

MC10LVEP11, MC100LVEP11

2.5V / 3.3V ECL 1:2 Differential Fanout Buffer

The MC10/100LVEP11 is a differential 1:2 fanout buffer. The device is pin and functionally equivalent to the EP11 device. With AC performance the same as the EP11 device, the LVEP11 is ideal for applications requiring lower voltage. Single-ended CLK input operation is limited to a $V_{CC} \geq 3.0$ V in PECL mode, or $V_{EE} \leq -3.0$ V in NECL mode.

The 100 Series contains temperature compensation.

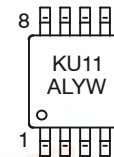
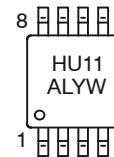
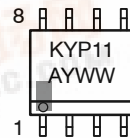
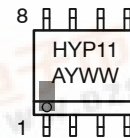
- 240 ps Typical Propagation Delay
- Maximum Frequency > 3.0 GHz Typical
- PECL Mode Operating Range: $V_{CC} = 2.375$ V to 3.8 V with $V_{EE} = 0$ V
- NECL Mode Operating Range: $V_{CC} = 0$ V with $V_{EE} = -2.375$ V to -3.8 V
- Open Input Default State
- Q Output Will Default LOW with Inputs Open or at V_{EE}
- LVDS Input Compatible



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MARKING DIAGRAMS*



H	= MC10
K	= MC100
A	= Assembly Location
L	= Wafer Lot
Y	= Year
W	= Work Week

*For additional marking information, refer to Application Note AND8002/D.

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 8 of this data sheet.

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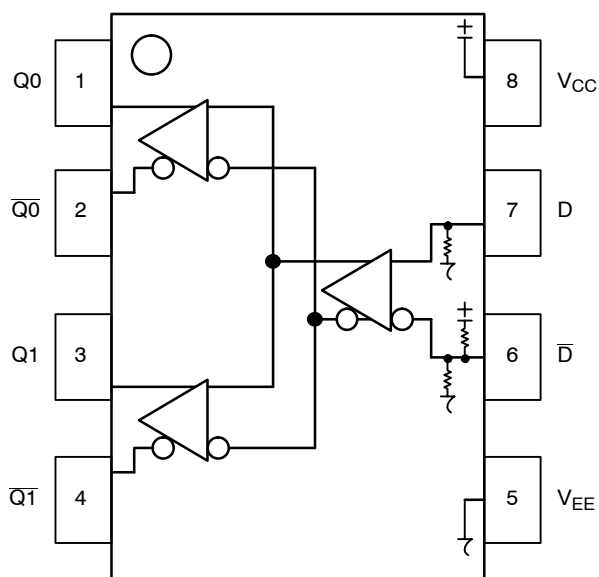


Figure 1. 8-Lead Pinout (Top View) and Logic Diagram

Table 1. PIN DESCRIPTION

PIN	FUNCTION
D*, $\overline{D}^{**}$	ECL Data Inputs
Q0, $\overline{Q0}$, Q1, $\overline{Q1}$	ECL Data Outputs
V _{CC}	Positive Supply
V _{EE}	Negative Supply

*Pins will default to 2/3 V_{CC} when left open.

**Pins will default LOW when left open.

Table 2. ATTRIBUTES

Characteristics	Value
Internal Input Pulldown Resistor	75 kΩ
Internal Input Pullup Resistor	37.5 kΩ
ESD Protection	Human Body Model Machine Model Charged Device Model
	> 4 kV > 200 V > 2 kV
Moisture Sensitivity, Indefinite Time Out of Drypack (Note 1)	Level 1
Flammability Rating	Oxygen Index: 28 to 34
	UL 94 V-0 @ 0.125 in
Transistor Count	110 Devices
Meets or exceeds JEDEC Spec EIA/JESD78 IC Latchup Test	

