

MAX14934–MAX14936

Four-Channel, 5kV_{RMS} Digital Isolators

General Description

The MAX14934–MAX14936 are a family of four-channel, 5kV digital isolators utilizing Maxim's proprietary process technology. For applications requiring 2.75kV of isolation, see the MAX14930–MAX14932. The MAX14934–MAX14936 family transfers digital signals between circuits with different power domains at ambient temperatures up to +125°C.

The MAX14934–MAX14936 family offers all three possible unidirectional channel configurations to accommodate any four-channel design, including SPI, RS-232, RS-485, and large digital IO modules. For applications requiring bidirectional channels, such as I²C, refer to the MAX14937.

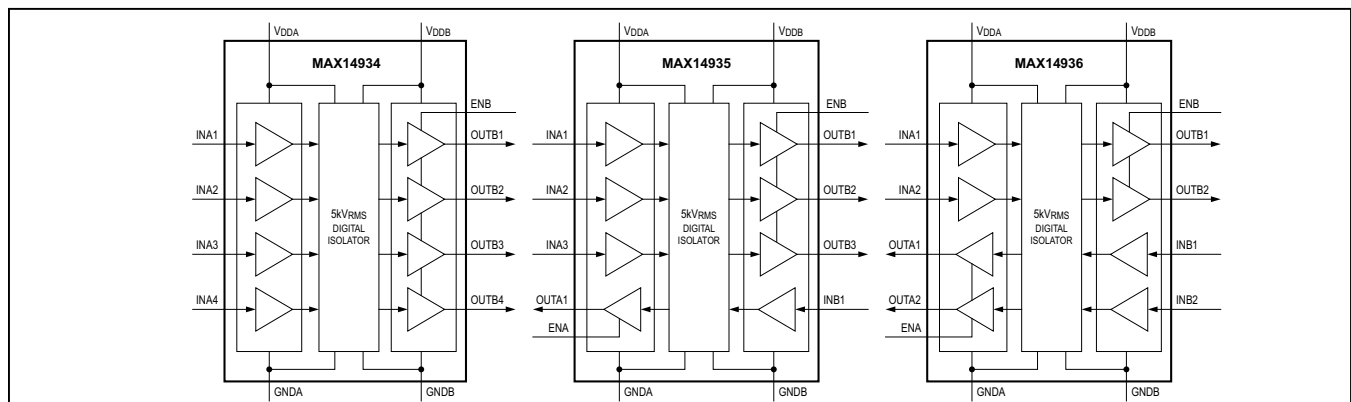
Devices are available with data rates from DC up to 1Mbps, 25Mbps, or 150Mbps. Each device is also available in either a default high or default low configuration. The default is the state an output goes to when its input is unpowered. See the [Ordering Information/Selector Guide](#) for the suffixes associated with each option.

Independent 1.71V to 5.5V supplies on each side of the isolator also make the devices suitable for use as level translators.

The MAX14934–MAX14936 are available in a 16-pin wide body (10.3mm x 7.5mm) SOIC package. All devices are rated for operation at ambient temperatures of -40°C to +125°C.

[Ordering Information/Selector Guide](#) appears at end of data sheet.

Functional Diagram



19-7067; Rev 1; 12/14

Benefits and Features

- Robust Galvanic Isolation of Digital Signals
 - Withstands 5kV_{RMS} for 60s (V_{ISO})
 - Continuously Withstands 848V_{RMS} (V_{IOWM})
 - 1200V_P Repetitive Peak Voltage (V_{IORM})
 - Withstands ± 10 kV Surge per IEC 61000-4-5
- Interfaces Directly with Most Micros and FPGAs
 - Accepts 1.71V to 5.5V Supplies
- Many Options Support Broad Applications
 - 3 Data Rates (1Mbps, 25Mbps, 150Mbps)
 - 3 Channel Direction Configuration
 - 2 Output Default States (High or Low)
- Low Power Consumption at High Data Rates
 - At 1.8V:
 - 2.5mA per Channel Typical at 1Mbps
 - 5.25mA per Channel Typical at 100Mbps
 - At 3.3V:
 - 2.6mA per Channel Typical at 1Mbps
 - 7.1mA per Channel Typical at 100Mbps

Safety Regulatory Approvals Pending

- UL According to UL1577
- cUL According to CSA Bulletin 5A
- VDE 0884-10

Applications

- Fieldbus Communications for Industrial Automation
- Isolated SPI, RS-232, RS-485/RS-422
- General Multichannel Isolation Applications
- Battery Management
- Medical Systems

Absolute Maximum Ratings

V _{DDA} to GNDA, V _{DDB} to GNDB	-0.3V to +6V	Continuous Power Dissipation (T _A = +70°C)
INA ₋ , ENA to GNDA	-0.3V to +6V	Wide SOIC (derate 14.1mW/°C above +70°C)
INB ₋ , ENB to GNDB	-0.3V to +6V	1126.8mW
OUTA ₋ to GNDA	-0.3V to (V _{DDA} + 0.3V)	Operating Temperature Range
OUTB ₋ to GNDB	-0.3V to (V _{DDB} + 0.3V)	-40°C to +125°C
Short-Circuit Duration		Maximum Junction Temperature
(OUTA ₋ to GNDA, OUTB ₋ to GNDB)	Continuous	+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)

Wide SOIC

Junction-to-Ambient Thermal Resistance (θ _{JA})	71°C/W
Junction-to-Case Thermal Resistance (θ _{JC})	23°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.maximintegrated.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.

DC Electrical Characteristics

(V_{DDA} - V_{GNDA} = +1.71V to +5.5V, V_{DDB} - V_{GNDB} = +1.71V to +5.5V, C_L = 15pF, T_A = -40°C to +125°C, unless otherwise noted. Typical values are at V_{DDA} - V_{GNDA} = +3.3V, V_{DDB} - V_{GNDB} = +3.3V, V_{GNDA} = V_{GNDB}, T_A = +25°C, unless otherwise noted.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
POWER SUPPLY						
Operating Supply Voltage	V _{DDA}	Relative to GNDA	1.71		5.5	V
	V _{DDB}	Relative to GNDB	1.71		5.5	V
Undervoltage Lockout Threshold	V _{UVLO-}	V _{DD-} rising	1.45	1.58	1.71	V
Undervoltage Lockout Threshold Hysteresis	V _{UVLO-} HYST			50		mV

DC Electrical Characteristics (continued)

(V_{DDA} - V_{GNDA} = +1.71V to +5.5V, V_{DDB} - V_{GNDB} = +1.71V to +5.5V, C_L = 15pF, T_A = -40°C to +125°C, unless otherwise noted. Typical values are at V_{DDA} - V_{GNDA} = +3.3V, V_{DDB} - V_{GNDB} = +3.3V, V_{GNDA} = V_{GNDB}, T_A = +25°C, unless otherwise noted.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Current (MAX14934_)	I _{DDA}	500kHz square wave	V _{DDA} = 5V	1.2	1.9	mA
			V _{DDA} = 3.3V	1.2	1.9	
			V _{DDA} = 2.5V	1.2	1.9	
			V _{DDA} = 1.8V	1.1	1.9	
		12.5MHz square wave (Note 3)	V _{DDA} = 5V	2.1	2.7	
			V _{DDA} = 3.3V	2	2.7	
			V _{DDA} = 2.5V	2	2.7	
			V _{DDA} = 1.8V	2	2.6	
		50MHz square wave (Note 3)	V _{DDA} = 5V	5	6.6	
			V _{DDA} = 3.3V	4.6	6.1	
			V _{DDA} = 2.5V	4.5	6.0	
			V _{DDA} = 1.8V	4.5	6.0	
	I _{DDB}	500kHz square wave	V _{DDB} = 5V	8.1	11.2	
			V _{DDB} = 3.3V	7.9	11.1	
			V _{DDB} = 2.5V	7.9	11.0	
			V _{DDB} = 1.8V	7.7	10.8	
		12.5MHz square wave (Note 3)	V _{DDB} = 5V	12.8	15.9	
			V _{DDB} = 3.3V	11.1	14.2	
			V _{DDB} = 2.5V	10.2	13.4	
			V _{DDB} = 1.8V	9.4	12.4	
		50MHz square wave (Note 3)	V _{DDB} = 5V	27.2	35.4	
			V _{DDB} = 3.3V	21.7	27.8	
			V _{DDB} = 2.5V	17.6	23.0	
			V _{DDB} = 1.8V	14.4	18.9	

