



# High-Speed, Low-Voltage, 1Ω CMOS Analog Switches/Multiplexers

## General Description

The MAX4781/MAX4782/MAX4783 are high-speed, low-voltage, low on-resistance, CMOS analog multiplexers/switches configured as an 8-channel multiplexer (MAX4781), two 4-channel multiplexers (MAX4782), and three single-pole/double-throw (SPDT) switches (MAX4783).

These devices operate with a +1.6V to +3.6V single supply. When powered from a +3V supply, MAX4781/MAX4782/MAX4783 feature a 1Ω max on-resistance ( $R_{ON}$ ), with 0.4Ω (max)  $R_{ON}$  matching between channels, and 0.2Ω (max)  $R_{ON}$  flatness. These devices handle Rail-to-Rail® analog signals and offer fast switching times of less than 25ns while consuming less than 3μW of quiescent power. They are available in space-saving 16-pin QFN (4mm x 4mm) and TSSOP packages.

## Applications

Battery-Operated Equipment  
 Audio Signal Routing  
 Low-Voltage Data-Acquisition Systems  
 Communications Circuits

*Rail-to-Rail is a registered trademark of Nippon Motorola, Ltd.*

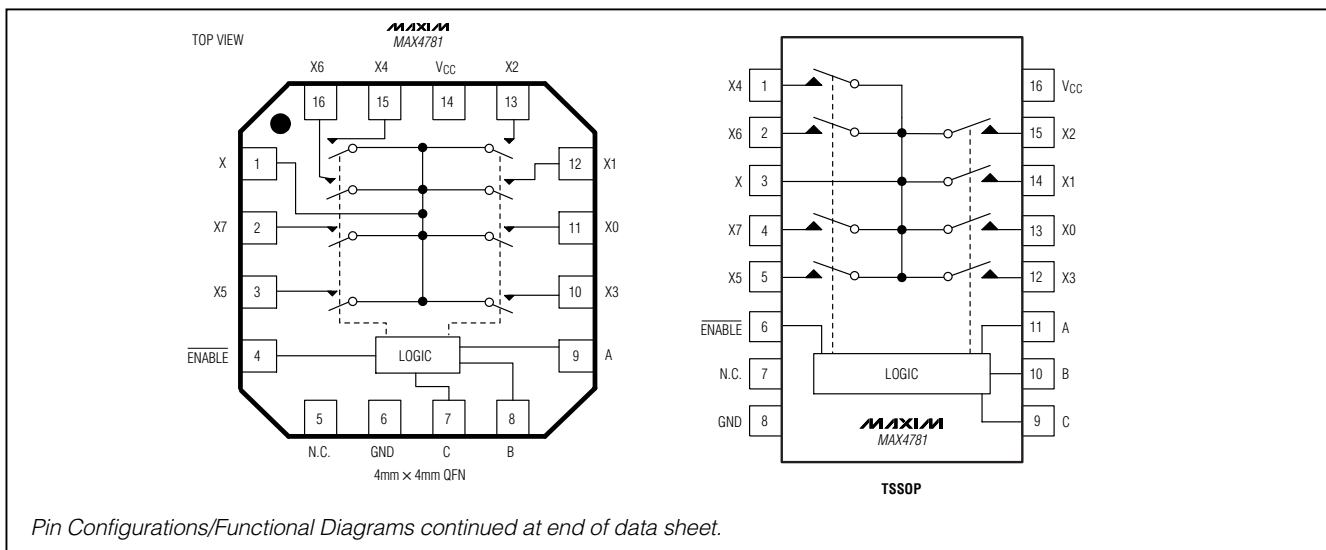
## Features

- ◆ On-Resistance
  - 1Ω (max) (+3V Supply)
  - 2.5Ω (max) (+1.8V Supply)
- ◆ On-Resistance Match Between Channels
  - 0.4Ω (max) (+3V Supply)
- ◆ On-Resistance Flatness
  - 0.2Ω (max) (+3V Supply)
- ◆ +1.6V to +3.6V Single-Supply Operation
- ◆ High-Current Handling Capacity (150mA Continuous)
- ◆ +1.8V CMOS-Logic Compatible (+3V Supply)
- ◆ Fast Switching Times:  $t_{ON} = 25ns$ ,  $t_{OFF} = 15ns$
- ◆ Pin Compatible with Industry-Standard 74HC4051/74HC4052/74HC4053 and MAX4617/MAX4618/MAX4619
- ◆ Available in 4mm x 4mm 16-Pin QFN

## Ordering Information

PART	TEMP RANGE	PIN-PACKAGE
MAX4781EUE	-40°C to +85°C	16 TSSOP
MAX4781EGE	-40°C to +85°C	16 QFN (4mm x 4mm)
MAX4782EUE	-40°C to +85°C	16 TSSOP
MAX4782EGE	-40°C to +85°C	16 QFN (4mm x 4mm)
MAX4783EUE	-40°C to +85°C	16 TSSOP
MAX4783EGE	-40°C to +85°C	16 QFN (4mm x 4mm)

## Pin Configurations/Functional Diagrams



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## ABSOLUTE MAXIMUM RATINGS

Voltages Referenced to GND	Continuous Power Dissipation
V <sub>CC</sub> , A, B, C, and $\overline{\text{ENABLE}}$ .....-0.3V to +4V	16-Pin QFN (derate 18.5mW/°C above +70°C) ..... 1481mW
Voltage at Any Other Terminal	16-Pin TSSOP (derate 5.7mW/°C above +70°C) ..... 457mW
(Note 1).....-0.3V to (V <sub>CC</sub> + 0.3V)	Operating Temperature Range .....-40°C to +85°C
Continuous Current into A, B, C, $\overline{\text{ENABLE}}$ .....±10mA	Junction Temperature .....+150°C
Continuous Current into X, Y, Z, X <sub>-</sub> , Y <sub>-</sub> , Z <sub>-</sub> .....±150mA	Storage Temperature Range .....-65°C to +150°C
Peak Current into X, Y, Z, X <sub>-</sub> , Y <sub>-</sub> , Z <sub>-</sub>	Lead Temperature (soldering, 10s) .....+300°C
(pulsed at 1ms, 10% duty cycle).....±300mA	

**Note 1:** Signals on X, Y, Z, X<sub>-</sub>, Y<sub>-</sub>, and Z<sub>-</sub> exceeding V<sub>CC</sub> or GND are clamped by internal diodes. Limit forward-diode current to maximum current rating.

