



# 2.7Gbps Dual Mux/Buffer with Loopback

**MAX3783**

## General Description

The MAX3783 is a dual serial multiplexer (mux) and buffer with selectable line-side loopback for system interconnect and serial backplane applications up to 2.7Gbps. Each independent channel consists of a transmitter with fanout of two and a receiver with a 2:1 input mux. Selectable loopback paths support system testing.

Operating from a single 3.3V supply, this device has current-mode logic (CML) inputs and outputs, which can be AC-coupled for PECL compatibility, if desired. The IC is packaged in a compact 48-pin TQFP-EP package with exposed pad. Typical power consumption is 1.12W.

## Applications

- 2.7Gbps Serial Communications
- System Interconnect
- Serial Backplane
- Fail-Over and Protection Switching

## Features

- ◆ Provides Redundant Serial I/O
- ◆ 11 ps Deterministic Jitter
- ◆ Selectable Loopback
- ◆ On-Chip 50Ω Termination Resistors
- ◆ 3.3V Power Supply
- ◆ Two-Port Integration

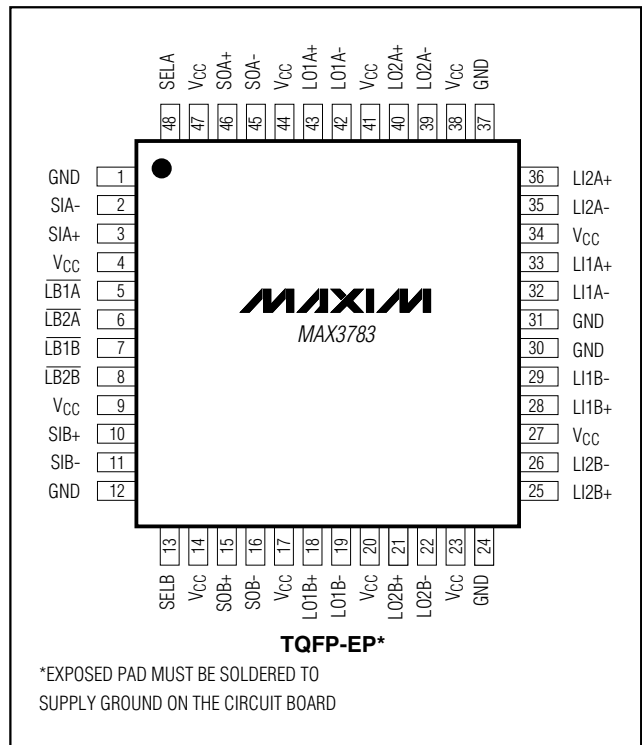
## Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE
MAX3783UCM	0°C to +85°C	48 TQFP-EP*

\* Exposed pad

## Pin Configuration

Typical Application Circuit appears at end of data sheet.



## 2.7Gbps Dual Mux/Buffer with Loopback

### ABSOLUTE MAXIMUM RATINGS

Supply Voltage, $V_{CC}$ .....	-0.5V to 4.0V	Continuous Power Dissipation ( $T_A = +85^\circ\text{C}$ )	
Continuous Current at Serial Outputs .....	$\pm 36\text{mA}$	48-Pin TQFP-EP (derate $27\text{mW}/^\circ\text{C}$ above $+85^\circ\text{C}$ ) .....	1.76W
Voltage at SEL_, $\overline{\text{LB}}$ _ Pins .....	-0.5V to ( $V_{CC} + 0.5\text{V}$ )	Storage Ambient Temperature .....	$-55^\circ\text{C}$ to $+150^\circ\text{C}$
Common-Mode Input Voltage ( $\text{SI}_-$ , $\text{LI}_-$ ) .....	-0.5V to ( $V_{CC} + 0.5\text{V}$ )	Lead Temperature (soldering, 10s) .....	$+300^\circ\text{C}$
Differential Input Voltage ( $\text{SI}_-$ , $\text{LI}_-$ ) (Note 1) .....	$\pm 2.8\text{V}$		

**Note 1:** The sum of the common-mode voltage and differential voltage on any input pin must be within -0.5V to ( $V_{CC} + 0.5\text{V}$ ).

