

0.75 Ω , Dual SPDT Audio Switch with Integrated Comparators

ABSOLUTE MAXIMUM RATINGS

V_{CC}, IN₋, CIN₋ to GND-0.3V to +6.0V
 NO₋, NC₋, COM₋, COUT₋ (Note 1)-0.3V to (V_{CC} + 0.3V)
 COUT₋ Continuous Current.....±20mA
 Closed Switch Continuous Current COM₋, NO₋, NC₋.....±300mA
 Peak Current COM₋, NO₋, NC₋
 (pulsed at 1ms, 50% duty cycle)±400mA
 Peak Current COM₋, NO₋, NC₋
 (pulsed at 1ms, 10% duty cycle)±500mA

Continuous Power Dissipation (T_A = +70°C)

16-Pin Thin QFN (derate 20.8mW/°C above +70°C)1667mW
 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

Note 1: Signals on NO, NC, or COM exceeding V_{CC} or GND are clamped by internal diodes. Signals on IN exceeding GND are clamped by an internal diode. 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

(V_{CC} = +2.7V to +5.5V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are at V_{CC} = +3.0V, T_A = +25°C, unless otherwise noted.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Supply Voltage	V _{CC}			2		5.5	V
Supply Current	I _{CC}	V _{CC} = 5.5V, V _{IN_} = 0V or V _{CC}			5	10	μA
ANALOG SWITCH							
Analog Signal Range	V _{NO_} , V _{NC_} , V _{COM_}			0		V _{CC}	V
On-Resistance (Note 3)	R _{ON}	V _{CC} = 2.7V, I _{COM_} = 100mA, V _{NC_} or V _{NO_} = 0V to V _{CC}	T _A = +25°C		0.75	1	Ω
			T _A = -40°C to +85°C		1.1		
On-Resistance Match Between Channels (Notes 3, 4)	ΔR _{ON}	V _{CC} = 2.7V, I _{COM_} = 100mA, V _{NC_} or V _{NO_} = 1.5V	T _A = +25°C		0.075	0.120	Ω
			T _A = -40°C to +85°C		0.135		
On-Resistance Flatness (Note 5)	R _{FLAT}	V _{CC} = 2.7V, I _{COM_} = 100mA, V _{NC_} or V _{NO_} = 0.75V, 1.5V, 1.75V	T _A = +25°C		0.18	0.275	Ω
			T _A = -40°C to +85°C		0.3		
NO_/NC_ Off-Leakage Current (Note 2)	I _{OFF}	V _{CC} = 5.5V, V _{NC_} or V _{NO_} = 1V or 4.5V, V _{COM_} = 4.5V or 1V	T _A = +25°C	-2		+2	nA
			T _A = -40°C to +85°C		-10 +10		
COM_ On-Leakage Current (Note 2)	I _{ON}	V _{CC} = 5.5V; V _{NC_} or V _{NO_} = 1V, 4.5V, or floating; V _{COM_} = 1V, 4.5V, or floating	T _A = +25°C	-2		+2	nA
			T _A = -40°C to +85°C		-15 +15		
DYNAMIC CHARACTERISTICS							
Turn-On Time	t _{ON}	V _{CC} = 2.7V, V _{NO_} or V _{NC_} = 1.5V, R _L = 300Ω, C _L = 50pF (Figure 1)	T _A = +25°C		40	60	ns
			T _A = -40°C to +85°C		100		

0.75Ω, Dual SPDT Audio Switch with Integrated Comparators

MAX4855

ELECTRICAL CHARACTERISTICS (continued)

