Dual Buffer Schmitt Trigger

1. Description

The 74LVC2G17 provides two non-inverting buffers with Schmitt trigger input. It is capable of transforming slowly changing input signals into sharply defined, jitter-free output signals. Inputs can be driven from either 3.3V or 5V devices. This feature allows the use of these devices as translators in a mixed 3.3V and 5V environment. This device is fully specified for partial power-down applications using I_{OFF}. The I_{OFF} circuitry disables the output, preventing the damaging backflow current through the device when it is powered down.

2. Features

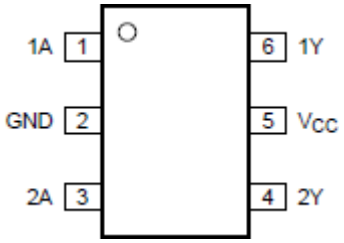
- Wide supply voltage range from 1.65V to 5.5V
- 5V tolerant inputs for interfacing with 5V logic
- ±24mA output drive (V_{CC}=3.0V)
- CMOS low power consumption
- Latch-up performance exceeds 250mA
- Direct interface with TTL levels
- Specified from -40℃ to +105℃
- Packaging information: SOT-23-6/SOT-363

3. Ordering Information

Type Number	Package Type	Packing	Notes
74LVC2G17DBV	SOT-23-6	Tape & Reel	
74LVC2G17DCK	SOT-363	Tape & Reel	

Note: If the physical information is inconsistent with the ordering information, please refer to the actual product.

4. Pinning



Pin Description

Pin No.	Pin Name	Description
1	1A	data input
2	GND	ground (0V)
3	2A	data input
4	2Y	data output
5	V_{CC}	supply voltage
6	1Y	data output

Function Table

Input	Output
nA	**nY**
L	L
H	H

Note: [1] H=HIGH voltage level; L=LOW voltage level.

5. Block Diagram

Block Diagram

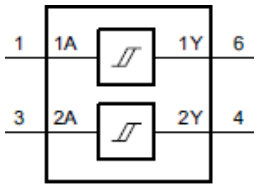


Fig. 1. Logic symbol

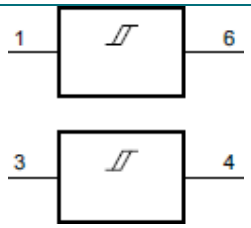


Fig. 2. IEC logic symbol

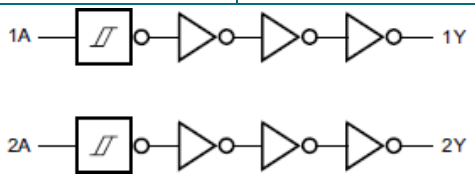


Fig. 3. Logic diagram

6. Electrical Parameter

Absolute Maximum Ratings

Parameter	Symbol	Conditions	Min.	Max.	Unit
supply voltage	V_{CC}	-	-0.5	+6.5	V
input clamping current	I_{IK}	V_I < 0V	-	-50	mA
input voltage	V_I	-	-0.5	+6.5	V
output clamping current	I_{OK}	V_O < 0V	-	-50	mA
output voltage	V_O	Active mode[1]	-0.5	V_{CC}+0.5	V
		Power-down mode[1]	-0.5	+6.5	V
output current	I_O	V_O=0V to V_{CC}	-	±50	mA
supply current	I_{CC}	-	-	100	mA
ground current	I_{GND}	-	-	-100	mA
storage temperature	T_{stg}	-	-65	+150	˚C
total power dissipation	P_{tot}	-	-	300	mW
Soldering temperature	T_L	10s	250		˚C

Note: [1] When V_{CC}=0V (Power-down mode), the output voltage can be 5.5V in normal operation.

Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
supply voltage	V_{CC}	-	1.65	-	5.5	V
input voltage	V_I	-	0	-	5.5	V
output voltage	V_O	-	0	-	^{V}CC	V
ambient temperature	T_{amb}	-	-40	-	+105	˚C

7. Electrical Characteristics

DC Characteristics 1

(T_{amb}=25˚C, voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
HIGH-level output voltage	V_{OH}	$V_I = V_{T+}$ or V_{T-}	I_O=-100uA; V_{CC}=1.65V to 5.5V	V_{CC} - 0.1	-	-	V
			I_O=-4mA; V_{CC}=1.65V	1.2	-	-	V
			I_O=-8mA; V_{CC}=2.3V	1.9	-	-	V
			I_O=-12mA; V_{CC}=2.7V	2.2	-	-	V
			I_O=-24mA; V_{CC}=3.0V	2.3	-	-	V
			I_O=-32mA; V_{CC}=4.5V	3.8	-	-	V
LOW-level output voltage	V_{OL}	$V_I = V_{T+}$ or V_{T-}	I_O=100uA; V_{CC}=1.65V to 5.5V	-	-	0.10	V
			I_O=4mA; V_{CC}=1.65V	-	-	0.45	V
			I_O=8mA; V_{CC}=2.3V	-	-	0.30	V
			I_O=12mA; V_{CC}=2.7V	-	-	0.40	V
			I_O=24mA; V_{CC}=3.0V	-	-	0.55	V
			I_O=32mA; V_{CC}=4.5V	-	-	0.55	V
input leakage current	I_I	V_I=5.5V or GND; V_{CC}=5.5V		-	±0.1	±1	uA
power-off leakage current	I_{OFF}	V_I or V_O=5.5V; V_{CC}=0V		-	±0.1	±2	uA
supply current	I_{CC}	V_I=V_{CC} or GND; I_O=0A; V_{CC}=5.5V		-	0.1	4	uA
additional supply current	ΔI_{CC}	V_I=V_{CC}-0.6V; I_O=0A; V_{CC}=2.3V to 5.5V		-	5	500	uA
input capacitance	C_I	-		-	3.5	-	pF

DC Characteristics 2

(T_{amb}=-40˚C to +85˚C, voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
HIGH-level output voltage	V_{OH}	$V_I = V_{T+}$ or V_{T-}	I_O=-100uA; V_{CC}=1.65V to 5.5V	V_{CC} - 0.1	-	-	V
			I_O=-4mA; V_{CC}=1.65V	0.95	-	-	V
			I_O=-8mA; V_{CC}=2.3V	1.7	-	-	V
			I_O=-12mA; V_{CC}=2.7V	1.9	-	-	V
			I_O=-24mA; V_{CC}=3.0V	2.0	-	-	V
			I_O=-32mA; V_{CC}=4.5V	3.4	-	-	V
LOW-level output voltage	V_{OL}	$V_I = V_{T+}$ or V_{T-}	I_O=100uA; V_{CC}=1.65V to 5.5V	-	-	0.10	V
			I_O=4mA; V_{CC}=1.65V	-	-	0.70	V
			I_O=8mA; V_{CC}=2.3V	-	-	0.45	V

			I_O=12mA; V_{CC}=2.7V	-	-	0.60	V
			I_O=24mA; V_{CC}=3.0V	-	-	0.80	V
			I_O=32mA; V_{CC}=4.5V	-	-	0.80	V
input leakage current	I_I	V_I=5.5V or GND; V_{CC}=5.5V		-	±0.1	±1	uA
power-off leakage current	I_{OFF}	V_I or V_O=5.5V; V_{CC}=0V		-	-	±2	uA
supply current	I_{CC}	V_I=V_{CC} or GND; I_O=0A; V_{CC}=5.5V		-	-	4	uA
additional supply current	ΔI_{CC}	V_I=V_{CC}-0.6V; I_O=0A; V_{CC}=2.3V to 5.5V		-	-	500	uA

Note: [1] All typical values are measured at V_{CC}=3.3V and T_{amb}=25°C.

