Features

- VDD Operation at 1.8V, 2.5V and 3.3V
- $V_{I/O}$ Accepts Signals up to 5.5V
- 1.8-V Compatible Control-Pin Inputs
- Low-Power Mode When OE Is Disabled (2 µA)
- r_{ON} = 6Ω Maximum
- Δr_{ON} = 0.2Ω Typical
- Cio(on) = 4pF Typical
- Support Over Voltage Protection
- Low Power Consumption (50 µA Maximum)
- ESD Performance

  IO Pins:

  12KV HBM

  1KV CDM

  +/-8KV contact Discharge (IEC61000-4-2)

  VDD, GND, S, $\overline{OE}$ Pins:

  4KV HBM

  1KV CDM
- -3dB Bandwidth (1.2 GHz Typical)
- Packaging (Pb-free & Green)

  10-contact, UDFN (ZW10)

  10-contact, UQFN (ZUA10)

Applications

- Tablets
- Smart Phone
- Mobile Industry Processor Interface (MIPI) Signal Routing

Description

The RS3SW221 is a high-bandwidth switch specially designed for the switching of high-speed USB 2.0 signals in handset and consumer applications, such as cell phones, digital cameras, and notebooks with hubs or controllers with limited USB I/Os.

The wide bandwidth (1.2 GHz) of this switch allows signals to pass with minimum edge and phase distortion. The device multiplexes differential outputs from a USB host device to one of two corresponding outputs. The switch is bidirectional and offers little or no attenuation of the high-speed signals at the outputs.

It is designed for low bit-to-bit skew and high channel-to-channel noise isolation, and is compatible with various standards, such as high-speed USB 2.0 (480 Mbps).

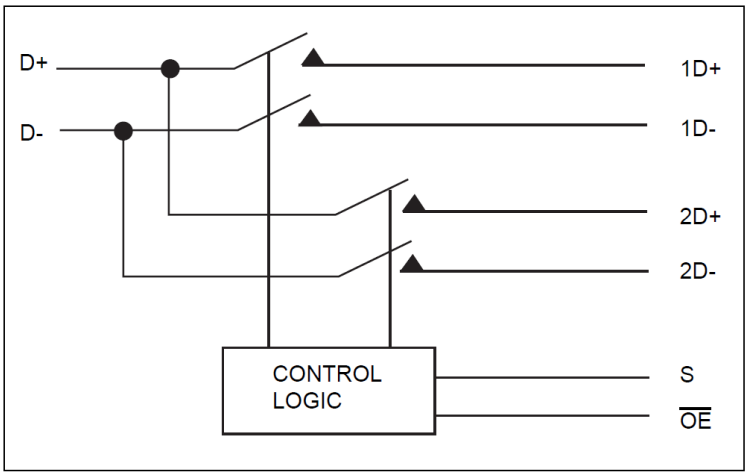
The RS3SW221 offer over voltage protection for the D+/D- pins as per the USB 2.0 specification. With the chip power on or off if D+/D- pins are shorted to VBUS (5V+/-5%), a less than 3.3V (typical) signal will transmit through 1D+/1D- and 2D+/2D- output.

Ordering Information

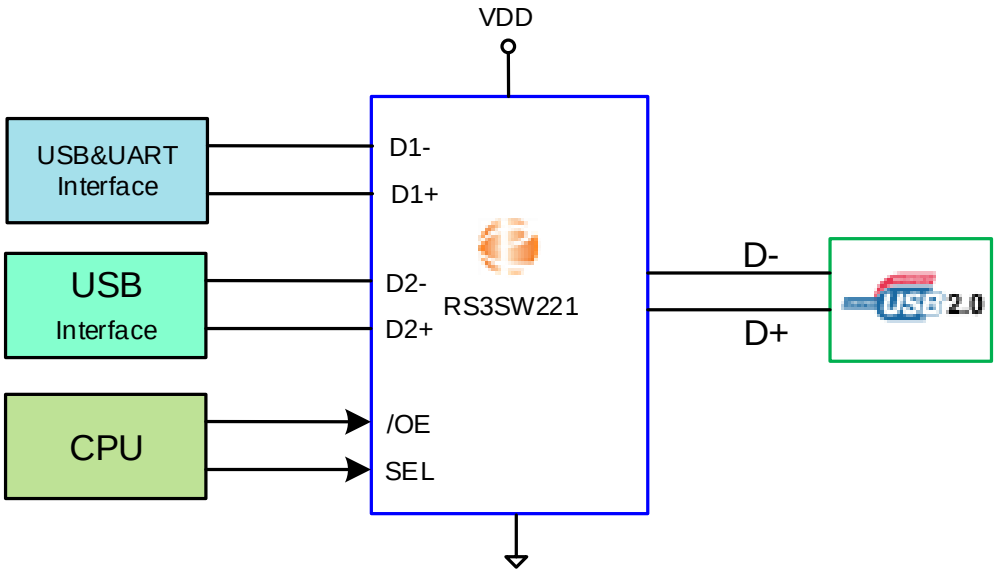
Part Number	Package	Description
RS3SW221ZUAE	ZUA	10-Pin, 1.5x2.0 (UQFN)
RS3SW221ZWE	ZW	10-Pin, 3x3 (UDFN)