($V_{CC} = +2.7V$ to $+5.5V$, $T_A = -40^{\circ}C$ to $+85^{\circ}C$, unless otherwise noted. Typical values are at $V_{CC} = +3.0V$, $T_A = +25^{\circ}C$, unless otherwise noted.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Turn-Off Time	t _{OFF}	V _{CC} = 2.7V, V _{NO_} or V _{NC_} = 1.5V, R _L = 300Ω, C _L = 50pF (Figure 1)	T _A = +25°C	30		40	ns
			T _A = -40°C to +85°C	60			
Break-Before-Make Time Delay (Note 3)	t _D	V _{CC} = 2.7V, V _{NO_} or V _{NC_} = 1.5V, R _L = 50Ω, C _L = 50pF (Figure 2)	T _A = +25°C	15		ns	
			T _A = -40°C to +85°C	2			
Charge Injection	Q	V _{COM_} = 1.5V, R _S = 0Ω, C _L = 1.0nF (Figure 3)		170		pC	
Off-Isolation (Note 6)		f = 100kHz, V _{COM_} = 1V _{RMS} , R _L = 50Ω, C _L = 5pF (Figure 4)		-75		dB	
Crosstalk	V _{CT}	f = 100kHz, V _{COM_} = 1V _{RMS} , R _L = 50Ω, C _L = 5pF (Figure 4)		-93		dB	
-3dB Bandwidth	BW	Signal = 0dBm, R _L = 50Ω, C _L = 5pF (Figure 4)		38		MHz	
Total Harmonic Distortion	THD	f = 20Hz to 20kHz, V _{COM_} = 1V + 2V _{P-P} , R _L = 32Ω		0.07		%	
NO_/NC_ Off-Capacitance	C _{OFF}	f = 1MHz (Figure 5)		50		pF	
COM On-Capacitance	C _{ON}	f = 1MHz (Figure 5)		150		pF	
DIGITAL I/O (IN_)							
Input-Logic High Voltage	V _{IH}	V _{CC} = 2V to 3.6V		1.4		V	
		V _{CC} = 3.6V to 5.5V		1.8			
Input-Logic Low Voltage	V _{IL}	V _{CC} = 2V to 3.6V		0.5		V	
		V _{CC} = 3.6V to 5.5V		0.8			
Input Leakage Current	I _{IN}	V _{IN_} = 0 or 5.5V		-0.5		+0.5	μA
COMPARATOR							
Comparator Range				0		5.5	V
Comparator Threshold		V _{CC} = 2V to 5.5V, falling input		0.3 x V _{CC}	0.33 x V _{CC}	0.36 x V _{CC}	V
Comparator Hysteresis		V _{CC} = 2V to 5.5V		50		mV	
Comparator Output High Voltage		I _{SOURCE} = 1mA		V _{CC} - 0.4V		V	
Comparator Output Low Voltage		I _{SINK} = 1mA		0.4		V	
Comparator Switching Time		Rising input (Figure 6)		2.5		μs	
		Falling input (Figure 6)		0.5			

Note 2: Specifications are 100% tested at $T_A = +85^{\circ}C$ only, and guaranteed by design and characterization over the specified temperature range.

Note 3: Guaranteed by design and characterization; not production tested.

Note 4: $\Delta R_{ON} = R_{ON(MAX)} - R_{ON(MIN)}$.

