Lead-free Green

SINGLE-POLE DOUBLE-THROW ANALOG SWITCH

Description

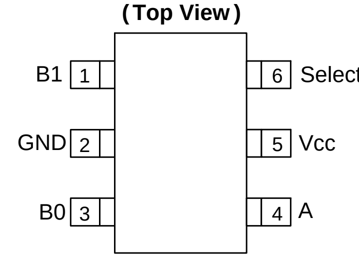
The 74LVC1G3157 is a single-pole, double-throw analog switch. The device is designed for operation with a power supply range of 1.65V to 5.5V. The bidirectional switch can handle signal amplitudes between Vcc and Ground. The OFF state impedance of the switch is typically 50MΩ while the ON state is typically 6Ω.

Features

- Wide Supply Voltage Range from 1.65 to 5.5V
- Control Pin Includes Hysteresis Allowing for Slower Input Rise and Fall Times
- CMOS Low Power Consumption
- Very Low ON-State Resistance
  - 7.5Ω (typical) at V_{CC} = 2.7V
  - 6.5Ω (typical) at V_{CC} = 3.3V
  - 6Ω (typical) at V_{CC} = 4.5V
- Break Before Make Switching
- Control Input accepts up to 5.5V Regardless of Vcc.
- Direct Interface with TTL Levels when V_{CC} = 3.3V
- ESD Protection Tested per JESD 22
  - Exceeds 200-V Machine Model (A115)
  - Exceeds 2,000-V Human Body Model (A114)
  - Exceeds 1,000-V Charged Device Model (C101)
- Latch-Up Exceeds 100mA per JESD 78, Class I
- Range of Package Options
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

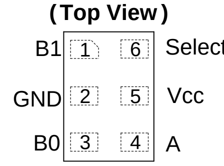
Pin Assignments

(Top View)



SOT363

(Top View)



X2-DFN1410-6

Packages not to scale

Applications

- Multiplexing of Analog Signals
- Multiplexing of Digital Signals
- Wide array of products such as:
  - Tablets, E-readers, Wearables
  - Cell Phones, Personal Navigation / GPS
  - MP3 Players, Cameras, Video Recorders
  - Computer Peripherals, Hard Drives, CD/DVD ROMs
  - TV, DVD, DVR, Set Top Boxes
  - PCs, Networking, Notebooks, Netbooks, PDAs

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html 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.

Ordering Information (Note 4)

74LVC1G 3157 XXX -7

Logic Device	Function	Package	Packing
74 : Logic Prefix LVC : 1.65 to 5.5 V Logic Family 1G : Single Gate	3157: Analog Switch SPDT	DW : SOT363 FZ4 : X2- DFN1410-6	-7 : 7” Tape & Reel

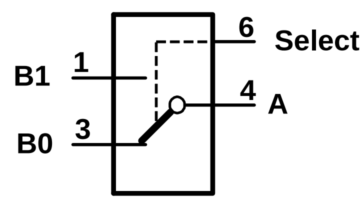
Device	Package Code	Package (Note 5)	Package Size	7” Tape and Reel (Note 6)	
				Quantity	Part Number Suffix
74LVC1G3157DW-7	DW	SOT363	2.0mm x 2.0mm x 1.1mm 0.65 mm lead pitch	3,000/Tape & Reel	-7
74LVC1G3157FZ4-7	FZ4	X2-DFN1410-6	1.4mm x 1.0mm x 0.4mm 0.5 mm pad pitch	5,000/Tape & Reel	-7

Notes: 4. For packaging details, go to our website at https://www.diodes.com/design/support/packaging/diodes-packaging/.
5. Pad layout as shown in Diodes Incorporated’s package outline PDFs, which can be found on our website at https://www.diodes.com/design/support/packaging/diodes-packaging/.
6. The taping orientation is located on our website at https://www.diodes.com/assets/Datasheets/ap02007.pdf.

Pin Descriptions

Pin Name	Description
B1	Selectable Data I/0
GND	Ground
B0	Selectable Data I/0
A	Common Data I/0
V_{CC}	Supply Voltage
Select	Selection Pin

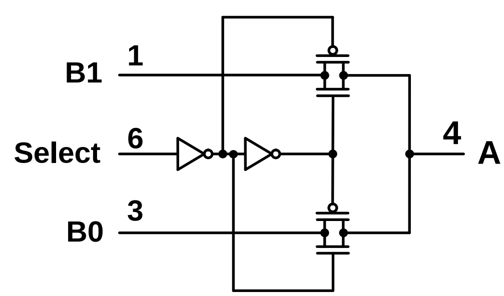
Logic Diagram



Function Table

Select	Status
H	B1 connected to A; B0 high impedance
L	B0 connected to A; B1 high impedance

Simplified Schematic



Absolute Maximum Ratings (Note 7)

Symbol	Description	Rating	Unit
ESD HBM	Human Body Model ESD Protection	2	kV
ESD CDM	Charged Device Model ESD Protection	1	kV
ESD MM	Machine Model ESD Protection	200	V
V_{CC}	Supply Voltage Range	-0.5 to 6.5	V
V_{IN}	Input Voltage Range Applicable to Select Pin	-0.5 to 6.5	V
V_{SW}	Voltage Range Applicable to B0, B1, and A Pins	-0.5 to V_{CC} +0.5	V
I_{IK}	Input Clamp Current V_I<0 Applicable to Select Pin	-50	mA
I_{IO}	Continuous Current Applicable to B0,B1, and A Pins	±50	mA
I_{CC}, I_{GND}	Continuous current through V_{CC} or GND	±100	mA
T_J	Operating Junction Temperature	-40 to +150	°C
T_{STG}	Storage Temperature	-65 to +150	°C

Note: 7. Stresses beyond the absolute maximum may result in immediate failure or reduced reliability. These are stress values and device operation should be within recommend values.

Recommended Operating Conditions

Symbol	Parameter		Min	Max	Unit
V_{CC}	Operating Voltage	Operating	1.65	5.5	V
V_{IN}	Select Input Voltage		0	5.5	V
V_{SW}	Switch Voltage (applicable to pins B0,B1,A)		-0.2	V_{CC}	V
Δt/ΔV	Input Transition Rise or Fall Rate – Select Pin	V_{CC} = 1.65 to 2.7V	-	20	ns/V
		V_{CC} = 2.7V to 5.5V	-	10	
T_A	Operating Free-Air Temperature	-	-40	+125	°C

Electrical Characteristics (All typical values are at, T_J = +25°C)

