



Dual-Audio, Log Taper Digital Potentiometers

General Description

The MAX5408/MAX5409 are dual logarithmic taper digital potentiometers with 32-tap points each. The MAX5408 is a dual potentiometer with one wiper per potentiometer. The MAX5409 is a dual potentiometer with two wipers per potentiometer (see *Functional Diagram*). An SPI™-compatible serial interface controls the wipers. The MAX5408/MAX5409 have a factory-set resistance of 10kΩ per potentiometer. A zero-crossing detect feature minimizes the audible noise generated by wiper transitions. These devices are ideal for audio applications requiring digitally controlled resistors. The MAX5408/MAX5409 have nominal resistor temperature-coefficients of 35ppm/°C end-to-end and 5ppm/°C ratiometric. The MAX5408/MAX5409 are available in 16-pin QSOP and 16-pin QFN packages and are specified over the extended temperature range (-40°C to +85°C).

Applications

Stereo Volume Control
Fading and Balancing Stereo Signals
Mechanical Potentiometer Replacement

SPI is a trademark of Motorola Inc.

Functional Diagram appears at end of data sheet.

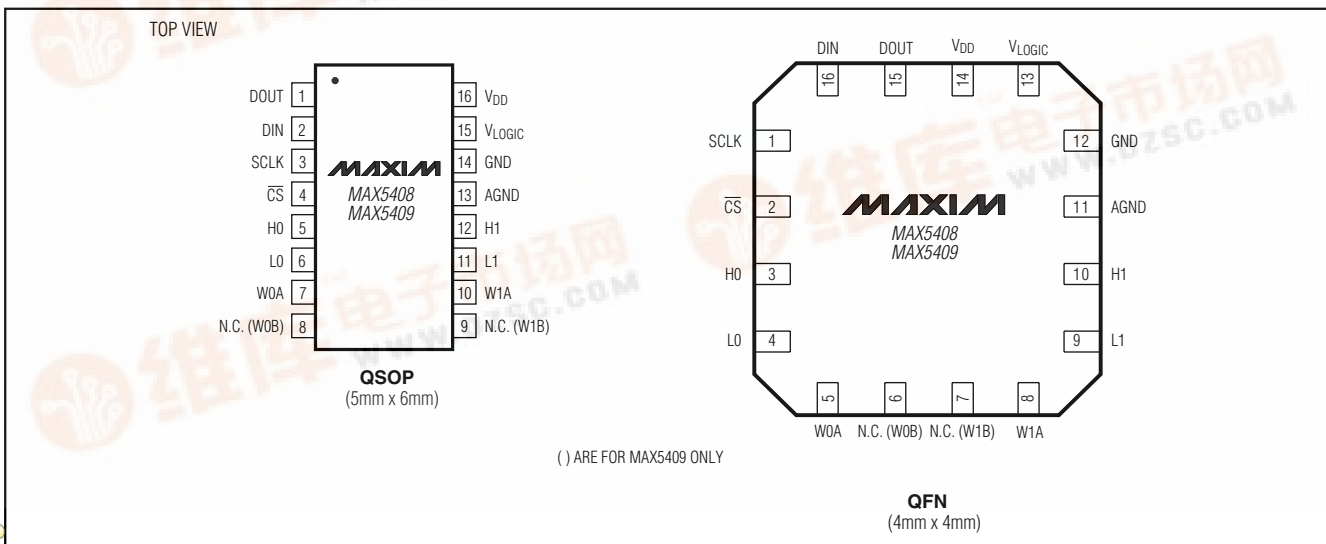
Features

- ◆ Log Taper with 2dB Steps Between Taps
- ◆ 32-Tap Positions for Each Wiper
- ◆ Small 16-Pin QSOP/QFN Packages
- ◆ +2.7V to +3.6V Single-Supply Operation
- ◆ Low 1μA Supply Current
- ◆ Zero-Crossing Detection for Clickless Switching
- ◆ Mute Function to -90dB
- ◆ 10kΩ Fixed Resistance Value
- ◆ 3-Wire SPI-Compatible Serial Data Interface
- ◆ Power-On Reset: Wiper Goes to Maximum Attenuation
- ◆ Digital Output for Readback and Daisy-Chaining Capabilities

Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE	WIPERS PER RESISTOR
MAX5408EEE	-40°C to +85°C	16 QSOP	1
MAX5408EGE	-40°C to +85°C	16 QFN	1
MAX5409EEE	-40°C to +85°C	16 QSOP	2
MAX5409EGE	-40°C to +85°C	16 QFN	2

Pin Configurations



MAX5408/MAX5409

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ABSOLUTE MAXIMUM RATINGS

V_{DD}, V_{LOGIC}, $\overline{\text{CS}}$, SCLK, DIN to GND -0.3V to +6V
 H₋, L₋, and W₋ to GND -0.3V to (V_{DD} + 0.3V)
 DOUT to GND -0.3V to (V_{DD} + 0.3V)
 AGND to GND -0.3V to +0.3V
 Input and Output Latchup Immunity ±200mA
 Maximum Continuous Current into H₋, L₋, and W₋ ±500μA

Continuous Power Dissipation (T_A = +70°C)
 QSOP (derate 8.3mW/°C above +70°C) 666.7mW
 QFN (derate 18.5mW/°C above +70°C) 1481mW
 Operating Temperature Range -40°C to +85°C
 Storage Temperature Range -60°C to +150°C
 Maximum Junction Temperature +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.

ELECTRICAL CHARACTERISTICS

(V_{DD} = +2.7V to +3.6V, V_H = V_{LOGIC}, V_L = 0, T_A = T_{MIN} to T_{MAX}. Typical values are at T_A = +25°C, unless otherwise specified.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
End-to-End Resistance			7	10	13	Ω
Maximum Bandwidth			100			kHz
Absolute Tolerance				±0.25		dB
Tap-to-Tap Tolerance				±0.1		dB
Total Harmonic Distortion	THD	V _{IN} = 1V _{RMS} , f = 1kHz, tap = -6dB		0.002		%
Channel Isolation				-100		dB
Interchannel Matching		f = 20Hz to 20kHz, tap = -6dB		±0.5		dB
Mute Attenuation				-90		dB
Power-Supply Rejection Ratio	PSRR			-80		dB
Wiper Resistance	R _W			1000	1700	Ω
Wiper Capacitance	C _W			10		pF
Digital Clock Feedthrough		f _{SCLK} = 20Hz to 20kHz, tap = -6dB		-90		dB
End-to-End Resistance Tempco	TC _R			35		ppm/°C
Ratiometric Resistance Tempco				5		ppm/°C
DIGITAL INPUTS (V_{LOGIC} > 4.5V)						
Input High Voltage	V _{IH}		2.4			V
Input Low Voltage	V _{IL}				0.8	V
Input Leakage Current					±1	μA
Input Capacitance				5		pF
DIGITAL INPUTS (V_{LOGIC} < 4.5V)						
Input High Voltage	V _{IH}		0.7 x V _{LOGIC}			V
Input Low Voltage	V _{IL}			0.3 x V _{LOGIC}		V
Input Leakage Current				±1		μA
Input Capacitance				5		pF
DIGITAL OUTPUT						
Output High Voltage	V _{OH}	I _{SOURCE} = 0.5mA	V _{LOGIC} - 0.5			V
Output Low Voltage	V _{OL}	I _{SINK} = 2mA		0.4		V

