

Features

- Latch-up Performance Exceeds 800 mA
- Supply Voltage: 1.65 V to 5.5 V
- Low On-State Resistance: Maximum 3 Ω at $V_S = 4.5$ V
- 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 Devices

Description

The TPW3157A is a high-performance Single Pole/Double Throw (SPDT) analog switch. The device features ultra-low R_{ON} of 3 Ω maximum at 4.5 V V_{CC} and operates over a wide V_{CC} range from 1.65 V to 5.5 V.

The TPW3157A 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 the direct interface with processor general purpose I/Os.

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Revision History

Date	Revision	Notes
2018-04-05	Rev.Pre.0	Pre-released version.
2018-10-01	Rev.A.0	Initial release.
2019-04-23	Rev.A.1	<ul style="list-style-type: none">• Changed the spec of ΔR_{ON} at 1.8 V_{CC}: from 3/5/5 Ω to 5/7/7 Ω.• Corrected the T_{off} test condition in Figure 3: from 50% of output to 90% of output.• Updated the date code information.• Updated the package information.
2022-07-20	Rev.A.2	Confirmed the MSL level 3.
2024-12-13	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 Tape and Reel Information. Updated the Package Outline Dimensions.

Pin Configuration and Functions

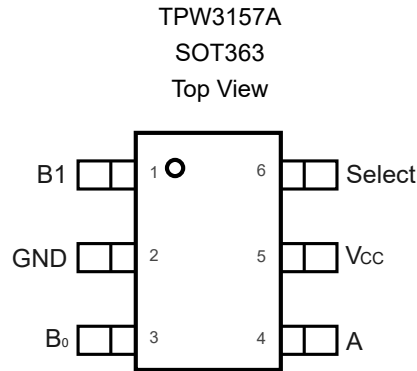


Table 1. Pin Functions: TPW3157A

Pin No.	Name	I/O	Description
1	B ₁		Switch port 1
2	GND		Ground
3	B ₀		Switch port 0
4	A		Common switch port
5	V _{CC}		Power supply
6	Select		Select pin

Table 2. Function Table

Input: Select Pin	Function
Low	B ₀ connected to A
High	B ₁ connected to A

Specifications

Absolute Maximum Ratings ⁽¹⁾

Parameter		Min	Max	Unit
	Supply Voltage, V_{CC}	-0.5	6	V
	Select Input Voltage	-0.5	6	V
	Select Input Diode Current		-50	mA
	Switch I/O Port Voltage	-0.5	$V_{CC} + 0.5$	V
	Switch I/O Port Diode Current	-50	50	mA
	Switch Current		120	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⁾	2	kV
LU	Latch Up	JESD 78, 25°C	800	mA
		JESD 78, 125°C	800	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	0	V_{CC}	V
Operating Temperature Range	-40	125	°C

(1) The select input must be held High or Low and must not float.

