# MICREL
*The Infinite Bandwidth Company™*

## 5V TTL-TO-DIFFERENTIAL PECL AND DIFFERENTIAL PECL-TO-TTL TRANSLATOR

### SY10ELT28
### SY100ELT28

## FEATURES

- **Guaranteed AC parameters over temperature:**
  - **$f_{MAX}$ > 160MHz (TTL)**
  - **< 5.5ns PECL-to-TTL propagation delay**
  - **< 1.5ns $t_r$ / $t_f$; PECL output**
  - **< 1.3ns TTL-to-PECL propagation delay**
- **Wide temperature range: −40°C to +85°C**
- **5V power supply**
- **$Q_{TTL}$ output will default low with inputs left open or < 1.3V**
- **$Q_{ECL}$ output will default high with inputs left open**
- **Internal PECL input pulldown resistors**
- **Available in 8-pin MSOP and SOIC packages**

## DESCRIPTION

The SY10/100ELT28 is a differential PECL-to-TTL translator and a TTL-to-differential PECL translator in a single package. Because PECL (Positive ECL) levels are used, only +5V and ground are required. The small outline 8-pin package and the dual translation design of the ELT28 makes it ideal for applications which are sending and receiving signals across a backplane.

## PIN CONFIGURATION/BLOCK DIAGRAM
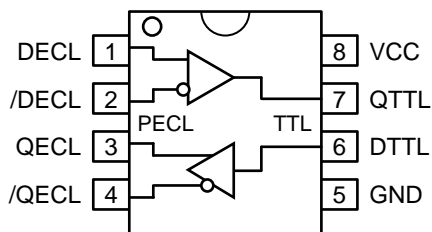


**TOP VIEW**
**(Available in MSOP or SOIC package)**

## PIN NAMES

| Pin | Function |
|---|---|
| DTTL | TTL Inputs |
| QTTL | TTL Outputs |
| DECL, /DECL | PECL Differential Inputs |
| QECL, /QECL | PECL Differential Outputs |
| $V_{CC}$ | Positive Supply |
| GND | Ground |

**1**

## ABSOLUTE MAXIMUM RATINGS[1]

| Symbol | Rating | | Value | Unit |
|--------|--------|--|-------|------|
| $V_{CC}$ | Power Supply Voltage | | −0.5 to +7.0 | V |
| $V_{IN}$ | Input Voltage | | 0 to +6.0 | V |
| $I_{OUT}$ | PECL Output Current | −Continuous<br>−Surge | 50<br>100 | mA |
| $T_A$ | Operating Temperature Range | | −40 to +85 | °C |
| $T_{store}$ | Storage Temperature Range | | −65 to +150 | °C |
| $\theta_{JA}$ | Package Thermal Resistance<br>(Junction-to-Ambient) | −Still-Air (SOIC)<br>−500lfpm (SOIC)<br><br>−Still-Air (MSOP)<br>−500lfpm (MSOP) | 160<br>109<br><br>206<br>155 | °C/W<br><br><br>°C/W |
| $\theta_{JC}$ | Package Thermal Resistance<br>(Junction-to-Case) | (SOIC)<br>(MSOP) | 39<br>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.

## DC ELECTRICAL CHARACTERISTICS[1]

$V_{CC}$ = +5V ±10%; $V_{EE}$ = 0V

| Symbol | Parameter | $T_A = -40°C$ | | | $T_A = +25°C$ | | | $T_A = +85°C$ | | | Unit | Condition |
|--------|-----------|------|------|------|------|------|------|------|------|------|------|-----------|
| | | Min. | Typ. | Max. | Min. | Typ. | Max. | Min. | Typ. | Max. | | |
| $V_{CC}$ | Power Supply Voltage | 4.75 | 5.0 | 5.5 | 4.75 | 5.0 | 5.5 | 4.75 | 5.0 | 5.5 | V | |
| $I_{CC}$ | Power Supply Current | — | 23 | 40 | — | 22 | 40 | — | 25 | 40 | mA | |
| $C_{IN}$ | Input Capacitance (SOIC)<br>(MSOP) | —<br>— | —<br>— | —<br>— | —<br>— | 0.75<br>1.1 | —<br>— | —<br>— | —<br>— | —<br>— | pF<br>pF | |

**NOTE:**

1. 10/100KELT 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. Input and output parameters vary 1:1 with $V_{CC}$. $V_{CC}$ can vary ±0.25V.

