

Low Voltage SPDT Analog Switch 2:1 Mux/Demux Bus Switch

Description

The DIODES PI5A3157B is a high-bandwidth, fast single-pole double-throw (SPDT) CMOS switch. It can be used as an analog switch or as a low-delay bus switch. Specified over a wide operating power supply voltage range, 1.65V to 5.5V, the PI5A3157B has a maximum ON resistance of 12Ω at 1.65V, 9Ω at 2.3V & 6Ω at 4.5V.

Break-before-make switching prevents both switches being enabled simultaneously. This eliminates signal disruption during switching.

The control input, S, is independent of supply voltage.

PI5A3157B is an improved direct replacement for the NC7SB3157.

Application(s)

- Cell Phones
- PDAs
- MP3 Players
- Portable Instrumentation
- Battery Powered Communications
- Computer Peripherals

Features

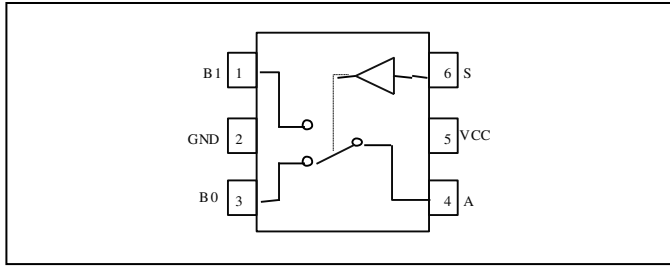
- CMOS Technology for Bus and Analog Applications
- Low On-Resistance: 8Ω at 3.0V
- Wide VCC Range: 1.65V to 5.5V
- Rail-to-Rail Signal Range
- Control Input Overvoltage Tolerance: 5.5V
- Fast Transition Speed: 2ns at 5.0V
- High Off Isolation: -63dB @ 10MHz
- Break-Before-Make Switching
- High Bandwidth: 350MHz
- Extended Industrial Temperature Range: -40°C to 85°C
- The PI5A3157B is an improved direct replacement for the NC7SB3157
- Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)
- Halogen and Antimony Free. "Green" Device (Note 3)
- For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please [contact us](#) or your local Diodes representative.
<https://www.diodes.com/quality/product-definitions/>
- Packaging (Pb-free & Green):
 - 6-pin, X1DFN 1mm×1mm (XDB)
 - 6-pin, SC70 (C6) (Not Recommended for New Design)
 - 6-Pin, SC70 (C)

Notes:

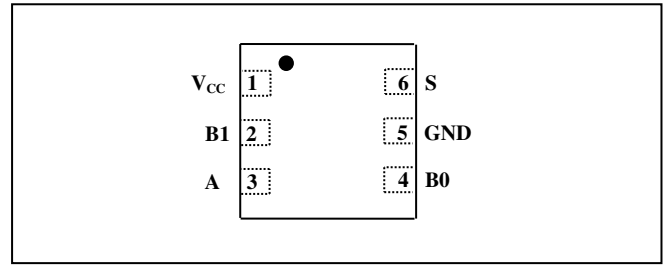
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Pin Configuration

Top Transparent View



SC70



X1DFN

Pin Description

Pin#		Pin Name	Description
SC70	X1DFN		
1	2	B1	Data Port
2	5	GND	Ground
3	4	B0	Data Port (Normally connected)
4	3	A	Common Output/Data Port
5	1	VCC	Positive Power Supply
6	6	S	Logic Control

Logic Function Table

Logic Inputs(S)	Function
0	B ₀ connect to A
1	B ₁ connect to A

Maximum Ratings

Storage Temperature.....	-65°C to +150°C
Ambient Temperature with Power Applied.....	-40°C to +85°C
Supply Voltage V_{CC}	-0.5V to +7.0V
DC Control Input Voltage V_S	-0.5V to +7.0V
DC Input Voltage V_{IN}	-0.5V to $V_{CC} + 0.5V$
DC Output Current V_{OUT}	128mA
DC V_{CC} or Ground Current I_{CC} / I_{GND}	$\pm 100mA$
Maximum Junction Temperature.....	125°C
Junction Lead Temperature (TL) (Soldering, 10 seconds).....	260°C
Power Dissipation (Pd) @ +85°C.....	180mW
ESD (HBM).....	2000V

Note:

Stresses greater than those listed under MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

Recommended Operating Conditions

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{CC}	Operating Voltage		1.65		5.5	V
V_S	Control Input Voltage		0		5.5	V
V_{IN}	Switch Input Voltage		0		V_{CC}	V
V_{OUT}	Output Voltage		0		V_{CC}	V
T_A	Operating Temperature		-40	25	85	°C
T_s						
tr, tf	Input Rise and Fall Time	Control Input $V_{CC} = 2.3V$ to $3.6V$	0		10	ns/V
		Control Input $V_{CC} = 4.5V$ to $5.5V$	0		5	ns/V

Note: Control input must be held HIGH or LOW; it must not float.

DC Electrical Characteristics

($T_A = -40^\circ C$ to $85^\circ C$, unless otherwise noted.)