Thermal Information

Package Type	θ_{JA}	θ_{JC}	Unit
SOT363	400		°C/W
SOT363	250	81	°C/W

Low-Voltage 5-Ω SPDT Analog Switch
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	-40°C to 125°C	Limit	Unit
Power Supply								
I_{CC}	Quiescent Supply Current	$V_{IN} = 0\text{ V or }V_{CC}$	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	$V_{IN} = 0\text{ V or }V_{CC}$	5.5		± 1	± 1	Max	μA
Analog Switch								
$R_{ON}^{(1)}$		$I_{OUT} = 100\text{ mA}$, $B0\text{ or }B1 = 3.5\text{ V}$	4.5	1.5			Typ	Ω
R_{ON}		$I_{OUT} = 100\text{ mA}$, $B0\text{ or }B1 = 3.5\text{ V}$	4.5	2	3	3	Max	Ω
ΔR_{ON}	Maximum On Resistance	$I_{OUT} = 100\text{ mA}$, $B0\text{ or }B1 = 3.5\text{ V}$	4.5	0.3	0.4	0.4	Max	Ω
$R_{FLAT(ON)}$	On Resistance Flatness	$I_{OUT} = 100\text{ mA}$, $B0\text{ or }B1 = 0\text{ V, }1\text{ V, }2\text{ V}$	4.5	0.5	0.6	0.6	Max	Ω
$I_{NO(OFF)}$, $I_{NC(OFF)}$	Switch OFF Leakage Current on B0, B1	$A = 1\text{ V, }4.5\text{ V}$, $B0\text{ or }B1 = 4.5\text{ V, }1\text{ V}$	5.5	± 10	± 50	± 100	Max	nA
$I_{A(OFF)}$	Switch OFF Leakage Current on A	$A = 1\text{ V, }4.5\text{ V}$, $B0\text{ or }B1 = 4.5\text{ V, }1\text{ V}$	5.5	± 20	± 100	± 200	Max	nA
$I_{A(ON)}$	Switch ON Leakage Current on A	$A = 1\text{ V, }4.5\text{ V}$, $B0\text{ or }B1 = 1\text{ V, }4.5\text{ V, or floating}$	5.5	± 20	± 100	± 200	Max	nA
Dynamic Characteristics								
t_{PHL} , t_{PLH}	Switch IN to OUT Time	$B0\text{ or }B1 = 3\text{ V}$, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, Figure 3	4.5	5			Max	ns
t_{PZH} , t_{PZL}	Switch Turn-on Time	$B0\text{ or }B1 = 3\text{ V}$, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, Figure 3	4.5	40	50	50	Max	ns
t_{PHZ} , t_{PLZ}	Switch Turn-off Time	$B0\text{ or }B1 = 3\text{ V}$, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, Figure 3	4.5	20	25	25	Max	ns
t_B	Break-Before-Make Time ⁽¹⁾	$B0\text{ or }B1 = 3\text{ V}$, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, Figure 4	4.5	20	40	40	Typ	ns
Q	Charge Injection ⁽¹⁾	$C_L = 1.0\text{ nF}$, $V_{GEN} = 0\text{ V}$, $R_{GEN} = 0\ \Omega$, Figure 5	5	20			Typ	pC
	OFF-Isolation ⁽¹⁾	$f = 1\text{ MHz}$, $R_L = 50\ \Omega$, Figure 6	5	-65			Typ	dB

Low-Voltage 5-Ω SPDT Analog Switch

Symbol	Parameter	Conditions	V _{CC} (V)	25°C	-40°C to 85°C	-40°C to 125°C	Limit	Unit
	Crosstalk ⁽¹⁾	f = 1 MHz, R _L = 50 Ω, Figure 7	5	-65			Typ	dB
BW	Bandwidth ⁽¹⁾	R _L = 50 Ω	5	100			Typ	MHz
THD	Total Harmonic Distortion ⁽¹⁾	R _L = 600 Ω, V _{IN} = 0.5 V _{PP} , f = 20 Hz to 20 kHz	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 tests and design simulation.

Low-Voltage 5-Ω SPDT Analog Switch
Electrical Characteristics (Continued)

