MAX4715/MAX4716

0.4Ω, Low-Voltage, Single-Supply SPST Analog Switches in SC70

General Description

The MAX4715/MAX4716 are low on-resistance, low-voltage, single-pole/single-throw (SPST) analog switches that operate from a +1.6V to +3.6V single supply. The MAX4715 is normally open (NO), and the MAX4716 is normally closed (NC). These devices also have fast switching speeds (t_{ON} = 18ns max, t_{OFF} = 12ns max).

When powered from a +3V supply, the MAX4715/ MAX4716 offer 0.4Ω max on-resistance (R_{ON}) with 0.1Ω max R_{ON} flatness. Their digital logic inputs are +1.8V CMOS compatible when using a single +3V supply.

The MAX4715 is pin compatible with the MAX4594, and the MAX4716 is pin compatible with the MAX4595. The MAX4715/MAX4716 are available in SC70-5 packages.

Applications

- Power Routing
- Battery-Operated Equipment
- Audio and Video Signal Routing
- Low-Voltage Data-Acquisition Systems
- Communications Circuits
- PCMCIA Cards
- Cellular Phones
- Modems
- Hard Drives

Benefits and Features

- Low Ron
 - 0.4Ω max (+3V Supply)
 - 1.2Ω max (+1.8V Supply)
- 0.1Ω max R_{ON} Flatness (+3V Supply)
- +1.6V to +3.6V Single-Supply Operation
- Available in 5-Pin SC70 Packages
- Fast Switching: t_{ON} = 18ns max, t_{OFF} = 12ns max
- +1.8V CMOS Logic Compatible (+3V Supply)
- Pin Compatible with MAX4594 (MAX4715)
 Pin Compatible with MAX4595 (MAX4716)

Ordering Information appears at end of data sheet.



MAX4715/MAX4716

0.4Ω , Low-Voltage, Single-Supply SPST Analog Switches in SC70

Absolute Maximum Ratings

Voltages Referenced to GND
V+, IN0.3V to +4V
COM, NO, NC (Note 1)0.3V to (V+ + 0.3V)
Continuous Current NO, NC to COM±300mA
Peak Switch Current NO, NC to COM
(pulsed at 1ms, 10% duty cycle max)±600mA
Continuous Power Dissipation (T _A = +70°C)
5-Pin SC70 (derate 3.1mW/°C above +70°C)247mW

Operating Temperature Range	
MAX471_EXK	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+ or GND are clamped by internal diodes.

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.

Package Information

5-PIN SC70

Outline Number	21-0076
----------------	---------

For the latest package outline information and land patterns (footprints), go to www.maximintegrated.com/packages. Note that a "+", "#", or "-" in the package code indicates RoHS status only. Package drawings may show a different suffix character, but the drawing pertains to the package regardless of RoHS status.

