Low-Voltage 1:10 Differential ECL/PECL/HSTL Clock Driver

XC100EP111

LOW–VOLTAGE 1:10 DIFFERENTIAL ECL/PECL/HSTL CLOCK DRIVER

The XC100EP111 is a low skew 1–to–10 differential driver, designed with clock distribution in mind. It accepts two clock sources into an input multiplexer. The ECL/PECL input signals can be either differential or single–ended if the V_{BB} output is used. HSTL inputs can be used when the EP111 is operating under PECL conditions. The selected signal is fanned out to 10 identical differential outputs.

- 100ps Part–to–Part Skew
- 35ps Output–to–Output Skew
- Differential Design
- V_{BB} Output
- Low Voltage V_{EE} Range of –2.375 to –3.8V for ECL
- Low Voltage V_{CC} Range of +2.375 to +3.8V for PECL and HSTL
- 75kΩ Input Pulldown Resistors
- ECL/PECL Outputs

FA SUFFIX
32–LEAD LQFP PACKAGE
CASE 873A–02

The EP111 is specifically designed, modeled and produced with low skew as the key goal. Optimal design and layout serve to minimize gate–to–gate skew within a device, and empirical modeling is used to determine process control limits that ensure consistent t_{pd} distributions from lot to lot. The net result is a dependable, guaranteed low skew device.

To ensure that the tight skew specification is met it is necessary that both sides of the differential output are terminated into 50Ω, even if only one side is being used. In most applications, all ten differential pairs will be used and therefore terminated. In the case where fewer than ten pairs are used, it is necessary to terminate at least the output pairs on the same package side as the pair(s) being used on that side, in order to maintain minimum skew. Failure to do this will result in small degradations of propagation delay (on the order of 10–20ps) of the output(s) being used which, while not being catastrophic to most designs, will mean a loss of skew margin.

The XC100EP111, as with most other ECL devices, can be operated from a positive V_{CC} supply in PECL mode. This allows the EP111 to be used for high performance clock distribution in +3.3V or +2.5V systems. Designers can take advantage of the EP111's performance to distribute low skew clocks across the backplane or the board. In a PECL environment, series or Thevenin line terminations are typically used as they require no additional power supplies. For more information on using PECL, designers should refer to Motorola Application Note AN1406/D.

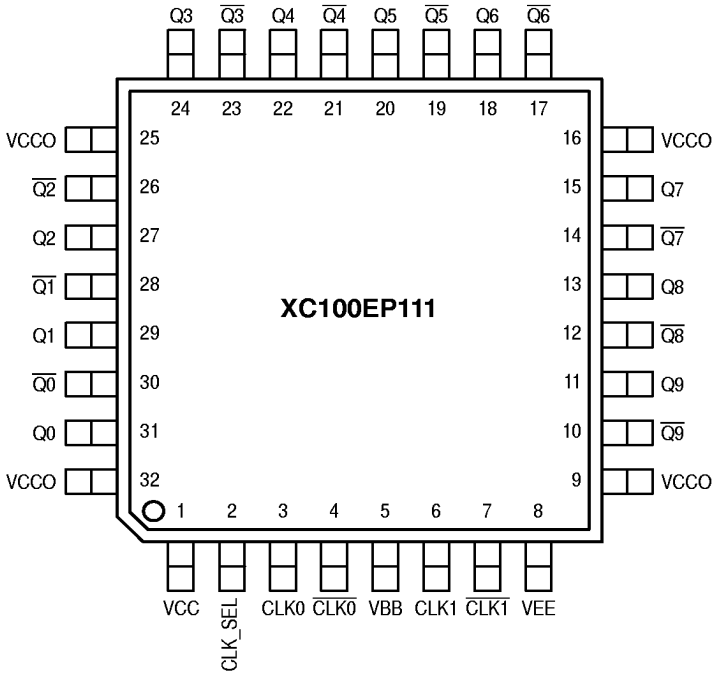


Figure 1. 32–Lead LQFP Pinout
(Top View)

