File E351759
Project 11CA62557

June 7, 2012

REPORT

on

COMPONENT - Nonoptical Isolating Devices

MAXIM INTEGRATED PRODUCTS
AUSTIN, TX

DESCRIPTION

PRODUCT COVERED:

USR – Single Protection Non-Optical Isolator, Model MAX14850 **and MAX14851**, may be followed by additional letters and/or numbers.

MAXIMUM PER CHANNEL RATINGS (at room temperature):

Model	Current (mA)		Power (mW)		Isolation Voltage (Vac)	Max Operating (Ambient) Temp (°C)	Max Junction Temp (°C)	Max Storage Temp (°C)	Max Data Rate **(Mbps)**
	Side A (Encoder or Emitter)	Side B (Decoder or Sensor)	Side A (Encoder or Emitter)	Side B (Decoder or Sensor)					
*MAX14850	24	24	132	132	600	125	150	150	50
MAX14851	**4.0**	**6.4**	**22**	**35.2**	**600**	**125**	**150**	**150**	**50**

GENERAL:

This digital isolator offers a low-power, low-cost, high electromagnetic interference (EMI) immunity, and stable temperature performance through proprietary process technology. The device uses a monolithic solution to isolate different ground domains and block high-voltage/high-current transients from sensitive or human interface circuitry. Four of the six channels are unidirectional, two in each direction. All four unidirectional channels support data rates of up to 50Mbps. The other two channels are bidirectional with data rates up to 2Mbps.

ENGINEERING CONSIDERATIONS (NOT FOR FIELD REPRESENTATIVE'S USE):

Use - For use only in products where the acceptability of the combination is determined by UL LLC.

* USR indicates this product was investigated under the UL Standard for Safety for Optical Isolators, UL 1577, **Fifth** Edition.

Conditions of Acceptability - Each device shall be reviewed with respect to the following conditions of acceptability:

1. The capability of the device to control a load has not been investigated.

2. These devices should be installed in a suitable end product enclosure.

*3. **The maximum junction temperature shall not be exceeded.**

4. For single protection devices, the insulation to the case has not been **evaluated.**

CONSTRUCTION DETAILS:

General - The product shall be constructed in accordance with the following description. All dimensions are approximate, unless specified as “max” or “min”.

MODEL MAX14850 – ILL. 1

General - Also represents model MAX14851.

1. Side A – Digital input/output with monolithic solution for isolation.

2. Side B – FET circuit.

3. Lead Frame / Bond Wire – Metal employed for current-carrying parts shall be of stainless steel, plated steel, copper, silver, gold, nickel, aluminum, an alloy of the same, or an equivalent material.

4. Case – Epoxy molding compound, Type G600, manufactured by Sumitomo. Molded using a high temperature and high-pressure process.

5. Isolation Capacitor - The isolation barrier is provided with 0.0026 mm thickness of silicon dioxide (SiO2) between the Silicon-Processed-Integrated capacitor plates made of ceramic.

19-6161; Rev 0; 12/11

EVALUATION KIT AVAILABLE

MAX14850

Six-Channel Digital Isolator

General Description

The MAX14850 is a six-channel digital isolator utilizing Maxim's proprietary process technology, whose monolithic design provides a compact and low-cost transfer of digital signals between circuits with different power domains. The technology enables low power consumption and stable high-temperature performance.

The four unidirectional channels are each capable of DC to 50Mbps, with two of the four channels passing data across the isolation barrier in each direction. The two bidirectional channels are open drain and each is capable of data rates from DC to 2Mbps.

Independent 3.0V to 5.5V supplies on each side of the isolator also make it suitable for use as a level translator. The MAX14850 can be used for isolating SPI busses, I^2C busses with clock stretching, RS-485/RS-422 busses, and general-purpose isolation. When used as a bus isolator, extra channels are available for power monitoring and reset signals.

The MAX14850 is available in a narrow body,16-pin SO (10mm x 4mm) package. The SO package is specified over the -40°C to +125°C automotive temperature range.

Applications

Industrial Control Systems

I^2C, SPI, SMBus, PMBus Interfaces

Isolated RS-485/RS-422

Telecommunication Systems

Battery Management

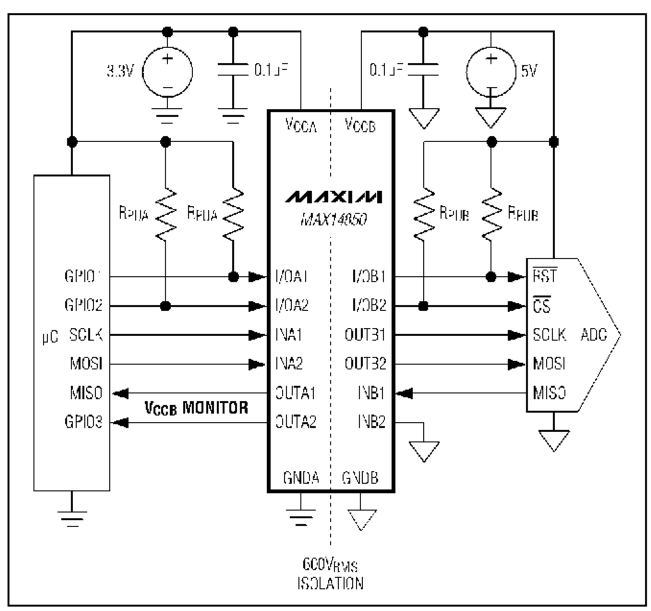
Medical Systems

Benefits and Features

- **Protection from High-Voltage Environments**
  - **600V_{RMS} Isolation for 60 Seconds**
  - **Short-Circuit Protection on Unidirectional Outputs**
- **Complete Digital Isolation Solution**
  - **Four Unidirectional Signal Paths: 2-In / 2-Out**
  - **Two Bidirectional Open-Drain Signal Paths**
  - **50Mbps (max) Unidirectional Data Rate**
  - **2Mbps (max) Bidirectional Data Rate**
- **Compatible with Many Interface Standards**
  - **I^2C With Clock Stretching**
  - **SPI**
  - **RS-422/RS-485**

***Ordering Information* appears at end of data sheet.**

Typical Operating Circuits



***Typical Operating Circuits* continued at end of data sheet.**

SPI is a registered trademark of Motorola, Inc.

Microwire is a registered trademark of National Semiconductor Corporation.

For information on other Maxim products, visit Maxim's website at www.maxim-ic.com.

MAX14850

Six-Channel Digital Isolator

ABSOLUTE MAXIMUM RATINGS

V_{CCA} to GNDA ....-0.3V to +6V
V_{CCB} to GNDB ....-0.3V to +6V
OUTA1, OUTA2 to GNDA .... -0.3V to (V_{CCA} + 0.3V)
OUTB1, OUTB2 to GNDB .... -0.3V to (V_{CCB} + 0.3V)
INB1, INB2, I/OA1, I/OA2 to GNDA ....-0.3V to +6V
INA1, INA2, I/OB1, I/OB2 to GNDB ....-0.3V to +6V
Short-Circuit Duration (OUTA_ to GNDA or
V_{CCA}, OUTB_ to GNDB or V_{CCB}) ....Continuous
Continuous Current (I/OA_, I/OB_) Pin.......................... ±50mA
Continuous Power Dissipation (T_A = +70°C)
SO (derate 13.3mW/°C above +70°C).................1067mW
Operating Temperature Range .... -40°C to +125°C
Junction Temperature ....+150°C
Storage Temperature Range........................... -65°C to +150°C
Lead Temperature (soldering, 10s) ....+300°C
Soldering Temperature (reflow) ....+260°C

PACKAGE THERMAL CHARACTERISTICS (Note 1)

SO
Junction-to-Ambient Thermal Resistance (θ_{JA}) ....75°C/W
Junction-to-Case Thermal Resistance (θ_{JC}) ....24°C/W

Note 1: Package thermal resistances were obtained using the method described in JEDEC specification JESD51-7, using a four-layer board. For detailed information on package thermal considerations, refer to **www.maxim-ic.com/thermal-tutorial**.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

