

## ISOPRO LOW POWER FIVE-CHANNEL DIGITAL ISOLATOR

### Features

- High-speed operation:  
DC to 150 Mbps
- Low propagation delay:  
<10 ns worst case
- Wide Operating Supply Voltage:  
2.70–5.5 V
- Ultra low power (typical)  
5 V Operation:
  - <1.6 mA per channel at 1 Mbps
  - <1.9 mA per channel at 10 Mbps
  - <6 mA per channel at 100 Mbps
 2.70 V Operation:
  - <1.4 mA per channel at 1 Mbps
  - <1.7 mA per channel at 10 Mbps
  - <4 mA per channel at 100 Mbps
- Precise timing (typical):
  - 2 ns pulse width distortion
  - 1 ns channel-channel matching
  - 2 ns pulse width skew
- Up to 2500  $V_{RMS}$  isolation
- Transient Immunity: 30 kV/ $\mu$ s
- Tri-state outputs with ENABLE control
- DC correct
- No start-up initialization required
- <15  $\mu$ s startup time
- High temperature operation:  
125 °C at 150 Mbps
- Wide body and narrow body SOIC-16 packages
- RoHS-compliant

### Applications

- Isolated switch mode supplies
- Isolated ADC, DAC
- Motor control
- Power factor correction systems

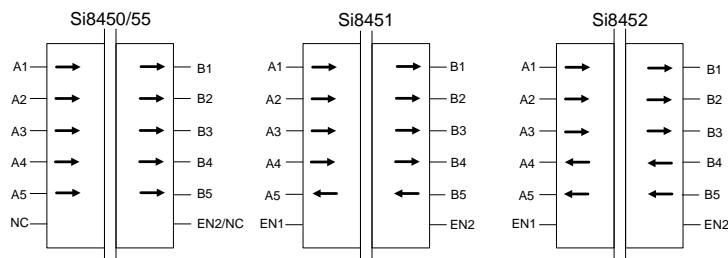
### Safety Regulatory Approvals

- UL 1577 recognized
  - 2500  $V_{RMS}$  for 1 minute
- CSA component notice 5A approval
  - IEC 60950 approved
- VDE certification conformity\*
  - IEC 60747-5-2  
(VDE0884 Part 2)

### Description

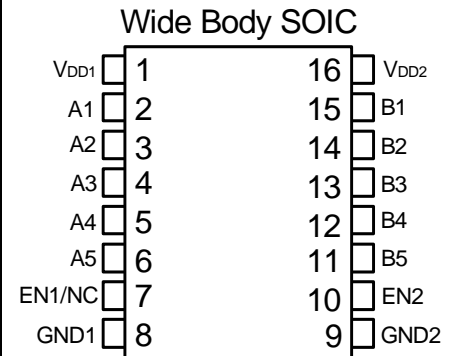
Silicon Lab's family of ultra low power digital isolators are CMOS devices that employ an RF coupler to transmit digital information across an isolation barrier. Very high speed operation at low power levels is achieved. These devices are available in 16-pin wide-body and narrow-body SOIC packages. Two speed grade options (1 and 150 Mbps) are available and achieve worst-case propagation delays of less than 10 ns.

### Block Diagram



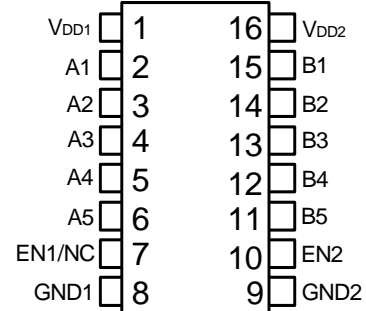
\*Note: Pending.

### Pin Assignments



Top View (Si8450/51/52)

### Narrow Body SOIC



Top View (Si8450/51/52)

Patents pending



---

**TABLE OF CONTENTS**


---

<b><u>Section</u></b>	<b><u>Page</u></b>
<b>1. Electrical Specifications</b> .....	<b>4</b>
<b>2. Typical Performance Characteristics</b> .....	<b>20</b>
<b>3. Application Information</b> .....	<b>22</b>
3.1. Theory of Operation .....	22
3.2. Eye Diagram .....	23
3.3. Layout Recommendations .....	24
<b>4. Errata and Design Migration Guidelines</b> .....	<b>26</b>
4.1. Enable Pin Causes Outputs to Go Low .....	26
4.2. Power Supply Bypass Capacitors .....	26
4.3. Latch Up Immunity .....	26
<b>5. Pin Descriptions (Si8450/51/52)</b> .....	<b>27</b>
<b>6. Pin Descriptions (Si8455)</b> .....	<b>28</b>
<b>7. Ordering Guide</b> .....	<b>29</b>
<b>8. Package Outline: 16-Pin Wide Body SOIC</b> .....	<b>30</b>
<b>9. Landing Pattern: 16-Pin Wide-Body SOIC</b> .....	<b>31</b>
<b>10. Package Outline: 16-Pin Narrow Body SOIC</b> .....	<b>32</b>
<b>11. Landing Pattern: 16-Pin Narrow Body SOIC</b> .....	<b>34</b>
<b>12. Top Marking: 16-Pin Wide Body SOIC</b> .....	<b>35</b>
<b>13. Top Marking: 16-Pin Narrow Body SOIC</b> .....	<b>36</b>
<b>Document Change List</b> .....	<b>37</b>
<b>Contact Information</b> .....	<b>38</b>

# Si8450/51/52/55

## 1. Electrical Specifications

**Table 1. Electrical Characteristics**

( $V_{DD1} = 5 V \pm 10\%$ ,  $V_{DD2} = 5 V \pm 10\%$ ,  $T_A = -40$  to  $125$  °C; applies to narrow and wide-body SOIC packages)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
High Level Input Voltage	$V_{IH}$		2.0	—	—	V
Low Level Input Voltage	$V_{IL}$		—	—	0.8	V
High Level Output Voltage	$V_{OH}$	$I_{OH} = -4$ mA	$V_{DD1}, V_{DD2} - 0.4$	4.8	—	V
Low Level Output Voltage	$V_{OL}$	$I_{OL} = 4$ mA	—	0.2	0.4	V
Input Leakage Current	$I_L$		—	—	$\pm 10$	$\mu$ A
Output Impedance <sup>1</sup>	$Z_O$	VDD = 5 V, 25 °C	—	50	—	$\Omega$
Enable Input High Current	$I_{ENH}$	$V_{ENx} = V_{IH}$	—	2	—	$\mu$ A
Enable Input Low Current	$I_{ENL}$	$V_{ENx} = V_{IL}$	—	2	—	$\mu$ A
<b>DC Supply Current (All inputs 0 V or at Supply)</b>						
<b>Si8450Ax, Bx, Si8455Bx</b>						
$V_{DD1}$		All inputs 0 DC	—	2	3	mA
$V_{DD2}$		All inputs 0 DC	—	3.5	5.5	
$V_{DD1}$		All inputs 1 DC	—	7	10.5	
$V_{DD2}$		All inputs 1 DC	—	3.5	5.5	
<b>Si8451Ax, Bx</b>						
$V_{DD1}$		All inputs 0 DC	—	2	3	mA
$V_{DD2}$		All inputs 0 DC	—	3	4.5	
$V_{DD1}$		All inputs 1 DC	—	6	9	
$V_{DD2}$		All inputs 1 DC	—	4.5	7	
<b>Si8452Ax, Bx</b>						
$V_{DD1}$		All inputs 0 DC	—	2.5	4	mA
$V_{DD2}$		All inputs 0 DC	—	3	4.5	
$V_{DD1}$		All inputs 1 DC	—	6	9	
$V_{DD2}$		All inputs 1 DC	—	5	7.5	
<b>1 Mbps Supply Current (All inputs = 500 kHz square wave, CI = 15 pF on all outputs)</b>						
<b>Si8450Ax, Bx, Si8455Bx</b>						
$V_{DD1}$			—	6	9	mA
$V_{DD2}$			—	4	6	
<b>Si8451Ax, Bx</b>						
$V_{DD1}$			—	5.5	8.5	mA
$V_{DD2}$			—	4.5	7	
<b>Si8452Ax, Bx</b>						
$V_{DD1}$			—	5	7.5	mA
$V_{DD2}$			—	5	7.5	
<b>Notes:</b>						
<ol style="list-style-type: none"> <li>The nominal output impedance of an isolator driver channel is approximately 50 <math>\Omega</math>, <math>\pm 40\%</math>, which is a combination of the value of the on-chip series termination resistor and channel resistance of the output driver FET. When driving loads where transmission line effects will be a factor, output pins should be terminated with 50 <math>\Omega</math> controlled impedance PCB traces.</li> <li><math>t_{PSK(P-P)}</math> is the magnitude of the difference in propagation delay times measured between different units operating at the same supply voltages, load, and ambient temperature.</li> <li>See "4. Errata and Design Migration Guidelines" on page 26 for more details.</li> <li>Start-up time is the time period from the application of power to valid data at the output.</li> </ol>						

**Table 1. Electrical Characteristics (Continued)**(V<sub>DD1</sub> = 5 V±10%, V<sub>DD2</sub> = 5 V±10%, T<sub>A</sub> = -40 to 125 °C; applies to narrow and wide-body SOIC packages)

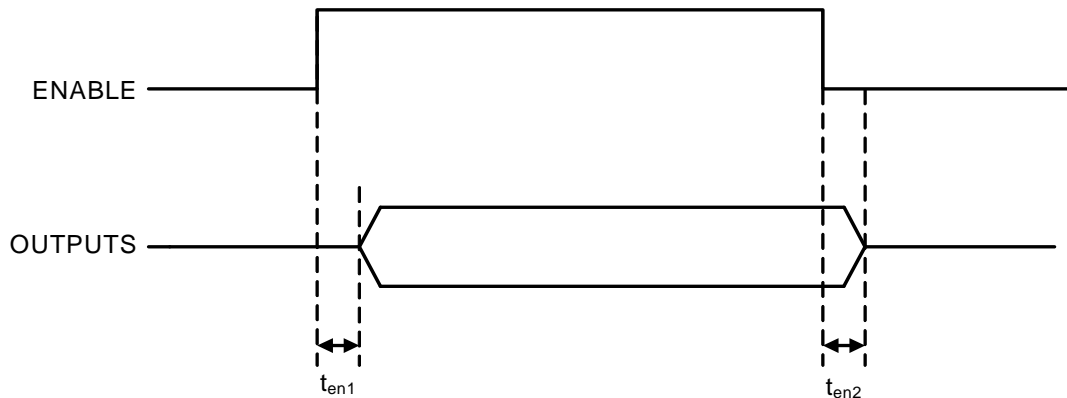
Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>10 Mbps Supply Current</b> (All inputs = 5 MHz square wave, CI = 15 pF on all outputs)						
<b>Si8450Bx, Si8455Bx</b>						
V <sub>DD1</sub>			—	6	—	mA
V <sub>DD2</sub>			—	5.5	—	
<b>Si8451Bx</b>						
V <sub>DD1</sub>			—	6	—	mA
V <sub>DD2</sub>			—	5.5	—	
<b>Si8452Bx</b>						
V <sub>DD1</sub>			—	6	—	mA
V <sub>DD2</sub>			—	6	—	
<b>100 Mbps Supply Current</b> (All inputs = 50 MHz square wave, CI = 15 pF on all outputs)						
<b>Si8450Bx, Si8455Bx</b>						
V <sub>DD1</sub>			—	5	7.5	mA
V <sub>DD2</sub>			—	24.5	37	
<b>Si8451Bx</b>						
V <sub>DD1</sub>			—	9	13.5	mA
V <sub>DD2</sub>			—	21	31.5	
<b>Si8452Bx</b>						
V <sub>DD1</sub>			—	13	19.5	mA
V <sub>DD2</sub>			—	17	25.5	
<b>Timing Characteristics</b>						
<b>Si845xAx</b>						
Maximum Data Rate			0	—	1	Mbps
Minimum Pulse Width			—	—	250	ns
Propagation Delay	t <sub>PHL</sub> , t <sub>PLH</sub>	See Figure 2	—	—	35	ns
Pulse Width Distortion (t <sub>PLH</sub> - t <sub>PHL</sub> )	PWD	See Figure 2	—	—	25	ns
Propagation Delay Skew <sup>2</sup>	t <sub>PSK(P-P)</sub>		—	—	40	ns
Channel-Channel Skew	t <sub>PSK</sub>		—	—	35	ns
<b>Notes:</b>						
1. The nominal output impedance of an isolator driver channel is approximately 50 Ω, ±40%, which is a combination of the value of the on-chip series termination resistor and channel resistance of the output driver FET. When driving loads where transmission line effects will be a factor, output pins should be terminated with 50 Ω controlled impedance PCB traces.						
2. t <sub>PSK(P-P)</sub> is the magnitude of the difference in propagation delay times measured between different units operating at the same supply voltages, load, and ambient temperature.						
3. See "4. Errata and Design Migration Guidelines" on page 26 for more details.						
4. Start-up time is the time period from the application of power to valid data at the output.						