Notes：
E = Pb-free and Green

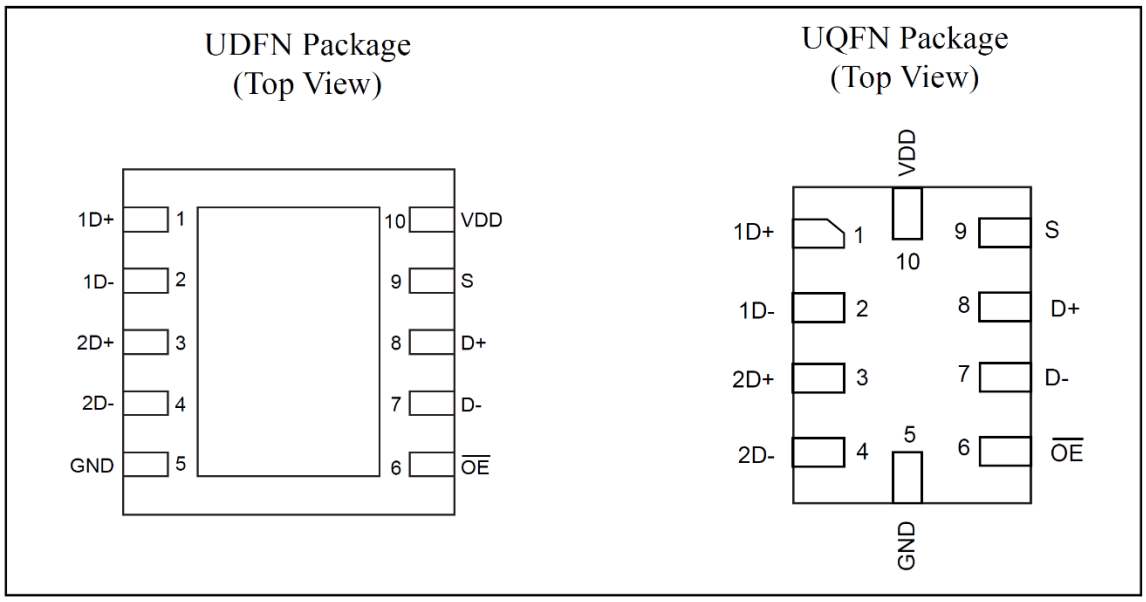
Block Diagram



Typical Application Diagram



Pin Configuration



Pin Description

Pin Name	Number	Description
1D+	1	Multiplexed high speed data port 1, differential +
1D-	2	Multiplexed high speed data port 1, differential -
2D+	3	Multiplexed high speed data port 2, differential +
2D-	4	Multiplexed high speed data port 2, differential -
GND	5	Ground
/OE	6	Active LOW, Output enable
D-	7	Common high speed data port, differential -
D+	8	Common high speed data port, differential +
S	9	Select input
VDD	10	Power supply

Functions Table

SEL	OE	Function
X	H	Disconnect
L	L	D- to D1-, D+ toD1+
H	L	D- to D2-, D+ to D2+

Absolute Maximum Ratings (1)

Over operating free-air temperature range (unless otherwise noted)

V_{DD} Supply Voltage Range	–0.5V to 4.6V
V_{IN} Control Input Voltage Range(2, 3)	–0.5V to 5.5V
$V_{I/O}$ Switch I/O Voltage Range(2, 3, 4)	–0.5V to 5.5V
I_{IK} Control Input Clamp Current (V_{IN} < 0)	–50mA
$I_{I/OK}$ I/O Port Clamp Current ($V_{I/O}$ < 0)	–50mA
$I_{I/O}$ ON-state Switch Current(5)	±120mA
Continuous Current through V_{DD} or GND	±100mA
θ_{JA} Package Thermal Impedance	
TLLGA Package	48.7°C/W
TDFN Package	243°C/W
T_{stg} Storage Temperature Range	–65 to 150°C
Tj Junction Temperature	125°C

Notes:

1. Stresses beyond those listed under "absolute maximum ratings" 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. All voltages are with respect to ground, unless otherwise specified.
3. The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
4. VI and VO are used to denote specific conditions for VI/O.
5. II and IO are used to denote specific conditions for II/O.
6. The package thermal impedance is calculated in accordance with JESD 51-7.

Recommended Operating Conditions (1)

Symbol	Description	Parameter	MIN	MAX	Unit
V_{DD}	Supply voltage		1.62	3.63	V
V_{IH}	High-level control input voltage	V_{DD} = 2.3 V to 2.7 V	1.3	-	
		V_{DD} = 2.7 V to 3.6 V	1.4	-	
V_{IL}	Low-level control input voltage	V_{DD} = 2.3 V to 2.7 V		0.6	
		V_{DD} = 2.7 V to 3.6 V		0.6	
$V_{I/O}$	Data input/output voltage		0	4.6	
T_A	Operating free-air temperature		–40	125	°C

Note:

1. All unused control inputs of the device must be held at V_{DD} or GND to ensure proper device operation.

Electrical Characteristics

Over operating free-air temperature range (unless otherwise noted)

Parameter		Testing Conditions		MIN	TYP	MAX	Unit
V_{IK}		VDD = 3.6V, 1.8V, II = –18 mA				–1.2	V
I_{IN}	Control Inputs	VDD = 3.6V,1.8V, 0V, VIN = 0V to 3.6V				±1	
I_{OZ} (3)		VDD = 3.6V, 1.8V, VIN = VDD or GND, VO = 0V to 3.6V, VI = 0V, Switch OFF				±1	
I(OFF)		VDD = 0V	VI/O = 0V to 3.6V			±2	
			VI/O = 0 to 2.7V			±1	
I_{CC}		VDD = 3.6V, 1.8V, VIN = VDD or GND,II/O = 0 V, Switch ON or OFF			25	50	
I_{CC} (low power mode)		VDD = 3.6V, 1.8V, VIN = VDD or GND,Switch disabled, (OE=high)				4	
DI_{CC} (3)	Control Inputs	VDD=3.6V,1.8V	SEL sweeps from 1.4V to 3.3V, /OE = 0V			15	
			OE/ sweeps from 1.4V to 3.3V, SEL = 0V			0.75	
C_{IN}	Control Inputs	VDD = 3.3V, 1.8V, VIN = 3.3V or 0V			1	2	
Cio(OFF)		VDD = 3.3V, 1.8V, VIN = 3.3V or 0V, Switch OFF			2	3	pF
Cio(ON)		VDD = 3.3V, 1.8V, VIN = 3.3V or 0V, Switch ON			4	6	
r_{ON}(5)		VDD = 3V, 1.8V	VI = 0V, IO = 30 mA			4	
			VI = 2.4V, IO = –15 mA			6	
Dr_{ON}(6)		VDD = 3V, 1.8V	VI = 0V, IO = 30 mA		0.2		Ω
			VI = 1.7V, IO = –15 mA		0.2		
r_{ON}(flat)		VDD = 3V, 1.8V	VI = 0V, IO = 30 mA		1		
			VI = 1.7V, IO = –15 mA		1		
Vpass		VDD = 1.8-3.3V	VIN > 3.8V, IO = 10uA	2.8	3.8	4.2	V

