

Features

- Latch-up Performance Exceeds 600 mA per JESD 78, Class II
- Supply Voltage: 1.65 V to 5.5 V
- Low On-State Resistance: Typical 0.6 Ω at $V_S = 2.7$ V
- Bandwidth: 80 MHz
- Break-Before-Make Switching
- Operation Temperature Range: -40°C to 85°C

Applications

- Industry Control Systems
- Battery-Powered Systems
- Audio Signal Routing
- Portable Instruments and Mobile Device

Description

The TPW1221 is a high-performance Single Pole/Double Throw (SPDT) analog switch. The device features ultra-low RON of 0.6-Ω maximum at 2.7-V V_{CC} and operates over a wide V_{CC} range from 1.65 V to 5.5 V.

The TPW1221 features very low quiescent current even when the control voltage is lower than the V_{CC} supply. This feature serves the portable applications very well allowing for a direct interface with processor general purpose I/Os.

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Revision History

Date	Revision	Notes
2020-06-15	Rev.A.0	Initial version.
2020-07-13	Rev.A.1	Added $V_{CC} = 1.65\text{ V}$ to 1.95 V spec.
2020-08-01	Rev.A.2	<ul style="list-style-type: none">Corrected the typo in Page 7, $V_{CC} = 1.65\text{ V}$ to 1.95 V spec.Changed the condition of timing spec from NCx or $NOx = 1.5\text{ V}$ to NCx or $NOx = 1\text{ V}$.
2024-12-12	Rev.A.3	The following updates are all about the new datasheet formats or typos, and the actual product remains unchanged. Updated to a new datasheet format. Updated the Package Outline Dimensions.

Pin Configuration and Functions

TPW1221
QFN1.4X1.8-10
Top View

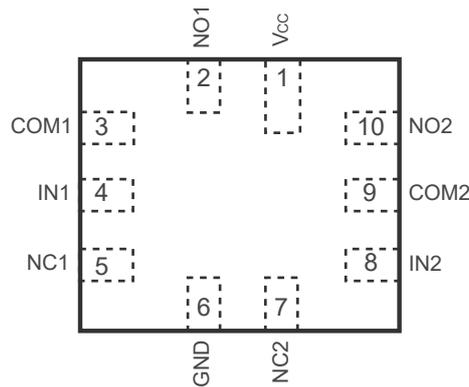


Table 1. Pin Functions

Pin No.	Name	I/O	Description
1	V _{CC}		Power supply
2	NO1		Switch port 1, normal open
3	COM1		Common switch port 1
4	IN1		Select pin 1
5	NC1		Switch port 1, normal close
6	GND		Ground
7	NC2		Switch port 2, normal close
8	IN2		Select pin 2
9	COM2		Common switch port 2
10	NO2		Switch port 2, normal open

Pin Description

Table 2. Function Table

IN1, IN2	NC1, NC2	NO1, NO2
Low	ON	OFF
High	OFF	ON

Specifications

Absolute Maximum Ratings ⁽¹⁾

Parameter		Min	Max	Unit
	Supply Voltage, V_{CC}	-0.5	6.9	V
	Select Input Voltage	-0.5	6.9	V
	Select Input Diode Current		-50	mA
	Switch I/O Port Voltage	Highest of -3 and $V_{CC} - 6.9$	$V_{CC} + 0.5$	V
	Switch I/O Port Diode Current	-50	50	mA
	Switch Current		250	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, Switch Pin ⁽¹⁾	8	kV
		ANSI/ESDA/JEDEC JS-001, Other Pin ⁽¹⁾	4	kV
CDM	Charged Device Model ESD	ANSI/ESDA/JEDEC JS-002 ⁽²⁾	1.5	kV
LU	Latch Up	JESD 78, 25°C	600	mA
		JESD 78, 125°C	400	mA

(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 operating temperature range, unless otherwise noted.

Parameter	Min	Max	Unit
Supply Voltage, V_{CC}	1.65	5.5	V
Select Input Voltage	0	V_{CC}	V
Input Transition Rise and Fall Rate		100	ns/V
Switch I/O Port Voltage ⁽²⁾	-2.5	V_{CC}	V

Low-Voltage 0.6-Ω SPDT Analog Switch

Parameter	Min	Max	Unit
Operating Temperature Range	-40	85	°C

- (1) The select input must be held HIGH or LOW and must not float.
- (2) The voltage across the switch should remain below 5.5 V.

