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

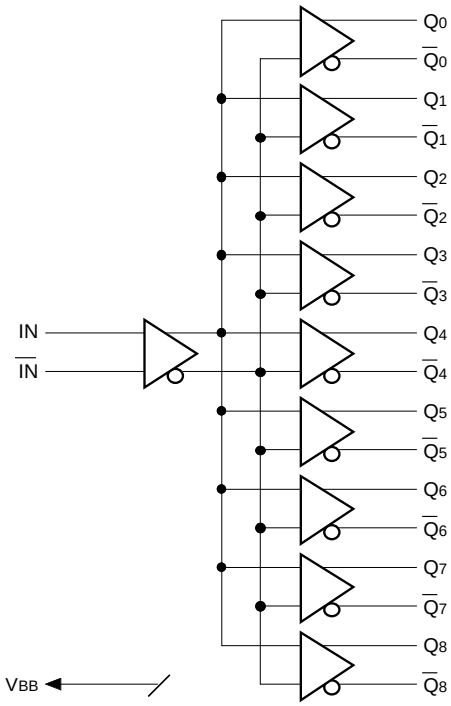
**Precision Edge® SY10E111A/L SY100E111A/L**

## FEATURES

- 5V and 3.3V power supply options
- 200ps part-to-part skew
- 50ps output-to-output skew
- Differential design
- $V_{BB}$ output
- Voltage and temperature compensated outputs
- 75KΩ input pulldown resistors
- Fully compatible with Motorola MC100LVE111
- Available in 28-pin PLCC package

Precision Edge®

## BLOCK DIAGRAM




## PIN NAMES

| Pin | Function |
|---|---|
| IN, $\overline{IN}$ | Differential Input Pair |
| $Q_0$, $\overline{Q_0}$ — $Q_8$, $\overline{Q_8}$ | Differential Outputs |
| $V_{BB}$ | $V_{BB}$ Output |
| $V_{CCO}$ | $V_{CC}$ to Output |

## DESCRIPTION

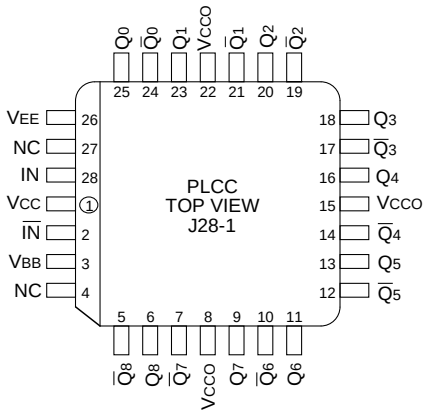
The SY10/100E111A/L are low skew 1-to-9 differential driver designed for clock distribution in mind. The SY10/100E111A/L's function and performance are similar to the popular SY10/100E111, with the improvement of lower jitter and the added feature of low voltage operation. It accepts one signal input, 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.

The E111A/L are 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 E111A/L, as with most other ECL devices, can be operated from a positive $V_{CC}$ supply in PECL mode. This allows the E111A/L to be used for high performance clock distribution in +5V/+3.3V systems. Designers can take advantage of the E111A/L'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.

