

Features

- Latch-Up Performance Exceeds 800 mA
- Supply Voltage: 1.65V to 5.5V
- Low ON-State Resistance: maximum 3Ω at $V_s = 4.5V$
- Bandwidth: 100 MHz
- Fast switching times: $t_{ON} = 40\text{ ns}$, $t_{OFF} = 15\text{ ns}$
- 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

Description

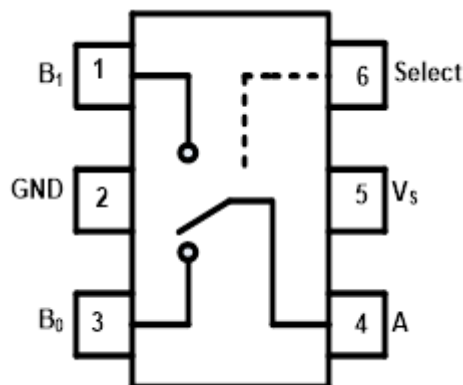
TPW3157A is high performance Single Pole/Double Throw (SPDT) analog switches. The devices feature ultra low R_{ON} of 3Ω maximum at 4.5V V_{CC} and will operate over the wide V_{CC} range of 1.65V to 5.5V.

The TPW3157A 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.

Function Table

Input: Select Pin	Function
Low	B0 Connected to A
High	B1 Connected to A

Pin Configuration



Pin Description

Pin name	Pin No	Pin function
B1	1	Switch Port 1
GND	2	Ground
B0	3	Switch Port 0
A	4	Common switch port
V_{CC}	5	Power supply
Select	6	Select pin

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Revision History

Date	Revision	Notes
2018/4/5	Rev.Pre	Pre-Release Version
2018/10/1	Rev.0	Initial Release Version
2019/4/23	Rev.0.01	Spec of Δ RON at 1.8Vcc change: 3/5/5ohm → 5/7/7ohm Correct Toff test condition in figure 3: 50% of output → 90% of output Update date code information Update package information
2022/7/20	Rev.A.1	Confirm the MSL level3

Order Information

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity
TPW3157A-CR	-40 to 125°C	6-Pin SC70	315	3	Tape and Reel, 3000

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	± 50 mA
Switch Current	120mA
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 and Latch Up 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
LU	Latch Up	JESD 78, 25°C	800	mA
		JESD 78, 125°C	800	mA

Thermal Information

Package Type	θ_{JA}	θ_{JC}	Unit
6-Pin SC70	400		°C/W
6-Pin SOT	250	81	°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
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} ⁽¹⁾		I _{OUT} = 100mA, B0 or B1 = 3.5V	4.5	1.5			Typ	Ω
R _{ON}		I _{OUT} = 100mA, B0 or B1 = 3.5V	4.5	2	3	3	Max	Ω
ΔR _{ON}	Maximum ON resistance	I _{OUT} = 100mA, B0 or B1 = 3.5V	4.5	0.3	0.4	0.4	Max	Ω
R _{FLAT(ON)}	On Resistance Flatness	I _{OUT} = 100mA, B0 or B1 = 0V, 1V, 2V	4.5	0.5	0.6	0.6	Max	Ω
I _{NO(OFF)} , I _{NC(OFF)}	Switch OFF Leakage Current on B0, B1	A = 1V, 4.5V, B0 or B1 = 4.5V, 1V	5.5	±10	±50	±100	Max	nA
I _{A(OFF)}	Switch OFF Leakage Current on A	A = 1V, 4.5V, B0 or B1 = 4.5V, 1V	5.5	±20	±100	±200	Max	nA
I _{A(ON)}	Switch ON Leakage Current on A	A = 1V, 4.5V, B0 or B1 = 1V, 4.5V or Floating	5.5	±20	±100	±200	Max	nA
Dynamic Characteristics								
t _{PHL} , t _{PLH}	Switch IN to OUT time	B0 or B1 = 3V, R _L = 50Ω, C _L = 35pF, Figure 3	4.5	5			Max	ns
t _{PZH} , t _{PZL}	Switch turn-on time	B0 or B1 = 3V, R _L = 50Ω, C _L = 35pF, Figure 3	4.5	40	50	50	Max	ns
t _{PHZ} , t _{PLZ}	Switch turn-off time	B0 or B1 = 3V, R _L = 50Ω, C _L = 35pF, Figure 3	4.5	20	25	25	Max	ns
t _B	Break before make time ⁽¹⁾	B0 or B1 = 3V, R _L = 50Ω, C _L = 35pF, Figure 4	4.5	20	40	40	Typ	ns
Q	Charge Injection ⁽¹⁾	C _L = 1.0nF, V _{GEN} = 0V, R _{GEN} = 0Ω, Figure 5	5	20			Typ	pC
	OFF-Isolation ⁽¹⁾	f = 1MHz, R _L = 50Ω, Figure 6	5	-65			Typ	dB
	Crosstalk ⁽¹⁾	f = 1MHz, R _L = 50Ω, Figure 7	5	-65			Typ	dB
BW	Bandwidth ⁽¹⁾	R _L = 50Ω	5	100			Typ	MHz
THD	Total Harmonic Distortion ⁽¹⁾	R _L = 600Ω, V _{IN} = 0.5V _{PP} , f = 20Hz to 20kHz	5	0.008			Typ	%
Capacitance								
C _{IN}	Select Input capacitance ⁽¹⁾		5	5			Typ	pF
C _{OFF}	B-Port Off capacitance ⁽¹⁾		5	12			Typ	pF
C _{ON}	ON Capacitance ⁽¹⁾		5	40			Typ	pF