Thermal Information

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

Electrical Characteristics

 All test conditions: $V_{CC} = 4.5\text{ V to }5.5\text{ V}$, unless otherwise noted.

Symbol	Parameter	Conditions	V_{CC} (V)	25°C	-40°C to 85°C	Limit	Unit
I_{CC}	Quiescent Supply Current	$V_{IN} = 0\text{ V or }V_{CC}$	5.5	1	2	Max	μA
ΔI_{CC}	Increase in I_{CC} per Input	Select input at 2.7 V, others at V_{CC} or GND	4.3	10	20	Max	μA
V_{IH}	Input Voltage High		5		1.6	Min	V
V_{IL}	Input Voltage Low		5		0.6	Max	V
I_{IN}	Control Input Leakage	$V_{IN} = 0\text{ V or }V_{CC}$	5.5	± 100	± 1	Max	μA
R_{ON}		$I_{OUT} = 100\text{ mA}$, NCx or $NOx = 3.5\text{ V}$	4.5	0.6		Typ	Ω
R_{ON}		$I_{OUT} = 100\text{ mA}$, NCx or $NOx = 3.5\text{ V}$	4.5	0.7	1	Max	Ω
ΔR_{ON}	On Resistance Match	$I_{OUT} = 100\text{ mA}$, NCx or $NOx = 3.5\text{ V}$	4.5	0.1	0.15	Max	Ω
$R_{FLAT(ON)}$	On Resistance Flatness	$I_{OUT} = 100\text{ mA}$, NCx or $NOx = 0\text{ V, }1\text{ V, }2\text{ V}$	4.5	0.2	0.25	Max	Ω
$I_{NO(OFF)}$, $I_{NC(OFF)}$	Switch OFF Leakage Current on B0, B1	$COMx = 1\text{ V, }4.5\text{ V}$, NCx or $NOx = 4.5\text{ V, }1\text{ V}$	5.5	± 100	$\pm 1,000$	Max	nA
$I_{A(OFF)}$	Switch OFF Leakage Current on A	$COMx = 1\text{ V, }4.5\text{ V}$, NCx or $NOx = 4.5\text{ V, }1\text{ V}$	5.5	± 100	$\pm 1,000$	Max	nA
$I_{A(ON)}$	Switch ON Leakage Current on A	$COMx = 1\text{ V, }4.5\text{ V}$, NCx or $NOx = \text{floating}$	5.5	± 100	$\pm 1,000$	Max	nA
t_{PHL} , t_{PLH}	Switch IN to OUT Time	NCx or $NOx = 3\text{ V}$, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, Figure 7	4.5	5		Typ	ns
t_{ON}	Switch Turn-on Time	NCx or $NOx = 3\text{ V}$, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, Figure 7	4.5	120	130	Max	ns
t_{OFF}	Switch Turn-off Time	NCx or $NOx = 3\text{ V}$, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, Figure 7	4.5	80	90	Max	ns
t_B	Break-Before-Make Time	NCx or $NOx = 3\text{ V}$, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, Figure 8	4.5	40		Typ	ns
Q	Charge Injection	$C_L = 1.0\text{ nF}$, $V_{GEN} = 0\text{ V}$, $R_{GEN} = 0\ \Omega$, Figure 9	5.5	20		Typ	pC
	OFF-Isolation	$f = 100\text{ kHz}$, $R_L = 50\ \Omega$, Figure 10	5	-65		Typ	dB
	Crosstalk	$f = 100\text{ kHz}$, $R_L = 50\ \Omega$, Figure 11	5	-65		Typ	dB
	Channel-to-Channel Crosstalk	$f = 100\text{ kHz}$, Figure 12	5	-120		Typ	dB
BW	Bandwidth	$R_L = 50\ \Omega$	5	80		Typ	MHz

Low-Voltage 0.6-Ω SPDT Analog Switch

Symbol	Parameter	Conditions	V _{CC} (V)	25°C	-40°C to 85°C	Limit	Unit
THD	Total Harmonic Distortion	R _L = 600 Ω, V _{IN} = 0.5 V _{PP} , f = 20 Hz to 20 kHz	5	-70		Typ	dB
C _{IN}	Select Input Capacitance		5	5		Typ	pF
C _{OFF}	OFF Capacitance		5	25		Typ	pF
C _{ON}	ON Capacitance		5	75		Typ	pF

Low-Voltage 0.6-Ω SPDT Analog Switch
Electrical Characteristics (Continued)

 All test conditions: $V_{CC} = 2.7\text{ V to }3.6\text{ V}$, unless otherwise noted.