Notes:

1. VIN and IIN refer to control inputs. VI, VO, II, and IO refer to data pins.
2. All typical values are at V_{DD} = 3.3 V (unless otherwise noted), T_A = 25°C.
3. For I/O ports, the parameter I_{OZ} includes the input leakage cur
4. This is the increase in supply current for each input that is at the specified TTL voltage level, rather than V_{DD} or GND.
5. Measured by the voltage drop between the input and output terminals at the indicated current through the switch. ON-state resistance is determined by the lower of the voltages of the two terminals.
6. Dron is delta Ron between channels

Dynamic Electrical Characteristics

Over operating range, T_A = –40°C to 85°C, V_{DD} = 3.3 V ± 10%, GND = 0V

Symbol	Parameter	Test Conditions	TYP(1)	Unit
X_{TALK}	Crosstalk	R_L = 50Ω, *f* = 250 MHz	–38	dB
O_{IRR}	OFF isolation	R_L = 50Ω, *f* = 250 MHz	–40	
BW	Bandwidth (–3 dB)	R_L = 50Ω	1.2	GHz

Note:
1. For Max or Min conditions, use the appropriate value specified under Electrical Characteristics for the applicable device type.

Switching Characteristics

Over operating range, T_A = –40°C to 85°C, V_{DD} = 3.3 V ± 10%, GND = 0V

Symbol	Parameter		MIN	TYP(1)	MAX	Unit
tpd	Propagation Delay (2,3)			0.25		ns
tON	Line enable time	SEL to D, 1D,2D			125	
		OE to D, 1D,2D			100	
tOFF	Line disable time	SEL to D, 1D,2D			12	
		OE to D, 1D,2D			12	
tSK(O)	Output skew between center port to any other port(2)			0.1	0.2	
tSK(P)	Skew between opposite transitions of the same output (tPHL – tPLH)(2)			0.1	0.2	
tVPASS	OVP response time			53		

Notes:
1. For Max or Min conditions, use the appropriate value specified under Electrical Characteristics for the applicable device type.
2. Specified by design
3. The switch contributes no propagational delay other than the RC delay of the on resistance of the switch and the load capacitance. The time constant for the switch alone is of the order of 0.25 ns for 10-pF load. Since this time constant is much smaller than the rise/fall times of typical driving signals, it adds very little propaga- tional delay to the system. Propagational delay of the bus switch, when used in a system, is determined by the driving circuit on the driving side of the switch and its interactions with the load on the driven side.

Application Information

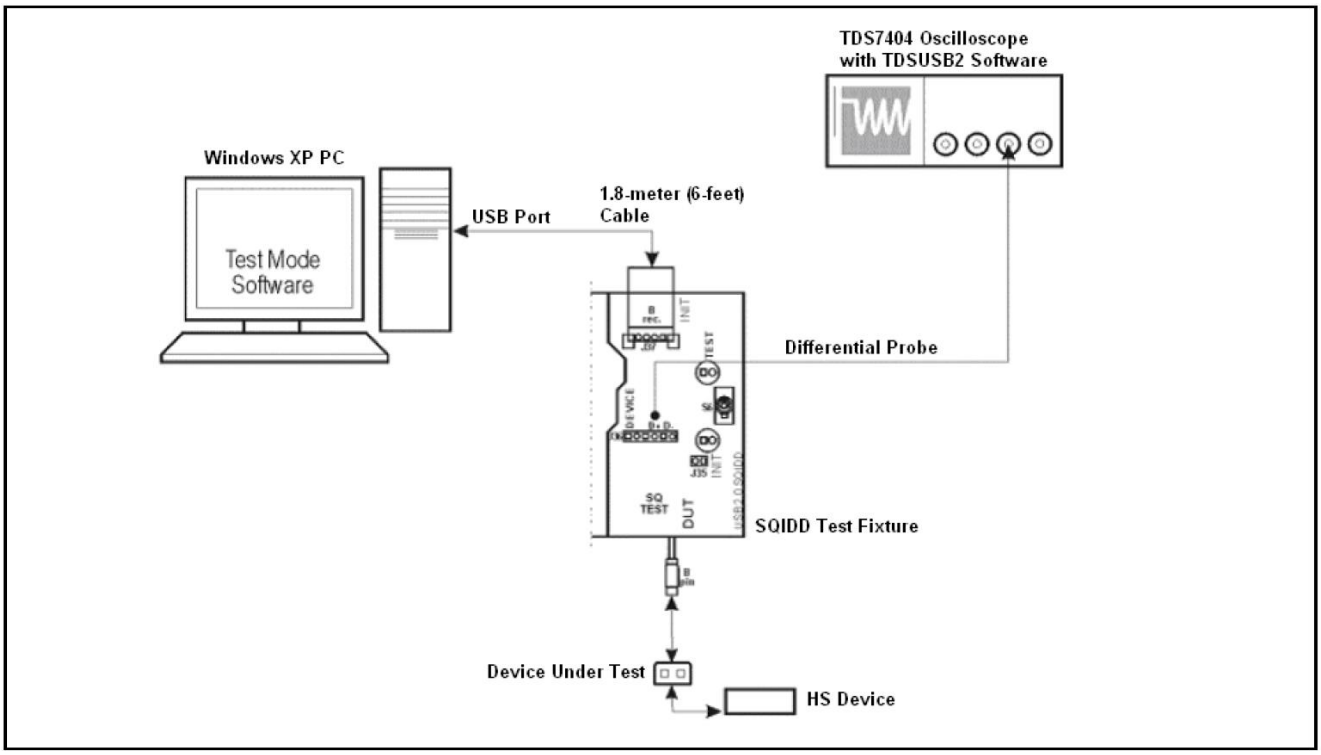
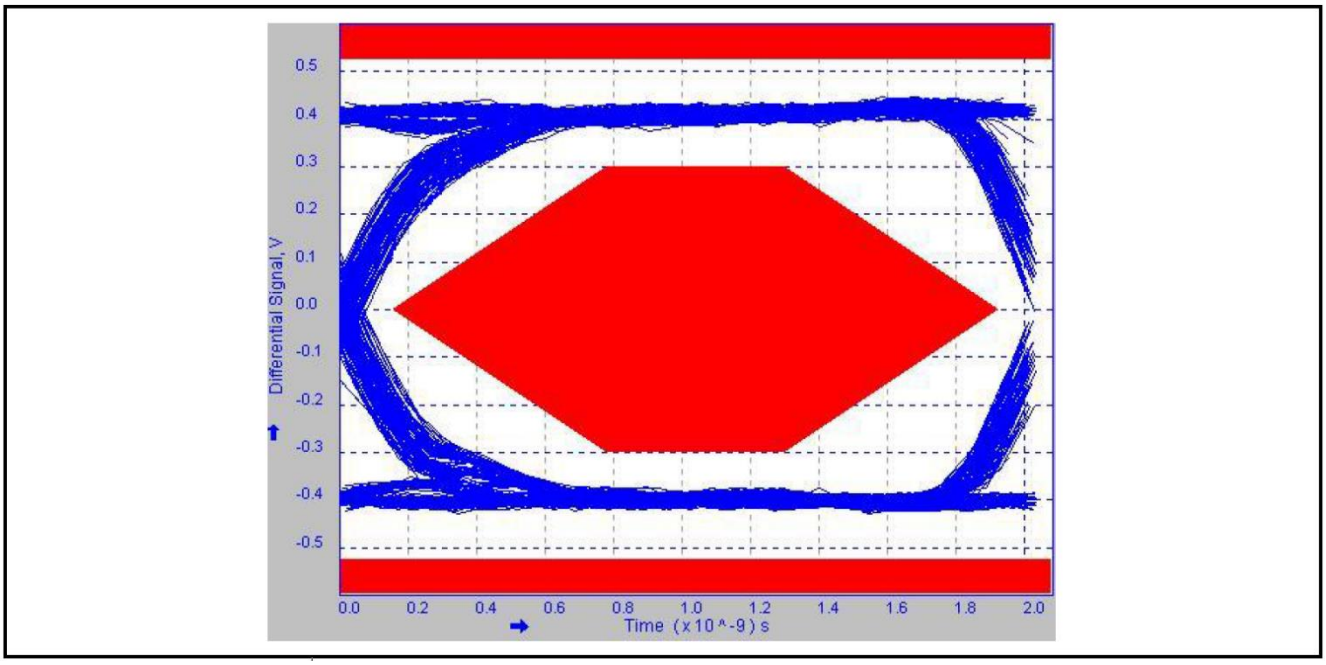


