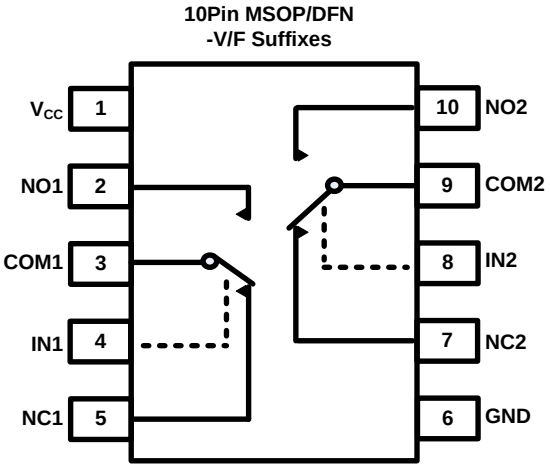
Features

- Latch-Up Performance Exceeds 800 mA Per JESD 78, Class II
- Supply Voltage: 1.65V to 5.5V
- Low ON-State Resistance: typical 0.95Ω at Vs = 4.5V
- Bandwidth: 100 MHz
- Fast switching times: t_{ON} =40 ns, t_{OFF} =15 ns
- Break-Before-Make Switching
- Operation Temperature Range: –40°C to 125°C

Applications

- Industry control systems
- Battery-powered systems
- Audio Signal Routing
- Portable Instruments and Mobile Device

Pin Configuration



Function Table

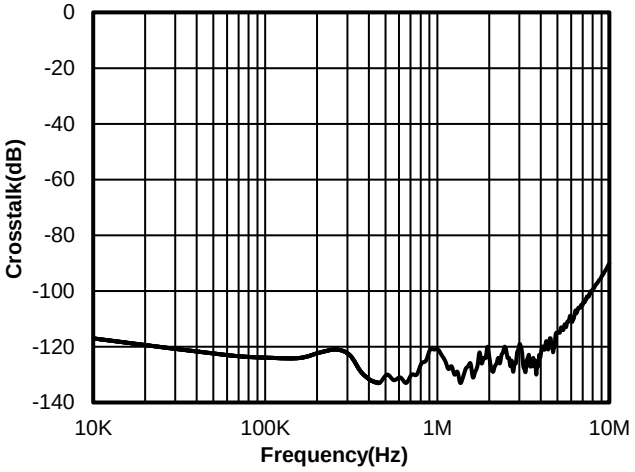
IN1, IN2	NC1, NC2	NO1, NO2
Low	ON	OFF
High	OFF	ON

Description

TPW3221 is high performance Single Pole/Double Throw (SPDT) analog switches. The devices feature ultra low RON of 1.2Ω maximum at 4.5V V_{CC} and will operate over the wide V_{CC} range of 1.65V to 5.5V.

The TPW3221 features very low quiescent current even when the control voltage is lower than the V_{CC} supply. This feature services the portable applications very well allowing for the direct interface with processor general purpose I/Os.

The TPW3221 has very excellent channel to channel crosstalk performance to fit the application with high channel to channel isolation requirement.



Pin Description

Pin name	Pin No	Pin function
V_{CC}	1	Power supply
NO1	2	Switch Port 1, Normal Open
COM1	3	Common switch port 1
IN1	4	Select pin 1
NC1	5	Switch Port 1, Normal Close
GND	6	Ground
NC2	7	Switch Port 2, Normal Close
IN2	8	Select pin 2
COM2	9	Common switch port 2
NO2	10	Switch Port 2, Normal Open

Table of Contents

Revision History

Date	Revision	Notes
2018/6/24	Rev.Pre	Pre-Release Version
2019/1/28	Rev.0	Initial Version
2019/7/24	Rev.0.01	Update Tape and Reel Information of TPW3221-FR: 3000->4000, remove data code information Correct Toff test condition in figure 6: 50% of output -> 90% of output Spec of ΔRON at 1.65Vcc change: 2/3/3ohm –> 5/7/7ohm Spec of Ton/Toff/Tb at 1.65Vcc change: “max” -> “typ”

Order Information

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity
TPW3221-VR	-40 to 125°C	10-Pin MSOP	W3221	3	Tape and Reel, 3000
TPW3221-FR	-40 to 125°C	10-Pin DFN 3*3	W3221	3	Tape and Reel, 4000

Absolute Maximum Ratings Note 1

Parameters	Rating
Supply Voltage, V_{CC}	-0.5V to 6V
Select Input Voltage	-0.5V to 6V
Select Input Diode Current	–50mA
Switch I/O Port Voltage	-0.5 to V_{CC} + 0.5
Switch I/O Port diode current	±50mA
Switch Current	200mA
Maximum Junction Temperature	150°C
Storage Temperature Range	–65 to 150°C
Lead Temperature (Soldering, 10 sec)	260°C

Note 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 Rating

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

Thermal Information

Package Type	θ_{JA}	θ_{JC}	Unit
10-Pin MSOP	150	100	°C/W
10-Pin DFN 3*3	75	54	°C/W

Recommended Operating Conditions Note 1

Over operating temperature range

Parameters	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	0V	V_{CC}	V
Operating Temperature Range	–40	125	°C

Note 1: Select input must be held HIGH or LOW and it must not float.

