SY10EP33V/SY100EP33V

5V/3.3V, 4GHz, ÷4 PECL/LVPECL Divider

Precision Edge®

General 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} to V_{CC} via a 0.01µF 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.

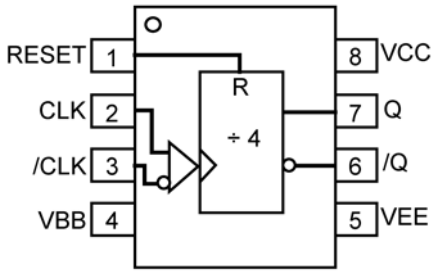
Data sheets and support documentation can be found on Micrel's web site at www.micrel.com.

ECL Pro™

Features

- Guaranteed maximum frequency >4GHz
- 3.3V and 5V power supply options
- Guaranteed propagation delay <460ps over temperature
- Internal 75kΩ input pull-down resistors
- Wide operating temperature range (–40°C to +85°C)
- Available in 8-pin MSOP and SOIC packages

Pin Configuration



Top View
(Available in MSOP or SOIC Package)

Pin Description

Pin Number	Pin Function
CLK, /CLK	ECL Clock Inputs with Internal 75kΩ Pull-Down Transistor. Default State is LOW
RESET	ECL Asynchronous Reset
VBB	Reference Voltage Output
Q, /Q	ECL Data Outputs

Truth Table

CLK	/CLK	RESET	Q	/Q
X	X	Z[2]	L	H
⌐	¬	L	F	F

Notes:

1. F = Divide by 4 function.
2. Z = LOW to HIGH transition.

Ordering Information[1]

Part Number	Package Type	Operating Range	Package Marking	Lead Finish
SY10EP33VZC	Z8-1	Commercial	HEP33V	Sn-Pb
SY10EP33VZCTR[2]	Z8-1	Commercial	HEP33V	Sn-Pb
SY100EP33VZC	Z8-1	Commercial	XEP33V	Sn-Pb
SY100EP33VZCTR[2]	Z8-1	Commercial	XEP33V	Sn-Pb
SY10EP33VKC	K8-1	Commercial	HP33	Sn-Pb
SY10EP33VKCTR[2]	K8-1	Commercial	HP33	Sn-Pb
SY100EP33VKC	K8-1	Commercial	XP33	Sn-Pb
SY100EP33VKCTR[2]	K8-1	Commercial	XP33	Sn-Pb
SY10EP33VZI	Z8-1	Industrial	HEP33V	Sn-Pb
SY10EP33VZITR[2]	Z8-1	Industrial	HEP33V	Sn-Pb
SY100EP33VZI	Z8-1	Industrial	XEP33V	Sn-Pb
SY100EP33VZITR[2]	Z8-1	Industrial	XEP33V	Sn-Pb
SY10EP33VKI	K8-1	Industrial	HP33	Sn-Pb
SY10EP33VKITR[2]	K8-1	Industrial	HP33	Sn-Pb
SY100EP33VKI	K8-1	Industrial	XP33	Sn-Pb
SY100EP33VKITR[2]	K8-1	Industrial	XP33	Sn-Pb
SY10EP33VZG[3]	Z8-1	Industrial	HEP33V with Pb-Free Bar-Line Indicator	NiPdAu/Pb-Free
SY10EP33VZGTR[2, 3]	Z8-1	Industrial	HEP33V with Pb-Free Bar-Line Indicator	NiPdAu/Pb-Free
SY100EP33VZG[3]	Z8-1	Industrial	XEP33V with Pb-Free Bar-Line Indicator	NiPdAu/Pb-Free
SY100EP33VZGTR[2, 3]	Z8-1	Industrial	XEP33V with Pb-Free Bar-Line Indicator	NiPdAu/Pb-Free
SY10EP33VKG[3]	K8-1	Industrial	HP33V with Pb-Free Bar-Line Indicator	NiPdAu/Pb-Free
SY10EP33VKGTR[2, 3]	K8-1	Industrial	HP33V with Pb-Free Bar-Line Indicator	NiPdAu/Pb-Free
SY100EP33VKG[3]	K8-1	Industrial	XP33V with Pb-Free Bar-Line Indicator	NiPdAu/Pb-Free
SY100EP33VKGTR[2, 3]	K8-1	Industrial	XP33V with Pb-Free Bar-Line Indicator	NiPdAu/Pb-Free

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.

