ABRIDGED DATA SHEET

МАХІМ

Dual SPDT Analog Switches with Over-Rail Signal Handling

MAX4850/MAX4850H/MAX4852/MAX4852H

General Description

The MAX4850/MAX4850H/MAX4852/MAX4852H family of dual SPDT (single-pole/double-throw) switches operate from a single +2V to +5.5V supply and can handle signals greater than the supply rail. These switches feature low 3.5Ω or 3.5Ω/7Ω on-resistance with low on-capacitance, making them ideal for switching audio and data signals.

The MAX4850/MAX4850H are configured with two SPDT switches and feature two comparators for headphone detection or mute/send key functions. The MAX4852 has two SPDT switches with no comparators for low 1µA supply current.

For over-rail applications, these devices offer either the pass-through or high-impedance option. For the MAX4850/MAX4852, the signal (up to 5.5V) passes through the switch without distortion even when the positive supply rail is exceeded. For the MAX4850H/MAX4852H, the switch input becomes high impedance when the input signal exceeds the supply rail.

The MAX4850/MAX4850H/MAX4852/MAX4852H are available in the space-saving (3mm x 3mm), 16-pin TQFN package and operate over the extended temperature range of -40°C to +85°C.

Applications

USB Switching

Audio-Signal Routing

Cellular Phones

Notebook Computers

PDAs and Other Handheld Devices

Features

♦ **USB 2.0 Full Speed (12MB) and USB 1.1 Signal Switching Compliant**

♦ **Switch Signals Greater than V$_{CC}$**

♦ **0.1ns Differential Skew**

♦ **3.5Ω/7Ω On-Resistance**

♦ **135MHz -3dB Bandwidth**

♦ **+2V to +5.5V Supply Range**

♦ **1.8V Logic Compatible**

♦ **Low Supply Current**
   1µA (MAX4852)
   5µA (MAX4850)
   10µA (MAX4850H/MAX4852H)

♦ **Available in a Space-Saving (3mm x 3mm), 16-Pin TQFN Package**

Ordering Information

PART	TEMP RANGE	PIN-PACKAGE	TOP MARK
MAX4850ETE	-40°C to +85°C	16 TQFN-EP*	ABU
MAX4850HETE	-40°C to +85°C	16 TQFN-EP*	ABV
MAX4852ETE	-40°C to +85°C	16 TQFN-EP*	ABZ
MAX4852HETE	-40°C to +85°C	16 TQFN-EP*	ACA

*EP = Exposed paddle.

Pin Configurations and Selector Guide appear at end of data sheet.

Block Diagrams/Truth Table
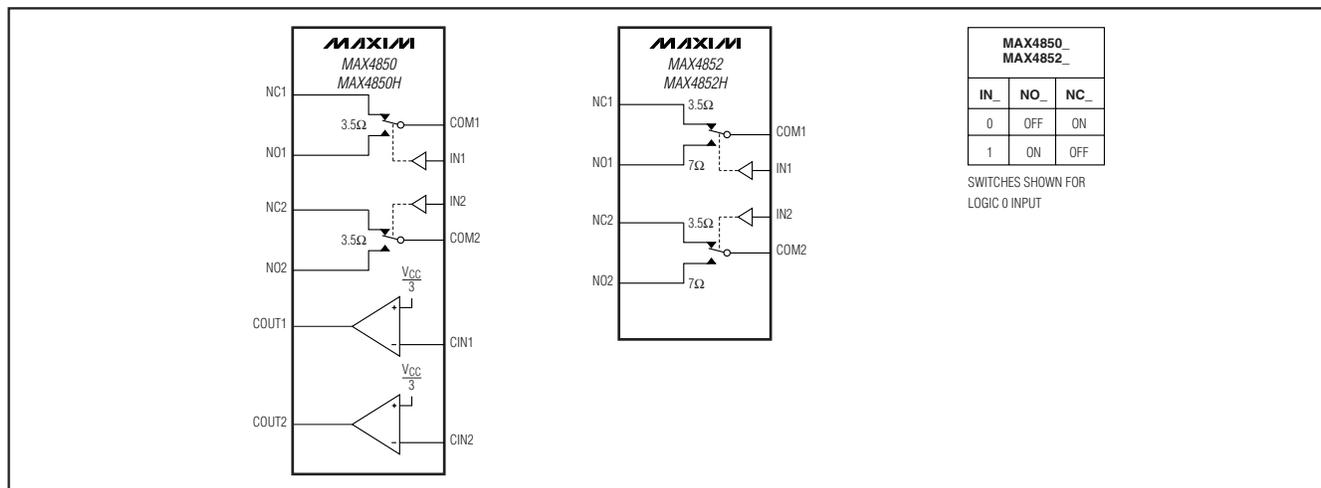
MAX4850_ MAX4852_		
IN_	**NO_**	**NC_**
0	OFF	ON
1	ON	OFF