# Si8450/51/52/55

**Table 1. Electrical Characteristics (Continued)**

( $V_{DD1} = 5 V \pm 10\%$ ,  $V_{DD2} = 5 V \pm 10\%$ ,  $T_A = -40$  to  $125$  °C; applies to narrow and wide-body SOIC packages)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>Si845xBx</b>						
Maximum Data Rate			0	—	150	Mbps
Minimum Pulse Width			—	—	6	ns
Propagation Delay	$t_{PHL}$ , $t_{PLH}$	See Figure 2	3	6	9.5	ns
Pulse Width Distortion $ t_{PLH} - t_{PHL} $	PWD	See Figure 2	—	—	2.5	ns
Propagation Delay Skew <sup>2</sup>	$t_{PSK(P-P)}$		—	—	3	ns
Channel-Channel Skew	$t_{PSK}$		—	—	2	ns
<b>All Models</b>						
Output Rise Time	$t_r$	$C_L = 15$ pF See Figure 2	—	2	4	ns
Output Fall Time	$t_f$	$C_L = 15$ pF See Figure 2	—	2	4	ns
Common Mode Transient Immunity	CMTI	$V_I = V_{DD}$ or $0$ V	—	30	—	kV/ $\mu$ s
Enable to Data Valid <sup>3</sup>	$t_{en1}$	See Figure 1	—	7.5	9	ns
Enable to Data Tri-State <sup>3</sup>	$t_{en2}$	See Figure 1	—	8	9.5	ns
Start-up Time <sup>3,4</sup>	$t_{SU}$		—	15	40	$\mu$ s
<b>Notes:</b>						
<ol style="list-style-type: none"> <li>1. The nominal output impedance of an isolator driver channel is approximately <math>50 \Omega</math>, <math>\pm 40\%</math>, which is a combination of the value of the on-chip series termination resistor and channel resistance of the output driver FET. When driving loads where transmission line effects will be a factor, output pins should be terminated with <math>50 \Omega</math> controlled impedance PCB traces.</li> <li>2. <math>t_{PSK(P-P)}</math> is the magnitude of the difference in propagation delay times measured between different units operating at the same supply voltages, load, and ambient temperature.</li> <li>3. See "4. Errata and Design Migration Guidelines" on page 26 for more details.</li> <li>4. Start-up time is the time period from the application of power to valid data at the output.</li> </ol>						



**Figure 1. ENABLE Timing Diagram**

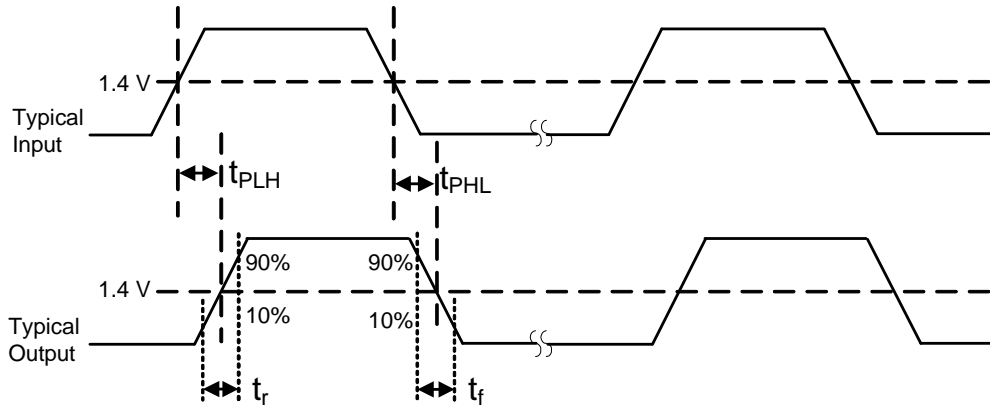


Figure 2. Propagation Delay Timing

# Si8450/51/52/55

**Table 2. Electrical Characteristics**

( $V_{DD1} = 3.3\text{ V} \pm 10\%$ ,  $V_{DD2} = 3.3\text{ V} \pm 10\%$ ,  $T_A = -40$  to  $125\text{ }^\circ\text{C}$ ; applies to narrow and wide-body SOIC packages)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
High Level Input Voltage	$V_{IH}$		2.0	—	—	V
Low Level Input Voltage	$V_{IL}$		—	—	0.8	V
High Level Output Voltage	$V_{OH}$	loh = -4 mA	$V_{DD1}, V_{DD2} - 0.4$	3.1	—	V
Low Level Output Voltage	$V_{OL}$	lol = 4 mA	—	0.2	0.4	V
Input Leakage Current	$I_L$		—	—	$\pm 10$	$\mu\text{A}$
Output Impedance <sup>1</sup>	$Z_O$	VDD = 5 V, 25 °C	—	50	—	$\Omega$
Enable Input High Current	$I_{ENH}$	$V_{ENx} = V_{IH}$	—	2	—	$\mu\text{A}$
Enable Input Low Current	$I_{ENL}$	$V_{ENx} = V_{IL}$	—	2	—	$\mu\text{A}$
<b>DC Supply Current (All inputs 0 V or at supply)</b>						
<b>Si8450Ax, Bx, Si8455Bx</b>						
$V_{DD1}$		All inputs 0 DC	—	2	3	mA
$V_{DD2}$		All inputs 0 DC	—	3.5	5.5	
$V_{DD1}$		All inputs 1 DC	—	7	10.5	
$V_{DD2}$		All inputs 1 DC	—	3.5	5.5	
<b>Si8451Ax, Bx</b>						
$V_{DD1}$		All inputs 0 DC	—	2	3	mA
$V_{DD2}$		All inputs 0 DC	—	3	4.5	
$V_{DD1}$		All inputs 1 DC	—	6	9	
$V_{DD2}$		All inputs 1 DC	—	4.5	7	
<b>Si8452Ax, Bx</b>						
$V_{DD1}$		All inputs 0 DC	—	2.5	4	mA
$V_{DD2}$		All inputs 0 DC	—	3	4.5	
$V_{DD1}$		All inputs 1 DC	—	6	9	
$V_{DD2}$		All inputs 1 DC	—	5	7.5	
<b>1 Mbps Supply Current (All inputs = 500 kHz square wave, CI = 15 pF on all outputs)</b>						
<b>Si8450Ax, Bx, Si8455Bx</b>						
$V_{DD1}$			—	6	9	mA
$V_{DD2}$			—	4	6	
<b>Si8451Ax, Bx</b>						
$V_{DD1}$			—	5.5	8.5	mA
$V_{DD2}$			—	4.5	7	
<b>Si8452Ax, Bx</b>						
$V_{DD1}$			—	5	7.5	mA
$V_{DD2}$			—	5	7.5	
<b>Notes:</b>						
<ol style="list-style-type: none"> <li>The nominal output impedance of an isolator driver channel is approximately <math>50\ \Omega</math>, <math>\pm 40\%</math>, which is a combination of the value of the on-chip series termination resistor and channel resistance of the output driver FET. When driving loads where transmission line effects will be a factor, output pins should be terminated with <math>50\ \Omega</math> controlled impedance PCB traces.</li> <li><math>t_{PSK(P-P)}</math> is the magnitude of the difference in propagation delay times measured between different units operating at the same supply voltages, load, and ambient temperature.</li> <li>See "4. Errata and Design Migration Guidelines" on page 26 for more details.</li> <li>Start-up time is the time period from the application of power to valid data at the output.</li> </ol>						



**Table 2. Electrical Characteristics (Continued)**(V<sub>DD1</sub> = 3.3 V±10%, V<sub>DD2</sub> = 3.3 V±10%, T<sub>A</sub> = -40 to 125 °C; applies to narrow and wide-body SOIC packages)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>10 Mbps Supply Current</b> (All inputs = 5 MHz square wave, CI = 15 pF on all outputs)						
<b>Si8450Bx, Si8455Bx</b>						
V <sub>DD1</sub>			—	6	—	mA
V <sub>DD2</sub>			—	5.5	—	
<b>Si8451Bx</b>						
V <sub>DD1</sub>			—	6	—	mA
V <sub>DD2</sub>			—	5.5	—	
<b>Si8452Bx</b>						
V <sub>DD1</sub>			—	6	—	mA
V <sub>DD2</sub>			—	6	—	
<b>100 Mbps Supply Current</b> (All inputs = 50 MHz square wave, CI = 15 pF on all outputs)						
<b>Si8450Bx, Si8455Bx</b>						
V <sub>DD1</sub>			—	4.5	7	mA
V <sub>DD2</sub>			—	17	25.5	
<b>Si8451Bx</b>						
V <sub>DD1</sub>			—	7	10.5	mA
V <sub>DD2</sub>			—	15	22.5	
<b>Si8452Bx</b>						
V <sub>DD1</sub>			—	10	15	mA
V <sub>DD2</sub>			—	12.5	19	
<b>Timing Characteristics</b>						
<b>Si845xAx</b>						
Maximum Data Rate			0	—	1	Mbps
Minimum Pulse Width			—	—	250	ns
Propagation Delay	t <sub>PHL</sub> , t <sub>PLH</sub>	See Figure 2	—	—	35	ns
Pulse Width Distortion  t <sub>PLH</sub> - t <sub>PHL</sub>	PWD	See Figure 2	—	—	25	ns
Propagation Delay Skew <sup>2</sup>	t <sub>PSK(P-P)</sub>		—	—	40	ns
Channel-Channel Skew	t <sub>PSK</sub>		—	—	35	ns
<b>Notes:</b>						
<ol style="list-style-type: none"> <li>1. The nominal output impedance of an isolator driver channel is approximately 50 Ω, ±40%, which is a combination of the value of the on-chip series termination resistor and channel resistance of the output driver FET. When driving loads where transmission line effects will be a factor, output pins should be terminated with 50 Ω controlled impedance PCB traces.</li> <li>2. t<sub>PSK(P-P)</sub> is the magnitude of the difference in propagation delay times measured between different units operating at the same supply voltages, load, and ambient temperature.</li> <li>3. See "4. Errata and Design Migration Guidelines" on page 26 for more details.</li> <li>4. Start-up time is the time period from the application of power to valid data at the output.</li> </ol>						

