

译文

TDS5B212MX,TDS5C212MX

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: “TDS5B212MX,TDS5C212MX ” 2026-01-16

翻译日: 2026-07-16

TDS5B212MX, TDS5C212MX

1. 功能

- 1-64GT/s 1-Lane Two Differential Channel, 2:1 Mux/1:2 De-Mux

2. 概要

TDS5B212MX、TDS5C212MX是高速差分型多路复用器(Mux)/多路分配器(De-Mux)。

推荐传输速率为1~64GT/s、可用于PCIe® 6.0、CXL3.x、USB4® Version 2.0、Thunderbolt™ 5、DisplayPort™ 2.0等从高速到低速的差分接口。

TDS5C212MX通过优化的引脚配置实现了高频特性的高带宽,TDS5B212MX采用与传统产品相同的引脚配置。

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,通过选择引脚(SEL)和输出使能引脚(OE)的组合来决定连接目标。

当输出使能(OE)为高电平时,开关与选择输入无关而处于非导通状态,从而降低功耗电流。

A端口(An+、An-)为便于器件开关调整操作,在正负端子(An+、An-)之间有20 kΩ的弱差分电阻、

An+、An-端子到GND有约1MΩ的弱下拉电阻。

工作温度范围为-40°C至125°C,也可用于工业用途。

3. 特点

- (1) 工作电源电压: $V_{CC} = 1.6 \sim 3.6 \text{ V}$
- (2) 工作温度范围: $T_{opr} = -40 \sim 125 \text{ }^{\circ}\text{C}$
- (3) 低功耗电流 使能模式时(典型值): $I_{ope} = 70 \mu\text{A}$
- (4) -3dB带宽(差分) BW(Diff) (典型值) : TDS5C212MX = 34 GHz
TDS5B212MX = 29 GHz
- (5) 差分插入损耗 DDIL (典型值) : TDS5C212MX = -1.2 dB @ f = 16 GHz
TDS5B212MX = -1.2 dB @ f = 16 GHz
- (6) 差分反射损耗 DDRL (典型值) : TDS5C212MX = -14 dB @ f = 16 GHz
TDS5B212MX = -15 dB @ f = 16 GHz
- (7) 差分关断隔离度 DDOIRR (典型值): TDS5C212MX = -24 dB @ f = 16 GHz
TDS5B212MX = -27 dB @ f = 16 GHz
- (8) 差分串扰 DDXT (典型值) : TDS5C212MX = -31 dB @ f = 16 GHz
TDS5B212MX = -31 dB @ f = 16 GHz
- (9) 封装: XQFN16

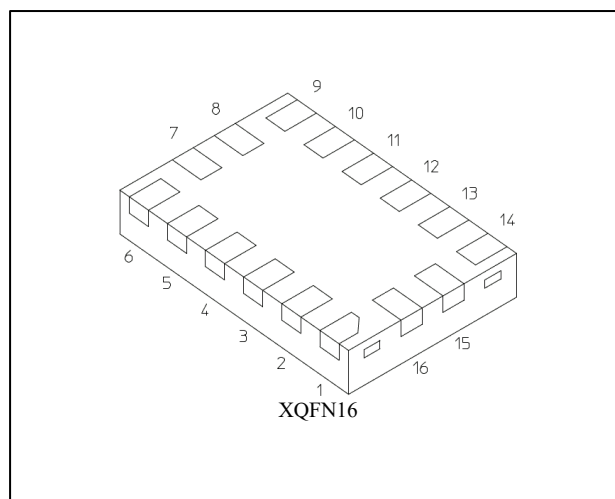
4. 支持的接口

- PCIe 6.0 (PAM4) / 5.0 / 4.0
- Thunderbolt 5 / 4 / 3
- USB 3.2 Gen 2/Gen 1
- CXL 3.x / 2.x / 1.x
- DisplayPort 2.0 / 1.4
- USB4 Version 2.0, Gen3/Gen2 (PAM3)
- SAS 3.0
- 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、产品名称、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

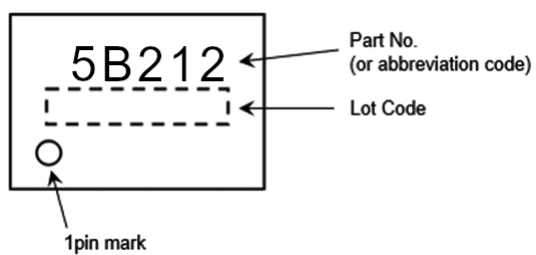
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5. 外观图

