Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!

Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

19-1907; Rev 1; 11/03

Fault-Protected, Low-Voltage, Quad SPST Analog Switches

General Description

The MAX4711/MAX4712/MAX4713 are fault-protected, Rail-to-Rail®, low-voltage analog switches featuring low on-resistance and guaranteed on-resistance flatness over the specified signal range. Due to the fault protection feature the analog switch input (NO_ or NC_) and output (COM_) pins are not symmetrical. The fault protection feature allows for the analog input to go beyond the plus or minus supplies without the device drawing excessive amounts of current from the analog inputs. When the analog inputs are driven beyond the supply rails when the switch is on, it will sense a fault and turn itself off and the analog switch output will be clamped to the same polarity supply as the input signal and will not go beyond the supply rails. This feature protects any electronic circuitry connected to the output from excessive voltages present on the analog inputs.

The MAX4711/MAX4712/MAX4713 are quad, single-pole/single-throw (SPST) analog switches. The MAX4711 has four normally closed switches (NC), the MAX4712 has four normally open switches (NO), and the MAX4713 has two NO and two NC switches. Switching times are less than 125ns for t_{ON}, and less than 80ns for t_{OFF}. These switches operate from a single +2.7V to +11V supply or from dual ±2.7V to ±5.5V supplies. All digital inputs have +0.8V to +2.4V logic thresholds, ensuring both TTL and CMOS logic compatibility when using ±4.5V to ±5.5V or single +4.5V to +11V supplies.

Applications

Communication Systems

Battery-Operated Systems

Signal Routing

Test Equipment

Data-Acquisition

Industrial and Process Control Systems

Avionics

Redundant/Backup Systems

Pin Configurations/Functional Diagrams/Truth Tables continued at end of data sheet.

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

Features

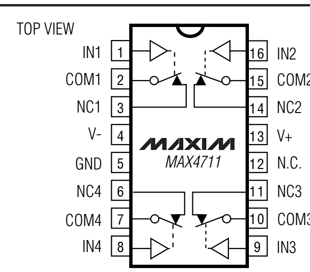
- **Fault-Protected Analog Inputs**
- **±12V Fault Protection with Power Off**
- **±7V Fault Protection with ±5V Supplies**
- **+12V and -7V Fault Protection with +5V Supply**
- **+12V and -9V Fault Protection with +3V Supply**
- **Fault-Protected Digital Inputs May Exceed V+ Supply Rail**
- **All Switches Off with Power Off**
- **Rail-to-Rail Signal Handling**
- **Output Clamped to Appropriate Supply Voltages During Fault Condition**
- **25Ω (max) R_{ON} at +25°C**
- **1Ω (max) On-Resistance Match Between Channels**
- **Single- and Dual-Supply Operation**
- **Pin-Compatible with Industry-Standard MAX391/MAX392/MAX393**
- **TTL- and CMOS-Compatible Logic Inputs**

Ordering Information

PART	TEMP RANGE	PIN-PACKAGE
MAX4711CUE	0°C to +70°C	16 TSSOP
MAX4711CSE	0°C to +70°C	16 Narrow SO
MAX4711CPE	0°C to +70°C	16 Plastic Dip
MAX4711EUE	-40°C to +85°C	16 TSSOP
MAX4711ESE	-40°C to +85°C	16 Narrow SO
MAX4711EPE	-40°C to +85°C	16 Plastic Dip

Ordering Information continued at end of data sheet.

Pin Configurations/Functional Diagrams/Truth Tables



DIP/SO/TSSOP

MAX4711	
LOGIC	SWITCH
0	ON
1	OFF

N.C. = NOT CONNECTED

For price, delivery, and to place orders, please contact Maxim Distribution at 1-888-629-4642, or visit Maxim's website at www.maxim-ic.com.

Fault-Protected, Low-Voltage, Quad SPST Analog Switches

ABSOLUTE MAXIMUM RATINGS

V+ ....-0.3V to +13V
V- ....-13V to +0.3V
V+ to V-..-0.3V to +13V
IN_..(V- + 12V) to (V- - 0.3V)
COM_ (Note 1).....................................(V- - 0.3V) to (V+ + 0.3V)
NO_, NC_ (Note 2).................................(V+ - 12V) to (V- + 12V)
Continuous Current into Any Terminal.............................±40mA
Peak Current, into Any Terminal
(pulsed at 1ms,10% duty cycle)................................±70mA

Continuous Power Dissipation (T_A = +70°C)
16-Pin TSSOP (derate 5.70mW/°C above +70°C)...........457mW
16-Pin Narrow SO (derate 8.70mW/°C above +70°C).....696mW
16-Pin Plastic Dip (derate 10.53mW/°C above +70°C)...842mW
Operating Temperature Ranges
MAX471_C_ E ....0°C to +70°C
MAX471_E_ E ....-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: COM_ pin is not fault-protected. Signals on COM_ exceeding V+ or V- are clamped by internal diodes. Limit forward diode current to maximum current rating.

Note 2: NO_ and NC_ pins are fault-protected. Signals on NO_ or NC_ exceeding -12V to +12V may damage device. These limits apply with V+ = V- = 0.

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+ = +4.5V to +5.5V, V- = -4.5V to -5.5V, V_{IH} = +2.4V, V_{IL} = +0.8V, GND = 0, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.) (Note 3)

PARAMETER	SYMBOL	CONDITIONS	T_A	MIN	TYP	MAX	UNITS
ANALOG SWITCH							
Fault-Free Analog Signal Range	$V_{COM\_}$, $V_{NO\_}$, $V_{NO\_}$	Applies with power on	C, E	V-		V+	V
On-Resistance	R_{ON}	V+ = +4.5V, V- = -4.5V, $V_{NO\_}$, $V_{NC\_}$ = ±3.5V, I_{OUT} = 10mA	+25°C		16	25	Ω
			C, E			30	
On-Resistance Match Between Channels (Note 4)	ΔR_{ON}	V+ = +4.5V, V- = -4.5V, $V_{NO\_}$, $V_{NC\_}$ = ±3.5V, I_{OUT} = 10mA	+25°C		0.2	1	Ω
			C, E			2	
On-Resistance Flatness	R_{FLAT}	V+ = +4.5V, V- = -4.5V, $V_{NO\_}$, $V_{NC\_}$ = ±3.5V, I_{OUT} = 10mA	+25°C		1.3	4	Ω
			C, E			5	
NO_, NC_ Off-Leakage Current (Note 5)	$I_{NO\_(OFF)}$, $I_{NC\_(OFF)}$	V+ = +5.5V, V- = -5.5V, $V_{COM\_}$ = ±4.5V, $V_{NO\_}$, $V_{NC\_}$ = 4.5V	+25°C	-0.5		+0.5	nA
			C, E	-10		+10	
COM_ Off-Leakage Current (Note 5)	$I_{COM\_(OFF)}$	V+ = +5.5V, V- = -5.5V, $V_{COM\_}$ = ±4.5V, $V_{NO\_}$, $V_{NC\_}$ = 4.5V	+25°C	-0.5		+0.5	nA
			C, E	-10		+10	
COM_ On-Leakage Current (Note 5)	$I_{COM\_(ON)}$	V+ = +5.5V, V- = -5.5V, $V_{COM\_}$ = ±4.5V, $V_{NO\_}$, $V_{NC\_}$ = ±4.5V or floating	+25°C	-0.5		+0.5	nA
			C, E	-20		+20	
FAULT							
Fault-Protected Analog Signal Range	$V_{NO\_}$, $V_{NC\_}$	Applies with power on	C, E	-12 + V+		+12 + V-	V
Fault-Protected Analog Signal Range	$V_{NO\_}$, $V_{NC\_}$	Applies with power off	C, E	-12		+12	V
COM_ Output-Leakage Current, Supplies ON (Note 5)	I_{COM}	All channels off, V+ = +5V, V- = -5V, $V_{NO\_}$, $V_{NC\_}$ = ±7V	+25°C	-50		+50	nA
			C, E	-500		+500	

ELECTRICAL CHARACTERISTICS—Dual Supplies (continued)

($V+ = +4.5V$ to $+5.5V$, $V- = -4.5V$ to $-5.5V$, $V_{IH} = +2.4V$, $V_{IL} = +0.8V$, GND = 0, $T_A = T_{MIN}$ to T_{MAX}, unless otherwise noted. Typical values are at $T_A = +25°C$.) (Note 3)