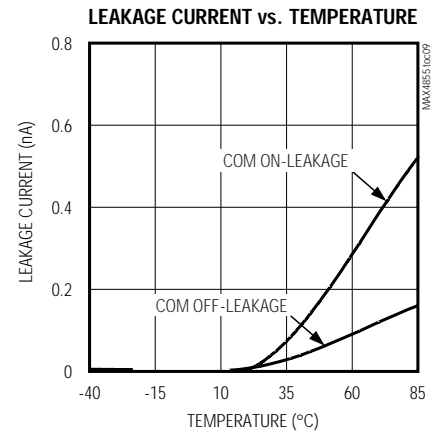
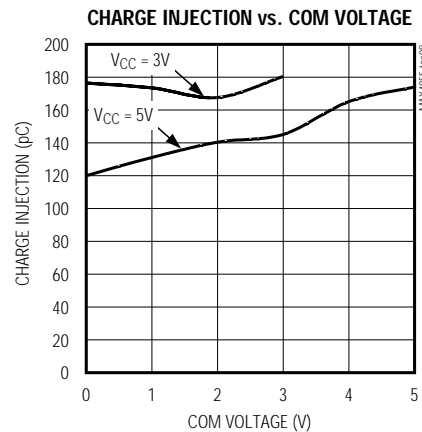
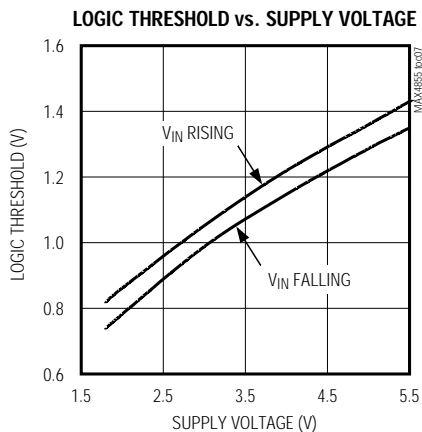
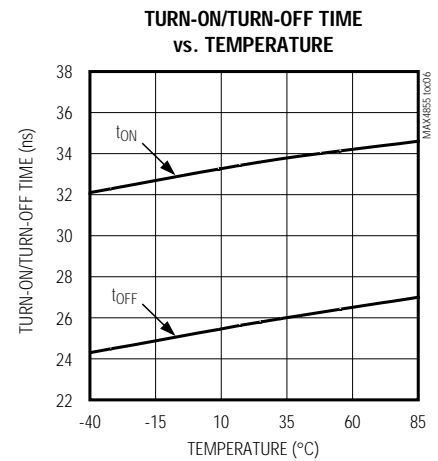
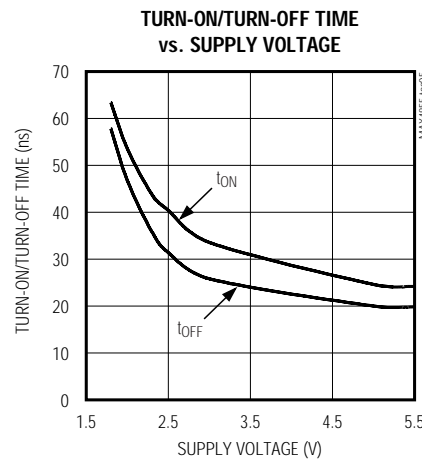
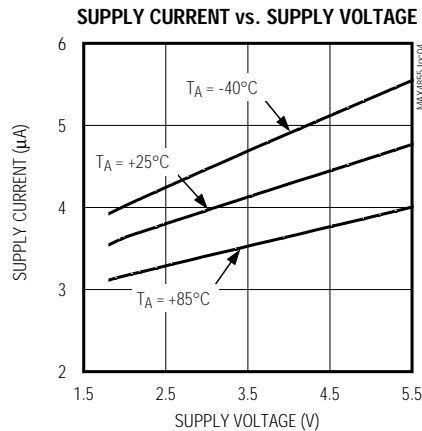
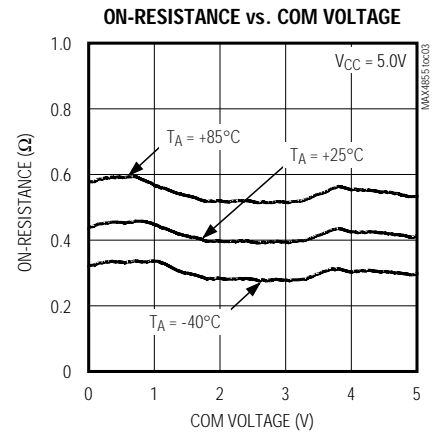
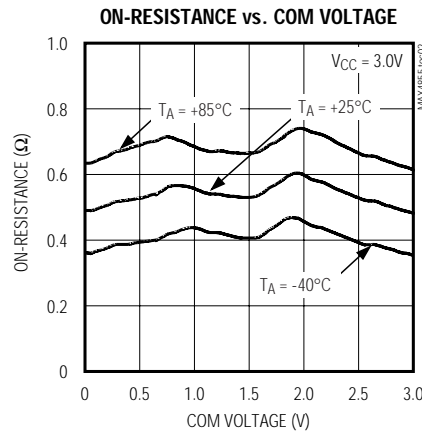
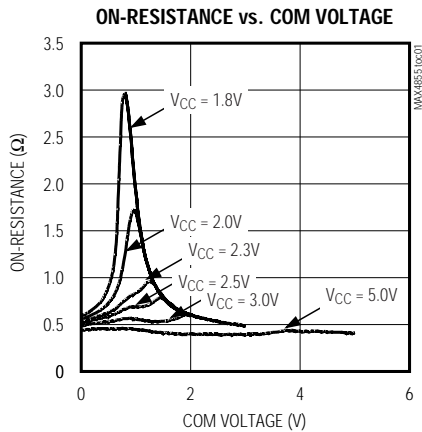
Note 5: Flatness is defined as the difference between the maximum and minimum value of on-resistance as measured over the specified analog signal ranges.

Note 6: Off-Isolation = $20\log_{10} (V_{COM_} / V_{NO_})$, $V_{COM_}$ = output, $V_{NO_}$ = input to off switch.

