} = 1.6 \text{ V}$ $V_{IN} = 1.65 \text{ to } 2.3$ 0.3 0.3 0.45 0	Bushold input minimum drive hold		V _{IN} = 0.7 V		1.65 to 2.3	2.3	45	_	
to change state (Note) V_{IN} = "H" → "L" 1.65 to 2.3 2.7 — 450 V_{IN} = "H" → "L" 1.65 to 2.3 2.7 — 450 V_{IN} Power-off leakage current V_{IN} = V_{IN}	•	IHOLD	V _{IN} = 1.6 V	^	1.65 to 2.3	2.3	-45	_	μΑ
to change state (Note) $V_{IN} = {}^{\circ}H^{\circ} \rightarrow {}^{\circ}L^{\circ}$ 1.65 to 2.3 2.7 — 450 Power-off leakage current $V_{IN} = {}^{\circ}H^{\circ} \rightarrow {}^{\circ}L^{\circ}$ 1.65 to 2.3 2.7 — 5.0 Power-off leakage current $V_{IN} = {}^{\circ}V_{IN} = {}^{\circ}V_{IN}$	Bushold input over-drive current	. ((V _{IN} = "L"→"H"		1.65 to 2.3	2.7	_	450	
Power-off leakage current $\begin{array}{c ccccccccccccccccccccccccccccccccccc$	•	IOD	V _{IN} = "H"→"L"	7/12/	1.65 to 2.3	2.7	_	-450	μΑ
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		loff1			0	0	_	5.0	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Power-off leakage current	l _{OFF2}	V_{IN} , $V_{OUT} = 0$ to	3.6 V	1.65 to 2.3	0	_	5.0	μΑ
Quiescent supply current $V_{INB} = V_{CCB}$ or GND $V_{INB} = V_{CCB}$ or GND $V_{INA} = V_{CCA}$ or GND $V_{INB} = V_{CCB}$ or		I _{OFF3}			1.65 to 2.3	Open	_	5.0	
Quiescent supply current I_{CCB} $V_{INA} = V_{CCA}$ or GND $V_{INB} = V_{CCB}$ or GND 1.65 to 2.3 2.3 to 2.7 — 5.0 I_{CCA} $V_{CCA} \le (V_{IN}, V_{OUT}) \le 3.6$		> I _{CCA}		/	1.65 to 2.3	2.3 to 2.7	_	5.0	
Αμ	Quiescent supply current	I _{CCB}			1.65 to 2.3	2.3 to 2.7	_	5.0	μА
I_{CCB} $V_{CCB} \le (V_{IN}, V_{OUT}) \le 3.6 \text{ V}$ $1.65 \text{ to } 2.3 2.3 \text{ to } 2.7 - \pm 5.0 \mu A$		ICCA	$V_{CCA} \le (V_{IN}, V_{O})$	UT) ≤ 3.6 V	1.65 to 2.3	2.3 to 2.7	_	±5.0	A
		IÇCB	$V_{CCB} \leq (V_{IN}, V_{O})$	UT) ≤ 3.6 V	1.65 to 2.3	2.3 to 2.7	_	±5.0	μΑ



DC Characteristics (1.4 V \leq V_{CCA} < 1.65 V, 2.3 V \leq V_{CCB} \leq 2.7 V)

