QUAD BILATERAL SWITCHES

1. Description

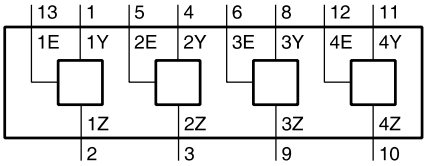
The FLH 74HC4066 and 74HCT4066 have four independent analog switches. Each switch has two input/output pins (pins nY or nZ) and an active HIGH enable input pin (pin nE). When pin nE = LOW the belonging analog switch is turned off.

The 74HC4066 and 74HCT4066 are pin compatible with the 74HC4016 and 74HCT4016 but exhibit a much lower on-resistance. In addition, the on-resistance is relatively constant over the full input signal range.

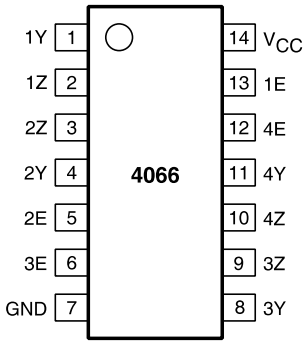
2. Features

- Input levels nE inputs:
  - For 74HC4066: CMOS level
  - For 74HCT4066: TTL level
- Very low “ON” resistance:
  - V_{CC}=4.5V, 50Ω
  - V_{CC} =6V, 45Ω
  - V_{CC} =9V, 35Ω

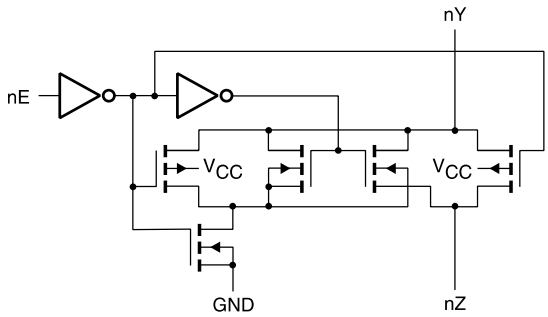
3. Functional Diagram



4. Pinning



5. Schematic diagram



6. Ordering Information

Type Number	Package Type	Packing
74HC4066D	SOP-14	Reel
74HCT4066D	SOP-14	Reel
74HC4066PW	TSSOP-14	Reel
74HCT4066PW	TSSOP-14	Reel

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

7. Pin Description

PIN	SYMBOL	DESCRIPTION
1	1Y	independent input/output
2	1Z	independent input/output
3	2Z	independent input/output
4	2Y	independent input/output
5	2E	enable input (active HIGH)
6	3E	enable input (active HIGH)
7	GND	ground (0 V)
8	3Y	independent input/output
9	3Z	independent input/output
10	4Z	independent input/output
11	4Y	independent input/output
12	4E	enable input (active HIGH)
13	1E	enable input (active HIGH)
14	V_{CC}	supply voltage

8. RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	74HC4066			74HCT4066			UNIT
			MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
V_{CC}	supply voltage		2.0	5.0	10.0	4.5	5.0	5.5	V
V_I	input voltage		GND	-	V_{CC}	GND	-	^{V}CC	V
V_S	switch voltage		GND	-	V_{CC}	GND	-	^{V}CC	V
T_{amb}	ambient temperature	see DC and AC characteristics per device	-40	+25	+85	-40	+25	+85	°C
			-40	-	+125	-40	-	+125	°C
t_r, t_f	input rise and fall times	V_{CC} = 2.0 V	-	6.0	1000	-	6.0	500	ns
		V_{CC} = 4.5 V	-	-	500	-	-	-	ns
		V_{CC} = 6.0 V	-	-	400	-	-	-	ns
		V_{CC} = 10.0 V	-	-	250	-	-	-	ns

9. LIMITING VALUES

Voltages are referenced to GND (ground = 0 V).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CC}	supply voltage		-0.5	+11.0	V
I_{IK}	input diode current	$V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V	-	±20	mA
I_{SK}	switch diode current	$V_S < -0.5$ V or $V_S > V_{CC} + 0.5$ V	-	±20	mA
I_S	switch current	$-0.5V < V_O < V_{CC} + 0.5$ V	-	±25	mA
I_{CC}, I_{GND}	V_{CC} or GND current		-	±50	mA
T_{stg}	storage temperature		-65	+150	°C
P_{tot}	power dissipation	T_{amb} = -40 °C to +125 °C; note 2	-	500	mW
P_S	power dissipation per switch		-	100	mW

10. DC CHARACTERISTICS

Voltages are referenced to GND (ground = 0 V); V_{is} is the input voltage at pins nY or nZ, whichever is assigned as an input; V_{os} is the output voltage at pins nY or nZ, whichever is assigned as an output.