DC Electrical Characteristics (continued)

($V_{DDA} - V_{GNDA} = +1.71V$ to $+5.5V$, $V_{DDB} - V_{GNDB} = +1.71V$ to $+5.5V$, $C_L = 15pF$, $T_A = -40^{\circ}C$ to $+125^{\circ}C$, unless otherwise noted. Typical values are at $V_{DDA} - V_{GNDA} = +3.3V$, $V_{DDB} - V_{GNDB} = +3.3V$, $V_{GNDA} = V_{GNDB}$, $T_A = +25^{\circ}C$, unless otherwise noted.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Current (MAX14935_)	I _{DDA}	500kHz square wave	V _{DDA} = 5V	3.4	5.3	mA
			V _{DDA} = 3.3V	3.3	5.3	
			V _{DDA} = 2.5V	3.3	5.3	
			V _{DDA} = 1.8V	3.2	5.1	
		12.5MHz square wave (Note 3)	V _{DDA} = 5V	5.6	7.1	
			V _{DDA} = 3.3V	5	6.6	
			V _{DDA} = 2.5V	4.7	6.4	
			V _{DDA} = 1.8V	4.5	6.1	
		50MHz square wave (Note 3)	V _{DDA} = 5V	12.4	16.0	
			V _{DDA} = 3.3V	10.1	13.0	
			V _{DDA} = 2.5V	9.1	11.6	
			V _{DDA} = 1.8V	8.2	10.4	
	I _{DDB}	500kHz square wave	V _{DDB} = 5V	6.5	9.2	
			V _{DDB} = 3.3V	6.4	9.1	
			V _{DDB} = 2.5V	6.3	9.1	
			V _{DDB} = 1.8V	6.2	8.9	
		12.5MHz square wave (Note 3)	V _{DDB} = 5V	10.3	12.8	
			V _{DDB} = 3.3V	8.9	11.6	
			V _{DDB} = 2.5V	8.2	11.0	
			V _{DDB} = 1.8V	7.6	10.3	
		50MHz square wave (Note 3)	V _{DDB} = 5V	22.7	29.1	
			V _{DDB} = 3.3V	17.7	23.0	
			V _{DDB} = 2.5V	14.7	19.4	
			V _{DDB} = 1.8V	11.9	15.9	

DC Electrical Characteristics (continued)

(V_{DDA} - V_{GNDA} = +1.71V to +5.5V, V_{DDB} - V_{GNDB} = +1.71V to +5.5V, C_L = 15pF, T_A = -40°C to +125°C, unless otherwise noted. Typical values are at V_{DDA} - V_{GNDA} = +3.3V, V_{DDB} - V_{GNDB} = +3.3V, V_{GNDA} = V_{GNDB}, T_A = +25°C, unless otherwise noted.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Supply Current (MAX14936_)	I _{DDA}	500kHz square wave	V _{DDA} = 5V	5.2	7.2	mA	
			V _{DDA} = 3.3V	5.2	7.2		
			V _{DDA} = 2.5V	5.2	7.2		
			V _{DDA} = 1.8V	5	7.0		
		12.5MHz square wave (Note 3)	V _{DDA} = 5V	8.2	10.0		
			V _{DDA} = 3.3V	7.2	9.1		
			V _{DDA} = 2.5V	6.7	8.7		
			V _{DDA} = 1.8V	6.3	8.2		
		50MHz square wave (Note 3)	V _{DDA} = 5V	18	23.3		
			V _{DDA} = 3.3V	14.2	18.4		
			V _{DDA} = 2.5V	12.3	16.1		
			V _{DDA} = 1.8V	10.5	13.6		
	I _{DDB}	500kHz square wave	V _{DDB} = 5V	5.2	7.2		
			V _{DDB} = 3.3V	5.2	7.2		
			V _{DDB} = 2.5V	5.2	7.2		
			V _{DDB} = 1.8V	5	7.0		
		12.5MHz square wave (Note 3)	V _{DDB} = 5V	8.2	10.0		
			V _{DDB} = 3.3V	7.2	9.1		
			V _{DDB} = 2.5V	6.7	8.7		
			V _{DDB} = 1.8V	6.3	8.2		
		50MHz square wave (Note 3)	V _{DDB} = 5V	18	23.3		
			V _{DDB} = 3.3V	14.2	18.4		
			V _{DDB} = 2.5V	12.3	16.1		
			V _{DDB} = 1.8V	10.5	13.6		

DC Electrical Characteristics (continued)

($V_{DDA} - V_{GNDA} = +1.71V$ to $+5.5V$, $V_{DDB} - V_{GNDB} = +1.71V$ to $+5.5V$, $C_L = 15pF$, $T_A = -40^{\circ}C$ to $+125^{\circ}C$, unless otherwise noted. Typical values are at $V_{DDA} - V_{GNDA} = +3.3V$, $V_{DDB} - V_{GNDB} = +3.3V$, $V_{GNDA} = V_{GNDB}$, $T_A = +25^{\circ}C$, unless otherwise noted.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
LOGIC INPUTS AND OUTPUTS						
Input High Voltage	V_{IH}	ENA, INA_ relative to GNDA	0.7 x V_{DDA}			V
		ENB, INB_ relative to GNDB	0.7 x V_{DDB}			
Input Low Voltage	V_{IL}	ENA, INA_ relative to GNDA	$1.71V \leq V_{DDA} \leq 1.89V$	0.6		V
			$2.25V \leq V_{DDA} \leq 5.5V$	0.8		
		ENB, INB_ relative to GNDB	$1.71V \leq V_{DDB} \leq 1.89V$	0.6		
			$2.25V \leq V_{DDB} \leq 5.5V$	0.8		
Input Hysteresis	V_{HYS}	$V_{INA_}$ relative to GNDA or $V_{INB_}$ relative to GNDB	MAX1493_A/D	410		mV
			MAX1493_B/E	410		
			MAX1493_C/F	80		
Input Leakage Current	I_L	$V_{INA_} = 0$ or V_{DDA} , $V_{INB_} = 0$ or V_{DDB}	-1		+1	μA
Input Capacitance	C_{IN}	INA_, INB_, $f = 1MHz$		2		pF
EN_ Pullup Current	I_{PU}		-4	-2.3	-1	μA
Output Voltage High	V_{OH}	$V_{OUTA_}$ relative to GNDA, $I_{OUTA_} = -4mA$ (Note 4)	$V_{DDA} - 0.4$			V
		$V_{OUTB_}$ relative to GNDB, $I_{OUTB_} = -4mA$ (Note 4)	$V_{DDB} - 0.4$			
Output Voltage Low	V_{OL}	$V_{OUTA_}$ relative to GNDA, $I_{OUTA_} = 4mA$ (Note 4)	0.4			V
		$V_{OUTB_}$ relative to GNDB, $I_{OUTB_} = 4mA$ (Note 4)	0.4			

