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19-2209; Rev 1; 5/09

32 x 16 Nonblocking Video Crosspoint Switch with I/O Buffers

General Description

The MAX4357 is a 32 × 16 highly integrated video crosspoint switch matrix with input and output buffers. This device operates from dual ±3V to ±5V supplies or from a single +5V supply. Digital logic is supplied from an independent single +2.7V to +5.5V supply. All inputs and outputs are buffered, with all outputs able to drive standard 75Ω reverse-terminated video loads.

The switch matrix configuration and output buffer gain are programmed through an SPI™/QSPI™-compatible, 3-wire serial interface and initialized with a single update signal. The unique serial interface operates in two modes facilitating both fast updates and initialization. On power-up, all outputs are initialized in the disabled state to avoid output conflicts in large-array configurations.

Superior flexibility, high integration, and space-saving packaging make this nonblocking switch matrix ideal for routing video signals in security and video-on-demand systems.

The MAX4357 is available in a 128-pin TQFP package and specified over an extended -40°C to +85°C temperature range.

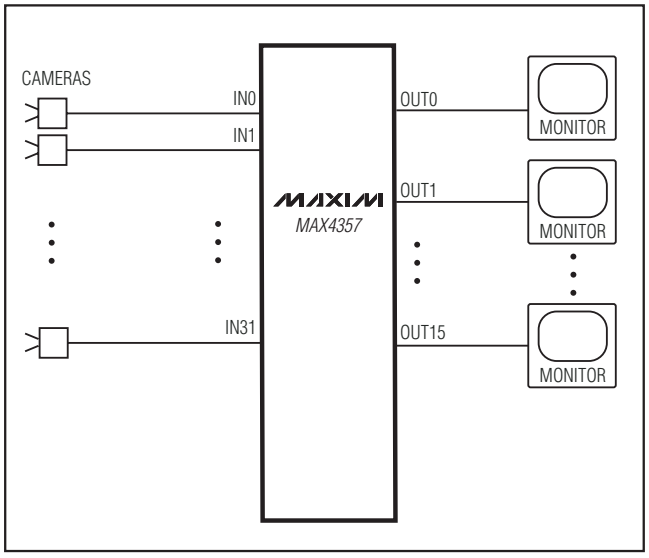
Applications

Security Systems

Video Routing

Video-On-Demand Systems

Typical Operating Circuit



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Features

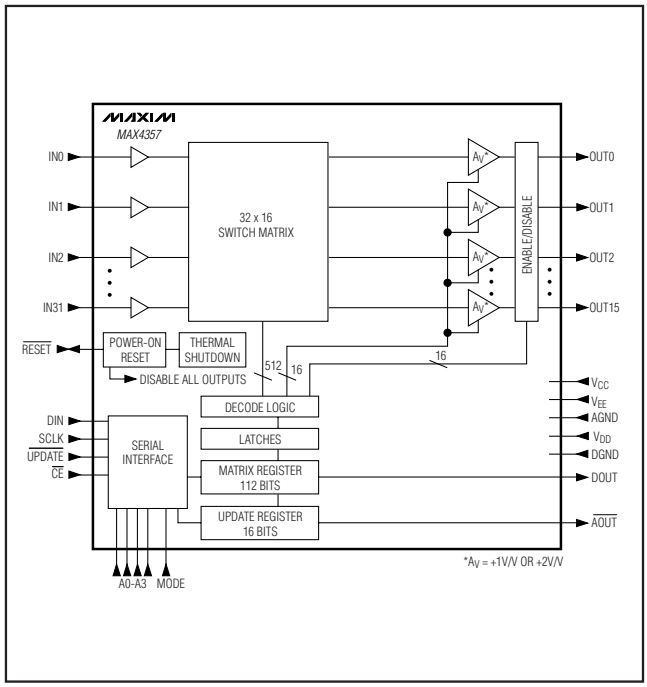
- **32 × 16 Nonblocking Matrix with Buffered Inputs and Outputs**
- **Operates from ±3V, ±5V, or +5V Supplies**
- **Each Output Individually Addressable**
- **Individually Programmable Output Buffer Gain (Av = +1V/V or +2V/V)**
- **High-Impedance Output Disable for Wired-OR Connections**
- **0.1dB Gain Flatness to 12MHz**
- **Minimum -62dB Crosstalk, -110dB Isolation at 6MHz**
- **0.05%/0.1° Differential Gain/Differential Phase Error**
- **Low 220mW Power Consumption (0.43mW per point)**

Ordering Information

PART	TEMP RANGE	PIN-PACKAGE
MAX4357ECD	-40°C to +85°C	128 TQFP

Pin Configuration appears at end of data sheet.

Functional Diagram



32 x 16 Nonblocking Video Crosspoint Switch with I/O Buffers

ABSOLUTE MAXIMUM RATINGS

Analog Supply Voltage (V_{CC} - V_{EE}) ..... +11V
Digital Supply Voltage (V_{DD} - DGND) ..... +6V
Analog Supplies to Analog Ground
(V_{CC} - AGND) and (AGND - V_{EE}) ..... +6V
Analog Ground to Digital Ground ..... -0.3V to +0.3V
IN_ Voltage Range ..... (V_{CC} + 0.3V) to (V_{EE} - 0.3V)
OUT_ Short-Circuit Duration to AGND, V_{CC}, or V_{EE} ..... Indefinite
SCLK, $\overline{CE}$, $\overline{UPDATE}$, MODE, A_, DIN, DOUT,
$\overline{RESET}$, $\overline{AOUT}$ ..... (V_{DD} + 0.3V) to (DGND - 0.3V)
Current into Any Analog Input Pin (IN_) ..... ±50mA
Current into Any Analog Output Pin (OUT_) ..... ±75mA
Continuous Power Dissipation (T_A = +70°C)
128-Pin TQFP (derate 25mW/°C above +70°C) 2W
Operating Temperature Range ..... -40°C to +85°C
Junction Temperature ..... +150°C
Storage Temperature Range ..... -65°C to +150°C
Lead Temperature (soldering, 10s) ..... +300°C

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—DUAL SUPPLIES ±5V

(V_{CC} = +5V, V_{EE} = -5V, V_{DD} = +5V, AGND = DGND = 0, $V_{IN\_}$ = 0, R_L = 150Ω to AGND, and T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Operating Supply Voltage Range	V_{CC} - V_{EE}	Guaranteed by PSRR test		4.5		10.5	V
Logic-Supply Voltage Range	V_{DD} to DGND			2.7		5.5	V
Gain (Note 1)	A_V	(V_{EE} + 2.5V) < $V_{IN\_}$ < (V_{CC} - 2.5V), A_V = +1V/V, R_L = 150Ω		0.97	0.995	1	V/V
		(V_{EE} + 2.5V) < $V_{IN\_}$ < (V_{CC} - 2.5V), A_V = +1V/V, R_L = 10kΩ		0.99	0.999	1	
		(V_{EE} + 3.75V) < $V_{IN\_}$ < (V_{CC} - 3.75V), A_V = +2V/V, R_L = 150Ω		1.92	1.996	2.08	
		(V_{EE} + 3.75V) < $V_{IN\_}$ < (V_{CC} - 3.75V) A_V = +2V/V, R_L = 10kΩ		1.94	2.008	2.06	
		(V_{EE} + 1V) < $V_{IN\_}$ < (V_{CC} - 1.2V), A_V = +1V/V, R_L = 10kΩ		0.95	0.994	1	
Gain Matching (Channel to Channel)		R_L = 10kΩ			0.5	1.5	%
		R_L = 150Ω			0.5	2	
Temperature Coefficient of Gain	TC_{AV}				10		ppm/°C
Input Voltage Range	$V_{IN\_}$	A_V = +1V/V	R_L = 10kΩ	V_{EE} + 1		V_{CC} - 1.2	V
			R_L = 150Ω	V_{EE} + 2.5		V_{CC} - 2.5	
		A_V = +2V/V	R_L = 10kΩ	V_{EE} + 3		V_{CC} - 3.1	
			R_L = 150Ω	V_{EE} + 3.75		V_{CC} - 3.75	

DC ELECTRICAL CHARACTERISTICS—DUAL SUPPLIES ±5V (continued)

(V_{CC} = +5V, V_{EE} = -5V, V_{DD} = +5V, AGND = DGND = 0, $V_{IN\_}$ = 0, R_L = 150Ω to AGND, and T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Output Voltage Range	V_{OUT}	R_L = 10kΩ		V_{EE} + 1		V_{CC} - 1.2	V
		R_L = 150Ω		V_{EE} + 2.5		V_{CC} - 2.5	
Input Bias Current	I_B				4	11	µA
Input Resistance	$R_{IN\_}$	(V_{EE} + 1V) < $V_{IN\_}$ < (V_{CC} - 1.2V)			10		MΩ
Output Offset Voltage	V_{OFFSET}	A_V = +1V/V			±5	±20	mV
		A_V = +2V/V			±10	±40	
Output Short-Circuit Current	I_{SC}	Sinking or sourcing, R_L = 1Ω			±40		mA
Enabled Output Impedance	Z_{OUT}	(V_{EE} + 1V) < $V_{IN\_}$ < (V_{CC} - 1.2V)			0.2		Ω
Output Leakage Current, Disable Mode	I_{OD}	(V_{EE} + 1V) < $V_{OUT\_}$ < (V_{CC} - 1.2V)			0.004	1	µA
DC Power-Supply Rejection Ratio	PSRR	4.5V < (V_{CC} - V_{EE}) < 10.5V		60	70		dB
Quiescent Supply Current	I_{CC}	R_L = ∞	Outputs enabled, T_A = +25°C		100	150	mA
			Outputs enabled			175	
			Outputs disabled		55	75	
	I_{EE}	R_L = ∞	Outputs enabled, T_A = +25°C		95	150	
			Outputs enabled			175	
			Outputs disabled		50	75	
	I_{DD}				4	8	

32 x 16 Nonblocking Video Crosspoint Switch with I/O Buffers

DC ELECTRICAL CHARACTERISTICS—DUAL SUPPLIES ±3V

(V_{CC} = +3V, V_{EE} = -3V, V_{DD} = +3V, AGND = DGND = 0, $V_{IN\_}$ = 0, R_L = 150Ω to AGND, and T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Operating Supply Voltage Range	V_{CC} - V_{EE}	Guaranteed by PSRR test		4.5		10.5	V
Logic-Supply Voltage Range	V_{DD} to DGND			2.7		5.5	V
Gain (Note 1)	A_V	(V_{EE} + 1V) < $V_{IN\_}$ < (V_{CC} - 1.2V), A_V = +1V/V, R_L = 150Ω		0.94	0.983	1	V/V
		(V_{EE} + 1V) < $V_{IN\_}$ < (V_{CC} - 1.2V), A_V = +1V/V, R_L = 10kΩ		0.96	0.993	1	
		(V_{EE} + 2V) < $V_{IN\_}$ < (V_{CC} - 2.1V), A_V = +2V/V, R_L = 150Ω		1.92	1.985	2.08	
		(V_{EE} + 2V) < $V_{IN\_}$ < (V_{CC} - 2.1V) A_V = +2V/V, R_L = 10kΩ		1.94	2.00	2.06	
Gain Matching (Channel to Channel)		R_L = 10kΩ			0.5	1.5	%
		R_L = 150Ω			0.5	2	
Temperature Coefficient of Gain	TC_{AV}				10		ppm/°C
Input Voltage Range	$V_{IN\_}$	A_V = +1V/V	R_L = 10kΩ	V_{EE} + 1		V_{CC} - 1.2	V
			R_L = 150Ω	V_{EE} + 1		V_{CC} - 1.2	
		A_V = +2V/V	R_L = 10kΩ	V_{EE} + 2		V_{CC} - 2.1	
			R_L = 150Ω	V_{EE} + 2		V_{CC} - 2.1	
Output Voltage Range	V_{OUT}	R_L = 10kΩ		V_{EE} + 1		V_{CC} - 1.2	V
		R_L = 150Ω		V_{EE} + 1		V_{CC} - 1.2	
Input Bias Current	I_B				4	11	µA
Input Resistance	R_{IN}	(V_{EE} + 1V) < $V_{IN\_}$ < (V_{CC} - 1.2V)			10		MΩ
Output Offset Voltage	V_{OFFSET}	A_V = +1V/V			±5	±20	mV
		A_V = +2V/V			±10	±40	

DC ELECTRICAL CHARACTERISTICS—DUAL SUPPLIES ±3V (continued)