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—Single +3V Supply

(V<sub>CC</sub> = +2.7V to +3.6V, GND = 0, V<sub>IH</sub> = 1.4V, V<sub>IL</sub> = 0.5V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted. Typical values are at T<sub>A</sub> = +25°C.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS	T <sub>A</sub>	MIN	TYP	MAX	UNITS
<b>ANALOG SWITCH</b>							
Analog Signal Range	V <sub>X</sub> , V <sub>Y</sub> , V <sub>Z</sub> , V <sub>X-</sub> , V <sub>Y-</sub> , V <sub>Z-</sub>			0		V <sub>CC</sub>	V
On-Resistance (Note 4)	R <sub>ON</sub>	V <sub>CC</sub> = +2.7V; I <sub>X-</sub> , I <sub>Y-</sub> , I <sub>Z-</sub> = 100mA; V <sub>X</sub> , V <sub>Y</sub> , V <sub>Z</sub> = 1.7V	+25°C		0.7	1	Ω
			T <sub>MIN</sub> to T <sub>MAX</sub>			1.2	
On-Resistance Match Between Channels (Notes 4, 5)	ΔR <sub>ON</sub>	V <sub>CC</sub> = +2.7V; I <sub>X-</sub> , I <sub>Y-</sub> , I <sub>Z-</sub> = 100mA; V <sub>X</sub> , V <sub>Y</sub> , V <sub>Z</sub> = 1.7V	+25°C		0.3	0.4	Ω
			T <sub>MIN</sub> to T <sub>MAX</sub>			0.6	
On-Resistance Flatness (Note 6)	R <sub>FLAT(ON)</sub>	V <sub>CC</sub> = +2.7V; I <sub>X-</sub> , I <sub>Y-</sub> , I <sub>Z-</sub> = 100mA; V <sub>X</sub> , V <sub>Y</sub> , V <sub>Z</sub> = 0, 0.7V, 1.7V	+25°C		0.1	0.2	Ω
			T <sub>MIN</sub> to T <sub>MAX</sub>			0.2	
X <sub>-</sub> , Y <sub>-</sub> , Z <sub>-</sub> Off-Leakage Current	I <sub>X(OFF)</sub> I <sub>Y(OFF)</sub> I <sub>Z(OFF)</sub>	V <sub>CC</sub> = +3.6V; V <sub>X-</sub> , V <sub>Y-</sub> , V <sub>Z-</sub> = 3.3V, 0.3V; V <sub>X</sub> , V <sub>Y</sub> , V <sub>Z</sub> = 0.3V, 3.3V	+25°C	-2	0.002	+2	nA
			T <sub>MIN</sub> to T <sub>MAX</sub>		-7		
X Off-Leakage Current (MAX4781 Only)	I <sub>X(OFF)</sub>	V <sub>CC</sub> = +3.6V; V <sub>X-</sub> = 3.3V, 0.3V; V <sub>X-</sub> = 0.3V, 3.3V	+25°C	-2	0.002	+2	nA
			T <sub>MIN</sub> to T <sub>MAX</sub>		-50		
X On-Leakage Current (MAX4781 Only)	I <sub>X(ON)</sub>	V <sub>CC</sub> = +3.6V V <sub>X-</sub> = 0.3V, 3.3V; V <sub>X-</sub> p = 0.3V, 3.3V or floating	+25°C	-2	0.002	+2	nA
			T <sub>MIN</sub> to T <sub>MAX</sub>		-50		
X, Y, Z Off-Leakage Current (MAX4782/MAX4783 Only)	I <sub>X(OFF)</sub> I <sub>Y(OFF)</sub> I <sub>Z(OFF)</sub>	V <sub>CC</sub> = +3.6V; V <sub>X-</sub> , V <sub>Y-</sub> , V <sub>Z-</sub> = 3.3V, 0.3V; V <sub>X</sub> , V <sub>Y</sub> , V <sub>Z</sub> = 0.3V, 3.3V	+25°C	-2	0.002	+2	nA
			T <sub>MIN</sub> to T <sub>MAX</sub>		-25		
X, Y, Z On-Leakage Current (MAX4782/MAX4783 Only)	I <sub>X(ON)</sub> I <sub>Y(ON)</sub> I <sub>Z(ON)</sub>	V <sub>CC</sub> = +3.6V; V <sub>X</sub> , V <sub>Y</sub> , V <sub>Z</sub> = 0.3V, 3.3V; V <sub>X</sub> , V <sub>Y</sub> , V <sub>Z</sub> = 0.3V, 3.3V or floating	+25°C	-2	0.002	+2	nA
			T <sub>MIN</sub> to T <sub>MAX</sub>		-25		

# High-Speed, Low-Voltage, 1Ω CMOS Analog Switches/Multiplexers

MAX4781/MAX4782/MAX4783

## ELECTRICAL CHARACTERISTICS—Single +3V Supply (continued)

(V<sub>CC</sub> = +2.7V to +3.6V, GND = 0, V<sub>IH</sub> = 1.4V, V<sub>IL</sub> = 0.5V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted. Typical values are at T<sub>A</sub> = +25°C.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS	T <sub>A</sub>	MIN	TYP	MAX	UNITS
<b>SWITCH DYNAMIC CHARACTERISTICS</b>							
Turn-On Time	t <sub>ON</sub>	V <sub>X_</sub> , V <sub>Y_</sub> , V <sub>Z_</sub> = 1.5V; R <sub>L</sub> = 50Ω; C <sub>L</sub> = 35pF; Figure 1	+25°C	11	25	ns	
			T <sub>MIN</sub> to T <sub>MAX</sub>	27			
Turn-Off Time	t <sub>OFF</sub>	V <sub>X_</sub> , V <sub>Y_</sub> , V <sub>Z_</sub> = 1.5V; R <sub>L</sub> = 50Ω; C <sub>L</sub> = 35pF; Figure 1	+25°C	4	15	ns	
			T <sub>MIN</sub> to T <sub>MAX</sub>	20			
Address Transition Time	t <sub>TRANS</sub>	V <sub>X_</sub> , V <sub>Y_</sub> , V <sub>Z_</sub> = 1.5V; R <sub>L</sub> = 50Ω; C <sub>L</sub> = 35pF; Figure 2	+25°C	11	25	ns	
			T <sub>MIN</sub> to T <sub>MAX</sub>	27			
Break-Before-Make Time (Note 7)	t <sub>BBM</sub>	V <sub>X_</sub> , V <sub>Y_</sub> , V <sub>Z_</sub> = 1.5V; R <sub>L</sub> = 50Ω; C <sub>L</sub> = 35pF; Figure 3	+25°C	18	ns		
			T <sub>MIN</sub> to T <sub>MAX</sub>	2			
Charge Injection	Q	V <sub>GEN</sub> = 0, R <sub>GEN</sub> = 0, C <sub>L</sub> = 1nF, Figure 4	+25°C	-110		pC	
Input Off-Capacitance	C <sub>X(OFF)</sub> , C <sub>Y(OFF)</sub> , C <sub>Z(OFF)</sub>	f = 1MHz, Figure 6	+25°C	38		pF	
Output Off-Capacitance	C <sub>X(OFF)</sub> , C <sub>Y(OFF)</sub> , C <sub>Z(OFF)</sub>	f = 1MHz, Figure 6	+25°C	MAX4781	310	pF	
				MAX4782	158		
				MAX4783	75		
Output On-Capacitance	C <sub>X(ON)</sub> , C <sub>Y(ON)</sub> , C <sub>Z(ON)</sub>	f = 1MHz, Figure 6	+25°C	MAX4781	380	pF	
				MAX4782	224		
				MAX4783	140		
Off-Isolation (Note 8)	V <sub>ISO</sub>	R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, Figure 5	f = 10MHz	-75	dB		
			f = 1MHz	-90			
Channel-to-Channel Crosstalk (Note 9)	V <sub>CT</sub>	R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, Figure 5	f = 10MHz	-65	dB		
			f = 1MHz	-80			
Total Harmonic Distortion	THD	f = 20Hz to 20kHz, 0.5V <sub>p-p</sub> , R <sub>L</sub> = 32Ω		0.045		%	
<b>DIGITAL I/O</b>							
Input Logic High	V <sub>IH</sub>		T <sub>MIN</sub> to T <sub>MAX</sub>	1.4		V	
Input Logic Low	V <sub>IL</sub>		T <sub>MIN</sub> to T <sub>MAX</sub>		0.5	V	
Input Leakage Current	I <sub>INL</sub>	V <sub>A</sub> , V <sub>B</sub> , V <sub>C</sub> = V <sub>ENABLE</sub> = 0 or 3.6V	T <sub>MIN</sub> to T <sub>MAX</sub>	-1	0.0005	+1	μA
<b>POWER SUPPLY</b>							
Power-Supply Range	V <sub>CC</sub>			+1.6		+3.6	V
Positive Supply Current	I <sub>CC</sub>	V <sub>CC</sub> = 3.6V; V <sub>A</sub> , V <sub>B</sub> , V <sub>C</sub> ; V <sub>ENABLE</sub> = 3.6V or 0				1	μA