Electrical Characteristics

V_{CC} = 4.5 to 5.5V, unless otherwise noted.

Symbol	Parameter	Conditions	V_{CC} (V)	25°C	-40°C to 85°C	-40°C to 125°C	Limit	Unit
Power Supply								
I_{CC}	Quiescent Supply Current	V_{IN} = 0V or V_{CC}	5.5	0.3	0.5	1.5	Max	μA
ΔI_{CC}	Increase in I_{CC} per Input	Select Input at 2.7V, others at V_{CC} or GND	4.3	30	35	35	Max	μA
Digital Input								
V_{IH}	Input Voltage High				2.4	2.4	Min	V
V_{IL}	Input Voltage Low				0.8	0.8	Max	V
I_{IN}	Control Input Leakage	V_{IN} = 0V or V_{CC}	5.5		±1	±1	Max	μA
Analog Switch								
R_{ON}		I_{OUT} = 100mA, NCx or NOx = 3.5V	4.5	0.95			Typ	Ω
R_{ON}		I_{OUT} = 100mA, NCx or NOx = 3.5V	4.5	1.2	1.4	1.5	Max	Ω
ΔR_{ON}	Maximum ON resistance	I_{OUT} = 100mA, NCx or NOx = 3.5V	4.5	0.12	0.15	0.2	Max	Ω
$R_{FLAT(ON)}$	On Resistance Flatness	I_{OUT} = 100mA, NCx or NOx = 0V, 1V, 2V	4.5	0.3	0.4	0.5	Max	Ω
$I_{NO(OFF)}$, $I_{NC(OFF)}$	Switch OFF Leakage Current on B0, B1	COMx = 1V, 4.5V, NCx or NOx = 4.5V, 1V	5.5	±10	±25	±50	Max	nA
$I_{A(OFF)}$	Switch OFF Leakage Current on A	COMx = 1V, 4.5V, NCx or NOx = 4.5V, 1V	5.5	±10	±50	±100	Max	nA
$I_{A(ON)}$	Switch ON Leakage Current on A	COMx = 1V, 4.5V, NCx or NOx = 1V, 4.5V or Floating	5.5	±10	±50	±100	Max	nA
Dynamic Characteristics								
t_{PHL}, t_{PLH}	Switch IN to OUT time	NCx or NOx = 3V,RL = 50Ω, CL = 35pF, Figure 7	4.5	5			Typ	ns
t_{ON}	Switch turn-on time	NCx or NOx = 3V,RL = 50Ω, CL = 35pF, Figure 7	4.5	40	45	45	Max	ns
t_{OFF}	Switch turn-off time	NCx or NOx = 3V,RL = 50Ω, CL = 35pF, Figure 7	4.5	15	20	20	Max	ns
t_B	Break before make time	NCx or NOx = 3V,RL = 50Ω, CL = 35pF, Figure 8	4.5	20	40	40	Typ	ns
Q	Charge Injection	C_L = 1.0nF, V_{GEN} = 0V, R_{GEN} = 0Ω, Figure 9	5.5	20			Typ	pC
	OFF-Isolation	f = 1MHz, RL = 50Ω, Figure 10	5	-65			Typ	dB
	Crosstalk	f = 1MHz, RL = 50Ω, Figure 11	5	-65			Typ	dB
	Channel to Channel Crosstalk	f = 1MHz, Figure 12	5	-120			Typ	dB
BW	Bandwidth	R_L = 50Ω	5	100			Typ	MHz
THD	Total Harmonic Distortion	R_L = 600Ω, V_{IN} = 0.5V_{PP}, f = 20Hz to 20kHz	5	0.004			Typ	%
Capacitance								
C_{IN}	Select Input capacitance		5	5			Typ	pF
C_{OFF}	B-Port Off capacitance		5	12			Typ	pF
C_{ON}	ON Capacitance		5	40			Typ	pF

V_{CC} = 2.7 to 3.6V, unless otherwise noted.

