



MMC 4066

QUAD BILATERAL SWITCH FOR TRANSMISSION OR MULTIPLEXING OF ANALOG OR DIGITAL SIGNALS

GENERAL DESCRIPTION

The MMC 4066 (E, F — intermediate temperature range and G, H — extended temperature range) are monolithic integrated circuits, available in 14-lead dual in-line plastic or ceramic package.

The MMC 4066 is a quad bilateral switch intended for the transmission or multiplexing of analog or digital signals. It is pin-for-pin compatible with MMC 4016, but exhibits a much lower ON resistance. In addition, the ON resistance is relatively constant over the full input-signal range. The MMC 4066 consists of four independent bilateral switches. A single control signal is required per switch. Both the p and n device in a given switch are biased ON or OFF simultaneously by the control signal.

As shown in schematic diagram, the well of the n-channel device on each switch is either tied to the input when the switch is ON or to V_{SS} when the switch is OFF. This configuration eliminates the variation of the switch-transistor threshold voltage with input signal, and thus keeps the ON resistance low over the full operating-signal range. The advantages over single-channel switches include peak input signal voltage swings equal to the full supply voltage, and more constant ON impedance over the input-signal range.

FEATURES

- 15 V digital or ± 7.5 V peak-to-peak switching
- 80 Ω typical ON resistance for 15 V operation
- Switch ON resistance matched to within 5 Ω over 15 V signal-input range
- High on/off output-voltage ratio: 65 dB typ. at $f_{is} = 10$ kHz, $R_L = 10$ k Ω
- High degree of linearity: < 0.5% distortion typ at $f_{is} = 1$ kHz, $V_{is} = 5$ Vp-p, $V_{DD} - V_{SS} \geq 10$ V, $R_L = 10$ k Ω
- Extremely low off switch leakage resulting in very low offset current and high effective OFF resistance; 10 pA typ. at $V_{DD} - V_{SS} = 10$ V, $T_A = 25^\circ\text{C}$
- Extremely high control input impedance (control circuit isolated from signal circuit); 10^{12} Ω typ.
- Low crosstalk between switches: -50 dB typ. at $f_{is} = 0.9$ MHz, $R_L = 1$ k
- Matched control-input to signal-output capacitance; reduces output signal transients

ABSOLUTE MAXIMUM RATINGS

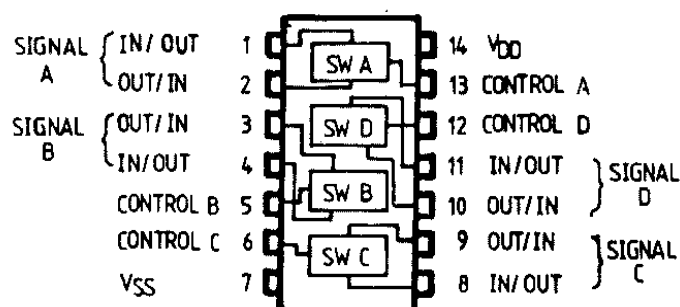
V_{DD}^*	Supply voltage: G and H types	-0.5 to 20	V
	E and F types	-0.5 to 18	V
V_i	Input voltage	-0.5 to $V_{DD} + 0.5$	V
I_i	DC input current (any one input)	± 10	mA
P_{tot}	Total power dissipation (per package)	200	mW
	Dissipation per output transistor for $T_A =$ full package-temperature range	100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

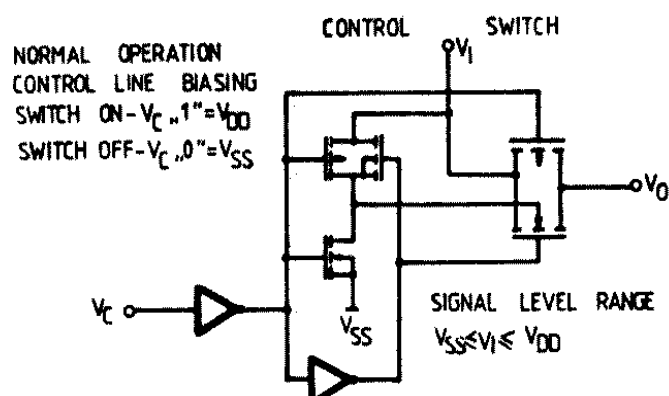
V_{DD}^*	Supply voltage: G and H types	3 to 18	V
	E and F types	3 to 15	V
V_i	Input voltage	0 to V_{DD}	V
T_A	Operating temperature: G and H types	-55 to 125	$^\circ\text{C}$
	E and F types	-40 to 85	$^\circ\text{C}$