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

( $V_{CC} = 3.0\text{V}$  to  $3.6\text{V}$ , serial data rate =  $2.75\text{Gbps}$ ,  $T_A = 0^\circ\text{C}$  to  $+85^\circ\text{C}$ . Typical values at  $V_{CC} = 3.3\text{V}$ ,  $T_A = +25^\circ\text{C}$ , unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Maximum Serial Data Rate			2.75	3.125		Gbps
Power Dissipation		AC-coupled inputs, outputs		1.12	1.68	W
Supply Current	$I_{CC}$			340	466	mA
CML Differential Output Voltage	$V_{OD}$	$R_L = 50\Omega$ to $V_{CC}$ , or $100\Omega$ differential (Note 2)	1200	1500	2200	mVp-p
CML Differential Input Voltage	$V_{ID}$		200	1600	2200	mVp-p
CML Output Impedance	$R_{OUT}$	Single ended	42.5	50	57.5	$\Omega$
CML Input Impedance	$R_{IN}$	Differential	85	100	116	$\Omega$
Random Jitter		(Note 3)		1	2	psRMS
Deterministic Jitter		(Notes 3, 4, 5)		11	25	psp-p
CML Output Edge Speed (20% to 80%)	$t_R, t_F$	2.5Gbps input (Note 3)		70	135	ps
		1.25Gbps input (Note 3)		80	200	
Propagation Delay		$\text{LI}_-$ to $\text{SO}_-$ , $\text{SI}_-$ to $\text{LO}_-$ , $\text{LI}_-$ to $\text{LO}_-$ (Note 3)		340	500	ps
Multiplexer Switch Time		SEL_ or $\overline{\text{LB}}$ _ to valid output		9		ns
TTL Input Current High		$V_{IH} = +2.0\text{V}$ to ( $V_{CC} + 0.3\text{V}$ )			180	$\mu\text{A}$
TTL Input Current Low		$V_{IL} = -0.3\text{V}$ to $+0.8\text{V}$			440	$\mu\text{A}$

**Note 2:** Typical value measured using a repeating 1010 pattern at 500Mbps.

**Note 3:** AC specifications are guaranteed by design and characterization.

**Note 4:** Deterministic jitter is measured with a repeating K28.5 pattern.

**Note 5:** With the peak-to-peak input swing on the selected (transmitted) CML input equal to or greater than that on the nonselected inputs.

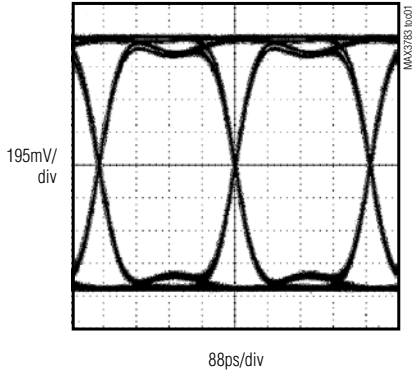
# 2.7Gbps Dual Mux/Buffer with Loopback

## Typical Operating Characteristics

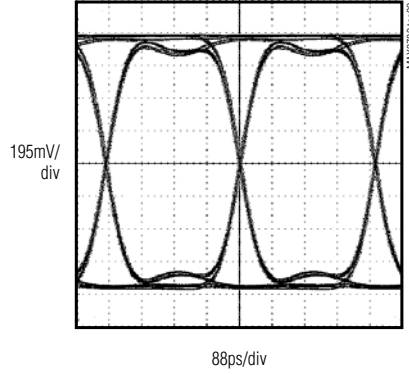
( $V_{CC} = 3.3V$ ,  $T_A = +25^\circ C$ , unless otherwise noted.)

**MAX3783**

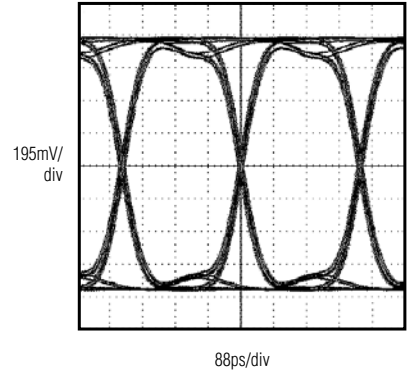
**ELECTRICAL EYE DIAGRAM**  
2.75 Gbps, 2<sup>23</sup> - 1 PRBS PATTERN