Parameter	Description	Test Conditions	Temperature ($T_A: ^\circ C$)	Min.	Typ.	Max.	Units	
V_{IAR}	Analog Input Signal Range	V_{CC}	$-40^\circ C$ to $85^\circ C$	0		V_{CC}	V	
R_{ON}	ON Resistance ⁽¹⁾	$V_{CC} = 4.5V, I_O = 30mA, V_{IN} = 0V$	25°C		4	6	Ω	
		$V_{CC} = 4.5V, I_O = -30mA, V_{IN} = 2.4V$			5	8		
		$V_{CC} = 4.5V, I_O = -30mA, V_{IN} = 4.5V$			7	11		
		$V_{CC} = 4.5V, I_O = 30mA, V_{IN} = 0V$	$-40^\circ C$ to $85^\circ C$			6		
		$V_{CC} = 4.5V, I_O = -30mA, V_{IN} = 2.4V$				8		
		$V_{CC} = 4.5V, I_O = -30mA, V_{IN} = 4.5V$				11		
		$V_{CC} = 3.0V, I_O = 24mA, V_{IN} = 0V$	25°C			5		8
		$V_{CC} = 3.0V, I_O = -24mA, V_{IN} = 3.0V$				10		15
		$V_{CC} = 3.0V, I_O = 24mA, V_{IN} = 0V$		$-40^\circ C$ to $85^\circ C$				
		$V_{CC} = 3.0V, I_O = -24mA, V_{IN} = 3.0V$				15		
		$V_{CC} = 2.3V, I_O = 8mA, V_{IN} = 0V$	25°C					6
		$V_{CC} = 2.3V, I_O = -8mA, V_{IN} = 2.3V$				13		20
		$V_{CC} = 2.3V, I_O = 8mA, V_{IN} = 0V$		$-40^\circ C$ to $85^\circ C$				
		$V_{CC} = 2.3V, I_O = -8mA, V_{IN} = 2.3V$				20		
		$V_{CC} = 1.65V, I_O = 4mA, V_{IN} = 0V$	25°C					8
		$V_{CC} = 1.65V, I_O = -4mA, V_{IN} = 1.65V$				20		30
$V_{CC} = 1.65V, I_O = 4mA, V_{IN} = 0V$	$-40^\circ C$ to $85^\circ C$					12		
$V_{CC} = 1.65V, I_O = -4mA, V_{IN} = 1.65V$					30			

Parameter	Description	Test Conditions	Temperature (T _A :°C)	Min.	Typ.	Max.	Units
ΔR _{ON}	ON Resistance Match Between Channels ^(1,2,3)	V _{CC} = 4.5V, I _A = -30mA, V _{IN} = 3.15V	25°C		0.15		Ω
		V _{CC} = 3.0V, I _A = -24mA, V _{IN} = 2.1V			0.2		
		V _{CC} = 2.3V, I _A = -8mA, V _{IN} = 1.6V			0.3		
		V _{CC} = 1.65V, I _A = -4mA, V _{IN} = 0V			0.5		
R _{ONF}	ON Resistance Flatness ^(1,2,4)	V _{CC} = 5.0V, I _A = -30mA, 0 ≤ V _{IN} ≤ V _{CC}	25°C		6		Ω
		V _{CC} = 3.3V, I _A = -24mA, 0 ≤ V _{IN} ≤ V _{CC}			12		
		V _{CC} = 2.5V, I _A = -8mA, 0 ≤ V _{IN} ≤ V _{CC}			22		
		V _{CC} = 1.8V, I _A = -4mA, 0 ≤ V _{IN} ≤ V _{CC}			90		
V _{IH}	Input High Voltage (Logic High Level)	V _{CC} = 1.65V	-40°C to 85°C	1			V
		V _{CC} = 2.3V		1.2			
		V _{CC} = 3V		1.3			
		V _{CC} = 4.2V		1.5			
		V _{CC} = 5.5V		1.8			
V _{IL}	Input Low Voltage (Logic Low Level)	V _{CC} = 1.65V	-40°C to 85°C			0.4	V
		V _{CC} = 2.3V				0.6	
		V _{CC} = 3V				0.8	
		V _{CC} = 4.2V				1	
		V _{CC} = 5.5V				1.2	
I _{LKC}	Input Leakage Current	0 ≤ V _{IN} ≤ 5.5V, V _{CC} = 0V to 5.5V	25°C			±0.1	μA
			-40°C to 85°C			±1.0	
I _{OFF}	OFF State Leakage Current	0 ≤ V _{IN} ≤ 5.5V, V _{CC} = 1.65V to 5.5V	25°C			±0.1	μA
			-40°C to 85°C			±10	
I _{CC}	Quiescent Supply Current	All channels ON or OFF, V _{IN} = V _{CC} or GND, I _{OUT} = 0, V _{CC} = 5.5V	25°C			1	μA
			-40°C to 85°C			5	

Notes:

1. Measured by voltage drop between A and B pins at the indicated current through the device. ON resistance is determined by the lower of the voltages on two ports (A or B).
2. Parameter is characterized but not tested in production.
3. ΔR_{ON} = R_{ON} max – R_{ON} min. measured at identical V_{CC}, temperature and voltage levels.
4. Flatness is defined as difference between maximum and minimum value of ON resistance over the specified range of conditions. Guaranteed by design.