Symbol	Parameter	Conditions	V_{CC} (V)	25°C	-40°C to 85°C	Limit	Unit
I_{CC}	Quiescent Supply Current	$V_{IN} = 0\text{ V or }V_{CC}$	3.6	1	2	Max	μA
ΔI_{CC}	Increase in I_{CC} per Input	Select input at 1.8 V, others at V_{CC} or GND	3.6	10	15	Max	μA
V_{IH}	Input Voltage High				1.3	Min	V
V_{IL}	Input Voltage Low				0.6	Max	V
I_{IN}	Control Input Leakage	$V_{IN} = 0\text{ V or }V_{CC}$	3.6		± 1	Max	μA
R_{ON}		$I_{OUT} = 100\text{ mA}$, NCx or NOx = ($V_{CC} - 4.5\text{ V}$), -1 V, 0 V, 1 V, 2 V, V_{CC}	2.7	0.6		Typ	Ω
			2.7	1.05	1.3	Max	Ω
ΔR_{ON}	On Resistance Match	$I_{OUT} = 100\text{ mA}$, NCx or NOx = ($V_{CC} - 4.5\text{ V}$), -1 V, 0 V, 1 V, 2 V, V_{CC}	2.7	0.05		Typ	Ω
			2.7	0.1	0.15	Max	Ω
$R_{FLAT(ON)}$	On Resistance Flatness	$I_{OUT} = 100\text{ mA}$, NCx or NOx = ($V_{CC} - 4.5\text{ V}$), -1 V, 0 V, 1 V, 2 V, V_{CC}	2.7	0.3		Typ	Ω
			2.7	0.37	0.45	Max	Ω
$I_{NO(OFF)}$, $I_{NC(OFF)}$	Switch OFF Leakage Current on B0, B1	COMx = -2.5V, 2.5 V, NCx or NOx = 2.5 V, -2.5 V	2.7	± 100	$\pm 1,000$	Max	nA
$I_{A(OFF)}$	Switch OFF Leakage Current on A	COMx = -2.5 V, 2.5 V, NCx or NOx = 2.5 V, -2.5 V	2.7	± 100	$\pm 1,000$	Max	nA
$I_{A(ON)}$	Switch ON Leakage Current on A	COMx = -2.5 V, 2.5 V, NCx or NOx = floating	2.7	± 100	$\pm 1,000$	Max	nA
t_{PHL} , t_{PLH}	Switch IN to OUT Time	NCx or NOx = 1.5 V, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, Figure 7	2.7	5		Typ	ns
t_{ON}	Switch Turn-on Time	NCx or NOx = 1.5 V, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, Figure 7	2.7	130	150	Max	ns
t_{OFF}	Switch Turn-off Time	NCx or NOx = 1.5 V, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, Figure 7	2.7	120	140	Max	ns
t_B	Break-Before-Make Time	NCx or NOx = 1.5 V, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, Figure 8	2.7	50		Typ	ns
Q	Charge Injection	$C_L = 1.0\text{ nF}$, $V_{GEN} = 0\text{ V}$, $R_{GEN} = 0\ \Omega$, Figure 9	3	10		Typ	pC
	OFF-Isolation	$f = 100\text{ kHz}$, $R_L = 50\ \Omega$, Figure 10	5	-65		Typ	dB
	Crosstalk	$f = 100\text{ kHz}$, $R_L = 50\ \Omega$, Figure 11	5	-65		Typ	dB
	Channel-to-Channel Crosstalk	$f = 100\text{ kHz}$, Figure 12	5	-120		Typ	dB
BW	Bandwidth	$R_L = 50\ \Omega$	3	80		Typ	MHz

Low-Voltage 0.6-Ω SPDT Analog Switch

Symbol	Parameter	Conditions	V _{CC} (V)	25°C	-40°C to 85°C	Limit	Unit
THD	Total Harmonic Distortion	R _L = 32 Ω, V _{IN} = 1 V _{RMS} , f = 20 Hz to 20 kHz	3.3	-69		Typ	dB

Low-Voltage 0.6-Ω SPDT Analog Switch
Electrical Characteristics (Continued)

 All test conditions: $V_{CC} = 1.65\text{ V to }1.95\text{ V}$, unless otherwise noted.