## PACKAGE/ORDERING INFORMATION




**28-Pin PLCC (J28-1)**

## Ordering Information(1)

| Part Number | Package Type | Operating Range | Package Marking | Lead Finish |
|---|---|---|---|---|
| SY10E111LJI | J28-1 | Industrial | SY10E111LJI | Sn-Pb |
| SY10E111LJITR(2) | J28-1 | Industrial | SY10E111LJI | Sn-Pb |
| SY100E111LJI | J28-1 | Industrial | SY100E111LJI | Sn-Pb |
| SY100E111LJITR(2) | J28-1 | Industrial | SY100E111LJI | Sn-Pb |
| SY10E111LJC | J28-1 | Commercial | SY10E111LJC | Sn-Pb |
| SY10E111LJCTR(2) | J28-1 | Commercial | SY10E111LJC | Sn-Pb |
| SY100E111LJC | J28-1 | Commercial | SY100E111LJC | Sn-Pb |
| SY100E111LJCTR(2) | J28-1 | Commercial | SY100E111LJC | Sn-Pb |
| SY10E111AJI | J28-1 | Industrial | SY10E111AJI | Sn-Pb |
| SY10E111AJITR(2) | J28-1 | Industrial | SY10E111AJI | Sn-Pb |
| SY100E111AJI | J28-1 | Industrial | SY100E111AJI | Sn-Pb |
| SY100E111AJITR(2) | J28-1 | Industrial | SY100E111AJI | Sn-Pb |
| SY10E111AJC | J28-1 | Commercial | SY10E111AJC | Sn-Pb |
| SY10E111AJCTR(2) | J28-1 | Commercial | SY10E111AJC | Sn-Pb |
| SY100E111AJC | J28-1 | Commercial | SY100E111AJC | Sn-Pb |
| SY100E111AJCTR(2) | J28-1 | Commercial | SY100E111AJC | Sn-Pb |
| SY10E111LJY(3) | J28-1 | Industrial | SY10E111LJY with Pb-Free bar-line indicator | Matte-Sn |
| SY10E111LJYTR(2, 3) | J28-1 | Industrial | SY10E111LJY with Pb-Free bar-line indicator | Matte-Sn |
| SY100E111LJY(3) | J28-1 | Industrial | SY100E111LJY with Pb-Free bar-line indicator | Matte-Sn |
| SY100E111LJYTR(2, 3) | J28-1 | Industrial | SY100E111LJY with Pb-Free bar-line indicator | Matte-Sn |
| SY10E111AJY(3) | J28-1 | Industiral | SY10E111AJY with Pb-Free bar-line indicator | Matte-Sn |
| SY10E111AJYTR(2, 3) | J28-1 | Industrial | SY10E111AJY with Pb-Free bar-line indicator | Matte-Sn |
| SY100E111AJY(3) | J28-1 | Industrial | SY100E111AJY with Pb-Free bar-line indicator | Matte-Sn |
| SY100E111AJYTR(2, 3) | J28-1 | Industrial | SY100E111AJY with Pb-Free bar-line indicator | Matte-Sn |

**Notes:**

1. Contact factory for die availability. Dice are guaranteed at $T_A$ = 25°C, DC Electricals only.
2. Tape and Reel.
3. Pb-Free package is recommended for new designs.

## PRODUCT/PROCESS INFORMATION

| | |
|---|---|
| **Process:** | Bipolar |
| **ESD Rating:** | Per Mil Std. 883 Human Body Model, >1.5kV (all pins). |

## ABSOLUTE MAXIMUM RATINGS(1)

| Symbol | Rating | Value | Unit |
|---|---|---|---|
| $V_{CC}$ | Power Supply Voltage ($V_{EE}$ = 0) | +6.0 to 0 | V |
| $V_{EE}$ | Power Supply Voltage ($V_{CC}$ = 0) | –6.0 to 0 | V |
| $V_{IN}$ | Input Voltage ($V_{CC}$ = 0V, $V_{IN}$ not more negative than $V_{EE}$)<br>Input Voltage ($V_{EE}$ = 0V, $V_{IN}$ not more positive than $V_{CC}$) | –6.0 to 0<br>+6.0 to 0 | V<br>V |
| $I_{OUT}$ | Output Current –Continuous<br>–Surge | 50<br>100 | mA |
| $T_{LEAD}$ | Lead Storage Temperature Range (soldering, 20sec.) | +260 | °C |
| $T_A$ | Operating Temperature Range | –40 to +85 | °C |
| $T_{store}$ | Storage Temperature Range | –65 to +150 | °C |
| $\theta_{JA}$ | Thermal Resistance (Junction-to-Ambient) –Still Air | 79 | °C/W |
| $\theta_{JC}$ | Thermal Resistance (Junction-to-Case) | 24 | °C/W |
| ESD | Mil Std. 883 Human Body Model, All Pins | >1.5k | V |

**Note 1.** Permanent device damage may occur if absolute maximum ratings are exceeded. This is a stress rating only and functional operation is not implied at conditions other than those detailed in the operational sections of this data sheet. Exposure to absolute maximum ratlng conditions for extended periods may affect device reliability.

## ECL DC ELECTRICAL CHARACTERISTICS(1)

$V_{EE}$ = $V_{EE}$ (Min.) to $V_{EE}$ (Max.); $V_{CC}$ = 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 | | | | | | | | | | | | | 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 Voltage 10EL | –1.43 | — | –1.30 | –1.38 | — | –1.27 | –1.35 | — | –1.25 | –1.31 | — | –1.19 | V |
| | 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 | 35 | — | 65 | 35 | — | 65 | 35 | — | 65 | 35 | — | 65 | |
| | 100EL | 35 | — | 65 | 35 | — | 65 | 35 | — | 65 | 35 | — | 75 | |

**Note 1.** Parametric values specified at:

| | | |
|---|---|---|
| 5 volt Power Supply Range | 100E111A Series: | -4.2V to -5.5V. |
| | 10E111A Series | -4.75V to -5.5V. |
| 3 volt Power Supply Range | 10/100E111L Series: | -3.0V to -3.8V. |

