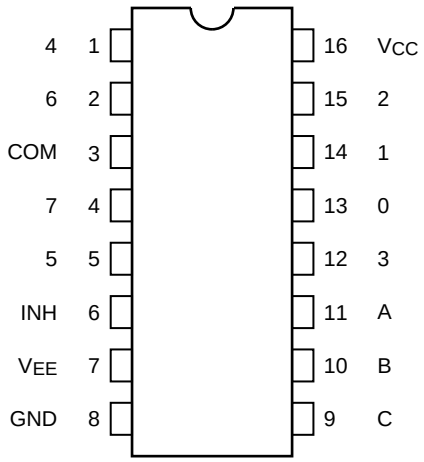
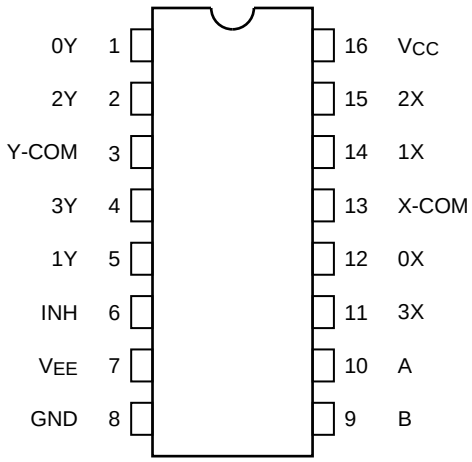
Pin Assignment

TC74HC4051A



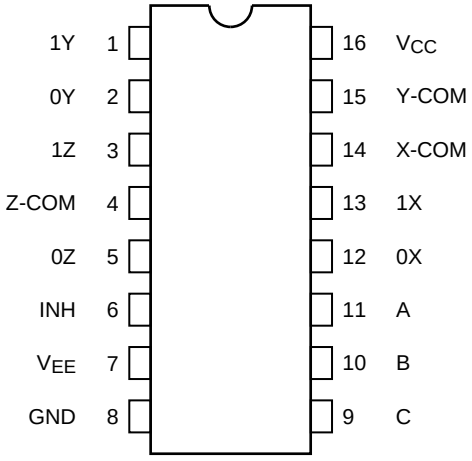
(top view)

TC74HC4052A



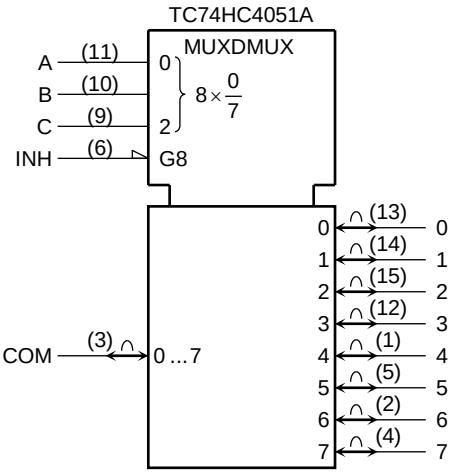
(top view)

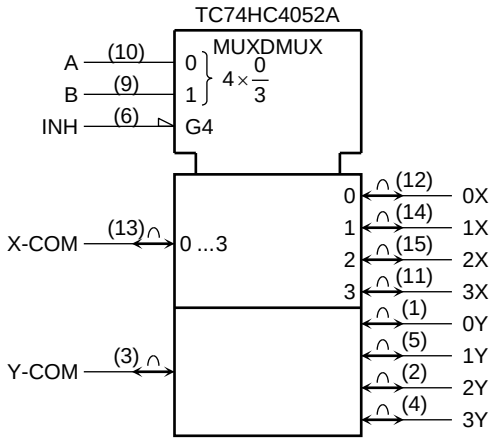
TC74HC4053A

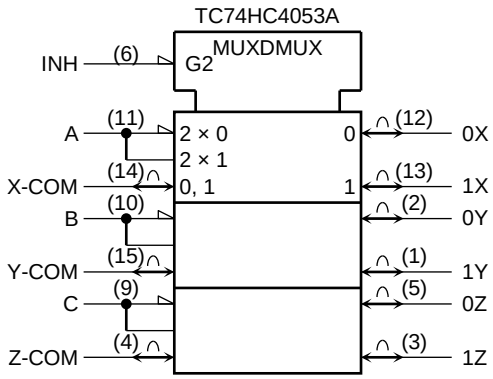


(top view)

