

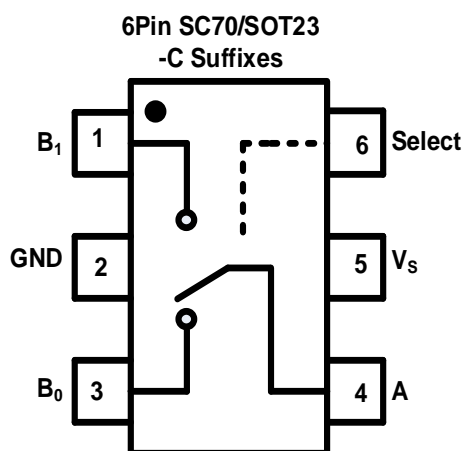
## Features

- 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  $V_s = 4.5V$
- Bandwidth: 100 MHz
- Fast switching times:  $t_{ON} = 40\text{ ns}$ ,  $t_{OFF} = 15\text{ ns}$
- Break-Before-Make Switching
- Operation Temperature Range:  $-40^{\circ}C$  to  $125^{\circ}C$

## Applications

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

## Pin Configuration



## Description

TPW4157 is high performance Single Pole/Double Throw (SPDT) analog switches. The devices feature ultra low RON of 1.15Ω maximum at 4.5V  $V_{CC}$  and will operate over the wide  $V_{CC}$  range of 1.65V to 5.5V.

The TPW4157 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 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
2018/3/24	Rev.Pre	Pre-Release Version
2018/11/1	Rev.0	Initial Release Version
2019/4/21	Rev.0.01	Update Mark Information Update Package Outline Correct Toff test condition in figure 6: 50% of output -> 90% of output Correct Tb test condition in Electrical Characteristics: B0 or B1 = 3V -> B0 or B1 = 1.5V; in figure 7: 0.9*Vout -> 0.9V Spec of ΔRON at 1.65Vcc change: 2/3/3ohm -> 5/7/7ohm
2021/4/1	Rev.A.0	Add TPW4157-TR
2022/3/23	Rev.B.0	Update SOT23-6 MSL from 1 to 3

## Order Information

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity
TPW4157-CR	-40 to 125°C	6-Pin SC70	415XX <sup>Note 1</sup>	1	Tape and Reel, 3000
TPW4157-TR	-40 to 125°C	6-Pin SOT23	415XX <sup>Note 1</sup>	3	Tape and Reel, 3000

Note 1: "XX" identify the date code information.

## Absolute Maximum Ratings <sup>Note 1</sup>

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	$\pm 50$ mA
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 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	$\theta_{JA}$	$\theta_{JC}$	Unit
6-Pin SC70	400		°C/W