 All test conditions: $V_{CC} = 2.7\text{ V}$ to 3.6 V , 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	$V_{IN} = 0\text{ V}$ 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	$V_{IN} = 0\text{ V}$ or V_{CC}	3.6		± 1	± 1	Max	μA
Analog Switch								
$R_{ON}^{(1)}$		$I_{OUT} = 100\text{ mA}$, $B0$ or $B1 = 1.5\text{ V}$	2.7	3			Typ	Ω
R_{ON}		$I_{OUT} = 100\text{ mA}$, $B0$ or $B1 = 1.5\text{ V}$	2.7	5	8	8	Max	Ω
ΔR_{ON}	Maximum On Resistance	$I_{OUT} = 100\text{ mA}$, $B0$ or $B1 = 1.5\text{ V}$	2.7	0.5	0.6	0.6	Max	Ω
$R_{FLAT(ON)}$	On Resistance Flatness	$I_{OUT} = 100\text{ mA}$, $B0$ or $B1 = 0\text{ V}$, 0.75 V , 1.5 V	2.7	1.5	2	2	Max	Ω
$I_{NO(OFF)}$, $I_{NC(OFF)}$	Switch OFF Leakage Current on $B0$, $B1$	$A = 1\text{ V}$, 4.5 V , $B0$ or $B1 = 4.5\text{ V}$, 1 V	3.6	± 10	± 50	± 100	Max	nA
$I_{A(OFF)}$	Switch OFF Leakage Current on A	$A = 1\text{ V}$, 4.5 V , $B0$ or $B1 = 4.5\text{ V}$, 1 V	3.6	± 20	± 100	± 200	Max	nA
$I_{A(ON)}$	Switch ON Leakage Current on A	$A = 1\text{ V}$, 4.5 V , $B0$ or $B1 = 1\text{ V}$, 4.5 V , or floating	3.6	± 20	± 100	± 200	Max	nA
Dynamic Characteristics								
t_{PHL} , t_{PLH}	Switch IN to OUT Time ⁽¹⁾	$B0$ or $B1 = 1.5\text{ V}$, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, Figure 3	2.7	10			Typ	ns
t_{PZH} , t_{PZL}	Switch Turn-on Time	$B0$ or $B1 = 1.5\text{ V}$, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, Figure 3	2.7	70	80	80	Max	ns
t_{PHZ} , t_{PLZ}	Switch Turn-off Time	$B0$ or $B1 = 1.5\text{ V}$, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, Figure 3	2.7	25	40	40	Max	ns
t_B	Break-Before-Make Time ⁽¹⁾	$B0$ or $B1 = 1.5\text{ V}$, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, Figure 4	2.7	20			Typ	ns
Q	Charge Injection ⁽¹⁾	$C_L = 1.0\text{ nF}$, $V_{GEN} = 0\text{ V}$, $R_{GEN} = 0\ \Omega$, Figure 5	3	20			Typ	pC
	OFF-Isolation ⁽¹⁾	$f = 1\text{ MHz}$, $R_L = 50\ \Omega$, Figure 6	3	-65			Typ	dB

Low-Voltage 5-Ω SPDT Analog Switch

Symbol	Parameter	Conditions	V _{CC} (V)	25°C	-40°C to 85°C	-40°C to 125°C	Limit	Unit
	Crosstalk ⁽¹⁾	f = 1 MHz, R _L = 50 Ω, Figure 7	3	-65			Typ	dB
BW	Bandwidth ⁽¹⁾	R _L = 50 Ω	3	100			Typ	MHz
THD	Total Harmonic Distortion ⁽¹⁾	R _L = 600 Ω, V _{IN} = 0.5 V _{PP} , f = 20 Hz to 20 kHz	3	0.01			Typ	%

