Precision, Quad, SPST Analog Switches

ABSOLUTE MAXIMUM RATINGS

Voltage Referenced to V-
V+ 44V
GND 25V
IN_, COM_, NO_, NC_ .....(V- - 2V) to (V+ + 2V) or 30mA (whichever occurs first)
Continuous Current (any terminal) 30mA
Peak Current COM, NO, NC
(pulsed at 1ms, 10% duty cycle max).....100mA
ESD.....2000V
Continuous Power Dissipation (T_A = +70°C) (Note 1)
Plastic DIP (derate 10.53mW/°C above +70°C).....842mW
Narrow SO (derate 8.70mW/°C above +70°C).....696mW
Thin QFN (derate 33.3mW/°C above +70°C).....2667mW
CERDIP (derate 10.00mW/°C above +70°C) 800mW
Operating Temperature Ranges:
MAX36_C_ _.....0°C to +70°C
MAX36_E_ _.....-40°C to +85°C
MAX36_MJE.....-55°C to +125°C
Storage Temperature Range .....-65°C to +150°C
Lead Temperature (soldering, 10s) .....+300°C

Note 1: All leads are soldered or welded to PC board.

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—Dual Supplies

(V+ = 15V, V- = -15V, GND = 0V, V_{INH} = 2.4V, V_{INL} = 0.8V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS			MIN	TYP (Note 2)	MAX	UNITS
ANALOG								
Analog-Signal Range	$V_{COM\_}$, $V_{NO\_}$, $V_{NC\_}$	(Note 3)			-15		15	V
On Resistance (COM_ to NO_ or COM_ to NC_ terminals)	R_{ON}	$I_{(NO\ or\ NC)}$ = -10mA, $V_{COM\_}$ = 8.5V or -8.5V, V+ = 13.5V, V- = -13.5V	T_A = +25°C			50	85	Ω
			T_A = T_{MIN} to T_{MAX}				100	
On Resistance Match Between Channels (Note 4)	R_{ON}	$I_{(NO\ or\ NC)}$ = -10mA, $V_{COM\_}$ = 10V or -10V, V+ = 15V, V- = -15V	T_A = +25°C				2	Ω
			T_A = T_{MIN} to T_{MAX}				4	
On Resistance Flatness (Note 4)	R_{ON}	$I_{(NO\ or\ NC)}$ = -10mA, $V_{COM\_}$ = 5V or -5V, V+ = 15V, V- = -15V	T_A = +25°C				9	Ω
			T_A = T_{MIN} to T_{MAX}				15	
Off Leakage Current (NO_ or NC_ terminal)	$I_{NO\_}$, $I_{NC\_}$	$V_{COM\_}$ = ±15.5V, $V_{NC\_}$ or $V_{NO\_}$ = ∓15.5V, V+ = 16.5V, V- = -16.5V	T_A = +25°C		-0.50	0.01	0.50	nA
			T_A = T_{MAX}	C, E	-4		4	
				M	-20		20	
Off Leakage Current (COM_ terminal)	I_{COM}	$V_{NC\_}$ or $V_{NO\_}$ = ±15.5V, $V_{COM\_}$ = ∓15.5V, V+ = 16.5V, V- = -16.5V	T_A = +25°C		-0.50	0.01	0.50	nA
			T_A = T_{MAX}	C, E	-4		4	
				M	-20		20	
On Leakage Current (COM_ and NC_ or NO_ terminal)	I_{COM} or I_{NO}, I_{NC}	$V_{COM\_}$ = ±15.5V, $V_{NC\_}$ or $V_{NO\_}$ = ±15.5V, V+ = 16.5V, V- = -16.5V	T_A = +25°C		-0.50	0.08	0.50	nA
			T_A = T_{MAX}	C, E	-6		6	
				M	-40		40	
DIGITAL								
Input Current with Input Voltage High	I_{INH}	$V_{IN\_}$ = 2.4V			-500	0.01	500	nA
Input Current with Input Voltage Low	I_{INH}	$V_{IN\_}$ = 0.8V			-500	0.01	500	nA

ELECTRICAL CHARACTERISTICS—Dual Supplies (continued)