# High-Speed, Low-Voltage, 1Ω CMOS Analog Switches/Multiplexers

## ELECTRICAL CHARACTERISTICS—Single +1.8V Supply

(V<sub>CC</sub> = +1.8V, GND = 0, V<sub>IH</sub> = 1V, V<sub>IL</sub> = 0.4V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted. Typical values are at T<sub>A</sub> = +25°C.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS	T <sub>A</sub>	MIN	TYP	MAX	UNITS
<b>ANALOG SWITCH</b>							
Analog Signal Range	V <sub>X-</sub> , V <sub>Y-</sub> , V <sub>Z-</sub> , V <sub>X</sub> , V <sub>Y</sub> , V <sub>Z</sub>			0		V <sub>CC</sub>	V
On-Resistance (Note 4)	R <sub>ON</sub>	V <sub>CC</sub> = 1.8V; I <sub>X-</sub> , I <sub>Y-</sub> , I <sub>Z-</sub> = 10mA; V <sub>X</sub> , V <sub>Y</sub> , V <sub>Z</sub> = 1.0V	+25°C T <sub>MIN</sub> to T <sub>MAX</sub>		1.6	2.5	Ω
On-Resistance Match Between Channels (Notes 4, 5)	ΔR <sub>ON</sub>	V <sub>CC</sub> = 1.8V; I <sub>X-</sub> , I <sub>Y-</sub> , I <sub>Z-</sub> = 10mA; V <sub>X</sub> , V <sub>Y</sub> , V <sub>Z</sub> = 1.0V	+25°C T <sub>MIN</sub> to T <sub>MAX</sub>		0.3	0.4	Ω
						0.6	
<b>SWITCH DYNAMIC CHARACTERISTICS</b>							
Turn-On Time	t <sub>ON</sub>	V <sub>X-</sub> , V <sub>Y-</sub> , V <sub>Z-</sub> = 1.0V; R <sub>L</sub> = 50Ω; C <sub>L</sub> = 35pF; Figure 1	+25°C T <sub>MIN</sub> to T <sub>MAX</sub>		17	30	ns
						32	
Turn-Off Time	t <sub>OFF</sub>	V <sub>X-</sub> , V <sub>Y-</sub> , V <sub>Z-</sub> = 1.0V; R <sub>L</sub> = 50Ω; C <sub>L</sub> = 35pF; Figure 1	+25°C T <sub>MIN</sub> to T <sub>MAX</sub>		8	20	ns
						22	
Address Transition Time	t <sub>TRANS</sub>	V <sub>X-</sub> , V <sub>Y-</sub> , V <sub>Z-</sub> = 1.0V; R <sub>L</sub> = 50Ω; C <sub>L</sub> = 35pF; Figure 2	+25°C T <sub>MIN</sub> to T <sub>MAX</sub>		17	30	ns
						32	
Break-Before-Make Time (Note 7)	t <sub>BBM</sub>	V <sub>X-</sub> , V <sub>Y-</sub> , V <sub>Z-</sub> = 1V; R <sub>L</sub> = 50Ω; C <sub>L</sub> = 35pF; Figure 3	+25°C T <sub>MIN</sub> to T <sub>MAX</sub>		26		ns
				1			
Charge Injection	Q	V <sub>GEN</sub> = 0, R <sub>GEN</sub> = 0, C <sub>L</sub> = 1nF, Figure 4	+25°C		-40		pC
<b>DIGITAL I/O</b>							
Input Logic High	V <sub>IH</sub>		T <sub>MIN</sub> to T <sub>MAX</sub>	1			V
Input Logic Low	V <sub>IL</sub>		T <sub>MIN</sub> to T <sub>MAX</sub>			0.4	V
Input Leakage Current	I <sub>IN-</sub>	V <sub>A</sub> , V <sub>B</sub> , V <sub>C</sub> = V <sub>ENABLE</sub> = 0 or 3.6V	T <sub>MIN</sub> to T <sub>MAX</sub>	-1	0.000	+1	μA
<b>POWER SUPPLY</b>							
Power-Supply Range	V <sub>CC</sub>			1.6		3.6	V
Positive Supply Current	I <sub>CC</sub>	V <sub>CC</sub> = 3.6V; V <sub>A</sub> , V <sub>B</sub> , V <sub>C</sub> , V <sub>ENABLE</sub> = 0 or 3.6V				1	μA

**Note 2:** The algebraic convention is used in this data sheet; the most negative value is shown in the minimum column.

**Note 3:** Devices are tested at maximum hot temperature and are guaranteed by design and correlation at T<sub>A</sub> = +25°C and -40°C specifications.

**Note 4:** R<sub>ON</sub> and ΔR<sub>ON</sub> matching specifications for QFN-packaged parts are guaranteed by design.

**Note 5:** ΔR<sub>ON</sub> = R<sub>ON</sub>(MAX) - R<sub>ON</sub>(MIN).

**Note 6:** Flatness is defined as the difference between the maximum and minimum value of on-resistance as measured over the specified analog signal ranges.

**Note 7:** Guaranteed by design; not production tested.

**Note 8:** Off-isolation = 20log<sub>10</sub>(V<sub>COM-</sub> / V<sub>NO</sub>), V<sub>COM-</sub> = output, V<sub>NO</sub> = input to off switch.

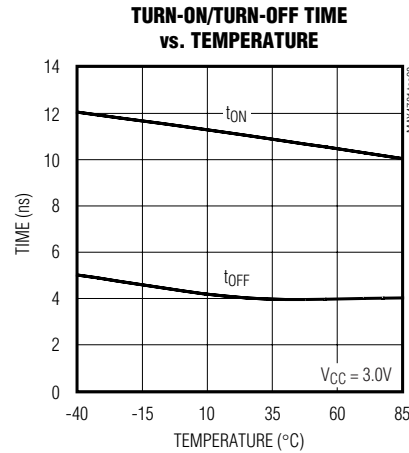
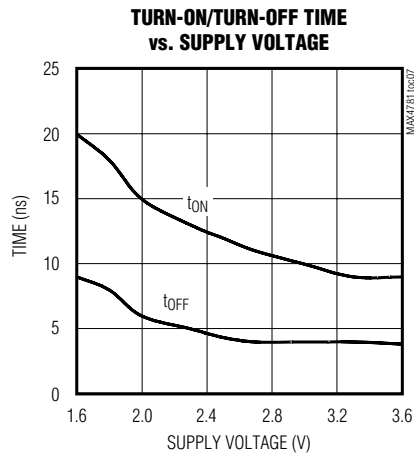
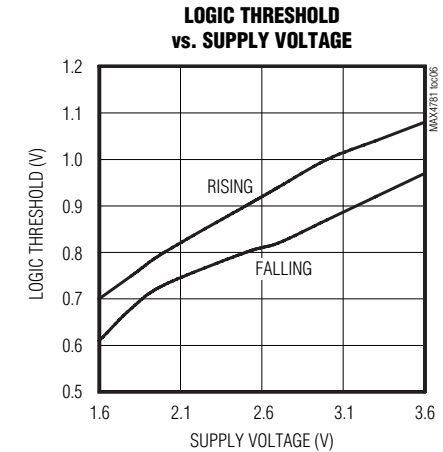
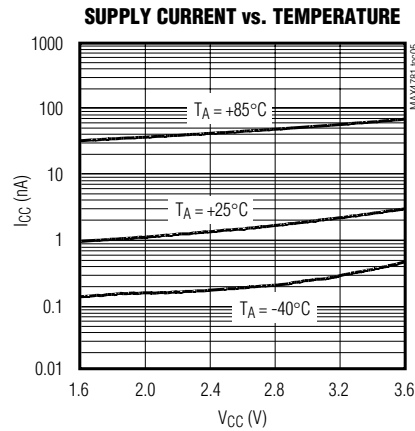
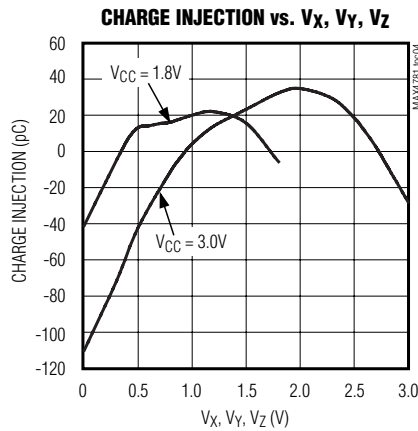
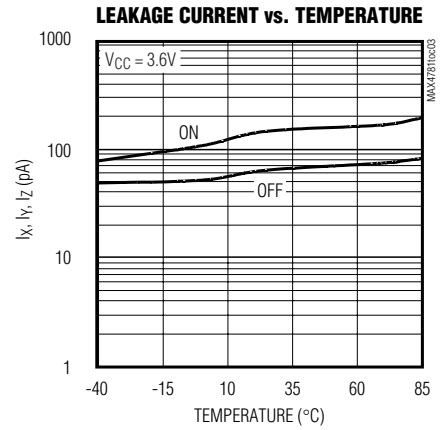
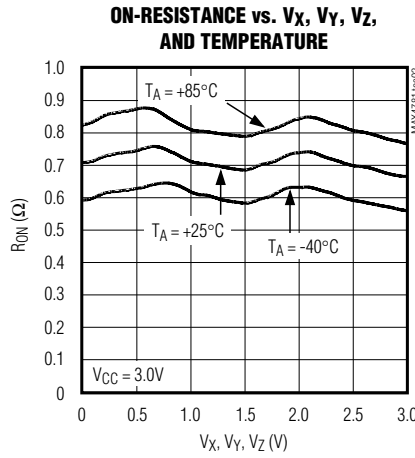
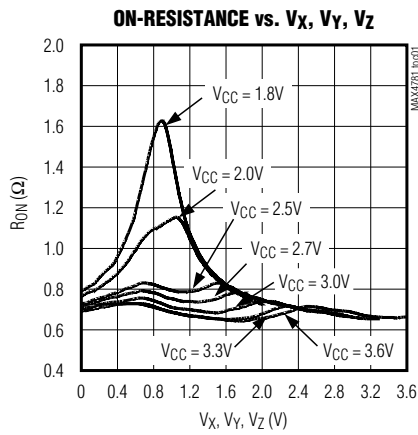
**Note 9:** Between any two channels.