PIN NAMES

Pins	Function
CLK0, $\overline{\text{CLK0}}$	Differential ECL/PECL Input Pair
CLK1, $\overline{\text{CLK1}}$	Differential HSTL Input Pair
Q0:9, $\overline{\text{Q0:9}}$	Differential PECL Outputs
CLK_SEL	Active Clock Select Input
VBB	V_{BB} Output

FUNCTION

CLK_SEL	Active Input
0	CLK0, $\overline{\text{CLK0}}$
1	CLK1, $\overline{\text{CLK1}}$

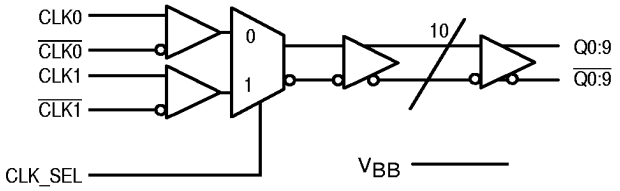


Figure 2. Logic Symbol

ECL DC CHARACTERISTICS

Symbol	Characteristic	–40°C			0°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
V_{OH}	Output HIGH Voltage	–1.03	–0.98	–0.93	–1.00	–0.95	–0.89	–0.99	–0.93	–0.88	–0.96	–0.89	–0.83	V
V_{OL}	Output LOW Voltage	–1.72	–1.60	–1.48	–1.81	–1.67	–1.53	–1.86	–1.70	–1.56	–1.97	–1.77	–1.60	V
V_{IH}	Input HIGH Voltage	–1.165		–0.88	–1.165		–0.88	–1.165		–0.88	–1.165		–0.88	V
V_{IL}	Input LOW Voltage	–1.81		–1.475	–1.81		–1.475	–1.81		–1.475	–1.81		–1.475	V
V_{BB}	Output Reference Voltage	–1.38		–1.26	–1.38		–1.26	–1.38		–1.26	–1.38		–1.26	V
V_{EE}	Power Supply Voltage	–2.375		–3.8	–2.375		–3.8	–2.375		–3.8	–2.375		–3.8	V
I_{IH}	Input High Current			150			150			150			150	μA
I_{EE}	Power Supply Current V_{EE} = –3.3 V V_{EE} = –2.5 V		60 60	70 65		70 65	80 70		70 70	80 75		80 75	90 80	mA
V_{CMR}	Common Mode Range	V_{EE} + 1.7		V_{CC} – 0.3	V_{EE} + 1.7		V_{CC} – 0.3	V_{EE} + 1.7		V_{CC} – 0.3	V_{EE} + 1.7		V_{CC} – 0.3	V
V_{PP}	Minimum Input Swing	500			500			500			500			mV

HSTL DC CHARACTERISTICS

Symbol	Characteristic	–40°C			0°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
V_{CMR}	Common Mode Range	V_{EE} + 0.9		V_{CC} – 1.1	V_{EE} + 0.9		V_{CC} – 1.1	V_{EE} + 0.9		V_{CC} – 1.1	V_{EE} + 0.9		V_{CC} – 1.1	V
V_{PP}	Minimum Input Swing	500			500			500			500			mV

PECL DC CHARACTERISTICS

Symbol	Characteristic	–40°C			0°C			25°C			85°C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
V_{OH}	Output HIGH Voltage(1)	2.27	2.32	2.37	2.30	2.35	2.41	2.31	2.37	2.42	2.34	2.41	2.47	V
V_{OL}	Output LOW Voltage(1)	1.58	1.70	1.82	1.49	1.63	1.77	1.44	1.60	1.74	1.33	1.53	1.70	V
V_{IH}	Input HIGH Voltage(1)	2.135		2.42	2.135		2.42	2.135		2.42	2.135		2.42	V
V_{IL}	Input LOW Voltage(1)	1.49		1.825	1.49		1.825	1.49		1.825	1.49		1.825	V
V_{BB}	Output Reference Voltage(1)	1.92		2.04	1.92		2.04	1.92		2.04	1.92		2.04	V
V_{EE}	Power Supply Voltage	2.375		3.8	2.375		3.8	2.375		3.8	2.375		3.8	V
I_{IH}	Input High Current			150			150			150			150	μA
I_{EE}	Power Supply Current V_{EE} = –3.3 V V_{EE} = –2.5 V		60 60	70 65		70 65	80 70		70 70	80 75		80 75	90 80	mA
V_{CMR}	Common Mode Range	V_{EE} + 1.7		V_{CC} – 0.3	V_{EE} + 1.7		V_{CC} – 0.3	V_{EE} + 1.7		V_{CC} – 0.3	V_{EE} + 1.7		V_{CC} – 0.3	V
V_{PP}	Minimum Input Swing	500			500			500			500			mV

