

TCUA221WBG, TCUA2221WBG

TCUA221WBG:USB2.0 High-Speed and Audio Switch with Negative Signal Capability

TCUA2221WBG:USB2.0 High-Speed and Audio Switch with Negative Signal Capability
(With Pop Sound Eliminator at Audio Switch)

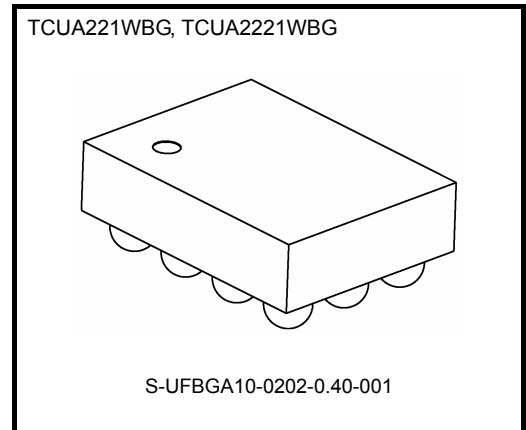
The TCUA221WBG and TCUA2221WBG are a dual SPDT switch for combined USB2.0 High-Speed and Audio signals.

The Audio switch is designed to allow audio signals to swing below ground.

When VBUS is High, the USB switches (D+, D-) are selected, regardless of the logic level of the Cont inputs. When VBUS is Low or left open and Cont is Low, the Audio switches (R, L) are selected.

The TCUA2221WBG also features shunt resistors on the Audio path to reduce clicks and pop-noises.

All the inputs are protected against electrostatic discharge.

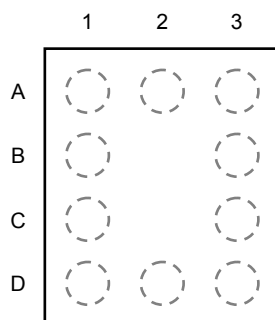


Weight
S-UFBGA10-0202-0.40-001 : 0.0025 g (typ.)

Features

- Operating voltage :VCC = 2.3 to 3.6 V
- ON-capacitance (D+, D-) : C_{I/O} = 7pF Switch On (typ.) @ VCC = 3.3 V
- ON-resistance (D+, D-) : RON = 5.5 Ω (typ.) @ VCC = 3 V, VIS = 0 V
- ON-resistance (R, L) : RON = 4.5 Ω (typ.) @ VCC = 3 V, VIS = 0 V
- RON Flatness(R, L) : RON Flatness = 2 Ω (typ.) @ VCC = 3 V
- ESD performance : Machine model ≥ ± 200V
Human body model ≥ ± 2000V
- Package : WCSP10B(1.2mm x 1.6mm)

Pin Assignment (top view)