Capacitance

 (T_A = 25°C, unless otherwise noted.)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
C _{IN}	Control Input	V _{CC} = 5.0V, f = 1 MHz ⁽¹⁾		2.5		pF
C _{IO-B}	For B Port, Switch OFF			5.0		
C _{IOA-ON}	For A Port, Switch ON			15.0		

Notes:

1. Capacitance is characterized but not tested in production

Switch and AC Characteristics

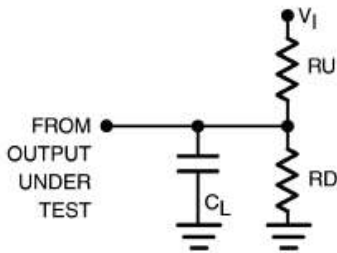
Parameter	Description	Test Conditions	Supply Voltage	Temperature (T _A : °C)	Min	Typ	Max	Units
t _{PLH} t _{PHL}	Propagation Delay: A to Bn	See test circuit diagrams 1 and 2. V _I Open ⁽²⁾	V _{CC} = 1.65V to 1.95V	-40 to 85°C			3.5	ns
			V _{CC} = 2.3V to 2.7V				1.1	
			V _{CC} = 3.0V to 3.6V				0.9	
			V _{CC} = 4.5V to 5.5V				0.6	
t _{PZL} t _{PZH}	Output Enable Turn ON Time:	See test circuit diagrams 1&2.	V _{CC} = 1.65V to 1.95V	-40 to 85°C	6		13	
			V _{CC} = 2.3V to 2.7V		3.5		8.0	

Parameter	Description	Test Conditions	Supply Voltage	Temperature (T _A : °C)	Min	Typ	Max	Units
	A to Bn	V _I = 2V _{CC} for t _{PZL} , V _I = 0V for t _{PZH}	V _{CC} = 3.0V to 3.6V V _{CC} = 4.5V to 5.5V		2.5 1.7		6.9 5.2	
t _{PLZ} t _{PHZ}	Output Disable Turn OFF Time: A to Bn	See test circuit diagrams 1 and 2. V _I = 2V _{CC} for t _{PLZ} , V _I = 0V for t _{PHZ}	V _{CC} = 1.65V to 1.95V V _{CC} = 2.3V to 2.7V V _{CC} = 3.0V to 3.6V V _{CC} = 4.5V to 5.5V	-40 to 85°C	3 2 1.5 0.8		13 9 7.0 4.5	
t _{BM}	Break Before Make Time	See test circuit diagram 3.	V _{CC} = 1.65V to 1.95V V _{CC} = 2.3V to 2.7V V _{CC} = 3.0V to 3.6V V _{CC} = 4.5V to 5.5V	-40 to 85°C		3.7 2.5 2.5 1.6		
Q	Charge Injection	C _L = 0.1nF, V _{GEN} = 0V, R _{GEN} = 0Ω. See test circuit 4.	V _{CC} = 5.0V V _{CC} = 3.3V	25°C		10 6		pC
OIRR	Off Isolation	R _L = 50Ω, V _{GEN} = 0V, R _{GEN} = 0Ω, f = 10MHz. See test circuit 5 ⁽³⁾	V _{CC} = 1.65V to 5.5V	25°C		-63		dB
X _{TALK}	Crosstalk Isolation	See test circuit 6 ⁽⁴⁾	V _{CC} = 1.65V to 5.5V	25°C		-64		
f _{3dB}	-3dB Bandwidth	See test circuit 9	V _{CC} = 1.65V to 5.5V	25°C		350		MHz
T _{HD}	Total Harmonic Distortion	R _L = 600Ω, V _{IN} = 0.5V _{pp} , f = 20Hz to 20kHz	V _{CC} = 5.0V	25°C		0.012		%

Notes:

- Guaranteed by design.
- The device contributes no other propagation delay other than the RC delay of the switch ON resistance and the 50pF load capacitance, when driven by an ideal voltage source with zero output impedance.
- Off Isolation = 20 Log₁₀ [V_{Bn}/V_A] and is measured in dB.
- Crosstalk Isolation = 20 Log₁₀ [V_{B1}/V_{B0}] and is measured in dB.

