

## FEATURES

- Guaranteed maximum frequency >4GHz
- 3.3V and 5V power supply options
- Guaranteed propagation delay <460ps over temperature
- Wide operating temperature range: -40°C to +85°C
- Available in 8-pin MSOP and SOIC packages



ECL Pro™

## DESCRIPTION

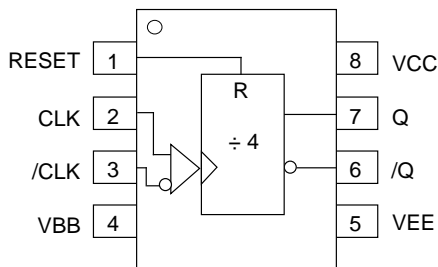
The SY10/100EP33V is an integrated ÷4 divider.

The  $V_{BB}$  pin, an internally generated voltage supply, is available to this device only. For single-ended input conditions, the unused differential input is connected to  $V_{BB}$  as a switching reference voltage.  $V_{BB}$  may also rebias AC-coupled inputs. When used, decouple  $V_{BB}$  and  $V_{CC}$  via a 0.01 $\mu$ F capacitor and limit current sourcing or sinking to 0.5mA. When not used,  $V_{BB}$  should be left open.

The reset pin is asynchronous and is asserted on the rising edge. Upon power-up, the internal flip-flops will attain a random state; the reset allows for the synchronous use of multiple EP33s in a system.

The 100K Series includes internal temperature compensation circuitry.

## PIN CONFIGURATION/BLOCK DIAGRAM



**TOP VIEW**  
(Available in MSOP or SOIC package)

## PIN NAMES

Pin	Function
CLK, /CLK	ECL Clock Inputs with Internal 75k $\Omega$ Pull-Down Resistor, Default State is LOW
RESET	ECL Asynchronous Reset
$V_{BB}$	Reference Voltage Output
Q, /Q	ECL Data Outputs

## TRUTH TABLE(1)

CLK	/CLK	RESET	Q	/Q
X	X	Z	L	H
$\downarrow$	$\uparrow$	L	F	F

Note 1. F = Divide by 4 function

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

Symbol	Rating	Value	Unit
V <sub>CC</sub>	Power Supply Voltage (V <sub>EE</sub> = 0)	+6.0 to 0	V
V <sub>EE</sub>	Power Supply Voltage (V <sub>CC</sub> = 0)	-6.0 to 0	V
V <sub>IN</sub>	Input Voltage (V <sub>CC</sub> = 0V, V <sub>IN</sub> not more negative than V <sub>EE</sub> ) Input Voltage (V <sub>EE</sub> = 0V, V <sub>IN</sub> not more positive than V <sub>CC</sub> )	-6.0 to 0	V
		+6.0 to 0	V
I <sub>OUT</sub>	Output Current	-Continuous	50
		-Surge	100
T <sub>A</sub>	Operating Temperature Range	-40 to +85	°C
T <sub>store</sub>	Storage Temperature Range	-65 to +150	°C
θ <sub>JA</sub>	Thermal Resistance (Junction-to-Ambient) SOIC-8	-Still Air	160
		-500lfpm	109
	MSOP-8	-Still Air	206
		-500lfpm	155
θ <sub>JC</sub>	Thermal Resistance (Junction-to-Case)	SOIC-8	39
		MSOP-8	39

**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 RATING conditions for extended periods may affect device reliability.

