2.5 V/3.3 V ECL ÷2, ÷4, ÷8 Clock Generation Chip

MC100LVEP34

ON Semiconductor®

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Description

The MC100LVEP34 is a low skew ÷2, ÷4, ÷8 clock generation chip designed explicitly for low skew clock generation applications. The internal dividers are synchronous to each other, therefore, the common output edges are all precisely aligned. The V_{BB} pin, an internally generated voltage supply, is available to this device only. For single−ended input conditions, the unused differential input is connected to V_{BB} as a switching reference voltage. V_{BB} may also rebias AC coupled inputs. When used, decouple V_{BB} and V_{CC} via a 0.01 μF capacitor and limit current sourcing or sinking to 0.5 mA. When not used, V_{BB} should be left open.

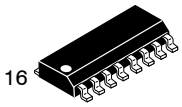
The common enable ($\overline{EN}$) is synchronous so that the internal dividers will only be enabled/disabled when the internal clock is already in the LOW state. This avoids any chance of generating a runt clock pulse on the internal clock when the device is enabled/disabled as can happen with an asynchronous control. An internal runt pulse could lead to losing synchronization between the internal divider stages. The internal enable flip−flop is clocked on the falling edge of the input clock; therefore, all associated specification limits are referenced to the negative edge of the clock input.

Upon start−up, the internal flip−flops will attain a random state; the master reset (MR) input allows for the synchronization of the internal dividers, as well as multiple LVEP34s in a system. 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.

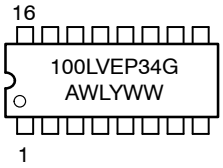
Features

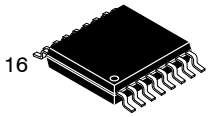
- 35 ps Output−to−Output Skew
- Synchronous Enable/Disable
- Master Reset for Synchronization
- The 100 Series Contains Temperature Compensation.
- PECL Mode Operating Range: V_{CC} = 2.375 V to 3.8 V with V_{EE} = 0 V
- NECL Mode Operating Range: V_{CC} = 0 V with V_{EE} = −2.375 V to −3.8 V
- Open Input Default State
- LVDS Input Compatible
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

MARKING DIAGRAMS*

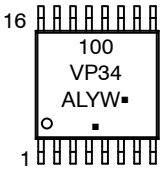


SO−16
D SUFFIX
CASE 751B





TSSOP−16
DT SUFFIX
CASE 948F



A	= Assembly Location
L, WL	= Wafer Lot
Y	= Year
W, WW	= Work Week
G or ▪	= Pb−Free Package

(Note: Microdot may be in either location)

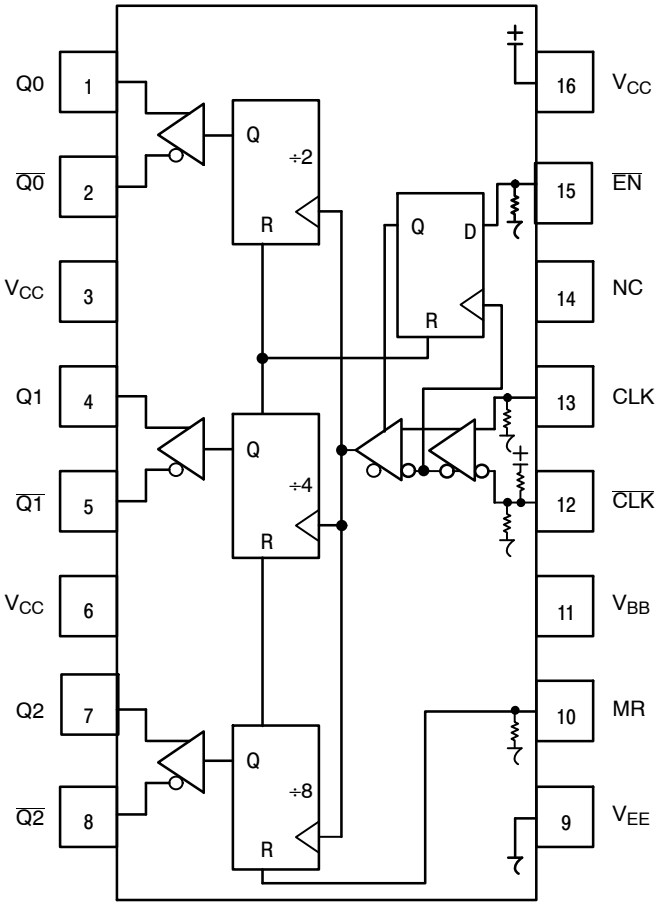
*For additional marking information, refer to Application Note AND8002/D.