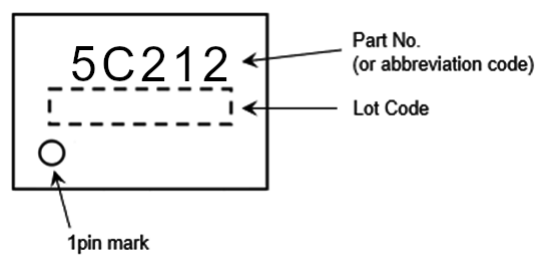


6. 产品标识

TDS5B212MX

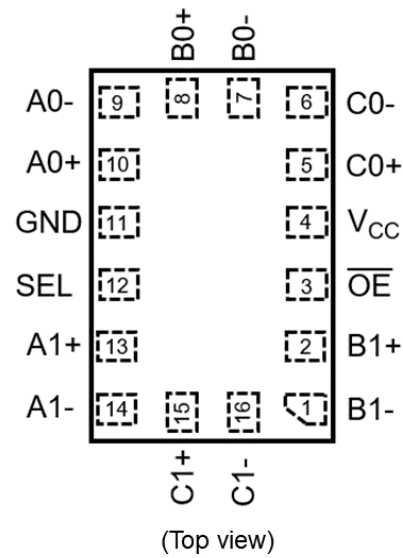


TDS5C212MX

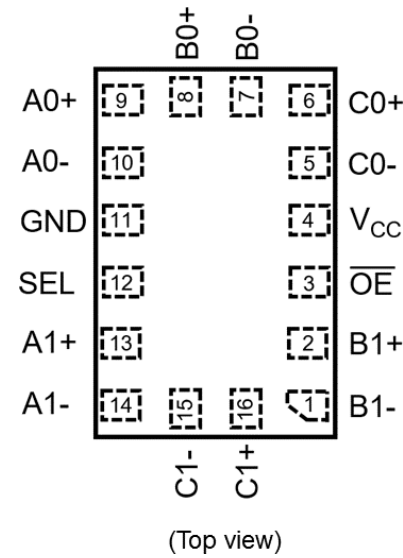


7. 引脚配置图

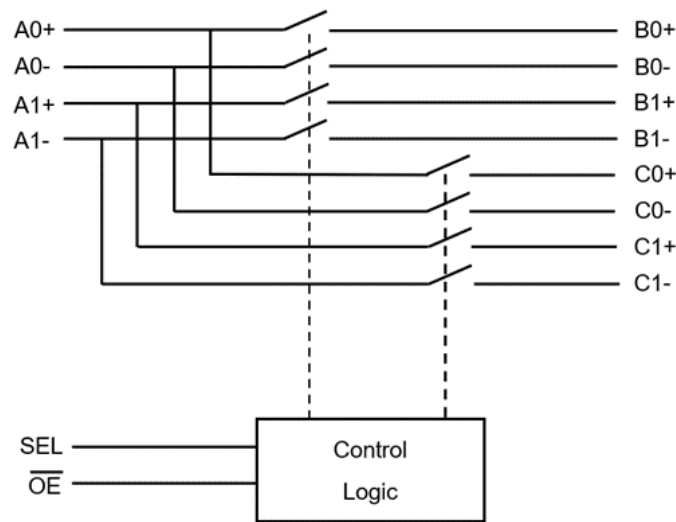
TDS5B212MX



TDS5C212MX



8. 框图



9. 真值表

Inputs OE	Inputs SEL	Function
L	L	An+ port = Bn+ port, An- port = Bn- port (n=0,1)
L	H	An+ port = Cn+ port, An- port = Cn- port (n=0,1)
H	—	An, Bn, Cn port Disconnect (Standby mode) (n=0,1)

—: Don't care

10. 绝对最大额定值(注)

项目	符号	备注	额定值	单位
电源电压	V_{CC}		-0.5 到 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 到 2.5	V
开关输入输出电流	I_S		32	mA
允许功耗	P_D	(注1)	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,如果在高负载(高温和大电流/高电压施加、大幅温度变化等)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、推定故障率等),进行适当的可靠性设计。

注1: $T_a = -40 \sim 105\text{ °C}$ 时,180 mW。 $T_a = 105 \sim 125\text{ °C}$ 范围内,请按-8.5 mW/°C降额至10 mW。