AC Characteristics 1

(T_{amb}=-40°C to +85°C, voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.[1]	Max.	Unit
nA to nY propagation delay	t_{pd}	see Figure 5[2]	V_{CC}=1.65V to 1.95V	1.5	5.6	10.5	ns
			V_{CC}=2.3V to 2.7V	1.0	3.7	6.5	ns
			V_{CC}=2.7V	1.0	3.8	6.5	ns
			V_{CC}=3.0V to 3.6V	1.0	3.6	5.7	ns
			V_{CC}=4.5V to 5.5V	1.0	2.7	4.3	ns
Power dissipation capacitance	C_{PD}	per buffer; V_{CC}=3.3V; [3] V_I=GND to V_{CC}		-	16.3	-	pF

Note:

1 Typical values are measured at T_{amb}=25°C and V_{CC}=1.8V, 2.5V, 2.7V, 3.3V and 5.0V respectively.

2 t_{pd} is the same as t_{PLH} and t_{PHL}.

3 C_{PD} is used to determine the dynamic power dissipation (P_D in uW).

P_D=C_{PD}×V_{CC}^2×f_i×N+ ∑(C_L×V_{CC}^2×f_o) where:

f_i=input frequency in MHz;

f_o=output frequency in MHz;

C_L=output load capacitance in pF;

V_{CC}=supply voltage in V;

N=number of inputs switching;

∑(C_L×V_{CC}^2×f_o)=sum of outputs.

AC Characteristics 2

(T_{amb}=-40°C to +105°C, voltages are referenced to GND (ground=0V), unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.[1]	Max.	Unit
nA to nY propagation delay	t_{pd}	see Figure 5[2]	V_{CC}=1.65V to 1.95V	1.5	-	13.1	ns
			V_{CC}=2.3V to 2.7V	1.0	-	8.5	ns
			V_{CC}=2.7V	1.0	-	8.5	ns
			V_{CC}=3.0V to 3.6V	1.0	-	7.1	ns
			V_{CC}=4.5V to 5.5V	1.0	-	5.4	ns

Note:

1 Typical values are measured at T_{amb}=25°C and V_{CC}=1.8V, 2.5V, 2.7V, 3.3V and 5.0V respectively.

2 t_{pd} is the same as t_{PLH} and t_{PHL}.

Transfer Characteristics 1

(T_{amb}=-40℃ to +85℃, voltages are referenced to GND (ground = 0V), unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
positive-going threshold voltage	V_{T+}	see Figure 6 and Figure 7	V_{CC}=1.8V	0.82	1.02	1.2	V
			V_{CC}=2.3V	1.03	1.25	1.45	V
			V_{CC}=3.0V	1.29	1.5	1.71	V
			V_{CC}=4.5V	1.84	2.15	2.41	V
			V_{CC}=5.5V	2.19	2.6	2.91	V
negative-going threshold voltage	V_{T-}	see Figure 6 and Figure 7	V_{CC}=1.8V	0.45	0.6	0.75	V
			V_{CC}=2.3V	0.64	0.8	0.96	V
			V_{CC}=3.0V	0.86	1.1	1.34	V
			V_{CC}=4.5V	1.35	1.75	2.09	V
			V_{CC}=5.5V	1.61	2.15	2.59	V
hysteresis voltage	V_H	(V_{T+} - V_{T-}); see Figure 6, Figure 7 and Figure 8	V_{CC}=1.8V	0.24	0.4	0.54	V
			V_{CC}=2.3V	0.26	0.4	0.57	V
			V_{CC}=3.0V	0.27	0.42	0.64	V
			V_{CC}=4.5V	0.28	0.45	0.65	V
			V_{CC}=5.5V	0.29	0.47	0.75	V

Transfer Characteristics 2

(T_{amb}=-40℃ to +105℃, voltages are referenced to GND (ground = 0V), unless otherwise specified.)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
positive-going threshold voltage	V_{T+}	see Figure 6 and Figure 7	V_{CC}=1.8V	0.79	-	1.2	V
			V_{CC}=2.3V	1.00	-	1.45	V
			V_{CC}=3.0V	1.26	-	1.71	V
			V_{CC}=4.5V	1.81	-	2.41	V
			V_{CC}=5.5V	2.16	-	2.91	V
negative-going threshold voltage	V_{T-}	see Figure 6 and Figure 7	V_{CC}=1.8V	0.45	-	0.78	V
			V_{CC}=2.3V	0.64	-	0.99	V
			V_{CC}=3.0V	0.86	-	1.37	V
			V_{CC}=4.5V	1.35	-	2.12	V
			V_{CC}=5.5V	1.61	-	2.62	V
hysteresis voltage	V_H	(V_{T+} - V_{T-}); see Figure 6, Figure 7 and Figure 8	V_{CC}=1.8V	0.17	-	0.54	V
			V_{CC}=2.3V	0.20	-	0.57	V
			V_{CC}=3.0V	0.21	-	0.64	V
			V_{CC}=4.5V	0.22	-	0.65	V
			V_{CC}=5.5V	0.23	-	0.75	V