# High-Speed, Low-Voltage, 1Ω CMOS Analog Switches/Multiplexers

## Typical Operating Characteristics

(GND = 0,  $T_A = +25^\circ\text{C}$ , unless otherwise noted.)

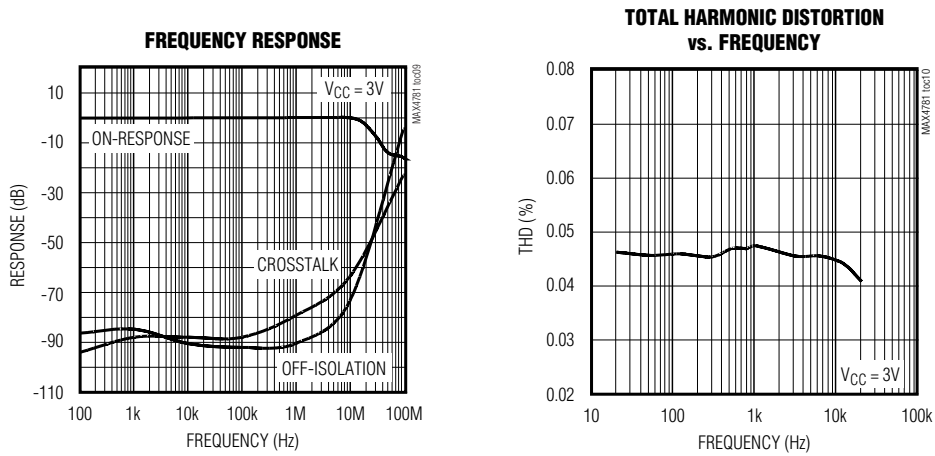
MAX4781/MAX4782/MAX4783



# High-Speed, Low-Voltage, 1Ω CMOS Analog Switches/Multiplexers

## Typical Operating Characteristics (continued)

(GND = 0, T<sub>A</sub> = +25°C, unless otherwise noted.)



## MAX4781 Pin Description

PIN		NAME	FUNCTION
TSSOP	QFN		
3	1	X	Analog Switch Output
6	4	$\overline{\text{ENABLE}}$	Digital Enable Input. Normally connect to GND. Drive to logic high to set all switches off.
7	5	N.C.	No Connection. Not internally connected.
8	6	GND	Ground
9	7	C	Digital Address C Input
10	8	B	Digital Address B Input
11	9	A	Digital Address A Input
13, 14, 15, 12, 1, 5, 2, 4	11, 12, 13, 10, 15, 3, 16, 2	X0–X7	Analog Switch Inputs X0–X7
16	14	VCC	Positive Analog and Digital Supply Voltage Input

# High-Speed, Low-Voltage, 1Ω CMOS Analog Switches/Multiplexers

## MAX4782 Pin Description

PIN		NAME	FUNCTION
TSSOP	QFN		
1, 5, 2, 4	15, 3, 16, 2	Y0–Y3	Analog Switch Y Inputs Y0–Y3
3	1	Y	Analog Switch Y Output
6	4	$\overline{\text{ENABLE}}$	Digital Enable Input. Normally connect to GND. Drive to logic high to set all switches off.
7	5	N.C.	No Connection. Not internally connected.
8	6	GND	Ground
9	7	B	Digital Address B Input
10	8	A	Digital Address A Input
12, 14, 15, 11	10, 12, 13, 9	X0–X3	Analog Switch X Inputs X0–X3
13	11	X	Analog Switch X Output
16	14	VCC	Positive Analog and Digital Supply Voltage Input

## MAX4783 Pin Description

PIN		NAME	FUNCTION
TSSOP	QFN		
1	15	Y1	Analog Switch Y Normally Open Input
2	16	Y0	Analog Switch Y Normally Closed Input
3	1	Z1	Analog Switch Z Normally Open Input
4	2	Z	Analog Switch Z Output
5	3	Z0	Analog Switch Z Normally Closed Input
6	4	$\overline{\text{ENABLE}}$	Digital Enable Input. Normally connect to GND. Drive to logic high to set all switches off.
7	5	N.C.	No Connection. Not internally connected.
8	6	GND	Ground
9	7	C	Digital Address C Input
10	8	B	Digital Address B Input
11	9	A	Digital Address A Input
12	10	X0	Analog Switch X Normally Closed Input
13	11	X1	Analog Switch X Normally Open Input
14	12	X	Analog Switch X Output
15	13	Y	Analog Switch Y Output
16	14	VCC	Positive Analog and Digital Supply Voltage Input

MAX4781/MAX4782/MAX4783

# High-Speed, Low-Voltage, $1\Omega$ CMOS Analog Switches/Multiplexers

## Applications Information

### Power-Supply Considerations

#### Overview

The MAX4781/MAX4782/MAX4783 construction is typical of most CMOS analog switches. There are two supply inputs:  $V_{CC}$  and GND.  $V_{CC}$  and GND drive the internal CMOS switches and set the limits of the analog voltage on any switch. Internal reverse ESD-protection diodes are connected between each analog signal input and both  $V_{CC}$  and GND. If any analog signal exceeds  $V_{CC}$  or GND, one of these diodes conducts. During normal operation, these and other reverse-biased ESD diodes leak, forming the only current drawn from  $V_{CC}$  or GND.

Virtually all the analog leakage current comes from the ESD diodes. Although the ESD diodes on a given signal input are identical and therefore fairly well balanced, they are reverse-biased differently. Each diode is biased by either  $V_{CC}$  or GND and the analog signal. Their leakages vary as the signal varies. The difference in the two diodes' leakages to  $V_{CC}$  and GND constitutes the analog-signal-path leakage current. All analog leakage current flows between each input and one of the supply terminals, not to the other switch terminal. Both sides of a given switch can show leakage currents of either the same or opposite polarity.

$V_{CC}$  and GND power the internal logic and set the input logic limits. Logic inputs have ESD-protection diodes to ground.

#### Power Supply

The MAX4781/MAX4782/MAX4783 operate from a single supply between +1.6V and +3.6V. Switch on-resistance increases as the supply voltage is lowered.

### High-Frequency Performance

In  $50\Omega$  systems, signal response is reasonably flat up to 50MHz (see the *Typical Operating Characteristics*). Above 20MHz, the on-response has several minor peaks that are highly layout dependent. In the off state, the switch acts like a capacitor and passes higher frequencies with less attenuation. At 10MHz, off-isolation is approximately -50dB in  $50\Omega$  systems, becoming worse (approximately 20dB per decade) as frequency increases. Higher circuit impedance also degrades off-isolation. Adjacent channel attenuation is approximately 3dB above that of a bare IC socket and is entirely because of capacitive coupling.