# Si8450/51/52/55

**Table 2. Electrical Characteristics (Continued)**

( $V_{DD1} = 3.3\text{ V} \pm 10\%$ ,  $V_{DD2} = 3.3\text{ V} \pm 10\%$ ,  $T_A = -40\text{ to }125\text{ }^\circ\text{C}$ ; applies to narrow and wide-body SOIC packages)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>Si845xBx</b>						
Maximum Data Rate			0	—	150	Mbps
Minimum Pulse Width			—	—	6	ns
Propagation Delay	$t_{PHL}, t_{PLH}$	See Figure 2	3	6	9.5	ns
Pulse Width Distortion $ t_{PLH} - t_{PHL} $	PWD	See Figure 2	—	—	2.5	ns
Propagation Delay Skew <sup>2</sup>	$t_{PSK(P-P)}$		—	—	3	ns
Channel-Channel Skew	$t_{PSK}$		—	—	2	ns
<b>All Models</b>						
Output Rise Time	$t_r$	$C_L = 15\text{ pF}$ See Figure 2	—	2	4	ns
Output Fall Time	$t_f$	$C_L = 15\text{ pF}$ See Figure 2	—	2	4	ns
Common Mode Transient Immunity at Logic Low Output	CMTI	$V_I = V_{DD}$ or 0 V	—	30	—	kV/ $\mu\text{s}$
Enable to Data Valid <sup>3</sup>	$t_{en1}$	See Figure 1	—	8	9.5	ns
Enable to Data Tri-State <sup>3</sup>	$t_{en2}$	See Figure 1	—	10	11.5	ns
Start-up Time <sup>3,4</sup>	$t_{SU}$		—	15	40	$\mu\text{s}$
<b>Notes:</b>						
<ol style="list-style-type: none"> <li>1. The nominal output impedance of an isolator driver channel is approximately <math>50\ \Omega</math>, <math>\pm 40\%</math>, which is a combination of the value of the on-chip series termination resistor and channel resistance of the output driver FET. When driving loads where transmission line effects will be a factor, output pins should be terminated with <math>50\ \Omega</math> controlled impedance PCB traces.</li> <li>2. <math>t_{PSK(P-P)}</math> is the magnitude of the difference in propagation delay times measured between different units operating at the same supply voltages, load, and ambient temperature.</li> <li>3. See "4. Errata and Design Migration Guidelines" on page 26 for more details.</li> <li>4. Start-up time is the time period from the application of power to valid data at the output.</li> </ol>						

**Table 3. Electrical Characteristics<sup>1</sup>**(V<sub>DD1</sub> = 2.70 V, V<sub>DD2</sub> = 2.70 V, T<sub>A</sub> = -40 to 125 °C; applies to narrow and wide-body SOIC packages)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
High Level Input Voltage	V <sub>IH</sub>		2.0	—	—	V
Low Level Input Voltage	V <sub>IL</sub>		—	—	0.8	V
High Level Output Voltage	V <sub>OH</sub>	I <sub>oh</sub> = -4 mA	V <sub>DD1</sub> , V <sub>DD2</sub> - 0.4	2.3	—	V
Low Level Output Voltage	V <sub>OL</sub>	I <sub>ol</sub> = 4 mA	—	0.2	0.4	V
Input Leakage Current	I <sub>L</sub>		—	—	±10	μA
Output Impedance <sup>2</sup>	Z <sub>O</sub>	VDD = 5 V, 25 °C	—	50	—	Ω
Enable Input High Current	I <sub>ENH</sub>	V <sub>ENx</sub> = V <sub>IH</sub>	—	2	—	μA
Enable Input Low Current	I <sub>ENL</sub>	V <sub>ENx</sub> = V <sub>IL</sub>	—	2	—	μA
<b>DC Supply Current (All inputs 0 V or at supply)</b>						
<b>Si8450Ax, Bx, Si8455Bx</b>						
V <sub>DD1</sub>		All inputs 0 DC	—	2	3	mA
V <sub>DD2</sub>		All inputs 0 DC	—	3.5	5.5	
V <sub>DD1</sub>		All inputs 1 DC	—	7	10.5	
V <sub>DD2</sub>		All inputs 1 DC	—	3.5	5.5	
<b>Si8451Ax, Bx</b>						
V <sub>DD1</sub>		All inputs 0 DC	—	2	3	mA
V <sub>DD2</sub>		All inputs 0 DC	—	3	4.5	
V <sub>DD1</sub>		All inputs 1 DC	—	6	9	
V <sub>DD2</sub>		All inputs 1 DC	—	4.5	7	
<b>Si8452Ax, Bx</b>						
V <sub>DD1</sub>		All inputs 0 DC	—	2.5	4	mA
V <sub>DD2</sub>		All inputs 0 DC	—	3	4.5	
V <sub>DD1</sub>		All inputs 1 DC	—	6	9	
V <sub>DD2</sub>		All inputs 1 DC	—	5	7.5	
<b>1 Mbps Supply Current (All inputs = 500 kHz square wave, CI = 15 pF on all outputs)</b>						
<b>Si8450Ax, Bx, Si8455Bx</b>						
V <sub>DD1</sub>			—	6	9	mA
V <sub>DD2</sub>			—	4	6	
<b>Si8451Ax, Bx</b>						
V <sub>DD1</sub>			—	5.5	8.5	mA
V <sub>DD2</sub>			—	4.5	7	
<b>Si8452Ax, Bx</b>						
V <sub>DD1</sub>			—	5	7.5	mA
V <sub>DD2</sub>			—	5	7.5	
<b>Notes:</b>						
1. Specifications in this table are valid at VDD1 = 2.6 V and VDD2 = 2.6 V when T <sub>A</sub> = 0 to 85 °C.						
2. The nominal output impedance of an isolator driver channel is approximately 50 Ω, ±40%, which is a combination of the value of the on-chip series termination resistor and channel resistance of the output driver FET. When driving loads where transmission line effects will be a factor, output pins should be terminated with 50 Ω controlled impedance PCB traces.						
3. t <sub>PSK(P-P)</sub> is the magnitude of the difference in propagation delay times measured between different units operating at the same supply voltages, load, and ambient temperature.						
4. See "4. Errata and Design Migration Guidelines" on page 26 for more details.						
5. Start-up time is the time period from the application of power to valid data at the output.						

# Si8450/51/52/55

**Table 3. Electrical Characteristics<sup>1</sup> (Continued)**

( $V_{DD1} = 2.70\text{ V}$ ,  $V_{DD2} = 2.70\text{ V}$ ,  $T_A = -40\text{ to }125\text{ }^\circ\text{C}$ ; applies to narrow and wide-body SOIC packages)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>10 Mbps Supply Current</b> (All inputs = 5 MHz square wave, CI = 15 pF on all outputs)						
<b>Si8450Bx, Si8455Bx</b>						
$V_{DD1}$			—	6	—	mA
$V_{DD2}$			—	5.5	—	
<b>Si8451Bx</b>						
$V_{DD1}$			—	6	—	mA
$V_{DD2}$			—	5.5	—	
<b>Si8452Bx</b>						
$V_{DD1}$			—	6	—	mA
$V_{DD2}$			—	6	—	
<b>100 Mbps Supply Current</b> (All inputs = 50 MHz square wave, CI = 15 pF on all outputs)						
<b>Si8450Bx, Si8455Bx</b>						
$V_{DD1}$			—	4.5	7	mA
$V_{DD2}$			—	13.5	20.5	
<b>Si8451Bx</b>						
$V_{DD1}$			—	6.5	10	mA
$V_{DD2}$			—	12	18	
<b>Si8452Bx</b>						
$V_{DD1}$			—	8.5	13	mA
$V_{DD2}$			—	10.5	16	
<b>Timing Characteristics</b>						
<b>Si845xAx</b>						
Maximum Data Rate			0	—	1	Mbps
Minimum Pulse Width			—	—	250	ns
Propagation Delay	$t_{PHL}, t_{PLH}$	See Figure 2	—	—	35	ns
Pulse Width Distortion $ t_{PLH} - t_{PHL} $	PWD	See Figure 2	—	—	25	ns
Propagation Delay Skew <sup>3</sup>	$t_{PSK(P-P)}$		—	—	40	ns
Channel-Channel Skew	$t_{PSK}$		—	—	35	ns
<b>Notes:</b>						
1. Specifications in this table are valid at $V_{DD1} = 2.6\text{ V}$ and $V_{DD2} = 2.6\text{ V}$ when $T_A = 0\text{ to }85\text{ }^\circ\text{C}$ .						
2. The nominal output impedance of an isolator driver channel is approximately $50\ \Omega$ , $\pm 40\%$ , which is a combination of the value of the on-chip series termination resistor and channel resistance of the output driver FET. When driving loads where transmission line effects will be a factor, output pins should be terminated with $50\ \Omega$ controlled impedance PCB traces.						
3. $t_{PSK(P-P)}$ is the magnitude of the difference in propagation delay times measured between different units operating at the same supply voltages, load, and ambient temperature.						
4. See "4. Errata and Design Migration Guidelines" on page 26 for more details.						
5. Start-up time is the time period from the application of power to valid data at the output.						

**Table 3. Electrical Characteristics<sup>1</sup> (Continued)**(V<sub>DD1</sub> = 2.70 V, V<sub>DD2</sub> = 2.70 V, T<sub>A</sub> = -40 to 125 °C; applies to narrow and wide-body SOIC packages)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>Si845xBx</b>						
Maximum Data Rate			0	—	150	Mbps
Minimum Pulse Width			—	—	6	ns
Propagation Delay	t <sub>PHL</sub> , t <sub>PLH</sub>	See Figure 2	3	6	9.5	ns
Pulse Width Distortion  t <sub>PLH</sub> - t <sub>PHL</sub>	PWD	See Figure 2	—	—	2.5	ns
Propagation Delay Skew <sup>3</sup>	t <sub>PSK(P-P)</sub>		—	—	3	ns
Channel-Channel Skew	t <sub>PSK</sub>		—	—	2	ns
<b>All Models</b>						
Output Rise Time	t <sub>r</sub>	C <sub>L</sub> = 15 pF See Figure 2	—	2	4	ns
Output Fall Time	t <sub>f</sub>	C <sub>L</sub> = 15 pF See Figure 2	—	2	4	ns
Common Mode Transient Immunity at Logic Low Output	CMTI	V <sub>I</sub> = V <sub>DD</sub> or 0 V	—	30	—	kV/μs
Enable to Data Valid <sup>4</sup>	t <sub>en1</sub>	See Figure 1	—	13.5	16	ns
Enable to Data Tri-State <sup>4</sup>	t <sub>en2</sub>	See Figure 1	—	16.5	19	ns
Start-up Time <sup>4,5</sup>	t <sub>SU</sub>		—	15	40	μs
<b>Notes:</b>						
<ol style="list-style-type: none"> <li>Specifications in this table are valid at V<sub>DD1</sub> = 2.6 V and V<sub>DD2</sub> = 2.6 V when T<sub>A</sub> = 0 to 85 °C.</li> <li>The nominal output impedance of an isolator driver channel is approximately 50 Ω, ±40%, which is a combination of the value of the on-chip series termination resistor and channel resistance of the output driver FET. When driving loads where transmission line effects will be a factor, output pins should be terminated with 50 Ω controlled impedance PCB traces.</li> <li>t<sub>PSK(P-P)</sub> is the magnitude of the difference in propagation delay times measured between different units operating at the same supply voltages, load, and ambient temperature.</li> <li>See "4. Errata and Design Migration Guidelines" on page 26 for more details.</li> <li>Start-up time is the time period from the application of power to valid data at the output.</li> </ol>						

# Si8450/51/52/55

**Table 4. Absolute Maximum Ratings**

Parameter	Symbol	Min	Typ	Max	Unit
Storage Temperature	$T_{STG}$	-65	—	150	°C
Ambient Temperature Under Bias	$T_A$	-40	—	125	°C
Supply Voltage	$V_{DD1}, V_{DD2}$	-0.5	—	5.75	V
Input Voltage	$V_I$	-0.5	—	$V_{DD} + 0.5$	V
Output Voltage	$V_O$	-0.5	—	$V_{DD} + 0.5$	V
Output Current Drive Channel	$L_O$	—	—	10	mA
Lead Solder Temperature (10 s)		—	—	260	°C
Maximum Isolation Voltage (1 s)		—	—	3600	$V_{RMS}$

**Note:** Permanent device damage may occur if the above Absolute Maximum Ratings are exceeded. Functional operation should be restricted to conditions as specified in the operational sections of this data sheet. Exposure to absolute maximum ratings for extended periods may degrade performance.

