USB 2.0 + HiFi Audio Switch

1 FEATURES

- **Supply Voltage Range: 2.7V to 5.5V**
- **Control Pins Compatible with 1.8V Interfaces**
- **I_{CC}: 46μA (TYP) at 5.5V**
- **High-Speed Data Path:**
  - **Input Signal Range: 0V to 3.5V**
  - **$R_{DS(ON)}$: 5Ω (TYP)**
  - **C_{ON}: 13pF (TYP)**
  - **Data Rate: USB 2.0-Compliant - up to 480Mbps**
- **Audio Path:**
  - **Input Signal Range: -2V to 2V**
  - **$R_{DS(ON)}$: 1.3Ω (TYP)**
  - **$R_{FLAT(ON)}$: 0.006Ω (TYP)**
  - **THD: 0.002% (TYP) (R_L = 16Ω/V_{IS} = 0.4V_{RMS})**
- **Extended Industrial Temperature Range: -40°C to 85°C**
- **Micro Size Packages: UQFN1.4X1.8-10**

2 APPLICATIONS

- **Smartphones**
- **Tablets**
- **USB 2.0 Hosts/Peripherals**
- **Audio/High-Speed Data Switching**

3 DESCRIPTIONS

The RS2237 is a double−pole/double−throw (DPDT) analog switch for routing high speed differential data and audio. The high−speed data path is compliant with High Speed USB 2.0, Full Speed USB 1.1, Low Speed USB 1.0 and any generic UART protocol. The multi−purpose audio path is capable of passing signals with negative voltages as low as 2 V below ground and features shunt resistors to reduce Pop and Click noise in the audio system.

The RS2237 is available UQFN1.4X1.8-10 package. It operates over an ambient temperature range of -40°C to 85°C.

Device Information (1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS2237	UQFN1.4X1.8-10	1.80mm×1.40mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

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4 REVISION HISTORY

Note: Page numbers for previous revisions may different from page numbers in the current version.

VERSION	Change Date	Change Item
A.0	2025/11/17	Preliminary version completed
A.0.1	2026/01/12	Update HBM value in ESD Ratings

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5 PACKAGE/ORDERING INFORMATION (1)

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING (2)	MSL (3)	PACKAGE OPTION
RS2237	RS2237YUTAQK10	-40°C ~85°C	UQFN1.4X1.8-10	2237	MSL3	Tape and Reel, 4000

NOTE:

(1) This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the right-hand navigation.

(2) There may be additional marking, which relates to the lot trace code information (data code and vendor code), the logo or the environmental category on the device.

(3) RUNIC classify the MSL level with using the common preconditioning setting in our assembly factory conforming to the JEDEC industrial standard J-STD-20F. Please align with RUNIC if your end application is quite critical to the preconditioning setting or if you have special requirement.

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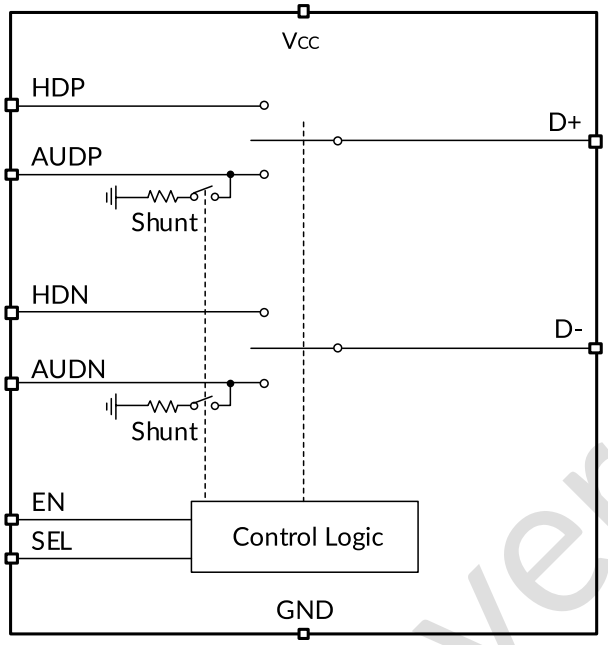
6 FUNCTIONAL BLOCK DIAGRAM



