

译文

TDS4A212MX,TDS4B212MX

本资料是为了参考的目的由原始文档翻译而来。使用本资料时，请务必以原始文档及其关联的最新东芝信息为准，并遵守该等原始文档和东芝信息。

原本: “TDS4A212MX,TDS4B212MX ” 2026-04-03

翻译日: 2026-07-16

TDS4A212MX, TDS4B212MX

1. 功能

- 1-32Gbps 1-Lane Two Differential Channel, 2:1 Mux/1:2 De-Mux

2. 概述

TDS4A212MX、TDS4B212MX是高速差分型多路复用器(Mux)/多路分解器(De-Mux)。推荐数据速率为1~32Gbps，可用于PCIe® 5.0、CXL 2.0、USB4® Version 2.0、Thunderbolt™ 4、DisplayPort™ 2.0等高速至低速差分接口。

TDS4B212MX采用针对高频特性优化的引脚配置、实现了高带宽；TDS4A212MX采用便于基板布线的引脚配置。

本产品可将A端口(An+、An-)与B端口(Bn+、Bn-)或C端口(Cn+、Cn-)中的任一端口连接、

可通过选择端子(SEL)与输出使能端子(OE)的组合来决定。

当输出使能(OE)为高电平时、与选择输入无关、开关处于非导通状态、从而降低消耗电流。

工作温度范围为-40°C至105°C、也可用于工业用途。

3. 特点

- (1) 工作电源电压:VCC = 1.6~3.6 V
- (2) 工作温度范围:Topr = -40~105°C
- (3) 低消耗电流 使能模式时(典型值):Iope = 60 µA
禁用模式时(最大值):ISTB = 10 µA
- (4) -3dB带宽(差分) BW(Diff)(典型值) : TDS4B212MX = 27.5 GHz
TDS4A212MX = 26.2 GHz
- (5) 差分插入损耗 DDIL(典型值) : TDS4B212MX = -1.3 dB @ f = 16 GHz
TDS4A212MX = -1.4 dB @ f = 16 GHz
- (6) 差分反射损耗DDRL(典型值) : TDS4B212MX = -16 dB @ f = 16 GHz
TDS4A212MX = -18 dB @ f = 16 GHz
- (7) 差分关断隔离DDOIRR(典型值) : TDS4B212MX = -14 dB @ f = 16 GHz
TDS4A212MX = -11 dB @ f = 16 GHz
- (8) 差分串扰DDXT(典型值) : TDS4B212MX = -36 dB @ f = 16 GHz
TDS4A212MX = -30 dB @ f = 16 GHz
- (9) 封装: XQFN16

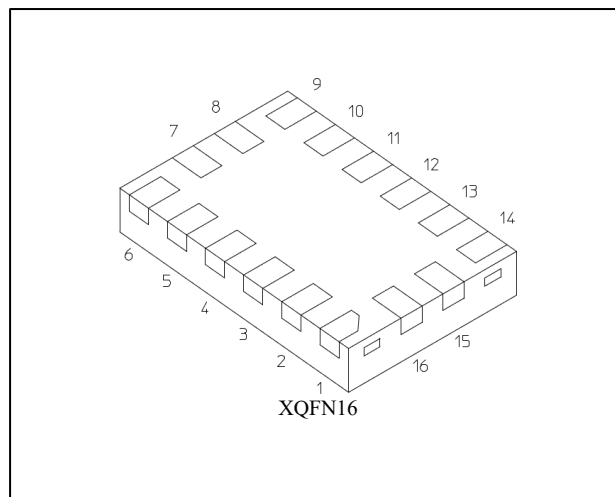
4. 支持的接口

- PCIe 5.0/4.0
- CXL 2.0/1.0
- USB4 Version 2.0, Gen3/Gen2
- SAS 3.0
- Thunderbolt 4/3
- DisplayPort 2.0/1.4
- USB 3.2 Gen 2/Gen 1
- PCIe®是PCI-SIG的商标。
- USB4®是USB Implementers Forum的商标。
- Thunderbolt™是Intel Corporation或其子公司的商标。
- DisplayPort™是Video Electronics Standards Association (VESA®)在美国及其他国家拥有的商标。
- 其他公司名称、商品名称、服务名称等可能是各公司作为商标使用的名称。