## Recommended Operating Conditions <sup>Note 1</sup>

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

**VCC = 4.5 to 5.5V, unless otherwise noted.**

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	25°C	-40°C to 85°C	-40°C to 125°C	Limit	Unit
<b>Power Supply</b>								
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> = 0V or V <sub>CC</sub>	5.5	0.3	0.5	1.5	Max	μA
ΔI <sub>CC</sub>	Increase in I <sub>CC</sub> per Input	Select Input at 2.7V, others at V <sub>CC</sub> or GND	4.3	20	25	25	Max	μA
<b>Digital Input</b>								
V <sub>IH</sub>	Input Voltage High				2.4	2.4	Min	V
V <sub>IL</sub>	Input Voltage Low				0.8	0.8	Max	V
I <sub>IN</sub>	Control Input Leakage	V <sub>IN</sub> = 0V or V <sub>CC</sub>	5.5		±1	±1	Max	μA
<b>Analog Switch</b>								
R <sub>ON</sub>		I <sub>OUT</sub> = 100mA, B0 or B1 = 3.5V	4.5	0.95			Typ	Ω
R <sub>ON</sub>		I <sub>OUT</sub> = 100mA, B0 or B1 = 3.5V	4.5	1.15	1.4	1.5	Max	Ω
ΔR <sub>ON</sub>	Maximum ON resistance	I <sub>OUT</sub> = 100mA, B0 or B1 = 3.5V	4.5	0.12	0.15	0.2	Max	Ω
R <sub>FLAT(ON)</sub>	On Resistance Flatness	I <sub>OUT</sub> = 100mA, B0 or B1 = 0V, 1V, 2V	4.5	0.3	0.4	0.5	Max	Ω
I <sub>NO(OFF)</sub> , I <sub>NC(OFF)</sub>	Switch OFF Leakage Current on B0, B1	A = 1V, 4.5V, B0 or B1 = 4.5V, 1V	5.5	±10	±25	±50	Max	nA
I <sub>A(OFF)</sub>	Switch OFF Leakage Current on A	A = 1V, 4.5V, B0 or B1 = 4.5V, 1V	5.5	±10	±50	±100	Max	nA
I <sub>A(ON)</sub>	Switch ON Leakage Current on A	A = 1V, 4.5V, B0 or B1 = 1V, 4.5V or Floating	5.5	±10	±50	±100	Max	nA
<b>Dynamic Characteristics</b>								
t <sub>PHL</sub> , t <sub>PLH</sub>	Switch IN to OUT time	B0 or B1 = 3V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, Figure 6	4.5	5			Typ	ns
t <sub>ON</sub>	Switch turn-on time	B0 or B1 = 3V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, Figure 6	4.5	40	45	45	Max	ns
t <sub>OFF</sub>	Switch turn-off time	B0 or B1 = 3V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, Figure 6	4.5	15	20	20	Max	ns
t <sub>B</sub>	Break before make time	B0 or B1 = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, Figure 7	4.5	20	40	40	Max	ns
Q	Charge Injection	C <sub>L</sub> = 1.0nF, V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0Ω, Figure 8	5.5	20			Typ	pC
	OFF-Isolation	f = 1MHz, R <sub>L</sub> = 50Ω, Figure 9	5	-65			Typ	dB
	Crosstalk	f = 1MHz, R <sub>L</sub> = 50Ω, Figure 10	5	-65			Typ	dB
BW	Bandwidth	R <sub>L</sub> = 50Ω	5	100			Typ	MHz
THD	Total Harmonic Distortion	R <sub>L</sub> = 600Ω, V <sub>IN</sub> = 0.5V <sub>PP</sub> , f = 20Hz to 20kHz	5	0.004			Typ	%
<b>Capacitance</b>								
C <sub>IN</sub>	Select Input capacitance		5	5			Typ	pF
C <sub>OFF</sub>	B-Port Off capacitance		5	12			Typ	pF
C <sub>ON</sub>	ON Capacitance		5	40			Typ	pF

**VCC = 2.7 to 3.6V, unless otherwise noted.**

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	25°C	-40°C to 85°C	-40°C to 125°C	Limit	Unit
<b>Power Supply</b>								
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> = 0V or V <sub>CC</sub>	3.6	0.3	0.5	1.5	Max	μA
<b>Digital Input</b>								
V <sub>IH</sub>	Input Voltage High				1.65	1.65	Min	V
V <sub>IL</sub>	Input Voltage Low				0.6	0.6	Max	V
I <sub>IN</sub>	Control Input Leakage	V <sub>IN</sub> = 0V or V <sub>CC</sub>	3.6		±1	±1	Max	μA
<b>Analog Switch</b>								
R <sub>ON</sub>		I <sub>OUT</sub> = 100mA, B0 or B1 = 1.5V	2.7	2			Typ	Ω
R <sub>ON</sub>		I <sub>OUT</sub> = 100mA, B0 or B1 = 1.5V	2.7	2.5	2.7	3	Max	Ω
ΔR <sub>ON</sub>	Maximum ON resistance	I <sub>OUT</sub> = 100mA, B0 or B1 = 1.5V	2.7	0.25	0.3	0.35	Max	Ω
R <sub>FLAT(ON)</sub>	On Resistance Flatness	I <sub>OUT</sub> = 100mA, B0 or B1 = 0V, 0.75V, 1.5V	2.7	1	1.1	1.2	Max	Ω
I <sub>NO(OFF)</sub> , I <sub>NC(OFF)</sub>	Switch OFF Leakage Current on B0, B1	A = 0V, 3.6V, B0 or B1 = 3.6V, 0V	3.6	±10	±25	±50	Max	nA
I <sub>A(OFF)</sub>	Switch OFF Leakage Current on A	A = 0V, 3.6V, B0 or B1 = 3.6V, 0V	3.6	±10	±50	±100	Max	nA
I <sub>A(ON)</sub>	Switch ON Leakage Current on A	A = 0V, 3.6V, B0 or B1 = 0V, 3.6V or Floating	3.6	±10	±50	±100	Max	nA
<b>Dynamic Characteristics</b>								
t <sub>PHL</sub> , t <sub>PLH</sub>	Switch IN to OUT time	B0 or B1 = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, Figure 6	2.7	10			Typ	ns
t <sub>ON</sub>	Switch turn-on time	B0 or B1 = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, Figure 6	2.7	60	70	70	Max	ns
t <sub>OFF</sub>	Switch turn-off time	B0 or B1 = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, Figure 6	2.7	25	30	30	Max	ns
t <sub>B</sub>	Break before make time	B0 or B1 = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, Figure 7	2.7	20			Typ	ns
Q	Charge Injection	C <sub>L</sub> = 1.0nF, V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0Ω, Figure 8	3	20			Typ	pC
	OFF-Isolation	f = 1MHz, R <sub>L</sub> = 50Ω, Figure 9	3	-65			Typ	dB
	Crosstalk	f = 1MHz, R <sub>L</sub> = 50Ω, Figure 10	3	-65			Typ	dB
BW	Bandwidth	R <sub>L</sub> = 50Ω	3	100			Typ	MHz
THD	Total Harmonic Distortion	R <sub>L</sub> = 600Ω, V <sub>IN</sub> = 0.5V <sub>PP</sub> , f = 20Hz to 20kHz	3	0.01			Typ	%