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 到 3.6	V
差分信号电压(峰峰值)	$V_{I/O(Diff)}$	0 至 1.8	V
共模信号电压	$V_{I/O(Com)}$	0 至 2.0	V
工作温度	T_{opr}	-40 到 125	°C
输入上升、下降时间	dt/dv	0 至 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到VCC或GND。

12. 电气特性

12.1. 直流特性

12.1.1. 直流特性(注)(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	最大	单位
高电平输入电压(OE, SEL)	V _{IH}	—	1.65 到 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
输入漏电流(OE, SEL)	I _{IN}	V _{IN} = 0~3.6 V	1.65 至 3.6	—	—	±1	μA
开关关断漏电流	I _{SZ}	V _S = 0~2.0 V, OE = V _{CC}	3.6	—	—	±1	μA
导通电阻	R _{ON}	V _S = 0 V, I _S = 8 mA	3.0	—	—	8.5	Ω
		V _S = 2 V, I _S = 8 mA	3.0	—	—	10	
功耗电流	I _{ope}	V _S = 0 V, OE = V _{CC} or GND	3.6	—	70	150	μA
		V _S = 2 V, OE = V _{CC} or GND	3.6	—	140	300	

注: 典型值是在Ta = 25 °C条件下的值。

12.1.2. 直流特性(注)(除非另有规定,Ta = -40~125 °C)

项目	符号	测量条件	V _{CC} (V)	最小	典型	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
输入漏电流(OE, SEL)	I _{IN}	V _{IN} = 0~3.6 V	1.65 至 3.6	—	—	±1	μA
开关关断漏电流	I _{SZ}	V _S = 0~2.0 V, OE = V _{CC}	1.65 至 3.6	—	—	±1	μA
导通电阻	R _{ON}	V _S = 0 V, I _S = 8 mA	3.0	—	—	9.0	Ω
		V _S = 2 V, I _S = 8 mA	3.0	—	—	12	
功耗电流	I _{ope}	V _S = 0 V, OE = V _{CC} or GND	3.6	—	70	150	μA
		V _S = 2 V, OE = V _{CC} or GND	3.6	—	140	300	

注: 典型值是在Ta = 25 °C条件下的值。

12.2. 高频特性(注)(除非另有规定, VCC = 1.6~3.6 V)

12.2.1. TDS5B212MX

项目	符号	备注	测量条件		典型	单位
-3dB带宽(差分)	BW _(Diff)	(注1)	R _L = 50 Ω, 图13.1		29	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	-0.7	
				f = 8.0 GHz	-0.8	
				f = 10.0 GHz	-0.9	
				f = 12.8 GHz	-1.1	
				f = 16.0 GHz	-1.2	
差分反射损耗	DDR _L	(注1)	R _L = 50 Ω 图13.1	f = 2.5 GHz	-21	dB
				f = 4.0 GHz	-23	
				f = 5.0 GHz	-20	
				f = 8.0 GHz	-20	
				f = 10.0 GHz	-19	
				f = 12.8 GHz	-20	
				f = 16.0 GHz	-15	
差分关断隔离度	DDOIRR	(注1)	R _L = 50 Ω 图13.2	f = 2.5 GHz	-43	dB
				f = 4.0 GHz	-38	
				f = 5.0 GHz	-36	
				f = 8.0 GHz	-29	
				f = 10.0 GHz	-26	
				f = 12.8 GHz	-26	
				f = 16.0 GHz	-27	
差分串扰	DDXT	(注1)	R _L = 50 Ω 图13.3, 13.4	f = 2.5 GHz	-47	dB
				f = 4.0 GHz	-43	
				f = 5.0 GHz	-41	
				f = 8.0 GHz	-37	
				f = 10.0 GHz	-35	
				f = 12.8 GHz	-33	
				f = 16.0 GHz	-31	

