

## 5 kV LED EMULATOR INPUT, LOGIC OUTPUT ISOLATORS

### Features

- High Speed: dc to 15 Mbps
- 2.5 to 5.5 V logic output
- Pin-compatible, drop-in upgrades for popular high-speed digital optocouplers
- Performance and reliability advantages vs. optocouplers
  - Resistant to temperature, age and forward current effects
  - 10x lower FIT rate for longer service life
  - Higher common-mode transient immunity: >50 kV/μs typical
  - Lower power and forward input diode current
- Wide range of product options
  - Inverting and non-inverting
  - Disable output high, low or tri-state
- 1 channel diode emulator input
- Propagation delay 30 ns
- Up to 5000 V<sub>RMS</sub> isolation
- 10 kV surge withstand capability
- AEC-Q100 qualified
- Wide operating temperature range
  - -40 to +125 °C
- RoHS-compliant packages
  - SOIC-8 (Narrow body)
  - DIP8 (Gull-wing)
  - SDIP6 (Stretched SO-6)
- Automotive-grade OPNs available
  - AIAG compliant PPAP documentation support
  - IMDs and CAMDs listing support

### Applications

- Industrial automation
- Motor controls and drives
- Isolated switch mode power supplies
- Isolated data acquisition
- Test and measurement equipment
- EV traction inverters

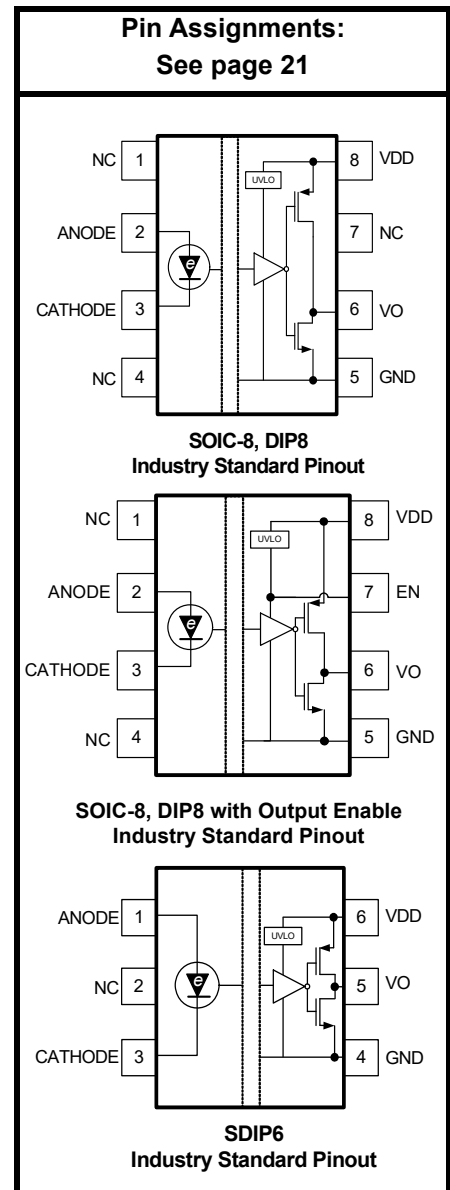
### Safety Regulatory Approvals (Pending)

- UL 1577 recognized
  - Up to 5000 V<sub>rms</sub> for 1 minute
- CSA component notice 5A approval
  - IEC 60950-1, 61010-1, 60601-1 (reinforced insulation)
- VDE certification conformity
  - IEC60747-5-2/VDE0884-10 (basic/reinforced insulation)
- CQC certification approval
  - GB4943.1

### Description

The Si871x/2x isolators are pin-compatible, single-channel, drop-in replacements for popular optocouplers with data rates up to 15 Mbps. These devices isolate high-speed digital signals and offer performance, reliability, and flexibility advantages not available with optocoupler solutions. The Si871x/2x series is based on Skyworks Solutions' proprietary CMOS isolation technology for low-power and high-speed operation and are resistant to the wear-out effects found in optocouplers that degrade performance with increasing temperature, forward current, and device age. As a result, the Si871x/2x series offer longer service life and dramatically higher reliability compared to optocouplers. Ordering options include logic output with and without output enable options.

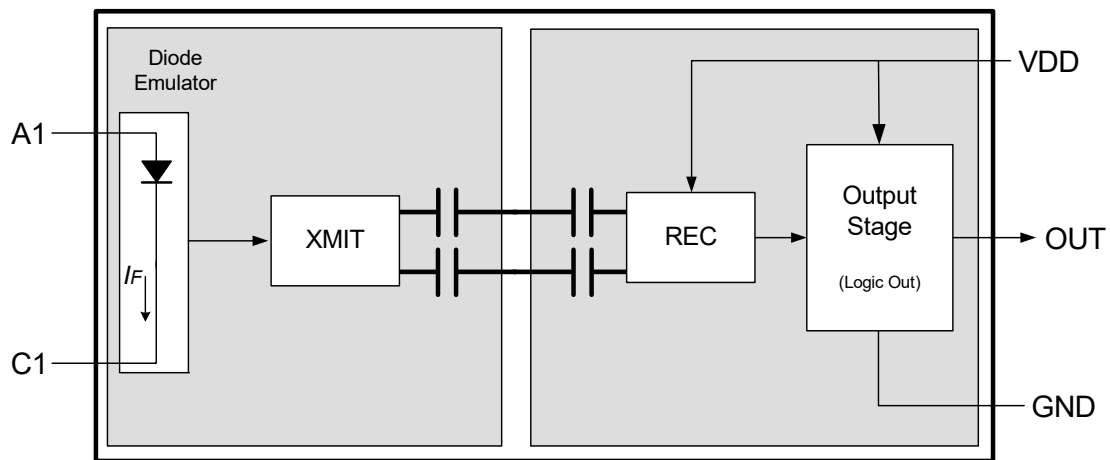
Automotive Grade is available for certain part numbers. These products are built using automotive-specific flows at all steps in the manufacturing process to ensure the robustness and low defectivity required for automotive applications.



Patent pending

# Si871x/2x

## Functional Block Diagram



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# Si871x/2x

## 1. Electrical Specifications

**Table 1. Recommended Operating Conditions**

| Parameter                       | Symbol                               | Min | Typ | Max | Unit |
|---------------------------------|--------------------------------------|-----|-----|-----|------|
| V <sub>DD</sub> Supply Voltage  | V <sub>DD</sub>                      | 2.5 | —   | 5.5 | V    |
| Input Current                   | I <sub>F(ON)</sub><br>(See Figure 1) | 6   | —   | 30  | mA   |
| Operating Temperature (Ambient) | T <sub>A</sub>                       | -40 | —   | 125 | °C   |

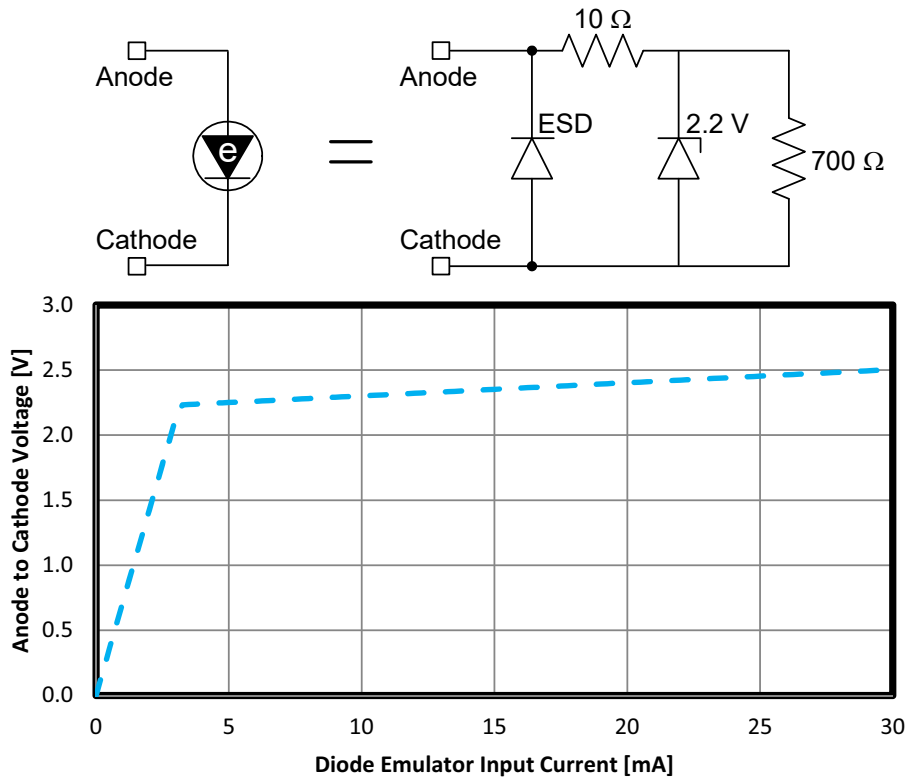
**Table 2. Electrical Characteristics**

V<sub>DD</sub> = 5 V; GND = 0 V; T<sub>A</sub> = -40 to +125 °C; typical specs at 25 °C

