

## FEATURES

- Guaranteed >3GHz bandwidth over temperature
- Guaranteed <440ps propagation delay
- 3.3V and 5V power supply options
- Wide operating temperature range: -40°C to +85°C
- Available in 8-pin (3mm) MSOP and SOIC package



ECL Pro™

## DESCRIPTION

The SY10EP31V is a D flip-flop with set and reset. The device is pin and functionally equivalent to the EL31 and LVEL31 devices. With AC performance much faster than the EL31 and LVEL31 devices, the EP31V is ideal for applications requiring the fastest AC performance available. Both SET and RESET inputs are asynchronous, level triggered signals. Data enters the master portion of the flip-flop when CLK is low and is transferred to the slave, and thus the outputs, upon a positive transition of the CLK.

## PIN NAMES

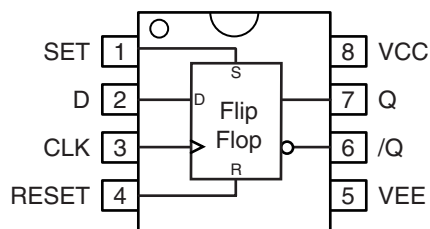
| Pin             | Function                                                                    |
|-----------------|-----------------------------------------------------------------------------|
| CLK             | ECL Clock Inputs                                                            |
| RESET           | ECL Asynchronous Reset                                                      |
| SET             | ECL Asynchronous Set                                                        |
| D               | ECL Data Input with Internal 75kΩ Pull-Down Resistor, Default State is LOW. |
| Q, /Q           | ECL Data Outputs                                                            |
| V <sub>CC</sub> | Positive Supply                                                             |
| V <sub>EE</sub> | Negative, 0 Supply                                                          |

## TRUTH TABLE

| D | SET | RESET | CLK | Q     |
|---|-----|-------|-----|-------|
| L | L   | L     | Z   | L     |
| H | L   | L     | Z   | H     |
| X | H   | L     | X   | H     |
| X | L   | H     | X   | L     |
| X | H   | H     | X   | UNDEF |

Z = LOW to HIGH Transition

## PACKAGE/ORDERING INFORMATION



8-Pin MSOP and SOIC Packages

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

| Part Number                     | Package Type | Operating Range | Package Marking                        | Lead Finish    |
|---------------------------------|--------------|-----------------|----------------------------------------|----------------|
| SY10EP31VKC                     | K8-1         | Commercial      | HP31                                   | Sn-Pb          |
| SY10EP31VKCTR <sup>(2)</sup>    | K8-1         | Commercial      | HP31                                   | Sn-Pb          |
| SY10EP31VZC                     | Z8-1         | Commercial      | HEP31V                                 | Sn-Pb          |
| SY10EP31VZCTR <sup>(2)</sup>    | Z8-1         | Commercial      | HEP31V                                 | Sn-Pb          |
| SY10EP31VKI                     | K8-1         | Industrial      | HP31                                   | Sn-Pb          |
| SY10EP31VKITR <sup>(2)</sup>    | K8-1         | Industrial      | HP31                                   | Sn-Pb          |
| SY10EP31VZI                     | Z8-1         | Industrial      | HEP31V                                 | Sn-Pb          |
| SY10EP31VZITR <sup>(2)</sup>    | Z8-1         | Industrial      | HEP31V                                 | Sn-Pb          |
| SY10EP31VKG <sup>(3)</sup>      | K8-1         | Industrial      | HP31 with Pb-Free bar-line indicator   | Pb-Free NiPdAu |
| SY10EP31VKGTR <sup>(2, 3)</sup> | K8-1         | Industrial      | HP31 with Pb-Free bar-line indicator   | Pb-Free NiPdAu |
| SY10EP31VZG <sup>(3)</sup>      | Z8-1         | Industrial      | HEP31V with Pb-Free bar-line indicator | Pb-Free NiPdAu |
| SY10EP31VZGTR <sup>(2, 3)</sup> | Z8-1         | Industrial      | HEP31V with Pb-Free bar-line indicator | Pb-Free NiPdAu |

