

Precision, Quad, SPST Analog Switches

ABSOLUTE MAXIMUM RATINGS

Voltage Referenced to V-		Continuous Power Dissipation (T _A = +70°C) (Note 1)
V+	44V	Plastic DIP (derate 10.53mW/°C above +70°C).....842mW
GND	25V	Thin QFN (derate 33.3mW/°C above +70°C).....2667mW
VL	(GND - 0.3V) to (V+ + 0.3V)	Narrow SO (derate 8.70mW/°C above +70°C)696mW
IN_, COM_, NO_, or NC_	(V- - 2V) to (V+ + 2V) or 30mA (whichever occurs first)	Operating Temperature Ranges:
Continuous Current (any terminal)	30mA	MAX36_C_
Peak Current COM_, NO_, or NC_	100mA (pulsed at 1ms, 10% duty cycle max)	MAX36_E_
ESD	2000V	Storage Temperature Range
		Lead Temperature (soldering, 10s)

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, VL = 5V, 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	R _{ON}	COM_ to NO_ or NC, I _{COM} = -10mA, V _{COM} = 8.5V or -8.5V, V+ = 13.5V, V- = -13.5V	T _A = +25°C		50	85	
			T _A = T _{MIN} to T _{MAX}			100	
On Resistance Match Between Channels (Note 4)	R _{ON}	I _{COM} = -10mA, V _{COM} = 10V or -10V, V+ = 15V, V- = -15V	T _A = +25°C			2	
			T _A = T _{MIN} to T _{MAX}			4	
On Resistance Flatness (Note 4)	R _{ON}	I _{COM} = -10mA, V _{COM} = 5V or -5V, V+ = 15V, V- = -15V	T _A = +25°C			9	
			T _A = T _{MIN} to T _{MAX}			15	
NC_ or NO_ Leakage Current	I _{NO_} , I _{NC}	NO_ or NC_ terminal, V _{COM} = ±15.5V, V _{NO} or V _{NC} = ±15.5V, V+ = 16.5V, V- = -16.5V	T _A = +25°C		-0.50	0.01	0.50
			T _A = T _{MIN} to T _{MAX}		-4		4
COM_ Off Leakage Current	I _{NO} , I _{NC}	COM_ terminal, V _{NO} or V _{NC} = ±15.5V, V _{COM} = ±15.5V, V+ = 16.5V, V- = -16.5V	T _A = +25°C		-0.50	0.01	0.50
			T _A = T _{MIN} to T _{MAX}		-4		4
COM_, NC_ or NO_ On Leakage Current	I _{COM} or I _{NO} , I _{NC}	COM_ to NC_ or NO_ V _{COM} = ±15.5V, V _{NO} or V _{NC} = ±15.5V, V+ = 16.5V, V- = -16.5V	T _A = +25°C		-0.50	0.08	0.50
			T _A = T _{MIN} to T _{MAX}		-6		6
INPUT							
Input Current with Input Voltage High	I _{INH}	V _{IN_} = 2.4V, all others = 0.8V	-0.5	-0.00001	0.5	αA	
Input Current with Input Voltage Low	I _{INL}	V _{IN_} = 0.8V, all others = 2.4V	-0.5	-0.00001	0.5	αA	

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ELECTRICAL CHARACTERISTICS—Dual Supplies (continued)