Absolute Maximum Ratings[1]

Power Supply Voltage
- V_{EE} = 0 ..... +6.0V to 0V
- V_{CC} = 0 ..... –6.0V to 0V

Input Voltage
- V_{CC} = 0V
- (V_{IN} not more negative than V_{EE}) ..... –6.0V to 0V
- V_{EE} = 0V
- (V_{IN} not more negative than V_{CC}) ..... +6.0V to 0V

Output Current
- Continuous 50mA
- Surge 100mA

Operating Ratings

Operating Temperature Range (T_A) ..... –40°C to +85°C
Lead Temperature (T_{LEAD}) ..... +260°C
Storage Temperature Range (T_{STORE}) ..... –65°C to +150°C
Thermal Resistance (Junction-to-Ambient)
- SOIC-8 (θ_{JA})
  - Still Air ..... 160°C/W
  - 500lfpm ..... 109°C/W
- MSOP-8 (θ_{JA})
  - Still Air ..... 206°C/W
  - 500lfpm ..... 155°C/W

Thermal Resistance (Junction-to-Case)
- SOIC-8 (θ_{JC}) ..... 39°C/W
- MSOP-8 (θ_{JC}) ..... 39°C/W

10EP LVPECL DC Electrical Characteristics[2]

V_{CC} = +3.3V ±10%; V_{EE} =0V[3]

Symbol	Parameter	T_A = –40°C			T_A = +25°C			T_A = +85°C			
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Unit
I_{EE}	Power Supply Current	–	–	36	–	26	36	–	–	36	mA
V_{OH}	Output HIGH Voltage[4]	2165	2290	2415	2230	2355	2480	2290	2415	2540	mV
V_{OL}	Output LOW Voltage[4]	1365	1490	1615	1430	1555	1680	1490	1615	1740	mV
V_{IH}	Input HIGH Voltage (Single-Ended)	2090	–	2415	2155	–	2480	2215	–	2540	mV
V_{IL}	Input LOW Voltage (Single-Ended)	1365	–	1690	1430	–	1755	1490	–	1815	mV
V_{BB}	Output Voltage	1790	1890	1990	1885	1955	2055	1915	2015	2115	mV
V_{IHCMR}	Input HIGH Voltage[5] 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	µA
I_{IL}	Input LOW Current										
	RESET, CLK	0.5	–	–	0.5	–	–	0.5	–	–	µA
	/CLK	–150	–	–	–150	–	–	–150	–	–	

Notes:

1. Permanent device damage may occur is 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.
2. 10EP circuits are designed to meet the DC specifications shown in 10EP LVPECL DC EC Table after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and traverse greater than 500lfpm is maintained.
3. Input and output parameters vary 1:1 with V_{CC}.
4. All loading with 50Ω to V_{CC} –2.0V.
5. The V_{IHCMR} range is referenced to the most positive side of the differential input signal.

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10EP PECL DC Electrical Characteristics[1]

V_{CC} = +5.0V ±10%; V_{EE} =0V[2]

Symbol	Parameter	T_A = –40°C			T_A = +25°C			T_A = +85°C			
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Unit
I_{EE}	Power Supply Current	–	–	36	–	26	36	–	–	36	mA
V_{OH}	Output HIGH Voltage[3]	3865	3990	4115	3930	4055	4180	3990	4115	4250	mV
V_{OL}	Output LOW Voltage[3]	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[4] 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	µA
I_{IL}	Input LOW Current										
	RESET, CLK	0.5	–	–	0.5	–	–	0.5	–	–	µA
	/CLK	–150	–	–	–150	–	–	–150	–	–	

Notes:

1. 10EP circuits are designed to meet the DC specifications shown in 10EP PECL DC EC Table after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and traverse greater than 500lfpm is maintained.
2. Input and output parameters vary 1:1 with V_{CC}.
3. All loading with 50Ω to V_{CC} –2.0V.
4. The V_{IHCMR} range is referenced to the most positive side of the differential input signal.

10EP ECL/LVECL DC Electrical Characteristics[1]

V_{CC} = 0V; V_{EE} = –3.3V to –5.0V ±10%[2]

Symbol	Parameter	T_A = –40°C			T_A = +25°C			T_A = +85°C			
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Unit
I_{EE}	Power Supply Current	–	–	36	–	26	36	–	–	36	mA
V_{OH}	Output HIGH Voltage[3]	–1135	–1010	–885	–1070	–945	–820	–1010	–885	–760	mV
V_{OL}	Output LOW Voltage[3]	–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[4] 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	µA
I_{IL}	Input LOW Current RESET, CLK /CLK	0.5 –150	– –	– –	0.5 –150	– –	– –	0.5 –150	– –	– –	µA

Notes:

1. 10EP circuits are designed to meet the DC specifications shown in 10EP PECL DC EC Table after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and traverse greater than 500lfpm is maintained.
2. Input and output parameters vary 1:1 with V_{CC}.
3. All loading with 50Ω to V_{CC} –2.0V.
4. The V_{IHCMR} (minimum) varies 1:1 with V_{EE}. The V_{IHCMR} range is referenced to the most positive side of the differential input signal.

