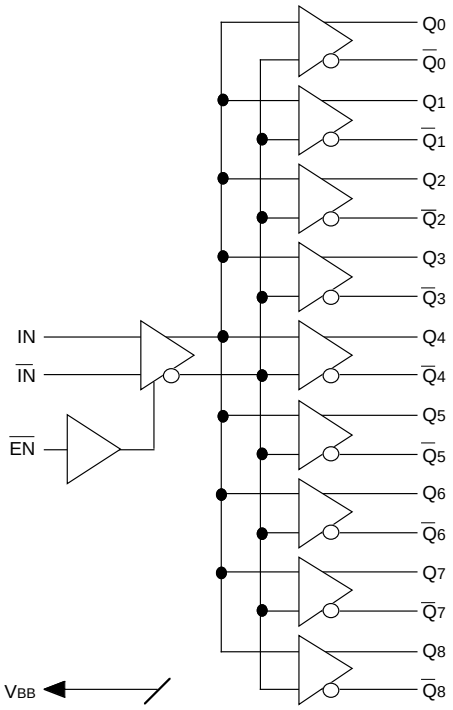
5V/3.3V 1:9 DIFFERENTIAL CLOCK DRIVER (w/ENABLE)

FEATURES

- 5V and 3.3V power supply options
- 200ps part-to-part skew
- 50ps output-to-output skew
- Differential design
- V_{BB} output
- Enable Input
- Voltage and temperature compensated outputs
- 75KΩ input pulldown resistors
- Fully compatible with Motorola MC10/100E111
- Available in 28-pin PLCC package

BLOCK DIAGRAM



DESCRIPTION

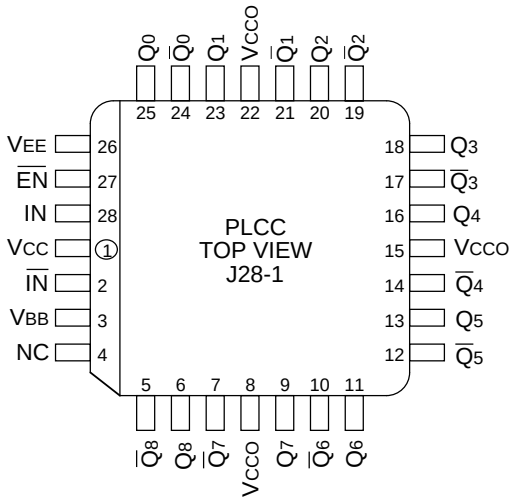
The SY10/100E111AE/LE are low skew 1-to-9 differential drivers designed for clock distribution in mind. The SY10/100E111AE/LE's function and performance are similar to the popular SY10/100E111, with the improvement of lower jitter and the added feature of low voltage operation. It accepts one signal input, which can be either differential or single-ended if the V_{BB} output is used. The signal is fanned out to 9 identical differential outputs. An enable input is also provided such that a logic HIGH disables the device by forcing all Q outputs LOW and all $\overline{Q}$ outputs HIGH.

The E111AE/LE 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 nine differential pairs will be used and therefore terminated. In the case where fewer that nine 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 E111AE/LE, as with most other ECL devices, can be operated from a positive V_{CC} supply in PECL mode. This allows the E111AE/LE to be used for high performance clock distribution in +5V/+3.3V systems. Designers can take advantage of the E111AE/LE'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 systems incorporating GTL, parallel termination offers the lowest power by taking advantage of the 1.2V supply as terminating voltage.

PIN CONFIGURATION



PIN NAMES

Pin	Function
IN, $\overline{IN}$	Differential Input Pair
$\overline{EN}$	Enable Input
Q_0, $\overline{Q}_0$ — Q_8, $\overline{Q}_8$	Differential Outputs
V_{BB}	V_{BB} Output
V_{CCO}	V_{CC} to Output

