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## FEATURES

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



Precision Edge®

## DESCRIPTION

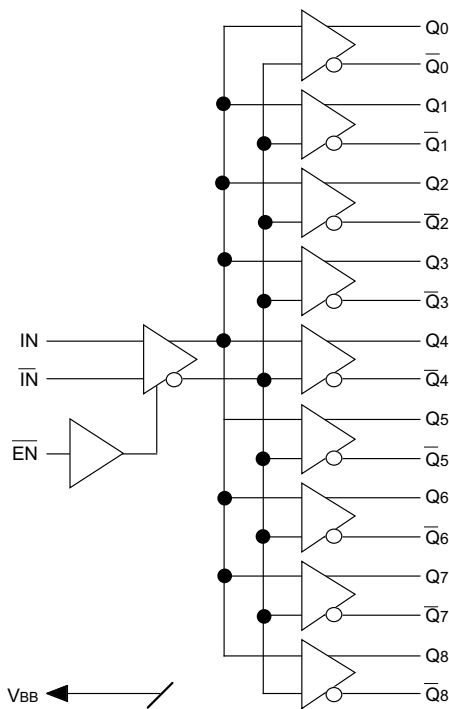
The SY10/100E111AE/LE are low skew 1-to-9 differential drivers designed for clock distribution in mind. The SY10/100E111AE/LE's function and performance are similar to the popular SY10/100E111, with the improvement of lower jitter and the added feature of low voltage operation. It accepts one signal input, which can be either differential or single-ended if the VBB 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  $\bar{Q}$  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 than 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 VCC 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.

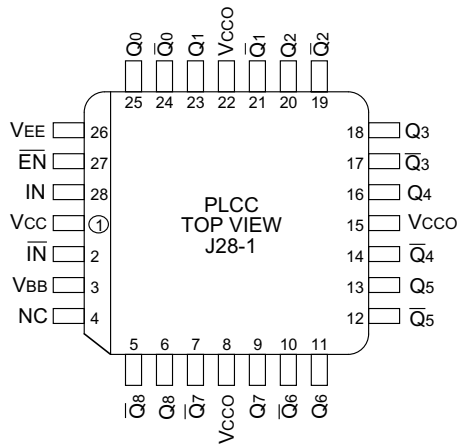
## BLOCK DIAGRAM



## PIN NAMES

Pin	Function
IN, $\bar{IN}$	Differential Input Pair
$\bar{EN}$	Enable Input
$Q_0, \bar{Q}_0 - Q_8, \bar{Q}_8$	Differential Outputs
VBB	VBB Output
VCCO	VCC to Output