Symbol	Parameter	Test Condition	V_{CC} (V)	T_A = -40 to +85°C			T_A = -40 to +125°C		Unit
				Min	Typical (Note 8)	Max	Min	Max	
V_{IH}	High Level Input Voltage Select Pin	-	1.65 to 1.95	$0.65V_{CC}$	-	-	$0.65V_{CC}$	-	V
			2.3 to 2.7	1.7	-	-	1.7	-	
			3 to 3.6	2.0	-	-	2.0	-	
			4.5 to 5.5	$0.7V_{CC}$	-	-	$0.7V_{CC}$	-	
V_{IL}	Low Level Input Voltage Select Pin	-	1.65 to 1.95	-	-	$0.35V_{CC}$	-	$0.35V_{CC}$	V
			2.3 to 2.7	-	-	0.7	-	0.7	
			3 to 3.6	-	-	0.8	-	0.8	
			4.5 to 5.5	-	-	$0.3V_{CC}$	-	$0.3V_{CC}$	
I_{IN}	Input Leakage Current Select Pin	0 ≤ Select ≤ 5.5V	0 to 5.5	-	±0.05	±1	-	±10	µA
$I_{S(OFF)}$	OFF State Leakage Current	0V ≤ A, B_n ≤ V_{CC} Figure 1	1.65 to 5.5	-	±0.05	±1	-	±10	µA
$I_{S(ON)}$	ON State Leakage Current	0V ≤ A, B_n ≤ V_{CC} Figure 2	1.65 to 5.5	-	±0.05	±1	-	±10	µA
$I_{S(ON)}$	ON State Leakage Current	-0.1V ≤ A, B_n ≤ V_{CC} Figure 2	1.65 to 5.5	-	±0.05	±2	-	±20	µA
I_{CC}	Quiescent Supply Current	Select = V_{CC} or GND A, Bn = V_{CC} or GND I_{OUT} = 0	5.5	-	1.0	10	-	40	µA
ΔI_{CC}	Additional Supply Current	Select= V_{CC} – 0.6V A, B_n = V_{CC} or GND I_{OUT} = 0	5.5	-	30	500	-	5,000	µA
C_I	Input Capacitance Select Pin	-	3.3	-	2.5	-	-	-	pF
$C_{S(OFF)}$	OFF State Capacitance	Select = V_{CC} or GND A, B_n = V_{CC} or GND I_{OUT} = 0	3.3	-	6.0	-	-	-	pF
$C_{S(ON)}$	ON State Capacitance	Select = V_{CC} or GND A, B_n = V_{CC} or GND I_{OUT} = 0	3.3	-	18	-	-	-	pF

Note: 8. Typical performance information is included in figures 11 to 34 on pages 11 to 14.

Electrical Characteristics (All typical values are at T_J = +25°C)

Symbol	Parameter	Test Condition (Note 9)	V_{CC} (V)	T_A = -40 to +85°C Min	Typ	Max	T_A = -40 to +125°C Min	Max	Unit
R_{ON}	ON Resistance	V_I = 0V, I_O = 4mA	1.65	-	12.5	18	-	27	Ω
		V_I = 1.65V, I_O = -4mA		-	14	18	-	35	
		V_I = 0V, I_O = 8mA	2.3	-	9.0	16	-	24	
		V_I = 2.3V, I_O =-8mA		-	9.0	2016	-	30	
		V_I = 0V, I_O = 12mA	2.7	-	8.0	14	-	21	
		V_I = 2.7V, I_O =-12mA		-	8.0	14	-	27	
		V_I = 0V, I_O = 24mA	3.0	-	7.0	12	-	18	
		V_I = 3.0V, I_O =-24mA		-	7.0	12	-	23	
		V_I = 0V, I_O = 32mA	4.5	-	5.5	10	-	15	
		V_I = 2.7V, I_O =-32mA		-	6.0	12	-	17	
		V_I = 4.5V, I_O =-32mA		-	5.5	10	-	15	
R_{RANGE}	On Resistance Over Signal Range	I_A = 4mA, $0 \le V_{BN} \le V_{CC}$	1.65	-	34	130	-	195	Ω
		I_A = 8mA, $0 \le V_{BN} \le V_{CC}$	2.3	-	5	30	-	45	
		I_A = 12mA, $0 \le V_{BN} \le V_{CC}$	2.7	-	4	25	-	38	
		I_A = 24mA, $0 \le V_{BN} \le V_{CC}$	3.0	-	7.8	20	-	30	
		I_A = 32mA, $0 \le V_{BN} \le V_{CC}$	4.5	-	6.2	15	-	23	
ΔR_{ON}	On Resistance Match Between Channels (Note 10)	I_A = -4mA, V_{BN} = 1.15 V	1.65	-	0.25	-	-	-	Ω
		I_A = -8mA, V_{BN} = 1.6 V	2.3	-	0.25	-	-	-	
		I_A = -12mA, V_{BN} = 1.9 V	2.7	-	0.25	-	-	-	
		I_A = -24mA, V_{BN} = 2.1	3.0	-	0.25	-	-	-	
		I_A = -32mA, V_{BN} = 3.15	4.5	-	0..25	-	-	-	
R_{flat}	On Resistance Flatness (Note 11)	I_A = -4mA, $0 \le V_{BN} \le V_{CC}$	1.65	-	26	110	-	150	Ω
		I_A = -8mA, $0 \le V_{BN} \le V_{CC}$	2.3	-	5.0	26	-	105	
		I_A = -24mA, $0 \le V_{BN} \le V_{CC}$	2.7	-	3.5	16	-	35	
		I_A = -24mA, $0 \le V_{BN} \le V_{CC}$	3.3	-	2.0	9	-	15	
		I_A = -32mA, $0 \le V_{BN} \le V_{CC}$	5.0	-	1.5	4	-	8	

Note: 9. Switch resistance test is measured per Figure 3.
10. ΔR_{ON} is measured at identical V_{CC}, temperature and voltage levels.
11. Flatness is defined as the difference between the maximum and minimum of ON resistance measured at identical V_{CC} and temperature.

