

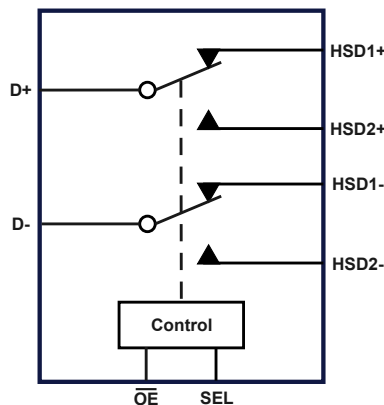
Features

- V_{CC} Supply Voltage: 1.8 V to 5.5 V
- $V_{I/O}$ Accepts Signals up to 5.5 V
- 1.8-V Compatible Control-Pin Inputs (S, $\overline{OE}$)
- Low-Power Mode When OE is Disabled (1 μ A)
- $R_{ON} = 7.3 \Omega$ Typical at 3 V
- $\Delta R_{ON} = 0.8 \Omega$ Typical
- $C_{io(on)} = 3.6$ pF
- Low Power Consumption (7 μ A)
- High Bandwidth: 2.5 GHz
- Break-Before-Make Switching
- Operation Temperature Range: -40°C to 125°C

Applications

- Industry Control Systems
- Mobile Phones
- Routes Signals for USB 1.0, 1.1, and 2.0
- Notebooks
- USB I/O Expansion

Block Diagram And Function Table



$\overline{OE}$	S	HSD1+, HSD1-	HSD2+, HSD2-
Low	Low	ON	OFF
Low	High	OFF	ON
High	X	OFF	OFF

NOTE: Switches shown for logic "0" input.

Description

The TPW3227 is a high-bandwidth analog switch designed for the switching of high-speed USB 2.0 signals in handsets and consumer electronics, such as notebooks and mobile phones, especially those equipped with hubs and controllers featuring limited USB I/Os. The device operates over the wide V_{CC} range from 1.8 V to 5.5 V.

The wide bandwidth (2.5 GHz) of the TPW3227 allows signals to pass with minimum edge, delay, and phase distortion. The device multiplexes differential output 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. The switch consumes very low quiescent current less than 1 μ A in a low power mode and is suitable for portable applications with a battery or limited power budget. The device has a very low bit-to-bit skew and excellent channel-to-channel crosstalk to fit applications with high channel-to-channel crosstalk requirements.

The TPW3227 device integrates ESD protection cells on all pins, is available in a tiny UTQFN package (1.4 mm x 1.8 mm), and is characterized over the free air temperature range from -40°C to 125°C .

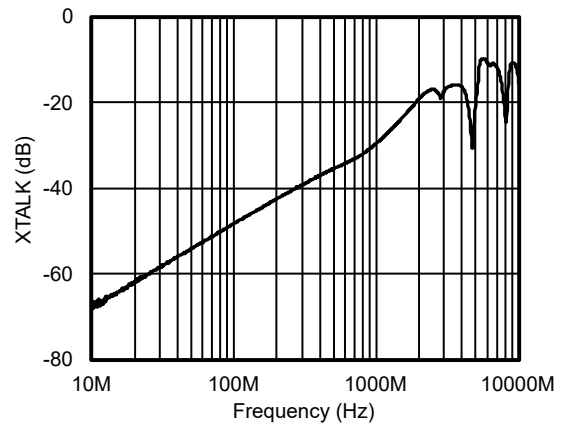


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High-Speed 1:2 Multiplexer and Demultiplexer Analog Switch**Revision History**

Date	Revision	Notes
2025-07-12	Rev.A.0	Initial Version.