(V_{CC} = +3V, V_{EE} = -3V, V_{DD} = +3V, AGND = DGND = 0, $V_{IN\_}$ = 0, R_L = 150Ω to AGND, and T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Output Short-Circuit Current	I_{SC}	Sinking or sourcing, R_L = 1Ω			±40		mA
Enabled Output Impedance	Z_{OUT}	(V_{EE} + 1V) < $V_{IN\_}$ < (V_{CC} - 1.2V)			0.2		Ω
Output Leakage Current, Disable Mode	I_{OD}	(V_{EE} + 1V) < $V_{OUT\_}$ < (V_{CC} - 1.2V)			0.004	1	µA
DC Power-Supply Rejection Ratio	PSRR	4.5V < (V_{CC} - V_{EE}) < 10.5V		60	75		dB
Quiescent Supply Current	I_{CC}	R_L = ∞	Outputs enabled		90		mA
			Outputs disabled		45		
	I_{EE}	R_L = ∞	Outputs enabled		85		
			Outputs disabled		40		
	I_{DD}				3		

DC ELECTRICAL CHARACTERISTICS—SINGLE SUPPLY +5V

(V_{CC} = +5V, V_{EE} = 0, V_{DD} = +5V, AGND = DGND = 0, $V_{IN\_}$ = +1.75V, A_V = +1V/V, R_L = 150Ω to AGND, and T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Operating Supply Voltage Range	V_{CC}	Guaranteed by PSRR test		4.5		5.5	V
Logic-Supply Voltage Range	V_{DD} to DGND			2.7		5.5	V
Gain (Note 1)	A_V	(V_{EE} + 1V) < V_{IN} < (V_{CC} - 2.5V), A_V = +1V/V, R_L = 150Ω		0.94	0.995	1	V
		(V_{EE} + 1V) < V_{IN} < (V_{CC} - 1.2V), A_V = +1V/V, R_L = 10kΩ		0.94	0.995	1	
Gain Matching (Channel to Channel)		R_L = 10kΩ			0.5	3	%
		R_L = 150Ω			0.5	3	
Temperature Coefficient of Gain	TC_{AV}				10		ppm/°C
Input Voltage Range	V_{IN}	A_V = +1V/V	R_L = 10kΩ	V_{EE} + 1		V_{CC} - 1.2	V
			R_L = 150Ω	V_{EE} + 1		V_{CC} - 2.5	
Output Voltage Range	V_{OUT}	A_V = +1V/V, R_L = 10kΩ		V_{EE} + 1		V_{CC} - 1.2	V
		A_V = +1V/V, R_L = 150Ω		V_{EE} + 1		V_{CC} - 2.5	

32 x 16 Nonblocking Video Crosspoint Switch with I/O Buffers

DC ELECTRICAL CHARACTERISTICS—SINGLE SUPPLY +5V (continued)

(V_{CC} = +5V, V_{EE} = 0, V_{DD} = +5V, AGND = DGND = 0, $V_{IN\_}$ = +1.75V, A_V = +1V/V, R_L = 150Ω to AGND, and T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Input Bias Current	I_B				4	11	µA
Input Resistance	R_{IN}	V_{EE} + 1V < $V_{IN\_}$ < V_{CC} - 1.2V			10		MΩ
Output Offset Voltage	V_{OFFSET}	A_V = +1V/V			±10	±40	mV
Output Short-Circuit Current	I_{SC}	Sinking or sourcing, R_L = 1Ω			±35		mA
Enabled Output Impedance	Z_{OUT}	(V_{EE} + 1V) < $V_{IN\_}$ < (V_{CC} - 1.2V)			0.2		Ω
Output Leakage Current, Disable Mode	I_{OD}	(V_{EE} + 1V) < $V_{OUT\_}$ < (V_{CC} - 1.2V)			0.004	1	µA
DC Power-Supply Rejection Ratio	PSRR	4.5V < V_{CC} - V_{EE} < 5.5V	T_A = +25°C to +85°C	50	65		dB
			T_A = -40°C to +85°C	35			
Quiescent Supply Current	I_{CC}	R_L = ∞	Outputs enabled, T_A = +25°C		90		mA
			Outputs disabled		40		
	I_{EE}	R_L = ∞	Outputs enabled, T_A = +25°C		85		
			Outputs disabled		35		
	I_{DD}				4		

LOGIC-LEVEL CHARACTERISTICS

(V_{CC} - V_{EE}) = +4.5V to +10.5V, V_{DD} = +2.7V to +5.5V, AGND = DGND = 0, $V_{IN\_}$ = 0, R_L = 150Ω to AGND, and T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Input Voltage High Level	V_{IH}	V_{DD} = +5.0V		3			V
		V_{DD} = +3V		2			
Input Voltage Low Level	V_{IL}	V_{DD} = +5.0V				0.8	V
		V_{DD} = +3V				0.6	
Input Current High Level	I_{IH}	V_I > 2V	Excluding $\overline{RESET}$	-1	0.01	1	µA
			$\overline{RESET}$	-30	-20		
Input Current Low Level	I_{IL}	V_I < 1V	Excluding $\overline{RESET}$	-1	0.01	1	µA
			$\overline{RESET}$	-300	-235		
Output Voltage High Level	V_{OH}	I_{SOURCE} = 1mA, V_{DD} = +5V		4.7	4.9		V
		I_{SOURCE} = 1mA, V_{DD} = +3V		2.7	2.9		
Output Voltage Low Level	V_{OL}	I_{SINK} = 1mA, V_{DD} = +5V			0.1	0.3	V
		I_{SINK} = 1mA, V_{DD} = +3V			0.1	0.3	
Output Current High Level	I_{OH}	V_{DD} = +5V, V_O = +4.9V		1	4		mA
		V_{DD} = +3V, V_{OUT} = +2.7V		1	8		
Output Current Low Level	I_{OL}	V_{DD} = +5V, V_O = +0.1V		1	4		mA
		V_{DD} = +3V, V_O = +0.3V		1	8		

AC ELECTRICAL CHARACTERISTICS—DUAL SUPPLIES ±5V

(V_{CC} = +5V, V_{EE} = -5V, V_{DD} = +5V, AGND = DGND = 0, $V_{IN\_}$ = 0, R_L = 150Ω to AGND, and T_A = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Small-Signal -3dB Bandwidth	BW_{SS}	$V_{OUT\_}$ = 20mVp-p	A_V = +1V/V		95		MHz
			A_V = +2V/V		70		
Medium-Signal -3dB Bandwidth	BW_{MS}	$V_{OUT\_}$ = 200mVp-p	A_V = +1V/V		90		MHz
			A_V = +2V/V		70		
Large-Signal -3dB Bandwidth	BW_{LS}	$V_{OUT\_}$ = 2Vp-p	A_V = +1V/V		40		MHz
			A_V = +2V/V		50		
Small-Signal 0.1dB Bandwidth	$BW_{0.1dB-SS}$	$V_{OUT\_}$ = 20mVp-p	A_V = +1V/V		15		MHz
			A_V = +2V/V		15		
Medium-Signal 0.1dB Bandwidth	$BW_{0.1dB-MS}$	$V_{OUT\_}$ = 200mVp-p	A_V = +1V/V		15		MHz
			A_V = +2V/V		15		
Large-Signal 0.1dB Bandwidth	$BW_{0.1dB-LS}$	$V_{OUT\_}$ = 2Vp-p	A_V = +1V/V		12		MHz
			A_V = +2V/V		12		
Slew Rate	SR	$V_{OUT\_}$ = 2V step, A_V = +1V/V			150		Vµs
		$V_{OUT\_}$ = 2V step, A_V = +2V/V			160		

32 x 16 Nonblocking Video Crosspoint Switch with I/O Buffers

AC ELECTRICAL CHARACTERISTICS—DUAL SUPPLIES ±5V (continued)

(V_{CC} = +5V, V_{EE} = -5V, V_{DD} = +5V, AGND = DGND = 0, $V_{IN\_}$ = 0, R_L = 150Ω to AGND, and T_A = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Settling Time	$t_{S\ 0.1\%}$	$V_{OUT\_}$ = 0 to 2V step	A_V = +1V/V		60		ns
			A_V = +2V/V		60		
Switching Transient (Glitch) (Note 3)		A_V = +1V/V			50		mV
		A_V = +2V/V			50		
AC Power-Supply Rejection Ratio		f = 100kHz			70		dB
		f = 1MHz			68		
Differential Gain Error (Note 4)		R_L = 1kΩ			0.01		%
		R_L = 150Ω			0.05		
Differential Phase Error (Note 4)		R_L = 1kΩ			0.03		Degrees
		R_L = 150Ω			0.1		
Crosstalk, All Hostile		f = 6MHz			-62		dB
Off-Isolation, Input-to-Output		f = 6MHz			-110		dB
Input Noise Voltage Density	e_n	BW = 6MHz			73		μV_{RMS}
Input Capacitance	C_{IN}				5		pF
Disabled Output Capacitance		Amplifier in disable mode			3		pF
Capacitive Load at 3dB Output Peaking					30		pF
Output Impedance	Z_{OUT}	f = 6MHz	Output enabled		3		Ω
			Output disabled		4k		

AC ELECTRICAL CHARACTERISTICS—DUAL SUPPLIES ±3V

(V_{CC} = +3V, V_{EE} = -3V, V_{DD} = +3V, AGND = DGND = 0, $V_{IN\_}$= 0, R_L = 150Ω to AGND, A_V = +1V/V, and T_A = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Small-Signal -3dB Bandwidth	BW_{SS}	$V_{OUT\_}$ = 20mVp-p	A_V = +1V/V		90		MHz
			A_V = +2V/V		65		
Medium-Signal -3dB Bandwidth	BW_{MS}	$V_{OUT\_}$ = 200mVp-p	A_V = +1V/V		90		MHz
			A_V = +2V/V		65		
Large-Signal -3dB Bandwidth	BW_{LS}	$V_{OUT\_}$ = 2Vp-p	A_V = +1V/V		30		MHz
			A_V = +2V/V		35		
Small-Signal 0.1dB Bandwidth	$BW_{0.1dB\text{-}SS}$	$V_{OUT\_}$ = 20mVp-p	A_V = +1V/V		15		MHz
			A_V = +2V/V		15		
Medium-Signal 0.1dB Bandwidth	$BW_{0.1dB\text{-}MS}$	$V_{OUT\_}$ = 200mVp-p	A_V = +1V/V		15		MHz
			A_V = +2V/V		15		
Large-Signal 0.1dB Bandwidth	$BW_{0.1dB\text{-}LS}$	$V_{OUT\_}$ = 2Vp-p	A_V = +1V/V		12		MHz
			A_V = +2V/V		12		

AC ELECTRICAL CHARACTERISTICS—DUAL SUPPLIES ±3V (continued)

(V_{CC} = +3V, V_{EE} = -3V, V_{DD} = +3V, AGND = DGND = 0, $V_{IN\_}$ = 0, R_L = 150Ω to AGND, A_V = +1V/V, and T_A = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Slew Rate	SR	$V_{OUT\_}$ = 2V step A_V = +1V/V			120		Vµs
		$V_{OUT\_}$ = 2V step A_V = +2V/V			120		
Settling Time	$t_{S\ 0.1\%}$	V_O = 0 to 2V step	A_V = +1V/V		60		ns
			A_V = +2V/V		60		
Switching Transient (Glitch) (Note 3)		A_V = +1V/V			15		mV
		A_V = +2V/V			20		
AC Power-Supply Rejection Ratio		f = 100kHz			60		dB
		f = 1MHz			40		
Differential Gain Error (Note 4)		R_L = 1kΩ			0.03		%
		R_L = 150Ω			0.2		
Differential Phase Error (Note 4)		R_L = 1kΩ			0.08		Degrees
		R_L = 150Ω			0.2		
Crosstalk, All Hostile		f = 6MHz			-63		dB
Off-Isolation, Input to Output		f = 6MHz			-112		dB
Input Noise Voltage Density	e_n	BW = 6MHz			73		μV_{RMS}
Input Capacitance	$C_{IN\_}$				5		pF
Disabled Output Capacitance		Amplifier in disable mode			3		pF
Capacitive Load at 3dB Output Peaking					30		pF
Output Impedance	Z_{OUT}	f = 6MHz	Output enabled		3		Ω
			Output disabled		4k		