IEC Logic Symbol







Truth Table

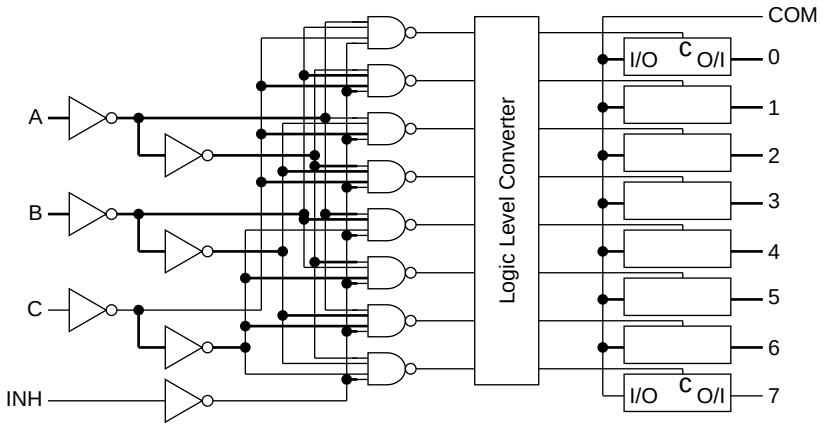
Control Inputs				“ON” Channel		
Inhibit	C*	B	A	HC4051A	HC4052A	HC4053A
L	L	L	L	0	0X, 0Y	0X, 0Y, 0Z
L	L	L	H	1	1X, 1Y	1X, 0Y, 0Z
L	L	H	L	2	2X, 2Y	0X, 1Y, 0Z
L	L	H	H	3	3X, 3Y	1X, 1Y, 0Z
L	H	L	L	4	—	0X, 0Y, 1Z
L	H	L	H	5	—	1X, 0Y, 1Z
L	H	H	L	6	—	0X, 1Y, 1Z
L	H	H	H	7	—	1X, 1Y, 1Z
H	X	X	X	None	None	None

X: Don’t care

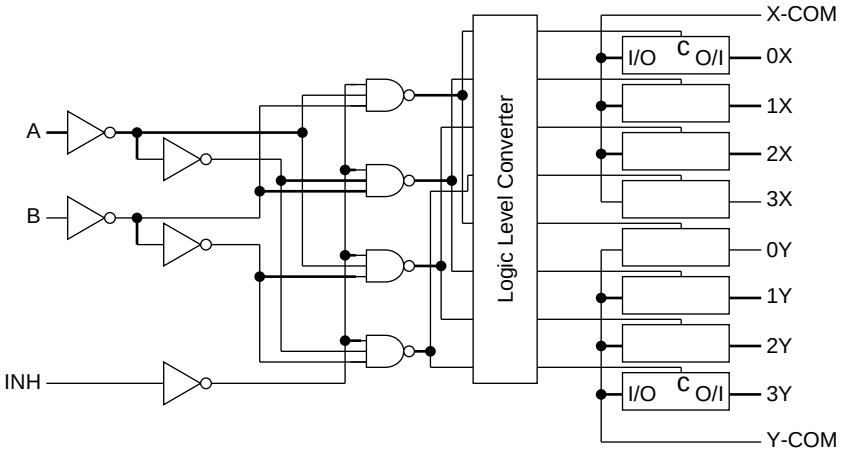
*: Except HC4052A

System Diagram

TC74HC4051A



TC74HC4052A



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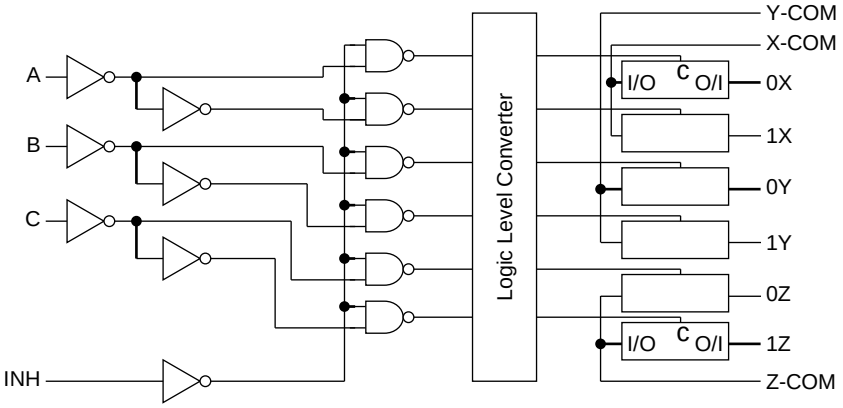