Pin Configuration and Functions

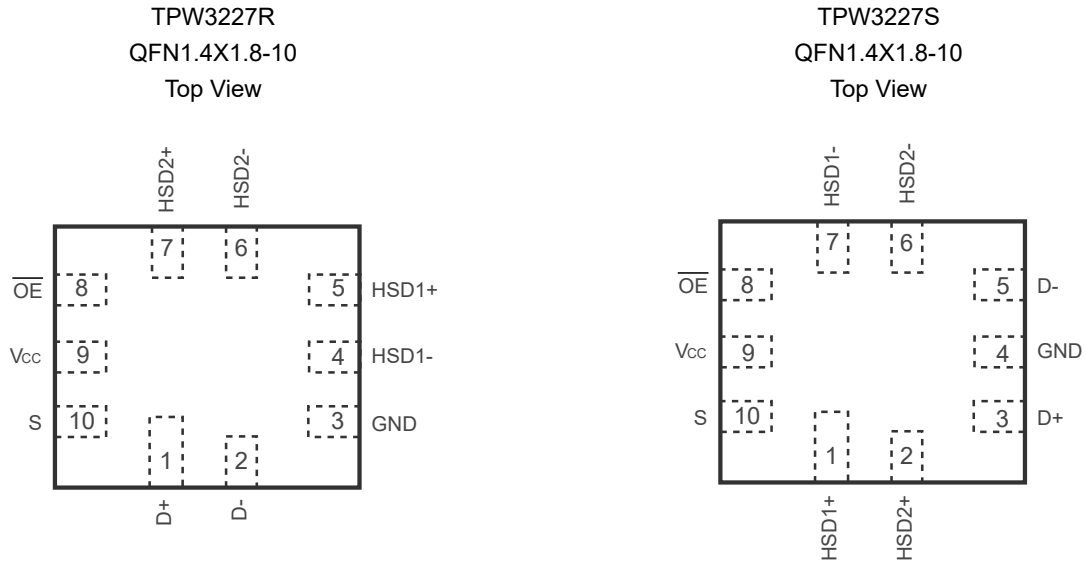


Table 1. Pin Functions : TPW3227

Pin No.		Name	I/O	Description
TPW3227R	TPW3227S			
1	3	D+	I/O	Common port
2	5	D-	I/O	Common Port
3	4	GND		Ground
4	7	HSD1-	I/O	Switch port 1
5	1	HSD1+	I/O	Switch port 1
6	6	HSD2-	I/O	Switch port 2
7	2	HSD2+	I/O	Switch port 2
8	8	$\overline{OE}$	I	Bus-switch enable
9	9	V _{CC}		Power supply
10	10	S	I	Select input

Table 2. Function Table

$\overline{OE}$	S	HSD1+, HSD1-	HSD2+, HSD2-
Low	Low	ON	OFF
Low	High	OFF	ON
High	X	OFF	OFF

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Specifications

Absolute Maximum Ratings ⁽¹⁾

Parameter		Min	Max	Unit
	Supply Voltage, V_{CC}	0	6.5	V
	Control Input Voltage, V_S , V_{OE}	-0.3	6.5	V
	Switch I/O Port Voltage	-0.3	6.5	V
	On-state Switch Continuous Current	-50	+50	mA
	On-state Switch Peak Current	-100	+100	mA
T_J	Maximum Junction Temperature		150	°C
T_{STG}	Storage Temperature Range	-65	150	°C
T_L	Lead Temperature (Soldering, 10 sec)		260	°C

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

ESD, Electrostatic Discharge Protection

Symbol	Parameter	Condition	Minimum Level	Unit
HBM	Human Body Model ESD	ANSI/ESDA/JEDEC JS-001 ⁽¹⁾	±4	kV
CDM	Charged Device Model ESD	ANSI/ESDA/JEDEC JS-002 ⁽²⁾	±1.5	kV

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

Recommended Operating Conditions ⁽¹⁾

All test conditions: over the operating temperature range, unless otherwise noted.

Parameter	Min	Max	Unit
Supply Voltage, V_{CC}	1.8	5.5	V
Control Input Voltage, V_S , V_{OE}	0	5.5	V
Switch I/O Port Voltage	0	V_{CC}	V
Operating Temperature Range	-40	125	°C

(1) The control input must be held HIGH or LOW and must not float.