74HC4066

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		OTHER	V_{CC} (V)				
T_{amb} = -40 °C to +85 °C							
V_{IH}	HIGH-level input voltage		2.0	1.5	1.2	-	V
			4.5	3.15	2.4	-	V
			6.0	4.2	3.2	-	V
			9.0	6.3	4.7	-	V
V_{IL}	LOW-level input voltage		2.0	-	0.8	0.50	V
			4.5	-	2.1	1.35	V
			6.0	-	2.8	1.80	V
			9.0	-	4.3	2.70	V
I_{LI}	input leakage current	$V_I = V_{CC}$ or GND	6.0	-	-	±1.0	mA
			10.0	-	-	±2.0	mA
$I_{S(OFF)}$	analog switch current OFF-state	per channel; $V_I = V_{IH}$ or V_{IL}; $V_S = V_{CC}$ - GND	10.0	-	-	±1.0	mA
$I_{S(ON)}$	analog switch current ON-state	$V_I = V_{IH}$ or V_{IL}; $V_S = V_{CC}$ - GND;	10.0	-	-	±1.0	mA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; V_{is} = GND or V_{CC}; $V_{os} = V_{CC}$ or GND	6.0	-	-	20.0	mA
			10.0	-	-	40.0	mA
SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		OTHER	V_{CC} (V)				
T_{amb} = -40 °C to +125 °C							
V_{IH}	HIGH-level input voltage		2.0	1.5	-	-	V

			4.5	3.15	-	-	V
			6.0	4.2	-	-	V
			9.0	6.3	-	-	V
V_{IL}	LOW-level input voltage		2.0	-	-	0.50	V
			4.5	-	-	1.35	V
			6.0	-	-	1.80	V
			9.0	-	-	2.70	V
I_{LI}	input leakage current	$V_I = V_{CC}$ or GND	6.0	-	-	±1.0	mA
			10.0	-	-	±2.0	mA
$I_{S(OFF)}$	analog switch current OFF-state	per channel; $V_I = V_{IH}$ or V_{IL}; $V_S = V_{CC}$ - GND	10.0	-	-	±1.0	mA
$I_{S(ON)}$	analog switch current ON-state	$V_I = V_{IH}$ or V_{IL}; $V_S = V_{CC}$ - GND	10.0	-	-	±1.0	mA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; V_{is} = GND or V_{CC}; $V_{os} = V_{CC}$ or GND	6.0	-	-	40.0	mA
			10.0	-	-	80.0	mA

74HCT4066

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		OTHER	V_{CC} (V)				
T_{amb} = -40 °C to +85 °C							
V_{IH}	HIGH-level input voltage		4.5 to 5.5	2.0	1.6	-	V
V_{IL}	LOW-level input voltage		4.5 to 5.5	-	1.2	0.8	V
I_{LI}	input leakage current	$V_I = V_{CC}$ or GND	5.5	-	-	±1.0	mA
$I_{S(OFF)}$	analog switch current OFF-state	per channel; $V_I = V_{IH}$ or V_{IL}; $V_S = V_{CC}$ - GND	5.5	-	-	±1.0	mA
$I_{S(ON)}$	analog switch current ON-state	$V_I = V_{IH}$ or V_{IL}; $V_S = V_{CC}$ - GND	5.5	-	-	±1.0	mA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; V_{is} = GND or V_{CC}; $V_{os} = V_{CC}$ or GND	4.5 to 5.5	-	-	20.0	mA
ΔI_{CC}	additional quiescent supply current per input	$V_I = V_{CC}$ - 2.1 V; other inputs at V_{CC} or GND	4.5 to 5.5	-	100	450	mA
T_{amb} = -40 °C to +125 °C							
V_{IH}	HIGH-level input voltage		4.5 to 5.5	2.0	-	-	V
V_{IL}	LOW-level input voltage		4.5 to 5.5	-	-	0.8	V
I_{LI}	input leakage current	$V_I = V_{CC}$ or GND	5.5	-	-	±1.0	mA
$I_{S(OFF)}$	analog switch current OFF-state	per channel; $V_I = V_{IH}$ or V_{IL}; $V_S = V_{CC}$ - GND	10.0	-	-	±1.0	mA