0.75 Ω , Dual SPDT Audio Switch with Integrated Comparators

Typical Operating Characteristics

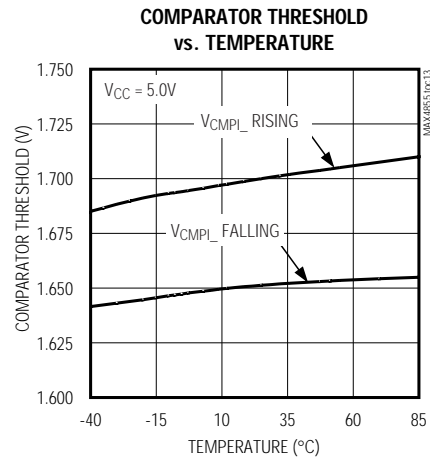
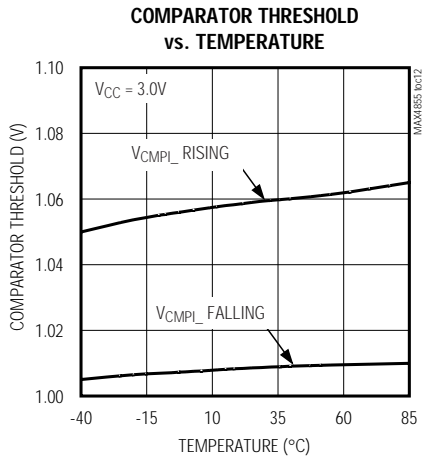
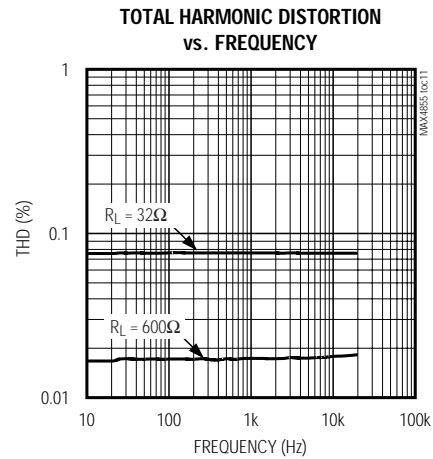
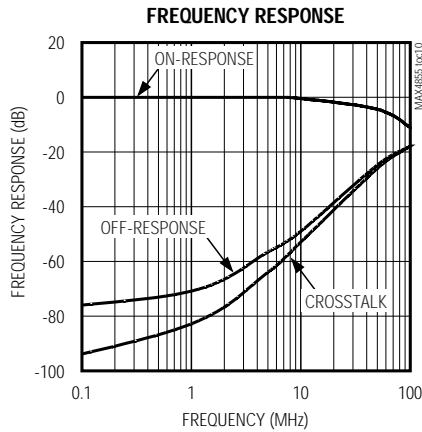
($V_{CC} = 3.0V$, $T_A = +25^\circ C$, unless otherwise noted.)



0.75 Ω , Dual SPDT Audio Switch with Integrated Comparators

MAX4855

Typical Operating Characteristics (continued)
($V_{CC} = 3.0V$, $T_A = +25^\circ C$, unless otherwise noted.)



0.75Ω, Dual SPDT Audio Switch with Integrated Comparators

Pin Description

PIN	NAME	FUNCTION
1, 8	N.C.	No Connection. Not internally connected.
2	CIN1	Inverting Input for Comparator 1
3	CIN2	Inverting Input for Comparator 2
4	COM1	Common Terminal for Analog Switch 1
5	NO1	Normally Open Terminal for Analog Switch 1
6	GND	Ground
7	NC2	Normally Closed Terminal for Analog Switch 2
9	IN2	Digital Control Input for Analog Switch 2. A logic LOW on IN2 connects COM2 to NC2 and a logic HIGH connects COM2 to NO2.
10	COM2	Common Terminal for Analog Switch 2
11	COOUT1	Output for Comparator 1
12	NO2	Normally Open Terminal for Analog Switch 2
13	COOUT2	Output for Comparator 2
14	VCC	Supply Voltage. Bypass to GND with a 0.01μF capacitor as close to the pin as possible.
15	IN1	Digital Control Input for Analog Switch 1. A logic LOW on IN1 connects COM1 to NC1 and a logic HIGH connects COM1 to NO1.
16	NC1	Normally Closed Terminal for Analog Switch 1
EP	—	Exposed Paddle. Connect to PC board ground plane.

Detailed Description

The MAX4855 dual SPDT, low on-resistance, low-voltage, analog switch operates from a +2V to +5.5V supply and can handle signals up to the power rails. In addition, the MAX4855 integrates two internal comparators that can be used for headphone or mute detection. The comparator threshold is internally generated to be approximately 1/3 of VCC.

Applications Information

Digital Control Inputs

The logic inputs (IN₁) accept up to +5.5V even if the supply voltages are below this level. For example, with a +3.3V VCC supply, IN₁ can be driven low to GND and high to +5.5V allowing for mixing of logic levels in a system. Driving IN₁ rail-to-rail minimizes power consumption. 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 the *Typical Operating Characteristics*). The switches are bidirectional, so the NO₁, NC₁, and COM₁ pins can be either inputs or outputs.

Comparator

The positive terminal of the comparator is internally set to VCC/3. When the negative terminal (CIN₁) is below the threshold (VCC/3), the comparator output (COOUT₁) is high. When CIN₁ rises above VCC/3, COOUT₁ is low.