(V₊ = 15V, V₋ = -15V, V_L = 5V, 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	T _A = +25°C	-1	0.001	1	μA
			T _A = T _{MIN} to T _{MAX}	-5		5	
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	
Logic Supply Current	I _L	All channels on or off, V _{IN} = 0V or 5V, V ₊ = 16.5V, V ₋ = -16.5V	T _A = +25°C	-1	0.001	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	T _A = +25°C	-1	-0.0001	1	μA
			T _A = T _{MIN} to T _{MAX}	-5		5	
DYNAMIC							
Turn-On Time	t _{ON}	V _{NO} or V _{NC} = ±10V, Figure 2	T _A = +25°C		150	250	ns
Turn-Off Time	t _{OFF}	MAX364, V _{NO} or V _{NC} = ±10V, Figure 2	T _A = +25°C		90	120	ns
		MAX365, V _{NO} or V _{NC} = ±10V, Figure 2	T _A = +25°C		110	170	ns
Charge Injection	Q	C _L = 1nF, V _{GEN} = 0V, R _{GEN} = 0Ω, Figure 3	T _A = +25°C		5	10	pC
Off Isolation (Note 5)	OIRR	R _L = 50Ω, C _L = 5pF, f = 1MHz, Figure 4	T _A = +25°C		60		dB
Crosstalk (Note 6)		R _L = 50Ω, C _L = 5pF, f = 1MHz, Figure 5	T _A = +25°C		100		dB
NC_ or NO_ Off Capacitance	C _(OFF)	f = 1MHz, Figure 6	T _A = +25°C		4		pF
COM_ Off Capacitance	C _{COM(OFF)}	f = 1MHz, Figure 6	T _A = +25°C		4		pF
Channel-On Capacitance	C _{COM(ON)}	f = 1MHz, Figure 6	T _A = +25°C		16		pF

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ELECTRICAL CHARACTERISTICS—Single Supply

(V+ = 12V, V- = 0V, VL = 5V, GND = 0V, VINH = 2.4V, VINL = 0.8V, TA = TMIN to TMAX, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP (Note 2)	MAX	UNITS
ANALOG							
Analog Signal Range	VCOM_, VNO_, VNC_	(Note 3)		0		12	V
On Resistance	RON	COM_ to NO_ or NC_, INC or INO = -10mA, VL = 5.25V, VCOM = 3V, 8V, V+ = 10.8V	TA = +25°C	100	160		Ω
			TA = TMIN to TMAX		200		
SUPPLY							
Power-Supply Range	V+, V-			10.8		24.0	V
Power-Supply Current	I+	All channels on or off, VIN = 0V or 5V	TA = +25°C	-1	0.001	1	μA
			TA = TMIN to TMAX	-5		5	
Negative Supply Current	I-	All channels on or off, VIN = 0V or 5V	TA = +25°C	-1	-0.0001	1	μA
			TA = TMIN to TMAX	-5		5	
Logic Supply Current	IL	All channels on or off, VIN = 0V or 5V	TA = +25°C	-1	0.001	1	μA
			TA = TMIN to TMAX	-5		5	
Ground Current	IGND	All channels on or off, VIN = 0V or 5V	TA = +25°C	-1	-0.0001	1	μA
			TA = TMIN to TMAX	-5		5	
DYNAMIC							
Turn-On Time	tON	VNC or VNO = 8V, Figure 2	TA = +25°C	300	400		ns
Turn-Off Time	tOFF	VNC or VNO = 8V, Figure 2	TA = +25°C	60	200		ns
Charge Injection	Q	CL = 1nF, VGEN = 0V, RGEN = 0Ω, Figure 3	TA = +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 2. Off Isolation = $20 \log_{10} \left(\frac{V_{COM}}{V_{NC} \text{ or } V_{NO}} \right)$, VCOM = output, VNO or VNC = input to off switch.