1. For additional information, see Application Note AND8003/D.

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Table 3. MAXIMUM RATINGS

Symbol	Parameter	Condition 1	Condition 2	Rating	Unit
V_{CC}	PECL Mode Power Supply	$V_{EE} = 0\text{ V}$		6	V
V_{EE}	NECL Mode Power Supply	$V_{CC} = 0\text{ V}$		-6	V
V_I	PECL Mode Input Voltage NECL Mode Input Voltage	$V_{EE} = 0\text{ V}$	$V_I \leq V_{CC}$	6	V
		$V_{CC} = 0\text{ V}$	$V_I \geq V_{EE}$	-6	V
I_{out}	Output Current	Continuous Surge		50	mA
				100	mA
T_A	Operating Temperature Range			-40 to +85	°C
T_{stg}	Storage Temperature Range			-65 to +150	°C
θ_{JA}	Thermal Resistance (Junction-to-Ambient)	0 lfpm	SOIC-8	190	°C/W
		500 lfpm	SOIC-8	130	°C/W
θ_{JC}	Thermal Resistance (Junction-to-Case)	Standard Board	SOIC-8	41 to 44	°C/W
θ_{JA}	Thermal Resistance (Junction-to-Ambient)	0 lfpm	TSSOP-8	185	°C/W
		500 lfpm	TSSOP-8	140	°C/W
θ_{JC}	Thermal Resistance (Junction-to-Case)	Standard Board	TSSOP-8	41 to 44	°C/W
T_{sol}	Wave Solder	<2 to 3 sec @ 248°C		265	°C

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

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Table 4. 10LVEP DC CHARACTERISTICS, PECL $V_{CC} = 2.5\text{ V}$, $V_{EE} = 0\text{ V}$ (Note 2)

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current	24	30	36	24	30	36	25	31	38	mA
V_{OH}	Output HIGH Voltage (Note 3)	1365	1490	1615	1430	1555	1680	1490	1615	1740	mV
V_{OL}	Output LOW Voltage (Note 3)	565	740	865	630	805	930	690	865	990	mV
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 4)	1.2		2.5	1.2		2.5	1.2		2.5	V
I_{IH}	Input HIGH Current			150			150			150	μA
I_{IL}	Input LOW Current	$\frac{D}{D}$ 0.5 -150			0.5 -150			0.5 -150			μA

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

2. Input and output parameters vary 1:1 with V_{CC} . V_{EE} can vary +0.125 V to -1.3 V.

3. All loading with 50 Ω to $V_{CC} - 2.0\text{ V}$.

4. V_{IHCMR} min varies 1:1 with V_{EE} . V_{IHCMR} max varies 1:1 with V_{CC} . The V_{IHCMR} range is referenced to the most positive side of the differential input signal. Single-Ended input CLK pin operation is limited to $V_{CC} \geq 3.0\text{ V}$ in PECL mode.

Table 5. 10LVEP DC CHARACTERISTICS, PECL $V_{CC} = 3.3\text{ V}$, $V_{EE} = 0\text{ V}$ (Note 5)

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current	24	30	36	24	30	36	25	31	38	mA
V_{OH}	Output HIGH Voltage (Note 6)	2165	2290	2415	2230	2355	2480	2290	2415	2540	mV
V_{OL}	Output LOW Voltage (Note 6)	1365	1540	1665	1430	1605	1730	1490	1665	1790	mV
V_{IH}	Input HIGH Voltage (Single-Ended) (Note 7)	2090		2415	2155		2480	2215		2540	mV
V_{IL}	Input LOW Voltage (Single-Ended) (Note 7)	1365		1690	1430		1755	1490		1815	mV
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 8)	1.2		3.3	1.2		3.3	1.2		3.3	V
I_{IH}	Input HIGH Current			150			150			150	μA
I_{IL}	Input LOW Current	$\frac{D}{D}$ 0.5 -150			0.5 -150			0.5 -150			μA

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

5. Input and output parameters vary 1:1 with V_{CC} . V_{EE} can vary +0.925 V to -0.5 V.

6. All loading with 50 Ω to $V_{CC} - 2.0\text{ V}$.

7. Single-Ended input CLK pin operation is limited to $V_{CC} \geq 3.0\text{ V}$ in PECL mode.

8. V_{IHCMR} min varies 1:1 with V_{EE} . V_{IHCMR} max varies 1:1 with V_{CC} . The V_{IHCMR} range is referenced to the most positive side of the differential input signal.