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

Low-Voltage 5-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	-40°C to 125°C	Limit	Unit
Power Supply								
I_{CC}	Quiescent Supply Current	$V_{IN} = 0\text{ V or }V_{CC}$	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	$V_{IN} = 0\text{ V or }V_{CC}$	1.95		± 1	± 1	Max	μA
Analog Switch								
$R_{ON}^{(1)}$		$I_{OUT} = 10\text{ mA}$, $B0\text{ or }B1 = 0.9\text{ V}$	1.65	15			Typ	Ω
R_{ON}		$I_{OUT} = 10\text{ mA}$, $B0\text{ or }B1 = 0.9\text{ V}$	1.65	20	25	25	Max	Ω
ΔR_{ON}	Maximum On Resistance	$I_{OUT} = 10\text{ mA}$, $B0\text{ or }B1 = 0.9\text{ V}$	1.65	5	7	7	Max	Ω
$I_{NO(OFF)}$, $I_{NC(OFF)}$	Switch OFF Leakage Current on B0, B1	$A = 0\text{ V}$, 1.95 V, $B0\text{ or }B1 = 1.95\text{ V, }0\text{ V}$	1.95	± 10	± 50	± 100	Max	nA
$I_{A(OFF)}$	Switch OFF Leakage Current on A	$A = 0\text{ V}$, 1.95 V, $B0\text{ or }B1 = 1.95\text{ V, }0\text{ V}$	1.95	± 20	± 100	± 200	Max	nA
$I_{A(ON)}$	Switch ON Leakage Current on A	$A = 0\text{ V}$, 1.95 V, $B0\text{ or }B1 = 0\text{ V, }1.95\text{ V, or floating}$	1.95	± 20	± 100	± 200	Max	nA
Dynamic Characteristics								
t_{PHL} , t_{PLH}	Switch IN to OUT Time ⁽¹⁾	$B0\text{ or }B1 = 1.0\text{ V}$, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, Figure 3	1.65	10			Typ	ns
t_{PZH} , t_{PZL}	Switch Turn-on Time	$B0\text{ or }B1 = 1.0\text{ V}$, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, Figure 3	1.65	80	90	90	Max	ns
t_{PHZ} , t_{PLZ}	Switch Turn-off Time	$B0\text{ or }B1 = 1.0\text{ V}$, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, Figure 3	1.65	50	70	70	Max	ns
t_B	Break-Before-Make Time	$B0\text{ or }B1 = 1.0\text{ V}$, $R_L = 50\ \Omega$, $C_L = 35\text{ pF}$, Figure 4	1.65	20			Max	ns
Q	Charge Injection ⁽¹⁾	$C_L = 1.0\text{ nF}$, $V_{GEN} = 0\text{ V}$, $R_{GEN} = 0\ \Omega$, Figure 5	1.8	20			Typ	pC
	OFF-Isolation ⁽¹⁾	$f = 1\text{ MHz}$, $R_L = 50\ \Omega$, Figure 6	1.8	-65			Typ	dB
	Crosstalk ⁽¹⁾	$f = 1\text{ MHz}$, $R_L = 50\ \Omega$, Figure 7	1.8	-65			Typ	dB

Low-Voltage 5-Ω SPDT Analog Switch

Symbol	Parameter	Conditions	V _{CC} (V)	25°C	-40°C to 85°C	-40°C to 125°C	Limit	Unit
BW	Bandwidth ⁽¹⁾	R _L = 50 Ω	1.8	100			Typ	MHz
THD	Total Harmonic Distortion ⁽¹⁾	R _L = 600 Ω, V _{IN} = 0.5 V _{PP} , f = 20 Hz to 20 kHz	1.8	0.01			Typ	%

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

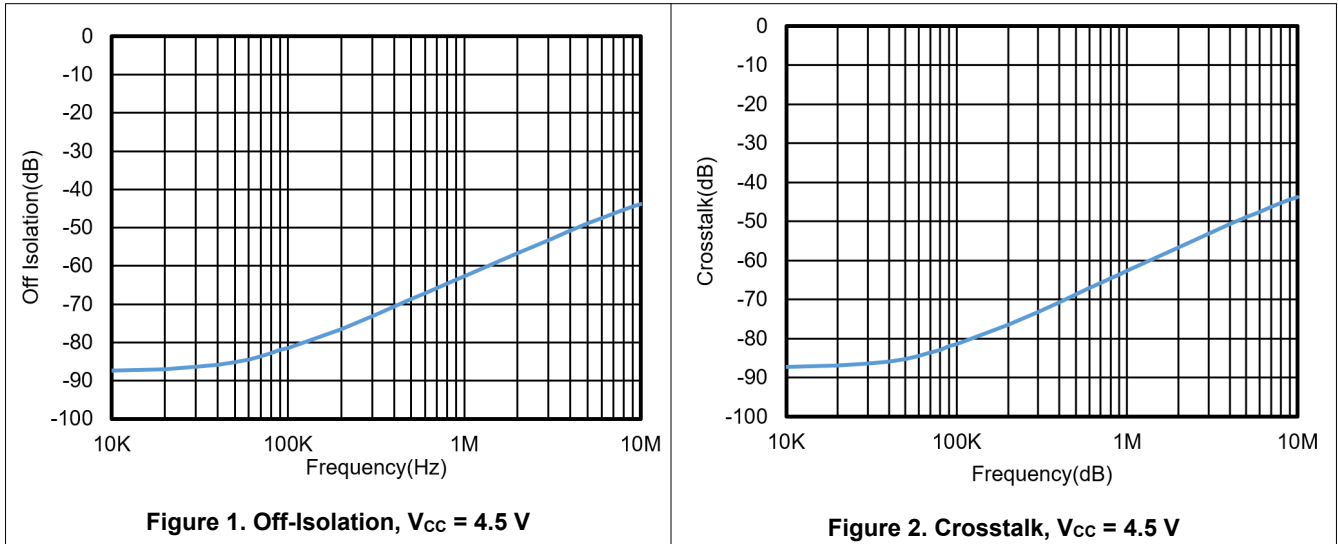
Electrical Characteristics (Continued)

