

# 低コスト、低電圧、クワッド、SPST CMOSアナログスイッチ

## 概要

MAX4066/MAX4066Aは、工業標準のデバイスよりも優れた性能を提供するクワッドSPST、CMOSアナログスイッチです。これらの新製品は+2.0V~+16Vの範囲で動作することが保証されており、3V、5V及び12Vの仕様で提供されています。どちらも45 $\Omega$ のオン抵抗、2(12V)のチャンネル間マッチング、及び全信号範囲で4 $\mu$ sの平坦性という特性を備えています。

どちらもTTL/CMOS入力レベルによって制御され、両方向性スイッチ又はマルチプレクサ/デマルチプレクサとして用いることができます。

MAX4066/MAX4066Aは低オフリーク電流(MAX4066Aは100pA)及び低消費電力(0.5 $\mu$ W)の特性を備えているため、バッテリー駆動機器に最適です。また、低歪みのオーディオアプリケーションにも適しています。MAX4066/MAX4066Aは14ピンDIP及びSOP、また16ピンQSOPパッケージで供給されています。ESD保護は2000V以上(3015.7法)です。

## アプリケーション

バッテリー駆動機器

オーディオ及びビデオ信号分配

低電圧データ収集機器

サンプル&ホールド回路

通信回路

## 特長

- ◆ 74HC4066とピンコンパチブル
- ◆ オン抵抗：170 $\Omega$  max(3V電源)を保証  
45 $\Omega$  max(12V電源)を保証
- ◆ チャンネル間マッチング：4 $\mu$ s max(MAX4066)を保証  
2 $\mu$ s max(MAX4066A)を保証
- ◆ 低リーク電流：+25 $^{\circ}$ Cで1nA(MAX4066)を保証  
+25 $^{\circ}$ Cで100pA(MAX4066A)を保証
- ◆ 単一電源動作：+2.0V~+16V
- ◆ 信号範囲：V<sub>+</sub>~GND
- ◆ TTL/CMOSロジックコンパチブル
- ◆ 低消費電力：0.5 $\mu$ W
- ◆ 低クロストーク：-86dB
- ◆ 低オフアイソレーション：-58dB
- ◆ 低歪み：0.03%
- ◆ 広帯域幅：100MHz以上

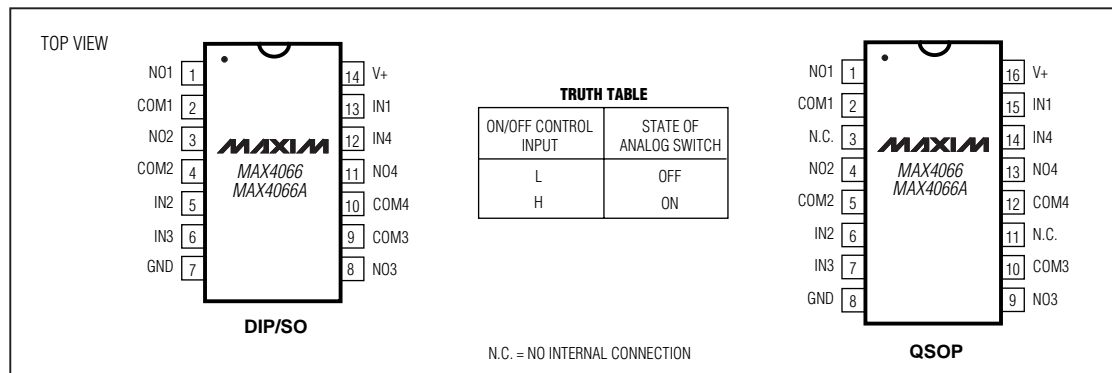
## 型番

PART	TEMP. RANGE	PIN-PACKAGE
MAX4066CPD	0 $^{\circ}$ C to +70 $^{\circ}$ C	14 Plastic DIP
MAX4066CSD	0 $^{\circ}$ C to +70 $^{\circ}$ C	14 Narrow SO
MAX4066CEE	0 $^{\circ}$ C to +70 $^{\circ}$ C	16 QSOP
MAX4066C/D	0 $^{\circ}$ C to +70 $^{\circ}$ C	Dice*

Ordering Information continued at end of data sheet.

\* Contact factory for dice specifications.