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ELECTRICAL CHARACTERISTICS (continued)

($V_{DD} = +2.7V$ to $+3.6V$, $V_{H_} = V_{LOGIC}$, $V_{L_} = 0$, $T_A = T_{MIN}$ to T_{MAX} . Typical values are at $T_A = +25^{\circ}C$, unless otherwise specified.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
TIMING CHARACTERISTICS (Figure 1)						
SCLK Clock Period	t _{CP}		100			ns
SCLK Pulse Width High	t _{CH}		40			ns
SCLK Pulse Width Low	t _{CL}		40			ns
$\overline{CS}$ Fall to SCLK Rise Setup Time	t _{CSS}		40			ns
SCLK Rise to $\overline{CS}$ Rise Hold Time	t _{CSH}		0			ns
DIN Setup Time	t _{DS}		40			ns
DIN Hold Time	t _{DH}		0			ns
SCLK Fall to DOUT Valid Propagation Delay	t _{DO}	C _{LOAD} = 200pF			80	ns
$\overline{CS}$ Rise to SCLK Rise Hold Time	t _{CS1}		40			ns
$\overline{CS}$ Pulse Width High	t _{CSW}		100			ns
Wiper Settling Time	t _W	Zero-Crossing Detect disabled		1		μs
POWER SUPPLIES						
Supply Voltage	V _{DD}		2.7		3.6	V
Active Supply Current	I _{DD}	f _{SCLK} = 2MHz, (Note 1)			100	μA
Standby Supply Current		(Note 2)		0.2	10	
Logic Supply Voltage	V _{LOGIC}		2.7		5.5	V
Logic Active Supply Current	I _{LOGIC}	f _{SCLK} = 2MHz, DOUT = floating (Note 3)			120	μA
Logic Standby Supply Current		DOUT = floating (Note 2)		1	10	

Note 1: Supply current measured while changing, wiper position with zero-crossing enabled.

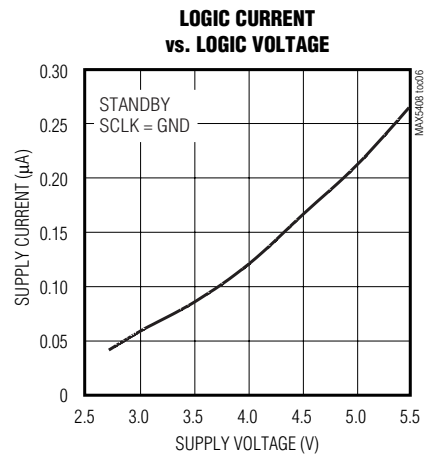
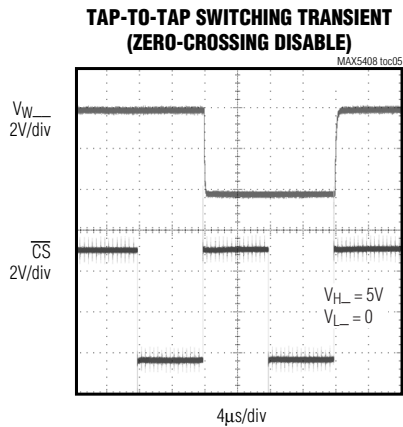
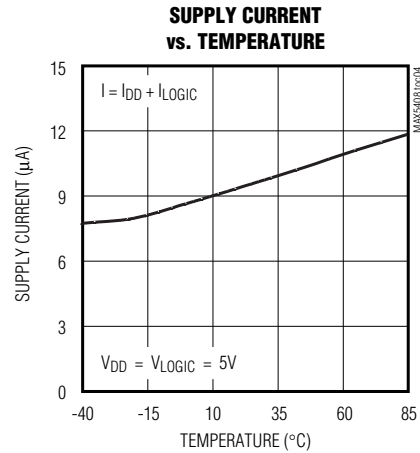
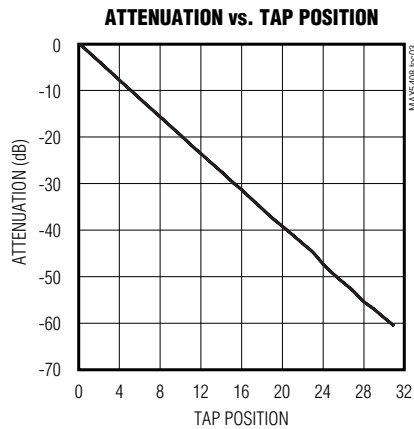
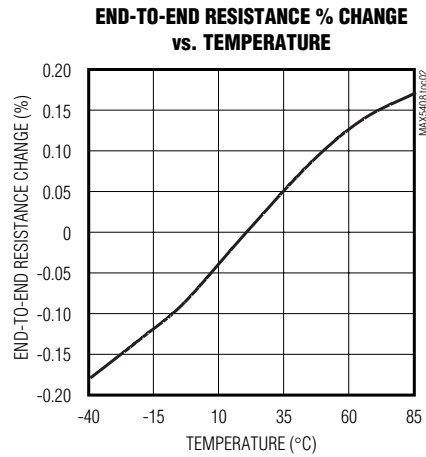
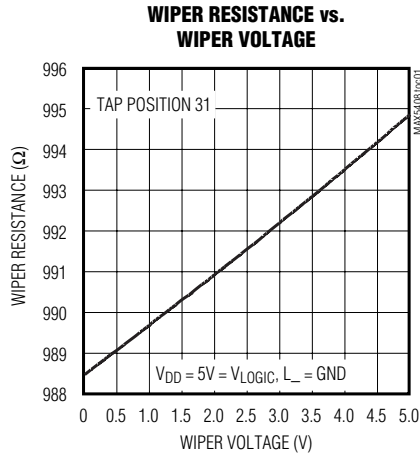
Note 2: Supply current measured while wiper position is fixed.

Note 3: Supply current measured changing wiper position.