Test Circuits and Timing Diagrams



Note: Input driven by 50ohm source terminated in 500ohm
 Note: C_L Includes load and stray capacitance
 Note: Input PRR=1.0MHz, $t_w = 500\text{nS}$

Figure 1. AC Test Circuit

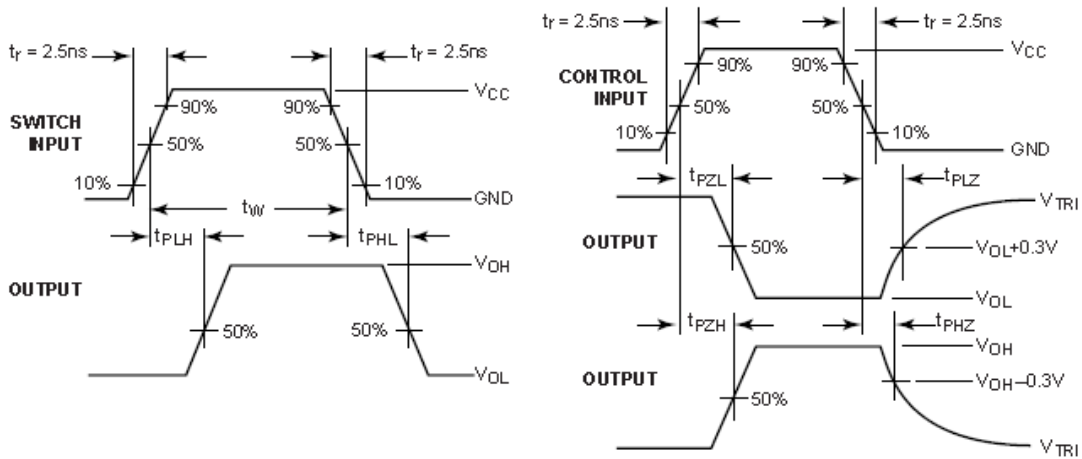


Figure 2. AC Waveforms

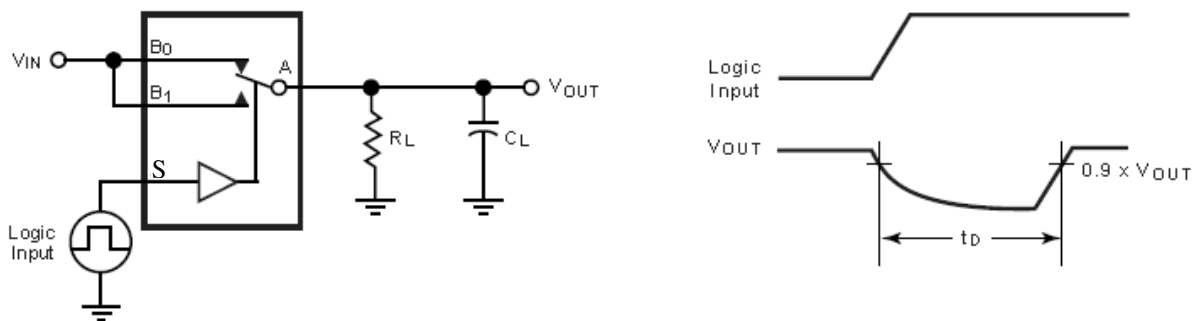


Figure 3. Break Before Make Interval Timing