(V_{CCA} – V_{GNDA} = 3.0V to 5.5V, V_{CCB} – V_{GNDB} = 3.0V to 5.5V, T_A = -40°C to +125°C, unless otherwise noted. Typical values are at V_{CCA} – V_{GNDA} = 3.3V, V_{CCB} – V_{GNDB} = 3.3V, and T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS			MIN	TYP	MAX	UNIT
DC CHARACTERISTICS								
Supply Voltage	V_{CCA}	Relative to GNDA			3.0		5.5	V
	V_{CCB}	Relative to GNDB			3.0		5.5	
Supply Current	I_{CCA}, I_{CCB}	Unidirectional inputs at DC or 2Mbps; bidirectional inputs at DC or switching at 2Mbps. No load.	V_{CCA} = +5V, V_{CCB} = +5V			7.2	11	mA
			V_{CCA} = +3.3V, V_{CCB} = +3.3V			6.2	9.5	
		All inputs switching at max data rate. No load. (Note 3)	V_{CCA} = +5V, V_{CCB} = +5V	T_A = +25°C		15	22	
				T_A = +125°C		17	24	
			V_{CCA} = +3.3V, V_{CCB} = +3.3V	T_A = +25°C		10	16	
				T_A = +125°C		11	18	
Undervoltage Lockout Threshold	V_{UVLO}	V_{CCA} - V_{GNDA}, V_{CCB} - V_{GNDB} (Note 4)				2		V
Undervoltage Lockout Hysteresis	$V_{UVLOHYS}$	V_{CCA} - V_{GNDA}, V_{CCB} - V_{GNDB} (Note 4)				0.1		V

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ELECTRICAL CHARACTERISTICS (continued)

($V_{CCA} - V_{GNDA}$ = 3.0V to 5.5V, $V_{CCB} - V_{GNDB}$ = 3.0V to 5.5V, T_A = -40°C to +125°C, unless otherwise noted. Typical values are at $V_{CCA} - V_{GNDA}$ = 3.3V, $V_{CCB} - V_{GNDB}$ = 3.3V, and T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
ISOLATION CHARACTERISTICS						
Isolation Voltage	V_{ISO}	t = 60s (Note 5)	600			V_{RMS}
Maximum Working Isolation Voltage	V_{IOWM}	V_{GNDB} - V_{GNDA} continuous (Note 3), 50-year life expectancy (Figure 4)			200	V_{RMS}
Insulation Resistance Across Barrier	R_{ISO}	(Note 3)		1		GΩ
Capacitance Across Isolation Barrier	C_{IO}	(Note 3)		12		pF
Internal Gap		Insulation Thickness (Note 3)	0.0026			mm
External Tracking (Creepage) (Note 3)	L(IO2)	SO	4.2			mm
Minimum External Air Gap (Clearance) (Note 3)	L(IO1)	SO	4.2			mm
Tracking Resistance (Comparative Tracking Index) (Note 3)	CTI	IEC 112 / VDE 030 Part 1		400		V
ESD Protection		All pins		±2.5		kV
LOGIC INPUTS AND OUTPUTS						
Input Threshold Voltage	V_{IT}	I/OA1, I/OA2, relative to GNDA	0.5		0.7	V
Input Logic-High Voltage	V_{IH}	INA1, INA2, relative to GNDA	0.7 x V_{CCA}			V
		INB1, INB2, relative to GNDB	0.7 x V_{CCB}			
		I/OA1, I/OA2, relative to GNDA	0.7			
		I/OB1, I/OB2, relative to GNDB	0.7 x V_{CCB}			
Input Logic-Low Voltage	V_{IL}	INA1, INA2, relative to GNDA			0.8	V
		INB1, INB2, relative to GNDB			0.8	
		I/OA1, I/OA2, relative to GNDA			0.5	
		I/OB1, I/OB2, relative to GNDB			0.3 x V_{CCB}	
Output Logic-High Voltage	V_{OH}	OUTA1, OUTA2, relative to GNDA, source current = 4mA	V_{CCA} - 0.4			V
		OUTB1, OUTB2, relative to GNDB, source current = 4mA	V_{CCB} - 0.4			

ELECTRICAL CHARACTERISTICS (continued)

($V_{CCA} - V_{GNDA}$ = 3.0V to 5.5V, $V_{CCB} - V_{GNDB}$ = 3.0V to 5.5V, T_A = -40°C to +125°C, unless otherwise noted. Typical values are at $V_{CCA} - V_{GNDA}$ = 3.3V, $V_{CCB} - V_{GNDB}$ = 3.3V, and T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
Output Logic-Low Voltage	V_{OL}	OUTA1, OUTA2, relative to GNDA, sink current = 4mA				0.8	V
		OUTB1, OUTB2, relative to GNDB, sink current = 4mA				0.8	
		I/OA1, I/OA2, relative to GNDA, sink current = 10mA		0.6		0.9	
		I/OA1, I/OA2, relative to GNDA, sink current = 0.5mA		0.6		0.85	
		I/OB1, I/OB2, relative to GNDB, sink current = 30mA				0.4	
Input/Output Logic-Low Threshold Difference	ΔV_{TOL}	I/OA1, I/OA2 (Note 6)		50			mV
Input Capacitance	C_{IN}	INA1, INA2, INB1, INB2, f = 1MHz			2		pF
DYNAMIC SWITCHING CHARACTERISTICS							
Common-Mode Transient Immunity	dV_{ISO}/dt	$V_{IN} = V_{CC\_}$ or $V_{GND\_}$ (Notes 3, 7)			1.5		kV/µs
Maximum Data Rate (Note 3)	DR_{MAX}	INA1 to OUTB1, INA2 to OUTB2, INB1 to OUTA1, INB2 to OUTA2		50			Mbps
		I/OA1 to I/OB1, I/OA2 to I/OB2, I/OB1 to I/OA1, I/OB2 to I/OA2		2			
Minimum Pulse Width	PW_{MIN}	INA1 to OUTB1, INA2 to OUTB2, INB1 to OUTA1, INB2 to OUTA2 (Note 3)		20			ns
Propagation Delay (Note 3)	t_{DPLH} t_{DPHL}	INA1 to OUTB1, INA2 to OUTB2, INB1 to OUTA1, INB2 to OUTA2, R_L = 1MΩ, C_L = 15pF, Figure 1	$V_{CCA} = V_{CCB}$ = +3.3V		20	30	ns
			$V_{CCA} = V_{CCB}$ = +5V		18	26	
		I/OA1 to I/OB1, I/OA2 to I/OB2, R_1 = 1.6kΩ, R_2 = 180Ω, $C_{L1} = C_{L2}$ = 15pF, Figure 2	$V_{CCA} = V_{CCB}$ = +3.3V		30	100	
			$V_{CCA} = V_{CCB}$ = +5V		30	100	
		I/OB1 to I/OA1, I/OB2 to I/OA2, R_1 = 1kΩ, R_2 = 120Ω, $C_{L1} = C_{L2}$ = 15pF, Figure 2	$V_{CCA} = V_{CCB}$ = +3.3V		60	100	
			$V_{CCA} = V_{CCB}$ = +5V		60	100	

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ELECTRICAL CHARACTERISTICS (continued)

($V_{CCA} - V_{GNDA}$ = 3.0V to 5.5V, $V_{CCB} - V_{GNDB}$ = 3.0V to 5.5V, T_A = -40°C to +125°C, unless otherwise noted. Typical values are at $V_{CCA} - V_{GNDA}$ = 3.3V, $V_{CCB} - V_{GNDB}$ = 3.3V, and T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
Pulse-Width Distortion $\|t_{DPLH} - t_{DPHL}\|$ (Notes 3, 8)	PWD	INA1 TO OUTB1, INA2 TO OUTB2, INB1 TO OUTA1, INB2 TO OUTA2, R_L = 1MΩ, C_L = 15pF, Figure 1	$V_{CCA} = V_{CCB}$ = +3.3V			7	ns
			$V_{CCA} = V_{CCB}$ = +5V			7	
		I/OA1 to I/OB1, I/OA2 to I/OB2, R_1 = 1.6kΩ, R_2 = 180Ω, $C_{L1} = C_{L2}$ = 15pF, Figure 2	$V_{CCA} = V_{CCB}$ = +3.3V			12	
			$V_{CCA} = V_{CCB}$ = +5V			12	
		I/OB1 to I/OA1, I/OB2 to I/OA2, R_1 = 1kΩ, R_2 = 120Ω, $C_{L1} = C_{L2}$ = 15pF, Figure 2	$V_{CCA} = V_{CCB}$ = +3.3V			60	
			$V_{CCA} = V_{CCB}$ = +5V			50	
Channel-to-Channel Skew (Notes 3, 8)	$t_{DSKEWCC}$	OUTB1 to OUTB2 output skew, Figure 1	$V_{CCA} = V_{CCB}$ = +3.3V			3	ns
			$V_{CCA} = V_{CCB}$ = +5V			3	
		OUTA1 to OUTA2 output skew, Figure 1	$V_{CCA} = V_{CCB}$ = +3.3V			3	
			$V_{CCA} = V_{CCB}$ = +5V			3	
		I/OB1 to I/OB2 output skew, Figure 2	$V_{CCA} = V_{CCB}$ = +3.3V			6	
			$V_{CCA} = V_{CCB}$ = +5V			5	
		I/OA1 to I/OA2 output skew, Figure 2	$V_{CCA} = V_{CCB}$ = +3.3V			20	
			$V_{CCA} = V_{CCB}$ = +5V			20	
Part-to-Part Skew (Notes 3, 8)	$t_{DSKEWPP}$	Δt_{DPLH}, Δt_{DPHL}				8	ns
Rise Time (Note 3)	t_R	OUTA1, OUTA2, OUTB1, OUTB2, 10% to 90%, Figure 1				5	ns