**PACKAGE/ORDERING INFORMATION**



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

**Ordering Information<sup>(1)</sup>**

Part Number	Package Type	Operating Range	Package Marking	Lead Finish
SY10E111AEJI	J28-1	Industrial	SY10E111AEJI	Sn-Pb
SY10E111AEJITR <sup>(2)</sup>	J28-1	Industrial	SY10E111AEJI	Sn-Pb
SY100E111AEJI	J28-1	Industrial	SY100E111AEJI	Sn-Pb
SY100E111AEJITR <sup>(2)</sup>	J28-1	Industrial	SY100E111AEJI	Sn-Pb
SY10E111AEJC	J28-1	Commercial	SY10E111AEJI	Sn-Pb
SY10E111AEJCTR <sup>(2)</sup>	J28-1	Commercial	SY10E111AEJI	Sn-Pb
SY100E111AEJC	J28-1	Commercial	SY100E111AEJI	Sn-Pb
SY100E111AEJCTR <sup>(2)</sup>	J28-1	Commercial	SY100E111AEJI	Sn-Pb
SY10E111LEJI	J28-1	Industrial	SY10E111LEJI	Sn-Pb
SY10E111LEJITR <sup>(2)</sup>	J28-1	Industrial	SY10E111LEJI	Sn-Pb
SY100E111LEJI	J28-1	Industrial	SY100E111LEJI	Sn-Pb
SY100E111LEJITR <sup>(2)</sup>	J28-1	Industrial	SY100E111LEJI	Sn-Pb
SY10E111LEJC	J28-1	Commercial	SY10E111LEJI	Sn-Pb
SY10E111LEJCTR <sup>(2)</sup>	J28-1	Commercial	SY10E111LEJI	Sn-Pb
SY100E111LEJC	J28-1	Commercial	SY100E111LEJI	Sn-Pb
SY100E111LEJCTR <sup>(2)</sup>	J28-1	Commercial	SY100E111LEJI	Sn-Pb
SY10E111AEJY <sup>(3)</sup>	J28-1	Industrial	SY10E111AEJY with Pb-Free bar-line indicator	Matte-Sn
SY10E111AEJYTR <sup>(2, 3)</sup>	J28-1	Industrial	SY10E111AEJY with Pb-Free bar-line indicator	Matte-Sn
SY100E111AEJY <sup>(3)</sup>	J28-1	Industrial	SY100E111AEJY with Pb-Free bar-line indicator	Matte-Sn
SY100E111AEJYTR <sup>(2, 3)</sup>	J28-1	Industrial	SY100E111AEJY with Pb-Free bar-line indicator	Matte-Sn
SY10E111LEJZ <sup>(3)</sup>	J28-1	Commercial	SY10E111LEJZ with Pb-Free bar-line indicator	Matte-Sn
SY10E111LEJZTR <sup>(2, 3)</sup>	J28-1	Commercial	SY10E111LEJZ with Pb-Free bar-line indicator	Matte-Sn
SY100E111LEJZ <sup>(3)</sup>	J28-1	Commercial	SY100E111LEJZ with Pb-Free bar-line indicator	Matte-Sn
SY100E111LEJZTR <sup>(2, 3)</sup>	J28-1	Commercial	SY100E111LEJZ with Pb-Free bar-line indicator	Matte-Sn
SY10E111LEJY <sup>(3)</sup>	J28-1	Industrial	SY10E111LEJY with Pb-Free bar-line indicator	Matte-Sn
SY10E111LEJYTR <sup>(2, 3)</sup>	J28-1	Industrial	SY10E111LEJY with Pb-Free bar-line indicator	Matte-Sn
SY100E111LEJY <sup>(3)</sup>	J28-1	Industrial	SY100E111LEJY with Pb-Free bar-line indicator	Matte-Sn
SY100E111LEJYTR <sup>(2, 3)</sup>	J28-1	Industrial	SY100E111LEJY with Pb-Free bar-line indicator	Matte-Sn

**Notes:**

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

**ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>**

SYMBOL	PARAMETER	RATING	UNIT
VEE	Power Supply (VCC = 0V)	-8.0 to 0	V
VI	Input Voltage (VCC = 0V)	0 to -6.0	V
IOUT	Output Current:	50 100	mA
	Continuous Surge		
TA	Operating Temperature Range	-40 to +85	°C
VEE <sup>(2)</sup>	Operating Range	-5.7 to -4.2	V
Tstore	Storage Temperature Range	-65 to +150	°C

**ECL DC ELECTRICAL CHARACTERISTICS<sup>(1)</sup>**

VEE = VEE (Min.) to VEE (Max.); VCC = GND

Symbol	Parameter	TA = -40°C			TA = 0°C			TA = +25°C			TA = +85°C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
VOH	Output HIGH Voltage													mV
	10EL	-1080	—	-890	-1020	—	-840	-980	—	-810	-910	—	-720	
	100EL	-1085	—	-880	-1025	—	-880	-1025	—	-880	-1025	—	-880	
VOL	Output LOW Voltage													mV
	10EL	-1950	—	-1650	-1950	—	-1630	-1950	—	-1630	-1950	—	-1595	
	100EL	-1830	—	-1550	-1810	—	-1620	-1810	—	-1620	-1810	—	-1620	
VIH	Input HIGH Voltage													mV
	10EL	-1230	—	-890	-1170	—	-840	-1130	—	-810	-1060	—	-720	
	100EL	-1165	—	-880	-1165	—	-880	-1165	—	-880	-1165	—	-880	
VIL	Input LOW Voltage													mV
	10EL	-1950	—	-1500	-1950	—	-1480	-1950	—	-1480	-1950	—	-1445	
	100EL	-1810	—	-1475	-1810	—	-1475	-1810	—	-1475	-1810	—	-1475	
VBB	Output Reference Voltage													V
	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 <sub>IH</sub>	Input HIGH Current	—	—	150	—	—	150	—	—	150	—	—	150	μA
I <sub>IL</sub>	Input LOW Current													μA
	10EL	0.5	—	—	0.5	—	—	0.5	—	—	0.3	—	—	
	100EL	0.5	—	—	0.5	—	—	0.5	—	—	0.5	—	—	
IEE	Power Supply Current													mA
	10EL	—	—	66	—	—	66	—	—	66	—	—	66	
	100EL	—	—	66	—	—	66	—	—	66	—	—	78	