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Typical Operating Characteristics

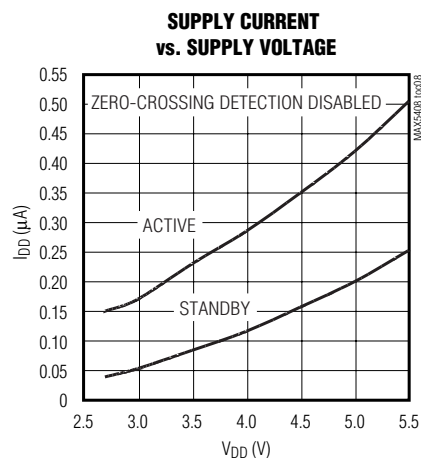
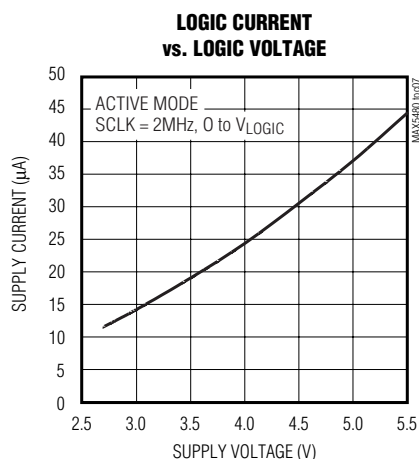
($V_{DD} = 5V$, $T_A = +25^\circ C$, unless otherwise specified)



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Typical Operating Characteristics (continued)

($V_{DD} = 5V$, $T_A = +25^\circ C$, unless otherwise specified)



Pin Description

PIN				NAME	FUNCTION
MAX5408 QFN	MAX5408 QSOP	MAX5409 QFN	MAX5409 QSOP		
1	3	1	3	SCLK	Serial Data Clock Input
2	4	2	4	$\overline{CS}$	Chip Select for Wiper Control
3	5	3	5	H0	High Terminal of Resistor 0
4	6	4	6	L0	Low Terminal of Resistor 0
5	7	5	7	W0A	Wiper Terminal A of Resistor 0
—	—	6	8	W0B	Wiper Terminal B of Resistor 0
—	—	7	9	W1B	Wiper Terminal B of Resistor 1
8	10	8	10	W1A	Wiper Terminal A of Resistor 1
9	11	9	11	L1	Low Terminal of Resistor 1
10	12	10	12	H1	High Terminal of Resistor 1
11	13	11	13	AGND	Analog Ground
12	14	12	14	GND	Ground
13	15	13	15	V_{LOGIC}	Power Supply for Interface Logic
14	16	14	16	V_{DD}	Power Supply for Wiper Switches
15	1	15	1	DOUT	Serial Data Out
16	2	16	2	DIN	Serial Data In
6, 7	8, 9	—	—	N.C	Not Connected

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Table 1. Serial Interface Programming Commands for MAX5408

8-BIT SERIAL WORD				FUNCTION
A0	A1	A2	D4–D0	
0	0	0	5-bit DAC Data	Program position of wiper W0A
0	0	1	5-bit DAC Data	Undefined
0	1	0	5-bit DAC Data	Program position of wiper W1A
0	1	1	5-bit DAC Data	Undefined
1	0	0	4-bit Mute Data, D0 = “don’t care”	Data for mute register (see Table 3)
1	0	1	4-bit Zero-Crossing Detection Data, D0 = “don’t care”	Data for zero-crossing detection register (see Table 5)
1	1	0	00000	Return wiper register for W0A
1	1	0	00001	Undefined
1	1	0	00010	Return wiper register for W1A
1	1	0	00011	Undefined
1	1	0	00100	Return mute register
1	1	0	00101	Return zero-crossing detection register
1	1	1	D4 = 0, D3–D0 = “don’t care”	Analog power-down
1	1	1	D4 = 1, D3–D0 = “don’t care”	Analog power-up

Detailed Description

Digital Serial Interface

An SPI-compatible serial interface controls the MAX5408/MAX5409. The input word to the device is eight bits long, composed of three address bits (A0, A1, and A2), followed by five data bits, with MSB first (see Tables 1 and 2). The first three address bits set the value of internal registers. The five data bits control the wiper position. For certain commands, some of the five data bits are “don’t cares”, but must be sent to the device.

The serial data is listed in Tables 1 and 2.

The control code determines:

- Potentiometer to update or register to set.
- Data for mute register (Tables 3 and 4).
- Data for zero-crossing detection register (Tables 5 and 6).

The data bits control the position of the wiper (Table 7). A logic low on the chip-select input ($\overline{CS}$) enables the device’s serial interface. A logic high on $\overline{CS}$ disables the interface control circuitry. See Figure 1 for serial-interface timing description.

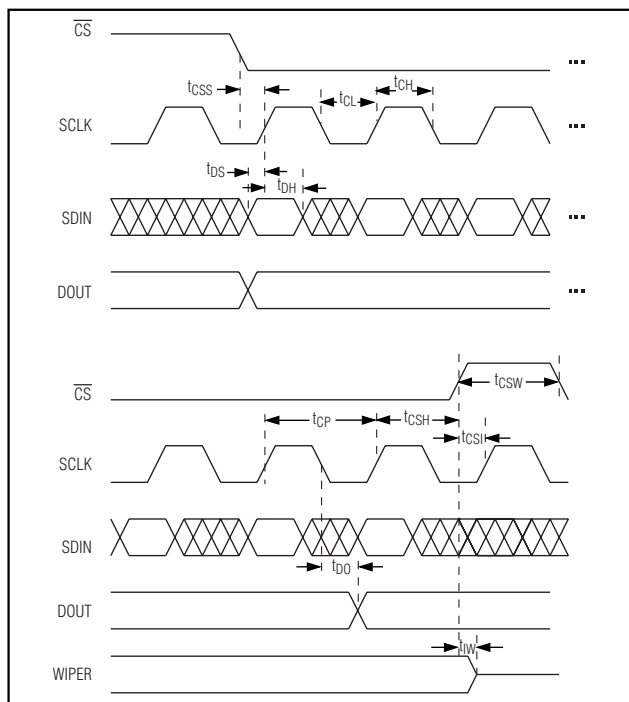


Figure 1. Serial Timing Diagram

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Table 2. Serial Interface Programming Commands for MAX5409

8-BIT SERIAL WORD				FUNCTION
A0	A1	A2	D4–D0	
0	0	0	5-bit DAC Data	Program position of wiper W0A
0	0	1	5-bit DAC Data	Program position of wiper W0B
0	1	0	5-bit DAC Data	Program position of wiper W1A
0	1	1	5-bit DAC Data	Program position of wiper W1B
1	0	0	4-bit Mute Data, D0 = "don't care"	Data for mute register (see Table 4)
1	0	1	4-bit Zero-Crossing Detection Data, D0 = "don't care"	Data for zero-crossing detection register (see Table 6)
1	1	0	00000	Return wiper register for W0A
1	1	0	00001	Return wiper register for W0B
1	1	0	00010	Return wiper register for W1A
1	1	0	00011	Return wiper register for W1B
1	1	0	00100	Return mute register
1	1	0	00101	Return zero-crossing detection register
1	1	1	D4 = 0, D3–D0 = "don't care"	Analog power-down
1	1	1	D4 = 1, D3–D0 = "don't care"	Analog power-up