**Table 5. Recommended Operating Conditions**

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Ambient Operating Temperature*	$T_A$	150 Mbps, 15 pF, 5 V	-40	25	125	°C
Supply Voltage	$V_{DD1}$		2.70	—	5.5	V
	$V_{DD2}$		2.70	—	5.5	V

**\*Note:** The maximum ambient temperature is dependent on data frequency, output loading, number of operating channels, and supply voltage.

**Table 6. Regulatory Information<sup>1</sup>**

<b>CSA</b>
The Si845x is certified under CSA Component Acceptance Notice 5A. For more details, see File 232873.
<b>VDE<sup>2</sup></b>
The Si845x is certified according to IEC 60747-5-2. For more details, see File 5006301-4880-0001.
<b>UL</b>
The Si845x is certified under UL1577 component recognition program. For more details, see File E257455.
<b>Notes:</b>
1. All 2.5 kV <sub>RMS</sub> rated devices are production tested to $\geq 3.0$ kV <sub>RMS</sub> for 1 sec. For more information, see "7. Ordering Guide" on page 29.
2. Pending.

Table 7. Insulation and Safety-Related Specifications

Parameter	Symbol	Test Condition	Value		Unit
			WB SOIC-16	NB SOIC-16	
Minimum Air Gap (Clearance)	L(IO1)		7.6 min	3.9 min	mm
Minimum External Tracking (Creepage)	L(IO2)		7.6 min	3.9 min	mm
Minimum Internal Gap (Internal Clearance)			0.008	0.008	mm
Tracking Resistance (Comparative Tracking Index)	CTI	DIN IEC 60112/VDE 0303 Part 1	>175	>175	V
Resistance (Input-Output) <sup>1</sup>	R <sub>IO</sub>		10 <sup>12</sup>	10 <sup>12</sup>	Ω
Capacitance (Input-Output) <sup>1</sup>	C <sub>IO</sub>	f = 1 MHz	2	2	pF
Input Capacitance <sup>2</sup>	C <sub>I</sub>		4.0	4.0	pF
<b>Notes:</b>					
1. To determine resistance and capacitance, the Si845x is converted into a 2-terminal device. Pins 1–8 are shorted together to form the first terminal and pins 9–16 are shorted together to form the second terminal. The parameters are then measured between these two terminals.					
2. Measured from input pin to ground.					

Table 8. IEC 60664-1 (VDE 0884 Part 2) Ratings

Parameter	Test Conditions	Specification
Basic isolation group	Material Group	IIIa
Installation Classification	Rated Mains Voltages ≤ 150 V <sub>RMS</sub>	I-IV
	Rated Mains Voltages ≤ 300 V <sub>RMS</sub>	I-III
	Rated Mains Voltages ≤ 400 V <sub>RMS</sub>	I-II

**Table 9. IEC 60747-5-2 Insulation Characteristics for Si845xxB\***

Parameter	Symbol	Test Condition	Characteristic	Unit
Maximum Working Insulation Voltage	$V_{IORM}$		560	V peak
Input to Output Test Voltage	$V_{PR}$	Method a After Environmental Tests Subgroup 1 ( $V_{IORM} \times 1.6 = V_{PR}$ , $t_m = 60$ sec, Partial Discharge < 5 pC)	896	V peak
		Method b1 ( $V_{IORM} \times 1.875 = V_{PR}$ , 100% Production Test, $t_m = 1$ sec, Partial Discharge < 5 pC)	1050	
		After Input and/or Safety Test Subgroup 2/3 ( $V_{IORM} \times 1.2 = V_{PR}$ , $t_m = 60$ sec, Partial Discharge < 5 pC)	672	
Highest Allowable Overvoltage (Transient Overvoltage, $t_{TR} = 10$ sec)	$V_{TR}$		4000	V peak
Pollution Degree (DIN VDE 0110, Table 1)			2	
Insulation Resistance at $T_S$ , $V_{IO} = 500$ V	$R_S$		$>10^9$	$\Omega$

**\*Note:** This isolator is suitable for basic electrical isolation only within the safety limit data. Maintenance of the safety data is ensured by protective circuits. The Si845x provides a climate classification of 40/125/21.

**Table 10. IEC Safety Limiting Values<sup>1</sup>**

Parameter	Symbol	Test Condition	Min	Typ	Max		Unit
					WB SOIC-16	NB SOIC-16	
Case Temperature	$T_S$		—	—	150	150	°C
Safety input, output, or supply current	$I_S$	$\theta_{JA} = 100$ °C/W (WB SOIC-16), 105 °C/W (NB SOIC-16), $V_I = 5.5$ V, $T_J = 150$ °C, $T_A = 25$ °C	—	—	220	215	mA
Device Power Dissipation <sup>2</sup>	$P_D$		—	—	415	415	mW

**Notes:**

- Maximum value allowed in the event of a failure; also see the thermal derating curve in Figure 3.
- The Si845x is tested with  $VDD1 = VDD2 = 5.5$  V,  $T_J = 150$  °C,  $CL = 15$  pF, input a 150 Mbps 50% duty cycle square wave.



Table 11. Thermal Characteristics

Parameter	Symbol	Test Condition	Min	Typ		Max	Unit
				WB SOIC-16	NB SOIC-16		
IC Junction-to-Air Thermal Resistance	$\theta_{JA}$		—	100	105	—	$^{\circ}\text{C}/\text{W}$

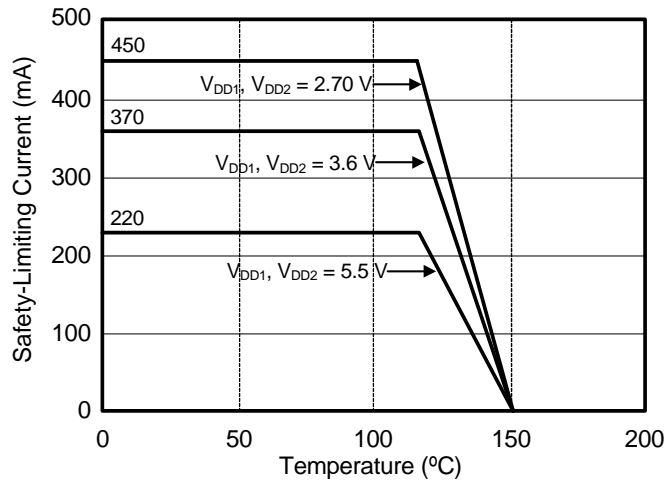


Figure 3. (WB SOIC-16) Thermal Derating Curve, Dependence of Safety Limiting Values with Case Temperature per DIN EN 60747-5-2

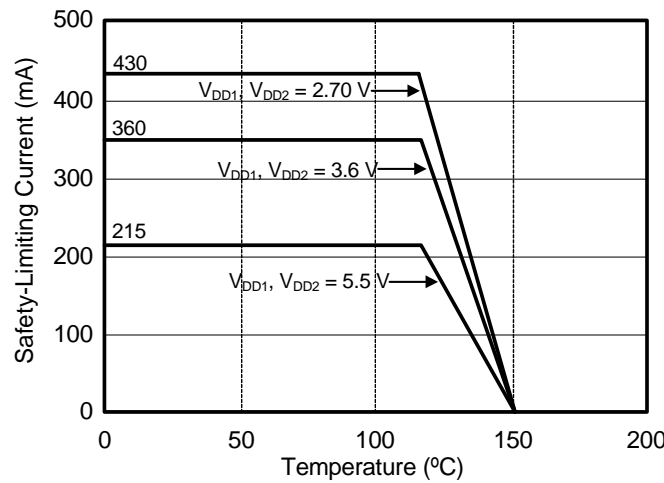


Figure 4. (NB SOIC-16) Thermal Derating Curve, Dependence of Safety Limiting Values with Case Temperature per DIN EN 60747-5-2

**Table 12. Si845x Logic Operation Table**

$V_I$ Input <sup>1,2</sup>	EN Input <sup>1,2,3,4</sup>	VDDI State <sup>1,5,6</sup>	VDDO State <sup>1,5,6</sup>	$V_O$ Output <sup>1,2</sup>	Comments
H	H or NC	P	P	H	Enabled, normal operation.
L	H or NC	P	P	L	
X	L	P	P	Hi-Z or L <sup>7</sup>	Disabled.
X	H or NC	UP	P	L	Upon transition of VDDI from unpowered to powered, $V_O$ returns to the same state as $V_I$ in less than 1 $\mu$ s.
X	L	UP	P	Hi-Z or L <sup>7</sup>	Disabled.
X	X	P	UP	Undetermined	Upon transition of VDDO from unpowered to powered, $V_O$ returns to the same state as $V_I$ within 1 $\mu$ s, if EN is in either the H or NC state. Upon transition of VDDO from unpowered to powered, $V_O$ returns to Hi-Z within 1 $\mu$ s if EN is L.

**Notes:**

1. VDDI and VDDO are the input and output power supplies.  $V_I$  and  $V_O$  are the respective input and output terminals. EN is the enable control input located on the same output side.
2. X = not applicable; H = Logic High; L = Logic Low; Hi-Z = High Impedance.
3. It is recommended that the enable inputs be connected to an external logic high or low level when the Si845x is operating in noisy environments.
4. No Connect (NC) replaces EN1 on Si8450. No Connects are not internally connected and can be left floating, tied to VDD, or tied to GND.
5. "Powered" state (P) is defined as  $2.70\text{ V} < VDD < 5.5\text{ V}$ .
6. "Unpowered" state (UP) is defined as  $VDD = 0\text{ V}$ .
7. When using the enable pin (EN) function, the output pin state is driven to a logic low state when the EN pin is disabled ( $EN = 0$ ). Note that this is different from the legacy isolators, in which the isolator outputs go into a high-impedance state when the EN pin is disabled ( $EN = 0$ ). See "4. Errata and Design Migration Guidelines" on page 26 for more details.

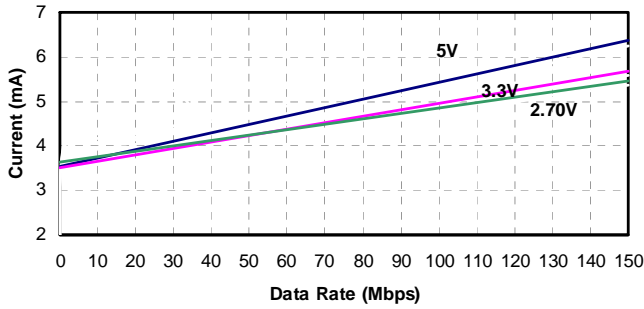
Table 13. Enable Input Truth Table<sup>1</sup>

P/N	EN1 <sup>1,2</sup>	EN2 <sup>1,2</sup>	Operation
Si8450	—	H	Outputs B1, B2, B3, B4, B5 are enabled and follow input state.
	—	L	Outputs B1, B2, B3, B4, B5 are disabled and Logic Low or in high impedance state. <sup>3</sup>
Si8451	H	X	Output A5 enabled and follow input state.
	L	X	Output A5 disabled and Logic Low or in high impedance state. <sup>3</sup>
	X	H	Outputs B1, B2, B3, B4 are enabled and follow input state.
	X	L	Outputs B1, B2, B3, B4 are disabled and Logic Low or in high impedance state. <sup>3</sup>
Si8452	H	X	Outputs A4 and A5 are enabled and follow input state.
	L	X	Outputs A4 and A5 are disabled and Logic Low or in high impedance state. <sup>3</sup>
	X	H	Outputs B1, B2, B3 are enabled and follow input state.
	X	L	Outputs B1, B2, B3 are disabled and Logic Low or in high impedance state. <sup>3</sup>
Si8455	—	—	Outputs B1, B2, B3, B4, B5 are enabled and follow input state.