FUNCTION TABLE

EN	SEL	Shunt Status	D+/D- Function
0	X	ON	No Connect
1	0	OFF	AUDP/AUDN
1	1	ON	HDP/HDN

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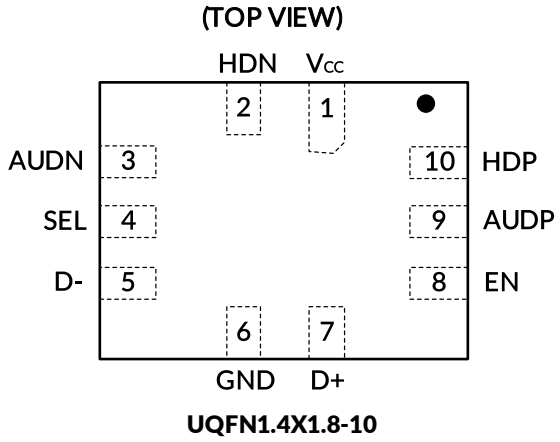
7 PIN CONFIGURATIONS



UQFN1.4X1.8-10

PIN DESCRIPTION

NAME	PIN	FUNCTION
	UQFN1.4X1.8-10	
V_{CC}	1	Power Supply
HDN	2	High Speed Differential Data (-)
AUDN	3	Audio Signal (-)
SEL	4	Function Select
D-	5	Audio/Data Common I/O (-)
GND	6	Ground
D+	7	Audio/Data Common I/O (+)
EN	8	Chip Enable
AUDP	9	Audio Signal (+)
HDP	10	High Speed Differential Data (+)

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8 SPECIFICATIONS

8.1 Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted) (1)

SYMBOL	PARAMETER		MIN	MAX	UNIT
V_{CC}	Positive DC Supply Voltage Range		-0.3	6	V
V_{IS}	Analog Input/Output Voltage Range	HDP, HDN	-0.3	3.7	V
		AUDP, AUDN	-2	3.7	V
		D+, D-	-2	3.7	V
V_{IN}	Digital Control Pin Voltage on EN, SEL		-0.3	V_{CC} + 0.3	V
θ_{JA}	Package thermal impedance (2)	UQFN1.4X1.8-10		115	°C/W
T_J	Junction Temperature			150	°C
T_{stg}	Storage Temperature Range		-65	150	°C
	Lead Temperature (Soldering, 10s)			260	°C

(1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.

(2) The package thermal impedance is calculated in accordance with JESD-51.

8.2 ESD Ratings

The following ESD information is provided for handling of ESD-sensitive devices in an ESD protected area only.

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-Body Model (HBM)	±4000	V
		Charged-Device Model (CDM)	±1000	V

ESD SENSITIVITY CAUTION

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

8.3 Recommended Operating Conditions

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

SYMBOL	PARAMETER		MIN	MAX	UNIT
V_{CC}	Supply Voltage		2.7	5.5	V
V_{IS}	Switch Input/Output Voltage Range	HDP, HDN	0	3.5	V
		AUDP, AUDN	-2	2	V
		D+, D-	-2	3.5	V
V_{IN}	Digital Control Input Voltage Range		0	V_{CC}	V
T_A	Operating Temperature		-40	85	°C

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8.4 Electrical Characteristics

V_{CC}= 2.7V to 5.5V, FULL= -40°C to 85°C. Typical values are at T_A = +25°C (unless otherwise noted).