ORDERING INFORMATION

Device	Package	Shipping†
MC100LVEP34DG	SOIC−16 (Pb−Free)	48 Units / Tube
MC100LVEP34DTG	TSSOP−16 (Pb−Free)	96 Units / Tube
MC100LVEP34DTR2G	TSSOP−16 (Pb−Free)	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.

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Warning: All V_{CC} and V_{EE} pins must be externally connected to Power Supply to guarantee proper operation.

Figure 1. 16−Lead Pinout (Top View) **and Logic Diagram**

Table 1. PIN DESCRIPTION

Pin	Function
CLK*, $\overline{\text{CLK}}$**	ECL Diff Clock Inputs
EN*	ECL Sync Enable
MR*	ECL Master Reset
Q0, $\overline{\text{Q0}}$	ECL Diff ÷2 Outputs
Q1, $\overline{\text{Q1}}$	ECL Diff ÷4 Outputs
Q2, $\overline{\text{Q2}}$	ECL Diff ÷8 Outputs
V_{BB}	Reference Voltage Output
V_{CC}	Positive Supply
V_{EE}	Negative Supply
NC	No Connect

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

Table 2. FUNCTION TABLE

CLK	$\overline{\text{EN}}$	MR	FUNCTION
Z	L	L	Divide
ZZ	H	L	Hold Q_{0-3}
X	X	H	Reset Q_{0-3}

Z = Low−to−High Transition
ZZ = High−to−Low Transition

Table 3. 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	 > 2 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−O @ 0.125 in
Transistor Count	210 Devices
Meets or exceeds JEDEC Spec EIA/JESD78 IC Latchup Test	

1. For additional Moisture Sensitivity information, refer to Application Note AND8003/D.

Table 4. MAXIMUM RATINGS

Symbol	Parameter	Condition 1	Condition 2	Rating	Unit
V_{CC}	PECL Mode Power Supply	V_{EE} = 0 V		6	V
V_{EE}	NECL Mode Power Supply	V_{CC} = 0 V		−6	V
V_I	PECL Mode Input Voltage NECL Mode Input Voltage	V_{EE} = 0 V V_{CC} = 0 V	$V_I \le V_{CC}$ $V_I \ge V_{EE}$	6 −6	V V
I_{out}	Output Current	Continuous Surge		50 100	mA mA
I_{BB}	V_{BB} Sink/Source			± 0.5	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 500 lfpm	SOIC−16 SOIC−16	100 60	°C/W °C/W
θ_{JC}	Thermal Resistance (Junction−to−Case)	Standard Board	SOIC−16	33 to 36	°C/W
θ_{JA}	Thermal Resistance (Junction−to−Ambient)	0 lfpm 500 lfpm	TSSOP−16 TSSOP−16	138 108	°C/W °C/W
θ_{JC}	Thermal Resistance (Junction−to−Case)	Standard Board	TSSOP−16	33 to 36	°C/W
T_{sol}	Wave Solder	<2 to 3 sec @ 248°C		265	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

Table 5. 100EP DC CHARACTERISTICS, PECL V_{CC} = 2.5 V, V_{EE} = 0 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	40	50	60	40	50	60	42	52	62	mA
V_{OH}	Output HIGH Voltage (Note 3)	1355	1480	1605	1355	1480	1605	1355	1480	1605	mV
V_{OL}	Output LOW Voltage (Note 3)	505	680	900	505	680	900	505	680	900	mV
V_{IH}	Input HIGH Voltage (Single−Ended) (Note 4)	1335		1620	1335		1620	1275		1620	mV
V_{IL}	Input LOW Voltage (Single−Ended) (Note 4)	505		900	505		900	505		900	mV
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential) (Note 4, Note 5)	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 D $\overline{D}$	 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.