## 10K PECL DC ELECTRICAL CHARACTERISTICS[1]

$V_{CC}$ = +5.0V ±10%

| Symbol | Parameter | $T_A = -40°C$ | | | $T_A = +25°C$ | | | $T_A = +85°C$ | | | Unit | Condition |
|--------|-----------|------|------|------|------|------|------|------|------|------|------|-----------|
| | | Min. | Typ. | Max. | Min. | Typ. | Max. | Min. | Typ. | Max. | | |
| $V_{OH}$ | Output HIGH Voltage | 3920 | 4010 | 4110 | 4020 | 4105 | 4190 | 4090 | 4185 | 4280 | mV | 50Ω $V_{CC}$−2V |
| $V_{OL}$ | Output LOW Voltage | 3050 | 3200 | 3350 | 3050 | 3210 | 3370 | 3050 | 3227 | 3405 | mV | 50Ω $V_{CC}$−2V |
| $V_{IH}$ | Input HIGH Voltage (Single-Ended) | 3770 | — | 4110 | 3870 | — | 4190 | 3940 | — | 4280 | mV | |
| $V_{IL}$ | Input LOW Voltage (Single-Ended) | 3050 | — | 3500 | 3050 | — | 3520 | 3050 | — | 3555 | mV | |
| $V_{IHCMR}$ | Input HIGH Voltage Common Mode Range[2] | 1.2 | — | $V_{CC}$ | 1.2 | — | $V_{CC}$ | 1.2 | — | $V_{CC}$ | mV | |

**NOTES:**

1. 10/100KELT 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.

2. $V_{IHCMR}$ (Min) varies 1:1 with GND, $V_{IHCMR}$ (Max) varies 1:1 with $V_{CC}$.

## 100K PECL DC ELECTRICAL CHARACTERISTICS[1]

$V_{CC}$ = +5.0V ±10%

| Symbol | Parameter | $T_A$ = −40°C | | | $T_A$ = +25°C | | | $T_A$ = +85°C | | | Unit | Condition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | Min. | Typ. | Max. | Min. | Typ. | Max. | | |
| $V_{OH}$ | Output HIGH Voltage | 3915 | 3995 | 4120 | 3975 | 4045 | 4120 | 3975 | 4050 | 4120 | mV | 50Ω $V_{CC}$−2V |
| $V_{OL}$ | Output LOW Voltage | 3170 | 3305 | 3445 | 3190 | 3295 | 3380 | 3190 | 3295 | 3380 | mV | 50Ω $V_{CC}$−2V |
| $V_{IH}$ | Input HIGH Voltage (Single-Ended) | 3835 | — | 4120 | 3835 | — | 4120 | 3835 | — | 4120 | mV | |
| $V_{IL}$ | Input LOW Voltage (Single-Ended) | 3190 | — | 3525 | 3190 | — | 3525 | 3190 | — | 3525 | mV | |
| $V_{IHCMR}$ | Input HIGH Voltage Common Mode Range[2] | 2.2 | — | $V_{CC}$ | 2.2 | — | $V_{CC}$ | 2.2 | — | $V_{CC}$ | V | |

**NOTES:**

1. 10/100KELT 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.

2. $V_{IHCMR}$ (Min) varies 1:1 with GND, $V_{IHCMR}$ (Max) varies 1:1 with $V_{CC}$.

## TTL DC ELECTRICAL CHARACTERISTICS[1]

$V_{CC}$ = +5.0V ±10%

| Symbol | Parameter | $T_A$ = −40°C | | | $T_A$ = +25°C | | | $T_A$ = +85°C | | | Unit | Condition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | Min. | Typ. | Max. | Min. | Typ. | Max. | | |
| $I_{IH}$ | Input HIGH Current | — | 10 | 20 | — | — | 20 | — | — | 20 | μA | $V_{IN}$ = 2.7V |
| | | — | — | 100 | — | — | 100 | — | — | 100 | μA | $V_{IN}$ = $V_{CC}$ |
| $I_{IL}$ | Input LOW Current | — | — | −600 | — | — | −600 | — | — | −600 | μA | $V_{IN}$ = 0.5V |
| $V_{IH}$ | Input HIGH Voltage | 2.0 | — | — | 2.0 | — | — | 2.0 | — | — | V | |
| $V_{IL}$ | Input LOW Voltage | — | — | 0.8 | — | — | 0.8 | — | — | 0.8 | V | |
| $V_{IK}$ | Input Clamp Diode Voltage | — | — | −1.2 | — | — | −1.2 | — | — | −1.2 | V | $I_{IK}$ = −18mA |
| $V_{OH}$ | Output HIGH Voltage | 2.4 | 2.9 | — | 2.4 | 3.4 | — | 2.4 | 3.9 | — | V | $I_{OH}$ = −3.0mA |
| $V_{OL}$ | Output LOW Voltage | — | 0.29 | 0.5 | — | 0.26 | 0.5 | — | 0.27 | 0.5 | V | $I_{OL}$ = 24mA |
| $I_{OSC}$ | Output Short-Circuit Current | −175 | — | −60 | −175 | — | −60 | −175 | — | −60 | μA | $V_O$ = 0V |