1. These values are for V_{CC} = 3.3 V. Level Specifications will vary 1:1 with V_{CC}.

AC CHARACTERISTICS (V_{EE} = –3.0 V to –3.8 V; V_{CC} = V_{CCO} = GND; Frequency < 500 MHz)

		–40°C			0°C			25°C			85°C				
Symbol	**Characteristic**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**	**Condition**
t_{PLH}	ECL/PECL Prop Delay to Output	310	380	450	350	415	475	375	445	510	480	575	680	ps	Note 1
t_{PHL}	HSTL Prop Delay to Output	340	415	485	380	450	510	410	480	545	520	615	720	ps	Note 1
t_{skew}	With–in Device Skew		15	30		15	30		15	35		35	65	ps	Note 1
	Part–to–Part Skew			145			130			135			200	ps	Note 1
f_{max}	Maximum Input Frequency		500			500			500			500		MHz	
t_r/t_f	Output Rise/Fall Time	200		600	200		600	200		600	200		600	ps	

AC CHARACTERISTICS (V_{EE} = –3.0 V to –3.8 V; V_{CC} = V_{CCO} = GND; Frequency > 500 MHz)

		–40°C			0°C			25°C			85°C				
Symbol	**Characteristic**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**	**Condition**
t_{PLH} t_{PHL}	ECL/PECL Prop Delay to Output	180	390	595	200	430	650	240	460	675	395	585	775	ps	Note 1
t_{skew}	With–in Device Skew		10	35		10	35		15	35		25	65	ps	Note 1
	Part–to–Part Skew			415			450			435			380	ps	Note 1
f_{max}	Maximum Input Frequency		1500			1500			1500			1500		MHz	
t_r/t_f	Output Rise/Fall Time	200		600	200		600	200		600	200		600	ps	

1. The Q9 output pair is excluded from these measurements. For specifications including Q9 please refer to the errata section of the data sheet. MC100EP111 will improve Q9 performance to match that of other outputs.

AC CHARACTERISTICS (V_{EE} = –2.5 V ±5%; V_{CC} = V_{CCO} = GND; Frequency < 500 MHz)

		–40°C			0°C			25°C			85°C				
Symbol	**Characteristic**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**	**Condition**
t_{PLH}	ECL/PECL Prop Delay to Output	315	375	435	335	410	480	370	435	500	465	545	630	ps	Note 1
t_{PHL}	HSTL Prop Delay to Output	355	420	480	375	450	520	410	480	540	515	595	680	ps	Note 1
t_{skew}	With–in Device Skew		15	30		15	30		15	30		25	50	ps	Note 1
	Part–to–Part Skew			125			145			130			165	ps	Note 1
f_{max}	Maximum Input Frequency		500			500			500			500		MHz	
t_r/t_f	Output Rise/Fall Time	200		600	200		600	200		600	200		600	ps	

AC CHARACTERISTICS (V_{EE} = –2.5 V ±5%; V_{CC} = V_{CCO} = GND; Frequency > 500 MHz)

		–40°C			0°C			25°C			85°C				
Symbol	**Characteristic**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**	**Condition**
t_{PLH} t_{PHL}	ECL/PECL Prop Delay to Output	170	390	600	210	430	635	225	450	665	365	560	750	ps	Note 1
t_{skew}	With–in Device Skew		10	35		10	35		10	35		20	45	ps	Note 1
	Part–to–Part Skew			430			425			440			385	ps	Note 1
f_{max}	Maximum Input Frequency		1500			1500			1500			1500		MHz	
t_r/t_f	Output Rise/Fall Time	200		600	200		600	200		600	200		600	ps	

1. The Q9 output pair is excluded from these measurements. For specifications including Q9 please refer to the errata section of the data sheet. MC100EP111 will improve Q9 performance to match that of other outputs.