$I_{S(ON)}$	analog switch current ON-state	$V_I = V_{IH}$ or V_{IL}; $V_S = V_{CC}$ - GND	10.0	-	-	±1.0	mA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; V_{is} = GND or V_{CC}; $V_{os} = V_{CC}$ or GND	4.5 to 5.5	-	-	40.0	mA
ΔI_{CC}	additional quiescent supply current per input	$V_I = V_{CC}$ - 2.1 V; other inputs at V_{CC} or GND	4.5 to 5.5	-	-	490	mA

Note:

1. All typical values are measured at T_{amb} = 25 °C.

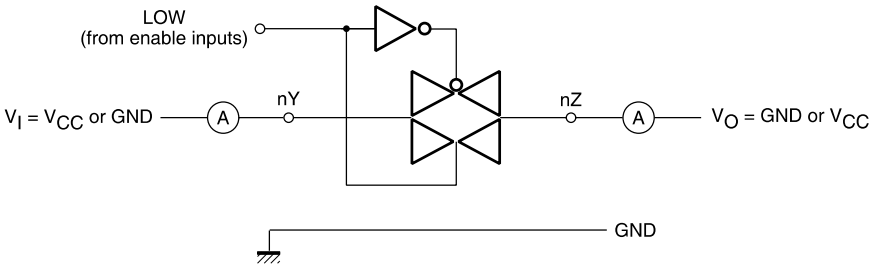


Fig. 1. Test circuit for measuring OFF-state current

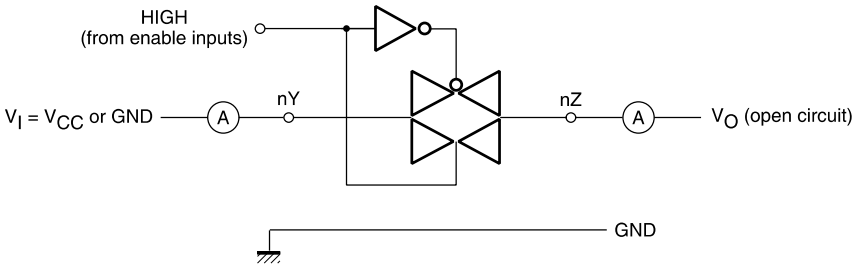


Fig. 2. Test circuit for measuring ON-state current

11. Resistance R_{ON} for 74HC4066 and 74HCT4066

For 74HC4066: V_{CC} = 2.0, 4.5, 6.0 and 9.0 V; for 74HCT4066: V_{CC} = 4.5 V; note 1; V_{is} is the input voltage at pins nY or nZ.

SYMBOL	PARAMETER	TEST CONDITIONS			MIN.	TYP.	MAX.	UNIT
		OTHER	I_S (mA)	V_{CC} (V)				
T_{amb} = -40 °C to +85 °C								
$R_{ON(peak)}$	ON-resistance (peak)	$V_I = V_{IH}$ or V_{IL}; $V_{is} = V_{CC}$ to GND	100	2.0	-	-	-	W
			1000	4.5	-	54	118	W
				6.0	-	42	105	W
				9.0	-	32	88	W
$R_{ON(rail)}$	ON-resistance (rail)	$V_I = V_{IH}$ or V_{IL}; V_{is} = GND	100	2.0	-	80	-	W
			1000	4.5	-	35	95	W
				6.0	-	27	82	W
				9.0	-	20	70	W