SWITCHES SHOWN FOR LOGIC 0 INPUT

МАХІМ

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

Dual SPDT Analog Switches with Over-Rail Signal Handling

Detailed Description

The MAX4850/MAX4850H/MAX4852/MAX4852H are low on-resistance, low-voltage, analog switches that operate from a +2V to +5.5V single supply and are fully specified for nominal 3.0V applications. These devices feature over-rail signal capability that allows signals up to 5.5V with supply voltages down to 2.0V. These devices are configured as dual SPDT switches.

These switches have low 50pF on-channel capacitance, which allows for 12Mbps switching of the data signals for USB 2.0 full speed/1.1 applications. The MAX485__ are designed to switch D+ and D- USB signals with a guaranteed skew of less than 1ns (see Figure 1), as measured from 50% of the input signal to 50% of the output signal.

The MAX4850_ feature a comparator that can be used for headphone or mute detection. The comparator threshold is internally generated to be approximately 1/3 of V_{CC}.

Applications Information

Digital Control Inputs

The logic inputs (IN_) accept up to +5.5V even if the supply voltages are below this level. For example, with a +3.3V V_{CC} supply, IN_ can be driven low to GND and high to +5.5V, allowing for mixing of logic levels in a system. Driving IN_ rail-to-rail minimizes power con- sumption. For a +2V supply voltage, the logic thresholds are 0.5V (low) and 1.4V (high); for a +5V supply voltage, the logic thresholds are 0.8V (low) and 1.8V (high).

Analog Signal Levels

The on-resistance of these switches changes very little for analog input signals across the entire supply voltage range (see *Typical Operating Characteristics*). The switches are bidirectional, so NO_, NC_, and COM_ can be either inputs or outputs.

Comparator

The positive terminal of the comparator is internally set to $V_{CC}/3$. When the negative terminal (CIN_) is below the threshold ($V_{CC}/3$), the comparator output (COUT_) goes high. When CIN_ rises above $V_{CC}/3$, COUT_ goes low.

The comparator threshold allows for detection of head- phones since headphone audio signals are typically biased to $V_{CC}/2$.

Power-Supply Sequencing

Caution: Do not exceed the absolute maximum ratings because stresses beyond the listed ratings may cause permanent damage to the device.

Proper power-supply sequencing is recommended for all CMOS devices. Always apply V_{CC} before applying analog signals, especially if the analog signal is not current-limited.