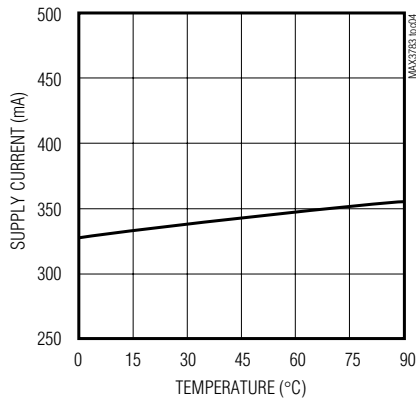
**ELECTRICAL EYE DIAGRAM**  
2.75 Gbps, K28.5 PATTERN



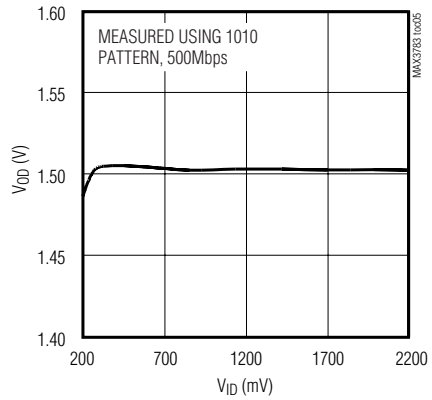
**ELECTRICAL EYE DIAGRAM**  
3.125 Gbps, K28.5 PATTERN



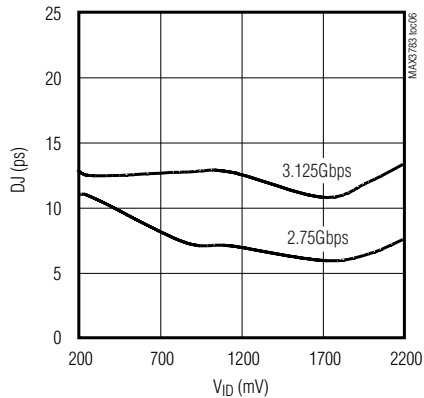
**SUPPLY CURRENT vs. TEMPERATURE**



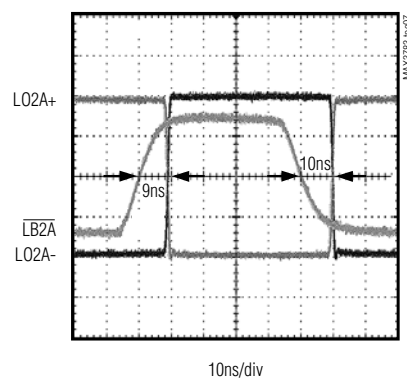
**CML DIFFERENTIAL OUTPUT VOLTAGE vs. CML DIFFERENTIAL INPUT VOLTAGE**



**DETERMINISTIC JITTER vs. CML DIFFERENTIAL INPUT VOLTAGE**



**MULTIPLEXER SWITCH TIME**



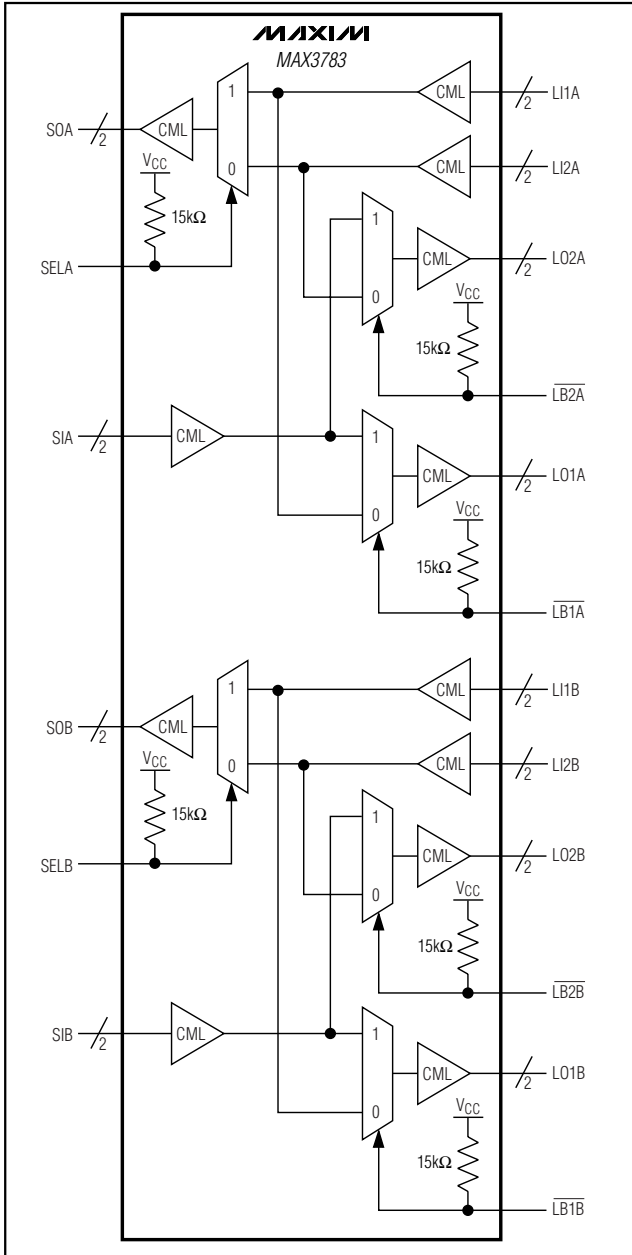
## 2.7Gbps Dual Mux/Buffer with Loopback