(V+ = 15V, V- = -15V, GND = 0V, V_{INH} = 2.4V, V_{INL} = 0.8V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP (Note 2)	MAX	UNITS
SUPPLY							
Power-Supply Range	V+, V-			±4.5		±20.0	V
Positive Supply Current	I+	All channels on or off, V_{IN} = 0V or 5V, V+ = 16.5V, V- = -16.5V			15	100	µA
Negative Supply Current	I-	All channels on or off, V_{IN} = 0V or 5V, V+ = 16.5V, V- = -16.5V	T_A = +25°C	-1	-0.0001	1	µA
			T_A = T_{MIN} to T_{MAX}	-5		5	
Ground Current	I_{GND}	All channels on or off, V_{IN} = 0V or 5V, V+ = 16.5V, V- = -16.5V		-100	-15		µA
DYNAMIC							
Turn-On Time	t_{ON}	Figure 1, V_S = ±10V, R_L = 1kΩ	T_A = +25°C		150	250	ns
Turn-Off Time	t_{OFF}	MAX361, Figure 1, V_{COM} = ±10V	T_A = +25°C		90	120	ns
		MAX362, Figure 1, V_{COM} = ±10V	T_A = +25°C		110	170	ns
Charge Injection	Q	C_L = 1nF, V_{GEN} = 0V, R_{GEN} = 0Ω, Figure 2	T_A = +25°C		5	10	pC
Off Isolation (Note 5)	OIRR	R_L = 50Ω, C_L = 5pF, f = 1MHz, Figure 3	T_A = +25°C		60		dB
Crosstalk (Note 6)		R_L = 50Ω, C_L = 5pF, f = 1MHz, Figure 4	T_A = +25°C		-100		dB
Off Capacitance NC or NO	$C_{(OFF)}$	f = 1MHz, Figure 5	T_A = +25°C		4		pF
Off Capacitance COM_	$C_{COM(OFF)}$	f = 1MHz, Figure 5	T_A = +25°C		4		pF
Channel-On Capacitance	$C_{COM(ON)}$	f = 1MHz, Figure 5	T_A = +25°C		16		pF

ELECTRICAL CHARACTERISTICS—Single Supply

(V+ = 12V, V- = 0V, GND = 0V, V_{INH} = 2.4V, V_{INL} = 0.8V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP (Note 2)	MAX	UNITS
SWITCH							
Analog-Signal Range	$V_{COM\_}$, $V_{NO\_}$, $V_{NC\_}$	(Note 3)		0		12	V
On Resistance (COM_ to NO_ or COM_ to NC_ terminals)	R_{ON}	$I_{(NC\ or\ NO)}$ = 1.0mA, $V_{COM\_}$ = 3V, 8V, V+ = 10.8V	T_A = +25°C		100	160	Ω
			T_A = T_{MIN} to T_{MAX}			200	
SUPPLY							
Power-Supply Range	V+			10		30	V
Positive Supply Current	I+	All channels on or off, V_{IN} = 0V or 5V			15	100	µA
Negative Supply Current	I-	All channels on or off, V_{IN} = 0V or 5V	T_A = +25°C	-1	-0.0001	1	µA
			T_A = T_{MIN} to T_{MAX}	-5		+5	µA
Ground Current	I_{GND}	All channels on or off, V_{IN} = 0V or 5V		-100	-15		
DYNAMIC							
Turn-On Time	t_{ON}	Figure 1, V_S = 8V	T_A = +25°C		300	400	ns
Turn-Off Time	t_{OFF}	Figure 1, V_S = 8V	T_A = +25°C		60	200	ns
Charge Injection	Q	C_L = 1nF, V_{GEN} = 0V,	T_A = +25°C		5	10	pC

Note 2: The algebraic convention, where the most negative value is a minimum and the most positive value a maximum, is used in this data sheet.

Note 3: Guaranteed by design.

Note 4: On resistance match between channels and flatness are guaranteed only with bipolar-supply operation.

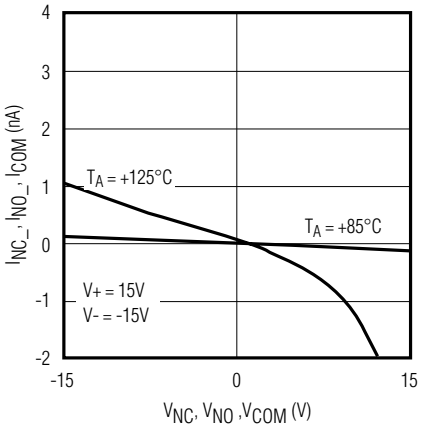
Note 5: See Figure 3. Off Isolation = $20 \log_{10} \left(\frac{V_{COM}}{V_{NC\_}\ or\ V_{NO\_}} \right)$, V_{COM} = output, $V_{NC\ or\ NO}$ = input to off switch.

Note 6: Between any two switches. See Figure 4.