(1). Test data is based on bench test and design simulation

Low Voltage 5Ω SPDT Analog Switch
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} ⁽¹⁾		I _{OUT} = 100mA, B0 or B1 = 1.5V	2.7	3			Typ	Ω
R _{ON}		I _{OUT} = 100mA, B0 or B1 = 1.5V	2.7	5	8	8	Max	Ω
ΔR _{ON}	Maximum ON resistance	I _{OUT} = 100mA, B0 or B1 = 1.5V	2.7	0.5	0.6	0.6	Max	Ω
R _{FLAT(ON)}	On Resistance Flatness	I _{OUT} = 100mA, B0 or B1 = 0V, 0.75V, 1.5V	2.7	1.5	2	2	Max	Ω
I _{NO(OFF)} , I _{NC(OFF)}	Switch OFF Leakage Current on B0, B1	A = 1V, 4.5V, B0 or B1 = 4.5V, 1V	3.6	±10	±50	±100	Max	nA
I _{A(OFF)}	Switch OFF Leakage Current on A	A = 1V, 4.5V, B0 or B1 = 4.5V, 1V	3.6	±20	±100	±200	Max	nA
I _{A(ON)}	Switch ON Leakage Current on A	A = 1V, 4.5V, B0 or B1 = 1V, 4.5V or Floating	3.6	±20	±100	±200	Max	nA
Dynamic Characteristics								
t _{PHL} , t _{PLH}	Switch IN to OUT time ⁽¹⁾	B0 or B1 = 1.5V, R _L = 50Ω, C _L = 35pF, Figure 3	2.7	10			Typ	ns
t _{PZH} , t _{PZL}	Switch turn-on time	B0 or B1 = 1.5V, R _L = 50Ω, C _L = 35pF, Figure 3	2.7	70	80	80	Max	ns
t _{PHZ} , t _{PLZ}	Switch turn-off time	B0 or B1 = 1.5V, R _L = 50Ω, C _L = 35pF, Figure 3	2.7	25	40	40	Max	ns
t _B	Break before make time ⁽¹⁾	B0 or B1 = 1.5V, R _L = 50Ω, C _L = 35pF, Figure 4	2.7	20			Typ	ns
Q	Charge Injection ⁽¹⁾	C _L = 1.0nF, V _{GEN} = 0V, R _{GEN} = 0Ω, Figure 5	3	20			Typ	pC
	OFF-Isolation ⁽¹⁾	f = 1MHz, R _L = 50Ω, Figure 6	3	-65			Typ	dB
	Crosstalk ⁽¹⁾	f = 1MHz, R _L = 50Ω, Figure 7	3	-65			Typ	dB
BW	Bandwidth ⁽¹⁾	R _L = 50Ω	3	100			Typ	MHz
THD	Total Harmonic Distortion ⁽¹⁾	R _L = 600Ω, V _{IN} = 0.5V _{PP} , f = 20Hz to 20kHz	3	0.01			Typ	%

