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STANDARD SPECIFICATION
FOR DESCRIPTION OF
"B" SERIES CMOS DEVICES

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STANDARD SPECIFICATION
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"B" SERIES CMOS DEVICES

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STANDARD SPECIFICATION FOR DESCRIPTION OF "B" SERIES CMOS DEVICES

(From JEDEC Council Ballot JCB-80-6, formulated under the cognizance of JEDEC Subcommittee JC-40.2 on CMOS Standardization.)

1.0 PURPOSE AND SCOPE

1.1 Purpose

To develop a standard of "B" Series CMOS Specification to provide for uniformity, multiplicity of sources, elimination of confusion, and ease of device specification and system design by users.

1.2 Scope

This Tentative Standard covers standard specifications for description of "B" Series CMOS Devices.

2.0 DEFINITIONS

2.1 "B" Series

"B" Series CMOS includes both buffered and unbuffered devices.

2.2 Buffered

A buffered device output is one that has the characteristic that the output "on" impedance is independent of any and all valid input logic conditions, both preceding and present.

2.3 Unbuffered - see paragraph 3.4 for definition.

3.0 STANDARD SPECIFICATION

3.1 Listing of Standard Specifications

3.1.1 Table 1 lists the standard dc specifications for "B" Series CMOS devices.

3.1.1.1 Table 24 lists the I_{OL} and I_{OH} standard specification specifically for the 4049UB and 4050B types. For I_{DD} , use same specification as for Buffers/Flip Flops in Table 1; also V_{OH} , V_{OL} , V_{IH} , V_{IL} , and I_{IN} are the same as in Table 1.

3.1.2 Analog Switch Standard

3.1.2.1 Table 2 lists dc standard specifications specifically for the 4016B type. For I_{DD} , use same specification as for Gates in Table 1; also I_I and C_i are the same as in Table 1.

3.1.2.2 Table 3 lists dc standard specifications specifically for the 4066B type. For I_{DD} , use same specification as for Gates in Table 1; also I_I and C_i are the same as in Table 1.

3.1.2.3 Standardized test conditions for additional analog-switch parameters are listed in Table 4.

3.1.2.4 AC Standards - see paragraph 3.1.3.

3.1.3 AC Standard Specifications

3.1.3.1 AC (Dynamic) Parameter Standard Test Methods and Definitions

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3.1.3.2 Standard ac Parameter Limits (continued)

Table 13-	4076B
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3.2 Absolute Maximum Ratings

In the maximum ratings listed below, voltages are referenced to V_{SS} .

ABSOLUTE MAXIMUM RATINGS

DC Supply Voltage	V_{DD}	-0.5 to +18	V
Input Voltage	V_I	-0.5 to $V_{DD} + 0.5$	V
DC Input Current	I_I	± 10	mA
Storage Temperature Range	T_{STG}	-65 to +150	$^{\circ}\text{C}$

3.3 Recommended Operating Conditions

Recommended operating voltages are listed below.

RECOMMENDED OPERATING CONDITIONS

DC Supply Voltage	V_{DD}	+3 to +15	V
Operating Ambient Temperature Range	T_A		
Military-Range Devices		-55 to +125	$^{\circ}\text{C}$
Commercial-Range Devices		-40 to +85	$^{\circ}\text{C}$

3.4 Designation of "B" Series CMOS Devices

Those parts which have analog inputs and/or outputs shall be included in the "B" Series providing those parts' maximum ratings and logical input and output parameters conform to the "B" Series, such as (including, but not limited to):

- 4046B
- Devices with Bipolar Outputs
- Analog Switches
- Analog Multiplexers
- Monostable and Astable Multivibrators
- Schmitt Triggers

Products that meet "B" Series specifications except that the logical outputs are not buffered and the V_{IL} and V_{IH} specifications differ from "B" Series as shown in Table 1 shall be marked with the UB designation, such as (including, but not limited to):

- 4000UB
- 4001UB
- 4002UB
- 4007UB
- 4009UB
- 4011UB
- 4012UB
- 4023UB
- 4025UB
- 4041UB
- 4049UB
- 4069UB
- 4441UB
- 4449UB
- 4501UB
- 4572UB

$T_{LOW} = -55^{\circ}\text{C}$ for Military Temp. Range device, -40°C for Commercial Temp. Range device
 $T_{HIGH} = +125^{\circ}\text{C}$ for Military Temp. Range device, $+85^{\circ}\text{C}$ for Commercial Temp. Range device
 #Applies for Worst Case Input Combinations