Symbol	Parameter	Conditions	V_{CC} (V)	25°C	-40°C to 85°C	-40°C to 125°C	Limit	Unit
Power Supply								
I_{CC}	Quiescent Supply Current	V_{IN} = 0V or V_{CC}	3.6	0.3	0.5	1.5	Max	μA
Digital Input								
V_{IH}	Input Voltage High				1.65	1.65	Min	V
V_{IL}	Input Voltage Low				0.6	0.6	Max	V
I_{IN}	Control Input Leakage	V_{IN} = 0V or V_{CC}	3.6		±1	±1	Max	μA
Analog Switch								
R_{ON}		I_{OUT} = 100mA, NCx or NOx = 1.5V	2.7	2			Typ	Ω
R_{ON}		I_{OUT} = 100mA, NCx or NOx = 1.5V	2.7	2.1	2.3	2.6	Max	Ω
ΔR_{ON}	Maximum ON resistance	I_{OUT} = 100mA, NCx or NOx = 1.5V	2.7	0.1	0.15	0.2	Max	Ω
$R_{FLAT(ON)}$	On Resistance Flatness	I_{OUT} = 100mA, NCx or NOx = 0V, 0.75V, 1.5V	2.7	1.2	1.3	1.4	Max	Ω
$I_{NO(OFF)}$, $I_{NC(OFF)}$	Switch OFF Leakage Current on B0, B1	COMx = 0V, 3.6V, NCx or NOx = 3.6V, 0V	3.6	±10	±25	±50	Max	nA
$I_{A(OFF)}$	Switch OFF Leakage Current on A	COMx = 0V, 3.6V, NCx or NOx = 3.6V, 0V	3.6	±10	±50	±100	Max	nA
$I_{A(ON)}$	Switch ON Leakage Current on A	COMx = 0V, 3.6V, NCx or NOx = 0V, 3.6V or Floating	3.6	±10	±50	±100	Max	nA
Dynamic Characteristics								
t_{PHL}, t_{PLH}	Switch IN to OUT time	NCx or NOx = 1.5V,RL = 50Ω, CL = 35pF, Figure 7	2.7	10			Typ	ns
t_{ON}	Switch turn-on time	NCx or NOx = 1.5V,RL = 50Ω, CL = 35pF, Figure 7	2.7	60	70	70	Max	ns
t_{OFF}	Switch turn-off time	NCx or NOx = 1.5V,RL = 50Ω, CL = 35pF, Figure 7	2.7	25	30	30	Max	ns
t_B	Break before make time	NCx or NOx = 1.5V,RL = 50Ω, CL = 35pF, Figure 8	2.7	20			Typ	ns
Q	Charge Injection	C_L = 1.0nF, V_{GEN} = 0V, R_{GEN} = 0Ω, Figure 9	3	20			Typ	pC
	OFF-Isolation	f = 1MHz, R_L = 50Ω, Figure 10	3	-65			Typ	dB
	Crosstalk	f = 1MHz, R_L = 50Ω, Figure 11	3	-65			Typ	dB
	Channel to Channel Crosstalk	f = 1MHz, Figure 12	3	-120			Typ	dB
BW	Bandwidth	R_L = 50Ω	3	100			Typ	MHz
THD	Total Harmonic Distortion	R_L = 600Ω, V_{IN} = 0.5V_{PP}, f = 20Hz to 20kHz	3	0.01			Typ	%

V_{CC} = 1.65 to 1.95V, unless otherwise noted.

Symbol	Parameter	Conditions	V_{CC} (V)	25°C	-40°C to 85°C	-40°C to 125°C	Limit	Unit
Power Supply								
I_{CC}	Quiescent Supply Current	V_{IN} = 0V or V_{CC}	1.95	0.3	0.5	1.5	Max	μA
Digital Input								
V_{IH}	Input Voltage High				1.4	1.4	Min	V
V_{IL}	Input Voltage Low				0.4	0.4	Max	V
I_{IN}	Control Input Leakage	V_{IN} = 0V or V_{CC}	1.95		±1	±1	Max	μA
Analog Switch								
R_{ON}		I_{OUT} = 10mA, NCx or NOx = 0.9V	1.65	10			Typ	Ω
R_{ON}		I_{OUT} = 10mA, NCx or NOx = 0.9V	1.65	15	18	18	Max	Ω
ΔR_{ON}	Maximum ON resistance	I_{OUT} = 10mA, NCx or NOx = 0.9V	1.65	5	7	7	Max	Ω
$I_{NO(OFF)}$, $I_{NC(OFF)}$	Switch OFF Leakage Current on B0, B1	COMx = 0V, 1.95V, NCx or NOx = 1.95V, 0V	1.95	±10	±25	±50	Max	nA
$I_{A(OFF)}$	Switch OFF Leakage Current on A	COMx = 0V, 1.95V, NCx or NOx = 1.95V, 0V	1.95	±10	±50	±100	Max	nA
$I_{A(ON)}$	Switch ON Leakage Current on A	COMx = 0V, 1.95V, NCx or NOx = 0V, 1.95V or Floating	1.95	±10	±50	±100	Max	nA
Dynamic Characteristics								
t_{PHL}, t_{PLH}	Switch IN to OUT time	NCx or NOx = 1.0V,RL = 50Ω, CL = 35pF, Figure 7	1.65	10			Typ	ns
t_{ON}	Switch turn-on time	NCx or NOx = 1.0V,RL = 50Ω, CL = 35pF, Figure 7	1.65	80			Typ	ns
t_{OFF}	Switch turn-off time	NCx or NOx = 1.0V,RL = 50Ω, CL = 35pF, Figure 7	1.65	55			Typ	ns
t_B	Break before make time	NCx or NOx = 1.0V,RL = 50Ω, CL = 35pF, Figure 8	1.65	20			Typ	ns
Q	Charge Injection	C_L = 1.0nF, V_{GEN} = 0V, R_{GEN} = 0Ω, Figure 9	1.8	20			Typ	pC
	OFF-Isolation	f = 1MHz, R_L = 50Ω, Figure 10	1.8	-65			Typ	dB
	Crosstalk	f = 1MHz, R_L = 50Ω, Figure 11	1.8	-65			Typ	dB
	Channel to Channel Crosstalk	f = 1MHz, Figure 12	1.8	-120			Typ	dB
BW	Bandwidth	R_L = 50Ω	1.8	100			Typ	MHz
THD	Total Harmonic Distortion	R_L = 600Ω, V_{IN} = 0.5V_{PP}, f = 20Hz to 20kHz	1.8	0.01			Typ	%