(1). Test data is based on bench test and design simulation

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} ⁽¹⁾		I _{OUT} = 10mA, B0 or B1 = 0.9V	1.65	15			Typ	Ω
R _{ON}		I _{OUT} = 10mA, B0 or B1 = 0.9V	1.65	20	25	25	Max	Ω
ΔR _{ON}	Maximum ON resistance	I _{OUT} = 10mA, B0 or B1 = 0.9V	1.65	5	7	7	Max	Ω
I _{NO(OFF)} , I _{NC(OFF)}	Switch OFF Leakage Current on B0, B1	A = 0V, 1.95V, B0 or B1 = 1.95V, 0V	1.95	±10	±50	±100	Max	nA
I _{A(OFF)}	Switch OFF Leakage Current on A	A = 0V, 1.95V, B0 or B1 = 1.95V, 0V	1.95	±20	±100	±200	Max	nA
I _{A(ON)}	Switch ON Leakage Current on A	A = 0V, 1.95V, B0 or B1 = 0V, 1.95V or Floating	1.95	±20	±100	±200	Max	nA
Dynamic Characteristics								
t _{PHL} , t _{PLH}	Switch IN to OUT time ⁽¹⁾	B0 or B1 = 1.0V, R _L = 50Ω, C _L = 35pF, Figure 3	1.65	10			Typ	ns
t _{PZH} , t _{PZL}	Switch turn-on time	B0 or B1 = 1.0V, R _L = 50Ω, C _L = 35pF, Figure 3	1.65	80	90	90	Max	ns
t _{PHZ} , t _{PLZ}	Switch turn-off time	B0 or B1 = 1.0V, R _L = 50Ω, C _L = 35pF, Figure 3	1.65	50	70	70	Max	ns
t _B	Break before make time	B0 or B1 = 1.0V, R _L = 50Ω, C _L = 35pF, Figure 4	1.65	20			Max	ns
Q	Charge Injection ⁽¹⁾	C _L = 1.0nF, V _{GEN} = 0V, R _{GEN} = 0Ω, Figure 5	1.8	20			Typ	pC
	OFF-Isolation ⁽¹⁾	f = 1MHz, R _L = 50Ω, Figure 6	1.8	-65			Typ	dB
	Crosstalk ⁽¹⁾	f = 1MHz, R _L = 50Ω, Figure 7	1.8	-65			Typ	dB
BW	Bandwidth ⁽¹⁾	R _L = 50Ω	1.8	100			Typ	MHz
THD	Total Harmonic Distortion ⁽¹⁾	R _L = 600Ω, V _{IN} = 0.5V _{PP} , f = 20Hz to 20kHz	1.8	0.01			Typ	%

(1). Test data is based on bench test and design simulation

T_A = 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	A = 1V, 4.5V, B0 or B1 = 4.5V, 1V	3.6	±10	Max	nA
I _{A(OFF)}	Switch OFF Leakage Current on A	A = 1V, 4.5V, B0 or B1 = 4.5V, 1V	3.6	±20	Max	nA
I _{A(ON)}	Switch ON Leakage Current on A	A = 1V, 4.5V, B0 or B1 = 1V, 4.5V or Floating	3.6	±20	Max	nA
I _{NO(OFF)} , I _{NC(OFF)}	Switch OFF Leakage Current on B0, B1	A = 1V, 4.5V, B0 or B1 = 4.5V, 1V	5.5	±10	Max	nA
I _{A(OFF)}	Switch OFF Leakage Current on A	A = 1V, 4.5V, B0 or B1 = 4.5V, 1V	5.5	±20	Max	nA
I _{A(ON)}	Switch ON Leakage Current on A	A = 1V, 4.5V, B0 or B1 = 1V, 4.5V or Floating	5.5	±20	Max	nA

Typical Performance Characteristics

$V_{CC} = 5V$, unless otherwise specified.

