

INTEGRATED CIRCUITS

GENERAL PURPOSE

LOGIC

HE4000B series

HE4000B FAMILY SPECIFICATIONS

The LOCMOS HE4000B range is a fully buffered digital integrated circuit family which meets the Jedec-B specifications. The members of this family are plug-in replacements for the well-known CMOS 4000 and 14500 ranges.

The HE family has the same advantages as conventional CMOS circuits, plus the additional LOCMOS advantages.

Advantages of CMOS

- low power dissipation - typically 10 nW per gate (static)
- wide operating supply voltage range
- wide operating temperature ranges:
 - 40 to +85 °C for standard temperature range (HEF)
 - 55 to +125 °C for extended temperature range (HEC)
- high DC fan-out
- inputs and outputs are protected against electrostatic voltages

In addition to these, the **LOCMOS HE4000B** range has:

- buffered outputs on **all** circuits
- higher speed
- higher packing density — essential for MSI/LSI
- excellent noise immunity

Recommended supply voltage range 3 to 15 V.

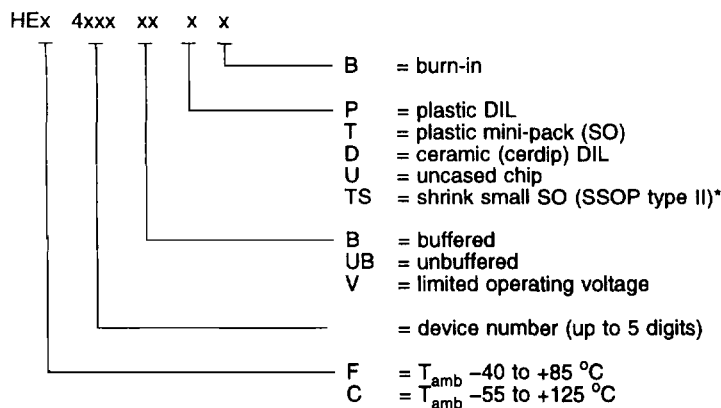
LOCMOS means Local Oxidation Complementary MOS

Inputs and outputs are protected against electrostatic effects in a wide variety of device-handling situations. However, to be totally safe, handling precautions should be taken into account.

Type number designation

Type numbers have a suffix which signifies the type of package and burn-in option.

HEx4xxxxxx complete type number which can be split as follows:



* For selected types only



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HE4000B FAMILY SPECIFICATIONS (cont.)

The HE family is designed with standardized output drive characteristics which, combined with relative intensity to output capacitance loading, simplify system design.

Family ratings

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage range	V_{DD} -0,5 to +18 V
Voltage on any input	V_I -0,5 to ($V_{DD} + 0,5$) V

DC current into any input or output $\pm I$ max. 10 mA

Power dissipation per package:

HEF (plastic and ceramic DIL)	
$T_{amb} = -40$ to $+70$ °C	P_{tot} max. 500 mW
$T_{amb} = +70$ to $+85$ °C	derate linearly by 8 mW/K

HEF (plastic SO mini-pack)	
$T_{amb} = -40$ to $+70$ °C	P_{tot} max. 400 mW
$T_{amb} = +70$ to $+85$ °C	derate linearly by 6 mW/K

HEC (ceramic DIL)	
$T_{amb} = -55$ to $+70$ °C	P_{tot} max. 500 mW
$T_{amb} = +70$ to $+125$ °C	derate linearly by 8 mW/K

Power dissipation per output P max. 100 mW

Storage temperature range T_{stg} -65 to $+150$ °C

Operating ambient temperature range

HEF	T_{amb} -40 to $+85$ °C
HEC	T_{amb} -55 to $+125$ °C

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DC family characteristics for HEF at $V_{SS} = 0$ V