T_{COMx} = 0°C to 50°C, unless otherwise noted.

Symbol	Parameter	Conditions	V_{CC} (V)	Spec	Limit	Unit
$I_{NO(OFF)}$, $I_{NC(OFF)}$	Switch OFF Leakage Current on B0, B1	COMx = 1V, 4.5V, NCx or NOx = 4.5V, 1V	3.6	±10	Max	nA
$I_{A(OFF)}$	Switch OFF Leakage Current on A	COMx = 1V, 4.5V, NCx or NOx = 4.5V, 1V	3.6	±20	Max	nA
$I_{A(ON)}$	Switch ON Leakage Current on A	COMx = 1V, 4.5V, NCx or NOx = 1V, 4.5V or Floating	3.6	±20	Max	nA
$I_{NO(OFF)}$, $I_{NC(OFF)}$	Switch OFF Leakage Current on B0, B1	COMx = 1V, 4.5V, NCx or NOx = 4.5V, 1V	5.5	±10	Max	nA
$I_{A(OFF)}$	Switch OFF Leakage Current on A	COMx = 1V, 4.5V, NCx or NOx = 4.5V, 1V	5.5	±20	Max	nA
$I_{A(ON)}$	Switch ON Leakage Current on A	COMx = 1V, 4.5V, NCx or NOx = 1V, 4.5V or Floating	5.5	±20	Max	nA