Table 3. Mute Register Bit Definitions for MAX5408

DATA BIT	VALUE	FUNCTION
D4	0	Set wiper W0A to preprogrammed value (-62dB on power-up)
	1	Set wiper W0A to L0
D3	"don't care"	Undefined
D2	0	Set wiper W1A to preprogrammed value (-62dB on power-up)
	1	Set wiper W1A to L0
D1	"don't care"	Undefined
D0	"don't care"	Undefined

Table 4. Mute Register Bit Definitions for MAX5409

DATA BIT	VALUE	FUNCTION
D4	0	Set wiper W0A to preprogrammed value (-62dB on power-up)
	1	Set wiper W0A to L0
D3	0	Set wiper W0B to preprogrammed value (-62dB on power-up)
	1	Set wiper W0B to L0
D2	0	Set wiper W1A to preprogrammed value (-62dB on power-up)
	1	Set wiper W1A to L1
D1	0	Set wiper W1B to preprogrammed value (-62dB on power-up)
	1	Set wiper W1B to L1
D0	"don't care"	Undefined

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Table 5. Zero-Crossing Detection Register Bit Definitions for MAX5408

DATA BIT	VALUE	FUNCTION
D4	0	Disable wiper W0A zero-crossing detection circuit
	1	Enable wiper W0A zero-crossing detection circuit
D3	"don't care"	Undefined
D2	0	Disable wiper W1A zero-crossing detection circuit
	1	Enable wiper W1A zero-crossing detection circuit
D1	"don't care"	Undefined
D0	"don't care"	Undefined

Table 6. Zero-Crossing Detection Register Bit Definitions for MAX5409

DATA BIT	VALUE	FUNCTION
D4	0	Disable wiper W0A zero-crossing detection circuit
	1	Enable wiper W0A zero-crossing detection circuit
D3	0	Disable wiper W0B zero-crossing detection circuit
	1	Enable wiper W0B zero-crossing detection circuit
D2	0	Disable wiper W1A zero-crossing detection circuit
	1	Enable wiper W1A zero-crossing detection circuit
D1	0	Disable wiper W1B zero-crossing detection circuit
	1	Enable wiper W1B zero-crossing detection circuit
D0	"don't care"	Undefined

Table 7. Attenuation and Wiper Position

POSITION	OUTPUT LEVEL (dB)
0	0
1	-2
2	-4
3	-6
4	-8
⋮	⋮
30	-60
31	-62
MUTE	<-90

The digital output, DOUT, lags the digital input signal, DIN by 8.5 clock cycles. Force $\overline{CS}$ high to disable DOUT, placing DOUT in three-state mode. Force $\overline{CS}$ low to enable DOUT and disable three-state mode.

Force $\overline{CS}$ high, after a word has been written to the MAX5408/MAX5409 to make a readback request. The next $\overline{CS}$ low period writes the requested data to DOUT.

A readback request overwrites any previous data in the shift register. Note that the data appears at DOUT in the order: A0, A1, A2, D4, D3, D2, D1, D0. A0 will be available after the first high-to-low transition of SCLK when $\overline{CS}$ is low. The input continues to load the shift register while data is being read out of the MAX5408/MAX5409. The input data appears at DOUT 8.5 clock cycles later. A $\overline{CS}$ transition from low-to-high latches the input data. For any control byte, the state of SCLK must be the same for both $\overline{CS}$ low-to-high transitions and $\overline{CS}$ high-to-low transitions, in order to preserve the data at DOUT while $\overline{CS}$ transitions.

Zero-Crossing Detection

The zero-crossing detection register enables the zero-crossing detect feature. The zero-crossing detect feature reduces the audible noise ("clicks and pops") that result from wiper transitions. The wiper changes position only when the voltage at L_- is the same as the voltage at H_- . The MAX5408/MAX5409 timeout and change the wiper position, if after 50ms no zero-crossing is detected.

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Power-On Reset

The power-on reset (POR) feature sets the wiper to the maximum attenuation (tap position 31, -62 dB) at power-up.

Mute Function

When mute is enabled, the wiper stays at its previous position. If a command to update the wiper position is issued when the device is in mute, the wiper will be set to its new position when mute is removed.

Applications Information

Attenuation Control

Figure 2 shows the application of an attenuation control. The op amps are connected in a follower configuration

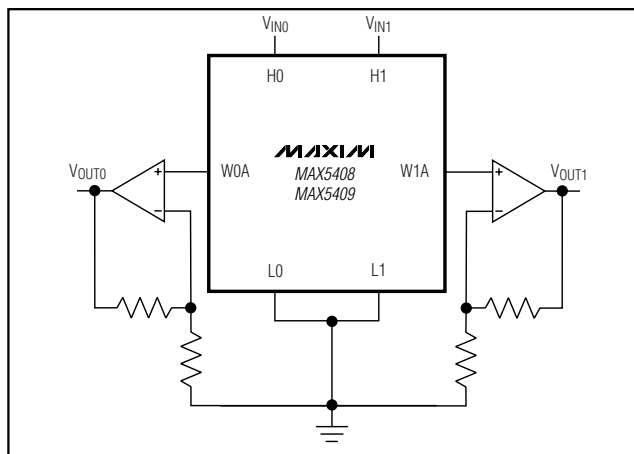


Figure 2. Attenuation Control

with a fixed gain. The digitally controlled potentiometer attenuates the input signal.

Stereo Volume Control

Figure 3 shows the application of stereo volume control. The op amps are connected in a follower configuration with fixed gain. The digitally controlled potentiometer attenuates the input signals. The second wiper of each potentiometer controls the signal amplitude at the rear set of speakers.

Daisy-Chaining

Figure 4 shows an application daisy-chaining the serial-interfaces of the MAX5408/MAX5409. A single-write command updates multiple devices from a single digital port in this configuration (see *Digital Serial Interface* section).

Gain Control

Figure 5 shows the application of a gain control. **Note:** Muting the potentiometer creates unpredictable behavior at the output of the op amp, and may seriously degrade the performance of the op amp.