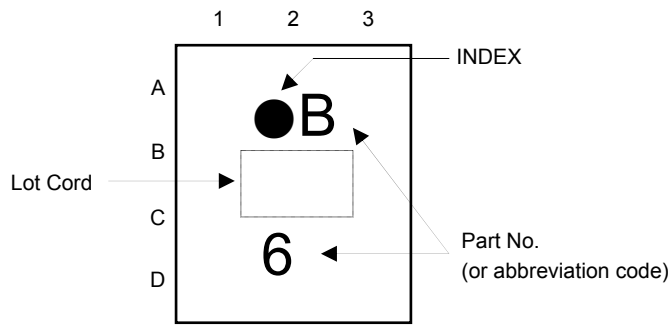


	1	2	3
A	D+	VCC	VBUS
B	D-	No Ball	COM+
C	R	No Ball	COM-
D	L	GND	Cont

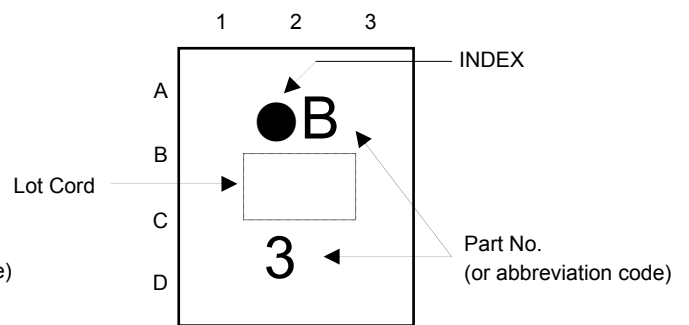
Start of commercial production
2011-04

Marking

TCUA221WBG



TCUA2221WBG

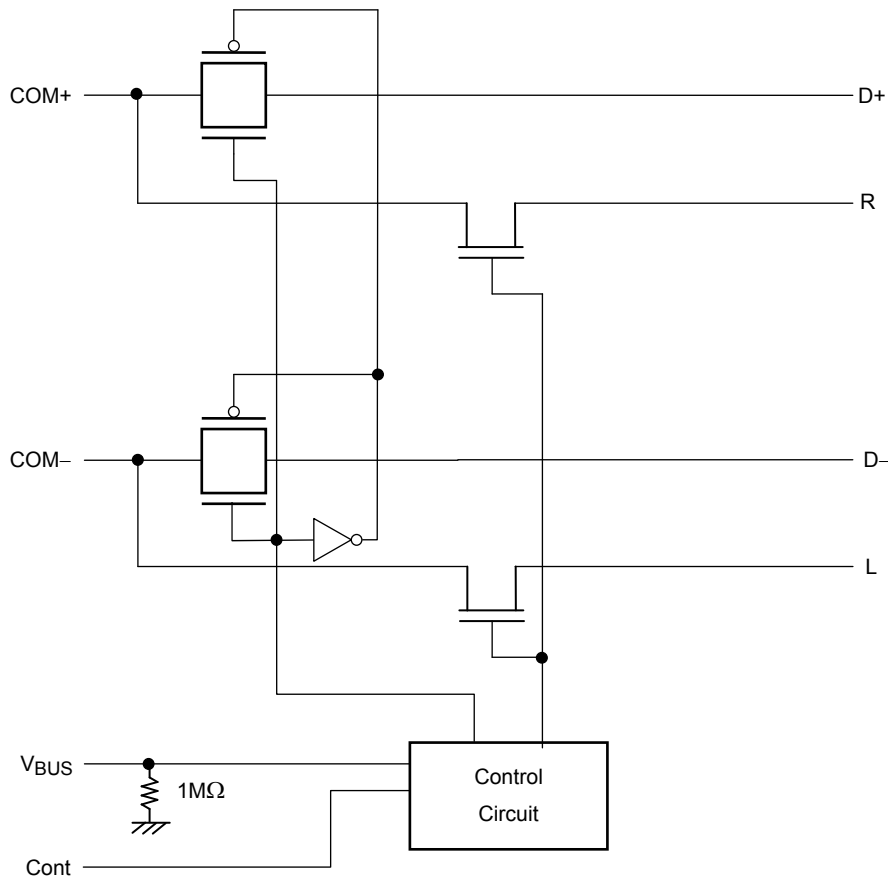


Truth Table

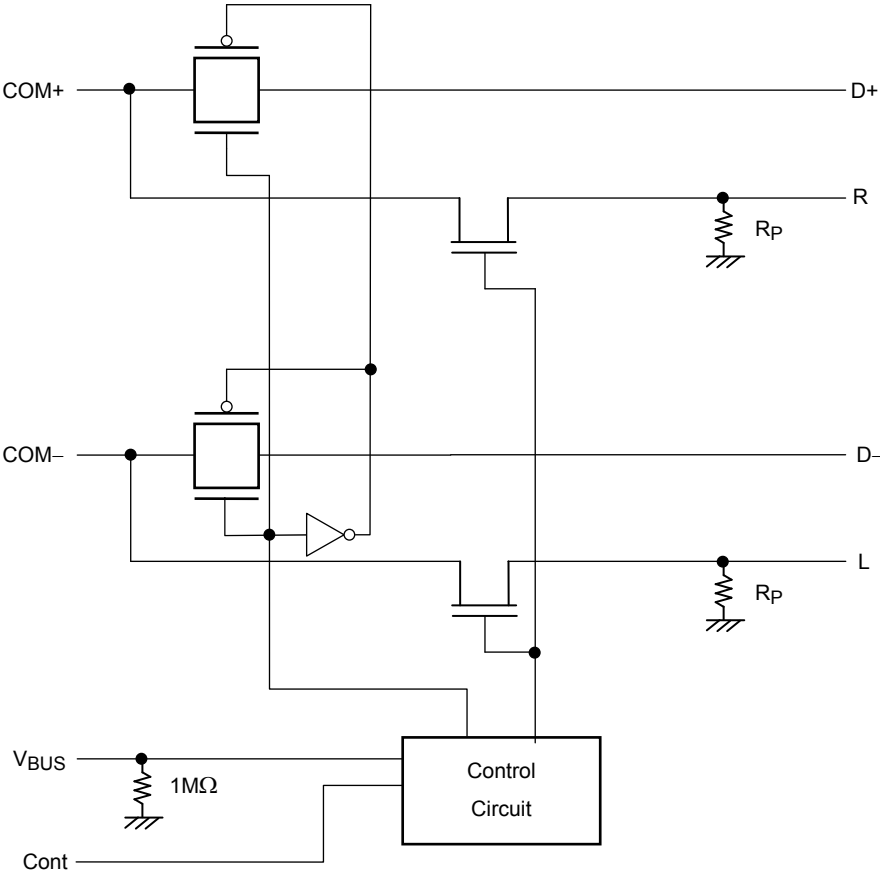
Inputs		Function
Cont	Vbus	
H or L	5V	COM+ port = D+ port, COM- port = D- port
L	L or Open	COM+ port = R port, COM- port = L port
H	L or Open	Disconnect

System Diagram

TCUA221WBG



TCUA2221WBG



Rp : Pop Sound Eliminator Resistor

Absolute Maximum Ratings (Note)

Characteristic		Symbol	Rating	Unit
Power supply range		V_{CC}	-0.5 to 4.6	V
Control pin input voltage		Cont	-0.5 to 4.6	V
		V_{BUS}	-0.5 to 6.0	
Switch I/O voltage	Switch ON	D+,D-	-0.5 to $V_{CC}+0.5$	V
		L,R	-2.0 to $V_{CC}+0.5$ (Note $-0.5 \leq V_{CC} - V_S \leq 6$)	
		COM+,COM-	-2.0 to $V_{CC}+0.5$ (Note $-0.5 \leq V_{CC} - V_S \leq 6$)	