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ELECTRICAL CHARACTERISTICS (continued)

($V_{CCA} - V_{GNDA}$ = 3.0V to 5.5V, $V_{CCB} - V_{GNDB}$ = 3.0V to 5.5V, T_A = -40°C to +125°C, unless otherwise noted. Typical values are at $V_{CCA} - V_{GNDA}$ = 3.3V, $V_{CCB} - V_{GNDB}$ = 3.3V, and T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
Fall Time (Note 3)	t_F	OUTA1, OUTA2, OUTB1, OUTB2, 90% to 10%, Figure 1				5	ns
		I/OA1, I/OA2, 90% to 10%, R_1 = 1.6kΩ, R_2 = 180Ω, C_{L1} = C_{L2} = 15pF, Figure 2	V_{CCA} = V_{CCB} = +3.3V		30	60	
			V_{CCA} = V_{CCB} = +5V		40	80	
		I/OB1, I/OB2, 90% to 10%, R_1 = 1kΩ, R_2 = 120Ω, C_{L1} = C_{L2} = 15pF, Figure 2	V_{CCA} = V_{CCB} = +3.3V		3	6	
			V_{CCA} = V_{CCB} = +5V		3	5	

Note 2: All units are production tested at T_A = +25°C. Specifications over temperature are guaranteed by design. All voltages of side A are referenced to GNDA. All voltages of side B are referenced to GNDB, unless otherwise noted.

Note 3: Guaranteed by design. Not production tested.

Note 4: The undervoltage lockout threshold and hysteresis guarantee that the outputs are in a known state during a slump in the supplies. See the *Detailed Description* section for more information.

Note 5: The isolation is guaranteed for t = 60s, and tested at 120% of the guaranteed value for 1s.

Note 6: $\Delta V_{IOL} = V_{OL} - V_{IL}$. This is the minimum difference between the output logic-low voltage and the input logic threshold for the same I/O pin. This ensures that the I/O channels are not latched low when any of the I/O inputs are driven low (see the *Bidirectional Channels* section).

Note 7: The common-mode transient immunity guarantees that the device will hold its outputs stable when the isolation voltage changes at the specified rate.

Note 8: Pulse-width distortion is defined as the difference in propagation delay between low-to-high and high-to-low transitions on the same channel. Channel-to-channel skew is defined as the difference in propagation delay between different channels on the same device. Part-to-part skew is defined as the difference in propagation delays (for unidirectional channels) between different devices, when both devices operate with the same supply voltage, at the same temperature and have identical package and test circuits.