**Notes:**

- Absolute maximum rating, beyond which device life may be impaired unless otherwise specified.
- Parametric values specified at:
 

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

### 3.3V PECL DC ELECTRICAL CHARACTERISTICS<sup>(1)</sup>

VCC = +3.0V to +3.8V, VEE = GND

Symbol	Parameter	TA = -40°C			TA = 0°C			TA = +25°C			TA = +85°C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
VOH	Output HIGH Voltage <sup>(2)</sup>													mV
	10EL	2220	—	2110	2280	—	2460	2320	—	2490	2390	—	2580	
	100EL	2215	—	2120	2275	—	2420	2275	—	2420	2275	—	2420	
VOL	Output LOW Voltage <sup>(2)</sup>													mV
	10EL	1350	—	1650	1350	—	1670	1350	—	1670	1350	—	1705	
	100EL	1470	—	1750	1490	—	1680	1490	—	1680	1490	—	1680	
VIH	Input HIGH Voltage <sup>(2)</sup>													mV
	10EL	2070	—	2410	2130	—	2460	2170	—	2490	2240	—	2580	
	100EL	2135	—	2420	2135	—	2420	2135	—	2420	2135	—	2420	
VIL	Input LOW Voltage <sup>(2)</sup>													mV
	10EL	1350	—	1800	1350	—	1820	1350	—	1820	1350	—	1855	
	100EL	1490	—	1825	1490	—	1825	1490	—	1825	1490	—	1825	
VBB	Output Reference Voltage <sup>(2)</sup>													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 <sub>IH</sub>	Input HIGH Current	—	—	150	—	—	150	—	—	150	—	—	150	μA
I <sub>IL</sub>	Input LOW Current													μA
	10EL	0.5	—	—	0.5	—	—	0.5	—	—	0.3	—	—	
	100EL	0.5	—	—	0.5	—	—	0.5	—	—	0.5	—	—	
I <sub>EE</sub>	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 Vcc = 3.3V. Level specifications will vary 1:1 with Vcc.

### 5V PECL DC ELECTRICAL CHARACTERISTICS<sup>(1)</sup>

VCC = VCC (Min.) to VCC (Max.); VEE = GND

Symbol	Parameter	TA = -40°C			TA = 0°C			TA = +25°C			TA = +85°C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
VOH	Output HIGH Voltage <sup>(2)</sup>													mV
	10EL	3920	—	4110	3980	—	4160	4020	—	4190	4090	—	4280	
	100EL	3915	—	4120	3975	—	4120	3975	—	4120	3975	—	4120	
VOL	Output LOW Voltage <sup>(2)</sup>													mV
	10EL	3050	—	3350	3050	—	3370	3050	—	3370	3050	—	3405	
	100EL	3170	—	3450	3190	—	3380	3190	—	3380	3190	—	3380	
VIH	Input HIGH Voltage <sup>(2)</sup>													mV
	10EL	3770	—	4110	3830	—	4160	3870	—	4190	3940	—	4280	
	100EL	3835	—	4120	3835	—	4120	3835	—	4120	3835	—	4120	
VIL	Input LOW Voltage <sup>(2)</sup>													mV
	10EL	3050	—	3500	3050	—	3520	3050	—	3520	3050	—	3555	
	100EL	3190	—	3525	3190	—	3525	3190	—	3525	3190	—	3525	
VBB	Output Reference Voltage <sup>(2)</sup>													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 <sub>IH</sub>	Input HIGH Current	—	—	150	—	—	150	—	—	150	—	—	150	μA
I <sub>IL</sub>	Input LOW Current													μA
	10EL	0.5	—	—	0.5	—	—	0.5	—	—	0.3	—	—	
	100EL	0.5	—	—	0.5	—	—	0.5	—	—	0.5	—	—	
I <sub>EE</sub>	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 Vcc = 5V. Level specifications will vary 1:1 with Vcc.