### Pin Nomenclature

The MAX4781/MAX4782/MAX4783 are pin compatible with the industry-standard 74HC4051/74HC4052/74HC4053 and the MAX4617/MAX4618/MAX4619. In single-supply applications, they function identically and have identical logic diagrams, although these parts differ electrically. The pin designations and logic diagrams in this data sheet conform to the original 1972 specifications published by RCA for the CD4051/CD4052/CD4053. These designations differ from the standard Maxim switch and mux designations found on other Maxim data sheets such as the MAX4051/MAX4052/MAX4053. Designers who are more comfortable with Maxim's standard designations are advised that the pin designations and logic diagrams on the MAX4051/MAX4052/MAX4053 data sheet can be applied to the MAX4781/MAX4782/MAX4783.



# High-Speed, Low-Voltage, 1Ω CMOS Analog Switches/Multiplexers

MAX4781/MAX4782/MAX4783

Table 1. Truth Table/Switch Programming

ENABLE INPUT	SELECT INPUT			ON SWITCHES		
	C*	B	A	MAX4781	MAX4782	MAX4783
H	✓	✓	✓	All switches open	All switches open	All switches open
L	L	L	L	X-X0	X-X0 Y-Y0	X-X0 Y-Y0 Z-Z0
L	L	L	H	X-X1	X-X1 Y-Y1	X-X1 Y-Y0 Z-Z0
L	L	H	L	X-X2	X-X2 Y-Y2	X-X0 Y-Y1 Z-Z0
L	L	H	H	X-X3	X-X3 Y-Y3	X-X1 Y-Y1 Z-Z0
L	H	L	L	X-X4	X-X0 Y-Y0	X-X0 Y-Y0 Z-Z1
L	H	L	H	X-X5	X-X1 Y-Y1	X-X1 Y-Y0 Z-Z1
L	H	H	L	X-X6	X-X2 Y-Y2	X-X0 Y-Y1 Z-Z1
L	H	H	H	X-X7	X-X3 Y-Y3	X-X1 Y-Y1 Z-Z1

✓ = Don't care.

\*Not present on MAX4782.

**Note:** Input and output pins are identical and interchangeable. Either can be considered an input or output. Signals pass equally well in either direction.