	Switch OFF or $V_{CC} = 0V$	D+,D-	-0.5 to 4.6	
		L,R	-0.5 to 4.6	
		COM+,COM-	-2.0 to 4.0	
Switch I/O current		I_S	50	mA
Power dissipation		P_D	180	mW
DC V_{CC}/GND current		I_{CC}/I_{GND}	± 100	mA
Storage temperature		T_{stg}	-65 to 150	$^{\circ}C$

Note: 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).

Operating Ranges (Note)

Characteristic		Symbol	Rating	Unit
Power supply voltage		V_{CC}	2.3 to 3.6	V
Control pin input voltage		Cont	0 to 3.6	V
		V_{BUS}	0 to 5.5	
Switch I/O voltage	Switch ON	USB(D+/D-)	0 to V_{CC}	V
		Audio(L/R)	-1.5 to V_{CC}	
		COM+/COM-	-1.5 to V_{CC}	
	Switch OFF or $V_{CC} = 0V$	USB(D+/D-)	0 to 3.6	
		Audio(L/R)	0 to 3.6	
		COM+/COM-	-1.5 to 3.6	
Operating temperature		T_{opr}	-40 to 85	$^{\circ}C$
Input rise and fall time		dt/dv	0 to 10	ns/V

Note: The operating ranges must be maintained to ensure the normal operation of the device. Unused inputs must be tied to either V_{CC} or GND.