产品量产开始时间

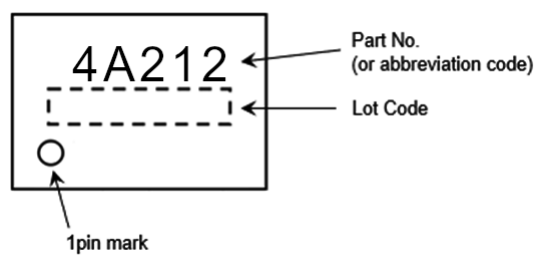
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5. 外观图

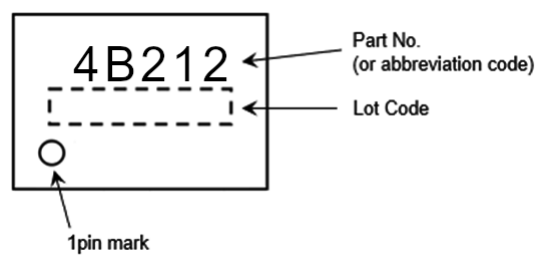


6. 产品标识

TDS4A212MX



TDS4B212MX



10. 绝对最大额定值(注)

项目	符号	额定值	单位
电源电压	V_{CC}	-0.5 至 4.0	V
输入电压 (OE, SEL)	V_{IN}	-0.5至4.0	V
开关输入输出电压	V_S	-0.5 至 2.5	V
开关输入输出电流	I_S	32	mA
允许损耗	P_D	180	mW
电源/GND电流	I_{CC}/I_{GND}	± 50	mA
存储温度	T_{stg}	-65 至 150	°C

注: 绝对最大额定值是即使瞬间也不得超过的值，任何一项都不得超过。

即使本产品的使用条件(使用温度/电流/电压等)在绝对最大额定值/工作范围以内使用，若在高负荷(高温及大电流/高电压施加、较大温度变化等)条件下连续使用，可靠性可能会显著降低。

请确认本公司半导体可靠性手册(使用注意事项及降额的理念和方法)以及个别可靠性信息(可靠性试验报告、估计故障率等)后，进行适当的可靠性设计。

11. 工作范围(注)

项目	符号	额定值	单位
电源电压	V_{CC}	1.6 至 3.6	V
输入电压 (OE, SEL)	V_{IN}	0 至 3.6	V
差分信号电压(peak to peak)	$V_{I/O(Diff)}$	0 到 1.8	V
共模信号电压	$V_{I/O(Com)}$	0 到 2.0	V
工作温度	T_{opr}	-40 到 105	°C
输入上升、下降时间	dt/dv	0 到 10	ns/V

注: 工作范围是保证工作的条件。

请将未使用的控制输入连接至VCC或GND。

12. 电气特性

12.1. DC特性

12.1.1. DC特性(注)(除非另有规定・Ta = -40至85°C)

项目	符号	测量条件	V _{CC} (V)	最小	典型值	最大	单位
高电平输入电压(OE, SEL)	V _{IH}	—	1.65 至 3.6	0.65 V _{CC}	—	—	V
低电平输入电压(OE, SEL)	V _{IL}	—	1.65至3.6	—	—	0.35 V _{CC}	V
输入泄漏电流(OE, SEL)	I _{IN}	V _{IN} = 0~3.6 V	1.65至3.6	—	—	±1	μA
开关关断泄漏电流	I _{SZ}	V _S = 0~2.5 V, OE = V _{CC}	1.65至3.6	—	—	±3	μA
导通电阻	R _{ON}	V _S = 0 V, I _S = 8 mA (TDS4A212)	3.0	—	—	8.4	Ω
		V _S = 0 V, I _S = 8 mA (TDS4B212)	3.0	—	—	7.9	
		V _S = 2 V, I _S = 8 mA	3.0	—	—	15	
待机电流	I _{STB}	OE = V _{CC} , SEL = V _{CC} or GND	3.6	—	—	10	μA
消耗电流	I _{ope}	OE = GND, SEL = V _{CC} or GND	3.6	—	60	150	μA