ERRATA

Enhancements are being made to eliminate the high temperature problems associated with Q9.

AC CHARACTERISTICS (V_{EE} = –3.0 V to –3.8 V; V_{CC} = V_{CCO} = GND; Frequency < 500 MHz)

		–40°C			0°C			25°C			85°C				
Symbol	**Characteristic**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**	**Condition**
t_{PLH}	ECL/PECL Prop Delay to Output	305	380	455	350	415	490	375	445	525	480	580	765	ps	
t_{PHL}	HSTL Prop Delay to Output	340	415	490	380	450	525	410	480	565	520	620	770	ps	
t_{skew}	With–in Device Skew		20	40		20	40		30	50		100	180	ps	
	Part–to–Part Skew			150			145			155			285	ps	
f_{max}	Maximum Input Frequency		500			500			500			500		MHz	
t_r/t_f	Output Rise/Fall Time	200		600	200		600	200		600	200		600	ps	

AC CHARACTERISTICS (V_{EE} = –3.0 V to –3.8 V; V_{CC} = V_{CCO} = GND; Frequency > 500 MHz)

		–40°C			0°C			25°C			85°C				
Symbol	**Characteristic**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**	**Condition**
t_{PLH} t_{PHL}	ECL/PECL Prop Delay to Output	180	395	600	200	430	660	240	465	680	395	590	795	ps	
t_{skew}	With–in Device Skew		15	40		20	40		25	55		65	220	ps	
	Part–to–Part Skew			420			460			440			400	ps	
f_{max}	Maximum Input Frequency		1500			1500			1500			1500		MHz	
t_r/t_f	Output Rise/Fall Time	200		600	200		600	200		600	200		600	ps	

AC CHARACTERISTICS (V_{EE} = –2.5 V ±5%; V_{CC} = V_{CCO} = GND; Frequency < 500 MHz)

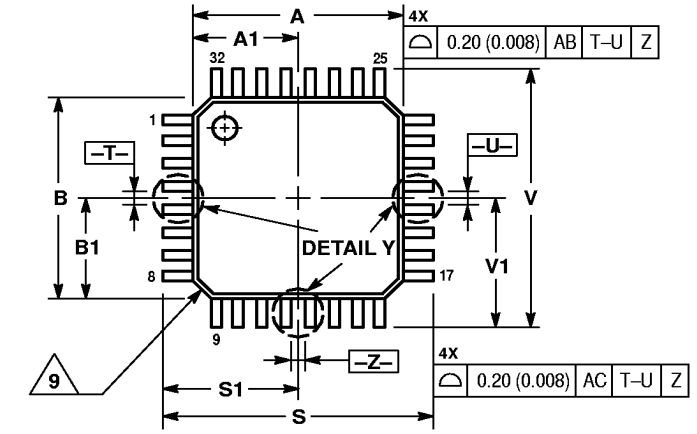
		–40°C			0°C			25°C			85°C				
Symbol	**Characteristic**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**	**Condition**
t_{PLH}	ECL/PECL Prop Delay to Output	315	375	440	335	410	495	370	435	515	465	550	675	ps	
t_{PHL}	HSTL Prop Delay to Output	355	420	485	380	451	525	410	480	560	515	600	730	ps	
t_{skew}	With–in Device Skew		20	35		20	40		25	45		60	100	ps	
	Part–to–Part Skew			125			160			145			215	ps	
f_{max}	Maximum Input Frequency		500			500			500			500		MHz	
t_r/t_f	Output Rise/Fall Time	200		600	200		600	200		600	200		600	ps	