PARAMETER	SYMBOL	CONDITIONS	T_A	MIN	TYP	MAX	UNITS
NO_ or NC_ Off-Leakage Current, Supplies ON (Note 5)	$I_{NO\_}$, $I_{NC\_}$	V+ = +5V, V- = -5V, $V_{NO\_}$, $V_{NC\_}$ = ±7V	+25°C	-50		+50	nA
			C, E	-500		+500	
NO_ or NC_ Input-Leakage Current, Supplies OFF (Note 5)	$I_{NO\_}$, $I_{NC\_}$	$V_{NO\_}$, $V_{NC\_}$ = ±12V, V± = 0	+25°C	-0.5		+0.5	µA
			C, E	-5		+5	
Output Clamp Current	$I_{COM\_}$	$V_{NO\_}$, $V_{NC\_}$ = +7V, V+ = +5V, V- = -5V	C, E	9	20	33	mA
		$V_{NO\_}$, $V_{NC\_}$ = -7V V+ = +5V, V- = -5V		-33	-16	-9	
Output Clamp Resistance	$R_{CLAMP\_}$	$V_{NO\_}$, $V_{NC\_}$ = ±7V	+25°C		200		Ω
Fault Trip Threshold			+25°C	V- - 0.4V		V+ + 0.4V	V
±Fault Output Turn-On Delay Time		$V_{NO\_}$, $V_{NC\_}$ = ±7V, R_{COM} = 1kΩ	+25°C		200		ns
±Fault Recovery Time		$V_{NO\_}$, $V_{NC\_}$ = ±7V, R_{COM} = 1kΩ	+25°C		700		ns
LOGIC INPUT							
Input Logic High	V_{IH}		C, E	2.4			V
Input Logic Low	V_{IL}		C, E			0.8	V
Input-Leakage Current (Note 5)	I_{IN}	$V_{IN\_}$ = 0 or V+	+25°C	-1		+1	µA
			C, E	-5		+5	
SWITCH DYNAMICS							
Turn-On Time	t_{ON}	$V_{NO\_}$ or $V_{NC\_}$ = ±3V, R_L = 300Ω, C_L = 35pF, Figure 2	+25°C		80	125	ns
			C, E			150	
Turn-Off Time	t_{OFF}	$V_{NO\_}$ or $V_{NC\_}$ = ±3V, R_L = 300Ω, C_L = 35pF, Figure 2	+25°C		50	80	ns
			C, E			100	
Break-Before-Make Time Delay (MAX4713 only)	t_{BBM}	$V_{NO\_}$ or $V_{NC\_}$ = ±3V, R_L = 300Ω, C_L = 35pF, Figure 2	+25°C	15	30		ns
			C, E	5			
Charge Injection	Q	V_{GEN} = 0, R_{GEN} = 0, C_L = 1nF, Figure 4	+25°C		25		pC
NO_ or NC_ Off-Capacitance	$C_{N\_(OFF)}$	f = 1MHz, Figure 5	+25°C		8		pF
COM_ Off-Capacitance	$C_{COM\_(OFF)}$	f = 1MHz, Figure 5	+25°C		8		pF
COM_ On-Capacitance	$C_{COM\_(ON)}$	f = 1MHz, Figure 5	+25°C		30		pF
Off-Isolation (Note 6)	V_{ISO}	R_L = 50Ω, C_L = 15pF, P_{IN} = 0, f = 1MHz, Figure 6	+25°C		-59		dB
Channel-to-Channel Crosstalk (Note 7)	V_{CT}	R_L = 50Ω, C_L = 15pF, P_{IN} = 0, f = 1MHz, Figure 6	+25°C		-87		dB

Fault-Protected, Low-Voltage, Quad SPST Analog Switches

ELECTRICAL CHARACTERISTICS—Dual Supplies (continued)

($V+ = +4.5V$ to $+5.5V$, $V- = -4.5V$ to $-5.5V$, $V_{IH} = +2.4V$, $V_{IL} = +0.8V$, GND = 0, $T_A = T_{MIN}$ to T_{MAX}, unless otherwise noted. Typical values are at $T_A = +25°C$.) (Note 3)

PARAMETER	SYMBOL	CONDITIONS	T_A	MIN	TYP	MAX	UNITS
POWER SUPPLY							
Power-Supply Range	V+, V-		C, E	±2.7		±5.5	V
V+ Supply Current	I+	All $V_{IN\_}$ = 0 or V+	+25°C		38	75	µA
			C, E			100	
V- Supply Current	I-	All $V_{IN\_}$ = 0 or V+	+25°C		38	75	µA
			C, E			100	
GND Supply Current	I_{GND}	All $V_{IN\_}$ = 0 or V+	+25°C		0	1	µA
			C, E			10	

ELECTRICAL CHARACTERISTICS—+5V Single Supply

($V+ = +4.5V$ to $+5.5V$, $V- = 0$, $V_{IH} = +2.4V$, $V_{IL} = +0.8V$, GND = 0, $T_A = T_{MIN}$ to T_{MAX}, unless otherwise noted. Typical values are at $T_A = +25°C$.) (Note 3)

PARAMETER	SYMBOL	CONDITIONS	T_A	MIN	TYP	MAX	UNITS
ANALOG SWITCH							
Fault-Free Analog Signal Range	$V_{COM\_}$, $V_{NO\_}$, $V_{NC\_}$	Power on	C, E	V-		V+	V
On-Resistance	R_{ON}	V+ = +4.5V, $V_{NO\_}$, $V_{NC\_}$ = +3.5V, I_{OUT} = 10mA	+25°C		30	40	Ω
			C, E			50	
On-Resistance Match Between Channels (Note 4)	ΔR_{ON}	V+ = +4.5V, $V_{NO\_}$, $V_{NC\_}$ = +3.5V, I_{OUT} = 10mA	+25°C		0.3	2	Ω
			C, E			3	
On-Resistance Flatness	R_{FLAT}	V+ = +4.5V, $V_{NO\_}$, $V_{NC\_}$ = +1.5V, +2.25V, +3.5V, I_{OUT} = 10mA	+25°C		2	5	Ω
			C, E			6	
NO_, NC_ Off-Leakage Current (Note 5)	$I_{NO\_(OFF)}$, $I_{NC\_(OFF)}$	V+ = +5.5V, $V_{COM\_}$ = +1V, +4.5V; $V_{NO\_}$, $V_{NC\_}$ = +4.5V, +1V	+25°C	-0.5		+0.5	nA
			C, E	-10		+10	
COM_ Off-Leakage Current (Note 5)	$I_{COM\_(OFF)}$	V+ = +5.5V, $V_{COM\_}$ = +1V, +4.5V; $V_{NO\_}$, $V_{NC\_}$ = +4.5V, +1V	+25°C	-0.5		+0.5	nA
			C, E	-10		+10	
COM_ On-Leakage Current (Note 5)	$I_{COM\_(ON)}$	V+ = +5.5V, $V_{COM\_}$ = +1V, +4.5V; $V_{NO\_}$, $V_{NC\_}$ = +1V, +4.5V, or floating	+25°C	-0.5		+0.5	nA
			C, E	-20		+20	
FAULT							
Fault-Protected Analog Signal Range	$V_{NO\_}$, $V_{NC\_}$	Power on	C, E	-12 + V+		+12	V

ELECTRICAL CHARACTERISTICS—+5V Single Supply (continued)

(V+ = +4.5V to +5.5V, V- = 0, V_{IH} = +2.4V, V_{IL} = +0.8V, GND = 0, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.) (Note 3)

PARAMETER	SYMBOL	CONDITIONS	T_A	MIN	TYP	MAX	UNITS
Fault-Protected Analog Signal Range	$V_{NO\_}$, $V_{NC\_}$	Power off	C, E	-12		+12	V
COM_ Output-Leakage Current, Supplies ON (Note 5)	$I_{COM\_}$	All channels off; $V_{NO\_}$, $V_{NC\_}$ = +12V or -7V, V+ = +5V	+25°C	-50		+50	nA
			C, E	-500		+500	
NO_ or NC_ Off-Leakage Current, Supplies ON (Note 5)	$I_{NO\_}$, $I_{NC\_}$	$V_{NO\_}$, $V_{NC\_}$ = +12V or -7V, V+ = +5V	+25°C	-50		+50	nA
			C, E	-500		+500	
NO_ or NC_ Input-Leakage Current, Supplies OFF (Note 5)	$I_{NO\_}$, $I_{NC\_}$	$V_{NO\_}$, $V_{NC\_}$ = ±12V, V± = 0	+25°C	-0.5		+0.5	µA
			C, E	-5		+5	
Output Clamp Current	$I_{COM\_}$	$V_{NO\_}$, $V_{NC\_}$ = +12V, V+ = 5V	C, E	2	6	11	mA
Output Clamp Resistance	$R_{CLAMP\_}$	Clamp on	+25°C		500		Ω
+Fault Output Turn-On Delay Time		$V_{NO\_}$, $V_{NC\_}$ = +12V, R_L = 300Ω, V+ = +5V	+25°C		200		ns
+Fault Recovery Time		$V_{NO\_}$, $V_{NC\_}$ = +12V, R_L = 300Ω, V+ = +5V	+25°C		500		µs
LOGIC INPUT							
Input Logic High	V_{IH}		C, E	2.4			V
Input Logic Low	V_{IL}		C, E			0.8	V
Input-Leakage Current (Note 5)	I_{IN}	$V_{IN\_}$ = 0 or V+	C, E	-1		+1	µA
SWITCH DYNAMICS							
Turn-On Time	t_{ON}	$V_{NO\_}$ or $V_{NC\_}$ = +3V, R_L = 300Ω, C_L = 35pF, Figure 2	+25°C		170	230	ns
			C, E			275	
Turn-Off Time	t_{OFF}	$V_{NO\_}$ or $V_{NC\_}$ = +3V, R_L = 300Ω, C_L = 35pF, Figure 2	+25°C		55	100	ns
			C, E			125	
Break-Before-Make Time Delay (MAX4713 only)	t_{BBM}	$V_{NO\_}$ or $V_{NC\_}$ = +3V, R_L = 300Ω, C_L = 35pF, Figure 2	+25°C	30	115		ns
			C, E	20			
Charge Injection	Q	V_{GEN}= 0, R_{GEN} = 0, C_L = 1nF, Figure 4	+25°C		-1		pC
POWER SUPPLY							
Power-Supply Range	V+		C, E	2.7		11	V
V+ Supply Current	I+	All $V_{IN\_}$ = 0 or V+	+25°C		34	65	µA
			C, E			75	