**AC ELECTRICAL CHARACTERISTICS<sup>(1)</sup>**

V<sub>EE</sub> = V<sub>EE</sub> (Min.) to V<sub>EE</sub> (Max.); V<sub>CC</sub> = GND

Symbol	Parameter	T <sub>A</sub> = -40°C			T <sub>A</sub> = 0°C			T <sub>A</sub> = +25°C			T <sub>A</sub> = +85°C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
f <sub>MAX</sub>	Maximum Toggle Frequency		800			800			800			800		MHz
t <sub>PD</sub>	Propagation Delay to Output IN (differential) <sup>(2)</sup>	380	—	680	430	—	630	430	—	630	430	—	630	ps
	IN (single-ended) <sup>(3)</sup>	280	—	780	330	—	730	330	—	730	330	—	730	
	Enable <sup>(4)</sup>	400	—	900	450	—	850	450	—	850	450	—	850	
	Disable <sup>(4)</sup>	400	—	900	450	—	850	450	—	850	450	—	850	
t <sub>skew</sub>	Within-Device Skew <sup>(5)</sup>	—	—	75	—	—	50	—	—	50	—	—	50	ps
	Part-to-Part Skew (Diff.)	—	—	250	—	—	200	—	—	200	—	—	200	
t <sub>s</sub>	Set-up Time, $\overline{EN}$ to IN <sup>(6)</sup>	250	—	0	200	0	—	200	0	—	200	0	—	ps
t <sub>H</sub>	Hold Time, IN to $\overline{EN}$ <sup>(7)</sup>	0	—	-200	0	-200	—	0	-200	—	0	-200	—	ps
t <sub>R</sub>	Release Time, $\overline{EN}$ to IN <sup>(8)</sup>	350	—	100	300	100	—	300	100	—	300	100	—	ps
t <sub>JITTER</sub>	Random Clock Jitter		1	2		1	2		1	2		1	2	ps <sub>RMS</sub>
V <sub>PP</sub>	Minimum Input Swing <sup>(9)</sup>	250	—	—	250	—	—	250	—	—	250	—	—	mV
V <sub>CMR</sub>	Common Mode Range <sup>(10)</sup>	-1.5	—	-0.4	-1.5	—	-0.4	-1.5	—	-0.4	-1.5	—	-0.4	V
t <sub>r</sub> t <sub>f</sub>	Rise/Fall Times 20% to 80%	200	—	650	200	—	600	200	—	600	200	—	600	ps

**Notes:**

- 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.
- 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.
- 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.
- 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 EN to the 50% point of a negative transition on Q (or a positive transition on  $\overline{Q}$ ).
- The within-device skew is defined as the worst case difference between any two similar delay paths within a single device.
- 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  $\pm 75$ mV to that IN/ $\overline{IN}$  transition (see Figure 1).
- 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  $\pm 75$ mV to that IN/ $\overline{IN}$  transition (see Figure 2).
- 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).
- V<sub>PP</sub> (min) is defined as the minimum input differential voltage which will cause no increase in the propagation delay. The V<sub>PP</sub> (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.
- V<sub>CMR</sub> is defined as the range within the V<sub>IH</sub> level may vary, with the device still meeting the propagation delay specification. the V<sub>IL</sub> level must be such that the peak-to-peak voltage is less than 1.0V and greater than or equal to V<sub>PP</sub> (min).  
For PECL operation: V<sub>CMR</sub> (max) = V<sub>CC</sub> - |V<sub>CMR</sub> (max)| and  
V<sub>CMR</sub> (min) = V<sub>CC</sub> - |V<sub>CMR</sub> (min)|