ECL DC ELECTRICAL CHARACTERISTICS

V_{EE} = V_{EE} (Min.) to V_{EE} (Max.); V_{CC} = GND

Symbol	Parameter	T_A = –40°C			T_A = 0°C			T_A = +25°C			T_A = +85°C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{OH}	Output HIGH Voltage													mV
	10EL	–1080	—	–890	–1020	—	–840	–980	—	–810	–910	—	–720	
	100EL	–1085	—	–880	–1025	—	–880	–1025	—	–880	–1025	—	–880	
V_{OL}	Output LOW Voltage													mV
	10EL	–1950	—	–1650	–1950	—	–1630	–1950	—	–1630	–1950	—	–1595	
	100EL	–1830	—	–1550	–1810	—	–1620	–1810	—	–1620	–1810	—	–1620	
V_{IH}	Input HIGH Voltage													mV
	10EL	–1230	—	–890	–1170	—	–840	–1130	—	–810	–1060	—	–720	
	100EL	–1165	—	–880	–1165	—	–880	–1165	—	–880	–1165	—	–880	
V_{IL}	Input LOW Voltage													mV
	10EL	–1950	—	–1500	–1950	—	–1480	–1950	—	–1480	–1950	—	–1445	
	100EL	–1810	—	–1475	–1810	—	–1475	–1810	—	–1475	–1810	—	–1475	
V_{BB}	Output Reference													V
	Voltage 10EL	–1.43	—	–1.30	–1.38	—	–1.27	–1.35	—	–1.25	–1.31	—	–1.19	
	100EL	–1.38	—	–1.26	–1.38	—	–1.26	–1.38	—	–1.26	–1.38	—	–1.26	
I_{IH}	Input HIGH Current	—	—	150	—	—	150	—	—	150	—	—	150	µA
I_{IL}	Input LOW Current													µA
	10EL	0.5	—	—	0.5	—	—	0.5	—	—	0.3	—	—	
	100EL	0.5	—	—	0.5	—	—	0.5	—	—	0.5	—	—	
I_{EE}	Power Supply Current													mA
	10EL	—	—	66	—	—	66	—	—	66	—	—	66	
	100EL	—	—	66	—	—	66	—	—	66	—	—	78	

NOTE:

1. Parametric values specified at: 5 volt Power Supply Range 100E111AE Series: -4.2V to -5.5V.
   10E111AE Series -4.75V to -5.5V.
   3 volt Power Supply Range 10/100E111LE Series: -3.0V to -3.8V.

3.3V PECL DC ELECTRICAL CHARACTERISTICS[1]

V_{CC} = +3.0V to +3.8V, V_{EE} = GND

		T_A = –40°C			T_A = 0°C			T_A = +25°C			T_A = +85°C			
Symbol	**Parameter**	**Min.**	**Typ.**	**Max.**	**Min.**	**Typ.**	**Max.**	**Min.**	**Typ.**	**Max.**	**Min.**	**Typ.**	**Max.**	**Unit**
V_{OH}	Output HIGH Voltage[2]													mV
	10EL	2220	—	2110	2280	—	2460	2320	—	2490	2390	—	2580	
	100EL	2215	—	2120	2275	—	2420	2275	—	2420	2275	—	2420	
V_{OL}	Output LOW Voltage[2]													mV
	10EL	1350	—	1650	1350	—	1670	1350	—	1670	1350	—	1705	
	100EL	1470	—	1750	1490	—	1680	1490	—	1680	1490	—	1680	
V_{IH}	Input HIGH Voltage[2]													mV
	10EL	2070	—	2410	2130	—	2460	2170	—	2490	2240	—	2580	
	100EL	2135	—	2420	2135	—	2420	2135	—	2420	2135	—	2420	
V_{IL}	Input LOW Voltage[2]													mV
	10EL	1350	—	1800	1350	—	1820	1350	—	1820	1350	—	1855	
	100EL	1490	—	1825	1490	—	1825	1490	—	1825	1490	—	1825	
V_{BB}	Output Reference Voltage[2]													V
	10EL	1.87	—	2.00	1.92	—	2.03	1.95	—	2.05	1.99	—	2.11	
	100EL	1.92	—	2.04	1.92	—	2.04	1.92	—	2.04	1.92	—	2.04	
I_{IH}	Input HIGH Current	—	—	150	—	—	150	—	—	150	—	—	150	µA
I_{IL}	Input LOW Current													µA
	10EL	0.5	—	—	0.5	—	—	0.5	—	—	0.3	—	—	
	100EL	0.5	—	—	0.5	—	—	0.5	—	—	0.5	—	—	
I_{EE}	Power Supply Current													mA
	10EL	—	—	66	—	—	66	—	—	66	—	—	66	
	100EL	—	—	66	—	—	66	—	—	66	—	—	78	

NOTES:

1. Parametric values specified at: 3 volt Power Supply Range 10/100E111LE Series: +3.0V to +3.8V.
2. These values are for V_{CC} = 3.3V. Level specifications will vary 1:1 with V_{CC}.

