MC10EP90, MC100EP90

-3.3V / -5V Triple ECL Input to LVPECL/PECL Output Translator

The MC10/100EP90 is a TRIPLE ECL TO LVPECL/PECL translator. The device receives differential LVECL or ECL signals and translates them to differential LVPECL or PECL output signals.

A V_{BB} output is provided for interfacing with single ended LVECL or ECL signals at the input. If a single ended input is to be used the V_{BB} output should be connected to the $\overline{D}$ input. The active signal would then drive the D input. When used the V_{BB} output should be bypassed to ground by a 0.01 μF capacitor. The V_{BB} output is designed to act as the switching reference for the EP90 under single ended input switching conditions, as a result this pin can only source/sink up to 0.5 mA of current.

To accomplish the level translation the EP90 requires three power rails. The V_{CC} supply should be connected to the positive supply, and the V_{EE} connected to the negative supply.

The 100 Series contains temperature compensation.

- 260 ps Typical Propagation Delay
- Maximum Frequency > 3 GHz Typical
- Voltage Supplies V_{CC} = 3.0 V to 5.5 V, V_{EE} = –3.0 V to –5.5 V, GND = 0 V
- Open Input Default State
- Safety Clamp on Inputs
- Fully Differential Design
- Q Output Will Default LOW with Inputs Open or at V_{EE}
- V_{BB} Output

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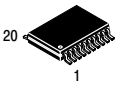
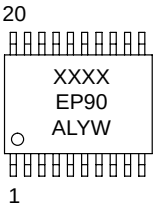
MARKING DIAGRAM*



TSSOP–20
DT SUFFIX
CASE 948E

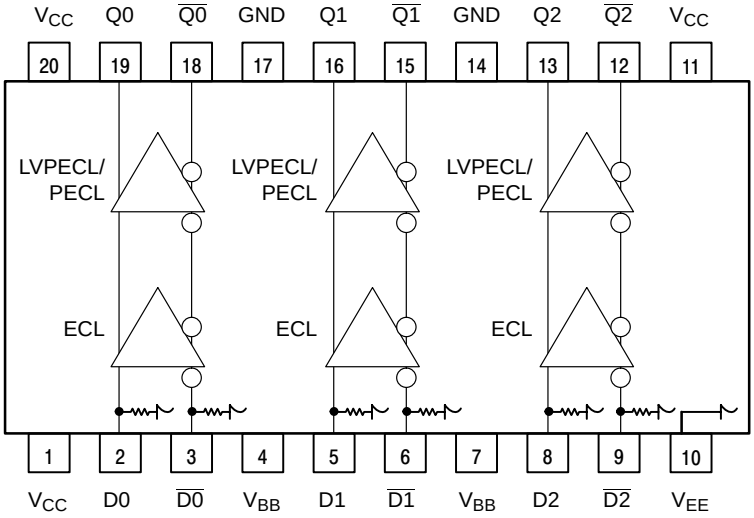


xxx = MC10 or 100
A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week

*For additional information, see Application Note AND8002/D

ORDERING INFORMATION

Device	Package	Shipping
MC10EP90DT	TSSOP–20	75 Units/Rail
MC10EP90DTR2	TSSOP–20	2500 Tape & Reel
MC100EP90DT	TSSOP–20	75 Units/Rail
MC100EP90DTR2	TSSOP–20	2500 Tape & Reel



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

Figure 1. 20–Lead TSSOP (Top View) **and Logic Diagram**

PIN DESCRIPTION

PIN	FUNCTION
Q(0:2), $\overline{Q}$(0:2)	Differential LVPECL or PECL Outputs
D(0:2)*, $\overline{D}$(0:2)*	Differential LVECL or ECL Inputs
V_{CC}	Positive Supply
GND	Ground
V_{EE}	Negative Supply
V_{BB}	Output Reference Supply

* Pins will default LOW when left open.