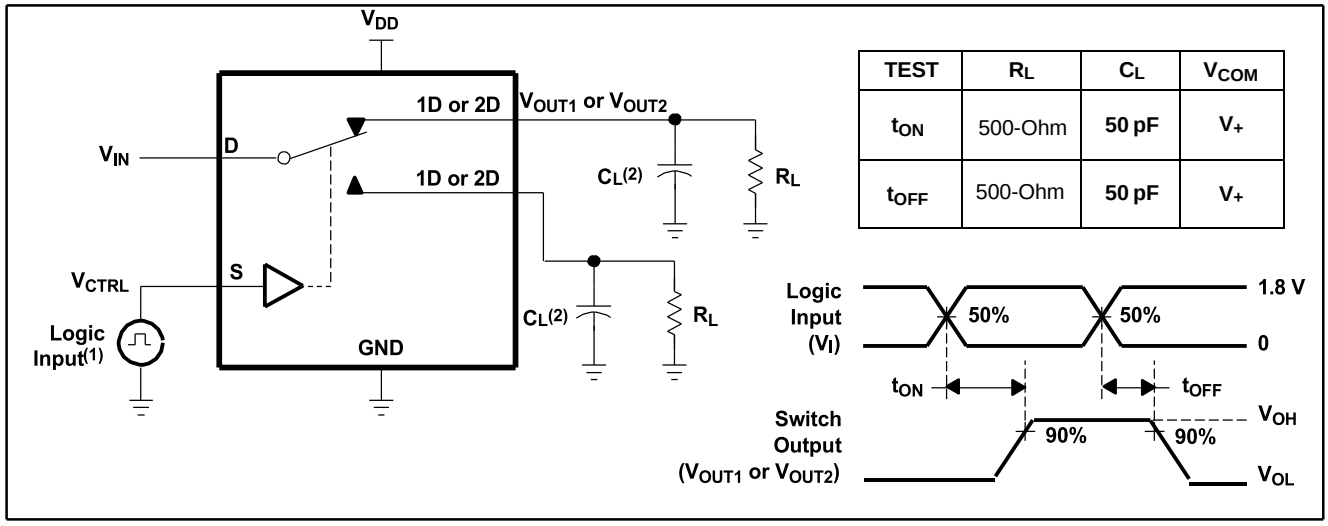
Figure 1: HS Eye Test Setup

Test Result



Test Result: High-speed, Up-stream, Near-end Eye of RS3SW221

Parameter Measurement Information



TEST	R_L	C_L	V_{COM}
t_{ON}	500-Ohm	50 pF	V_+
t_{OFF}	500-Ohm	50 pF	V_+

(1) All input pulses are supplied by generators having the following characteristics: PRR =10 khz, t_r<=5 ns, t_f <=5 ns.
(2) C_L includes probe and jig capacitance.