# High-Speed, Low-Voltage, 1Ω CMOS Analog Switches/Multiplexers

## Test Circuits/Timing Diagrams

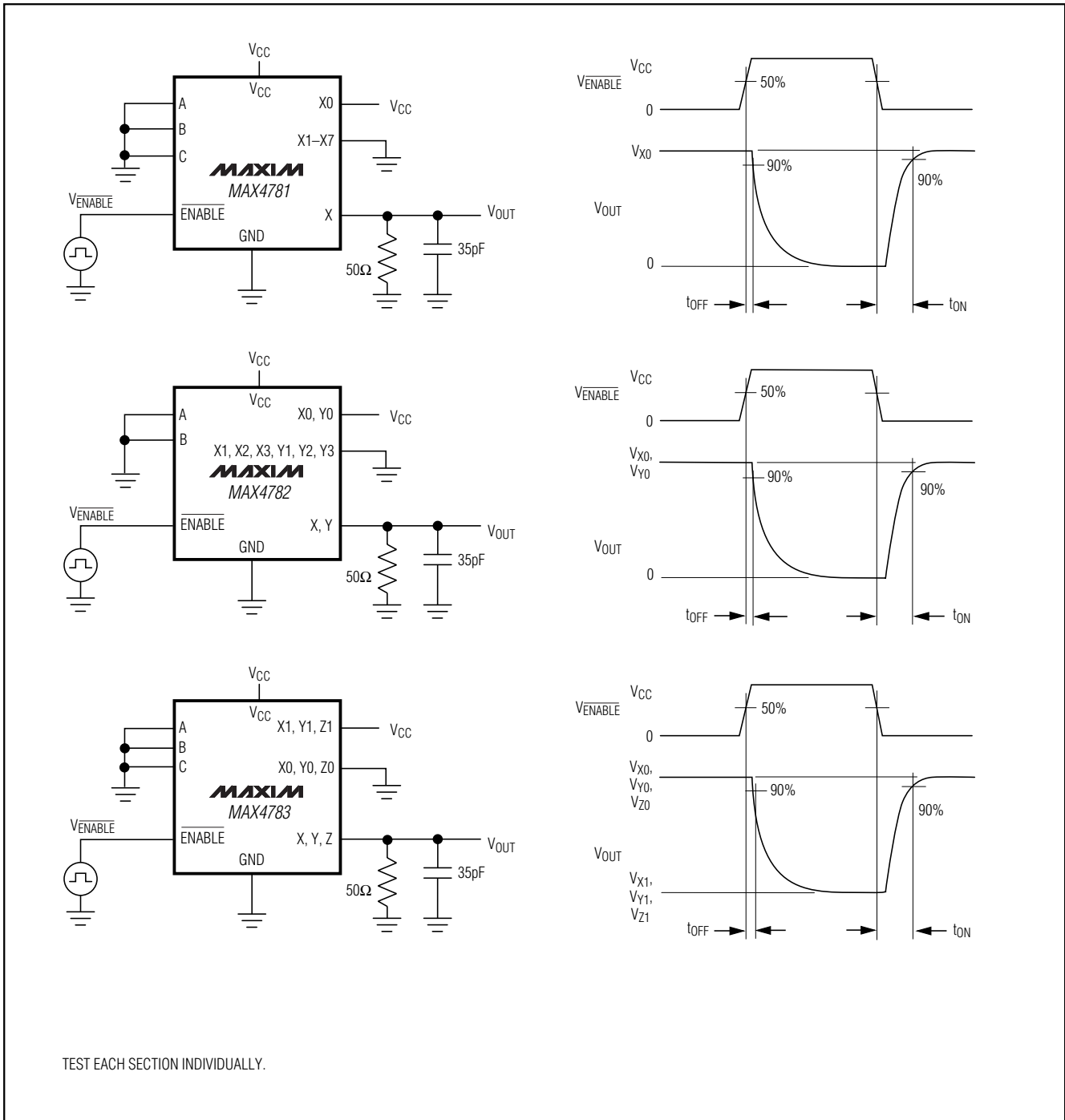


Figure 1. Enable Switching Times

# High-Speed, Low-Voltage, 1Ω CMOS Analog Switches/Multiplexers

## Test Circuits/Timing Diagrams (continued)

MAX4781/MAX4782/MAX4783

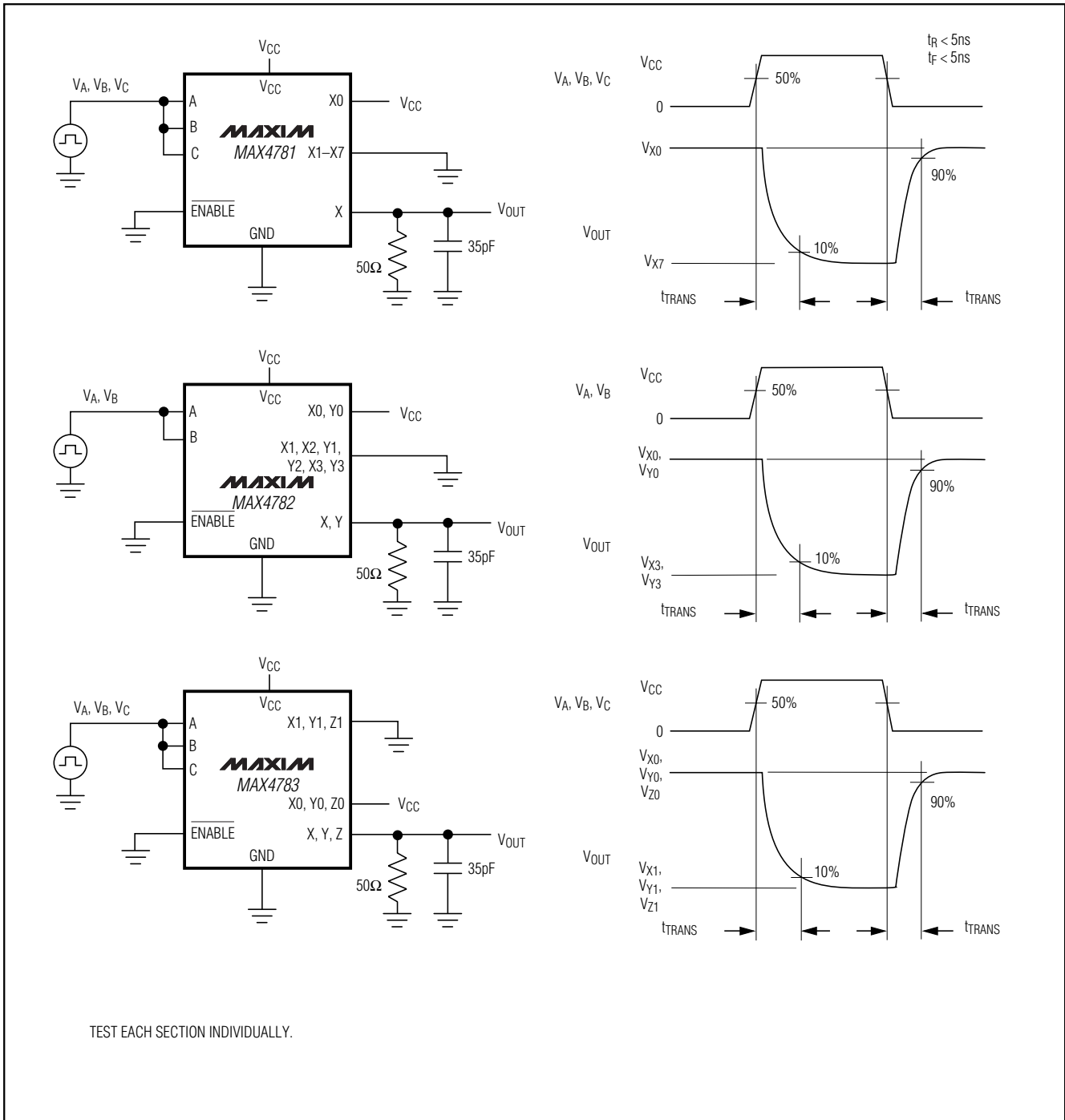


Figure 2. Address Transition Times

# High-Speed, Low-Voltage, 1Ω CMOS Analog Switches/Multiplexers

## Test Circuits/Timing Diagrams (continued)

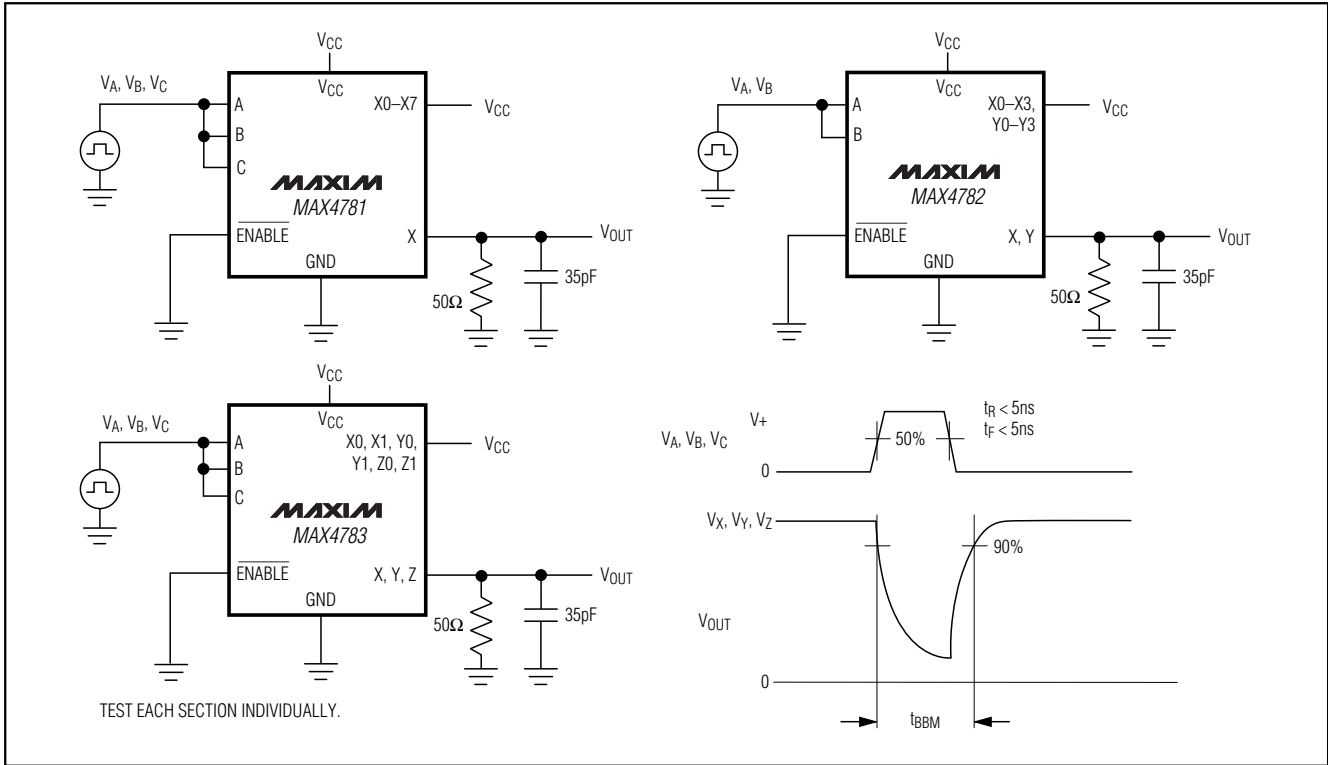


Figure 3. Break-Before-Make Interval

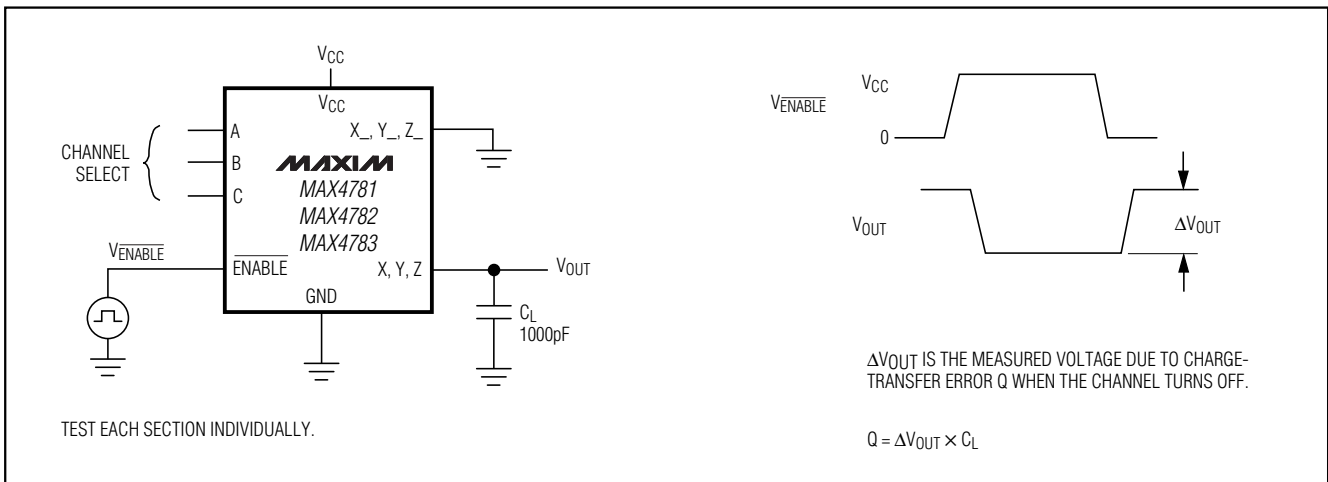


Figure 4. Charge Injection