Test Circuits/Timing Diagrams

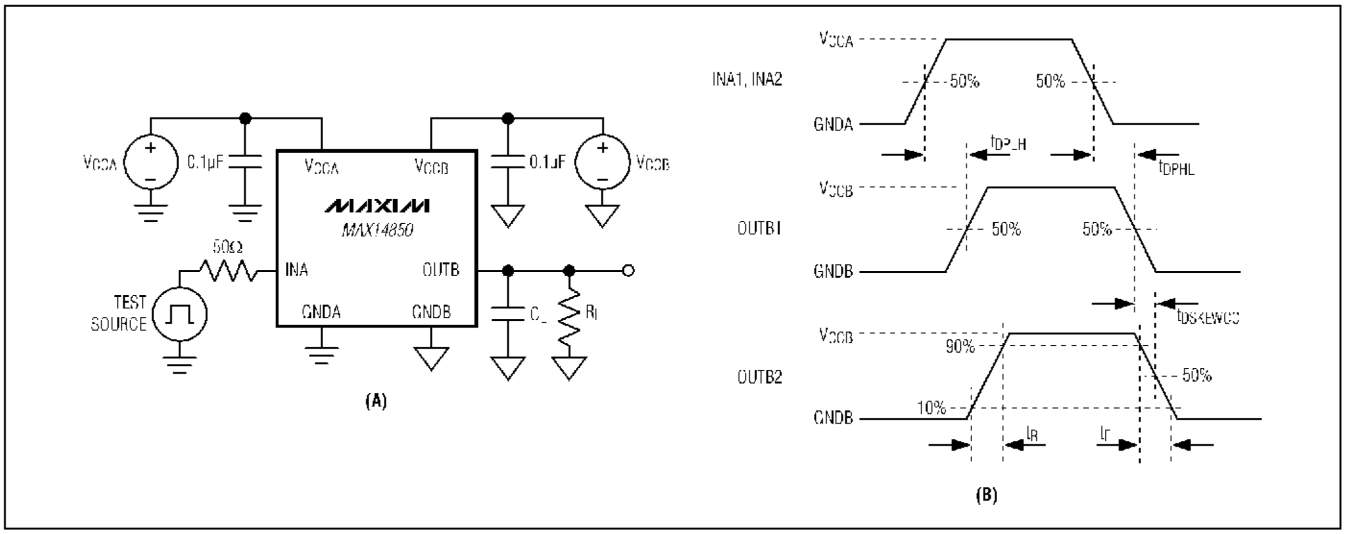

Figure 1. Test Circuit (A) and Timing Diagram (B) for Unidirectional Channels

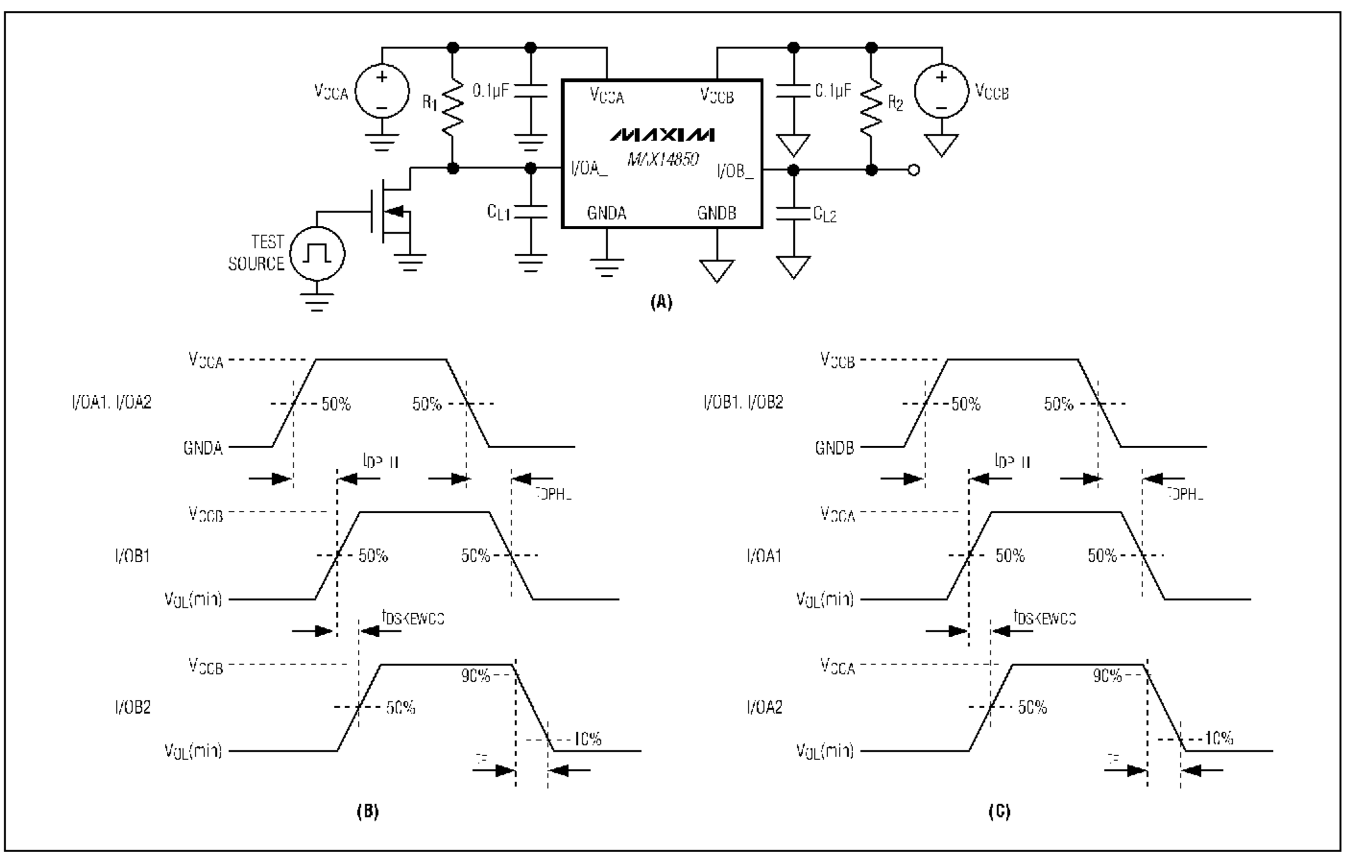

Figure 2. Test Circuit (A) and Timing Diagrams (B) and (C) for Bidirectional Channels

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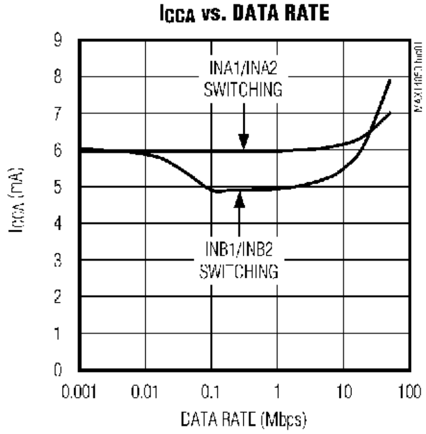
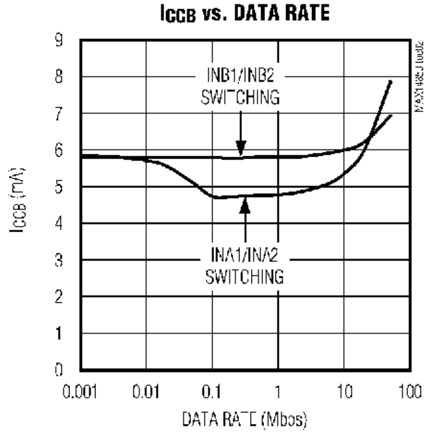
Typical Operating Characteristics

($V_{CCA} – V_{GNDA}$ = 3.3V, $V_{CCB} – V_{GNDB}$ = 3.3V, $V_{GNDA} – V_{GNDB}$ = TBDV$_{RMS}$, all inputs idle, T_A = +25°C, unless otherwise noted.)

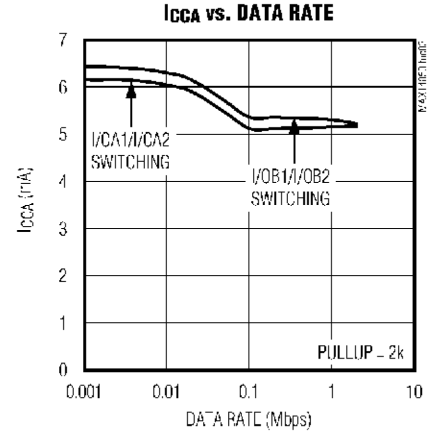
I_{CCA} vs. DATA RATE



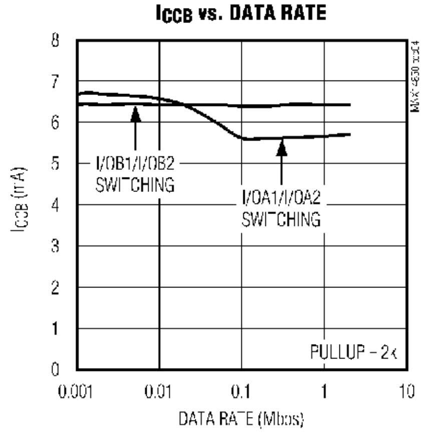
I_{CCB} vs. DATA RATE



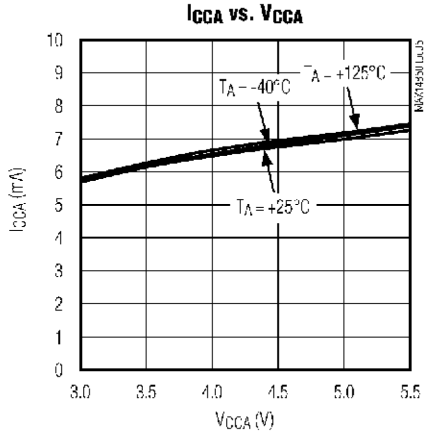
I_{CCA} vs. DATA RATE



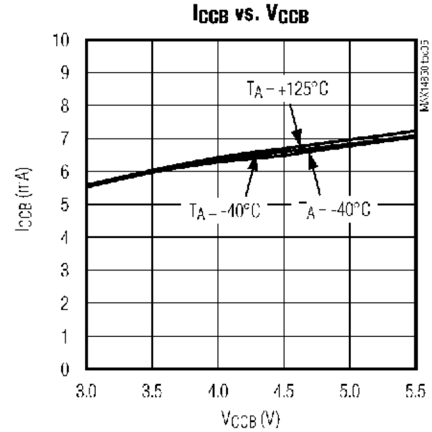
I_{CCB} vs. DATA RATE



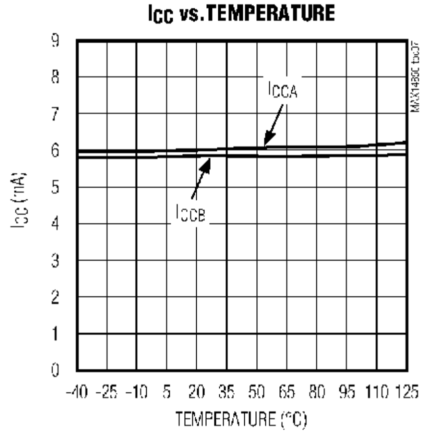
I_{CCA} vs. V_{CCA}



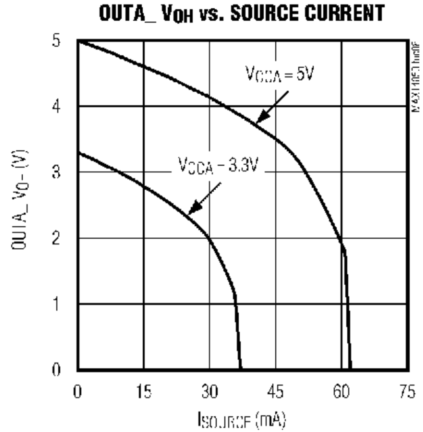
I_{CCB} vs. V_{CCB}



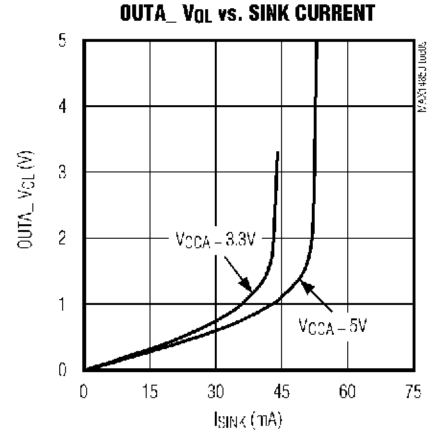
I_{CC} vs. TEMPERATURE



OUTA_ V_{OH} vs. SOURCE CURRENT



OUTA_ V_{OL} vs. SINK CURRENT



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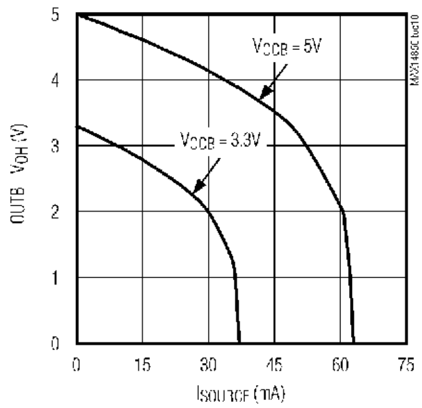
Six-Channel Digital Isolator

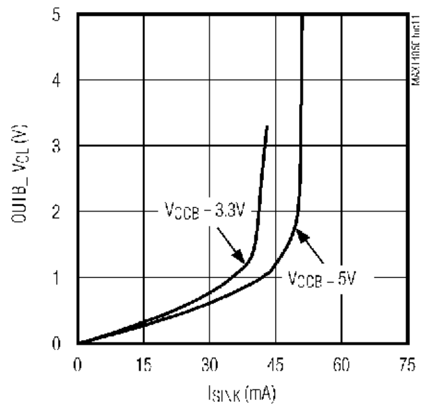
Typical Operating Characteristics (continued)

($V_{CCA} - V_{GNDA}$ = 3.3V, $V_{CCB} - V_{GNDB}$ = 3.3V, $V_{GNDA} - V_{GNDB}$ = TBDV$_{RMS}$, all inputs idle, T_A = +25°C, unless otherwise noted.)