Dynamic Electrical Characteristics (MAX1493_A/D)

(V_{DDA} - V_{GNDA} = +1.71V to +5.5V, V_{DDB} - V_{GNDB} = +1.71V to +5.5V, C_L = 15pF, T_A = -40°C to +125°C, unless otherwise noted. Typical values are at V_{DDA} - V_{GNDA} = +3.3V, V_{DDB} - V_{GNDB} = +3.3V, V_{GNDA} = V_{GNDB}, T_A = +25°C, unless otherwise noted.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
INPUT AND OUTPUT CHANNELS						
Common-Mode Transient Immunity	CMTI	IN__ = GND_ or VDD_ (Note 5)		25		kV/μs
Maximum Data Rate	DR _{MAX}		1			Mbps
Minimum Pulse Width	PW _{MIN}	INA_ to OUTB_, INB_ to OUTA_			1	μs
Glitch Rejection		INA_ to OUTB_, INB_ to OUTA_		32		ns
Propagation Delay (Figure 1)	t _{PLH}	INA_ to OUTB_, INB_ to OUTA_, C _L = 15pF	4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V	38.2	54.1	ns
			3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V	38.7	54.6	
			2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V	39.7	55.6	
			1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V	42.9	58.4	
	t _{PHL}	INA_ to OUTB_, INB_ to OUTA_, C _L = 15pF	4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V	38.6	55.3	
			3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V	38.9	55.6	
			2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V	39.8	56.1	
			1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V	42.3	60.2	
Pulse-Width Distortion	PWD	t _{PLH} - t _{PHL}	4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V	0.4	4.5	ns
			3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V	0.2	4.3	
			2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V	0.1	3.9	
			1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V	0.6	4.7	
Propagation Delay Skew Part-to-Part (Same Channel)	t _{SPLH}		4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V		26.6	ns
			3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V		26.6	
			2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V		26.6	
			1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V		26.9	
	t _{SPHL}		4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V		27.9	
			3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V		27.7	
			2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V		27.6	
			1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V		29.7	
Propagation Delay Skew Channel-to-Channel (Same Direction)	t _{SCSLH}		4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V		6.7	ns
			3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V		6.7	
			2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V		6.7	
			1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V		6.7	
	t _{SCSHL}		4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V		6.7	
			3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V		6.7	
			2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V		6.7	
			1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V		6.7	

Dynamic Electrical Characteristics (MAX1493_A/D) (Continued)

($V_{DDA} - V_{GNDA} = +1.71V$ to $+5.5V$, $V_{DDB} - V_{GNDB} = +1.71V$ to $+5.5V$, $C_L = 15pF$, $T_A = -40^\circ C$ to $+125^\circ C$, unless otherwise noted. Typical values are at $V_{DDA} - V_{GNDA} = +3.3V$, $V_{DDB} - V_{GNDB} = +3.3V$, $V_{GNDA} = V_{GNDB}$, $T_A = +25^\circ C$, unless otherwise noted.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	
Propagation Delay Skew Channel-to-Channel (Opposing Direction)	t_{SCOLH}	$4.5V \leq V_{DDA}$, $V_{DDB} \leq 5.5V$			26.6	ns	
		$3.0V \leq V_{DDA}$, $V_{DDB} \leq 3.6V$			26.6		
		$2.25V \leq V_{DDA}$, $V_{DDB} \leq 2.75V$			26.6		
		$1.71V \leq V_{DDA}$, $V_{DDB} \leq 1.89V$			26.9		
	t_{SCOHL}	$4.5V \leq V_{DDA}$, $V_{DDB} \leq 5.5V$					27.9
		$3.0V \leq V_{DDA}$, $V_{DDB} \leq 3.6V$					27.7
		$2.25V \leq V_{DDA}$, $V_{DDB} \leq 2.75V$					27.6
		$1.71V \leq V_{DDA}$, $V_{DDB} \leq 1.89V$					29.7
Rise Time (Figure 1)	t_R	$4.5V \leq V_{DDA}$, $V_{DDB} \leq 5.5V$		2		ns	
		$3.0V \leq V_{DDA}$, $V_{DDB} \leq 3.6V$		2			
		$2.25V \leq V_{DDA}$, $V_{DDB} \leq 2.75V$		2			
		$1.71V \leq V_{DDA}$, $V_{DDB} \leq 1.89V$		2			
Fall Time (Figure 1)	t_F	$4.5V \leq V_{DDA}$, $V_{DDB} \leq 5.5V$		2		ns	
		$3.0V \leq V_{DDA}$, $V_{DDB} \leq 3.6V$		2			
		$2.25V \leq V_{DDA}$, $V_{DDB} \leq 2.75V$		2			
		$1.71V \leq V_{DDA}$, $V_{DDB} \leq 1.89V$		2			
Enable to Data Valid	t_{EN}	$4.5V \leq V_{DDA}$, $V_{DDB} \leq 5.5V$			5.1	ns	
		$3.0V \leq V_{DDA}$, $V_{DDB} \leq 3.6V$			5.5		
		$2.25V \leq V_{DDA}$, $V_{DDB} \leq 2.75V$			6.7		
		$1.71V \leq V_{DDA}$, $V_{DDB} \leq 1.89V$			16.3		
Enable to Three-State	t_{TRI}	$4.5V \leq V_{DDA}$, $V_{DDB} \leq 5.5V$			2.7	ns	
		$3.0V \leq V_{DDA}$, $V_{DDB} \leq 3.6V$			4.4		
		$2.25V \leq V_{DDA}$, $V_{DDB} \leq 2.75V$			7.0		
		$1.71V \leq V_{DDA}$, $V_{DDB} \leq 1.89V$			11.7		

Dynamic Electrical Characteristics (MAX1493_B/E)

(V_{DDA} - V_{GNDA} = +1.71V to +5.5V, V_{DDB} - V_{GNDB} = +1.71V to +5.5V, C_L = 15pF, T_A = -40°C to +125°C, unless otherwise noted. Typical values are at V_{DDA} - V_{GNDA} = +3.3V, V_{DDB} - V_{GNDB} = +3.3V, V_{GNDA} = V_{GNDB}, T_A = +25°C, unless otherwise noted.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
INPUT AND OUTPUT CHANNELS						
Common-Mode Transient Immunity	CMTI	IN__ = GND_ or VDD_ (Note 5)		25		kV/μs
Maximum Data Rate	DR _{MAX}		25			Mbps
Minimum Pulse Width	PW _{MIN}	INA_ to OUTB_, INB_ to OUTA_			40	ns
Glitch Rejection		INA_ to OUTB_, INB_ to OUTA_		15		ns
Propagation Delay (Figure 1)	t _{PLH}	INA_ to OUTB_, INB_ to OUTA_, C _L = 15pF	4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V	20.9	27.5	ns
			3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V	21.4	28.7	
			2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V	22.4	31.2	
			1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V	25.7	36.9	
	t _{PHL}	INA_ to OUTB_, INB_ to OUTA_, C _L = 15pF	4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V	21.1	28.8	
			3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V	21.5	29.8	
			2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V	22.3	31.9	
			1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V	24.9	37.4	
Pulse-Width Distortion	PWD	t _{PLH} - t _{PHL}	4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V	0.2	2.6	ns
			3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V	0.1	2.6	
			2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V	0.1	2.4	
			1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V	0.7	3.2	
Propagation Delay Skew Part-to-Part (Same Channel)	t _{SPLH}		4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V		11.7	ns
			3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V		11.5	
			2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V		11.3	
			1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V		13.6	
	t _{SPHL}		4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V		9.8	
			3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V		9.8	
			2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V		11.1	
			1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V		14.4	
Propagation Delay Skew Channel-to-Channel (Same Direction)	t _{SCSLH}		4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V		3	ns
			3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V		3	
			2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V		3	
			1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V		3	
	t _{SCSHL}		4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V		3	
			3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V		3	
			2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V		3	
			1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V		3	