## 3.3V PECL DC ELECTRICAL CHARACTERISTICS[1]

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

| | | TA = –40°C | | | TA = 0°C | | | TA = +25°C | | | TA = +85°C | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Symbol** | **Parameter** | **Min.** | **Typ.** | **Max.** | **Min.** | **Typ.** | **Max.** | **Min.** | **Typ.** | **Max.** | **Min.** | **Typ.** | **Max.** | **Unit** |
| $V_{OH}$ | Output HIGH Voltage | | | | | | | | | | | | | mV |
| | **Note 2** 10EL | 2220 | — | 2110 | 2280 | — | 2460 | 2320 | — | 2490 | 2390 | — | 2580 | |
| | 100EL | 2215 | — | 2120 | 2275 | — | 2420 | 2275 | — | 2420 | 2275 | — | 2420 | |
| $V_{OL}$ | Output LOW Voltage | | | | | | | | | | | | | mV |
| | **Note 2** 10EL | 1350 | — | 1650 | 1350 | — | 1670 | 1350 | — | 1670 | 1350 | — | 1705 | |
| | 100EL | 1470 | — | 1750 | 1490 | — | 1680 | 1490 | — | 1680 | 1490 | — | 1680 | |
| $V_{IH}$ | Input HIGH Voltage | | | | | | | | | | | | | mV |
| | **Note 2** 10EL | 2070 | — | 2410 | 2130 | — | 2460 | 2170 | — | 2490 | 2240 | — | 2580 | |
| | 100EL | 2135 | — | 2420 | 2135 | — | 2420 | 2135 | — | 2420 | 2135 | — | 2420 | |
| $V_{IL}$ | Input LOW Voltage | | | | | | | | | | | | | mV |
| | **Note 2** 10EL | 1350 | — | 1800 | 1350 | — | 1820 | 1350 | — | 1820 | 1350 | — | 1855 | |
| | 100EL | 1490 | — | 1825 | 1490 | — | 1825 | 1490 | — | 1825 | 1490 | — | 1825 | |
| $V_{BB}$ | Output Reference | | | | | | | | | | | | | V |
| | Voltage, **Note 2** 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 | |

**Note 1.** Parametric values specified at: 3 volt Power Supply Range 10/100E111L Series: +3.0V to +3.8V.

**Note 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

| | | TA = –40°C | | | TA = 0°C | | | TA = +25°C | | | TA = +85°C | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Symbol** | **Parameter** | **Min.** | **Typ.** | **Max.** | **Min.** | **Typ.** | **Max.** | **Min.** | **Typ.** | **Max.** | **Min.** | **Typ.** | **Max.** | **Unit** |
| $V_{OH}$ | Output HIGH Voltage | | | | | | | | | | | | | mV |
| | **Note 2** 10EL | 3920 | — | 4110 | 3980 | — | 4160 | 4020 | — | 4190 | 4090 | — | 4280 | |
| | 100EL | 3915 | — | 4120 | 3975 | — | 4120 | 3975 | — | 4120 | 3975 | — | 4120 | |
| $V_{OL}$ | Output LOW Voltage | | | | | | | | | | | | | mV |
| | **Note 2** 10EL | 3050 | — | 3350 | 3050 | — | 3370 | 3050 | — | 3370 | 3050 | — | 3405 | |
| | 100EL | 3170 | — | 3450 | 3190 | — | 3380 | 3190 | — | 3380 | 3190 | — | 3380 | |
| $V_{IH}$ | Input HIGH Voltage | | | | | | | | | | | | | mV |
| | **Note 2** 10EL | 3770 | — | 4110 | 3830 | — | 4160 | 3870 | — | 4190 | 3940 | — | 4280 | |
| | 100EL | 3835 | — | 4120 | 3835 | — | 4120 | 3835 | — | 4120 | 3835 | — | 4120 | |
| $V_{IL}$ | Input LOW Voltage | | | | | | | | | | | | | mV |
| | **Note 2** 10EL | 3050 | — | 3500 | 3050 | — | 3520 | 3050 | — | 3520 | 3050 | — | 3555 | |
| | 100EL | 3190 | — | 3525 | 3190 | — | 3525 | 3190 | — | 3525 | 3190 | — | 3525 | |
| $V_{BB}$ | Output Reference | | | | | | | | | | | | | V |
| | Voltage, **Note 2** 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 | |

**Note 1.** Parametric values specified at: 5 volt Power Supply Range 100E111A Series: +4.2V to +5.5V.
10E111A Series +4.75V to +5.5V.