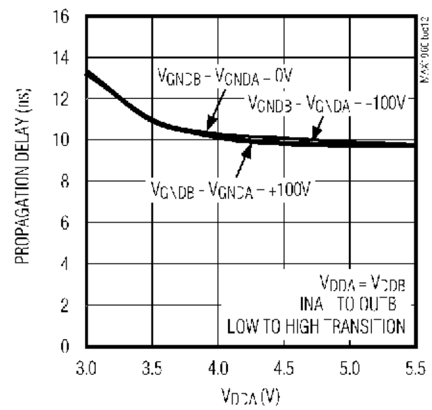
OUTB_ V_{OH} vs. SOURCE CURRENT



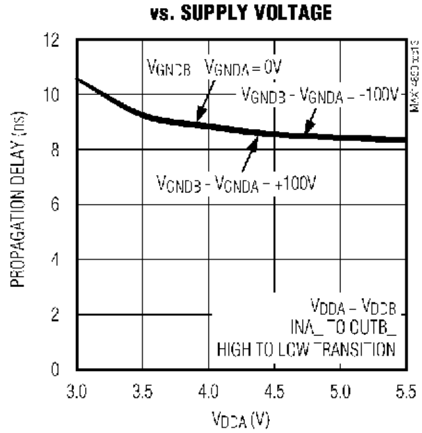
OUTB_ V_{OL} vs. SINK CURRENT



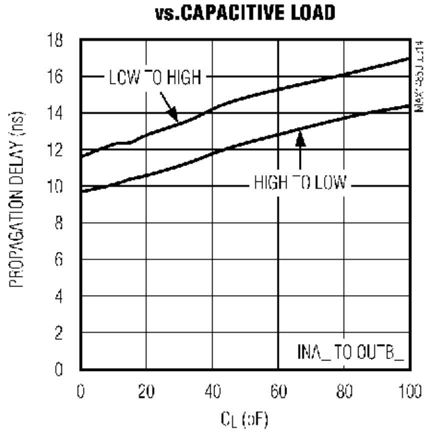
PROPAGATION DELAY vs. SUPPLY VOLTAGE



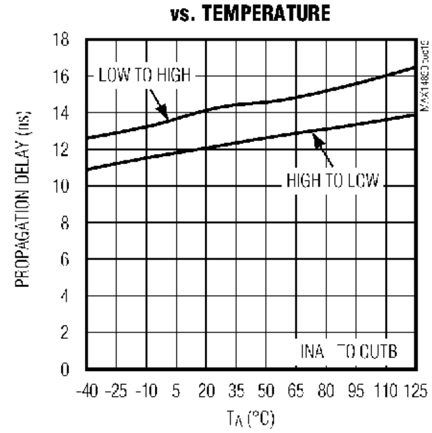
PROPAGATION DELAY vs. SUPPLY VOLTAGE



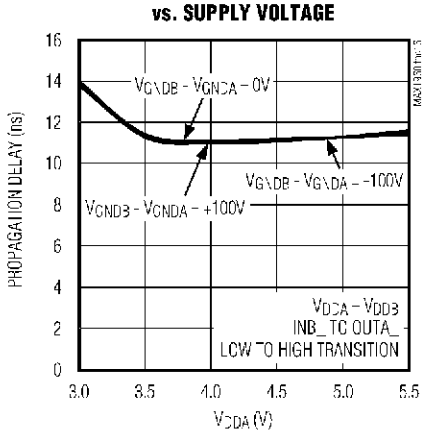
PROPAGATION DELAY vs. CAPACITIVE LOAD



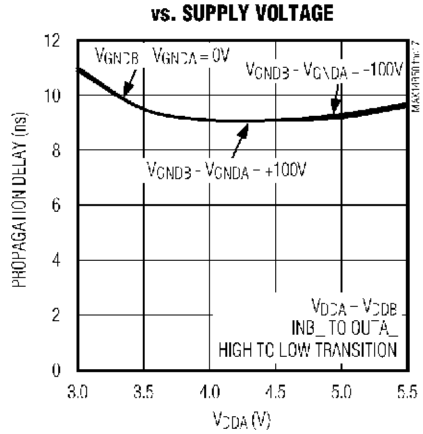
PROPAGATION DELAY vs. TEMPERATURE



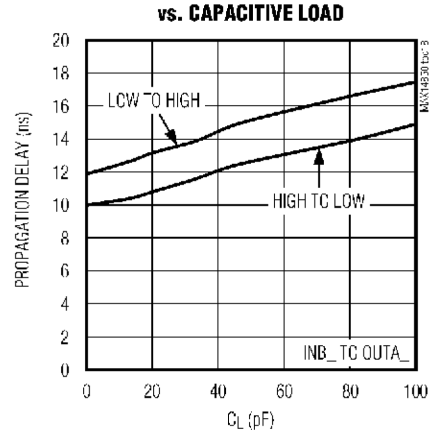
PROPAGATION DELAY vs. SUPPLY VOLTAGE



PROPAGATION DELAY vs. SUPPLY VOLTAGE



PROPAGATION DELAY vs. CAPACITIVE LOAD



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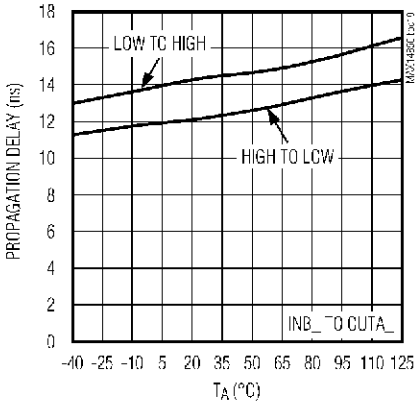
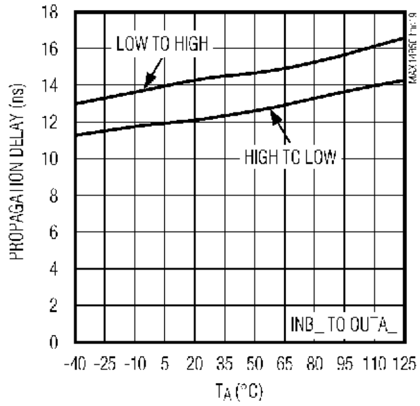
Typical Operating Characteristics (continued)

($V_{CCA} - V_{GNDA}$ = 3.3V, $V_{CCB} - V_{GNDB}$ = 3.3V, $V_{GNDA} - V_{GNDB}$ = TBDV_{RMS}, all inputs idle, T_A = +25°C, unless otherwise noted.