### Pin Description

PIN	NAME	FUNCTION
1, 12, 24, 30, 31, 37	GND	Supply Ground
2	SIA-	Serial Input A Negative, CML
3	SIA+	Serial Input A Positive, CML
4, 9, 14, 17, 20, 23, 27, 34, 38, 41, 44, 47	VCC	+3.3V Supply
5	$\overline{\text{LB1A}}$	Line Out 1A Loopback Mode Select. TTL low selects loopback.
6	$\overline{\text{LB2A}}$	Line Out 2A Loopback Mode Select. TTL low selects loopback.
7	$\overline{\text{LB1B}}$	Line Out 1B Loopback Mode Select. TTL low selects loopback.
8	$\overline{\text{LB2B}}$	Line Out 2B Loopback Mode Select. TTL low selects loopback.
10	SIB+	Serial Input B Positive, CML
11	SIB-	Serial Input B Negative, CML
13	SELB	Serial Output B Input Select, TTL
15	SOB+	Serial Output B Positive, CML
16	SOB-	Serial Output B Negative, CML
18	LO1B+	Line Out 1B Positive, CML
19	LO1B-	Line Out 1B Negative, CML
21	LO2B+	Line Out 2B Positive, CML
22	LO2B-	Line Out 2B Negative, CML
25	LI2B+	Line In 2B Positive, CML
26	LI2B-	Line In 2B Negative, CML
28	LI1B+	Line In 1B Positive, CML
29	LI1B-	Line In 1B Negative, CML
32	LI1A-	Line In 1A Negative, CML
33	LI1A+	Line In 1A Positive, CML
35	LI2A-	Line In 2A Negative, CML
36	LI2A+	Line In 2A Positive, CML
39	LO2A-	Line Out 2A Negative, CML
40	LO2A+	Line Out 2A Positive, CML
42	LO1A-	Line Out 1A Negative, CML
43	LO1A+	Line Out 1A Positive, CML
45	SOA-	Serial Output A Negative, CML
46	SOA+	Serial Output A Positive, CML
48	SELA	Serial Out A Input Select, TTL
EP	Exposed Pad	Ground. Must be soldered to the circuit board for proper thermal and electrical performance (see <i>EP Package</i> ).

# 2.7Gbps Dual Mux/Buffer with Loopback

## Functional Diagram



## Detailed Description

The MAX3783 is a 2.7Gbps dual serial mux/buffer with selectable line-side loopback for system test. Each half of the MAX3783 provides a transmitter with a fanout of two and a receiver with a 2:1 mux, as shown in the functional diagram.

## Input Stages

The input amplifiers accept CML or AC-coupled PECL signals and each input has an on-chip 100Ω differential impedance for optimal termination, as shown in Figure 1.

