

**FEATURES**

- 2.5GHz min.  $f_{MAX}$
- 2.3V to 5.7V power supply
- Single bit register memory
- Synchronizes 1 bit of data to a clock
- Optimized to work with SuperLite™ family
- Fully differential
- Accepts CML, PECL, LVPECL input logic levels
- Source terminated CML outputs for fast edge rates
- Available in a tiny 10-pin MSOP

**SuperLite™****DESCRIPTION**

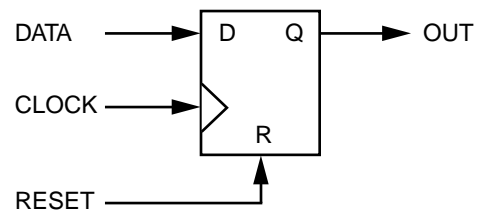
The SY55852U is a flip-flop used to synchronize data to a clock. Its differential output will reproduce and remember the value on its input at the rising edge of the clock. In addition, an asynchronous, level sensitive reset is provided. For a synchronous reset, the SY55851U AnyGate® can be used.

SY55852U inputs can be terminated with a single resistor between the true and complement pins of a given input.

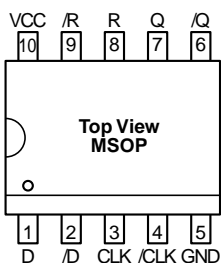
The SY55852U is a member of Micrel's SuperLite™ family of high-speed CML logic. This family features very small packaging and 2.3V to 5.7V operation.

**APPLICATIONS**

- High-speed logic
- OC-48 communication systems

**FUNCTIONAL BLOCK DIAGRAM**

## PACKAGE/ORDERING INFORMATION



10-Pin MSOP (K10-1)

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

| Part Number                    | Package Type | Operating Range | Package Marking                        | Lead Finish    |
|--------------------------------|--------------|-----------------|--|----------------|
| SY55852UKC                     | K10-1        | Commercial      | 55852U                                 | Sn-Pb          |
| SY55852UKCTR <sup>(2)</sup>    | K10-1        | Commercial      | 55852U                                 | Sn-Pb          |
| SY55852UKI                     | K10-1        | Industrial      | 55852U                                 | Sn-Pb          |
| SY55852UKITR <sup>(2)</sup>    | K10-1        | Industrial      | 55852U                                 | Sn-Pb          |
| SY55852UKG <sup>(3)</sup>      | K10-1        | Industrial      | 55852U with Pb-Free bar line indicator | NiPdAu Pb-Free |
| SY55852UKGTR <sup>(2, 3)</sup> | K10-1        | Industrial      | 55852U with Pb-Free bar line indicator | NiPdAu Pb-Free |

#### Notes:

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

## PIN DESCRIPTION

| Pin Number | Pin Name  | Pin Function   |
|------------|-----------|--|
| 1, 2       | D, /D     | CML/PECL/LVPECL Input (Differential): This is the single bit of data that gets clocked in and remembered.  |
| 3, 4       | CLK, /CLK | CML/PECL/LVPECL Input (Differential): The rising edge of this signal is the clock signal that determines when the Boolean value at the data input gets stored. |
| 5          | GND       | Ground.  |
| 6, 7       | /Q, Q     | CML Output (Differential): This is the output of the flip-flop.  |
| 8, 9       | R, /R     | CML/PECL/LVPECL Input (Differential): This is an asynchronous active high level reset, that forces the flip-flop into a known state, namely zero.              |
| 10         | VCC       | Power Supply.  |

## TRUTH TABLE

| D | CLK | R | Q         | /Q         |
|---|-----|---|-----------|------------|
| X | X   | 1 | 0         | 1          |
| X | 0   | 0 | $Q_{N-1}$ | $/Q_{N-1}$ |
| X | 1   | 0 | $Q_{N-1}$ | $/Q_{N-1}$ |
| 0 |     | 0 | 0         | 1          |
| 1 |     | 0 | 1         | 0          |

## FUNCTIONAL DESCRIPTION

### Establishing Static Logic Inputs

The true pin of an input pair is internally biased to ground through a 75kΩ resistor. The complement pin of an input pair is internally biased halfway between  $V_{CC}$  and ground by a voltage divider consisting of two 75kΩ resistors. To keep an input at static logic zero at  $V_{CC} > 3.0V$ , leave both inputs unconnected. For  $V_{CC} \leq 3.0V$ , connect the

complement inputs to  $V_{CC}$  and leave the true inputs unconnected. To make an input static logic one, connect the true input to  $V_{CC}$ , leave the complement input unconnected. These are the only safe ways to cause inputs to be at a static value. In particular, no input pin should be directly connected to ground. All NC (no connect) pins should be unconnected.