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100EP LVPECL DC Electrical Characteristics[1]

V_{CC} = +3.3V ±10%; V_{EE} = 0V ±10%[2]

Symbol	Parameter	T_A = –40°C			T_A = +25°C			T_A = +85°C			
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Unit
I_{EE}	Power Supply Current	–	–	36	–	30	36	–	–	40	mA
V_{OH}	Output HIGH Voltage[3]	2155	2280	2405	2155	2280	2405	2155	2280	2405	mV
V_{OL}	Output LOW Voltage[3]	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[4] 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	µA
I_{IL}	Input LOW Current										
	RESET, CLK	0.5	–	–	0.5	–	–	0.5	–	–	µA
	/CLK	–150	–	–	–150	–	–	–150	–	–	

Notes:

1. 100EP circuits are designed to meet the DC specifications shown in 100EP LVPECL DC EC Table after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and traverse greater than 500lfpm is maintained.
2. Input and output parameters vary 1:1 with V_{CC}.
3. All loading with 50Ω to V_{CC} –2.0V.
4. The V_{IHCMR} (minimum) varies 1:1 with V_{EE}. The V_{IHCMR} range is referenced to the most positive side of the differential input signal.

100EP PECL DC Electrical Characteristics[1]

V_{CC} = +5.0V ±10%; V_{EE} = 0V[2]

Symbol	Parameter	T_A = –40°C			T_A = +25°C			T_A = +85°C			
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Unit
I_{EE}	Power Supply Current	–	–	36	–	30	36	–	–	40	mA
V_{OH}	Output HIGH Voltage[3]	3855	3980	4105	3855	3980	4105	3855	3980	4105	mV
V_{OL}	Output LOW Voltage[3]	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[4] 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	µA
I_{IL}	Input LOW Current										
	RESET, CLK	0.5	–	–	0.5	–	–	0.5	–	–	µA
	/CLK	–150	–	–	–150	–	–	–150	–	–	

Notes:

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 greater than 500lfpm is maintained.
2. Input and output parameters vary 1:1 with V_{CC}.
3. All loading with 50Ω to V_{CC} –2.0V.
4. The V_{IHCMR} range is referenced to the most positive side of the differential input signal.

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100EP ECL/LVECL DC Electrical Characteristics[1]

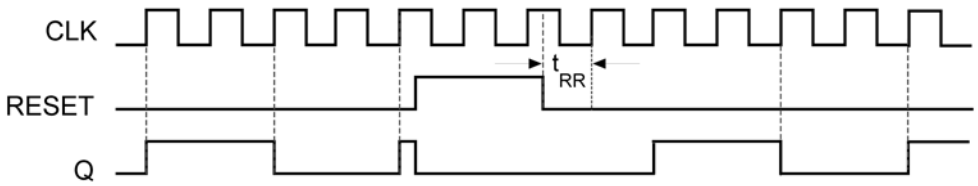
V_{CC} = 0V; V_{EE} = −3.3V to −5.0V ±10%[2]

Symbol	Parameter	T_A = –40°C			T_A = +25°C			T_A = +85°C			
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Unit
I_{EE}	Power Supply Current	–	–	36	–	30	36	–	–	40	mA
V_{OH}	Output HIGH Voltage[4]	–1145	–1020	–895	–1145	–1020	–895	–1145	–1020	–895	mV
V_{OL}	Output LOW Voltage[4]	–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[5] 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	µA
I_{IL}	Input LOW Current RESET, CLK	0.5	–	–	0.5	–	–	0.5	–	–	µA
	/CLK	–150	–	–	–150	–	–	–150	–	–	

Notes:

1. 100EP circuits are designed to meet the DC specifications shown in 100EP PECL DC EC Table after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and traverse greater than 500lfpm is maintained.
2. Input and output parameters vary 1:1 with V_{CC}.
3. All loading with 50Ω to V_{CC} –2.0V.
4. The V_{IHCMR} (minimum) varies 1:1 with V_{EE}. The V_{IHCMR} range is referenced to the most positive side of the differential input signal.