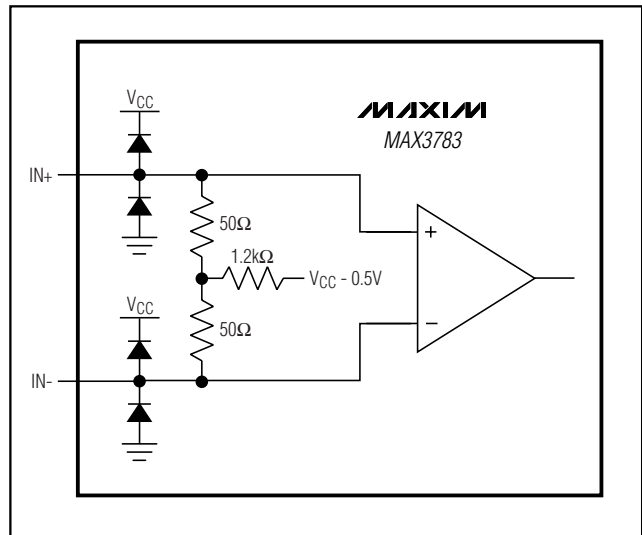


Figure 1. Input Structure

## Control Lines

TTL-compatible control lines are provided to select the MAX3783's operating mode (Table 1). SELA and SELB set the mux for channels A and B, respectively, to select LI1\_ or LI2\_ to connect to the SO\_ output. LB1A, LB1B, LB2A, and LB2B enable loopback mode for each of the four LO\_ outputs. All control lines are internally pulled high through 15kΩ resistors.

Table 1. Operating Modes

SEL_	SO_
0	LI2_
1	LI1_

LB_	LO_
0	LI_
1	SI_

## Output Buffers

The outputs are high-speed CML interfaces with 50Ω back termination, as shown in Figure 2.

## Exposed-Pad (EP) Package

The exposed pad on the 48-pin TQFP-EP provides a very low thermal-resistance path for heat removal from the IC. The pad is also electrical ground on the MAX3783 and must be soldered to the circuit board for proper thermal and electrical performance.