Electrical Characteristics

DC Characteristics (Ta = -40 to 85°C)

Parameter		Symbol	Test Condition	V _{CC} (V)	Min.	Typ.	Max.	Unit	
High-level input voltage	V _{BUS}	V _{IH}	—	2.3 to 3.6	V _{CC} + 0.6	—	—	V	
Low-level input voltage	V _{BUS}	V _{IL}	—	2.3 to 3.6	—	—	V _{CC} - 0.5		
High-level input voltage	Cont	V _{IH}	—	2.3 to 2.5	0.50 × V _{CC}	—	—		
				2.7 to 3.0	0.45 × V _{CC}	—	—		
				3.3 to 3.6	0.40 × V _{CC}	—	—		
Low-level input voltage	Cont	V _{IL}	—	2.3 to 3.6	—	—	0.15 × V _{CC}		
Input leakage current	V _{BUS}	I _{IN}	V _{IN} = 0 to 5.5 V	2.3 to 3.6	—	—	±10	μA	
	Cont	I _{IN}	V _{IN} = 0 to 3.6 V	2.3 to 3.6	—	—	±1	μA	
Power-off leakage current	D+,D-	I _{OFF}	V _{IN} = 0 to 3.6 V	0	—	—	±10	μA	
	R,L	I _{OFF}	V _{IN} = 0 to 3.6 V	UA221	0	—	—	±10	μA
				UA2221	0	-60	—	120	
COM+, COM-	I _{OFF}	V _{IN} = -1.5 to 3.6 V	0	—	—	±10	μA		
Off-state leakage current (switch off)	D+,D-	I _{SZ}	V _{IS} = 0 to V _{CC} , Switch OFF	2.3 to 3.6	—	—	±10	μA	
	R,L	I _{SZ}	V _{IS} = 0 to V _{CC} , Switch OFF	UA221	2.3 to 3.6	—	—	±10	μA
				UA2221		-60	—	120	
COM+, COM-	I _{SZ}	V _{IS} = -1.5 to V _{CC} , Switch OFF	2.3 to 3.6	—	—	±10	μA		
ON-resistance	D+,D-	R _{ON}	V _{BUS} = 4.25 V, V _{IS} = 0 V, I _{IS} = 30 mA (Note)	3.0	—	5.5	10	Ω	
			V _{BUS} = 4.25 V, V _{IS} = 1.0 V, I _{IS} = 30 mA (Note)	3.0	—	6.5	12		
			V _{BUS} = 4.25 V, V _{IS} = 3.0 V, I _{IS} = 30 mA (Note)	3.0	—	22	40		
	R,L	R _{ON}	V _{IS} = -1.0 V, I _{IS} = 30 mA (Note)	3.0	—	4.0	8		
			V _{IS} = 0 V, I _{IS} = 30 mA (Note)	3.0	—	4.5	9		
			V _{IS} = 1.0 V, I _{IS} = 30 mA (Note)	3.0	—	6.0	11		
ON-resistance Flatness	R,L	R _{FLAT(ON)}	V _{IS} = -1.0 V to 1.0 V, I _{IS} = 30 mA (Note)	3.0	—	2.0	—		
Quiescent supply current		I _{CC}	V _{IN} (Cont) = V _{CC} or GND, V _{BUS} = 0 V or 5 V, I _{OUT} = 0 A	3.6	—	—	2	μA	
		ΔI _{CC}	V _{IN} (Cont) = 1.8V	3.6	—	—	40	μA	
				2.7	—	—	10		
Pop Sound Eliminator Resistor		R _P	V _{IS} = 0 to V _{CC} , I _{IS} = 30 mA (Note)	UA2221	3.6	—	50	—	Ω

Note: All typical values are at Ta = 25°C.

AC Characteristics (Ta = -40 to 85°C)

Characteristics	Symbol	Test Condition	V _{CC} (V)	Min	Typ.	Max	Unit
Propagation Delay Time (Note)	t _{PLH} , t _{PHL}	C _L = 5 pF See Fig. 1	3.3 ± 0.3	—	0.25	—	ns
Turn ON Time (Cont, V _{BUS} to Output)	t _{on}	R _L = 50 Ω, C _L = 5 pF See Fig. 2	3.3 ± 0.3	—	—	1.0	μs
Turn OFF Time (Cont, V _{BUS} to Output)	t _{off}	R _L = 50 Ω, C _L = 5 pF See Fig. 2	3.3 ± 0.3	—	—	1.0	μs
Break Before Make	TBBM	R _L = 50 Ω, C _L = 5 pF See Fig. 3	3.3 ± 0.3	2.0	—	15	ns

Note: This parameter is guaranteed by design.