ELECTRICAL CHARACTERISTICS—+3V Single Supply

($V+ = +2.7V$ to $+3.6V$, $V- = 0$, $V_{IH} = +2.0V$, $V_{IL} = +0.6V$, GND = 0, $T_A = T_{MIN}$ to T_{MAX}, unless otherwise noted. Typical values are at $T_A = +25°C$.) (Note 3)

PARAMETER	SYMBOL	CONDITIONS	T_A	MIN	TYP	MAX	UNITS
ANALOG SWITCH							
Fault-Free Analog Signal Range	$V_{COM\_}$, $V_{NO\_}$, $V_{NC\_}$	Power-on	C, E	V-		V+	V
On-Resistance	R_{ON}	$V+ = +2.7V$, $V_{NO\_}$, $V_{NC\_} = +1V$, $I_{OUT} = 1mA$	+25°C		54	75	Ω
			C, E			100	
On-Resistance Match Between Channels (Note 4)	ΔR_{ON}	$V+ = +2.7V$, $V_{NO\_}$, $V_{NC\_} = +1V$, $I_{OUT} = 1mA$	+25°C		1	7	Ω
			C, E			9	
NO_, NC_ Off-Leakage Current (Note 5)	$I_{NO\_(OFF)}$, $I_{NC\_(OFF)}$	$V+ = +3.6V$, $V_{COM\_} = +0.7V, +3V$; $V_{NO\_}$, $V_{NC\_} = +3V, +0.7V$	+25°C	-0.5		+0.5	nA
			C, E	-10		+10	
COM_ Off-Leakage Current (Note 5)	$I_{COM\_(OFF)}$	$V+ = +3.6V$, $V_{COM\_} = +0.7V, +3V$; $V_{NO\_}$, $V_{NC\_} = +3V, +0.7V$	+25°C	-0.5		+0.5	nA
			C, E	-10		+10	
COM_ On-Leakage Current (Note 5)	$I_{COM\_(ON)}$	$V+ = +3.6V$, $V_{COM\_} = +0.7, +3V$; $V_{NO\_}$, $V_{NC\_} = +0.7V, +3V$, or floating	+25°C	-0.5		+0.5	nA
			C, E	-20		+20	
FAULT							
Fault-Protected Analog Signal Range	$V_{NO\_}$, $V_{NC\_}$	Power-on	C, E	-12 + V+		+12	V
Fault-Protected Analog Signal Range	$V_{NO\_}$, $V_{NC\_}$	Power-off	C, E	-12		+12	V
COM_ Output-Leakage Current, Supplies ON (Note 5)	I_{COM}	All channels off; $V_{NO\_}$, $V_{NC\_} = +12V$ or $-9V$, $V+ = +3V$	+25°C	-50		+50	nA
			C, E	-500		+500	
NO_ or NC_ Off-Leakage Current, Supplies ON (Note 5)	$I_{NO\_}$, $I_{NC\_}$	$V_{NO\_}$, $V_{NC\_} = +12V$ or $-9V$, $V+ = +3V$	+25°C	-50		+50	nA
			C, E	-500		+500	
NO_ or NC_ Input-Leakage Current, Supplies OFF (Note 5)	$I_{NO\_}$, $I_{NC\_}$	$V_{NO\_}$, $V_{NC\_} = \pm12V$, $V\pm = 0$	+25°C	-0.5		+0.5	µA
			C, E	-5		+5	
Output Clamp Current	$I_{COM\_}$	$V_{NO\_}$, $V_{NC\_} = +12V$, $V+ = +3V$	C, E	0.5		3.0	mA
Output Clamp Resistance	$R_{CLAMP\_}$	$V+ = +3V$, $V_{NO\_}$, $V_{NC\_} = +12V$; clamp on	+25°C		600		kΩ
+Fault Output Turn-On Delay Time		$V_{NO\_}$, $V_{NC\_} = +12V$, $R_L = 300Ω$, $V+ = +3V$	+25°C		200		ns
+Fault Recovery Time		$V_{NO\_}$, $V_{NC\_} = +12V$, $R_L = 300Ω$, $V+ = +3V$	+25°C		2.2		µs

ELECTRICAL CHARACTERISTICS—+3V Single Supply (continued)

(V+ = +2.7V to +3.6V, V- = 0, V_{IH} = +2.0V, V_{IL} = +0.6V, GND = 0, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.) (Note 3)

PARAMETER	SYMBOL	CONDITIONS	T_A	MIN	TYP	MAX	UNITS
LOGIC INPUT							
Input Logic High	V_{IH}		C, E	2			V
Input Logic Low	V_{IL}		C, E			0.6	V
Input-Leakage Current (Note 5)	$I_{IN\_}$	$V_{IN\_}$ = 0 or V+	C, E	-5		+5	μA
SWITCH DYNAMICS							
Turn-On Time	t_{ON}	V+ = +2.7V, $V_{NO\_}$ or $V_{NC\_}$ = +1.5V, R_L = 300Ω, C_L = 35pF, Figure 2	+25°C		340	500	ns
			C, E			600	
Turn-Off Time	t_{OFF}	V+ = +2.7V, $V_{NO\_}$ or $V_{NC\_}$ = +1.5V, R_L = 300Ω, C_L = 35pF, Figure 2	+25°C		100	175	ns
			C, E			225	
Break-Before-Make Time Delay (MAX4713 only)	t_{BBM}	V+ = +2.7V, $V_{NO\_}$ or $V_{NC\_}$ = +1.5V, R_L = 300Ω, C_L = 35pF, Figure 2	+25°C	60	240		ns
			C, E	50			
POWER SUPPLY							
Power-Supply Range	V+		C, E	2.7		11	V
V+ Supply Current	I+	All $V_{IN\_}$ = 0 or V+	+25°C		8	15	μA
			C, E			20	

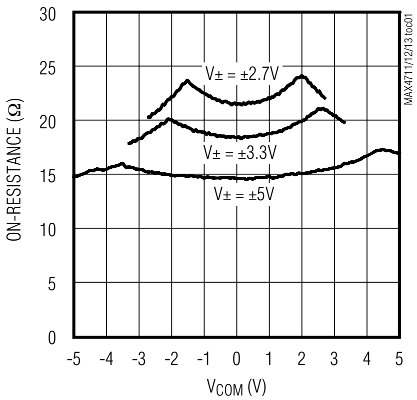
Note 3: Algebraic convention is used in this data sheet; the most negative value is shown in the minimum column.
Note 4: $\Delta R_{ON} = \Delta R_{ON}(MAX) - \Delta R_{ON}(MIN)$
Note 5: Leakage parameters are 100% tested at maximum-rated temperature and with dual supplies. Leakage parameters are guaranteed by correlation at +25°C.
Note 6: Off-isolation = 20 $\log_{10}$ [$V_{COM\_}$/($V_{NO\_}$ or $V_{NC\_}$)], $V_{COM\_}$ = output, $V_{NO\_}$ or $V_{NC\_}$ = input to off switch.
Note 7: Between any two switches.