Symbol	Parameter	Conditions	V_{CC} (V)	25°C	-40°C to 85°C	Limit	Unit
I_{CC}	Quiescent Supply Current	$V_{IN} = 0\text{ V or }V_{CC}$	1.95	1	2	Max	μA
V_{IH}	Input Voltage High				1.2	Min	V
V_{IL}	Input Voltage Low				0.4	Max	V
I_{IN}	Control Input Leakage	$V_{IN} = 0\text{ V or }V_{CC}$	1.95		±1	Max	μA
R_{ON}		$I_{OUT} = 10\text{ mA}$, $NCx\text{ or }NOx = 0\text{ V, }0.8\text{ V, }1\text{ V}$	1.65	2		Typ	Ω
			1.65	6	10	Max	Ω
ΔR_{ON}	On Resistance Match	$I_{OUT} = 10\text{ mA}$, $NCx\text{ or }NOx = 0\text{ V, }0.8\text{ V, }1\text{ V}$	1.65	0.2		Typ	Ω
			1.65	1	1.5	Max	Ω
t_{PHL}, t_{PLH}	Switch IN to OUT Time	$NCx\text{ or }NOx = 1\text{ V, }R_L = 50\text{ }\Omega$, $C_L = 35\text{ pF}$, Figure 7	1.65	10		Typ	ns
t_{ON}	Switch Turn-on Time	$NCx\text{ or }NOx = 1\text{ V, }R_L = 50\text{ }\Omega$, $C_L = 35\text{ pF}$, Figure 7	1.65	240	300	Max	ns
t_{OFF}	Switch Turn-off Time	$NCx\text{ or }NOx = 1\text{ V, }R_L = 50\text{ }\Omega$, $C_L = 35\text{ pF}$, Figure 7	1.65	240	300	Max	ns
t_B	Break-Before-Make Time	$NCx\text{ or }NOx = 1\text{ V, }R_L = 50\text{ }\Omega$, $C_L = 35\text{ pF}$, Figure 8	1.65	50		Typ	ns