MAX4850/MAX4850H/MAX4852/MAX4852H

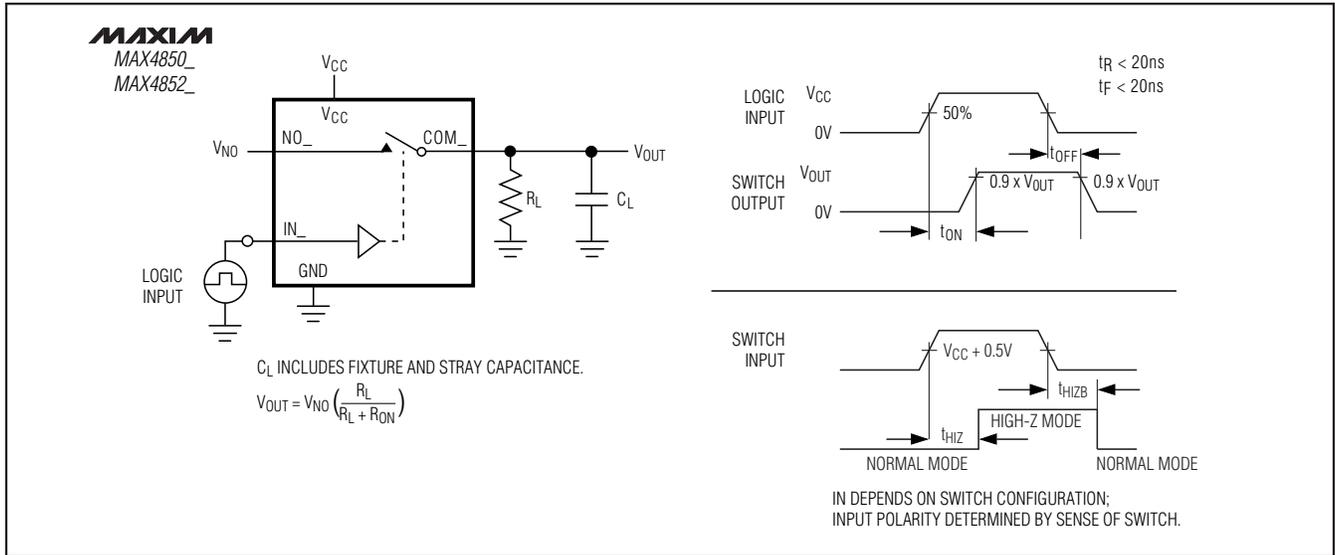# Dual SPDT Analog Switches with Over-Rail Signal Handling
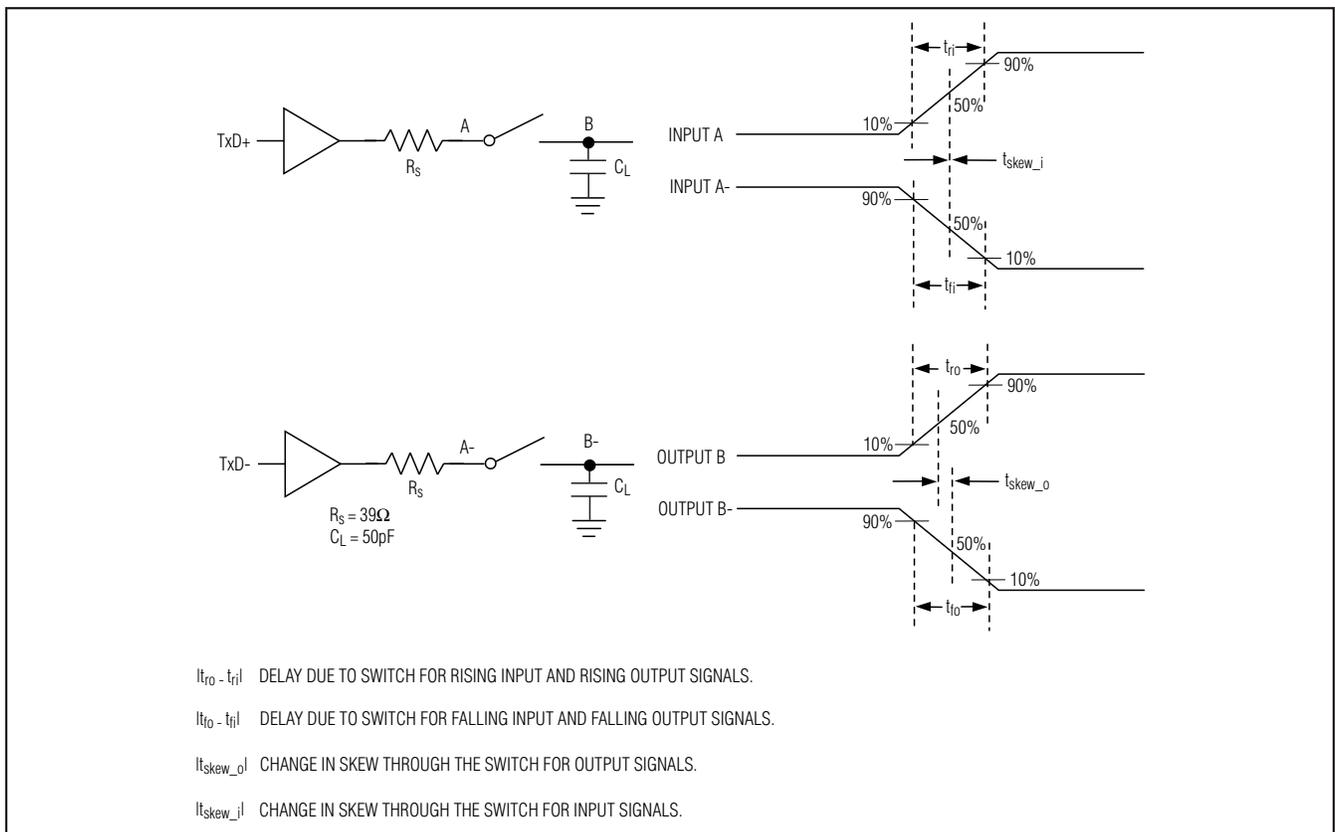
Test Circuits/Timing Diagrams