FUNCTIONAL DIAGRAM



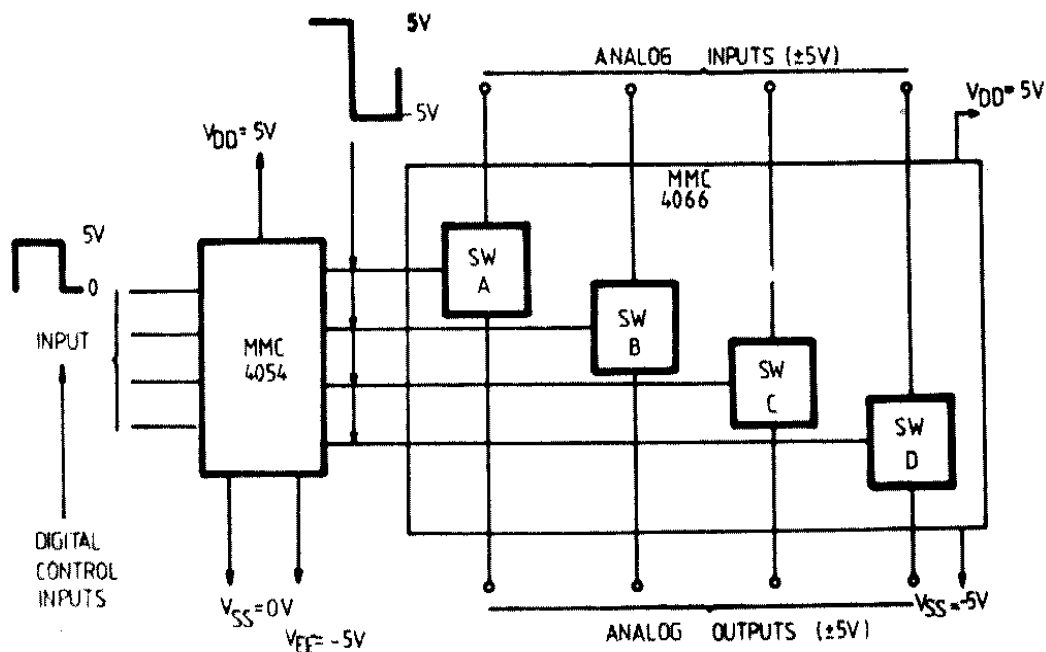
SCHEMATIC DIAGRAM

1 of 4 identical switches and its associated control circuitry



TYPICAL APPLICATIONS

Bidirectional signal transmission via digital control logic



ELECTRICAL CHARACTERISTICS

(T_A = 25°C, typical temperature coefficient for all V_{DD} values is 0.3% /°C)

PARAMETER		TEST CONDITIONS			VALUES							UNIT				
					V _I (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		0/ 5	5			0.25		0.01	0.25		7.5	μA			
			0/10	10			0.5		0.01	0.5		15				
			0/15	15			1		0.01	1		30				
			0/20	20			5		0.02	5		150				
	E, F types		0/ 5	5			1		0.01	1		7.5				
			0/10	10			2		0.01	2		15				
			0/15	15			4		0.01	4		30				

Signal Inputs (V_{IS}) and Outputs (V_{OS})