注: 典型值是在Ta = 25 °C条件下的值。

注1: 此项目是设计保证项目。

12.2.2. TDS5C212MX

项目	符号	备注	测量条件		典型	单位
-3dB带宽(差分)	BW _(Diff)	(注1)	$R_L = 50\ \Omega$, 图13.1		34	GHz
差分插入损耗	DDIL	(注1)	$R_L = 50\ \Omega$ 图13.1	f = 2.5 GHz	-0.6	dB
				f = 4.0 GHz	-0.7	
				f = 5.0 GHz	-0.7	
				f = 8.0 GHz	-0.8	
				f = 10.0 GHz	-0.9	
				f = 12.8 GHz	-1.1	
				f = 16.0 GHz	-1.2	
差分反射损耗	DDR _L	(注1)	$R_L = 50\ \Omega$ 图13.1	f = 2.5 GHz	-21	dB
				f = 4.0 GHz	-23	
				f = 5.0 GHz	-21	
				f = 8.0 GHz	-24	
				f = 10.0 GHz	-21	
				f = 12.8 GHz	-20	
				f = 16.0 GHz	-14	
差分关断隔离度	DDOIRR	(注1)	$R_L = 50\ \Omega$ 图13.2	f = 2.5 GHz	-43	dB
				f = 4.0 GHz	-37	
				f = 5.0 GHz	-33	
				f = 8.0 GHz	-27	
				f = 10.0 GHz	-25	
				f = 12.8 GHz	-24	
				f = 16.0 GHz	-24	
差分串扰	DDXT	(注1)	$R_L = 50\ \Omega$ 图13.3, 13.4	f = 2.5 GHz	-47	dB
				f = 4.0 GHz	-43	
				f = 5.0 GHz	-41	
				f = 8.0 GHz	-37	
				f = 10.0 GHz	-35	
				f = 12.8 GHz	-33	
				f = 16.0 GHz	-31	

注: 典型值是在Ta = 25 °C条件下的值。

注1: 此项目是设计保证项目。

12.3. 开关特性 (除非另有规定, $T_a = 25\text{ }^{\circ}\text{C}$)**12.3.1. TDS5B212MX**

项目	符号	备注	测量条件	VCC (V)	典型	单位
传播延迟时间	t_{PLH}/t_{PHL}	(注1)	RL = 50Ω, f = 16 GHz 图13.1, 13.7	3.3	26	ps
输出偏移 (位间)	$t_{SK(b)}$	(注1)	RL = 50Ω, f = 1 GHz 图13.1, 13.8	3.3	2	ps
输出偏移 (通道间)	$t_{SK(CH)}$	(注1)	RL = 50Ω, f = 16 GHz 图 13.1, 13.7	3.3	2	ps

注1: 此项目是设计保证项目。

12.3.2. TDS5C212MX

项目	符号	备注	测量条件	VCC (V)	典型	单位
传播延迟时间	t_{PLH}/t_{PHL}	(注1)	RL = 50Ω, f = 16 GHz 图 13.1, 13.7	3.3	26	ps
输出偏移 (位间)	$t_{SK(b)}$	(注1)	RL = 50Ω, f = 1 GHz 图 13.1, 13.8	3.3	3	ps
输出偏移 (通道间)	$t_{SK(CH)}$	(注1)	RL = 50Ω, f = 16 GHz 图 13.1, 13.7	3.3	2	ps

注1: 此项目是设计保证项目。

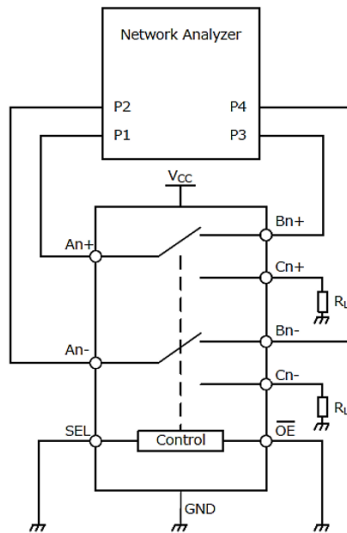
12.4. 时序特性**12.4.1. 时序特性 (除非另有规定, $T_a = -40\sim 85\text{ }^{\circ}\text{C}$)**

项目	符号	测量条件	VCC (V)	最小	典型	最大	单位
启动时间	t_{sup}	RL = 50Ω, CL = 5 pF 图13.5	1.65至3.6	—	—	100	μs
导通时间 (SEL→Output)	t_{on}	RL = 50Ω, CL = 5 pF 图 13.5	1.65至3.6	—	—	400	ns
导通时间 (OE→Output)			1.65至3.6	—	—	400	
关断时间 (SEL→Output)	t_{off}	RL = 50Ω, CL = 5 pF 图 13.5	1.65至3.6	—	—	100	ns
关断时间 (OE→Output)			1.65至3.6	—	—	100	
先断后合	TBBM	RL = 50Ω, CL = 5 pF 图13.6	1.65至3.6	55	—	400	ns

12.4.2. 时序特性 (除非另有规定, $T_a = -40\sim 125\text{ }^{\circ}\text{C}$)