Figure 1. Switching Time

Figure 2. Input/Output Skew Timing Diagram

Dual SPDT Analog Switches with Over-Rail Signal Handling

MAX4850/MAX4850H/MAX4852/MAX4852H

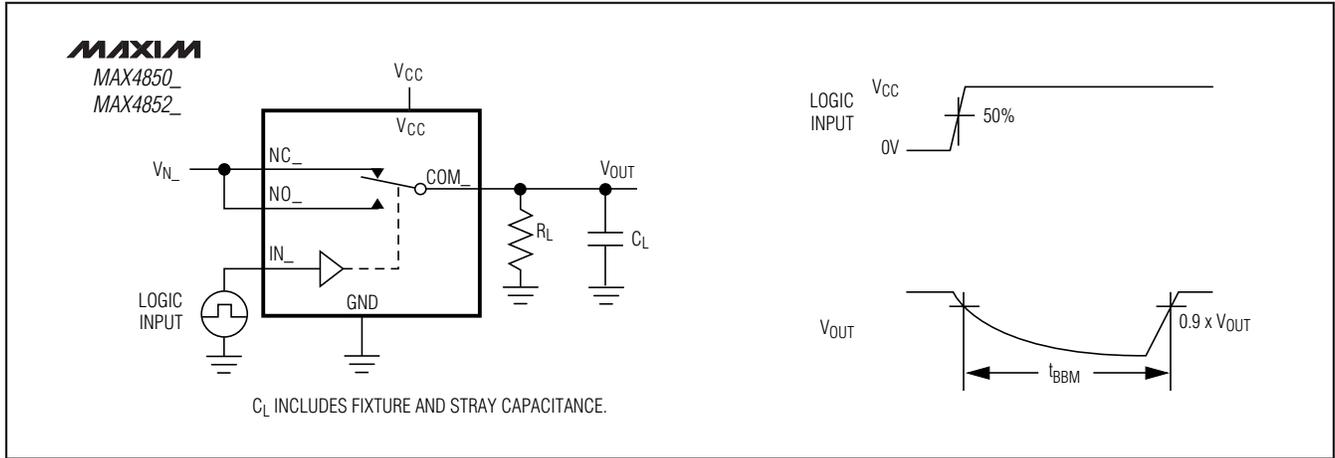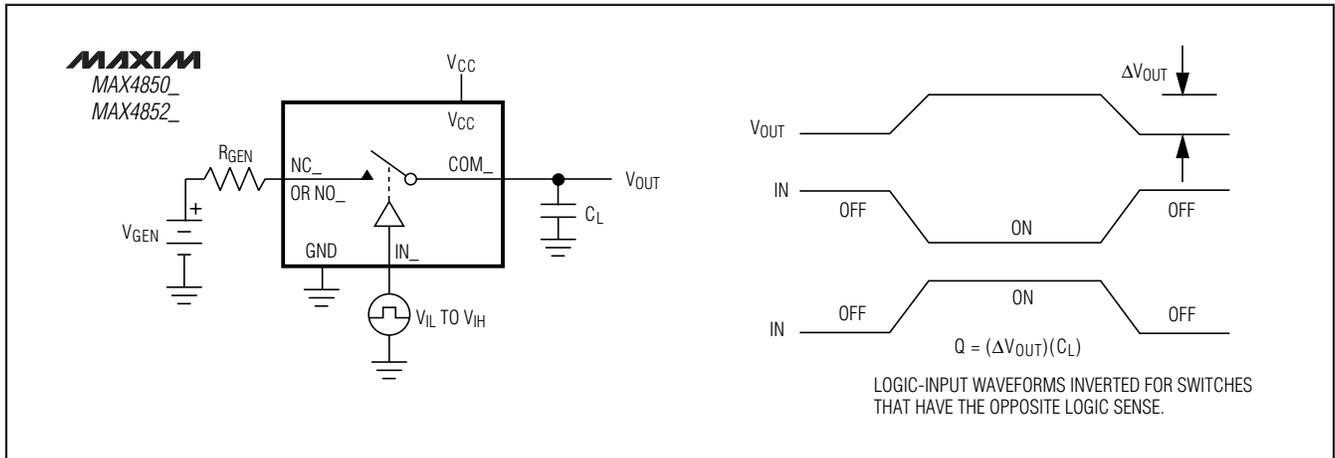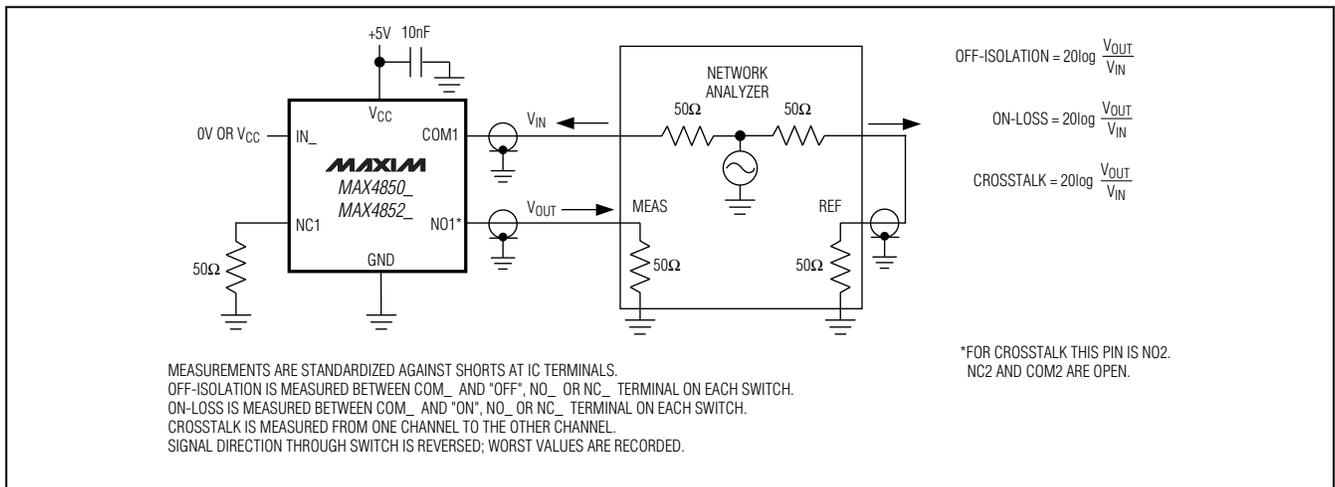Figure 3. Break-Before-Make Interval