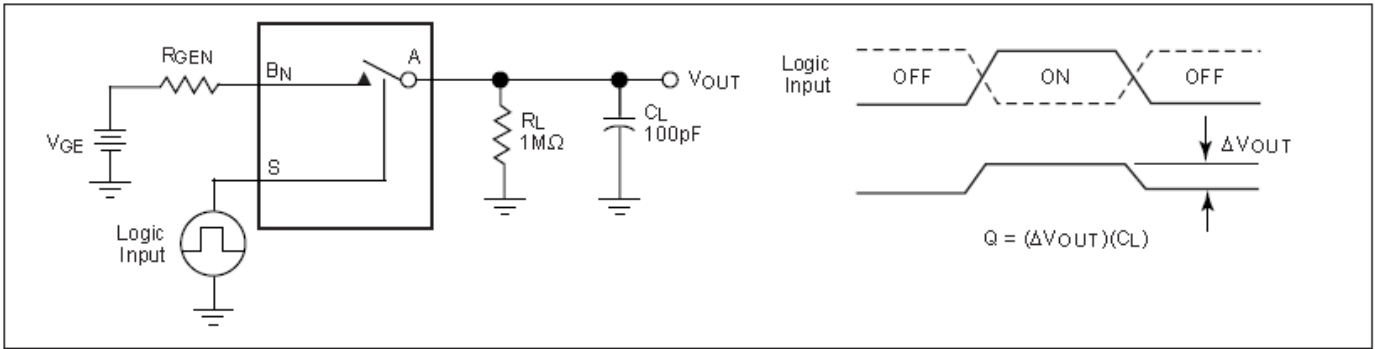


Figure 4. Charge Injection Test

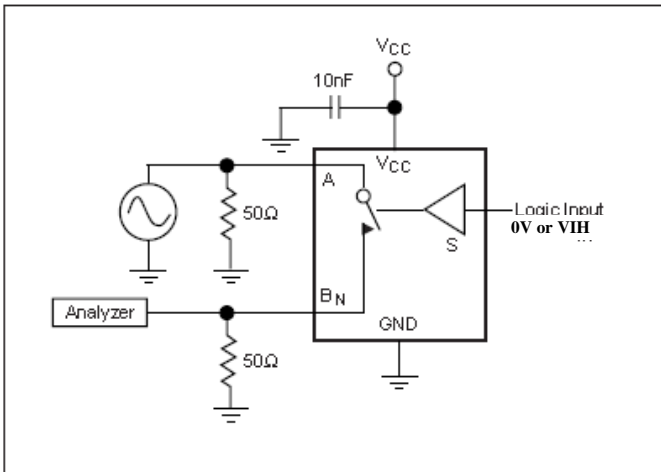


Figure 5. Off Isolation



Figure 6. Crosstalk

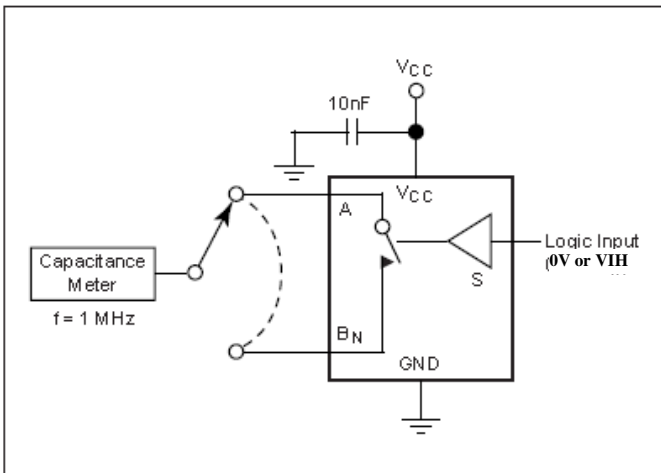


Figure 7. Channel Off Capacitance

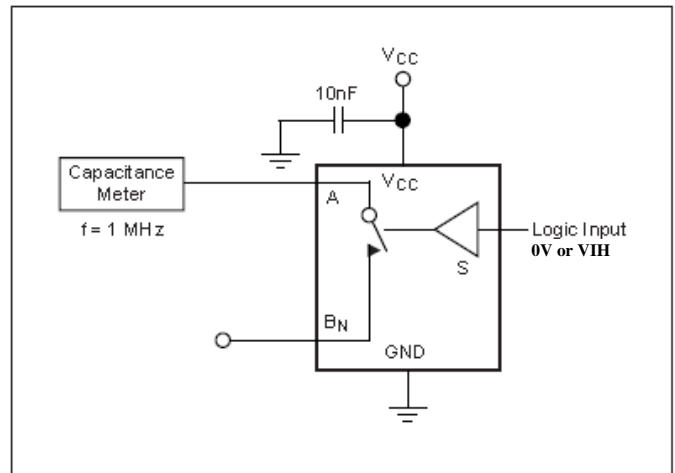


Figure 8. Channel On Capacitance

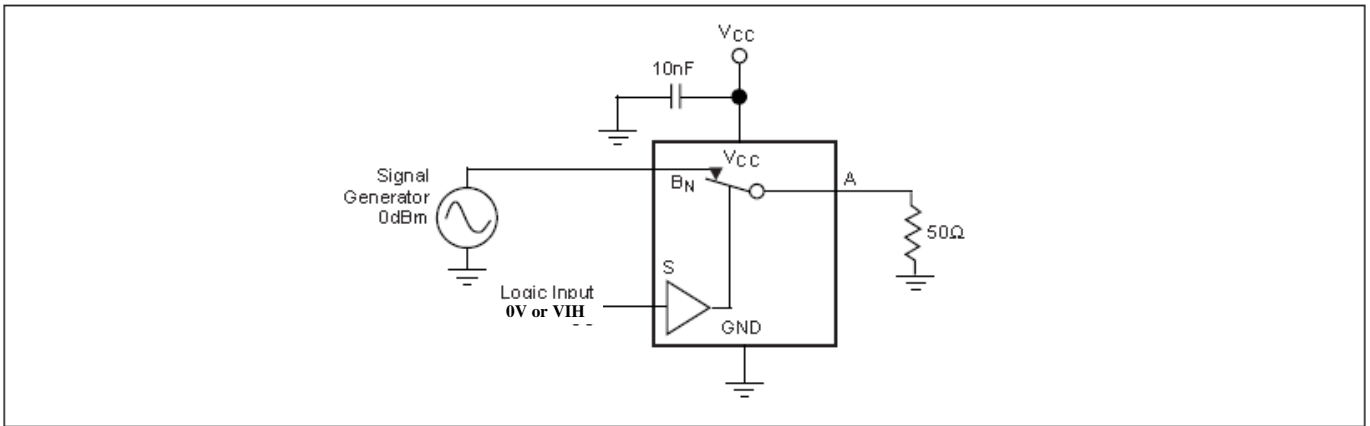
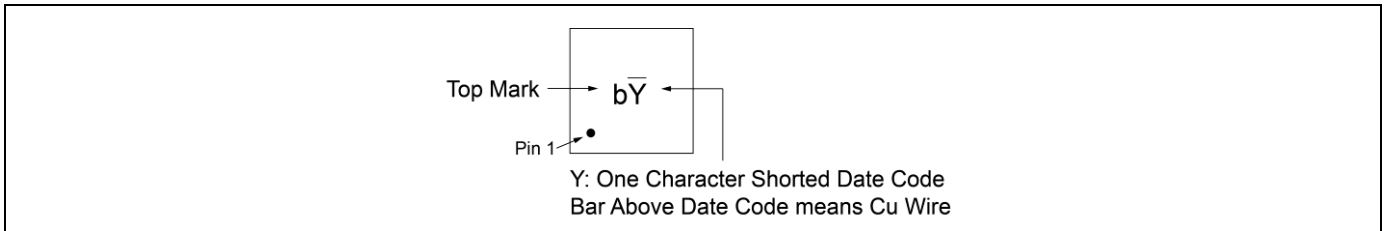