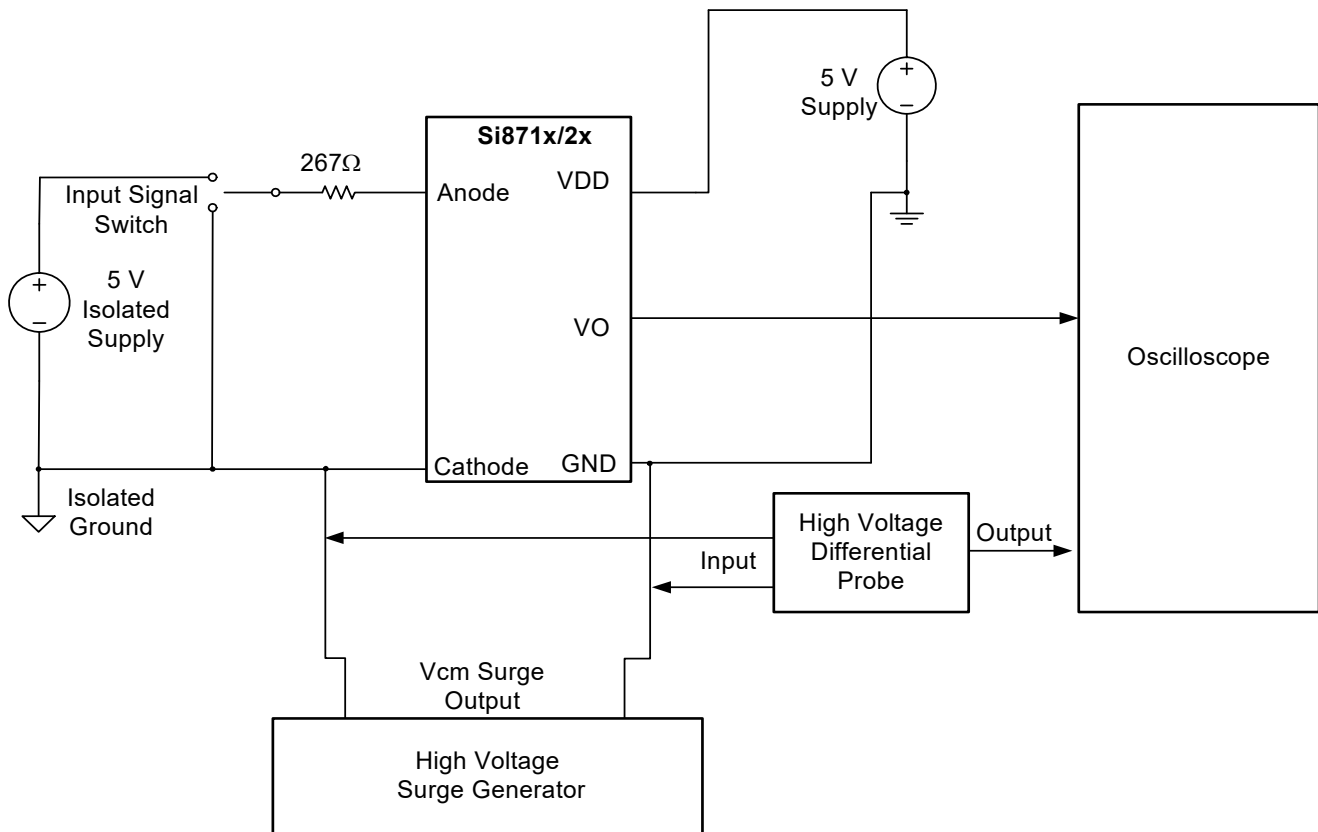
| Parameter                   | Symbol              | Test Condition  | Min                   | Typ                   | Max    | Unit     |
|-----------------------------|---------------------|---|-----------------------|-----------------------|--------|----------|
| <b>DC Parameters</b>        |                     |   |                       |                       |        |          |
| Supply Voltage              | V <sub>DD</sub>     | (V <sub>DD</sub> -GND)  | 2.5                   | —                     | 5.5    | V        |
| Supply Current              | I <sub>DD</sub>     | Output high or low<br>(V <sub>DD</sub> = 2.5 to 5.5 V)        | —                     | 1.5                   | —      | mA       |
| Input Current Threshold     | I <sub>F(TH)</sub>  |   | —                     | —                     | 3.6    | mA       |
| Input Current Hysteresis    | I <sub>HYS</sub>    |   | —                     | 0.34                  | —      | mA       |
| Input Forward Voltage (OFF) | V <sub>F(OFF)</sub> | Measured at ANODE with respect to CATHODE.                    | —                     | —                     | 1      | V        |
| Input Forward Voltage (ON)  | V <sub>F(ON)</sub>  | Measured at ANODE with respect to CATHODE.                    | 1.4                   | —                     | 2.8    | V        |
| Input Capacitance           | C <sub>I</sub>      | f = 100 kHz,<br>V <sub>F</sub> = 0 V,<br>V <sub>F</sub> = 2 V | —<br>—                | 15<br>15              | —<br>— | pF<br>pF |
| Logic Low Output Voltage    | V <sub>OL</sub>     | I <sub>OL</sub> = 4 mA  | —                     | 0.2                   | 0.4    | V        |
| Logic High Output Voltage   | V <sub>OH</sub>     | I <sub>OH</sub> = -4 mA                                       | V <sub>DD</sub> - 0.4 | V <sub>DD</sub> - 0.2 | —      | V        |
| Output Impedance            | Z <sub>O</sub>      |   | —                     | 50                    | —      | Ω        |
| Enable High Min             | V <sub>EH</sub>     |   | V <sub>DD</sub> - 0.4 | —                     | —      | V        |
| Enable Low Max              | V <sub>EL</sub>     |   | —                     | —                     | 0.4    | V        |
| Enable High Current Draw    | I <sub>EH</sub>     | V <sub>DD</sub> = V <sub>EH</sub> = 5 V                       | —                     | 0                     | —      | μA       |
| Enable Low Current Draw     | I <sub>EL</sub>     | V <sub>DD</sub> = 5 V, V <sub>EL</sub> = 0 V                  | —                     | -30                   | 0      | μA       |
| UVLO Threshold +            | V <sub>DDUV+</sub>  | See Figure 8 on page 16.<br>V <sub>DD</sub> rising            | —                     | 2.2                   | 2.35   | V        |
| UVLO Threshold -            | V <sub>DDUV-</sub>  | See Figure 8 on page 16.<br>V <sub>DD</sub> falling           | —                     | 2                     | 2.25   | V        |
| UVLO lockout hysteresis     | V <sub>DDHYS</sub>  |   | 50                    | 100                   | —      | mV       |

**Table 2. Electrical Characteristics (Continued)**V<sub>DD</sub> = 5 V; GND = 0 V; T<sub>A</sub> = -40 to +125 °C; typical specs at 25 °C

| Parameter  | Symbol                | Test Condition  | Min | Typ | Max | Unit             |
|--|-----------------------|---|-----|-----|-----|------------------|
| <b>AC Switching Parameters (V<sub>DD</sub> = 5 V, C<sub>L</sub> = 15 pF)</b> |                       |   |     |     |     |                  |
| Maximum Data Rate  | F <sub>DATA</sub>     |   | DC  | —   | 15  | M <sub>BPS</sub> |
| Minimum Pulse Width  | MPW                   |   | 66  | —   | —   | ns               |
| Propagation Delay<br>(Low-to-High)   | t <sub>PLH</sub>      | C <sub>L</sub> = 15 pF  | 5   | —   | 50  | ns               |
| Propagation Delay<br>(High-to-Low)   | t <sub>PHL</sub>      | C <sub>L</sub> = 15 pF  | 5   | —   | 50  | ns               |
| Pulse Width Distortion   | PWD                   | t <sub>PLH</sub> - t <sub>PHL</sub>   | —   | —   | 25  | ns               |
| Propagation Delay<br>Skew  | t <sub>PSK(p-p)</sub> | t <sub>PSK(p-p)</sub> is the magnitude of the difference in prop delays between different units operating at same supply voltage, load, and ambient temp. | —   | —   | 25  | ns               |
| Rise Time*   | t <sub>R</sub>        | C <sub>L</sub> = 15 pF  | —   | 2.5 | 4   | ns               |
| Fall Time*   | t <sub>F</sub>        | C <sub>L</sub> = 15 pF  | —   | 2.5 | 4   | ns               |
| Device Startup Time  | t <sub>START</sub>    |   | —   | —   | 40  | μs               |
| Common Mode<br>Transient Immunity  | CMTI                  | Output = low or high<br>V <sub>CM</sub> = 1500 V (See Figure 2)<br>I <sub>F</sub> = 6 mA  | 35  | 50  | —   | kV/μs            |
| <b>*Note:</b> Guaranteed by design and/or characterization                   |                       |   |     |     |     |                  |



**Figure 1. Diode Emulator Model and I-V Curve**



**Figure 2. Common Mode Transient Immunity Characterization Circuit**

# Si871x/2x

**Table 3. Regulatory Information\***

|   |
|---|
| <b>CSA</b>  |
| The Si871x/2x is certified under CSA Component Acceptance Notice 5A. For more details, see File 232873.   |
| 61010-1: Up to 600 V <sub>RMS</sub> reinforced insulation working voltage; up to 600 V <sub>RMS</sub> basic insulation working voltage.   |
| 60950-1: Up to 1000 V <sub>RMS</sub> reinforced insulation working voltage; up to 1000 V <sub>RMS</sub> basic insulation working voltage.   |
| 60601-1: Up to 250 V <sub>RMS</sub> reinforced insulation working voltage; up to 500 V <sub>RMS</sub> basic insulation working voltage.   |
| <b>VDE</b>  |
| The Si871x/2x is certified according to IEC60747 and VDE0884. For more details, see File 5006301-4880-0001.   |
| 60747-5-2: Up to 1414 V <sub>peak</sub> for basic insulation working voltage.   |
| VDE0884-10: Up to 1414 V <sub>peak</sub> for reinforced insulation working voltage.   |
| <b>UL</b>   |
| The Si871x/2x is certified under UL1577 component recognition program. For more details, see File E257455.  |
| Rated up to 5000 V <sub>RMS</sub> isolation voltage for basic protection.   |
| <b>CQC</b>  |
| The Si871x/2x is certified under GB4943.1-2011. For more details, see File V2012CQC001041.  |
| Rated up to 1000 V <sub>RMS</sub> reinforced insulation working voltage; up to 1000 V <sub>RMS</sub> basic insulation working voltage.  |
| <b>*Note:</b> Regulatory Certifications apply to 3.75 kV <sub>RMS</sub> rated devices which are production tested to 4.5 kV <sub>RMS</sub> for 1 sec.<br>Regulatory Certifications apply to 5.0 kV <sub>RMS</sub> rated devices which are production tested to 6.0 kV <sub>RMS</sub> for 1 sec.<br>For more information, see "8.Ordering Guide" on page 22. |

**Table 4. Insulation and Safety-Related Specifications**

| Parameter  | Symbol          | Test Condition | Value            |                  |                  | Unit |
|--|-----------------|----------------|------------------|------------------|------------------|------|
|  |                 |                | SOIC-8           | DIP8             | SDIP6            |      |
| Nominal Air Gap (Clearance)  | L(IO1)          |                | 4.7 min          | 7.2 min          | 9.6 min          | mm   |
| Nominal External Tracking (Creepage)   | L(IO2)          |                | 3.9 min          | 7.0 min          | 8.3 min          | mm   |
| Minimum Internal Gap (Internal Clearance)  |                 |                | 0.016            | 0.016            | 0.016            | mm   |
| Tracking Resistance (Proof Tracking Index)   | PTI             | IEC60112       | 600              | 600              | 600              | V    |
| Erosion Depth  | ED              |                | 0.031            | 0.031            | 0.057            | mm   |
| Resistance (Input-Output)*   | R <sub>IO</sub> |                | 10 <sup>12</sup> | 10 <sup>12</sup> | 10 <sup>12</sup> | Ω    |
| Capacitance (Input-Output)*  | C <sub>IO</sub> | f = 1 MHz      | 1                | 1                | 1                | pF   |
| <b>*Note:</b> To determine resistance and capacitance, the Si871x/2x is converted into a 2-terminal device. Pins 1–4 (1–3, SDIP6) are shorted together to form the first terminal, and pins 5–8 (4–6, SDIP6) are shorted together to form the second terminal. The parameters are then measured between these two terminals. |                 |                |                  |                  |                  |      |