8. Testing Circuit

AC Testing Circuit

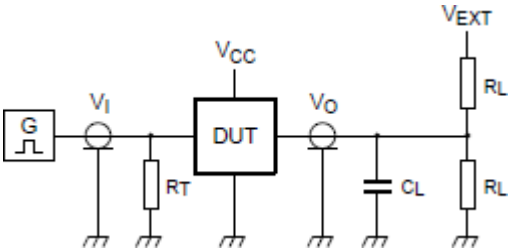


Fig. 4. Test circuit for measuring switching times

Definitions for test circuit:

R_L=Load resistance.

C_L=Load capacitance including jig and probe capacitance.

R_T=Termination resistance; should be equal to the output impedance Z_o of the pulse generator.

V_{EXT}=External voltage for measuring switching times.

AC Testing Waveforms

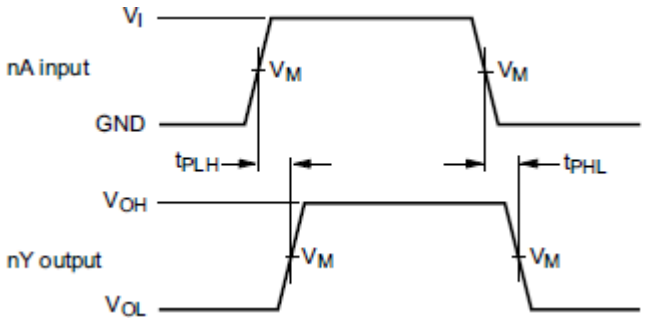


Fig. 5. The input nA to output nY propagation delays and the output transition times

Transfer Characteristics Waveforms

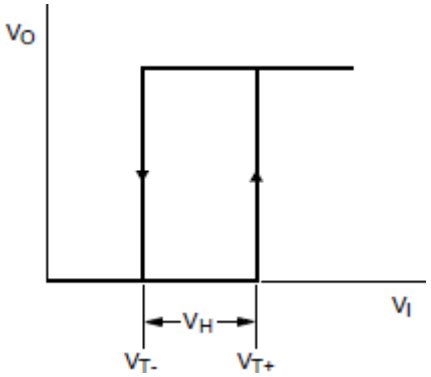


Fig. 6. Transfer characteristic

V_{T+} and V_{T-} limits at 70% and 20%:

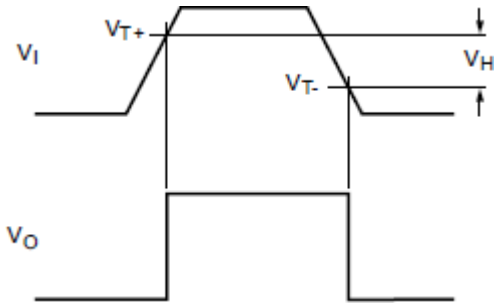


Fig. 7. Definition of V_{T+}, V_{T-} and V_H

V_{CC}=3.0V:

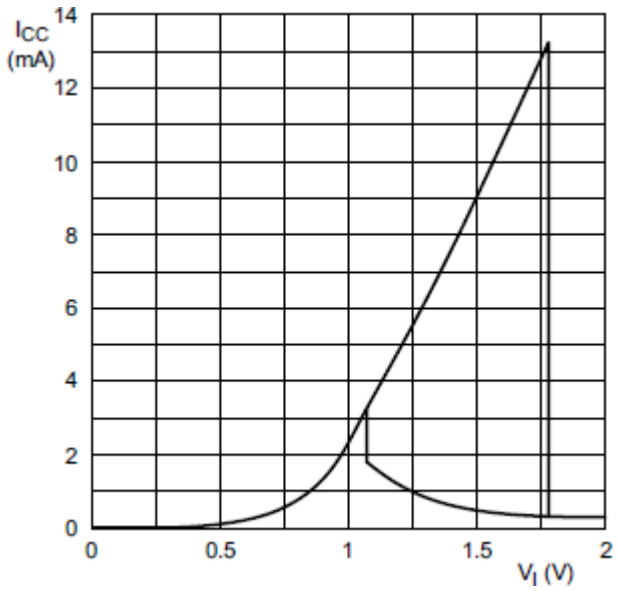


Fig. 8. Typical transfer characteristics

Measurement Points

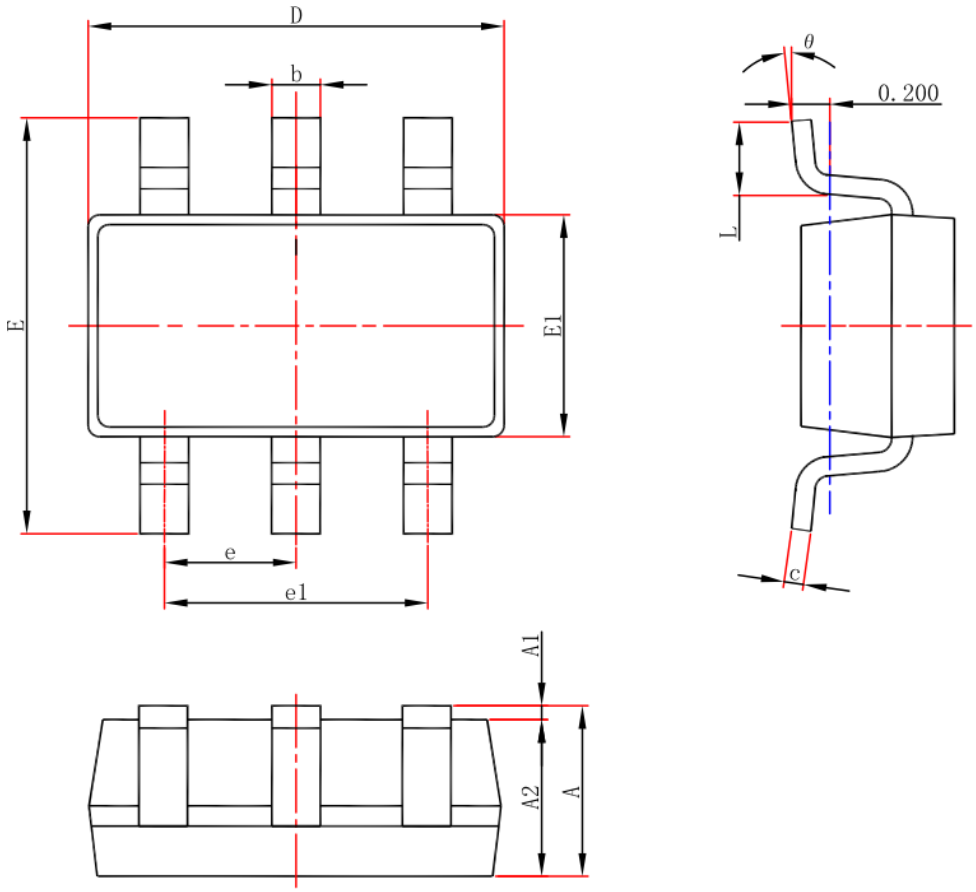
Supply voltage	Input	Output
V_{CC}	V_M	V_M
1.65V to 1.95V	0.5×V_{CC}	0.5×V_{CC}
2.3V to 2.7V	0.5×V_{CC}	0.5×V_{CC}
2.7V	1.5V	1.5V
3.0V to 3.6V	1.5V	1.5V
4.5V to 5.5V	0.5×V_{CC}	0.5×V_{CC}