Typical Performance Characteristics

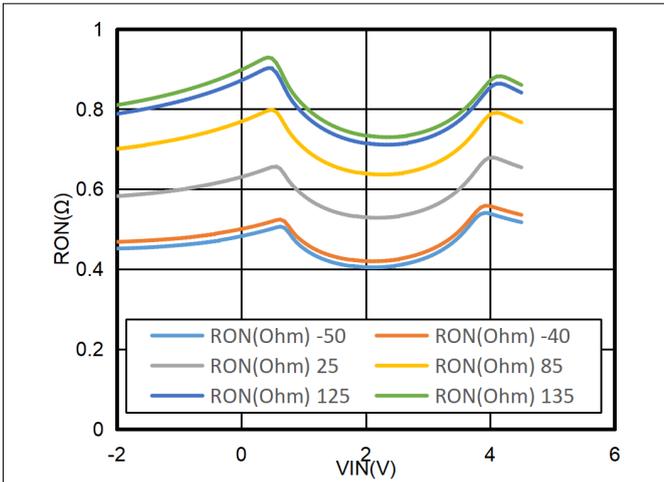


Figure 1. RON, V_{CC} = 4.5 V, Temp = -40, 25, 85, 125°C

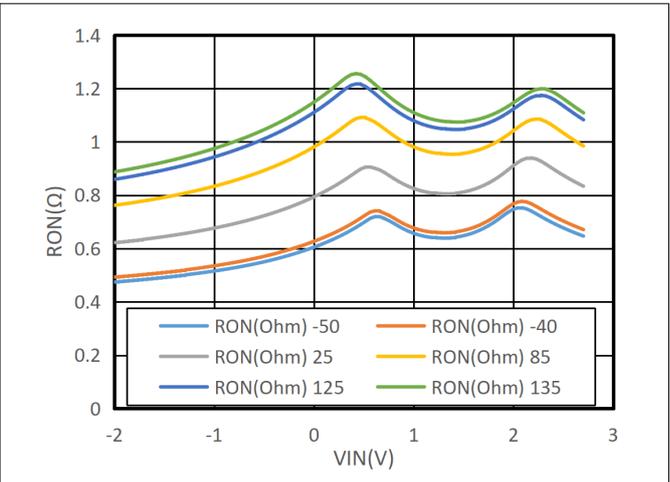


Figure 2. RON, V_{CC} = 2.7 V, Temp = -40, 25, 85, 125°C

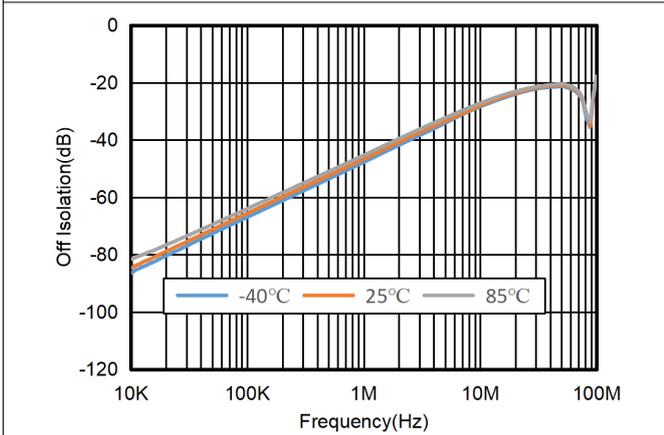


Figure 3. Off-Isolation, V_{CC} = 2.7 V

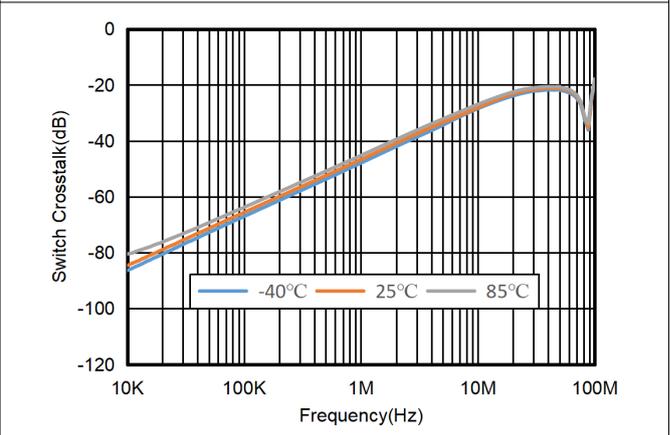


Figure 4. Crosstalk, V_{CC} = 2.7 V

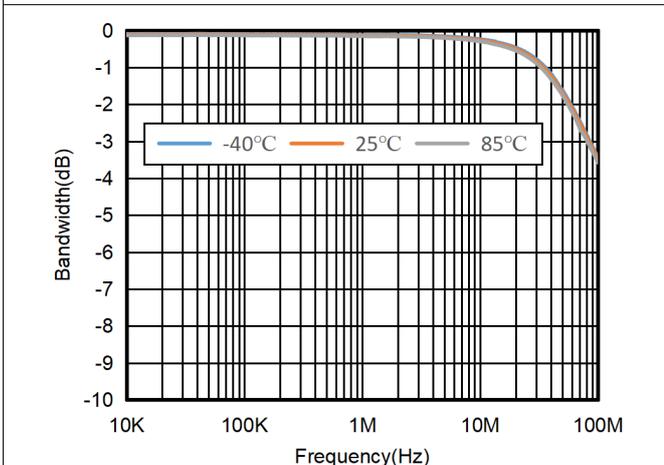