Electrical Characteristics—Single +3V Supply

(V+ = +2.7V to +3.6V, V_{IH} = +1.4V, V_{IL} = +0.5V, T_A = T_{MIN} to T_{MAX} , unless otherwise noted. Typical values are at V+ = +3.0V and T_A = +25°C.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS	TA	MIN	TYP	MAX	UNITS	
ANALOG SWITCH								
Analog Signal Range	V _{COM} , V _{NO} , V _{NC}			0		V+	V	
On-Resistance (Note 6)	R _{ON}	V+ = 2.7V, I _{COM} = 100mA,	+25°C		0.3	0.4	Ω	
On-resistance (recte o)	TON	V _{NO} or V _{NC} = 1.5V	T _{MIN} to T _{MAX}			0.45	32	
On-Resistance Flatness	R _{FLAT(ON)}	V+ = 2.7V, I _{COM} = 100mA,	+25°C		0.05	0.09	Ω	
(Note 4)	TTEAT(ON)	V_{NO} or $V_{NC} = 0.6, 1.5V, 2.1V$	T _{MIN} to T _{MAX}			0.1	32	
NO, NC Off-Leakage	I _{NO(OFF)} or	V+ = 3.3V, V _{COM} = 0.3V, 3V	+25°C	-1	0.01	1	nA	
Current	I _{NC(OFF)} or	V_{NO} or $V_{NC} = 3V$, 0.3V	T _{MIN} to T _{MAX}	-10		10	11/3	
COM Off-Leakage Current	I _{COM(OFF)}	V+ = 3.3V, V _{COM} = 0.3V, 3V	+25°C	-1	0.01	1	nA	
	'COM(OFF)	V_{NO} or $V_{NC} = 3V$, 0.3V	T _{MIN} to T _{MAX}	-10		10		
COM On-Leakage Current	I _{COM(ON)}	$V + = 3.3V, V_{COM} = 0.3V, 3V,$	+25°C	-2		2	nA	
- Com on Loanago Garroni	·COM(ON)	V_{NO} or V_{NC} = 0.3V, 3V or open	T _{MIN} to T _{MAX}	-10		10	11/4	
DYNAMIC								
Turn-On Time	t _{ON}	V_{NO} or V_{NC} = 1.5V, R_L = 50 Ω , C_L = 35pF, Figure 1	+25°C		12	18	ns	
Tani on time	·ON		T _{MIN} to T _{MAX}			20	110	
Turn-Off Time	t _{OFF}	V_{NO} or V_{NC} = 1.5V, R_L = 50 Ω , C_L = 35pF, Figure 1 T_{MIN} to T_{MAX}	+25°C		6	12	ns	
Tan on Time	OFF		T _{MIN} to T _{MAX}			15	1.0	
Charge Injection	Q	V _{GEN} = 0, R _{GEN} = 0, C _L = 1.0nF, <u>Figure 2</u>	+25°C		20		pC	
Off-Isolation (Note 5)	V _{ISO}	$f = 1MHz$, $V_{COM} = 1V_{RMS}$, $R_L = 50\Omega$, $C_L = 5pF$, Figure 3	+25°C		-54		dB	
Total Harmonic Distortion	THD	f = 20Hz to $20kHz$, $V_{COM} = 2V_{P-P}$, $R_L = 32\Omega$	+25°C		0.01		%	
NC or NO Off-Capacitance	C _{NO(OFF)}	f = 1MHz, Figure 4	+25°C		55		pF	
COM Off-Capacitance	C _{COM(OFF})	f = 1MHz, Figure 4	+25°C		55		pF	
COM On-Capacitance	C _{COM(ON)}	f = 1MHz, Figure 4	+25°C		80		pF	
LOGIC INPUT								
Input Voltage Low	V _{IL}					0.5	V	
Input Voltage High	V _{IH}			1.4			V	
Input Leakage Current	I _{IN}	V _{IN} = 0 or V+		-1		1	μA	
SUPPLY								
Power-Supply Range	V+			1.6		3.6	V	
Desition County County	1.		+25°C		0.04	0.2		
Positive Supply Current	l+	$V+ = +3.6V$, $V_{IN} = 0$ or $V+$	T _{MIN} to T _{MAX}		,	2	μA	

Electrical Characteristics—Single +1.8V Supply

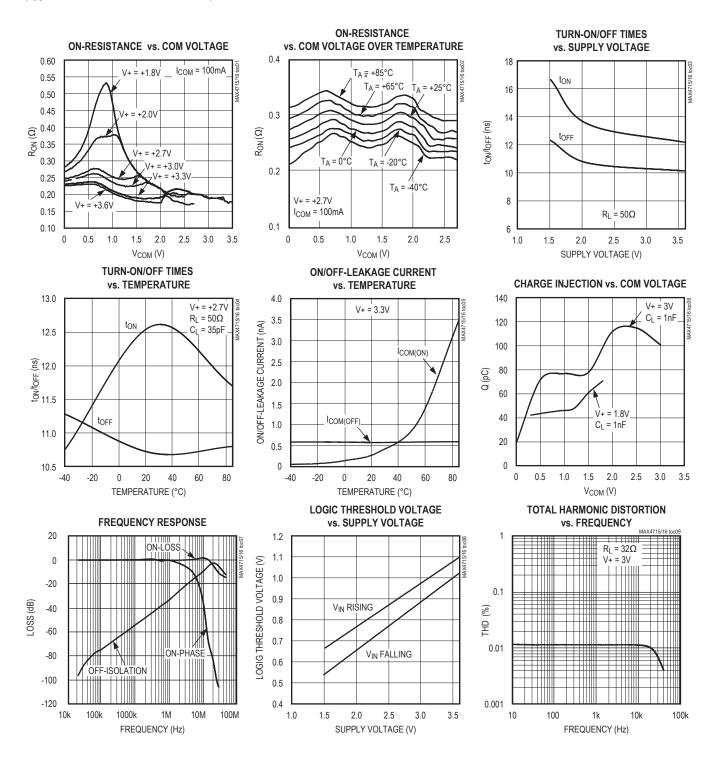
 $(V+=+1.8V,\,V_{IH}=+1V,\,V_{IL}=+0.4V,\,T_A=T_{MIN}\,to\,T_{MAX},\,unless\,otherwise\,noted.\,Typical\,values\,are\,at\,T_A=+25^{\circ}C.)\,(Notes\,2,\,3)$