Typical Performance Characteristics

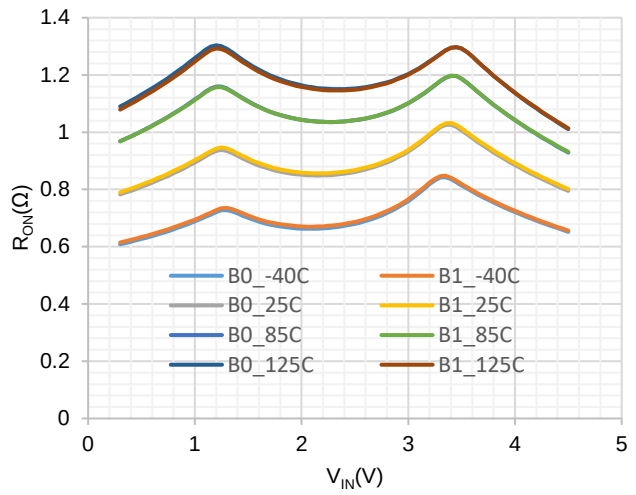


Figure 1. R_{ON}, V_{CC} = 4.5V, Temp = -40, 25, 85,125°C

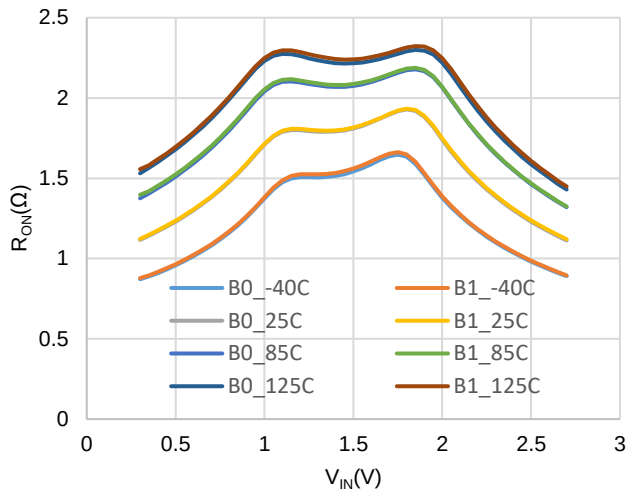


Figure 2. R_{ON}, V_{CC} = 2.7V, Temp = -40, 25, 85, 125°C

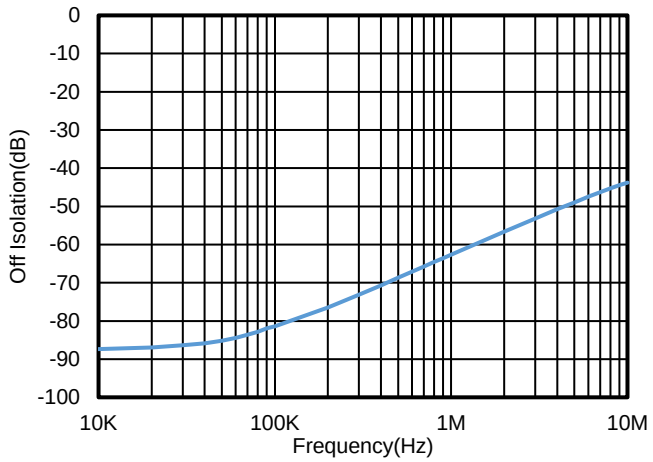


Figure 3. Off-Isolation, V_{CC} = 4.5V

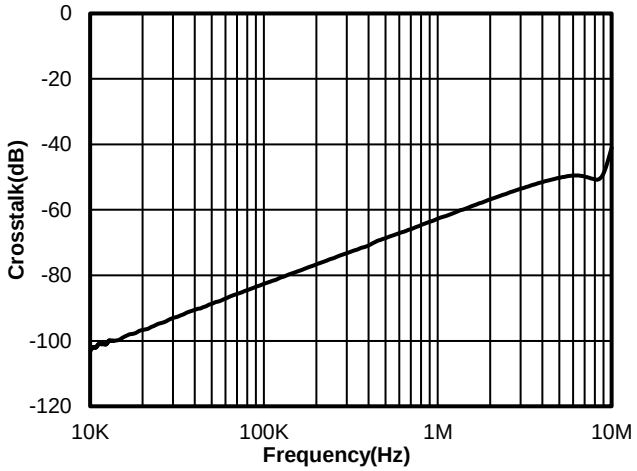