Test Data

Supply voltage	Input		Load		V_{EXT}
V_{CC}	V_I	$t_r = t_f$	C_L	R_L	t_{PLH}, t_{PHL}
1.65V to 1.95V	V_{CC}	≤ 2.0ns	30pF	1kΩ	open
2.3V to 2.7V	V_{CC}	≤ 2.0ns	30pF	500Ω	open
2.7V	2.7V	≤ 2.5ns	50pF	500Ω	open
3.0V to 3.6V	2.7V	≤ 2.5ns	50pF	500Ω	open
4.5V to 5.5V	V_{CC}	≤ 2.5ns	50pF	500Ω	open

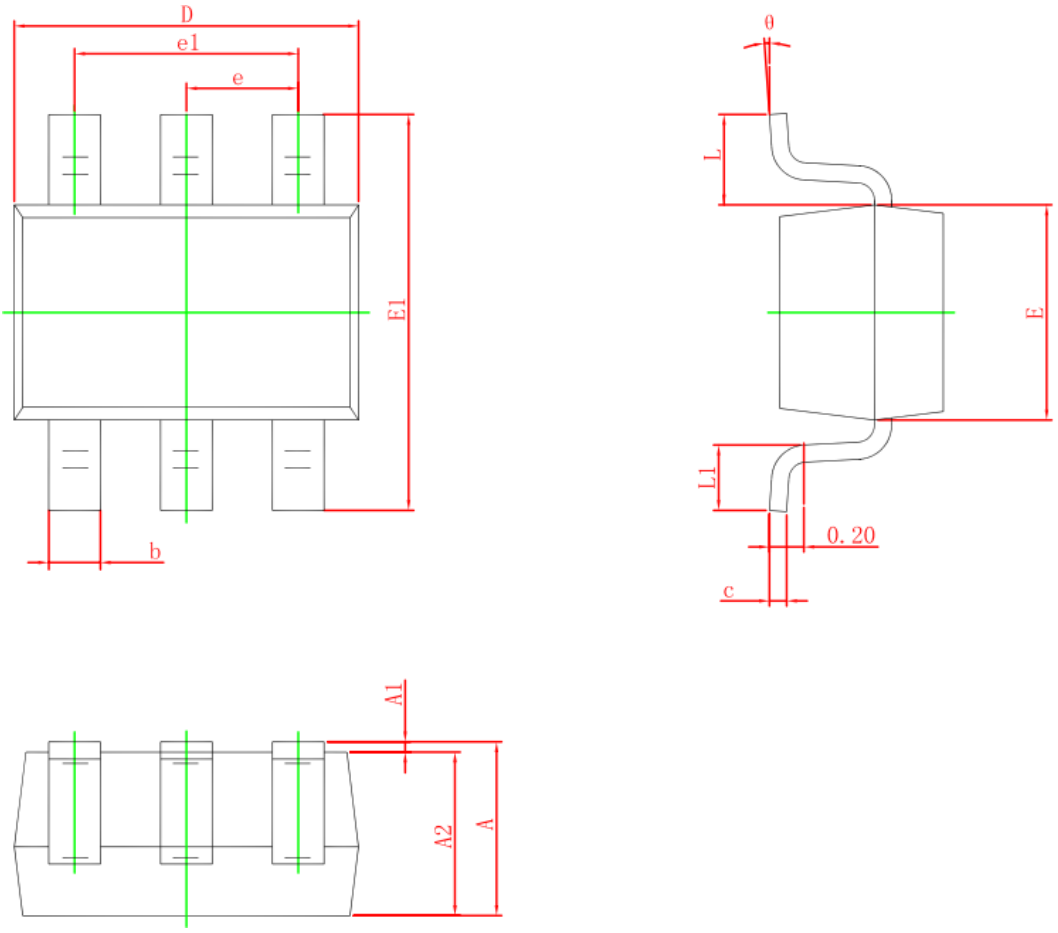
9. Package Outlines

SOT-23-6



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
θ	0°	8°	0°	8°

SOT-363



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	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.650 TYP.		0.026 TYP.	
e1	1.200	1.400	0.047	0.055
L	0.525 REF.		0.021 REF.	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°

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