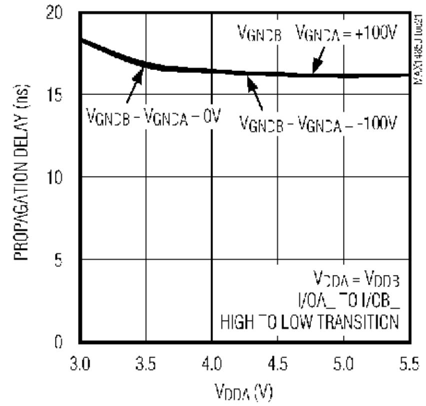
PROPAGATION DELAY vs. TEMPERATURE



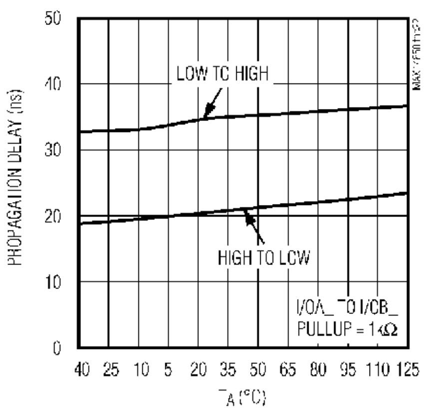
PROPAGATION DELAY vs. TEMPERATURE



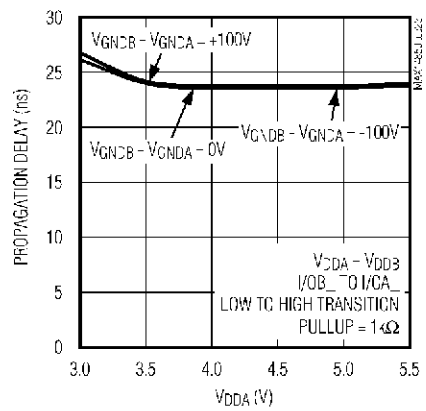
PROPAGATION DELAY vs. SUPPLY VOLTAGE



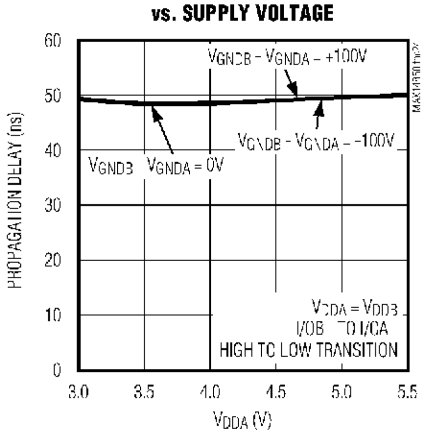
PROPAGATION DELAY vs.TEMPERATURE



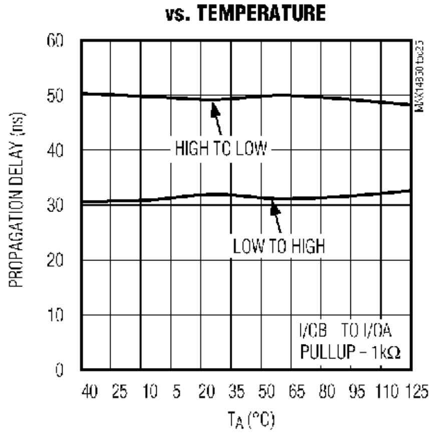
PROPAGATION DELAY vs. SUPPLY VOLTAGE



PROPAGATION DELAY vs. SUPPLY VOLTAGE



PROPAGATION DELAY vs. TEMPERATURE



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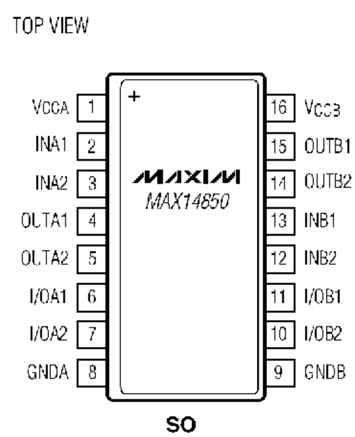
Pin Configuration



Pin Description

PIN	NAME	FUNCTION	VOLTAGE RELATIVE TO
1	V_{CCA}	Supply Voltage of Logic Side A. Bypass V_{CCA} with a 0.1μF ceramic capacitor to GNDA.	GNDA
2	INA1	Logic Input 1 on Side A. INA1 is translated to OUTB1.	GNDA
3	INA2	Logic Input 2 on Side A. INA2 is translated to OUTB2.	GNDA
4	OUTA1	Logic Output 1 on Side A. OUTA1 is a push-pull output.	GNDA
5	OUTA2	Logic Output 2 on Side A. OUTA2 is a push-pull output.	GNDA
6	I/OA1	Bidirectional Input/Output 1 on Side A. I/OA1 is translated to/from I/OB1 and is a open-drain output.	GNDA
7	I/OA2	Bidirectional Input/Output 2 on Side A. I/OA2 is translated to/from I/OB2 and is a open-drain output.	GNDA
8	GNDA	Ground Reference for Side A	—
9	GNDB	Ground Reference for Side B	—

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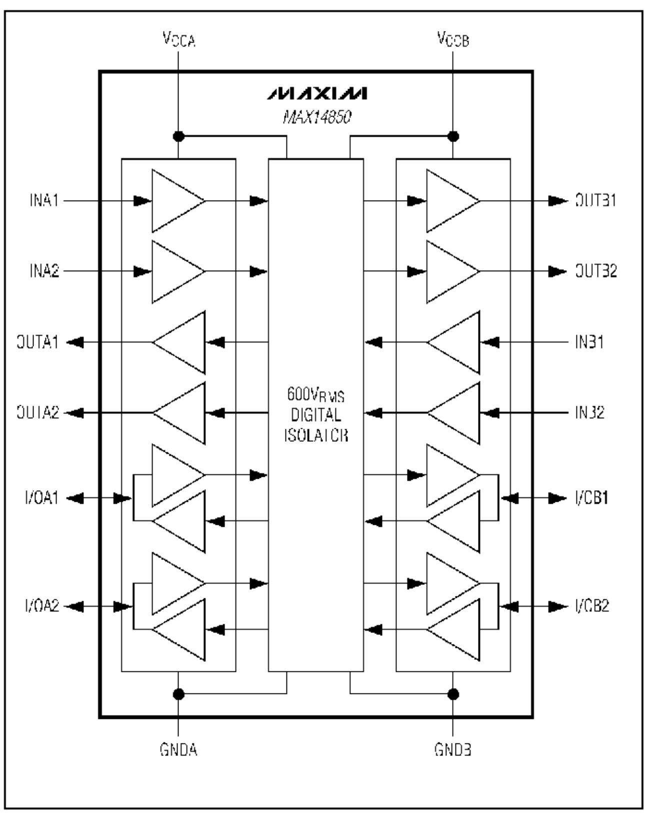
Pin Description (continued)

10	I/OB2	Bidirectional Input/Output 2 on Side B. I/OB2 is translated to/from I/OA2 and is a open-drain output.	GNDB
11	I/OB1	Bidirectional Input/Output 1 on Side B. I/OB1 is translated to/from I/OA1 and is a open-drain output.	GNDB
12	INB2	Logic Input 2 on Side B. INB2 is translated to OUTA2.	GNDB
13	INB1	Logic Input 1 on Side B. INB1 is translated to OUTA1.	GNDB
14	OUTB2	Logic Output 2 on Side B. OUTB2 is a push-pull output.	GNDB
15	OUTB1	Logic Output 1 on Side B. OUTB1 is a push-pull output.	GNDB
16	V_{CCB}	Supply Voltage of Logic Side B. Bypass V_{CCB} with a 0.1μF ceramic capacitor to GNDB.	GNDB

Functional Diagram



Detailed Description

The MAX14850 is a six-channel digital isolator. The device is rated for 600V_{RMS} isolation voltage for 60 seconds. This digital isolator offers a low-power, low-cost, high electromagnetic interference (EMI) immunity, and stable temperature performance through Maxim's proprietary process technology. The device uses a monolithic solution to isolate different ground domains and block high-voltage/high-current transients from sensitive or human interface circuitry. Four of the six channels are unidirectional, two in each direction. All four unidirectional channels support data rates of up to 50Mbps. The other two channels are bidirectional with data rates up to 2Mbps.

Isolation of I^2C, SPI™/Microwire®, and other serial busses can be achieved with the MAX14850. The device features two supply inputs, V_{CCA} and V_{CCB}, that independently set the logic levels on either side of the device. V_{CCA} and V_{CCB} are referenced to GNDA and GNDB, respectively. The MAX14850 features a refresh mode to ensure accuracy of data when the inputs are DC.

Digital Isolation

The MAX14850 provides galvanic isolation for digital signals that are transmitted between two ground domains. Up to 200V_{RMS} of continuous isolation is supported as well as transient differences of up to 850V_{RMS}.

Six-Channel Digital Isolator

Ground Isolation/Level Shifting

The MAX14850 tolerates a ground difference of $600V_{RMS}$. Therefore, V_{GNDA} can be 850VDC higher or lower than V_{GNDB}. In addition, the device translates logic levels when (V_{CCA}–V_{GNDA}) is higher or lower voltage than (V_{CCB}–V_{GNDB}), as long as each is within the valid 3.0V to 5.5V range.

Unidirectional and Bidirectional Channels

The MAX14850 operates both as a unidirectional device and bidirectional device simultaneously. Each unidirectional channel can only be used in the direction shown in the functional diagram. The bidirectional channels function without requiring a direction control input.