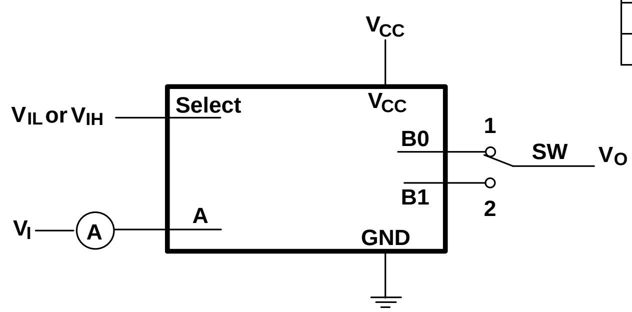
Switching Characteristics

Symbol	Parameter	Test Condition	V_{CC} Volts	T_A = -40 to +85°C			T_A = -40 to +125°C		Unit	Figure Number
				Min	Typ	Max	Min	Max		
t_{PHL} t_{PLH}	Propagation Delay A to B_n	V_I = OPEN (Note 12)	1.65 to 1.95	-	-	2.0	-	3.0	ns	Figure 4
			2.3 to 2.7	-	-	1.2	-	2.0		
			2.7	-	-	1.0	-	1.5		
			3.0 to 3.6	-	-	0.8	-	1.5		
			4.5 to 5.5	-	-	0.6	-	1.0		
t_{PZL} t_{PZH}	Output Enable Time Switch to B_n	V_I = 2 x V_{CC} for t_{PZL} V_I = 0V for t_{PZH} (Note 13)	1.65 to 1.95	1.0	8.7	14.0	1.0	14.0	ns	Figure 4
			2.3 to 2.7	1.0	5.3	7.5	1.0	7.5		
			2.7	1.0	4.9	6.0	1.0	6.0		
			3.0 to 3.6	0.5	4.0	5.5	0.5	5.5		
			4.5 to 5.5	0.5	3.0	4.0	0.5	4.0		
t_{PLZ} t_{PHZ}	Output Disable Time Switch to B_n	V_I = 2 x V_{CC} for t_{PLZ} V_I = 0V for t_{PHZ} (Note 13)	1.65 to 1.95	2.5	6.0	8.5	2.5	8.5	ns	Figure 4
			2.3 to 2.7	2.0	4.4	8.2	2.0	8.2		
			2.7	1.5	4.2	8.0	1.5	8.0		
			3.0 to 3.6	1.5	3.6	7.8	1.5	7.8		
			4.5 to 5.5	0.8	2.9	7.5	0.8	7.5		
t_{B-M}	Break Before Make Time (Note 9)	-	1.65 to 1.95	0.5	-		0.5	-	ns	Figure 5
			2.3 to 2.7	0.5	-	-	0.5	-		
			2.7	0.5	-	-	0.5	-		
			3.0 to 3.6	0.5		-	0.5	-		
			4.5 to 5.5	0.5	-	-	0.5			
Q	Charge Injection (Note 9)	C_L = 0.1 nF, V_{GEN} = 0V R_{GEN} = 0 Ω	5.0	-	7.0	-	-	-	pC	Figure 6
			3.3		3.0	-	-	-		
QIRR	Off Isolation (Note 11)	R_L = 50 Ω , f = 10MHz	1.65 ~ 5.5	-	-42	-	-	-	dB	Figure 7
Xtalk	Crosstalk	R_L = 50 Ω , f = 10MHz	1.65 ~ 5.5	-	-42	-	-	-	dB	Figure 8
BW	-3dB Bandwidth	R_L = 50 Ω	1.65 ~ 5.5	-	300	-	-	-	MHz	Figure 9
THD	Total Harmonic Distortion (Note 9)	R_L = 600 Ω, 0.5 V_{P-P}, f = 600Hz to 20kHz	5.0	-	0.1	-	-	-	%	Figure 10

Notes: 12. Due to the symmetry of the part, the direction of the propagation delay applies to either direction A to B_n or B_n to A. Propagation time is the calculated RC time constant of the typical ON resistance of the switch and the specified load capacitance when capacitance when driven by an ideal voltage source.
13. The Switch signal enable and disables time are the same for Bn and A if they are reversed at input and output.

Parameter Measurement Information

SW	Select
1	V_{IH}
2	V_{IL}



Condition 1: V_I = GND, $V_O = V_{CC}$

Condition 2: $V_I = V_{CC}$, V_O = GND

Figure 1 OFF –State Leakage Curent Test

SW	Select
1	V_{IL}
2	V_{IH}

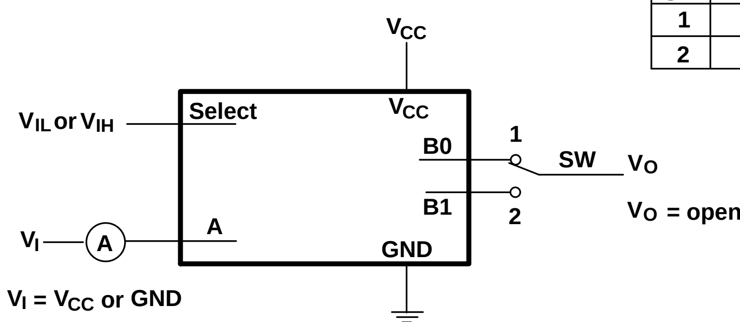
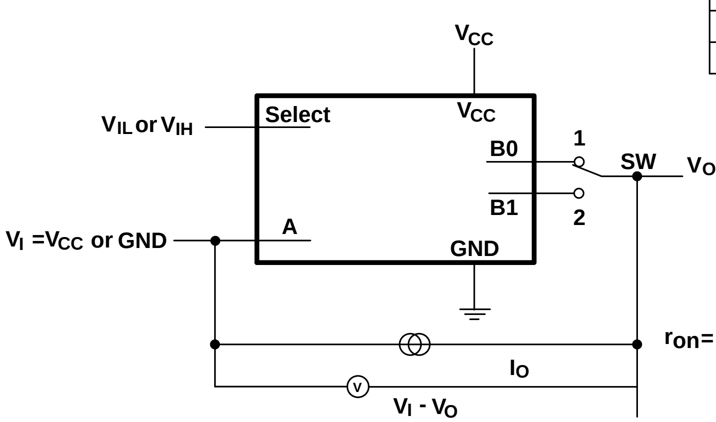


Figure 2 ON –State Leakage Curent Test

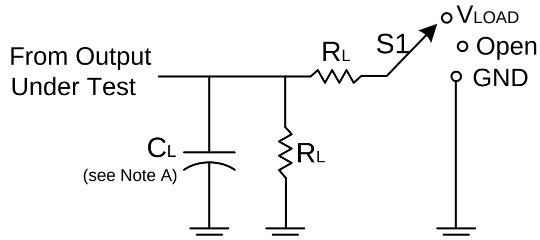
SW	Select
1	V_{IL}
2	V_{IH}



$$r_{on} = \left| \frac{V_I - V_O}{I_O} \right| \Omega$$

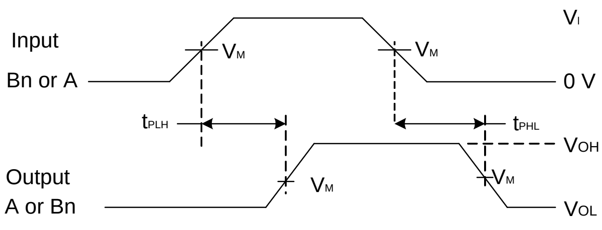
Figure 3 ON State Resistance Test

Parameter Measurement Information (Notes 15-19)

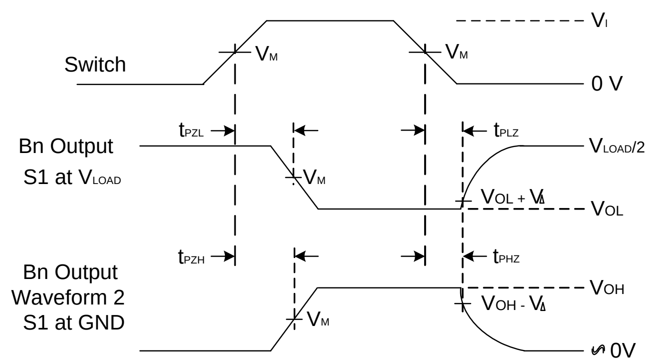


TEST	S1	R_L
t_{PLH}/t_{PHL}	Open	500Ω
t_{PLZ}/t_{PZL}	Vload	500Ω
t_{PHZ}/t_{PZH}	GND	500Ω

V_{CC}	Inputs		V_M	V_{LOAD}	C_L (Note 14)	V∆
	V_I	t_r/t_f				
1.8V ± 0.15V	V_{CC}	≤2ns	$V_{CC}/2$	2 x V_{CC}	50pF	0.1V
2.5V ± 0.2V	V_{CC}	≤2ns	$V_{CC}/2$	2 x V_{CC}	50pF	0.1V
3.3V ± 0.3V	V_{CC}	≤2.5ns	$V_{CC}/2$	2 x V_{CC}	50pF	0.1V
5V ± 0.5V	V_{CC}	≤2.5ns	$V_{CC}/2$	2 x V_{CC}	50pF	0.1V



Voltage Waveform Propagation Delay Times



Voltage Waveform Enable and Disable Times

Figure 4 Load Circuit and Voltage Waveforms

Notes:
14. Includes test lead and test apparatus capacitance.
15. All pulses are supplied at pulse repetition rate ≤ 10MHz.
16. Inputs are measured separately one transition per measurement.
17. t_{PLZ} and t_{PHZ} are the same as t_{dis}.
18. t_{PZL} and t_{PZH} are the same as t_{EN}.
19. t_{PLH} and t_{PHL} are the same as t_{PD}.