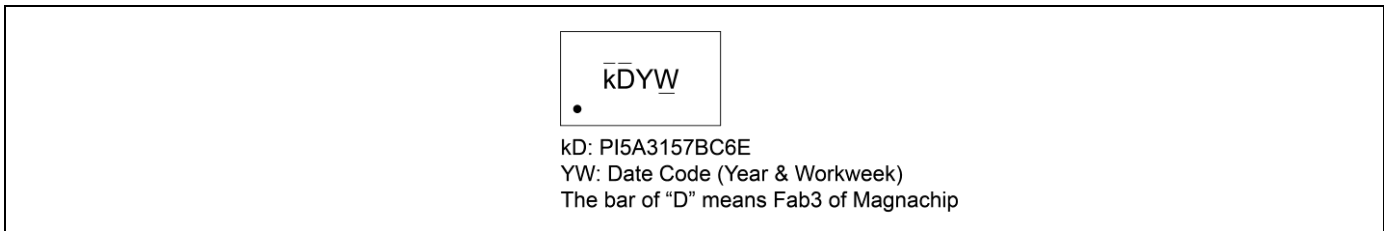
Figure 9. Bandwidth

Part Marking

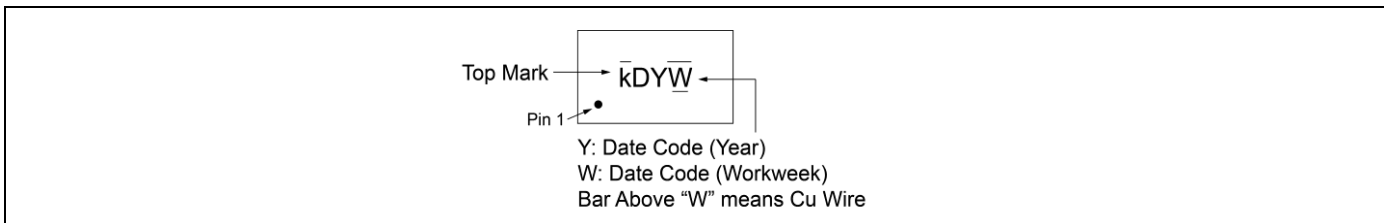
XDB Package



C6 Package

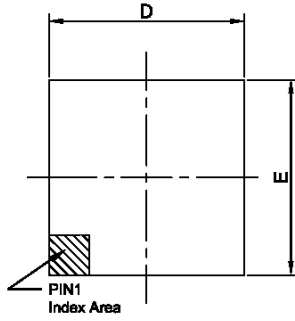


C Package

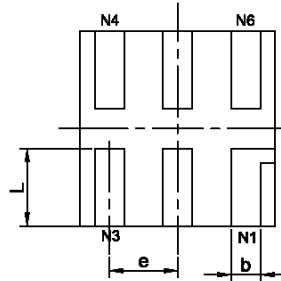


Packaging Mechanical

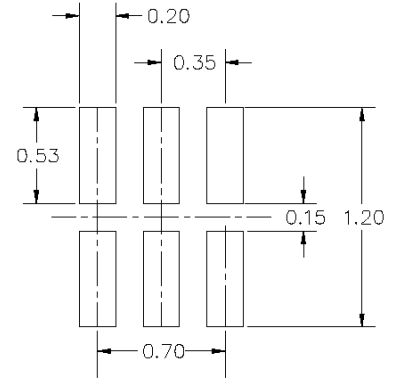
6-X1DFN (XDB)



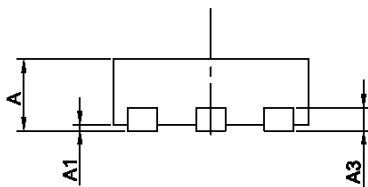
TOP VIEW



BOTTOM VIEW



RECOMMENDED LAND PATTERN(Unit:mm)