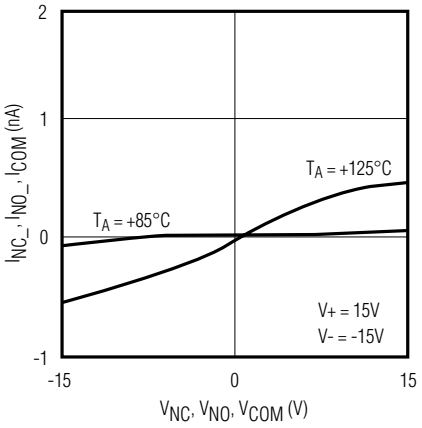
Typical Operating Characteristics

(T_A = +25°C, unless otherwise noted.)

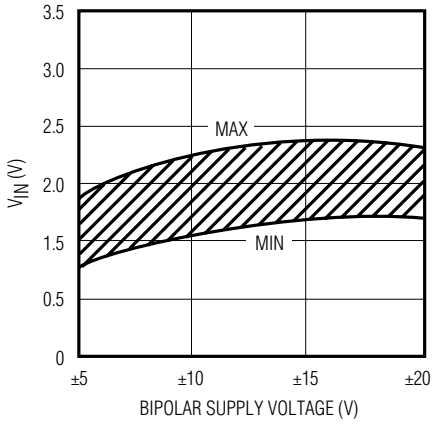
ON LEAKAGE CURRENTS



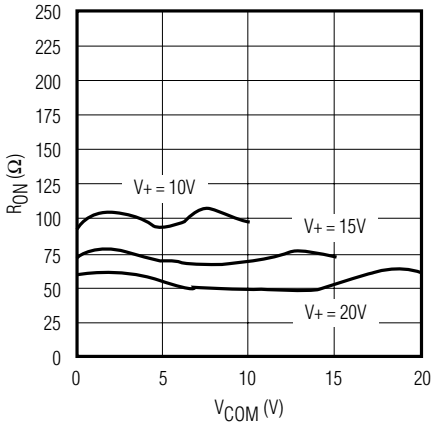
OFF LEAKAGE CURRENTS



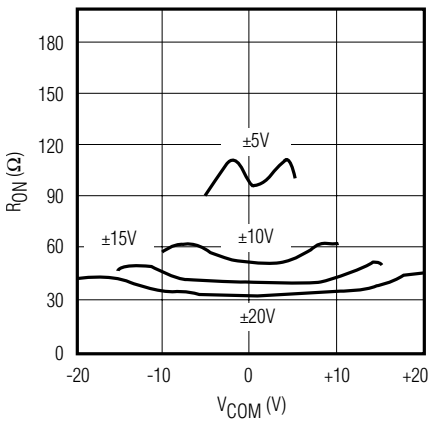
SWITCHING THRESHOLD vs. BIPOLAR SUPPLY VOLTAGE



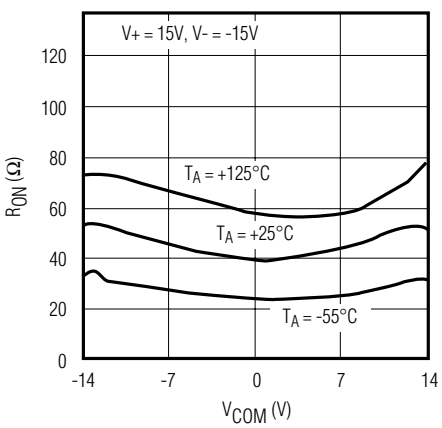
ON RESISTANCE vs. V_{COM} AND UNIPOLAR SUPPLY VOLTAGE



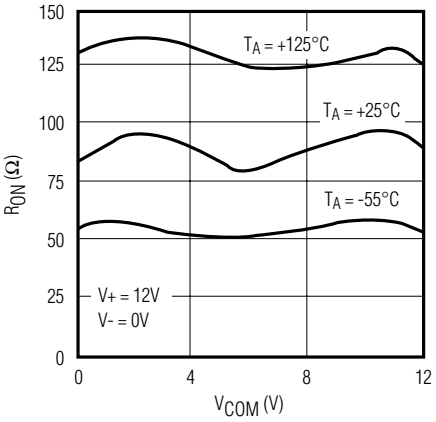
ON RESISTANCE vs. V_{COM} AND BIPOLAR SUPPLY VOLTAGE