Parameter Measurement Information (Continued)

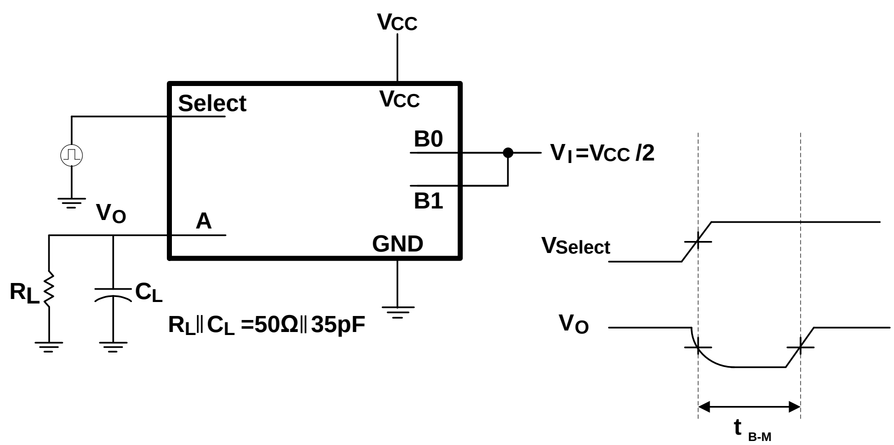


Figure 5 Break before Make Timing Test

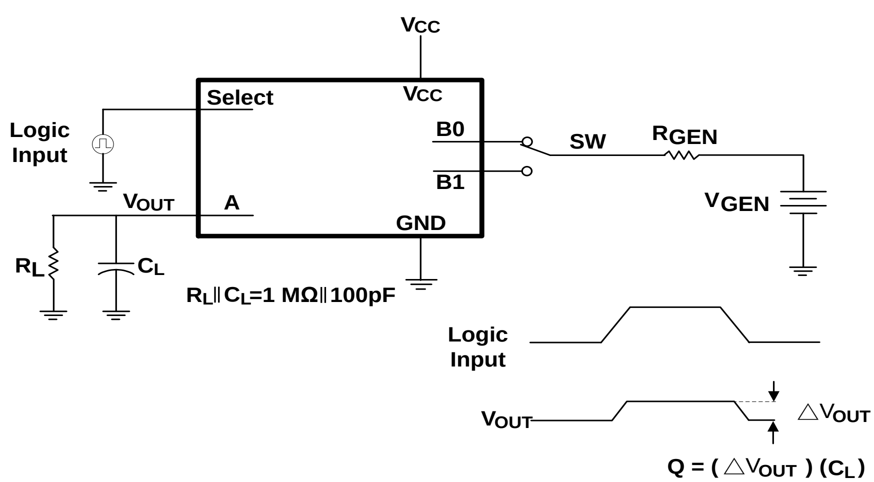


Figure 6 Charge Injection

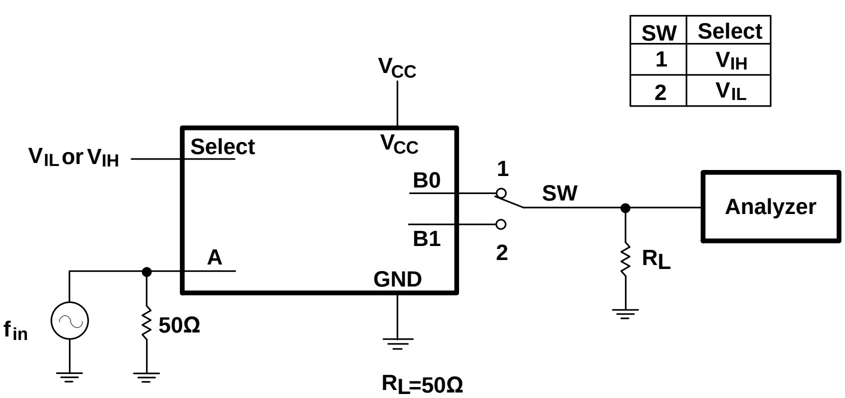
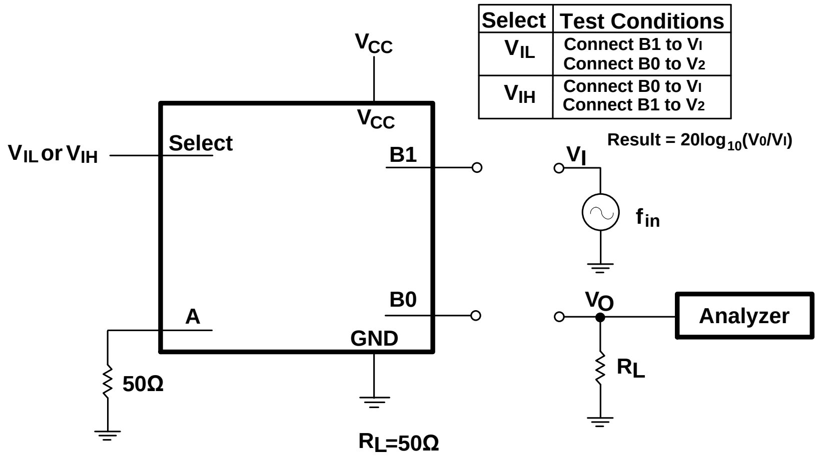


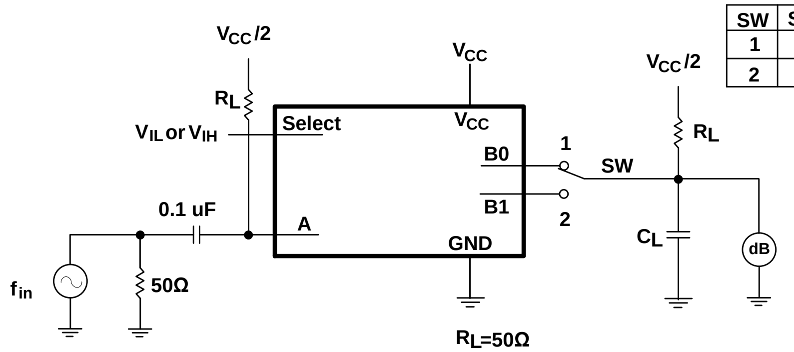
Figure 7 OFF Isolation

Parameter Measurement Information (Cont.)