Absolute Maximum Ratings (Note 1)

Characteristics	Symbol	Rating	Unit
Supply voltage range	V_{CC}	-0.5 to 7	V
Supply voltage range	V_{CC}-V_{EE}	-0.5 to 13	V
Control input voltage	V_{IN}	-0.5 to V_{CC} + 0.5	V
Switch I/O voltage	$V_{I/O}$	V_{EE} - 0.5 to V_{CC} + 0.5	V
Control input diode current	I_{CK}	±20	mA
I/O diode current	I_{IOK}	±20	mA
Switch through current	I_T	±25	mA
DC V_{CC} or ground current	I_{CC}	±50	mA
Power dissipation	P_D	500 (DIP) (Note 2)/180 (SOP/TSSOP)	mW
Storage temperature	T_{stg}	-65 to 150	°C

Note 1: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.
Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook (“Handling Precautions”/“Derating Concept and Methods”) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 2: 500 mW in the range of Ta = -40 to 65°C. From Ta = 65 to 85°C a derating factor of -10 mW/°C should be applied up to 300 mW.

Operating Ranges (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage range	V_{CC}	2 to 6	V
Supply voltage range	V_{EE}	-6 to 0	V
Supply voltage range	V_{CC}-V_{EE}	2 to 12	V
Control input voltage	V_{IN}	0 to V_{CC}	V
Switch I/O voltage	$V_{I/O}$	V_{EE} to V_{CC}	V
Operating temperature	T_{opr}	-40 to 85	°C
Control input rise and fall time	t_r, t_f	0 to 1000 (V_{CC} = 2.0 V) 0 to 500 (V_{CC} = 4.5 V) 0 to 400 (V_{CC} = 6.0 V)	ns

Note: The operating ranges must be maintained to ensure the normal operation of the device.
Unused control inputs must be tied to either V_{CC} or GND.

Electrical Characteristics

DC Characteristics

Characteristics	Symbol	Test Condition			Ta = 25°C			Ta = -40 to 85°C		Unit
			V_{EE} (V)	V_{CC} (V)	Min	Typ.	Max	Min	Max	
High-level control input voltage	V_{IHC}	—		2.0	1.50	—	—	1.50	—	V
				4.5	3.15	—	—	3.15	—	
				6.0	4.20	—	—	4.20	—	
Low-level control input voltage	V_{ILC}	—		2.0	—	—	0.50	—	0.50	V
				4.5	—	—	1.35	—	1.35	
				6.0	—	—	1.80	—	1.80	
ON resistance	R_{ON}	V_{IN} = V_{ILC} or V_{IHC}	GND	4.5	—	85	180	—	225	Ω
		$V_{I/O}$ = V_{CC} to V_{EE}	-4.5	4.5	—	55	120	—	150	
		$I_{I/O} \leq$ 2 mA	-6.0	6.0	—	50	100	—	125	
		V_{IN} = V_{ILC} or V_{IHC}	GND	2.0	—	150	—	—	—	
			GND	4.5	—	70	150	—	190	
		$V_{I/O}$ = V_{CC} or V_{EE}	-4.5	4.5	—	50	100	—	125	
		$I_{I/O} \leq$ 2 mA	-6.0	6.0	—	45	80	—	100	
Difference of ON resistance between switches	ΔR_{ON}	V_{IN} = V_{ILC} or V_{IHC}	GND	4.5	—	10	30	—	35	Ω
		$V_{I/O}$ = V_{CC} to V_{EE}	-4.5	4.5	—	5	12	—	15	
		$I_{I/O} \leq$ 2 mA	-6.0	6.0	—	5	10	—	12	
Input/output leakage current (switch off)	I_{OFF}	V_{OS} = V_{CC} or GND V_{IS} = GND or V_{CC} V_{IN} = V_{ILC} or V_{IHC}	GND	6.0	—	—	±60	—	±600	nA
			-6.0	6.0	—	—	±100	—	±1000	
Switch input leakage current (switch on, output open)	I_{IZ}	V_{OS} = V_{CC} or GND V_{IN} = V_{ILC} or V_{IHC}	GND	6.0	—	—	±60	—	±600	nA
			-6.0	6.0	—	—	±100	—	±1000	
Control input current	I_{IN}	V_{IN} = V_{CC} or GND	GND	6.0	—	—	±0.1	—	±1.0	μA
Quiescent supply current	I_{CC}	V_{IN} = V_{CC} or GND	GND	6.0	—	—	4.0	—	40.0	μA
			-6.0	6.0	—	—	8.0	—	80.0	