R _{ON} On resistance	G, H types	V _C = V _{DD} R _L = 10 kΩ return to $\frac{V_{DD}-V_{SS}}{2}$ V _{IS} = V _{SS} to V _{DD}	5		800		470	1050		1300	Ω	
			10		310		180	400		550		
			15		200		125	240		320		
	E, F types		5		850		470	1050		1200		
			10		330		180	400		500		
			15		210		125	240		300		
Δ _{ON} Resistance Between Any 2 switches, ΔR _{ON}		R _L = 10kΩ, V _C = V _{DD}	5				15				Ω	
			10				10					
			15				5					
TDH Total Harmonic Distorsion		V _C =V _{DD} =5V, V _{SS} =-5V, V _{IS} (p-p)=5V (Sine wave centered in 0V) R _L = 10 kΩ f _{IS} = 1 kHz sine wave					0.4				%	
-3dB Cutoff Frequency (switch on)		V _C =V _{DD} =5V, V _{SS} =-5V, V _{IS} (p-p)=5V (Sine wave centered on 0V) R _L = 1 kΩ					40				MHz	
-50dB Fedthrough Frequency (switch off)		V _C =V _{DD} =5V, V _{IS} (p-p)=5V (Sine wave centered on 0V) R _L = 1 kΩ					1				MHz	
-50dB Crosstalk Frequency		V _C (A) = V _{DD} = +5V V _C (B) = V _{SS} = -5V V _{IS} (A) = 5Vp-p, 50Ω source R _L = 1 kΩ					8				MHz	
t _{pd} Propagation delay (Signal Input to Signal output)		R _L = 200 kΩ V _C =V _{DD} , V _{SS} = GND, C _L =50 pF, V _{IS} = 10V (Square wave centred on 5V) t _{ri} = t _r = 20 ns	5				20	40			ns	
			10				10	20				
			15				7	15				
C _{IS} Input capacitance		V _{DD} = +5V					8				pF	
C _{OS} Output capacitance		V _C =V _{SS} = -5V					8					
C _L Feedthrough							0.5					

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PARAMETER		TEST CONDITIONS	V _{DD} (V)	VALUES						UNIT	
				T _{LOW}		25°C			T _{HIGH}		
				min.	max.	min.	typ	max.	min.		max.
Input/Output Leakage current switch OFF	G, H types	V _C =0V V _{is} = 18V; V _{os} = 0V V _{is} = 0V; V _{os} = 18V	18		±0.1		±10 ⁻³	±0.1		±1	μA
	E, F types	V _C =0V V _{is} = 15V; V _{os} = 0V V _{is} = 0V; V _{os} = 15V	15		±0.3		±10 ⁻³	±0.3		±1	
Control (V _C)											
V _{ILC} Control input Low voltage		I _{is} < 10 μA V _{is} = V _{SS} ; V _{os} = V _{DD} and V _{is} = V _{DD} ; V _{os} = V _{SS}	5		1			1		1	V
			10		2			2		2	
			15		2			2		2	
V _{IHC} Control input High voltage			5	3.5		3.5			3.5		V
			10	7		7			7		
			15	11		11			11		
I _{IH} , I _{IL} Input leakage current	G, H types	V _{is} ≤ V _{DD} V _{DD} - V _{SS} = 18 V	18		±0.1		±10 ⁻⁵	±0.1		±1	μA
	E, F types	V _{DD} - V _{SS} = 15 V V _{CC} ≤ V _{DD} - V _{SS}	15		±0.3		±10 ⁻⁵	±0.3		±1	
Crosstalk (control input to signal output)		V _C = 10 V (Sq wave) t _r , t _f = 20 ns R _L = 10 kΩ	10				50				mW
Turn-On propagation delay		V _{IN} = V _{DD} ; t _r , t _f = 20 ns; C _L = 50 pF, R _L = 1 kΩ	5				35	70			ns
			10				20	40			
			15				15	30			
Control input Repetition rate		V _{is} = V _{DD} ; V _{SS} = GND R _L = 1 kΩ to gnd C _L = 50 pF V _C = 10 V (Square wave centered on 5 V) t _r , t _f = 20 ns V _{os} = 1/2 V _{OH} ○ 1 KHZ	5				6				MHz
			10				9				
			15				9.5				
C _i Input capacitance		Any input					5	7.5			pF

- * T_{LOW} = - 55°C for G, H devices; -40°C for E, F devices
- * T_{HIGH} = +125°C for G, H devices; +85°C for E, F devices.

The Noise Margin for both "1" and "0" level is:

- 1 V min. with V_{DD} = 5 V
- 2 V min. with V_{DD} = 10 V
- 2.5 V min. with V_{DD} = 15 V