C_L INCLUDES FIXTURE AND STRAY CAPACITANCE.

Figure 4. Charge Injection

$Q = (\Delta V_{OUT})(C_L)$

LOGIC-INPUT WAVEFORMS INVERTED FOR SWITCHES THAT HAVE THE OPPOSITE LOGIC SENSE.

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

$$\text{OFF-ISOLATION} = 20\log\frac{V_{OUT}}{V_{IN}}$$

$$\text{ON-LOSS} = 20\log\frac{V_{OUT}}{V_{IN}}$$

$$\text{CROSSTALK} = 20\log\frac{V_{OUT}}{V_{IN}}$$

*FOR CROSSTALK THIS PIN IS NO2. NC2 AND COM2 ARE OPEN.

MEASUREMENTS ARE STANDARDIZED AGAINST SHORTS AT IC TERMINALS.
OFF-ISOLATION IS MEASURED BETWEEN COM_ AND "OFF", NO_ OR NC_ TERMINAL ON EACH SWITCH.
ON-LOSS IS MEASURED BETWEEN COM_ AND "ON", NO_ OR NC_ TERMINAL ON EACH SWITCH.
CROSSTALK IS MEASURED FROM ONE CHANNEL TO THE OTHER CHANNEL.
SIGNAL DIRECTION THROUGH SWITCH IS REVERSED; WORST VALUES ARE RECORDED.