The comparator threshold allows for detection of headphones since headphone audio signals are typically biased to VCC/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 VCC before applying analog signals, especially if the analog signal is not current-limited.

0.75Ω, Dual SPDT Audio Switch with Integrated Comparators

Test Circuits/Timing Diagrams

MAX4855

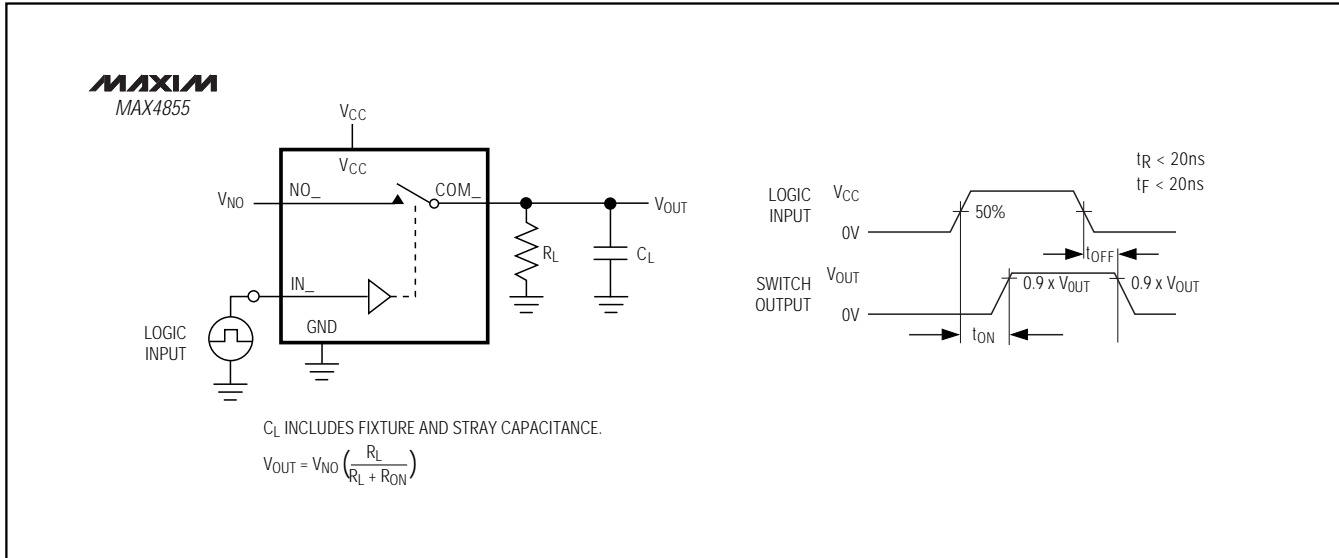


Figure 1. Switching Time

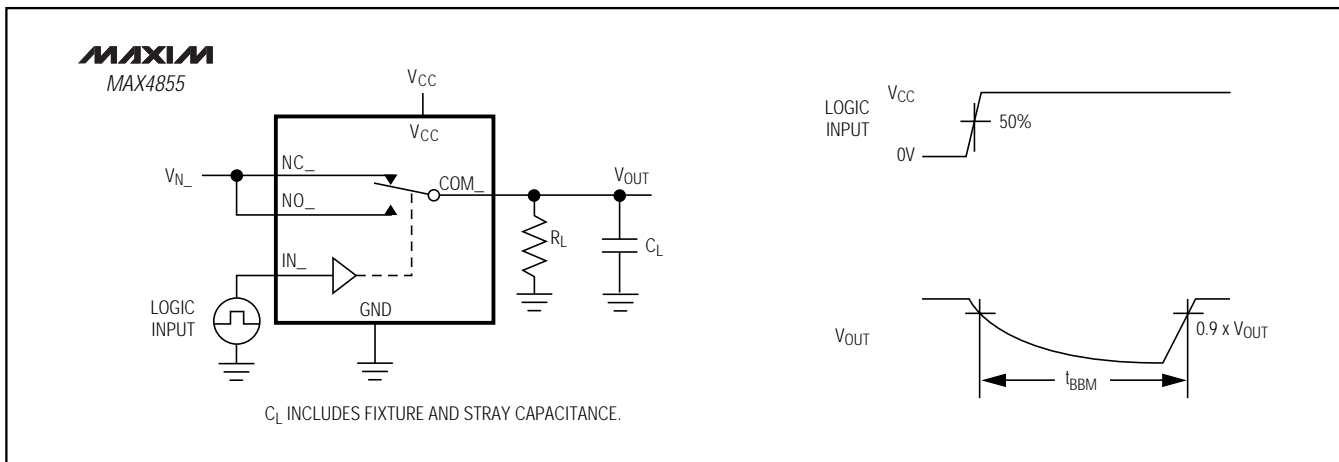


Figure 2. Break-Before-Make Interval

0.75Ω, Dual SPDT Audio Switch with Integrated Comparators

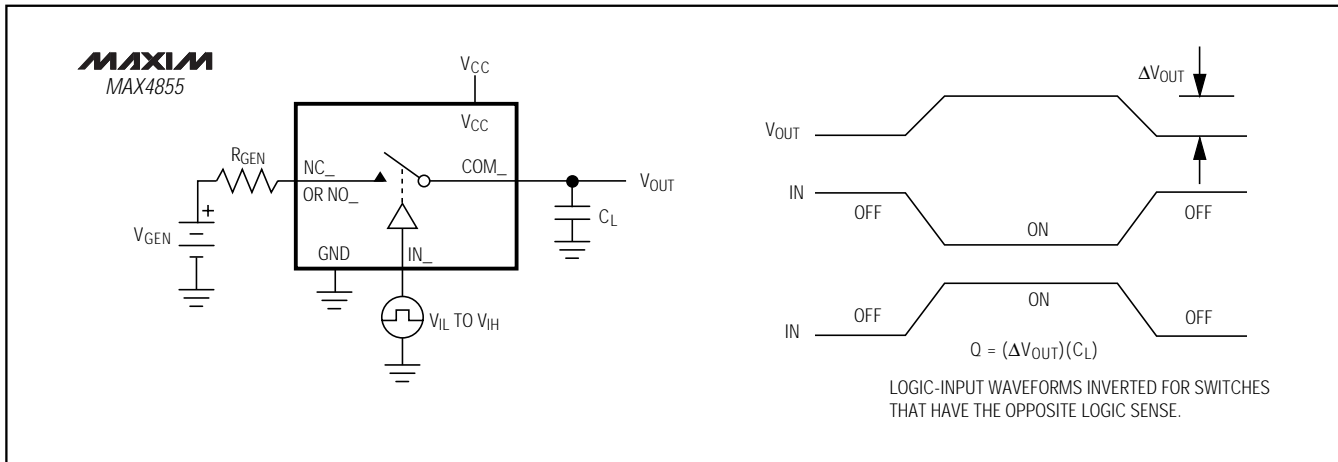


Figure 3. Charge Injection