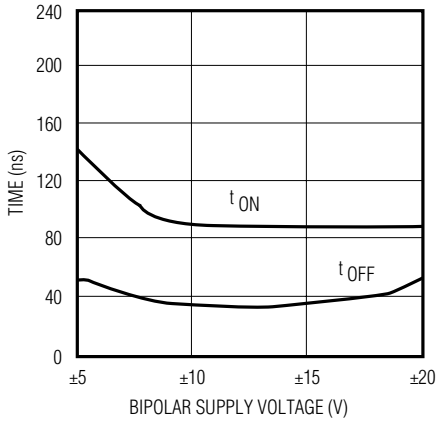
ON RESISTANCE vs. V_{COM} AND BIPOLAR VOLTAGE AND TEMPERATURE



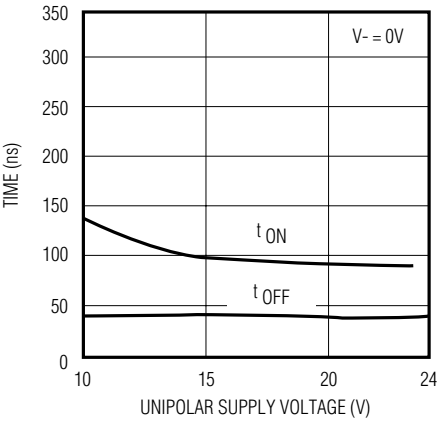
ON RESISTANCE vs. V_{COM} AND UNIPOLAR SUPPLY VOLTAGE AND TEMPERATURE



SWITCHING TIME vs. BIPOLAR SUPPLY VOLTAGE

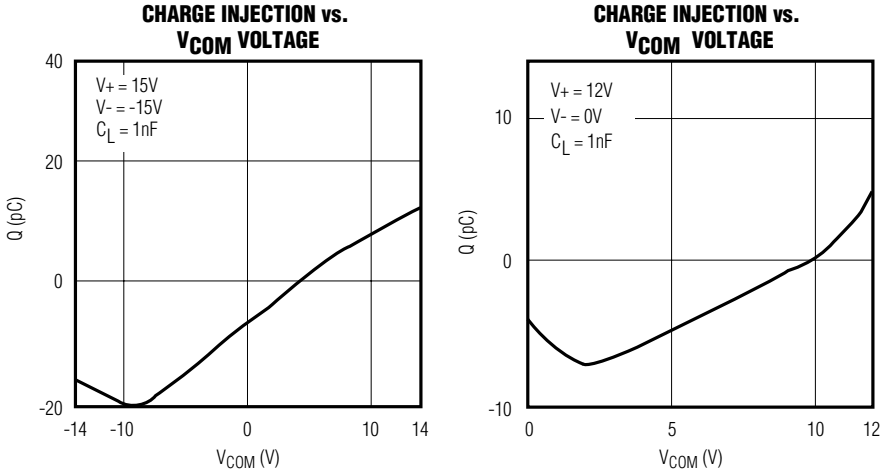


SWITCHING TIMES vs. UNIPOLAR SUPPLY VOLTAGE



Typical Operating Characteristics (continued)

(T_A = +25°C, unless otherwise noted.)



Pin Description

PIN	NAME	NAME	FUNCTION
DIP/SO	THIN QFN		
1, 16, 9, 8	15, 14, 7, 6	IN1–IN4	Logic Control Input
2, 15, 10, 7	16, 13, 8, 5	COM1–COM4	Analog-Switch Drain Terminal
3, 14, 11, 6	1, 12, 9, 4	NO1–NO4 or NC1–NC4	NC (normally closed, MAX361) NO (normally open, MAX362) Analog-Switch Terminal
4	2	V-	Negative-Supply Voltage Input
5	3	GND	Ground
12	10	N.C.	No Connection. Not internally connected
13	11	V+	Positive-Supply Voltage Input—Connected to Substrate
—	EP	PAD	Exposed Pad—Connect pad to V+

Applications Information

Operation with Supply Voltages Other Than ±15V

Using supply voltages other than ±15V is reduces the analog signal range. The MAX361/MAX362 switches operate with bipolar supplies of ±4.5V to ±20V. Typical operating characteristic graphs show typical on resistance for ±15V, ±10V, and ±5V supplies. Switching times increase by a factor of two or more for ±5V operation. The MAX361/MAX362 can also operate from +10V to +30V unipolar supplies. Both parts can also be powered from unbalanced supplies such as +24V and -5V. Connect V- to 0V when operating with a single supply.

Proper power-supply sequencing is recommended for all CMOS devices. Do not exceed the absolute maximum ratings, because stresses beyond the listed ratings may cause permanent damage to the devices. Always sequence V+ on first, followed by V-, and logic inputs. If power-supply sequencing is not possible, add two small signal diodes in series with the supply pins for overvoltage protection (Figure 6). Adding the diodes reduces the analog signal range to 1V below V+ and 1V below V-, but low switch resistance and low leakage characteristics are unaffected. Device operation is unchanged, and the difference from V+ to V- should not exceed +44V.