PARAMETER	SYMBOL	CONDITIONS	T_A	MIN(1)	TYP(2)	MAX(1)	UNIT
DC Electrical Characteristic							
Power Supply							
Supply Current	I_{CC}	V_{CC} = 2.7V, I_{IS} = 0mA	25°C		26	35	μA
			FULL			50	μA
		V_{CC} = 5.5V, I_{IS} = 0mA	25°C		46	55	μA
			FULL			70	μA
Input High Voltage	V_{IH}		FULL	1.8			V
Input Low Voltage	V_{IL}		FULL			0.4	V
Input Hysteresis	V_{IHYS}	V_{CC} = 2.7V	25°C		220		mV
Leakage Current	I_{IN}	V_{CC} = 2.7V to 5.5V	FULL			±50	nA
Audio Switch (AUDP/AUDN ↔ D+/D-)							
On-Resistance	R_{ON}	V_{CC} = 3.0V to 5.5V, V_{IS} = -2.0V to 2V, I_{IS} = 50mA	25°C		1.3	1.6	Ω
			FULL			1.8	
On-Resistance Matching - Between Channels	ΔR_{ON}	V_{CC} = 3.0V to 5.5V, V_{IS} = -2.0V to 2V, I_{IS} = 50mA	25°C		0.02		Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	V_{CC} = 3.0V to 5.5V, V_{IS} = -2.0V to 2V, I_{IS} = 50mA	25°C		0.006		Ω
Shunt Resistance	R_{SH}		25°C		760		Ω
Data Switch (HDP/HDN ↔ D+/D-)							
On-Resistance	R_{ON}	V_{CC} = 3.0V to 5.5V, V_{IS} = 0V to 1.7V, I_{IS} = 15mA	25°C		5	6	Ω
			FULL			7	Ω
On-Resistance Matching - Between Channels	ΔR_{ON}	V_{CC} = 3.0V to 5.5V, V_{IS} = 0V to 1.7V, I_{IS} = 15mA	25°C		0.05		Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	V_{CC} = 3.0V to 5.5V, V_{IS} = 0V to 1.7V, I_{IS} = 15mA	25°C		0.004		Ω
Off-State Leakage	$I_{SW(OFF)}$	V_{IS} = 0V to 3.5V, see Figure 7	FULL			±100	nA
On-State Leakage	$I_{SW(ON)}$	V_{IS} = 0V to 3.5V, see Figure 8	FULL			±100	nA
AC Electrical Characteristics							
Audio Switch (AUDP/AUDN ↔ D+/D-)							
Audio THD	THD	f = 20Hz to 20kHz, V_{IS} = 0.4V_{RMS}, DC bias = 0V, R_L = 16Ω	25°C		0.002		%
		f = 20Hz to 20kHz, V_{IS} = 0.4V_{RMS}, DC bias = 0V, R_L = 32Ω	25°C		0.001		%
		f = 20Hz to 20kHz, V_{IS} = 4V_{P-P}, DC bias = 0V, R_L = 16Ω	25°C		0.002		%
		f = 20Hz to 20kHz, V_{IS} = 4V_{P-P}, DC bias = 0V, R_L = 32Ω	25°C		0.002		%
Power Supply Ripple Rejection	PSRR	From V_{CC} to AUDP/AUDN, f=217Hz, R_L=16Ω	25°C		-110		dB
Data Switch (HDP/HDN ↔ D+/D-)							
Equivalent On Capacitance	C_{ON}	Switch on, f = 1MHz	25°C		13		pF
Equivalent Off Capacitance	C_{OFF}	Switch off, f = 1MHz	25°C		6		pF
Differential Insertion Loss	D_{IL}	f = 10MHz, See Figure 9	25°C		-0.62		dB
		f = 800MHz, See Figure 9	25°C		-3.54		dB
Differential Off Isolation	D_{ISO}	f = 10MHz, See Figure 10	25°C		-50		dB
		f = 800MHz, See Figure 10	25°C		-27		dB
Differential Crosstalk	D_{CTK}	f = 10MHz, See Figure 11	25°C		-58		dB
		f = 800MHz, See Figure 11	25°C		-27		dB

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Power Supply Rejection Ratio	PSRR	PSRR From V_{CC} to D+/D-, f=217Hz, R_L=50Ω		25°C		-110		dB
Dynamic Timing								
Propagation Delay (3)	t_{PD}	V_{NOn} or V_{NCn} = 0V, R_L = 50Ω		25°C		1		ns
Bit - to - Bit Skew (4)	$t_{SK(B-B)}$	Within the same differential channel, see Figure 12		25°C		500		ps
Turn - On Time	t_{ON}	V_{IS} = 1V, R_L = 50Ω, C_L = 7pF (fixture only), see Figure 13	EN or SEL to AUDP/AUDN	25°C		11.5		ms
			EN or SEL to HDP/HDN	25°C		0.02		
Turn - Off Time	t_{OFF}	V_{IS} = 1V, R_L = 50Ω, C_L = 7pF (fixture only), see Figure 13	EN or SEL to AUDP/AUDN	25°C		10.5		µs
			EN or SEL to HDP/HDN	25°C		0.3		

NOTE:

(1) Limits are 100% production tested at 25°C. Limits over the operating temperature range are ensured through correlations using statistical quality control (SQC) method.