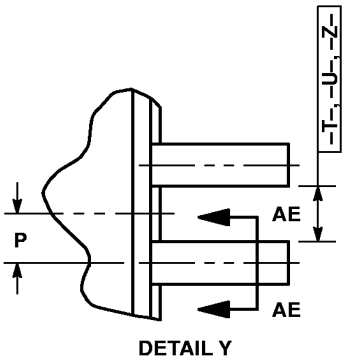
AC CHARACTERISTICS (V_{EE} = –2.5 V ±5%; V_{CC} = V_{CCO} = GND; Frequency > 500 MHz)

		–40°C			0°C			25°C			85°C				
Symbol	**Characteristic**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**	**Condition**
t_{PLH} t_{PHL}	ECL/PECL Prop Delay to Output	170	390	600	210	430	640	225	450	675	365	565	750	ps	
t_{skew}	With–in Device Skew		15	40		20	45		20	50		50	120	ps	
	Part–to–Part Skew			430			430			450			385	ps	
f_{max}	Maximum Input Frequency		1500			1500			1500			1500		MHz	
t_r/t_f	Output Rise/Fall Time	200		600	200		600	200		600	200		600	ps	

OUTLINE DIMENSIONS

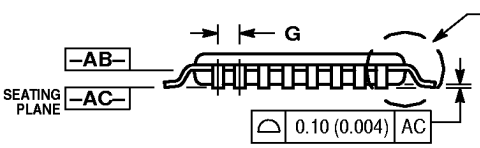
FA SUFFIX
PLASTIC LQFP PACKAGE
CASE 873A–02
ISSUE A

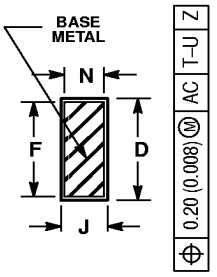




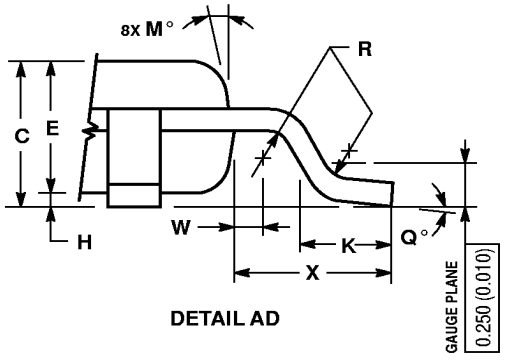
DETAIL Y

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DATUM PLANE –AB– IS LOCATED AT BOTTOM OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE BOTTOM OF THE PARTING LINE.
4. DATUMS –T–, –U–, AND –Z– TO BE DETERMINED AT DATUM PLANE –AB–.
5. DIMENSIONS S AND V TO BE DETERMINED AT SEATING PLANE –AC–.
6. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.250 (0.010) PER SIDE. DIMENSIONS A AND B DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE –AB–.
7. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. DAMBAR PROTRUSION SHALL NOT CAUSE THE D DIMENSION TO EXCEED 0.520 (0.020).
8. MINIMUM SOLDER PLATE THICKNESS SHALL BE 0.0076 (0.0003).
9. EXACT SHAPE OF EACH CORNER MAY VARY FROM DEPICTION.





SECTION AE–AE



DETAIL AD

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	7.000 BSC		0.276 BSC	
A1	3.500 BSC		0.138 BSC	
B	7.000 BSC		0.276 BSC	
B1	3.500 BSC		0.138 BSC	
C	1.400	1.600	0.055	0.063
D	0.300	0.450	0.012	0.018
E	1.350	1.450	0.053	0.057
F	0.300	0.400	0.012	0.016
G	0.800 BSC		0.031 BSC	
H	0.050	0.150	0.002	0.006
J	0.090	0.200	0.004	0.008
K	0.500	0.700	0.020	0.028
M	12° REF		12° REF	
N	0.090	0.160	0.004	0.006
P	0.400 BSC		0.016 BSC	
Q	1°	5°	1°	5°
R	0.150	0.250	0.006	0.010
S	9.000 BSC		0.354 BSC	
S1	4.500 BSC		0.177 BSC	
V	9.000 BSC		0.354 BSC	
V1	4.500 BSC		0.177 BSC	
W	0.200 REF		0.008 REF	
X	1.000 REF		0.039 REF	

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