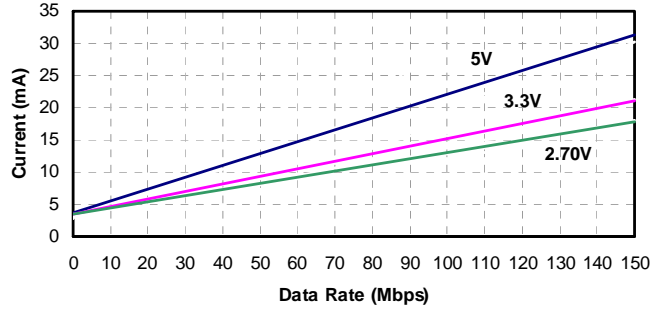
**Notes:**

1. Enable inputs EN1 and EN2 can be used for multiplexing, for clock sync, or other output control. These inputs are internally pulled-up to local VDD by a 3  $\mu$ A current source allowing them to be connected to an external logic level (high or low) or left floating. To minimize noise coupling, do **not** connect circuit traces to EN1 or EN2 if they are left floating. If EN1, EN2 are unused, it is recommended they be connected to an external logic level, especially if the Si845x is operating in a noisy environment.
2. X = not applicable; H = Logic High; L = Logic Low.
3. When using the enable pin (EN) function, the output pin state is driven to a logic low state when the EN pin is disabled (EN = 0). Note that this is different from the legacy isolators, in which the isolator outputs go into a high-impedance state when the EN pin is disabled (EN = 0). See "4. Errata and Design Migration Guidelines" on page 26 for more details.

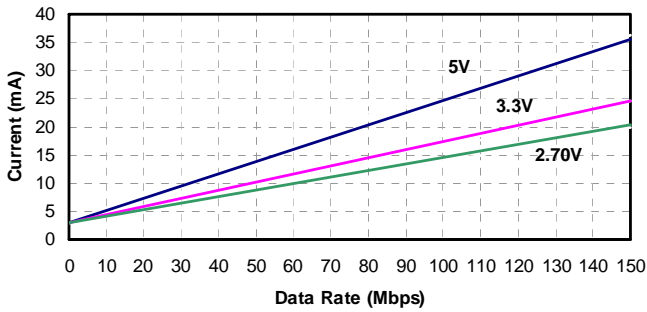
## 2. Typical Performance Characteristics



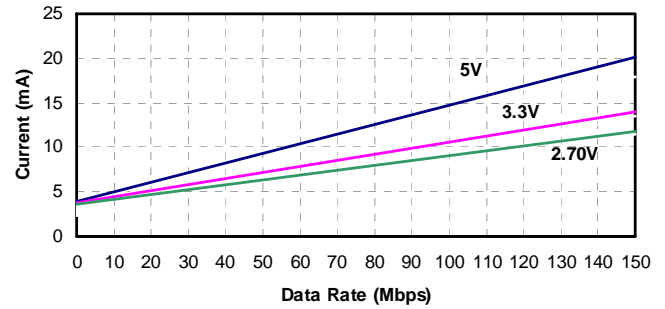
**Figure 5. Si8450/55 Typical  $V_{DD1}$  Supply Current vs. Data Rate 5, 3.3, and 2.70 V Operation**



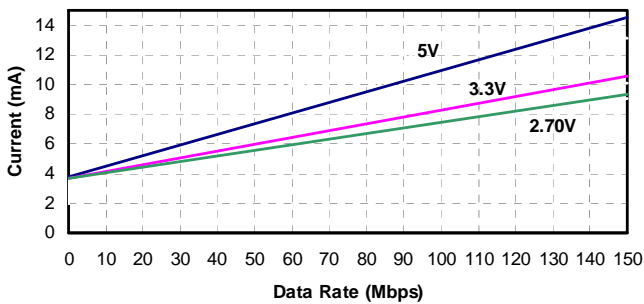
**Figure 8. Si8451 Typical  $V_{DD2}$  Supply Current vs. Data Rate 5, 3.3, and 2.70 V Operation (15 pF Load)**



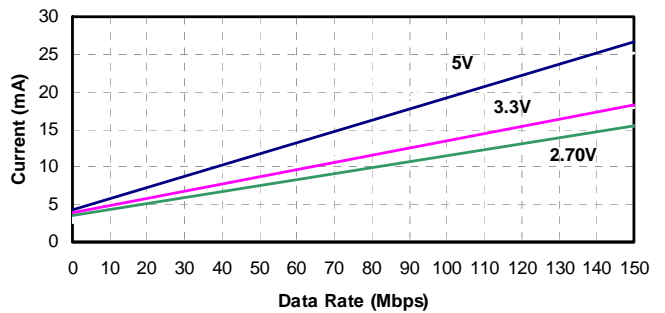
**Figure 6. Si8450/55 Typical  $V_{DD2}$  Supply Current vs. Data Rate 5, 3.3, and 2.70 V Operation (15 pF Load)**



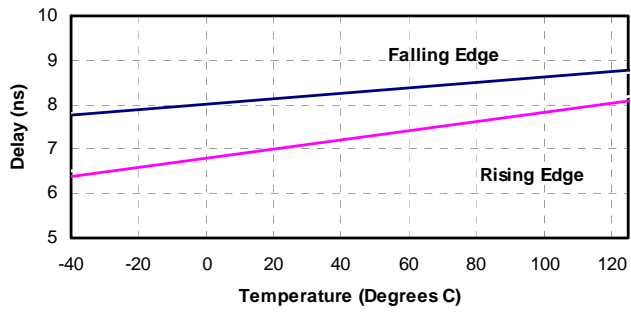
**Figure 9. Si8452 Typical  $V_{DD1}$  Supply Current vs. Data Rate 5, 3.3, and 2.70 V Operation (15 pF Load)**



**Figure 7. Si8451 Typical  $V_{DD1}$  Supply Current vs. Data Rate 5, 3.3, and 2.70 V Operation (15 pF Load)**



**Figure 10. Si8452 Typical  $V_{DD2}$  Supply Current vs. Data Rate 5, 3.3, and 2.70 V Operation (15 pF Load)**

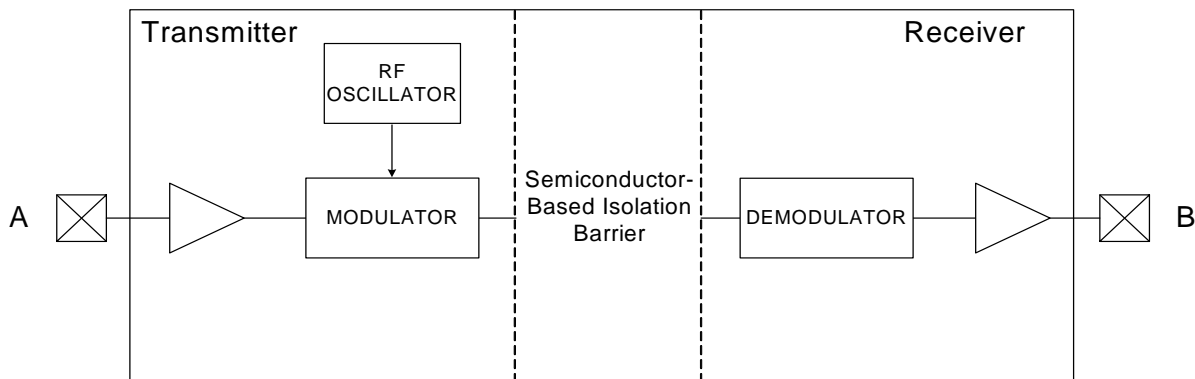


**Figure 11. Propagation Delay vs. Temperature**

## 3. Application Information

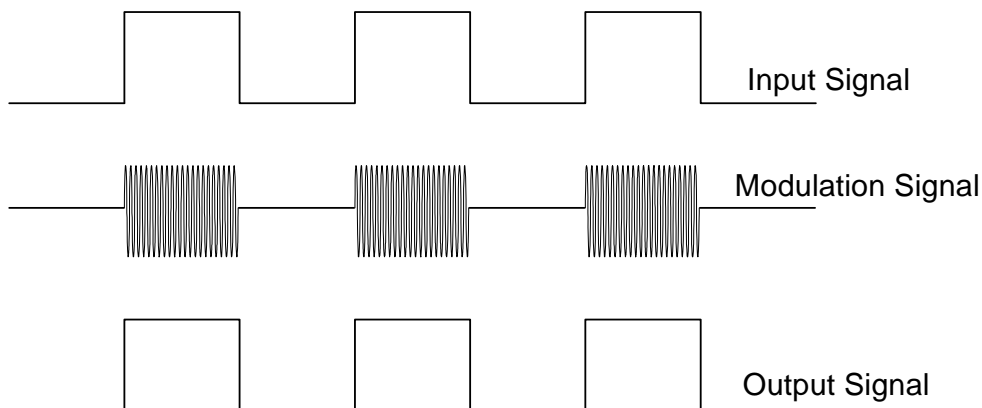
### 3.1. Theory of Operation

The operation of an Si845x 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 a single Si845x channel is shown in Figure 12.



**Figure 12. Simplified Channel Diagram**

A channel consists of an RF Transmitter and RF Receiver separated by a semiconductor-based isolation barrier. Referring to the Transmitter, input A modulates the carrier provided by an RF oscillator using on/off keying. The Receiver contains a demodulator that decodes the input state according to its RF energy content and applies the result to output B via the output driver. This RF on/off keying scheme is superior to pulse code schemes as it provides best-in-class noise immunity, low power consumption, and better immunity to magnetic fields. See Figure 13 for more details.



**Figure 13. Modulation Scheme**

### 3.2. Eye Diagram

Figure 14 illustrates an eye-diagram taken on an Si8450. For the data source, the test used an Anritsu (MP1763C) Pulse Pattern Generator set to 1000 ns/div. The output of the generator's clock and data from an Si8450 were captured on an oscilloscope. The results illustrate that data integrity was maintained even at the high data rate of 150 Mbps. The results also show that 2 ns pulse width distortion and 250 ps peak jitter were exhibited.