Figure 4. Crosstalk, V_{CC} = 4.5V

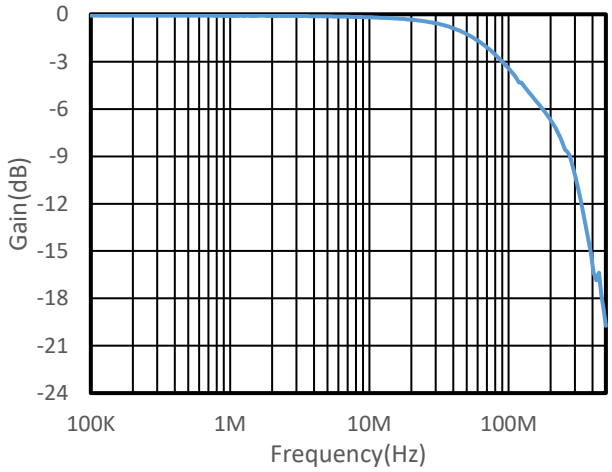


Figure 5. Bandwidth, V_{CC} = 4.5V

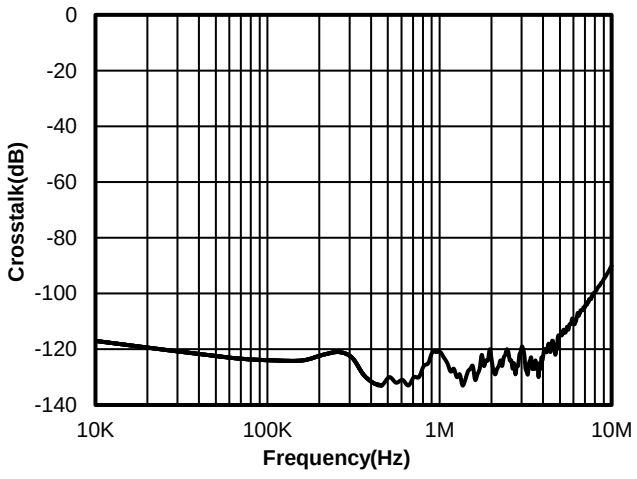


Figure 6. Channel to Channel Crosstalk, V_{CC} = 4.5V

Test Circuit and Waveforms

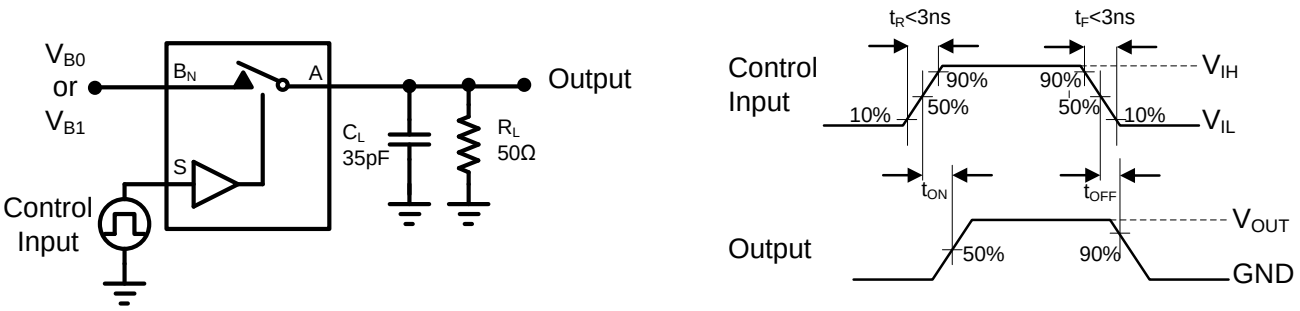


Figure 7 AC Test Circuit and Test Waveforms

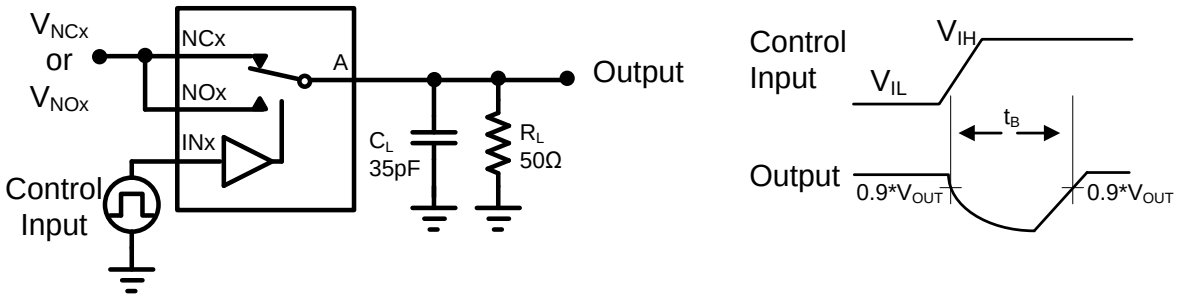


Figure 8 Switch Break Time