Dynamic Electrical Characteristics (MAX1493_B/E) (Continued)

(V_{DDA} - V_{GNDA} = +1.71V to +5.5V, V_{DDB} - V_{GNDB} = +1.71V to +5.5V, C_L = 15pF, T_A = -40°C to +125°C, unless otherwise noted. Typical values are at V_{DDA} - V_{GNDA} = +3.3V, V_{DDB} - V_{GNDB} = +3.3V, V_{GNDA} = V_{GNDB}, T_A = +25°C, unless otherwise noted.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Propagation Delay Skew Channel to Channel (Opposing Direction)	t _{SCOLH}	4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V			11.7	ns
		3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V			11.5	
		2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V			11.3	
		1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V			13.6	
	t _{SCOHL}	4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V			9.8	
		3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V			9.8	
		2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V			11.1	
		1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V			14.4	
Rise Time (Figure 1)	t _R	4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V		2	ns	
		3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V		2		
		2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V		2		
		1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V		2		
Fall Time (Figure 1)	t _F	4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V		2	ns	
		3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V		2		
		2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V		2		
		1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V		2		
Enable to Data Valid	t _{EN}	4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V			5.1	ns
		3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V			5.5	
		2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V			6.7	
		1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V			16.3	
Enable to Three-State	t _{TRI}	4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V			2.7	ns
		3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V			4.4	
		2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V			7.0	
		1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V			11.7	

Dynamic Electrical Characteristics (MAX1493_C/F)

(V_{DDA} - V_{GND A} = +1.71V to +5.5V, V_{DDB} - V_{GND B} = +1.71V to +5.5V, C_L = 15pF, T_A = -40°C to +125°C, unless otherwise noted. Typical values are at V_{DDA} - V_{GND A} = +3.3V, V_{DDB} - V_{GND B} = +3.3V, V_{GND A} = V_{GND B}, T_A = +25°C, unless otherwise noted.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
INPUT AND OUTPUT CHANNELS						
Common-Mode Transient Immunity	CMTI	IN _{__} = GND _{__} or V _{DD} _{__} (Note 5)		25		kV/μs
Maximum Data Rate	DR _{MAX}		150			Mbps
Minimum Pulse Width	PW _{MIN}	INA _{__} to OUTB _{__} , INB _{__} to OUTB _{__}			6.67	ns
Propagation Delay (Figure 1)	t _{PLH}	INA _{__} to OUTB _{__} , INB _{__} to OUTA _{__} , C _L = 15pF	4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V	5.1	7.5	ns
			3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V	5.2	8.1	
			2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V	5.8	9.7	
			1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V	8.1	14	
	t _{PHL}	INA _{__} to OUTB _{__} , INB _{__} to OUTA _{__} , C _L = 15pF	4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V	4.9	7.4	
			3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V	5.3	8.3	
			2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V	5.9	10.2	
			1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V	8.2	14.9	
Pulse-Width Distortion	PWD	t _{PLH} - t _{PHL}	4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V	0.2	1	ns
			3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V	0.1	1	
			2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V	0.1	1	
			1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V	0.1	1	
Propagation Delay Skew Part-to-Part (Same Channel)	t _{SPLH}		4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V		3.0	ns
			3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V		3.3	
			2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V		4.3	
			1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V		7.1	
	t _{SPHL}		4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V		2.8	
			3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V		3.4	
			2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V		4.6	
			1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V		7.9	
Propagation Delay Skew Channel-to-Channel (Same Direction)	t _{SCSLH}		4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V		0.9	ns
			3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V		1.2	
			2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V		1.4	
			1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V		1.6	
	t _{SCSHL}		4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V		0.9	
			3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V		1.2	
			2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V		1.4	
			1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V		1.6	

Dynamic Electrical Characteristics (MAX1493_C/F) (continued)

(V_{DDA} - V_{GNDA} = +1.71V to +5.5V, V_{DDB} - V_{GNDB} = +1.71V to +5.5V, C_L = 15pF, T_A = -40°C to +125°C, unless otherwise noted. Typical values are at V_{DDA} - V_{GNDA} = +3.3V, V_{DDB} - V_{GNDB} = +3.3V, V_{GNDA} = V_{GNDB}, T_A = +25°C, unless otherwise noted.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Propagation Delay Skew Channel-to-Channel (Opposing Direction)	t _{SCOLH}	4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V			3	ns
		3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V			3.3	
		2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V			4.3	
		1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V			7.1	
	t _{SCOHL}	4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V			2.8	
		3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V			3.4	
		2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V			4.6	
		1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V			7.9	
Rise Time (Figure 1)	t _R	4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V		2	ns	
		3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V		2		
		2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V		2		
		1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V		2		
Fall Time (Figure 1)	t _F	4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V		2	ns	
		3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V		2		
		2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V		2		
		1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V		2		
Enable to Data Valid	t _{EN}	4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V			5.1	ns
		3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V			5.5	
		2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V			6.7	
		1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V			16.3	
Enable to Three-State	t _{TRI}	4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V			2.7	ns
		3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V			4.4	
		2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V			7.0	
		V _{DDA} , V _{DDB} ≤ 1.89V			11.7	
Peak Eye Diagram Jitter	T _{JIT(PK)}	V _{DDA} , V _{DDB} = 5.0V			140	ps
		V _{DDA} , V _{DDB} = 3.3V			130	
		V _{DDA} , V _{DDB} = 2.5V			140	
		V _{DDA} , V _{DDB} = 1.8V			160	

ESD Protection

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
ESD		Human Body Model, All Pins		±4		kV

Note 2: All devices are 100% production tested at T_A = +125°C. Specifications over temperature are guaranteed by design.

Note 3: Not production tested. Guaranteed by design.

Note 4: All currents into the device are positive. All currents out of the device are negative.

Note 5: CMTI is the maximum sustainable common-mode voltage slew rate while maintaining the correct output. CMTI applies to both rising and falling common-mode voltage edges. Tested with the transient generator connected between GNDA and GNDB (V_{CM} = 1000V).

Safety Regulatory Approvals (Pending)

UL
The MAX14934–MAX14936 are certified under UL1577. For more details, refer to File E351759.
Rated up to 5000V _{RMS} isolation voltage for single protection.
cUL
Pending
VDE
Pending
TUV
Pending

Insulation Characteristics

PARAMETER	SYMBOL	CONDITIONS	VALUE	UNITS
Partial Discharge Test Voltage	V _{PR}	Method B1 = V _{IORM} × 1.875 (t = 1s, partial discharge < 5pC)	2250	V _P
Repetitive Peak Isolation Voltage	V _{IORM}		1200	V _P
Working Isolation Voltage	V _{IOWM}		848	V _{RMS}
Maximum Transient Isolation Voltage	V _{IOTM}	t = 1s	8400	V _P
Maximum Withstand Isolation Voltage	V _{ISO}	f = 60Hz, duration = 60s	5000	V _{RMS}
Maximum Surge Isolation Voltage	V _{IOSM}	Basic insulation	10	kV
Insulation Resistance	R _S	T _A = +150°C V _{IO} = 500V	> 10 ⁹	Ω
Barrier Capacitance Input to Output	CIO	f = 1MHz	2	pF
Minimum Creepage Distance	CPG	Wide SOIC	8	mm
Minimum Clearance Distance	CLR	Wide SOIC	8	mm
Internal Clearance		Distance through insulation	0.015	mm
Comparative Tracking Resistance Index	CTI	Material Group II (IEC 60112)	575	
Climatic Category			40/125/21	
Pollution Degree (DIN VDE 0110, Table 1)			2	