2. Input and output parameters vary 1:1 with V_{CC}.
3. All loading with 50 Ω to V_{CC} − 2.0 V.
4. Do not use V_{BB} at V_{CC} < 3.0 V. Single−Ended input CLK pin operation is limited to $V_{CC} \geq 3.0$ V in PECL mode.
5. 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 6. 100EP DC CHARACTERISTICS, PECL V_{CC} = 3.3 V, V_{EE} = 0 V (Note 6)

Symbol	Characteristic	−40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current	40	50	60	40	50	60	42	52	62	mA
V_{OH}	Output HIGH Voltage (Note 7)	2155	2280	2405	2155	2280	2405	2155	2280	2405	mV
V_{OL}	Output LOW Voltage (Note 7)	1305	1570	1700	1305	1570	1700	1305	1570	1700	mV
V_{IH}	Input HIGH Voltage (Single−Ended)	2075		2420	2075		2420	2075		2420	mV
V_{IL}	Input LOW Voltage (Single−Ended)	1305		1700	1305		1700	1305		1700	mV
V_{BB}	Output Voltage Reference (Note 8)	1775	1875	1975	1775	1875	1975	1775	1875	1975	mV
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential) (Note 9)	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 D $\overline{D}$	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.

6. Input and output parameters vary 1:1 with V_{CC}. V_{EE} can vary +0.925 V to −0.5 V.
7. All loading with 50 Ω to V_{CC} − 2.0 V.
8. Single−Ended input CLK pin operation is limited to $V_{CC} \geq 3.0$ V in PECL mode.
9. 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. 100EP DC CHARACTERISTICS, NECL V_{CC} = 0 V, V_{EE} = −3.8 V to −2.375 V (Note 10)

Symbol	Characteristic	−40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{EE}	Power Supply Current	40	50	60	40	50	60	42	52	62	mA
V_{OH}	Output HIGH Voltage (Note 11)	−1145	−1020	−895	−1145	−1020	−895	−1145	−1020	−895	mV
V_{OL}	Output LOW Voltage (Note 11)	−1995	−1700	−1600	−1995	−1700	−1600	−1995	−1700	−1600	mV
V_{IH}	Input HIGH Voltage (Single−Ended)	−1225		−880	−1225		−880	−1225		−880	mV
V_{IL}	Input LOW Voltage (Single−Ended)	−1995		−1600	−1995		−1600	−1995		−1600	mV
V_{BB}	Output Voltage Reference (Note 12)	−1525	−1425	−1325	−1525	−1425	−1325	−1525	−1425	−1325	mV
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential) (Note 13)	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 D $\overline{D}$	 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.

10. Input and output parameters vary 1:1 with V_{CC}.
11. All loading with 50 Ω to V_{CC} − 2.0 V.
12. Single−Ended input CLK pin operation is limited to $V_{EE} \le -3.0$ V in NECL mode.
13. 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 8. AC CHARACTERISTICS V_{CC}= 0 V; V_{EE}= −3.8 V to −2.375 V or V_{CC}= 2.375 V to 3.8 V; V_{EE}= 0 V (Note 14)