Select	Test Conditions
V_{IL}	Connect B1 to V_I Connect B0 to V_2
V_{IH}	Connect B0 to V_I Connect B1 to V_2

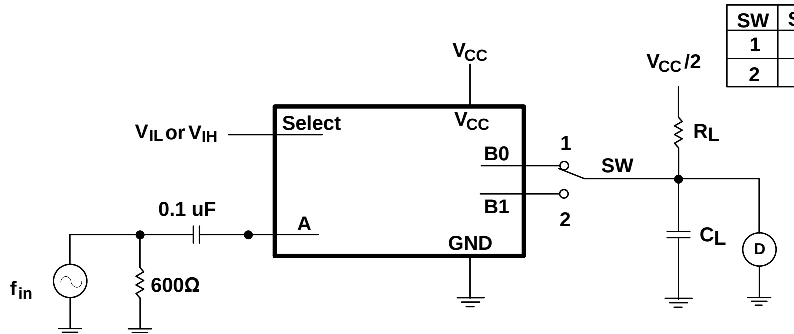
Figure 8 Cross Talk



SW	Select
1	V_{IL}
2	V_{IH}

Adjust fin voltage to obtain 0 dBm level at input.
Adjust fin frequency until dB meter reads -3 dB.

Figure 9 Bandwdith



SW	Select
1	V_{IL}
2	V_{IH}

Figure 10 THD

Typical Performance Characteristics

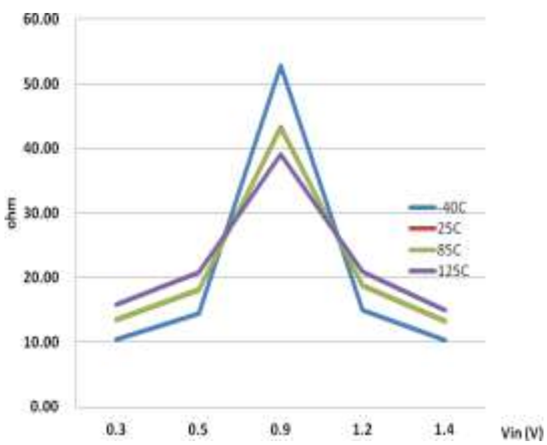


Figure 11 ON state Resistance Vcc = 1.65 V; I_{Bn} = 4ma

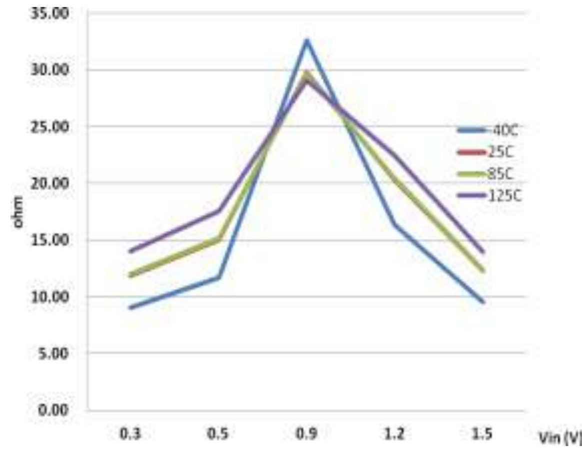


Figure 12 ON state Resistance Vcc = 1.8 V; I_{Bn} = 4ma

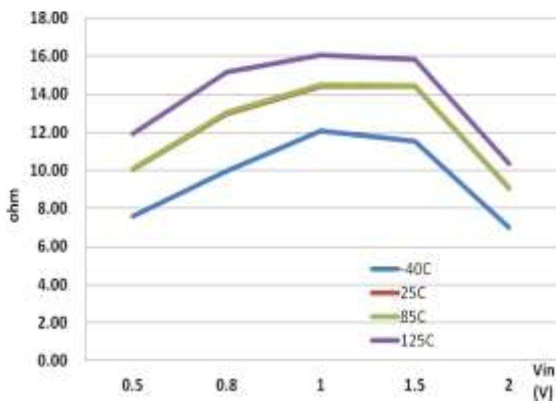


Figure 13 ON state Resistance Vcc = 2.3 V; I_{Bn} = 8ma

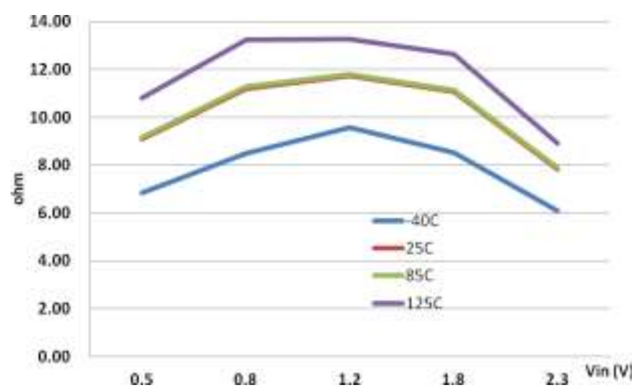


Figure 14 ON state Resistance Vcc = 2.5 V; I_{Bn} = 8ma

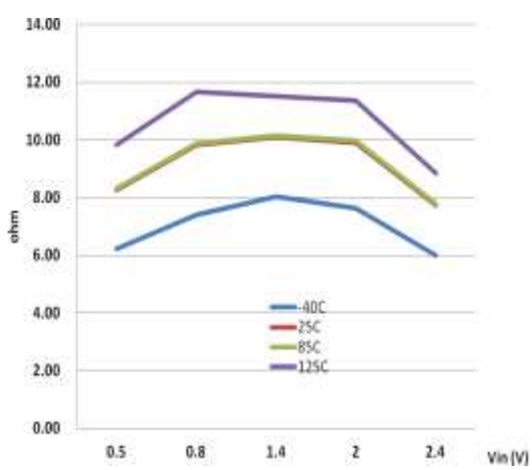


Figure 15 ON state Resistance Vcc = 2.7 V; I_{Bn} = 12ma

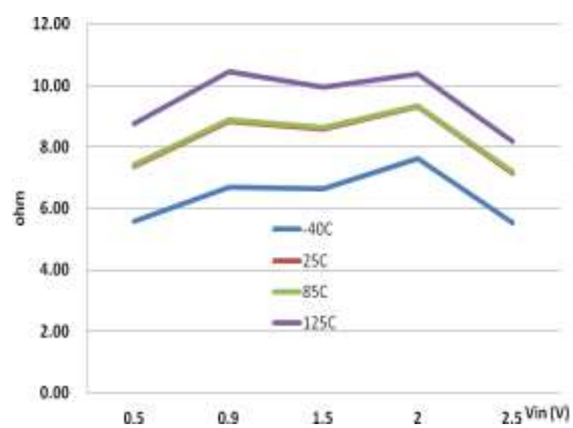


Figure 16 ON state Resistance Vcc = 3 V; I_{Bn} = 24ma

Typical Performance Characteristics (Continued)