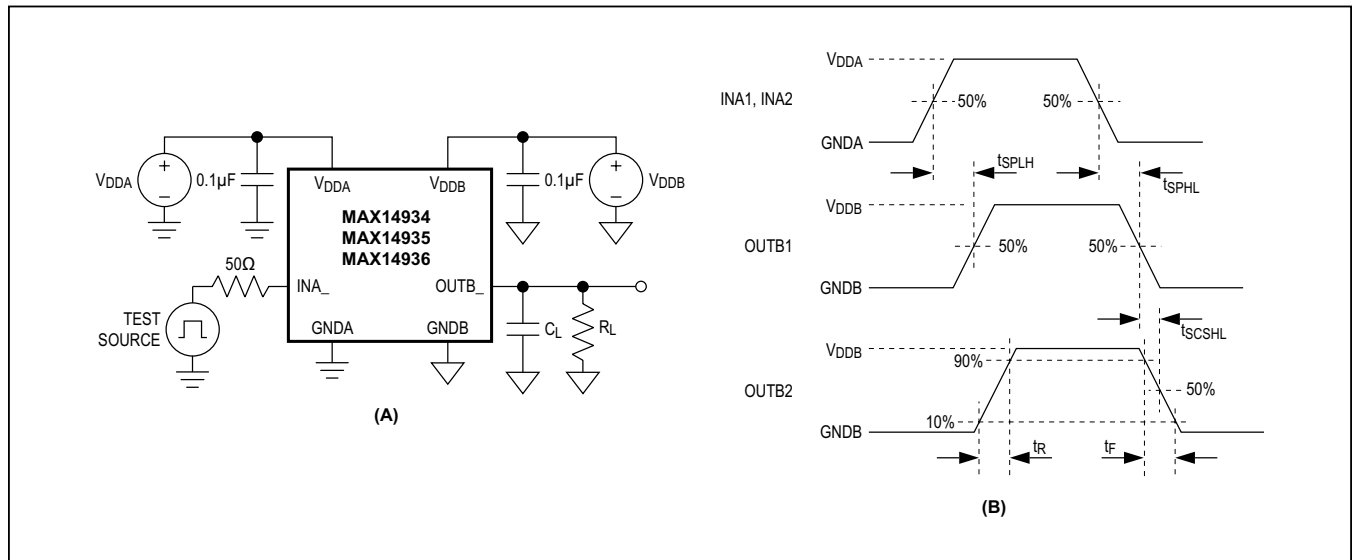
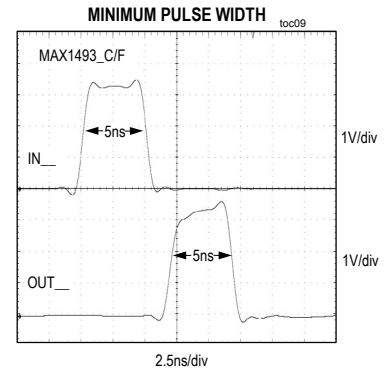
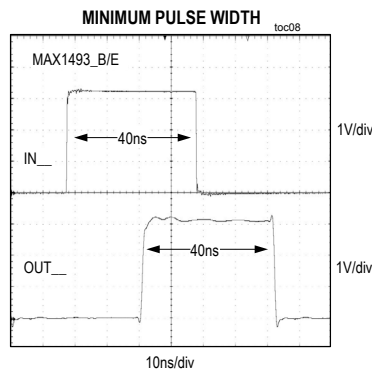
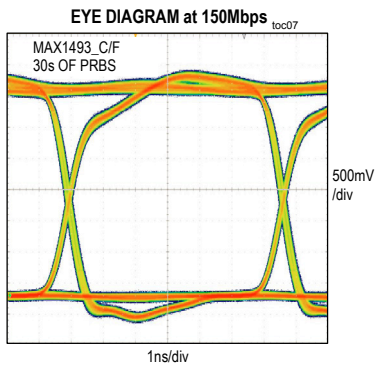
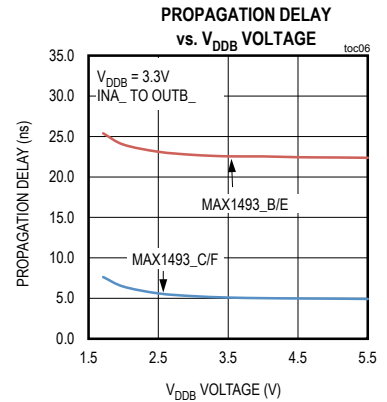
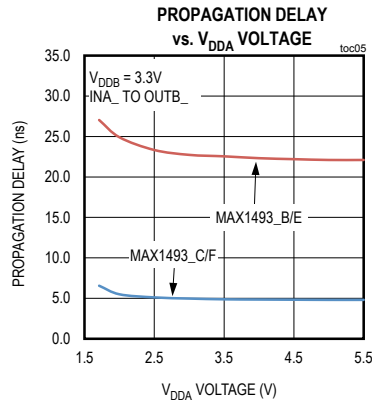
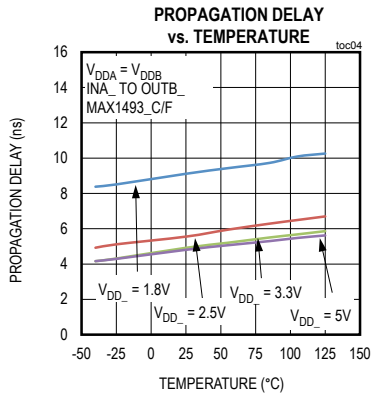
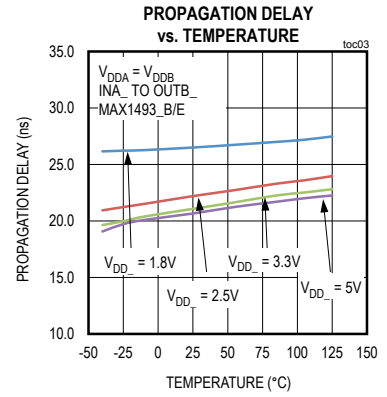
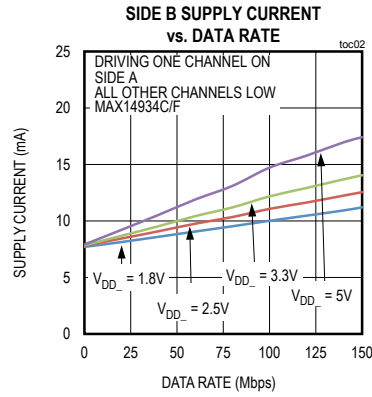
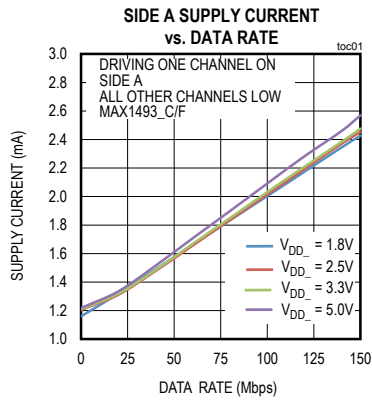