5V PECL DC ELECTRICAL CHARACTERISTICS[1]

V_{CC} = V_{CC} (Min.) to V_{CC} (Max.); V_{EE} = GND

		T_A = –40°C			T_A = 0°C			T_A = +25°C			T_A = +85°C			
Symbol	**Parameter**	**Min.**	**Typ.**	**Max.**	**Min.**	**Typ.**	**Max.**	**Min.**	**Typ.**	**Max.**	**Min.**	**Typ.**	**Max.**	**Unit**
V_{OH}	Output HIGH Voltage[2]													mV
	10EL	3920	—	4110	3980	—	4160	4020	—	4190	4090	—	4280	
	100EL	3915	—	4120	3975	—	4120	3975	—	4120	3975	—	4120	
V_{OL}	Output LOW Voltage[2]													mV
	10EL	3050	—	3350	3050	—	3370	3050	—	3370	3050	—	3405	
	100EL	3170	—	3450	3190	—	3380	3190	—	3380	3190	—	3380	
V_{IH}	Input HIGH Voltage[2]													mV
	10EL	3770	—	4110	3830	—	4160	3870	—	4190	3940	—	4280	
	100EL	3835	—	4120	3835	—	4120	3835	—	4120	3835	—	4120	
V_{IL}	Input LOW Voltage[2]													mV
	10EL	3050	—	3500	3050	—	3520	3050	—	3520	3050	—	3555	
	100EL	3190	—	3525	3190	—	3525	3190	—	3525	3190	—	3525	
V_{BB}	Output Reference Voltage[2]													V
	10EL	3.57	—	3.70	3.62	—	3.73	3.65	—	3.75	3.69	—	3.81	
	100EL	3.62	—	3.74	3.62	—	3.74	3.62	—	3.74	3.62	—	3.74	
I_{IH}	Input HIGH Current	—	—	150	—	—	150	—	—	150	—	—	150	µA
I_{IL}	Input LOW Current													µA
	10EL	0.5	—	—	0.5	—	—	0.5	—	—	0.3	—	—	
	100EL	0.5	—	—	0.5	—	—	0.5	—	—	0.5	—	—	
I_{EE}	Power Supply Current													mA
	10EL	—	—	66	—	—	66	—	—	66	—	—	66	
	100EL	—	—	66	—	—	66	—	—	66	—	—	78	

NOTES:

1. Parametric values specified at: 5 volt Power Supply Range 100E111AE Series: +4.2V to +5.5V.
   10E111AE Series +4.75V to +5.5V.
2. These values are for V_{CC} = 5V. Level specifications will vary 1:1 with V_{CC}.

AC ELECTRICAL CHARACTERISTICS[1]

V_{EE} = V_{EE} (Min.) to V_{EE} (Max.); V_{CC} = GND

Symbol	Parameter	T_A = –40°C			T_A = 0°C			T_A = +25°C			T_A = +85°C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
t_{PLH} t_{PHL}	Propagation Delay to Output IN (differential)[2] IN (single-ended)[3] Enable[4] Disable[4]	 380 280 400 400	 — — — —	 680 780 900 900	 430 330 450 450	 — — — —	 630 730 850 850	 430 330 450 450	 — — — —	 630 730 850 850	 430 330 450 450	 — — — —	 630 730 850 850	ps
t_{skew}	Within-Device Skew[5] Part-to-Part Skew (Diff.)	— —	— —	75 250	— —	— —	50 200	— —	— —	50 200	— —	— —	50 200	ps
t_S	Set-up Time, $\overline{EN}$ to IN[6]	250	—	0	200	0	—	200	0	—	200	0	—	ps
t_H	Hold Time, IN to $\overline{EN}$[7]	0	—	–200	0	–200	—	0	–200	—	0	–200	—	ps
t_R	Release Time, $\overline{EN}$ to IN[8]	350	—	100	300	100	—	300	100	—	300	100	—	ps
V_{PP}	Minimum Input Swing[9]	250	—	—	250	—	—	250	—	—	250	—	—	mV
V_{CMR}	Common Mode Range[10]	–1.5	—	–0.4	–1.5	—	–0.4	–1.5	—	–0.4	–1.5	—	–0.4	V
t_r t_f	Rise/Fall Times 20% to 80%	200	—	650	200	—	600	200	—	600	200	—	600	ps