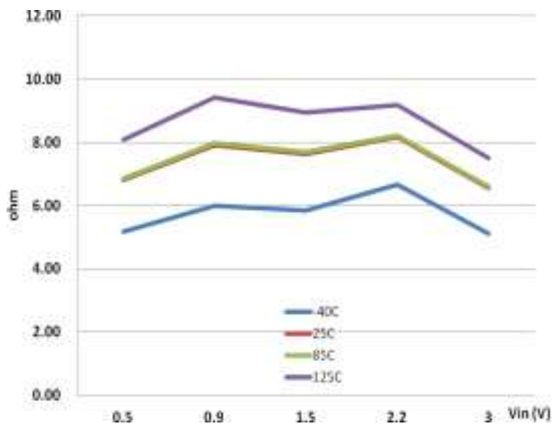


Figure 17 ON state Resistance Vcc = 3.3 V; I_{Bn} = 24ma

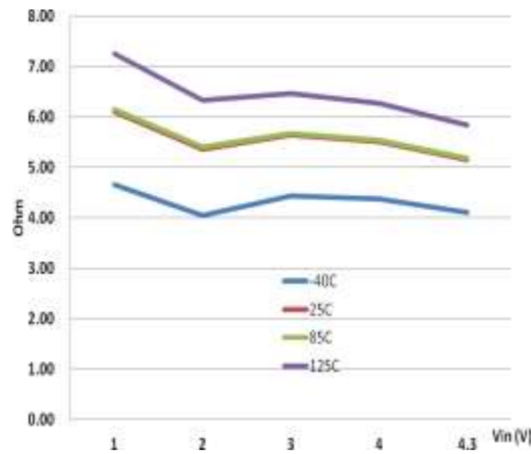


Figure 18 ON state Resistance Vcc = 4.5 V; I_{Bn} = 32ma

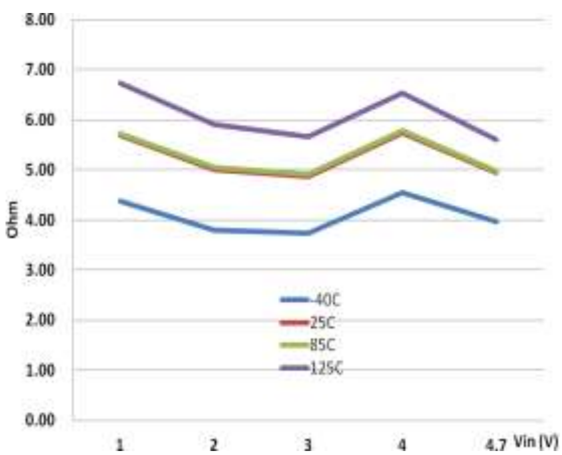


Figure 19 ON state Resistance Vcc = 5.5 V; I_{Bn} = 32ma

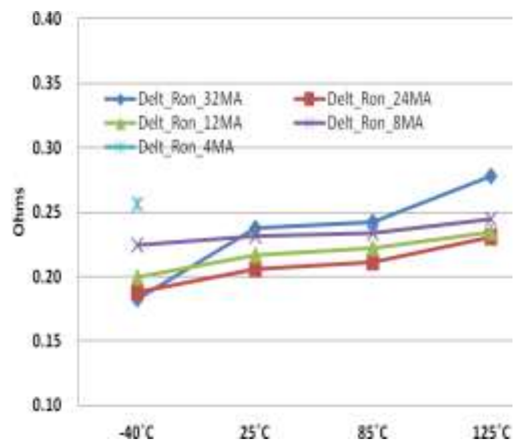


Figure 20 △Ron-Resistance Match Between Channels

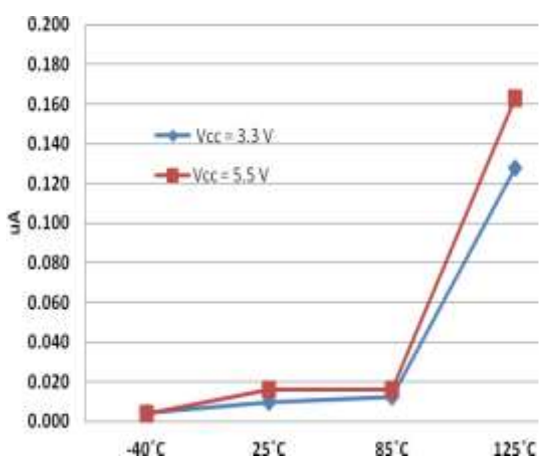


Figure 21 $I_{S(OFF)}$ OFF state leakage V_{IN} = 0 V

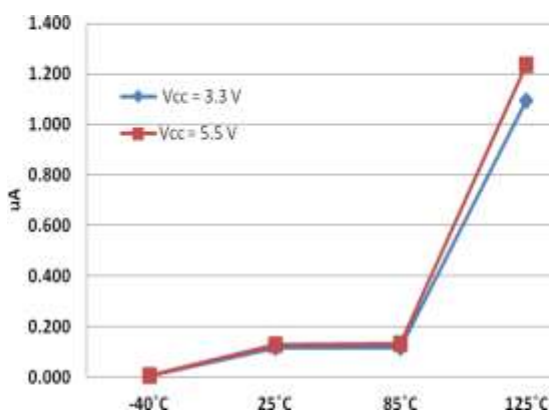


Figure 22 $I_{S(OFF)}$ OFF state leakage V_{IN} = -0.1 V

Typical Performance Characteristics (Cont.)