Analog Switch Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	V _{CC} (V)	Min	Typ.	Max	Unit	
Off Isolation (Non-Adjacent)	D+,D-	OIRR	RT = 50 Ω, f = 240 MHz See Fig. 4	3.3 ± 0.3	—	-36	—	dB
	R,L							
Crosstalk (Non-Adjacent)	D+,D-	X _{talk}	RT = 50 Ω, f = 240MHz See Fig. 5	3.3 ± 0.3	—	-36	—	dB
	R,L							
-3dB Bandwidth	D+,D-	BW	RT = 50 Ω, C _L = 0 pF See Fig. 6	3.3 ± 0.3	—	720	—	MHz
Sine Wave Distortion	R,L	T.H.D	V _{IN} = 2 V _{p-p} , R _L = 1 kΩ, f = 1 kHz	3.3 ± 0.3	—	0.1	—	%

Note: This parameter is guaranteed by design.

Capacitive Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	V _{CC} (V)	Typ.	Unit		
Control pin input capacitance	V _{BUS}	C _{IN}	V _{IN} = 0 V	3.3	20	pF	
	Cont			3.3	4		
Switch terminal Off capacitance	D+,D-	C _{I/O}	V _{I/O} = 0 V, V _{BUS} = GND or open	3.3	3	pF	
	L,R			V _{I/O} = 0 V, Cont = V _{CC}	3.3		3.5
	COM+,COM-			V _{I/O} = 0 V, V _{BUS} = GND or open, Cont = V _{CC}	3.3		4
Switch terminal On capacitance	D+,D-	C _{I/O}	V _{I/O} = 0 V, V _{BUS} = 4.25 V	3.3	7	pF	
	L,R			V _{I/O} = 0 V, V _{BUS} = GND or open, Cont = GND	3.3		8

Note: This parameter is guaranteed by design.

AC TEST Circuit Load / Waveform

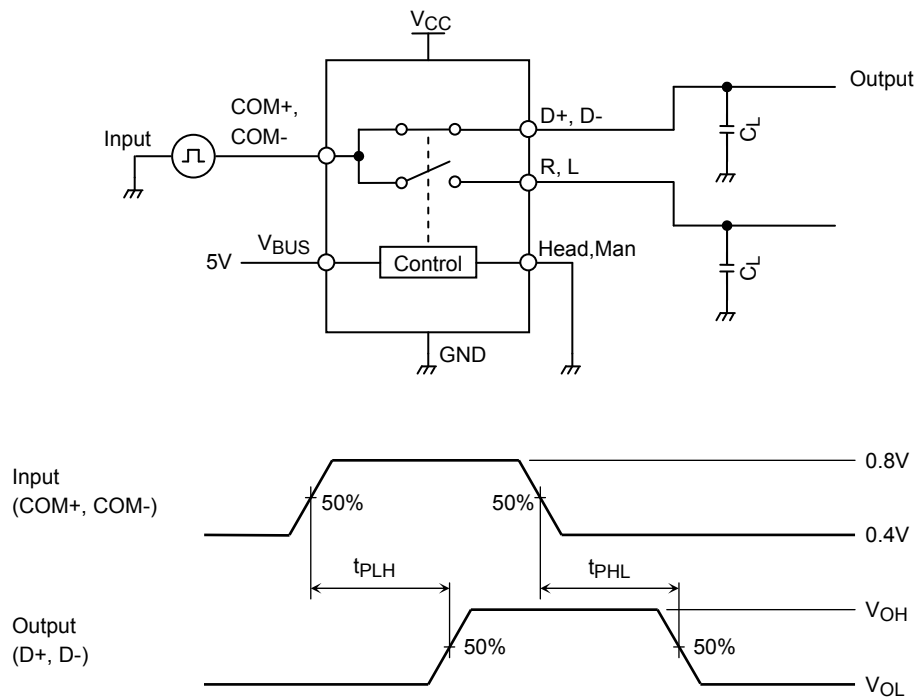


Figure1 Propagation Delay Time (t_{PLH} , t_{PHL})