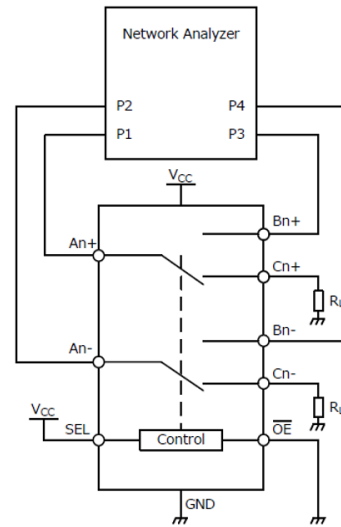
项目	符号	测量条件	VCC (V)	最小	典型	最大	单位
启动时间	t_{sup}	RL = 50Ω, CL = 5 pF 图 13.5	1.65至3.6	—	—	110	μs
导通时间 (SEL→Output)	t_{on}	RL = 50Ω, CL = 5 pF 图 13.5	1.65至3.6	—	—	450	ns
导通时间 (OE→Output)			1.65至3.6	—	—	450	
关断时间 (SEL→Output)	t_{off}	RL = 50Ω, CL = 5 pF 图 13.5	1.65至3.6	—	—	110	ns
关断时间 (OE→Output)			1.65至3.6	—	—	110	
先断后合	TBBM	RL = 50Ω, CL = 5 pF 图 13.6	1.65至3.6	55	—	450	ns

13. 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 -3dB



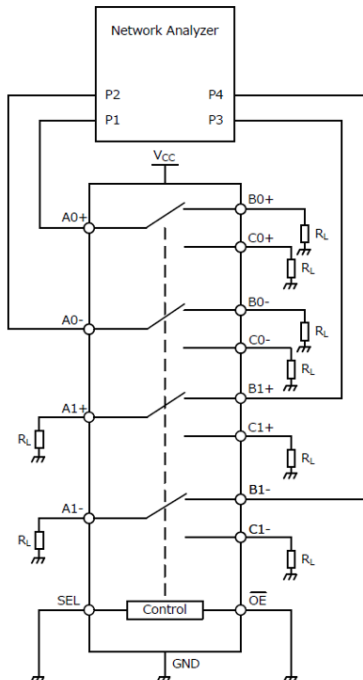
$R_L = 50 \Omega$
All unused ports are connected to GND through 50Ω pull-down resistors.
This figure is an example showing how to measure An and Bn.