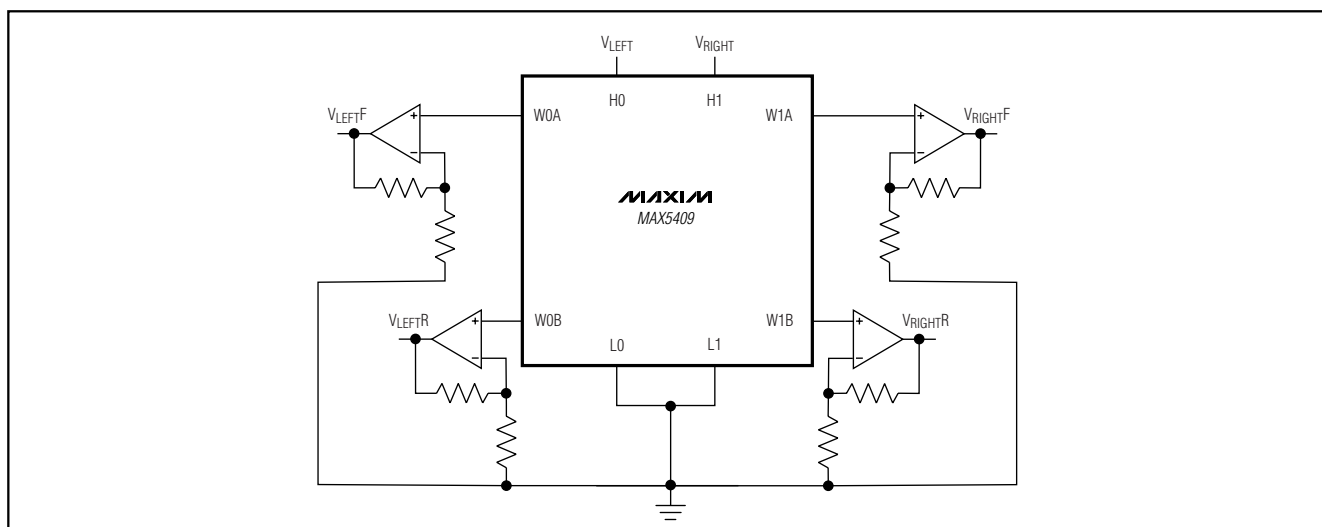


Figure 3. Stereo Volume Control with Front and Rear Fade

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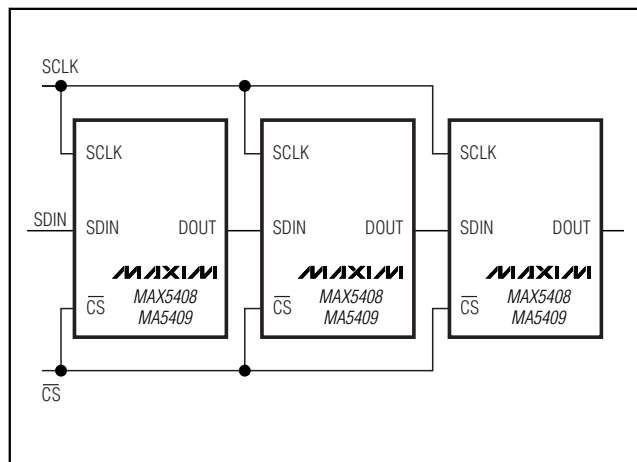