FUNCTION TABLE

Function	V_{CC}	GND	V_{EE}
–5V ECL to 5V PECL	5 V	0 V	–5 V
–5V ECL to 3.3V PECL	3.3 V	0 V	–5 V
–3.3V ECL to 5V PECL	5 V	0 V	–3.3 V
–3.3V ECL to 3.3V PECL	3.3 V	0 V	–3.3 V

ATTRIBUTES

Characteristics	Value
Internal Input Pulldown Resistor	75 kΩ
Internal Input Pullup Resistor	N/A
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	UL–94 code V–0 A 1/8” 28 to 34
Transistor Count	350 Devices
Meets or exceeds JEDEC Spec EIA/JESD78 IC Latchup Test	

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

MAXIMUM RATINGS (Note 2.)

Symbol	Parameter	Condition 1	Condition 2	Rating	Units
V_{CC}	PECL Mode Power Supply	GND = 0 V		6	V
V_{EE}	NECL Mode Power Supply	GND = 0 V		–6	V
V_I	PECL Mode Input Voltage NECL Mode Input Voltage	GND = 0 V GND = 0 V	$V_I \leq V_{CC}$ $V_I \geq V_{EE}$	6 –6	V V
I_{out}	Output Current	Continuous Surge		50 100	mA mA
I_{BB}	V_{BB} Sink/Source			± 0.5	mA
TA	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	20 TSSOP 20 TSSOP	140 100	°C/W °C/W
θ_{JC}	Thermal Resistance (Junction to Case)	std bd	20 TSSOP	23 to 41	°C/W
T_{sol}	Wave Solder	<2 to 3 sec @ 248°C		265	°C

2. Maximum Ratings are those values beyond which device damage may occur.

10EP DC CHARACTERISTICS V_{CC} = 3.3 V, V_{EE} = –5.5V to –3.0V; GND = 0 V (Note 3.)

		–40°C			25°C			85°C			
Symbol	**Characteristic**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**
I_{EE}	Negative Power Supply Current	5	13	20	5	13	20	5	13	20	mA
I_{CC}	Positive Power Supply Current	43	55	67	43	55	67	43	55	67	mA
V_{OH}	Output HIGH Voltage (Note 4.)	2165	2290	2415	2230	2355	2480	2290	2415	2540	mV
V_{OL}	Output LOW Voltage (Note 4.)	1365	1490	1615	1430	1555	1680	1490	1615	1740	mV
V_{IH}	Input HIGH Voltage (Single Ended)	–1210		–885	–1145		–820	–1085		–760	mV
V_{IL}	Input LOW Voltage (Single Ended)	–1935		–1610	–1870		–1545	–1810		–1485	mV
V_{BB}	Output Voltage Reference	–1510	–1410	–1310	–1445	–1345	–1245	–1385	–1285	–1185	mV
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential) (Note 5.)	V_{EE}+2.0		0.0	V_{EE}+2.0		0.0	V_{EE}+2.0		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: 10EP circuits are designed to meet the DC specifications shown in the above table after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse airflow greater than 500 lfpm is maintained.

3. Input and output parameters vary 1:1 with V_{CC}.
4. All loading with 50 ohms to V_{CC}–2.0 volts.
5. V_{IHCMR} min varies 1:1 with V_{EE}, max varies 1:1 with V_{CC}. The V_{IHCMR} range is referenced to the most positive side of the differential input signal.

10EP DC CHARACTERISTICS V_{CC} = 5.0 V, V_{EE} = –5.5V to –3.0V; GND = 0 V (Note 6.)