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Table 6. 10LVEP DC CHARACTERISTICS, NECL $V_{CC} = 0\text{ V}$, $V_{EE} = -3.8\text{ V}$ to -2.375 V (Note 9)

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current	24	30	36	24	30	36	25	31	38	mA
V_{OH}	Output HIGH Voltage (Note 10)	-1135	-1010	-885	-1070	-945	-820	-1010	-885	-760	mV
V_{OL}	Output LOW Voltage (Note 10)	-1935	-1760	-1635	-1870	-1695	-1570	-1810	-1635	-1510	mV
V_{IH}	Input HIGH Voltage (Single-Ended) (Note 11)	-1210		-885	-1145		-820	-1085		-760	mV
V_{IL}	Input LOW Voltage (Single-Ended) (Note 11)	-1935		-1610	-1870		-1545	-1810		-1485	mV
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 12)	$V_{EE}+1.2$		0.0	$V_{EE}+1.2$		0.0	$V_{EE}+1.2$		0.0	V
I_{IH}	Input HIGH Current			150			150			150	μA
I_{IL}	Input LOW Current	$\frac{D}{D}$ 0.5 -150			0.5 -150			0.5 -150			μA

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

9. Input and output parameters vary 1:1 with V_{CC} .

10. All loading with $50\ \Omega$ to $V_{CC} - 2.0\text{ V}$.

11. Single-Ended input CLK pin operation is limited to $V_{EE} \leq -3.0\text{ V}$ in NECL mode.

12. V_{IHCMR} min varies 1:1 with V_{EE} , V_{IHCMR} max varies 1:1 with V_{CC} . The V_{IHCMR} range is referenced to the most positive side of the differential input signal.

Table 7. 100LVEP DC CHARACTERISTICS, PECL $V_{CC} = 2.5\text{ V}$, $V_{EE} = 0\text{ V}$ (Note 13)

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current	25	31	37	29	35	41	32	38	45	mA
V_{OH}	Output HIGH Voltage (Note 14)	1355	1480	1605	1355	1480	1605	1355	1480	1605	mV
V_{OL}	Output LOW Voltage (Note 14)	555	730	900	555	730	900	555	730	900	mV
V_{IH}	Input HIGH Voltage (Single-Ended)	1335		1620	1335		1620	1335		1620	mV
V_{IL}	Input LOW Voltage (Single-Ended)	555		900	555		900	555		900	mV
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 15)	1.2		2.5	1.2		2.5	1.2		2.5	V
I_{IH}	Input HIGH Current			150			150			150	μA
I_{IL}	Input LOW Current	$\frac{D}{D}$ 0.5 -150			0.5 -150			0.5 -150			μA

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

13. Input and output parameters vary 1:1 with V_{CC} . V_{EE} can vary $+0.125\text{ V}$ to -1.3 V .

14. All loading with $50\ \Omega$ to $V_{CC} - 2.0\text{ V}$.

15. V_{IHCMR} min varies 1:1 with V_{EE} , V_{IHCMR} max varies 1:1 with V_{CC} . The V_{IHCMR} range is referenced to the most positive side of the differential input signal. Single-Ended input CLK pin operation is limited to $V_{CC} \geq 3.0\text{ V}$ in PECL mode.