Characteristics	Symbol	Test C	ondition	V _{CCA} (V)	V _{CCB} (V)	Ta = -40	to 85°C	Unit
	,			00/11/	002 ()	Min	Max	
H-level input voltage	V_{IHA}	DIR, $\overline{\text{OE}}$, An		1.4 to 1.65	2.3 to 2.7	0.65 × V _{CCA}	_	V
	V_{IHB}	Bn		1.4 to 1.65	2.3 to 2.7	1.6	_	
L-level input voltage	V _{ILA}	DIR, OE, An		1.4 to 1.65	2.3 to 2.7	7	0.30 × V _{CCA}	V
	V_{ILB}	Bn		1.4 to 1.65	2.3 to 2.7)_	0.7	
	V _{OHA}		$I_{OHA} = -100 \mu A$	1.4 to 1.65	2.3 to 2.7	V _{CCA} - 0.2		
H-level output voltage		V _{IN} = V _{IH} or V _{IL}	$I_{OHA} = -1 \text{ mA}$	1.4	2.3 to 2.7	1.05	_	V
Triever output voltage	V _{OHB}	VIN - VIH OI VIL	I _{OHB} = -100 μA	1.4 to 1.65	2.3 to 2.7	V _{CCB} - 0.2	_	V
			I _{OHB} = -9 mA	1.4 to 1.65	2.3	7.17	\rightarrow	
	V		I _{OLA} = 100 μA	1.4 to 1.65	2.3 to 2.7		0.2	
L lovel output veltage	V_{OLA}	\/\/or\/	I _{OLA} = 1 mA)) 1.4	2.3 to 2.7	2)/5	0.35	V
L-level output voltage	V	$V_{IN} = V_{IH}$ or V_{IL}	I _{OLB} = 100 μA	1.4 to 1.65	2.3 to 2.7	90)	0.2	V
	V_{OLB}		I _{OLB} = 9mA	1.4 to 1.65	2.3	>_	0.6	
	I _{OZA}	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = 0$ to 3.6	V	1.4 to 1.65	2.3 to 2.7	_	±5.0	
3-state output OFF state current	I _{OZB}	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $V_{OUT} = 0 \text{ to } 3.6$		1.4 to 1.65	2.3 to 2.7	_	±5.0	μА
Input leakage current	I _{IN}	V _{IN} (DIR, OE)	= 0 to 3.6 V	1.4 to 1.65	2.3 to 2.7	_	±2.0	μА
Bushold input minimum drive hold		V _{IN} = 0.7 V		1.4 to 1.65	2.3	45	_	^
current	IHOLD	V _{IN} = 1.6 V	^	1.4 to 1.65	2.3	-45	_	μΑ
Bushold input over-drive current	((V _{IN} = "L"→"H"		1.4 to 1.65	2.7	_	450	
to change state (Note)	lod	V _{IN} = "H"→"L"	163	1.4 to 1.65	2.7	_	-450	μΑ
	loff1)		0	0	_	5.0	
Power-off leakage current	I _{OFF2}	V _{IN} , V _{OUT} = 0 to	3.6 V	1.4 to 1.65	0	_	5.0	μΑ
	IOFF3			1.4 to 1.65	Open	_	5.0	
	> I _{CCA}	$V_{INA} = V_{CCA}$ or $V_{INB} = V_{CCB}$ or		1.4 to 1.65	2.3 to 2.7		5.0	•
Quiescent supply current	I _{CCB}	V _{INA} = V _{CCA} or V _{INB} = V _{CCB} or		1.4 to 1.65	2.3 to 2.7	_	5.0	μΑ
	I _{CCA}	$V_{CCA} \le (V_{IN}, V_{CCA})$	ouT) ≤ 3.6 V	1.4 to 1.65	2.3 to 2.7	_	±5.0	^
	ICCB	V _{CCB} ≤ (V _{IN} , V _C	ouT) ≤ 3.6 V	1.4 to 1.65	2.3 to 2.7	_	±5.0	μА

DC Characteristics (1.1 V \leq V_{CCA} < 1.4 V, 2.3 V \leq V_{CCB} \leq 2.7 V)