Dual SPDT Analog Switches with Over-Rail Signal Handling
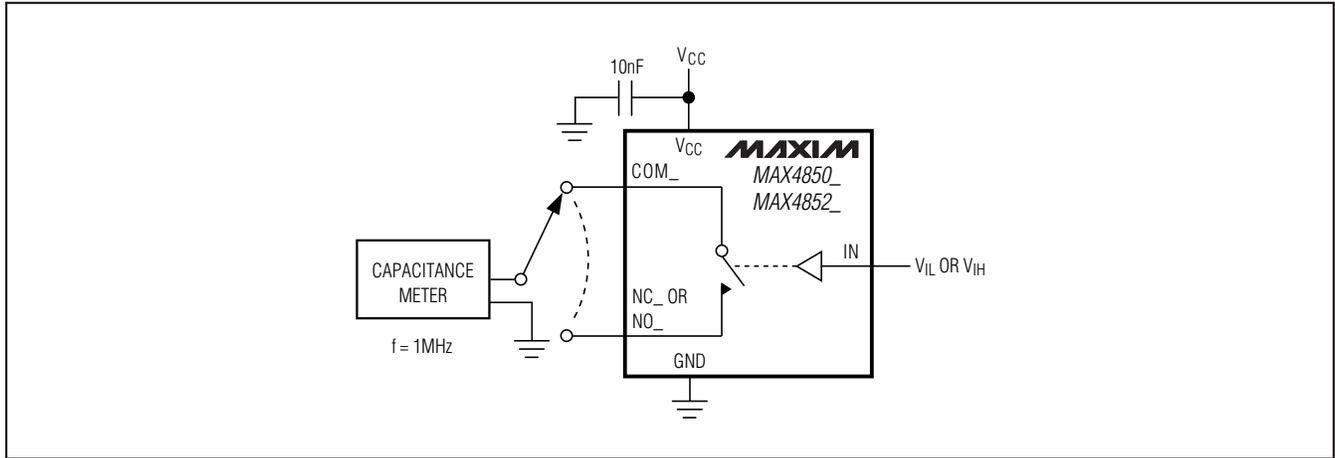
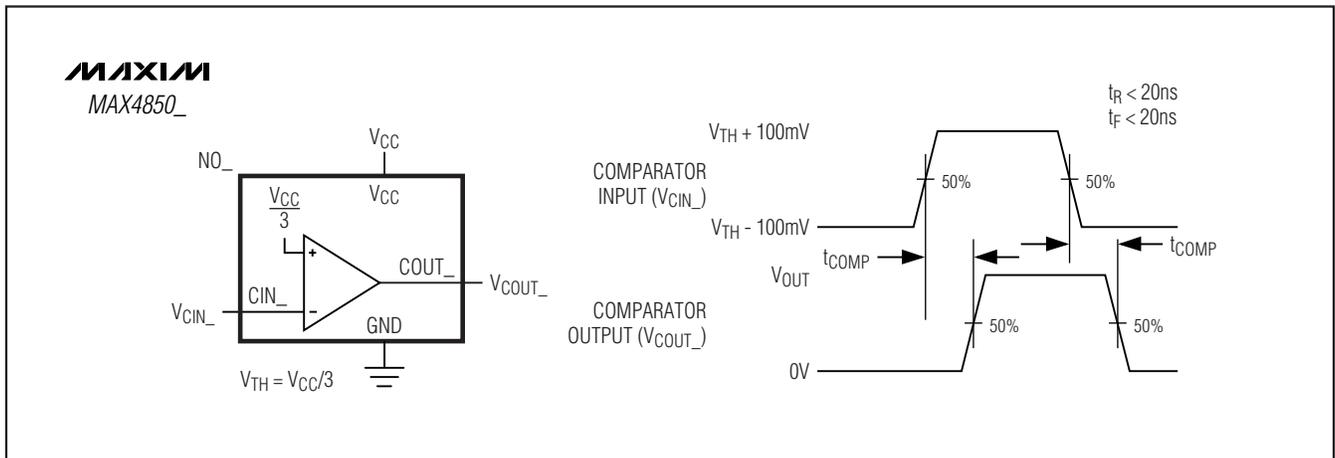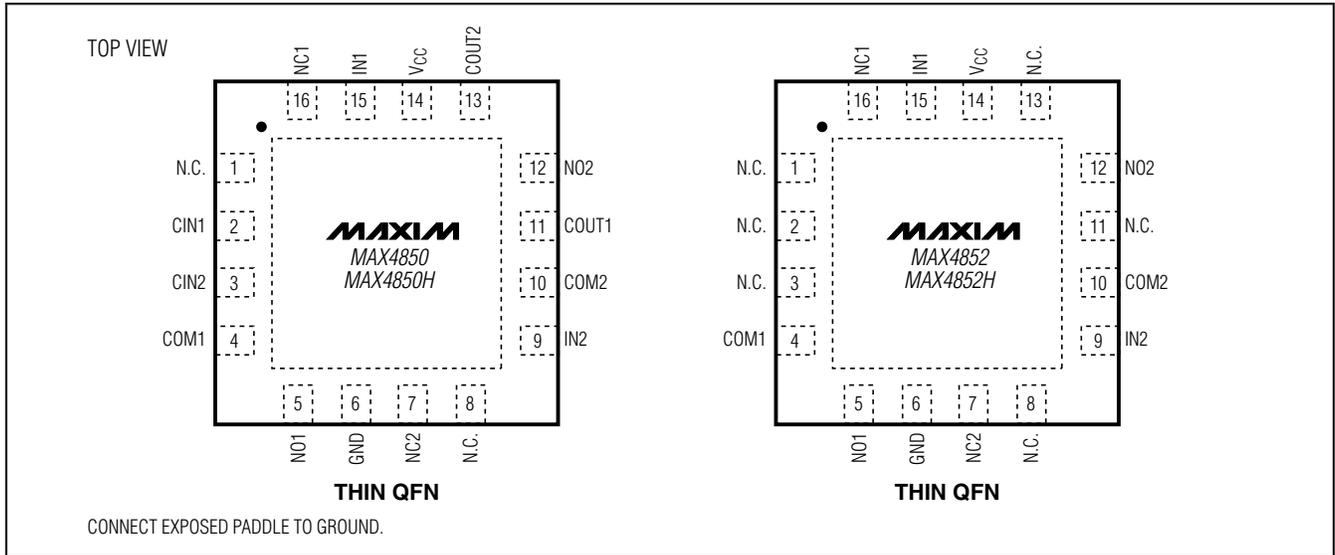MAX4850/MAX4850H/MAX4852/MAX4852H