**TIMING DIAGRAMS**

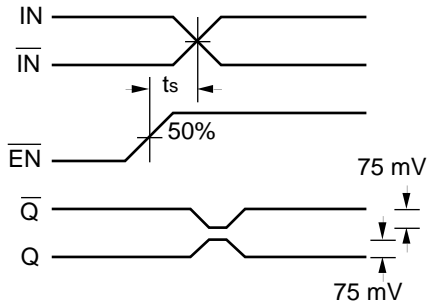


Figure 1. Set-up Time

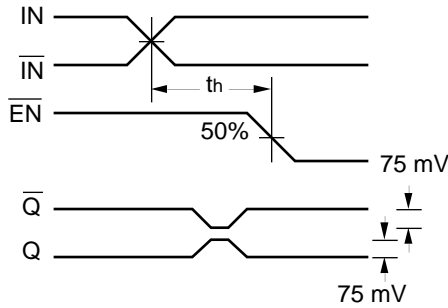


Figure 2. Hold Time

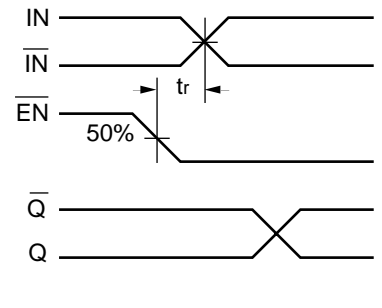
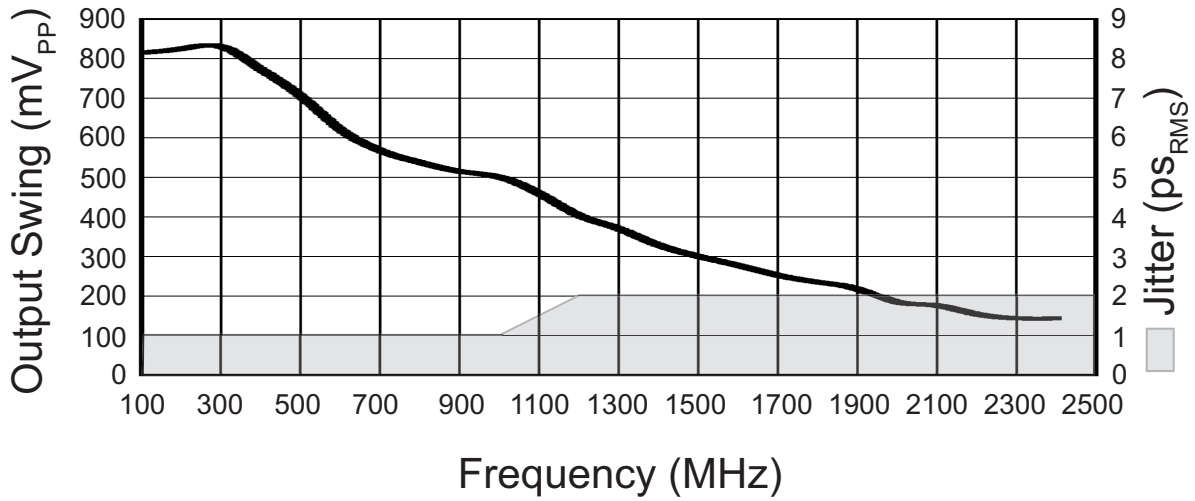
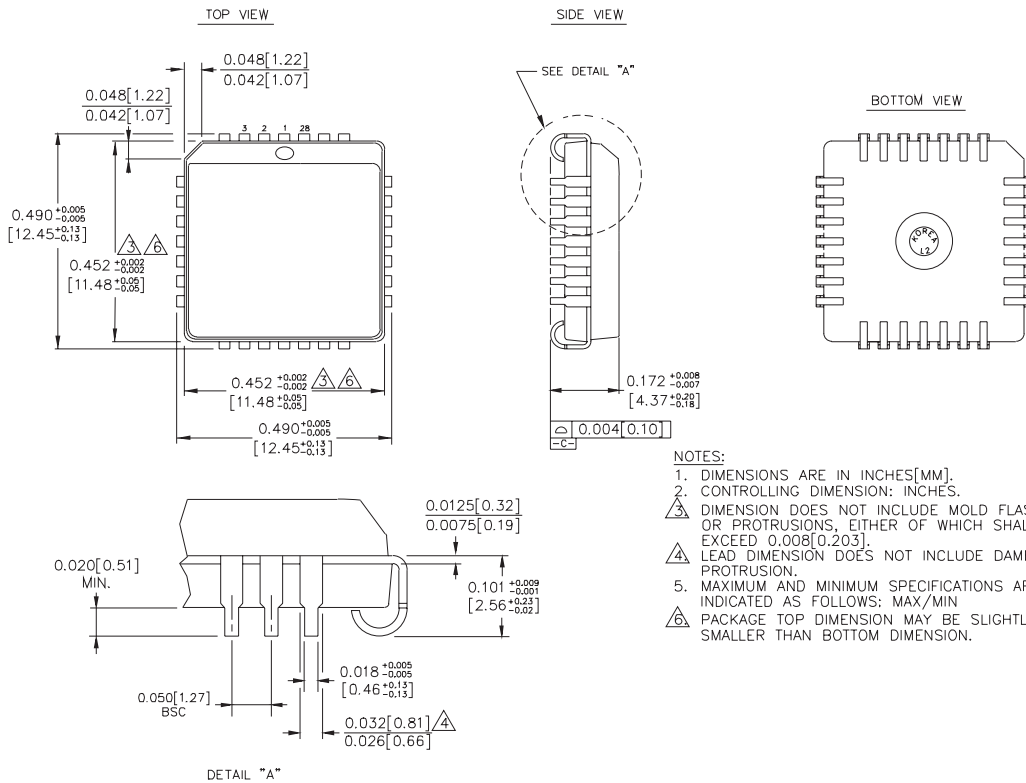


Figure 3. Release Time

**Frequency Response/Jitter**



**28-PIN 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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