注:典型值是Ta = 25°C条件下的值。

12.1.2. DC特性(注)(除非另有规定・Ta = -40至105°C)

项目	符号	测量条件	V _{CC} (V)	最小	典型值	最大	单位
高电平输入电压(OE, SEL)	V _{IH}	—	1.65至3.6	0.65 × V _{CC}	—	—	V
低电平输入电压(OE, SEL)	V _{IL}	—	1.65至3.6	—	—	0.35 × V _{CC}	V
输入泄漏电流(OE, SEL)	I _{IN}	V _{IN} = 0~3.6 V	1.65至3.6	—	—	±1	μA
开关关断泄漏电流	I _{SZ}	V _S = 0~2.5 V, OE = V _{CC}	1.65至3.6	—	—	±4	μA
导通电阻	R _{ON}	V _S = 0 V, I _S = 8 mA (TDS4A212)	3.0	—	—	8.9	Ω
		V _S = 0 V, I _S = 8 mA (TDS4B212)	3.0	—	—	8.4	
		V _S = 2 V, I _S = 8 mA	3.0	—	—	16	
待机电流	I _{STB}	OE = V _{CC} , SEL = V _{CC} or GND	3.6	—	—	10	μA
消耗电流	I _{ope}	OE = GND, SEL = V _{CC} or GND	3.6	—	60	150	μA

注:典型值是Ta = 25°C条件下的值。

12.2. 高频特性(注)(除非另有规定，VCC = 1.6至3.6 V)

12.2.1. TDS4A212MX

项目	符号	注释	测量条件		典型值	单位
-3dB带宽(差分)	BW _(Diff)	(注1)	R _L = 50 Ω、图13.1		26.2	GHz
差分插入损耗	DDIL	(注1)	R _L = 50 Ω 图13.1	f = 2.5 GHz	-0.6	dB
				f = 4.0 GHz	-0.7	
				f = 5.0 GHz	-0.8	
				f = 8.0 GHz	-1.0	
				f = 10.0 GHz	-1.0	
				f = 12.8 GHz	-1.2	
				f = 16.0 GHz	-1.4	
差分反射损耗	DDR _L	(注1)	R _L = 50 Ω 图13.1	f = 2.5 GHz	-18	dB
				f = 4.0 GHz	-19	
				f = 5.0 GHz	-15	
				f = 8.0 GHz	-14	
				f = 10.0 GHz	-17	
				f = 12.8 GHz	-17	
				f = 16.0 GHz	-18	
差分关断隔离	DDOIRR	(注1)	R _L = 50 Ω 图13.2	f = 2.5 GHz	-25	dB
				f = 4.0 GHz	-22	
				f = 5.0 GHz	-20	
				f = 8.0 GHz	-19	
				f = 10.0 GHz	-17	
				f = 12.8 GHz	-12	
				f = 16.0 GHz	-11	
差分串扰	DDXT	(注1)	R _L = 50 Ω 图13.3, 13.4	f = 2.5 GHz	-40	dB
				f = 4.0 GHz	-37	
				f = 5.0 GHz	-36	
				f = 8.0 GHz	-34	
				f = 10.0 GHz	-32	
				f = 12.8 GHz	-31	
				f = 16.0 GHz	-30	

注: 典型值是Ta = 25°C条件下的值。

注1: 此项目是通过设计保证的项目。

12.2.2. TDS4B212MX

项目	符号	注释	测量条件		典型值	单位
-3dB带宽(差分)	BW _(Diff)	(注1)	R _L = 50 Ω、图13.1		27.5	GHz
差分插入损耗	DDIL	(注1)	R _L = 50 Ω 图13.1	f = 2.5 GHz	-0.5	dB
				f = 4.0 GHz	-0.6	
				f = 5.0 GHz	-0.6	
				f = 8.0 GHz	-0.8	
				f = 10.0 GHz	-0.8	
				f = 12.8 GHz	-1.0	
				f = 16.0 GHz	-1.3	
差分反射损耗	DDRL	(注1)	R _L = 50 Ω 图13.1	f = 2.5 GHz	-20	dB
				f = 4.0 GHz	-18	
				f = 5.0 GHz	-17	
				f = 8.0 GHz	-15	
				f = 10.0 GHz	-20	
				f = 12.8 GHz	-17	
				f = 16.0 GHz	-16	
差分关断隔离	DDOIRR	(注1)	R _L = 50 Ω 图13.2	f = 2.5 GHz	-25	dB
				f = 4.0 GHz	-21	
				f = 5.0 GHz	-20	
				f = 8.0 GHz	-17	
				f = 10.0 GHz	-16	
				f = 12.8 GHz	-17	
				f = 16.0 GHz	-14	
差分串扰	DDXT	(注1)	R _L = 50 Ω 图13.3, 13.4	f = 2.5 GHz	-68	dB
				f = 4.0 GHz	-60	
				f = 5.0 GHz	-56	
				f = 8.0 GHz	-48	
				f = 10.0 GHz	-44	
				f = 12.8 GHz	-39	
				f = 16.0 GHz	-36	