		$V_I = V_{IH}$ or V_{IL}; $V_{is} = V_{CC}$	100	2.0	-	100	-	W
			1000	4.5	-	42	106	W
				6.0	-	35	94	W
				9.0	-	27	78	W
ΔR_{ON}	maximum variation of ON-resistance between any two channels	$V_I = V_{IH}$ or V_{IL}; $V_{is} = V_{CC}$ to GND	-	2.0	-	-	-	W
				4.5	-	5	-	W
				6.0	-	4	-	W
				9.0	-	3	-	W
Tamb = -40 °C to +125 °C								
$R_{ON(peak)}$	ON-resistance (peak)	$V_I = V_{IH}$ or V_{IL}; $V_{is} = V_{CC}$ to GND	100	2.0	-	-	-	W
			1000	4.5	-	-	142	W
				6.0	-	-	126	W
				9.0	-	-	105	W
$R_{ON(rail)}$	ON-resistance (rail)	$V_I = V_{IH}$ or V_{IL}; V_{is} = GND	100	2.0	-	-	-	W
			1000	4.5	-	-	115	W
				6.0	-	-	100	W
				9.0	-	-	85	W
		$V_I = V_{IH}$ or V_{IL}; $V_{is} = V_{CC}$	100	2.0	-	-	-	W
			1000	4.5	-	-	128	W
				6.0	-	-	113	W
				9.0	-	-	95	W

Notes

1. At supply voltages approaching 2 V, the analog ON-resistance switch becomes extremely non-linear. Therefore, it is recommended that these devices are being used to transmit digital signals only, when using these supply voltages.
2. All typical values are measured at T_{amb} = 25 °C.

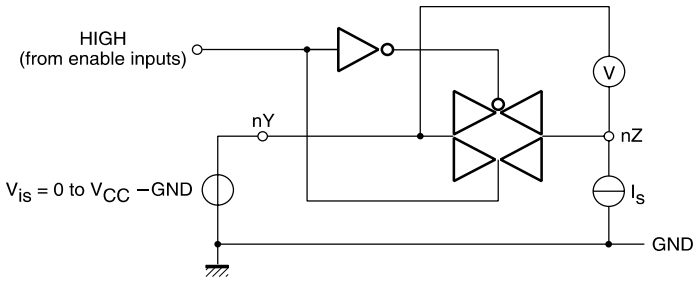


Fig. 3. Test circuit for measuring ON-resistance (R_{ON}).

12. AC CHARACTERISTICS

GND = 0 V; $t_r = t_f = 6$ ns; $C_L = 50$ pF; V_{is} is the input voltage at pins nY or nZ, whichever is assigned as an input; V_{os} is the output voltage at pins nY or nZ, whichever is assigned as an output.

74HC4066

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		OTHER	V_{CC} (V)				
T_{amb} = -40 °C to +85 °C							
t_{PHL}/t_{PLH}	propagation delay V_{is} to V_{os}	$R_L = \infty$	2.0	-	8	75	ns
			4.5	-	3	15	ns
			6.0	-	2	13	ns
			9.0	-	2	10	ns
t_{PZH}/t_{PZL}	turn-on time nE to V_{os}	R_L =1 kW	2.0	-	36	125	ns
			4.5	-	13	25	ns
			6.0	-	10	21	ns
			9.0	-	8	16	ns
t_{PHZ}/t_{PLZ}	turn-off time nE to V_{os}	R_L =1 kW	2.0	-	44	190	ns
			4.5	-	16	38	ns
			6.0	-	13	33	ns
			9.0	-	16	26	ns
T_{amb} = -40 °C to +125 °C							
t_{PHL}/t_{PLH}	propagation delay V_{is} to V_{os}	$R_L = \infty$	2.0	-	-	90	ns
			4.5	-	-	18	ns
			6.0	-	-	15	ns
			9.0	-	-	12	ns
t_{PZH}/t_{PZL}	turn-on time nE to V_{os}	R_L =1 kW	2.0	-	-	150	ns
			4.5	-	-	30	ns
			6.0	-	-	26	ns
			9.0	-	-	20	ns
t_{PHZ}/t_{PLZ}	turn-off time nE to V_{os}	R_L =1 kW	2.0	-	-	225	ns
			4.5	-	-	45	ns
			6.0	-	-	38	ns
			9.0	-	-	30	ns