Thermal Information

Package Type	θ_{JA}	θ_{JC}	Unit
QFN1.4X1.8-10	150	100	°C/W

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Electrical Characteristics

All test conditions: over operating temperature range, unless otherwise noted.

Symbol	Parameter	Conditions	Temp	Min	Typ	Max	Unit
Power Supply							
I_{CC}	Active Supply Current	$V_{CC} = 5.5\text{ V}$, $\overline{OE} = 0\text{ V}$, $S = 0\text{ V}$ or V_{CC} , $V_{IO} = 0\text{ V}$ or floating	Full		4.5	7	μA
I_{STDN}	Shutdown Supply Current (low power mode)	$V_{CC} = 5.5\text{ V}$, $\overline{OE} = V_{CC}$, $S = 0\text{ V}$ or V_{CC} , $V_{IO} = 0\text{ V}$ or floating	Full			1	μA
ΔI_{CC}	Increase in I_{CC} per Input	$V_{CC} = 5.5\text{ V}$, One input at 1.8 V, others at V_{CC} or GND	Full			12	μA
Digital Input							
V_{IH}	Input Voltage High, control pin ($\overline{OE}$, S)		Full	1.5			V
V_{IL}	Input Voltage Low, control pin ($\overline{OE}$, S)		Full			0.5	V
I_{IN}	Control Input Leakage	$V_{CC} = 5.5\text{ V}$, $V_{IN} = 0\text{ V}$ or V_{CC}	Full	-1		1	μA
Analog Switch							
R_{ON}	ON-state Resistance	$V_{CC} = 3\text{ V}$, $I_{OUT} = 8\text{ mA}$, $V_{IN} = 0\text{ V}$ to 0.4 V	Full		7.3	11	Ω
R_{ON}	ON-state Resistance	$V_{CC} = 5\text{ V}$, $I_{OUT} = 8\text{ mA}$, $V_{IN} = 0\text{ V}$ to 0.4 V	Full		5.6	8	Ω
ΔR_{ON}	ON-state Resistance Match between Channels	$V_{CC} = 3\text{ V}$, $I_{OUT} = 8\text{ mA}$, $V_{IN} = 0\text{ V}$ to 0.4 V	Full		0.8	1	Ω
ΔR_{ON}	ON-state Resistance Match between Channels	$V_{CC} = 5\text{ V}$, $I_{OUT} = 8\text{ mA}$, $V_{IN} = 0\text{ V}$ to 0.4 V	Full		0.8	1	Ω
$R_{FLAT(ON)}$	On-state Resistance Flatness	$V_{CC} = 3\text{ V}$, $I_{OUT} = 8\text{ mA}$, $V_{IN} = 0\text{ V}$ to 1 V	Full		0.04	0.2	Ω
$R_{FLAT(ON)}$	On-state Resistance Flatness	$V_{CC} = 5\text{ V}$, $I_{OUT} = 8\text{ mA}$, $V_{IN} = 0\text{ V}$ to 1 V	Full		0.04	0.2	Ω
$I_{D(OFF)}$	Power OFF Leakage Current on D	$V_{CC} = 0\text{ V}$, $\overline{OE}$, S = 0 V or 3.6 V, $V_D = 0\text{ V}$ to 3.6 V, HSDn floating	Full	-1		1	μA
$I_{D(OFF)}$	Power OFF Leakage Current on D	$V_{CC} = 0\text{ V}$, $\overline{OE}$, S = 0 V or 5.5 V, $V_D = 0\text{ V}$ to 5.5 V, HSDn floating	Full	-1		1	μA
$I_{HSD(OFF)}$	Switch OFF Leakage Current on HSDn	$V_{CC} = 3.6\text{ V}$, $\overline{OE} = V_{CC}$, S = 0 V or V_{CC} , $V_D = 3.3\text{ V}$, 0.3 V, $V_{HSDn} = 0.3\text{ V}$, 3.3 V	Full	-1		1	μA