# High-Speed, Low-Voltage, 1Ω CMOS Analog Switches/Multiplexers

## Test Circuits/Timing Diagrams (continued)

MAX4781/MAX4782/MAX4783

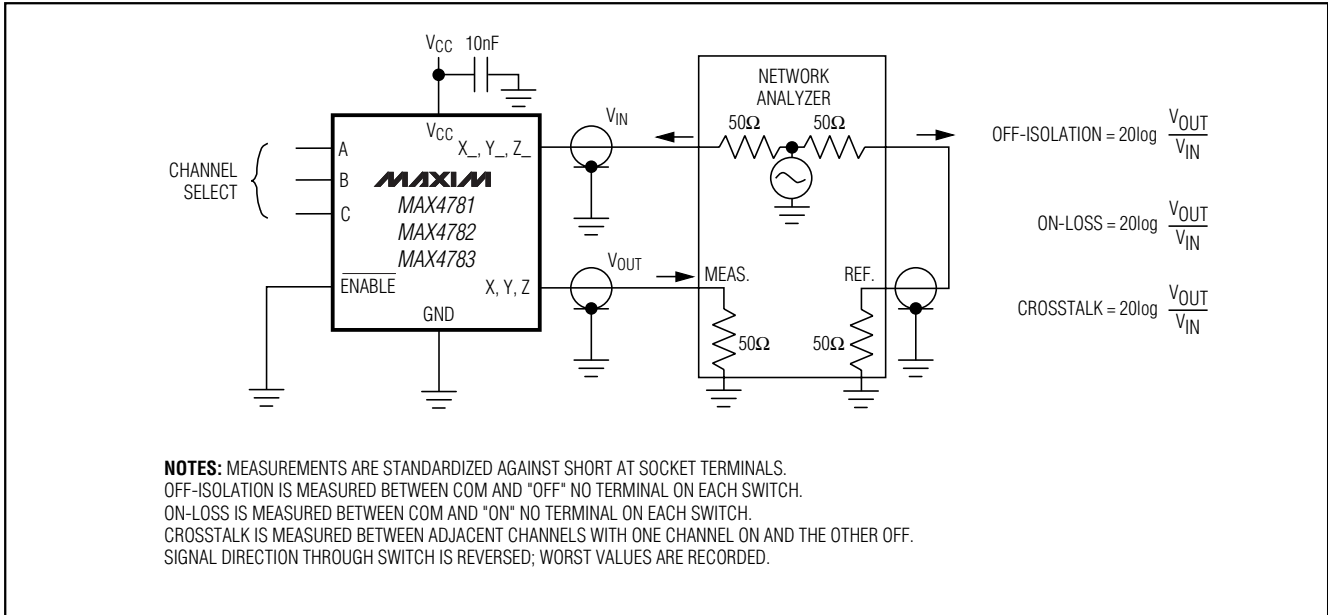


Figure 5. Off-Isolation, On-Loss, and Crosstalk

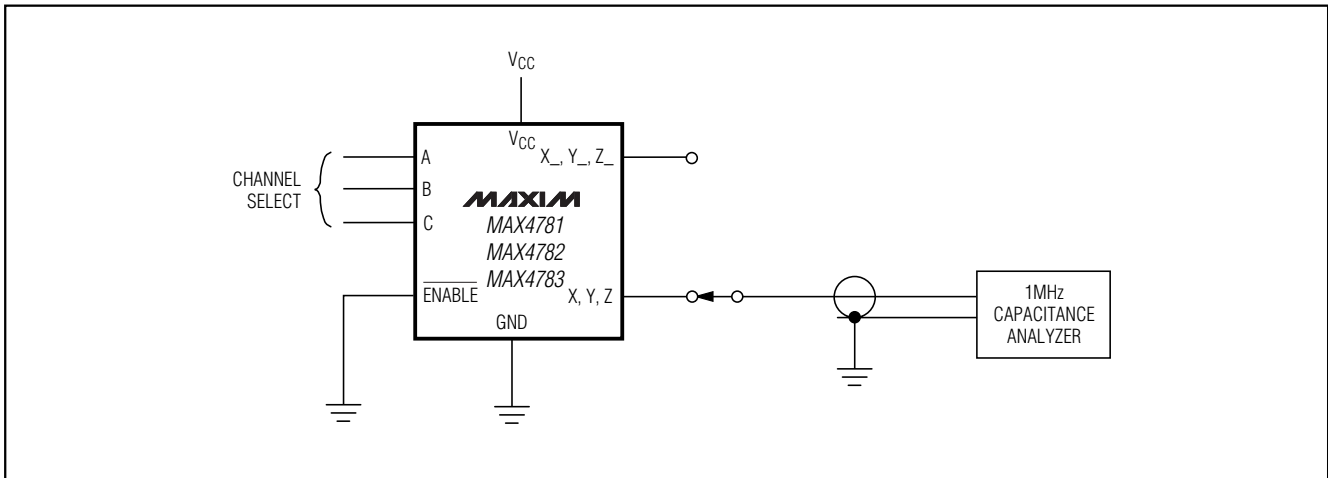


Figure 6. Capacitance

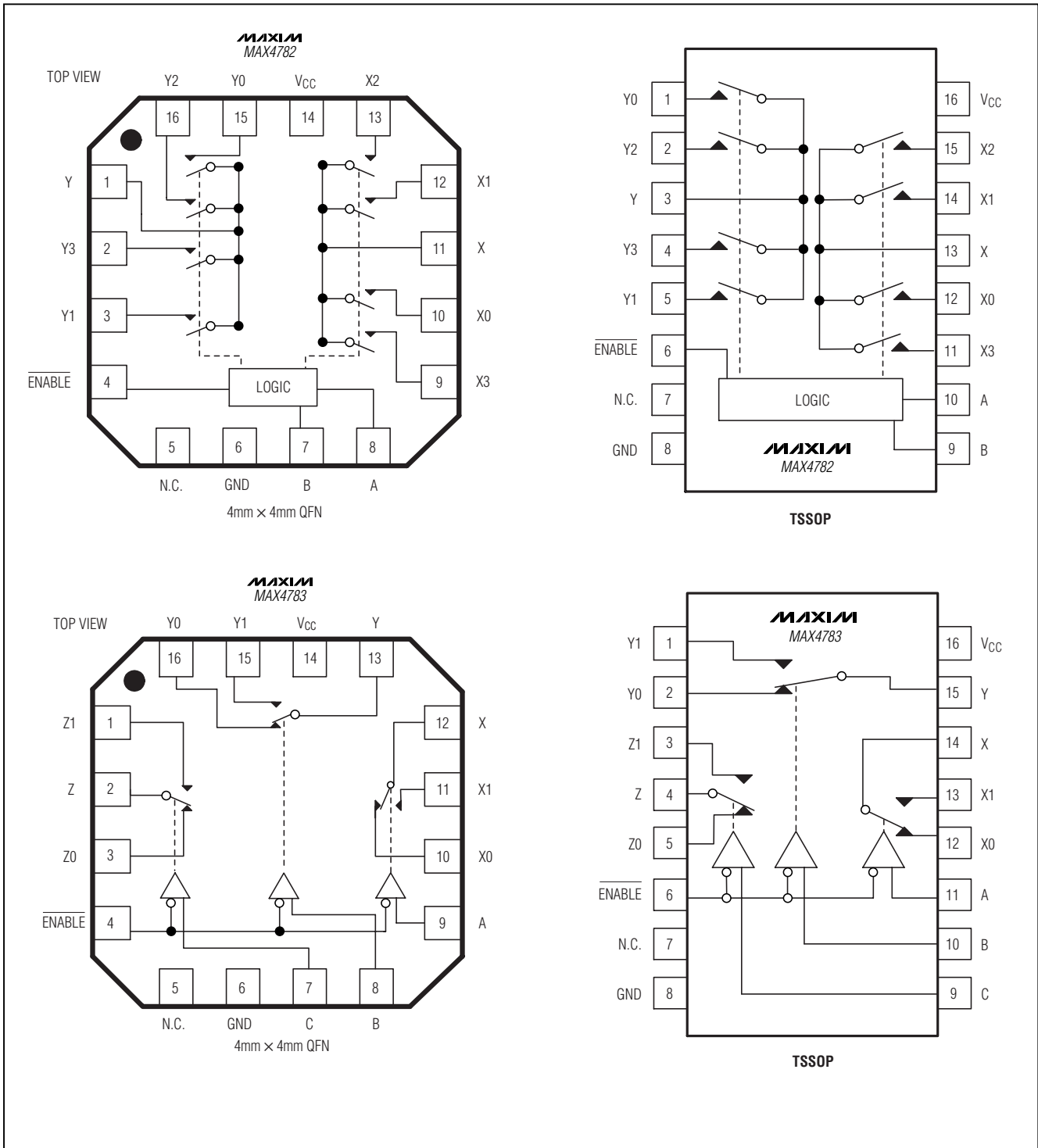
## Chip Information

TRANSISTOR COUNT: 659

PROCESS: CMOS

# High-Speed, Low-Voltage, 1Ω CMOS Analog Switches/Multiplexers

## Pin Configurations/Functional Diagrams (continued)



# High-Speed, Low-Voltage, 1Ω CMOS Analog Switches/Multiplexers

## Package Information

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to [www.maxim-ic.com/packages](http://www.maxim-ic.com/packages).)