Characteristics	Symbol	Test Co	ondition	V _{CCA} (V)	V _{CCB} (V)	Ta = -40 Min	to 85°C Max	Unit
H-level input voltage	V _{IHA}	DIR, $\overline{\text{OE}}$, An	DIR, $\overline{\text{OE}}$, An		2.3 to 2.7	0.65 × V _{CCA}	_	V
	V_{IHB}	Bn	Bn		2.3 to 2.7	1.6	_	
L-level input voltage	V_{ILA}	DIR, OE, An		1.1 to 1.4	2.3 to 2.7	7	$\begin{array}{c} 0.30 \times \\ V_{CCA} \end{array}$	V
	V_{ILB}	Bn		1.1 to 1.4	2.3 to 2.7	/_	0.7	
	V _{OHA}		I _{OHA} = -100 μA	1.1 to 1.4	2.3 to 2.7	V _{CCA} - 0.2	_	
H-level output voltage	V _{OHB}	$V_{IN} = V_{IH}$ or V_{IL}	I _{OHB} = -100 μA	1.1 to 1.4	2.3 to 2.7	V _{CCB} – 0.2	_	V
			$I_{OHB} = -9 \text{ mA}$	1.1 to 1.4	2.3	17		
	V _{OLA}		I _{OLA} = 100 μA	1.1 to 1.4	2.3 to 2.7	4	0,2	
L-level output voltage	V _{OLB}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OLB} = 100 \mu A$	1.1 to 1.4	2.3 to 2.7	$\langle - \rangle$	0.2	V
	*OLB		I _{OLB} = 9 mA)1.1 to 1.4	2.3	245	0.6	
2 state output OFF state ourrest	I _{OZA}	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = 0$ to 3.6	V _{IN} = V _{IH} or V _{IL} V _{OUT} = 0 to 3.6 V		2.3 to 2.7	50)	±5.0	^
3-state output OFF state current	I _{OZB}	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $V_{OUT} = 0 \text{ to } 3.6$		1.1 to 1.4	2.3 to 2.7	_	±5.0	μА
Input leakage current	I _{IN}	V _{IN} (DIR, OE)	= 0 to 3.6 V	1.1 to 1.4	2.3 to 2.7	_	±2.0	μА
Bushold input minimum drive hold	1	V _{IN} = 0.7 V	> /	1.1 to 1.4	2.3	45	_	^
current	IHOLD	V _{IN} = 1.6 V		1.1 to 1.4	2.3	-45	_	μА
Bushold input over-drive current	lias	V _{IN} = "L"→"H"		1.1 to 1.4	2.7	_	450	^
to change state (Note)	liod	V _{IN} = "H"→"L"	\wedge	1.1 to 1.4	2.7	_	-450	μА
	loff1			0	0	_	5.0	
Power-off leakage current	IOFF2	V_{IN} , $V_{OUT} = 0$ to	3.6 V	1.1 to 1.4	0	_	5.0	μΑ
	loFF3			1.1 to 1.4	Open	_	5.0	
	TGCA	V _{INA} = V _{CCA} or GND V _{INB} = V _{CCB} or GND		1.1 to 1.4	2.3 to 2.7		5.0	
Quiescent supply current	ICCB	V _{INA} = V _{CCA} or GND V _{INB} = V _{CCB} or GND		1.1 to 1.4	2.3 to 2.7	_	5.0	μА
	I _{CCA}	$V_{CCA} \le (V_{IN}, V_{O})$	UT) ≤ 3.6 V	1.1 to 1.4	2.3 to 2.7	_	±5.0	^
	I _{CCB}	$V_{CCB} \le (V_{IN}, V_{O})$	UT) ≤ 3.6 V	1.1 to 1.4	2.3 to 2.7	_	±5.0	μА

DC Characteristics (1.1 V \leq V_{CCA} < 1.4 V, 1.65 V \leq V_{CCB} < 2.3 V)