Figure 2. Turn-On (t_{ON}) and Turn-Off Time (t_{OFF})

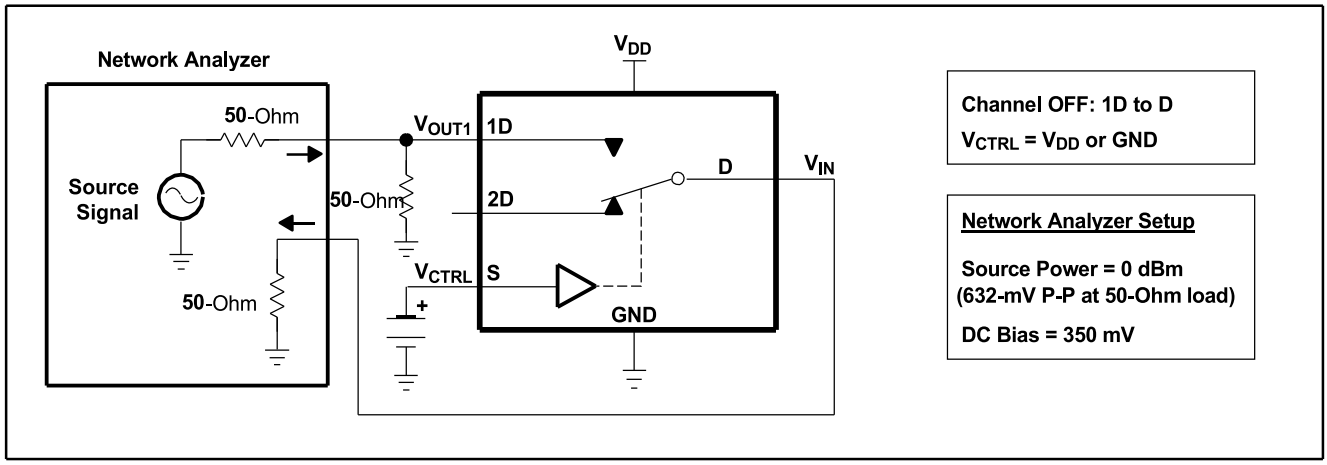


Figure 3. OFF Isolation (O_{ISO})

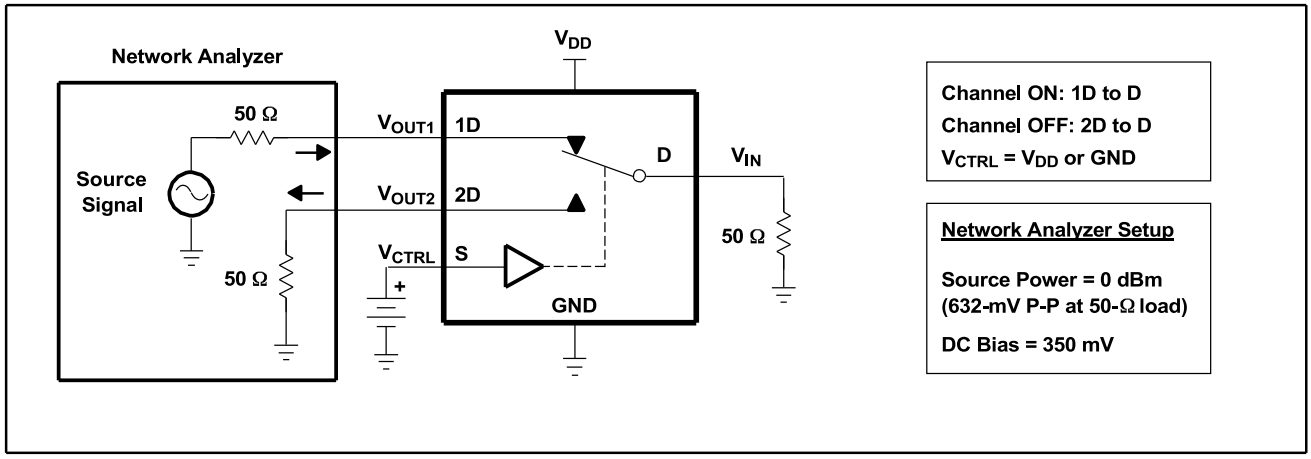


Figure 4. Crosstalk (X_{TALK})

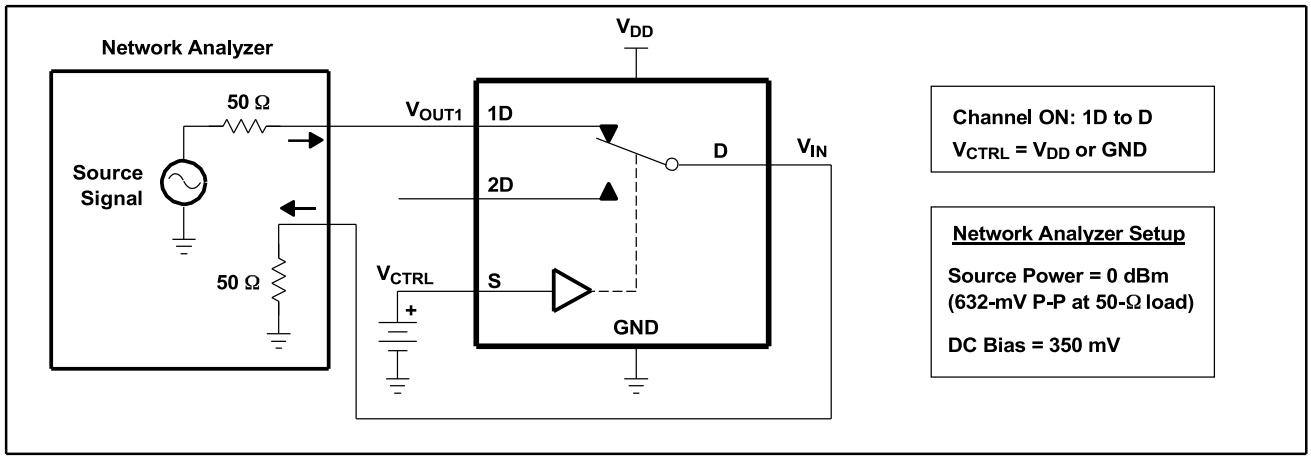


Figure 5. Bandwidth (BW)