**NOTES:**

1. 10/100KELT 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.

## AC ELECTRICAL CHARACTERISTICS

$V_{CC}$ = +5.0V ±10%

| Symbol | Parameter | | $T_A$ = −40°C | | | $T_A$ = +25°C | | | $T_A$ = +85°C | | | Unit | Condition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | Min. | Typ. | Max. | Min. | Typ. | Max. | | |
| $f_{MAX}$ | MaximumFrequency[1] | PECL | 700 | — | — | 700 | — | — | 700 | — | — | MHz | |
| | | TTL | 160 | — | — | 160 | — | — | 160 | — | — | MHz | |
| $t_{PLH}$ | Propagation Delay | DECL → QTTL | 1.5 | — | 5.5 | 1.5 | — | 5.5 | 1.5 | — | 5.5 | ns | $C_L$ = 20pF |
| | | DTTL → QECL | 0.2 | — | 1.2 | 0.2 | 1.2 | 1.5 | 0.2 | — | 1.35 | ns | 50Ω to$V_{CC}$−2V |
| $t_{PHL}$ | Propagation Delay | DECL → QTTL | 1.5 | — | 5.5 | 1.5 | — | 5.5 | 1.5 | — | 5.5 | ns | $C_L$ = 20pF |
| | | DTTL → QECL | 0.2 | — | 1.2 | 0.2 | 1.2 | 1.5 | 0.2 | — | 1.35 | ns | 50Ω to$V_{CC}$−2V |
| $V_{PP}$ | PECL Input VoltageSwing[2] (Single-Ended)[3] | | 200 | 800 | 1000 | 200 | 800 | 1000 | 200 | 800 | 1000 | mV | |
| $t_r$ $t_f$ | QECL Output Rise/Fall Times (20% to 80%) | | 0.15 | — | 1.5 | 0.15 | 0.3 | 1.5 | 0.15 | — | 1.5 | ns | 50Ω to $V_{CC}$ −2V |
| | QTTL Output Rise/Fall Times (10% to 90%) | TTL | — | 1.0 | — | — | 0.80 | — | — | 0.7 | — | ns | $C_L$ = 20pF; TTL Output |

**NOTES:**

1. $f_{MAX}$ is defined as the maximum toggle frequency.

2. $V_{PP}$ (Min) is the minimum input swing for which AC parameters are guaranteed.

3. See "Timing Waveform."

## TIMING WAVEFORM



Q(0:9)

/Q(0:9)

150mV to 1200mV
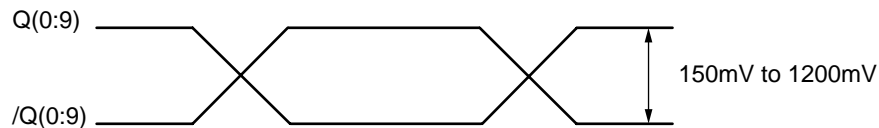
## PRODUCT ORDERING CODE

| Ordering Code | Package Type | Operating Range | Package Marking |
|---|---|---|---|
| SY10ELT28ZI | Z8-1 | Industrial | XEL28 |
| SY10ELT28ZITR* | Z8-1 | Industrial | XEL28 |
| SY100ELT28ZI | Z8-1 | Industrial | XEL28 |
| SY100ELT28ZITR* | Z8-1 | Industrial | XEL28 |