Characteristics	Symbol	Toot C	andition	V _{CCA} (V)	V _{CCB} (V)	Ta = -40	to 85°C	Unit
Characteristics	Symbol	Test O	Test Condition		ACCB (A)	Min	Max	Offic
H-level input voltage	V _{IHA}	DIR, OE, An	DIR, $\overline{\text{OE}}$, An		1.65 to 2.3	0.65 × V _{CCA}		V
r-ievei iriput voitage	V _{IHB}	Bn	3n 1		1.65 to 2.3	0.65 × V _{CCB}		V
lovel input veltage	VILA	DIR, OE, An		1.1 to 1.4	1.65 to 2.3))~	0.30 × V _{CCA}	V
level input voltage	V _{ILB}	Bn		1.1 to 1.4	1.65 to 2.3	_	0.35 × V _{CCB}	V
	V _{OHA}		$I_{OHA} = -100 \mu A$	1.1 to 1.4	1.65 to 2.3	V _{CCA} - 0.2		
H-level output voltage	V _{OHB}	$V_{IN} = V_{IH}$ or V_{IL}	I _{OHB} = -100 μA	1.1 to 1.4	1.65 to 2.3	V _{CCB} -0.2	1	V
			$I_{OHB} = -3 \text{ mA}$	1.1 to 1.4	1.65	1.25	\ <u>\</u>	
	V _{OLA}		$I_{OLA} = 100 \mu\text{A}$	1.1 to 1.4	1.65 to 2.3		0.2	
level output voltage	V _{OLB}	$V_{IN} = V_{IH}$ or V_{IL}	I _{OLB} = 100 μA	1.1 to 1.4	1.65 to 2.3		0.2	V
	VOLB		I _{OLB} = 3 mA	1.1 to 1.4	1.65	70	0.3	
3-state output OFF state current	I _{OZA}	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $V_{OUT} = 0 \text{ to } 3.6^4$	v V	1.1 to 1.4	1.65 to 2.3	_	±5.0	^
sstate output OFF state current	I _{OZB}	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = 0$ to 3.6	V	1.1 to 1.4	1.65 to 2.3		±5.0	μА
nput leakage current	I _{IN}	V _{IN} (DIR, \overline{OE})	0 to 3.6 V	1.1 to 1.4	1.65 to 2.3	_	±2.0	μА
Bushold input minimum drive hold		V _{IN} = 0.58 V		1.1 to 1.4	1.65	20		^
current	IHOLD	V _{IN} = 1.07 V		1.1 to 1.4	1.65	-20		μА
Bushold input over-drive current	1(V _{IN} = "L"→"H"	\wedge	1.1 to 1.4	1.95	_	300	^
to change state (Note)	lod	V _{IN} = "H"→"L"		1.1 to 1.4	1.95	_	-300	μА
	IOFF1			0	0	_	5.0	
Power-off leakage current	loff2	V_{IN} , $V_{OUT} = 0$ to	3.6 V	1.1 to 1.4	0	_	5.0	μА
	l _{OFF3}			1.1 to 1.4	Open	_	5.0	
	ICCA	$V_{INA} = V_{CCA}$ or $V_{INB} = V_{CCB}$ or		1.1 to 1.4	1.65 to 2.3	_	5.0	^
Autocoont cumply current		V _{INA} = V _{CCA} or V _{INB} = V _{CCB} or		1.1 to 1.4	1.65 to 2.3		5.0	μΑ
	ICCA	V _{CCA} ≤ (V _{IN} , V _C	_{UT}) ≤ 3.6 V	1.1 to 1.4	1.65 to 2.3	_	±5.0	^
	I _{CCB}	V _{CCB} ≤ (V _{IN} , V _C	_{UT}) ≤ 3.6 V	1.1 to 1.4	1.65 to 2.3	_	±5.0	μА

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AC Characteristics (Ta = -40 to 85°C, Input: $t_r = t_f = 2.0$ ns)

 $V_{CCA} = 2.5 \pm 0.2$ V, $V_{CCB} = 3.3 \pm 0.3$ V

Characteristics	Symbol	Test Condition	Min	Max	Unit
Propagation delay time	t _{pLH}	Figure 1 Figure 2	1.0	5.4	
$(Bn \rightarrow An)$	t _{pHL}	Figure 1, Figure 2	1.0	3.4	
3-state output enable time	t _{pZL}	Figure 1, Figure 3	1.0	8.4	ns
$(\overline{OE} \to An)$	t _{pZH}	rigule 1, rigule 3	1.0	0,4	113
3-state output disable time	t _{pLZ}	Figure 1, Figure 3	(//0)	6.7	
$(\overline{OE} \to An)$	t _{pHZ}	Figure 1, Figure 3	(1.0)	0.7	
Propagation delay time	t _{pLH}	Figure 1, Figure 2	11.0	6.8	
$(An \rightarrow Bn)$	t _{pHL}	Figure 1, Figure 2)r.0	0.0	
3-state output enable time	t _{pZL}	Figure 1, Figure 3	1.0	8.7	ns
$(\overline{OE} \to Bn)$	t _{pZH}	Figure 1, Figure 3	1.0	0.7	119
3-state output disable time	t _{pLZ}	Figure 1, Figure 3	⟨₺.0	3.9	
$(\overline{OE} \to Bn)$	t _{pHZ}	rigule 1, rigule 3	3.0	9.9	(γ)
Output to output skew	t _{osLH}	(Note)	2	0.5	ns
Output to output show	t _{osHL}	(Note)			110

Note: Parameter guaranteed by design.