(2) Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration.

(3) No delays other than the RC network formed by the load resistance and the load capacitance of the switch are added on the bus. For a 10pF load, this delay is 5ns which is much smaller than rise and fall time of typical driving systems. Propagation delays on the bus are determined by the driving circuit on the driving side and its interactions with the load of the driven side.

(4) This parameter is ensured by design and/or characterization and is not tested in production.

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8.5 Typical Characteristics

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

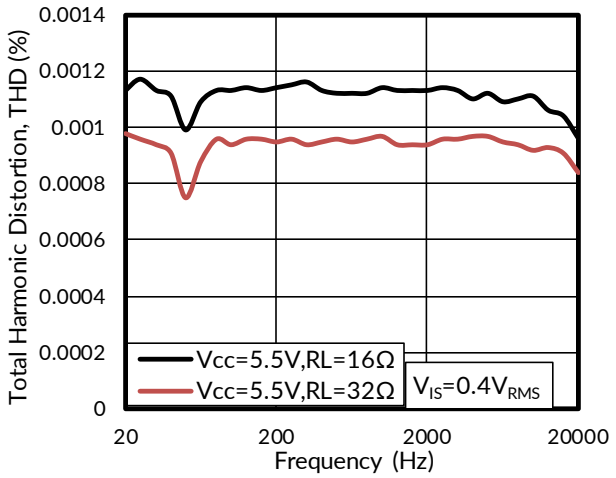