**VCC = 1.65 to 1.95V, unless otherwise noted.**

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	25°C	-40°C to 85°C	-40°C to 125°C	Limit	Unit
<b>Power Supply</b>								
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> = 0V or V <sub>CC</sub>	1.95	0.3	0.5	1.5	Max	μA
<b>Digital Input</b>								
V <sub>IH</sub>	Input Voltage High				1.4	1.4	Min	V
V <sub>IL</sub>	Input Voltage Low				0.4	0.4	Max	V
I <sub>IN</sub>	Control Input Leakage	V <sub>IN</sub> = 0V or V <sub>CC</sub>	1.95		±1	±1	Max	μA
<b>Analog Switch</b>								
R <sub>ON</sub>		I <sub>OUT</sub> = 10mA, B0 or B1 = 0.9V	1.65	10			Typ	Ω
R <sub>ON</sub>		I <sub>OUT</sub> = 10mA, B0 or B1 = 0.9V	1.65	15	18	18	Max	Ω
ΔR <sub>ON</sub>	Maximum ON resistance	I <sub>OUT</sub> = 10mA, B0 or B1 = 0.9V	1.65	5	7	7	Max	Ω
I <sub>NO(OFF)</sub> , I <sub>NC(OFF)</sub>	Switch OFF Leakage Current on B0, B1	A = 0V, 1.95V, B0 or B1 = 1.95V, 0V	1.95	±10	±25	±50	Max	nA
I <sub>A(OFF)</sub>	Switch OFF Leakage Current on A	A = 0V, 1.95V, B0 or B1 = 1.95V, 0V	1.95	±10	±50	±100	Max	nA
I <sub>A(ON)</sub>	Switch ON Leakage Current on A	A = 0V, 1.95V, B0 or B1 = 0V, 1.95V or Floating	1.95	±10	±50	±100	Max	nA
<b>Dynamic Characteristics</b>								
t <sub>PHL</sub> , t <sub>PLH</sub>	Switch IN to OUT time	B0 or B1 = 1.0V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, Figure 6	1.65	10			Typ	ns
t <sub>ON</sub>	Switch turn-on time	B0 or B1 = 1.0V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, Figure 6	1.65	80	90	90	Max	ns
t <sub>OFF</sub>	Switch turn-off time	B0 or B1 = 1.0V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, Figure 6	1.65	50	70	70	Max	ns
t <sub>B</sub>	Break before make time	B0 or B1 = 1.0V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, Figure 7	1.65	20			Typ	ns
Q	Charge Injection	C <sub>L</sub> = 1.0nF, V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0Ω, Figure 8	1.8	20			Typ	pC
	OFF-Isolation	f = 1MHz, R <sub>L</sub> = 50Ω, Figure 9	1.8	-65			Typ	dB
	Crosstalk	f = 1MHz, R <sub>L</sub> = 50Ω, Figure 10	1.8	-65			Typ	dB
BW	Bandwidth	R <sub>L</sub> = 50Ω	1.8	100			Typ	MHz
THD	Total Harmonic Distortion	R <sub>L</sub> = 600Ω, V <sub>IN</sub> = 0.5V <sub>PP</sub> , f = 20Hz to 20kHz	1.8	0.01			Typ	%