## Notes:

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

**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> )<br>Input Voltage (V <sub>EE</sub> = 0V, V <sub>IN</sub> not more positive than V <sub>CC</sub> ) | –6.0 to 0<br>+6.0 to 0 | V<br>V |
| I <sub>OUT</sub>   | Output Current<br>–Continuous<br>–Surge                                                                                                                                                        | 50<br>100              | mA     |
| T <sub>A</sub>     | Operating Temperature Range                                                                                                                                                                    | –40 to +85             | °C     |
| T <sub>LEAD</sub>  | Lead Temperature (soldering, 20sec.)                                                                                                                                                           | +260                   | °C     |
| T <sub>store</sub> | Storage Temperature Range                                                                                                                                                                      | –65 to +150            | °C     |
| θ <sub>JA</sub>    | Thermal Resistance (Junction-to-Ambient)<br>SOIC-8 –Still Air<br>–500lfpm                                                                                                                      | 160                    | °C/W   |
|                    |                                                                                                                                                                                                | 109                    | °C/W   |
|                    | MSOP-8 –Still Air<br>–500lfpm                                                                                                                                                                  | 206                    | °C/W   |
|                    |                                                                                                                                                                                                | 155                    | °C/W   |
| θ <sub>JC</sub>    | Thermal Resistance (Junction-to-Case)<br>SOIC-8<br>MSOP-8                                                                                                                                      | 39                     | °C/W   |
|                    |                                                                                                                                                                                                | 39                     | °C/W   |

**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.

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

V<sub>CC</sub> = +5.0V ±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 <sup>(3)</sup> | —                      | 34   | 44   | —                      | 35   | 45   | —                      | 37   | 47   | mA   |
| V <sub>OH</sub> | Output HIGH Voltage <sup>(4)</sup>  | 3865                   | 3940 | 4115 | 3930                   | 4055 | 4180 | 3990                   | 4115 | 4240 | mV   |
| V <sub>OL</sub> | Output LOW Voltage <sup>(4)</sup>   | 3050                   | 3190 | 3315 | 3050                   | 3255 | 3380 | 3050                   | 3315 | 3440 | mV   |
| V <sub>IH</sub> | Input HIGH Voltage                  | 3790                   | —    | 4115 | 3855                   | —    | 4180 | 3915                   | —    | 4240 | mV   |
| V <sub>IL</sub> | Input LOW Voltage                   | 3065                   | —    | 3390 | 3130                   | —    | 3455 | 3190                   | —    | 3515 | mV   |
| I <sub>IH</sub> | Input HIGH Current                  | —                      | —    | 150  | —                      | —    | 150  | —                      | —    | 150  | μA   |
| I <sub>IL</sub> | Input LOW Current                   | 0.5                    | —    | —    | 0.5                    | —    | —    | 0.5                    | —    | —    | 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.** V<sub>CC</sub> = 0V, V<sub>EE</sub> = V<sub>EE</sub>(min) to V<sub>EE</sub>(max), all other pins floating.

**Note 4.** All loading with 50Ω to V<sub>CC</sub> – 2.0V.

**3.3V 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 <sup>(3)</sup> | —                   | 34   | 44   | —                   | 35   | 45   | —                   | 37   | 47   | mA      |
| $V_{OH}$ | Output HIGH Voltage <sup>(4)</sup>  | 2165                | 2240 | 2415 | 2230                | 2355 | 2480 | 2290                | 2415 | 2540 | mV      |
| $V_{OL}$ | Output LOW Voltage <sup>(4)</sup>   | 1350                | 1490 | 1615 | 1350                | 1555 | 1680 | 1350                | 1615 | 1740 | mV      |
| $V_{IH}$ | Input HIGH Voltage                  | 2090                | —    | 2415 | 2155                | —    | 2480 | 2215                | —    | 2540 | mV      |
| $V_{IL}$ | Input LOW Voltage                   | 1365                | —    | 1690 | 1430                | —    | 1755 | 1490                | —    | 1815 | mV      |
| $I_{IH}$ | Input HIGH Current                  | —                   | —    | 150  | —                   | —    | 150  | —                   | —    | 150  | $\mu A$ |
| $I_{IL}$ | Input LOW Current                   | 0.5                 | —    | —    | 0.5                 | —    | —    | 0.5                 | —    | —    | $\mu A$ |

**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.**  $V_{CC} = 0V$ ,  $V_{EE} = V_{EE}(\text{min})$  to  $V_{EE}(\text{max})$ , all other pins floating.