图13.2 差分关断隔离度

带宽(差分)、差分插入损耗、差分反射损耗、传播

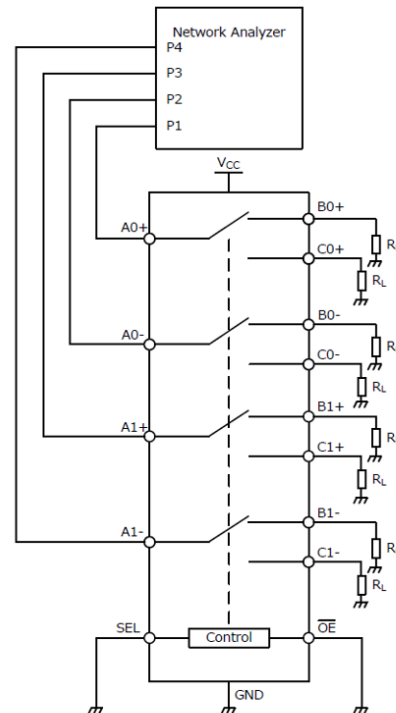
延迟时间、

输出偏移 (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

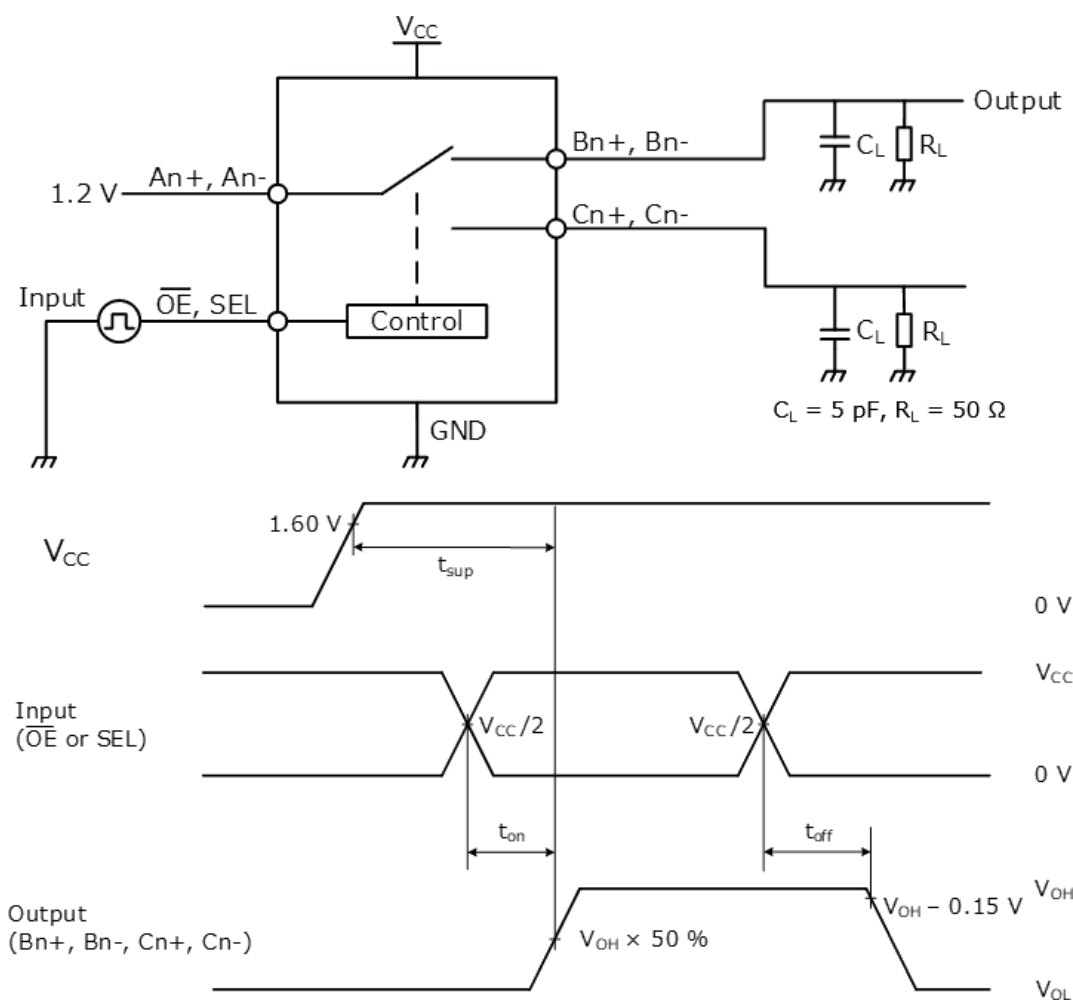