## ピン配置/真理値表



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MAX4066/MAX4066A

## ABSOLUTE MAXIMUM RATINGS

(Voltages referenced to GND)

V+	.....-0.3V to +17V
V <sub>IN</sub> , V <sub>COM</sub> , V <sub>NO</sub> (Note 1)	.....-0.3V to (V + +0.3V)
Current (any terminal)	.....30mA
Peak Current (any terminal)	.....100mA
ESD per Method 3015.7	.....>2000V
Continuous Power Dissipation (T <sub>A</sub> = +70°C)	
Plastic DIP (derate 10.00mW/°C above +70°C)	.....800mW
Narrow SO (derate 8.00mW/°C above +70°C)	.....640mW
QSOP (derate 9.52mW/°C above +70°C)	.....762mW

CERDIP (derate 9.09mW/°C above +70°C)	.....727mW
Operating Temperature Ranges	
MAX4066C_/MAX4066AC_	.....0°C to +70°C
MAX4066E_/MAX4066AE_	.....-40°C to +85°C
MAX4066MJD/MAX4066AMJD	.....-55°C to +125°C
Storage Temperature Range	.....-65°C to +150°C
Lead Temperature (soldering, 10sec)	.....+300°C

**Note 1:** Signals on NO<sub>1</sub>, COM<sub>1</sub>, or IN<sub>1</sub> exceeding V+ or GND are clamped by internal diodes. 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—Single +12V Supply

(V+ = 12V ±10%, GND = 0V, V<sub>INH</sub> = 4.0V, V<sub>INL</sub> = 0.8V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP (Note 2)	MAX	UNITS	
<b>ANALOG SWITCH</b>							
Analog Signal Range	V <sub>COM</sub> , V <sub>NO</sub>	(Note 3)	0		V+	V	
On-Resistance	R <sub>ON</sub>	V+ = 12V, I <sub>COM</sub> = 2mA, V <sub>NO</sub> = 10V	T <sub>A</sub> = +25°C		16	45	Ω
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>	C, E		55	
				M		75	
On-Resistance Match Between Channels (Note 4)	ΔR <sub>ON</sub>	V+ = 12V, I <sub>COM</sub> = 2mA, V <sub>NO</sub> = 10V	T <sub>A</sub> = +25°C		0.5	4	Ω
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>	MAX4066		0.5	
				MAX4066A		2	
On-Resistance Flatness (Note 5)	R <sub>FLAT(ON)</sub>	V+ = 12V, I <sub>COM</sub> = 2mA, V <sub>NO</sub> = 10V, 5V, 1V	T <sub>A</sub> = +25°C		2	4	Ω
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>			6	
NO or NC Off Leakage Current (Note 6)	I <sub>NO(OFF)</sub>	V+ = 12V, V <sub>COM</sub> = 0V, V <sub>NO</sub> = 10V	T <sub>A</sub> = +25°C		MAX4066	-1	nA
					MAX4066A	-0.1	
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>	C, E		6	
M		-100		100			
COM Off Leakage Current (Note 6)	I <sub>COM(OFF)</sub>	V+ = 12V, V <sub>COM</sub> = 0V, V <sub>NO</sub> = 10V	T <sub>A</sub> = +25°C		MAX4066	-1	nA
					MAX4066A	-0.1	
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>	C, E		-6	
M		-100		100			
COM On Leakage Current (Note 6)	I <sub>COM(ON)</sub>	V+ = 12V, V <sub>COM</sub> = 10V, V <sub>NO</sub> = 10V	T <sub>A</sub> = +25°C		MAX4066	-2	nA
					MAX4066A	-0.2	
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>	C, E		-12	
M		-200		200			

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## ELECTRICAL CHARACTERISTICS—Single +12V Supply (continued)

(V+ = 12V ±10%, GND = 0V, V<sub>INH</sub> = 4.0V, V<sub>INL</sub> = 0.8V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP (Note 2)	MAX	UNITS	
<b>LOGIC INPUT</b>							
Input Current with Input Voltage High	I <sub>INH</sub>	I <sub>N</sub> = 5.0V, all others = 0.8V	-0.5	0.005	0.5	μA	
Input Current with Input Voltage Low	I <sub>INL</sub>	I <sub>N</sub> = 0.8V, all others = 5.0V	-0.5	0.005	0.5	μA	
<b>DYNAMIC</b>							
Turn-On Time	t <sub>ON</sub>	V <sub>COM</sub> = 10V, Figure 2	T <sub>A</sub> = +25°C	25	100	ns	
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>		150		
Turn-Off Time	t <sub>OFF</sub>	V <sub>COM</sub> = 10V, Figure 2	T <sub>A</sub> = +25°C	15	75	ns	
			T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>		100		
On-Channel Bandwidth	BW	Signal = 0dbm, Figure 4, 50Ω in and out	T <sub>A</sub> = +25°C	100		MHz	
Charge Injection (Note 3)	V <sub>CTE</sub>	C <sub>L</sub> = 1.0nF, V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0Ω, Figure 3	T <sub>A</sub> = +25°C	1	10	pC	
Off Isolation (Note 7)	V <sub>ISO</sub>	R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, f = 1MHz, Figure 4	T <sub>A</sub> = +25°C		-58	dB	
Crosstalk (Note 8)	V <sub>CT</sub>	R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, f = 1MHz, Figure 5	T <sub>A</sub> = +25°C		-86	dB	
NO Capacitance	C <sub>(OFF)</sub>	f = 1MHz, Figure 6	T <sub>A</sub> = +25°C	9		pF	
COM Off Capacitance	C <sub>COM(OFF)</sub>	f = 1MHz, Figure 6	T <sub>A</sub> = +25°C	9		pF	
COM On Capacitance	C <sub>COM(ON)</sub>	f = 1MHz, Figure 6	T <sub>A</sub> = +25°C	22		pF	
<b>SUPPLY</b>							
Power-Supply Range						V	
Supply Current	I <sub>+</sub>	V <sub>IN</sub> = 0V or V <sub>+</sub> , all channels on or off	T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>	-1	0.001	1	μA
Total Harmonic Distortion	THD		T <sub>A</sub> = T <sub>MIN</sub> to T <sub>MAX</sub>	0.03			%