32 x 16 Nonblocking Video Crosspoint Switch with I/O Buffers

AC ELECTRICAL CHARACTERISTICS—SINGLE SUPPLY +5V

(V_{CC} = +5V, V_{EE} = 0, V_{DD} = +5V, AGND = DGND = 0, $V_{IN\_}$ = 1.75V, R_L = 150Ω to AGND, A_V = +1V/V, and T_A = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Small-Signal -3dB Bandwidth	BW_{SS}	$V_{OUT\_}$ = 20mVp-p			90		MHz
Medium-Signal -3dB Bandwidth	BW_{MS}	$V_{OUT\_}$ = 200mVp-p			90		MHz
Large-Signal -3dB Bandwidth	BW_{LS}	$V_{OUT\_}$ = 1.5Vp-p			38		MHz
Small-Signal 0.1dB Bandwidth	$BW_{0.1dB-SS}$	$V_{OUT\_}$ = 20mVp-p			12		MHz
Medium-Signal 0.1dB Bandwidth	$BW_{0.1dB-MS}$	$V_{OUT\_}$ = 200mVp-p			12		MHz
Large-Signal 0.1dB Bandwidth	$BW_{0.1dB-LS}$	$V_{OUT\_}$ = 1.5Vp-p			12		MHz
Slew Rate	SR	$V_{OUT\_}$ = 2V step, A_V = +1V/V			100		V/µs
Settling Time	$t_{S\ 0.1\%}$	$V_{OUT\_}$ = 0 to 2V step			60		ns
Switching Transient (Glitch)					25		mV
AC Power-Supply Rejection Ratio		f = 100kHz			70		dB
		f = 1MHz			69		
Differential Gain Error (Note 4)		R_L = 1kΩ			0.03		%
		R_L = 150Ω			0.15		
Differential Phase Error (Note 4)		R_L = 1kΩ			0.06		Degrees
		R_L = 150Ω			0.2		
Crosstalk, All Hostile		f = 6MHz			-63		dB
Off-Isolation, Input-to-Output		f = 6MHz			-110		dB
Input Noise Voltage	e_n	BW = 6MHz			73		$µV_{RMS}$
Input Capacitance	$C_{IN\_}$				5		pF
Disabled Output Capacitance		Amplifier in disable mode			3		pF
Capacitive Load at 3dB Output Peaking					30		pF
Output Impedance	Z_{OUT}	f = 6MHz	Output enabled		3		Ω
			Output disabled		4k		

SWITCHING CHARACTERISTICS

((V_{CC} - V_{EE}) = +4.5V to +10.5V, V_{DD} = +2.7V to +5.5V, DGND = AGND = 0, $V_{IN\_}$ = 0 for dual supplies, $V_{IN\_}$ = +1.75V for single supply, R_L = 150Ω to AGND, C_L = 100pF, A_V = +1V/V, and T_A = T_{MIN} - T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Delay: $\overline{UPDATE}$ to Video Out	t_{PdUdVo}	V_{IN} = 0.5V step		200	450	ns
Delay: $\overline{UPDATE}$ to $\overline{AOUT}$	t_{PdUdAo}	MODE = 0, time to $\overline{AOUT}$ = low after $\overline{UPDATE}$ = low		30	200	ns
Delay: SCLK to DOUT Valid	t_{PdDo}	Logic state change in DOUT on active SCLK edge		30	200	ns
Delay: Output Disable	$t_{PdHOeVo}$	V_{OUT} = 0.5V, 1kΩ pulldown to AGND		300	800	ns
Delay: Output Enable	$t_{PdLOeVo}$	Output disabled, 1kΩ pulldown to AGND, V_{IN} = 0.5V		200	800	ns
Setup: $\overline{CE}$ to SCLK	t_{SuCe}				100	ns
Setup: DIN to SCLK	t_{SuDi}		100			ns
Hold Time: SCLK to DIN	t_{HdDi}		100			ns
Minimum High Time: SCLK	t_{MnHCk}		100			ns
Minimum Low Time: SCLK	t_{MnLCk}		100			ns
Minimum Low Time: $\overline{UPDATE}$	t_{MnLUd}		100			ns
Setup Time: $\overline{UPDATE}$ to SCLK	t_{SuHUd}	Rising edge of $\overline{UPDATE}$ to falling edge of SCLK	100			ns
Hold Time: SCLK to $\overline{UPDATE}$	t_{HdHUd}	Falling edge of SCLK to falling edge of $\overline{UPDATE}$	100			ns
Setup Time: MODE to SCLK	t_{SuMd}	Minimum time from clock edge to MODE with valid data clocking	100			ns
Hold Time: MODE to SCLK	t_{HdMd}	Minimum time from clock edge to MODE with valid data clocking	100			ns
Minimum Low Time: $\overline{RESET}$	t_{MnLRst}				300	ns
Delay: $\overline{RESET}$	t_{PdRst}	10kΩ pulldown to AGND			600	ns

Note 1: Associated output voltage may be determined by multiplying the input voltage by the specified gain (A_V) and adding output offset voltage.

Note 2: Logic-level characteristics apply to the following pins: DIN, DOUT, SCLK, $\overline{CE}$, $\overline{UPDATE}$, $\overline{RESET}$, A3–A0, MODE, and $\overline{AOUT}$.

Note 3: Switching transient settling time is guaranteed by the settling time (t_S) specification. Switching transient is a result of updating the switch matrix.

Note 4: Input test signal: 3.58MHz sine wave of amplitude 40IRE superimposed on a linear ramp (0 to 100IRE). IRE is a unit of video-signal amplitude developed by the International Radio Engineers: 140IRE = 1.0V.

Note 5: All devices are 100% production tested at T_A = +25°C. Specifications over temperature limits are guaranteed by design.

32 x 16 Nonblocking Video Crosspoint Switch with I/O Buffers

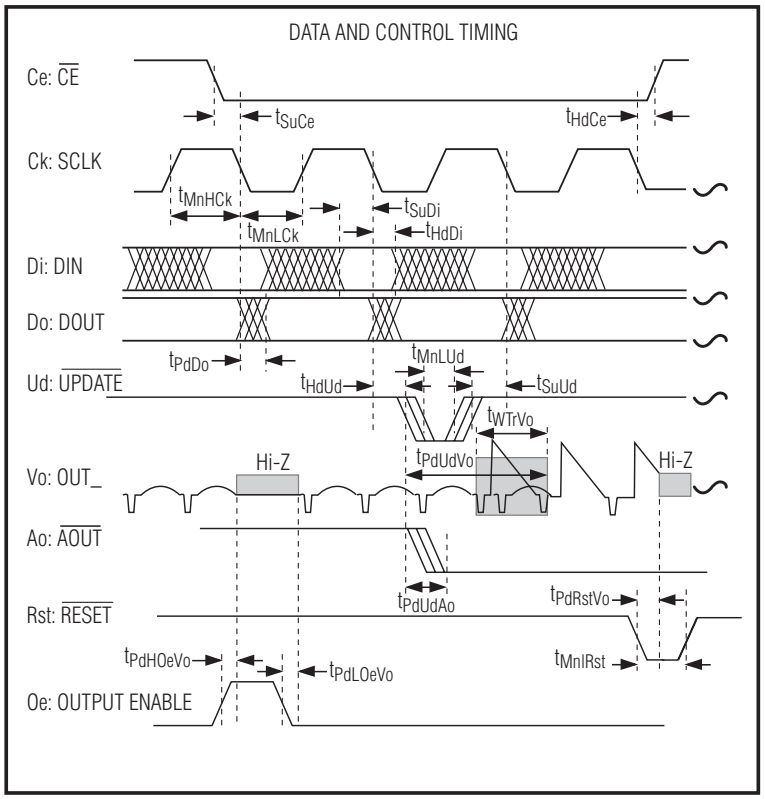
Symbol Definitions

SYMBOL	TYPE	DESCRIPTION
Ao	Signal	Address Valid Flag ($\overline{AOUT}$)
Ce	Signal	Clock Enable ($\overline{CE}$)
Ck	Signal	Clock (SCLK)
Di	Signal	Serial Data In (DIN)
Do	Signal	Serial Data Output (DOUT)
Md	Signal	MODE
Oe	Signal	Output Enable
Rst	Signal	Reset Input ($\overline{RESET}$)
Ud	Signal	$\overline{UPDATE}$
Vo	Signal	Video Out (OUT)
H	Property	High or Low-to-High Transition
Hd	Property	Hold
L	Property	Low or High-to-Low Transition
Mn	Property	Minimum
Mx	Property	Maximum
Pd	Property	Propagation delay
Su	Property	Setup
Tr	Property	Transition
W	Property	Width

Naming Conventions

- All parameters with time units are given “t” designation, with appropriate subscript modifiers.
- Propagation delays for clocked signals are from active edge of clock.
- Propagation delay for level sensitive signals is from input to output at 50% point of a transition.
- Setup and Hold times are measured from 50% point of signal transition to 50% point of clocking signal transition.
- Setup time refers to any signal that must be stable before active clock edge, even if signal is not latched or clocked itself.
- Hold time refers to any signal that must be stable during and after active clock edge, even if signal is not latched or clocked.
- Propagation delays to unobservable internal signals are modified to setup and hold designations applied to observable I/O signals.

Timing Diagram



TIMING PARAMETER DEFINITIONS	
NAME	**DESCRIPTION**
t_{HdDi}	Hold Time: Clock to Data In
t_{MnHCk}	Min High Time: Clk
t_{MnLCk}	Min Low Time: Clk
t_{MnLUd}	Min Low Time: Update
t_{SuHUd}	Setup Time: UPDATE to Clk with UPDATE High
Not Valid	Setup Time: UPDATE to Clk with UPDATE Low
t_{HdHUd}	Hold Time: Clk to UPDATE with UPDATE high
Not Valid	Hold Time: Clk to UPDATE with UPDATE Low
t_{PdDiDo}	Asynchronous Delay: Data In to Data Out
t_{MnMd}	Min Low Time: MODE
t_{MxTr}	Max Rise Time: Clk, Update
t_{MnLRst}	Min Low Time: Reset
$t_{PdRstVo}$	Delay: Reset to Video Output

TIMING PARAMETER DEFINITIONS	
NAME	**DESCRIPTION**
t_{PdUdVo}	Delay: Update to Video Out
t_{PdUdAo}	Delay: UPDATE to Aout
t_{PdDo}	Delay: Clk to Data Out
$t_{PdHOeVo}$	Delay: Output Enable to Video Output (High: Disable)
$t_{PdLOeVo}$	Delay: Output Enable to Video Output (Low: Enable)
t_{SuCe}	Setup: Clock Enable to Clock
t_{SuDi}	Setup Time: Data In to Clock

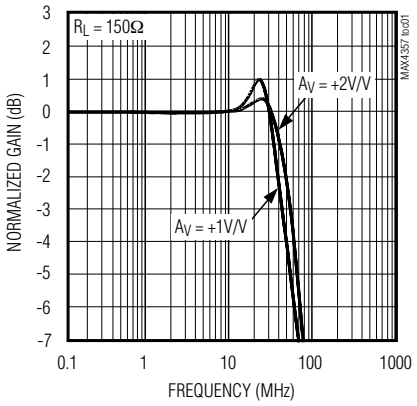
Figure 1. Timing Diagram

32 x 16 Nonblocking Video Crosspoint Switch with I/O Buffers

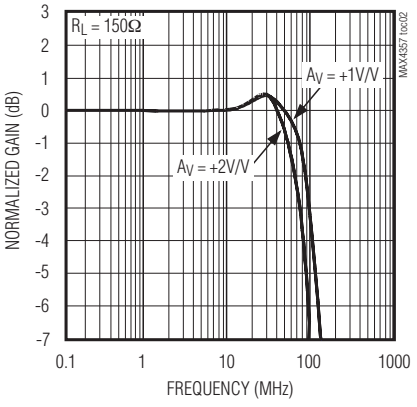
Typical Operating Characteristics—Dual Supplies ±5V

(V_{CC} = +5V and V_{EE} = -5V, V_{DD} = +5V, AGND = DGND = 0, $V_{IN\_}$ = 0, R_L = 150Ω to AGND, A_V = +1V/V, and T_A = +25°C, unless otherwise noted.)

