

**MMC 4016**

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

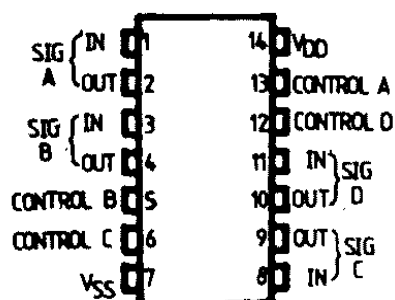
V_{DD}^*	Supply voltage: G and H types	-0.5 to	20	V
	E and F types	-0.5 to	18	V
V_i	Input voltage	-0.5 to	$V_{DD} + 0.5$	V
I_i	DC input current (any one input)		± 10	mA
P_{tot}	Total power dissipation (per package)		200	mW
	Dissipation per output transistor for $T_A =$ full package-temperature range		100	mW
T_A	Operating temperature: G and H types	-55 to	125	$^\circ\text{C}$
	E and F types	-40 to	85	$^\circ\text{C}$
T_{stg}	Storage temperature	-65 to	150	$^\circ\text{C}$

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

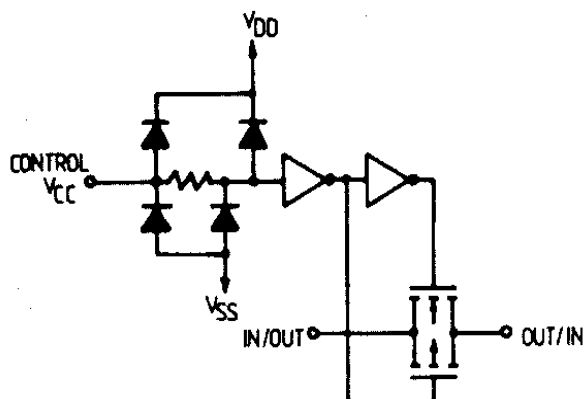
RECOMMENDED OPERATING CONDITIONS

V_{DD}^*	Supply voltage: G and H types	3 to	18	V
	E and F types	3 to	15	V
V_i	Input voltage	0 to	V_{DD}	V
T_A	Operating temperature: G and H types	-55 to	125	$^\circ\text{C}$
	E and F types	-40 to	85	$^\circ\text{C}$

CONNECTION DIAGRAM



SCHEMATIC DIAGRAM



TYPICAL „ON” RESISTANCE CHARACTERISTICS, $T_A = 25^\circ\text{C}$.

CHARACTERISTIC*	SUPPLY CONDITIONS		LOAD CONDITIONS					
			$R_L = 1\text{ k}\Omega$		$R_L = 10\text{ k}\Omega$		$R_L = 100\text{ k}\Omega$	
	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
$R_{ON}(\text{max.})$	+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
$R_{ON}(\text{max.})$	+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
$R_{ON}(\text{max.})$	+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
$R_{ON}(\text{max.})$	+2.5	-2.5	232 k	± 0.25	300 k	± 0.25	870 k	± 0.25

* Variation from a perfect switch, $R_{ON} = 0\ \Omega$ **STATIC ELECTRICAL CHARACTERISTICS**

(over recommended operating conditions)

PARAMETER			TEST CONDITIONS				VALUES						UNIT	
				$V_C = V_{DO}$	V_{SS} (V)	V_{DO} (V)	T_{LOW}		$25^{\circ}C$			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	$R_L = 10\text{ k}\Omega$	+7.5	-7.5	V_{IS} +7.5		360		200	400		600	Ω
					-7.5		360		200	400		600	
					± 0.25		775		280	850		1230	
	E, F types	$R_L = 10\text{ k}\Omega$	+7.5	-7.5	+7.5		370		200	400		520	Ω
					-7.5		370		200	400		520	
					± 0.25		790		280	850		1080	
	H, G types	$R_L = 10\text{ k}\Omega$	+5	-5	+5		600		250	660		960	Ω
					-5		600		250	660		960	
					± 0.25		1870		580	2000		2600	
	E, F types	$R_L = 10\text{ k}\Omega$	+5	-5	+5		610		250	660		840	Ω
					-5		610		250	660		840	
					± 0.25		1900		580	2000		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		+15	0	+15 +0.25 +9.3		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		+10	0	+10 +0.25 +5.6		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			

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	TEST CONDITIONS					VALUES			UNIT	
	V_C (V)	R_L (k Ω)	f_i (KHz.)	V_i (V)	V_{SS} (V)	V_{DD} (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) $20 \log \frac{V_o}{V_i} = -50$ dB	$V_{C(A)} = V_{DD} = +5$ $V_{C(B)} = V_{SS} = -5$	1		$V_{i(A)} \Delta$ 5pp				0.9		MHz
Frequency response switch "ON" (Sine wave input) at $20 \log \frac{V_o}{V_i} = -3$ dB	$= V_{DD}$ $= +5$	1		5p-p	-5			40		MHz
Feedthrough (Switch OFF) at $20 \log \frac{V_o}{V_i} = -50$ dB	$= V_{SS}$ $= -5$	1		-5p-p		5		1.25		MHz
Sine wave distortion	$= V_{DD}$ $= 5$	10	1	5p-p	-5			0.4		%
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	$V_{DD} - V_{SS} = 10$ 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

(Δ) Symetrical about OV

($\bullet$) For all test conditions.