Table 5. IEC 60664-1 (VDE 0884) Ratings

| Parameter                   | Test Condition                                    | Specification |       |       |
|-----------------------------|---|---------------|-------|-------|
|                             |   | SOIC-8        | DIP8  | SDIP6 |
| Basic Isolation Group       | Material Group                                    | I             | I     | I     |
| Installation Classification | Rated Mains Voltages $\leq$ 150 V <sub>RMS</sub>  | I-IV          | I-IV  | I-IV  |
|                             | Rated Mains Voltages $\leq$ 300 V <sub>RMS</sub>  | I-IV          | I-IV  | I-IV  |
|                             | Rated Mains Voltages $\leq$ 450 V <sub>RMS</sub>  | I-III         | I-III | I-IV  |
|                             | Rated Mains Voltages $\leq$ 600 V <sub>RMS</sub>  | I-III         | I-III | I-IV  |
|                             | Rated Mains Voltages $\leq$ 1000 V <sub>RMS</sub> | I-II          | I-II  | I-III |

Table 6. IEC 60747-5-2 (VDE 0884-10) Insulation Characteristics\*

| Parameter  | Symbol            | Test Condition  | Characteristic   |                  |                  | Unit   |
|--|-------------------|---|------------------|------------------|------------------|--------|
|  |                   |   | SOIC-8           | DIP8             | SDIP6            |        |
| Maximum Working Insulation Voltage                                   | V <sub>IORM</sub> |   | 630              | 891              | 1140             | V peak |
| Input to Output Test Voltage   | V <sub>PR</sub>   | Method b1<br>(V <sub>IORM</sub> × 1.875 = V <sub>PR</sub> , 100%<br>Production Test, t <sub>m</sub> = 1 sec,<br>Partial Discharge < 5 pC) | 1181             | 1671             | 2138             | V peak |
| Transient Overvoltage  | V <sub>IOTM</sub> | t = 60 sec  | 6000             | 6000             | 8000             | V peak |
| Pollution Degree<br>(DIN VDE 0110, Table 1)                          |                   |   | 2                | 2                | 2                |        |
| Insulation Resistance at<br>T <sub>S</sub> , V <sub>IO</sub> = 500 V | R <sub>S</sub>    |   | >10 <sup>9</sup> | >10 <sup>9</sup> | >10 <sup>9</sup> | Ω      |

**\*Note:** This isolator is suitable for reinforced electrical isolation only within the safety limit data. Maintenance of the safety data is ensured by protective circuits. The Si871x/2x provides a climate classification of 40/125/21.

# Si871x/2x

Table 7. IEC Safety Limiting Values

| Parameter        | Symbol | Test Condition  | Max    |      |       | Unit |
|------------------|--------|---|--------|------|-------|------|
|                  |        |   | SOIC-8 | DIP8 | SDIP6 |      |
| Case Temperature | $T_S$  |   | 140    | 140  | 140   | °C   |
| Input Current    | $I_S$  | $\theta_{JA} = 110\text{ °C/W (SOIC-8),}$<br>$110\text{ °C/W (DIP8),}$<br>$105\text{ °C/W (SDIP6),}$<br>$V_F = 2.8\text{ V, } T_J = 140\text{ °C,}$<br>$T_A = 25\text{ °C}$ | 370    | 370  | 390   | mA   |
| Output Power     | $P_S$  |   | 1      | 1    | 1     | W    |

**Note:** Maximum value allowed in the event of a failure; also see the thermal derating curve in Figures 3, 4, and 5.

Table 8. Thermal Characteristics

| Parameter                             | Symbol        | Typ    |      |       | Unit                        |
|---------------------------------------|---------------|--------|------|-------|-----------------------------|
|                                       |               | SOIC-8 | DIP8 | SDIP6 |                             |
| IC Junction-to-Air Thermal Resistance | $\theta_{JA}$ | 110    | 110  | 105   | $^{\circ}\text{C}/\text{W}$ |

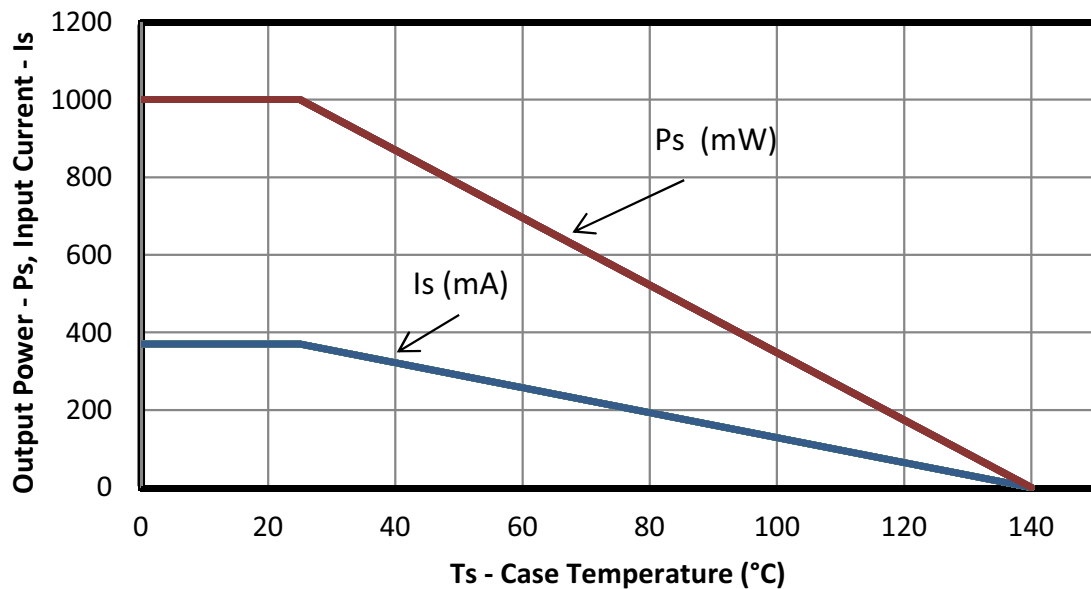


Figure 3. (SOIC-8) Thermal Derating Curve, Dependence of Safety Limiting Values with Case Temperature per DIN EN 60747-5-2 and VDE0884-10

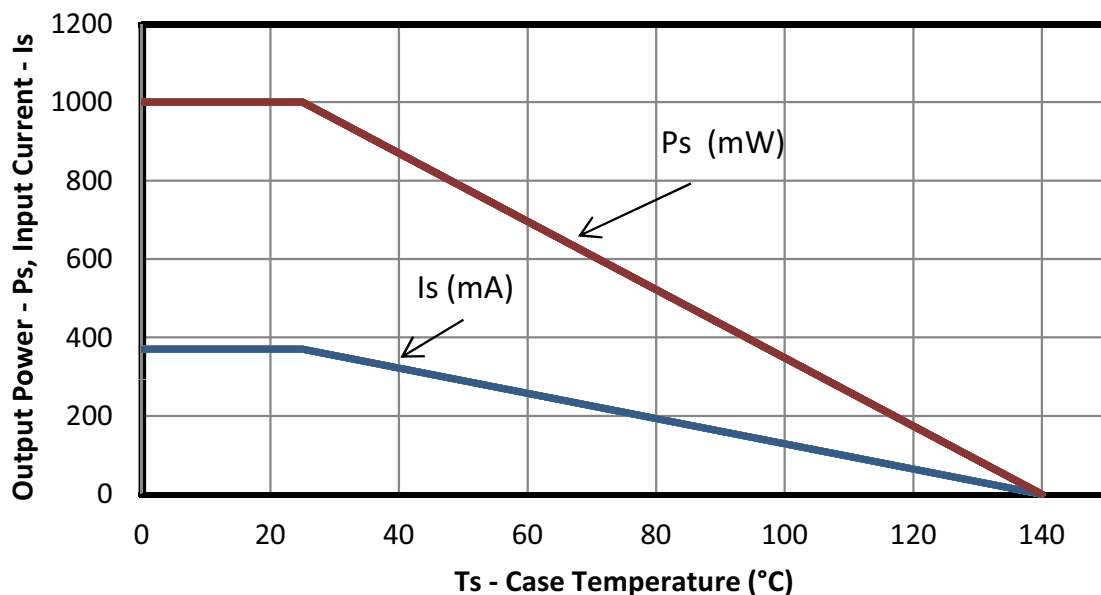
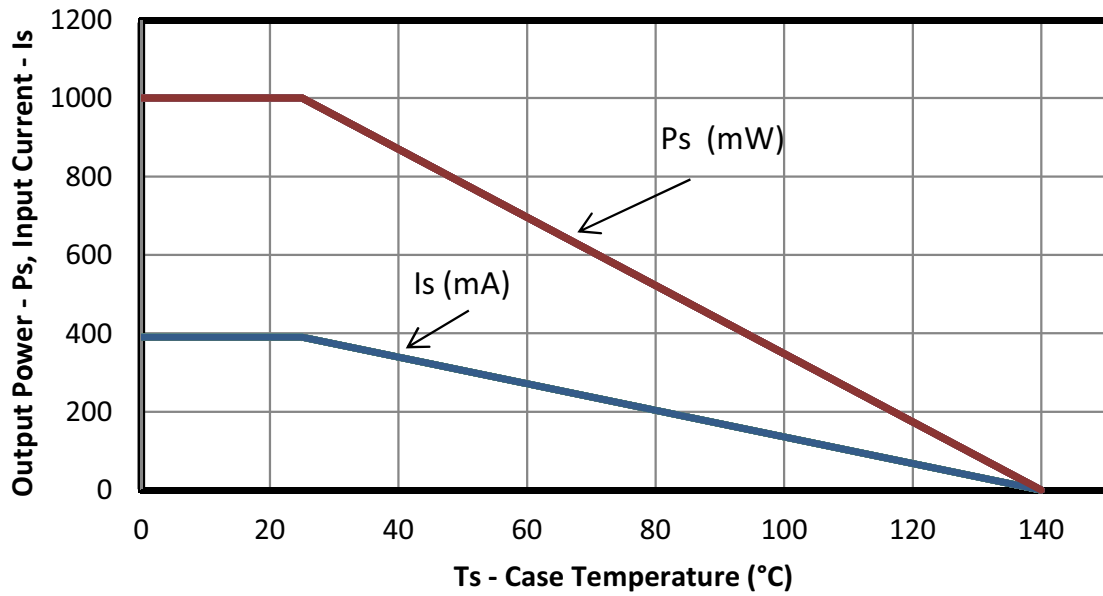