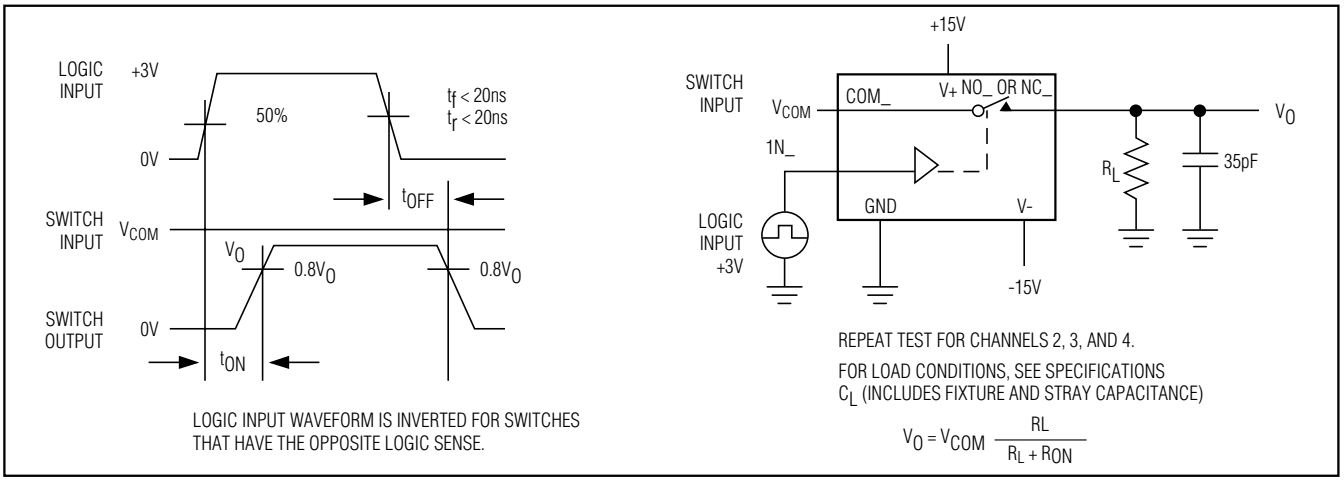


Figure 1. Switching-Time Test Circuit

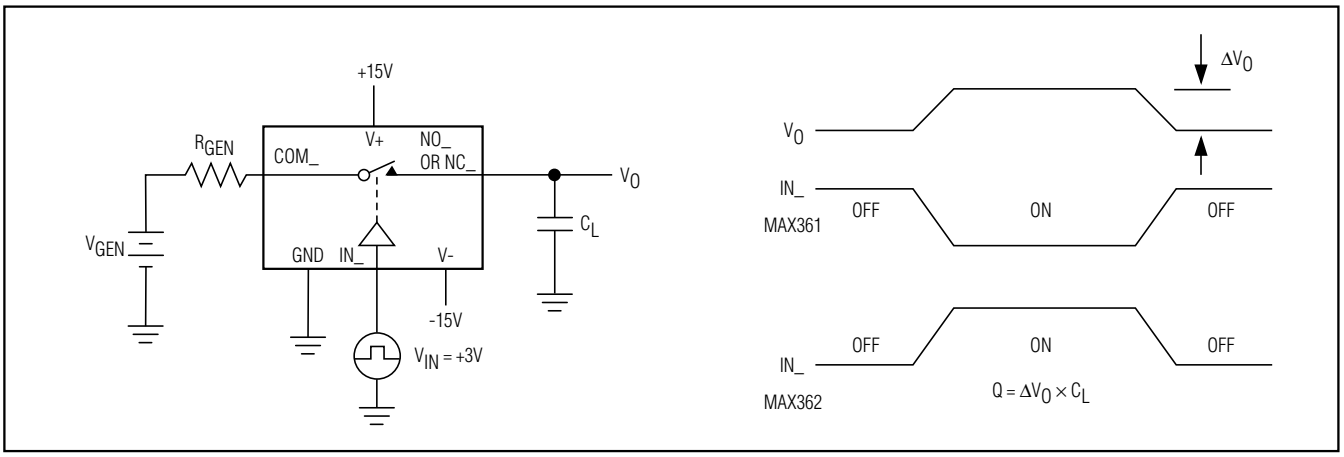


Figure 2. Charge-Injection Test Circuit

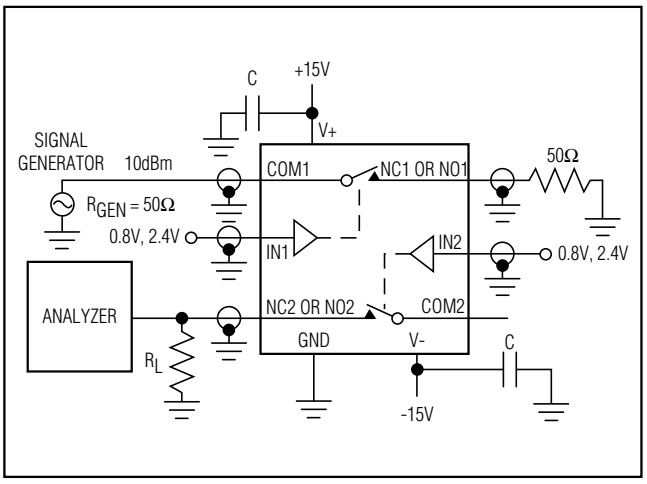


Figure 3. Crosstalk Test Circuit (repeat for channels 3 and 4)