		–40°C			25°C			85°C			
Symbol	**Characteristic**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**
I_{EE}	Negative Power Supply Current	5	13	20	5	13	20	5	13	20	mA
I_{CC}	Positive Power Supply Current	43	55	67	43	55	67	43	55	67	mA
V_{OH}	Output HIGH Voltage (Note 7.)	3865	3990	4115	3930	4055	4180	3990	4115	4240	mV
V_{OL}	Output LOW Voltage (Note 7.)	3065	3190	3315	3130	3255	3380	3190	3315	3440	mV
V_{IH}	Input HIGH Voltage (Single Ended)	–1210		–885	–1145		–820	–1085		–760	mV
V_{IL}	Input LOW Voltage (Single Ended)	–1935		–1690	–1870		–1545	–1810		–1485	mV
V_{BB}	Output Voltage Reference	–1510	–1410	–1310	–1445	–1345	–1245	–1385	–1285	–1185	mV
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential) (Note 8.)	V_{EE}+2.0		0.0	V_{EE}+2.0		0.0	V_{EE}+2.0		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: 10EP circuits are designed to meet the DC specifications shown in the above table after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse airflow greater than 500 lfpm is maintained.

6. Input and output parameters vary 1:1 with V_{CC}.
7. All loading with 50 ohms to V_{CC}–2.0 volts.
8. V_{IHCMR} min varies 1:1 with V_{EE}, max varies 1:1 with V_{CC}. The V_{IHCMR} range is referenced to the most positive side of the differential input signal.

100EP DC CHARACTERISTICS V_{CC} = 3.3 V, V_{EE} = –5.5V to –3.0V; GND = 0 V (Note 9.)

Symbol	Characteristic	–40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{EE}	Negative Power Supply Current	5	13	20	5	13	20	5	13	20	mA
I_{CC}	Positive Power Supply Current	45	58	70	50	62	75	53	65	78	mA
V_{OH}	Output HIGH Voltage (Note 10.)	2155	2280	2405	2155	2280	2405	2155	2280	2405	mV
V_{OL}	Output LOW Voltage (Note 10.)	1355	1480	1605	1355	1480	1605	1355	1480	1605	mV
V_{IH}	Input HIGH Voltage (Single Ended)	–1210		–885	–1145		–820	–1085		–760	mV
V_{IL}	Input LOW Voltage (Single Ended)	–1935		–1610	–1870		–1545	–1810		–1485	mV
V_{BB}	Output Voltage Reference	–1525	–1425	–1325	–1525	–1425	–1325	–1525	–1425	–1325	mV
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential) (Note 11.)	V_{EE}+2.0		0.0	V_{EE}+2.0		0.0	V_{EE}+2.0		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: 100EP circuits are designed to meet the DC specifications shown in the above table after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse airflow greater than 500 lfpm is maintained.

9. Input and output parameters vary 1:1 with V_{CC}.
10. All loading with 50 ohms to V_{CC}–2.0 volts.
11. V_{IHCMR} min varies 1:1 with V_{EE}, max varies 1:1 with V_{CC}. The V_{IHCMR} range is referenced to the most positive side of the differential input signal.

100EP DC CHARACTERISTICS V_{CC} = 5.0 V, V_{EE} = –5.5V to –3.0V; GND = 0 V (Note 12.)

Symbol	Characteristic	–40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{EE}	Negative Power Supply Current	5	13	20	5	13	20	5	13	20	mA
I_{CC}	Positive Power Supply Current	45	58	70	50	62	75	53	65	78	mA
V_{OH}	Output HIGH Voltage (Note 13.)	3855	3980	4105	3855	3980	4105	3855	3980	4105	mV
V_{OL}	Output LOW Voltage (Note 13.)	3055	3180	3305	3055	3180	3305	3055	3180	3305	mV
V_{IH}	Input HIGH Voltage (Single Ended)	–1210		–885	–1145		–820	–1085		–760	mV
V_{IL}	Input LOW Voltage (Single Ended)	–1935		–1610	–1870		–1545	–1810		–1485	mV
V_{BB}	Output Voltage Reference	–1525	–1425	–1325	–1525	–1425	–1325	–1525	–1425	–1325	mV
V_{IHCMR}	Input HIGH Voltage Common Mode Range (Differential) (Note 14.)	V_{EE}+2.0		0.0	V_{EE}+2.0		0.0	V_{EE}+2.0		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: 100EP circuits are designed to meet the DC specifications shown in the above table after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse airflow greater than 500 lfpm is maintained.