注: 典型值是Ta = 25°C条件下的值。

注1: 此项目是通过设计保证的项目。

12.3. 开关特性 (除非另有规定, Ta = 25°C)

12.3.1. TDS4A212MX

项目	符号	注释	测量条件	V _{CC} (V)	典型值	最大	单位
传播延迟时间	t _{PLH} /t _{PHL}	(注1)	R _L = 50 Ω, f = 10 GHz 图13.1, 13.7	3.3	33	—	ps
输出偏斜 (位间)	t _{SK(b)}	(注1)	R _L = 50 Ω, f = 10 GHz 图13.1, 13.8	3.3	6	—	ps
输出偏斜 (通道间)	t _{SK(CH)}	(注1)	R _L = 50 Ω, f = 10 GHz 图 13.1, 13.7	3.3	6	—	ps

注1: 此项目是通过设计保证的项目。

12.3.2. TDS4B212MX

项目	符号	注释	测量条件	V _{CC} (V)	典型值	最大	单位
传播延迟时间	t _{PLH} /t _{PHL}	(注1)	R _L = 50 Ω, f = 10 GHz 图 13.1, 13.7	3.3	30	—	ps
输出偏斜 (位间)	t _{SK(b)}	(注1)	R _L = 50 Ω, f = 10 GHz 图 13.1, 13.8	3.3	4	—	ps
输出偏斜 (通道间)	t _{SK(CH)}	(注1)	R _L = 50 Ω, f = 10 GHz 图 13.1, 13.7	3.3	2	—	ps

注1: 此项目是通过设计保证的项目。

12.4. 时序特性

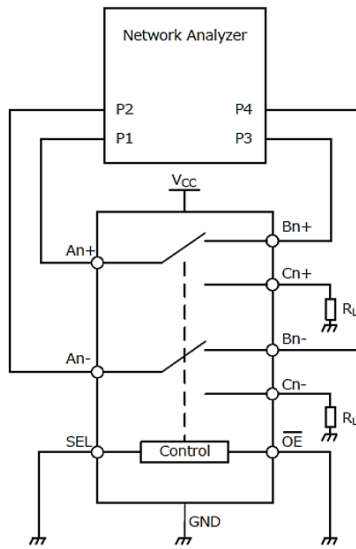
12.4.1. 时序特性 (除非另有规定, Ta = -40~85°C)

项目	符号	测量条件	V _{CC} (V)	最小	典型值	最大	单位
启动时间	t _{sup}	图13.5	1.65至3.6	—	—	100	μs
导通时间 (SEL→Output)	t _{on}	RL = 50 Ω, CL = 5 pF 图 13.5	1.65至3.6	—	—	180	ns
导通时间 (OE→Output)			1.65至3.6	—	—	100	μs
关断时间 (SEL→Output)	t _{off}	RL = 50 Ω, CL = 5 pF 图 13.5	1.65至3.6	—	—	18	ns
关断时间 (OE→Output)			1.65至3.6	—	—	21	ns
先断后通	TBBM	RL = 50 Ω, CL = 5 pF 图13.6	1.65至3.6	55	—	160	ns

12.4.2. 时序特性 (除非另有规定, Ta = -40~105°C)

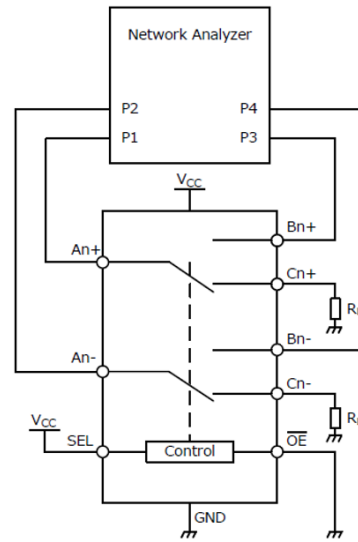
项目	符号	测量条件	V _{CC} (V)	最小	典型值	最大	单位
启动时间	t _{sup}	图 13.5	1.65至3.6	—	—	110	μs
导通时间 (SEL→Output)	t _{on}	RL = 50 Ω, CL = 5 pF 图 13.5	1.65至3.6	—	—	180	ns
导通时间 (OE→Output)			1.65至3.6	—	—	110	μs
关断时间 (SEL→Output)	t _{off}	RL = 50 Ω, CL = 5 pF 图 13.5	1.65至3.6	—	—	20	ns
关断时间 (OE→Output)			1.65至3.6	—	—	25	ns
先断后通	TBBM	RL = 50 Ω, CL = 5 pF 图 13.6	1.65至3.6	55	—	160	ns

13. AC电气特性测量电路



$R_L = 50 \Omega$
All unused ports are connected to GND through 50Ω pull-down resistors.
This figure is an example showing how to measure An and Bn.