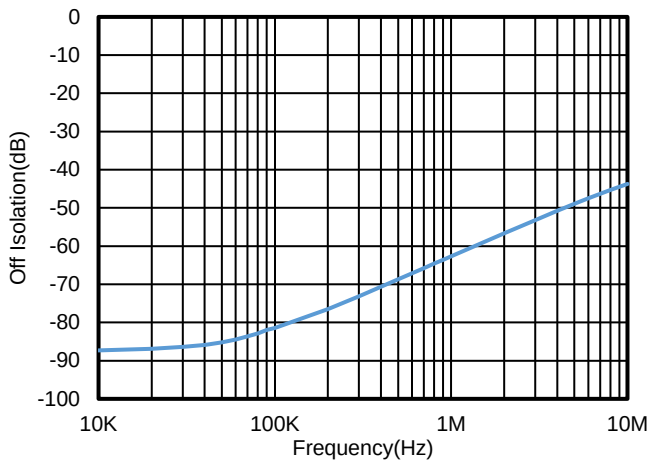


Figure 1. Off-Isolation, $V_{CC} = 4.5V$

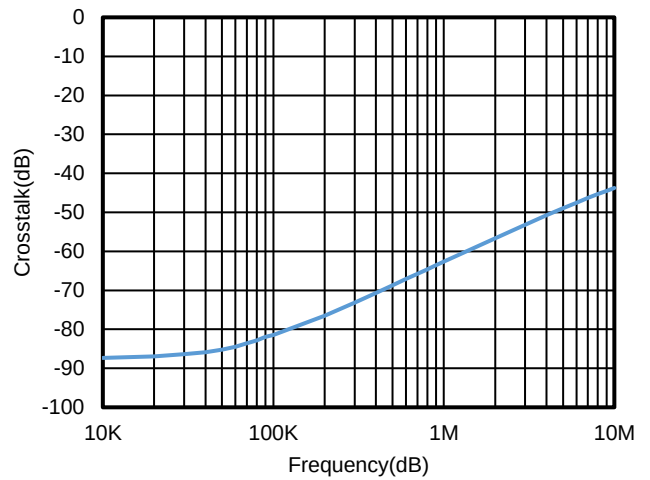


Figure 2. Crosstalk, $V_{CC} = 4.5V$

Test Circuit and Waveforms

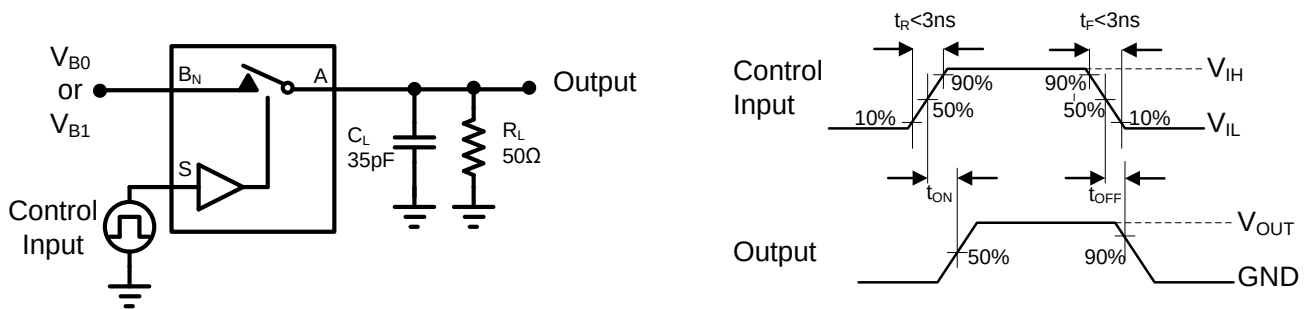


Figure 3 AC Test Circuit and Test Waveforms