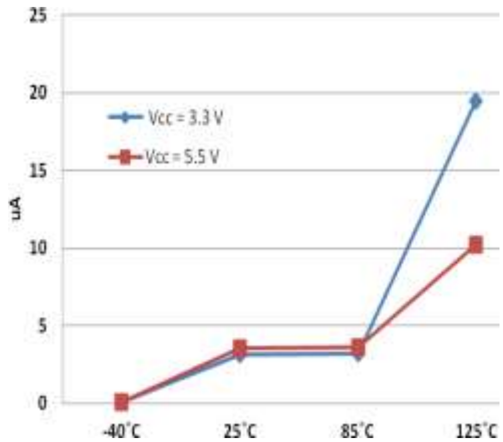


Figure 23 $I_{S(OFF)}$ OFF state leakage V_{IN} = -0.2 V

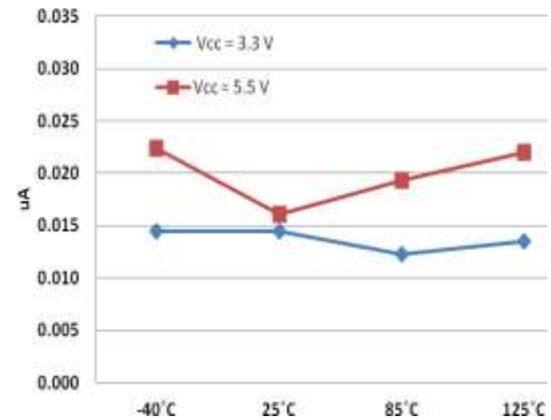


Figure 24 $I_{S(ON)}$ ON state leakage V_{IN} = 0 V

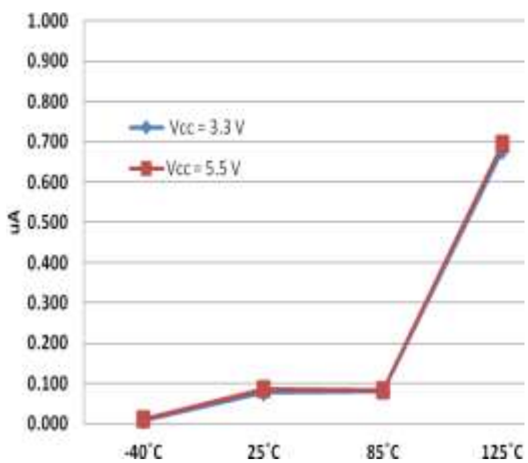


Figure 25 $I_{S(ON)}$ ON state leakage V_{IN} = -0.1 V

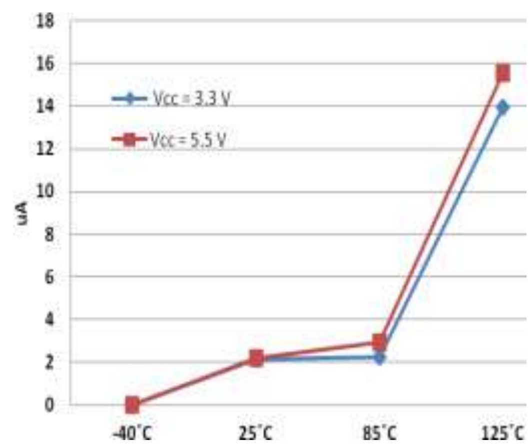


Figure 26 $I_{S(ON)}$ ON state leakage V_{IN} = -0.2V

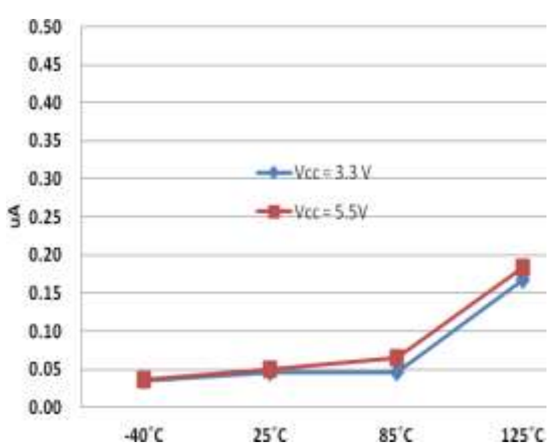


Figure 27 I_{CC} verses Temperture

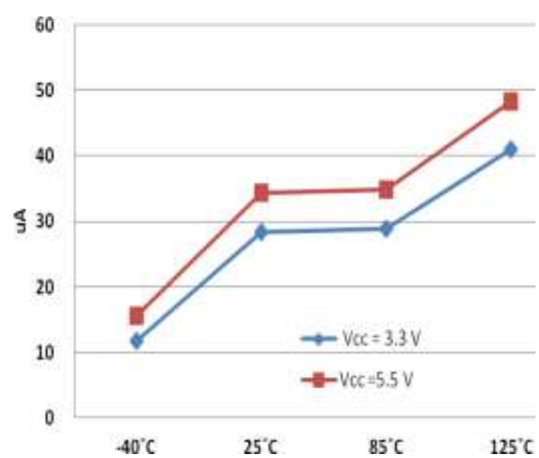


Figure 28 Delta I_{CC} verses Temperture

Typical Performance Characteristics (Cont.)

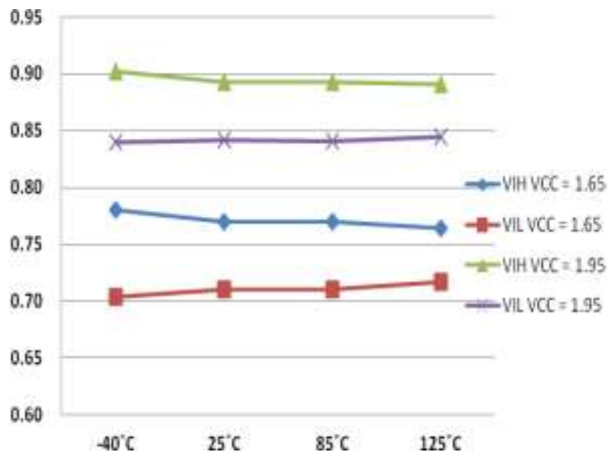


Figure 29 V_{IH}, V_{IL}, Hysteresis V_{CC} = 1.65 V and V_{CC}= 1.95 V

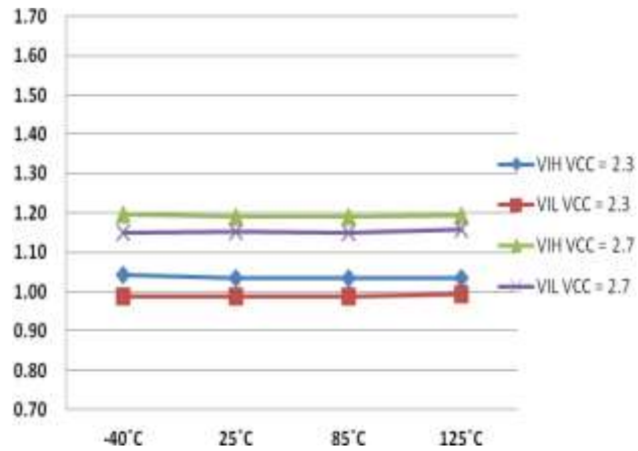


Figure 30 V_{IH}, V_{IL}, Hysteresis V_{CC} = 2.3 V and V_{CC}= 2.7 V

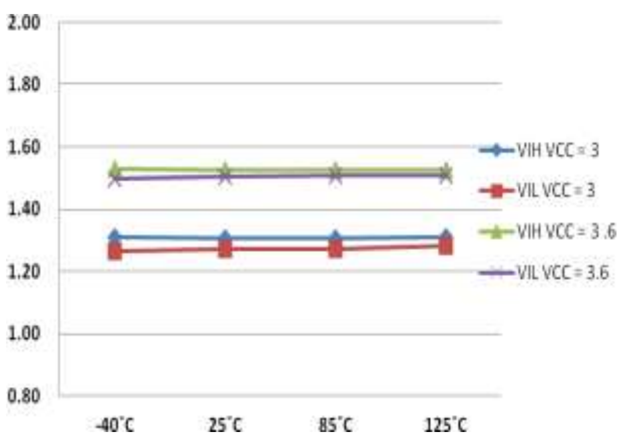


Figure 31 V_{IH}, V_{IL}, Hysteresis V_{CC} = 3 V and V_{CC}= 3.3 V

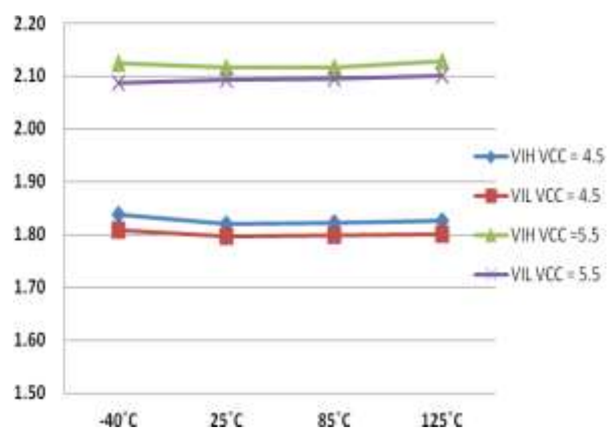
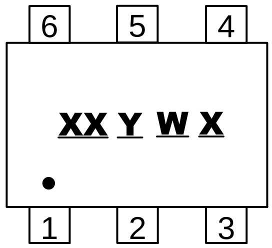