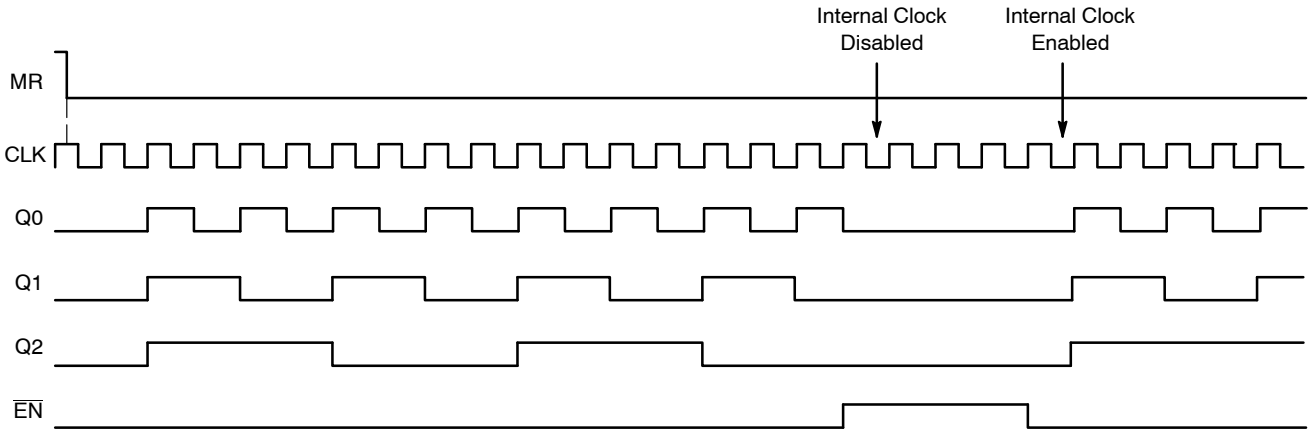
Symbol	Characteristic		−40°C			25°C			85°C			Unit
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
f_{max}	Maximum Toggle Frequency (See Figure 4. F_{max})		2.8			2.8			2.8			GHz
t_{PLH} t_{PHL}	Propagation Delay to Output	CLK to Q0, Q1, Q2 MR to Q	550 500	650 600	750 700	600 550	700 650	800 750	650 600	750 700	850 800	ps
t_{JITTER}	RMS Clock Jitter (See Figure 4. F_{max}/JITTER)	DIV2 ≤ 2.5 GHz DIV2 ≤ 3.0 GHz DIV4 ≤ 2.5 GHz DIV4 ≤ 3.0 GHz DIV8 ≤ 2.5 GHz DIV8 ≤ 3.0 GHz		0.36 0.34 0.26 0.32 0.27 0.32	0.4 0.4 0.4 		0.30 0.40 0.29 0.38 0.30 0.39	0.4 0.5 0.5 		0.35 0.63 0.33 0.60 0.34 1.10	0.6 0.5 0.5 	ps
t_S	Setup Time $\overline{EN}$		150	50		150	50		150	50		ps
t_H	Hold Time $\overline{EN}$		200	100		200	100		200	100		ps
t_{RR}	Set/Reset Recovery		300	200		300	200		300	200		ps
V_{PP}	Input Swing (Note 15)		150		1000	150		1000	150		1000	mV
t_r t_f	Output Rise/Fall Times Q (20% − 80%)		90	170	200	100	180	250	120	200	280	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.

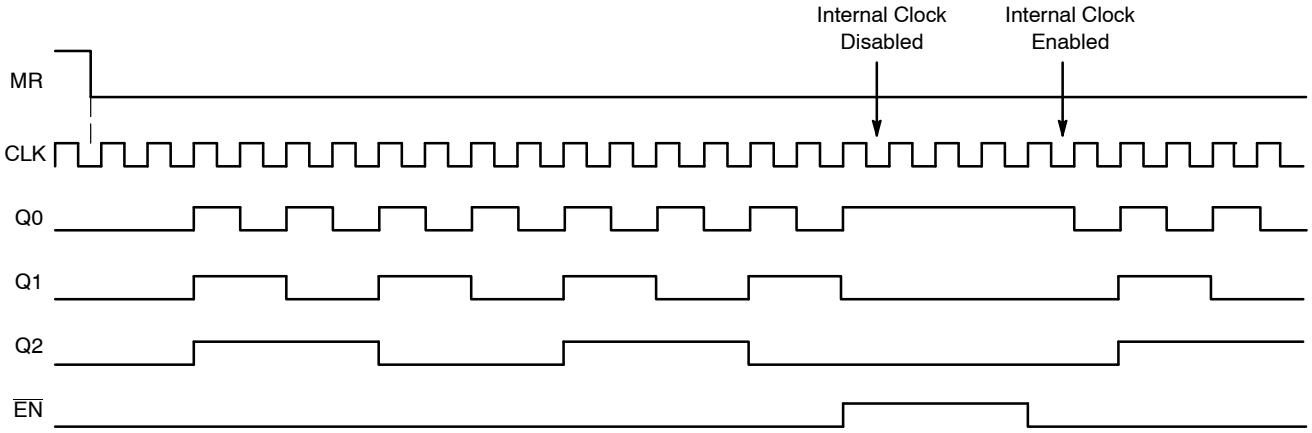
14. Measured using a 750 mV source, 50% duty cycle clock source. All loading with 50 Ω to V_{CC} − 2.0 V.
15. $V_{PP(}$min) is minimum input swing for which AC parameters guaranteed. The device has a DC gain of ≈40.