Figure 5. Bandwidth, V_{CC} = 2.7 V

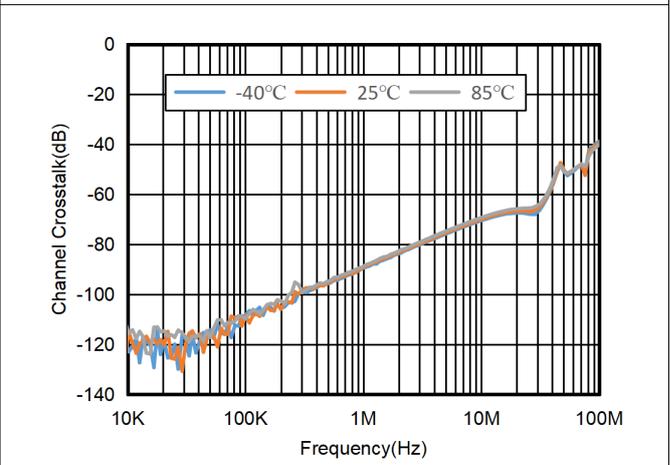


Figure 6. Channel-to-Channel Crosstalk, V_{CC} = 2.7 V

Test Circuit and Waveforms

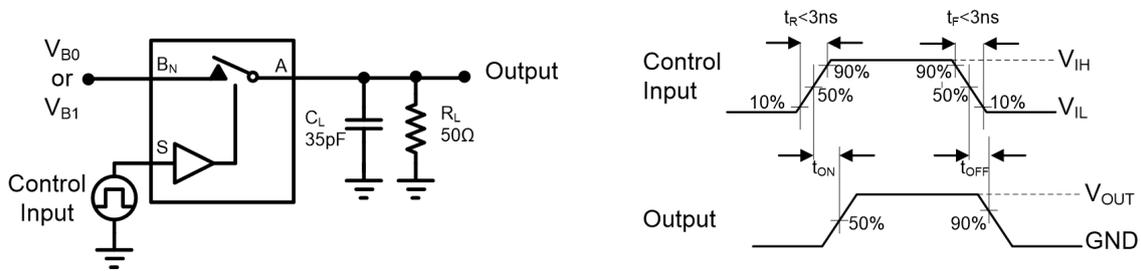


Figure 7. AC Test Circuit and Test Waveforms

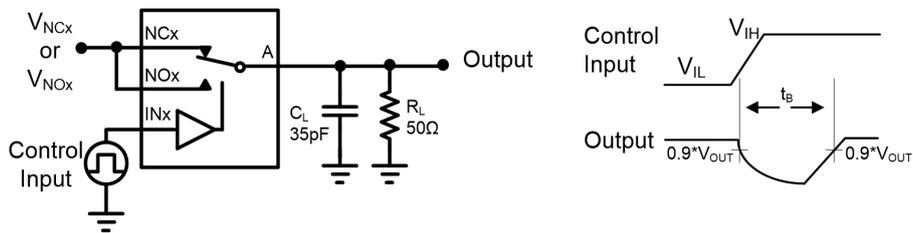


Figure 8. Switch Break Time

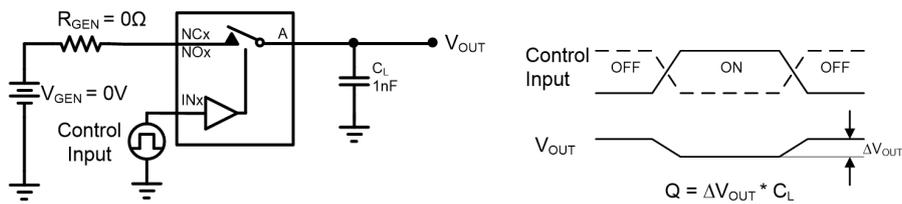


Figure 9. Charge Injection

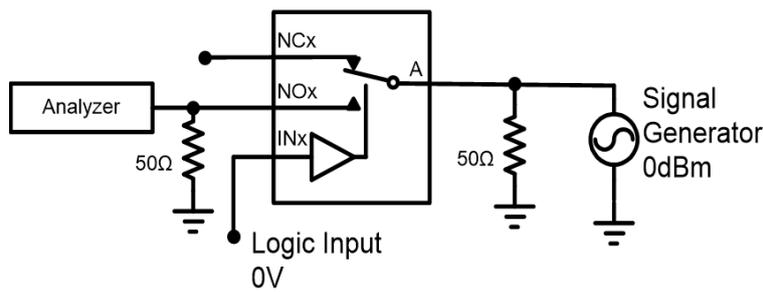