Figure 4. (DIP8) Thermal Derating Curve, Dependence of Safety Limiting Values with Case Temperature per DIN EN 60747-5-2 and VDE0884-10



**Figure 5. (SDIP6) Thermal Derating Curve, Dependence of Safety Limiting Values with Case Temperature per DIN EN 60747-5-2 and VDE0884-10**

Table 9. Absolute Maximum Ratings\*

| Parameter   | Symbol       | Min  | Max          | Unit      |
|---|--------------|------|--------------|-----------|
| Storage Temperature   | $T_{STG}$    | -65  | +150         | °C        |
| Operating Temperature   | $T_A$        | -40  | +125         | °C        |
| Junction Temperature  | $T_J$        | —    | +140         | °C        |
| Average Forward Input Current   | $I_{F(AVG)}$ | —    | 30           | mA        |
| Peak Transient Input Current<br>( $< 1 \mu s$ pulse width, 300 pps)   | $I_{FTR}$    | —    | 1            | A         |
| Reverse Input Voltage   | $V_R$        | —    | 0.3          | V         |
| Supply Voltage  | $V_{DD}$     | -0.5 | 7            | V         |
| Output Voltage  | $V_{OUT}$    | -0.5 | $V_{DD}+0.5$ | V         |
| Enable Voltage  | $V_{EOUT}$   | -0.5 | $V_{DD}+0.5$ | V         |
| Output Source or Sink Current   | $I_O$        | —    | 22           | mA        |
| Input Power Dissipation   | $P_I$        | —    | 90           | mW        |
| Output Power Dissipation  | $P_O$        | —    | 163          | mW        |
| Total Power Dissipation   | $P_T$        | —    | 253          | mW        |
| Lead Solder Temperature (10 s)  |              | —    | 260          | °C        |
| HBM Rating ESD  |              | 3    | —            | kV        |
| Machine Model ESD   |              | 250  | —            | V         |
| CDM   |              | 2    | —            | kV        |
| Maximum Isolation Voltage (1 s) SOIC-8  |              | —    | 4500         | $V_{RMS}$ |
| Maximum Isolation Voltage (1 s) DIP8  |              | —    | 4500         | $V_{RMS}$ |
| Maximum Isolation Voltage (1 s) SDIP6   |              | —    | 6500         | $V_{RMS}$ |
| <b>*Note:</b> Permanent device damage may occur if the absolute maximum ratings are exceeded. Functional operation should be restricted to the conditions specified in the operational sections of this data sheet. |              |      |              |           |

# Si871x/2x

## 2. Application Information

### 2.1. Theory of Operation

The Si871x/2x are pin-compatible, single-channel, drop-in replacements for popular optocouplers with data rates up to 15 Mbps. The operation of an Si871x/2x channel is analogous to that of an opto coupler, except an RF carrier is modulated instead of light. This simple architecture provides a robust isolated data path and requires no special considerations or initialization at start-up. A simplified block diagram for the Si871x/2x is shown in Figure 6.

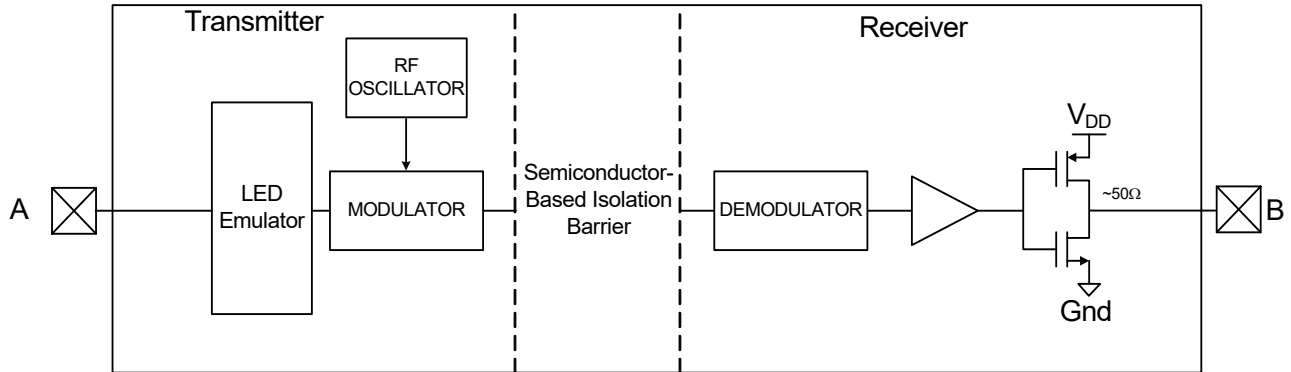


Figure 6. Simplified Channel Diagram

### 3. Technical Description

#### 3.1. Device Behavior

Truth tables for the Si871x/2x are summarized in Table 10.

**Table 10. Si871x/2x Truth Table Summary\***

| Input   | Enable | Output |
|---|--------|--------|
| <b>Si8715 (Non-inverting)</b>   |        |        |
| OFF   | N/A    | LOW    |
| ON  | N/A    | HIGH   |
| <b>Si8716 (Inverting)</b>   |        |        |
| OFF   | HIGH   | HIGH   |
| ON  | HIGH   | LOW    |
| X   | LOW    | HIGH   |
| <b>Si8717 (Non-inverting)</b>   |        |        |
| OFF   | HIGH   | LOW    |
| ON  | HIGH   | HIGH   |
| X   | LOW    | HI-Z   |
| <b>Si8718 (Inverting)</b>   |        |        |
| OFF   | HIGH   | HIGH   |
| ON  | HIGH   | LOW    |
| X   | LOW    | HI-Z   |
| <b>Si8719 (Inverting)</b>   |        |        |
| OFF   | N/A    | HIGH   |
| ON  | N/A    | LOW    |
| <b>Si8720 (Inverting)</b>   |        |        |
| OFF   | HIGH   | HIGH   |
| ON  | HIGH   | LOW    |
| X   | LOW    | LOW    |
| <p><b>*Note:</b> This truth table assumes VDD is powered (VDD &gt; UVLO). If VDD is below UVLO, see "3.3. Under Voltage Lockout (UVLO)" on page 16 for more information. When VDD &lt; UVLO, the output state is not guaranteed. In this condition, the output level is determined by external circuitry connected to the output.</p> |        |        |

# Si871x/2x

## 3.2. Device Startup

During start-up, for the Si8716, Output  $V_O$  is high until  $V_{DD}$  rises above the UVLO+ threshold for a minimum time period of  $t_{START}$ . Following this, the output is low when the current flowing from anode to cathode is  $> I_{F(ON)}$ . Device startup, normal operation, and shutdown behavior for the Si8716 is shown in Figure 7. Note that Figure 7 assumes that Enable is asserted and that the outputs are operating in their normal operating condition (inverting for the Si8716). See Table 10 for more details on the Enable function.

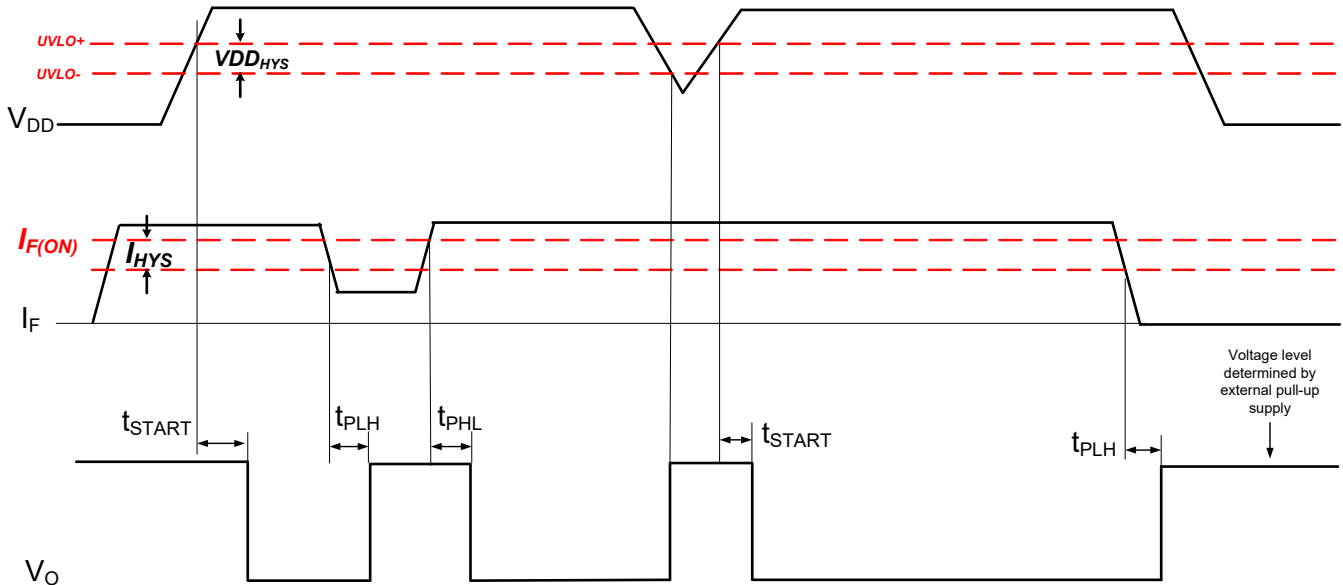


Figure 7. Si8716 Operating Behavior ( $I_F \geq I_{F(MIN)}$  when  $V_F \geq V_{F(MIN)}$ )

## 3.3. Under Voltage Lockout (UVLO)

The UVLO circuit unconditionally drives  $V_O$  to its default state when  $V_{DD}$  is below the lockout threshold. Referring to Figure 8, upon power up, the Si871x/2x is maintained in UVLO until  $V_{DD}$  rises above  $V_{DD_{UV+}}$ . During power down, the Si871x/2x enters UVLO when  $V_{DD}$  falls below the UVLO threshold plus hysteresis (i.e.,  $V_{DD} \leq V_{DD_{UV+}} - V_{DD_{HYS}}$ ).