Unidirectional Channels

The device features four unidirectional channels that operate independently with guaranteed data rates from DC to 50Mbps. The output driver of each unidirectional channel is push-pull, eliminating the need for pullup resistors. The outputs are able to drive both TTL and CMOS logic inputs.

Bidirectional Channels

The device features two bidirectional channels that have open-drain outputs. The bidirectional channels do not require a direction control input. A logic-low on one side causes the corresponding pin on the other side to be pulled low while avoiding data latching within the device. The input logic-low threshold (V_{IT}) of I/OA1 and I/OA2 are at least 50mV lower than the output logic-low voltages of I/OA1 and I/OA2. This prevents an output logic-low on side A from being accepted as an input low and subsequently transmitted to side B, thus preventing a latching action.

The I/OA1, I/OA2, I/OB1, and I/OB2 pins have open-drain outputs, requiring pullup resistors to their respective supplies for logic-high outputs. The output low voltages are guaranteed for sink currents of up to 30mA for side B, and 10mA for side A (see the *Electrical Characteristics* table).

The bidirectional channels of the device support I^2C clock stretching.

Startup and Undervoltage Lockout

The V_{CCA} and V_{CCB} supplies are both internally monitored for undervoltage conditions. Undervoltage events can occur during power-up, power-down, or during normal operation due to a slump in the supplies. When an undervoltage event is detected on either of the supplies, all outputs on both sides are automatically controlled, regardless of the status of the inputs. The bidirectional outputs become high impedance and are pulled high by the external pullup resistor on the open-drain output. The unidirectional outputs are pulled high internally to the voltage of the V_{CCA} or V_{CCB} supply during undervoltage conditions.

When an undervoltage condition is detected on either supply, all unidirectional outputs are pulled to the supplies (Table 1). The bidirectional outputs are high impedance and pulled to the supplies by the external pullup resistors.

Safety Regulatory Approvals

The MAX14850 is safety certified by UL, CSA, and IEC 60747-5-2. Per UL1577, the MAX14850 is 100% tested at an equivalent V_{ISO} of $720V_{RMS}$ for one second (see Table 2).

Figure 3 shows the behavior of the outputs during power-up and power-down.

Table 1. Output Behavior During Undervoltage Conditions

V_{IN}	V_{CCA}	V_{CCB}	$V_{OUTA\_}$	$V_{OUTB\_}$
1	Powered	Powered	1	1
0	Powered	Powered	0	0
X	Under Voltage	Powered	Follows V_{CCA}	1
X	Powered	Under Voltage	1	Follows V_{CCB}

Table 2. Safety Regulatory Approvals (Pending)

Safety Agency	Standard	Isolation Level	File Number
UL	UL1577 Recognized	$600V_{RMS}$ isolation voltage	Pending
CSA	Approved to Notice #5A	Basic insulation per IEC 60950-1	Pending
TUV / VDE	Approved to 60747-5-5	$600V_{RMS}$	Pending

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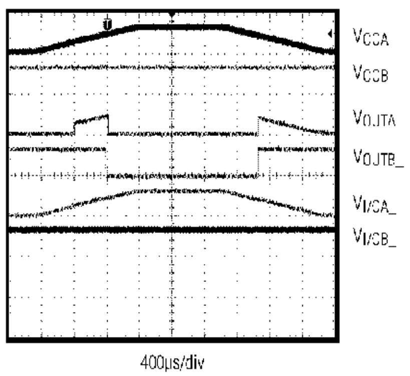

Figure 3. Undervoltage Lockout Behavior

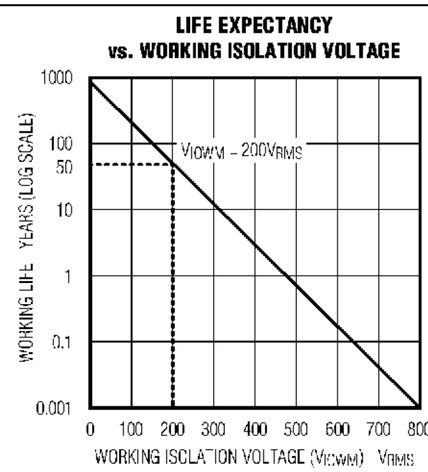

Figure 4. Life Expectancy vs. Working Isolation Voltage

Applications Information

Affect of Continuous Isolation on Lifetime

High-voltage conditions cause insulation to degrade over time. Higher voltages result in faster degradation. Even the high-quality insulating material used in the MAX14850 can degrade over long periods of time with a constant high-voltage across the isolation barrier. Figure 4 shows the life expectancy of the MAX14850 vs. working isolation voltage

Power-Supply Sequencing

The MAX14850 does not require special power-supply sequencing. The logic levels are set independently on either side by V_{CCA} and V_{CCB}. Each supply can be present over the entire specified range regardless of the level or presence of the other.

Power-Supply Decoupling

To reduce ripple and the chance of introducing data errors, bypass V_{CCA} and V_{CCB} with 0.1µF ceramic capacitors to GNDA and GNDB, respectively. Place the bypass capacitors as close to the power-supply input pins as possible.