High-Speed 1:2 Multiplexer and Demultiplexer Analog Switch

Symbol	Parameter	Conditions	Temp	Min	Typ	Max	Unit
$I_{HSD(OFF)}$	Switch OFF Leakage Current on HSDn	$V_{CC} = 5.5\text{ V}$, $\overline{OE} = V_{CC}$, $S = 0\text{ V}$ or V_{CC} , $V_D = 4.5\text{ V}$, 1 V , $V_{HSDn} = 1\text{ V}$, 4.5 V	Full	-1		1	μA
$I_{HSD(ON)}$	Switch ON Leakage Current on HSDn	$V_{CC} = 3.6\text{ V}$, $\overline{OE} = 0\text{ V}$, $S = 0\text{ V}$ or V_{CC} , D floating, $V_{HSDn} = 0.3\text{ V}$ or 3.3 V	Full	-1		1	μA
$I_{HSD(ON)}$	Switch ON Leakage Current on HSDn	$V_{CC} = 5.5\text{ V}$, $\overline{OE} = 0\text{ V}$, $S = 0\text{ V}$ or V_{CC} , D floating, $V_{HSDn} = 1\text{ V}$ or 4.5 V	Full	-1		1	μA
Dynamic Characteristics							
t_{PD}	Propagation Delay	$V_{CC} = 3.3\text{ V}$, $R_L = 50\ \Omega$, $C_L = 10\text{ pF}$, Figure 11	25°C		50		ps
t_{PD}	Propagation Delay	$V_{CC} = 5\text{ V}$, $R_L = 50\ \Omega$, $C_L = 10\text{ pF}$, Figure 11	25°C		50		ps
skew	Output Skew Between Channels	$V_{CC} = 3.3\text{ V}$, $R_L = 50\ \Omega$, $C_L = 10\text{ pF}$	25°C		10		ps
skew	Output Skew Between Channels	$V_{CC} = 5\text{ V}$, $R_L = 50\ \Omega$, $C_L = 10\text{ pF}$	25°C		10		ps
t_{ON}	Switch Turn-on Time	$V_{CC} = 3.3\text{ V}$, $V_{IN} = 0.8\text{ V}$, $R_L = 50\ \Omega$, $C_L = 10\text{ pF}$, Figure 5	25°C		40		ns
t_{ON}	Switch Turn-on Time	$V_{CC} = 5\text{ V}$, $V_{IN} = 0.8\text{ V}$, $R_L = 50\ \Omega$, $C_L = 10\text{ pF}$, Figure 5	25°C		30		ns
t_{OFF}	Switch Turn-off Time	$V_{CC} = 3.3\text{ V}$, $V_{IN} = 0.8\text{ V}$, $R_L = 50\ \Omega$, $C_L = 10\text{ pF}$, Figure 5	25°C		15		ns
t_{OFF}	Switch Turn-off Time	$V_{CC} = 5\text{ V}$, $V_{IN} = 0.8\text{ V}$, $R_L = 50\ \Omega$, $C_L = 10\text{ pF}$, Figure 5	25°C		15		ns
t_B	Break-Before-Make Time	$V_{CC} = 3.3\text{ V}$, $V_{IN} = 0.8\text{ V}$, $R_L = 50\ \Omega$, $C_L = 10\text{ pF}$, Figure 6	25°C		30		ns
t_B	Break-Before-Make Time	$V_{CC} = 5\text{ V}$, $V_{IN} = 0.8\text{ V}$, $R_L = 50\ \Omega$, $C_L = 10\text{ pF}$, Figure 6	25°C		22		ns
Q	Charge Injection	$V_{CC} = 3.3\text{ V}$, $C_L = 1.0\text{ nF}$, $V_{GEN} = 0\text{ V}$, $R_{GEN} = 0\ \Omega$, Figure 7	25°C		4		pC
Q	Charge Injection	$V_{CC} = 5\text{ V}$, $C_L = 1.0\text{ nF}$, $V_{GEN} = 0\text{ V}$, $R_{GEN} = 0\ \Omega$, Figure 7	25°C		5.5		pC
	OFF-Isolation	$V_{CC} = 3.3\text{ V}$, $f = 250\text{ MHz}$, $R_L = 50\ \Omega$, Figure 8	25°C		-24		dB
	OFF-Isolation	$V_{CC} = 5\text{ V}$, $f = 250\text{ MHz}$, $R_L = 50\ \Omega$, Figure 8	25°C		-24		dB
	Crosstalk	$V_{CC} = 3.3\text{ V}$, $f = 250\text{ MHz}$, $R_L = 50\ \Omega$, Figure 9	25°C		-40		dB
	Crosstalk	$V_{CC} = 5\text{ V}$, $f = 250\text{ MHz}$, $R_L = 50\ \Omega$, Figure 9	25°C		-40		dB