12. Input and output parameters vary 1:1 with V_{CC}.
13. All loading with 50 ohms to V_{CC}–2.0 volts.
14. V_{IHCMR} min varies 1:1 with V_{EE}, max varies 1:1 with V_{CC}.. The V_{IHCMR} range is referenced to the most positive side of the differential input signal.

AC CHARACTERISTICS V_{EE} = –3.0 V to –5.5 V; V_{CC} = 3.0 V to 5.5 V; GND = 0 V (Note 15.)

Symbol	Characteristic	–40°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
f_{max}	Maximum Frequency (See Figure 2 F_{max}/JITTER)		> 3			> 3			> 3		GHz
t_{PLH}, t_{PHL}	Propagation Delay to Output Differential	170	240	310	200	260	340	230	300	370	ps
t_{SKEW}	Duty Cycle Skew (Note 16.)		5.0	20		5.0	20		5.0	20	ps
	Within Device Skew Q, $\overline{Q}$ Device to Device Skew (Note 16.)			80 140			80 140			80 140	
t_{JITTER}	Cycle–to–Cycle Jitter (See Figure 2 F_{max}/JITTER)		0.2	< 1		0.2	< 1		0.2	< 1	ps
V_{PP}	Input Voltage Swing (Diff.)	150	800	1200	150	800	1200	150	800	1200	mV
t_r t_f	Output Rise/Fall Times Q, $\overline{Q}$ (20% – 80%)	70	120	170	80	130	180	100	150	230	ps

15. Measured using a 750 mV source, 50% duty cycle clock source. All loading with 50 ohms to V_{CC}–2.0 V.
16. Skew is measured between outputs under identical transitions. Duty cycle skew is defined only for differential operation when the delays are measured from the cross point of the inputs to the cross point of the outputs.