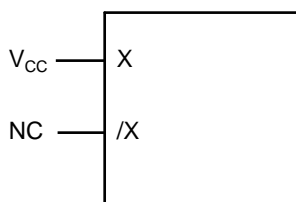


Figure 1. Hard Wiring a Logic “1” (1)

**Note 1.** X is either D, CLK, R input. /X is either /D, /CLK, /R input.

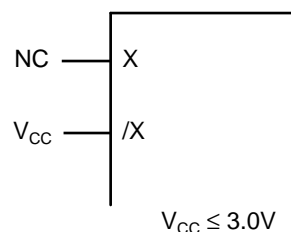
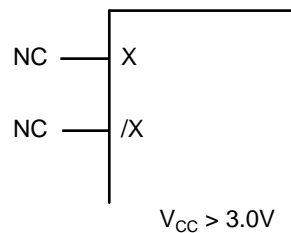


Figure 2. Hard Wiring a Logic “0” (1)

### Absolute Maximum Ratings<sup>(1)</sup>

|                                       |                                  |
|---------------------------------------|----------------------------------|
| Supply Voltage ( $V_{CC}$ )           | -0.5V to +6.0V                   |
| CML Output Voltage                    | $V_{CC} - 1.0$ to $V_{CC} + 0.5$ |
| Lead Temperature (soldering, 20 sec.) | 260°C                            |
| Storage Temperature ( $T_S$ )         | -65°C to +150°C                  |

### Operating Ratings<sup>(2)</sup>

|                               |                          |
|-------------------------------|--------------------------|
| Supply Voltage ( $V_{IN}$ )   | -0.5 to $V_{CC} + 0.5$ V |
| Ambient Temperature ( $T_A$ ) | -40°C to +85°C           |
| Package Thermal Resistance    |                          |
| MSOP ( $\theta_{JA}$ )        |                          |
| Still-Air                     | 113°C/W                  |
| 500lpm                        | 96°C/W                   |

**Notes:**

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.
2. The data sheet limits are not guaranteed if the device is operated beyond the operating ratings.

## DC ELECTRICAL CHARACTERISTICS<sup>(1)</sup>

$V_{CC} = +2.3$ V to +5.7V; GND = 0V;  $T_A = -40$ °C to +85°C; unless otherwise noted.

| Symbol   | Parameter            | Condition | Min | Typ | Max | Units |
|----------|----------------------|-----------|-----|-----|-----|-------|
| $V_{CC}$ | Power Supply Voltage |           | 2.3 |     | 5.7 | V     |
| $I_{CC}$ | Power Supply Current |           |     |     | 36  | mA    |

**Note:**

1. The device is guaranteed to meet the DC specifications, shown in the table above, after thermal equilibrium has been established. The device is tested in a socket such that transverse airflow of  $\geq 500$ lpm is maintained.

## CML DC ELECTRICAL CHARACTERISTICS<sup>(1)</sup>

$V_{CC} = +2.3$ V to +5.7V; GND = 0V;  $T_A = -40$ °C to +85°C; unless otherwise noted.

| Symbol      | Parameter                  | Condition   | Min              | Typ                     | Max              | Units       |
|-------------|----------------------------|---|------------------|-------------------------|------------------|-------------|
| $V_{ID}$    | Differential Input Voltage |   | 100              |                         |                  | mV          |
| $V_{IH}$    | Input HIGH Voltage         | <b>Note 2</b>   | 1.6              | —                       | $V_{CC}$         | V           |
| $V_{IL}$    | Input LOW Voltage          | <b>Note 2</b>   | 1.5              | —                       | $V_{CC} - 0.1$   | V           |
| $V_{OH}$    | Output HIGH Voltage        | No Load   | $V_{CC} - 0.020$ | $V_{CC} - 0.010$        | $V_{CC}$         | V           |
| $V_{OL}$    | Output LOW Voltage         | No Load   | $V_{CC} - 0.97$  | $V_{CC} - 0.825$        | $V_{CC} - 0.660$ | V           |
| $V_{OS}$    | Output Voltage Swing       | No Load, <b>Note 3</b><br>50Ω Environment, <b>Note 4</b><br>100Ω Environment, <b>Note 5</b> | 0.660            | 0.800<br>0.200<br>0.400 | 0.950            | V<br>V<br>V |
| $R_{DRIVE}$ | Output Source Impedance    |   | 80               | 100                     | 120              | Ω           |