74HCT4066

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		OTHER	V_{CC} (V)				
T_{amb} = -40 °C to +85 °C							
t_{PHL}/t_{PLH}	propagation delay V_{is} to V_{os}	$R_L = \infty$	4.5	-	3	15	ns
t_{PZH}/t_{PZL}	turn-on time nE to V_{os}	R_L =1 kW	4.5	-	12	30	ns

t_{PHZ}/t_{PLZ}	turn-off time nE to V_{os}	R_L =1 kW	4.5	-	20	44	ns
T_{amb} = -40 °C to +125 °C							
t_{PHL}/t_{PLH}	propagation delay V_{is} to V_{os}	R_L = ∞	4.5	-	-	18	ns
t_{PZH}/t_{PZL}	turn-on time nE to V_{os}	R_L =1 kW	4.5	-	-	36	ns
t_{PHZ}/t_{PLZ}	turn-off time nE to V_{os}	R_L =1 kW	4.5	-	-	53	ns

Note

1. All typical values are measured at T_{amb} = 25 °C.

13. AC WAVEFORMS

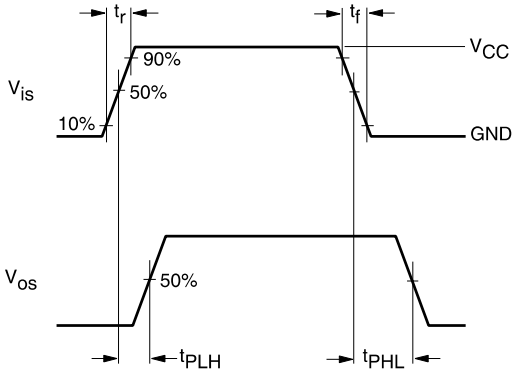
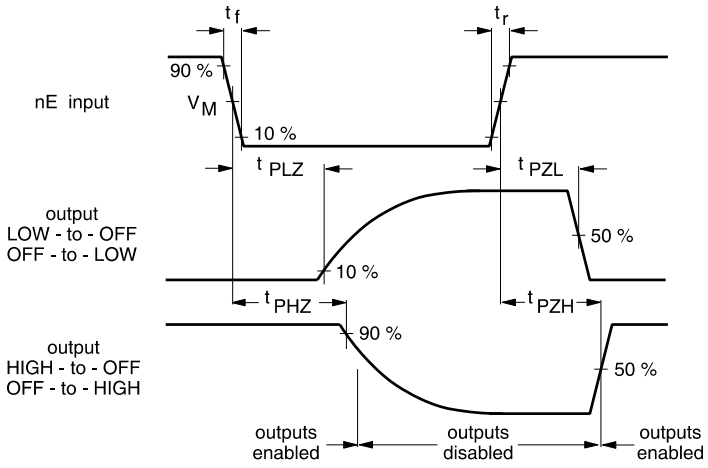


Fig. 4. Waveforms showing the input (V_{is}) to output (V_{os}) propagation delays.



74HC4066: V_M = 50 %; V_I = GND to V_{CC}.

74HCT4066: V_M = 1.3 V; V_I = GND to 3 V.

Fig. 5. Waveforms showing the turn-on and turn-off times

14. TEST CIRCUIT AND WAVEFORMS

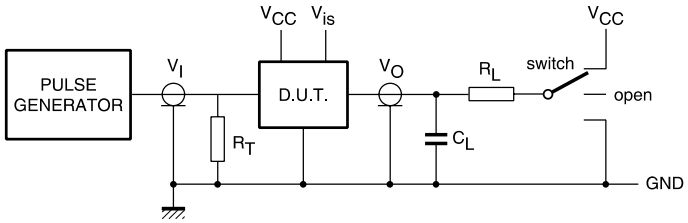


Fig. 6. Test circuit for measuring AC performance

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.

t_f = 6 ns; when measuring f_{max}, there is no constraint to t_r and t_f with 50 % duty factor.