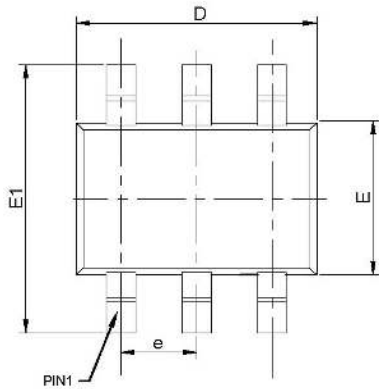
SIDE VIEW

PKG. DIMENSIONS(MM)		
SYMBOL	Min	Max
A	-	0.40
A1	0.00	0.05
A3	0.13 REF	
D	0.95	1.05
E	0.95	1.05
b	0.14	0.20
L	0.35	0.45
e	0.35 BSC	

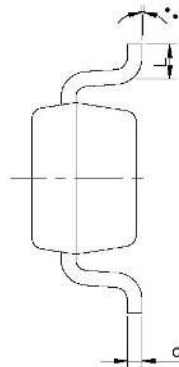
Notes:

1. Ref: JEDEC MO-287A
2. RECOMMENDED LAND PATTERN IS FOR REFERENCE ONLY.

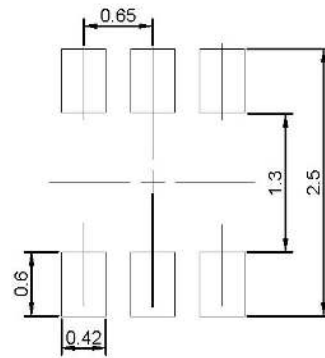
6-SC70 (C6)



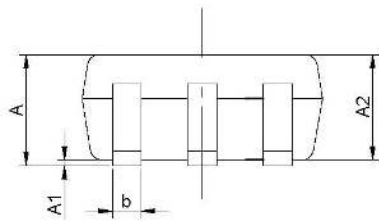
TOP VIEW



BOTTOM VIEW



RECOMMENDED LAND PATTERN (unit:mm)



SIDE VIEW

PKG. DIMENSIONS(MM)		
SYMBOL	Min	Max
A	-	1.10
A1	0.00	0.10
A2	0.70	1.00
b	0.15	0.40
c	0.08	0.22
D	1.80	2.20
E	1.10	1.40
E1	1.80	2.45
e	0.65 BSC	
L	0.26	0.46
θ	0°	8°

Notes:

1. Comply with MO-203C/AB, except b Max, D Min and D Max.
2. PACKAGE OUTLINE DIMENSIONS DO NOT INCLUDE MOLD FLASH AND METAL BURR
3. LAND PATTERN REFERENCE DIODES SOT363 PACKAGE INFORMATION.



DATE: 12/16/21

DESCRIPTION: 6-Pin, SOT363 (SC70)

PACKAGE CODE: C (C6)

DOCUMENT CONTROL#: PD-1902

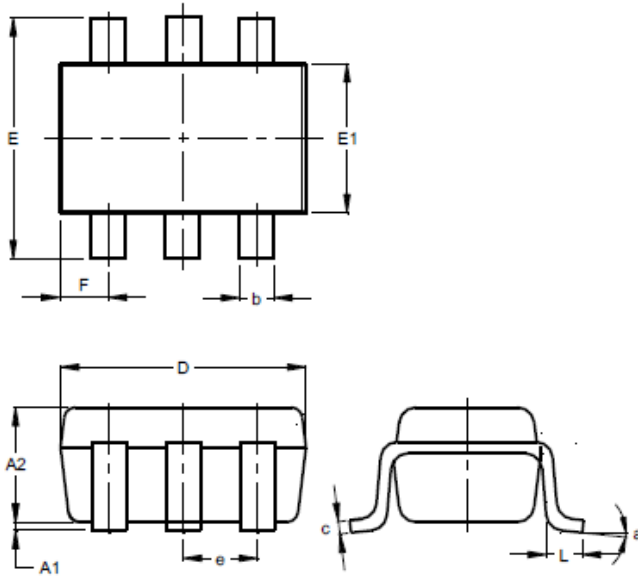
REVISION: D

21-1534

6-SC70 (C)

Package Outline Dimensions

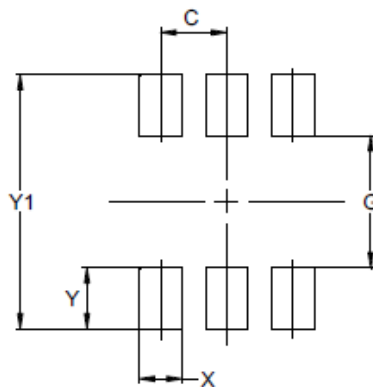
SOT363



SOT363			
Dim	Min	Max	Typ
A1	0.00	0.10	0.05
A2	0.90	1.00	0.95
b	0.10	0.30	0.25
c	0.10	0.22	0.11
D	1.80	2.20	2.15
E	2.00	2.20	2.10
E1	1.15	1.35	1.30
e	0.650 BSC		
F	0.40	0.45	0.425
L	0.25	0.40	0.30
a	0°	8°	--
All Dimensions in mm			

Suggested Pad Layout

SOT363



Dimensions	Value (in mm)
C	0.650
G	1.300
X	0.420
Y	0.600
Y1	2.500

Note: The suggested land pattern dimensions have been provided for reference only, as actual pad layouts may vary depending on application. These dimensions may be modified based on user equipment capability or fabrication criteria. A more robust pattern may be desired for wave soldering and is calculated by adding 0.2 mm to the 'Z' dimension. For further information, please reference document IPC-7351A, Naming Convention for Standard SMT Land Patterns, and for International grid details, please see document IEC, Publication 97.