图 13.5 启动时间、导通时间、关断时间

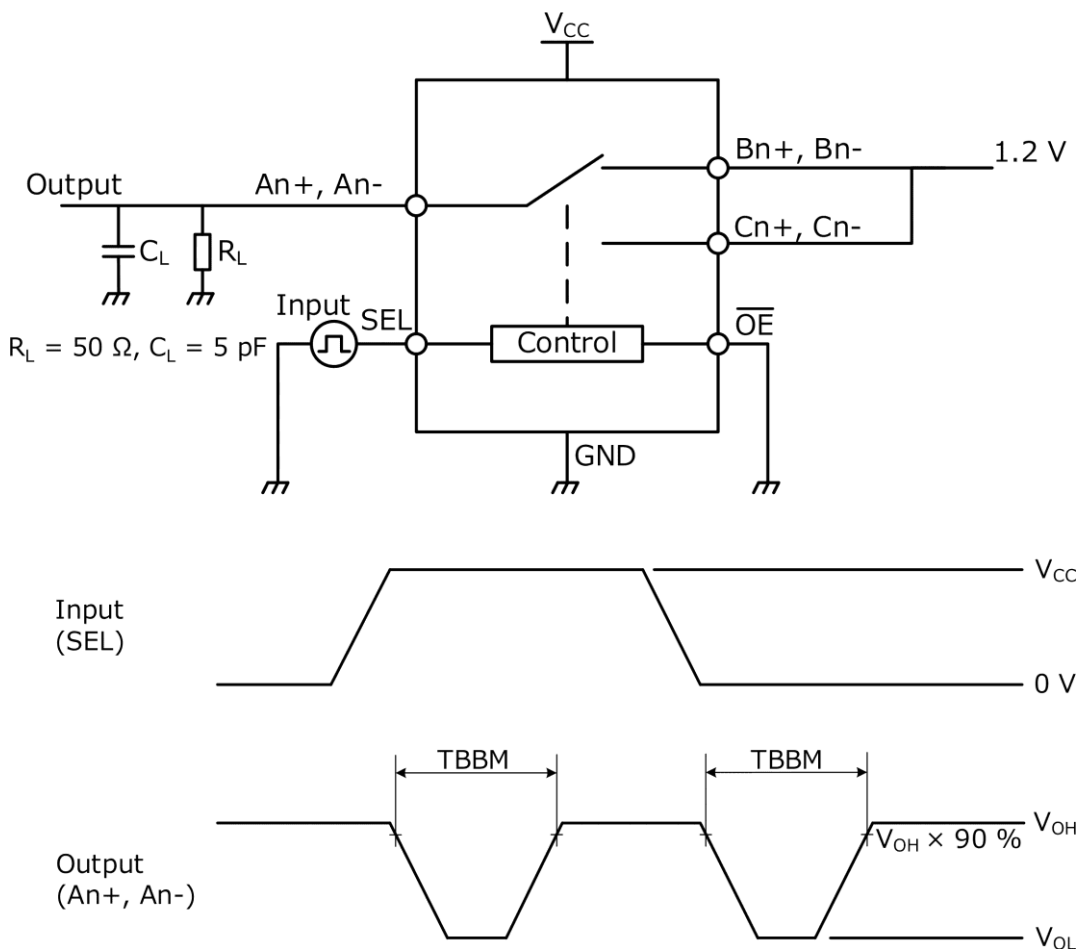


图 13.6 先断后合

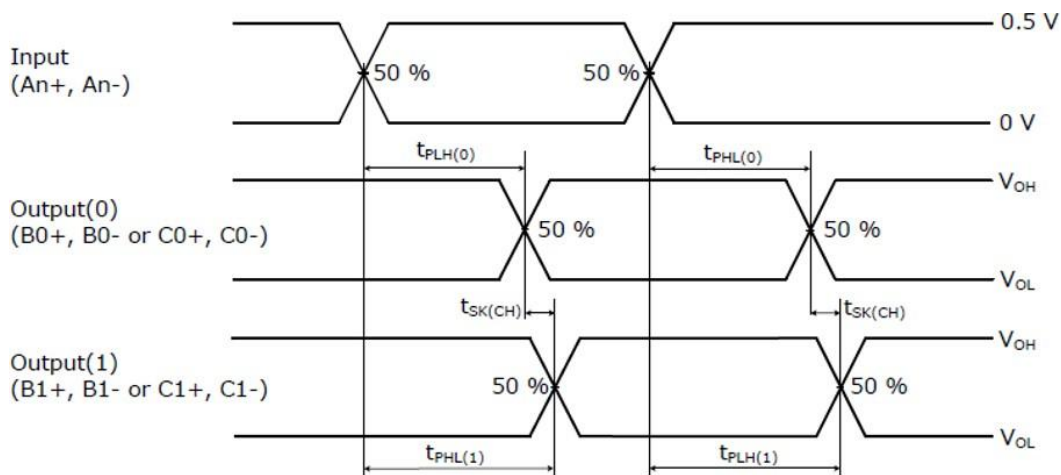


图13.7 输出偏移 (通道间)、传播延迟时间

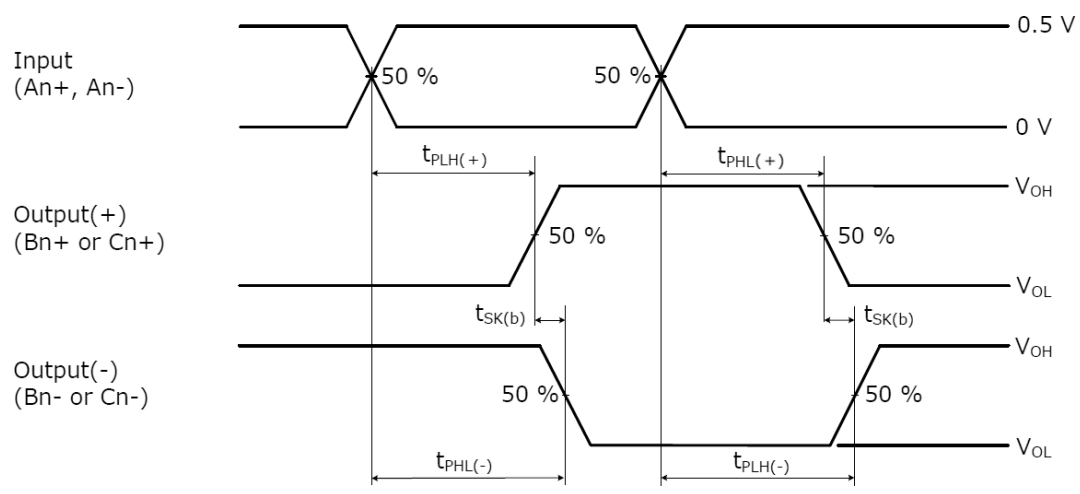