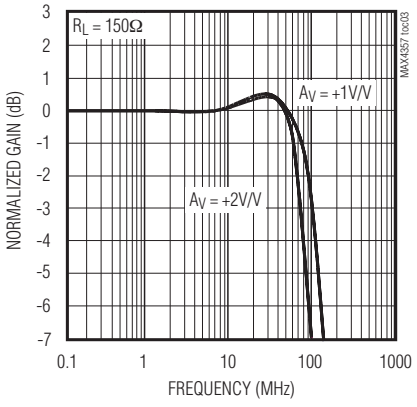
LARGE-SIGNAL FREQUENCY RESPONSE



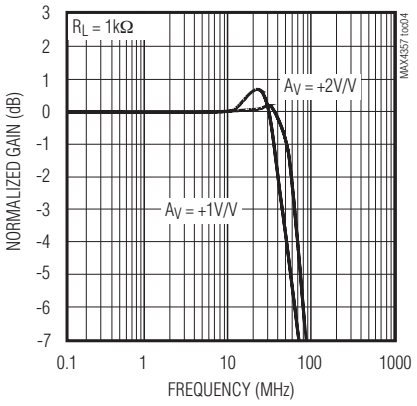
MEDIUM-SIGNAL FREQUENCY RESPONSE



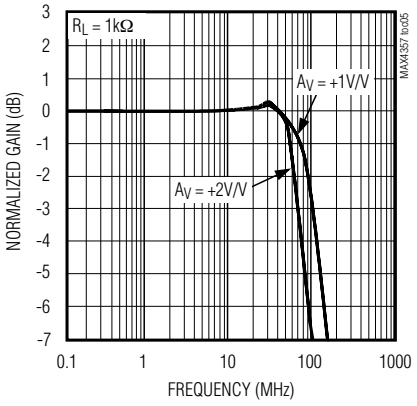
SMALL-SIGNAL FREQUENCY RESPONSE



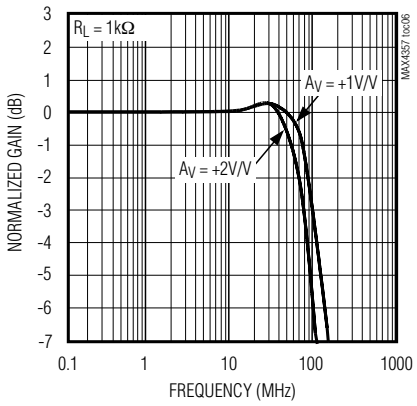
LARGE-SIGNAL FREQUENCY RESPONSE



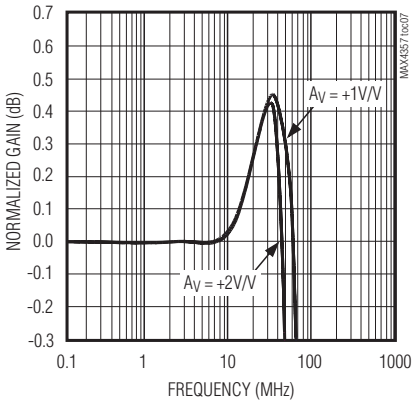
MEDIUM-SIGNAL FREQUENCY RESPONSE



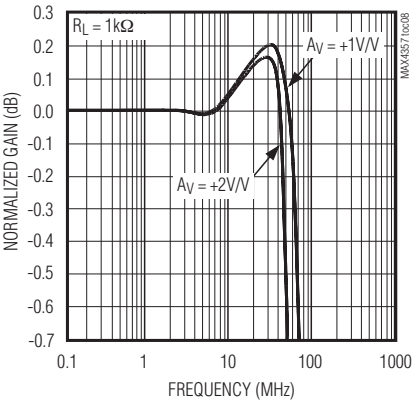
SMALL-SIGNAL FREQUENCY RESPONSE



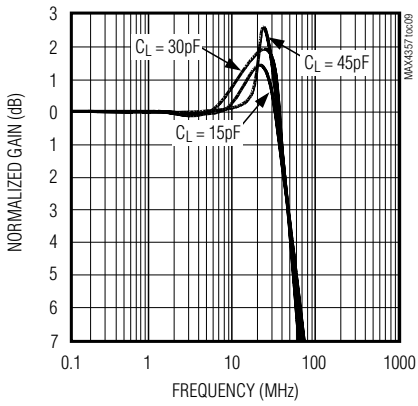
LARGE-SIGNAL GAIN FLATNESS vs. FREQUENCY



LARGE-SIGNAL GAIN FLATNESS vs. FREQUENCY



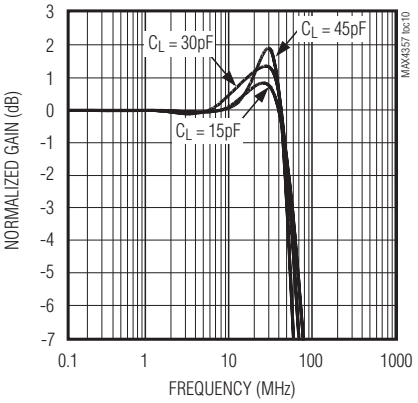
LARGE-SIGNAL FREQUENCY RESPONSE (A_V = +1V/V)



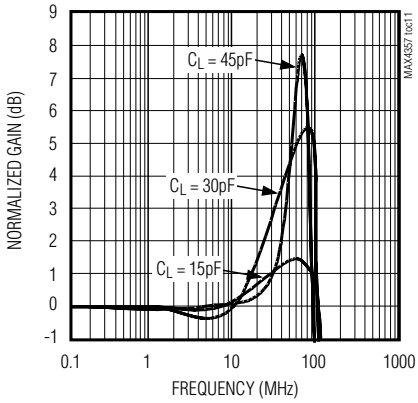
Typical Operating Characteristics—Dual Supplies ±5V (continued)

(V_{CC} = +5V and V_{EE} = -5V, V_{DD} = +5V, AGND = DGND = 0, $V_{IN\_}$ = 0, R_L = 150Ω to AGND, A_V = +1V/V, and T_A = +25°C, unless otherwise noted.)

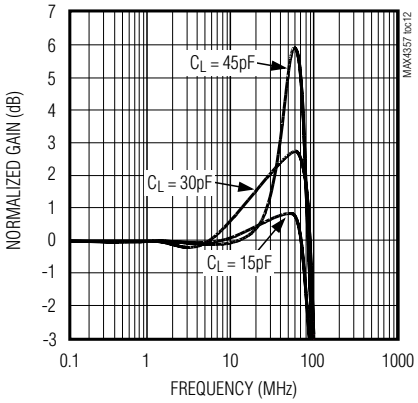
LARGE-SIGNAL FREQUENCY RESPONSE (A_V = +2V/V)



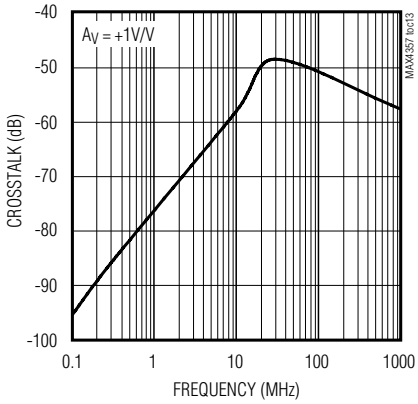
MEDIUM-SIGNAL FREQUENCY RESPONSE (A_V = +1V/V)



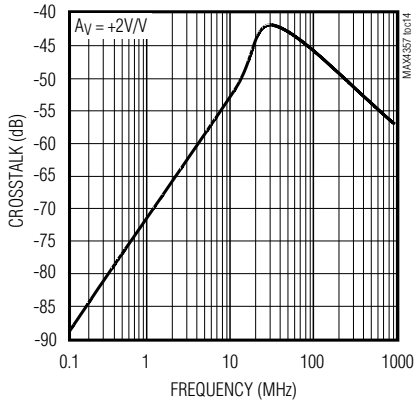
MEDIUM-SIGNAL FREQUENCY RESPONSE (A_V = +2V/V)



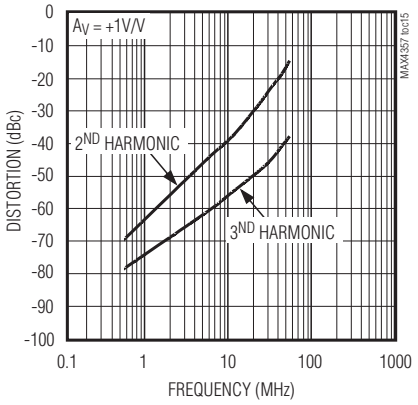
CROSSTALK vs. FREQUENCY



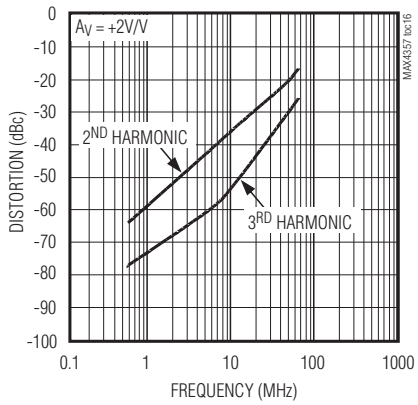
CROSSTALK vs. FREQUENCY



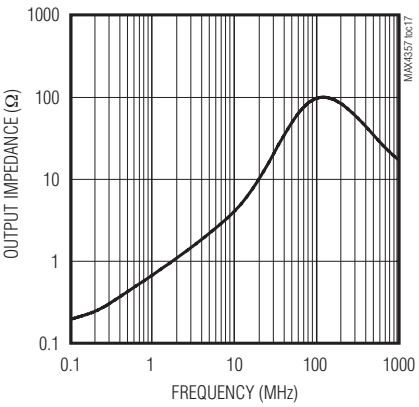
DISTORTION vs. FREQUENCY



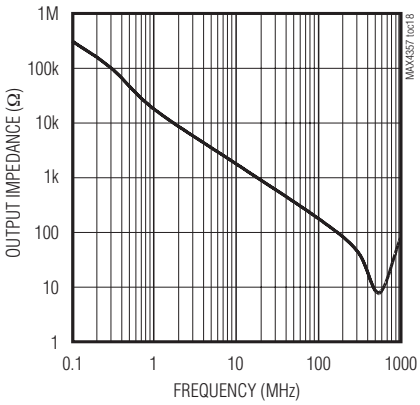
DISTORTION vs. FREQUENCY



ENABLED OUTPUT IMPEDANCE vs. FREQUENCY



DISABLED OUTPUT IMPEDANCE vs. FREQUENCY

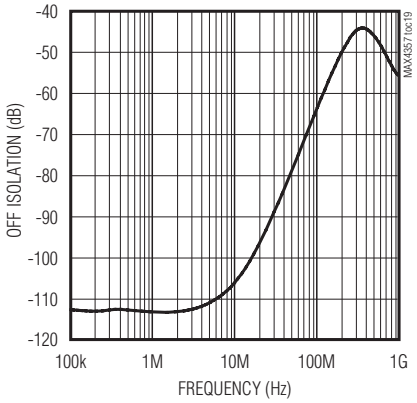


32 x 16 Nonblocking Video Crosspoint Switch with I/O Buffers

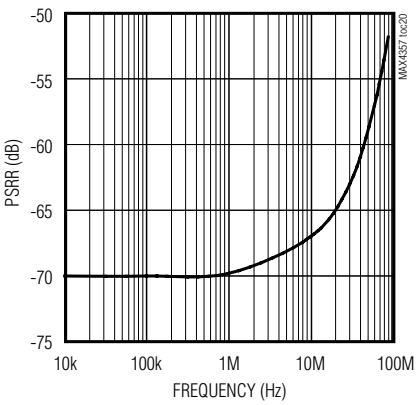
Typical Operating Characteristics—Dual Supplies ±5V (continued)

(V_{CC} = +5V and V_{EE} = -5V, V_{DD} = +5V, AGND = DGND = 0, $V_{IN\_}$ = 0, R_L = 150Ω to AGND, A_V = +1V/V, and T_A = +25°C, unless otherwise noted.)