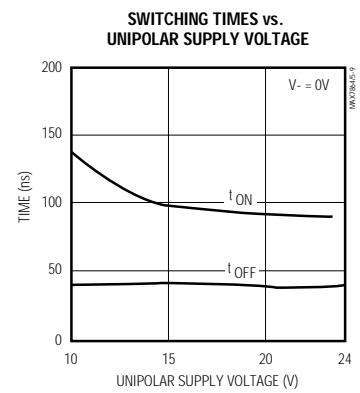
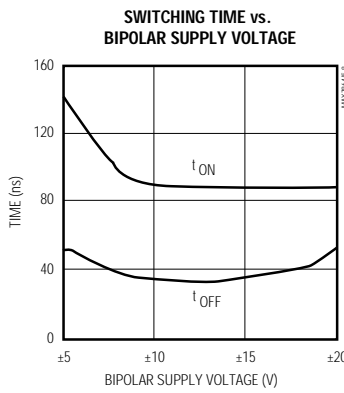
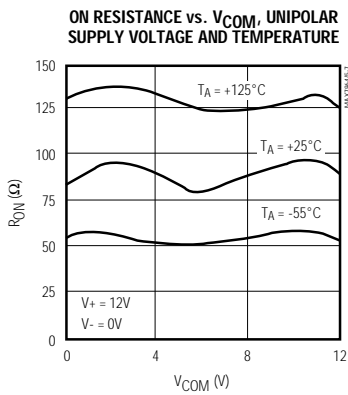
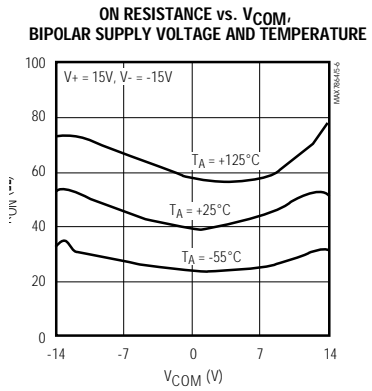
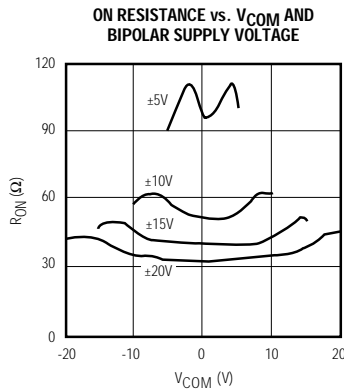
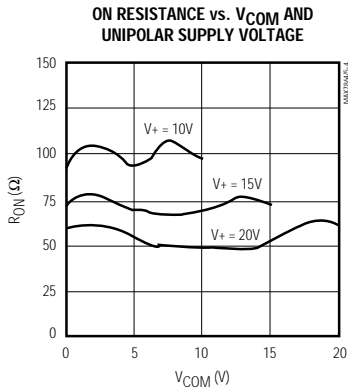
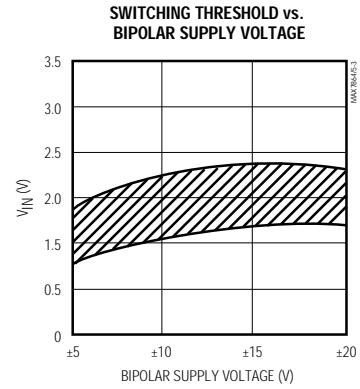
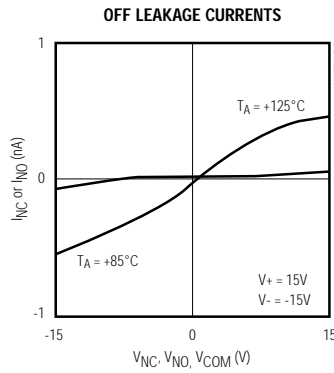
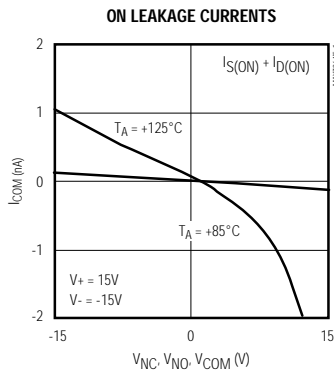
Note 6: Between any two switches. See Figure 5.

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Typical Operating Characteristics

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

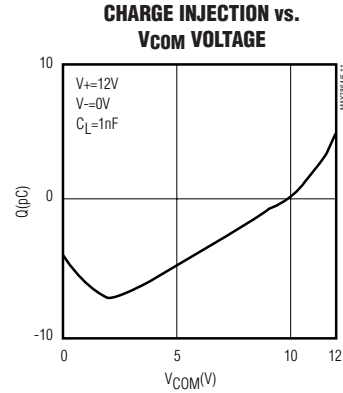
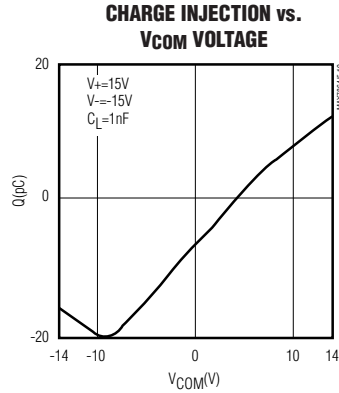
MAX364/MAX365