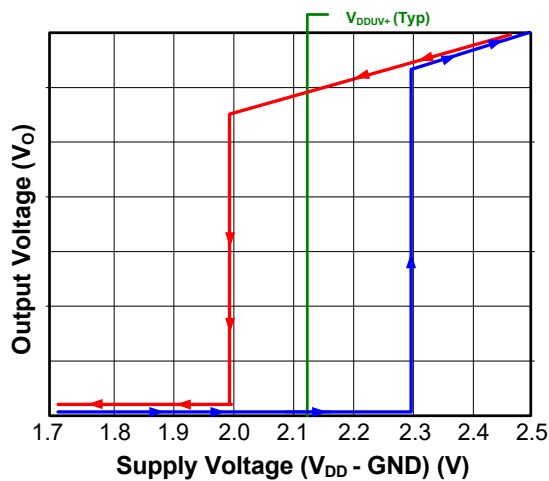


Figure 8. Si871x/2x UVLO Response

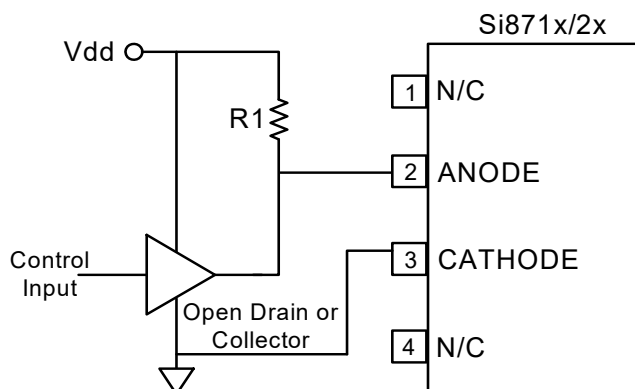


## 4. Applications

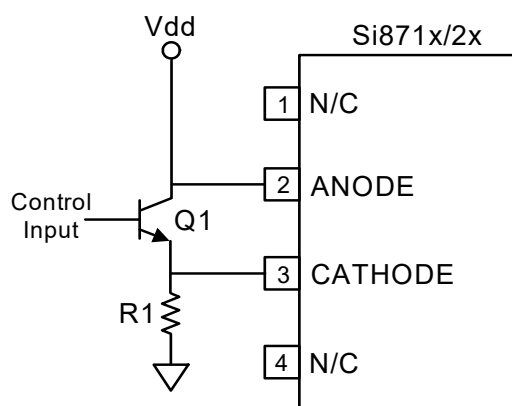
The following sections detail the input and output circuits necessary for proper operation of the Si871x/2x family.

### 4.1. Input Circuit Design

Opto coupler manufacturers typically recommend the circuits shown in Figures 9 and 10. These circuits are specifically designed to improve opto-coupler input common-mode rejection and increase noise immunity.



**Figure 9. Si871x/2x Input Circuit**



**Figure 10. High CMR Si871x/2x Input Circuit**

The optically-coupled circuit of Figure 9 turns the LED on when the control input is high. However, internal capacitive coupling from the LED to the power and ground conductors can momentarily force the LED into its off state when the anode and cathode inputs are subjected to a high common-mode transient. The circuit shown in Figure 10 addresses this issue by using a value of R1 sufficiently low to overdrive the LED, ensuring it remains on during an input common-mode transient. Q1 shorts the LED off in the low output state, again increasing common-mode transient immunity.

Some opto coupler applications recommend reverse-biasing the LED when the control input is off to prevent coupled noise from energizing the LED. The Si871x/2x input circuit requires less current and has twice the off-state noise margin compared to opto couplers. However, high CMR opto coupler designs that overdrive the LED (see Figure 10) may require increasing the value of R1 to limit input current  $I_F$  to its maximum rating when using the Si871x/2x. In addition, there is no benefit in driving the Si871x/2x input diode into reverse bias when in the off state. Consequently, opto coupler circuits using this technique should either leave the negative bias circuitry unpopulated or modify the circuitry (e.g., add a clamp diode or current limiting resistor) to ensure that the anode pin of the Si871x/2x is no more than  $-0.3$  V with respect to the cathode when reverse-biased.

# Si871x/2x

New designs should consider the input circuit configurations of Figure 11, which are more efficient than those of Figures 9 and 10. As shown, S1 and S2 represent any suitable switch, such as a BJT or MOSFET, analog transmission gate, processor I/O, etc. Also, note that the Si871x/2x input can be driven from the I/O port of any MCU or FPGA capable of sourcing a minimum of 6 mA (see Figure 11B). Additionally, note that the Si871x/2x propagation delay and output drive do not significantly change for values of  $I_F$  between  $I_{F(MIN)}$  and  $I_{F(MAX)}$ .

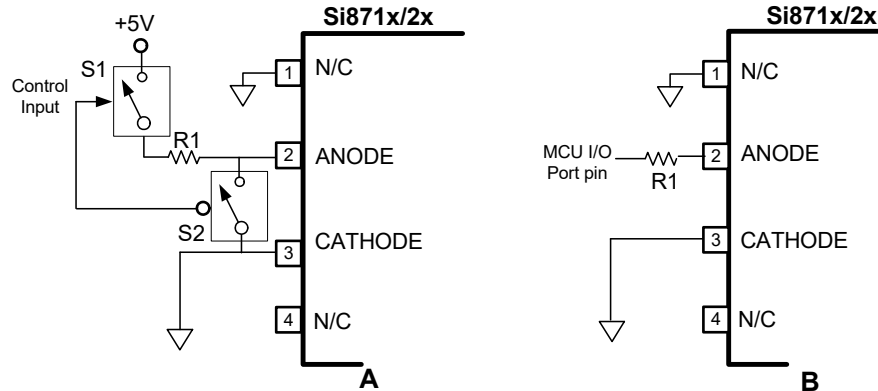
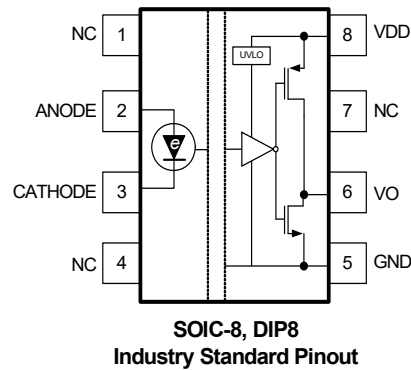


Figure 11. Si871x/2x Other Input Circuit Configurations

## 4.2. Output Circuit Design and Power Supply Connections

GND can be biased at, above, or below ground as long as the voltage on  $V_{DD}$  with respect to GND is a maximum of 5.5 V.  $V_{DD}$  decoupling capacitors should be placed as close to the package pins as possible. The optimum values for these capacitors depend on load current and the distance between the chip and its power source. It is recommended that 0.1 and 1  $\mu$ F bypass capacitors be used to reduce high-frequency noise and maximize performance. Opto replacement applications should limit their supply voltages to 5.5 V or less.

## 5. Pin Descriptions (SOIC-8, DIP8)



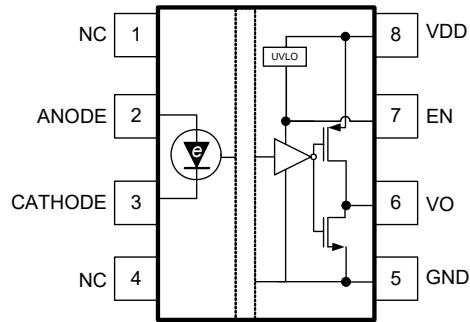
**Figure 12. Pin Configuration**

**Table 11. Pin Descriptions (SOIC-8, DIP8)**

| Pin | Name     | Description   |
|-----|----------|---|
| 1   | NC*      | No connect.   |
| 2   | ANODE    | Anode of LED emulator. $V_O$ follows the signal applied to this input with respect to the CATHODE input.                          |
| 3   | CATHODE  | Cathode of LED emulator. $V_O$ follows the signal applied to ANODE with respect to this input.                                    |
| 4   | NC*      | No connect.   |
| 5   | GND      | Ground reference for $V_{DD}$ . This terminal is typically connected to ground but may be tied to a negative or positive voltage. |
| 6   | $V_O$    | Output signal.  |
| 7   | NC*      | No connect.   |
| 8   | $V_{DD}$ | Output-side power supply input referenced to GND (5.5 V max).   |

**\*Note:** No Connect. These pins are not internally connected. To maximize CMTI performance, these pins should be connected to the ground plane.

## 6. Pin Descriptions (SOIC-8, DIP8) with Output Enable



SOIC-8, DIP8 with Output Enable  
Industry Standard Pinout

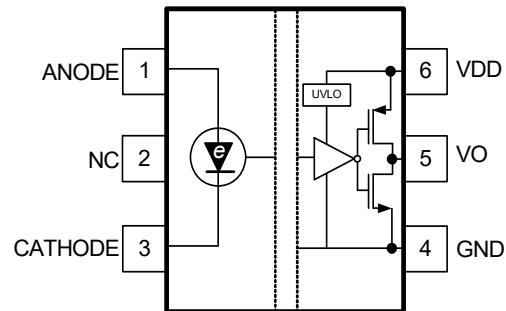
Figure 13. Pin Configuration

Table 12. Pin Descriptions (SOIC-8, DIP8) with Output Enable

| Pin | Name     | Description   |
|-----|----------|---|
| 1   | NC*      | No connect.   |
| 2   | ANODE    | Anode of LED emulator. $V_O$ follows the signal applied to this input with respect to the CATHODE input.                          |
| 3   | CATHODE  | Cathode of LED emulator. $V_O$ follows the signal applied to ANODE with respect to this input.                                    |
| 4   | NC*      | No connect.   |
| 5   | GND      | Ground reference for $V_{DD}$ . This terminal is typically connected to ground but may be tied to a negative or positive voltage. |
| 6   | $V_O$    | Output signal.  |
| 7   | EN       | Output enable. Tied to $V_{DD}$ to enable output.   |
| 8   | $V_{DD}$ | Output-side power supply input referenced to GND (5.5 V max).   |

**\*Note:** No Connect. These pins are not internally connected. To maximize CMTI performance, these pins should be connected to the ground plane.