PARAMETER	SYMBOL	CONDITIONS	TA	MIN	TYP	MAX	UNITS
ANALOG SWITCH	,						
Analog Signal Range	V _{COM} , V _{NO} , V _{NC}			0		V+	V
On-Resistance	R _{ON}	I _{COM} = 10mA, V _{NO} or V _{NC} = 0.9V	+25°C		0.6	1.2	Ω
Oli-Nesistalice			T _{MIN} to T _{MAX}			2.5	
NO or NC Off-Leakage	I _{NO(OFF)} or	V _{COM} = 0.3V, 1.5V,	+25°C	-1		1	nA
Current	I _{NC(OFF)}	V_{NO} or $V_{NC} = 1.5V, 0.3V$	T _{MIN} to T _{MAX}	-10	,	10	
COM Off-Leakage Current	I _{COM(OFF)}	V _{COM} = 0.3V, 1.5V,	+25°C	-1		1	nA
OOM On-Leakage Ourrent	'COM(OFF)	V_{NO} or $V_{NC} = 1.5V, 0.3V$	T _{MIN} to T _{MAX}	-10		10	
COM On-Leakage Current	la avvavo	V _{COM} = 1.5V, 0.3V, V _{NO} or	+25°C	-2		2	nA
COM On-Leakage Current I _{COM(ON)}		V _{NC} = 1.5V, 0.3V, or open	T _{MIN} to T _{MAX}	-10	,	10	
DYNAMIC							
Turn-On Time	t _{ON}	V_{NO} or V_{NC} = 1.5V, R_L = 50 Ω , C_L = 35pF, Figure 1	+25°C		18	25	ns
Turn-On Time			T _{MIN} to T _{MAX}			30	113
Turn-Off Time	torr	V_{NO} or $V_{NC} = 1.5V$, $R_{L} = 50\Omega$,	+25°C		9	20	ns
Turn-Oil Time	toff	C _L = 35pF, <u>Figure 1</u>	T _{MIN} to T _{MAX}			25	113
Charge Injection	Q	V _{GEN} = 0, R _{GEN} = 0, C _L = 1nF, <u>Figure 2</u>	+25°C		40		рС
LOGIC INPUT							
Input Voltage Low	V _{IL}					0.4	V
Input Voltage High	V _{IH}			1			V
Input Leakage Current	I _{IN}	V _{IN} = 0 or V+				1	μA
SUPPLY							
Decitive Cumply Current	l+	V _{IN} = 0 or V+	+25°C		0.04	0.2	
Positive Supply Current			T _{MIN} to T _{MAX}			2	μA

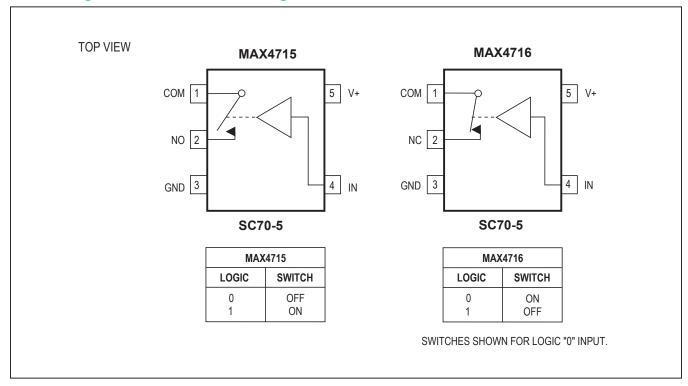
- **Note 2:** The algebraic convention, where the most negative value is a minimum and the most positive value a maximum, is used in this data sheet.
- **Note 3:** SC70-packaged parts are 100% tested at +25°C. Limits across the full temperature range are guaranteed by design and correlation.
- **Note 4:** Flatness is defined as the difference between the maximum and minimum values of on-resistance as measured over the specified analog signal range.
- Note 5: Off-Isolation = $20log_{10}$ [V_{COM} / (V_{NC} or V_{NO})], V_{COM} = output, V_{NC} or V_{NO} = input to off switch.
- Note 6: Guaranteed by design.