High-Speed 1:2 Multiplexer and Demultiplexer Analog Switch

Symbol	Parameter	Conditions	Temp	Min	Typ	Max	Unit
BW	Bandwidth	$V_{CC} = 3.3\text{ V}$, $R_L = 50\ \Omega$, Figure 10	25°C		2500		MHz
BW	Bandwidth	$V_{CC} = 5\text{ V}$, $R_L = 50\ \Omega$, Figure 10	25°C		2500		MHz
Capacitance							
C_{ON}	On Capacitance	$V_{CC} = 3.3\text{ V}$, $f = 1\text{ MHz}$, $f = 30\text{ MHz}$	25°C		3.6		pF
C_{ON}	On Capacitance	$V_{CC} = 3.3\text{ V}$, $f = 250\text{ MHz}$	25°C		1.8		pF

(1) C_{ON} is guaranteed by simulation.

High-Speed 1:2 Multiplexer and Demultiplexer Analog Switch

Typical Performance Characteristics

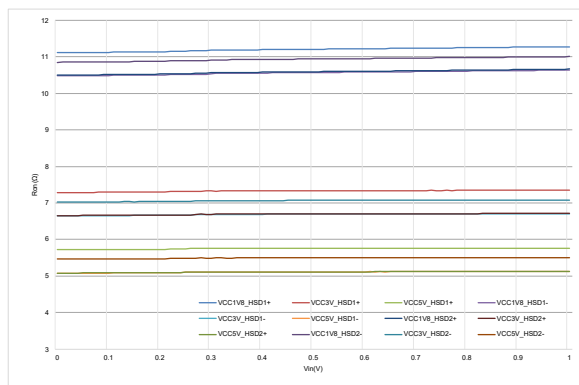


Figure 1. R_{ON} , $V_{CC} = 1.8\text{ V}, 3\text{ V}, 5\text{ V}$, Temp = 25°C

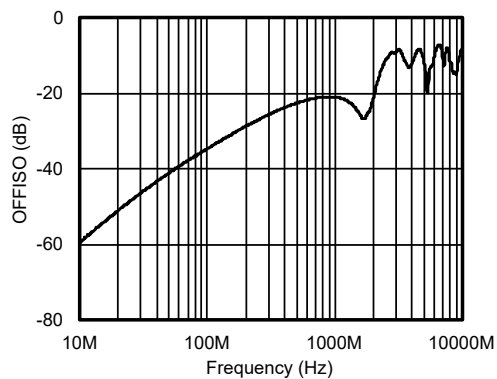


Figure 2. Off-Isolation, $V_{CC} = 3.3\text{ V}$

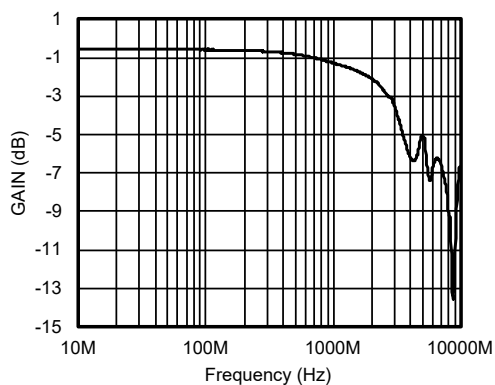


Figure 3. Bandwidth, $V_{CC} = 3.3\text{ V}$

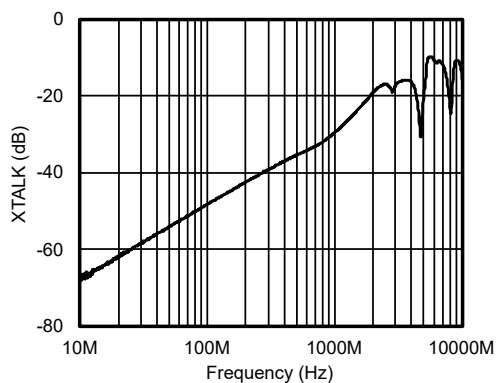


Figure 4. Crosstalk, $V_{CC} = 3.3\text{ V}$

Test Circuit and Waveforms

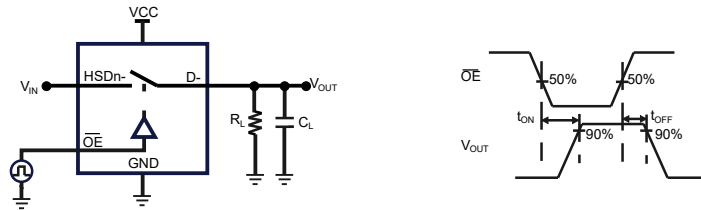


Figure 5. AC Test Circuit and Test Waveforms

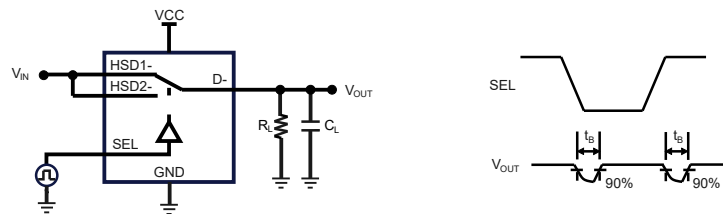


Figure 6. Switch Break Time

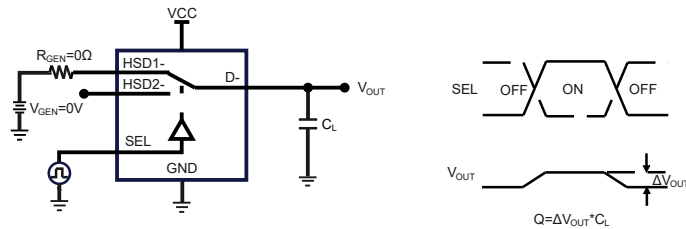


Figure 7. Charge Injection