PARAMETER	TEMP. RANGE	V_{DD} (V)	CONDITIONS	T_{LOW}^{*}		$+25^{\circ}\text{C}$		T_{HIGH}^{*}		UNITS
				MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
I_{DD}	Quiescent Device Current	MIL	$V_I = V_{SS}$ or V_{DD} (All valid input combinations)		0.25		0.25		7.5	μA
		10			0.5		0.5		15.0	
		15			1.0		1.0		30.0	
GATES	COMM.	5	$V_I = V_{SS}$ or V_{DD} (All valid input combinations)		1.0		1.0		7.5	μA
		10			2.0		2.0		15.0	
		15			4.0		4.0		30.0	
BUFFERS, FLIP-FLOPS	MIL	5	$V_I = V_{SS}$ or V_{DD} (All valid input combinations)		1.0		1.0		30.0	μA
		10			2.0		2.0		60.0	
		15			4.0		4.0		120.0	
COMM.	COMM.	5	$V_I = V_{SS}$ or V_{DD} (All valid input combinations)		4.0		4.0		30.0	μA
		10			8.0		8.0		60.0	
		15			16.0		16.0		120.0	
MSI	MIL	5	$V_I = V_{SS}$ or V_{DD} (All valid input combinations)		5.0		5.0		150.0	μA
		10			10.0		10.0		300.0	
		15			20.0		20.0		600.0	
COMM.	COMM.	5	$V_I = V_{SS}$ or V_{DD} (All valid input combinations)		20.0		20.0		150.0	μA
		10			40.0		40.0		300.0	
		15			80.0		80.0		600.0	
V_{OL}	Low-Level Output Voltage	5	$V_I = V_{SS}$ or V_{DD} $I_O < 1 \mu\text{A}$		0.05		0.05		0.05	V
V_{OH}	High-Level Output Voltage	10	$V_I = V_{SS}$ or V_{DD} $I_O < 1 \mu\text{A}$		0.05		0.05		0.05	
		15		4.95 9.95 14.95	0.05	4.95 9.95 14.95	0.05	4.95 9.95 14.95	0.05	
V_{IL}	Input Low Voltage "B" Types	5	$V_O = 0.5V$ or $4.5V$ $V_O = 1.0V$ or $9.0V$ $V_O = 1.5V$ or $13.5V$ $ I_O < 1 \mu\text{A}$		1.5		1.5		1.5	V
		10			3.0		3.0		3.0	
		15			4.0		4.0		4.0	
V_{IH}	Input High Voltage "B" Types	5	$V_O = 0.5V$ or $4.5V$ $V_O = 1.0V$ or $9.0V$ $V_O = 1.5V$ or $13.5V$ $ I_O < 1 \mu\text{A}$		1.0		1.0		1.0	V
		10			2.0		2.0		2.0	
		15			2.5		2.5		2.5	
V_{IH}	Input High Voltage "B" Types	5	$V_O = 0.5V$ or $4.5V$ $V_O = 1.0V$ or $9.0V$ $V_O = 1.5V$ or $13.5V$ $ I_O < 1 \mu\text{A}$			3.5		3.5		V
		10				7.0		7.0		
		15				11.0		11.0		
V_{IH}	Input High Voltage "B" Types	5	$V_O = 0.5V$ or $4.5V$ $V_O = 1.0V$ or $9.0V$ $V_O = 1.5V$ or $13.5V$ $ I_O < 1 \mu\text{A}$			4.0		4.0		V
		10				8.0		8.0		
		15				12.5		12.5		