All test conditions: $T_A = 0^\circ\text{C}$ 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 = 1 V, 4.5 V, B0 or B1 = 4.5 V, 1 V	3.6	±10	Max	nA
I _{A(OFF)}	Switch OFF Leakage Current on A	A = 1 V, 4.5 V, B0 or B1 = 4.5 V, 1 V	3.6	±20	Max	nA
I _{A(ON)}	Switch ON Leakage Current on A	A = 1 V, 4.5 V, B0 or B1 = 1 V, 4.5 V, or floating	3.6	±20	Max	nA
I _{NO(OFF)} , I _{NC(OFF)}	Switch OFF Leakage Current on B0, B1	A = 1 V, 4.5 V, B0 or B1 = 4.5 V, 1 V	5.5	±10	Max	nA
I _{A(OFF)}	Switch OFF Leakage Current on A	A = 1 V, 4.5 V, B0 or B1 = 4.5 V, 1 V	5.5	±20	Max	nA
I _{A(ON)}	Switch ON Leakage Current on A	A = 1 V, 4.5 V, B0 or B1 = 1 V, 4.5 V, or floating	5.5	±20	Max	nA

Typical Performance Characteristics

All test conditions: $V_{CC} = 5\text{ V}$, unless otherwise noted.



Test Circuit and Waveforms