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Typical Operating Characteristics

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



Pin Description

PIN		NAME	FUNCTION
DIP/SO	QFN		
1, 16, 9, 8	15, 14, 7, 6	IN1–N4	Logic Control Input
2, 15, 10, 7	16, 13, 8, 5	COM1–COM4	Analog-Switch Common Terminal
3, 14, 11, 6	1, 12, 9, 4	NC1–NC4 or NO1–NO4	NC (normally closed, MAX364) NO (normally closed, MAX365) Analog-Switch Terminal
4	2	V-	Negative-Supply Voltage Input
5	3	GND	Ground
12	10	V _L	Logic-Supply Voltage Input
13	11	V+	Positive-Supply Voltage Input—Connected to Substrate
—	EP	PAD	Exposed Pad. Connect PAD to V+

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Applications Information

Application Hints

1. Switches are open when power is off.
2. IN₋, COM₋, NO₋, and NC₋ should not exceed V₊ or V₋, even with the power off.
3. Switch leakage is from each analog switch terminal to V₊ or V₋, not to the other switch terminal.

Operation with Supply Voltages Other than ±15V

The main limitation of supply voltages other than ±15V is reduction in the analog signal range. The MAX364/MAX365 switches operate with ±5V to ±20V bipolar supplies. The *Typical Operating Characteristics* 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 MAX364/MAX365 operate from unipolar supplies of +10V to +24V. Both parts can be powered from a single +10V to +24V supply, as well as from unbalanced supplies, such as +24V and -5V. Connect V₋ to 0V when operating with a single supply. VL must be connected to +5V to be TTL compatible or to V₊ for CMOS logic input levels.

Overvoltage Protection

Proper power-supply sequencing is recommended for all CMOS devices. It is important not to exceed the absolute maximum ratings, because stresses beyond those listed may cause permanent damage to the devices. Always sequence V₊ on first, followed by VL, V₋, and logic inputs. If power-supply sequencing is not possible, protect the devices from overvoltage by

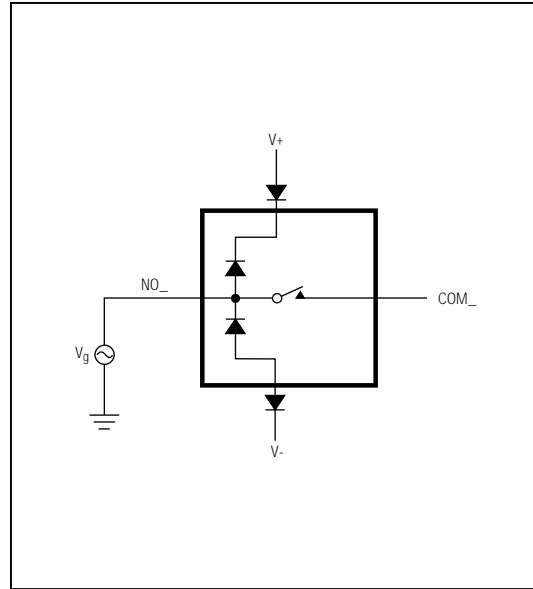


Figure 1. Overvoltage Protection Using Blocking Diodes

adding two small signal diodes in series with the supply pins (Figure 1). 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 between V₊ to V₋ should not exceed +44V.

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Test Circuits/Timing Diagrams