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## ELECTRICAL CHARACTERISTICS—Single +5V Supply

(V+ = 5V ±10%, V- = 0V ±10%, GND = 0V, VINH = 2.4V, VINL = 0.8V, TA = TMIN to TMAX, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP (Note 2)	MAX	UNITS	
<b>ANALOG SWITCH</b>								
Analog Signal Range	VCOM, VNO	(Note 3)		0		V+	V	
On-Resistance	RON	V+ = 4.5V, ICOM = -1.0mA, VNO = 3.5V	TA = +25°C	45	75		Ω	
			TA = TMIN to TMAX	C, E	52			100
				M				125
On-Resistance Match Between Channels (Note 4)	ΔRON	V+ = 5V, ICOM = -1.0mA, VNO = 3V	TA = +25°C	0.3	4		Ω	
			TA = TMIN to TMAX		12			
On-Resistance Flatness (Notes 3, 5)	RFLAT(ON)	V+ = 5V, ICOM = -1.0mA, VNO = 1V, 3V	TA = +25°C	4	6		Ω	
			TA = TMIN to TMAX		8			
NO Off Leakage Current (Note 6)	INO(OFF)	V+ = 5.5V, VCOM = 0V, VNO = 4.5V	TA = +25°C	MAX4066	-1	1	nA	
				MAX4066A	-0.1	0.1		
				TA = TMIN to TMAX	C, E	-6		6
M	-100	100						
COM Off Leakage Current (Note 6)	ICOM(OFF)	V+ = 5.5V, VCOM = 0V, VNO = 4.5V	TA = +25°C	MAX4066	-1	1	nA	
				MAX4066A	-0.1	0.1		
				TA = TMIN to TMAX	C, E	-6		6
M	-100	100						
COM On Leakage Current (Note 6)	ICOM(ON)	V+ = 5.5V, VCOM = 5V, VNO = 4.5V	TA = +25°C	MAX4066	-2	2	nA	
				MAX4066A	-0.2	0.2		
				TA = TMIN to TMAX	C, E	-12		12
M	-200	200						
<b>DYNAMIC</b>								
Turn-On Time	tON	VNO = 3V	TA = +25°C	43	125		ns	
			TA = TMIN to TMAX		175			
Turn-Off Time	tOFF	VNO = 3V	TA = +25°C	18	75		ns	
			TA = TMIN to TMAX		125			
On-Channel Bandwidth	BW	Signal = 0dBm, 50Ω in and out, Figure 4		100			MHz	
Charge Injection (Note 3)	Q	VGEN = 0V, RGEN = 0V, CL = 1.0nF, Figure 3		2	10		pC	
<b>SUPPLY</b>								
Positive Supply Current	I+	V+ = 5.5V, VIN = 0V or V+, all channels on or off		-1	1		μA	

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## ELECTRICAL CHARACTERISTICS—Single +3V Supply