Note: For high voltage applications, the appropriate industry sector guidelines should be considered with regards to creepage and clearance distances between device Terminals and PCB tracking.

For latest package info.

please check: <http://www.diodes.com/design/support/packaging/pericom-packaging/packaging-mechanicals-and-thermal-characteristics/>

Ordering Information

Part Number	Package Code	Package Description	Top Marking
PI5A3157BXDBEX	XDB	6-Pin, 1x1 (X1DFN)	b \overline{Y}
PI5A3157BC6EX	C6	6-Pin, SOT363 (SC70) (Not Recommended for New Design)	\overline{k} \overline{D} \overline{YW}
PI5A3157BCEX	C	6-Pin, SOT363 (SC70)	\overline{k} \overline{DY} \overline{W}

Notes:

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. E = Pb-free and Green
5. X suffix = Tape/Reel

IMPORTANT NOTICE

1. DIODES INCORPORATED (Diodes) AND ITS SUBSIDIARIES MAKE NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARDS TO ANY INFORMATION CONTAINED IN THIS DOCUMENT, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION).
2. The Information contained herein is for informational purpose only and is provided only to illustrate the operation of Diodes' products described herein and application examples. Diodes does not assume any liability arising out of the application or use of this document or any product described herein. This document is intended for skilled and technically trained engineering customers and users who design with Diodes' products. Diodes' products may be used to facilitate safety-related applications; however, in all instances customers and users are responsible for (a) selecting the appropriate Diodes products for their applications, (b) evaluating the suitability of Diodes' products for their intended applications, (c) ensuring their applications, which incorporate Diodes' products, comply the applicable legal and regulatory requirements as well as safety and functional-safety related standards, and (d) ensuring they design with appropriate safeguards (including testing, validation, quality control techniques, redundancy, malfunction prevention, and appropriate treatment for aging degradation) to minimize the risks associated with their applications.
3. Diodes assumes no liability for any application-related information, support, assistance or feedback that may be provided by Diodes from time to time. Any customer or user of this document or products described herein will assume all risks and liabilities associated with such use, and will hold Diodes and all companies whose products are represented herein or on Diodes' websites, harmless against all damages and liabilities.
4. Products described herein may be covered by one or more United States, international or foreign patents and pending patent applications. Product names and markings noted herein may also be covered by one or more United States, international or foreign trademarks and trademark applications. Diodes does not convey any license under any of its intellectual property rights or the rights of any third parties (including third parties whose products and services may be described in this document or on Diodes' website) under this document.
5. Diodes' products are provided subject to Diodes' Standard Terms and Conditions of Sale (<https://www.diodes.com/about/company/terms-and-conditions/terms-and-conditions-of-sales/>) or other applicable terms. This document does not alter or expand the applicable warranties provided by Diodes. Diodes does not warrant or accept any liability whatsoever in respect of any products purchased through unauthorized sales channel.
6. Diodes' products and technology may not be used for or incorporated into any products or systems whose manufacture, use or sale is prohibited under any applicable laws and regulations. Should customers or users use Diodes' products in contravention of any applicable laws or regulations, or for any unintended or unauthorized application, customers and users will (a) be solely responsible for any damages, losses or penalties arising in connection therewith or as a result thereof, and (b) indemnify and hold Diodes and its representatives and agents harmless against any and all claims, damages, expenses, and attorney fees arising out of, directly or indirectly, any claim relating to any noncompliance with the applicable laws and regulations, as well as any unintended or unauthorized application.
7. While efforts have been made to ensure the information contained in this document is accurate, complete and current, it may contain technical inaccuracies, omissions and typographical errors. Diodes does not warrant that information contained in this document is error-free and Diodes is under no obligation to update or otherwise correct this information. Notwithstanding the foregoing, Diodes reserves the right to make modifications, enhancements, improvements, corrections or other changes without further notice to this document and any product described herein. This document is written in English but may be translated into multiple languages for reference. Only the English version of this document is the final and determinative format released by Diodes.
8. Any unauthorized copying, modification, distribution, transmission, display or other use of this document (or any portion hereof) is prohibited. Diodes assumes no responsibility for any losses incurred by the customers or users or any third parties arising from any such unauthorized use.
9. This Notice may be periodically updated with the most recent version available at <https://www.diodes.com/about/company/terms-and-conditions/important-notice>

The Diodes logo is a registered trademark of Diodes Incorporated in the United States and other countries.
All other trademarks are the property of their respective owners.
© 2023 Diodes Incorporated. All Rights Reserved.

www.diodes.com