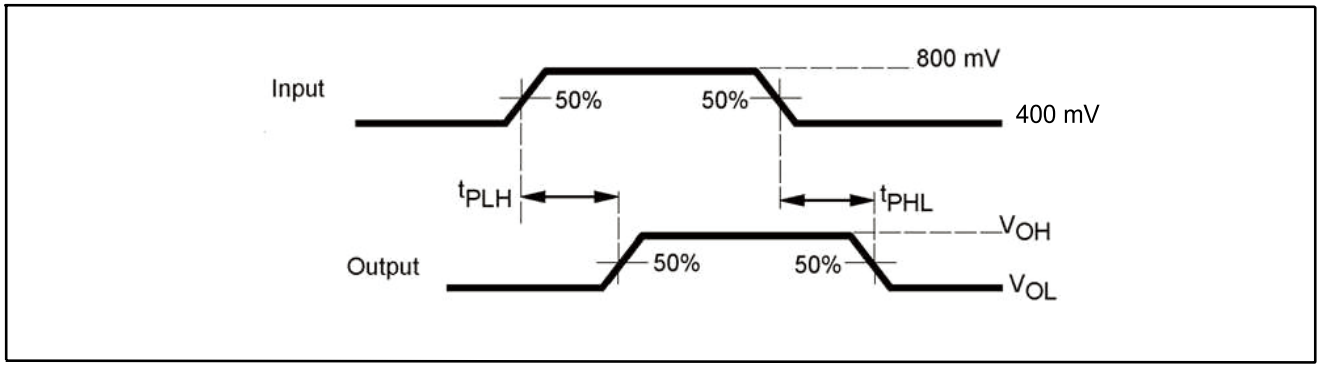


Figure 6. Propagation Delay

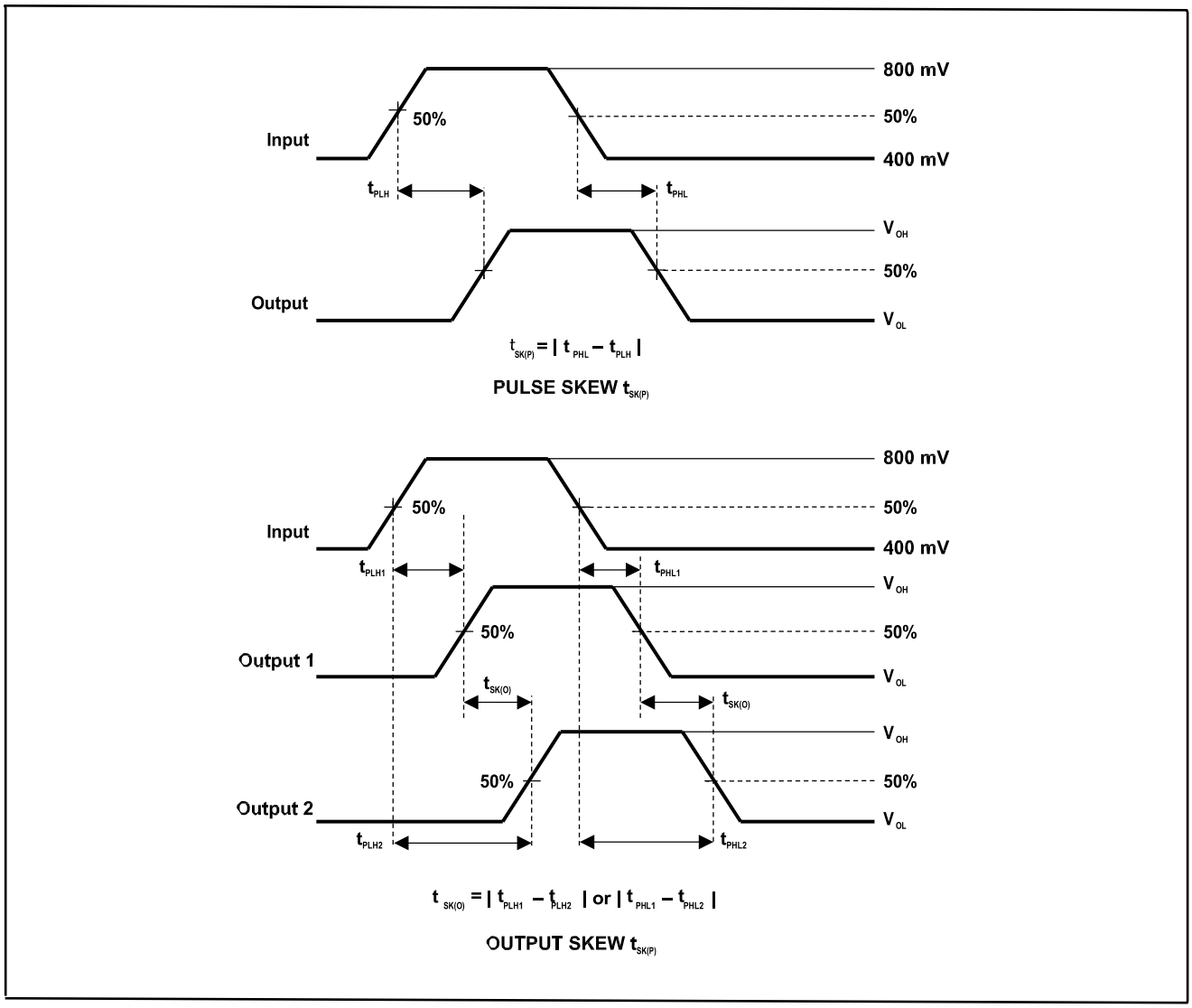


Figure 7. Skew Test

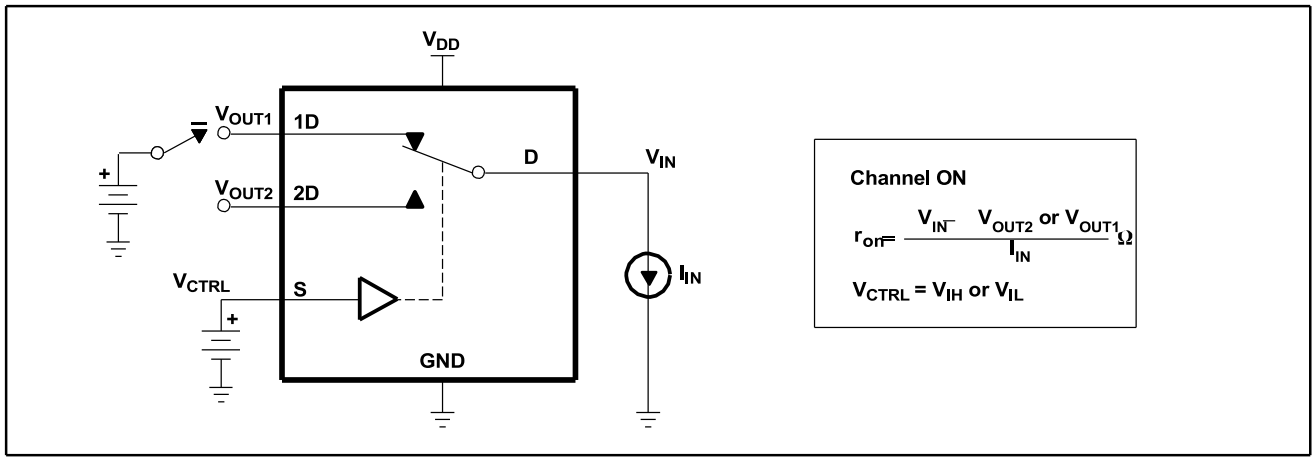


