# Linear Building Block – Single Comparators in SOT Packages

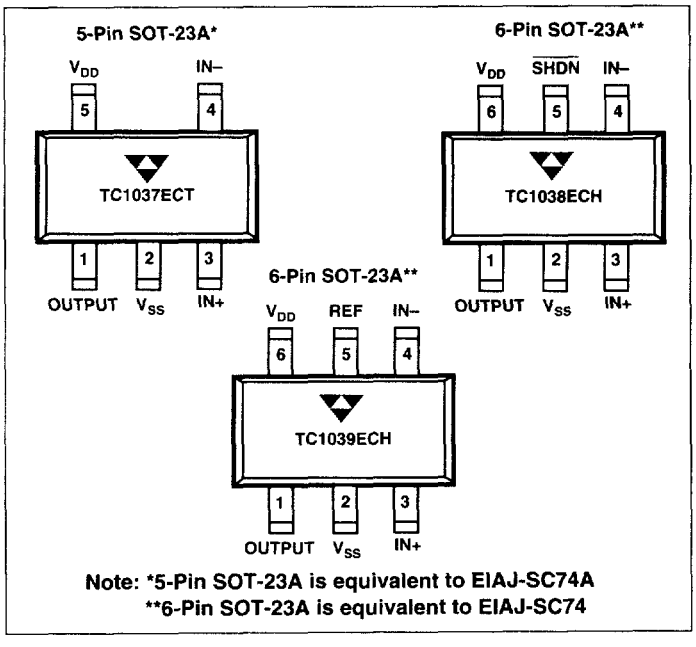
## FEATURES

- Tiny SOT-23A Packages Save Space!
- Optimized for Single-Supply Operation
- Ultra Low Input Bias Current ..... Less than 100pA
- Low Quiescent Current ..... 4 µA (TC1037)
  ..... 4 µA, 0.05 µA in Shutdown Mode (TC1038)
  ..... 6 µA (TC1039)
- Shutdown Mode (TC1038)
- 2.0% Accurate Independent Voltage Reference (TC1039)
- Rail-to-Rail Inputs and Outputs
- Operation Down to $V_{DD}$ = 1.8V

## APPLICATIONS

- Power Management Circuits
- Battery Operated Equipment
- Consumer Products

## PIN CONFIGURATION




Note: *5-Pin SOT-23A is equivalent to EIAJ-SC74A
**6-Pin SOT-23A is equivalent to EIAJ-SC74

## GENERAL DESCRIPTION

The TC1037/1038/1039 are single, low-power comparators designed for low-power applications.

These comparators are specifically designed for operation from a single supply. However, operation from dual supplies also is possible, and power supply current is independent of the magnitude of the power supply voltage. The TC1037/1038/1039 operate from two 1.5V alkaline cells down to $V_{DD}$ = 1.8V. Active supply current is 4 µA for the TC1037/1038 and 6 µA for the TC1039. Input and output swing of these devices is rail-to-rail.

An active low shutdown input, $\overline{SHDN}$, is available on the TC1038 and disables the comparator, placing its output in a high-impedance state. The TC1038 draws only 0.05 µA (typical) when the shutdown mode is active.

An internally biased 1.20V bandgap reference is included in the TC1039. The reference is accurate to 2.0 percent tolerance. This reference is independent of the comparator in the TC1039.

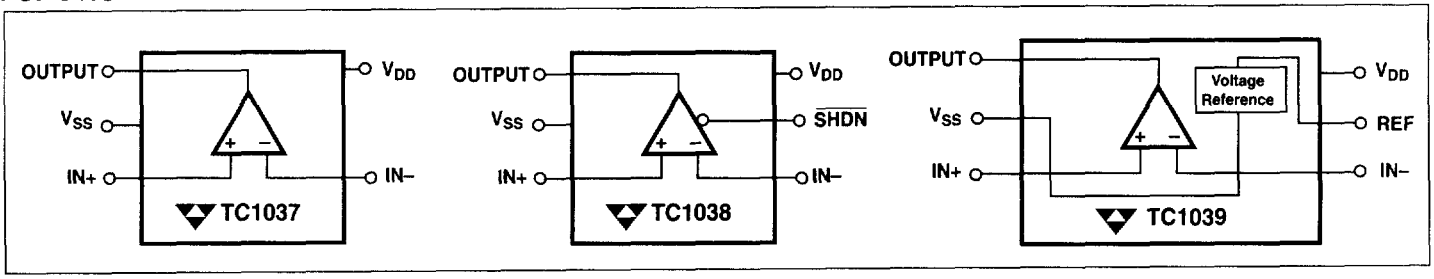
Packaged in a 5-pin SOT-23A (TC1037) or 6-pin SOT-23A (TC1038/1039), these single comparators are ideal for applications requiring high integration, small size, and low power.