Figure 1. Total Harmonic Distortion vs Frequency

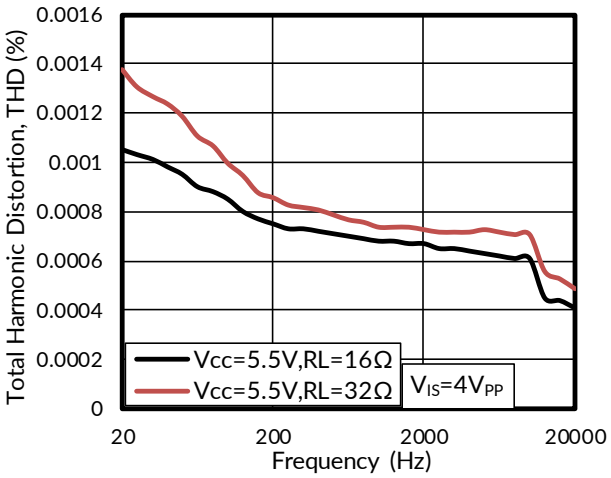


Figure 2. Total Harmonic Distortion vs Frequency

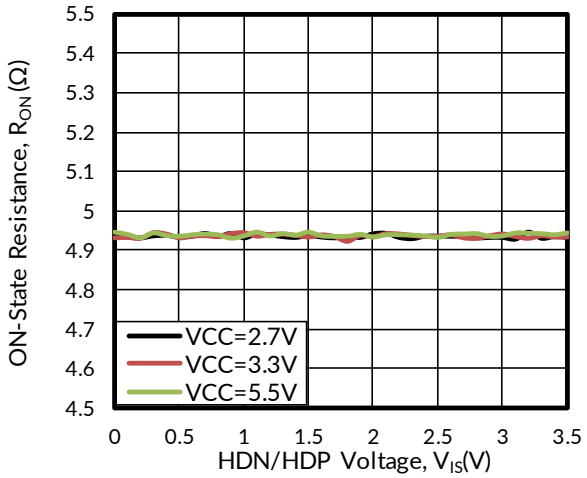


Figure 3. ON-State Resistance vs HDN/HDP Voltage

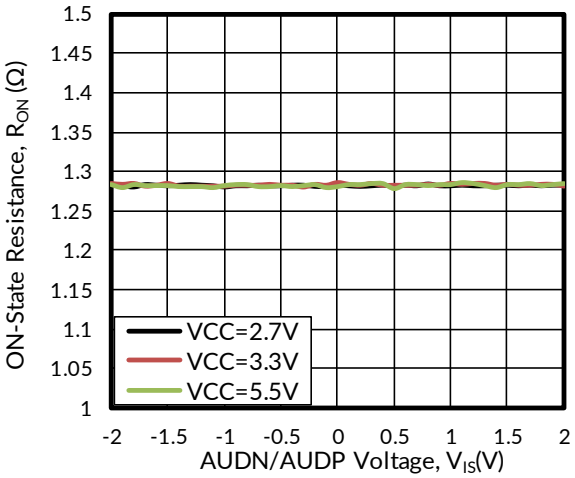


Figure 4. ON-State Resistance vs AUDN/AUDP Voltage

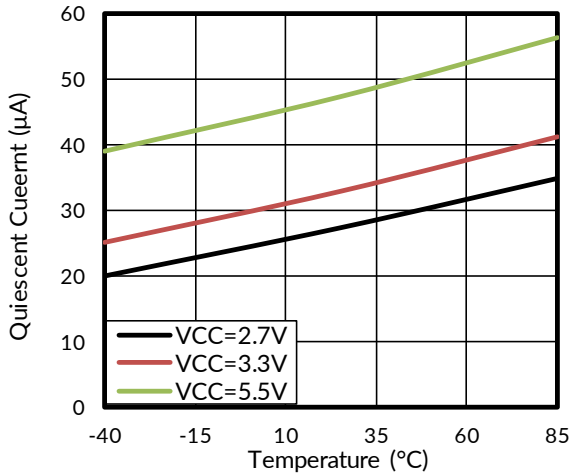


Figure 5. Quiescent Current vs Temperature

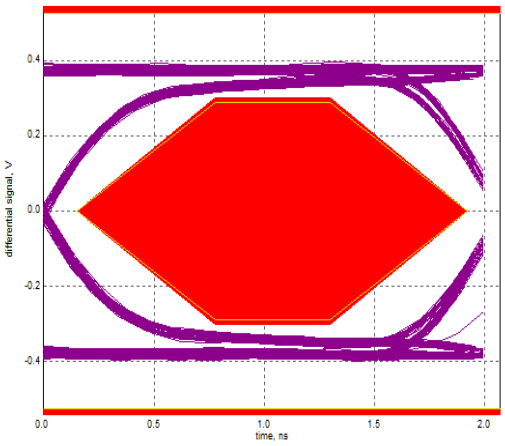


Figure 6. Eye Pattern

9 PARAMETER MEASUREMENT INFORMATION

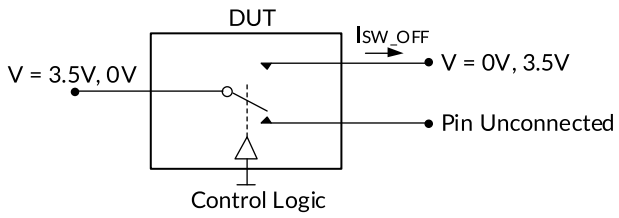


Figure 7. Off-State Leakage

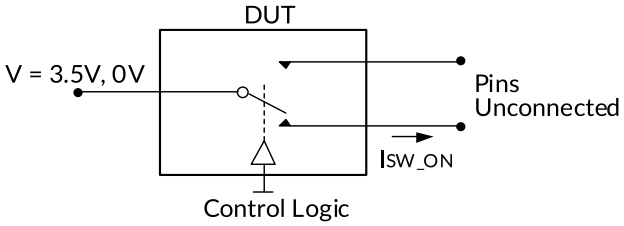


Figure 8. On-State Leakage

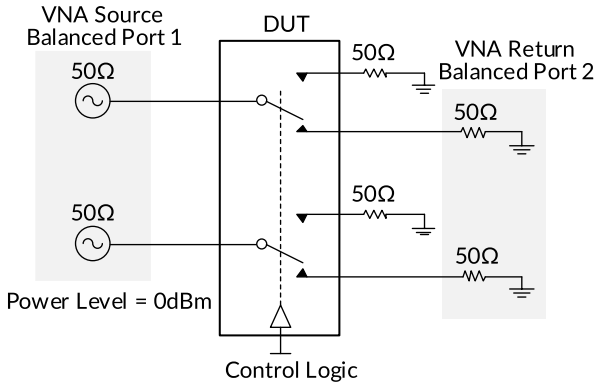


Figure 9. Differential Insertion Loss (S_{DD21})