 $(t_{OSLH} = |t_{PLHm} - t_{PLHn}|, t_{OSHL} = |t_{PHLm} - t_{PHLn}|)$

 $V_{CCA}=1.8\pm0.15~\text{V},~V_{CCB}=3.3\pm0.3\text{ V}$

Characteristics	Symbol	Test Condition	Min	Max	Unit
Propagation delay time $(Bn \to An)$	t _{pLH}	Figure 1, Figure 2	1.0	8.9	
3-state output enable time (OE → An)	t _{pZL}	Figure 1, Figure 3	1.0	13.4	ns
3-state output disable time (OE → An)	t _{pLZ}	Figure 1, Figure 3	1.0	10.9	
Propagation delay time (An → Bn)	t _{pLH}	Figure 1, Figure 2	1.0	7.8	
3-state output enable time (OE → Bn)	t _{pZL}	Figure 1, Figure 3	1.0	10.7	ns
3-state output disable time (OE → Bn)	t _{pLZ}	Figure 1, Figure 3	1.0	5.2	
Output to output skew	t _{osLH}	(Note)	_	0.5	ns

Note: Parameter guaranteed by design.

 $V_{CCA} = 1.5 \pm 0.1$ V, $V_{CCB} = 3.3 \pm 0.3$ V

Characteristics	Symbol	Test Condition	Min	Max	Unit
Propagation delay time	t _{pLH}	Figure 1 Figure 2	1.0	10.3	
$(Bn \rightarrow An)$	t _{pHL}	Figure 1, Figure 2	1.0	10.3	
3-state output enable time	t _{pZL}	Figure 1, Figure 3	1.0	18.5	ns
$(\overline{OE} \to An)$	t _{pZH}	rigule 1, rigule 3	1.0	10.5	113
3-state output disable time	t _{pLZ}	Figure 1, Figure 3	1.0	190	
$(\overline{OE} \to An)$	t _{pHZ}	rigule 1, rigule 3	1.0	13,0	
Propagation delay time	t _{pLH}	Figure 1, Figure 2	1.0	8.6	
$(An \rightarrow Bn)$	t _{pHL}	Figure 1, Figure 2	1.0	0.0	
3-state output enable time	t _{pZL}	Figure 1, Figure 3	1.0	14.3	ns
$(\overline{OE} \to Bn)$	t _{pZH}	Figure 1, Figure 3	1.0	14.3	113
3-state output disable time	t _{pLZ}	Figure 1 Figure 2	1.0	6.6	
$(\overline{OE} \to Bn)$	t _{pHZ}	Figure 1, Figure 3	1.0	0.0	
Output to output skew	t _{osLH}	(Note)	\Diamond	1,5	
Output to output skew	t _{osHL}	(Note)			ns

Note: Parameter guaranteed by design.

 $(t_{OSLH} = |t_{DLHm} - t_{DLHn}|, t_{OSHL} = |t_{DHLm} - t_{DHLn}|)$

 $V_{CCA} = 1.2 \pm 0.1 \text{ V}, V_{CCB} = 3.3 \pm 0.3 \text{ V}$

Characteristics	Symbol	Test Condition	Min	Max	Unit
Propagation delay time $(Bn \to An) \label{eq:Bn}$	t _{pLH}	Figure 1, Figure 2	1.0	61	
3-state output enable time (OE → An)	t _{pZL}	Figure 1, Figure 3	1.0	95	ns
3-state output disable time (OE → An)	t _{pLZ} t _{pHZ}	Figure 1, Figure 3	1.0	44	
Propagation delay time $(An \rightarrow Bn)$	t _{pLH}	Figure 1, Figure 2	1.0	22	
3-state output enable time (OE → Bn)	t _{pZL}	Figure 1, Figure 3	1.0	52	ns
3-state output disable time (OE → Bn)	t _{pLZ} t _{pHZ}	Figure 1, Figure 3	1.0	18	
Output to output skew	t _{osHL}	(Note)	_	1.5	ns

Note: Parameter guaranteed by design.