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Table 8. 100LVEP DC CHARACTERISTICS, PECL $V_{CC} = 3.3\text{ V}$, $V_{EE} = 0\text{ V}$ (Note 16)

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current	25	31	37	29	35	41	32	38	45	mA
V_{OH}	Output HIGH Voltage (Note 17)	2155	2280	2405	2155	2280	2405	2155	2280	2405	mV
V_{OL}	Output LOW Voltage (Note 17)	1355	1530	1700	1355	1530	1700	1355	1530	1700	mV
V_{IH}	Input HIGH Voltage (Single-Ended) (Note 18)	2135		2420	2135		2420	2135		2420	mV
V_{IL}	Input LOW Voltage (Single-Ended) (Note 18)	1355		1700	1355		1700	1355		1700	mV
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 19)	1.2		3.3	1.2		3.3	1.2		3.3	V
I_{IH}	Input HIGH Current			150			150			150	μA
I_{IL}	Input LOW Current	$\frac{D}{\bar{D}}$	0.5 -150		0.5 -150			0.5 -150			μA

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

16. Input and output parameters vary 1:1 with V_{CC} . V_{EE} can vary +0.925 V to -0.5 V.

17. All loading with 50 Ω to $V_{CC} - 2.0\text{ V}$.

18. Single-Ended input CLK pin operation is limited to $V_{CC} \geq 3.0\text{ V}$ in PECL mode.

19. V_{IHCMR} min varies 1:1 with V_{EE} , V_{IHCMR} max varies 1:1 with V_{CC} . The V_{IHCMR} range is referenced to the most positive side of the differential input signal.

Table 9. 100LVEP DC CHARACTERISTICS, NECL $V_{CC} = 0\text{ V}$; $V_{EE} = -3.8\text{ V}$ to -2.375 V (Note 20)

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current	25	31	37	29	35	41	32	38	45	mA
V_{OH}	Output HIGH Voltage (Note 21)	-1145	-1020	-895	-1145	-1020	-895	-1145	-1020	-895	mV
V_{OL}	Output LOW Voltage (Note 21)	-1945	-1770	-1600	-1945	-1770	-1600	-1945	-1770	-1600	mV
V_{IH}	Input HIGH Voltage (Single-Ended) (Note 22)	-1165		-880	-1165		-880	-1165		-880	mV
V_{IL}	Input LOW Voltage (Single-Ended) (Note 22)	-1945	-1425	-1600	-1945	-1425	-1600	-1945	-1425	-1600	mV
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 23)	$V_{EE}+1.2$		0.0	$V_{EE}+1.2$		0.0	$V_{EE}+1.2$		0.0	V
I_{IH}	Input HIGH Current			150			150			150	μA
I_{IL}	Input LOW Current	$\frac{D}{\bar{D}}$	0.5 -150		0.5 -150			0.5 -150			μA

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

20. Input and output parameters vary 1:1 with V_{CC} .

21. All loading with 50 Ω to $V_{CC} - 2.0\text{ V}$.

22. Single-Ended input CLK pin operation is limited to $V_{EE} \leq -3.0\text{ V}$ in NECL mode.

23. V_{IHCMR} min varies 1:1 with V_{EE} , V_{IHCMR} max varies 1:1 with V_{CC} . The V_{IHCMR} range is referenced to the most positive side of the differential input signal.

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Table 10. AC CHARACTERISTICS $V_{CC} = 0\text{ V}$; $V_{EE} = -3.8\text{ V}$ to -2.375 V or $V_{CC} = 2.375\text{ V}$ to 3.8 V ; $V_{EE} = 0\text{ V}$ (Note 24)