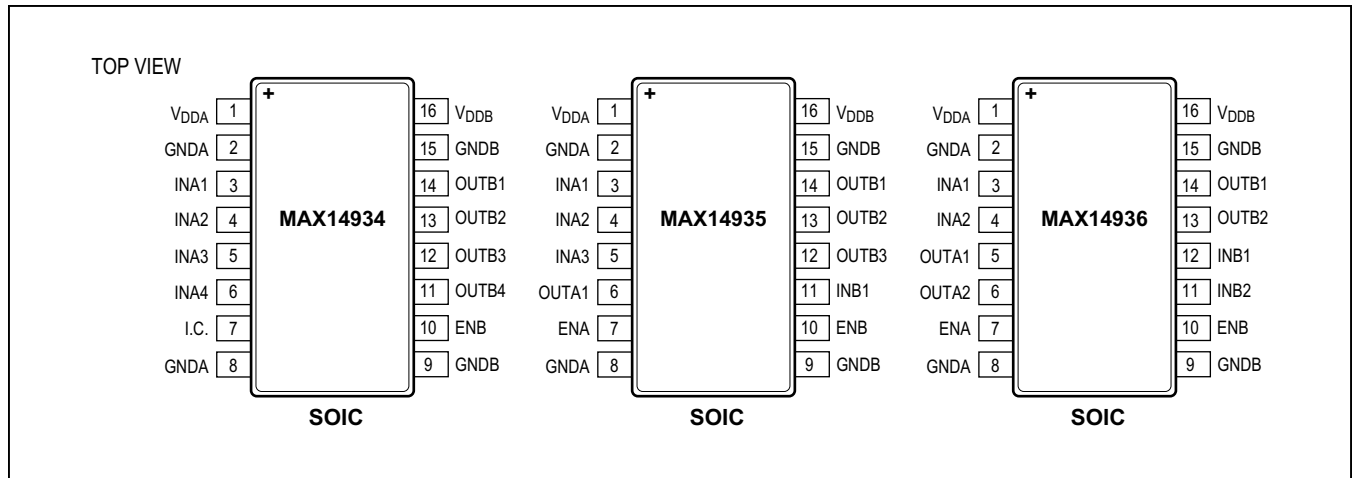
Figure 1. Test Circuit (A) and Timing Diagram (B)

Typical Operating Characteristics

($V_{DDA} - V_{GNDA} = +3.3V$, $V_{DDB} - V_{GNDB} = +3.3V$, $V_{GNDA} = V_{GNDB}$, $T_A = +25^\circ C$, unless otherwise noted.)