 $V_{CCA} = 1.8 \pm 0.15$ V, $V_{CCB} = 2.5 \pm 0.2$ V

Characteristics	Symbol	Test Condition	Min	Max	Unit
Propagation delay time	t _{pLH}	Figure 1, Figure 2	1.0	9.1	
$(Bn \rightarrow An)$	t _{pHL}	rigule 1, rigule 2	1.0	9.1	
3-state output enable time	t _{pZL}	Figure 1 Figure 2	1.0	13.5	ns
$(\overline{OE} \to An)$	t _{pZH}	Figure 1, Figure 3	1.0	13.5	113
3-state output disable time	t _{pLZ}	Figure 1, Figure 3	1.0		
$(\overline{OE} \to An)$	t _{pHZ}	rigule 1, rigule 3		11,8	
Propagation delay time	t _{pLH}	Figure 1 Figure 2	1.0	9.5	
$(An \rightarrow Bn)$	t _{pHL}	Figure 1, Figure 2	1.0	9.5	
3-state output enable time	t _{pZL}	Figure 1 Figure 2	1.0	12.6	ns
$(\overline{\sf OE} \ \to \sf Bn)$	t _{pZH}	Figure 1, Figure 3	1.0	12.0	119
3-state output disable time	t _{pLZ}	Figure 1, Figure 3	1.0	5.1	
$(\overline{OE} \to Bn)$	t _{pHZ}	rigule 1, rigule 3	1.0	331	
Output to output allow	t _{osLH}	(Note 1)	\Diamond	0.5	
Output to output skew	t _{osHL}	(Note 1)		0.5	ns

Note: Parameter guaranteed by design.

 $(t_{OSLH} = |t_{pLHm} - t_{pLHn}|, t_{OSHL} = |t_{pHLm} - t_{pHLn}|)$

 $V_{CCA} = 1.5 \pm 0.1 \text{ V}, V_{CCB} = 2.5 \pm 0.2 \text{ V}$

Characteristics	Symbol	Test Condition	Min	Max	Unit
Propagation delay time $(Bn \to An) \label{eq:Bn}$	t _р LH t _р HL	Figure 1, Figure 2	1.0	10.8	
3-state output enable time (OE → An)	t _{pZL}	Figure 1, Figure 3	1.0	18.3	ns
3-state output disable time (OE → An)	t _{pLZ}	Figure 1, Figure 3	1.0	14.2	
Propagation delay time (An → Bn)	t _{pLH}	Figure 1, Figure 2	1.0	10.5	
3-state output enable time (OE → Bn)	t _{pZL}	Figure 1, Figure 3	1.0	15.4	ns
3-state output disable time (OE → Bn)	t _{pLZ} t _{pHZ}	Figure 1, Figure 3	1.0	6.4	
Output to output skew	t _{os} LH	(Note)		1.5	ns

Note: Parameter guaranteed by design.

 $V_{CCA} = 1.2 \pm 0.1$ V, $V_{CCB} = 2.5 \pm 0.2$ V

Characteristics	Symbol	Test Condition	Min	Max	Unit
Propagation delay time	t _{pLH}	Figure 1, Figure 2	1.0	60	
$(Bn \rightarrow An)$	t _{pHL}	rigule 1, rigule 2	1.0	00	
3-state output enable time	t _{pZL}	Figure 1, Figure 3	1.0	95	ns
$(\overline{OE} \to An)$	t _{pZH}	rigule 1, rigule 3	1.0	95	113
3-state output disable time	t _{pLZ}	Figure 1, Figure 3	1.0	45	
$(\overline{OE} \to An)$	t _{pHZ}	rigule 1, rigule 3		43	
Propagation delay time	t _{pLH}	Figure 1, Figure 2	1.0	23	
$(An \rightarrow Bn)$	t _{pHL}	Figure 1, Figure 2	1.0	23	
3-state output enable time	t _{pZL}	Figure 1, Figure 3	1.0	54	ns
$(\overline{OE} \to Bn)$	t _{pZH}	Figure 1, Figure 3	1.0	34	113
3-state output disable time	t _{pLZ}	Figure 1 Figure 2	1.0	1.7	
$(\overline{OE} \to Bn)$	t _{pHZ}	Figure 1, Figure 3	1.0	17	
Output to output skow	t _{osLH}	(Note)	\Diamond	1,5	
Output to output skew	t _{osHL}	(Note)			ns

Note: Parameter guaranteed by design.

 $(t_{OSLH} = |t_{DLHm} - t_{DLHn}|, t_{OSHL} = |t_{DHLm} - t_{DHLn}|)$

 $V_{CCA} = 1.2 \pm 0.1 \text{ V}, V_{CCB} = 1.8 \pm 0.15 \text{ V}$

Characteristics	Symbol	Test Condition	Min	Max	Unit
Propagation delay time $(Bn \to An) \label{eq:Bn}$	t _{pLH}	Figure 1, Figure 2	1.0	58	
3-state output enable time (OE → An)	t _{pZL}	Figure 1, Figure 3	1.0	92	ns
3-state output disable time (OE → An)	t _{pLZ}	Figure 1, Figure 3	1.0	47	
Propagation delay time $(An \rightarrow Bn)$	t _{pLH}	Figure 1, Figure 2	1.0	30	
3-state output enable time (OE → Bn)	t _{pZL}	Figure 1, Figure 3	1.0	55	ns
3-state output disable time (OE → Bn)	t _{pLZ} t _{pHZ}	Figure 1, Figure 3	1.0	17	
Output to output skew	t _{osHL}	(Note)	_	1.5	ns

Note: Parameter guaranteed by design.