MAX4781/MAX4782/MAX4783

TSSOP4, 4.0mm, EPS

	COMMON DIMENSIONS			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	—	1.10	—	.043
A <sub>1</sub>	0.05	0.15	.002	.006
A <sub>2</sub>	0.85	0.95	.033	.037
b	0.19	0.30	.007	.012
b <sub>1</sub>	0.19	0.25	.007	.010
c	0.09	0.20	.004	.008
c <sub>1</sub>	0.09	0.14	.004	.006
D	SEE VARIATIONS		SEE VARIATIONS	
E	4.30	4.50	.169	.177
e	0.65 BSC		.026 BSC	
H	6.25	6.55	.246	.258
L	0.50	0.70	.020	.028
N	SEE VARIATIONS		SEE VARIATIONS	
α	0°	8°	0°	8°

JEDEC	N		VARIATIONS			
			MILLIMETERS		INCHES	
			MIN.	MAX.	MIN.	MAX.
AB-1	14	D	4.90	5.10	.193	.201
AB	16	D	4.90	5.10	.193	.201
AC	20	D	6.40	6.60	.252	.260
AD	24	D	7.70	7.90	.303	.311
AE	28	D	9.60	9.80	.378	.386

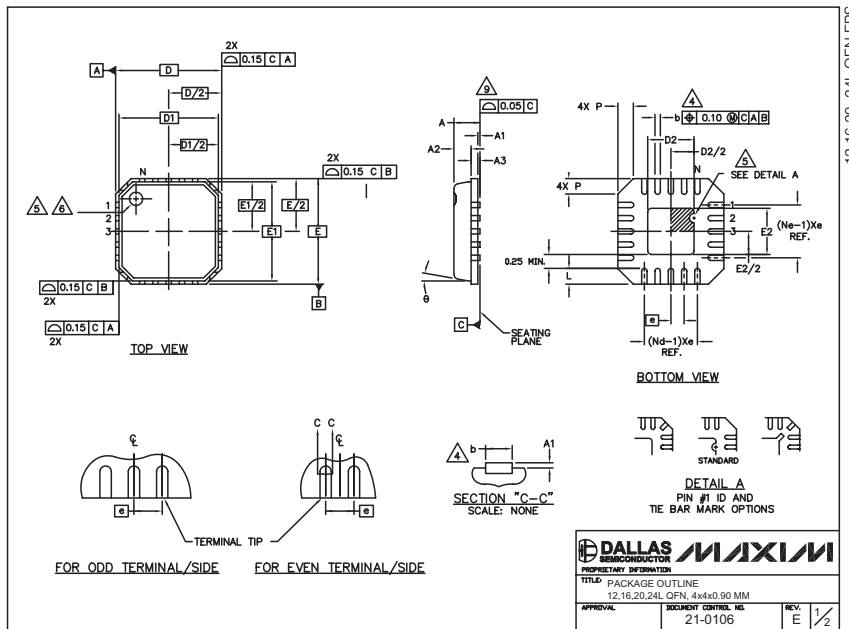
**NOTES:**

- DIMENSIONS D AND E DO NOT INCLUDE FLASH
- MOLD FLASH OR PROTRUSIONS NOT TO EXCEED 0.15mm PER SIDE
- CONTROLLING DIMENSION: MILLIMETER
- MEETS JEDEC OUTLINE MO-153. SEE JEDEC VARIATIONS TABLE
- 'N' REFERS TO NUMBER OF LEADS
- THE LEAD TIPS MUST LIE WITHIN A SPECIFIED ZONE. THIS TOLERANCE ZONE IS DEFINED BY TWO PARALLEL PLANES. ONE PLANE IS THE SEATING PLANE, DATUM [-C-]; THE OTHER PLANE IS AT THE SPECIFIED DISTANCE FROM [-C-] IN THE DIRECTION INDICATED

# High-Speed, Low-Voltage, 1Ω CMOS Analog Switches/Multiplexers

## Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to [www.maxim-ic.com/packages](http://www.maxim-ic.com/packages).)



12,16,20, 24L QFN EPS

**NOTES:**

- DIE THICKNESS ALLOWABLE IS 0.305mm MAXIMUM (.012 INCHES MAXIMUM).
- DIMENSIONING & TOLERANCES CONFORM MUST TO ASME Y14.5M. - 1994.
- N IS THE NUMBER OF TERMINALS.  
 Nd IS THE NUMBER OF TERMINALS IN X-DIRECTION &  
 Ne IS THE NUMBER OF TERMINALS IN Y-DIRECTION.
- DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.20 AND 0.25mm FROM TERMINAL TIP.
- THE PIN #1 IDENTIFIER MUST BE EXISTED ON THE TOP SURFACE OF THE PACKAGE BY USING INDENTATION MARK OR INK/LASER MARKED. DETAILS OF PIN #1 IDENTIFIER IS OPTIONAL, BUT MUST BE LOCATED WITHIN DIMENSIONS INDICATED.
- EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- PACKAGE WARPAGE MAX 0.05mm.
- APPLIED FOR EXPOSED PAD AND TERMINALS. EXCLUDE EMBEDDING PART OF EXPOSED PAD FROM MEASURING.
- MEETS JEDEC MO220; EXCEPT DIMENSION "b".
- THIS PACKAGE OUTLINE APPLIES TO PUNCHED QFN (STEPPED SIDES).

DIM.	COMMON DIMENSIONS		
	MIN.	NOM.	MAX.
A	0.80	0.90	1.00
A1	0.00	0.01	0.05
A2	0.00	0.65	0.80
A3	0.20 REF.		
D	4.00 BSC		
D1	3.75 BSC		
E	4.00 BSC		
E1	3.75 BSC		
θ	0°	-	12°
P	0.24	0.42	0.60

PKG. CODE	PITCH VARIATION A			N	PITCH VARIATION B			Nd	PITCH VARIATION C			Ne	PITCH VARIATION D		
	MIN.	NOM.	MAX.		MIN.	NOM.	MAX.		MIN.	NOM.	MAX.		MIN.	NOM.	MAX.
	0.80 BSC				0.65 BSC				0.50 BSC				0.50 BSC		
G1244-2	1.95	2.10	2.25	3	1.95	2.10	2.25	3	1.95	2.10	2.25	3	1.95	2.10	2.25
G1644-1	1.95	2.10	2.25	3	1.95	2.10	2.25	3	1.95	2.10	2.25	3	1.95	2.10	2.25
G2044-3	1.95	2.10	2.25	3	1.95	2.10	2.25	3	1.95	2.10	2.25	3	1.95	2.10	2.25
G2044-4	1.55	1.70	1.85	4	1.55	1.70	1.85	4	1.55	1.70	1.85	4	1.55	1.70	1.85
G2444-1	1.95	2.10	2.25	3	1.95	2.10	2.25	3	1.95	2.10	2.25	3	1.95	2.10	2.25

PKG. CODE	EXPOSED PAD VARIATION					
	D2		E2		E2	
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
G1244-2	1.95	2.10	2.25	1.95	2.10	2.25
G1644-1	1.95	2.10	2.25	1.95	2.10	2.25
G2044-3	1.95	2.10	2.25	1.95	2.10	2.25
G2044-4	1.55	1.70	1.85	1.55	1.70	1.85
G2444-1	1.95	2.10	2.25	1.95	2.10	2.25

**DALLAS SEMICONDUCTOR MAXIM**  
 PROPRIETARY INFORMATION  
 TITLE: PACKAGE OUTLINE  
 12,16,20,24L QFN, 4x4x0.90 MM  
 APPROVAL: \_\_\_\_\_ DOCUMENT CONTROL NO: 21-0106 REV: E 2/2

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