## 7. Pin Descriptions (SDIP6)



**SDIP6**

**Industry Standard Pinout**

**Figure 14. Pin Configuration**

**Table 13. Pin Descriptions (SDIP6)**

| Pin | Name     | Description   |
|-----|----------|---|
| 1   | ANODE    | Anode of LED emulator. $V_O$ follows the signal applied to this input with respect to the CATHODE input.                          |
| 2   | NC*      | No connect.   |
| 3   | CATHODE  | Cathode of LED emulator. $V_O$ follows the signal applied to ANODE with respect to this input.                                    |
| 4   | GND      | Ground reference for $V_{DD}$ . This terminal is typically connected to ground but may be tied to a negative or positive voltage. |
| 5   | $V_O$    | Output signal.  |
| 6   | $V_{DD}$ | Output-side power supply input referenced to GND (5.5 V max).   |

**\*Note:** No Connect. These pins are not internally connected. To maximize CMTI performance, these pins should be connected to the ground plane.

# Si871x/2x

## 8. Ordering Guide

**Table 14. Si871x/2x Ordering Guide<sup>1,2,3</sup>**

| Ordering Part Number (OPN)  | Ordering Options                  |  |                   |                                      |          |
|---|-----------------------------------|--|-------------------|--------------------------------------|----------|
|   | Input/Output Configuration        | Data Rate Cross Reference                                | Insulation Rating | Enable Pin/ Output State when Active | Pkg Type |
| <b>Logic Output (Available in SOIC-8, DIP8, and SDIP6)</b>  |                                   |  |                   |                                      |          |
| Si8715BC-A-IS   | High CMTI<br>Non-inverting Output | 15 Mbps  | 3.75 kVrms        | No, N/A                              | SOIC-8   |
| Si8716BC-A-IS   | High CMTI<br>Inverting Output     | 15 Mbps<br>ACPL-061L, HCPL-0600,<br>HCPL-0601, HCPL-0611 | 3.75 kVrms        | Yes, High                            | SOIC-8   |
| Si8717BC-A-IS   | High CMTI<br>Non-inverting Output | 15 Mbps  | 3.75 kVrms        | Yes, Hi-z                            | SOIC-8   |
| Si8718BC-A-IS   | High CMTI<br>Inverting Output     | 15 Mbps<br>ACPL-C61L,<br>ACPL-W70L                       | 3.75 kVrms        | Yes, Hi-z                            | SOIC-8   |
| Si8719BC-A-IS   | High CMTI<br>Inverting Output     | 15 Mbps  | 3.75 kVrms        | No, N/A                              | SOIC-8   |
| Si8720BC-A-IS   | High CMTI<br>Inverting Output     | 15 Mbps  | 3.75 kVrms        | Yes, Low                             | SOIC-8   |
| Si8715BC-A-IP   | High CMTI<br>Non-inverting Output | 15 Mbps<br>ACPL-4800,<br>HCPL-2202,<br>HCPL-2212         | 3.75 kVrms        | No, N/A                              | DIP8/GW  |
| Si8716BC-A-IP   | High CMTI<br>Inverting Output     | 15 Mbps<br>6N137, HCPL-2601,<br>HCPL-2611                | 3.75 kVrms        | Yes, High                            | DIP8/GW  |
| Si8717BC-A-IP   | High CMTI<br>Non-inverting Output | 15 Mbps  | 3.75 kVrms        | Yes, Hi-z                            | DIP8/GW  |
| Si8718BC-A-IP   | High CMTI<br>Inverting Output     | 15 Mbps  | 3.75 kVrms        | Yes, Hi-z                            | DIP8/GW  |
| Si8719BC-A-IP   | High CMTI<br>Inverting Output     | 15 Mbps  | 3.75 kVrms        | No, N/A                              | DIP8/GW  |
| Si8720BC-A-IP   | High CMTI<br>Inverting Output     | 15 Mbps  | 3.75 kVrms        | Yes, Low                             | DIP8/GW  |
| <b>Notes:</b>   |                                   |  |                   |                                      |          |
| <ol style="list-style-type: none"> <li>1. All packages are RoHS-compliant with peak solder reflow temperatures of 260 °C according to the JEDEC industry standard classifications.</li> <li>2. "Si" and "SI" are used interchangeably.</li> <li>3. AEC-Q100 qualified.</li> </ol> |                                   |  |                   |                                      |          |

Table 14. Si871x/2x Ordering Guide<sup>1,2,3</sup> (Continued)

| Ordering Part Number (OPN) | Ordering Options                  |  |                   |                                      |          |
|----------------------------|-----------------------------------|--|-------------------|--------------------------------------|----------|
|                            | Input/Output Configuration        | Data Rate Cross Reference                                  | Insulation Rating | Enable Pin/ Output State when Active | Pkg Type |
| Si8715BD-A-IS              | High CMTI<br>Non-inverting Output | 15 Mbps<br>ACPL-W21L, PS9303L2                             | 5.0 kVrms         | No, N/A                              | SDIP6    |
| Si8719BD-A-IS              | High CMTI<br>Inverting Output     | 15 Mbps<br>ACPL-W61L,<br>ACPL-W481,<br>ACPL-W70L, TLP2766F | 5.0 kVrms         | No, N/A                              | SDIP6    |

**Notes:**

1. All packages are RoHS-compliant with peak solder reflow temperatures of 260 °C according to the JEDEC industry standard classifications.
2. “Si” and “SI” are used interchangeably.
3. AEC-Q100 qualified.

# Si871x/2x

## 8.1. Automotive Grade OPNs

Automotive-grade devices are built using automotive-specific flows at all steps in the manufacturing process to ensure robustness and low defectivity. These devices are supported with AIAG-compliant Production Part Approval Process (PPAP) documentation, and feature International Material Data System (IMDS) and China Automotive Material Data System (CAMDS) listing. Qualifications are compliant with AEC-Q100, and a zero-defect methodology is maintained throughout definition, design, evaluation, qualification, and mass production steps.

**Table 15. Si87xx Ordering Guide<sup>1,2,3</sup>**

| Ordering Part Number (OPN) | Ordering Options           |   |                   |                                     |          |
|----------------------------|----------------------------|---|-------------------|-------------------------------------|----------|
|                            | Input/Output Configuration | Data Rate Cross Reference                 | Insulation Rating | Enable Pin/Ouptut State when Active | Pkg Type |
| Si8716BC-AP                | High CMTI Inverting Output | 15 Mbps<br>6N137, HCPL-2601,<br>HCPL-2611 | 3.75 kVrms        | Yes, High                           | DIP8/GW  |

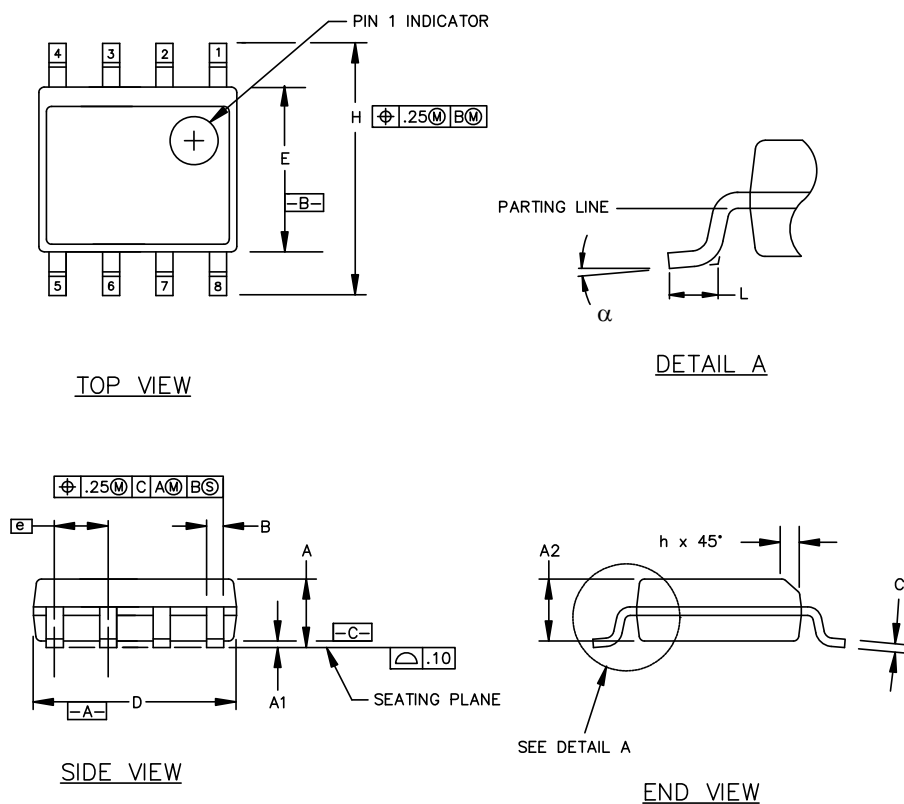
**Notes:**

1. All packages are RoHS-compliant.
2. "Si" and "SI" are used interchangeably.
3. An "R" at the end of the part number denotes tape and reel packaging option.
4. Automotive-Grade devices (with an "-A" suffix) are identical in construction materials, topside marking, and electrical parameters to their Industrial-Grade (with an "-I" suffix) version counterparts. Automotive-Grade products are produced utilizing full automotive process flows and additional statistical process controls throughout the manufacturing flow. The Automotive-Grade part number is included on shipping labels.
5. Additional Ordering Part Numbers may be available in Automotive-Grade. Please contact your local Skyworks Solutions sales representative for further information.



## 9. Package Outline: 8-Pin Narrow Body SOIC

Figure 15 illustrates the package details for the Si871x/2x in an 8-pin narrow-body SOIC package. Table 16 lists the values for the dimensions shown in the illustration.