TABLE 1 - STANDARD dc SPECIFICATIONS

LIMITS											
PARAMETER		TEMP. RANGE	V _{DD} (Vdc)	CONDITIONS	T _{LOW} *		+25°C		T _{HIGH} *		UNITS
					MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
I _{OL}	Output Low (Sink) Current	MIL	5	V _O = 0.4V V _I = 0 or 5V	0.64		0.51		0.36		mA
			10	V _O = 0.5V V _I = 0 or 10V	1.6		1.3		0.9		
			15	V _O = 1.5V V _I = 0 or 15V	4.2		3.4		2.4		
		Comm.	5	V _O = 0.4V V _I = 0 or 5V	0.52		0.44		0.36		
I _{OH}	Output High (Source) Current	MIL	5	V _O = 4.6 V _I = 0 or 5V	-0.25		-0.2		-0.14		mA
			10	V _O = 9.5V V _I = 0 or 10V	-0.62		-0.5		-0.35		
			15	V _O = 13.5V V _I = 0 or 15V	-1.8		-1.5		-1.1		
		Comm.	5	V _O = 4.6V V _I = 0 or 5V	-0.2		-0.16		-0.12		
I _I	Input Current	MIL	15	V _I = 0 or 15V		+0.1		+0.1		+1.0	μA
		Comm.	15	V _I = 0 or 15V		+0.3		+0.3		+1.0	
		MIL	15	V _I = 0V or 15V		+0.4		+0.4		+12	
		Comm.	15	V _I = 0V or 15V		+1.6		+1.6		+12	
C _i	Input Capacitance per Unit Load	ALL		Any input				7.5			pF

*T_{LOW} = -55°C for Military Temp. Range device -40°C for Commercial Temp. Range Device

*T_{HIGH} = +125°C for Military Temp. Range device, +85°C for Commercial Temp. Range Device

TABLE 1 (Continued)



PARAMETER	TEMP. RANGE	V _{DD} V	CONDITIONS	LIMITS					
				T _{LOW} *		25°C		T _{HIGH} *	
				Min.	Max.	Min.	Max.	Min.	Max.
V _{ILC}	ALL	5, 10, 15	I _{IS} = +10 uA V _{IS} = V _{SS} or V _{DD} V _O = V _{DD} or V _{SS}		0.9		0.7		0.4
V _{IHC}	ALL	5, 10, 15	See Table 2A	3.5, 7.0, 11.0	-	3.5, 7.0, 11.0	-	3.5, 7.0, 11.0	-
R _{ON}	COMM.	10	V _C = V _{DD} R _L = 10kΩ Returned to V _{DD} -V _{SS} 2	V _{IS} V _{DD} or V _{SS} 4.75 To 5.25V V _{DD} or V _{SS} 7.25 to 7.75					
		10							
		15							
		15							
I _{IS}	MIL	10	V _{DD} or V _{SS}	-	600	-	660	-	840
		10	4.75 To 5.25V	-	1870	-	2000	-	2380
		15	V _{DD} or V _{SS}	-	360	-	400	-	520
		15	7.25 To 7.75V	-	775	-	850	-	1080
Input/Output Switch Leakage Current	MIL	15	V _C = 0 V _{IS} = 15V or 0V	-	+0.1	-	+0.1	-	+1
	COMM.	15	V _{OS} = 0V or 15V	-	+0.3	-	+0.3	-	+3

Table 2 - Specific Standard DC Specifications for 4016B

* T_{LOW} = -55°C for Military Temp. Range Device, -40°C for Commercial Temp. Range Device

* T_{HIGH} = +125°C for Military Temp. Range Device, +85°C for Commercial Temp. Range Device

TEMPERATURE RANGE	V_{DD}	SWITCH INPUT				SWITCH OUTPUT $V_{OS}(V)$	
		$V_{IS}(V)$	$I_{IS}(mA)$			Min.	Max.
			T_{LOW}	25°	T_{HIGH}		
MIL	5	0	0.25	0.2	0.14	-	0.4
	5	5	-0.25	-0.2	-0.14	4.6	-
	10	0	0.62	0.5	0.35	-	0.5
	10	10	-0.62	-0.5	-0.35	9.5	-
	15	0	1.8	1.5	1.1	13.5	1.5
	15	15	-1.8	-1.5	-1.1	-13.5	-
COMM.	5	0	0.2	0.16	0.12	-	0.4
	5	5	-0.2	-0.16	-0.12	4.6	-
	10	0	0.5	0.4	0.3	-	0.5
	10	10	-0.5	-0.4	-0.3	9.5	-
	15	0	1.4	1.2	1.0	-	1.5
	15	15	-1.4	-1.2	-1.0	13.5	-