Timing Diagram



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AC Electrical Characteristics[1,2]

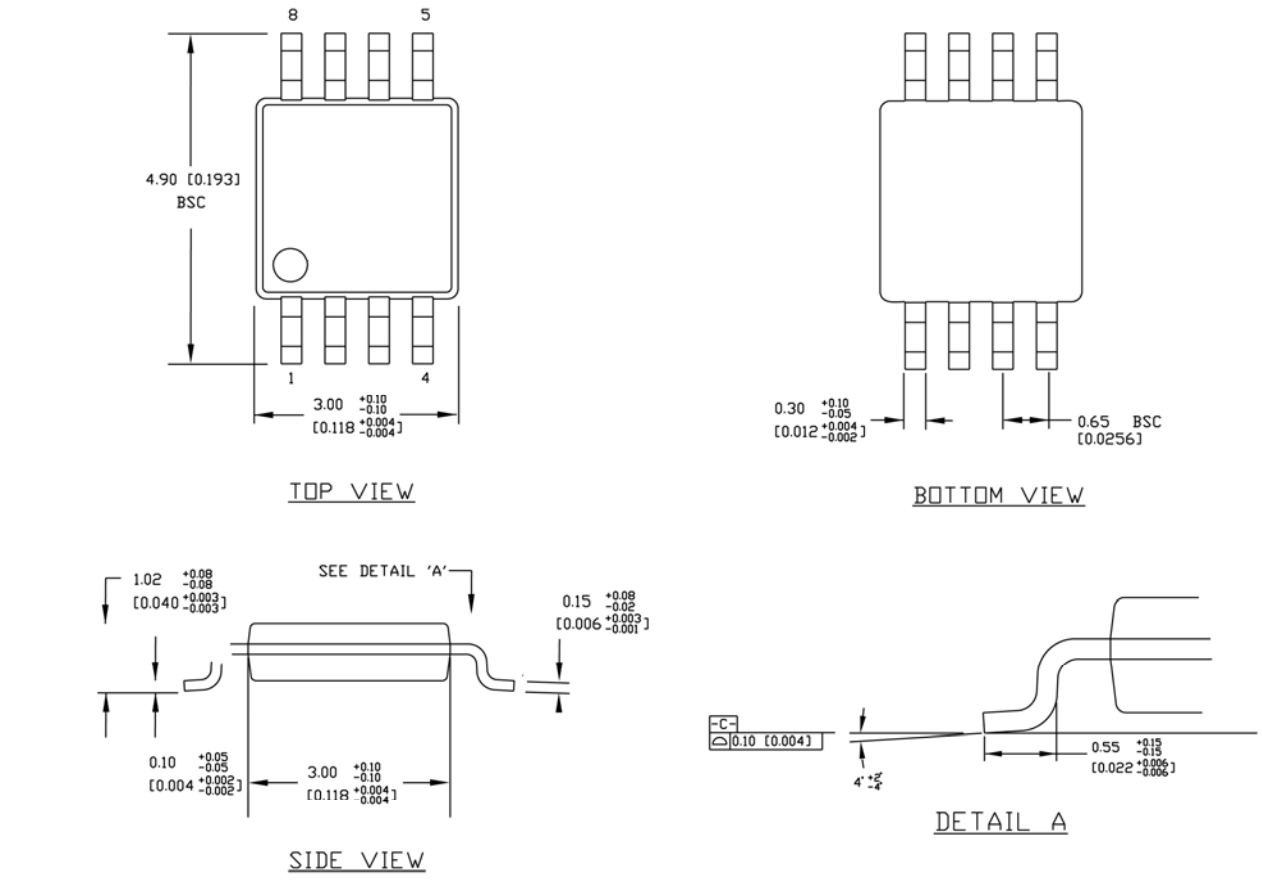
NECL: V_{CC} = 0V; V_{EE} = −3.3V to −5.0V ±10%; PECL: V_{EE} = 0V, V_{CC} = +3.3V to +5.0 ±10%.

Symbol	Parameter	T_A = –40°C			T_A = +25°C			T_A = +85°C			
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Unit
f_{MAX}	Maximum Frequency [3]	4	–	–	4	–	–	4	–	–	GHz
	Propagation Delay to Output										ps
t_{PLH}	CLK → Q	300	380	440	300	380	440	320	400	460	
t_{PHL}	(SY10EP33V) RESET → Q	300	420	470	290	420	470	320	450	500	
	(SY100EP33V) RESET → Q	310	420	470	310	420	470	320	450	500	
t_{RR}	Set/Reset Recovery[3]	200	–	–	200	100	–	200	–	–	ps
t_{PW}	Minimum Pulse Width RESET	550	–	–	550	200	–	550	–	–	ps
t_{JITTER}	Cycle-to-Cycle RMS Jitter[4]	–	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