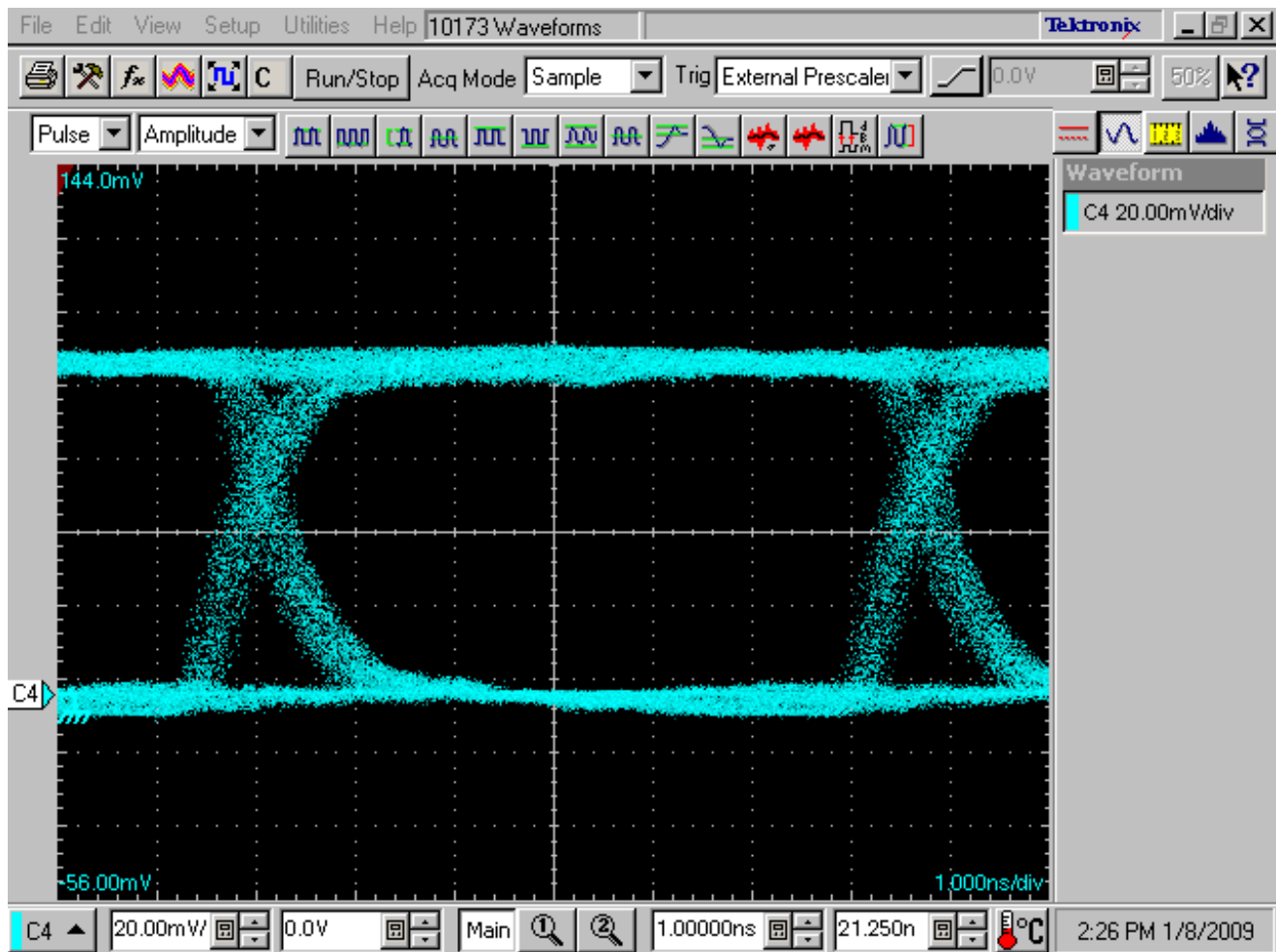


Figure 14. Eye Diagram

## 3.3. Layout Recommendations

Dielectric isolation is a set of specifications produced by the safety regulatory agencies from around the world that describes the physical construction of electrical equipment that derives power from a high-voltage power system such as 100–240 V<sub>AC</sub> systems or industrial power systems. The dielectric test (or HIPOT test) given in the safety specifications places a very high voltage between the input power pins of a product and the user circuits and the user touchable surfaces of the product. For the IEC relating to products deriving their power from the 220–240 V power grids, the test voltage is 2500 V<sub>AC</sub> (or 3750 V<sub>DC</sub>—the peak equivalent voltage).

There are two terms described in the safety specifications:

- Creepage—the distance along the insulating surface an arc may travel.
- Clearance—the distance through the shortest path through air that an arc may travel.

Figure 15 illustrates the accepted method of providing the proper creepage distance along the surface. For a 120 V<sub>AC</sub> application, this distance is 3.2 mm, and the narrow-body SOIC package can be used. For a 220–240 V<sub>AC</sub> application, this distance is 6.4 mm, and a wide-body SOIC package must be used. There must be no copper traces within this 3.2 or 6.4 mm exclusion area, and the surface should have a conformal coating, such as solder resist. The digital isolator chip must straddle this exclusion area.

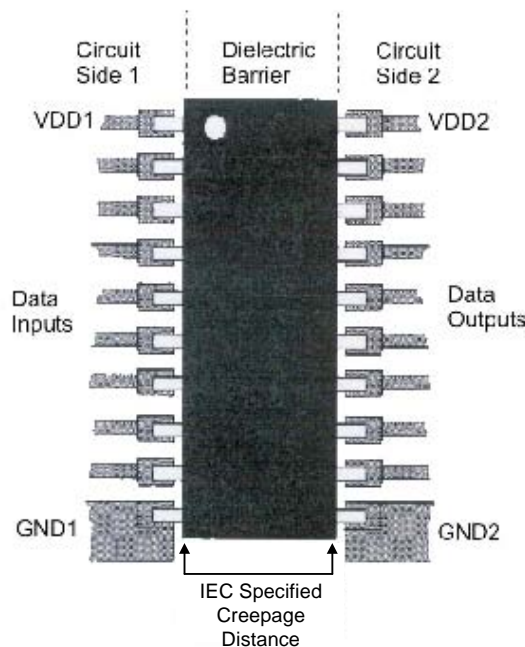


Figure 15. Creepage Distance

### 3.3.1. Supply Bypass

The Si845x requires a 1  $\mu$ F bypass capacitor between V<sub>DD1</sub> and GND1 and V<sub>DD2</sub> and GND2. The capacitor should be placed as close as possible to the package. See "4. Errata and Design Migration Guidelines" on page 26 for more details.

### 3.3.2. Pin Connections

For narrow-body devices, Pin 2 and Pin 8 GND must be externally connected to respective ground. Pin 9 and Pin 15 must also be connected to external ground. No connect pins are not internally connected. They can be left floating, tied to VDD, or tied to GND.

### 3.3.3. Output Pin Termination

The nominal output impedance of an isolator driver channel is approximately 50  $\Omega$ ,  $\pm 40\%$ , which is a combination of the value of the on-chip series termination resistor and channel resistance of the output driver FET. When driving loads where transmission line effects will be a factor, output pins should be terminated with 50  $\Omega$  controlled impedance PCB traces.



### 3.3.4. RF Radiated Emissions

The Si845x family uses a RF carrier frequency of approximately 700 MHz. This results in a small amount of radiated emissions at this frequency and its harmonics. The radiation is not from the IC chip but due to a small amount of RF energy driving the isolated ground planes which can act as a dipole antenna.

The unshielded Si845x evaluation board passes FCC Class B (Part 15) requirements. Table 14 shows measured emissions compared to FCC requirements. Note that the data reflects worst-case conditions where all inputs are tied to logic 1 and the RF transmitters are fully active.

Radiated emissions can be reduced if the circuit board is enclosed in a shielded enclosure or if the PCB is a less efficient antenna.

**Table 14. Radiated Emissions**

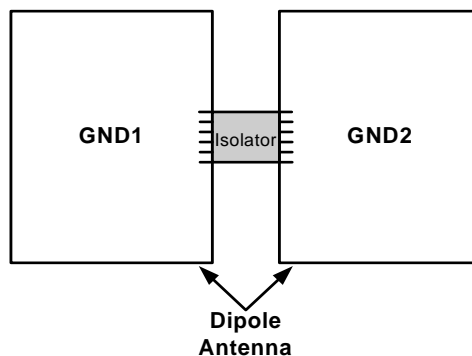
Frequency (MHz)	Measured (dB $\mu$ V/m)	FCC Spec (dB $\mu$ V/m)	Compared to Spec (dB)
712	29	37	-8
1424	39	54	-15
2136	42	54	-12
2848	43	54	-11
4272	44	54	-10
4984	44	54	-10
5696	44	54	-10

### 3.3.5. RF, Magnetic, and Common Mode Transient Immunity

The Si84xx families have very high common mode transient immunity while transmitting data. This is typically measured by applying a square pulse with very fast rise/fall times between the isolated grounds. Measurements show no failures at 30 kV/ $\mu$ s (typical). During a high surge event, the output may glitch low for up to 20–30 ns, but the output corrects immediately after the surge event.

The Si84xx families pass the industrial requirements of CISPR24 for RF immunity of 10 V/m using an unshielded evaluation board. As shown in Figure 16, the isolated ground planes form a parasitic dipole antenna. The PCB should be laid-out to not act as an efficient antenna for the RF frequency of interest. RF susceptibility is also significantly reduced when the end system is housed in a metal enclosure, or otherwise shielded.

The Si845x digital isolator can be used in close proximity to large motors and various other magnetic-field producing equipment. In theory, data transmission errors can occur if the magnetic field is too large and the field is too close to the isolator. However, in actual use, the Si84xx devices provide extremely high immunity to external magnetic fields and have been independently evaluated to withstand magnetic fields of at least 1000 A/m according to the IEC 61000-4-8 and IEC 61000-4-9 specifications.



**Figure 16. Dipole Antenna**

## 4. Errata and Design Migration Guidelines

When using the new ISOpro products, or when migrating from Silicon Labs' legacy isolators, designers must consider and adhere to the following requirements.

### 4.1. Enable Pin Causes Outputs to Go Low

When using the enable pin (EN1, EN2) function on the new ISOpro 5-channel (Si8450/1/2) isolators, the corresponding output pin states (pin = An, Bn, where n can be 1..5) are driven to a logic low (to ground) when the enable pin is disabled (EN1 or EN2 = 0). This functionality is different from the legacy 3-channel (Si8430/1) and 4-channel (Si8440/1/2) isolators. On those devices, the isolator outputs go into a high-impedance state (Hi-Z) when the enable pin is disabled (EN1 = 0 or EN2 = 0).

#### 4.1.1. Resolution

The enable pin functionality causing the outputs to go low will be supported in production for the current revisions of the ISOpro devices. The next revisions of the devices will correct the enable pin functionality (i.e., the outputs will go into the high-impedance state to match the legacy isolator products). Refer to the Ordering Guide sections of the datasheet(s) for more information.

### 4.2. Power Supply Bypass Capacitors

When using the ISOpro isolators with power supplies  $\geq 4.5$  V, sufficient VDD bypass capacitors must be present on both the VDD1 and VDD2 pins to ensure the VDD rise time is less than  $0.5$  V/ $\mu$ s (which is  $> 9$   $\mu$ s for a  $\geq 4.5$  V supply). Although rise time is power supply dependent,  $\geq 1$   $\mu$ F capacitors are required on both power supply pins (VDD1, VDD2) of the isolator device.

#### 4.2.1. Resolution

This issue will be eliminated with the next revision of the device. Refer to "7. Ordering Guide" on page 29 for more information.

### 4.3. Latch Up Immunity

ISOpro latch up immunity generally exceeds  $\pm 200$  mA per pin. Exceptions: Certain pins provide  $< 100$  mA of latch-up immunity. To increase latch-up immunity on these pins,  $100 \Omega$  of equivalent resistance must be included in series with *all* of the pins listed in Table 15. The  $100 \Omega$  equivalent resistance can be comprised of the source driver's output resistance and a series termination resistor.

#### 4.3.1. Resolution

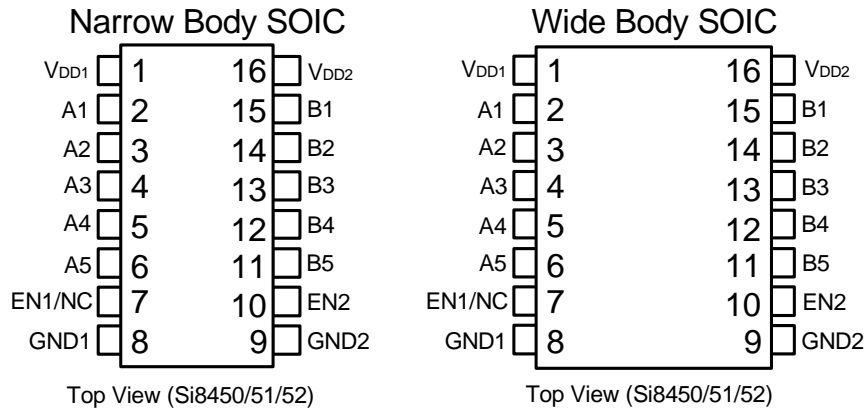
This issue will be eliminated with the next revision of the device. Refer to the Ordering Guide for more information.