**Note 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. | |
| $t_{PD}$ | Propagation Delay to Output | | | | | | | | | | | | | ps |
| | IN (differential), **Note 2** | 380 | — | 680 | 430 | — | 630 | 430 | — | 630 | 430 | — | 630 | |
| | IN (single-ended), **Note 3** | 280 | — | 780 | 330 | — | 730 | 330 | — | 730 | 330 | — | 730 | |
| $t_{skew}$ | Within-Device Skew, **Note 4** | — | — | 75 | — | — | 50 | — | — | 50 | — | — | 50 | ps |
| | Part-to-Part Skew (Diff.) | — | — | 250 | — | — | 200 | — | — | 200 | — | — | 200 | |
| $V_{PP}$ | Minimum Input Swing, **Note 5** | 250 | — | — | 250 | — | — | 250 | — | — | 250 | — | — | mV |
| $V_{CMR}$ | Common Mode Range, **Note 6** | –1.5 | — | –0.4 | –1.5 | — | –0.4 | –1.5 | — | –0.4 | –1.5 | — | –0.4 | V |
| $t_r$ | Rise/Fall Times | 200 | — | 650 | 200 | — | 600 | 200 | — | 600 | 200 | — | 600 | ps |
| $t_f$ | 20% to 80% | | | | | | | | | | | | | |

**Note 1.** Parametric values specified at: 5 volt Power Supply Range 100E111A Series: -4.2V to -5.5V.
10E111A Series -4.75V to -5.5V.
3 volt Power Supply Range 10/100E111L Series: -3.0V to -3.8V.

**Note 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.

**Note 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.

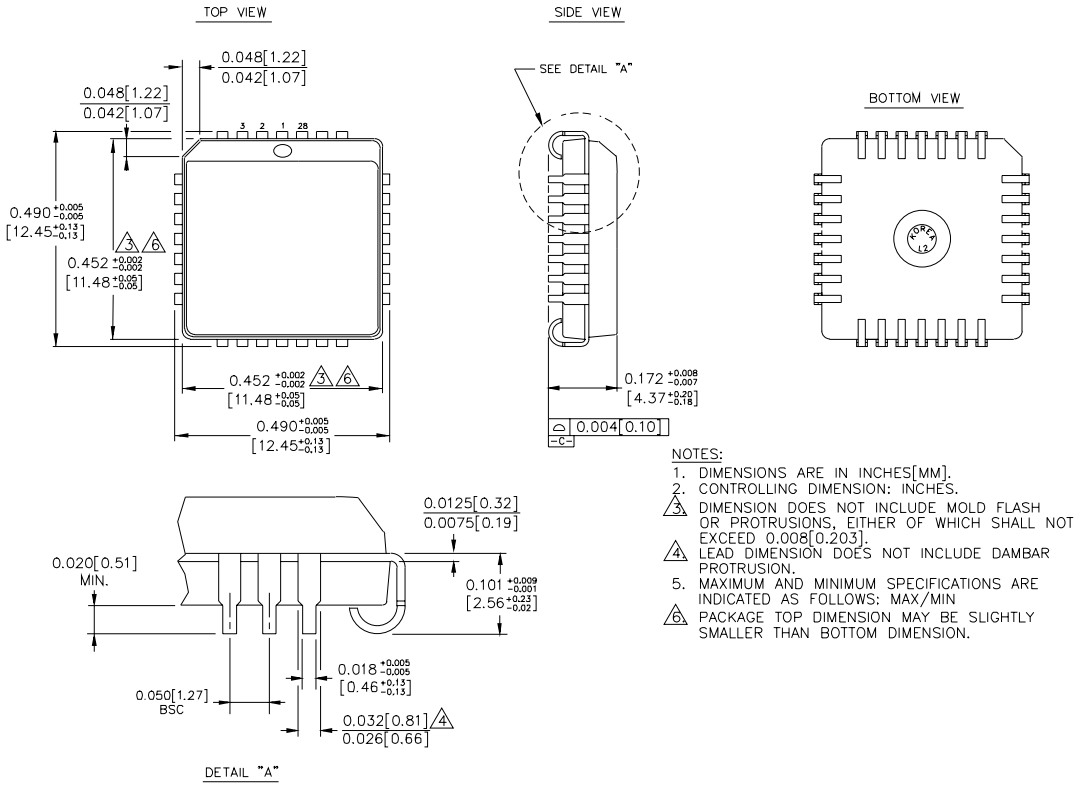
**Note 4.** The within-device skew is defined as the worst case difference between any two similar delay paths within a single device.

**Note 5.** $V_{PP}$ (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 E111A/L as a differential input as low as 50mV will still produce full ECL levels at the output.

**Note 6.** $V_{CMR}$ 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)|

## 28-PIN PLCC (J28-1)




**Package Notes:**

**Note 1.** Package meets Level 1 moisture sensitivity.

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