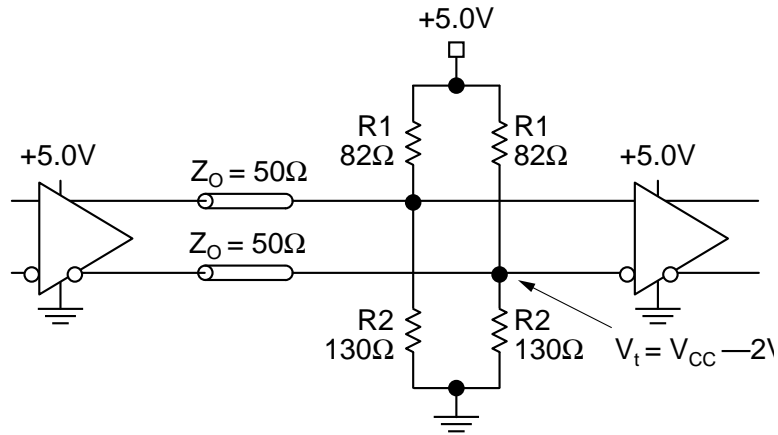| Ordering Code | Package Type | Operating Range | Package Marking |
|---|---|---|---|
| SY10ELT28KI | K8-1 | Industrial | XL28 |
| SY10ELT28KITR* | K8-1 | Industrial | XL28 |
| SY100ELT28KI | K8-1 | Industrial | XL28 |
| SY100ELT28KITR* | K8-1 | Industrial | XL28 |

*Tape and Reel

## TERMINATION RECOMMENDATIONS

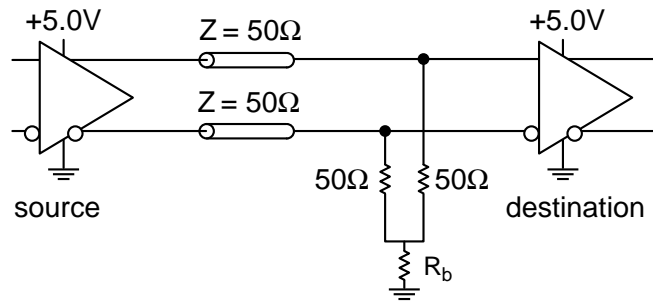**Figure 1. +5V PECL Parallel Termination–Thevenin Equivalent**
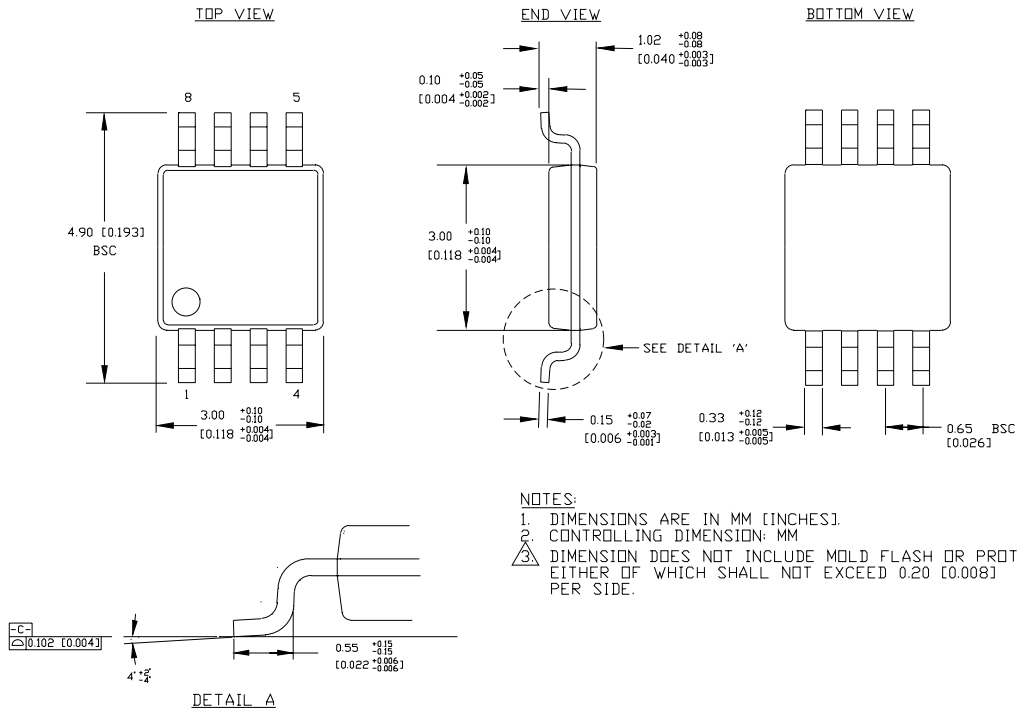
**Figure 2. +5V PECL Three-Resistor "Y–Termination"**
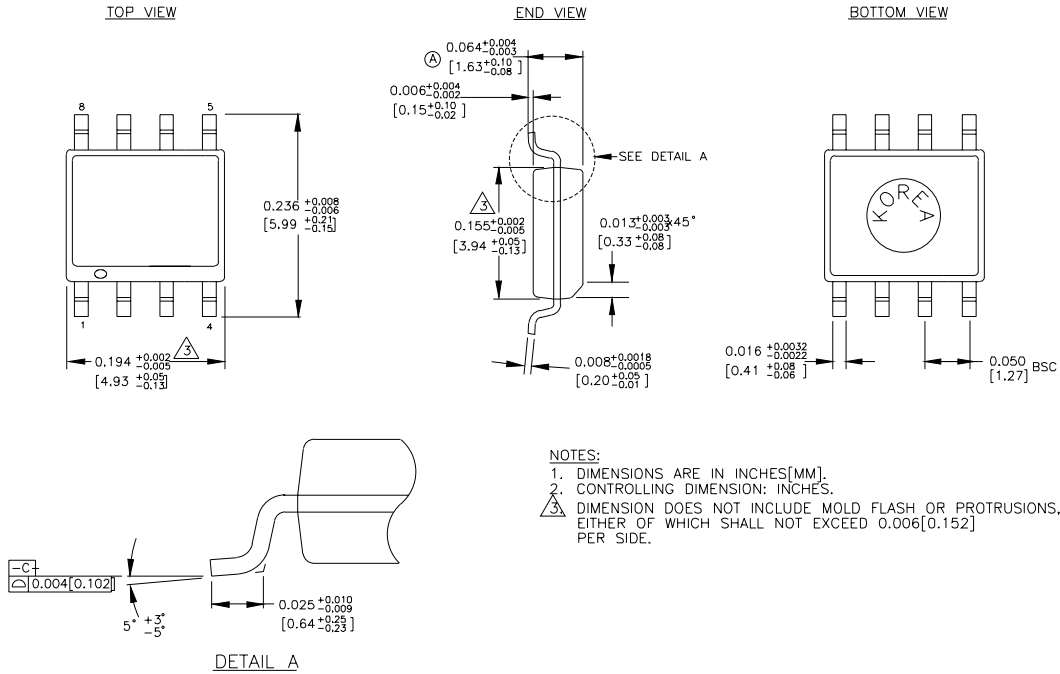
**Notes:**