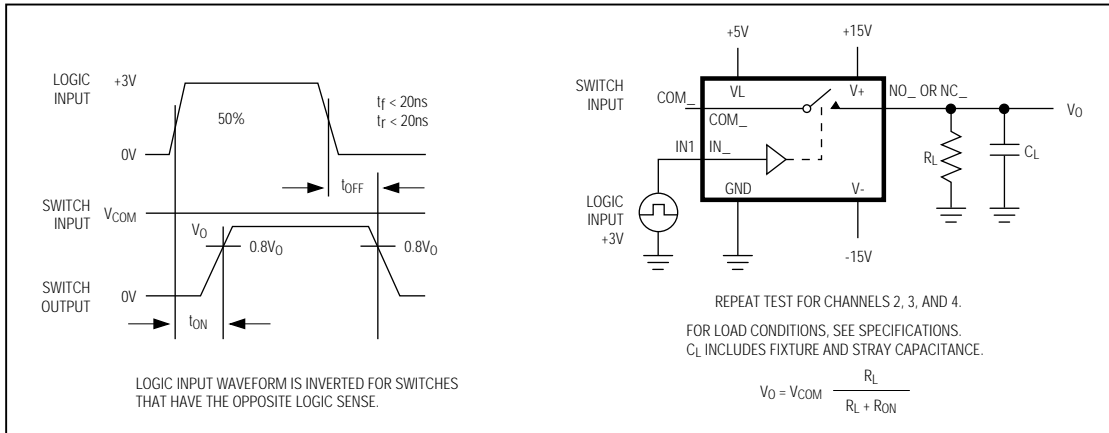


Figure 2. Switching-Time Test Circuit

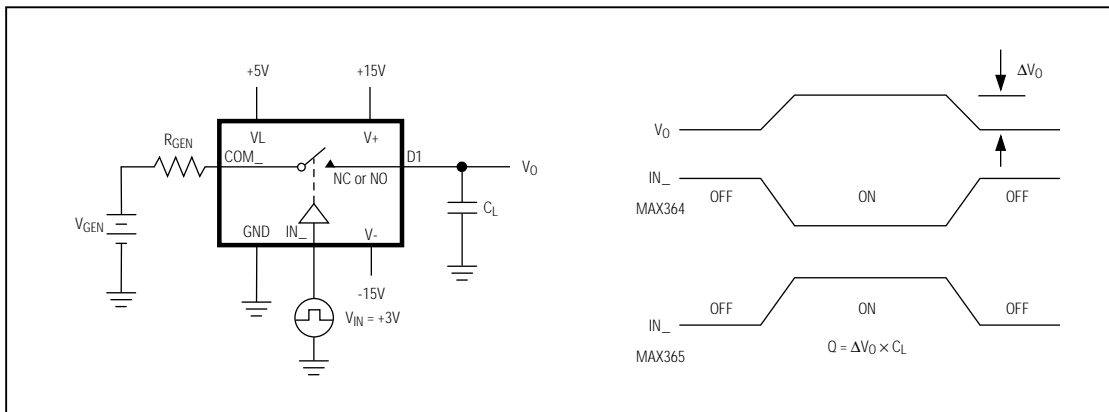


Figure 3. Charge-Injection Test Circuit

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Test Circuits/Timing Diagrams (continued)