Figure 4. Daisy-Chaining of Serial Interfaces

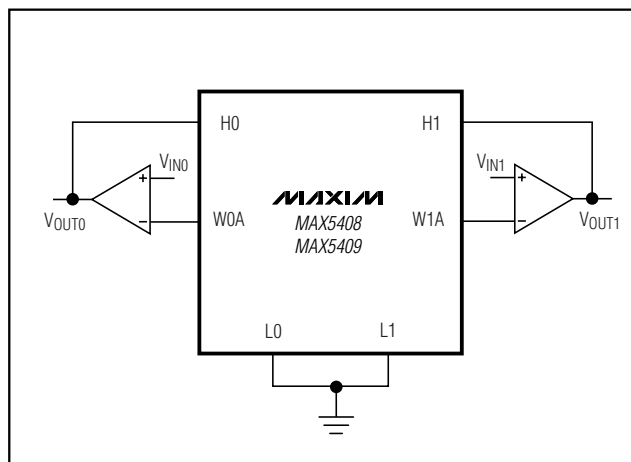


Figure 5. Gain Control

Chip Information

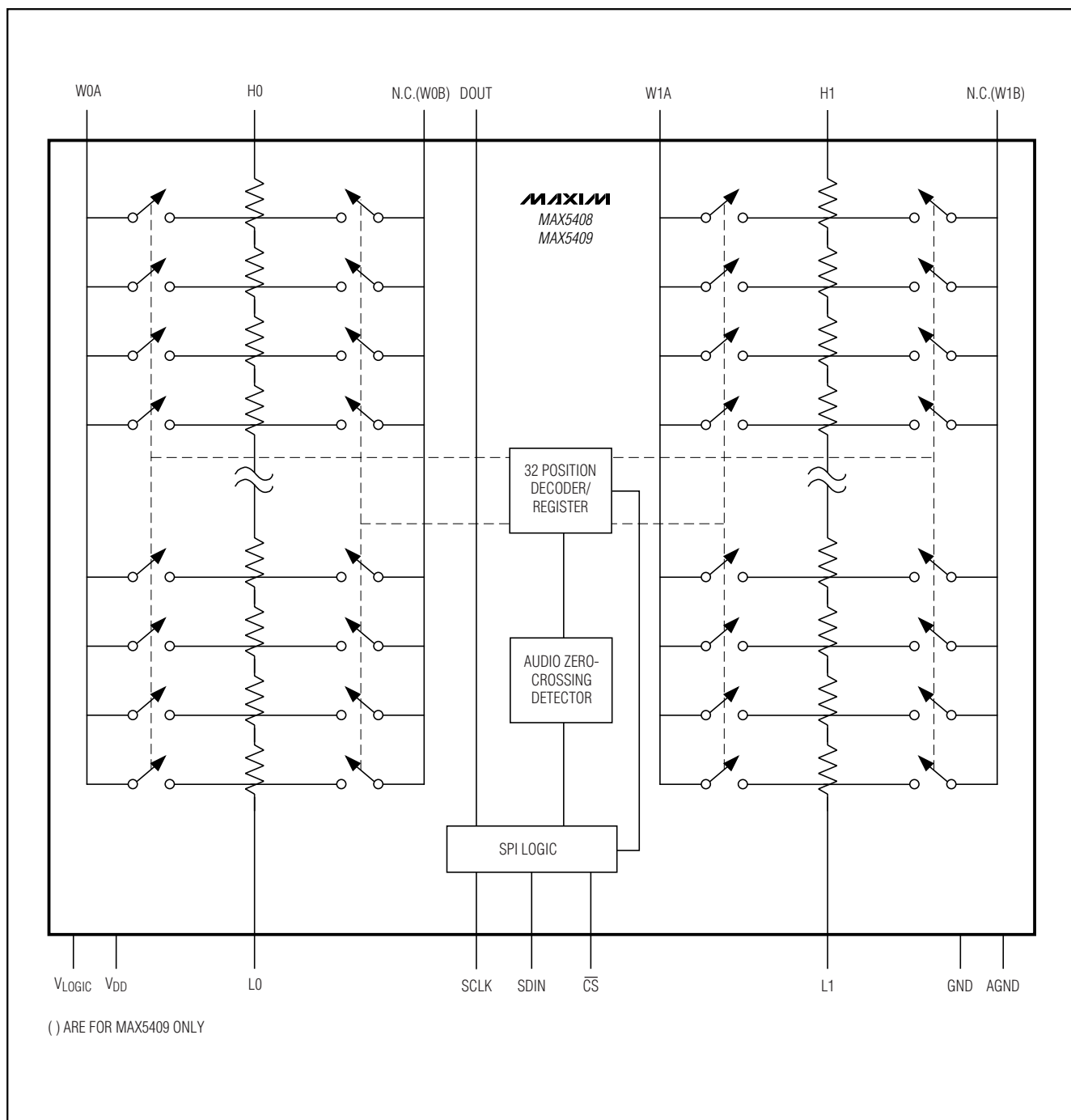
TRANSISTOR COUNT: 12759

PROCESS: BiCMOS

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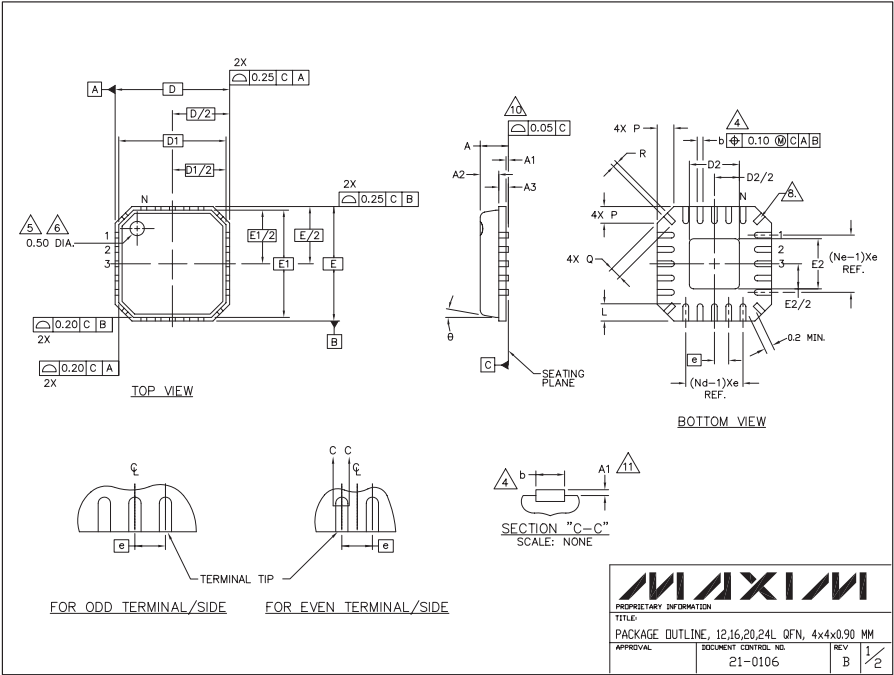
Functional Diagram

MAX5408/MAX5409



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Package Information



NOTES:

1. DIE THICKNESS ALLOWABLE IS 0.305mm MAXIMUM (.012 INCHES MAXIMUM)
2. DIMENSIONING & TOLERANCES CONFORM MUST TO ASME Y14.5M. - 1994.
3. N IS THE NUMBER OF TERMINALS.
Nd IS THE NUMBER OF TERMINALS IN X-DIRECTION &
Ne IS THE NUMBER OF TERMINALS IN Y-DIRECTION.
4. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.20 AND 0.25mm FROM TERMINAL TIP.
5. THE PIN #1 IDENTIFIER MUST BE EXISTED ON THE TOP SURFACE OF THE PACKAGE BY USING INDENTATION MARK OR OTHER FEATURE OF PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
7. ALL DIMENSIONS ARE IN MILLIMETERS.
8. THE SHAPE SHOWN ON FOUR CORNERS ARE NOT ACTUAL 1/0.
9. PACKAGE WARPAGE MAX 0.05mm.
10. APPLIED FOR EXPOSED PAD AND TERMINALS.
EXCLUDE EMBEDDING PART OF EXPOSED PAD FROM MEASURING.
11. APPLIED ONLY FOR TERMINALS.
12. MEETS JEDEC MO220.

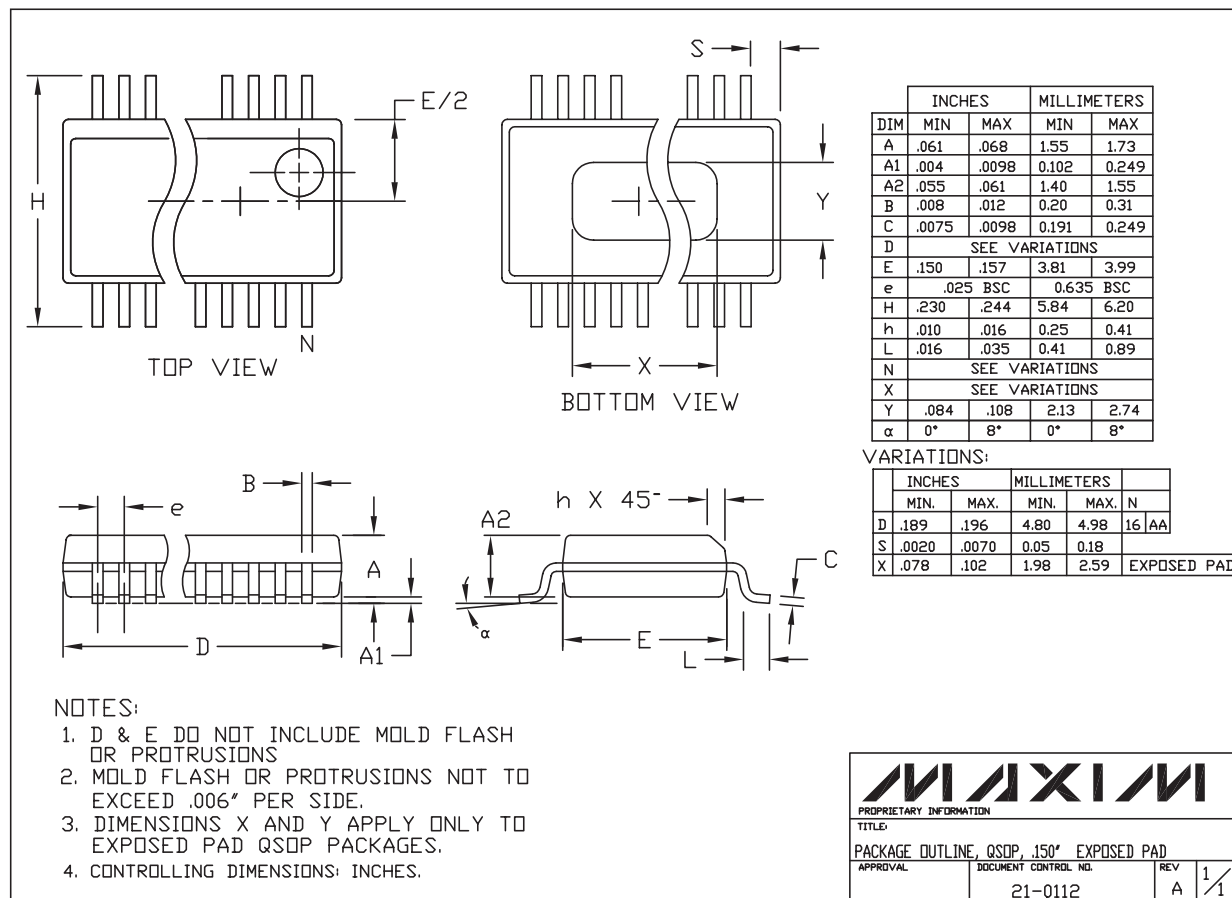
SYMBOL	COMMON DIMENSIONS			N ₁
	MIN.	NOM.	MAX.	
A	—	0.85	1.00	11
A1	0.00	0.01	0.05	11
A2	—	0.85	0.80	11
A3	—	0.20 REF.	—	11
D	—	4.00 BSC	—	11
D1	—	3.75 BSC	—	11
F	—	4.00 BSC	—	11
E1	—	3.75 BSC	—	11
θ	—	12°	—	11
P	0.24	0.42	0.60	11
R	0.13	0.17	0.23	11