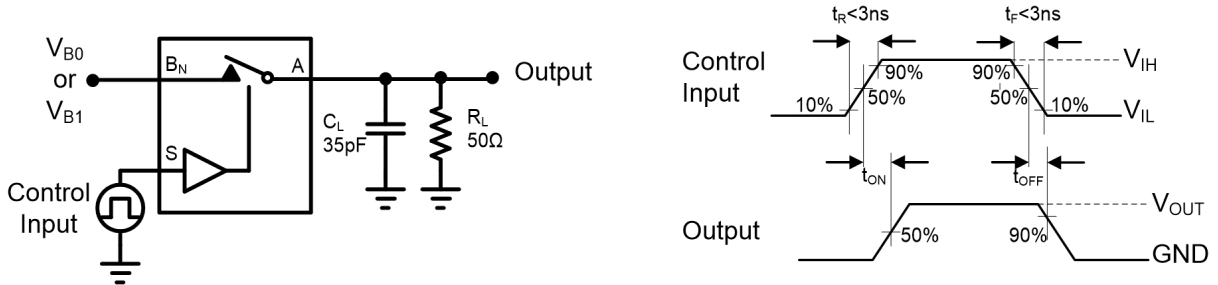


Figure 3. AC Test Circuit and Test Waveforms

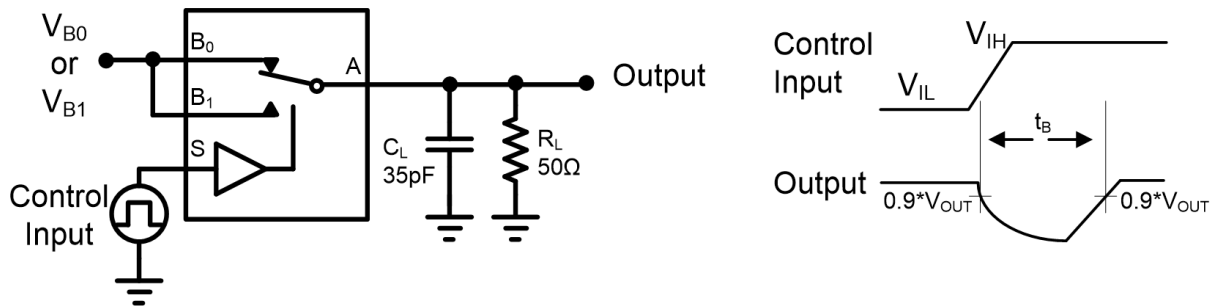


Figure 4. Switch Break Time

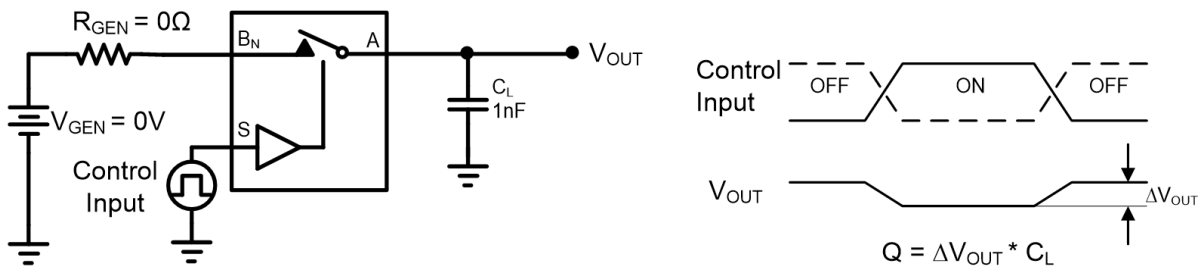


Figure 5. Charge Injection

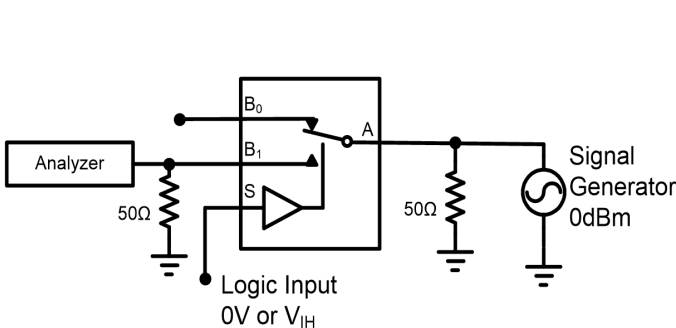


Figure 6. Off Isolation

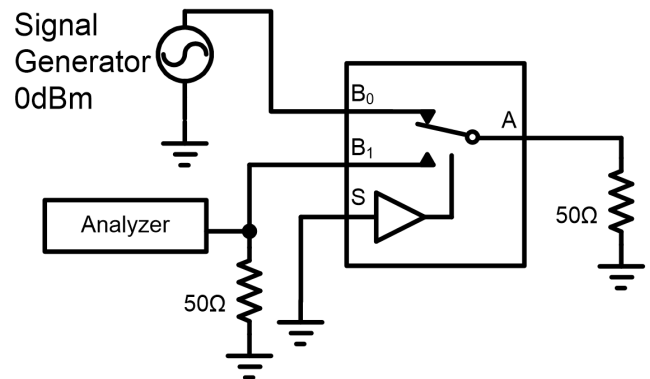
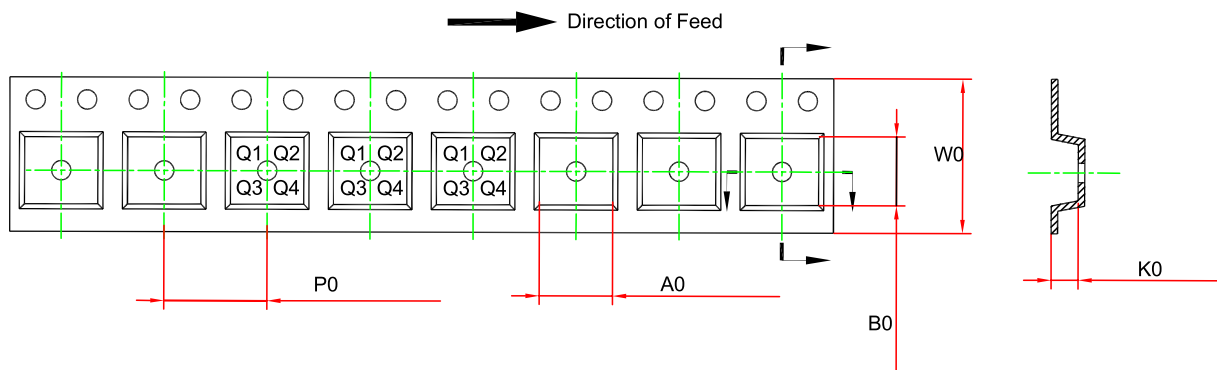
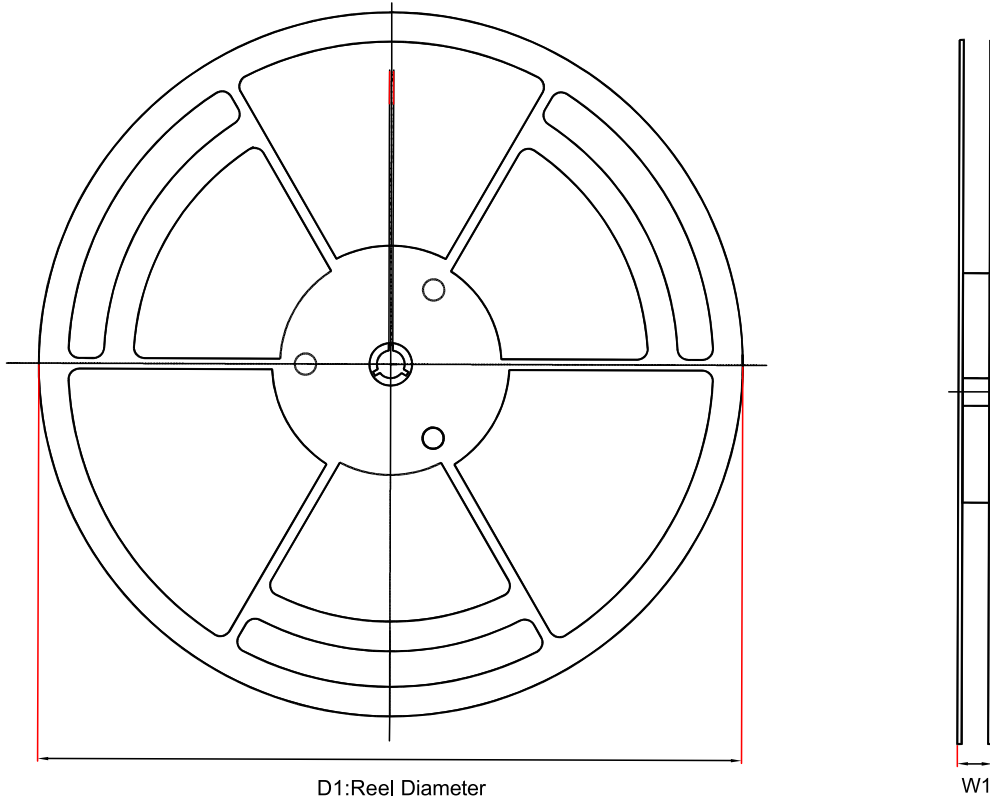