Symbol	Characteristic	-40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
$f_{\max}$	Maximum Frequency (Figure 2)		3			3			3		GHz
t_{PLH} , t_{PHL}	Propagation Delay (Differential Configuration) CLK to Q, $\bar{Q}$	170	230	300	180	240	310	210	270	360	ps
t_{SKEW}	Within Device Skew Q, $\bar{Q}$ Device to Device Skew (Note 25)		5.0	20 130		5.0	20 130		5.0	20 150	ps
t_{JITTER}	CLOCK Random Jitter (RMS) @ $\leq 3.0\text{ GHz}$ (Figure 2)		0.2	1		0.2	1		0.2	1	ps
V_{PP}	Input Voltage Swing (Differential Configuration)	150	800	1200	150	800	1200	150	800	1200	mV
t_r , t_f	Output Rise/Fall Times Q, $\bar{Q}$ (20% – 80%)	70	110	170	80	120	180	100	140	200	ps

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

24. Measured using a 750 mV source, 50% duty cycle clock source. All loading with $50\ \Omega$ to $V_{CC} - 2.0\text{ V}$.

25. Skew is measured between outputs under identical transitions.

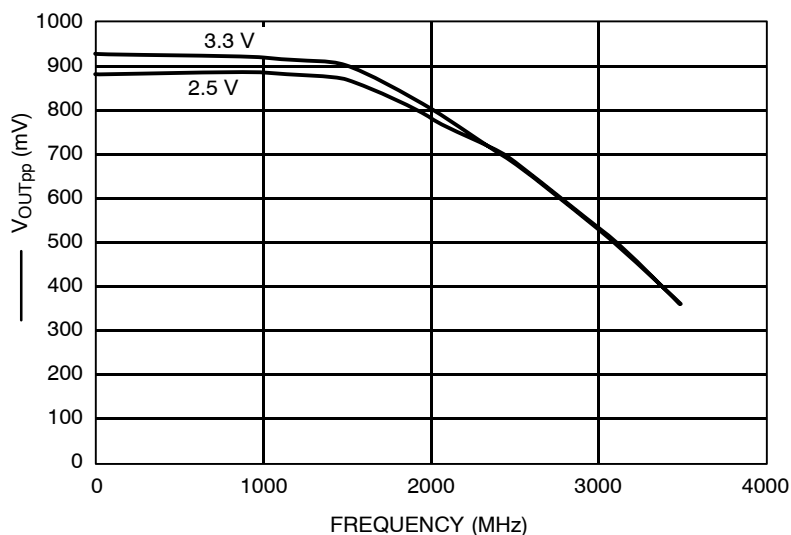


Figure 2. $F_{\max}$ Typical

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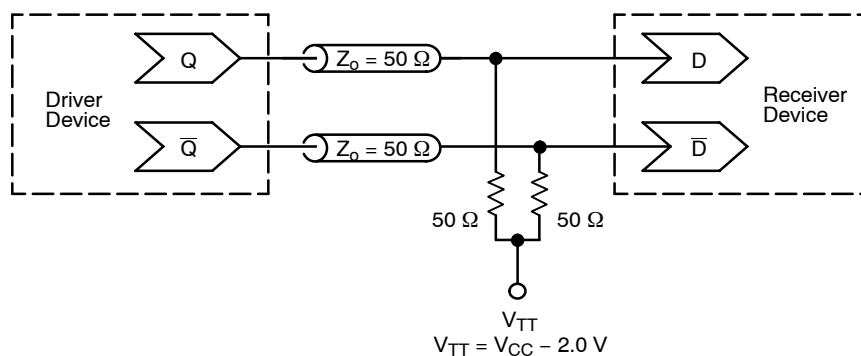


Figure 3. Typical Termination for Output Driver and Device Evaluation
(See Application Note AND8020/D – Termination of ECL Logic Devices.)