Notes:

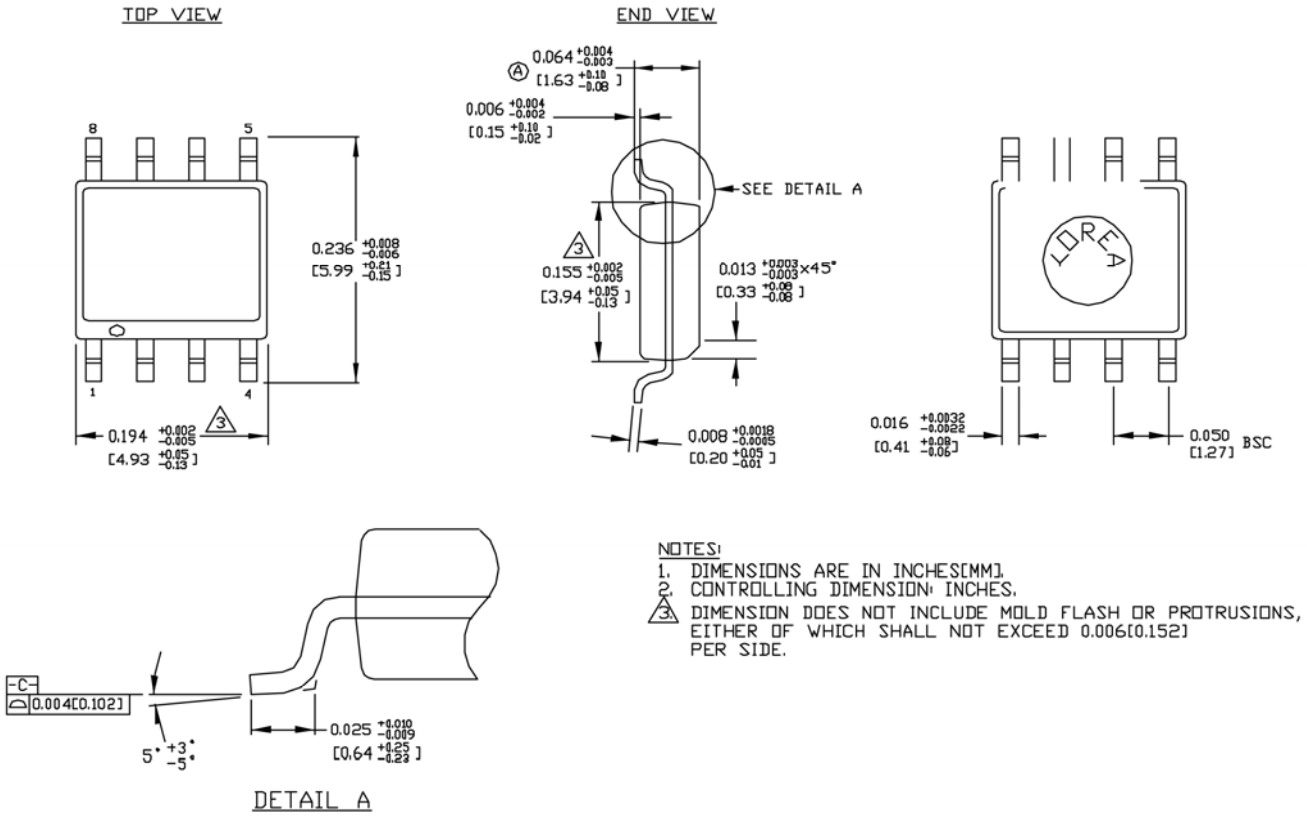
1. Measured using a 750mVsource, 50% duty cycle clock source. All loading with 50Ω to V_{CC} −2.0V.
2. Specifications for packaged product only.
3. Setup time of reset going low before the rising edge of incoming clock.
4. f_{MAX} guaranteed for functionality only. V_{OL} and V_{OH} levels are guaranteed at DC only.

Package Information



NOTES:
1. DIMENSIONS ARE IN MM [INCHES].
2. CONTROLLING DIMENSION: MM
3. DIMENSION DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS, EITHER OF WHICH SHALL NOT EXCEED 0.20 [0.008] PER SIDE.

8-pin MSOP (K8-1)



8-pin SOIC .150" WIDE (Z8-1)

MICREL, INC. 2180 FORTUNE DRIVE SAN JOSE, CA 95131 USA
TEL +1 (408) 944-0800 FAX +1 (408) 474-1000 WEB http://www.micrel.com