**Table 15. Affected Ordering Part Numbers**

Affected Ordering Part Numbers*	Device Revision	Pin#	Name	Pin Type
Si8450SV-A-IS/IS1, Si8451SV-A-IS/IS1, Si8452SV-A-IS/IS1	A	2	A1	Input
		6	A5	Input or Output
		10	EN2	Input
		14	B2	Output
Si8455SV-A-IS/IS1	A	2	A1	Input
		6	A5	Input
		14	B2	Output

\*Note: "SV" = Speed Grade/Isolation Rating (AA, AB, BA, BB).

## 5. Pin Descriptions (Si8450/51/52)

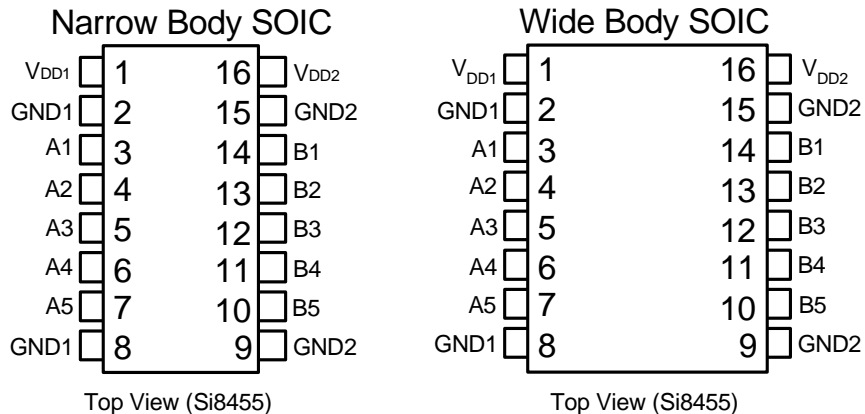


Name	SOIC-16 Pin#	Type	Description
V <sub>DD1</sub>	1	Supply	Side 1 power supply.
A1	2	Digital Input	Side 1 digital input.
A2	3	Digital Input	Side 1 digital input.
A3	4	Digital Input	Side 1 digital input.
A4	5	Digital I/O	Side 1 digital input or output.
A5	6	Digital I/O	Side 1 digital input or output.
EN1/NC*	7	Digital Input	Side 1 active high enable. NC on Si8450.
GND1	8	Ground	Side 1 ground.
GND2	9	Ground	Side 2 ground.
EN2	10	Digital Input	Side 2 active high enable.
B5	11	Digital I/O	Side 2 digital input or output.
B4	12	Digital I/O	Side 2 digital input or output.
B3	13	Digital Output	Side 2 digital output.
B2	14	Digital Output	Side 2 digital output.
B1	15	Digital Output	Side 2 digital output.
V <sub>DD2</sub>	16	Supply	Side 2 power supply.

**\*Note:** No Connect. These pins are not internally connected. They can be left floating, tied to V<sub>DD</sub> or tied to GND.

# Si8450/51/52/55

## 6. Pin Descriptions (Si8455)



Name	SOIC-16 Pin#	Type	Description*
V <sub>DD1</sub>	1	Supply	Side 1 power supply.
GND1	2	Ground	Side 1 ground.
A1	3	Digital Input	Side 1 digital input.
A2	4	Digital Input	Side 1 digital input.
A3	5	Digital Input	Side 1 digital input.
A4	6	Digital Input	Side 1 digital input.
A5	7	Digital Input	Side 1 digital input.
GND1	8	Ground	Side 1 ground.
GND2	9	Ground	Side 2 ground.
B5	10	Digital Output	Side 2 digital output.
B4	11	Digital Output	Side 2 digital output.
B3	12	Digital Output	Side 2 digital output.
B2	13	Digital Output	Side 2 digital output.
B1	14	Digital Output	Side 2 digital output.
GND2	15	Ground	Side 2 ground.
V <sub>DD2</sub>	16	Supply	Side 2 power supply.

**\*Note:** For narrow-body devices, Pin 2 and Pin 8 GND must be externally connected to respective ground. Pin 9 and Pin 15 must also be connected to external ground.

## 7. Ordering Guide

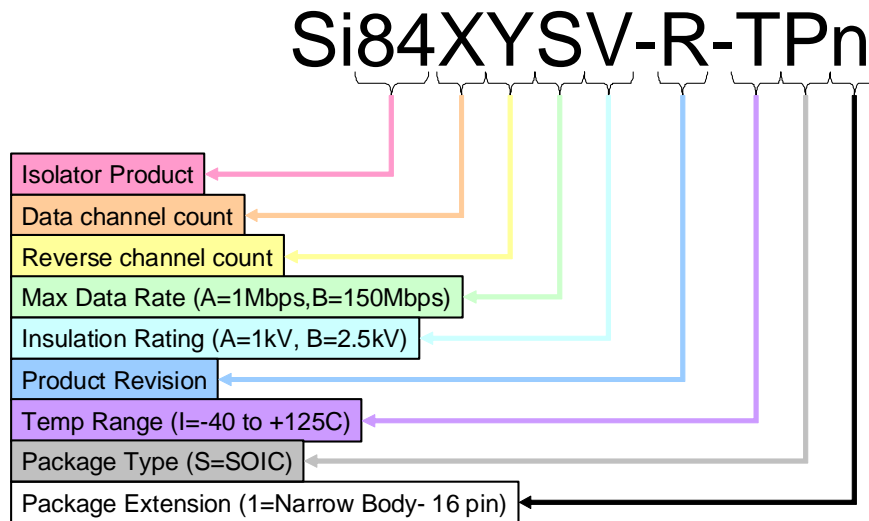


Figure 17. Ordering Part Number (OPN) Convention

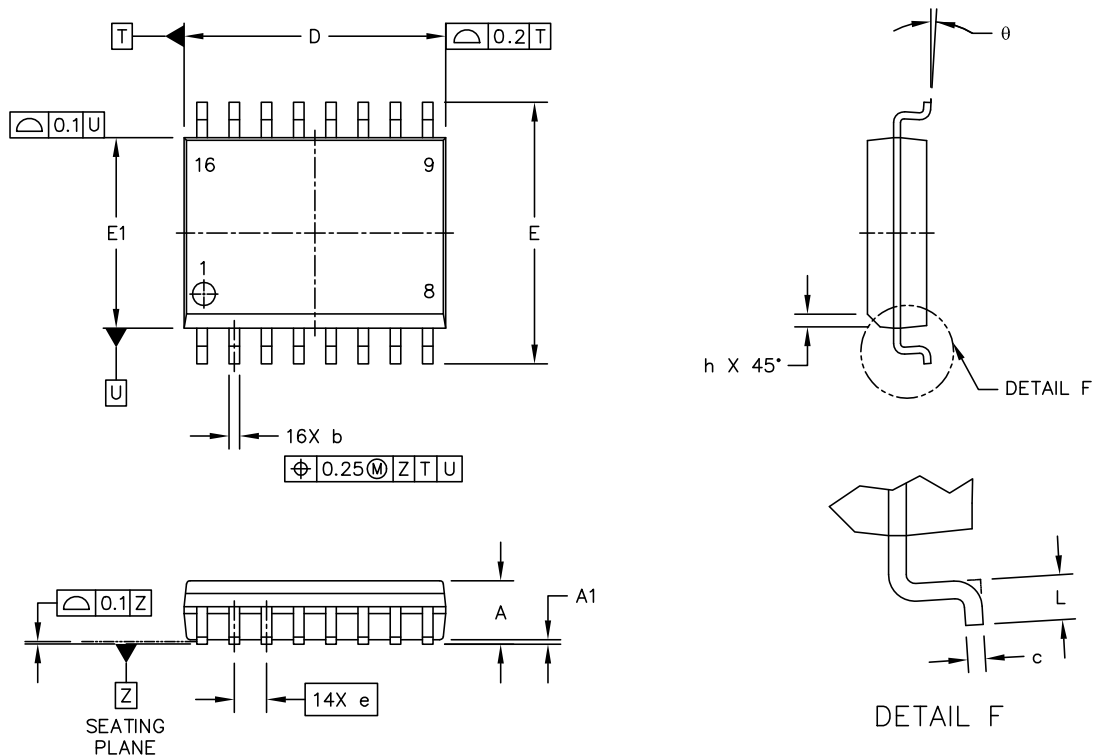
Table 16. Ordering Guide for Valid OPNs\*

Ordering Part Number (OPN)	Number of Inputs VDD1 Side	Number of Inputs VDD2 Side	Maximum Data Rate (Mbps)	Isolation Rating	Temp Range	Package Type	Legacy Part Equivalent
Si8450AA-A-IS1	5	0	1	1 kVrms	-40 to 125 °C	NB SOIC-16	—
Si8450BA-A-IS1	5	0	150				—
Si8451AA-A-IS1	4	1	1				—
Si8451BA-A-IS1	4	1	150				—
Si8452AA-A-IS1	3	2	1				—
Si8452BA-A-IS1	3	2	150				—
Si8455BA-A-IS1	5	0	150				—
Si8450AB-A-IS1	5	0	1	2.5 kVrms	-40 to 125 °C	NB SOIC-16	—
Si8450BB-A-IS1	5	0	150				—
Si8451AB-A-IS1	4	1	1				—
Si8451BB-A-IS1	4	1	150				—
Si8452AB-A-IS1	3	2	1				—
Si8452BB-A-IS1	3	2	150				—
Si8455BB-A-IS1	5	0	150				—

\***Note:** All packages are RoHS-compliant. Moisture sensitivity level is MSL3 with peak reflow temperature of 260 °C according to the JEDEC industry standard classifications, and peak solder temperature.

## 8. Package Outline: 16-Pin Wide Body SOIC

Figure 18 illustrates the package details for the Si845x Digital Isolator. Table 17 lists the values for the dimensions shown in the illustration.



**Figure 18. 16-Pin Wide Body SOIC**

**Table 17. Package Diagram Dimensions**

Symbol	Millimeters	
	Min	Max
A	—	2.65
A1	0.1	0.3
D	10.3 BSC	
E	10.3 BSC	
E1	7.5 BSC	
b	0.31	0.51
c	0.20	0.33
e	1.27 BSC	
h	0.25	0.75
L	0.4	1.27
θ	0°	7°

### 9. Landing Pattern: 16-Pin Wide-Body SOIC

Figure 19 illustrates the recommended landing pattern details for the Si845x in a 16-pin wide-body SOIC. Table 18 lists the values for the dimensions shown in the illustration.