**TA = 0°C to 50°C, unless otherwise noted.**

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	Spec	Limit	Unit
I <sub>NO(OFF)</sub> , I <sub>NC(OFF)</sub>	Switch OFF Leakage Current on B0, B1	A = 1V, 4.5V, B0 or B1 = 4.5V, 1V	3.6	±10	Max	nA
I <sub>A(OFF)</sub>	Switch OFF Leakage Current on A	A = 1V, 4.5V, B0 or B1 = 4.5V, 1V	3.6	±20	Max	nA
I <sub>A(ON)</sub>	Switch ON Leakage Current on A	A = 1V, 4.5V, B0 or B1 = 1V, 4.5V or Floating	3.6	±20	Max	nA
I <sub>NO(OFF)</sub> , I <sub>NC(OFF)</sub>	Switch OFF Leakage Current on B0, B1	A = 1V, 4.5V, B0 or B1 = 4.5V, 1V	5.5	±10	Max	nA
I <sub>A(OFF)</sub>	Switch OFF Leakage Current on A	A = 1V, 4.5V, B0 or B1 = 4.5V, 1V	5.5	±20	Max	nA
I <sub>A(ON)</sub>	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<sub>CC</sub> = 5V, unless otherwise specified.

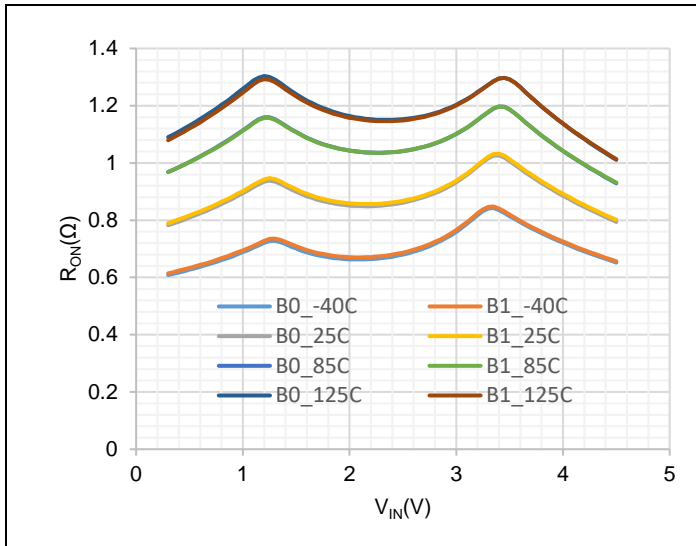


Figure 1. R<sub>ON</sub>, V<sub>CC</sub> = 4.5V, Temp = -40, 25, 85, 125°C

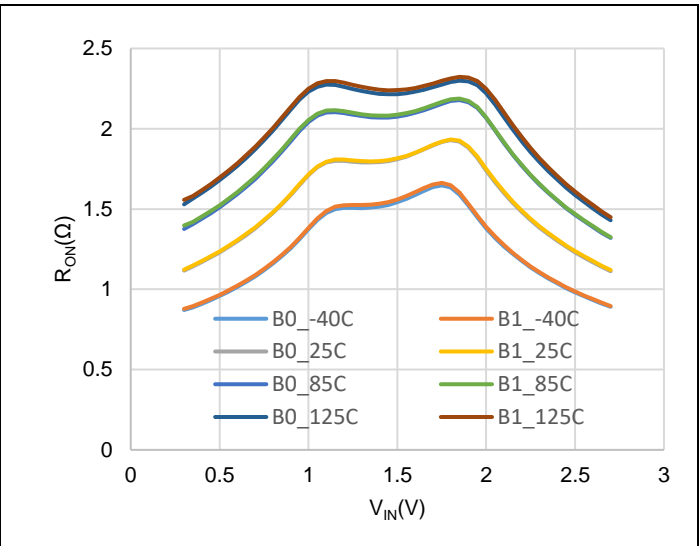