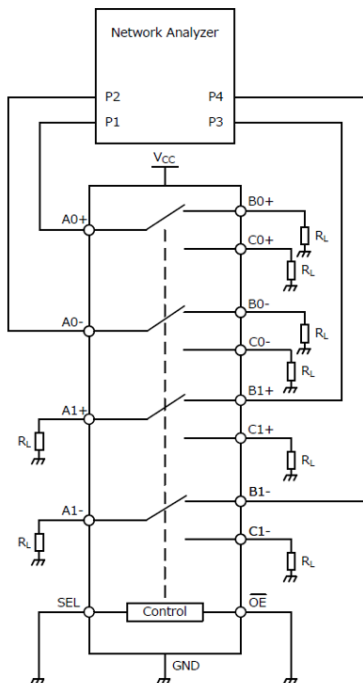
图13.1 -



$R_L = 50 \Omega$
All unused ports are connected to GND through 50Ω pull-down resistors.
This figure is an example showing how to measure An and Bn.

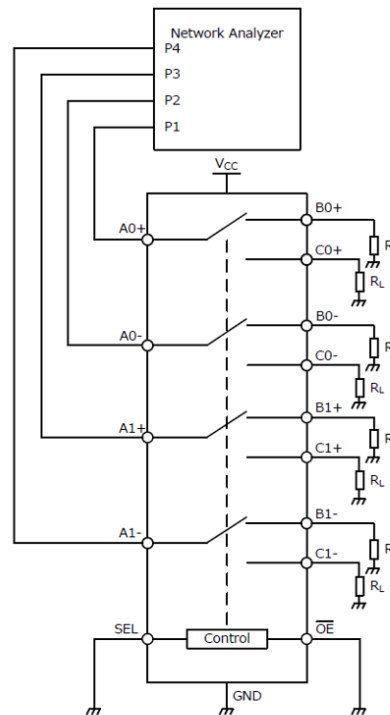
图13.2 差分关断隔离度

3dB带宽(差分)、差分插入损耗、差分反射损耗、
传播延迟时间、
输出偏斜 (位间、通道间)



$R_L = 50 \Omega$
All unused ports are connected to GND through 50Ω pull-down resistors.
This figure is an example showing how to measure A0 and B1.

图13.3 差分串扰 远端



$R_L = 50 \Omega$
All unused ports are connected to GND through 50Ω pull-down resistors.
This figure is an example showing how to measure A0 and A1.