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

There are two distinct functional relationships between the Master Reset and Clock:



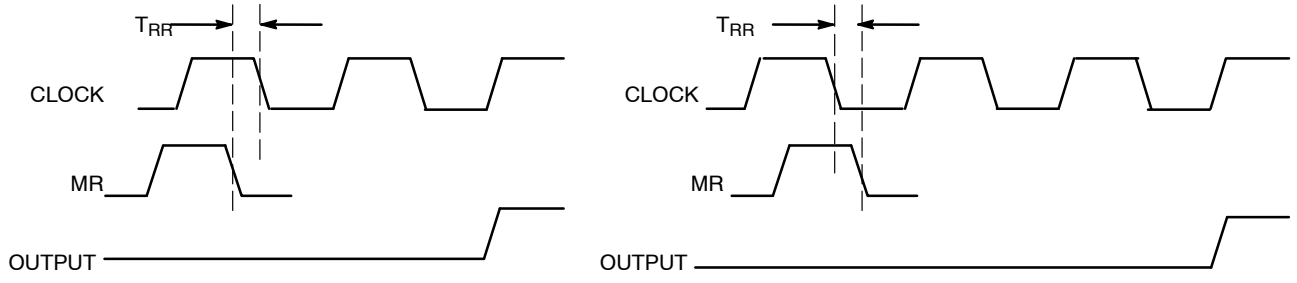
CASE 1: If the MR is de−asserted (H−L), while the Clock is still high, the outputs will follow the second ensuing clock rising edge.



CASE 2: If the MR is de−asserted (H−L), after the Clock has transitioned low, the outputs will follow the third ensuing clock rising edge.

Figure 2. Timing Diagrams

The $\overline{EN}$ signal will “freeze” the internal divider flip−flops on the first falling edge of CLK after its assertion. The internal divider flip−flops will maintain their state during the freeze. When $\overline{EN}$ is deasserted (LOW), and after the next falling edge of CLK, then the internal divider flip−flops will “unfreeze” and continue to their next state count with proper phase relationships.