Fault-Protected, Low-Voltage, Quad SPST Analog Switches

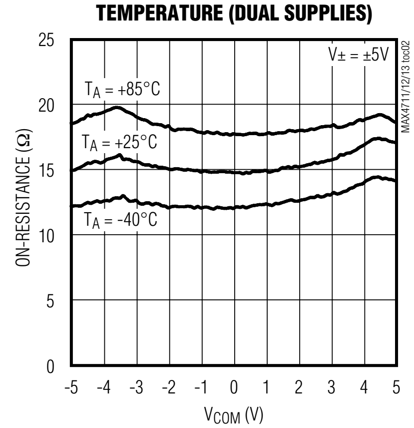
Typical Operating Characteristics

(V+ = +5V, V- = -5V, T_A = +25°C, unless otherwise noted.)

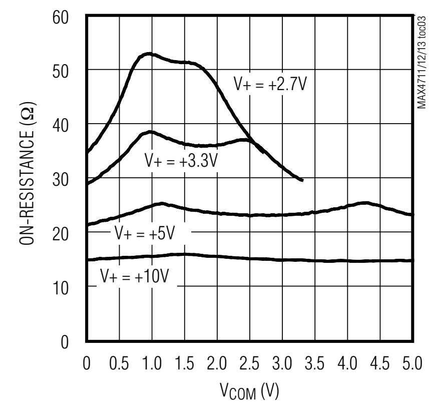
ON-RESISTANCE vs. V_{COM} (DUAL SUPPLIES)



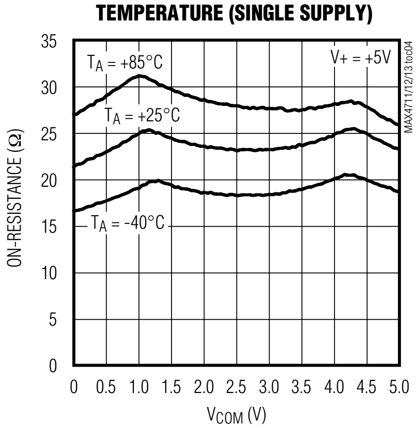
ON-RESISTANCE vs. V_{COM} AND TEMPERATURE (DUAL SUPPLIES)



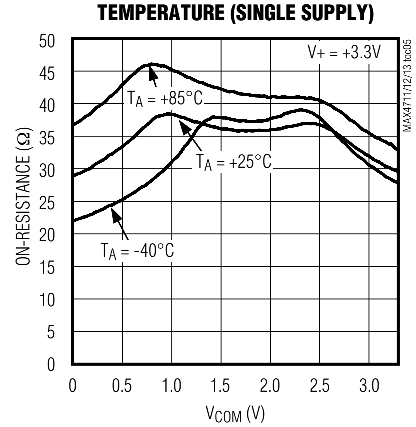
ON-RESISTANCE vs. V_{COM} (SINGLE SUPPLY)



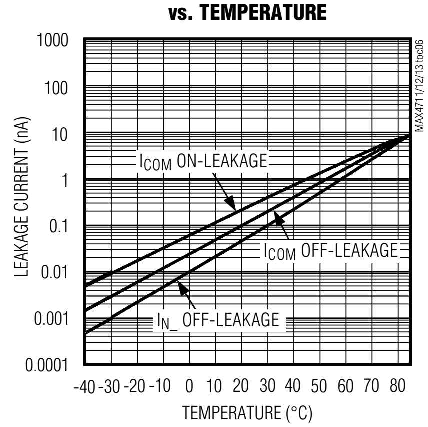
ON-RESISTANCE vs. V_{COM} AND TEMPERATURE (SINGLE SUPPLY)



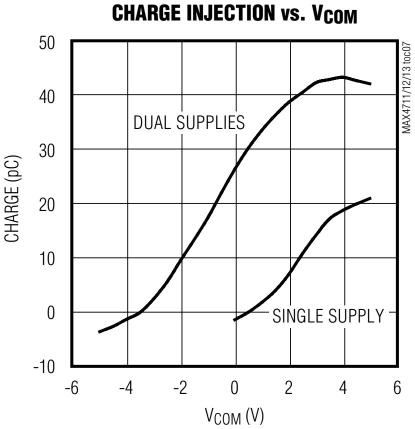
ON-RESISTANCE vs. V_{COM} AND TEMPERATURE (SINGLE SUPPLY)



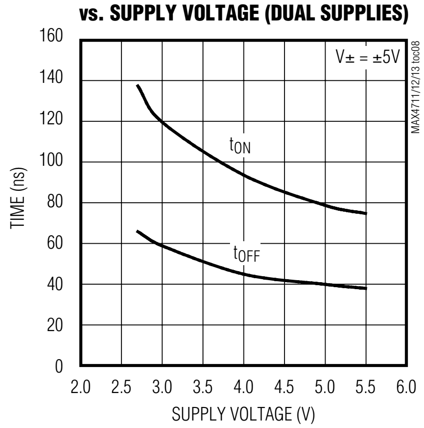
ON/OFF-LEAKAGE CURRENT vs. TEMPERATURE



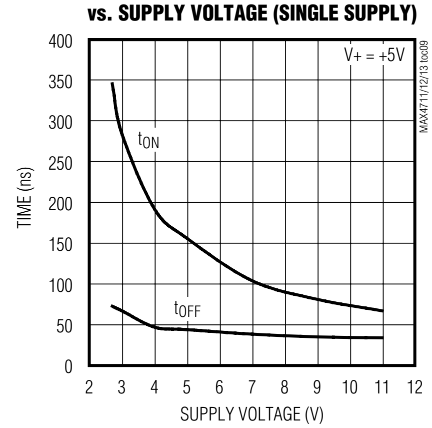
CHARGE INJECTION vs. V_{COM}



TURN-ON/TURN-OFF TIME vs. SUPPLY VOLTAGE (DUAL SUPPLIES)



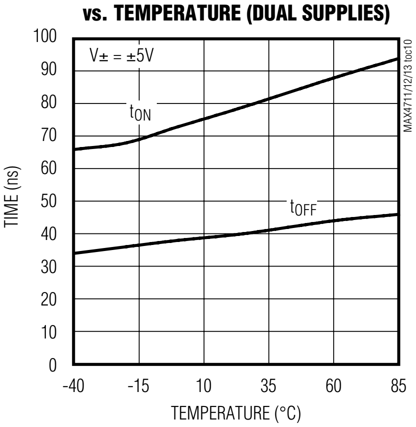
TURN-ON/TURN-OFF TIME vs. SUPPLY VOLTAGE (SINGLE SUPPLY)



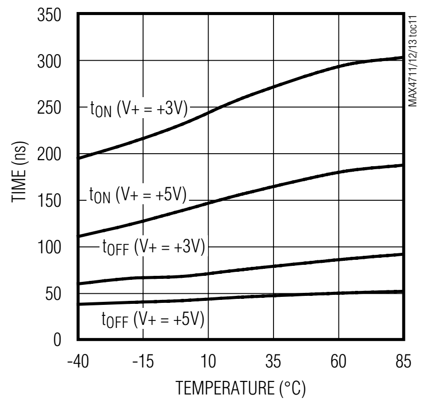
Typical Operating Characteristics (continued)

(V+ = +5V, V- = -5V, T_A = +25°C, unless otherwise noted.)

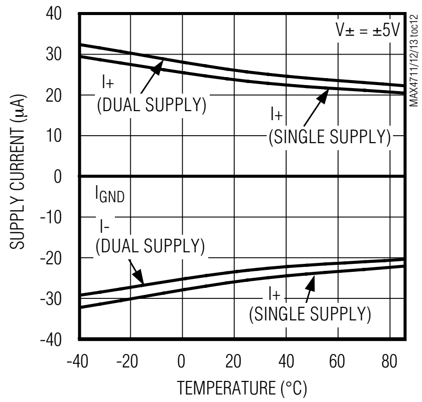
TURN-ON/TURN-OFF TIME vs. TEMPERATURE (DUAL SUPPLIES)



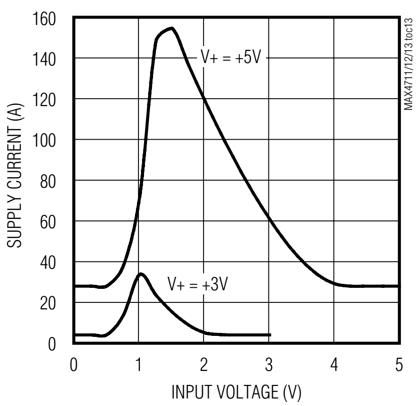
TURN-ON/TURN-OFF TIME vs. TEMPERATURE (SINGLE SUPPLY)