Figure 6. Channel Off-/On-Capacitance

Figure 7. Comparator Switching Time

$$V_{TH} = V_{CC}/3$$

Dual SPDT Analog Switches with Over-Rail Signal Handling

MAX4850/MAX4850H/MAX4852/MAX4852H

Pin Configurations

TOP VIEW

MAX4850
MAX4850H

THIN QFN

MAX4852
MAX4852H

THIN QFN

CONNECT EXPOSED PADDLE TO GROUND.

Selector Guide

PART	R_{ON} NC_/NO_ (Ω)	COMPARATORS	OVER-RAIL HANDLING
MAX4850	3.5/3.5	2	Input signal passes through the switch
MAX4850H	3.5/3.5	2	High-impedance switch input
MAX4852	3.5/7	—	Input signal passes through the switch
MAX4852H	3.5/7	—	High-impedance switch input

Chip Information

TRANSISTOR COUNT: 735
PROCESS: CMOS

Typical Operating Circuit
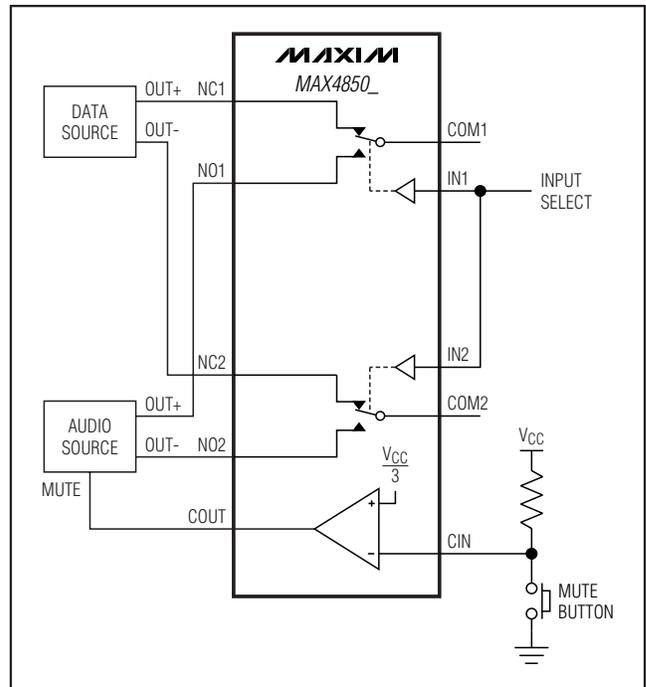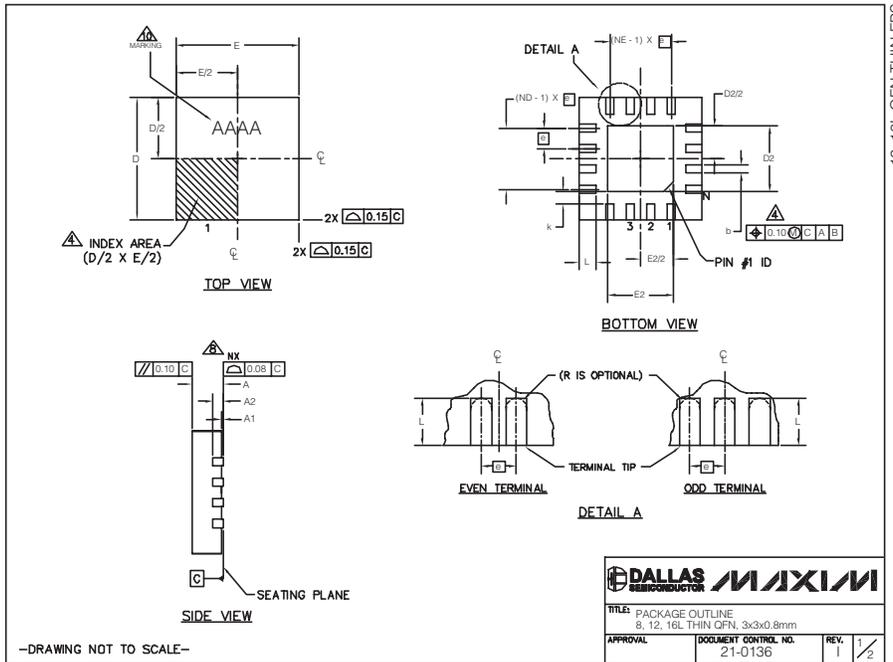
Dual SPDT Analog Switches with Over-Rail Signal Handling