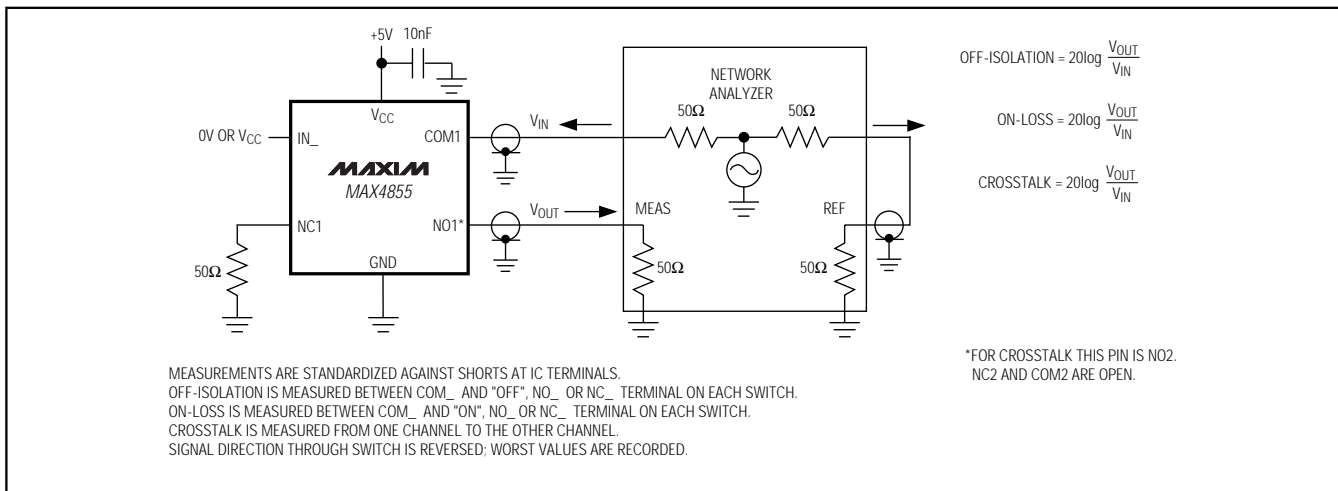


Figure 4. On-Loss, Off-Isolation, and Crosstalk

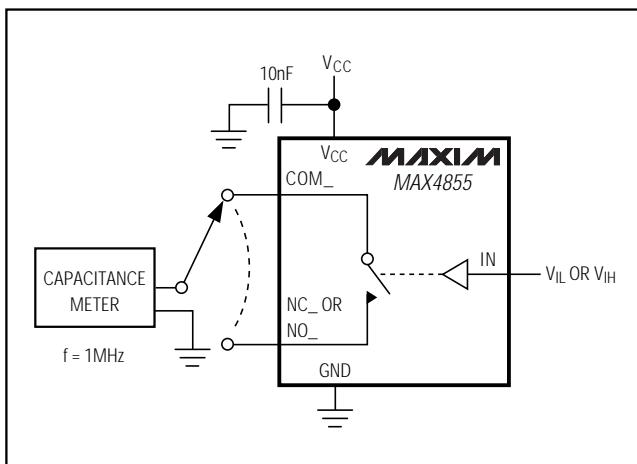


Figure 5. Channel Off-/On-Capacitance

0.75Ω, Dual SPDT Audio Switch with Integrated Comparators

MAX4855

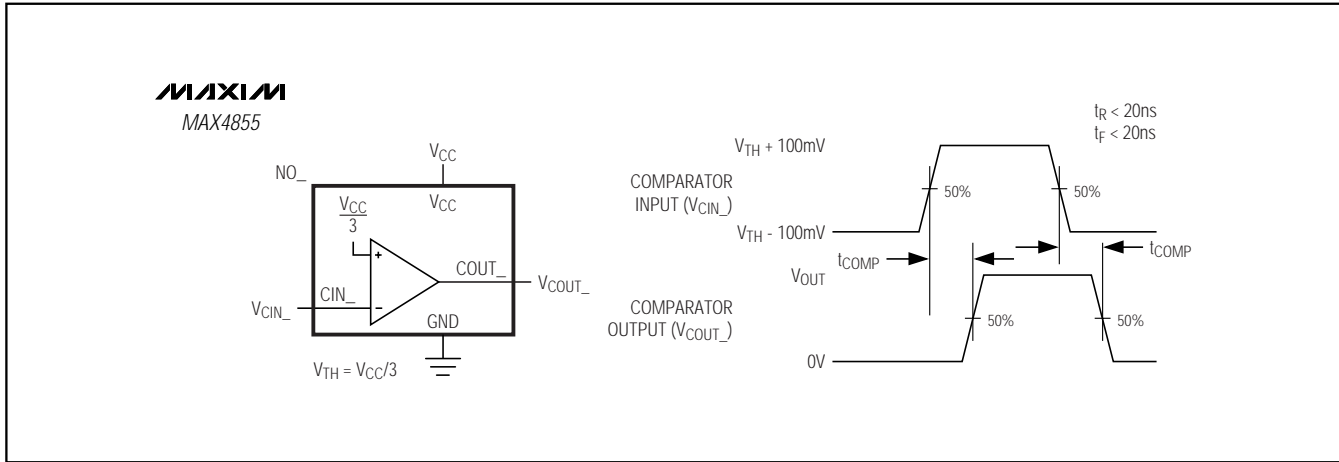
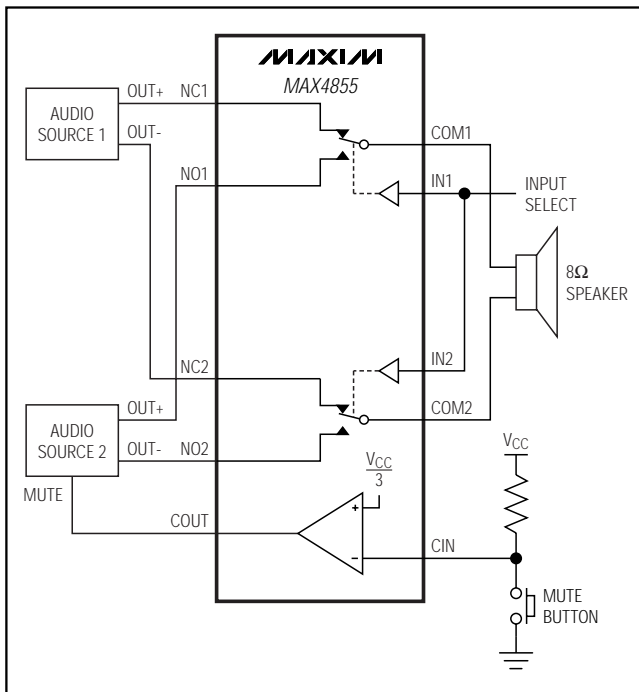