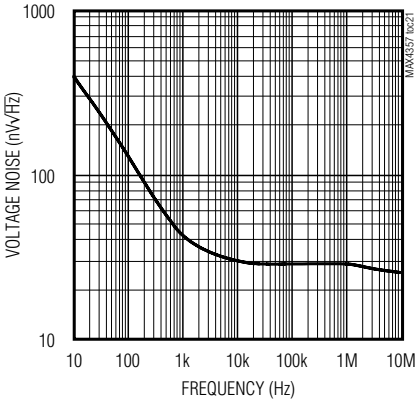
OFF-ISOLATION vs. FREQUENCY



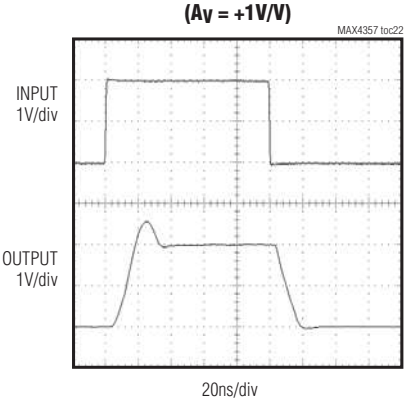
POWER-SUPPLY REJECTION RATIO vs. FREQUENCY



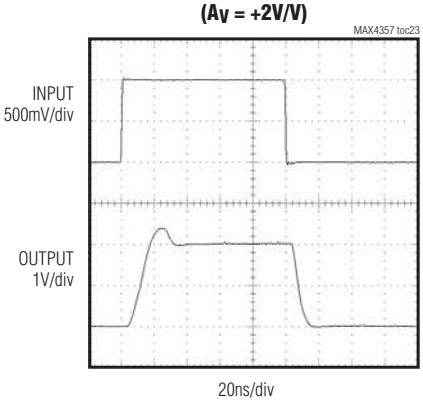
INPUT VOLTAGE NOISE vs. FREQUENCY



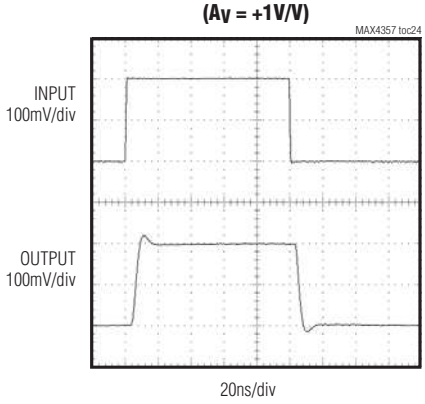
LARGE-SIGNAL PULSE RESPONSE (A_V = +1V/V)



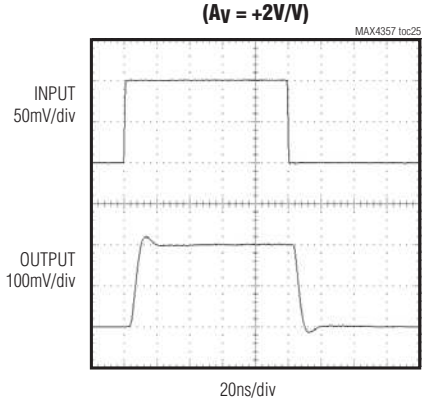
LARGE-SIGNAL PULSE RESPONSE (A_V = +2V/V)



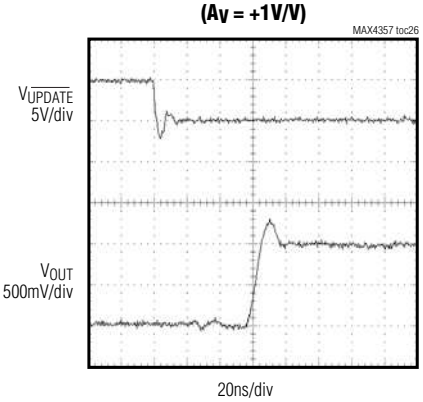
MEDIUM-SIGNAL PULSE RESPONSE (A_V = +1V/V)



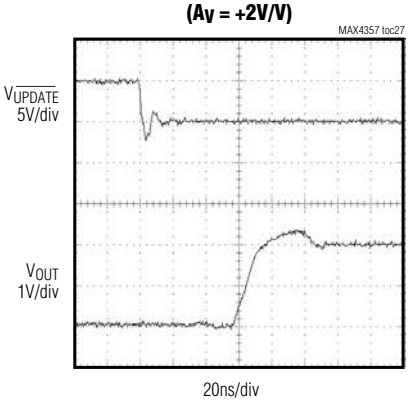
MEDIUM-SIGNAL PULSE RESPONSE (A_V = +2V/V)



SWITCHING TIME (A_V = +1V/V)



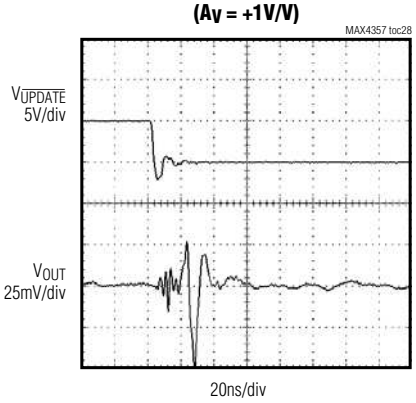
SWITCHING TIME (A_V = +2V/V)



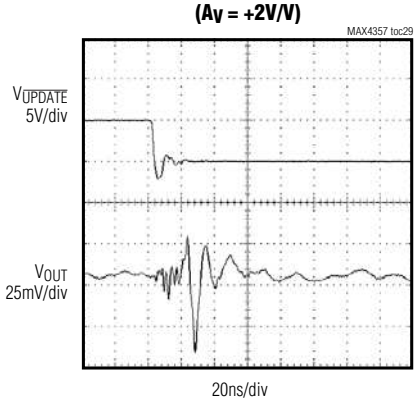
Typical Operating Characteristics—Dual Supplies ±5V (continued)

(V_{CC} = +5V and V_{EE} = -5V, V_{DD} = +5V, AGND = DGND = 0, $V_{IN\_}$ = 0, R_L = 150Ω to AGND, A_V = +1V/V, and T_A = +25°C, unless otherwise noted.)

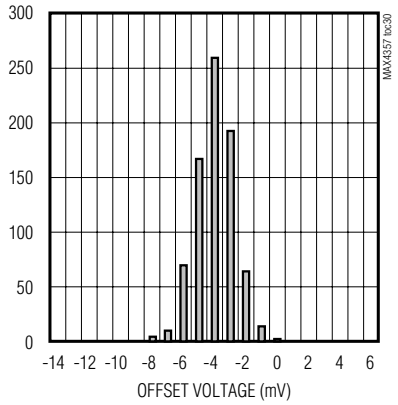
SWITCHING TRANSIENT (GLITCH) (A_V = +1V/V)



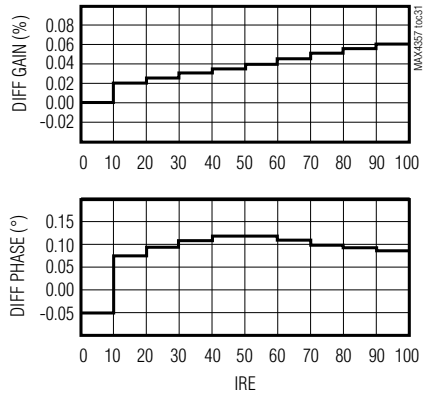
SWITCHING TRANSIENT (GLITCH) (A_V = +2V/V)



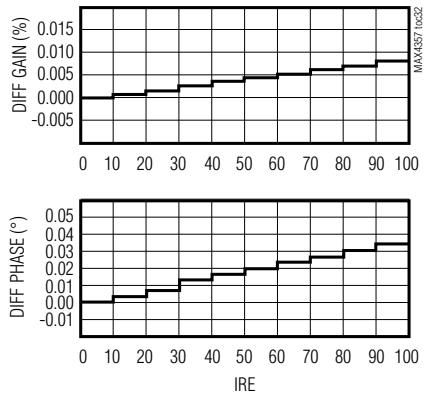
OFFSET VOLTAGE DISTRIBUTION



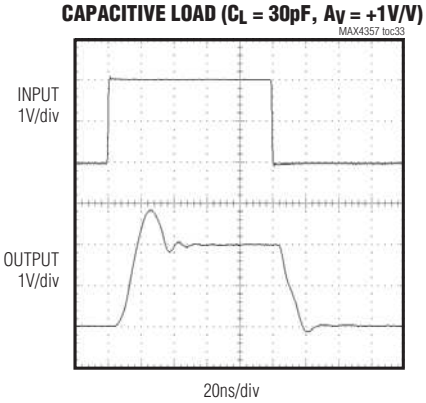
DIFFERENTIAL GAIN AND PHASE vs. DC VOLTAGE (R_L = 150Ω)



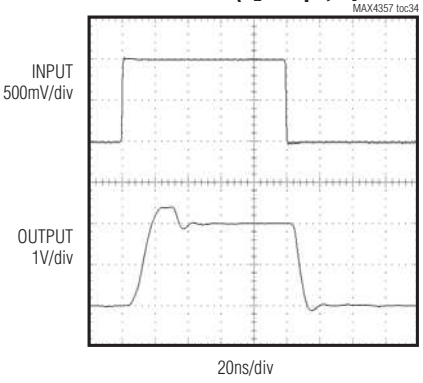
DIFFERENTIAL GAIN AND PHASE vs. DC VOLTAGE (R_L = 1kΩ)



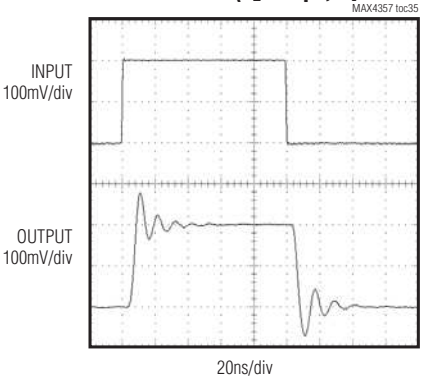
LARGE-SIGNAL PULSE RESPONSE WITH CAPACITIVE LOAD (C_L = 30pF, A_V = +1V/V)



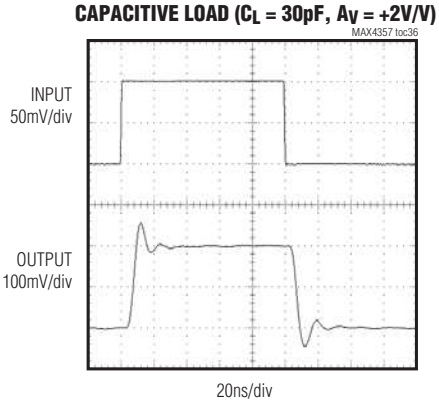
LARGE-SIGNAL PULSE RESPONSE WITH CAPACITIVE LOAD (C_L = 30pF, A_V = +2V/V)



MEDIUM-SIGNAL PULSE RESPONSE WITH CAPACITIVE LOAD (C_L = 30pF, A_V = +1V/V)



MEDIUM-SIGNAL PULSE RESPONSE WITH CAPACITIVE LOAD (C_L = 30pF, A_V = +2V/V)

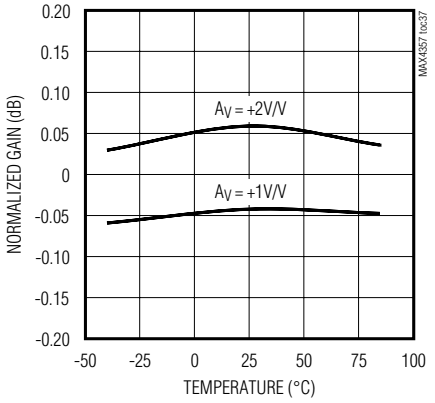


32 x 16 Nonblocking Video Crosspoint Switch with I/O Buffers

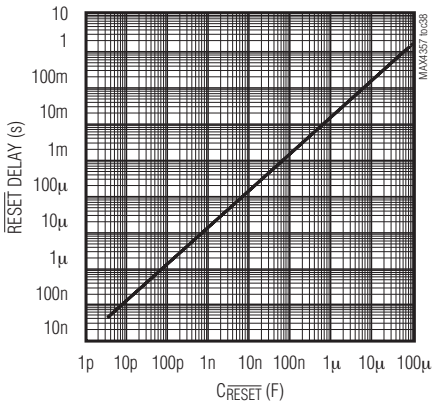
Typical Operating Characteristics—Dual Supplies ±5V (continued)

(V_{CC} = +5V and V_{EE} = -5V, V_{DD} = +5V, AGND = DGND = 0, $V_{IN\_}$ = 0, R_L = 150Ω to AGND, A_V = +1V/V, and T_A = +25°C, unless otherwise noted.)

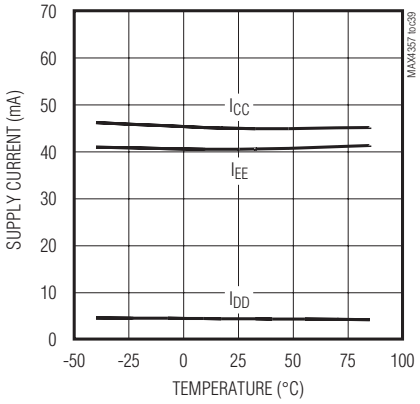
GAIN vs. TEMPERATURE



$\overline{RESET}$ DELAY vs. $\overline{RESET}$ CAPACITANCE



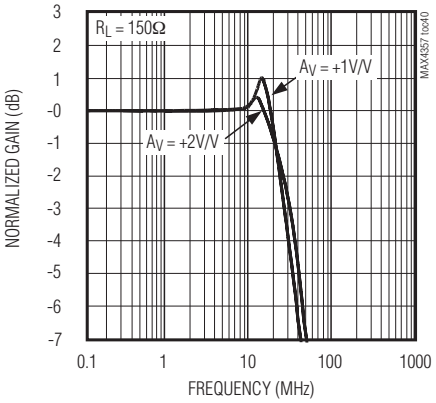
SUPPLY CURRENT vs. TEMPERATURE



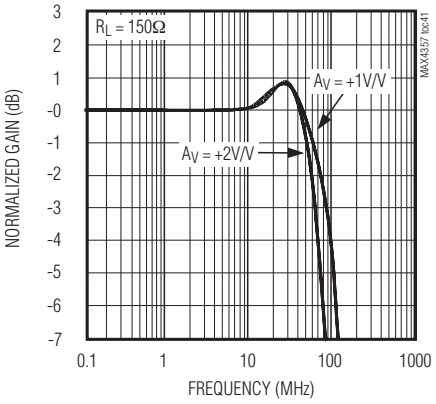
Typical Operating Characteristics—Dual Supplies ±3V

(V_{CC} = +3V and V_{EE} = -3V, V_{DD} = +3V, AGND = DGND = 0, $V_{IN\_}$ = 0, R_L = 150Ω to AGND, A_V = +1V/V, and T_A = +25°C, unless otherwise noted.)