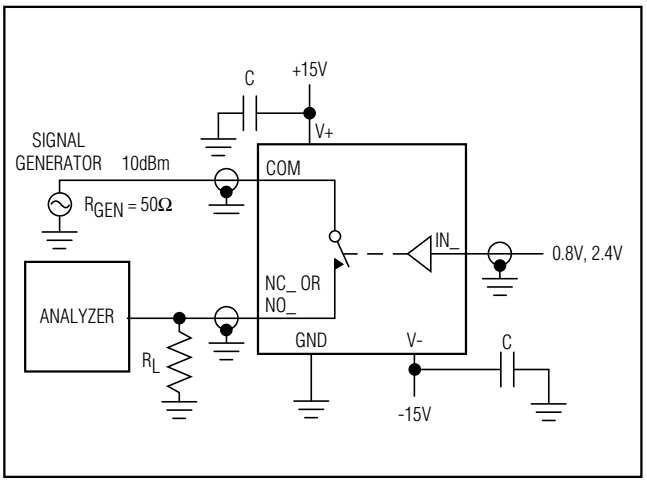


Figure 4. Off-Isolation Test Circuit

Precision Quad SPST Analog Switches

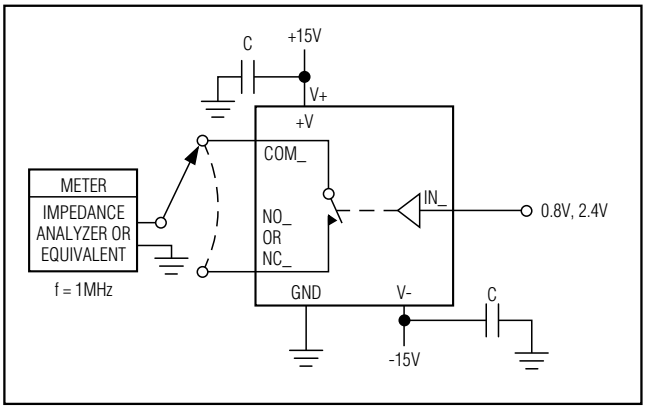


Figure 5. Channel Capacitance Test Circuit

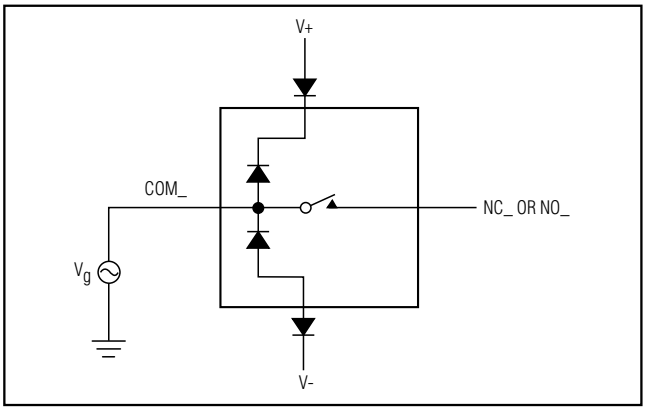
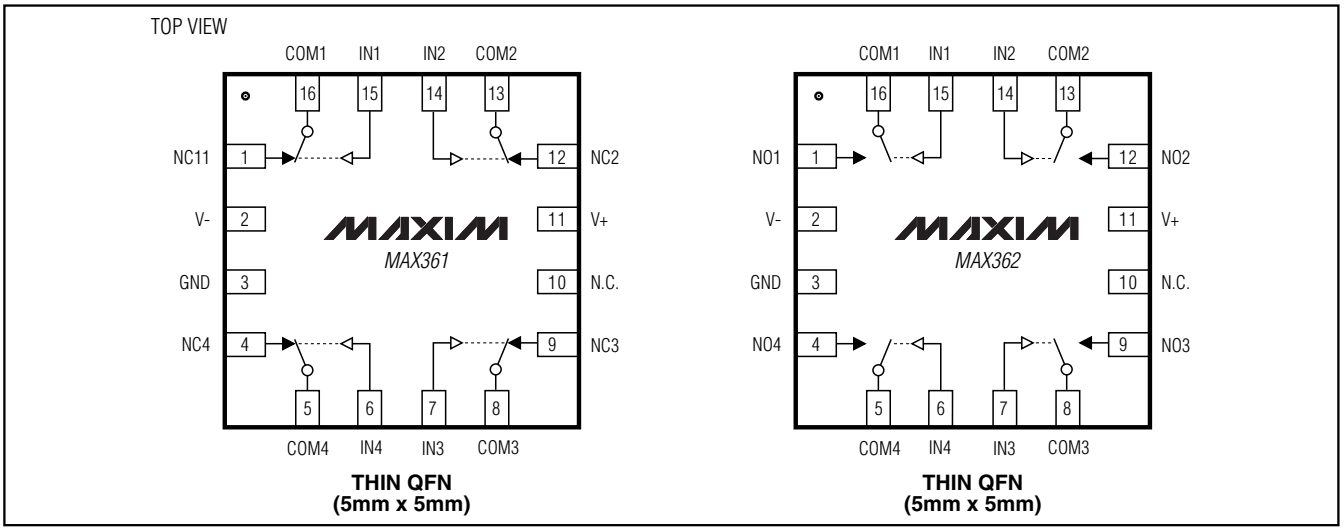


Figure 6. Overvoltage Protection Using Blocking Diodes

Pin Configurations (continued)