CASE 1 **CASE 2**

Figure 3. Reset Recovery Time

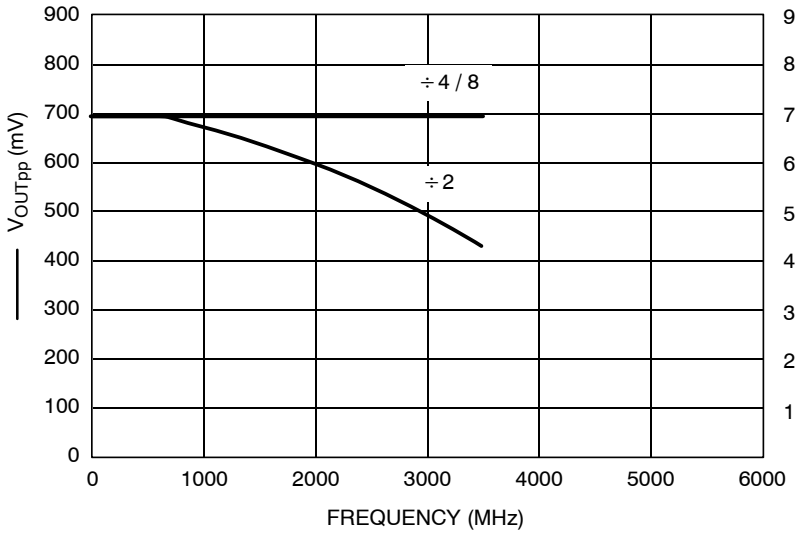


Figure 4. F_{max}

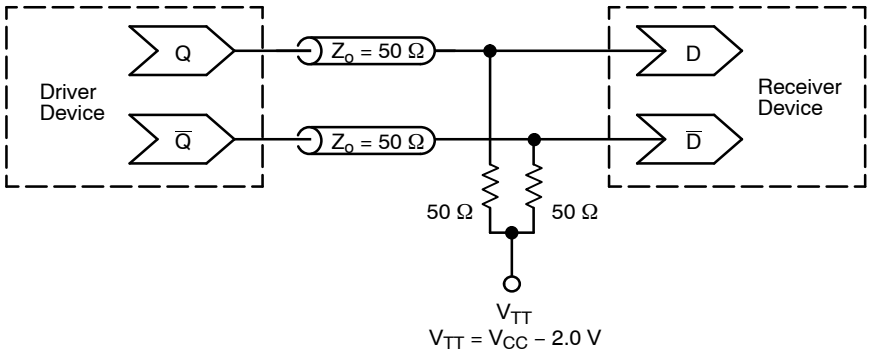


Figure 5. Typical Termination for Output Driver and Device Evaluation (See Application Note AND8020/D – Termination of ECL Logic Devices.)

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

AN1672/D – The ECL Translator Guide

AND8001/D – Odd Number Counters Design

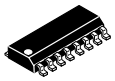
AND8002/D – Marking and Date Codes

AND8020/D – Termination of ECL Logic Devices

AND8066/D – Interfacing with ECLinPS

AND8090/D – AC Characteristics of ECL Devices

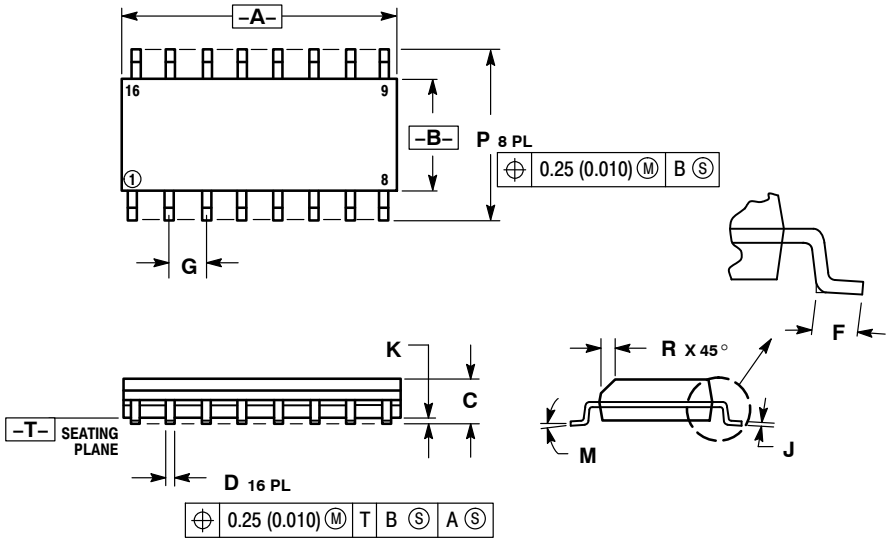
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SCALE 1:1

SOIC–16
CASE 751B–05
ISSUE K

DATE 29 DEC 2006



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS 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.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

STYLE 1:
PIN 1. COLLECTOR
2. BASE
3. EMITTER
4. NO CONNECTION
5. EMITTER
6. BASE
7. COLLECTOR
8. COLLECTOR
9. BASE
10. EMITTER
11. NO CONNECTION
12. EMITTER
13. BASE
14. COLLECTOR
15. EMITTER
16. COLLECTOR