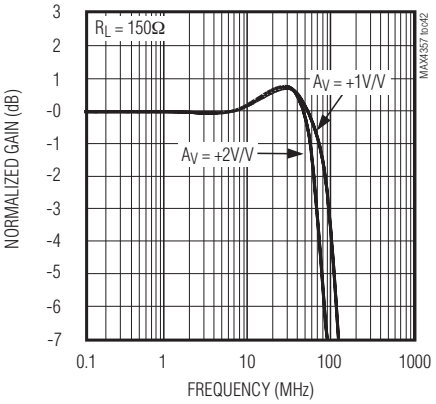
LARGE-SIGNAL FREQUENCY RESPONSE



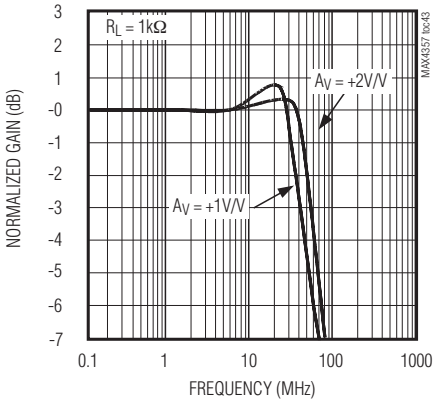
MEDIUM-SIGNAL FREQUENCY RESPONSE



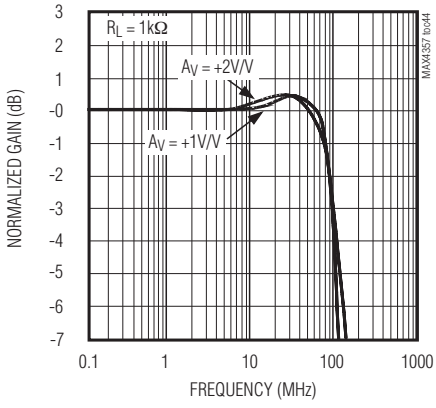
SMALL-SIGNAL FREQUENCY RESPONSE



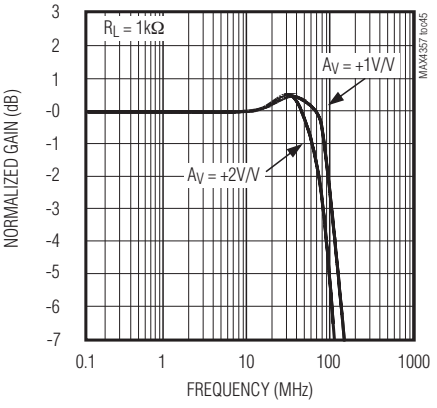
LARGE-SIGNAL FREQUENCY RESPONSE



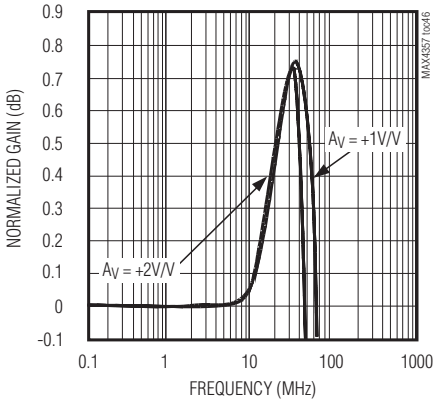
MEDIUM-SIGNAL FREQUENCY RESPONSE



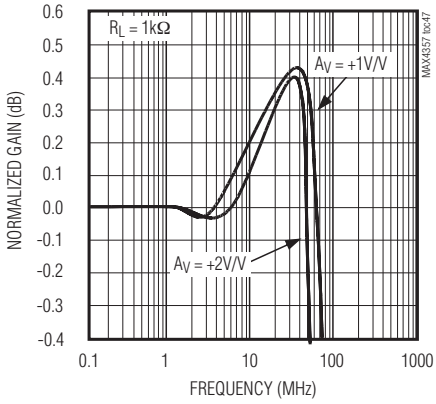
SMALL-SIGNAL FREQUENCY RESPONSE



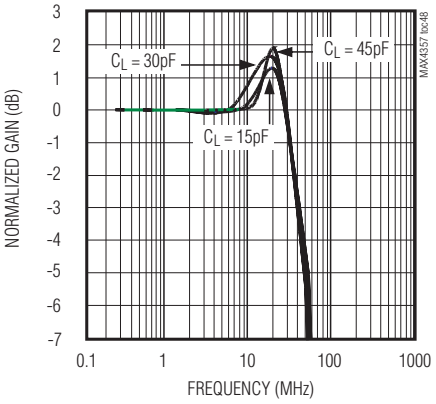
LARGE-SIGNAL GAIN FLATNESS vs. FREQUENCY



LARGE-SIGNAL GAIN FLATNESS vs. FREQUENCY



LARGE-SIGNAL FREQUENCY RESPONSE (AV = +1V/V)

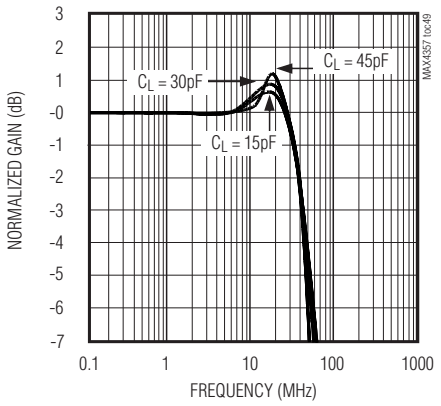


32 x 16 Nonblocking Video Crosspoint Switch with I/O Buffers

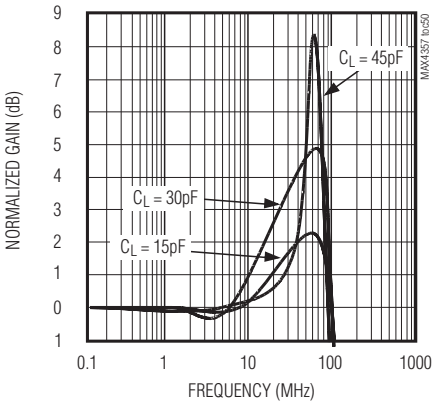
Typical Operating Characteristics—Dual Supplies ±3V (continued)

(V_{CC} = +3V and V_{EE} = -3V, V_{DD} = +3V, AGND = DGND = 0, $V_{IN\_}$ = 0, R_L = 150Ω to AGND, A_V = +1V/V, and T_A = +25°C, unless otherwise noted.)

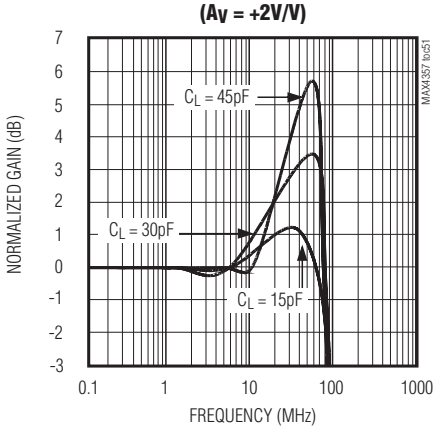
LARGE-SIGNAL FREQUENCY RESPONSE (A_V = +2V/V)



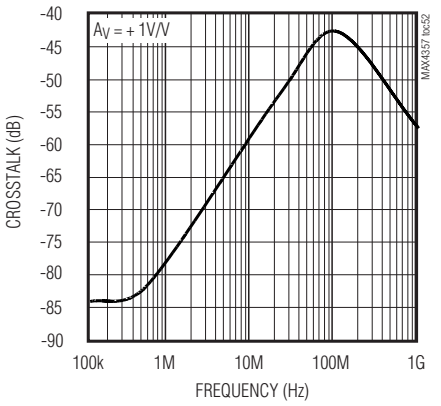
MEDIUM-SIGNAL FREQUENCY RESPONSE (A_V = +1V/V)



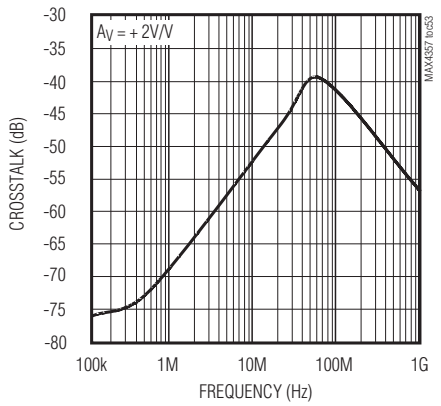
MEDIUM-SIGNAL FREQUENCY RESPONSE (A_V = +2V/V)



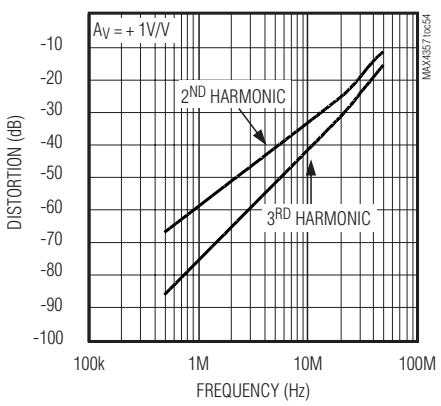
CROSSTALK vs. FREQUENCY



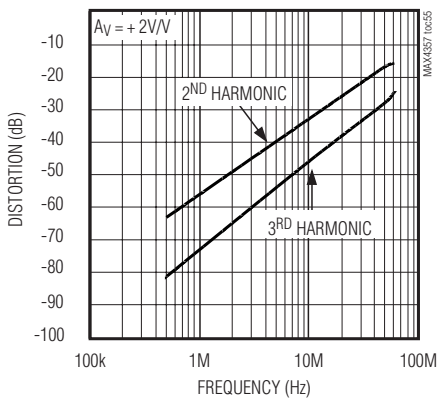
CROSSTALK vs. FREQUENCY



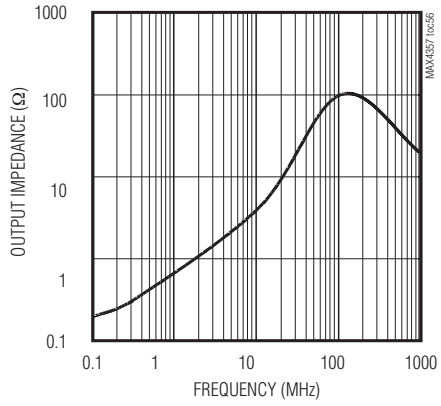
DISTORTION vs. FREQUENCY



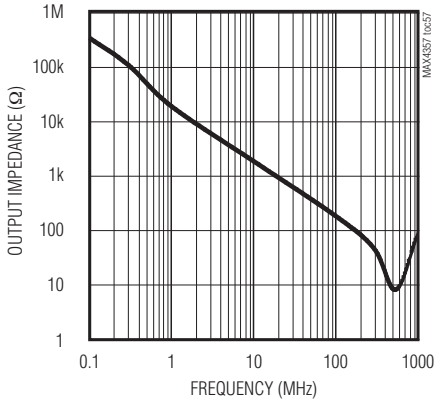
DISTORTION vs. FREQUENCY



ENABLED OUTPUT IMPEDANCE vs. FREQUENCY



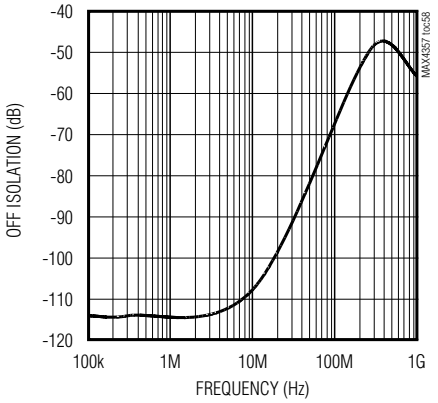
DISABLED OUTPUT IMPEDANCE vs. FREQUENCY



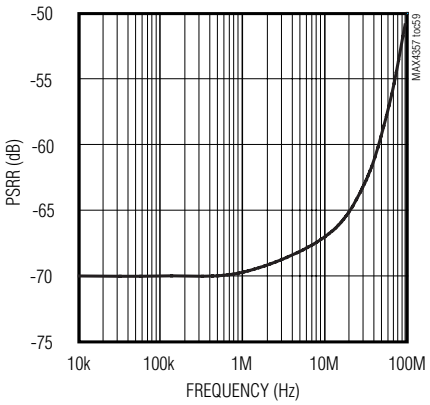
Typical Operating Characteristics—Dual Supplies ±3V (continued)

(V_{CC} = +3V and V_{EE} = -3V, V_{DD} = +3V, AGND = DGND = 0, $V_{IN\_}$ = 0, R_L = 150Ω to AGND, A_V = +1V/V, and T_A = +25°C, unless otherwise noted.)