Dynamic Switching Characteristics (Ta = 25°C, Input: $t_r = t_f = 2.0$ ns, $C_L = 30$ pF)

Characteristics		Symbol	Test Condition			Тур.	Unit					
Onaracteristics		Oymboi	rest condition	V _{CCA} (V)	V _{CCB} (V)	Typ.	Onit					
				2.5	3.3	0.8						
	$A\toB$	$A\toB$	$A\toB$	$A \rightarrow B$			1.8	3.3	8.0			
Quiet output maximum		V _{OLP}	$V_{IH} = V_{CC}, V_{IL} = 0 V$	1.8	2.5	0.6	V					
dynamic V _{OL}		VOLP	(Note)	2.5	3.3	0.6	·					
	$B \rightarrow A$			1.8	3.3	0.25						
			_	(1.8/	2.5	0.25						
				2.5	3.3	-0.8						
	$A \rightarrow B$			1.8	3.3	-0.8						
Quiet output minimum		V _{OLV}	V _{IH} = V _{CC} , V _{IL} = 0 V	1.8	2.5	-0.6	V					
dynamic V _{OL}	$B \rightarrow A$						VOLV	(Note)	2.5	3.3	-0.6	v
				1.8	3.3	-0.25						
			(7/6)	1.8	2.5	-0.25						
				2.5	3.3	4.6						
	$A \rightarrow B$			1.8	3,3	4.6						
Quiet output maximum		V _{OHP}	$V_{IH} = V_{CC}, V_{IL} = 0 V$	(1.8	2.5	3.3	V					
dynamic V _{OH}		VOHP	(Note)	2.5	3.3	3.3	v					
	$B \rightarrow A$						//1.8	3.3	2.3			
		4(1.8	2.5	2.3						
				2.5	3.3	2.0						
	$A \rightarrow B$			1.8	3.3	2.0						
Quiet output minimum dynamic V _{OH}		VOHV	V _{IH} = V _{CC} , V _{IL} = 0 V	1.8	2.5	1.7	V					
	$B \rightarrow A$	(VOHV	(Note)	2.5	3.3	1.7	v					
				1.8	3.3	1.3						
	\setminus ((//)		1.8	2.5	1.3						

Note: Parameter guaranteed by design.

Capacitive Characteristics (Ta = 25° C)

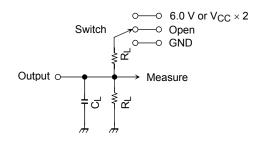
Characteristics	Symbol		Test Circuit			Tvn	Unit		
Characteristics	Symbol		rest Circuit	V _{CCA} (V)	V _{CCB} (V)	Тур.	Offic		
Input capacitance	CIN	DIR, OE		2.5	3.3	7	pF		
Bus I/O capacitance	CI/O	An, Bn		2.5	3.3	8	pF		
	> (()	OE = "L"	$A \rightarrow B (DIR = "H")$	2.5	3.3	3			
	Coordinate		$B \rightarrow A (DIR = "L")$	2.5	3.3	16			
	C _{PDA}	СРДА	OPDA	OE = "H"	$A \rightarrow B (DIR = "H")$	2.5	3.3	0	
Power dissipation capacitance		OL = II	$B \rightarrow A (DIR = "L")$	2.5	3.3	0	pF		
(Note)	C _{PDB} -		OE = "L"	$A \rightarrow B (DIR = "H")$	2.5	3.3	16	ρι	
				OL - L	$B \rightarrow A (DIR = "L")$	2.5	3.3	5	
		OE = "H"	$A \rightarrow B (DIR = "H")$	2.5	3.3	0			
		OL = H	$B \rightarrow A (DIR = "L")$	2.5	3.3	1			

Note: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation:

 $I_{CC (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/4 \text{ (per bit)}$