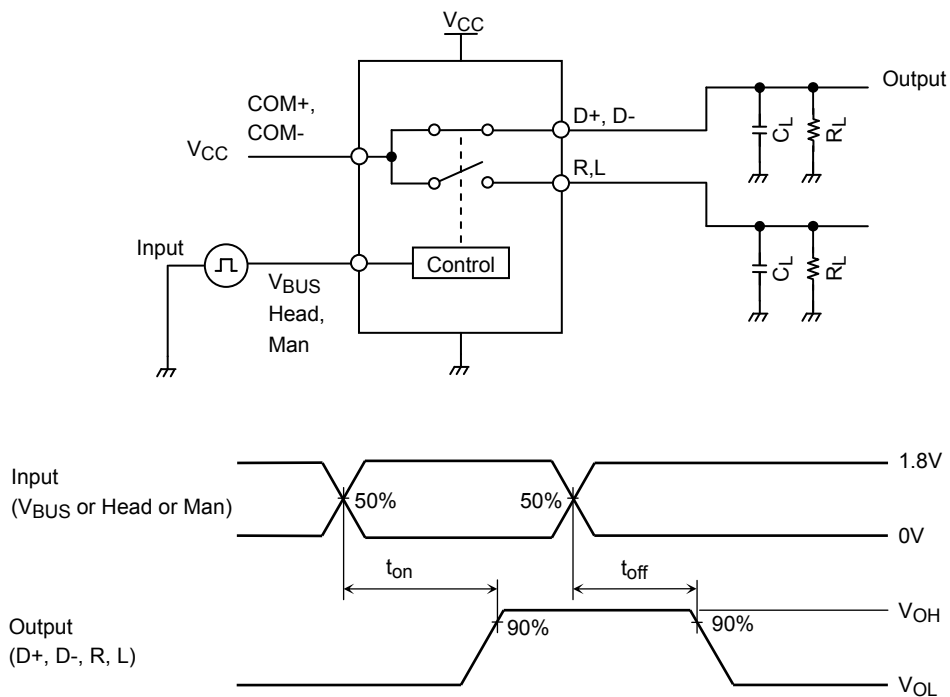


Figure2 Turn ON / Turn OFF (t_{on} t_{off})

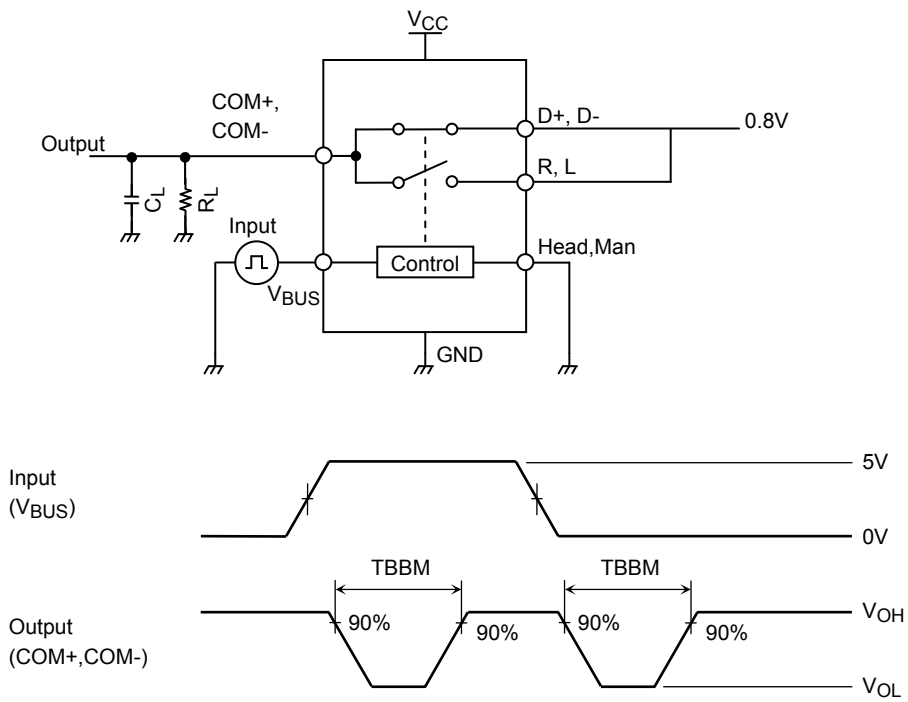


Figure 3 Break Before Make (TBBM)