NOTES:

1. Parametric values specified at: 5 volt Power Supply Range 100E111AE Series: -4.2V to -5.5V.
   10E111AE Series -4.75V to -5.5V.
   3 volt Power Supply Range 10/100E111LE Series: -3.0V to -3.8V.
2. The differential propagation delay is defined as the delay from the crossing points of the differential input signals to the crossing point of the differential output signals.
3. The single-ended propagation delay is defined as the delay from the 50% point of the input signal to the 50% point of the output signal.
4. Enable is defined as the propagation delay from the 50% point of a negative transition on $\overline{EN}$ to the 50% point of a positive transition on Q (or a negative transition on $\overline{Q}$). Disable is defined as the propagation delay from the 50% point of a positive transition on $\overline{EN}$ to the 50% point of a negative transition on Q (or a positive transition on $\overline{Q}$).
5. The within-device skew is defined as the worst case difference between any two similar delay paths within a single device.
6. The set-up time is the minimum time that $\overline{EN}$ must be asserted prior to the next transition of IN/$\overline{IN}$ to prevent an output response greater than ±75mV to that IN/$\overline{IN}$ transition (see Figure 1).
7. The hold time is the minimum time that $\overline{EN}$ must remain asserted after a negative going IN or a positive going $\overline{IN}$ to prevent an output response greater than ±75mV to that IN/$\overline{IN}$ transition (see Figure 2).
8. The release time is the minimum time that $\overline{EN}$ must be de-asserted prior to the next IN/$\overline{IN}$ transition to ensure an output response that meets the specified IN to Q propagation delay and output transition times (see Figure 3).
9. V_{PP} (min) is defined as the minimum input differential voltage which will cause no increase in the propagation delay. The V_{PP} (min) is AC limited for the E111AE/LE, as a differential input as low as 50mV will still produce full ECL levels at the output.
10. V_{CMR} is defined as the range within the V_{IH} level may vary, with the device still meeting the propagation delay specification. the V_{IL} level must be such that the peak-to-peak voltage is less than 1.0V and greater than or equal to V_{PP} (min).
    For PECL operation: V_{CMR} (max) = V_{CC} – |V_{CMR} (max)| and
    V_{CMR} (min) = V_{CC} – |V_{CMR} (min)|

TIMING DIAGRAMS

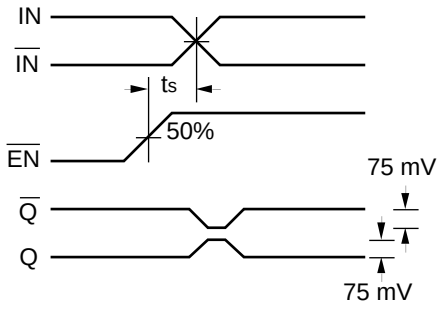


Figure 1. Set-up Time

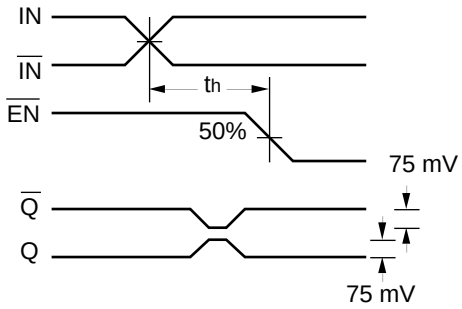


Figure 2. Hold Time

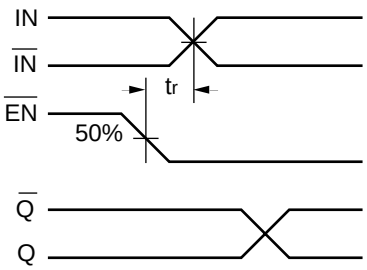


Figure 3. Release Time

PRODUCT ORDERING CODE

5V

Ordering Code	Package Type	Operating Range	VEE Range (V)
SY10E111AEJC	J28-1	Commercial	-4.75 to -5.5
SY10E111AEJCTR	J28-1	Commercial	-4.75 to -5.5
SY100E111AEJC	J28-1	Commercial	-4.2 to -5.5
SY100E111AEJCTR	J28-1	Commercial	-4.2 to -5.5