# 2.7Gbps Dual Mux/Buffer with Loopback

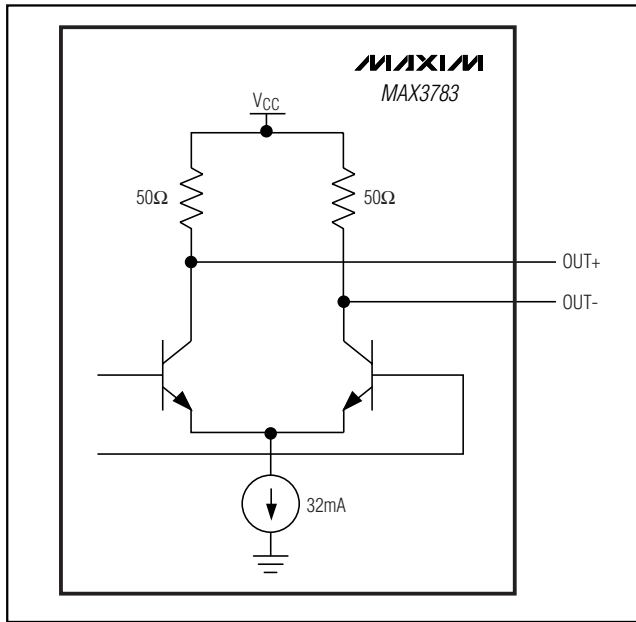


Figure 2. CML Output Structure

## Chip Information

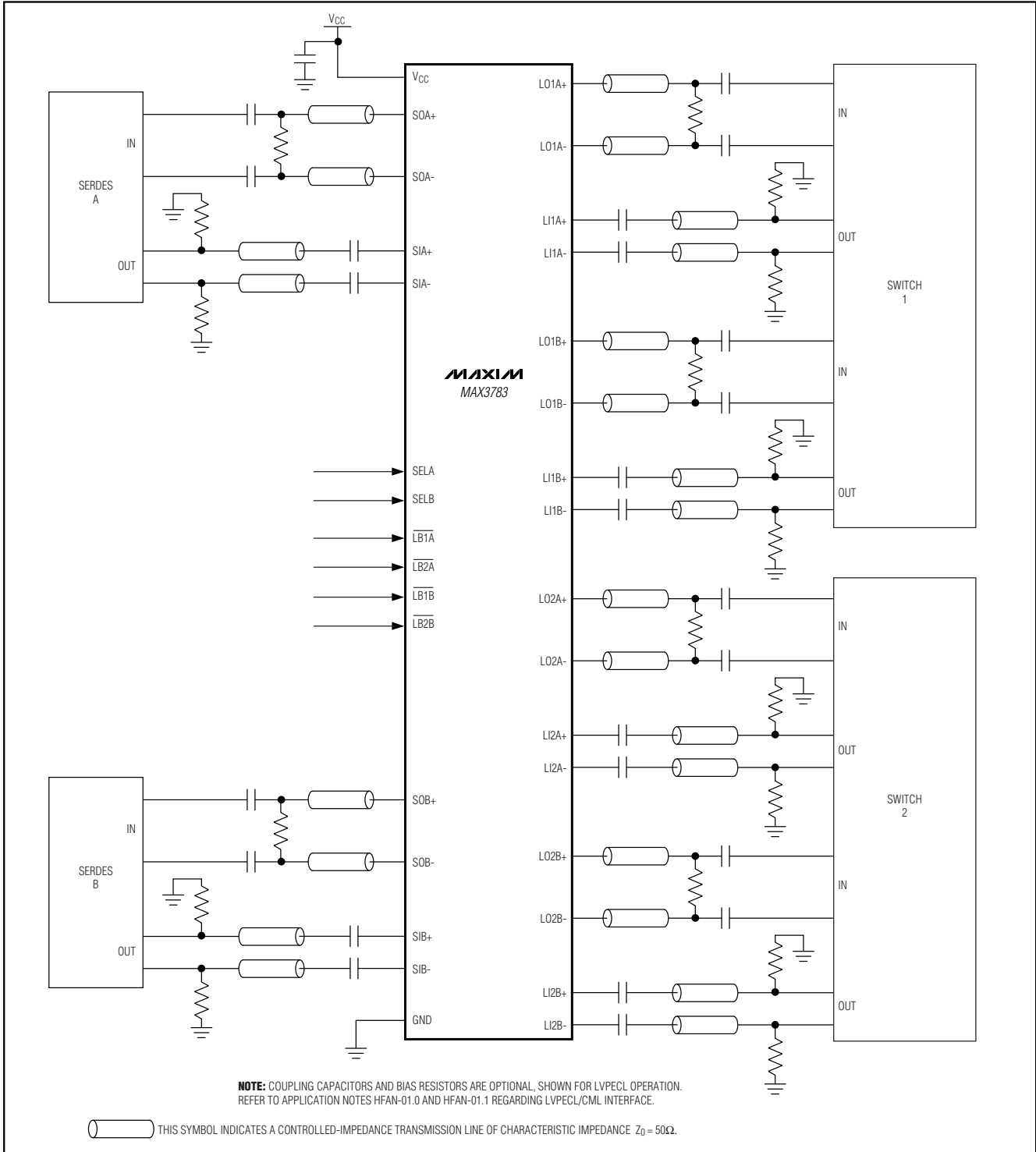
TRANSISTOR COUNT: 2816

PROCESS: Bipolar

# 2.7Gbps Dual Mux/Buffer with Loopback

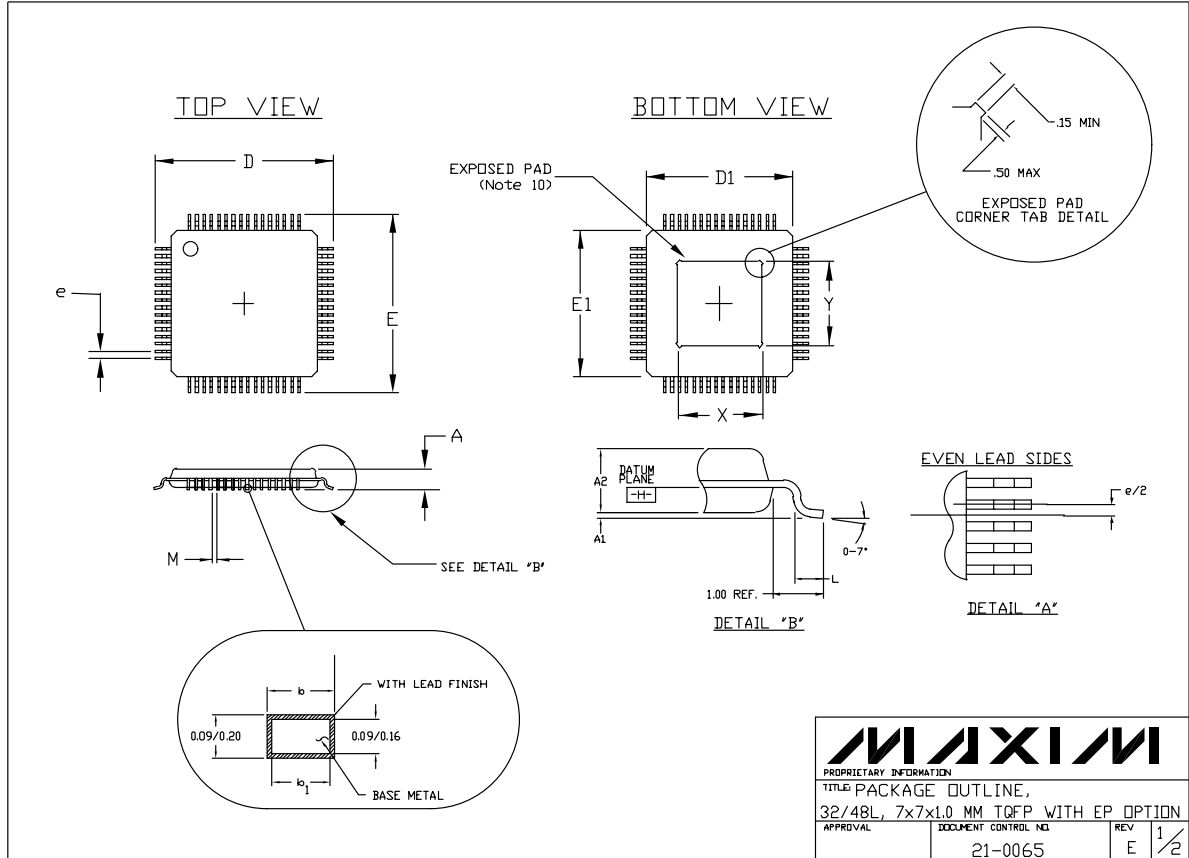
## Typical Application Circuit

**MAX3783**



# 2.7Gbps Dual Mux/Buffer with Loopback

## Package Information





# 2.7Gbps Dual Mux/Buffer with Loopback

## Package Information (continued)


**MAX3783**

**NOTES:**

1. ALL DIMENSIONS AND TOLERANCING CONFORM TO ANSI Y14.5-1982.
2. DATUM PLANE [—H—] IS LOCATED AT MOLD PARTING LINE AND COINCIDENT WITH LEAD, WHERE LEAD EXITS PLASTIC BODY AT BOTTOM OF PARTING LINE.
3. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1 DIMENSIONS.
4. THE TOP OF PACKAGE IS SMALLER THAN THE BOTTOM OF PACKAGE BY 0.15 MILLIMETERS.
5. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 MM TOTAL IN EXCESS OF THE b DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. CONTROLLING DIMENSION: MILLIMETER.
7. THIS OUTLINE CONFORMS TO JEDEC PUBLICATION 95 REGISTRATION MO-136, VARIATIONS AC AND AE.
8. LEADS SHALL BE COPLANAR WITHIN .004 INCH.