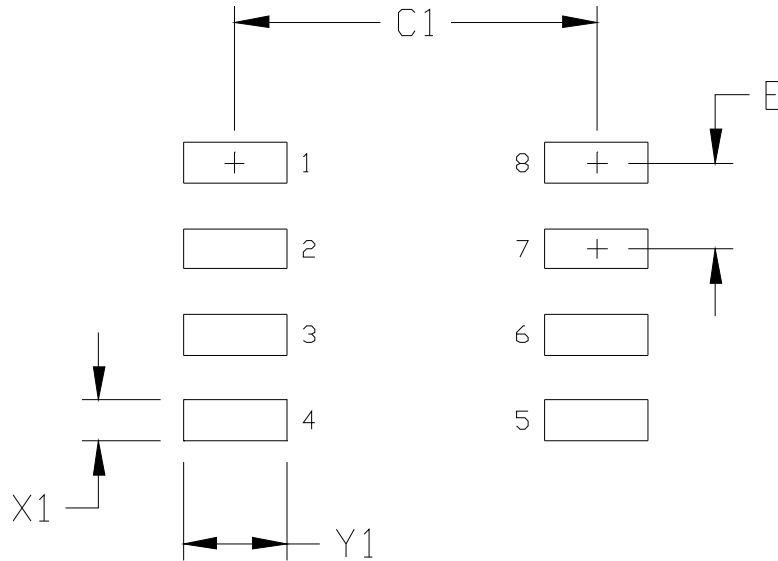
**Figure 15. 8-Pin Narrow Body SOIC Package**

**Table 16. 8-Pin Narrow Body SOIC Package Diagram Dimensions**

| Symbol   | Millimeters |          |
|----------|-------------|----------|
|          | Min         | Max      |
| A        | 1.35        | 1.75     |
| A1       | 0.10        | 0.25     |
| A2       | 1.40 REF    | 1.55 REF |
| B        | 0.33        | 0.51     |
| C        | 0.19        | 0.25     |
| D        | 4.80        | 5.00     |
| E        | 3.80        | 4.00     |
| e        | 1.27 BSC    |          |
| H        | 5.80        | 6.20     |
| h        | 0.25        | 0.50     |
| L        | 0.40        | 1.27     |
| $\alpha$ | 0°          | 8°       |

## 10. Land Pattern: 8-Pin Narrow Body SOIC

Figure 16 illustrates the recommended land pattern details for the Si871x/2x in an 8-pin narrow-body SOIC. Table 17 lists the values for the dimensions shown in the illustration.



**Figure 16. 8-Pin Narrow Body SOIC Land Pattern**

**Table 17. 8-Pin Narrow Body SOIC Land Pattern Dimensions**

| Dimension   | Feature            | (mm) |
|---|--------------------|------|
| C1  | Pad Column Spacing | 5.40 |
| E   | Pad Row Pitch      | 1.27 |
| X1  | Pad Width          | 0.60 |
| Y1  | Pad Length         | 1.55 |
| <b>Notes:</b>   |                    |      |
| <ol style="list-style-type: none"> <li>1. This Land Pattern Design is based on IPC-7351 pattern SOIC127P600X173-8N for Density Level B (Median Land Protrusion).</li> <li>2. All feature sizes shown are at Maximum Material Condition (MMC) and a card fabrication tolerance of 0.05 mm is assumed.</li> </ol> |                    |      |

## 11. Package Outline: DIP8

Figure 17 illustrates the package details for the Si871x/2x in a DIP8 package. Table 18 lists the values for the dimensions shown in the illustration.

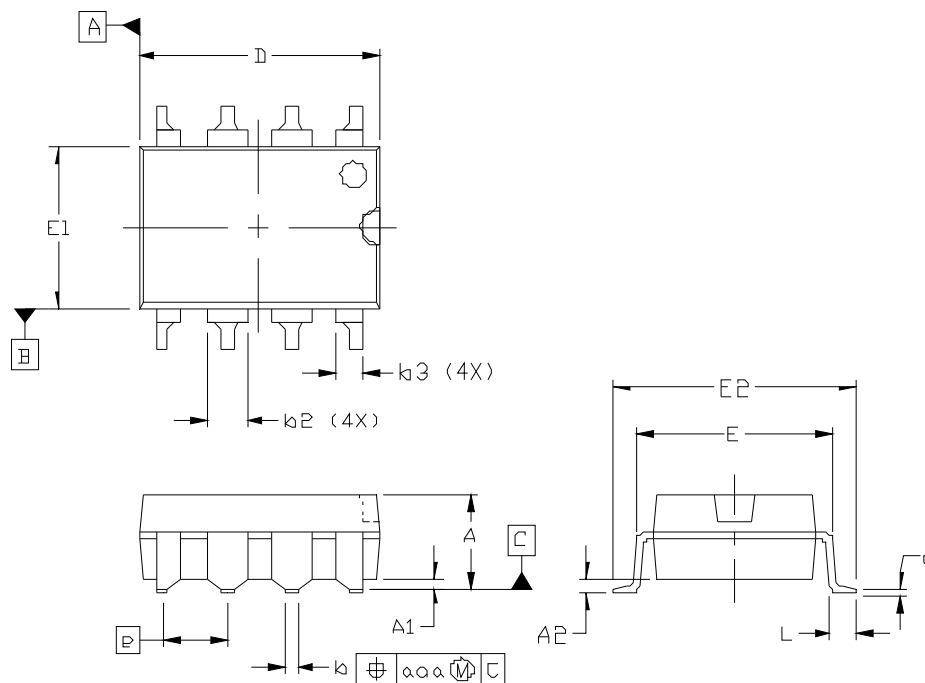


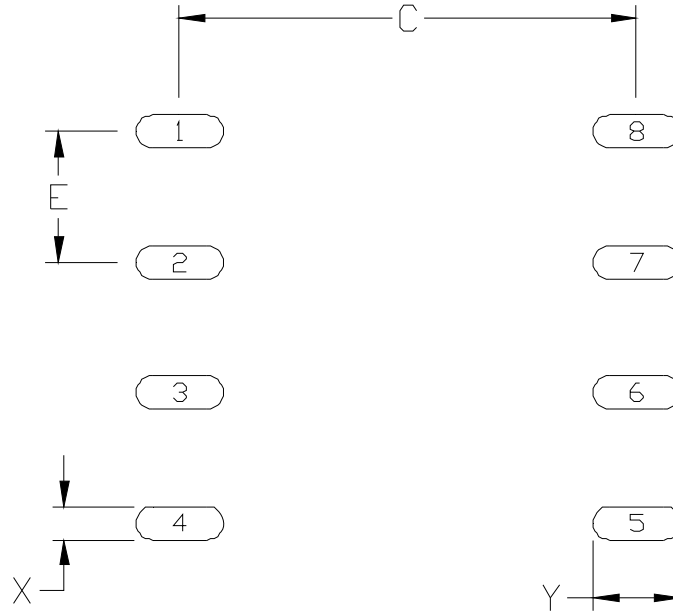
Figure 17. DIP8 Package

Table 18. DIP8 Package Diagram Dimensions

| Dimension   | Min       | Max  |
|---|-----------|------|
| A   | —         | 4.19 |
| A1  | 0.55      | 0.75 |
| A2  | 3.17      | 3.43 |
| b   | 0.35      | 0.55 |
| b2  | 1.14      | 1.78 |
| b3  | 0.76      | 1.14 |
| c   | 0.20      | 0.33 |
| D   | 9.40      | 9.90 |
| E   | 7.37      | 7.87 |
| E1  | 6.10      | 6.60 |
| E2  | 9.40      | 9.90 |
| e   | 2.54 BSC. |      |
| L   | 0.38      | 0.89 |
| aaa   | —         | 0.25 |
| <b>Notes:</b>   |           |      |
| 1. All dimensions shown are in millimeters (mm) unless otherwise noted. |           |      |
| 2. Dimensioning and Tolerancing per ANSI Y14.5M-1994.                   |           |      |

## 12. Land Pattern: DIP8

Figure 18 illustrates the recommended land pattern details for the Si871x/2x in a DIP8 package. Table 19 lists the values for the dimensions shown in the illustration.



**Figure 18. DIP8 Land Pattern**

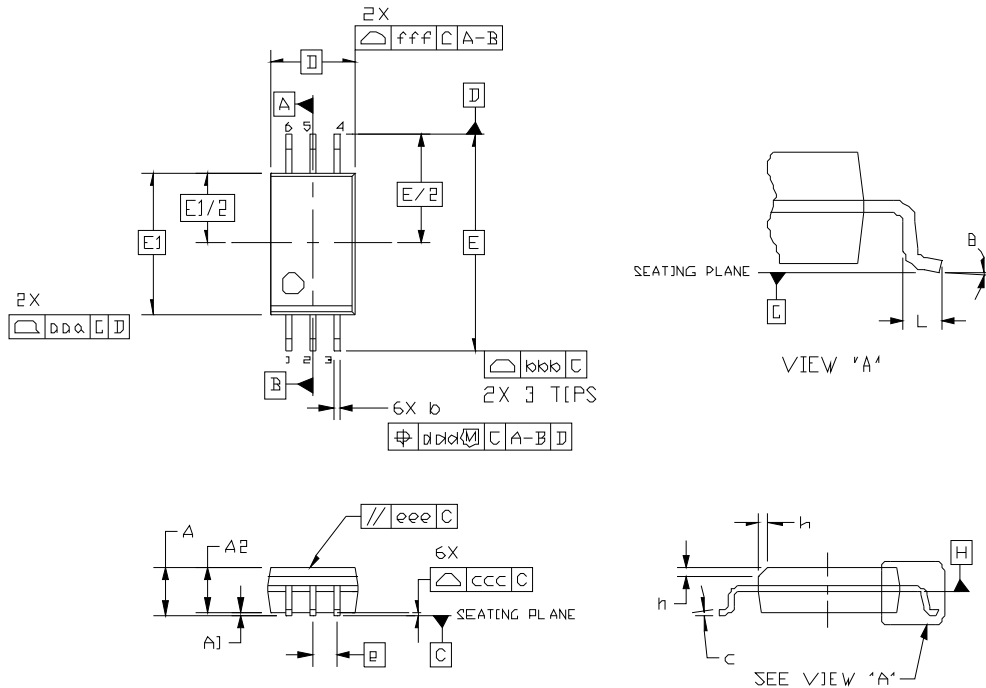
**Table 19. DIP8 Land Pattern Dimensions\***

| Dimension | Min      | Max  |
|-----------|----------|------|
| C         | 8.85     | 8.90 |
| E         | 2.54 BSC |      |
| X         | 0.60     | 0.65 |
| Y         | 1.65     | 1.70 |

**\*Note:** This Land Pattern Design is based on the IPC-7351 specification.

### 13. Package Outline: SDIP6

Figure 19 illustrates the package details for the Si871x/2x in an SDIP6 package. Table 20 lists the values for the dimensions shown in the illustration.