## (10EP) LVPECL DC ELECTRICAL CHARACTERISTICS<sup>(1)</sup>

V<sub>CC</sub> = +3.3V ±10%; V<sub>EE</sub> = 0V<sup>(2)</sup>

Symbol	Parameter	T <sub>A</sub> = -40°C			T <sub>A</sub> = +25°C			T <sub>A</sub> = +85°C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
I <sub>EE</sub>	Power Supply Current	—	—	36	—	26	36	—	—	36	mA
V <sub>OH</sub>	Output HIGH Voltage <sup>(3)</sup>	2165	2290	2415	2230	2355	2480	2290	2415	2540	mV
V <sub>OL</sub>	Output LOW Voltage <sup>(3)</sup>	1365	1490	1615	1430	1555	1680	1490	1615	1740	mV
V <sub>IH</sub>	Input HIGH Voltage (Single-Ended)	2090	—	2415	2155	—	2480	2215	—	2540	mV
V <sub>IL</sub>	Input LOW Voltage (Single-Ended)	1365	—	1690	1430	—	1755	1490	—	1815	mV
V <sub>BB</sub>	Output Voltage	1790	1890	1990	1885	1955	2055	1915	2015	2115	mV
V <sub>IHCMR</sub>	Input HIGH Voltage <sup>(4)</sup> Common Mode Range (Differential)	2.0	—	V <sub>CC</sub>	2.0	—	V <sub>CC</sub>	2.0	—	V <sub>CC</sub>	V
I <sub>IH</sub>	Input HIGH Current	—	—	150	—	—	150	—	—	150	μA
I <sub>IL</sub>	Input LOW Current RESET, CLK /CLK	0.5 -150	— —	— —	0.5 -150	— —	— —	0.5 -150	— —	— —	μA

**Note 1.** 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 traverse airflow greater than 500lfpm is maintained.

**Note 2.** Input and output parameters vary 1:1 with V<sub>CC</sub>.

**Note 3.** All loading with 50Ω to V<sub>CC</sub> -2.0V.

**Note 4.** The V<sub>IHCMR</sub> range is referenced to the most positive side of the differential input signal.

**(10EP) PECL DC ELECTRICAL CHARACTERISTICS<sup>(1)</sup>**

$V_{CC} = +5.0V \pm 10\%$ ;  $V_{EE} = 0V^{(2)}$

Symbol	Parameter	$T_A = -40^\circ C$			$T_A = +25^\circ C$			$T_A = +85^\circ C$			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
$I_{EE}$	Power Supply Current	—	—	36	—	26	36	—	—	36	mA
$V_{OH}$	Output HIGH Voltage <sup>(3)</sup>	3865	3990	4115	3930	4055	4180	3990	4115	4240	mV
$V_{OL}$	Output LOW Voltage <sup>(3)</sup>	3065	3190	3315	3130	3255	3380	3190	3315	3440	mV
$V_{IH}$	Input HIGH Voltage (Single-Ended)	3790	—	4115	3855	—	4180	3915	—	4240	mV
$V_{IL}$	Input LOW Voltage (Single-Ended)	3065	—	3390	3130	—	3455	3190	—	3515	mV
$V_{BB}$	Output Voltage	3490	3590	3690	3555	3655	3755	3615	3715	3815	mV
$V_{IHCMR}$	Input HIGH Voltage <sup>(4)</sup> Common Mode Range (Differential)	2.0	—	$V_{CC}$	2.0	—	$V_{CC}$	2.0	—	$V_{CC}$	V
$I_{IH}$	Input HIGH Current	—	—	150	—	—	150	—	—	150	$\mu A$
$I_{IL}$	Input LOW Current RESET, CLK /CLK	0.5 -150	— —	— —	0.5 -150	— —	— —	0.5 -150	— —	— —	$\mu A$