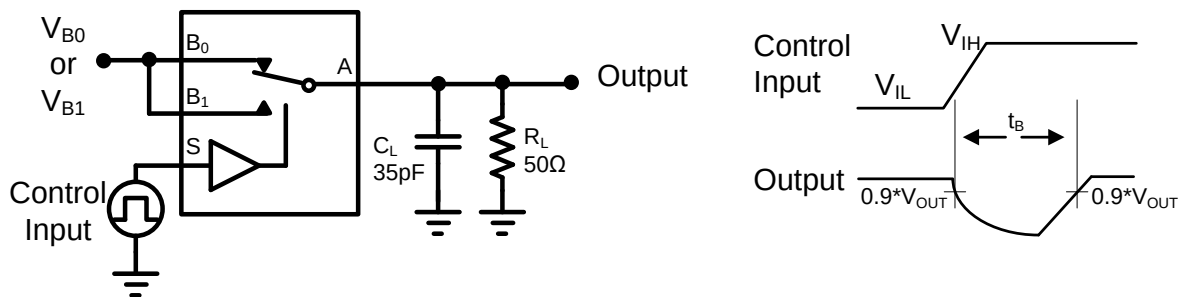


Figure 4 Switch Break Time

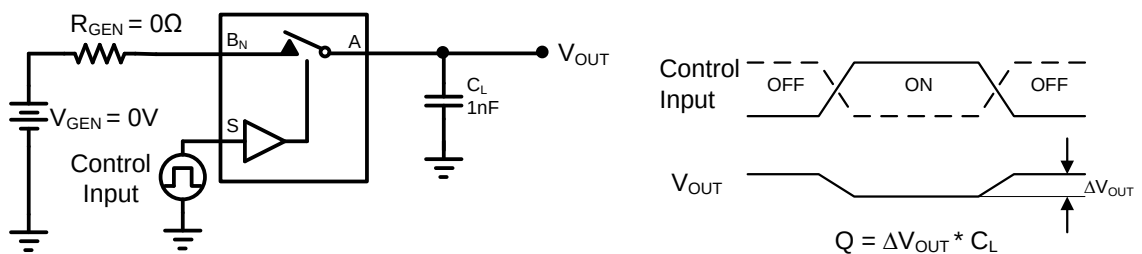


Figure 5 Charge Injection

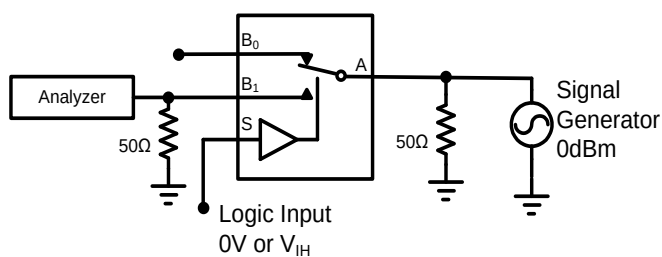


Figure 6 Off Isolation

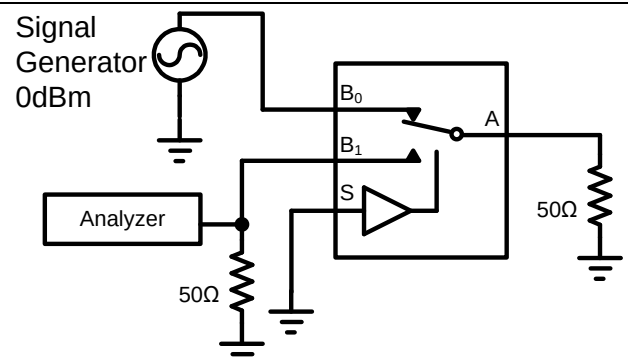
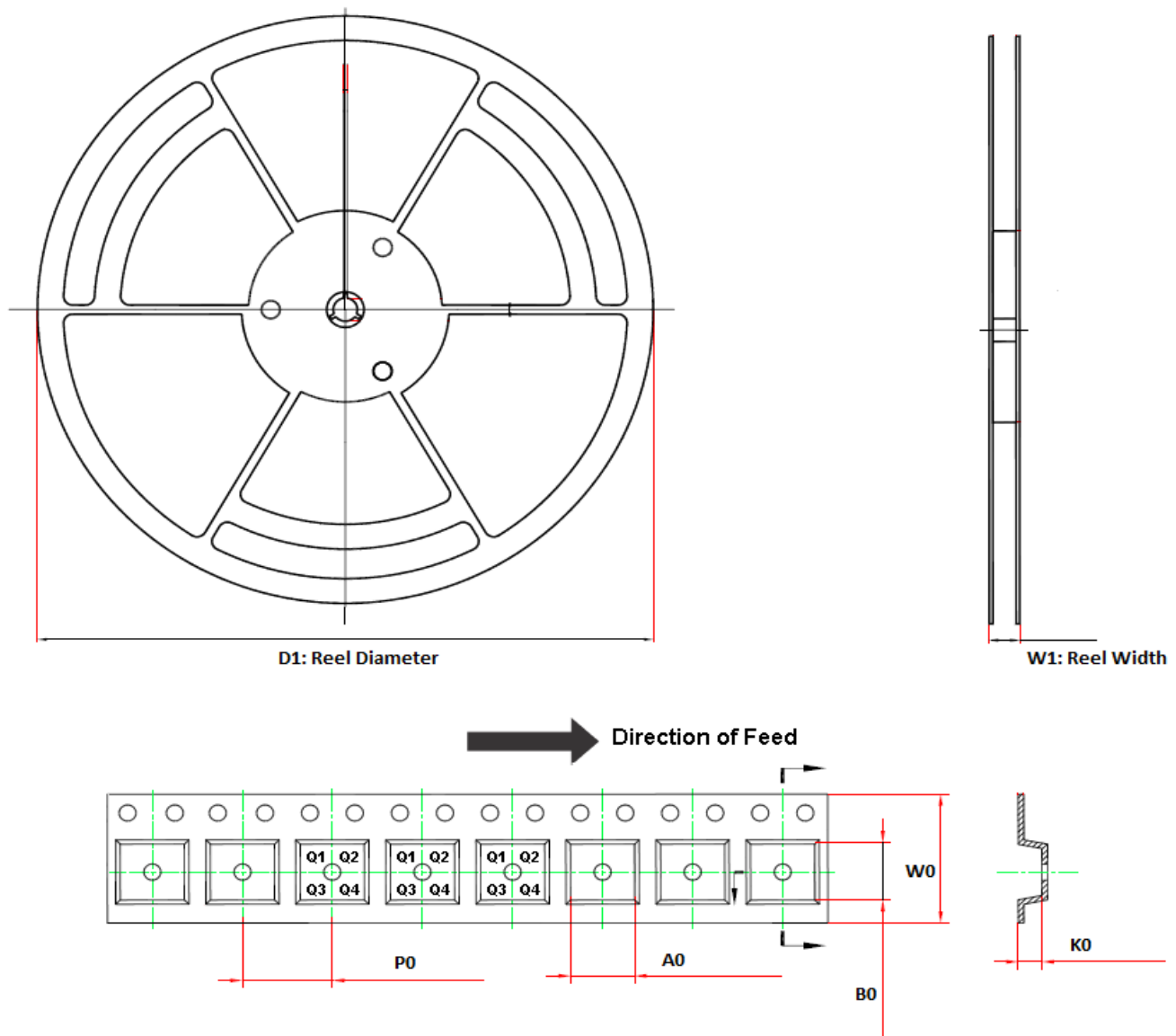