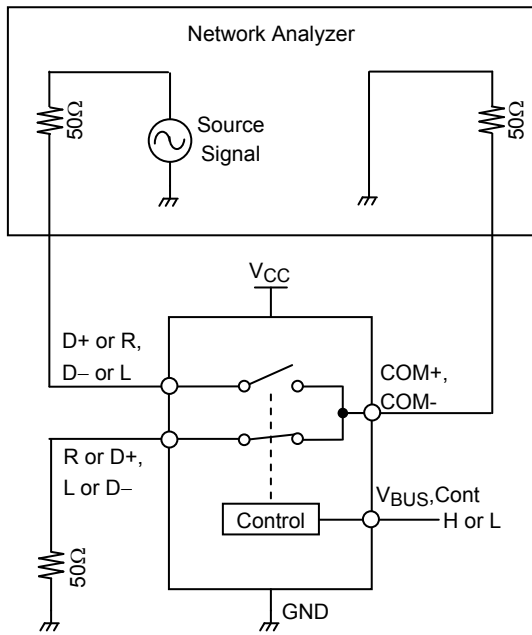


Figure4 OFF Isolation

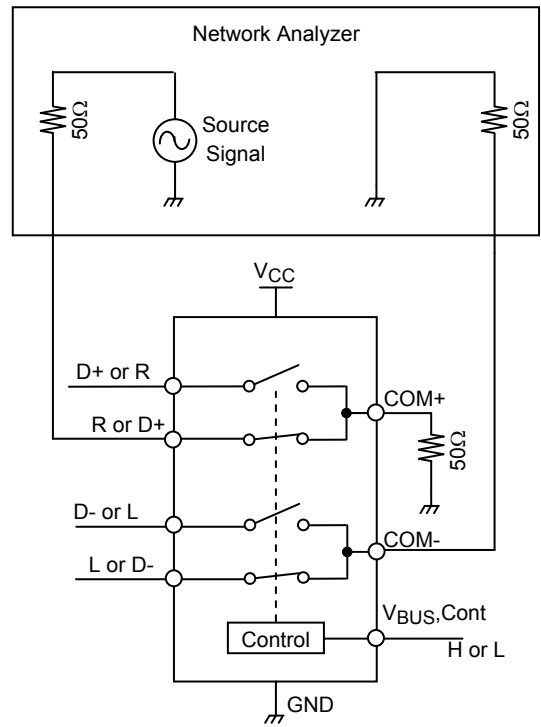


Figure5 Crosstalk

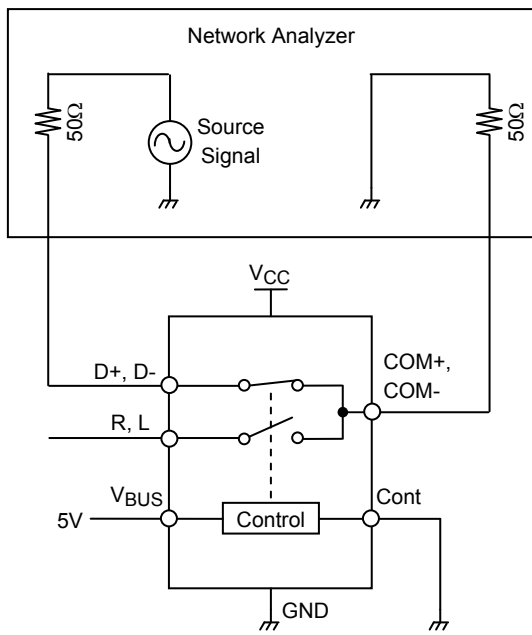
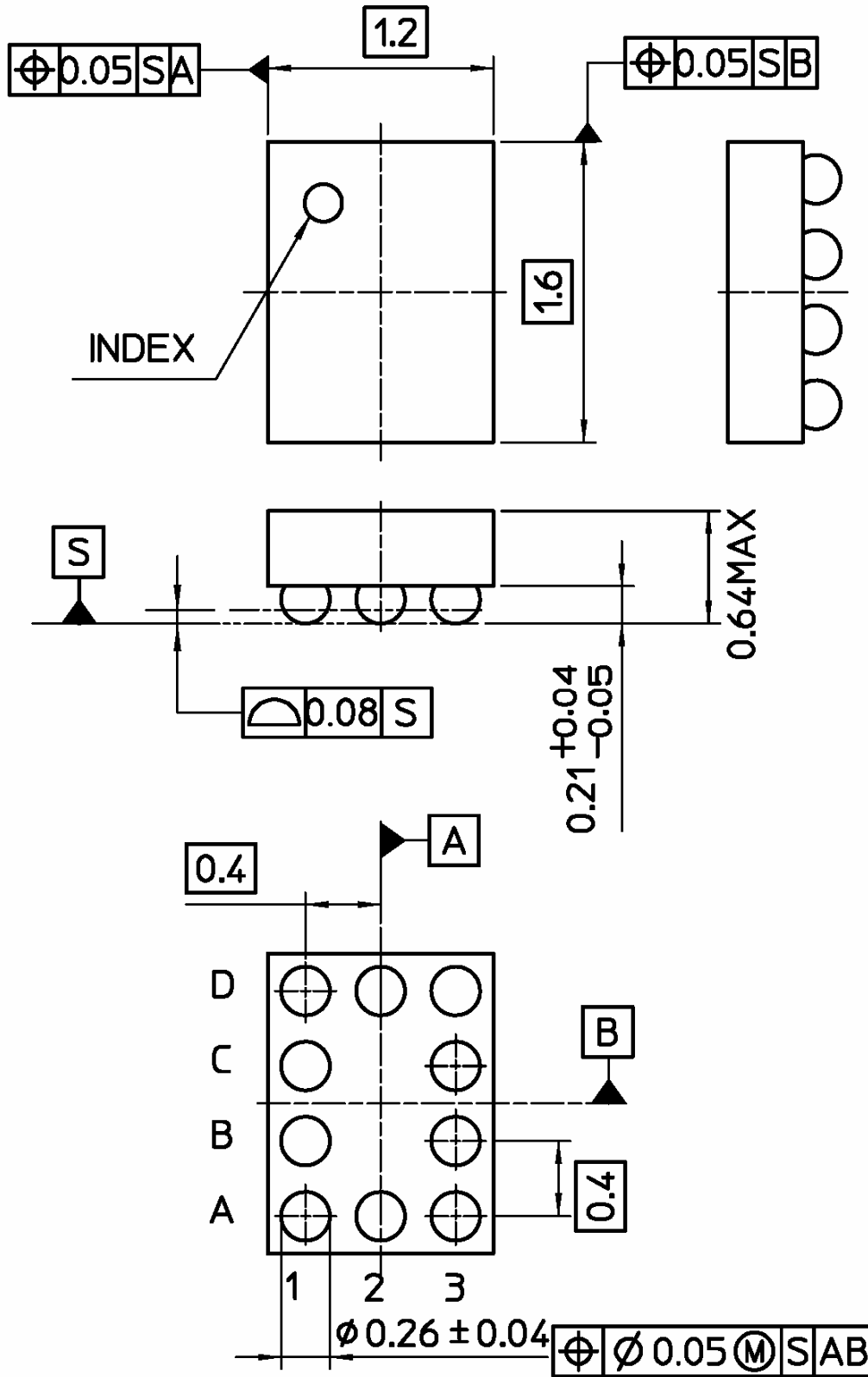


Figure6 -3dB BandWidth

Package Dimension

S-UFBGA10-0202-0.40-001

Unit: mm



The resin used in this product includes no flame retardants.

Weight: 0.0025g (Typ.)

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