Typical Operating Characteristics

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



Pin Configurations/Functional Diagrams/Truth Tables



Pin Description

BU	IMP		FUNCTION	
MAX4715	MAX4716	NAME	FUNCTION	
1	1	COM	Analog Switch—Common	
2	_	NO	Analog Switch—Normally Open	
3 2 NC Analog Switch—Normally Closed		Analog Switch—Normally Closed		
_	3	GND	Ground	
4	4	IN	Digital Control Input	
5 5 V+		V+	Positive Supply Input	

0.4Ω , Low-Voltage, Single-Supply SPST Analog Switches in SC70

Detailed Description

The MAX4715/MAX4716 are low on-resistance (R_{ON}), low-voltage, single-pole/single-throw (SPST) analog switches that operate from a +1.6V to +3.6V single supply. The MAX4715 is normally open (NO), and the MAX4716 is normally closed (NC).

When powered from a +3V supply, their 0.4Ω R_{ON} allows high continuous currents to be switched in a variety of applications.

Applications Information

Logic Inputs

The MAX4715/MAX4716 logic inputs can be driven up to +3.6V regardless of the supply voltage. For example,

with a +3.3V supply, IN may be driven low to GND and high to +3.6V. Driving IN Rail-to-Rail® minimizes power consumption.

Analog Signal Levels

Analog signals that range over the entire supply voltage (V+ to GND) can be passed with very little change in on-resistance (see the <u>Typical Operating Characteristics</u> section). The switches are bidirectional, so the NO, NC, and COM pins can be used as either inputs or outputs.

Rail-to-Rail is a registered trademark of Nippon Motorola Ltd.

Test Circuits/Timing Diagrams

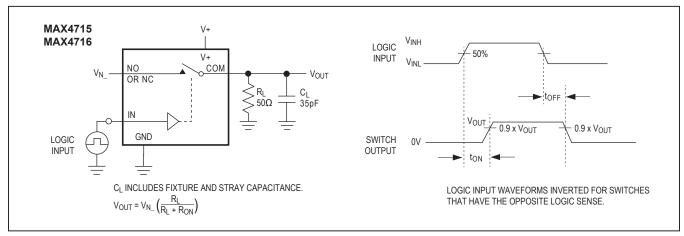


Figure 1. Switching Time

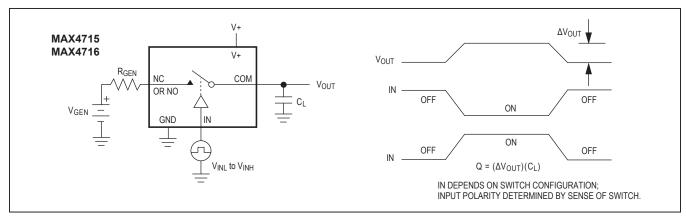


Figure 2. Charge Injection

Test Circuits/Timing Diagrams (continued)

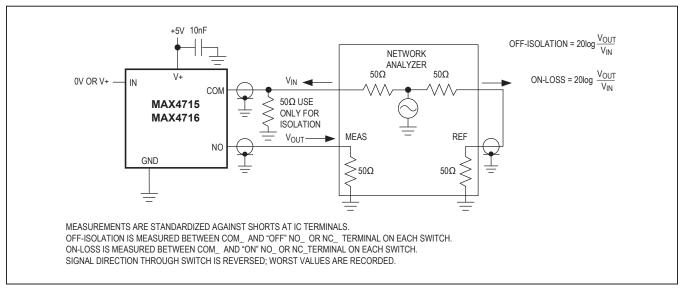


Figure 3. On-Loss and Off-Isolation

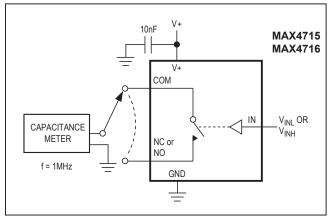


Figure 4. Channel Off/On-Capacitance

Ordering Information

PART	TEMP. RANGE	PIN- PACKAGE	TOP MARK	
MAX4715EXK+T	-40°C to +85°C	5 SC70-5	ACJ	
MAX4716EXK+T	-40°C to +85°C	5 SC70-5	ACK	

+ Denotes a lead(Pb)-free/RoHS-compliant package. T = Tape and reel.

Chip Information

TRANSISTOR COUNT: 135

PROCESS: CMOS

MAX4715/MAX4716

0.4Ω , Low-Voltage, Single-Supply SPST Analog Switches in SC70

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED	
0	4/01	Initial release	_	
1	3/20	Updated the Ordering Information table	8	

For pricing, delivery, and ordering information, please visit Maxim Integrated's online storefront at https://www.maximintegrated.com/en/storefront/storefront.html.

Maxim Integrated cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim Integrated product. No circuit patent licenses are implied. Maxim Integrated reserves the right to change the circuitry and specifications without notice at any time. The parametric values (min and max limits) shown in the Electrical Characteristics table are guaranteed. Other parametric values quoted in this data sheet are provided for guidance.