STYLE 2:
PIN 1. CATHODE
2. ANODE
3. NO CONNECTION
4. CATHODE
5. CATHODE
6. NO CONNECTION
7. ANODE
8. CATHODE
9. CATHODE
10. ANODE
11. NO CONNECTION
12. CATHODE
13. CATHODE
14. NO CONNECTION
15. ANODE
16. CATHODE

STYLE 3:
PIN 1. COLLECTOR, DYE #1
2. BASE, #1
3. EMITTER, #1
4. COLLECTOR, #1
5. COLLECTOR, #2
6. BASE, #2
7. EMITTER, #2
8. COLLECTOR, #2
9. COLLECTOR, #3
10. BASE, #3
11. EMITTER, #3
12. COLLECTOR, #3
13. COLLECTOR, #4
14. BASE, #4
15. EMITTER, #4
16. COLLECTOR, #4

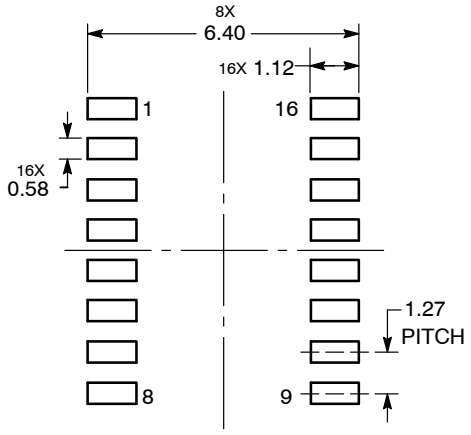
STYLE 4:
PIN 1. COLLECTOR, DYE #1
2. COLLECTOR, #1
3. COLLECTOR, #2
4. COLLECTOR, #2
5. COLLECTOR, #3
6. COLLECTOR, #3
7. COLLECTOR, #4
8. COLLECTOR, #4
9. BASE, #4
10. EMITTER, #4
11. BASE, #3
12. EMITTER, #3
13. BASE, #2
14. EMITTER, #2
15. BASE, #1
16. EMITTER, #1

STYLE 5:
PIN 1. DRAIN, DYE #1
2. DRAIN, #1
3. DRAIN, #2
4. DRAIN, #2
5. DRAIN, #3
6. DRAIN, #3
7. DRAIN, #4
8. DRAIN, #4
9. GATE, #4
10. SOURCE, #4
11. GATE, #3
12. SOURCE, #3
13. GATE, #2
14. SOURCE, #2
15. GATE, #1
16. SOURCE, #1

STYLE 6:
PIN 1. CATHODE
2. CATHODE
3. CATHODE
4. CATHODE
5. CATHODE
6. CATHODE
7. CATHODE
8. CATHODE
9. ANODE
10. ANODE
11. ANODE
12. ANODE
13. ANODE
14. ANODE
15. ANODE
16. ANODE

STYLE 7:
PIN 1. SOURCE N-CH
2. COMMON DRAIN (OUTPUT)
3. COMMON DRAIN (OUTPUT)
4. GATE P-CH
5. COMMON DRAIN (OUTPUT)
6. COMMON DRAIN (OUTPUT)
7. COMMON DRAIN (OUTPUT)
8. SOURCE P-CH
9. SOURCE P-CH
10. COMMON DRAIN (OUTPUT)
11. COMMON DRAIN (OUTPUT)
12. COMMON DRAIN (OUTPUT)
13. GATE N-CH
14. COMMON DRAIN (OUTPUT)
15. COMMON DRAIN (OUTPUT)
16. SOURCE N-CH

SOLDERING FOOTPRINT



DIMENSIONS: MILLIMETERS

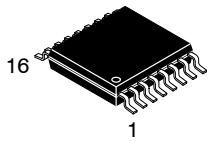
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DESCRIPTION:	SOIC–16	PAGE 1 OF 1

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MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