**Notes:**

1. Equilibrium temperature.
2. Inputs must be biased to logic LOW or HIGH when  $V_{CC}$  is less than 3.0V.
3. Actual voltage levels and differential swing will depend on customer termination scheme. Typically, a 400mV swing is available in the 100Ω environment and a 200mV swing in the 50Ω environment. Refer to the "CML Termination" diagram for more details.
4. See Figure 3a and 3b.
5. See Figure 4.

**AC ELECTRICAL CHARACTERISTICS(1)**

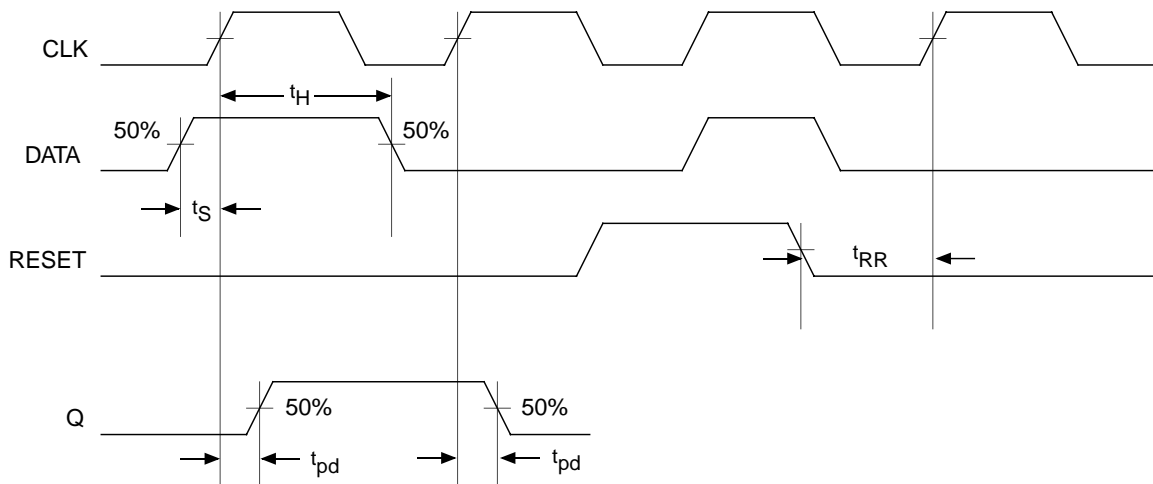
$V_{CC} = 2.3V$  to  $5.7V$ ;  $GND = 0V$ ;  $T_A = -40^{\circ}C$  to  $+85^{\circ}C$ ; unless noted.

| Symbol     | Parameter                                  | Condition          | Min  | Typ | Max        | Units |
|------------|--|--------------------|--|-----|------------|-------|
| $f_{MAX}$  | Max. Operating Frequency                   |                    | 2.5  |     |            | GHz   |
| $t_{pd}$   | Propagation Delay                          | CLK to Q<br>R to Q |  |     | 400<br>500 | ps    |
| $t_S$      | Set-Up Time                                |                    | 40   |     |            | ps    |
| $t_H$      | Hold Time                                  |                    | 40   |     |            | ps    |
| $t_{RR}$   | Reset Recovery                             |                    | 400  |     |            | ps    |
| $t_{PW}$   | Minimum Pulse Width                        | CLK to Q<br>R to Q | $V_{CC} < 3V$<br>160<br>$V_{CC} \geq 3V$<br>140<br>250 |     |            | ps    |
| $t_r, t_f$ | CML Output Rise/Fall Times<br>(20% to 80%) |                    | 35   |     | 150        | ps    |