Figure 8. ON-State Resistance (r_{on})

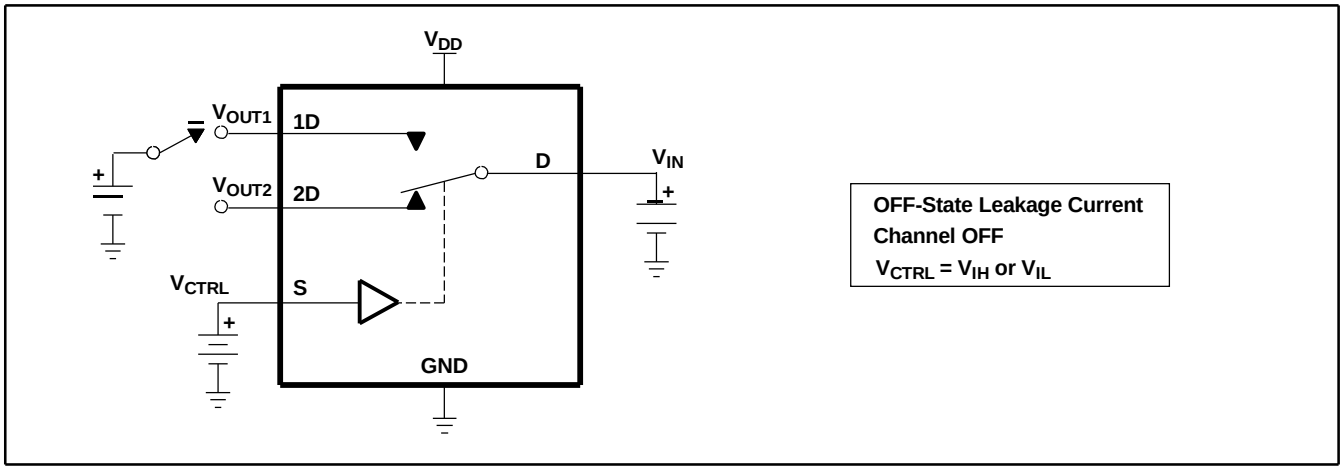


Figure 9. OFF-State Leakage Current

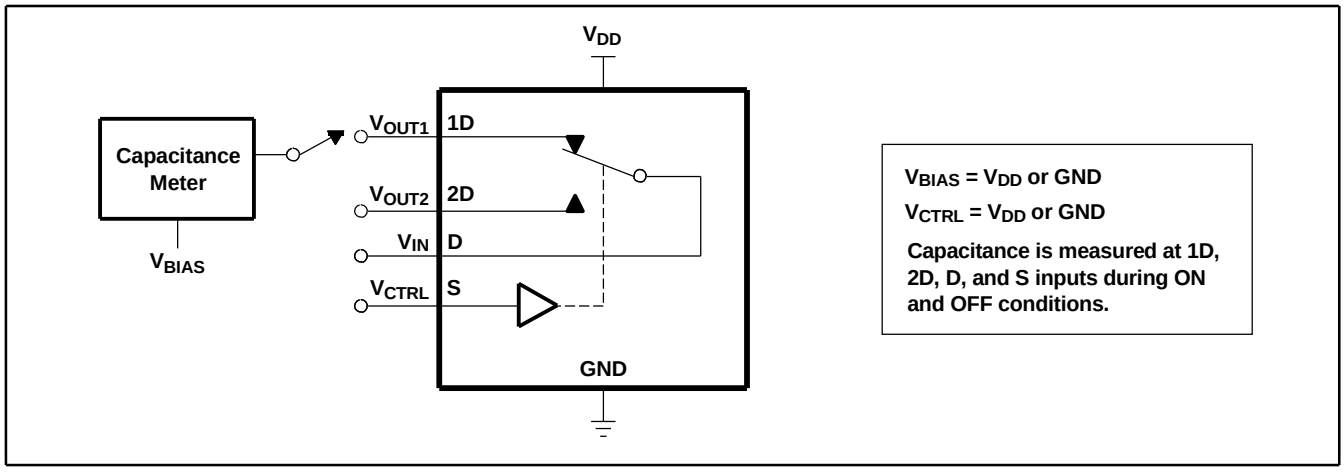
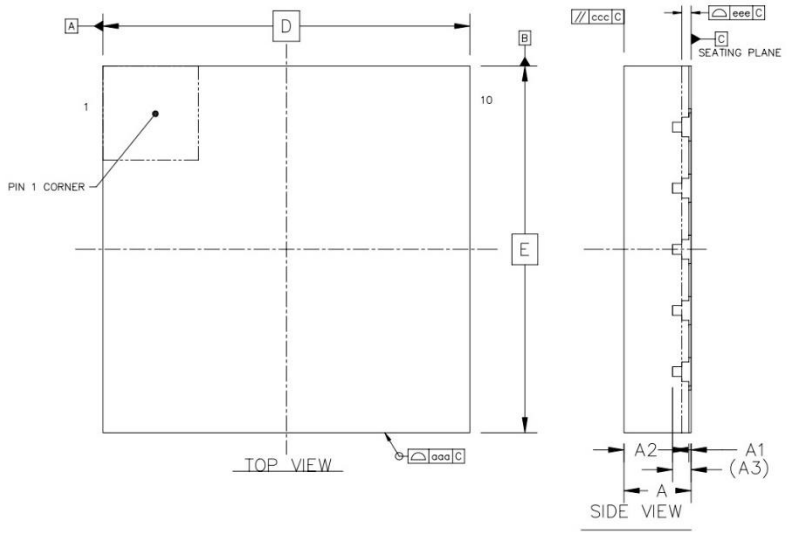