**Note 1.** 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 traverse airflow greater than 500lfpm is maintained.

**Note 2.** Input and output parameters vary 1:1 with  $V_{CC}$ .

**Note 3.** All loading with  $50\Omega$  to  $V_{CC} - 2.0V$ .

**Note 4.** The  $V_{IHCMR}$  range is referenced to the most positive side of the differential input signal.

**(10EP) ECL/LVECL DC ELECTRICAL CHARACTERISTICS<sup>(1)</sup>**

$V_{CC} = 0V$ ;  $V_{EE} = -3.3V$  to  $-5.0V \pm 10\%^{(2)}$

Symbol	Parameter	$T_A = -40^\circ C$			$T_A = +25^\circ C$			$T_A = +85^\circ C$			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
$I_{EE}$	Power Supply Current	—	—	36	—	26	36	—	—	36	mA
$V_{OH}$	Output HIGH Voltage <sup>(3)</sup>	-1135	-1010	-885	-1070	-945	-820	-1010	-885	-760	mV
$V_{OL}$	Output LOW Voltage <sup>(3)</sup>	-1935	-1810	-1685	-1870	-1745	-1620	-1810	-1685	-1560	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	-1510	-1410	-1310	-1445	-1345	-1245	-1385	-1285	-1185	mV
$V_{IHCMR}$	Input HIGH Voltage <sup>(4)</sup> Common Mode Range (Differential)	$V_{EE} + 2.0$		0.0	$V_{EE} + 2.0$		0.0	$V_{EE} + 2.0$		0.0	V
$I_{IH}$	Input HIGH Current	—	—	150	—	—	150	—	—	150	$\mu A$
$I_{IL}$	Input LOW Current RESET, CLK /CLK	0.5 -150	— —	— —	0.5 -150	— —	— —	0.5 -150	— —	— —	$\mu A$

**Note 1.** 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 traverse airflow greater than 500lfpm is maintained.

**Note 2.** Input and output parameters vary 1:1 with  $V_{CC}$ .

**Note 3.** All loading with  $50\Omega$  to  $V_{CC} - 2.0V$ .

**Note 4.**  $V_{IHCMR}$  (Min) varies 1:1 with  $V_{EE}$ . The  $V_{IHCMR}$  range is referenced to the most positive side of the differential input signal.

### (100EP) LVPECL DC ELECTRICAL CHARACTERISTICS<sup>(1)</sup>

$V_{CC} = +3.3V \pm 10\%$ ;  $V_{EE} = 0V^{(2)}$

Symbol	Parameter	$T_A = -40^\circ C$			$T_A = +25^\circ C$			$T_A = +85^\circ C$			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
$I_{EE}$	Power Supply Current	—	—	36	—	30	36	—	—	40	mA
$V_{OH}$	Output HIGH Voltage <sup>(3)</sup>	2155	2280	2405	2155	2280	2405	2155	2280	2405	mV
$V_{OL}$	Output LOW Voltage <sup>(3)</sup>	1355	1480	1605	1355	1480	1605	1355	1480	1605	mV
$V_{IH}$	Input HIGH Voltage (Single-Ended)	2075	—	2420	2075	—	2420	2075	—	2420	mV
$V_{IL}$	Input LOW Voltage (Single-Ended)	1355	—	1675	1355	—	1675	1355	—	1675	mV
$V_{BB}$	Output Voltage	1775	1875	1975	1775	1875	1975	1775	1875	1975	mV
$V_{IHCMR}$	Input HIGH Voltage <sup>(4)</sup> Common Mode Range (Differential)	2.0	—	$V_{CC}$	2.0	—	$V_{CC}$	2.0	—	$V_{CC}$	V
$I_{IH}$	Input HIGH Current	—	—	150	—	—	150	—	—	150	$\mu A$
$I_{IL}$	Input LOW Current RESET, CLK /CLK	0.5 -150	— —	— —	0.5 -150	— —	— —	0.5 -150	— —	— —	$\mu A$

**Note 1.** 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 traverse airflow greater than 500lfpm is maintained.

**Note 2.** Input and output parameters vary 1:1 with  $V_{CC}$ .

**Note 3.** All loading with  $50\Omega$  to  $V_{CC} - 2.0V$ .

**Note 4.** The  $V_{IHCMR}$  range is referenced to the most positive side of the differential input signal.

### (100EP) PECL DC ELECTRICAL CHARACTERISTICS<sup>(1)</sup>

$V_{CC} = +5.0V \pm 10\%$ ;  $V_{EE} = 0V^{(2)}$

Symbol	Parameter	$T_A = -40^\circ C$			$T_A = +25^\circ C$			$T_A = +85^\circ C$			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
$I_{EE}$	Power Supply Current	—	—	36	—	30	36	—	—	40	mA
$V_{OH}$	Output HIGH Voltage <sup>(3)</sup>	3855	3980	4105	3855	3980	4105	3855	3980	4105	mV
$V_{OL}$	Output LOW Voltage <sup>(3)</sup>	3055	3180	3305	3055	3180	3305	3055	3180	3305	mV
$V_{IH}$	Input HIGH Voltage (Single-Ended)	3775	—	4120	3775	—	4120	3775	—	4120	mV
$V_{IL}$	Input LOW Voltage (Single-Ended)	3055	—	3375	3055	—	3375	3055	—	3375	mV
$V_{BB}$	Output Voltage	3475	3575	3675	3475	3575	3675	3475	3575	3675	mV
$V_{IHCMR}$	Input HIGH Voltage <sup>(4)</sup> Common Mode Range (Differential)	2.0	—	$V_{CC}$	2.0	—	$V_{CC}$	2.0	—	$V_{CC}$	V
$I_{IH}$	Input HIGH Current	—	—	150	—	—	150	—	—	150	$\mu A$
$I_{IL}$	Input LOW Current RESET, CLK /CLK	0.5 -150	— —	— —	0.5 -150	— —	— —	0.5 -150	— —	— —	$\mu A$