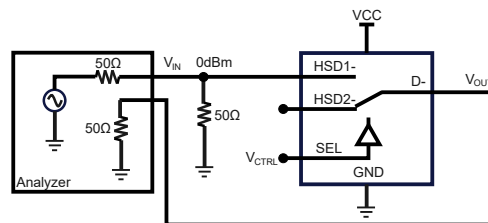


Figure 8. Off Isolation

High-Speed 1:2 Multiplexer and Demultiplexer Analog Switch

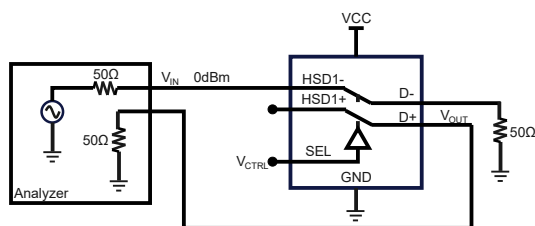


Figure 9. Crosstalk

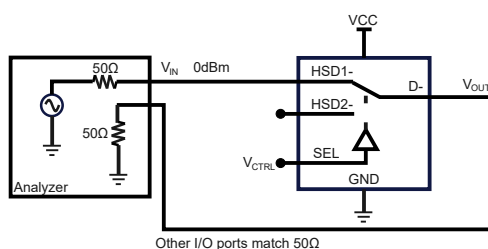


Figure 10. Bandwidth

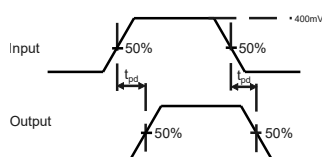


Figure 11. Propagation Delay

Application and Implementation

Note

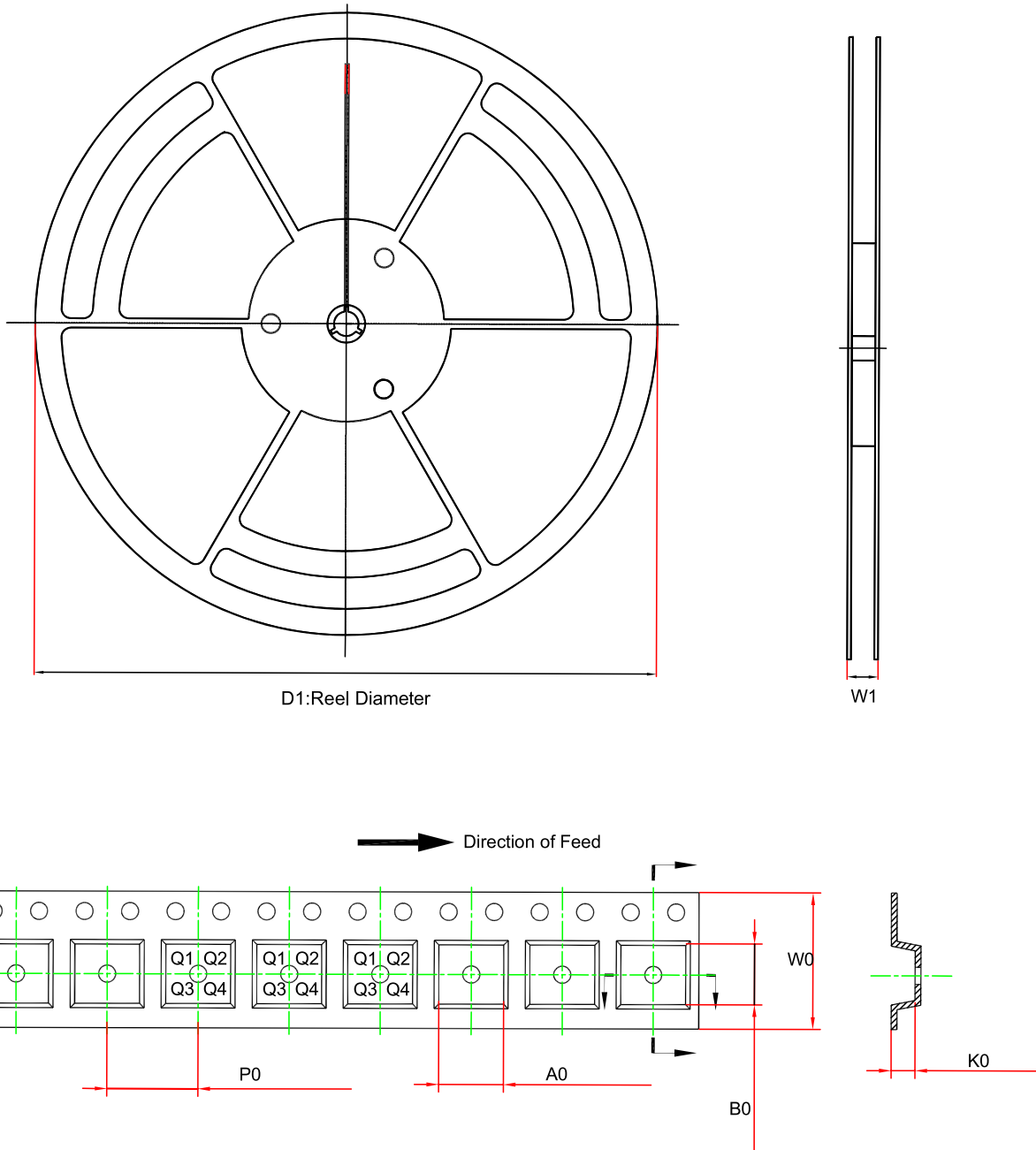
Information in the following application sections is not part of the 3PEAK's component specification and 3PEAK does not warrant its accuracy or completeness. 3PEAK's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