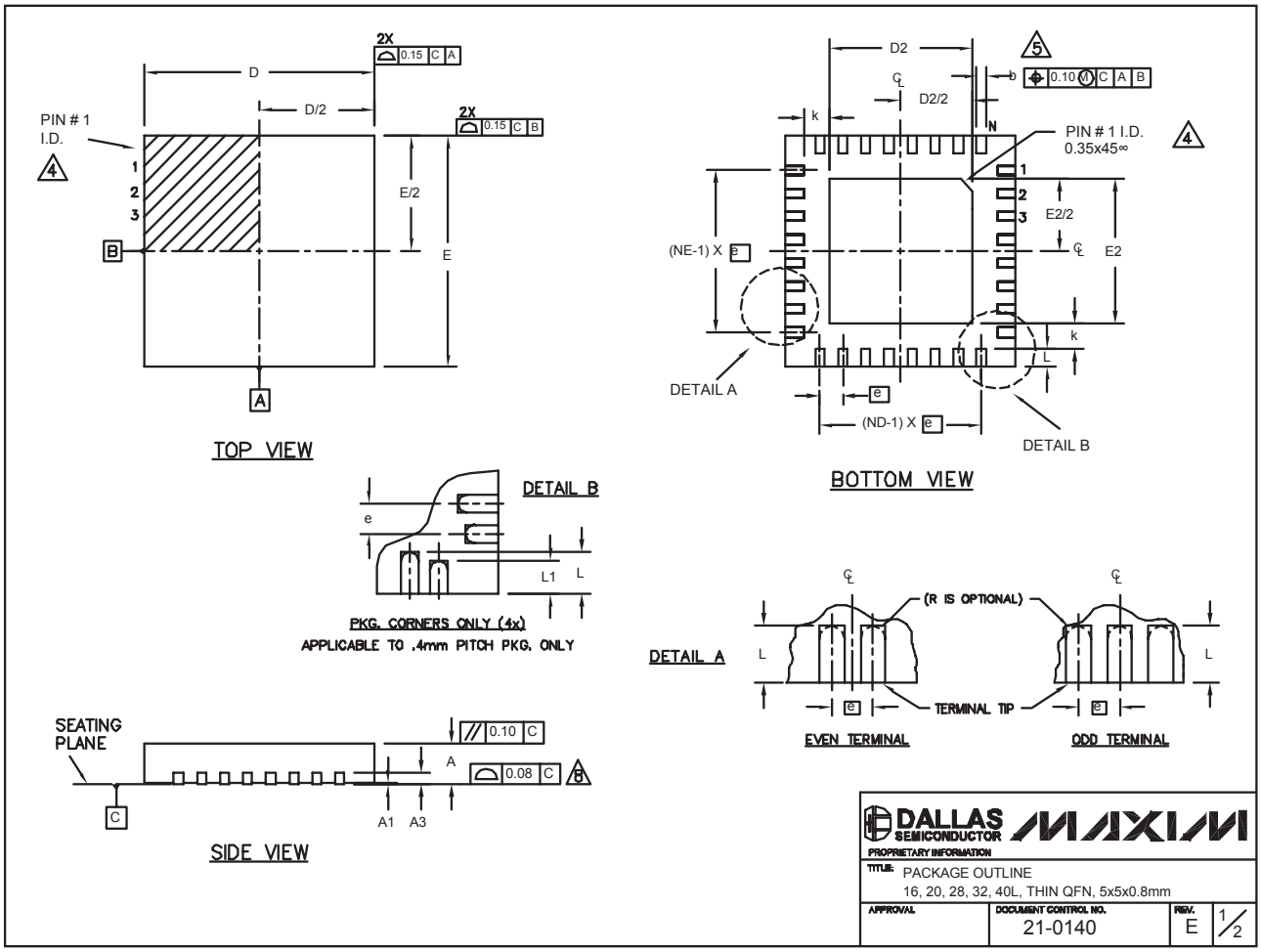


TRANSISTOR COUNT: 126;
SUBSTRATE CONNECTED TO V+.

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**.)

QFN THIN.EPS



Precision Quad SPST Analog Switches

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**.)

COMMON DIMENSIONS															
PKG.	16L 5x5			20L 5x5			28L 5x5			32L 5x5			40L 5x5		
SYMBOL	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	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	0.70	0.75	0.80	0.70	0.75	0.80
A1	0	0.02	0.05	0	0.02	0.05	0	0.02	0.05	0	0.02	0.05	0	-	0.05
A3	0.20 REF.			0.20 REF.			0.20 REF.			0.20 REF.			0.20 REF.		
b	0.25	0.30	0.35	0.25	0.30	0.35	0.20	0.25	0.30	0.20	0.25	0.30	0.15	0.20	0.25
D	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10
E	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10	4.90	5.00	5.10
e	0.80 BSC.			0.65 BSC.			0.50 BSC.			0.50 BSC.			0.40 BSC.		
k	0.25	-	-	0.25	-	-	0.25	-	-	0.25	-	-	0.25	0.35	0.45
L	0.30	0.40	0.50	0.45	0.55	0.65	0.45	0.55	0.65	0.30	0.40	0.50	0.40	0.50	0.60
L1	-	-	-	-	-	-	-	-	-	-	-	-	0.30	0.40	0.50
N	16			20			28			32			40		
ND	4			5			7			8			10		
NE	4			5			7			8			10		
JEDEC	WHHB			WHHC			WHHD-1			WHHD-2			-		