AC Characteristics (C_L = 50 pF, input: $t_r = t_f$ = 6 ns, GND = 0 V)

Characteristics	Symbol	Test Condition			Ta = 25°C			Ta = -40 to 85°C		Unit
			V_{EE} (V)	V_{CC} (V)	Min	Typ.	Max	Min	Max	
Phase difference between input and output	$\varphi_{I/O}$	All types	GND	2.0	—	25	60	—	75	ns
			GND	4.5	—	6	12	—	15	
			GND	6.0	—	5	10	—	13	
			-4.5	4.5		4	—	—	—	
Output enable time	t_{pZL} t_{pZH}	4051A (Note 1)	GND	2.0	—	64	225	—	280	ns
			GND	4.5	—	18	45	—	56	
			GND	6.0	—	15	38	—	48	
			-4.5	4.5		18	—	—	—	
		4052A (Note 1)	GND	2.0	—	64	225	—	280	
			GND	4.5	—	18	45	—	56	
			GND	6.0	—	15	38	—	48	
			-4.5	4.5		18	—	—	—	
		4053A (Note 1)	GND	2.0	—	50	225	—	280	
			GND	4.5	—	14	45	—	56	
			GND	6.0	—	12	38	—	48	
			-4.5	4.5		14	—	—	—	
Output disable time	t_{pLZ} t_{pHZ}	4051A (Note 1)	GND	2.0	—	100	250	—	315	ns
			GND	4.5	—	33	50	—	63	
			GND	6.0	—	28	43	—	54	
			-4.5	4.5		29	—	—	—	
		4052A (Note 1)	GND	2.0	—	100	250	—	315	
			GND	4.5	—	33	50	—	63	
			GND	6.0	—	28	43	—	54	
			-4.5	4.5		29	—	—	—	
		4053A (Note 1)	GND	2.0	—	95	225	—	280	
			GND	4.5	—	30	45	—	56	
			GND	6.0	—	26	38	—	48	
			-4.5	4.5		26	—	—	—	
Control input capacitance	C_{IN}	All types	—	—	—	5	10	—	10	pF
COMMON terminal capacitance	C_{IS}	4051A	-5.0	5.0	—	36	70	—	70	pF
		4052A			—	19	40	—	40	
		4053A			—	11	20	—	20	
SWITCH terminal capacitance	C_{OS}	4051A	-5.0	5.0	—	7	15	—	15	pF
		4052A			—	7	15	—	15	
		4053A			—	7	15	—	15	
Feedthrough capacitance	C_{IOS}	4051A	-5.0	5.0	—	0.95	2	—	2	pF
		4052A			—	0.85	2	—	2	
		4053A			—	0.75	2	—	2	
Power dissipation capacitance	C_{PD}	4051A (Note 2)	GND	5.0	—	70	—	—	—	pF
		4052A (Note 2)			—	71	—	—	—	
		4053A (Note 2)			—	67	—	—	—	

Note 1: R_L = 1 kΩ

Note 2: C_{PD} is defined as the value of the internal equivalent capacitance of IC which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation:

$$I_{CC\ (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

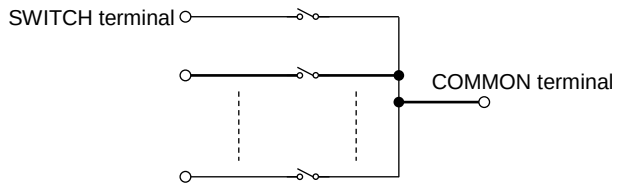
Analog Switch Characteristics (GND = 0 V, Ta = 25°C) (Note 1)