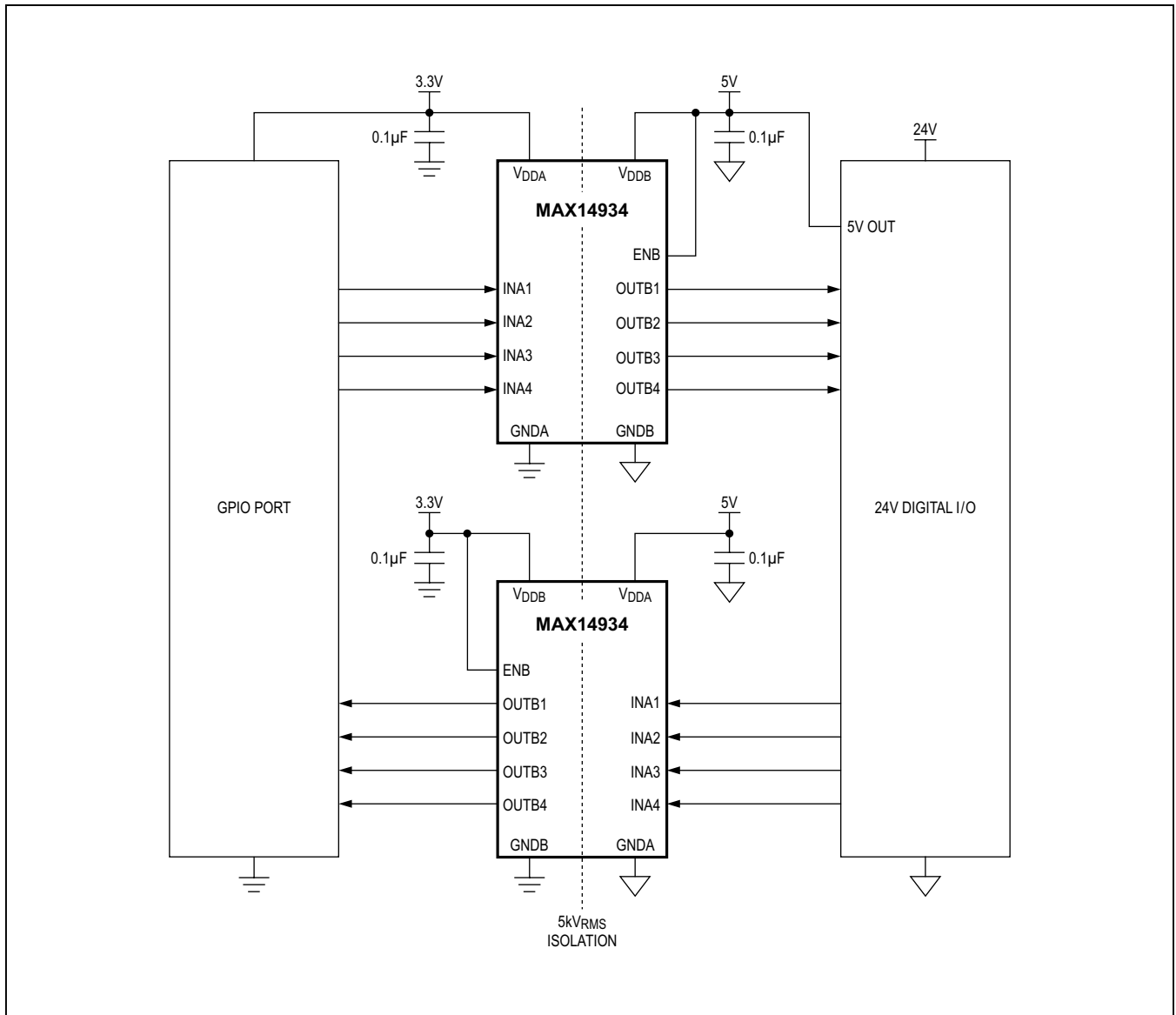
Pin Configurations



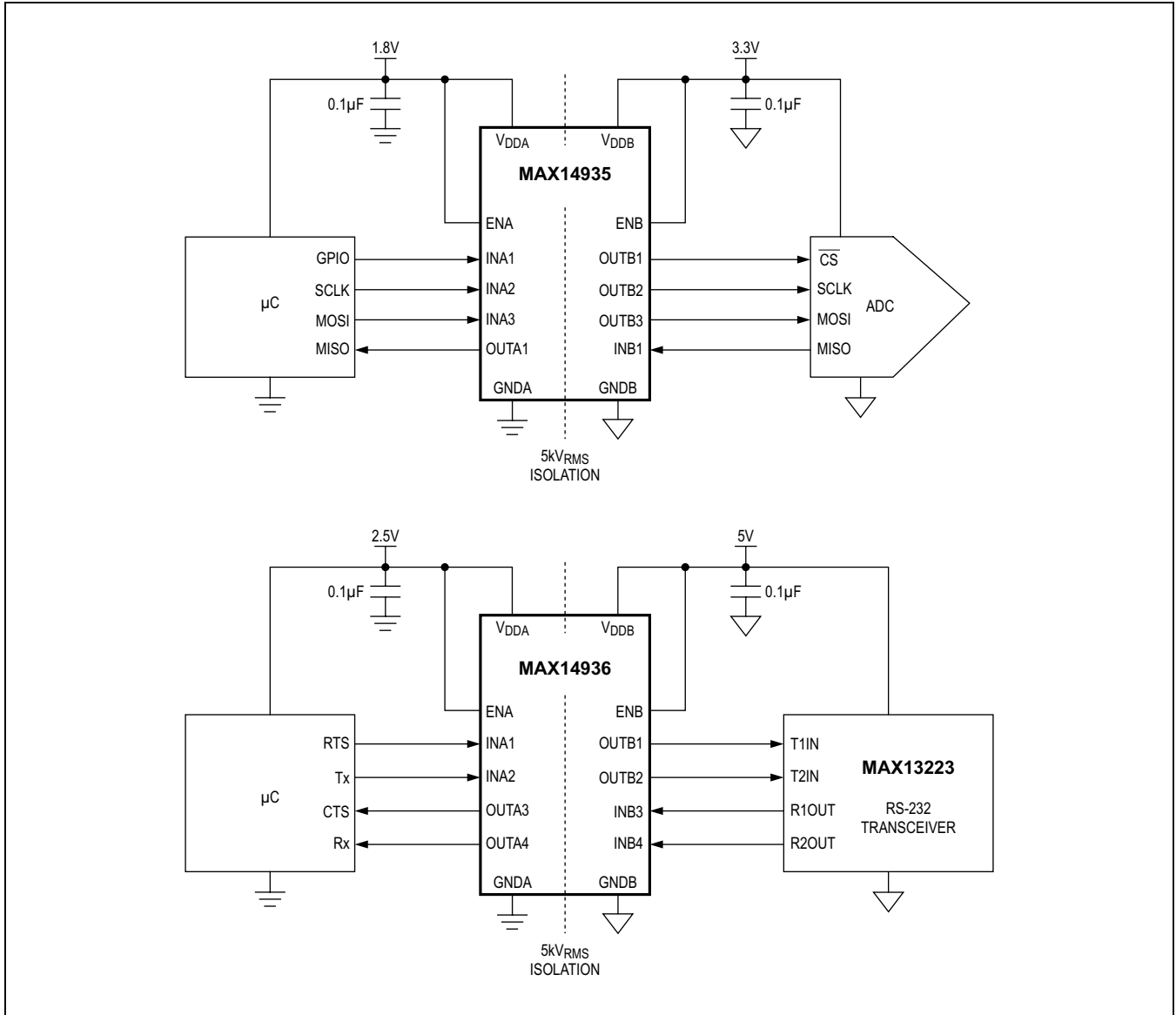
Pin Description

PIN			NAME	FUNCTION	VOLTAGE RELATIVE TO
MAX14934	MAX14935	MAX14936			
1	1	1	V _{DDA}	Power Supply. Bypass V _{DDA} with a 0.1µF ceramic capacitor as close as possible to the pin.	GNDA
2, 8	2, 8	2, 8	GNDA	Ground Reference for Side A	—
3	3	3	INA1	Logic Input 1 on Side A. INA1 corresponds to OUTB1.	GNDA
4	4	4	INA2	Logic Input 2 on Side A. INA2 corresponds to OUTB2.	GNDA
5	5	—	INA3	Logic Input 3 on Side A. INA3 corresponds to OUTB3.	GNDA
6	—	—	INA4	Logic Input 4 on Side A. INA4 corresponds to OUTB4.	GNDA
7	—	—	I.C.	Internally Connected. Leave unconnected or connect to GNDA.	—
—	6	5	OUTA1	Logic Output 1 on Side A	GNDA
—	—	6	OUTA2	Logic Output 2 on Side A	GNDA
—	7	7	ENA	Active-High Enable for Side A. ENA has an internal 2µA pullup to V _{DDA} .	GNDA
9, 15	9, 15	9, 15	GNDB	Ground Reference for Side B	—
10	10	10	ENB	Active-High Enable for Side B. ENB has an internal 2µA pullup to V _{DDB} .	GNDB
11	—	—	OUTB4	Logic Output 4 on Side B	GNDB
—	11	12	INB1	Logic Input 1 on Side B. INB1 corresponds to OUTA1.	GNDB
—	—	11	INB2	Logic Input 2 on Side B. INB2 corresponds to OUTA2.	GNDB
12	12	—	OUTB3	Logic Output 3 on Side B	GNDB
13	13	13	OUTB2	Logic Output 2 on Side B	GNDB
14	14	14	OUTB1	Logic Output 1 on Side B	GNDB
16	16	16	V _{DDB}	Power Supply. Bypass V _{DDB} with a 0.1µF ceramic capacitor as close as possible to the pin.	GNDB

Typical Operating Circuit



Typical Operating Circuit (continued)



Detailed Description

The MAX14934–MAX14936 are a family of four-channel digital isolators. The MAX14934–MAX14936 family transfers digital signals between circuits with different power domains. The devices are rated for 5kV_{RMS} isolation voltage for 60 seconds. This family of digital isolators offers low-power operation, high electromagnetic interference (EMI) immunity, and stable temperature performance through Maxim's proprietary process technology. The devices isolate different ground domains and block high-voltage/high-current transients from sensitive or human interface circuitry.

The MAX14934–MAX14936 family offers three unidirectional channel configurations for design convenience. The MAX14934 features four channels transferring digital signals in one direction for applications such as isolated digital I/O. The MAX14935 has three channels transmitting data in one direction and one channel transmitting in the opposite direction, making it ideal for applications such as isolated SPI and RS-485 communication. The MAX14936 provides further design flexibility with two channels in each direction for isolated RS-232 or other applications.

Devices are available with data rates from DC up to 1Mbps (A/D versions), 25Mbps (B/E versions), or 150Mbps (C/F versions). Each device can also be ordered with default-high or default-low outputs. This is the state an output will go to when the input side of the device is unpowered.

The devices have two supply inputs, V_{DDA} and V_{DDB}, that independently set the logic levels on either side of the device. V_{DDA} and V_{DDB} are referenced to GNDA and GNDB, respectively. The MAX14934–MAX14936 family also features a refresh circuit to ensure output accuracy when an input remains in the same state indefinitely.

Digital Isolation

The MAX14934–MAX14936 family provides galvanic isolation for digital signals that are transmitted between two ground domains. Up to 1200V_{PEAK} of continuous isolation is supported, as well as transient differences of up to 5kV_{RMS} for up to 60 seconds.

Level Shifting

The wide supply voltage range of both V_{DDA} and V_{DDB} allows the MAX14934–MAX14936 family to be used for level translation in addition to isolation. V_{DDA} and V_{DDB} can be independently set to any voltage from 1.71V to 5.5V. The supply voltage sets the logic level on the corresponding side of the isolator.

Unidirectional Channels

Each channel of the MAX14934–MAX14936 is unidirectional; it only passes data in one direction, as indicated in the functional diagram. Each device features four unidirectional channels that operate independently with guaranteed data rates from DC up to 1Mbps (A/D versions), 25Mbps (B/E versions), or 150Mbps (C/F versions). The output driver of each channel is push-pull, eliminating the need for pullup resistors. The outputs are able to drive both TTL and CMOS logic inputs.

Startup and Undervoltage Lockout

The V_{DDA} and V_{DDB} supplies are both internally monitored for undervoltage conditions. Undervoltage events can occur during power-up, power-down, or during normal operation due to a sagging supply voltage. When an undervoltage condition is detected on either supply, all outputs go to their default states regardless of the status of the inputs (Table 1). Figures 2–5 show the behavior of the outputs during power-up and power-down.