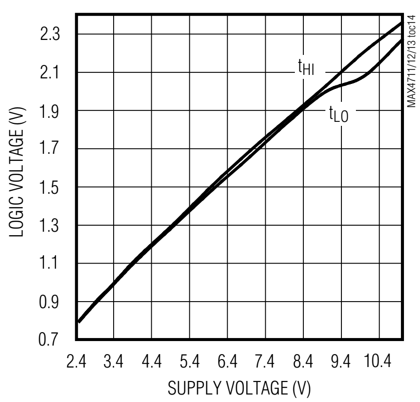
SUPPLY CURRENT vs. TEMPERATURE V_{IN} = 0 OR 5V



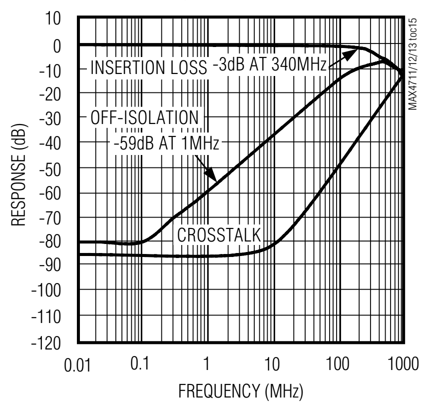
SUPPLY CURRENT vs. INPUT VOLTAGE



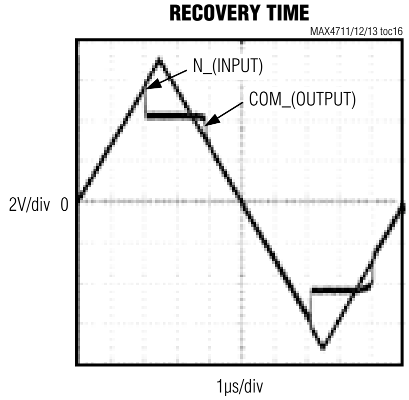
LOGIC LEVEL THRESHOLD vs. SUPPLY VOLTAGE



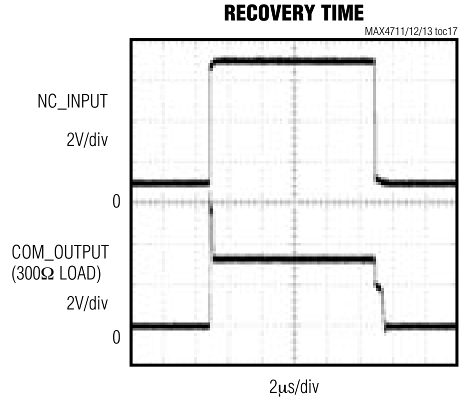
FREQUENCY RESPONSE



FAULT TURN-ON DELAY AND RECOVERY TIME



FAULT TURN-ON DELAY AND RECOVERY TIME



Fault-Protected, Low-Voltage, Quad SPST Analog Switches

Pin Description

PIN			NAME	FUNCTION
MAX4711	MAX4712	MAX4713		
1, 16, 9, 8	1, 16, 9, 8	1, 16, 9, 8	IN1, IN2, IN3, IN4	Logic Inputs. Fault-protected to (V- + 12V).
2, 15, 10, 7	2, 15, 10, 7	2, 15, 10, 7	COM1, COM2, COM3, COM4	Analog Switch Common Terminals
3, 14, 11, 6	—	—	NC1, NC2, NC3, NC4	Fault-Protected Analog Switch Normally Closed Terminals
—	3, 14, 11, 6	—	NO1, NO2, NO3, NO4	Fault-Protected Analog Switch Normally Open Terminals
—	—	3, 6	NO1, NO4	Fault-Protected Analog Switch Normally Open Terminals
—	—	14, 11	NC2, NC3	Fault-Protected Analog Switch Normally Closed Terminals
4	4	4	V-	Negative Supply Voltage Input. Connect to GND for single-supply operation.
5	5	5	GND	Ground
12	12	12	N.C.	No Connection. Not internally connected.
13	13	13	V+	Positive Supply Input

Detailed Description

The MAX4711/MAX4712/MAX4713 differ considerably from traditional fault-protection switches, with several advantages. First, they are constructed with two parallel FET's allowing very low on-resistance. Second, they allow signals on the NC_ or NO_ pins that are within or slightly beyond the supply rails to be passed through the switch to the COM terminal, allowing rail-to-rail signal operation. Third, when a signal on NC_ or NO_ exceeds the supply rails by about 150mV (a fault condition) the voltage on COM_ is limited to the same polarity supply voltage. Operation is identical for both fault polarities.

During a fault condition, the NO_ or NC_ input becomes high impedance regardless of the switch state or load resistance. If the switch is on, the COM_ output current is supplied from V+ or V- by the clamp FET's that are connected from COM to each supply. These FET's can typically source or sink up to 15mA. When power is removed, the fault protection is still in effect. In this case, the NO_ or NC_ terminals are a virtual open circuit. The fault can be up to ±12V.

The COM_ pins are not fault-protected, they act as normal CMOS switch terminals. If a voltage source is connected to any COM_ pin, it should be limited to the supply voltages. Exceeding the supply voltage will cause high currents to flow through the ESD-protected diodes, possibly damaging the device (see *Absolute Maximum Ratings*).

Pin Compatibility

These switches have identical pinouts to common non-fault-protected CMOS switches. Care should be exercised while considering them for direct replacements in existing printed circuit boards since only the NO_ and NC_ pins of each switch are fault-protected.

Internal Construction

Internal construction is shown in Figure 1, with the analog signal paths shown in bold. A single NO switch is shown; the NC configuration is identical except the logic-level translator is inverting. The analog switch is formed by the parallel combination of N-channel FET (N1) and P-channel FET (P1), which are driven on and off simultaneously according to the input fault condition and the logic-level state.

Normal Operation

Two comparators continuously compare the voltage on the NO_ (or NC_) pin with V+ and V-. When the signal on NO_ or NC_ is between V+ and V- the switch acts normally, with FETs N1 and P1 turning on and off in response to IN_ signals. The parallel combination of N1 and P1 forms a low-value resistor between NO_ (or

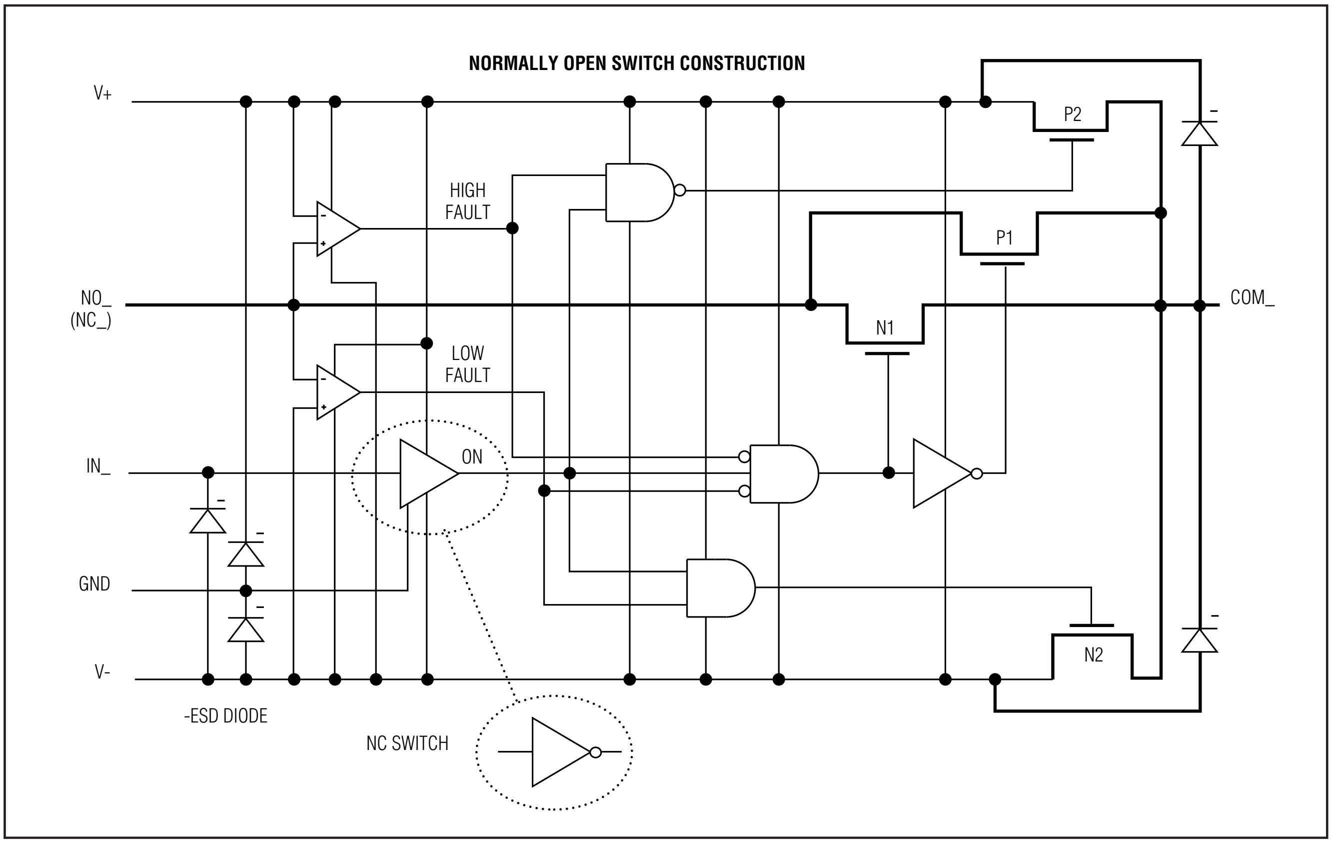


Figure 1. Block Diagram

NC_) and COM_ so that signals pass equally well in either direction.