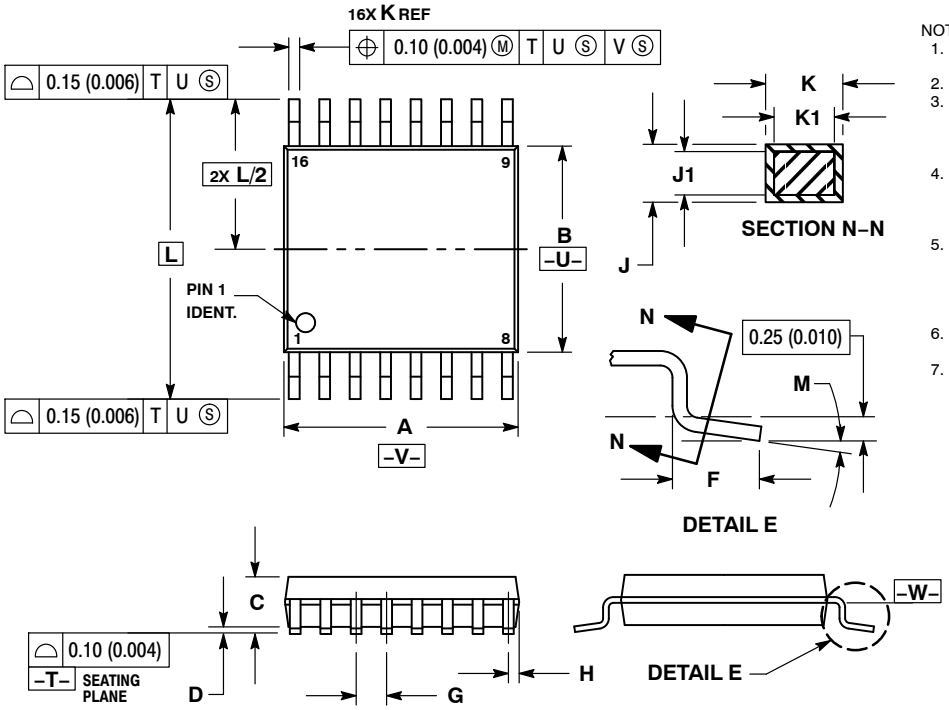
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SCALE 2:1

TSSOP−16
CASE 948F−01
ISSUE B

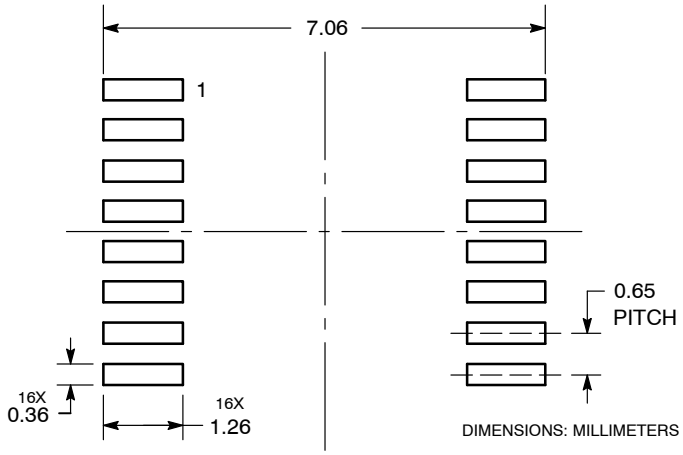
DATE 19 OCT 2006



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. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE −W−.

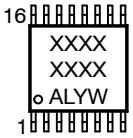
	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.90	5.10	0.193	0.200
B	4.30	4.50	0.169	0.177
C	−−−	1.20	−−−	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.18	0.28	0.007	0.011
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0 °	8 °	0 °	8 °

SOLDERING FOOTPRINT



DIMENSIONS: MILLIMETERS

GENERIC MARKING DIAGRAM*



XXXX	= Specific Device Code
A	= Assembly Location
L	= Wafer Lot
Y	= Year
W	= Work Week
G or ▪	= Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “ ▪”, may or may not be present.

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