

QUAD BILATERAL SWITCH

GENERAL DESCRIPTION

The MMC 4016 (intermediate or extended temperature range) are monolithic integrated circuit, available in 14-lead dual in-line plastic or ceramic package.

The MMC 4016 types are quad bilateral switches intended for the transmission or multiplexing of analog or digital signals. Each of the four independent bilateral switches has a single control signal input which simultaneously biases both the p and n device in a given switch ON or OFF.

FEATURES

- 20 V digital or ± 10 V peak-to-peak switching
- 280 ohm typical ON resistance for 15 V operation
- Switch on resistance matched to within 10 ohm typ. over 15 V signal input range
- Extremely high control input impedance (control circuit isolated from signal circuit 10^{12} ohm typ.)
- Extremely low off switch leakage resulting in very low offset current and high effective off resistance: 110 pA typ. $V_{DD}, V_{SS} = 18$ V, $T_A = 25^\circ\text{C}$
- Matched control-input to signal-output capacitance: reduces output signal transients.
- Frequency response switch on = 40 MHz (typ.).

ABSOLUTE MAXIMUM RATINGS

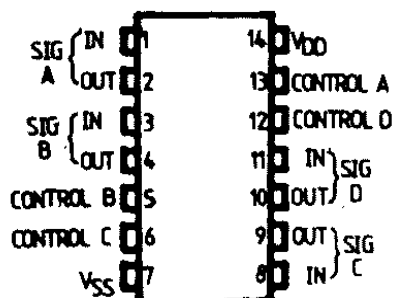
V_{DD}^*	Supply voltage: G and H types E and F types	-0.5 to	20	V
V_i	Input voltage	-0.5 to	18	V
I_i	DC input current (any one input)	-0.5 to	$V_{DD} + 0.5$	V
P_{tot}	Total power dissipation (per package)		± 10	mA
	Dissipation per output transistor for $T_A =$ full package-temperature range		200	mW
T_A	Operating temperature: G and H types E and F types		100	mW
			125	$^\circ\text{C}$
T_{stg}	Storage temperature		85	$^\circ\text{C}$
			150	$^\circ\text{C}$

* All voltage values are referred to V_{SS} pin voltage

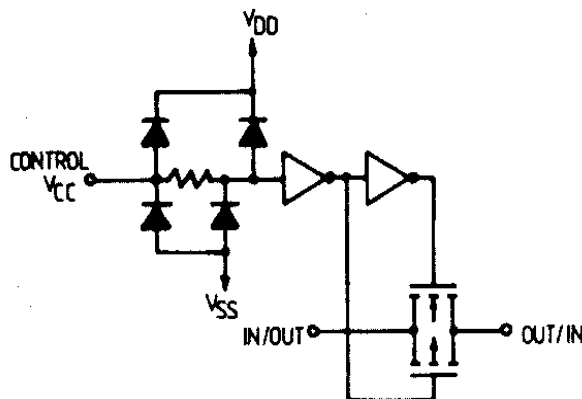
RECOMMENDED OPERATING CONDITIONS

V_{DD}^*	Supply voltage: G and H types E and F types	3 to	18	V
V_i	Input voltage	3 to	15	V
T_A	Operating temperature: G and H types E and F types	0 to	V_{DD}	V
			125	$^\circ\text{C}$
			85	$^\circ\text{C}$

CONNECTION DIAGRAM



SCHEMATIC DIAGRAM



TYPICAL „ON” RESISTANCE CHARACTERISTICS,

T_A = 25°C.

CHARACTERISTIC*	SUPPLY CONDITIONS		LOAD CONDITIONS					
			R _L = 1 kΩ		R _L = 10 kΩ		R _L = 100 kΩ	
	V _{DD} (V)	V _{SS} (V)	VALUE (Ω)	V _{IS} (V)	VALUE (Ω)	V _{IS} (V)	VALUE (Ω)	V _{IS} (V)
R _{ON}	+15	0	200 200	+15 0	200 200	+15 0	180 200	+15 0
R _{ON} (max.)	+15	0	300	+11	300	+9.3	320	+9.2
R _{ON}	+10	0	290 290	+10 0	250 250	+10 0	240 300	+10 0
R _{ON} (max.)	+10	0	500	+7.4	560	+5.6	610	+5.5
R _{ON}	+5	0	860 600	+5 0	470 580	+5 0	450 800	+5 0
R _{ON} (max.)	+5	0	1.7 k	+4.2	7k	+2.9	33 k	+2.7
R _{ON}	+2.5	-2.5	590 720	+2.5 -2.5	450 520	+2.5 -2.5	490 520	+2.5 -2.5
R _{ON} (max.)	+2.5	-2.5	232 k	± 0.25	300 k	± 0.25	870 k	± 0.25

* Variation from a perfect switch, R_{ON} = 0 Ω

STATIC ELECTRICAL CHARACTERISTICS

(over recommended operating conditions)