**Note 4.** All loading with  $50\Omega$  to  $V_{CC} - 2.0V$ .

**NECL 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 <sup>(3)</sup> | —                   | 34    | 44    | —                   | 35    | 45    | —                   | 37    | 47    | mA      |
| $V_{OH}$ | Output HIGH Voltage <sup>(4)</sup>  | -1135               | -1060 | -885  | -1070               | -945  | -820  | -1010               | -885  | -760  | mV      |
| $V_{OL}$ | Output LOW Voltage <sup>(4)</sup>   | -1950               | -1810 | -1685 | -1950               | -1745 | -1620 | -1950               | -1685 | -1560 | mV      |
| $V_{IH}$ | Input HIGH Voltage                  | -1210               | —     | -885  | -1145               | —     | -820  | -1085               | —     | -760  | mV      |
| $V_{IL}$ | Input LOW Voltage                   | -1935               | —     | -1610 | -1870               | —     | -1545 | -1810               | —     | -1485 | mV      |
| $I_{IH}$ | Input HIGH Current                  | —                   | —     | 150   | —                   | —     | 150   | —                   | —     | 150   | $\mu A$ |
| $I_{IL}$ | Input LOW Current                   | 0.5                 | —     | —     | 0.5                 | —     | —     | 0.5                 | —     | —     | $\mu A$ |

**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.**  $V_{CC} = 0V$ ,  $V_{EE} = V_{EE}(\text{Min})$  to  $V_{EE}(\text{Max})$ , all other pins floating.

**Note 4.** All loading with  $50\Omega$  to  $V_{CC} - 2.0V$ .

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

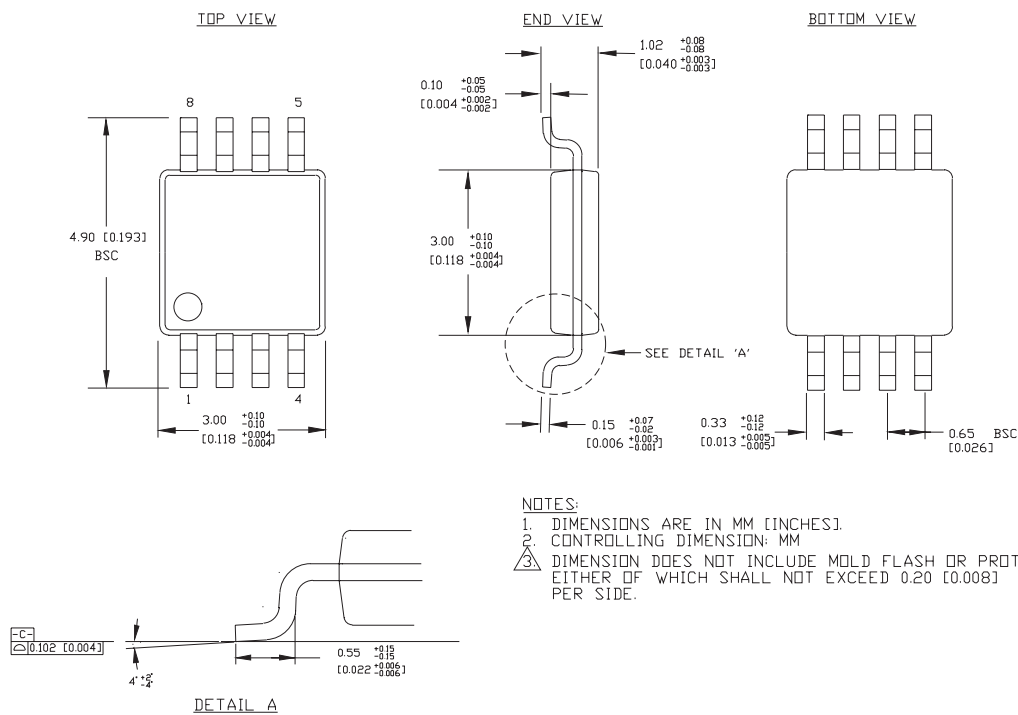
NECL operation:  $V_{CC} = 0V$ ,  $V_{EE} = -3.3V$  to  $-5.0V \pm 10\%$ ; PECL operation:  $V_{EE} = 0V$ ,  $V_{CC} = +3.3V$  to  $+5.0V \pm 10\%$ .