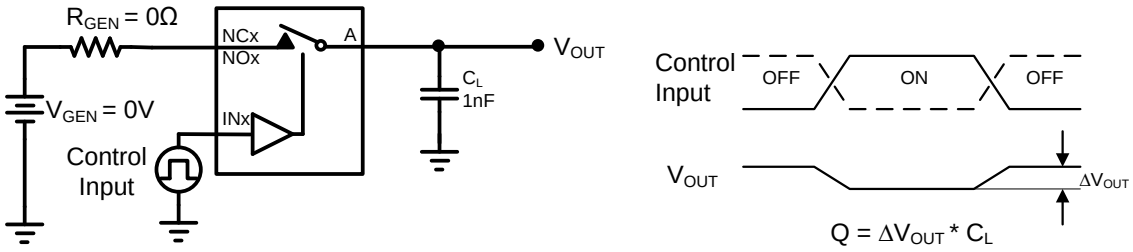


Figure 9 Charge Injection

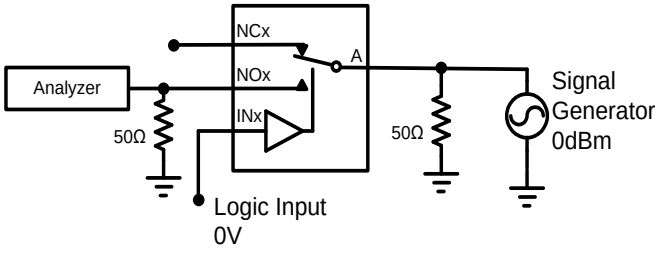


Figure 10 Off Isolation

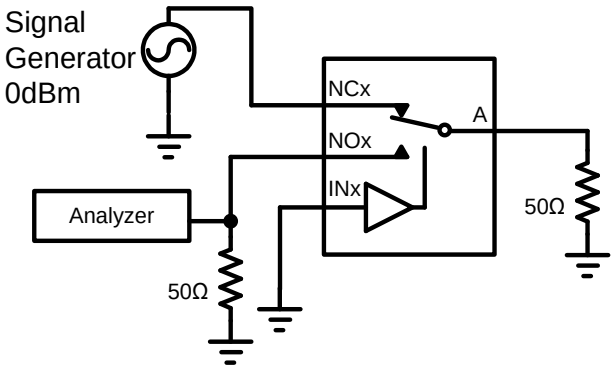


Figure 11 Crosstalk

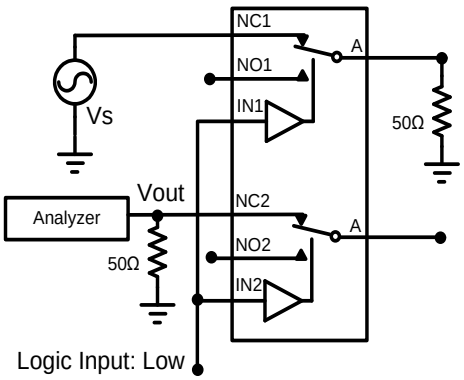
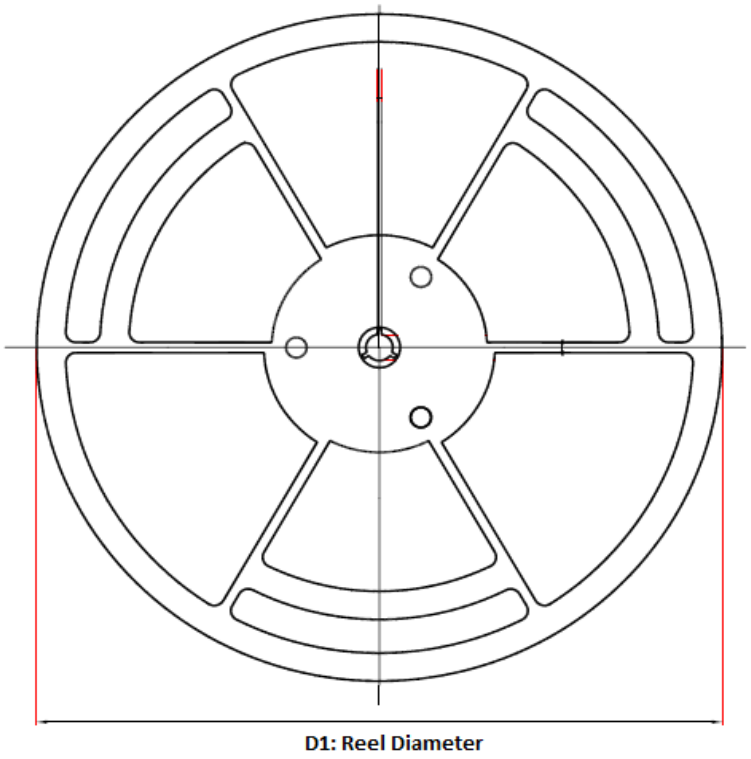


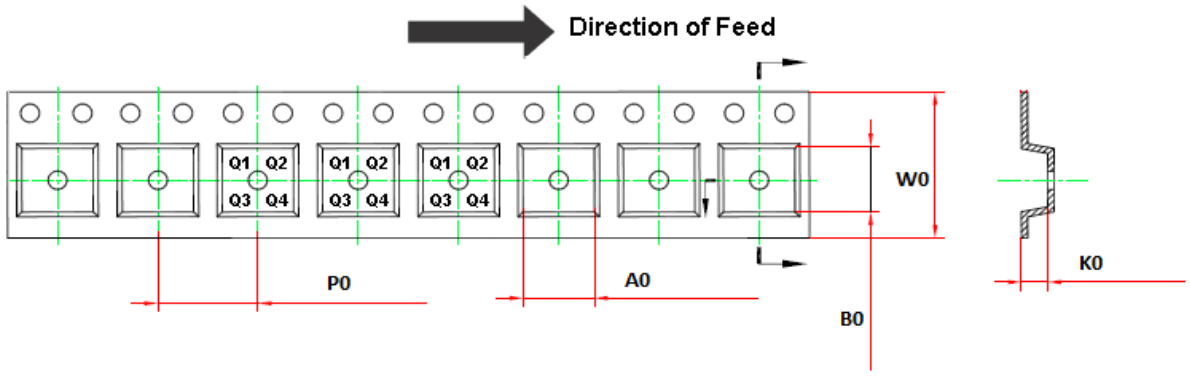
Figure 12 Chanel to Channel Crosstalk, NC1 to NC2