Figure 2. R<sub>ON</sub>, V<sub>CC</sub> = 2.7V, Temp = -40, 25, 85, 125°C

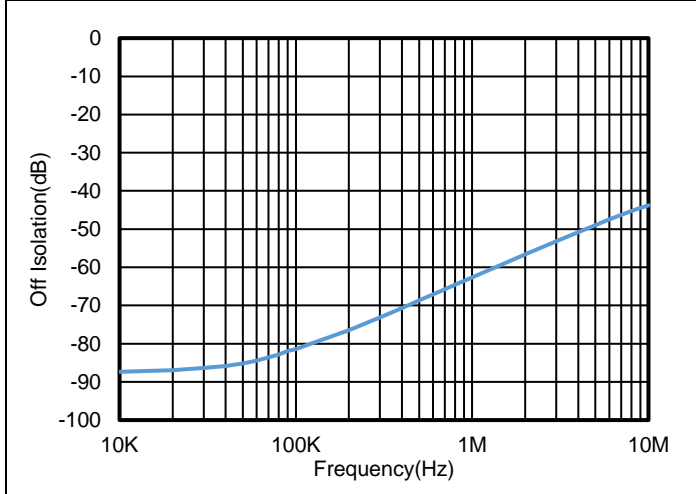


Figure 3. Off-Isolation, V<sub>CC</sub> = 4.5V

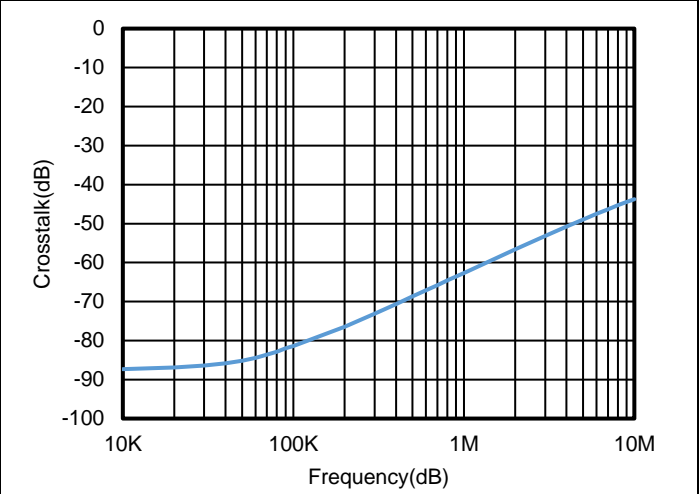


Figure 4. Crosstalk, V<sub>CC</sub> = 4.5V

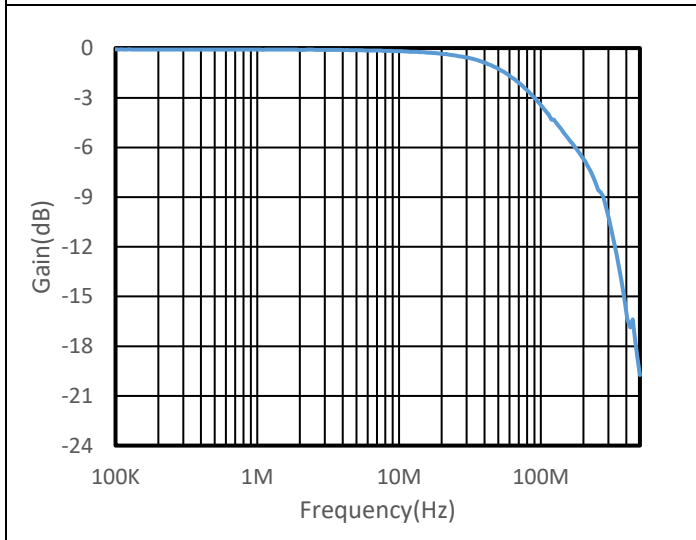


Figure 5. Bandwidth, V<sub>CC</sub> = 4.5V

**Test Circuit and Waveforms**

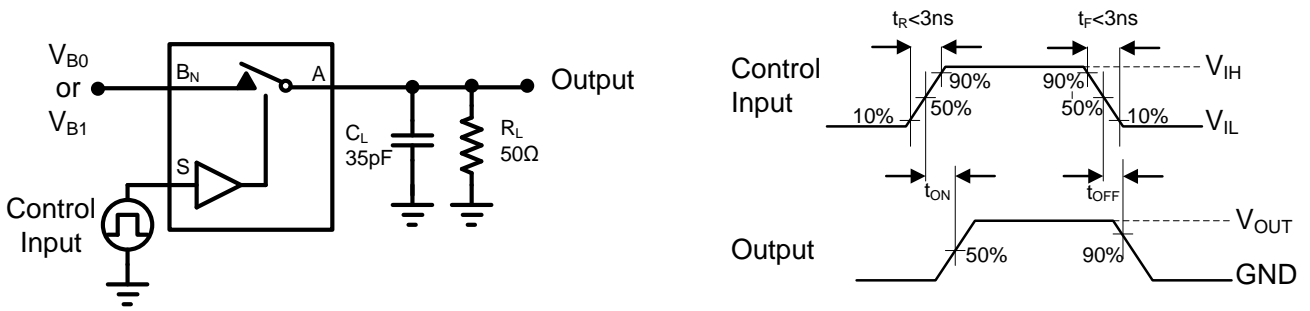


Figure 6 AC Test Circuit and Test Waveforms

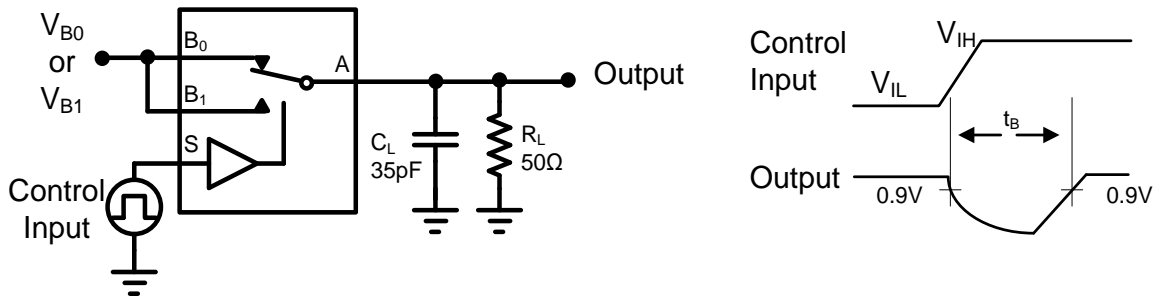