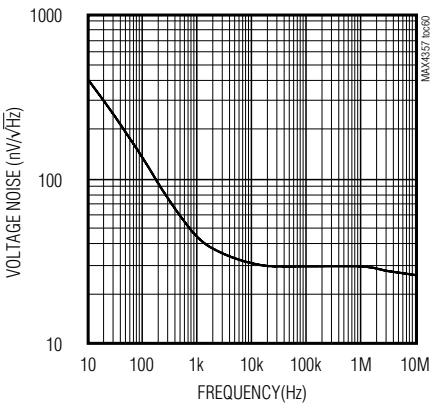
OFF-ISOLATION vs. FREQUENCY



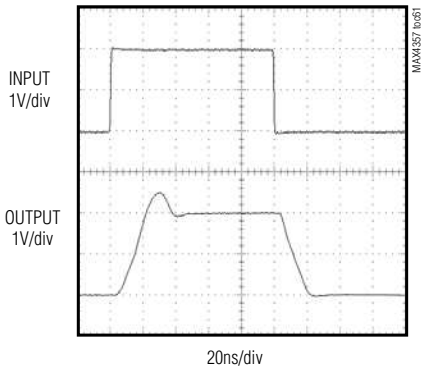
POWER-SUPPLY REJECTION RATIO vs. FREQUENCY



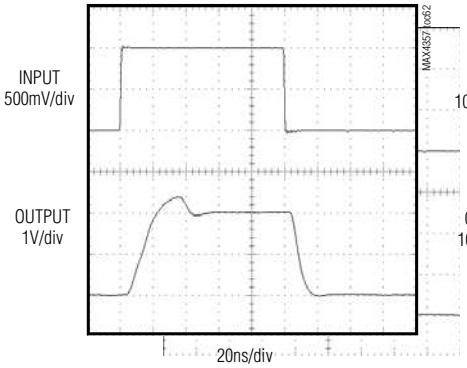
INPUT VOLTAGE NOISE vs. FREQUENCY



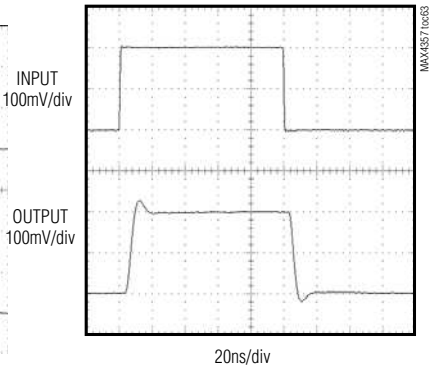
LARGE-SIGNAL PULSE RESPONSE (A_V = +1V/V)



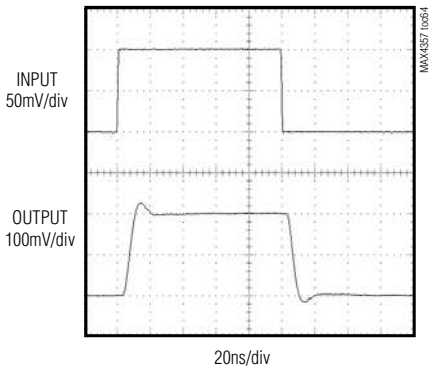
LARGE-SIGNAL PULSE RESPONSE (A_V = +2V/V)



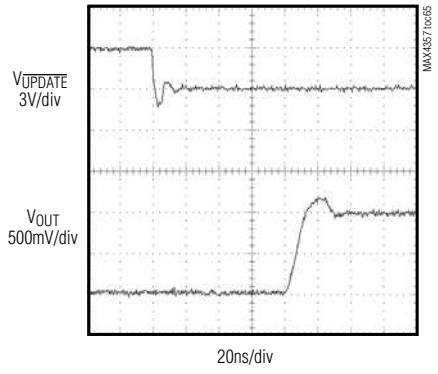
MEDIUM-SIGNAL PULSE RESPONSE (A_V = +1V/V)



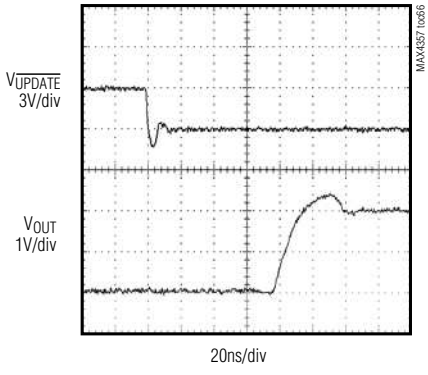
MEDIUM-SIGNAL PULSE RESPONSE (A_V = +2V/V)



SWITCHING TIME (A_V = +1V/V)



SWITCHING TIME (A_V = +2V/V)

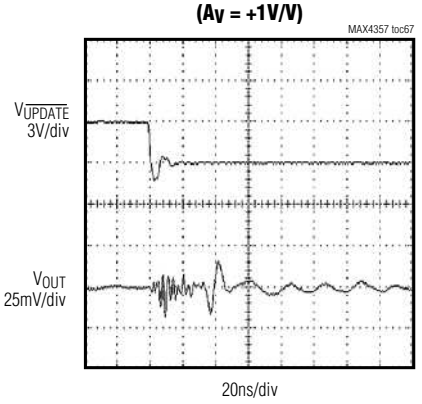


32 x 16 Nonblocking Video Crosspoint Switch with I/O Buffers

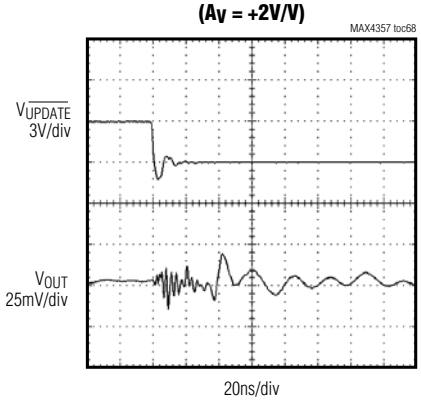
Typical Operating Characteristics—Dual Supplies ±3V (continued)

(V_{CC} = +3V and V_{EE} = -3V, V_{DD} = +3V, AGND = DGND = 0, $V_{IN\_}$ = 0, R_L = 150Ω to AGND, A_V = +1V/V, and T_A = +25°C, unless otherwise noted.)

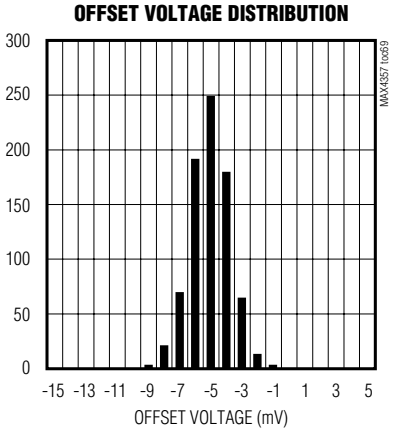
SWITCHING TRANSIENT GLITCH (A_V = +1V/V)



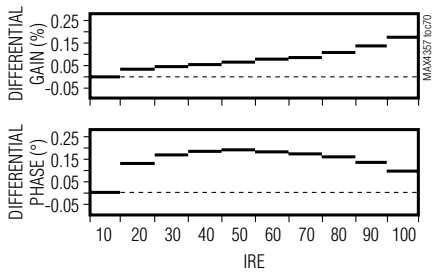
SWITCHING TRANSIENT GLITCH (A_V = +2V/V)



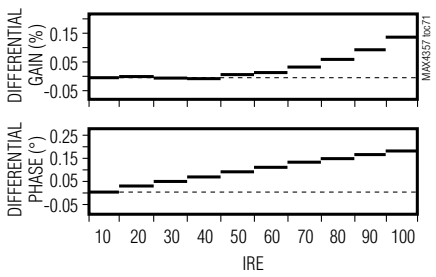
OFFSET VOLTAGE DISTRIBUTION



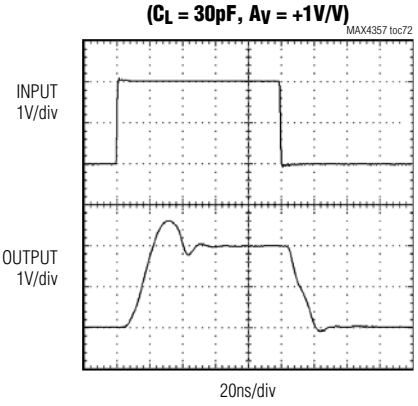
DIFFERENTIAL GAIN AND PHASE (R_L = 150Ω)



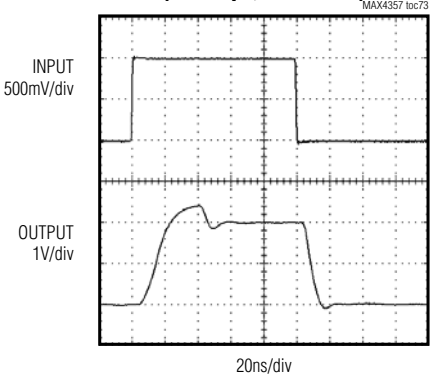
DIFFERENTIAL GAIN AND PHASE (R_L = 1kΩ)



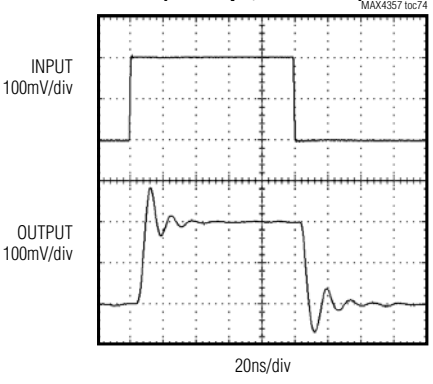
LARGE-SIGNAL PULSE RESPONSE WITH CAPACITIVE LOAD (C_L = 30pF, A_V = +1V/V)



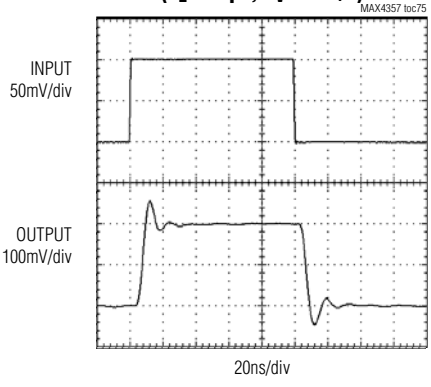
LARGE-SIGNAL PULSE RESPONSE WITH CAPACITIVE LOAD (C_L = 30pF, A_V = +2V/V)



MEDIUM-SIGNAL PULSE RESPONSE WITH CAPACITIVE LOAD (C_L = 30pF, A_V = +1V/V)



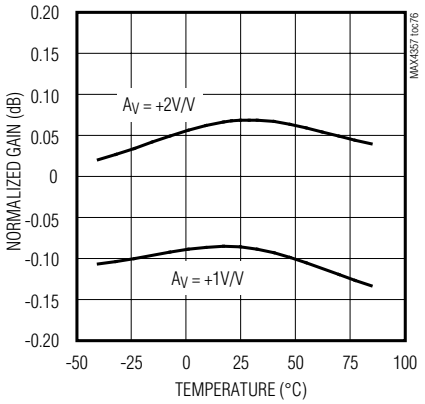
MEDIUM-SIGNAL PULSE RESPONSE WITH CAPACITIVE LOAD (C_L = 30pF, A_V = +2V/V)



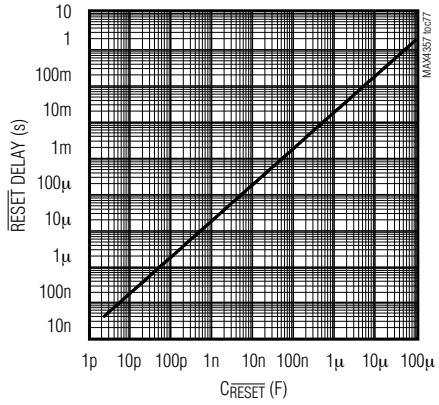
Typical Operating Characteristics—Dual Supplies ±3V (continued)

(V_{CC} = +3V and V_{EE} = -3V, V_{DD} = +3V, AGND = DGND = 0, $V_{IN\_}$ = 0, R_L = 150Ω to AGND, A_V = +1V/V, and T_A = +25°C, unless otherwise noted.)