Figure 10. Off Isolation

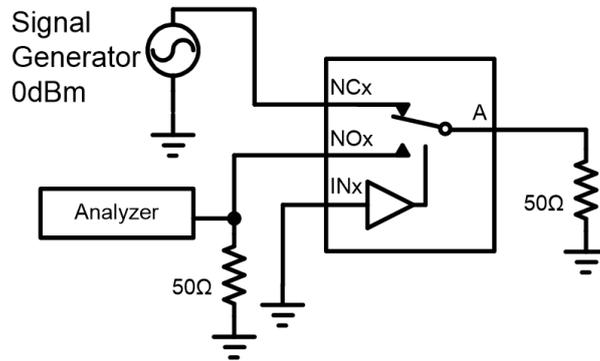


Figure 11. Crosstalk

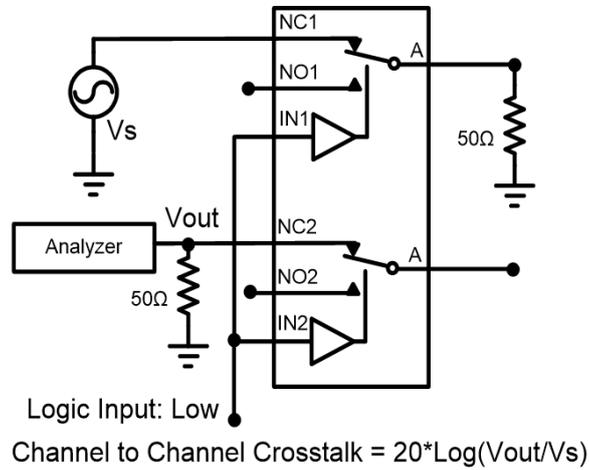


Figure 12. Channel-to-Channel Crosstalk, NC1 to NC2

Application and Implementation

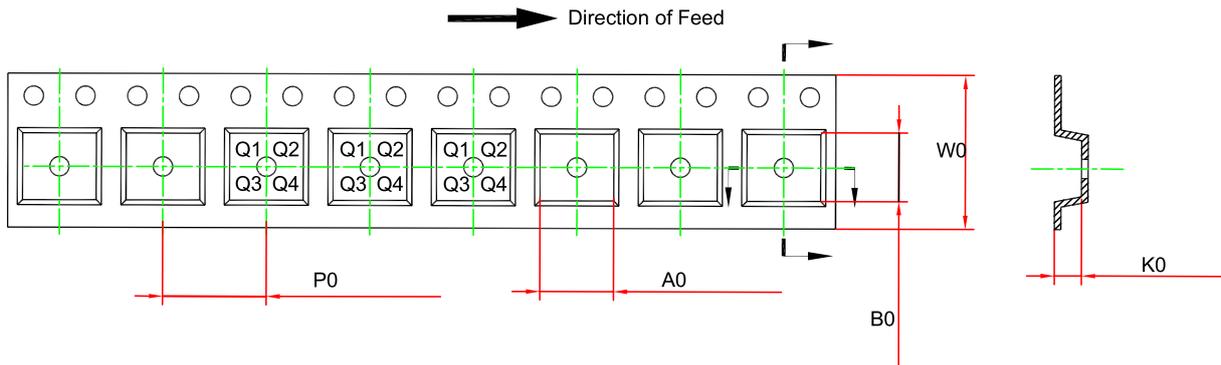
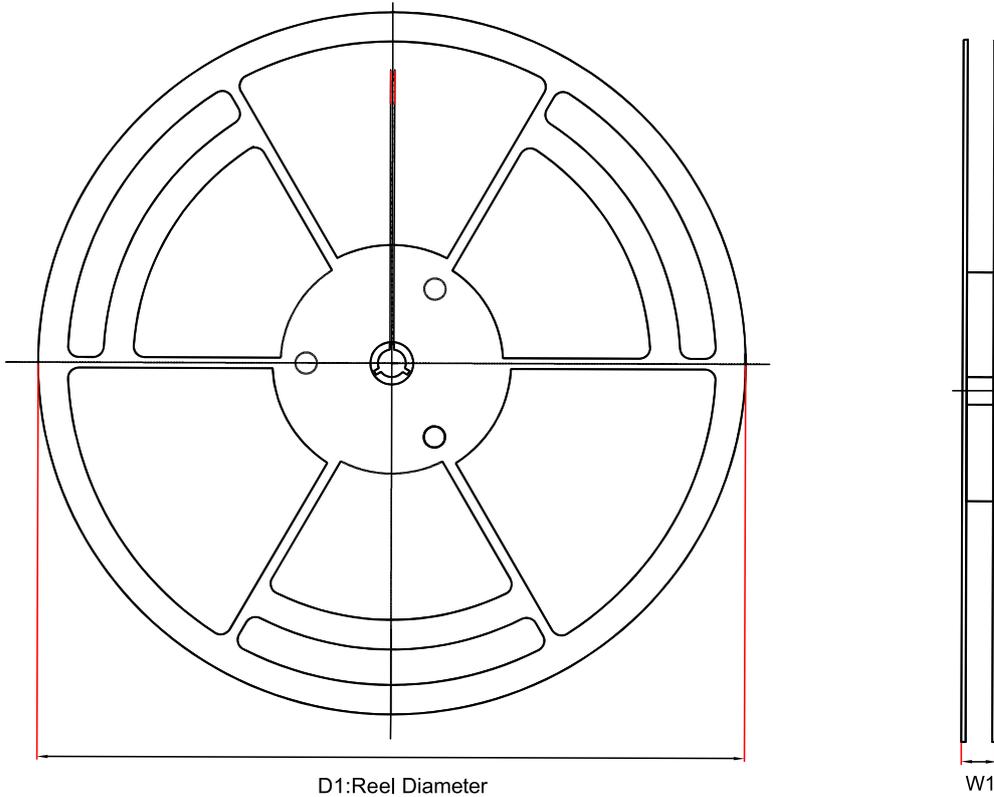
Note

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-μF bypass capacitor on V_{CC} and GND is recommended to prevent power disturbance.