Figure 7 Switch Break Time

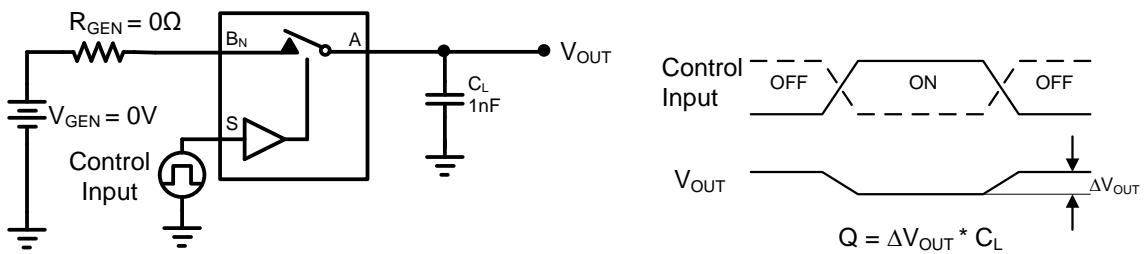


Figure 8 Charge Injection

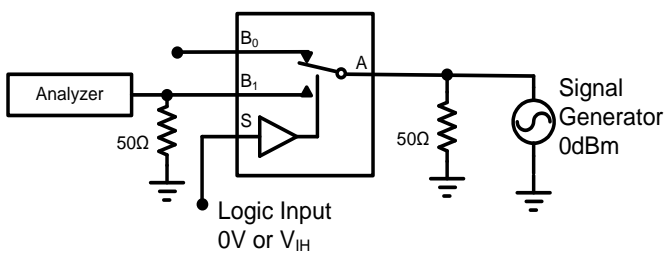


Figure 9 Off Isolation

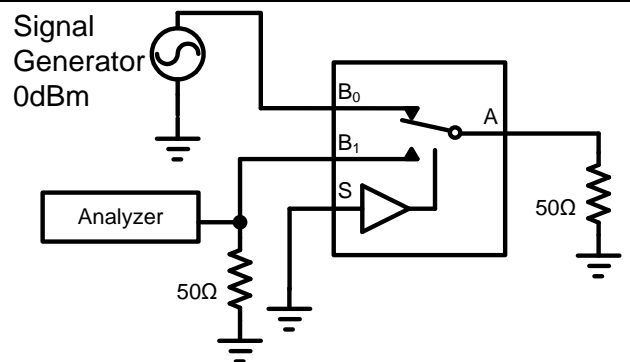
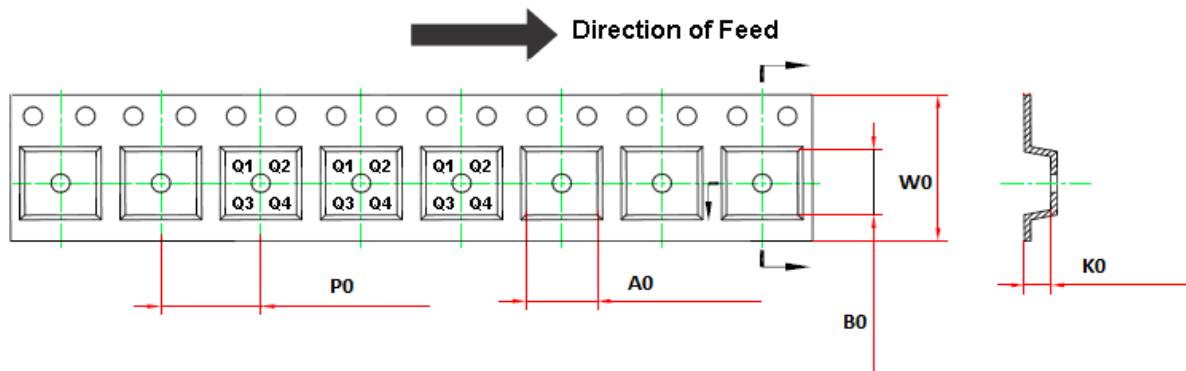
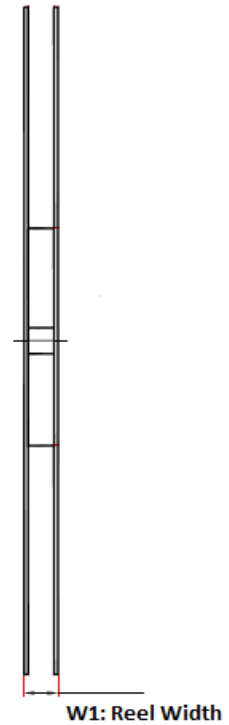
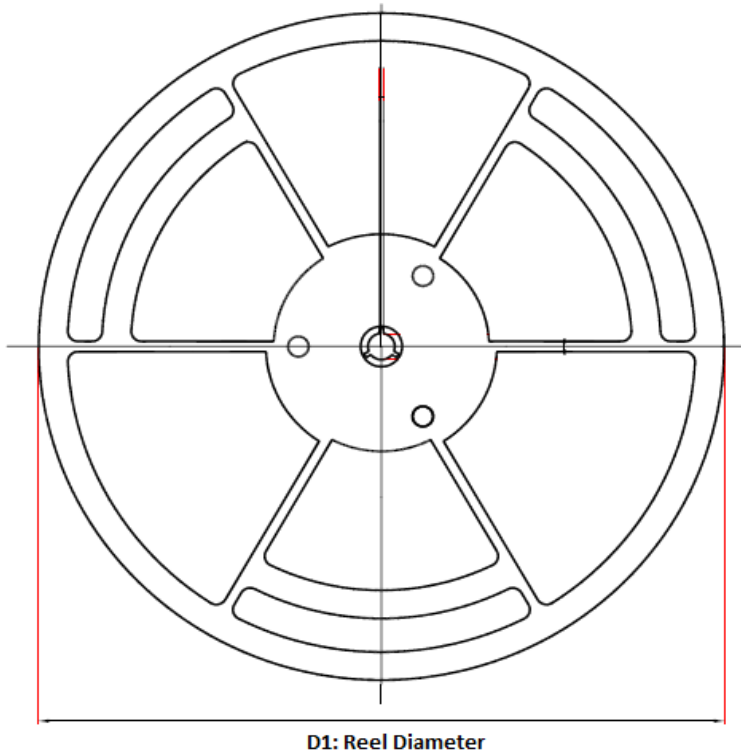


Figure 10 Crosstalk

## Application Information

A 0.1-μF bypass capacitor on V<sub>CC</sub> and GND is recommended to prevent power disturbance.