GAIN vs. TEMPERATURE



$\overline{RESET}$ DELAY vs. $\overline{RESET}$ CAPACITANCE

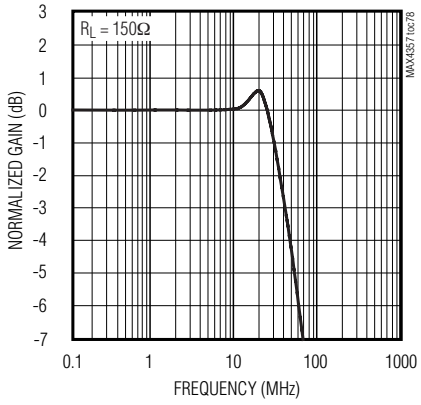


32 x 16 Nonblocking Video Crosspoint Switch with I/O Buffers

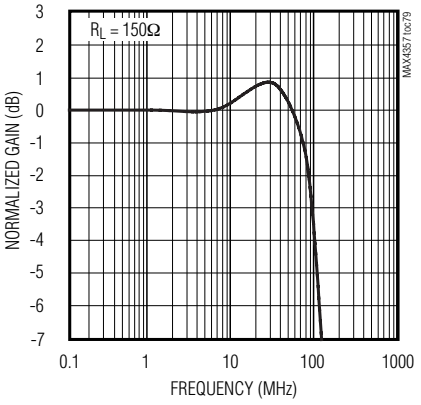
Typical Operating Characteristics—Single Supply +5V

(V_{CC} = +5V and V_{EE} = 0, V_{DD} = +5V, AGND = DGND = 0, $V_{IN\_}$ = 0, R_L = 150Ω to AGND, A_V = +1V/V, and T_A = +25°C, unless otherwise noted.)

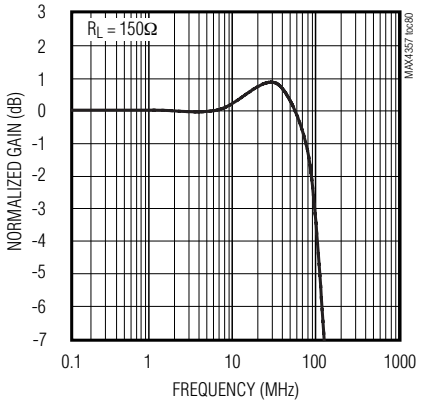
LARGE-SIGNAL FREQUENCY RESPONSE



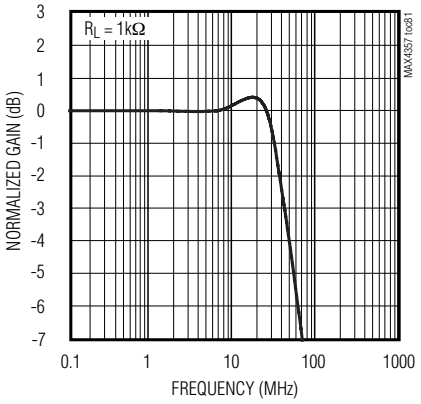
MEDIUM-SIGNAL FREQUENCY RESPONSE



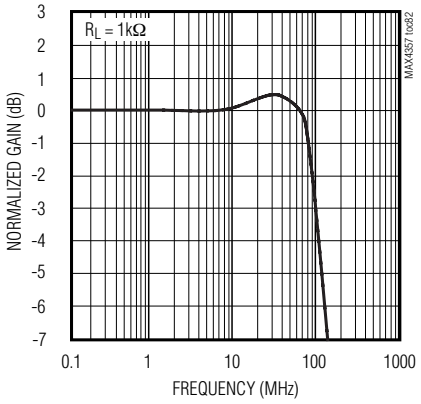
SMALL-SIGNAL FREQUENCY RESPONSE



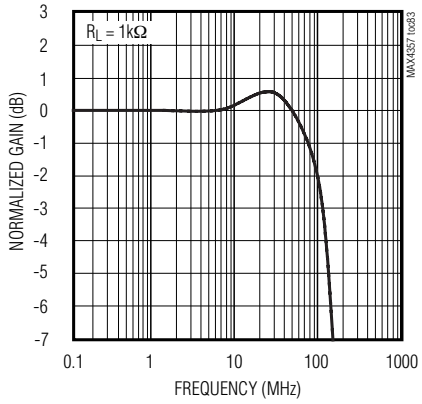
LARGE-SIGNAL FREQUENCY RESPONSE



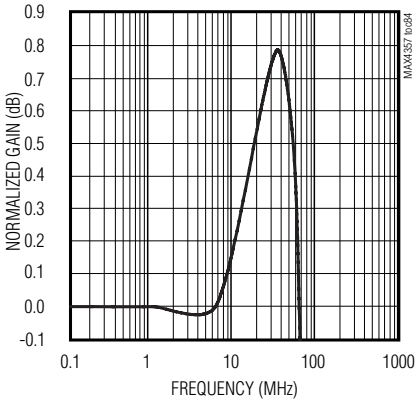
MEDIUM-SIGNAL FREQUENCY RESPONSE



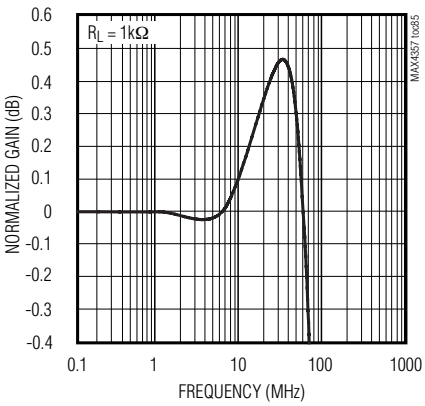
SMALL-SIGNAL FREQUENCY RESPONSE



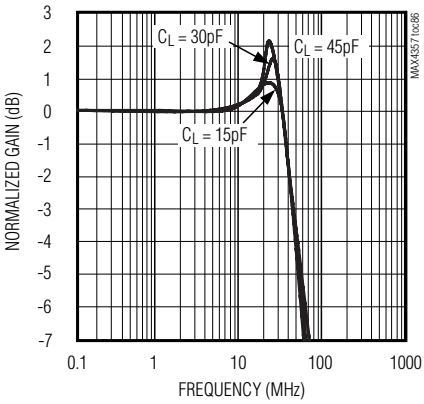
LARGE-SIGNAL GAIN FLATNESS vs. FREQUENCY



LARGE-SIGNAL GAIN FLATNESS vs. FREQUENCY



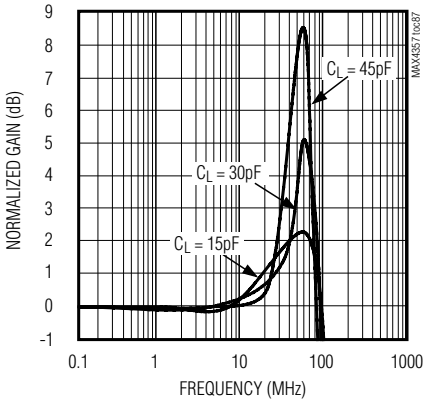
LARGE-SIGNAL FREQUENCY RESPONSE (AV = +1V/V)



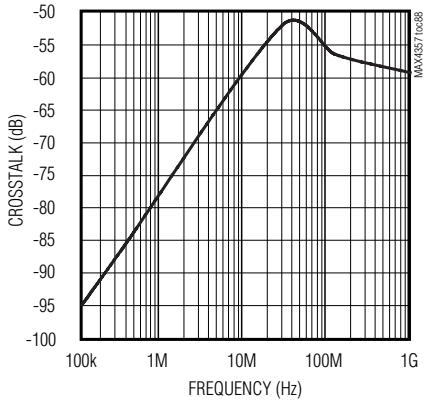
Typical Operating Characteristics—Single Supply +5V (continued)

(V_{CC} = +5V and V_{EE} = 0, V_{DD} = +5V, AGND = DGND = 0, $V_{IN\_}$ = 0, R_L = 150Ω to AGND, A_V = +1V/V, and T_A = +25°C, unless otherwise noted.)

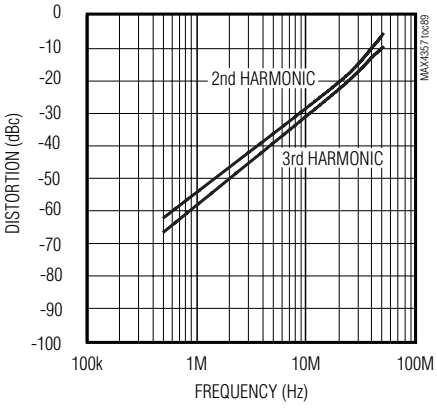
MEDIUM-SIGNAL FREQUENCY RESPONSE (A_V = +1V/V)



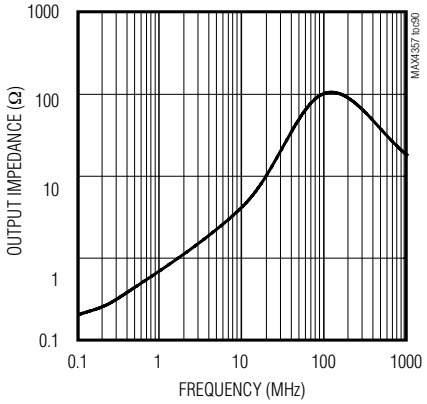
CROSSTALK vs. FREQUENCY



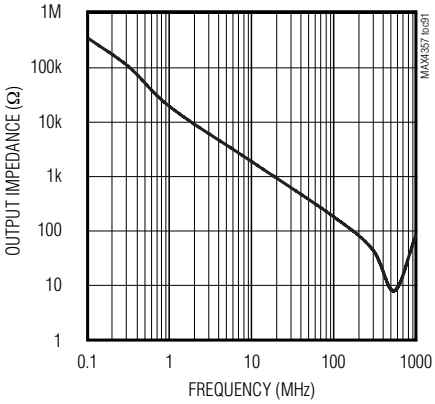
DISTORTION vs. FREQUENCY



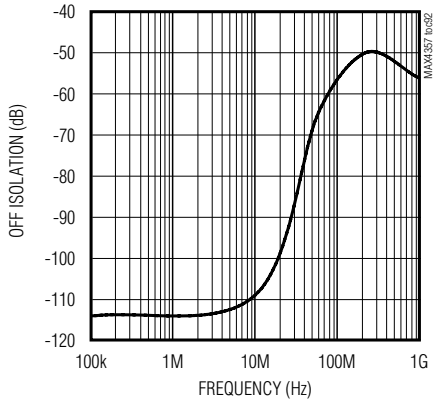
ENABLED OUTPUT IMPEDANCE vs. FREQUENCY



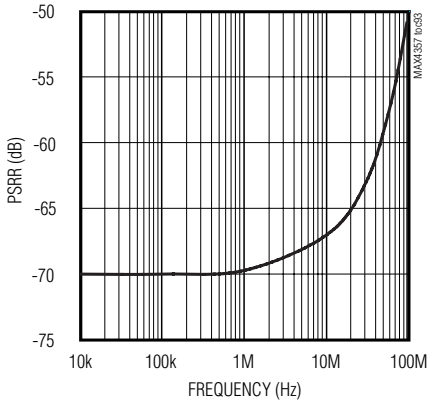
DISABLED OUTPUT IMPEDANCE vs. FREQUENCY



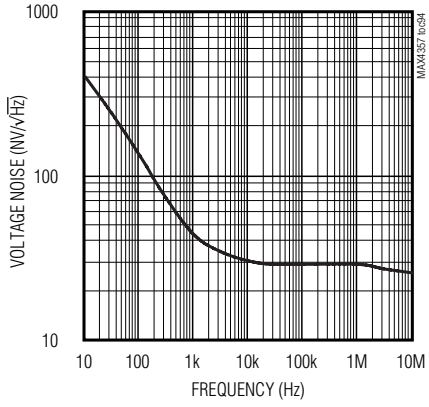
OFF-ISOLATION vs. FREQUENCY



POWER-SUPPLY REJECTION RATIO vs. FREQUENCY



INPUT VOLTAGE NOISE vs. FREQUENCY



LARGE-SIGNAL PULSE RESPONSE