(V+ = 2.7V to 3.3V ±10%, GND = 0V, VINH = 2.4V, VINL = 0.8V, TA = TMIN to TMAX, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP (Note 2)	MAX	UNITS
<b>ANALOG SWITCH</b>							
Analog Signal Range	VCOM, VNO	(Note 3)		0		V+	V
Channel On-Resistance	RON	V+ = 3V, ICOM = -1.0mA, VNO = 1.5V	TA = +25°C		170		Ω
			TA = TMIN to TMAX		225		
<b>DYNAMIC</b>							
Turn-On Time (Note 3)	tON	V+ = 3V, VNO or VNC = 1.5V	TA = +25°C		80	185	ns
			TA = TMIN to TMAX			230	
Turn-Off Time (Note 3)	tOFF	V+ = 3V, VNO or VNC = 1.5V	TA = +25°C		28	150	ns
			TA = TMIN to TMAX			200	
Charge Injection (Note 3)	Q	CL = 1.0nF, VGEN = 0V, RGEN = 0V	TA = +25°C		2	10	pC
<b>SUPPLY</b>							
Positive Supply Current	I+	V+ = 3.6V, VIN = 0V or V+, all channels on or off		-1	0.001	1	μA

**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:**  $\Delta R_{ON} = R_{ON}(\text{max}) - R_{ON}(\text{min})$ .

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

**Note 6:** Leakage parameters are 100% tested at maximum-rated hot temperature and guaranteed by correlation at +25°C.

**Note 7:** Off Isolation =  $20\log_{10}(V_{COM} / V_{NO})$ . VCOM = output, VNO = input to off switch.

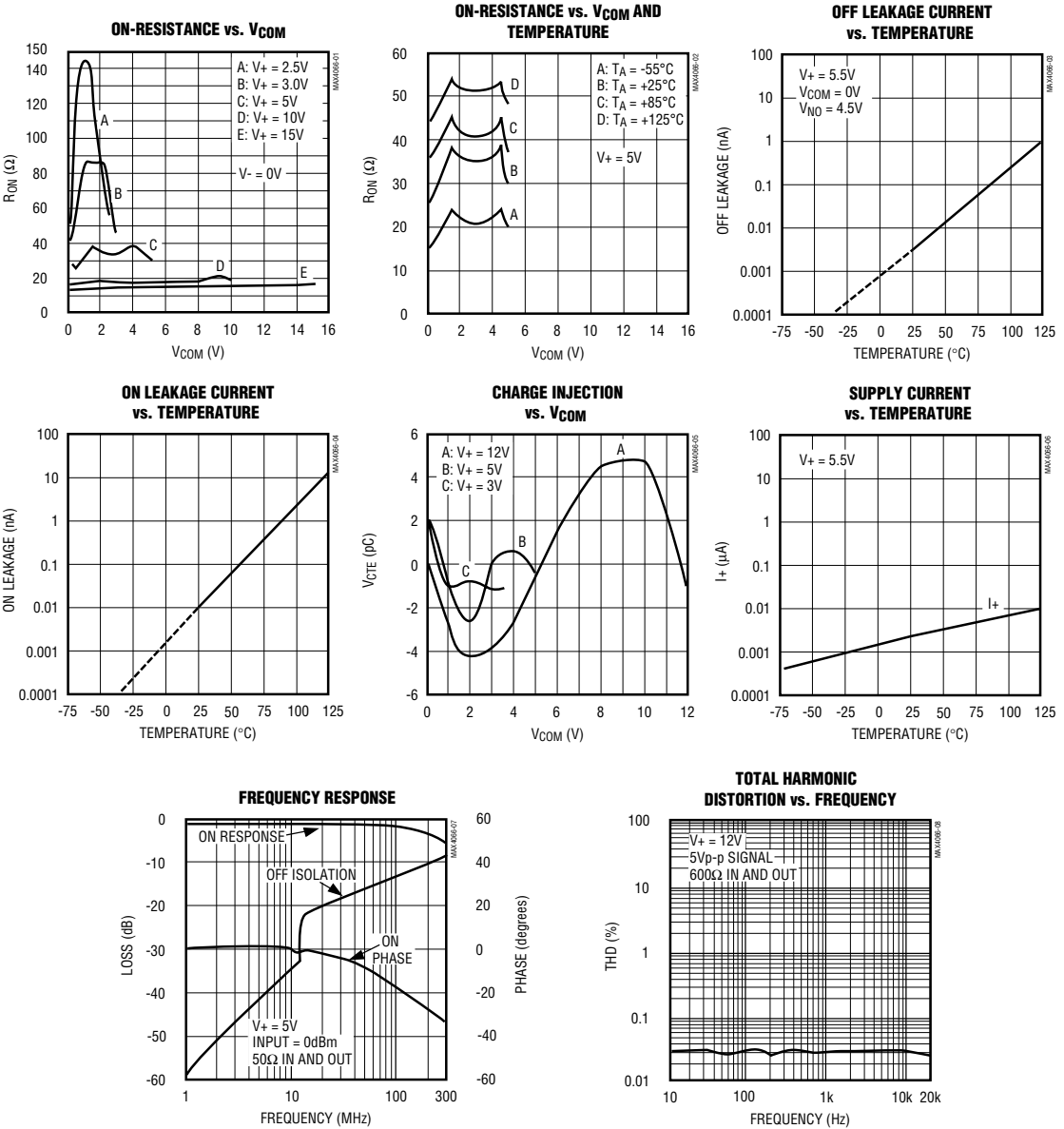
**Note 8:** Between any two switches.