Characteristics	Symbol	Test Condition		V_{EE} (V)	V_{CC} (V)	Typ.	Unit
Sine wave distortion (T.H.D)		R_L = 10 kΩ, C_L = 50 pF, f_{IN} = 1 kHz	V_{IN} = 4.0 V_{p-p}	-2.25	2.25	0.025	%
			V_{IN} = 8.0 V_{p-p}	-4.5	4.5	0.020	
			V_{IN} = 11.0 V_{p-p}	-6.0	6.0	0.018	
Frequency response (switch on)	f_{max}	Adjust f_{IN} voltage to obtain 0dBm at V_{OS} Increase f_{IN} frequency until dB meter reads -3dB R_L = 50 Ω, C_L = 10 pF f_{IN} = 1 MHz, sine wave	All (Note 2)	-2.25	2.25	120	MHz
			4051A (Note 3)			45	
			4052A (Note 3)			70	
			4053A (Note 3)			95	
			All (Note 2)	-4.5	4.5	190	
			4051A (Note 3)			70	
			4052A (Note 3)			110	
			4053A (Note 3)			150	
			All (Note 2)	-6.0	6.0	200	
			4051A (Note 3)			85	
			4052A (Note 3)			140	
			4053A (Note 3)			190	
Feed through attenuation (switch off)		V_{IN} is centered at (V_{CC} - V_{EE})/2 Adjust input for 0dBm R_L = 600 Ω, C_L = 50 pF f_{IN} = 1 MHz, sine wave		-2.25	2.25	-50	dB
				-4.5	4.5	-50	
				-6.0	6.0	-50	
Crosstalk (control input to signal output)		R_L = 600 Ω, C_L = 50 pF f_{IN} = 1 MHz, square wave (t_r = t_f = 6 ns)		-2.25	2.25	60	mV
				-4.5	4.5	140	
				-6.0	6.0	200	
Crosstalk (between any switches)		Adjust V_{IN} to obtain 0dBm at input R_L = 600 Ω, C_L = 50 pF f_{IN} = 1 MHz, sine wave		-2.25	2.25	-50	dB
				-4.5	4.5	-50	
				-6.0	6.0	-50	

Note 1: These characteristics are determined by design of devices.

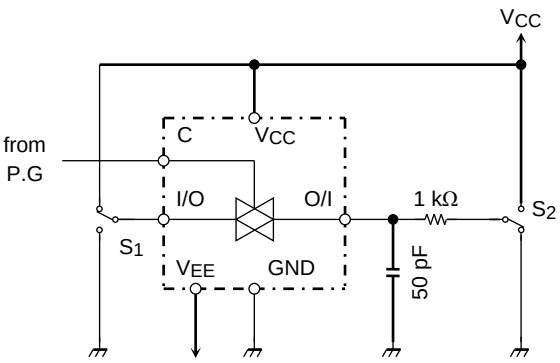
Note 2: Input COMMON terminal, and measured at SWITCH terminal.

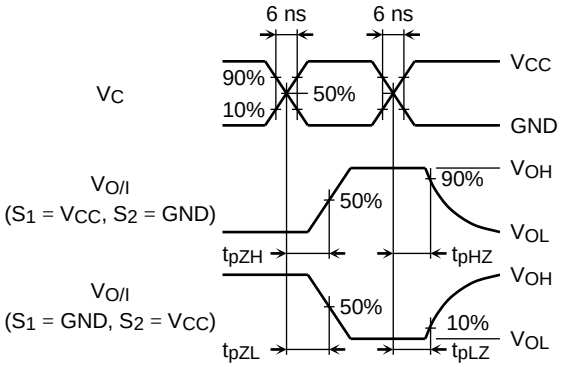
Note 3: Input SWITCH terminal, and measured at COMMON terminal.