Positive Fault Condition

When the signal on NO_ (or NC_) exceeds V+ by about 150mV, the high-fault comparator output is high, turning off FETs N1 and P1. This makes the NO_ (or NC_) input high impedance regardless of the switch state. If the switch state is “off”, all FETs are turned off and both NO_ (or NC_) and COM_ are high impedance. If the switch state is “on”, clamp FET P2 is turned on, sourcing current from V+ to COM_.

Negative Fault Condition

When the signal on NO_ (or NC_) exceeds V- by about 150mV, the low-fault comparator output is high, turning off FETs N1 and P1. This makes the NO_ (or NC_) input high impedance regardless of the switch state. If the switch state is “off”, all FETs are turned off and both NO_ (or NC_) and COM_ are high impedance. If the switch state is “on”, clamp FET N2 is turned on, sinking current from COM_ to V-.

Transient Fault Response and Recovery

When a fast rise-time or fall-time transient on NC_ or NO_ exceeds V+ or V-, the output (COM_) follows the input to the supply rail with only a few nanoseconds delay. This delay is due to the switch on-resistance and circuit capacitance to ground. When the input transient returns to within the supply rails, however, there is a 700ns output recovery delay time. These values depend on the COM_ output resistance and capacitance, and are not production tested or guaranteed. The delays are not dependent on the fault amplitude. Higher COM_ output resistance and capacitance increase recovery times.

COM_ and IN_ Pins

FETs N2 and P2 can source about ±15mA from V+ or V- to COM_ in the fault condition. Ensure that if the COM_ pin is connected to a low-resistance load, the absolute maximum current rating of 40mA is never exceeded both in normal and fault conditions.

Fault-Protected, Low-Voltage, Quad SPST Analog Switches

The COM_ pins do not have fault protection. Reverse ESD-protection diodes are internally connected between COM_, and V+ and V-. If a signal on COM_ exceeds V+ or V- by more than a diode drop, one of these diodes will conduct. The IN_ pin can exceed the positive supply voltage, but they can go below the negative supply by only a diode drop. The maximum voltage on these pins is 12V if operating from a single supply, regardless of the supply voltage (including 0 volts), and if operating from dual supplies, the maximum voltage is (V- + 12V).

Fault-Protection Voltage and Power Off

The maximum fault voltage on the NC_ or NO_ pins is ±12V with power off.

IN_ Logic-Level Thresholds

The logic-level thresholds are CMOS and TTL compatible when using ±4.5V to ±5.5V or single +4.5V to +11V supplies. When using a +2.7V supply, the logic thresholds are V_{IH} = 2.0V and V_{IL} = 0.6V.

Dual Supplies

The MAX4711/MAX4712/MAX4713 operate with bipolar supplies between ±2.7V and ±5.5V. The V+ and V- supplies need not be symmetrical, but their difference should not exceed 11V.

Single Supply

The MAX4711/MAX4712/MAX4713 operate from a single supply between +2.7V and +11V when V- is connected to GND.

Chip Information

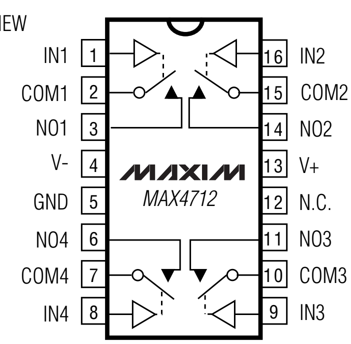
TRANSISTOR COUNT: 463

Ordering Information (continued)

PART	TEMP RANGE	PIN-PACKAGE
MAX4712CUE	0°C to +70°C	16 TSSOP
MAX4712CSE	0°C to +70°C	16 Narrow SO
MAX4712CPE	0°C to +70°C	16 Plastic Dip
MAX4712EUE	-40°C to +85°C	16 TSSOP
MAX4712ESE	-40°C to +85°C	16 Narrow SO
MAX4712EPE	-40°C to +85°C	16 Plastic Dip
MAX4713CUE	0°C to +70°C	16 TSSOP
MAX4713CSE	0°C to +70°C	16 Narrow SO
MAX4713CPE	0°C to +70°C	16 Plastic Dip
MAX4713EUE	-40°C to +85°C	16 TSSOP
MAX4713ESE	-40°C to +85°C	16 Narrow SO
MAX4713EPE	-40°C to +85°C	16 Plastic Dip

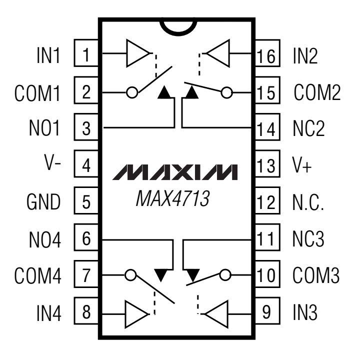
Pin Configurations/Functional Diagrams/Truth Tables (continued)