Figure 32 V_{IH}, V_{IL}, Hysteresis V_{CC} = 4.5 V and V_{CC}= 5.5 V

Marking Information

(1) SOT363

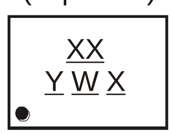


XX : Identification code
Y : Year 0~9
W : Week : A~Z : 1~26 week;
a~z : 27~52 week; z represents 52 and 53 week
X : A~Z : Internal Code

Part Number	Package	Identification Code
74LVC1G3157DW	SOT363	J7

(2) X2-DFN1410-6

(Top View)



XX : Identification Code
Y : Year 0~9
W : Week : A~Z : 1~26 week;
a~z : 27~52 week;
z represents 52 and 53 week
X : A~Z : Internal Code

Part Number	Package	Identification Code
74LVC1G3157FZ4	X2-DFN1410-6	J7

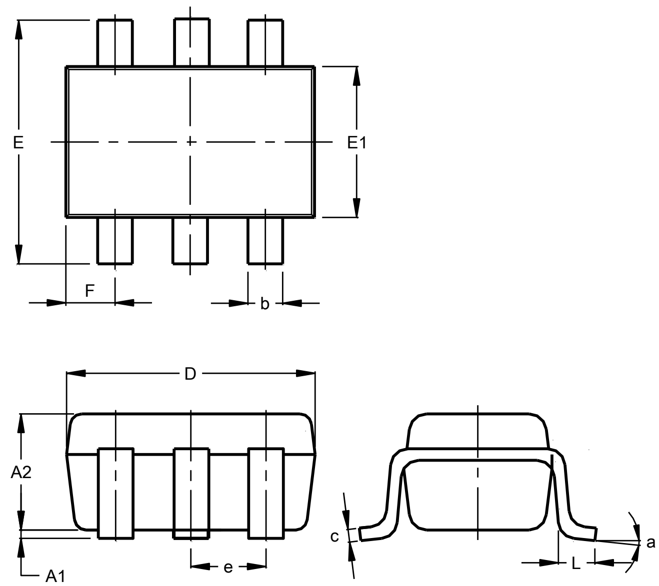
Package Characteristics (All typical values are at V_{CC} = 3.3V, T_A = +25°C)

Symbol	Parameter	Test Conditions	V_{CC}	Min	Typ.	Max	Unit
θ_{JA}	Thermal Resistance Junction-to-Ambient	SOT363	(Note 20)	-	371	-	°C/W
		X2-DFN1410-6		-	460	-	
θ_{JC}	Thermal Resistance Junction-to-Case	SOT363	(Note 20)	-	143	-	°C/W
		X2-DFN1410-6		-	265	-	

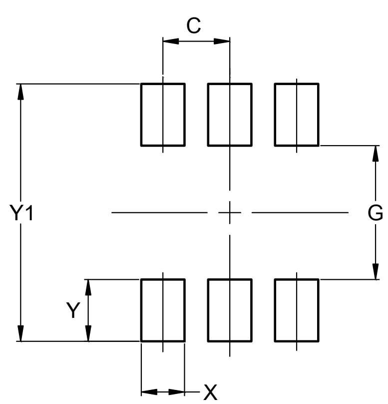
Note: 20. Test condition SOT363, and X2-DFN1410-6: Device mounted on FR-4 substrate PC board, 2oz. copper, with minimum recommended pad layout.

SOT363 Package Outline Dimensions and Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.



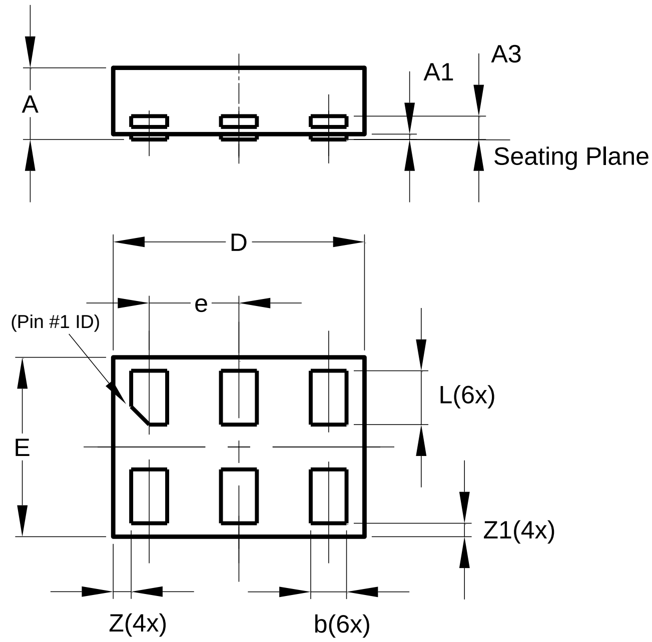
SOT363			
Dim	**Min**	**Max**	**Typ**
A1	0.00	0.10	0.05
A2	0.90	1.00	1.00
b	0.10	0.30	0.25
c	0.10	0.22	0.11
D	1.80	2.20	2.15
E	2.00	2.20	2.10
E1	1.15	1.35	1.30
e	0.650 BSC		
F	0.40	0.45	0.425
L	0.25	0.40	0.30
a	0°	8°	--
All Dimensions in mm			



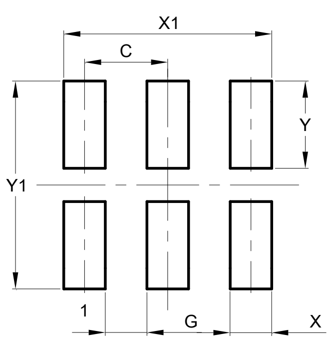
Dimensions	Value (in mm)
C	0.650
G	1.300
X	0.420
Y	0.600
Y1	2.500

X2-DFN1410-6 Package Outline Dimensions and Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.



X2-DFN1410-6			
Dim	**Min**	**Max**	**Typ**
A	—	0.40	0.39
A1	0.00	0.05	0.02
A3	—	—	0.13
b	0.15	0.25	0.20
D	1.35	1.45	1.40
E	0.95	1.05	1.00
e	—	—	0.50
L	0.25	0.35	0.30
Z	—	—	0.10
Z1	0.045	0.105	0.075
All Dimensions in mm			



Dimensions	Value (in mm)
C	0.500
G	0.250
X	0.250
X1	1.250
Y	0.525
Y1	1.250