| 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>(2)</sup>                                 | 3                   | —          | —          | 3                   | —          | —          | 3                   | —          | —          | GHz               |
| $t_{PD}$       | Propagation Delay to Output<br>CLK → Q, /Q<br>SET, RESET → Q, /Q | 250<br>230          | 330<br>380 | 400<br>450 | 270<br>230          | 340<br>400 | 410<br>410 | 300<br>230          | 370<br>430 | 440<br>500 | ps                |
| $t_{RR}$       | Set/Reset Recovery                                               | 225                 | —          | —          | 225                 | —          | —          | 225                 | —          | —          | ps                |
| $t_S$          | Setup Time                                                       | 100                 | —          | —          | 100                 | —          | —          | 100                 | —          | —          | ps                |
| $t_H$          | Hold Time                                                        | 150                 | —          | —          | 150                 | —          | —          | 150                 | —          | —          | ps                |
| $t_{PW}$       | Minimum Pulse Width<br>SET, RESET                                | 550                 | 450        | —          | 550                 | 450        | —          | 550                 | 450        | —          | ps<br>ps          |
| $t_{JITTER}$   | Cycle-to-Cycle RMS Jitter                                        | —                   | 0.2        | <1.0       | —                   | 0.2        | <1.0       | —                   | 0.2        | <1.0       | ps <sub>RMS</sub> |
| $t_r$<br>$t_f$ | Output Rise/Fall Times Q, /Q<br>(20% to 80%)                     | 50                  | 120        | 180        | 60                  | 130        | 200        | 70                  | 150        | 220        | ps                |

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

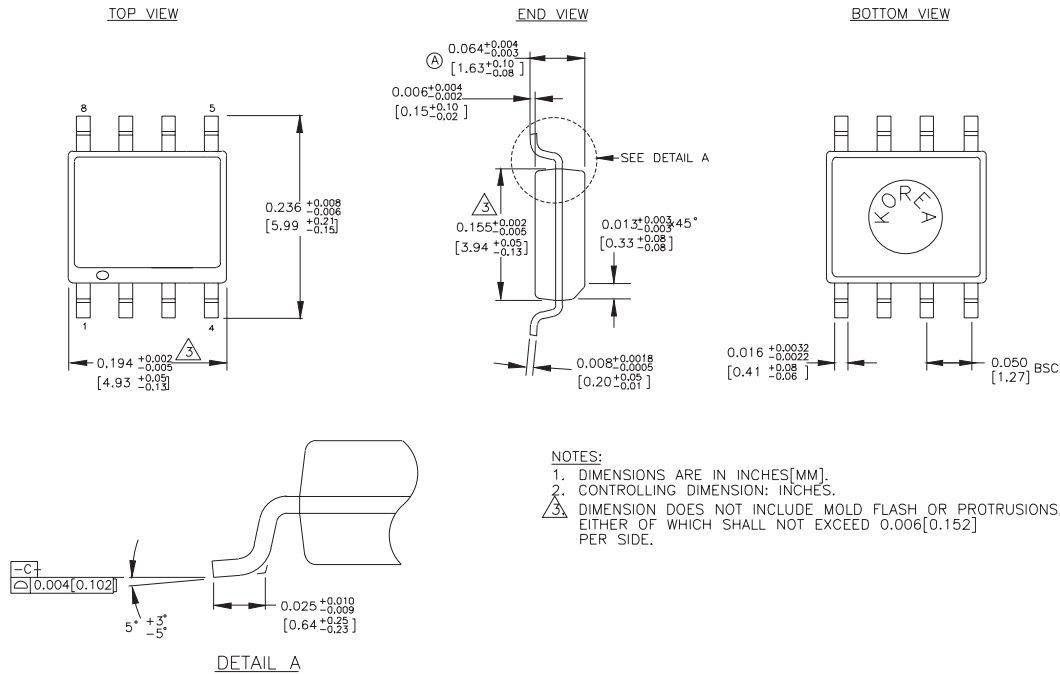
**Note 2.**  $f_{MAX}$  guaranteed for functionality only.  $V_{OL}$  and  $V_{OH}$  levels are guaranteed at DC only.

## 8-PIN MSOP (K8-1)



Rev. 01

## 8-PIN PLASTIC SOIC (Z8-1)



Rev. 03

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