MAX364/MAX365

FREQUENCY TESTED	SIGNAL GENERATOR	ANALYZER
100Hz to 13MHz	AUTOMATIC SYNTHESIZER	SPECTRUM ANALYZER

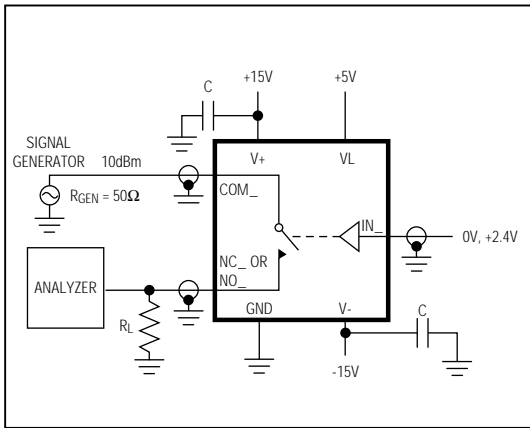


Figure 4. Off Isolation Test Circuit

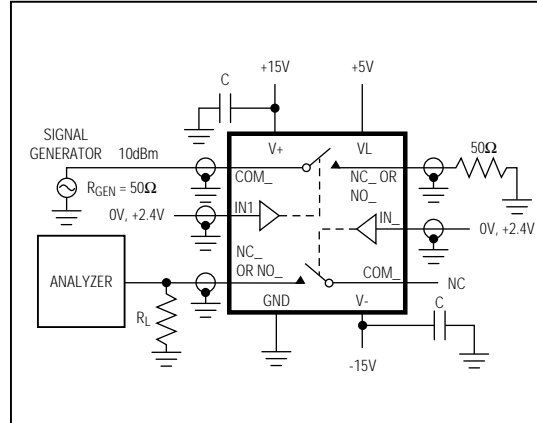


Figure 5. Crosstalk Test Circuit

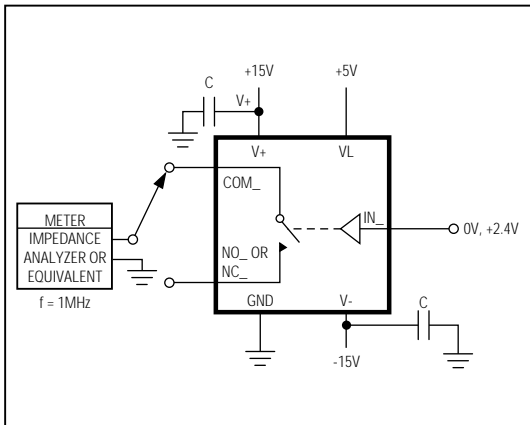


Figure 6. COM_, NC_, NO_ Off Capacitance

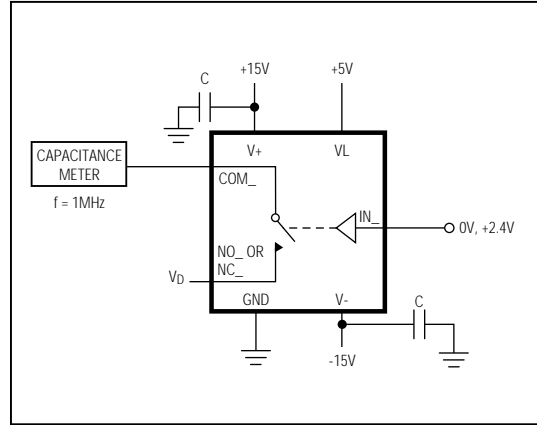
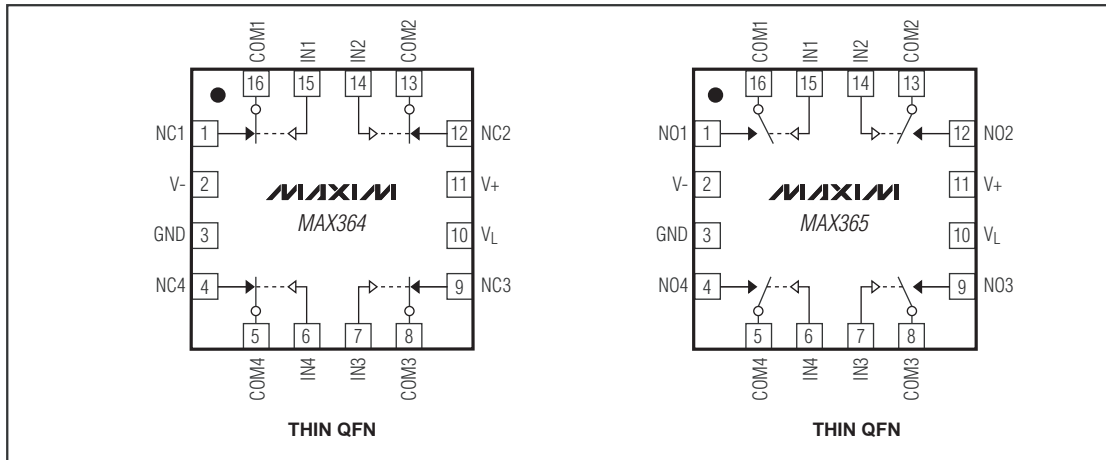


Figure 7. COM_, NC_, NO_ On Capacitance

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Pin Configurations/Functional Diagrams (continued)