PITCH VARIATION A				N ₁	N ₂	PITCH VARIATION B				N ₃	N ₄	PITCH VARIATION C				N ₅	N ₆	PITCH VARIATION D				N ₇	N ₈
MIN.	NOM.	MAX.	MIN.			NOM.	MAX.	MIN.	NOM.			MAX.	MIN.	NOM.	MAX.								
0	0.60	0.80	1.00	0	0.65	0.85	1.05	0	0.50	0.70	0.90	0	0.50	0.70	0.90	0	0.50	0.70	0.90	0	0.50	0.70	0.90
1	0.30	0.40	0.50	1	0.35	0.45	0.55	1	0.20	0.30	0.40	1	0.20	0.30	0.40	1	0.20	0.30	0.40	1	0.20	0.30	0.40
2	0.10	0.20	0.30	2	0.15	0.25	0.35	2	0.10	0.20	0.30	2	0.10	0.20	0.30	2	0.10	0.20	0.30	2	0.10	0.20	0.30
3	0.05	0.10	0.15	3	0.08	0.12	0.16	3	0.05	0.10	0.15	3	0.05	0.10	0.15	3	0.05	0.10	0.15	3	0.05	0.10	0.15
4	0.02	0.04	0.06	4	0.03	0.06	0.09	4	0.02	0.04	0.06	4	0.02	0.04	0.06	4	0.02	0.04	0.06	4	0.02	0.04	0.06
5	0.01	0.02	0.03	5	0.01	0.02	0.03	5	0.01	0.02	0.03	5	0.01	0.02	0.03	5	0.01	0.02	0.03	5	0.01	0.02	0.03
6	0.00	0.01	0.02	6	0.00	0.01	0.02	6	0.00	0.01	0.02	6	0.00	0.01	0.02	6	0.00	0.01	0.02	6	0.00	0.01	0.02
7	0.00	0.00	0.01	7	0.00	0.00	0.01	7	0.00	0.00	0.01	7	0.00	0.00	0.01	7	0.00	0.00	0.01	7	0.00	0.00	0.01
8	0.00	0.00	0.00	8	0.00	0.00	0.00	8	0.00	0.00	0.00	8	0.00	0.00	0.00	8	0.00	0.00	0.00	8	0.00	0.00	0.00
9	0.00	0.00	0.00	9	0.00	0.00	0.00	9	0.00	0.00	0.00	9	0.00	0.00	0.00	9	0.00	0.00	0.00	9	0.00	0.00	0.00
10	0.00	0.00	0.00	10	0.00	0.00	0.00	10	0.00	0.00	0.00	10	0.00	0.00	0.00	10	0.00	0.00	0.00	10	0.00	0.00	0.00
11	0.00	0.00	0.00	11	0.00	0.00	0.00	11	0.00	0.00	0.00	11	0.00	0.00	0.00	11	0.00	0.00	0.00	11	0.00	0.00	0.00
12	0.00	0.00	0.00	12	0.00	0.00	0.00	12	0.00	0.00	0.00	12	0.00	0.00	0.00	12	0.00	0.00	0.00	12	0.00	0.00	0.00
13	0.00	0.00	0.00	13	0.00	0.00	0.00	13	0.00	0.00	0.00	13	0.00	0.00	0.00	13	0.00	0.00	0.00	13	0.00	0.00	0.00
14	0.00	0.00	0.00	14	0.00	0.00	0.00	14	0.00	0.00	0.00	14	0.00	0.00	0.00	14	0.00	0.00	0.00	14	0.00	0.00	0.00
15	0.00	0.00	0.00	15	0.00	0.00	0.00	15	0.00	0.00	0.00	15	0.00	0.00	0.00	15	0.00	0.00	0.00	15	0.00	0.00	0.00
16	0.00	0.00	0.00	16	0.00	0.00	0.00	16	0.00	0.00	0.00	16	0.00	0.00	0.00	16	0.00	0.00	0.00	16	0.00	0.00	0.00
17	0.00	0.00	0.00	17	0.00	0.00	0.00	17	0.00	0.00	0.00	17	0.00	0.00	0.00	17	0.00	0.00	0.00	17	0.00	0.00	0.00
18	0.00	0.00	0.00	18	0.00	0.00	0.00	18	0.00	0.00	0.00	18	0.00	0.00	0.00	18	0.00	0.00	0.00	18	0.00	0.00	0.00
19	0.00	0.00	0.00	19	0.00	0.00	0.00	19	0.00	0.00	0.00	19	0.00	0.00	0.00	19	0.00	0.00	0.00	19	0.00	0.00	0.00
20	0.00	0.00	0.00	20	0.00	0.00	0.00	20	0.00	0.00	0.00	20	0.00	0.00	0.00	20	0.00	0.00	0.00	20	0.00	0.00	0.00
21	0.00	0.00	0.00	21	0.00	0.00	0.00	21	0.00	0.00	0.00	21	0.00	0.00	0.00	21	0.00	0.00	0.00	21	0.00	0.00	0.00
22	0.00	0.00	0.00	22	0.00	0.00	0.00	22	0.00	0.00	0.00	22	0.00	0.00	0.00	22	0.00	0.00	0.00	22	0.00	0.00	0.00
23	0.00	0.00	0.00	23	0.00	0.00	0.00	23	0.00	0.00	0.00	23	0.00	0.00	0.00	23	0.00	0.00	0.00	23	0.00	0.00	0.00
24	0.00	0.00	0.00	24	0.00	0.00	0.00	24	0.00	0.00	0.00	24	0.00	0.00	0.00	24	0.00	0.00	0.00	24	0.00	0.00	0.00
25	0.00	0.00	0.00	25	0.00	0.00	0.00	25	0.00	0.00	0.00	25	0.00	0.00	0.00	25	0.00	0.00	0.00	25	0.00	0.00	0.00
26	0.00	0.00	0.00	26	0.00	0.00	0.00	26	0.00	0.00	0.00	26	0.00	0.00	0.00	26	0.00	0.00	0.00	26	0.00	0.00	0.00
27	0.00	0.00	0.00	27	0.00	0.00	0.00	27	0.00	0.00	0.00	27	0.00	0.00	0.00	27	0.00	0.00	0.00	27	0.00	0.00	0.00
28	0.00	0.00	0.00	28	0.00	0.00	0.00	28	0.00	0.00	0.00	28	0.00	0.00	0.00	28	0.00	0.00	0.00	28	0.00	0.00	0.00