PARAMETER		TEST CONDITIONS				VALUES						UNIT
		V _C = V _{DD}	V _{SS} (V)	V _{DD} (V)	T _{LOW}		25°C			T _{HIGH}		
					min.	max.	min.	typ	max.	min.	max.	
I _L Quiescent device current (all switches ON or all switches OFF)	G, H types			5		0.25		0.01	0.25		7.5	μA
				10		0.5		0.01	0.5		15	
				15		1		0.01	1		30	
				20		5		0.02	5		150	
	E, F types			5		1		0.01	1		7.5	
				10		2		0.01	2		15	
				15		4		0.01	4		30	

Switch

R _{ON} ON Resistance	H, G types	R _L = 10 kΩ	+7.5	-7.5	V _{IS}	360	200	400	600
					+7.5 -7.5 ±0.25				
	E, F types				+7.5	370	200	400	520
					-7.5 +0.25	370 790	200 280	400 850	520 1080
	H, G types	R _L = 10 kΩ	+5	-5	+5	600	250	660	960
					-5 ±0.25	600 1870	250 580	660 2000	960 2600
	E, F types				+5	610	250	660	840
					-5 ±0.25	610 1900	250 580	660 2000	840 2380

STATIC ELECTRICAL CHARACTERISTICS

(over recommended operating conditions)

PARAMETER		TEST CONDITIONS				VALUES						UNIT	
			$V_C = V_{DD}$	V_{SS} (V)	V_{DD} (V)	T_{LOW}		25°C			T_{HIGH}		
						min.	max.	min.	typ.	max.	min.		max.
	G, H types	$R_L = 10\text{ k}\Omega$	+15	0	+15 +0.25 +9.3		360 360 775		200 200 300	400 400 850		600 600 1230	Ω
	E, F types						370 370 790		200 200 300	400 400 800		520 520 1080	
	G, H types	$R_L = 10\text{ k}\Omega$	+10	0	+10 +0.25 +5.6		600 600 1870		250 250 560	660 660 2000		960 960 2600	Ω
	E, F types						610 610 1900		250 250 560	660 660 2000		840 840 2380	
ΔR_{ON} Resistance (between any 2 of 4 switches)		$R_L = 10\text{ k}\Omega$	+7.5 +5	-7.5 -5	± 7.5 ± 5				10 15				Ω
Input or output leakage current switch OFF (effective OFF resistance)	G, H types		$V_{DD} + 18$	$V_C = V_{SS}$ 0					± 0.1	10^{-5}	± 0.1	1	μA
	E, F types		$V_{DD} + 15$	$V_C = V_{SS}$ 0					± 0.3	10^{-5}	± 0.3	1	
C_i Input capacitance C_o Output capacitance C_{i0} Feedthrough			$V_{CC} = V_{SS} = -5$		+5					4 4 0.2			pF

Control (V_C)

V_{TH} Switch threshold voltage		$I_{IS} = 10\ \mu A$	5 10 15	1 2 2		1 2 2	2.25 4.5 6.75		1 2 2		V
I_i Input current	G, H types	$V_{IS} \leq V_{DD}$	18		± 0.1		$\pm 10^{-5}$	± 0.1		± 1	μA
	E, F types		15		± 0.3		$\pm 10^{-5}$	± 0.3	± 1		
C_i Input capacitance							5 7.5				pF

DYNAMIC ELECTRICAL CHARACTERISTICS

($T_A = 25^\circ\text{C}$, $C_L = 50\text{ pF}$ all input square wave rise and fall time = 20 ns).

PARAMETER	V_C (V)	TEST CONDITIONS					VALUES -			UNIT
		R_L (k Ω)	f_i (KHz.)	V_i (V)	V_{SS} (V)	V_{Dp} (V)		typ.	max.	
Switch										
t_{pd} Propagation delay time (Signal input to output)	= V_{DD}	10		10 sq Wave	GND	5 10 15		40 20 15	100 50 40	ns
Crosstalk between any 2 of 4 switches (f -50 dB) $20 \log \frac{V_O}{V_I} = -50\text{ dB}$	$V_{C(A)} = V_{DD} = +5$ $V_{C(B)} = V_{SS} = -5$	1		$V_{i(A)} \blacktriangle$ 5pp				0.9		MHz
Frequency response switch "ON" (Sine wave input) at $20 \log \frac{V_O}{V_I} = -3\text{ dB}$	= V_{DD} = +5	1		5p-p	-5			40		MHz
Feedthrough (Switch OFF) at $20 \log \frac{V_O}{V_I} = -50\text{ dB}$	= V_{SS} = -5	1		-5p-p		5		1.25		MHz
Sine wave distortion	= V_{DD} = 5	10	1	5p-p	-5			0.4		% _o
Control (V_C)										
Propagation delay: (Turn ON control to output)	$V_{DD} - V_{SS}$ (Sq. wave)	1		V_{DD} or V_{SS}		5 10 15	$V_{DD} - V_{SS} = 10\text{ V}$	35 20 15	70 40 30	ns
Max. allowable control input repetition rate	10 (Sq. wave)	1		V_{DD}	GND	10		10		MHz
Crosstalk (Control input to signal output)	10 (Sq. wave)	10			GND	10		50		mV

(\blacktriangle) Symmetrical about 0V

(\bullet) For all test conditions.