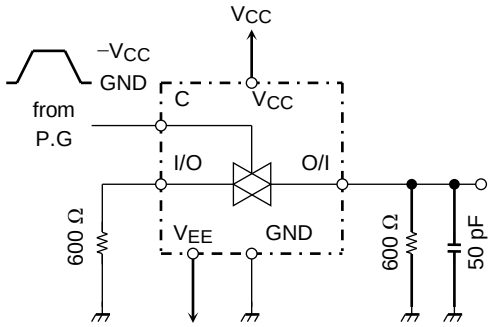
Switching Characteristics Test Circuits

1. t_{pLZ}, t_{pHZ}, t_{pZL}, t_{pZH}

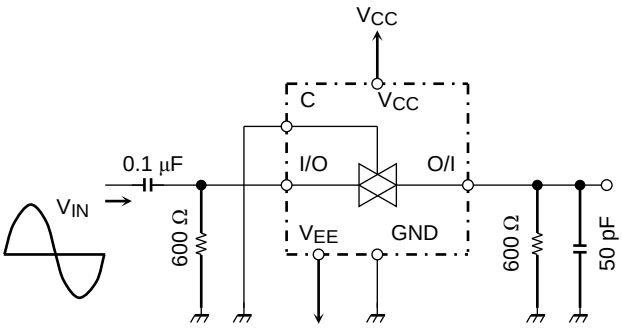




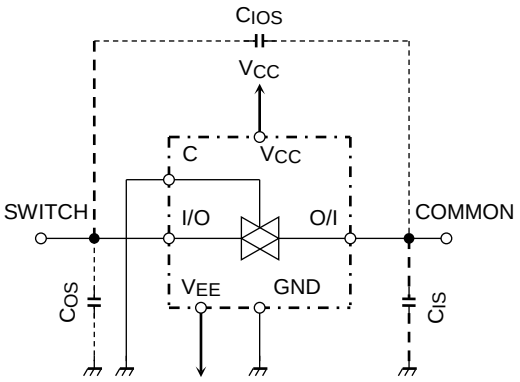
2. Cross Talk (control input-switch output) f_{IN} = 1 MHz duty = 50% $t_r = t_f$ = 6 ns