**Note 1.** 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 traverse airflow greater than 500lfpm is maintained.

**Note 2.** Input and output parameters vary 1:1 with  $V_{CC}$ .

**Note 3.** All loading with  $50\Omega$  to  $V_{CC} - 2.0V$ .

**Note 4.** The  $V_{IHCMR}$  range is referenced to the most positive side of the differential input signal.

### (100EP) ECL/LVECL DC ELECTRICAL CHARACTERISTICS<sup>(1)</sup>

$V_{CC} = 0V$ ;  $V_{EE} = -3.3V$  to  $-5.0V \pm 10\%$ <sup>(2)</sup>

Symbol	Parameter	$T_A = -40^\circ C$			$T_A = +25^\circ C$			$T_A = +85^\circ C$			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
$I_{EE}$	Power Supply Current	—	—	36	—	30	36	—	—	40	mA
$V_{OH}$	Output HIGH Voltage <sup>(3)</sup>	-1145	-1020	-895	-1145	-1020	-895	-1145	-1020	-895	mV
$V_{OL}$	Output LOW Voltage <sup>(3)</sup>	-1945	-1820	-1695	-1945	-1820	-1695	-1945	-1820	-1695	mV
$V_{IH}$	Input HIGH Voltage (Single-Ended)	-1225	—	-880	-1225	—	-880	-1225	—	-880	mV
$V_{IL}$	Input LOW Voltage (Single-Ended)	-1945	—	-1625	-1945	—	-1625	-1945	—	-1625	mV
$V_{BB}$	Output Voltage	-1525	-1425	-1325	-1525	-1425	-1325	-1525	-1425	-1325	mV
$V_{IHCMR}$	Input HIGH Voltage <sup>(4)</sup> Common Mode Range (Differential)	$V_{EE} + 2.0$		0.0	$V_{EE} + 2.0$		0.0	$V_{EE} + 2.0$		0.0	V
$I_{IH}$	Input HIGH Current	—	—	150	—	—	150	—	—	150	$\mu A$
$I_{IL}$	Input LOW Current RESET, CLK /CLK	0.5 -150	— —	— —	0.5 -150	— —	— —	0.5 -150	— —	— —	$\mu A$

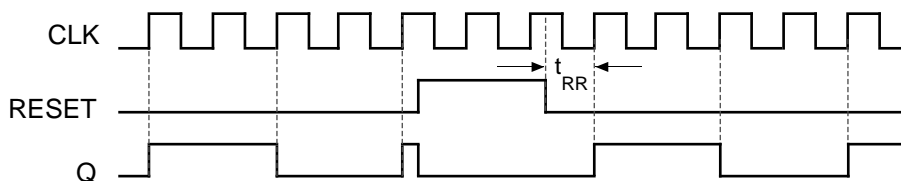
**Note 1.** 100EP circuits are designed to meet the DC specifications shown in the above table after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and traverse airflow greater than 500lfpm is maintained.

**Note 2.** Input and output parameters vary 1:1 with  $V_{CC}$ .

**Note 3.** All loading with  $50\Omega$  to  $V_{CC} - 2.0V$ .

**Note 4.**  $V_{IHCMR}$  (Min) varies 1:1 with  $V_{EE}$ . The  $V_{IHCMR}$  range is referenced to the most positive side of the differential input signal.

### TIMING DIAGRAM



## AC ELECTRICAL CHARACTERISTICS(1, 2)

NECL:  $V_{CC} = 0V$ ,  $V_{EE} = -3.3V$  to  $-5.0V \pm 10\%$ ; PECL:  $V_{EE} = 0V$ ,  $V_{CC} = +3.3V$  to  $+5.0V \pm 10\%$ .