5V

Ordering Code	Package Type	Operating Range	VEE Range (V)
SY10E111AEJI	J28-1	Industrial	-4.75 to -5.5
SY10E111AEJITR	J28-1	Industrial	-4.75 to -5.5
SY100E111AEJI	J28-1	Industrial	-4.2 to -5.5
SY100E111AEJITR	J28-1	Industrial	-4.2 to -5.5

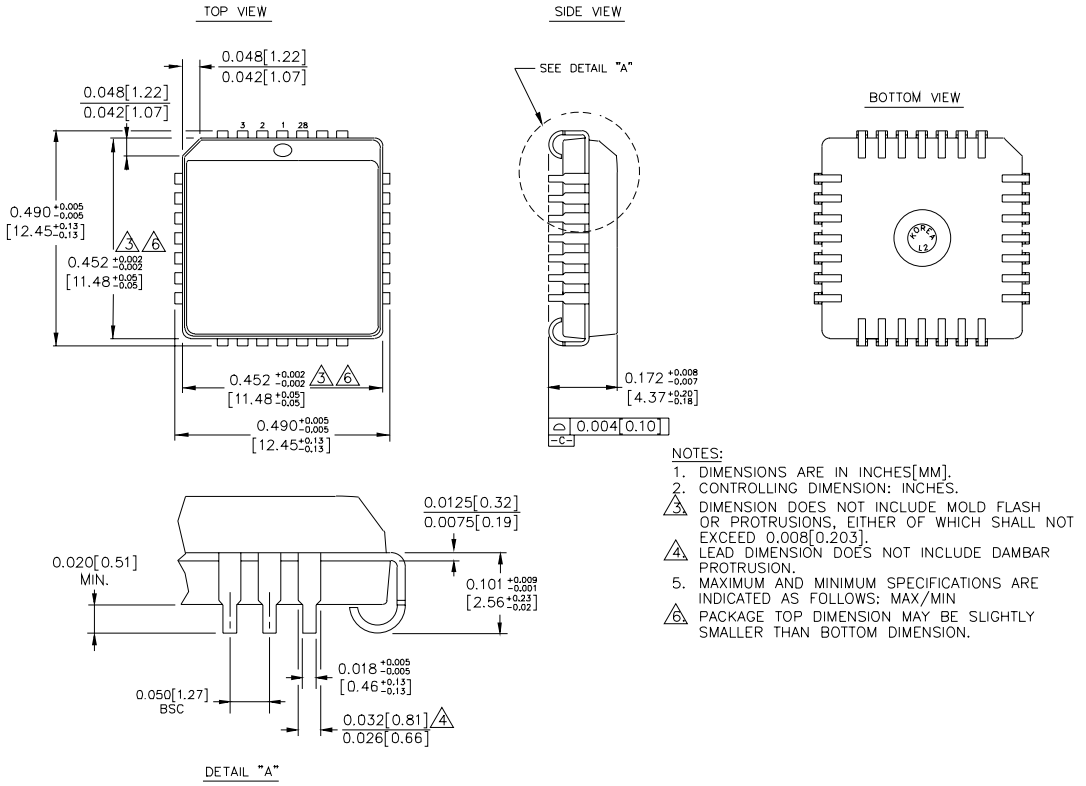
3.3V

SY10E111LEJC	J28-1	Commercial	-3.0 to -3.8
SY10E111LEJCTR	J28-1	Commercial	-3.0 to -3.8
SY100E111LEJC	J28-1	Commercial	-3.0 to -3.8
SY100E111LEJCTR	J28-1	Commercial	-3.0 to -3.8

3.3V

SY10E111LEJI	J28-1	Industrial	-3.0 to -3.8
SY10E111LEJITR	J28-1	Industrial	-3.0 to -3.8
SY100E111LEJI	J28-1	Industrial	-3.0 to -3.8
SY100E111LEJITR	J28-1	Industrial	-3.0 to -3.8

28 LEAD PLCC (J28-1)



NOTES:
1. DIMENSIONS ARE IN INCHES[MM].
2. CONTROLLING DIMENSION: INCHES.
3. DIMENSION DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS, EITHER OF WHICH SHALL NOT EXCEED 0.008[0.203].
4. LEAD DIMENSION DOES NOT INCLUDE DAMBAR PROTRUSION.
5. MAXIMUM AND MINIMUM SPECIFICATIONS ARE INDICATED AS FOLLOWS: MAX/MIN
6. PACKAGE TOP DIMENSION MAY BE SLIGHTLY SMALLER THAN BOTTOM DIMENSION.

Rev. 03

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