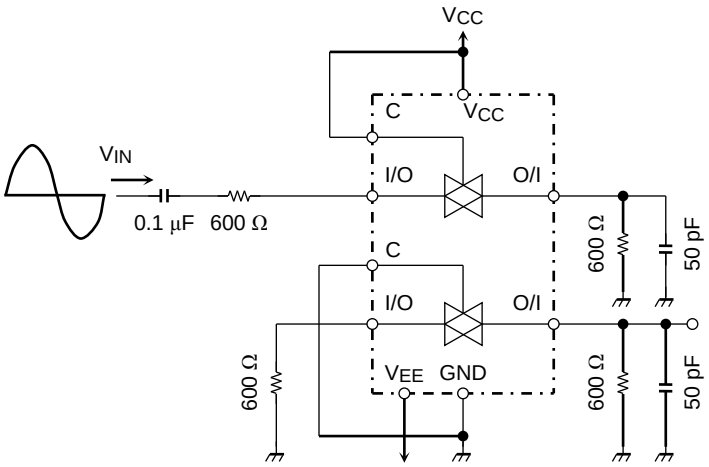
3. Feedthrough Attenuation



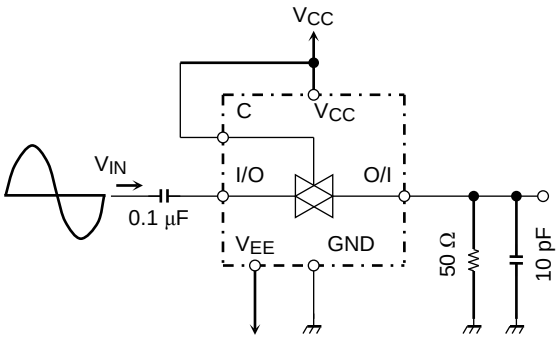
4. C_{IOS}, C_{IS}, C_{OS}



5. Cross Talk (between any two switches)

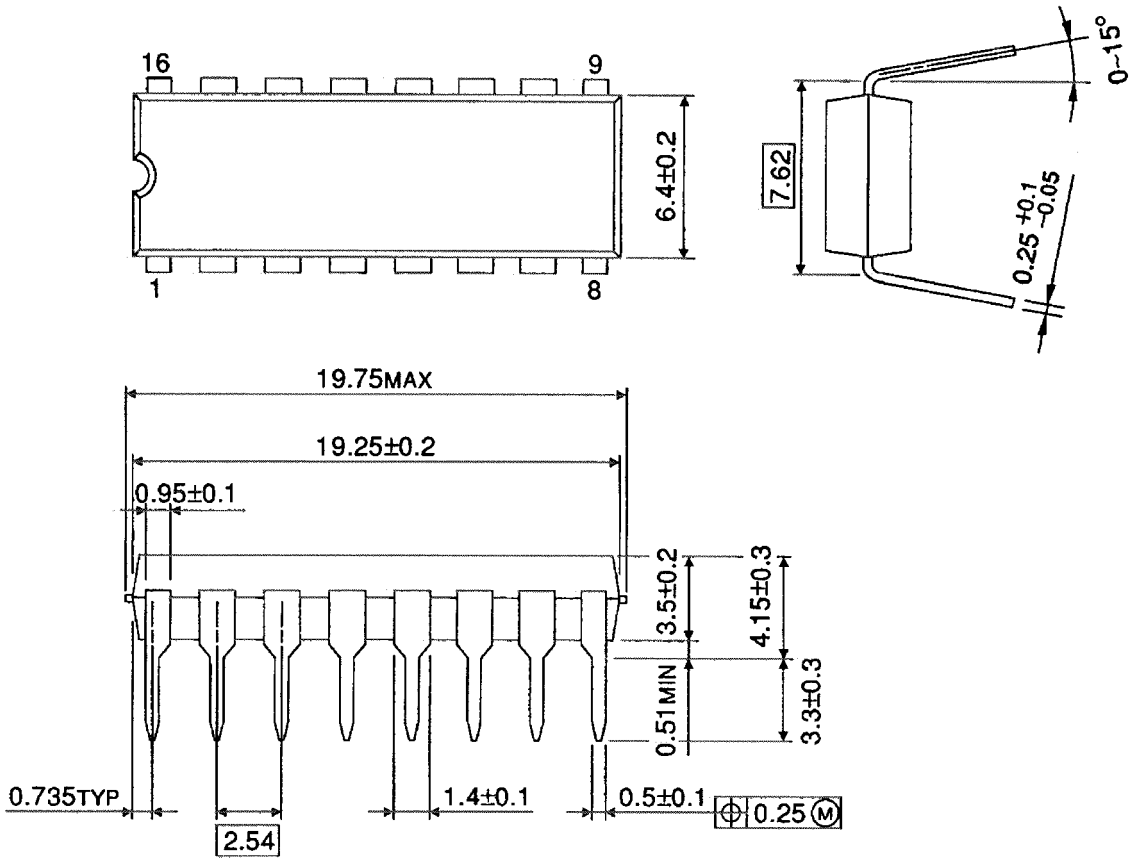


6. Frequency Response (switch on)



Package Dimensions

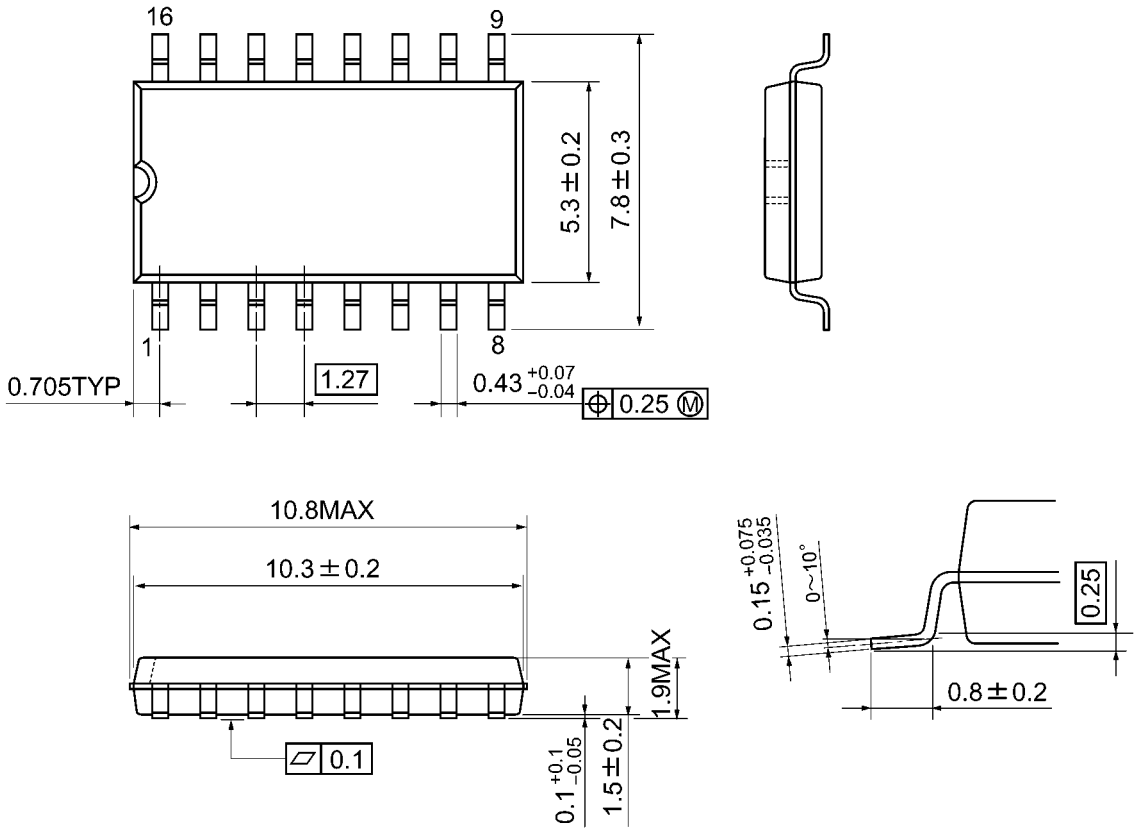
DIP16-P-300-2.54A Unit : mm



Weight: 1.00 g (typ.)