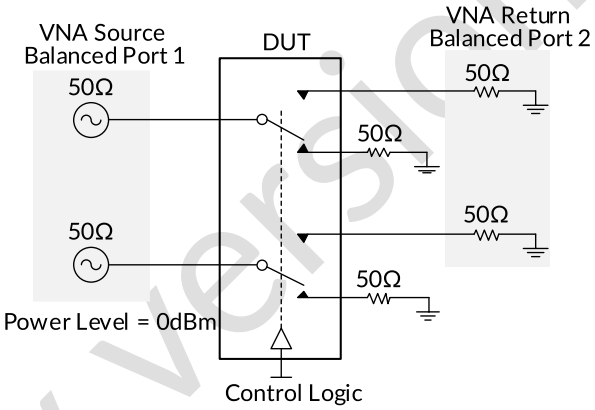


Figure 10. Differential Off Isolation (S_{DD21})

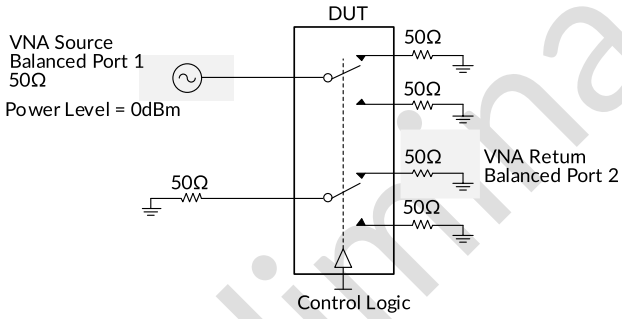


Figure 11. Differential Crosstalk (S_{DD21})

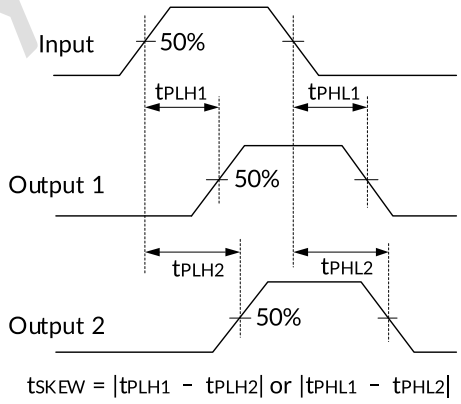
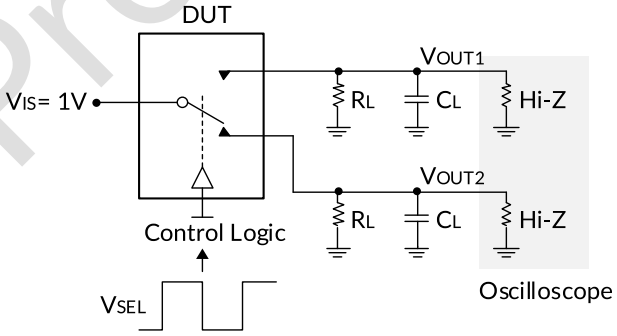


Figure 12. Bit-to-Bit and Channel-to-Channel Skew



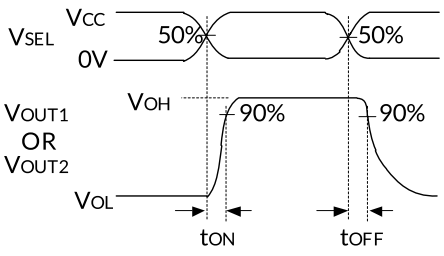


Figure 13. Turn-On and Turn-Off Times

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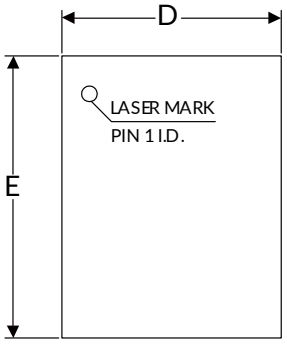
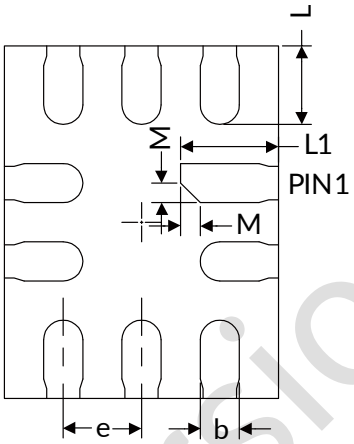
10 PACKAGE OUTLINE DIMENSIONS