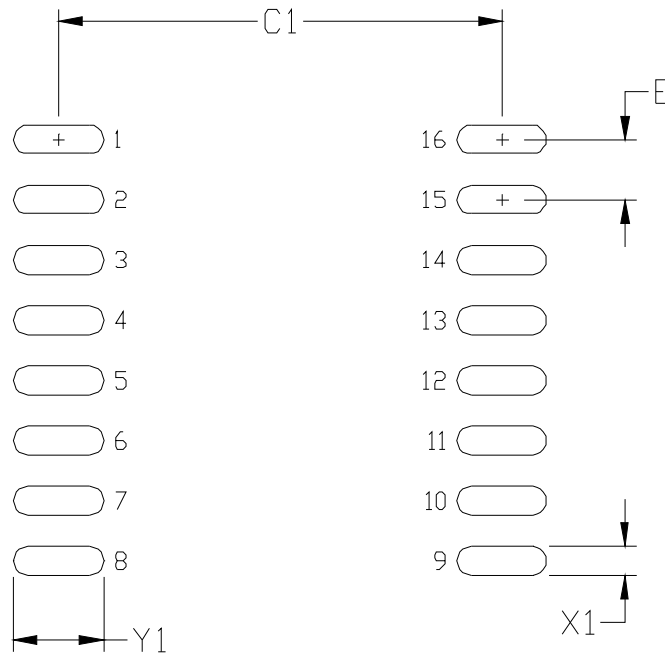


Figure 19. 16-Pin SOIC Land Pattern

Table 18. 16-Pin Wide Body SOIC Landing Pattern Dimensions

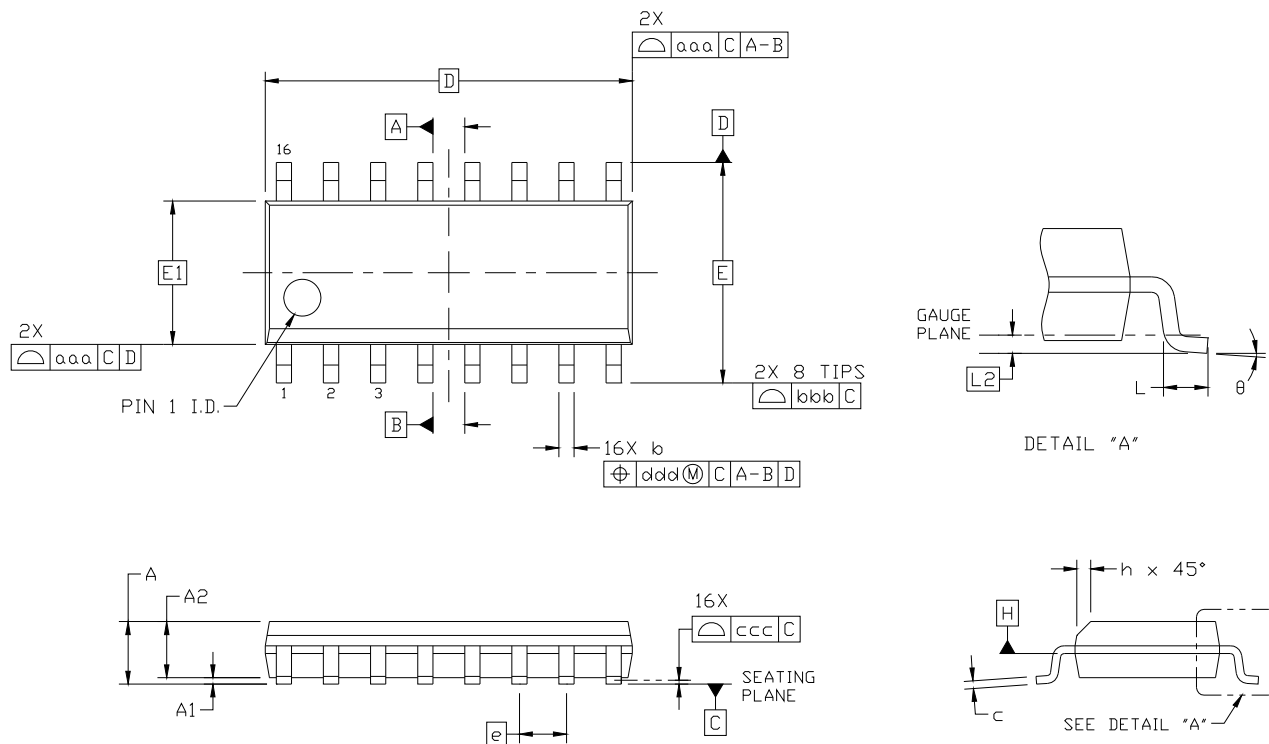
Dimension	Feature	(mm)
C1	Pad Column Spacing	9.40
E	Pad Row Pitch	1.27
X1	Pad Width	0.60
Y1	Pad Length	1.90

**Notes:**

1. This Land Pattern Design is based on IPC-7351 pattern SOIC127P1032X265-16AN for Density Level B (Median Land Protrusion).
2. All feature sizes shown are at Maximum Material Condition (MMC) and a card fabrication tolerance of 0.05mm is assumed.

## 10. Package Outline: 16-Pin Narrow Body SOIC

Figure 20 illustrates the package details for the Si845x in a 16-pin narrow-body SOIC (SO-16). Table 19 lists the values for the dimensions shown in the illustration. All packages are Pb-free and RoHS compliant. Moisture sensitivity level is MSL3 with peak reflow temperature of 260 °C according to the JEDEC industry classification and peak solder temperature.



**Figure 20. 16-pin Small Outline Integrated Circuit (SOIC) Package**

**Table 19. Package Diagram Dimensions**

Dimension	Min	Max
A	—	1.75
A1	0.10	0.25
A2	1.25	—
b	0.31	0.51
c	0.17	0.25
D	9.90 BSC	
E	6.00 BSC	
E1	3.90 BSC	
e	1.27 BSC	
L	0.40	1.27



**Table 19. Package Diagram Dimensions (Continued)**

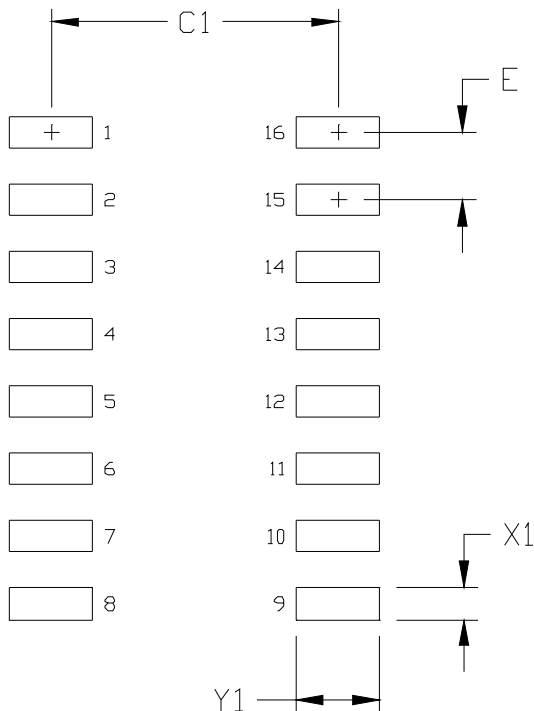
L2	0.25 BSC	
h	0.25	0.50
$\theta$	0°	8°
aaa	0.10	
bbb	0.20	
ccc	0.10	
ddd	0.25	

**Notes:**

1. All dimensions shown are in millimeters (mm) unless otherwise noted.
2. Dimensioning and Tolerancing per ANSI Y14.5M-1994.
3. This drawing conforms to the JEDEC Solid State Outline MS-012, Variation AC.
4. Recommended card reflow profile is per the JEDEC/IPC J-STD-020 specification for Small Body Components.

## 11. Landing Pattern: 16-Pin Narrow Body SOIC

Figure 21 illustrates the recommended landing pattern details for the Si845x in a 16-pin narrow-body SOIC. Table 20 lists the values for the dimensions shown in the illustration.



**Figure 21. 16-Pin Narrow Body SOIC PCB Landing Pattern**

**Table 20. 16-Pin Narrow Body SOIC Landing 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

**Notes:**

1. This Land Pattern Design is based on IPC-7351 pattern SOIC127P600X165-16N for Density Level B (Median Land Protrusion).
2. All feature sizes shown are at Maximum Material Condition (MMC) and a card fabrication tolerance of 0.05 mm is assumed.

12. Top Marking: 16-Pin Wide Body SOIC

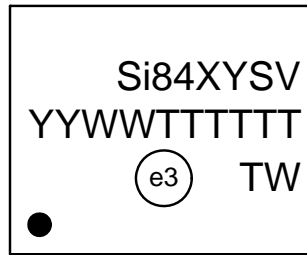


Figure 22. Si8450/51/52/55 Top Marking

Table 21. Top Marking Explanation

<b>Line 1 Marking:</b>	Base Part Number Ordering Options  (See Ordering Guide for more information).	Si84 = Isolator product series XY = Channel Configuration X = # of data channels (5, 4, 3, 2, 1) Y = # of reverse channels (2, 1, 0)* S = Speed Grade A = 1 Mbps; B = 150 Mbps V = Insulation rating A = 1 kV; B = 2.5 kV
	<b>Line 2 Marking:</b>	
	YY = Year WW = Workweek	Assigned by Assembly House. Corresponds to the year and workweek of the mold date.
	TTTTTT = Mfg Code	Manufacturing Code from Assembly House
<b>Line 3 Marking:</b>	Circle = 1.5 mm Diameter (Center-Justified)	"e3" Pb-Free Symbol
	Country of Origin ISO Code Abbreviation	TW = Taiwan
<b>*Note:</b> Si8455 has 0 reverse channels.		

## 13. Top Marking: 16-Pin Narrow Body SOIC

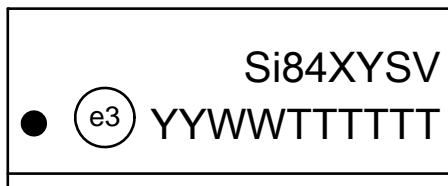


Figure 23. 16-Pin Narrow Body SOIC Top Marking

Table 22. 16-Pin Narrow Body SOIC Top Marking Table

<b>Line 1 Marking:</b>	Base Part Number Ordering Options  (See Ordering Guide for more information).	Si84 = Isolator product series XY = Channel Configuration X = # of data channels (5, 4, 3, 2, 1) Y = # of reverse channels (2, 1, 0)* S = Speed Grade A = 1 Mbps; B = 150 Mbps V = Insulation rating A = 1 kV; B = 2.5 kV
	<b>Line 2 Marking:</b>	Circle = 1.2 mm Diameter
	YY = Year WW = Work Week	"e3" Pb-Free Symbol Assigned by the Assembly House. Corresponds to the year and work week of the mold date.
	TTTTTT = Mfg code	Manufacturing Code from Assembly Purchase Order form.
	Circle = 1.2 mm diameter	"e3" Pb-Free Symbol.

## DOCUMENT CHANGE LIST

### Revision 0.1 to Revision 0.2

- Updated all specs to reflect latest silicon.
- Added "4. Errata and Design Migration Guidelines" on page 26.
- Added "13. Top Marking: 16-Pin Narrow Body SOIC" on page 36.

## CONTACT INFORMATION

### Silicon Laboratories Inc.

400 West Cesar Chavez  
Austin, TX 78701  
Tel: 1+(512) 416-8500  
Fax: 1+(512) 416-9669  
Toll Free: 1+(877) 444-3032

Please visit the Silicon Labs Technical Support web page:  
<https://www.silabs.com/support/pages/contacttechnicalsupport.aspx>  
and register to submit a technical support request.

The information in this document is believed to be accurate in all respects at the time of publication but is subject to change without notice. Silicon Laboratories assumes no responsibility for errors and omissions, and disclaims responsibility for any consequences resulting from the use of information included herein. Additionally, Silicon Laboratories assumes no responsibility for the functioning of undescribed features or parameters. Silicon Laboratories reserves the right to make changes without further notice. Silicon Laboratories makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Silicon Laboratories assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. Silicon Laboratories products are not designed, intended, or authorized for use in applications intended to support or sustain life, or for any other application in which the failure of the Silicon Laboratories product could create a situation where personal injury or death may occur. Should Buyer purchase or use Silicon Laboratories products for any such unintended or unauthorized application, Buyer shall indemnify and hold Silicon Laboratories harmless against all claims and damages.

Silicon Laboratories and Silicon Labs are trademarks of Silicon Laboratories Inc.  
Other products or brandnames mentioned herein are trademarks or registered trademarks of their respective holders.