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## 標準動作特性

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



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## 端子説明

端子		名称	機能
DIP/SOP	QSOP		
1, 3, 8, 11	1, 4, 9, 13	NO1-NO4	アナログスイッチのノーマリオープン端子(双方向)
2, 4, 9, 10	2, 5, 10, 12	COM1-COM4	アナログスイッチのコモン端子(双方向)
—	3, 11	N.C.	内部接続なし
13, 5, 6, 12	15, 6, 7, 14	IN1-IN4	ロジック制御入力
7	8	GND	グラウンド
14	16	V+	正電源電圧

## アプリケーション情報

### 過電圧保護

CMOSデバイスでは、常に適正な電源シーケンスが必要とされます。デバイスが定格以上のストレスにさらされた場合、恒久的な損傷を受ける恐れがあるため、絶対最大定格を超えないようにしてください。必ず $V_+$ を最初にオンにし、次にロジック入力をオンにしてください。電源シーケンスを守れない場合は、過電圧保護用に小信号ダイオードを電源端子と直列に2個接続してください(図1)。ダイオードを加えることによって、アナログ信号範囲が $(V_+ - 1V) \sim (GND + 1V)$ の範囲に狭まりますが、低スイッチ抵抗及び低リーク電流特性は影響を受けません。素子の動作は変わらないため、 $V_+$ とGNDの電圧差は17Vを超えないようにしてください。