**Note:**

1. Tested using environment of Figure 3b,  $50\Omega$  load CML output.

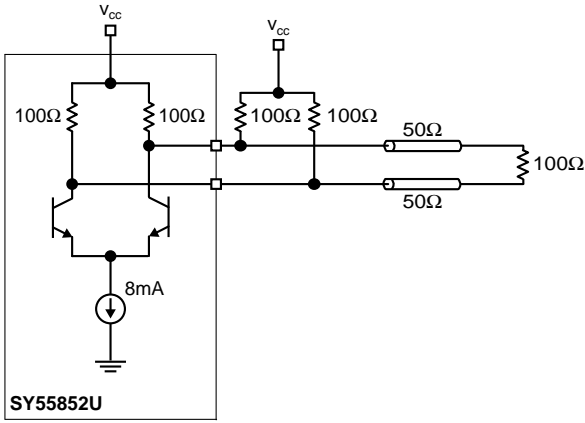
**TIMING DIAGRAMS**



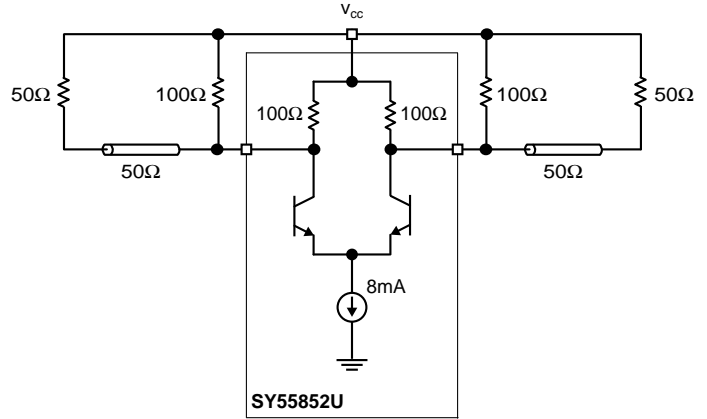
**CML TERMINATION**

All inputs accept the output from any other member of this family. All outputs are source terminated 100Ω CML differential drivers as shown in Figures 3 and 4. SY55852U expects the inputs to be terminated, and that good high

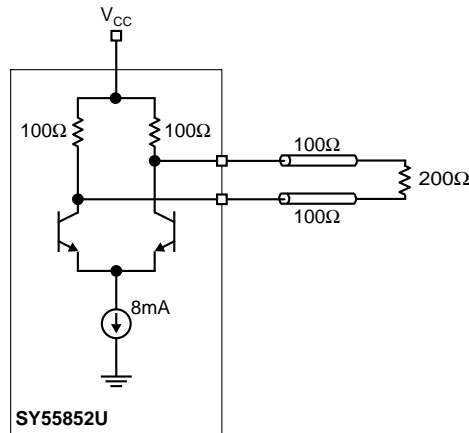
speed design practices be adhered to. SY55852U inputs are designed to accept a termination resistor between the true and complement inputs of a differential pair. 0402 form factor chip resistors will fit with some trace fanout.



**Figure 3a. Differentially Terminated (50Ω Load CML Output)**

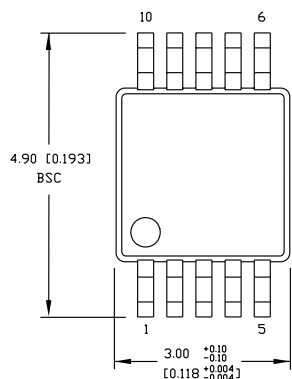


**Figure 3b. Individually Terminated (50Ω Load CML Output)**

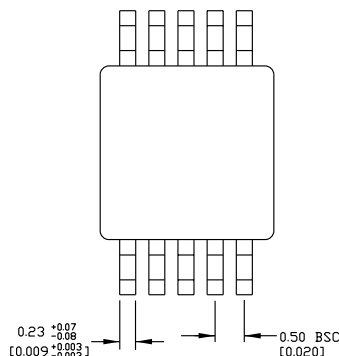


**Figure 4. 100Ω Load CML Output**

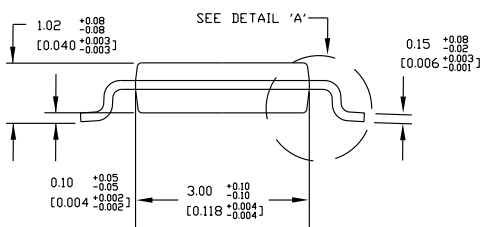
**10-PIN MSOP (K10-1)**



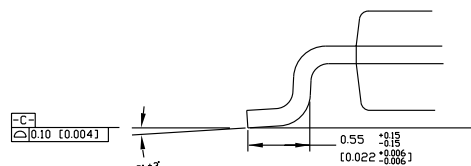
TOP VIEW



BOTTOM VIEW



SIDE VIEW



DETAIL A

- 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.

**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>

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Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: [ocean@oceanchips.ru](mailto:ocean@oceanchips.ru)

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А