## ORDERING INFORMATION

| Part No. | Package | Temp. Range |
|---|---|---|
| TC1037CECT | 5-Pin SOT-23A | – 40°C to +85°C |
| TC1038CECH | 6-Pin SOT-23A | – 40°C to +85°C |
| TC1039CECH | 6-Pin SOT-23A | – 40°C to +85°C |

***TC1043EV Evaluation Kit for Linear Building Blocks Family***

## FUNCTIONAL BLOCK DIAGRAM



# TC1037/1038/1039

## ABSOLUTE MAXIMUM RATINGS*

Supply Voltage ..... 6.0V
Voltage on Any Pin: (With Respect to Supplies) ..... ($V_{SS}$ – 0.3V) to ($V_{DD}$ +0.3V)
Operating Temperature Range: ..... – 40°C to + 85°C
Storage Temperature Range ..... – 55°C to +150°C
Lead Temperature (Soldering, 10 sec) ..... +260°C

* Static-sensitive device. Unused devices must be stored in conductive material. Protect devices from static discharge and static fields. Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to Absolute Maximum Rating Conditions for extended periods may affect device reliability.

**ELECTRICAL CHARACTERISTICS:** Typical values apply at 25°C and $V_{DD}$ = 3.0V. Minimum and maximum values apply for $V_{DD}$ = 1.8V to 5.5V, and $T_A$ = –40°C to +85°C, unless otherwise specified.

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{DD}$ | Supply Voltage | | 1.8 | — | 5.5 | V |
| $I_Q$ | Supply Current, Operating (TC1039) | All Outputs Unloaded | — | 6 | 10 | µA |
| | (TC1037/8) | $\overline{SHDN}$ = $V_{DD}$ for TC1038 | — | 4 | 8 | µA |
| $I_{SHDN}$ | (TC1038 Only) | $\overline{SHDN}$ = $V_{SS}$ | — | — | 0.3 | µA |
| **Shutdown Input (TC1038 Only)** | | | | | | |
| $V_{IH}$ | Input High Threshold | | 80% $V_{DD}$ | — | — | V |
| $V_{IL}$ | Input Low Threshold | | — | — | 20% $V_{DD}$ | V |
| $I_{SI}$ | Shutdown Input Current | | — | — | ±100 | nA |
| **Comparator** | | | | | | |
| $R_{OUT(SD)}$ | Output Resistance in Shutdown | $\overline{SHDN}$ = $V_{SS}$ (TC1038 Only) | 20 | — | — | M |
| $C_{OUT(SD)}$ | Output Capacitance in Shutdown | $\overline{SHDN}$ = $V_{SS}$ (TC1038 Only) | — | — | 5 | pF |
| $T_{SEL}$ | Select Time | $V_{OUT}$ Valid from $\overline{SHDN}$ = $V_{IH}$ $R_L$ =10K to $V_{SS}$ (TC1038 Only) | — | 20 | — | µsec |
| $T_{DESEL}$ | Deselect Time | $V_{OUT}$ Invalid from $\overline{SHDN}$ = $V_{IL}$ $R_L$ =10K to $V_{SS}$ (TC1038 Only) | — | 500 | — | nsec |
| $V_{ICMR}$ | Common Mode Input Voltage Range | | $V_{SS}$ – 0.2 | — | $V_{DD}$ +0.2 | V |
| $V_{OS}$ | Input Offset Voltage | $V_{DD}$ = 3V, $V_{CM}$ =1.5V, $T_A$ = 25°C | –5 | — | +5 | mV |
| | | $T_A$ = –40°C to 85°C | –5 | | +5 | mV |
| $I_B$ | Input Bias Current | $T_A$ = 25°C, IN+, IN– = $V_{DD}$ to $V_{SS}$ | — | — | ±100 | pA |
| $V_{OH}$ | Output High Voltage | $R_L$ = 10K to $V_{SS}$ | $V_{DD}$ – 0.3 | — | — | V |
| $V_{OL}$ | Output Low Voltage | $R_L$ = 10K to $V_{DD}$ | — | — | 0.3 | V |
| CMRR | Common Mode Rejection Ratio | $T_A$ = 25°C, $V_{DD}$ = 5V $V_{CM}$ = $V_{DD}$ to $V_{SS}$ | 66 | — | — | dB |
| PSRR | Power Supply Rejection Ratio | $T_A$ = 25°C, $V_{CM}$ =1.2V $V_{DD}$ = 1.8V to 5V | 60 | — | — | dB |
| $I_{SRC}$ | Output Source Current | IN+ = $V_{DD}$, IN– = $V_{SS}$ Output Shorted to $V_{SS}$ $V_{DD}$ = 1.8V | 1 | — | — | mA |
| $I_{SINK}$ | Output Sink Current | IN+ = $V_{SS}$, IN– = $V_{DD}$, Output Shorted to $V_{DD}$ $V_{DD}$ = 1.8V | 2 | — | — | mA |
| $t_{PD1}$ | Response Time | 100mV Overdrive, $C_L$ = 100pF | — | 4 | — | µsec |
| $t_{PD2}$ | Response Time | 10mV Overdrive, $C_L$ = 100pF | — | 6 | — | µsec |
| $V_{REF}$ | Reference Voltage | | 1.176 | 1.200 | 1.224 | V |
| $I_{REF(SOURCE)}$ | Source Current | | 50 | — | — | µA |
| $I_{REF(SINK)}$ | Sink Current | | 50 | — | — | µA |
| $C_{L(REF)}$ | Load Capacitance | | — | — | 100 | pF |
| $N_{VREF}$ | Voltage Noise | 100 Hz to 100 KHz | — | 20 | — | µVRMS |
| | Noise Density | 1 KHz | — | 1.0 | — | $\mu V/\sqrt{Hz}$ |