TOP VIEW



DIP/SO/TSSOP

MAX4712	
LOGIC	SWITCH
0	OFF
1	ON



DIP/SO/TSSOP

MAX4713		
LOGIC	SWITCHES 1, 4	SWITCHES 2, 3
0	OFF	ON
1	ON	OFF

SWITCHES SHOWN FOR LOGIC "0" INPUT

Test Circuits/Timing Diagrams

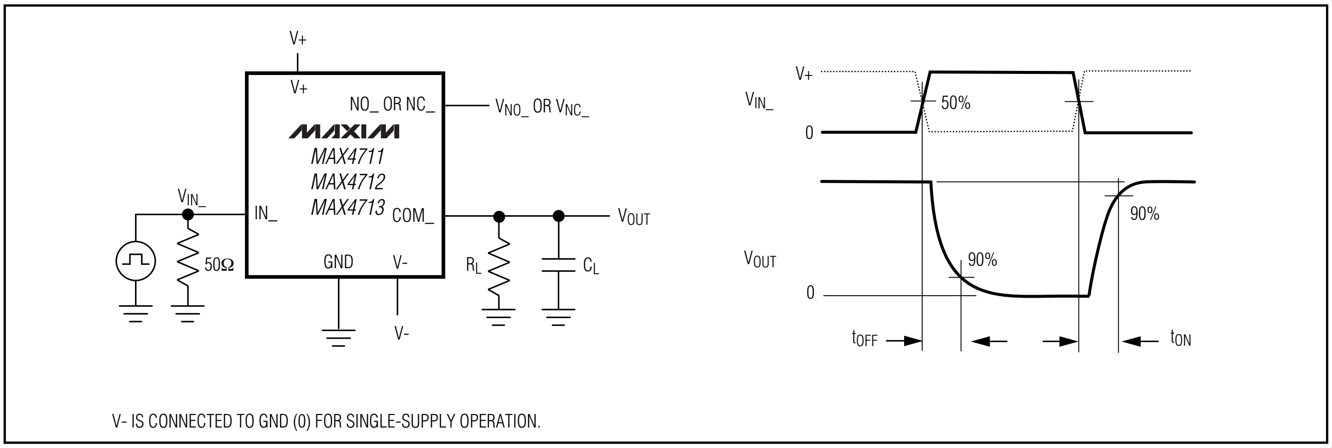


Figure 2. Switch Turn-On/Turn-Off Times

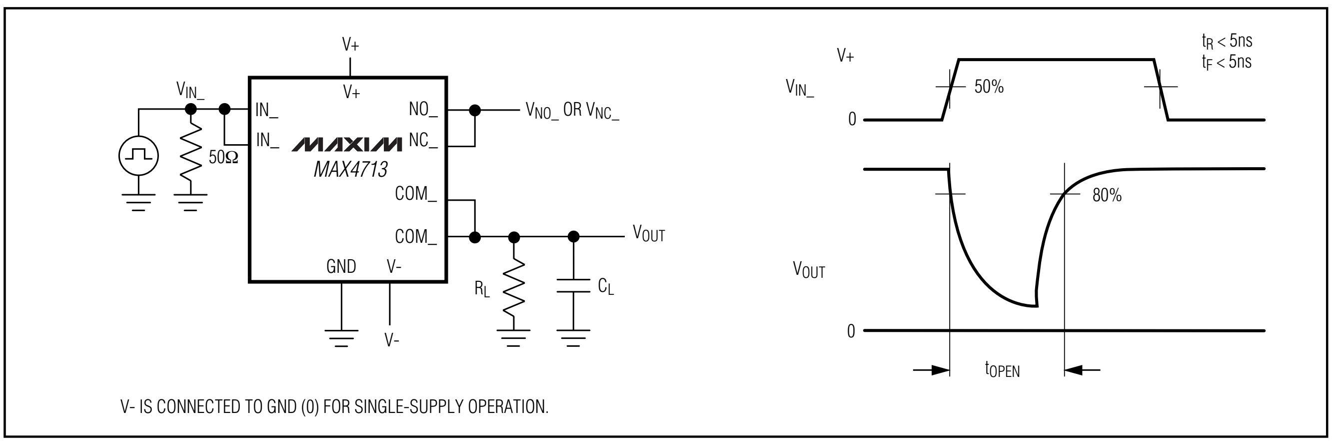


Figure 3. MAX4713 Break-Before-Make Interval

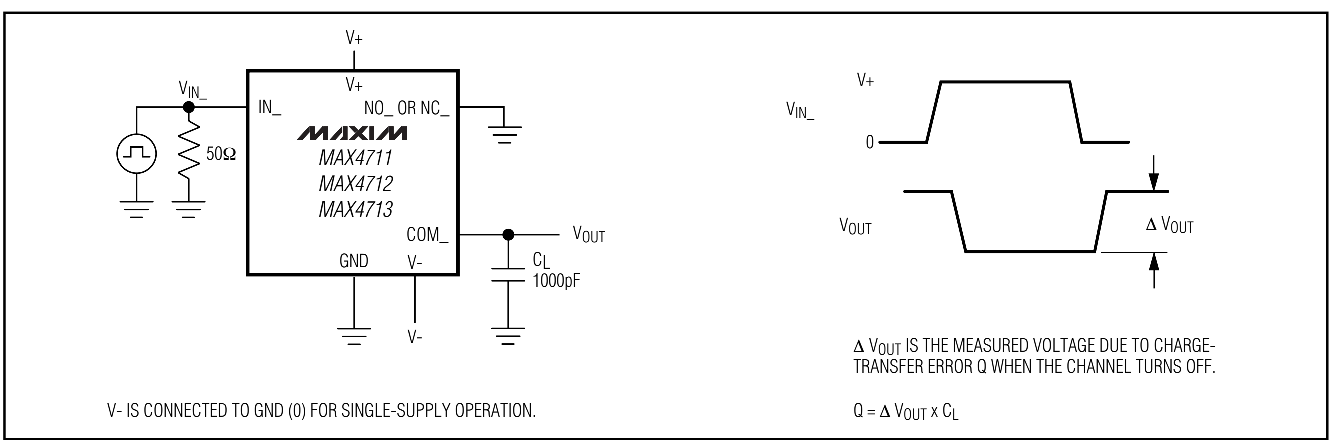


Figure 4. Charge Injection

Fault-Protected, Low-Voltage, Quad SPST Analog Switches

Test Circuits/Timing Diagrams (continued)

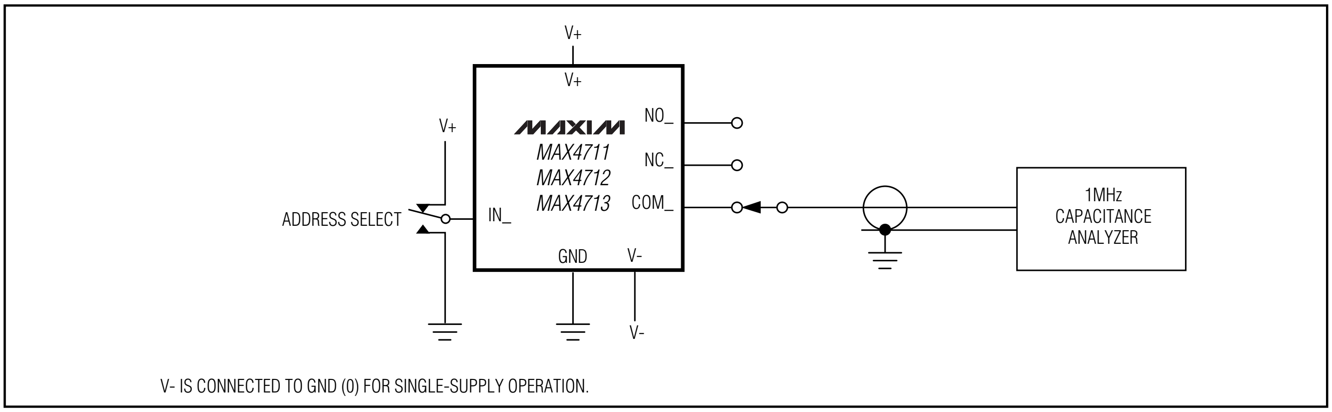


Figure 5. COM_, NO_, NC_ Capacitance

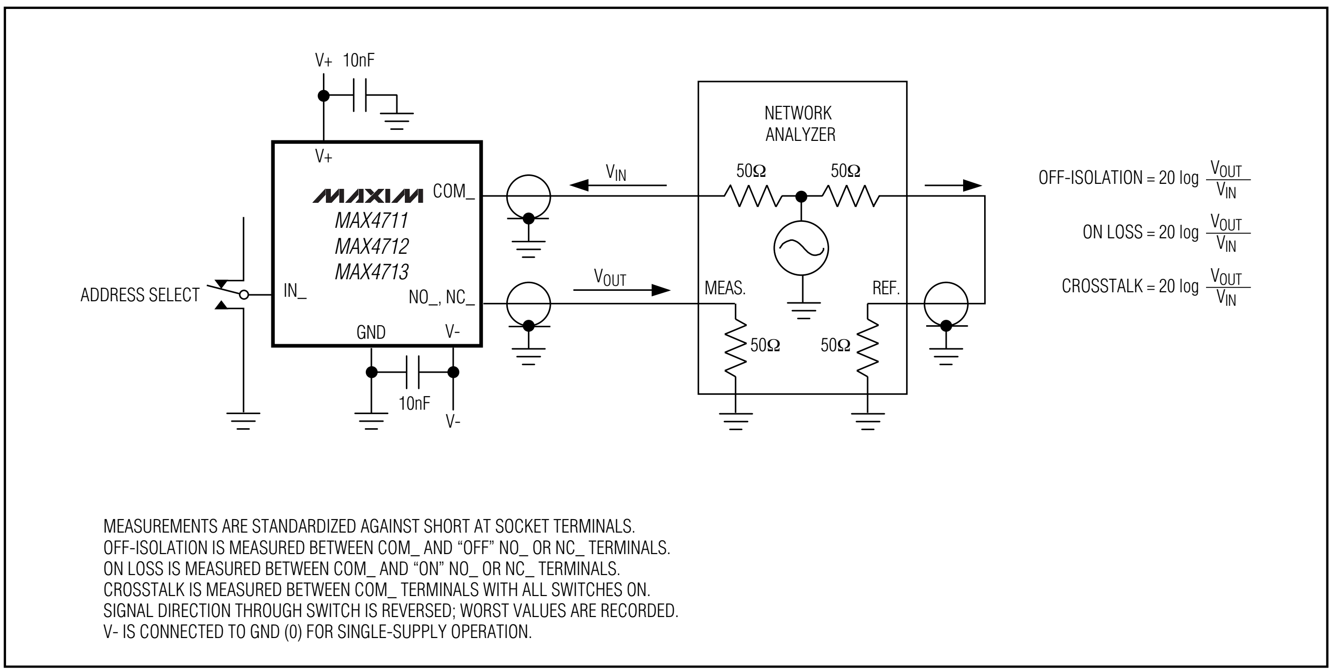
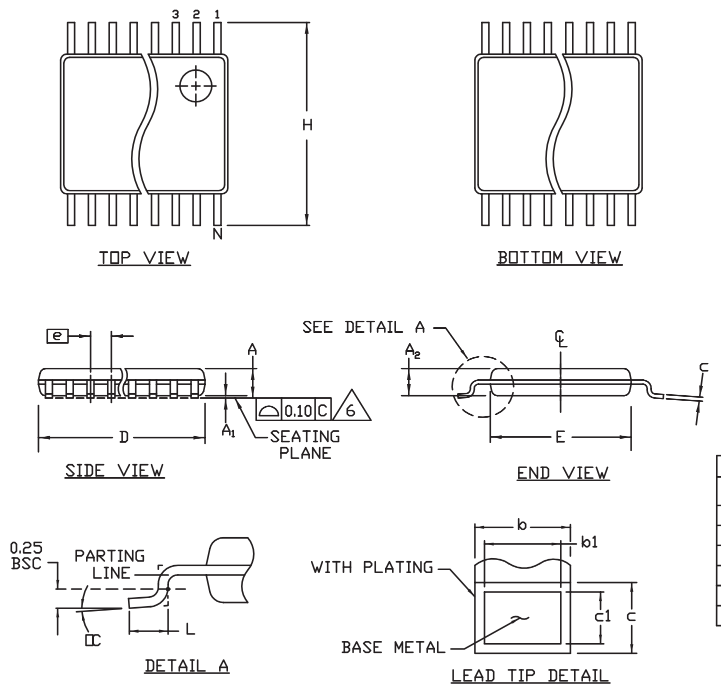


Figure 6. Frequency Response, Off-Isolation, and Crosstalk

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**.)