Table 1. Output Behavior During Undervoltage Conditions

VIN_	VDDA	VDDB	VOUTA_	VOUTB_
1	Powered	Powered	1	1
0	Powered	Powered	0	0
X	Undervoltage	Powered	Default	Default
X	Powered	Undervoltage	Default	Default

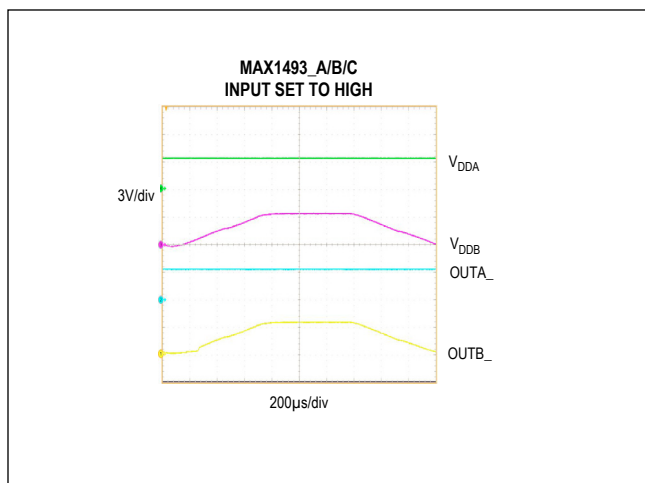


Figure 2. Undervoltage Lockout Behavior (MAX1493_A/BC High)

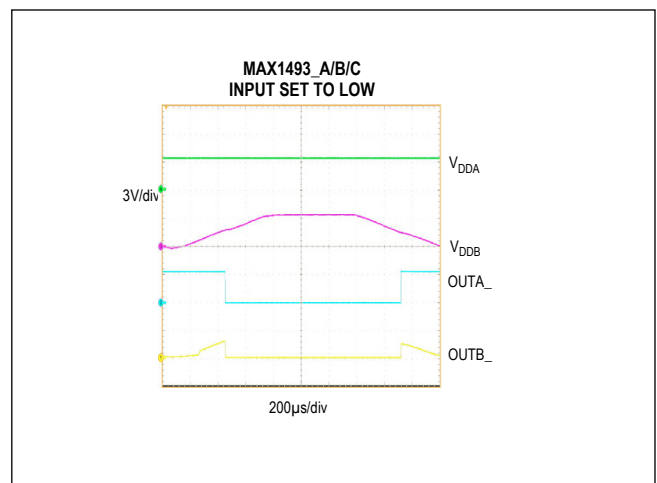


Figure 3. Undervoltage Lockout Behavior (MAX1493_A/BC Low)

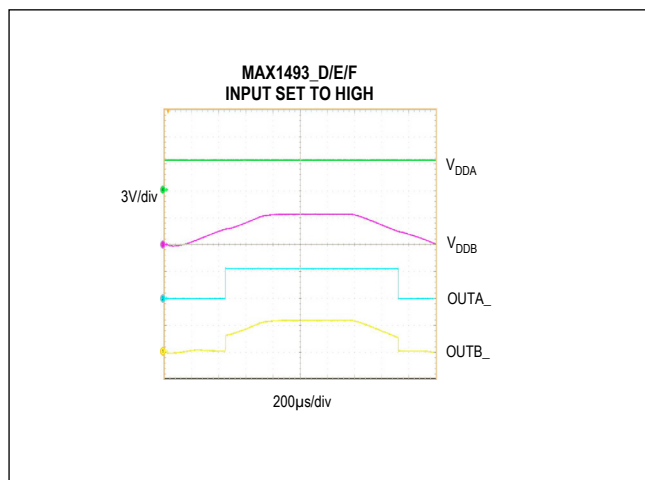


Figure 4. Undervoltage Lockout Behavior (MAX1493_D/E/F High)

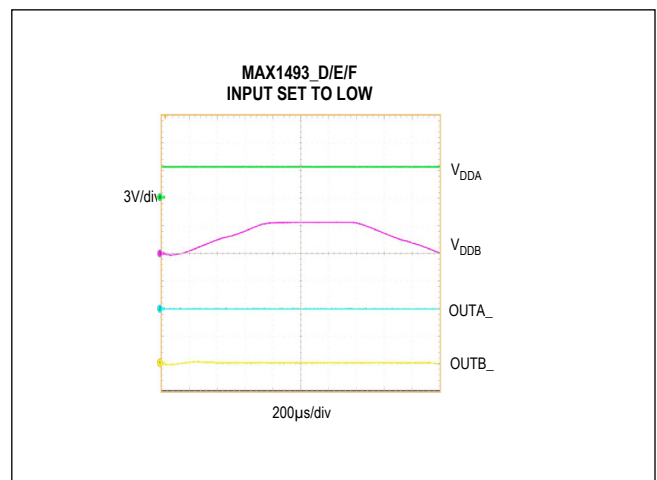


Figure 5. Undervoltage Lockout Behavior (MAX1493_D/E/F Low)

Applications Information

Power-Supply Sequencing

The MAX14934–MAX14936 do not require special power-supply sequencing. The logic levels are set independently on either side by V_{DDA} and V_{DDB} . Each supply can be

present over the entire specified range regardless of the level or presence of the other supply.

Power-Supply Decoupling

To reduce ripple and the chance of introducing data errors, bypass V_{DDA} and V_{DDB} with 0.1 μ F ceramic capacitors to G_{ND}A and G_{ND}B, respectively. Place the bypass capacitors as close to the power-supply input pins as possible.

Ordering Information/Selector Guide

PART	CHANNEL CONFIGURATION	DATA RATE (Mbps)	OUTPUT	TEMP RANGE (°C)	PIN-PACKAGE
MAX14934AAWE+**	4/0	1	Default high	-40 to +125	16 wide SOIC
MAX14934BAWE+	4/0	25	Default high	-40 to +125	16 wide SOIC
MAX14934CAWE+	4/0	150	Default high	-40 to +125	16 wide SOIC
MAX14934DAWE+**	4/0	1	Default low	-40 to +125	16 wide SOIC
MAX14934EAW+	4/0	25	Default low	-40 to +125	16 wide SOIC
MAX14934FAWE+	4/0	150	Default low	-40 to +125	16 wide SOIC
MAX14935AAWE+**	3/1	1	Default high	-40 to +125	16 wide SOIC
MAX14935BAWE+	3/1	25	Default high	-40 to +125	16 wide SOIC
MAX14935CAWE+	3/1	150	Default high	-40 to +125	16 wide SOIC
MAX14935DAWE+	3/1	1	Default low	-40 to +125	16 wide SOIC
MAX14935EAW+	3/1	25	Default low	-40 to +125	16 wide SOIC
MAX14935FAWE+	3/1	150	Default low	-40 to +125	16 wide SOIC
MAX14936AAWE+**	2/2	1	Default high	-40 to +125	16 wide SOIC
MAX14936BAWE+**	2/2	25	Default high	-40 to +125	16 wide SOIC
MAX14936CAWE+**	2/2	150	Default high	-40 to +125	16 wide SOIC
MAX14936DAWE+**	2/2	1	Default low	-40 to +125	16 wide SOIC
MAX14936EAW+**	2/2	25	Default low	-40 to +125	16 wide SOIC
MAX14936FAWE+**	2/2	150	Default low	-40 to +125	16 wide SOIC

+Denotes a lead(Pb)-free/RoHS-compliant package.

**Future product—contact factory for availability.

Chip Information

PROCESS: BICMOS

Package Information

For the latest package outline information and land patterns (footprints), go to www.maximintegrated.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 Wide SOIC	W16M+8	21-0042	90-0107

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	9/14	Initial release	—
1	12/14	Removed future product notation from MAX14935DAWE+ in <i>Ordering Information</i> table, changed “basic insulation” to “single protection” in <i>Safety Regulatory Approvals</i> table, and updated third bullet of <i>Many Options Support Broad Applications</i> in <i>Features and Benefits</i> section.	1, 13, 22

For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim Integrated's website at www.maximintegrated.com.

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