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 in 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 kΩ
- High degree of linearity: < 0.5% distortion typ at f_{is} =1 kHz, V_{is} = 5 Vp-p, V_{DD}—V_{SS} ≥ 10 V, R_L = 10 kΩ
- 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°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

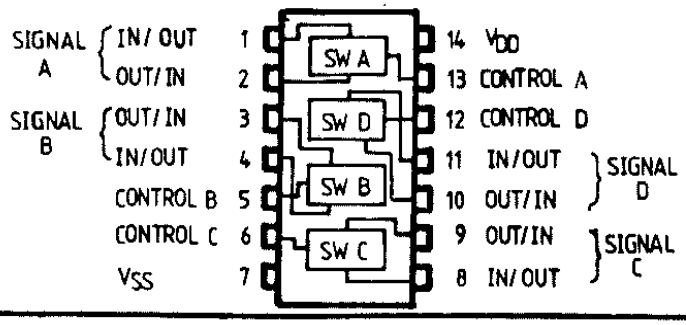
V_{DD}*	Supply voltage: G and H types	-0.5 to	20	V
	E and F types	-0.5 to	18	V
V_i	Input voltage	-0.5 to	V_{DD}+0.5	V
I_i	DC input current (any one input)		±10	mA
P_{tot}	Total power dissipation (per package)		200	mW
	Dissipation per output transistor for T_A = full package-temperature range		100	mW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

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

RECOMMENDED OPERATING CONDITIONS

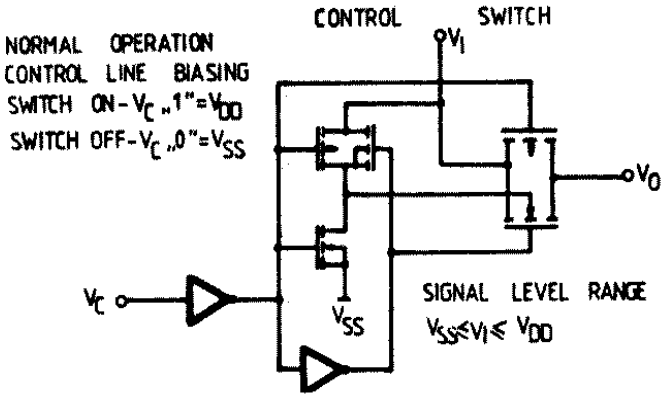
V_{DD}*	Supply voltage: G and H types	3 to	18	V
	E and F types	3 to	15	V
V_i	Input voltage	0 to	V_{DD}	V
T_A	Operating temperature: G and H types	-55 to	125	°C
	E and F types	-40 to	85	°C

FUNCTIONAL DIAGRAM



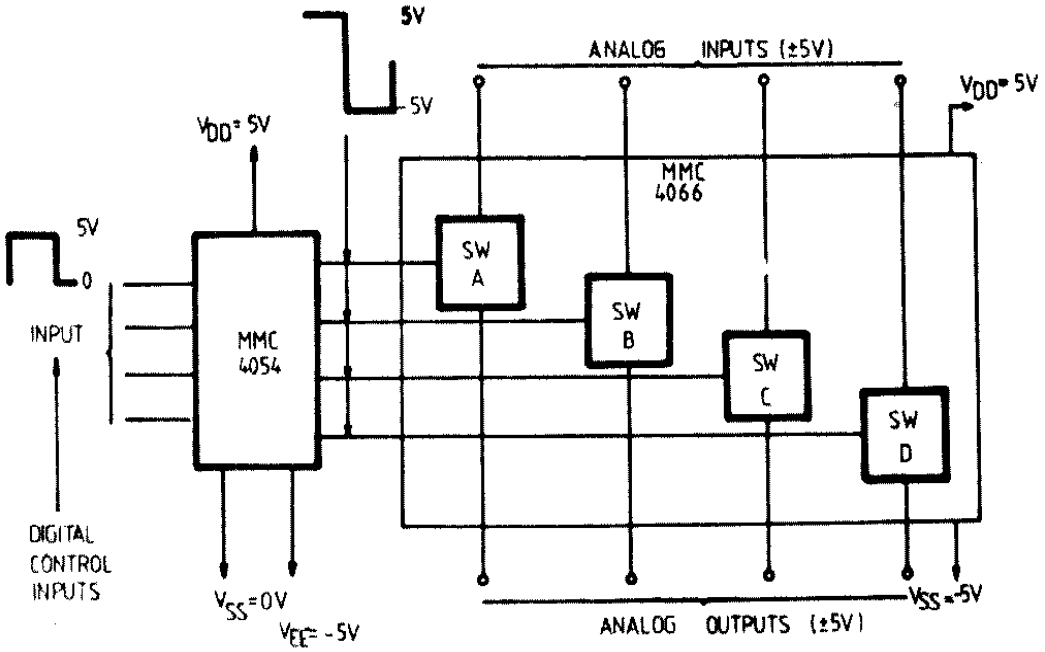
SCHEMATIC DIAGRAM

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	V_I (V)	V_{DD} (V)	VALUES T_{LOW}* min.	T_{LOW}* max.	25°C min.	25°C typ.	25°C max.	T_{HIGH}* min.	T_{HIGH}* max.	UNIT
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 = VDD 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 Feedthrough 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_r = t_f = 20 ns	5				20	40			ns
			10				10	20			
			15				7	15			
C_{is} Input capacitance		V_{DD}= +5V V_C=V_{SS}= -5V					8				pF
C_{os} Output capacitance							8				
$C_{...}$ Feedthrough							0.5				

PARAMETER		TEST CONDITIONS	V_{DD} (V)	VALUES T^*_{LOW} min.	T^*_{LOW} max.	25°C min.	25°C typ	25°C max.	T^*_{HIGH} min.	T^*_{HIGH} max.	UNIT
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	$V_{is} \leq V_{DD}$ $V_{DD} - V_{SS}$ = 18 V	18		±0.1		$±10^{-5}$	±0.1		±1	µA
	E, F types	$V_{DD} - V_{SS}$ = 15 V $V_{CC} \leq V_{DD} - V_{SS}$	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_{os} O 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