Package Dimensions

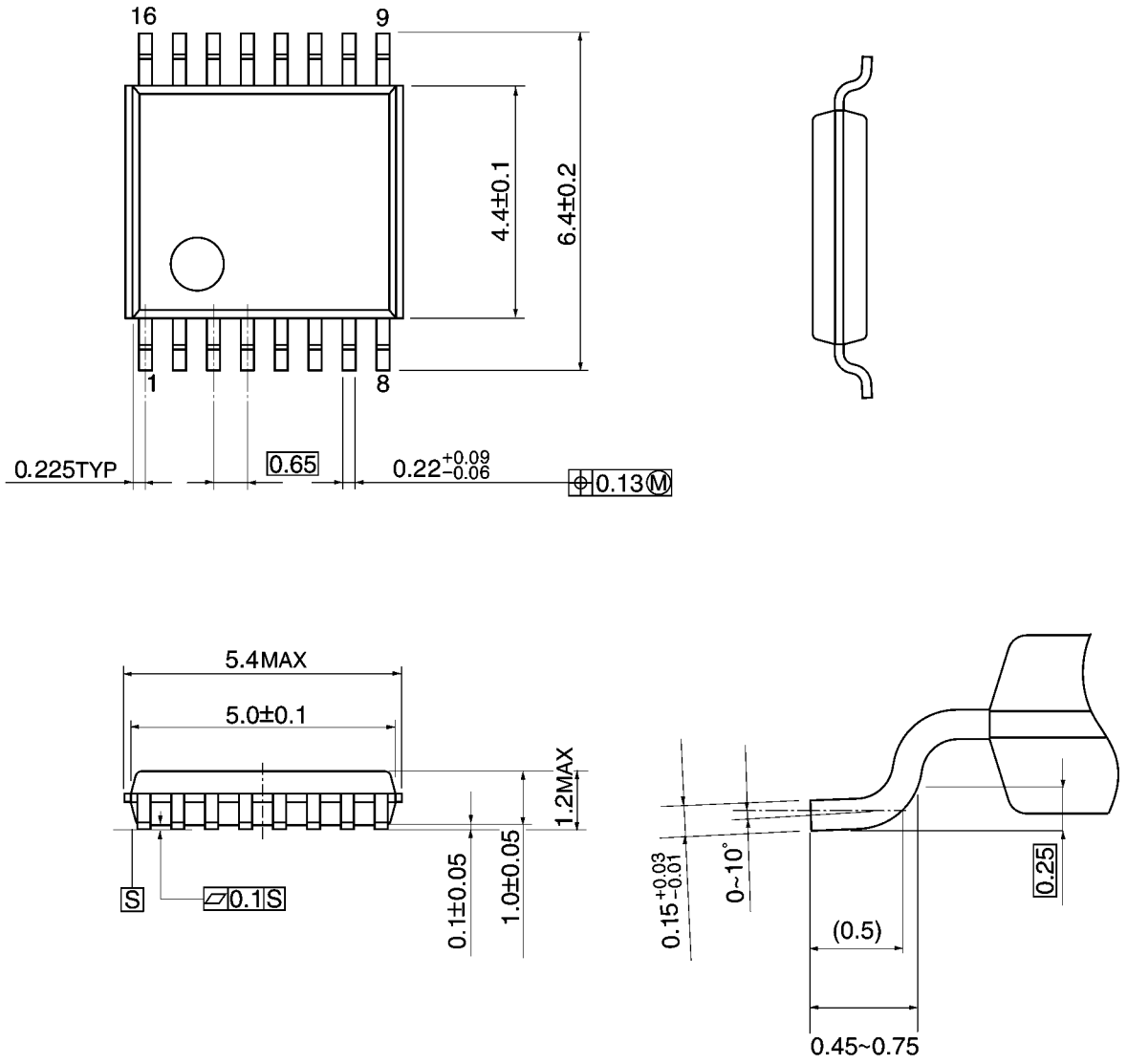
SOP16-P-300-1.27A Unit: mm



Weight: 0.18 g (typ.)

Package Dimensions

TSSOP16-P-0044-0.65A Unit: mm



Weight: 0.06 g (typ.)

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