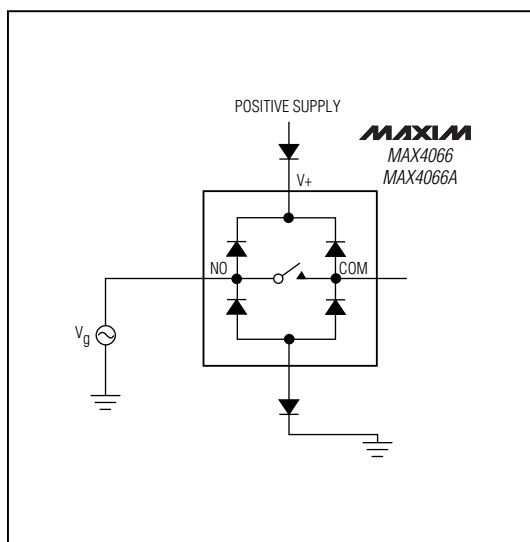


図1. 2つの外付ブロッキングダイオードを用いた過電圧保護

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## テスト回路/タイミング図

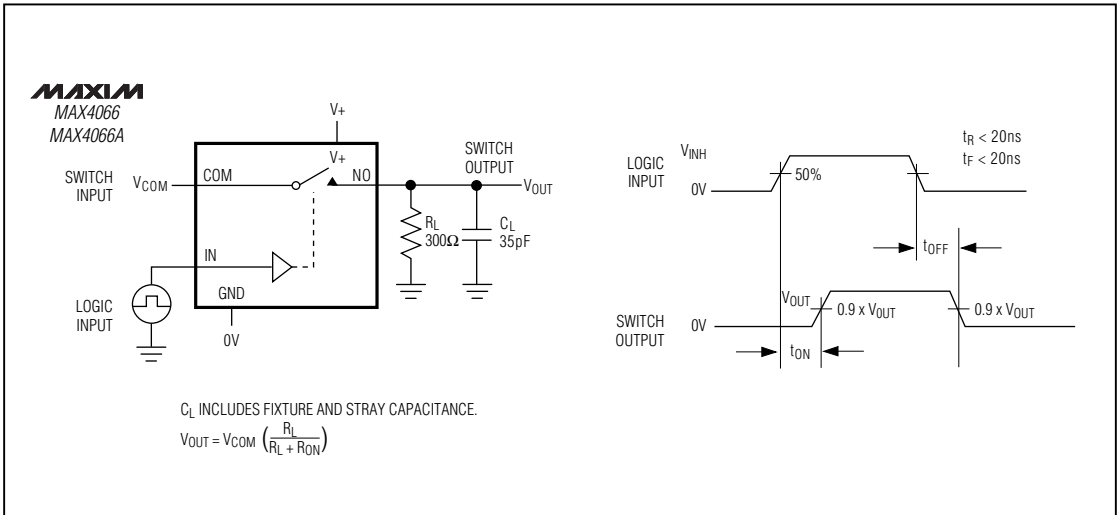


図2. スイッチング時間

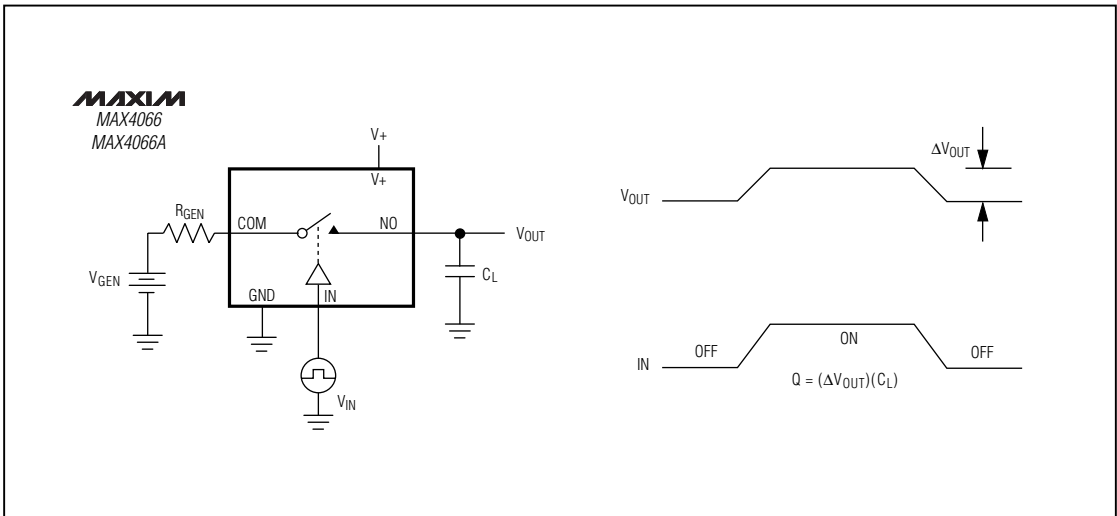


図3. チャージインジェクション



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## テスト回路(続き)