1. Power-saving alternative to 4-resistor, Thevenin termination.

2. Place termination resistors as close to destination inputs as possible.

3. $R_b$ resistor sets the DC bias voltage, equal to $V_t$. For 5.0V supply, $R_b$ value is 110Ω.

# 8 LEAD MSOP (K8-1)

TOP VIEW

END VIEW

BOTTOM VIEW

8   5

1   4

4.90 [0.193]
BSC

3.00  +0.10
      -0.10
[0.118 +0.004
       -0.004]

1.02  +0.08
      -0.08
[0.040 +0.003
       -0.003]

0.10  +0.05
      -0.05
[0.004 +0.002
       -0.002]

3.00  +0.10
      -0.10
[0.118 +0.0004
       -0.0004]

SEE DETAIL 'A'

0.15  +0.07
      -0.02
[0.006 +0.003
       -0.001]

0.33  +0.12
      -0.12
[0.013 +0.005
       -0.005]

0.65  BSC
[0.026]

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.

-C-
[0.102 [0.004]]

4° +2°
   -4°

0.55  +0.15
      -0.15
[0.022 +0.006
       -0.006]

DETAIL A

Rev. 01

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

TOP VIEW

END VIEW

BOTTOM VIEW

8          5

1          4

0.236 +0.008 -0.006
[5.99 +0.21 -0.15]

0.194 +0.002 -0.005
[4.93 +0.05 -0.13]

0.064 +0.004 -0.003
[1.63 +0.10 -0.08]

0.006 +0.004 -0.002
[0.15 +0.10 -0.02]

SEE DETAIL A

0.155 +0.002 -0.005
[3.94 +0.05 -0.13]

0.013 +0.003 -0.003 45°
[0.33 +0.08 -0.08]

0.008 +0.0018 -0.0005
[0.20 +0.05 -0.01]

KOREA

0.016 +0.0032 -0.0022
[0.41 +0.08 -0.06]

0.050 BSC
[1.27]

-C-
0.004[0.102]

5° +3° -5°

0.025 +0.010 -0.009
[0.64 +0.25 -0.23]

DETAIL A

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 0.006[0.152] PER SIDE.

Rev. 03