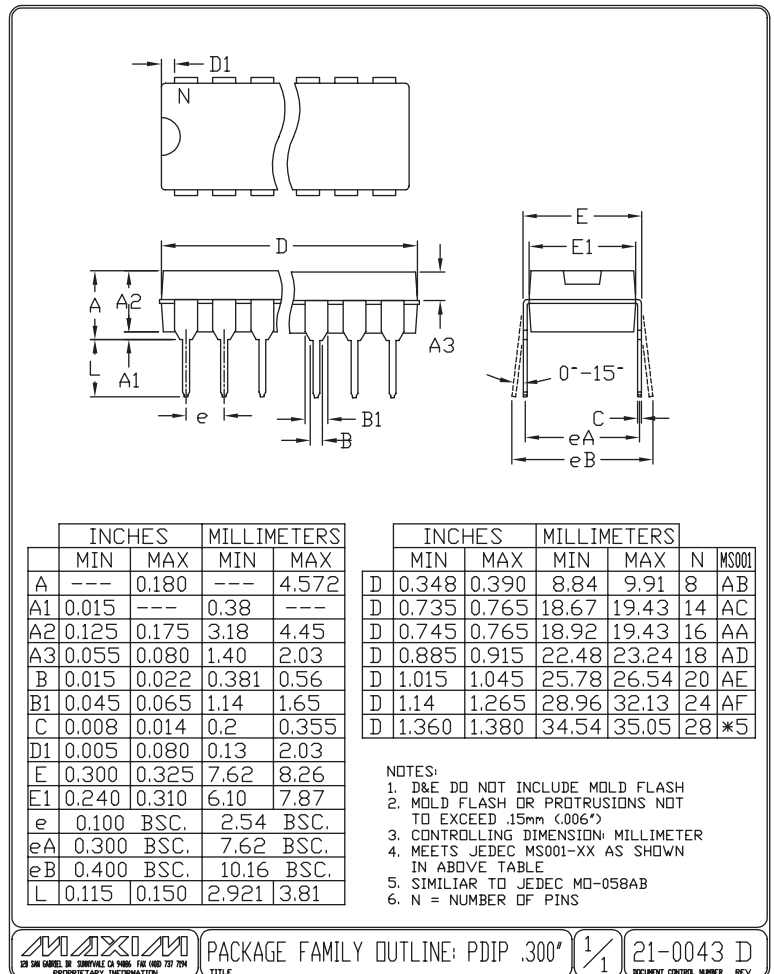


Precision, Quad, SPST Analog Switches

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.)