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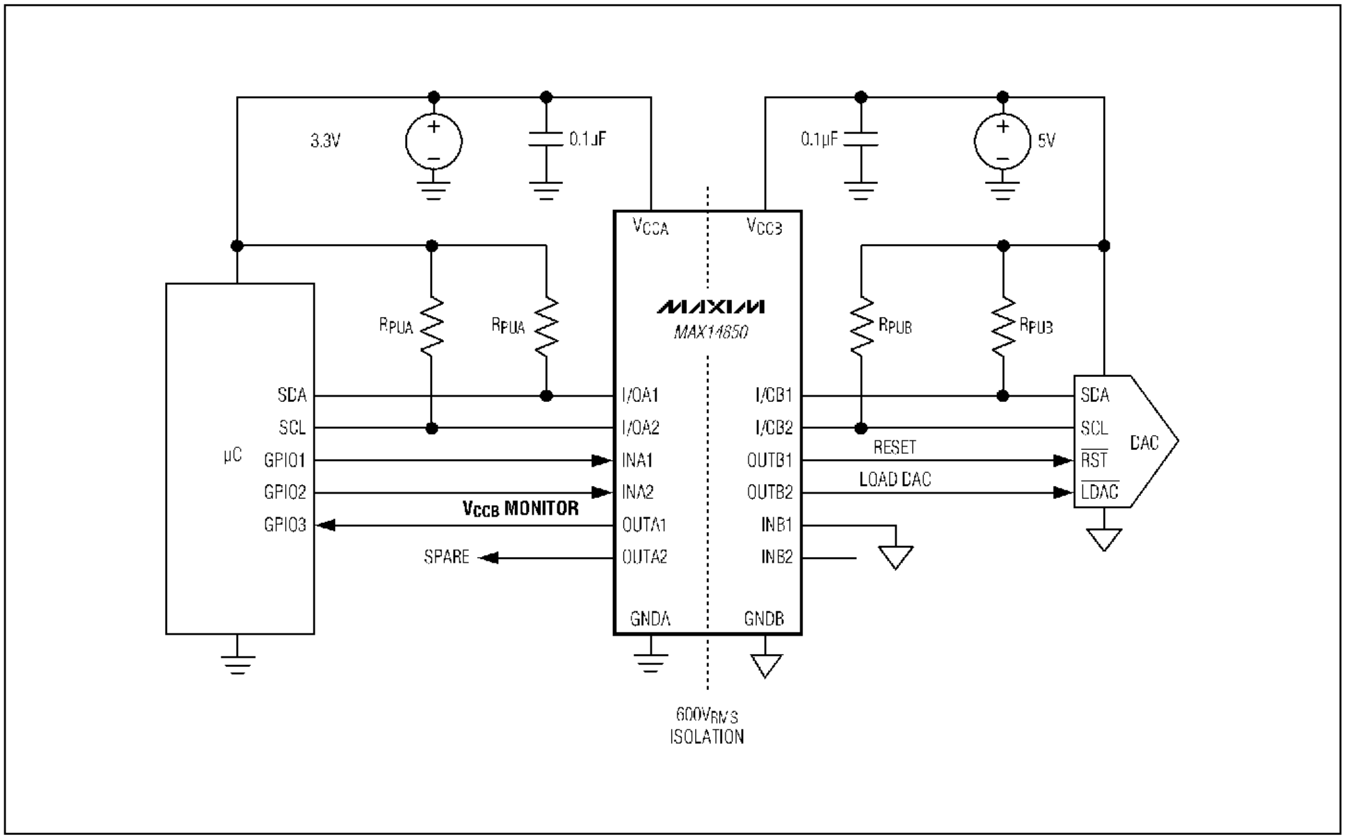
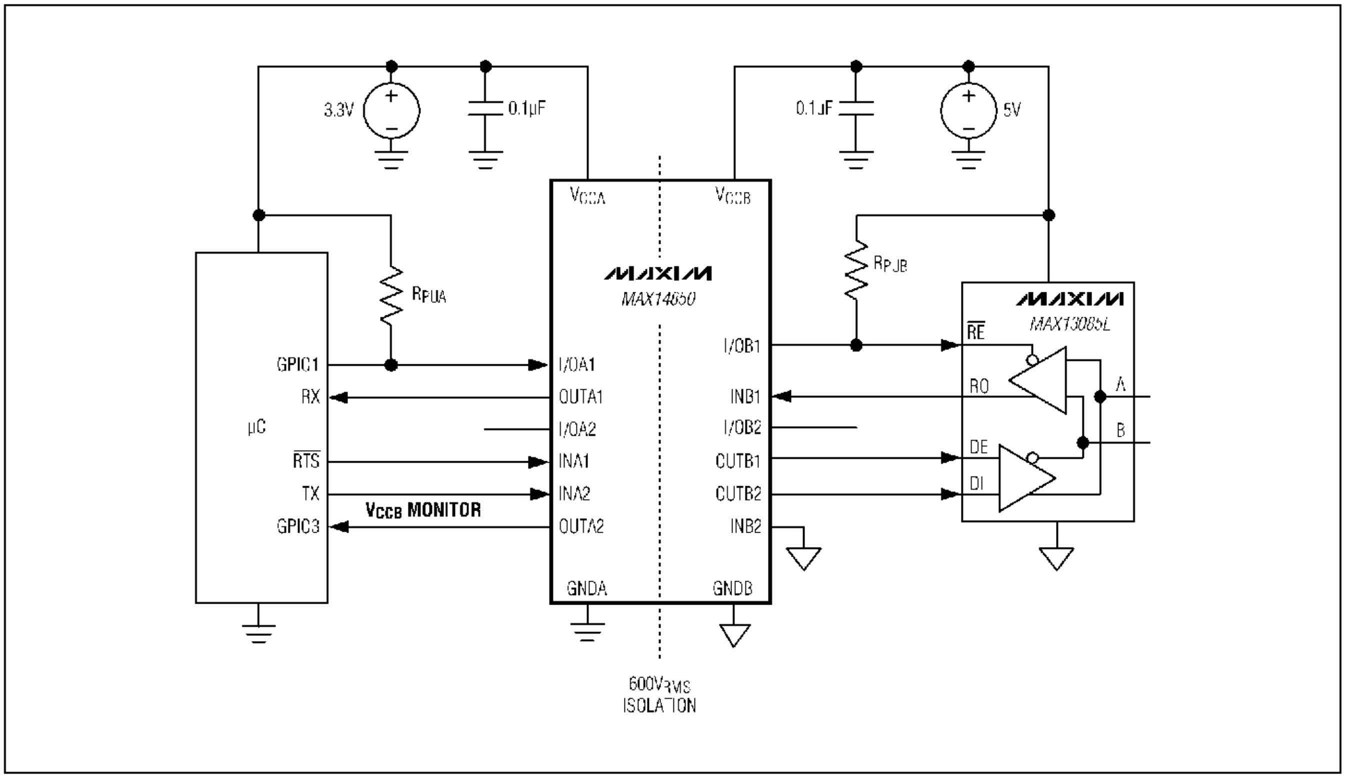
Typical Operating Circuits (continued)



Six-Channel Digital Isolator

Typical Operating Circuits (continued)



Ordering Information

PART	TEMP RANGE	PIN-PACKAGE
MAX14850ASE+	-40°C to +125°C	16 SO

+ Denotes a lead(Pb)-free/RoHS-compliant package.
**All packages are lead free.*

Chip Information

PROCESS: BiCMOS

Package Information

For the latest package outline information and land patterns (footprints), go to **www.maxim-ic.com/packages**. Note that a "+", "#", or "-" in the package code indicates RoHS status only. Package drawings may show a different suffix character, but the drawing pertains to the package regardless of RoHS status.

PACKAGE TYPE	PACKAGE CODE	OUTLINE NO.	LAND PATTERN NO.
16 SO	S16+3	21-0041	90-0097

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Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	12/11	Initial release	—

TEST RECORD NO. 1

SAMPLES:

Samples of the Single Protection Non-Optical Isolators as indicated below and constructed as described herein were submitted by the manufacturer for examination and testing.

Model	Enclosure Type/ Mfr
MAX14850ASE	Type G600, manufactured by Sumitomo

Testing Model MAX14850ASE is considered representative of Model MAX14850.

GENERAL:

Test results relate only to the items tested.

The following tests were conducted.

Dielectric Voltage Withstand Test:	Section 11.5-11.8
Overload Test:	Section 11A
Limited Thermal Aging Test:	Section 12

The test methods and results of the above tests have been reviewed and found in accordance with the applicable requirements of UL 1577, the Standard for Optical Isolators, Fourth Edition, with revisions through and including 2012-05-04 and, therefore, such products are judged eligible to bear UL's Mark as described on the Conclusion Page of this Report.

TEST RECORD NO. 2

SAMPLES:

This investigation covers the addition of model MAX14851.

MAXIMUM RATINGS PER CHANNEL (at 25°C ambient):

Model	Current (mA)		Power (mW)		Isolation Voltage (@ 60 sec)	Max Operating Ambient Temp (°C)	Max Junction Temp (°C)	Max Storage Temp (°C)	Max Data Trans-mission Rate (Mbps) Encoder (Side 1)
	Encoder (Side 1)	Decoder (Side 2)	Encoder (Side 1)	Decoder (Side 2)					
MAX14851	4.0	6.4	22	35.2	600	125	150	150	50

GENERAL:

Test results relate only to the items tested.

Tests were considered covered as follows:

File Reference/ Report Date	Test Record No./ Model	Enclosure	Isolation Barrier	Tests	Representative of the following construction types
E351759/ 2012-06-07 (V1S1)	1/ MAX14850ASE	G600	Silcon Dioxide	DVWT, Overload, LTA	FET output circuit, 0.0026 mm minimum through insulation thickness, 132/132 mW encoder/decoder power, 125°C max operating temp, 150°C max junction temp, 150°C max storage temp, 600 Vac isolation, 50 Mbps.

Test Record Summary:

The results of this investigation indicate that the products evaluated comply with the applicable requirements in Standard for Optical Isolators UL 1577, Fifth Edition, revised January 23, 2015, and, therefore, such products are judged eligible to bear UL's Mark as described on the Conclusion Page of this Report.

Test Record by:	Reviewed by:
Jason Ferguson Senior Project Engineer	Phil York Staff Engineering Associate

CONCLUSION

Samples of the components covered by this Report have been found to comply with the requirements covering the category and the components are found to comply with UL's applicable requirements. The description and test result in this Report are only applicable to the sample(s) investigated by UL and does not signify the product(s) described as being covered under UL's Follow-Up Service Program. When covered under UL's Follow-Up Service Program, the manufacturer is authorized to use the Recognized Marking on such products which comply with UL's Follow-Up Service Procedure and any other applicable requirements of UL LLC. The Recognized Component Mark of Underwriters Laboratories Inc. on the product, or the Recognized Marking symbol on the product and the Recognized Component Mark on the smallest unit container in which the product is packaged, is the only method to identify products investigated by UL to published requirements and manufactured under UL's Recognition and Follow-Up Service.

This Report is intended solely for the use of UL and the Applicant for establishment of UL certification coverage of the product under UL's Follow-Up Service. Any use of the Report other than to indicate that the sample(s) of the product covered by the Report has been found to comply with UL's applicable requirements is not authorized and renders the Report null and void. UL shall not incur any obligation or liability for any loss, expense, or punitive damages, arising out of or in connection with the use or reliance upon the contents of this Report to anyone other than the Applicant as provided in the agreement between UL and Applicant. Any use or reference to UL's name or certification mark(s) by anyone other than the Applicant in accordance with the agreement is prohibited without the express written approval of UL. Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL.

Report by:	Reviewed by:
Conrad Chen	Jacqueline Noack
Senior Project Engineer	Senior Project Engineer