EXPOSED PAD VARIATIONS							
PKG. CODES	D2			E2			DOWN BONDS ALLOWED
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	
T1655-1	3.00	3.10	3.20	3.00	3.10	3.20	NO
T1655-2	3.00	3.10	3.20	3.00	3.10	3.20	YES
T2055-2	3.00	3.10	3.20	3.00	3.10	3.20	NO
T2055-3	3.00	3.10	3.20	3.00	3.10	3.20	YES
T2055-4	3.00	3.10	3.20	3.00	3.10	3.20	NO
T2855-1	3.15	3.25	3.35	3.15	3.25	3.35	NO
T2855-2	2.60	2.70	2.80	2.60	2.70	2.80	NO
T2855-3	3.15	3.25	3.35	3.15	3.25	3.35	YES
T2855-4	2.60	2.70	2.80	2.60	2.70	2.80	YES
T2855-5	2.60	2.70	2.80	2.60	2.70	2.80	NO
T2855-6	3.15	3.25	3.35	3.15	3.25	3.35	NO
T2855-7	2.60	2.70	2.80	2.60	2.70	2.80	YES
T3255-2	3.00	3.10	3.20	3.00	3.10	3.20	NO
T3255-3	3.00	3.10	3.20	3.00	3.10	3.20	YES
T3255-4	3.00	3.10	3.20	3.00	3.10	3.20	NO
T4055-1	3.20	3.30	3.40	3.20	3.30	3.40	YES

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 0.25 mm AND 0.30 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, EXCEPT EXPOSED PAD DIMENSION FOR T2855-1, T2855-3 AND T2855-6.
10. WARPAGE SHALL NOT EXCEED 0.10 mm.

DALLAS SEMICONDUCTOR MAXIM

PROPRIETARY INFORMATION

TITLE: PACKAGE OUTLINE
16, 20, 28, 32, 40L, THIN QFN, 5x5x0.8mm

APPROVAL	DOCUMENT CONTROL NO.	REV.	
	21-0140	E	2/2