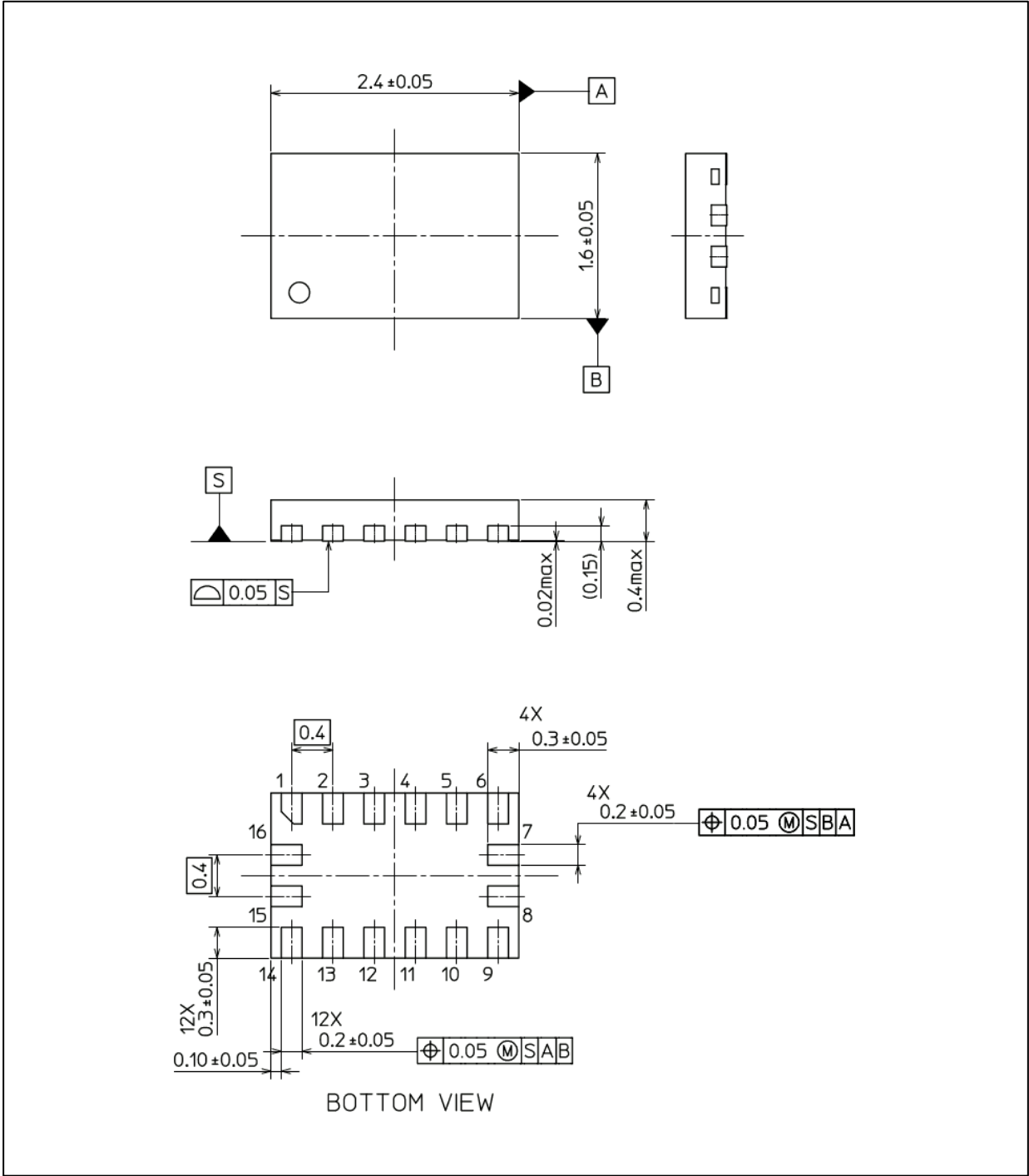


图13.8 输出偏移(位间)

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

东芝公司及其子公司和关联公司以下统称为"本公司"。
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