Symbol	Parameter	$T_A = -40^\circ C$			$T_A = +25^\circ C$			$T_A = +85^\circ C$			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
$f_{MAX}$	Maximum Frequency <sup>(3)</sup>	4	—	—	4	—	—	4	—	—	GHz
$t_{PLH}$ $t_{PHL}$	Propagation Delay to Output CLK → Q (SY10EP33V) RESET → Q (SY100EP33V) RESET → Q	300 300 310	380 420 420	440 470 470	300 290 310	380 420 420	440 470 470	320 320 320	400 450 450	460 500 500	ps
$t_{RR}$	Set/Reset Recovery	200	—	—	200	100	—	200	—	—	ps
$t_{PW}$	Minimum Pulse Width RESET	550	—	—	550	200	—	550	—	—	ps
$t_{JITTER}$	Cycle-to-Cycle RMS Jitter <sup>(3)</sup>	—	0.2	< 1	—	0.2	< 1	—	0.2	< 1	ps(rms)
$V_{PP}$	Input Voltage Swing (Differential)	150	800	1200	150	800	1200	150	800	1200	mV
$t_r$ $t_f$	Output Rise/Fall Times Q, /Q (20% to 80%)	90	170	200	100	180	220	120	200	240	ps

**Note 1.** Measured using a 750mV source, 50% duty cycle clock source. All loading with  $50\Omega$  to  $V_{CC} - 2.0V$ .

**Note 2.** Specifications for packaged product only.

**Note 3.**  $f_{MAX}$  guaranteed for functionality only.  $V_{OL}$  and  $V_{OH}$  levels are guaranteed at DC only.

## PRODUCT ORDERING CODE

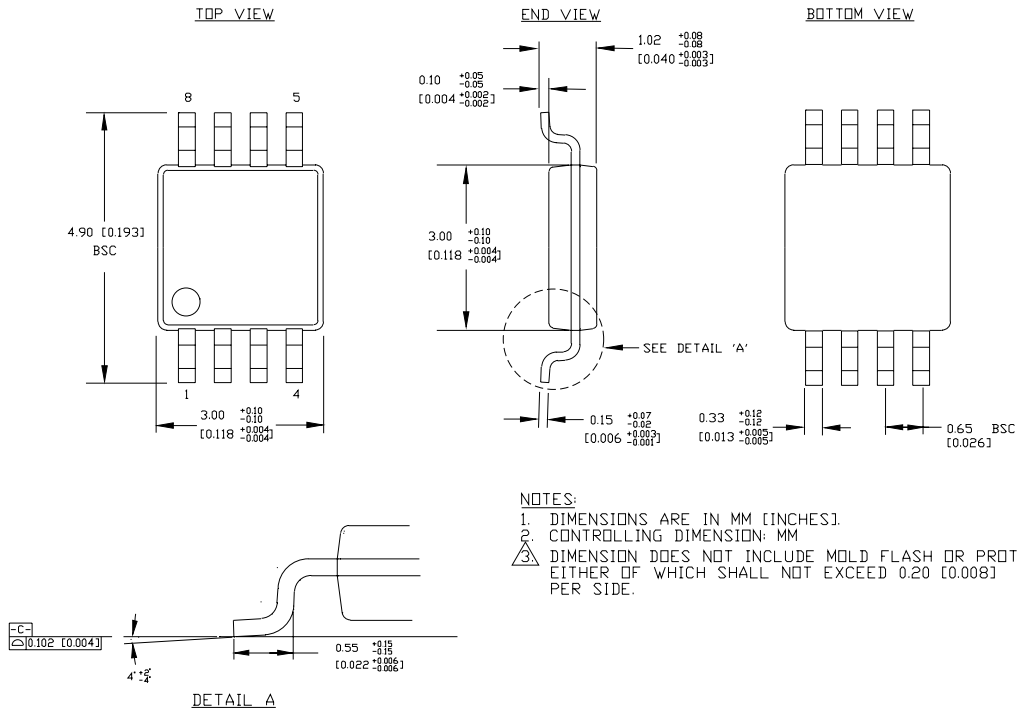
Ordering Code	Package Type	Operating Range	Package Marking
SY10EP33VZC	Z8-1	Commerical	HEP33V
SY10EP33VZCTR <sup>(1)</sup>	Z8-1	Commerical	HEP33V
SY100EP33VZC	Z8-1	Commerical	XEP33V
SY100EP33VZCTR <sup>(1)</sup>	Z8-1	Commerical	XEP33V
SY10EP33VKC	K8-1	Commerical	HP33
SY10EP33VKCTR <sup>(1)</sup>	K8-1	Commerical	HP33
SY100EP33VKC	K8-1	Commerical	XP33
SY100EP33VKCTR <sup>(1)</sup>	K8-1	Commerical	XP33