29	0.00	0.00	0.00	29	0.00	0.00	0.00	29	0.00	0.00	0.00	29	0.00	0.00	0.00	29	0.00	0.00	0.00	29	0.00	0.00	0.00
30	0.00	0.00	0.00	30	0.00	0.00	0.00	30	0.00	0.00	0.00	30	0.00	0.00	0.00	30	0.00	0.00	0.00	30	0.00	0.00	0.00
31	0.00	0.00	0.00	31	0.00	0.00	0.00	31	0.00	0.00	0.00	31	0.00	0.00	0.00	31	0.00	0.00	0.00	31	0.00	0.00	0.00
32	0.00	0.00	0.00	32	0.00	0.00	0.00	32	0.00	0.00	0.00	32	0.00	0.00	0.00	32	0.00	0.00	0.00	32	0.00	0.00	0.00
33	0.00	0.00	0.00	33	0.00	0.00	0.00	33	0.00	0.00	0.00	33	0.00	0.00	0.00	33	0.00	0.00	0.00	33	0.00	0.00	0.00
34	0.00	0.00	0.00	34	0.00	0.00	0.00	34	0.00	0.00	0.00	34	0.00	0.00	0.00	34	0.00	0.00	0.00	34	0.00	0.00	0.00
35	0.00	0.00	0.00	35	0.00	0.00	0.00	35	0.00	0.00	0.00	35	0.00	0.00	0.00	35	0.00	0.00	0.00	35	0.00	0.00	0.00
36	0.00	0.00	0.00	36	0.00	0.00	0.00	36	0.00	0.00	0.00	36	0.00	0.00	0.00	36	0.00	0.00	0.00	36	0.00	0.00	0.00
37	0.00	0.00	0.00	37	0.00	0.00	0.00	37	0.00	0.00	0.00	37	0.00	0.00	0.00	37	0.00	0.00	0.00	37	0.00	0.00	0.00
38	0.00	0.00	0.00	38	0.00	0.00	0.00	38	0.00	0.00	0.00	38	0.00	0.00	0.00	38	0.00	0.00	0.00	38	0.00	0.00	0.00
39	0.00	0.00	0.00	39	0.00	0.00	0.00	39	0.00	0.00	0.00	39	0.00	0.00	0.00	39	0.00	0.00	0.00	39	0.00	0.00	0.00
40	0.00	0.00	0.00	40	0.00	0.00	0.00	40	0.00	0.00	0.00	40	0.00	0.00	0.00	40	0.00	0.00	0.00	40	0.00	0.00	0.00
41	0.00	0.00	0.00	41	0.00	0.00	0.00	41	0.00	0.00	0.00	41	0.00	0.00	0.00	41	0.00	0.00	0.00	41	0.00	0.00	0.00
42	0.00	0.00	0.00	42	0.00	0.00	0.00	42	0.00	0.00	0.00	42	0.00	0.00	0.00	42	0.00	0.00	0.00	42	0.00	0.00	0.00
43	0.00	0.00	0.00	43	0.00	0.00	0.00	43	0.00	0.00	0.00	43	0.00	0.00	0.00	43	0.00	0.00	0.00	43	0.00	0.00	0.00
44	0.00	0.00	0.00	44	0.00	0.00	0.00	44	0.00	0.00	0.00	44	0.00	0.00	0.00	44	0.00	0.00	0.00	44	0.00	0.00	0.00
45	0.00	0.00	0.00	45	0.00	0.00	0.00	45	0.00	0.00	0.00	45	0.00	0.00	0.00	45	0.00	0.00	0.00	45	0.00	0.00	0.00
46	0.00	0.00	0.00	46	0.00	0.00	0.00	46	0.00	0.00	0.00	46	0.00	0.00	0.00	46	0.00	0.00	0.00	46	0.00	0.00	0.00
47	0.00	0.00	0.00	47	0.00	0.00	0.00	47	0.00	0.00	0.00	47	0.00	0.00	0.00	47	0.00	0.00	0.00	47	0.00	0.00	0.00
48	0.00	0.00	0.00	48	0.00	0.00	0.00	48	0.00	0.00	0.00	48	0.00	0.00	0.00	48	0.00	0.00	0.00	48	0.00	0.00	0.00
49	0.00	0.00	0.00	49	0.00	0.00	0.00	49	0.00	0.00	0.00	49	0.00	0.00	0.00	49	0.00	0.00	0.00	49	0.00	0.00	0.00
50	0.00	0.00	0.00	50	0.00	0.00	0.00	50	0.00	0.00	0.00	50	0.00	0.00	0.00	50	0.00	0.00	0.00	50	0.00	0.00	0.00
51	0.00	0.00	0.00	51	0.00	0.00	0.00	51	0.00	0.00	0.00	51	0.00	0.00	0.00	51	0.00	0.00	0.00	51	0.00	0.00	0.00
52	0.00	0.00	0.00	52	0.00	0.00	0.00	52	0.00	0.00	0.00	52	0.00	0.00	0.00	52	0.00	0.00	0.00	52	0.00	0.00	0.00
53	0.00	0.00	0.00	53	0.00	0.00	0.00	53	0.00	0.00	0.00	53	0.00	0.00	0.00	53	0.00	0.00	0.00	53	0.00	0.00	0.00
54	0.00	0.00	0.00	54	0.00	0.00	0.00	54	0.00	0.00	0.00	54	0.00	0.00	0.00	54	0.00	0.00	0.00	54	0.00	0.00	0.00
55	0.00	0.00	0.00	55	0.00	0.00	0.00	55	0.00	0.00	0.00	55	0.00	0.00	0.00	55	0.00	0.00	0.00	55	0.00	0.00	0.00
56	0.00	0.00	0.00	56	0.00	0.00	0.00	56	0.00	0.00	0.00	56	0.00	0.00	0.00	56	0.00	0.00	0.00	56	0.00	0.00	0.00
57	0.00	0.00	0.00	57	0.00	0.00	0.00	57	0.00	0.00	0.00	57	0.00	0.00	0.00	57	0.00	0.00	0.00	57	0.00	0.00	0.00
58	0.00	0.00	0.00	58	0.00	0.00	0.00	58	0.00	0.00	0.00	58	0.00										

Dual-Audio, Log Taper Digital Potentiometers

Package Information (continued)

MAX5408/MAX5409



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