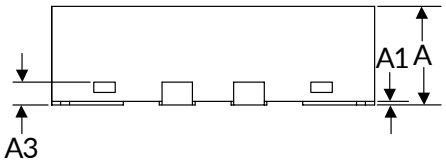
UQFN1.4X1.8-10 (3)



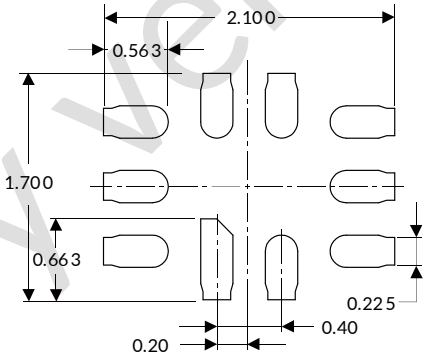
TOP VIEW



BOTTOM VIEW



SIDE VIEW



RECOMMENDED LAND PATTERN

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	0.500	0.600	0.020	0.024
A1	0.000	0.050	0.000	0.002
A3	0.127 REF (2)		0.005 REF (2)	
b	0.150	0.250	0.006	0.010
D (1)	1.350	1.450	0.053	0.057
E (1)	1.750	1.850	0.069	0.073
e	0.300	0.500	0.012	0.020
L	0.350	0.450	0.014	0.018
L1	0.450	0.550	0.018	0.022
M	0.100 REF (2)		0.004 REF (2)	

NOTE:

1. Plastic or metal protrusions of 0.075mm maximum per side are not included.
2. REF is the abbreviation for Reference.
3. This drawing is subject to change without notice.

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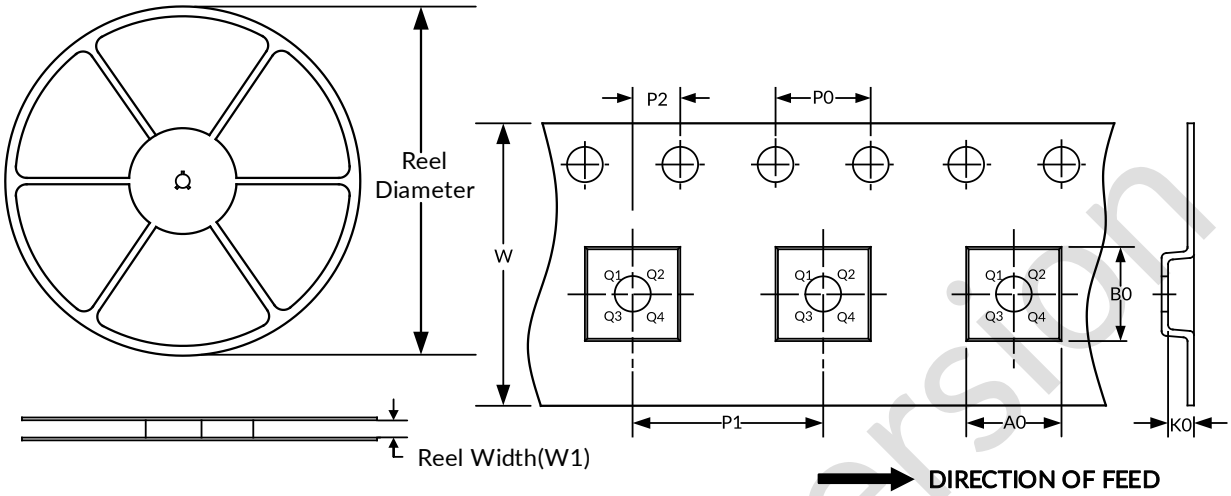
11 TAPE AND REEL INFORMATION

REEL DIMENSIONS

TAPE DIMENSION



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
UQFN1.4X1.8-10	7”	9.0	1.60	2.00	0.85	4.0	4.0	2.0	8.0	Q1

NOTE:
1. All dimensions are nominal.
2. Plastic or metal protrusions of 0.15mm maximum per side are not included.

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