Ordering Code	Package Type	Operating Range	Package Marking
SY10EP33VZI <sup>(2)</sup>	Z8-1	Industrial	HEP33V
SY10EP33VZITR <sup>(1, 2)</sup>	Z8-1	Industrial	HEP33V
SY100EP33VZI <sup>(2)</sup>	Z8-1	Industrial	XEP33V
SY100EP33VZITR <sup>(1, 2)</sup>	Z8-1	Industrial	XEP33V
SY10EP33VKI <sup>(2)</sup>	K8-1	Industrial	HP33
SY10EP33VKITR <sup>(1, 2)</sup>	K8-1	Industrial	HP33
SY100EP33VKI <sup>(2)</sup>	K8-1	Industrial	XP33
SY100EP33VKITR <sup>(1, 2)</sup>	K8-1	Industrial	XP33

**Note 1.** Tape and Reel.

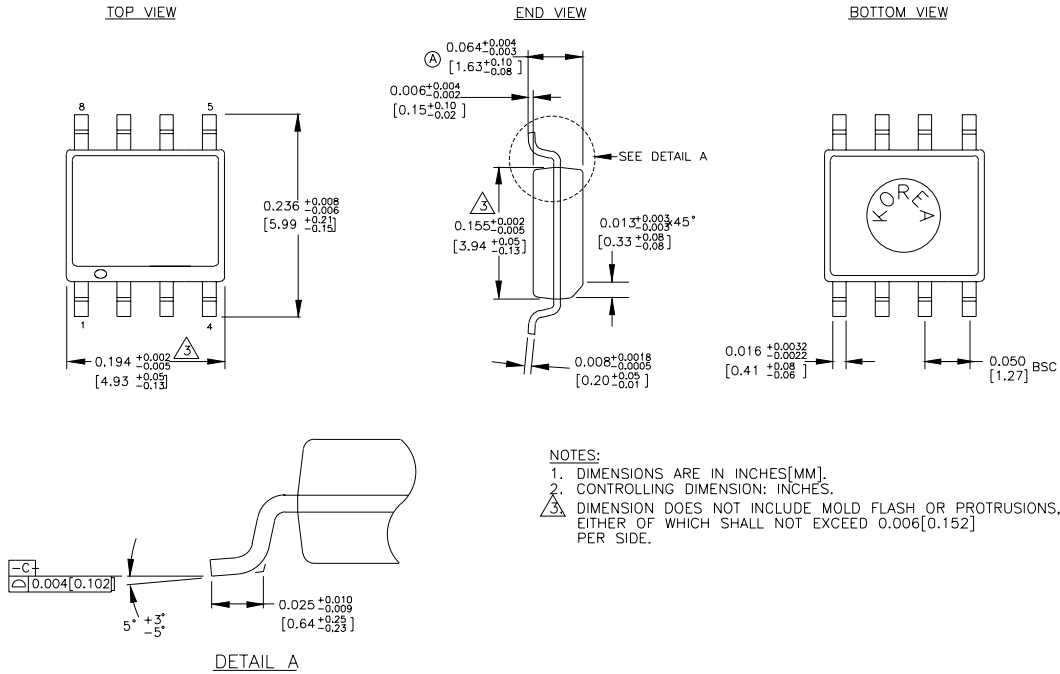
**Note 2.** Recommended for new designs.

**8 LEAD MSOP (K8-1)**



Rev. 01

**8 LEAD SOIC .150" WIDE (Z8-1)**



Rev. 03

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