Figure 7 Crosstalk

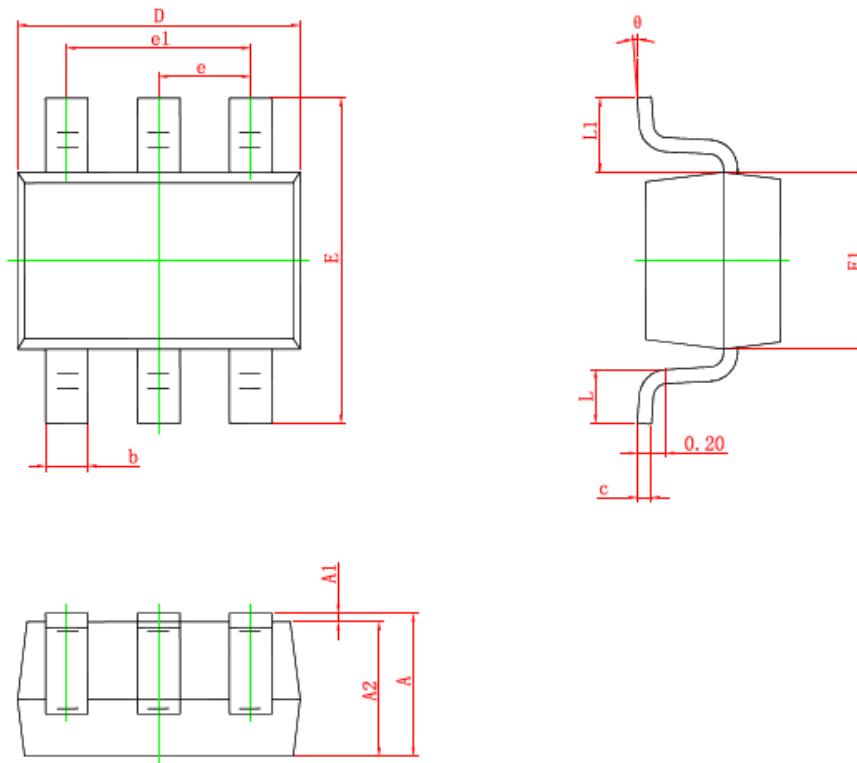
Tape and Reel Information



Order Number	Package	D1	W1	A0	B0	K0	P0	W0	Pin1 Quadrant
TPW3157A-CR	6-Pin SC70	178±1	12.3±1	2.4±0.1	2.5±0.1	1.2±0.1	4.0±0.1	8.0±0.1	Q3

Package Outline Dimensions

SC70-6



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.110	0.175	0.004	0.007
D	2.000	2.200	0.079	0.087
E	2.150	2.450	0.085	0.096
E1	1.150	1.350	0.045	0.053
e	0.650 TYP.		0.026 TYP.	
e1	1.200	1.400	0.047	0.055
L	0.260	0.460	0.010	0.018
L1	0.525 REF.		0.021 REF.	
θ	0°	8°	0°	8°

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