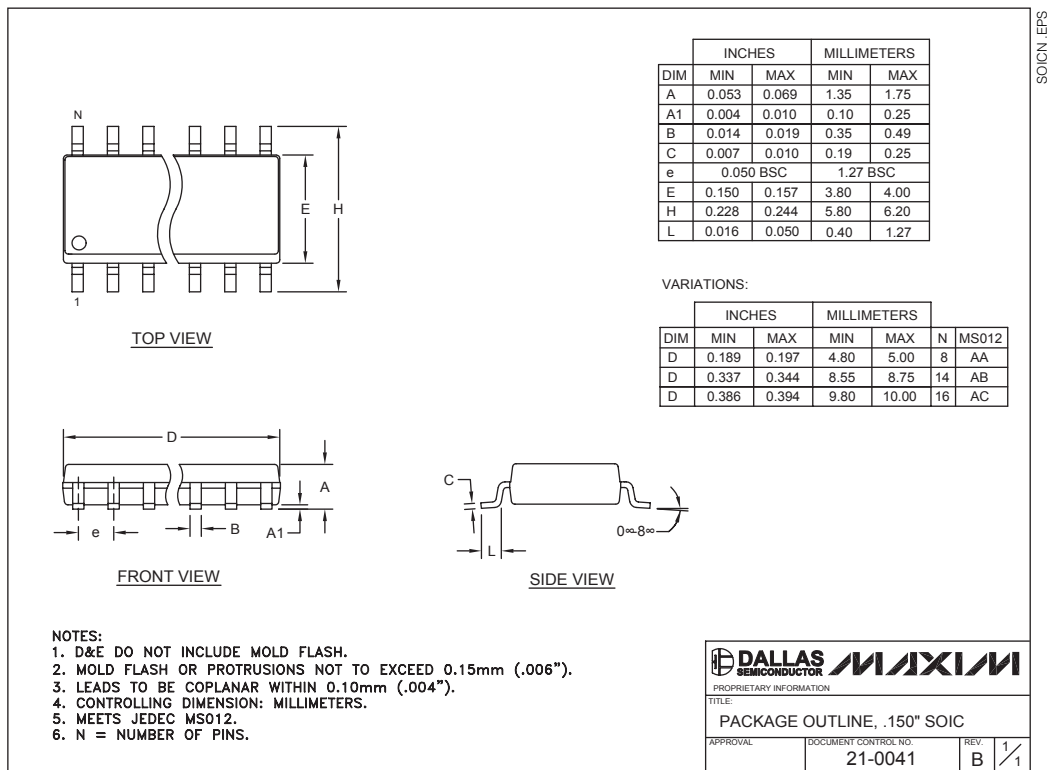
MAX364/MAX365



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.)



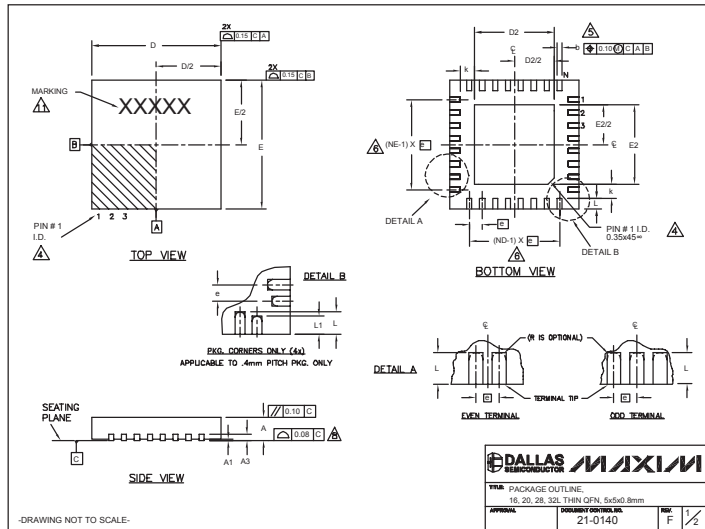
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Precision, Quad, SPST Analog Switches

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.)

MAX364/MAX365



COMMON DIMENSIONS												
SYMBOL	16L 5x5			20L 5x5			28L 5x5			32L 5x5		
	MIN.	NCM.	MAX.	MIN.	NCM.	MAX.	MIN.	NCM.	MAX.	MIN.	NCM.	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
A1	0	0.02	0.05	0	0.02	0.05	0	0.02	0.05	0	0.02	0.05
A3	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
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
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
e	0.80 BSC.			0.65 BSC.			0.50 BSC.			0.50 BSC.		
k	0.25	-	-	0.25	-	-	0.25	-	-	0.25	-	-
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
L1	-	-	-	-	-	-	-	-	-	-	-	-
N	16			20			28			32		
ND	4			5			7			8		
NE	4			5			7			8		
JEDEC	WHHB			WHHC			WHHD-1			WHHD-2		

EXPOSED PAD VARIATIONS										
PKG. CODES	D2			E2			L	DOWN BOND ALLOWED		
	MIN.	NCM.	MAX.	MIN.	NCM.	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		
T1655N-1	3.00	3.10	3.20	3.00	3.10	3.20	**	NO		
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		
T2055-5	3.15	3.25	3.35	3.15	3.25	3.35	0.40	Y		
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		
T2855-8	3.15	3.25	3.35	3.15	3.25	3.35	0.40	Y		
T2855N-1	3.15	3.25	3.35	3.15	3.25	3.35	**	N		
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		
T3255N-1	3.00	3.10	3.20	3.00	3.10	3.20	**	NO		

**SEE COMMON DIMENSIONS TABLE

DALLAS
REPRODUCER **MAXIM**

TITLE: PACKAGE OUTLINE
16, 20, 28, 32L THIN QFN, 5x5x0.8mm
APPROVAL: DOCUMENT CONTROL NO. 21-0140 REV. F 1/2

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