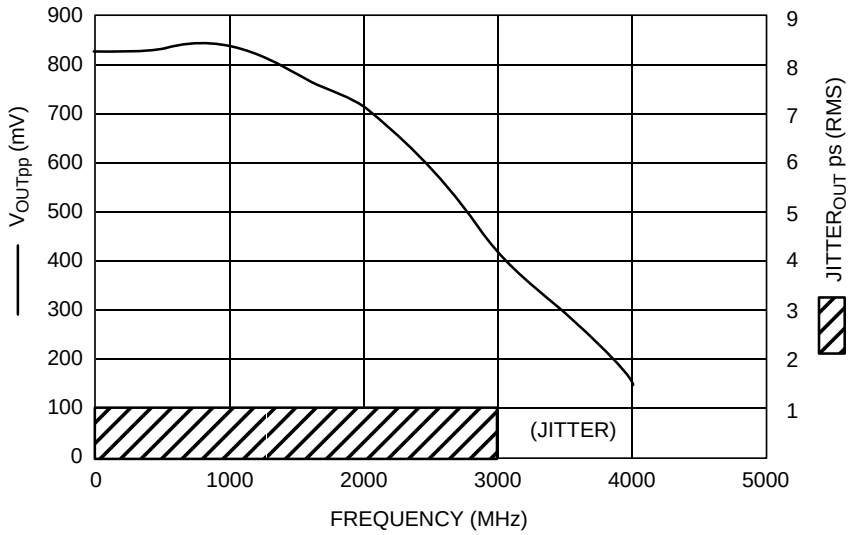


Figure 2. F_{max}/Jitter

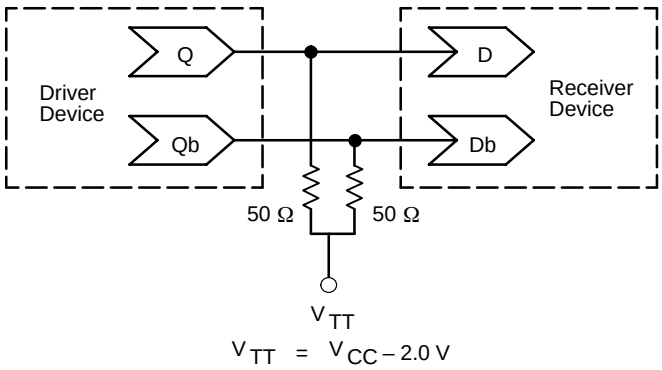


Figure 3. Typical Termination for Output Driver and Device Evaluation
(Refer to Application Note AND8020 – Termination of ECL Logic Devices.)

Resource Reference of Application Notes

AN1404	–	ECLinPS Circuit Performance at Non–Standard V_{IH} Levels
AN1405	–	ECL Clock Distribution Techniques
AN1406	–	Designing with PECL (ECL at +5.0 V)
AN1504	–	Metastability and the ECLinPS Family
AN1568	–	Interfacing Between LVDS and ECL
AN1650	–	Using Wire–OR Ties in ECLinPS Designs
AN1672	–	The ECL Translator Guide
AND8001	–	Odd Number Counters Design
AND8002	–	Marking and Date Codes
AND8009	–	ECLinPS Plus Spice I/O Model Kit
AND8020	–	Termination of ECL Logic Devices

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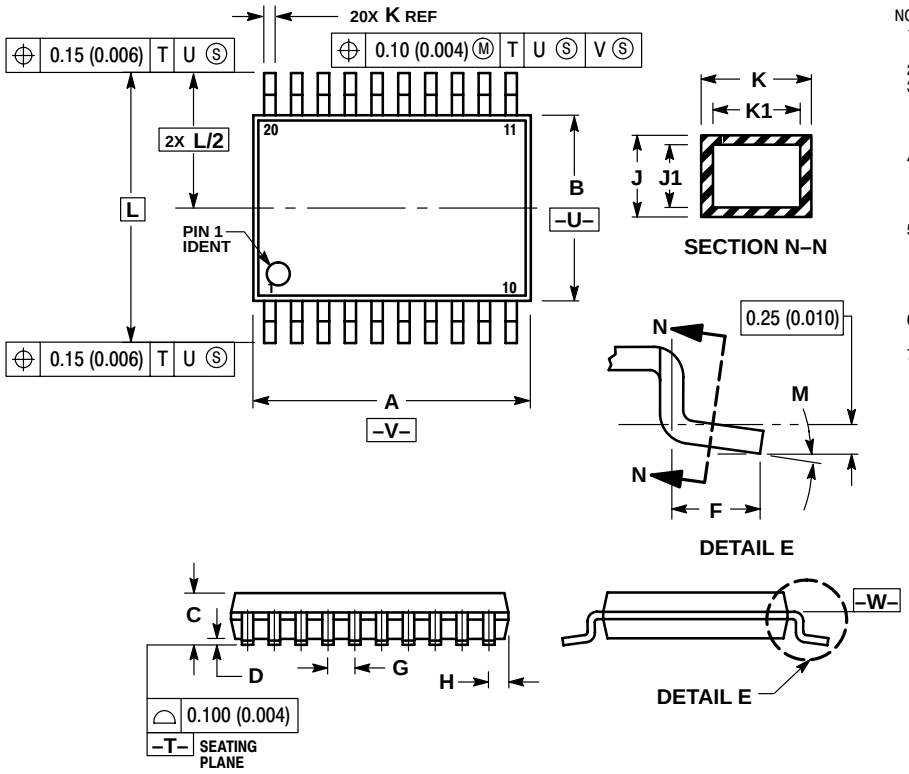
PACKAGE DIMENSIONS

TSSOP–20
DT SUFFIX
PLASTIC TSSOP PACKAGE
CASE 948E–02
ISSUE A



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. ICONTROLLING 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	6.40	6.60	0.252	0.260
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	0.27	0.37	0.011	0.015
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°

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