ORDERING INFORMATION

Device	Package	Shipping [†]
MC10LVEP11D	SOIC–8	98 Units / Rail
MC10LVEP11DR2	SOIC–8	2500 / Tape & Reel
MC10LVEP11DT	TSSOP–8	100 Units / Rail
MC10LVEP11DTR2	TSSOP–8	2500 / Tape & Reel
MC100LVEP11D	SOIC–8	98 Units / Rail
MC100LVEP11DR2	SOIC–8	2500 / Tape & Reel
MC100LVEP11DT	TSSOP–8	100 Units / Rail
MC100LVEP11DTR2	TSSOP–8	2500 / Tape & Reel

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

Resource Reference of Application Notes

- AN1405/D** – ECL Clock Distribution Techniques
- AN1406/D** – Designing with PECL (ECL at +5.0 V)
- AN1503/D** – ECLinPS™ I/O SPICE Modeling Kit
- AN1504/D** – Metastability and the ECLinPS Family
- AN1568/D** – Interfacing Between LVDS and ECL
- AN1642/D** – The ECL Translator Guide
- AND8001/D** – Odd Number Counters Design
- AND8002/D** – Marking and Date Codes
- AND8020/D** – Termination of ECL Logic Devices
- AND8066/D** – Interfacing with ECLinPS
- AND8090/D** – AC Characteristics of ECL Devices

PACKAGE DIMENSIONS

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751-01 THRU 751-06 ARE OBSOLETE. NEW STANDARD IS 751-07.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0°	8°	0°	8°
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

Figure 1: Schematic diagram of the experimental setup. The diagram shows a cross-section of a channel with four vertical tubes. The channel height is 7.0, with a bottom section of 0.275 and a top section of 1.52. The channel width is 0.060. The distance between the tubes is 0.155. The distance from the left wall to the first tube is 0.024, and the distance from the last tube to the right wall is 0.050. The distance between the tubes is 0.1270. The diagram is labeled 'Figure 1' and 'Schematic diagram of the experimental setup'.

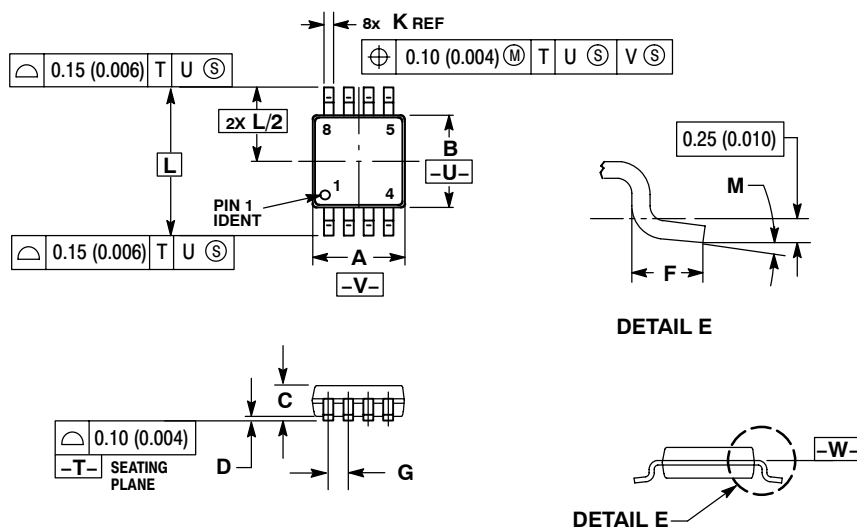
SCALE 6:1 $\left(\frac{\text{mm}}{\text{inches}} \right)$

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PACKAGE DIMENSIONS

TSSOP-8 DT SUFFIX PLASTIC TSSOP PACKAGE CASE 948R-02 ISSUE A



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: MILLIMETER.
 3. DIMENSION A DOES NOT INCLUDE MOLD FLASH. PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
 4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
 5. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
 6. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.90	3.10	0.114	0.122
B	2.90	3.10	0.114	0.122
C	0.80	1.10	0.031	0.043
D	0.05	0.15	0.002	0.006
F	0.40	0.70	0.016	0.028
G	0.65 BSC		0.026 BSC	
K	0.25	0.40	0.010	0.016
L	4.90 BSC		0.193 BSC	
M	0°	6°	0°	6°

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