TABLE 2A
4016B SWITCH TEST
CONDITIONS FOR V_{IHC}

PARAMETER	TEMP. RANGE	V _{DD} (V)	CONDITIONS	LIMITS						UNIT
				T _{LOW} *		25° C		T _{HIGH} *		
				MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
V _{ILC}	ALL	5	I _{IS} = ± 10 μA	-	1.0	-	1.0	-	1.0	V
		10	V _{IS} = V _{SS} or V _{DD}	-	2.0	-	2.0	-	2.0	
		15	V _{OS} = V _{DD} or V _{SS}	-	2.0	-	2.0	-	2.0	
V _{IHC}	ALL	5	See Table 3A	3.5	-	3.5	-	3.5	-	V
		10		7.0	-	7.0	-	7.0	-	
		15		11.0	-	11.0	-	11.0	-	
R _{ON}	MIL	5	V _C = V _{DD}	-	2000	-	2500	-	3500	Ω
		10	R _L = 10kΩ Returned	-	400	-	500	-	550	
		15	To $\frac{V_{DD} - V_{SS}}{2}$	-	250	-	280	-	320	
	COMM.	5	V _{IS} = V _{SS} to V _{DD}	-	2100	-	2500	-	3200	Ω
		15		-	450	-	500	-	520	
Input/Output Switch Leakage Current	MIL	15	V _C = 0	-	±0.1	-	±0.1	-	±1	μA
			V _{IS} = 15V or 0V	-		-		-		
	COMM.	15	V _{OS} = 0V or 15V	-	±0.3	-	±0.3	-	±3	μA

TABLE 3 - Specific Standard DC Specifications for 4066H

* $T_{LOW} = -55^{\circ}C$ for Military Temp. Range Device, $-40^{\circ}C$ for Commercial Temp. Range Device
 * $T_{HIGH} = +125^{\circ}C$ for Military Range Device, $+85^{\circ}C$ for Commercial Temp. Range Device

TEMP RANGE	V_{DD}	SWITCH INPUT				SWITCH OUTPUT $V_{OS}(V)$	
		$V_{IS}(V)$	$I_S(mA)$			MIN.	MAX.
			T_{LO}	$25^{\circ}C$	T_{HI}		
MTL	5	0	0.64	0.51	0.36		0.4
	5	5	-0.64	-0.51	-0.36	4.6	-
	10	0	1.6	1.3	0.9		0.5
	10	10	-1.6	-1.3	-0.9	9.5	-
	15	0	4.2	3.4	2.4		1.5
	15	15	-4.2	-3.4	-2.4	13.5	-
COMM.	5	0	0.52	0.44	0.36		0.4
	5	5	-0.52	-0.44	-0.36	4.6	-
	10	0	1.3	1.1	0.9		0.5
	10	10	-1.3	-1.1	-0.9	9.5	-
	15	0	3.6	3.0	2.4		1.5
	15	15	-3.6	-3.0	-2.4	13.5	-

TABLE 3A
4066B SWITCH TEST
CONDITIONS FOR V_{IHC}

PARAMETER	TEST CONDITIONS	UNIT
Total Harmonic Distortion	$V_C = V_{DD} = +5V$ $V_{SS} = -5V$ $V_{IS(pp)} = 5V$ Sine Wave centered on 0 Volts $R_L = 10k \Omega$ $F_{is} = 1 \text{ kHz}$ Sine Wave	% (max)
Cutoff Frequency	$V_C = V_{DD} = +5V$ $V_{SS} = -5V$ $V_{IS(pp)} = 5V$ Sine Wave centered on 0 Volts $R_L = 1k \Omega$ $20 \log_{10} \frac{V_{OS @ (f_{max})}}{V_{OS @ (kHz)}} = -3db$	MHz (min)
-50 dB Feedthrough Frequency (Switch Off)	$V_{DD} = +5V$ $V_C = V_{SS} = -5V$ $V_{IS(pp)} = 5V$ Sine Wave centered on 0 Volts $R_L = 1k \Omega$ $20 \log_{10} \frac{V_{OS}}{V_{IS}} = -50 \text{ dB}$	MHz (min)
-50 dB Crosstalk Frequency (Between any 2 of 4 Switches)	$V_C(A) = V_{DD} = +5V$ $V_C(B) = V_{SS} = -5V$ $V_{IS(pp)}(A) = 5V$ Sine Wave centered on 0 Volts $R_L = 1k \Omega$ $20 \log_{10} \frac{V_{OS(B)}}{V_{IS(A)}} = -50 \text{ dB}$ Source Impedance to inputs of both switches $= 50 \Omega$	MHz (min)

TABLE 4
STANDARD TEST CONDITIONS
For ac characteristics for 4016B and 4066B