Figure 6. Comparator Switching Time

Typical Operating Circuit



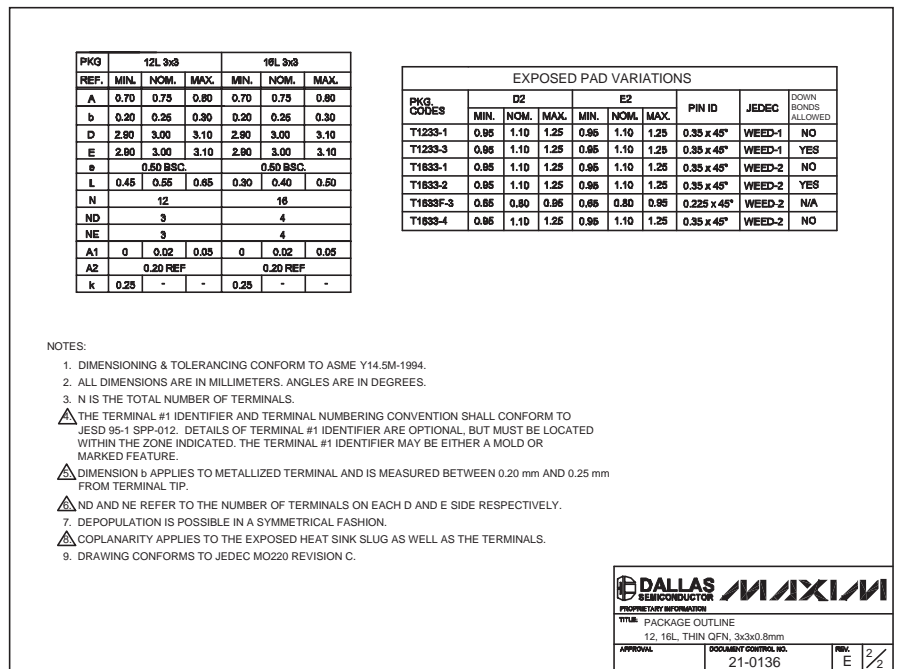
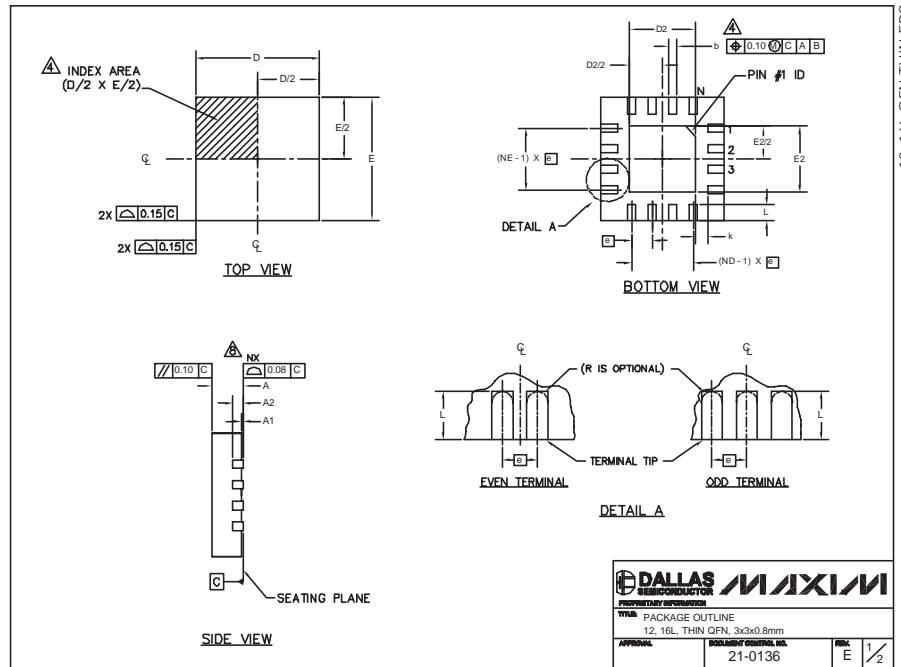
Chip Information

TRANSISTOR COUNT: 735
PROCESS: CMOS

0.75Ω, Dual SPDT Audio Switch with Integrated Comparators

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.)



Maxim cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim product. No circuit patent licenses are implied. Maxim reserves the right to change the circuitry and specifications without notice at any time.

10 _____ Maxim Integrated Products, 120 San Gabriel Drive, Sunnyvale, CA 94086 408-737-7600

© 2004 Maxim Integrated Products

Printed USA

MAXIM is a registered trademark of Maxim Integrated Products.