图13.4 差分串扰 近端

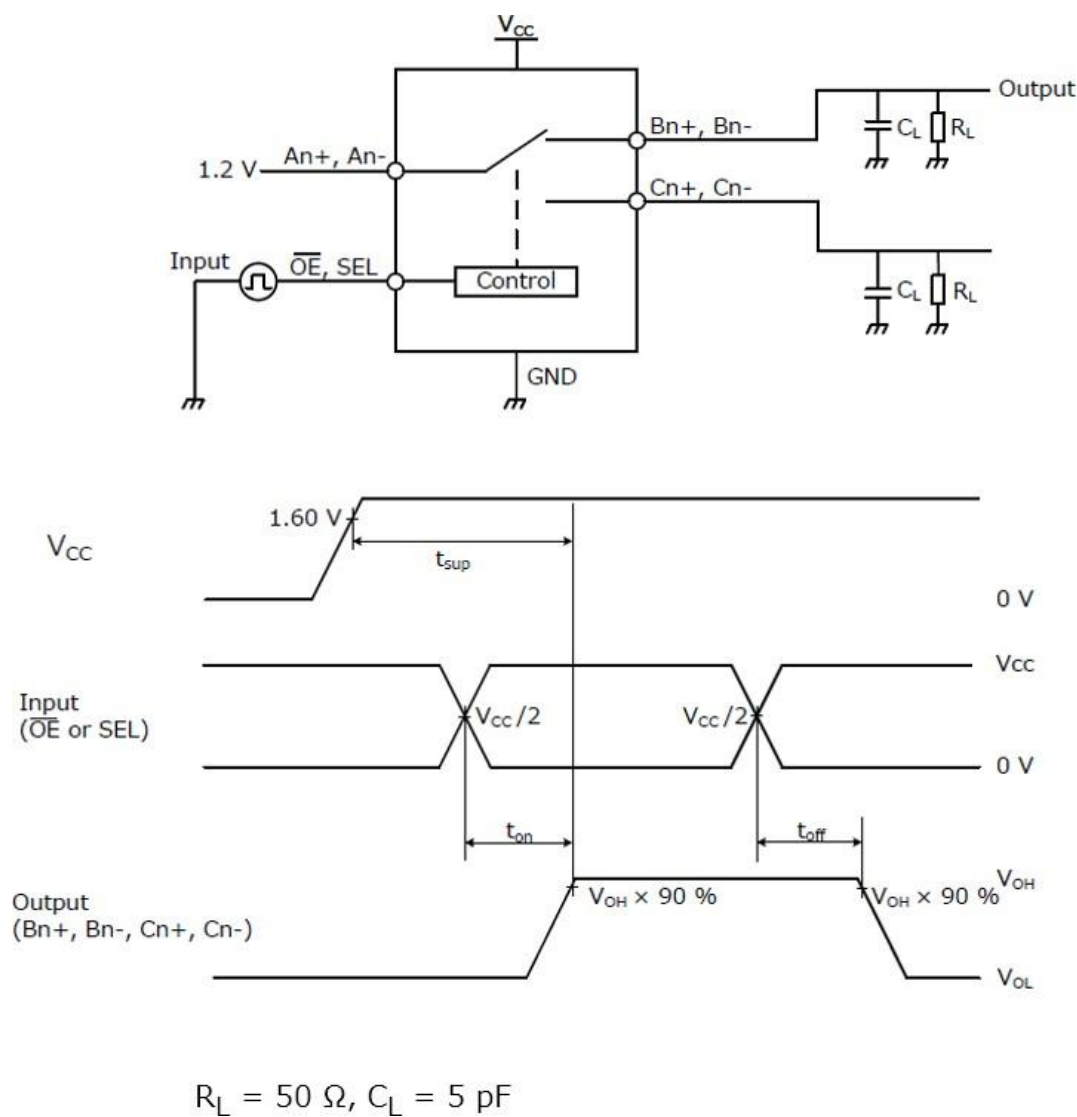


图 13.5 启动、导通、关断

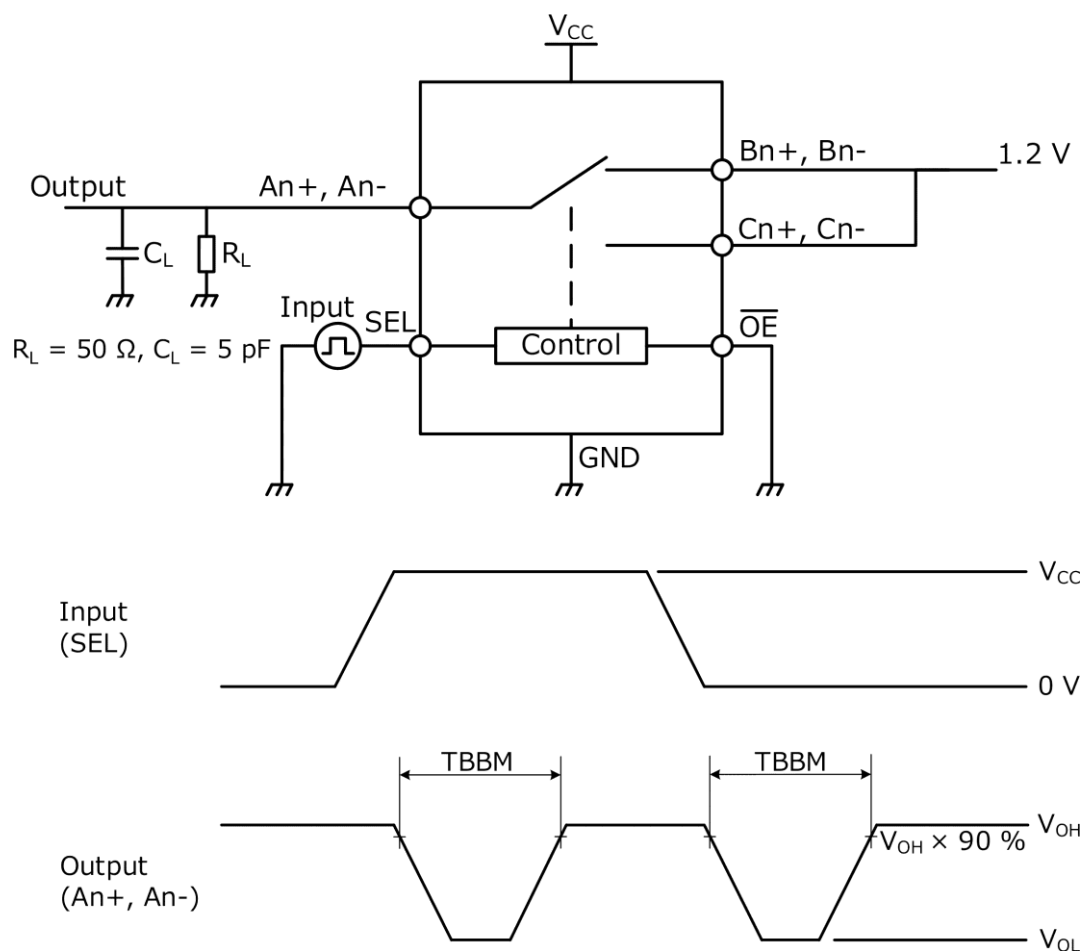


图 13.6 先断后通