9. EXPOSED DIE PAD SHALL BE COPLANAR WITH BOTTOM OF PACKAGE WITHIN 2 MILS (.05 MM).
10. DIMENSIONS X & Y APPLY TO EXPOSED PAD (EP) VERSIONS ONLY. SEE INDIVIDUAL PRODUCT DATASHEET TO DETERMINE IF A PRODUCT USES EXPOSED PAD PACKAGE.

SYMBOL	JEDEC VARIATION ALL DIMENSIONS IN MILLIMETERS					
	AC			AE		
	MIN.	NDM.	MAX.	MIN.	NDM.	MAX.
A	<del>0.05</del>	<del>0.10</del>	1.20	<del>0.05</del>	<del>0.10</del>	1.20
A1	0.05	0.10	0.15	0.05	0.10	0.15
A2	0.95	1.00	1.05	0.95	1.00	1.05
D	9.00 BSC.			9.00 BSC.		
D1	7.00 BSC.			7.00 BSC.		
E	9.00 BSC.			9.00 BSC.		
E1	7.00 BSC.			7.00 BSC.		
L	0.45	0.60	0.75	0.45	0.60	0.75
M	0.15	<del>0.15</del>	<del>0.15</del>	0.14	<del>0.14</del>	<del>0.14</del>
N	32			48		
e	0.80 BSC.			0.50 BSC.		
b	0.30	0.37	0.45	0.17	0.22	0.27
b1	0.30	0.35	0.40	0.17	0.20	0.23
*X	3.20	3.50	3.80	3.70	4.00	4.30
*Y	3.20	3.50	3.80	3.70	4.00	4.30

\* EXPOSED PAD  
(Note 10)

		
<small>PROPRIETARY INFORMATION</small>		
TITLE: PACKAGE OUTLINE, 32/48L, 7x7x1.0 MM TQFP WITH EP OPTION		
<small>APPROVAL</small>	<small>DOCUMENT CONTROL NO.</small>	<small>REV</small>
	21-0065	E 2/2

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