**Figure 19. SDIP6 Package**

**Table 20. SDIP6 Package Diagram Dimensions**

| Dimension | Min       | Max  |
|-----------|-----------|------|
| A         | —         | 2.65 |
| A1        | 0.10      | 0.30 |
| A2        | 2.05      | —    |
| b         | 0.31      | 0.51 |
| c         | 0.20      | 0.33 |
| D         | 4.58 BSC  |      |
| E         | 11.50 BSC |      |
| E1        | 7.50 BSC  |      |
| e         | 1.27 BSC  |      |
| L         | 0.40      | 1.27 |
| h         | 0.25      | 0.75 |

**Notes:**

1. All dimensions shown are in millimeters (mm) unless otherwise noted.
2. Dimensioning and Tolerancing per ANSI Y14.5M-1994.

**Table 20. SDIP6 Package Diagram Dimensions (Continued)**

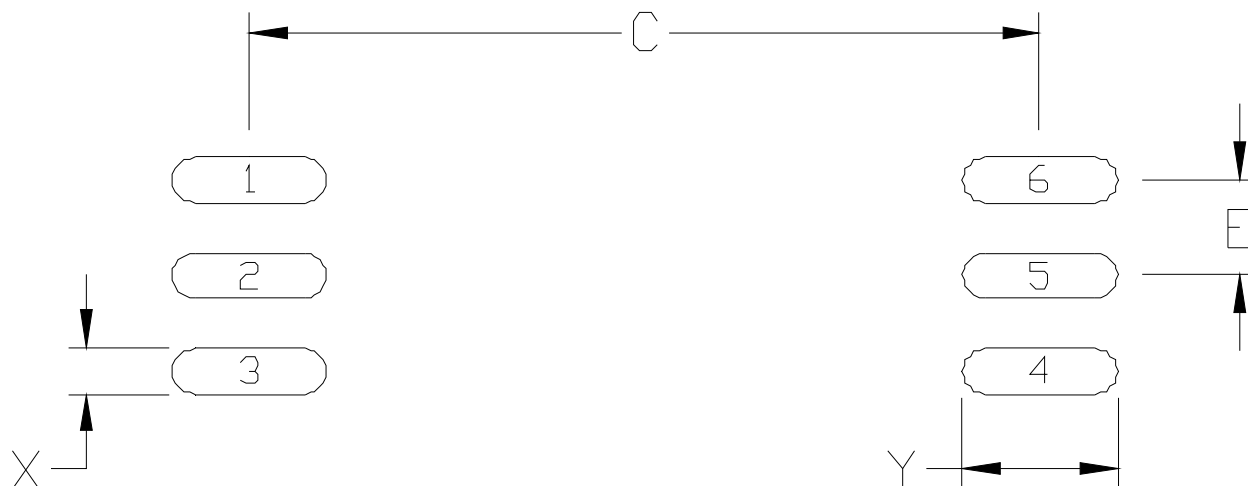
| <b>Dimension</b> | <b>Min</b> | <b>Max</b> |
|------------------|------------|------------|
| $\theta$         | 0°         | 8°         |
| aaa              | —          | 0.10       |
| bbb              | —          | 0.33       |
| ccc              | —          | 0.10       |
| ddd              | —          | 0.25       |
| eee              | —          | 0.10       |
| fff              | —          | 0.20       |

**Notes:**

1. All dimensions shown are in millimeters (mm) unless otherwise noted.
2. Dimensioning and Tolerancing per ANSI Y14.5M-1994.

## 14. Land Pattern: SDIP6

Figure 20 illustrates the recommended land pattern details for the Si871x/2x in an SDIP6 package. Table 21 lists the values for the dimensions shown in the illustration.



**Figure 20. SDIP6 Land Pattern**

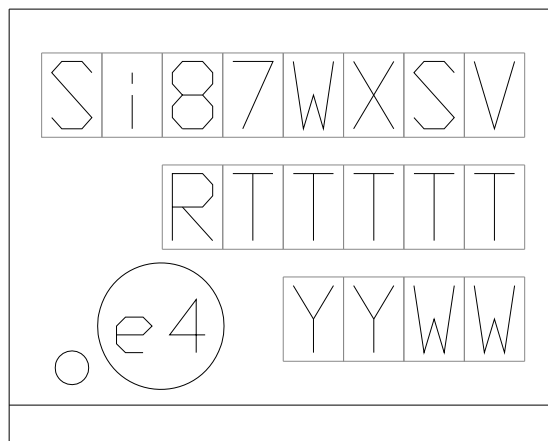
**Table 21. SDIP6 Land Pattern Dimensions\***

| Dimension  | Min      | Max   |
|--|----------|-------|
| C  | 10.45    | 10.50 |
| E  | 1.27 BSC |       |
| X  | 0.55     | 0.60  |
| Y  | 2.00     | 2.05  |
| <b>*Note:</b> This Land Pattern Design is based on the IPC-7351 specification. |          |       |

# Si871x/2x

## 15. Top Markings

### 15.1. Top Marking (8-Pin Narrow Body SOIC)

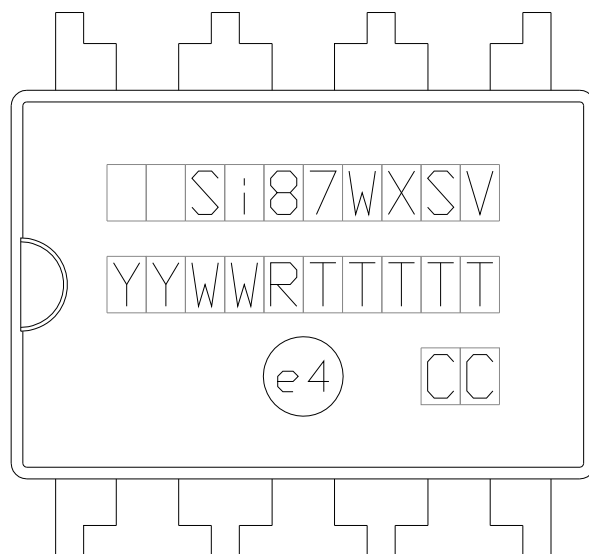


### 15.2. Top Marking Explanation (8-Pin Narrow Body SOIC)

|                        |   |  |
|------------------------|---|--|
| <b>Line 1 Marking:</b> | Customer Part Number                        | <p>Si87 = Base name of product series<br/> W = Isolator product series (1 or 2)<br/> X = Output configuration<br/> 5/9 = no enable<br/> 6 = enable, output high when active<br/> 7/8 = enable, output Hi-z when active<br/> 0 = enable, output low when active<br/> S = Performance Grade:<br/> A = 15 Mbps, 20 kV/μs minimum CMTI<br/> B = 15 Mbps, 35 kV/μs minimum CMTI<br/> V = Insulation rating<br/> C = 3.75 kV</p> |
| <b>Line 2 Marking:</b> | RTTTTT = Mfg Code                           | <p>Manufacturing Code from the Assembly Purchase Order form.<br/> “R” indicates revision.</p>  |
| <b>Line 3 Marking:</b> | Circle = 43 mils Diameter<br>Left-Justified | “e4” Pb-Free Symbol  |
|                        | YY = Year<br>WW = Work Week                 | Assigned by the Assembly House. Corresponds to the year and work week of the mold date.  |



## 15.3. Top Marking (DIP8)

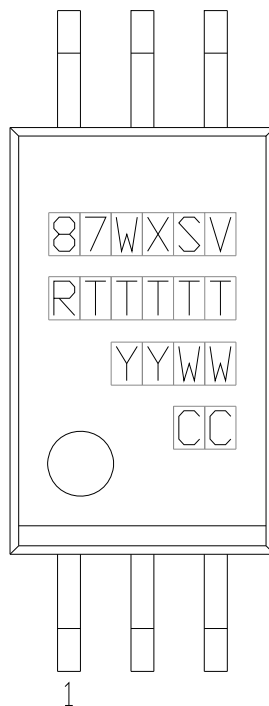


## 15.4. Top Marking Explanation (DIP8)

|                        |   |   |
|------------------------|---|---|
| <b>Line 1 Marking:</b> | Customer Part Number                          | Si87 = Base name of product series<br>W = Isolator product series (1 or 2)<br>X = Output configuration<br>5/9 = no enable<br>6 = enable, output high when active<br>7/8 = enable, output Hi-z when active<br>0 = enable, output low when active<br>S = Performance Grade:<br>A = 15 Mbps, 20 kV/μs minimum CMTI<br>B = 15 Mbps, 35 kV/μs minimum CMTI<br>V = Insulation rating<br>C = 3.75 kV |
| <b>Line 2 Marking:</b> | YY = Year<br>WW = Work Week                   | Assigned by the Assembly House. Corresponds to the year and work week of the mold date.   |
|                        | RTTTTT = Mfg Code                             | Manufacturing Code from the Assembly Purchase Order form.<br>"R" indicates revision.  |
| <b>Line 3 Marking:</b> | Circle = 51 mils Diameter<br>Center-Justified | "e4" Pb-Free Symbol   |
|                        | Country of Origin<br>(Iso-Code Abbreviation)  | CC  |

# Si871x/2x

## 15.5. Top Marking (SDIP6)



## 15.6. Top Marking Explanation (SDIP6)

|                        |  |  |
|------------------------|--|--|
| <b>Line 1 Marking:</b> | Device                                       | <p>87 = Base name of product series<br/> W = Isolator product series (1 or 2)<br/> X = Output configuration<br/> 5/9 = no enable<br/> 6 = enable, output high when active<br/> 7/8 = enable, output Hi-z when active<br/> 0 = enable, output low when active<br/> S = Performance Grade:<br/> A = 15 Mbps, 20 kV/<math>\mu</math>s minimum CMTI<br/> B = 15 Mbps, 35 kV/<math>\mu</math>s minimum CMTI<br/> V = Insulation rating<br/> C = 3.75 kV; D = 5.0 kV</p> |
| <b>Line 2 Marking:</b> | RTTTTT = Mfg Code                            | <p>Manufacturing Code from the Assembly Purchase Order form.<br/> “R” indicates revision.</p>  |
| <b>Line 3 Marking:</b> | YY = Year<br>WW = Work Week                  | <p>Assigned by the Assembly House. Corresponds to the year and work week of the mold date.</p>   |
| <b>Line 4 Marking:</b> | Country of Origin<br>(Iso-Code Abbreviation) | CC   |

## DOCUMENT CHANGE LIST

### Revision 0.9 to Revision 1.0

- Updated Table 2 on page 4.
- Updated Table 5 on page 9.
- Updated Table 6 on page 9.
- Updated Table 9 on page 13.
- Updated Figure 8 on page 16.

### Revision 1.0 to Revision 1.01

- Added "8.1.Automotive Grade OPNs" on page 24.