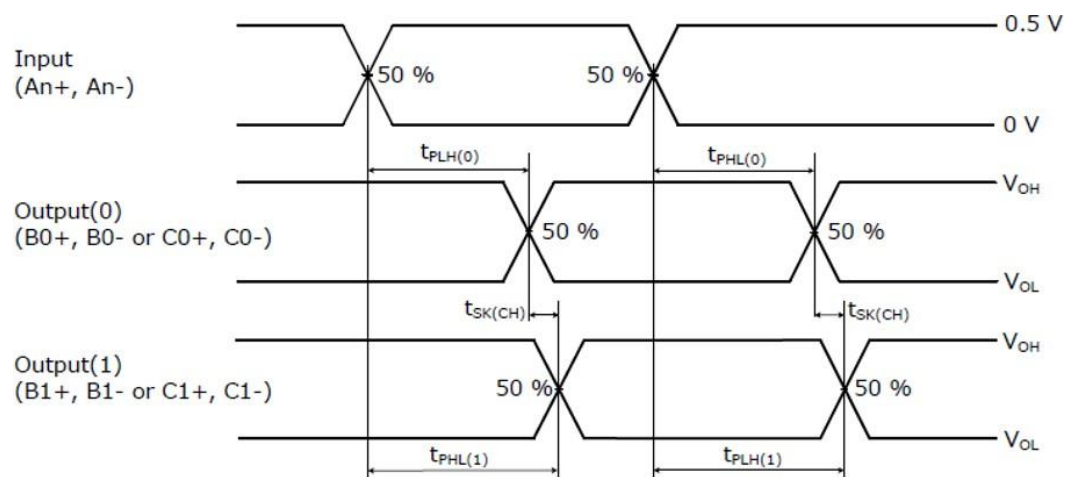


图13.7 输出偏斜(通道间)、传播延迟时间

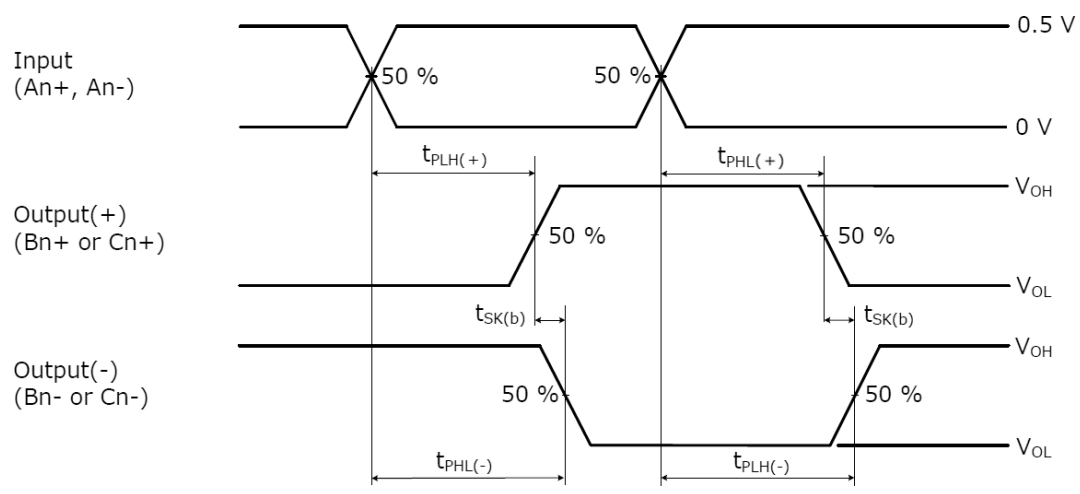
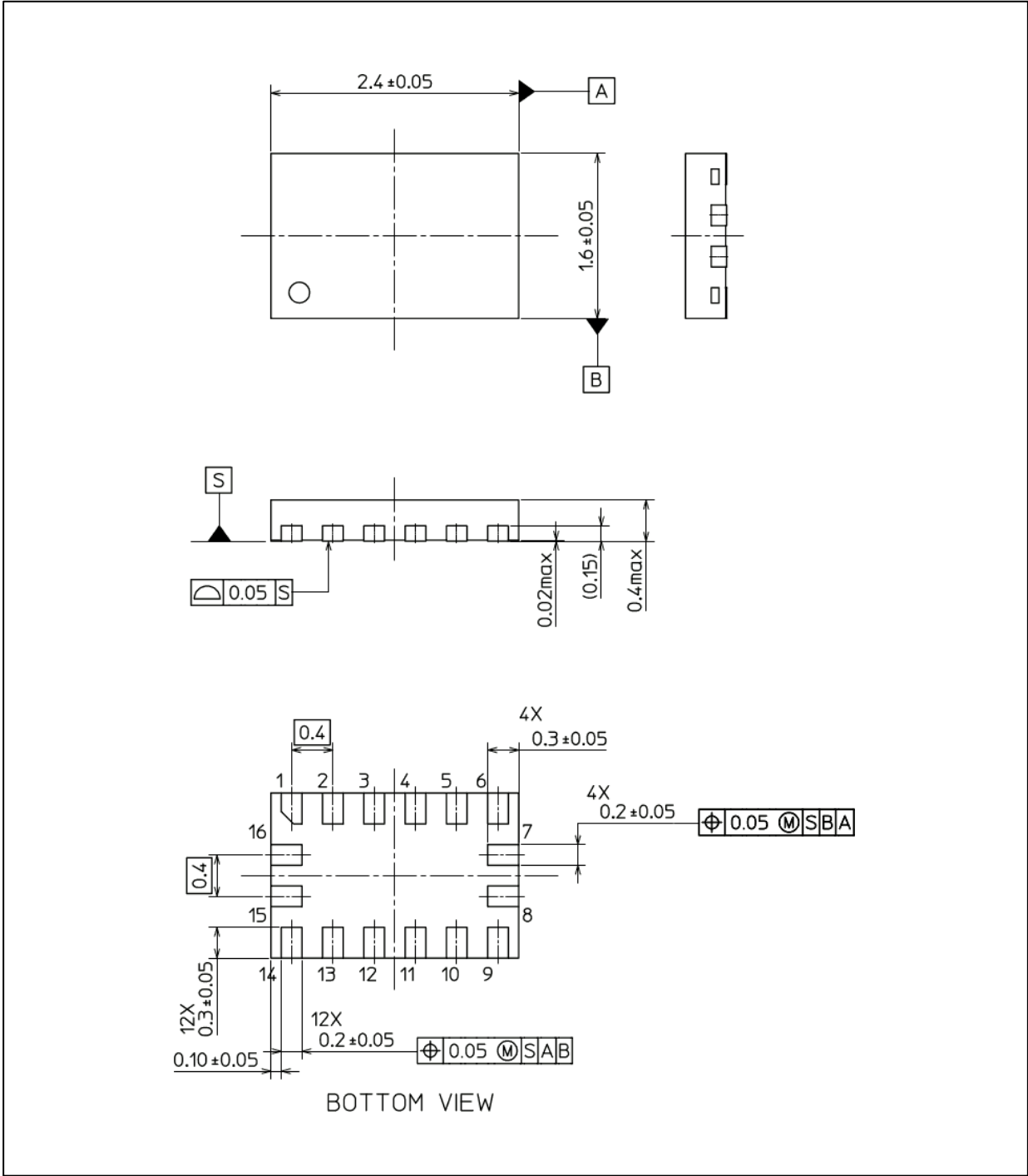


图13.8 输出偏斜(位间)

外形尺寸图

Unit: mm



质量: 3.9 mg (typ.)

封装名称
通用名称: XQFN16

产品使用注意事项

株式会社东芝及其子公司和关联公司以下简称"本公司"。
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