AC Test Circuit



Parameter	Switch
t _{pLH} , t _{pHL}	Open
	6.0 V @ $V_{CC} = 3.3 \pm 0.3 \text{ V}$
	$V_{CC} \times 2$ @ $V_{CC} = 2.5 \pm 0.2 \text{ V}$
t_{pLZ}, t_{pZL}	@ V _{CC} = 1.8 ± 0.15 V
. ($@V_{CC} = 1.5 \pm 0.1 \text{ V}$
	$@V_{CC} = 1.2 \pm 0.1 V$
t _{pHZ} , t _{pZH}	GND

		V _{CC} (output)	
Symbol	$3.3 \pm 0.3 \text{ V}$ $2.5 \pm 0.2 \text{ V}$	1.8 ± 0.15 V 1.5 ± 0.1 V	1.2±0.1V
R_{L}	500 Ω	1 kΩ 2 kΩ	10 kΩ
C_L	30 pF	30 pF 15 pF	15 pF



AC Waveform

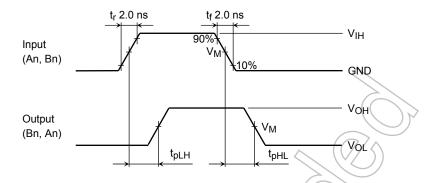


Figure 2 t_{pLH}, t_{pHL}

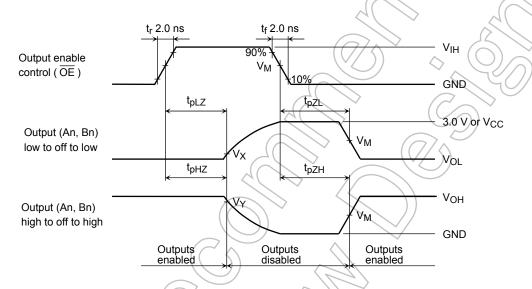
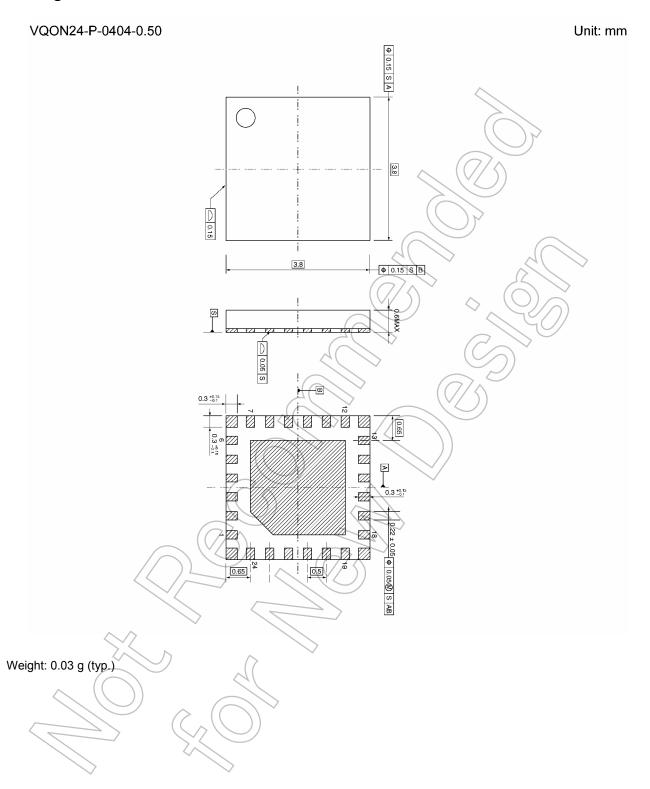


Figure 3 t_{pLZ}, t_{pHZ}, t_{pZL}, t_{pZH}

Symbol	Vcc		
	3.3 ± 0.3 V	2.5 ± 0.2 V 1.8 ± 0.15 V	$\begin{array}{c} 1.5 \pm 0.1 \ \text{V} \\ 1.2 \pm 0.1 \ \text{V} \end{array}$
V _{IH}	2.7 V	V _{CC}	V _{CC}
V _M	1.5 V	V _{CC} /2	V _{CC} /2
VX	V _{OL} + 0.3 V	V _{OL} + 0.15 V	V _{OL} + 0.1 V
(V _Y	V _{OH} – 0.3 V	V _{OH} – 0.15 V	V _{OH} – 0.1 V

20 2014-03-01

Package Dimensions



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