MAX4066/MAX4066A

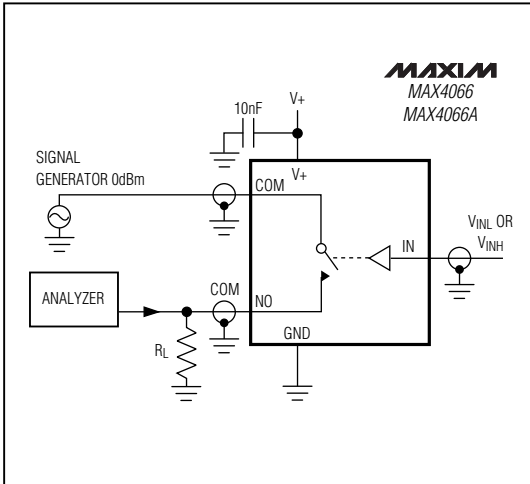


図4. オフアイソレーション/オンチャンネル帯域幅

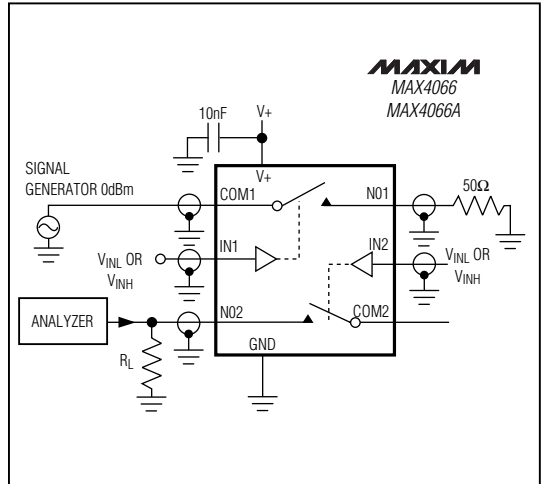


図5. クロストーク

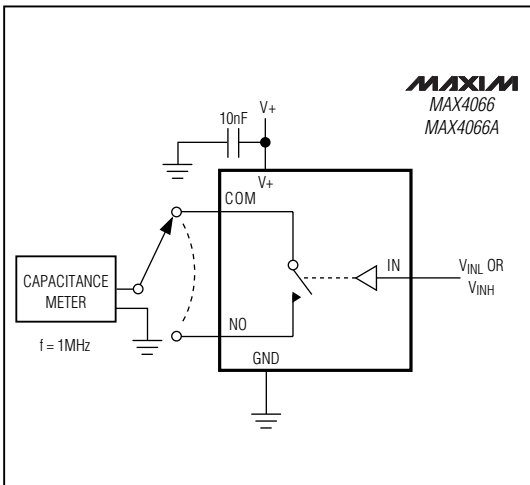


図6. チャンネルオフ/オン容量

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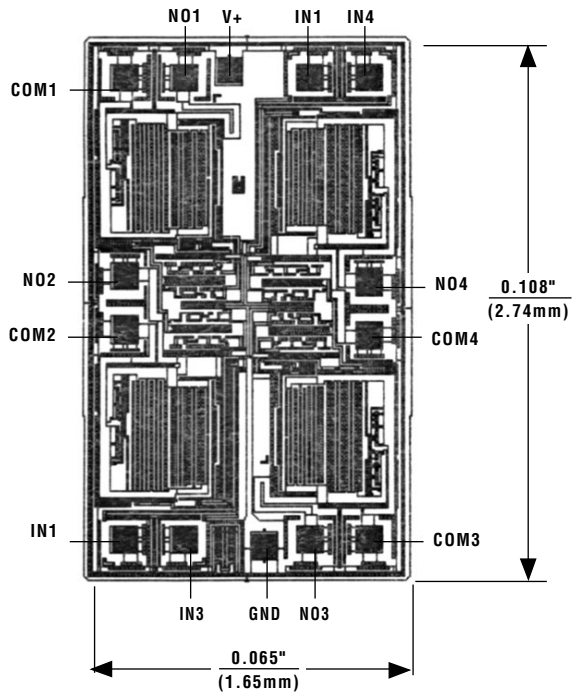
型番(続き) \_\_\_\_\_

PART	TEMP. RANGE	PIN-PACKAGE
MAX4066EPD	-40°C to +85°C	14 Plastic DIP
MAX4066ESD	-40°C to +85°C	14 Narrow SO
MAX4066MJD	-55°C to +125°C	14 CERDIP**
<b>MAX4066ACPD</b>	0°C to +70°C	14 Plastic DIP
MAX4066ACSD	0°C to +70°C	14 Narrow SO
MAX4066ACEE	0°C to +70°C	16 QSOP
MAX4066AEPD	-40°C to +85°C	14 Plastic DIP
MAX4066AESD	-40°C to +85°C	14 Narrow SO
MAX4066AEEE	-40°C to +85°C	16 QSOP
MAX4066AMJD	-55°C to +125°C	14 CERDIP**

\* Contact factory for dice specifications.

\*\* Contact factory for availability.