Application Information

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

Tape and Reel Information



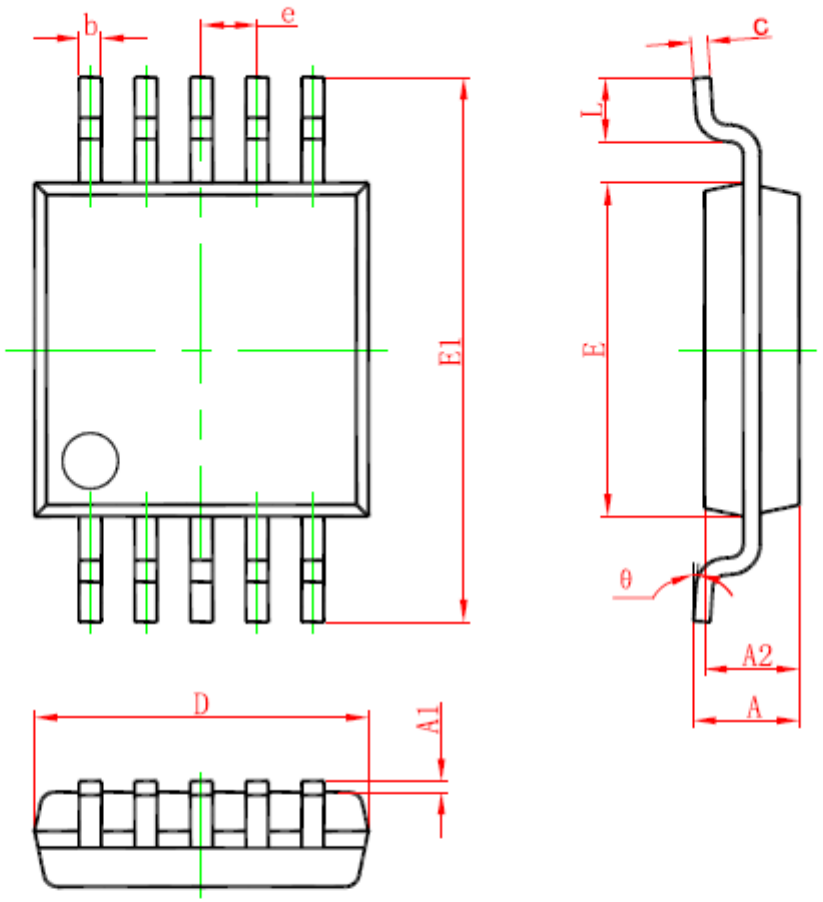


Order Number	Package	D1	W1	A0	B0	K0	P0	W0	Pin1 Quadrant
TPW3221-VR	10-Pin MSOP	330.0	17.6	5.20	3.30	1.50	8.00	12.00	Q1
TPW3221-FR	10-Pin DFN	330.0	17.6	3.35	3.35	1.13	8.00	12.00	Q1

Package Outline Dimensions

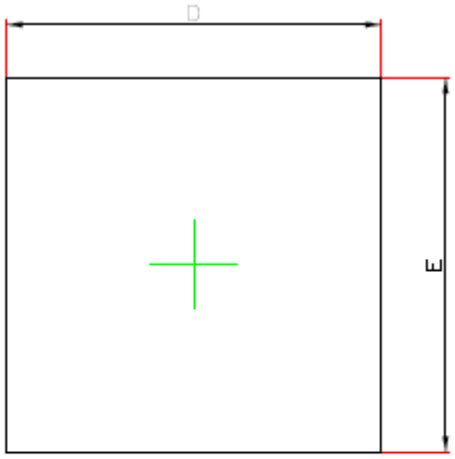
MSOP-10

MSOP10 PACKAGE OUTLINE DIMENSIONS

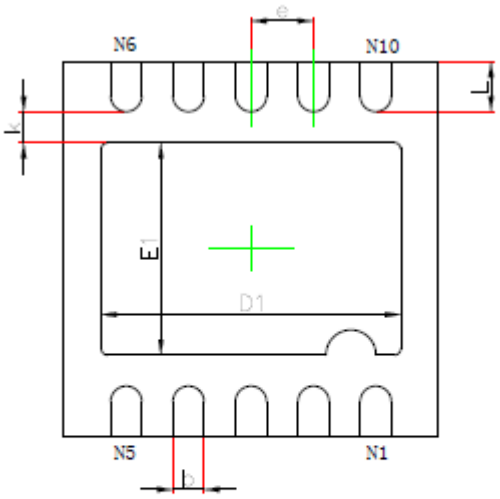


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.180	0.280	0.007	0.011
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
e	0.50(BSC)		0.020(BSC)	
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

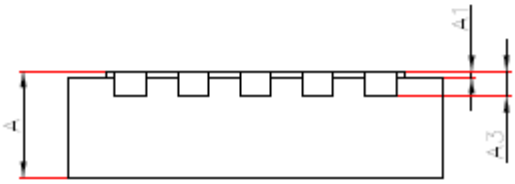
DFN-10 3*3



TOP VIEW



BOTTOM VIEW



SIDE VIEW

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	2.924	3.076	0.115	0.121
E	2.924	3.076	0.115	0.121
D1	2.300	2.500	0.091	0.098
E1	1.600	1.800	0.063	0.071
k	0.200MIN.		0.008MIN.	
b	0.200	0.300	0.008	0.012
e	0.500TYP.		0.020TYP.	
L	0.324	0.476	0.013	0.019

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