TEST	SWITCH	V_{is}
t_{PZH}	GND	V_{CC}
t_{PZL}	V_{CC}	G_{ND}
t_{PHZ}	GND	V_{CC}
t_{PLZ}	V_{CC}	GND
other	open	pulse

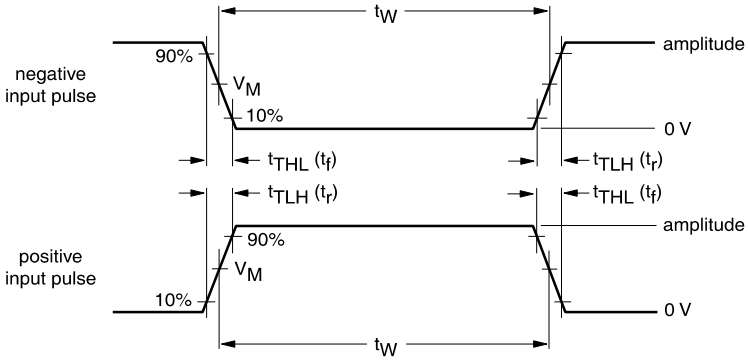
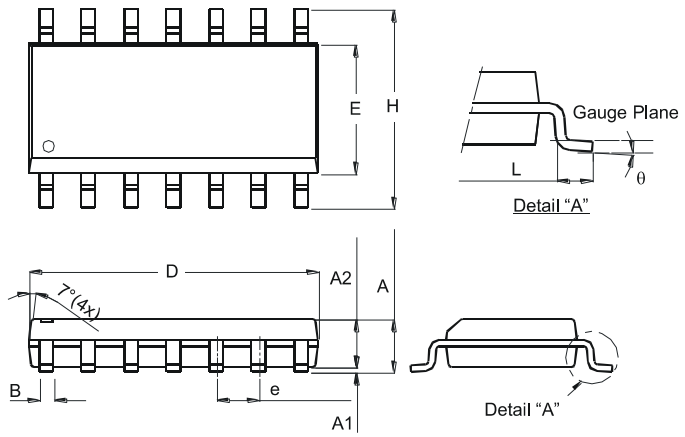


Fig. 7. Input pulse definitions

FAMILY	AMPLITUDE	V_M	t_r and t_f	
			f_{max}; PULSE WIDTH	OTHER
74HC4066	V_{CC}	50 %	<2 ns	6 ns
74HCT4066	3.0 V	1.3 V	<2 ns	6 ns

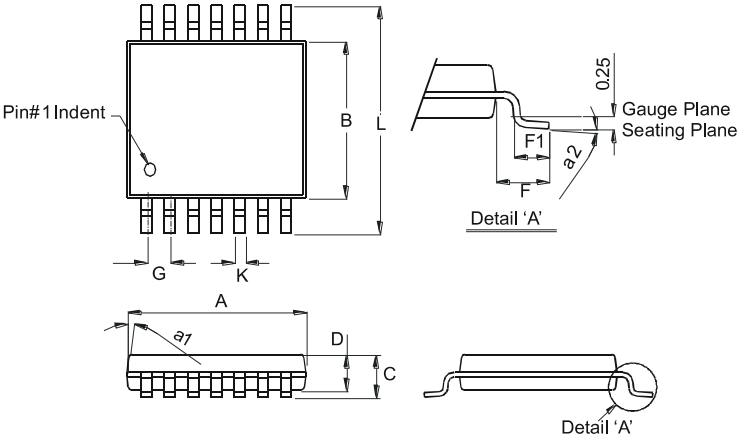
15. Package Outlines

SOP-14



SOP-14		
Dim	**Min**	**Max**
A	1.47	1.73
A1	0.10	0.25
A2	1.45 Typ	
B	0.33	0.51
D	8.53	8.74
E	3.80	3.99
e	1.27 Typ	
H	5.80	6.20
L	0.38	1.27
θ	0°	8°
All Dimensions in mm		

TSSOP-14



TSSOP-14		
Dim	**Min**	**Max**
a1	7° (4X)	
a2	0°	8°
A	4.9	5.10
B	4.30	4.50
C	-	1.2
D	0.8	1.05
F	1.00 Typ	
F1	0.45	0.75
G	0.65 Typ	
K	0.19	0.30
L	6.40 Typ	
All Dimensions in mm		

16. Disclaimers

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