Figure 7. Crosstalk

Tape and Reel Information

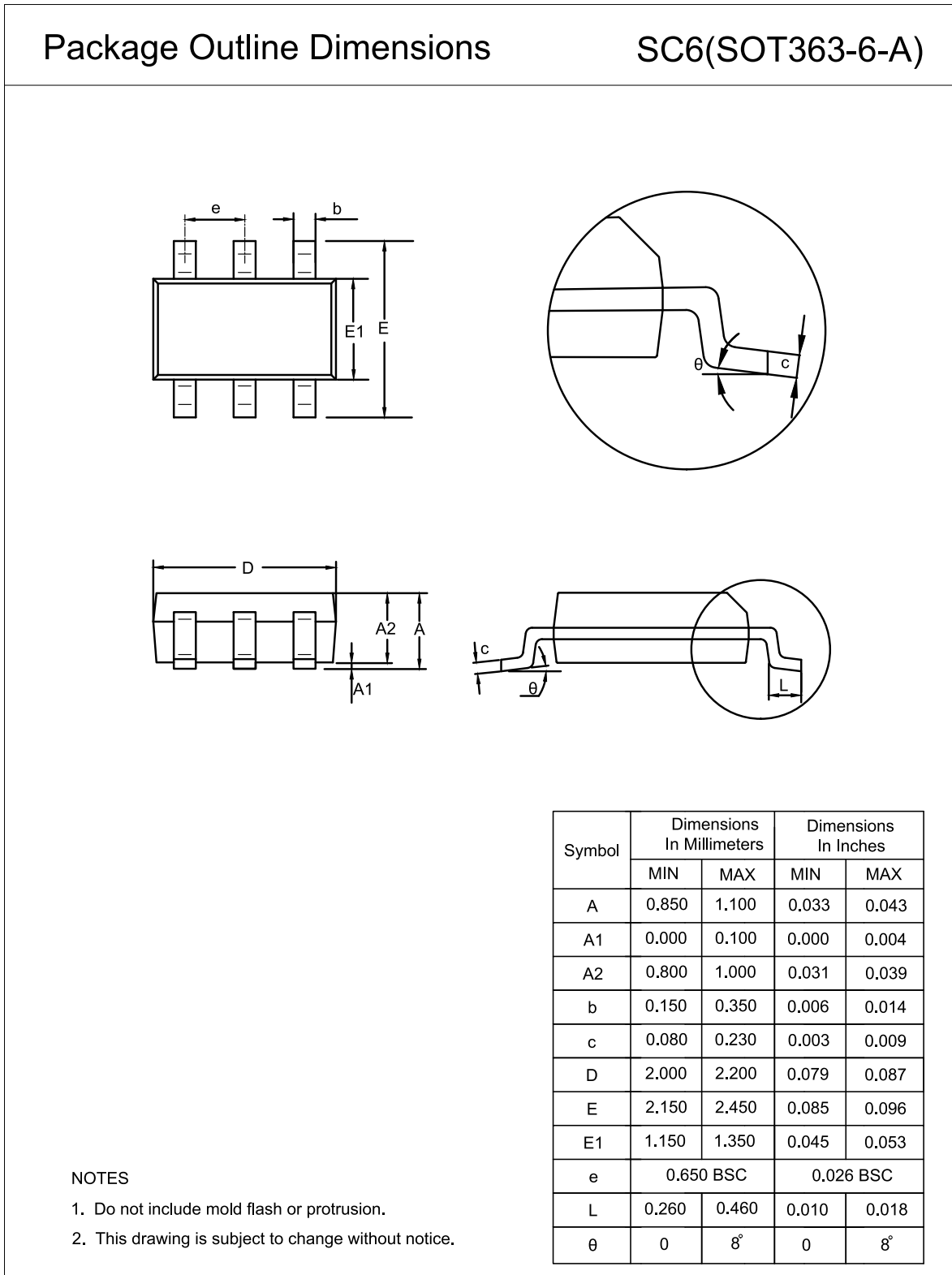


Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm) ⁽¹⁾	B0 (mm) ⁽¹⁾	K0 (mm) ⁽¹⁾	P0 (mm)	W0 (mm)	Pin1 Quadrant
TPW3157A-CR	SOT363 (SC70-6)	178	12.1	2.4	2.5	1.2	4	8	Q3

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

Package Outline Dimensions

SOT363 (SC70-6)



Order Information

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity	Eco Plan
TPW3157A-CR	-40 to 125°C	SOT363 (SC70-6)	315	3	Tape and Reel, 3000	Green

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

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