Application Information

A 0.1- μ F bypass capacitor on V_{CC} and GND is recommended to prevent power disturbance.

High-Speed 1:2 Multiplexer and Demultiplexer Analog Switch

Tape and Reel Information



Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm) ⁽¹⁾	B0 (mm) ⁽¹⁾	K0 (mm) ⁽¹⁾	P0 (mm)	W0 (mm)	Pin1 Quadrant
TPW3227R-QFQR	QFN1.4X1.8-10	180.0	13.1	1.6	2	0.85	4.00	8.00	Q1
TPW3227S-QFQR	QFN1.4X1.8-10	180.0	13.1	1.6	2	0.85	4.00	8.00	Q1

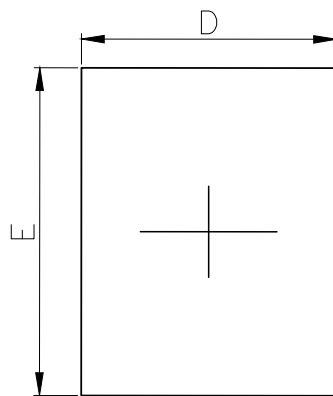
(1) The value is for reference only. Contact the 3PEAK factory for more information.

Package Outline Dimensions

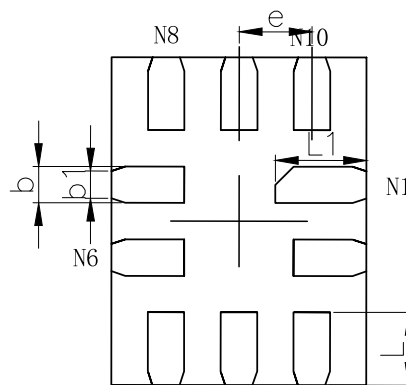
QFN1.4X1.8-10

Package Outline Dimensions

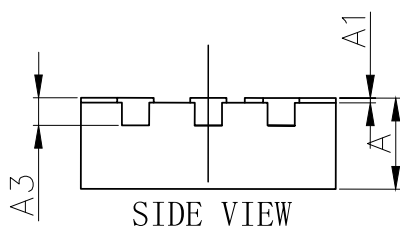
QFQ(QFN1.4X1.8-10-A)



TOP VIEW



BOTTOM VIEW



SIDE VIEW

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.500	0.600	0.020	0.024
A1	0.000	0.050	0.000	0.002
b	0.150	0.250	0.006	0.010
b1	0.100	0.200	0.004	0.008
A3	0.152 REF		0.006 REF	
D	1.350	1.450	0.053	0.057
E	1.750	1.850	0.069	0.073
e	0.400 BSC		0.016 BSC	
L	0.350	0.450	0.014	0.018
L1	0.450	0.550	0.018	0.022

NOTES

1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

High-Speed 1:2 Multiplexer and Demultiplexer Analog Switch**Order Information**

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity	Eco Plan
TPW3227R-QFQR	-40 to 125°C	QFN1.4X1.8-10	AAF	MSL3	Tape and Reel,4000	Green
TPW3227S-QFQR ⁽¹⁾	-40 to 125°C	QFN1.4X1.8-10	AAG	MSL3	Tape and Reel,4000	Green

(1) For future products, contact the 3PEAK factory for more information and samples.

Green: 3PEAK defines "Green" to mean RoHS compatible and free of halogen substances.

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