TSSOP4.40mm.EPS



SYMBOL	COMMON DIMENSIONS			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	—	1.10		.043
A_1	0.05	0.15	.002	.006
A_2	0.85	0.95	.033	.037
b	0.19	0.30	.007	.012
b_1	0.19	0.25	.007	.010
c	0.09	0.20	.004	.008
c_1	0.09	0.14	.004	.006
D	SEE VARIATIONS		SEE VARIATIONS	
E	4.30	4.50	.169	.177
e	0.65 BSC		.026 BSC	
H	6.25	6.55	.246	.258
L	0.50	0.70	.020	.028
N	SEE VARIATIONS		SEE VARIATIONS	
α	0°	8°	0°	8°

JEDEC			VARIATIONS			
MO-153	N		MILLIMETERS		INCHES	
			MIN.	MAX.	MIN.	MAX.
AB-1	14	D	4.90	5.10	.193	.201
AB	16	D	4.90	5.10	.193	.201
AC	20	D	6.40	6.60	.252	.260
AD	24	D	7.70	7.90	.303	.311
AE	28	D	9.60	9.80	.378	.386

NOTES:
1. DIMENSIONS D AND E DO NOT INCLUDE FLASH
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED 0.15mm PER SIDE
3. CONTROLLING DIMENSION: MILLIMETER
4. MEETS JEDEC OUTLINE MO-153. SEE JEDEC VARIATIONS TABLE
5. "N" REFERS TO NUMBER OF LEADS
6. THE LEAD TIPS MUST LIE WITHIN A SPECIFIED ZONE. THIS TOLERANCE ZONE IS DEFINED BY TWO PARALLEL PLANES. ONE PLANE IS THE SEATING PLANE, DATUM [-C-]; THE OTHER PLANE IS AT THE SPECIFIED DISTANCE FROM [-C-] IN THE DIRECTION INDICATED

DALLAS SEMICONDUCTOR MAXIM

PROPRIETARY INFORMATION

TITLE: PACKAGE OUTLINE, TSSOP 4.40mm BODY

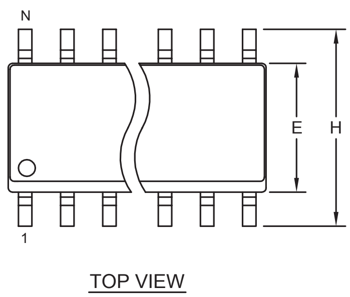
APPROVAL	DOCUMENT CONTROL NO.	REV.	
	21-0066	F	1/1

Fault-Protected, Low-Voltage, 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**.)

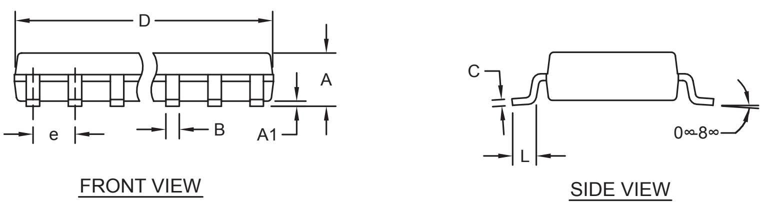
SOICN .EPS



DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	0.053	0.069	1.35	1.75
A1	0.004	0.010	0.10	0.25
B	0.014	0.019	0.35	0.49
C	0.007	0.010	0.19	0.25
e	0.050 BSC		1.27 BSC	
E	0.150	0.157	3.80	4.00
H	0.228	0.244	5.80	6.20
L	0.016	0.050	0.40	1.27

VARIATIONS:

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX	N	MS012
D	0.189	0.197	4.80	5.00	8	AA
D	0.337	0.344	8.55	8.75	14	AB
D	0.386	0.394	9.80	10.00	16	AC



NOTES:
1. D&E DO NOT INCLUDE MOLD FLASH.
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED 0.15mm (.006").
3. LEADS TO BE COPLANAR WITHIN 0.10mm (.004").
4. CONTROLLING DIMENSION: MILLIMETERS.
5. MEETS JEDEC MS012.
6. N = NUMBER OF PINS.

DALLAS SEMICONDUCTOR MAXIM

PROPRIETARY INFORMATION

TITLE:

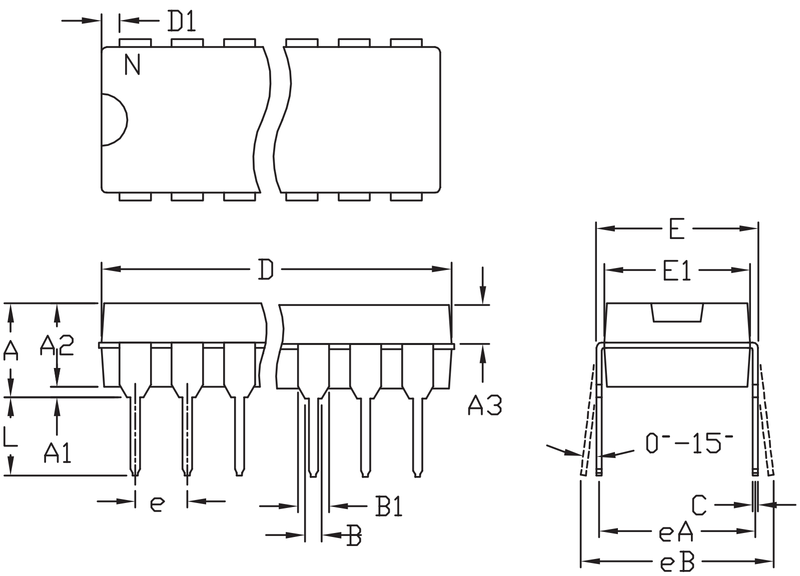
PACKAGE OUTLINE, .150" SOIC

APPROVAL	DOCUMENT CONTROL NO.	REV.	
	21-0041	B	1/1

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**.)

PDIPN.EPS



	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	---	0.180	---	4.572
A1	0.015	---	0.38	---
A2	0.125	0.175	3.18	4.45
A3	0.055	0.080	1.40	2.03
B	0.015	0.022	0.381	0.56
B1	0.045	0.065	1.14	1.65
C	0.008	0.014	0.2	0.355
D1	0.005	0.080	0.13	2.03
E	0.300	0.325	7.62	8.26
E1	0.240	0.310	6.10	7.87
e	0.100 BSC.		2.54 BSC.	
eA	0.300 BSC.		7.62 BSC.	
eB	0.400 BSC.		10.16 BSC.	
L	0.115	0.150	2.921	3.81

	INCHES		MILLIMETERS			
	MIN	MAX	MIN	MAX	N	MS001
D	0.348	0.390	8.84	9.91	8	AB
D	0.735	0.765	18.67	19.43	14	AC
D	0.745	0.765	18.92	19.43	16	AA
D	0.885	0.915	22.48	23.24	18	AD
D	1.015	1.045	25.78	26.54	20	AE
D	1.14	1.265	28.96	32.13	24	AF
D	1.360	1.380	34.54	35.05	28	*5

NOTES:
1. D&E DO NOT INCLUDE MOLD FLASH
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED .15mm (.006")
3. CONTROLLING DIMENSION: MILLIMETER
4. MEETS JEDEC MS001-XX AS SHOWN IN ABOVE TABLE
5. SIMILIAR TO JEDEC MO-058AB
6. N = NUMBER OF PINS

MAXIM 120 SAN GABRIEL DR SUNNYVALE CA 94086 FAX (408) 737 7194 PROPRIETARY INFORMATION | TITLE: PACKAGE FAMILY OUTLINE: PDIP .300" | 1/1 | DOCUMENT CONTROL NUMBER 21-0043 REV D

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.

© 2003 Maxim Integrated Products Printed USA MAXIM is a registered trademark of Maxim Integrated Products.