Figure 10. Capacitance

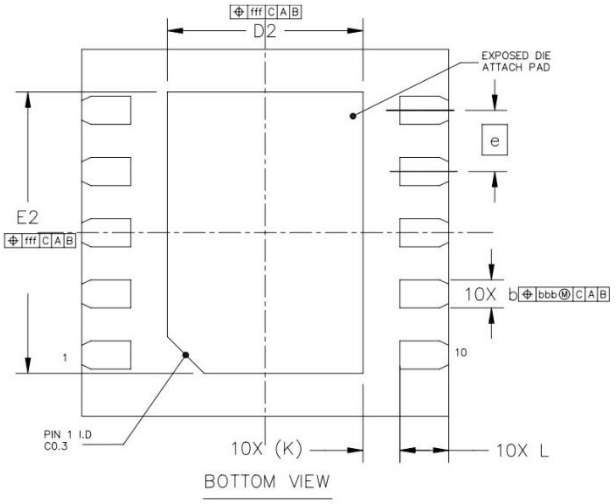
Package Information

10-UDFN (ZW)



		SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS		A	0.5000	0.5500	0.6000
STAND OFF		A1	0	0.02	0.0500
MOLD THICKNESS		A2	---	0.398	---
L/F THICKNESS		A3		0.152 REF	
LEAD WIDTH		b	0.18	0.23	0.28
BODY SIZE	X	D		3 BSC	
	Y	E		3 BSC	
LEAD PITCH		e		0.50 BSC	
EP SIZE	X	D2	1.50	1.60	1.70
	Y	E2	2.20	2.30	2.40
LEAD LENGTH		L	0.30	0.40	0.50
LEAD TIP TO EXPOSED PAD EDGE		K		0.30 REF	
PACKAGE EDGE TOLERANCE		aaa		0.1000	
MOLD FLATNESS		ccc		0.1000	
COPLANARITY		eee		0.0800	
LEAD OFFSET		bbb		0.1000	
EXPOSED PAD OFFSET		fff		0.1000	

Note:
1.All dimensions are in mm.
2.Dimensions exclude burrs, mold flash or protrusions.
3.Refer Jedec MO-220



UDFN3X3-10L(ZW10) POD Rev.0

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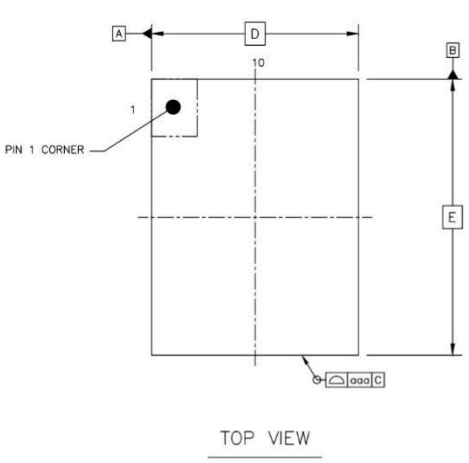
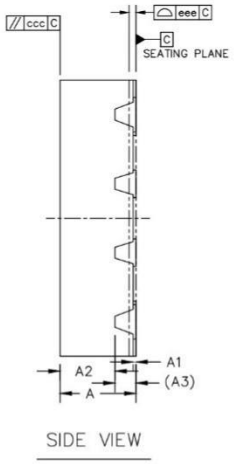
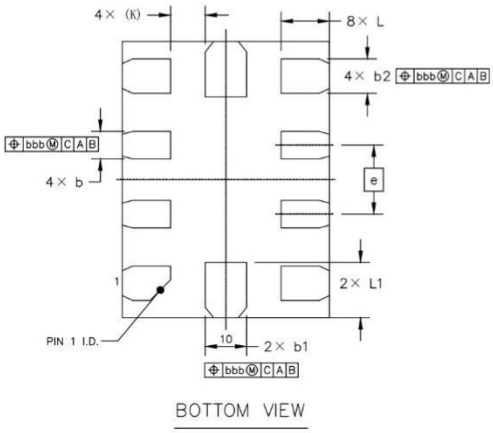
10-UQFN (ZUA)





		SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS		A	0.5	0.55	0.6
STAND OFF		A1	0	0.02	0.05
MOLD THICKNESS		A2	---	0.398	---
L/F THICKNESS		A3		0.152 REF	
LEAD WIDTH		b	0.15	0.2	0.25
		b1	0.25	0.3	0.35
		b2	0.2	0.25	0.3
BODY SIZE	X	D		1.5 BSC	
	Y	E		2 BSC	
LEAD PITCH		e		0.5 BSC	
LEAD LENGTH		L	0.3	0.35	0.4
		L1	0.35	0.40	0.45
LEAD TIP TO EXPOSED PAD EDGE		K		0.25 REF	
PACKAGE EDGE TOLERANCE		aaa		0.1	
MOLD FLATNESS		ccc		0.1	
COPLANARITY		eee		0.05	
LEAD OFFSET		bbb		0.1	



Note:
1.All dimensions are in mm.
2.Dimensions exclude burrs, mold flash or protrusions.
3.Refer Jedec MO-220

UQFN1.5X2.0-10L (ZUA) POD Rev. 0
Raystar Microelectronics Technology Inc.

Revision History

Revision	Description	Date
0.9	Preliminary	2023/12/25
1.0	Initial release	2024/3/26