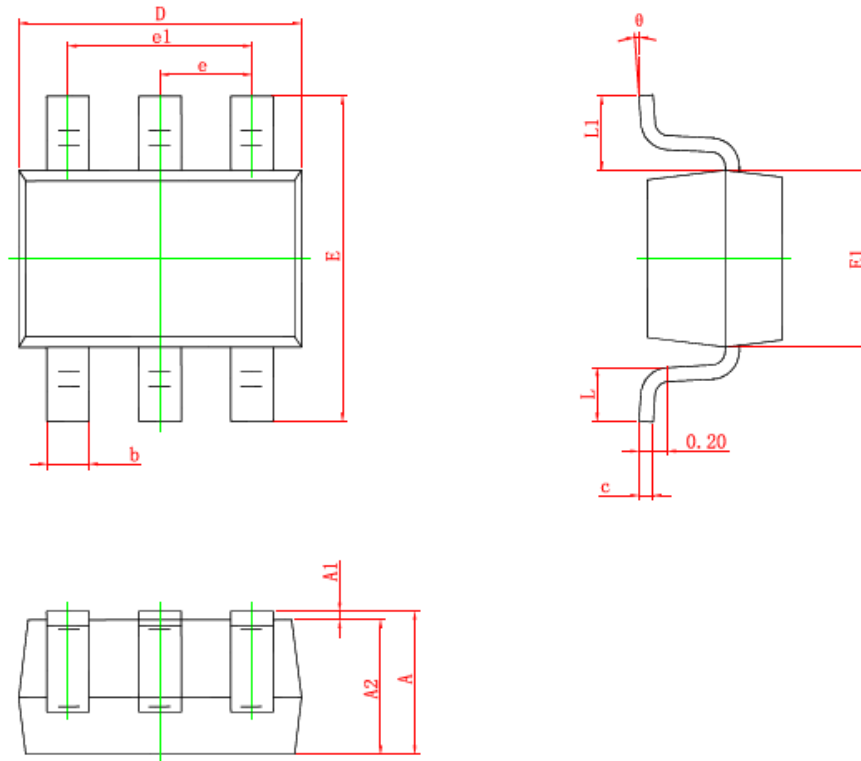
### Tape and Reel Information



Order Number	Package	D1	W1	A0	B0	K0	P0	W0	Pin1 Quadrant
TPW4157-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

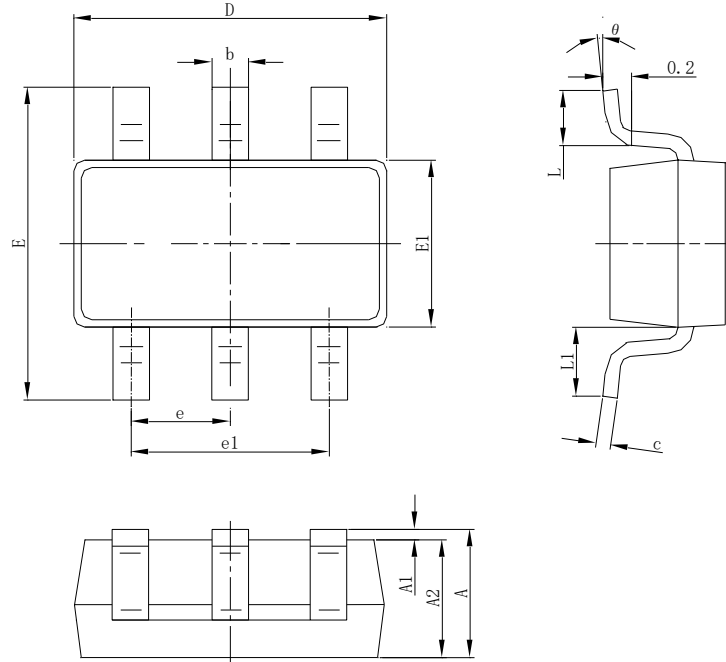
### Package Outline Dimensions

#### 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°

SOT23-6



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E1	1.500	1.700	0.059	0.067
E	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
L1	0.600REF.		0.024REF.	
θ	0°	8°	0°	8°

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