チップ構造図 \_\_\_\_\_



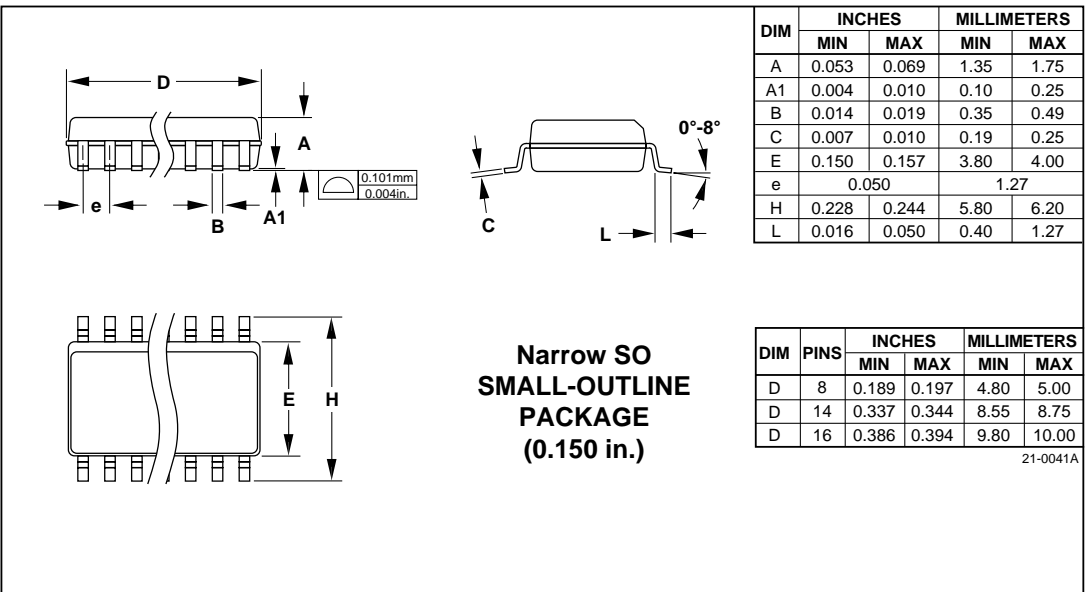
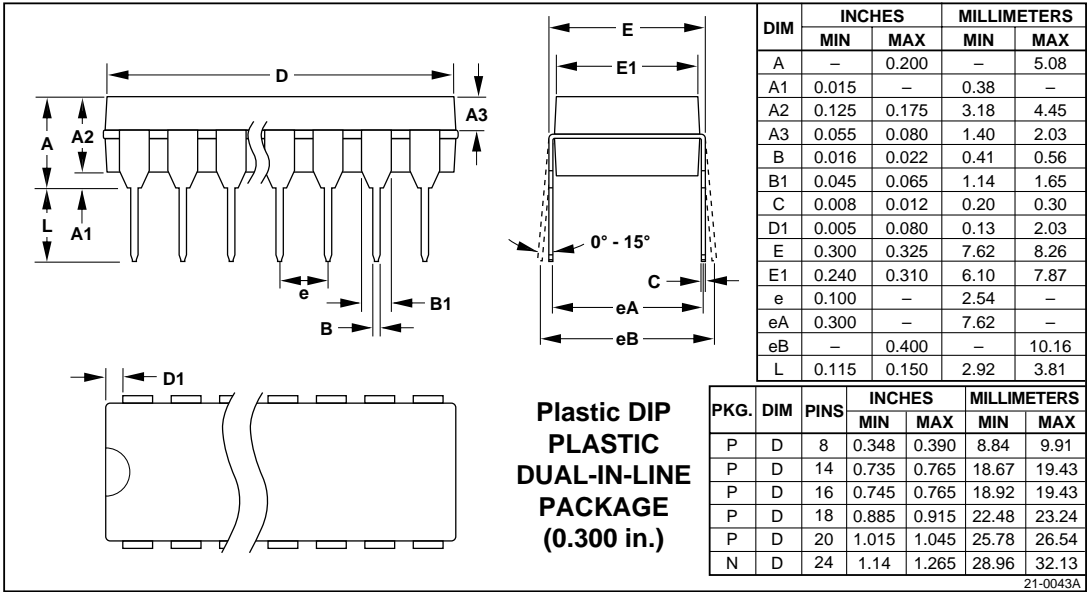
TRANSISTOR COUNT: 69

SUBSTRATE CONNECTED TO V+

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## パッケージ

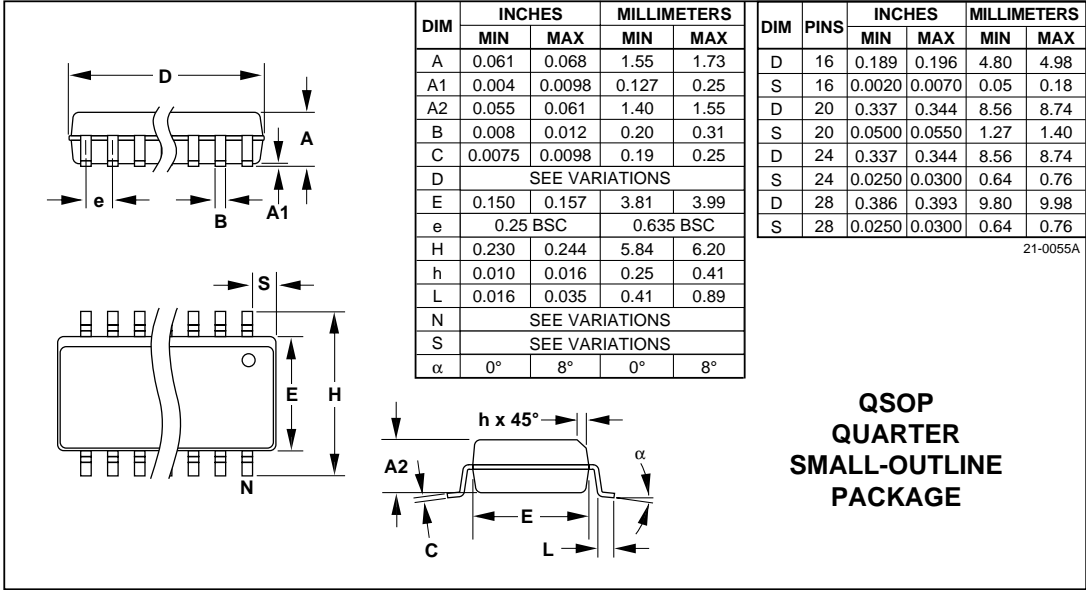
MAX4066/MAX4066A



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MAX4066/MAX4066A

パッケージ(続き)



販売代理店

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