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**.)

PKG	8L 3x3			12L 3x3			16L 3x3		
REF.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.80	0.70	0.75	0.80	0.70	0.75	0.80
b	0.25	0.30	0.35	0.20	0.25	0.30	0.20	0.25	0.30
D	2.90	3.00	3.10	2.90	3.00	3.10	2.90	3.00	3.10
E	2.90	3.00	3.10	2.90	3.00	3.10	2.90	3.00	3.10
e	0.65 BSC.			0.50 BSC.			0.50 BSC.		
L	0.35	0.55	0.75	0.45	0.55	0.65	0.30	0.40	0.50
N	8			12			16		
ND	2			3			4		
NE	2			3			4		
A1	0	0.02	0.05	0	0.02	0.05	0	0.02	0.05
A2	0.20 REF			0.20 REF			0.20 REF		
k	0.25	-	-	0.25	-	-	0.25	-	-

EXPOSED PAD VARIATIONS								
PKG. CODES	D2			E2			PIN ID	JEDEC
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.		
TQ833-1	0.25	0.70	1.25	0.25	0.70	1.25	0.35 x 45°	WEEC
T1233-1	0.95	1.10	1.25	0.95	1.10	1.25	0.35 x 45°	WEED-1
T1233-3	0.95	1.10	1.25	0.95	1.10	1.25	0.35 x 45°	WEED-1
T1233-4	0.95	1.10	1.25	0.95	1.10	1.25	0.35 x 45°	WEED-1
T1633-2	0.95	1.10	1.25	0.95	1.10	1.25	0.35 x 45°	WEED-2
T1633F-3	0.65	0.80	0.95	0.65	0.80	0.95	0.225 x 45°	WEED-2
T1633FH-3	0.65	0.80	0.95	0.65	0.80	0.95	0.225 x 45°	WEED-2
T1633-4	0.95	1.10	1.25	0.95	1.10	1.25	0.35 x 45°	WEED-2
T1633-5	0.95	1.10	1.25	0.95	1.10	1.25	0.35 x 45°	WEED-2

NOTES:
1. DIMENSIONING & TOLERANCING CONFORM TO ASME Y14.5M-1994.
2. ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
3. N IS THE TOTAL NUMBER OF TERMINALS.
4. THE TERMINAL #1 IDENTIFIER AND TERMINAL NUMBERING CONVENTION SHALL CONFORM TO JESD 95-1 SPP-012. DETAILS OF TERMINAL #1 IDENTIFIER ARE OPTIONAL, BUT MUST BE LOCATED WITHIN THE ZONE INDICATED. THE TERMINAL #1 IDENTIFIER MAY BE EITHER A MOLD OR MARKED FEATURE.
5. DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.20 mm AND 0.25 mm FROM TERMINAL TIP.
6. ND AND NE REFER TO THE NUMBER OF TERMINALS ON EACH D AND E SIDE RESPECTIVELY.
7. DEPOPULATION IS POSSIBLE IN A SYMMETRICAL FASHION.
8. COPLANARITY APPLIES TO THE EXPOSED HEAT SINK SLUG AS WELL AS THE TERMINALS .
9. DRAWING CONFORMS TO JEDEC MO220 REVISION C.
10. MARKING IS FOR PACKAGE ORIENTATION REFERENCE ONLY.
11. NUMBER OF LEADS SHOWN ARE FOR REFERENCE ONLY.
12. WARPAGE NOT TO EXCEED 0.10mm.

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