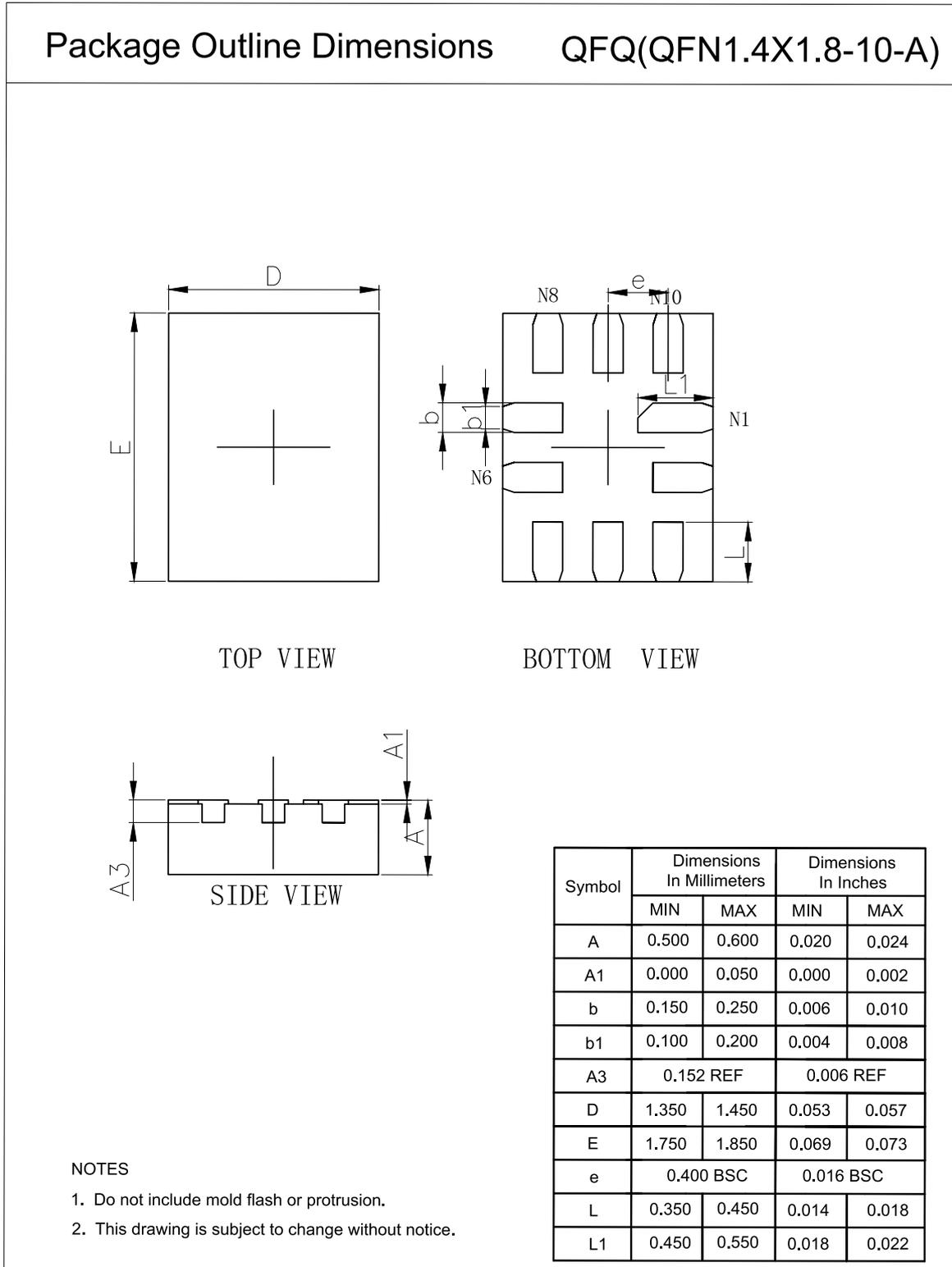
Tape and Reel Information



Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	W0 (mm)	Pin1 Quadrant
TPW1221-QF2AR	QFN1.4X1.8-10	180	13.1	1.6	2.0	0.85	4	8	Q1

Package Outline Dimensions

QFN1.4X1.8-10



Order Information

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity	Eco Plan
TPW1221-QF2AR	-40 to 85°C	QFN1.4X1.8-10	W12	3	Tape and Reel, 4000	Green

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

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