parameter	symbol	$T_{amb} = -40$ °C		$T_{amb} = +25$ °C		$T_{amb} = +85$ °C		V_{DD} V	conditions
		min.	max.	min.	max.	min.	max.		
Quiescent device current for gates	I_{DD} (μA)	-	1.0	-	1.0	-	7.5	5	all valid input combinations; $V_I = V_{SS}$ or V_{DD} ; $I_O = 0$
		-	2.0	-	2.0	-	15.0	10	
		-	4.0	-	4.0	-	30.0	15	
Quiescent device current for buffers and flip-flops	I_{DD} (μA)	-	4.0	-	4.0	-	30	5	all valid input combinations; $V_I = V_{SS}$ or V_{DD} ; $I_O = 0$
		-	8.0	-	8.0	-	60	10	
		-	16.0	-	16.0	-	120	15	
Quiescent device current for MSI	I_{DD} (μA)	-	20	-	20	-	150	5	all valid input combinations; $V_I = V_{SS}$ or V_{DD} ; $I_O = 0$
		-	40	-	40	-	300	10	
		-	80	-	80	-	600	15	
Quiescent device current for LSI	I_{DD} (μA)	-	50	-	50	-	375	5	all valid input combinations $V_I = V_{SS}$ or V_{DD} ; $I_O = 0$
		-	100	-	100	-	750	10	
		-	200	-	200	-	1500	15	
Output voltage LOW $I_{O1} < 1$ μA	V_{OL} (V)	-	0.05	-	0.05	-	0.05	5	$V_I = V_{SS}$ or V_{DD} $V_I = V_{SS}$ or V_{DD} $V_I = V_{SS}$ or V_{DD}
		-	0.05	-	0.05	-	0.05	10	
		-	0.05	-	0.05	-	0.05	15	
Output voltage HIGH $I_{O1} < 1$ μA	V_{OH} (V)	4.95	-	4.95	-	4.95	-	5	$V_I = V_{SS}$ or V_{DD} $V_I = V_{SS}$ or V_{DD} $V_I = V_{SS}$ or V_{DD}
		9.95	-	9.95	-	9.95	-	10	
		14.95	-	14.95	-	14.95	-	15	
Input voltage LOW $I_{O1} < 1$ μA (buffered stages only)	V_{IL} (V)	-	1.5	-	1.5	-	1.5	5	$V_O = 0.5$ or $4.5V$ $V_O = 1.0$ or $9.0V$ $V_O = 1.5$ or $13.5V$
		-	3.0	-	3.0	-	3.0	10	
		-	4.0	-	4.0	-	4.0	15	
Input voltage HIGH $I_{O1} < 1$ μA (buffered stages only)	V_{IH} (V)	3.5	-	3.5	-	3.5	-	5	$V_O = 0.5$ or $4.5V$ $V_O = 1.0$ or $9.0V$ $V_O = 1.5$ or $13.5V$
		7.0	-	7.0	-	7.0	-	10	
		11.0	-	11.0	-	11.0	-	15	
Input voltage LOW $I_{O1} < 1$ μA (unbuffered stages only)	V_{IL} (V)	-	1.0	-	1.0	-	1.0	5	$V_O = 0.5$ or $4.5V$ $V_O = 1.0$ or $9V$ $V_O = 1.5$ or $13.5V$
		-	2.0	-	2.0	-	2.0	10	
		-	2.5	-	2.5	-	2.5	15	
Input voltage HIGH $I_{O1} < 1$ μA (unbuffered stages only)	V_{IH} (V)	4.0	-	4.0	-	4.0	-	5	$V_O = 0.5$ or $4.5V$ $V_O = 1.0$ or $9.0V$ $V_O = 1.5$ or $13.5V$
		8.0	-	8.0	-	8.0	-	10	
		12.5	-	12.5	-	12.5	-	15	
Output (sink) current LOW	I_{OL} (mA)	0.52	-	0.44	-	0.36	-	5	$V_O=0.4$; $V_I=0/5V$ $V_O=0.5$; $V_I=0/10V$ $V_O=1.5$; $V_I=0/15V$
		1.3	-	1.1	-	0.9	-	10	
		3.6	-	3.0	-	2.4	-	15	
Output (source) current HIGH	$-I_{OH}$ (mA)	0.52	-	0.44	-	0.36	-	5	$V_O=4.6$; $V_I=0/5V$ $V_O=9.5$; $V_I=0/10V$ $V_O=13.5$; $V_I=0/15V$
		1.3	-	1.1	-	0.9	-	10	
		3.6	-	3.0	-	2.4	-	15	
Output (source) current (HIGH)	$-I_{OH}$ (mA)	1.7	-	1.4	-	1.1	-	5	$V_O=2.5$; $V_I=0/5V$
Input leakage current	$\pm I_{IN}$ (μA)	-	0.3	-	0.3	-	1.0	15	$V_I = 0$ or 15 V
3-state output leakage current HIGH	I_{OZH} (μA)	-	1.6	-	1.6	-	12.0	15	output returned to V_{DD}
3-state output leakage current LOW	$-I_{OZL}$ (μA)	-	1.6	-	1.6	-	12.0	15	output returned to V_{SS}
Input capacitance per unit load	C_I (pF)	-	-	-	7.5	-	-	-	digital inputs

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DC family characteristics for HEC at $V_{SS} = 0$ V

parameter	symbol	$T_{amb} = -55$ °C		$T_{amb} = +25$ °C		$T_{amb} = +125$ °C		V_{DD} V	conditions
		min.	max.	min.	max.	min.	max.		
Quiescent device current for gates	I_{DD} (μA)	-	0.25	-	0.25	-	7.5	5	all valid input combinations; $V_I = V_{SS}$ or V_{DD} ; $I_O = 0$
		-	0.5	-	0.5	-	15.0	10	
		-	1.0	-	1.0	-	30.0	15	
Quiescent device current for buffers and flip-flops	I_{DD} (μA)	-	1.0	-	1.0	-	30	5	all valid input combinations; $V_I = V_{SS}$ or V_{DD} ; $I_O = 0$
		-	2.0	-	2.0	-	60	10	
		-	4.0	-	4.0	-	120	15	
Quiescent device current for MSI	I_{DD} (μA)	-	5.0	-	5.0	-	150	5	all valid input combinations; $V_I = V_{SS}$ or V_{DD} ; $I_O = 0$
		-	10.0	-	10.0	-	300	10	
		-	20.0	-	20.0	-	600	15	
Quiescent device current for LSI	I_{DD} (μA)	-	15.0	-	15.0	-	375	5	all valid input combinations; $V_I = V_{SS}$ or V_{DD} ; $I_O = 0$
		-	25.0	-	25.0	-	750	10	
		-	50.0	-	50.0	-	1500	15	
Output voltage LOW $ I_O < 1$ μA	V_{OL} (V)	-	0.05	-	0.05	-	0.05	5	$V_I = V_{SS}$ or V_{DD} $V_I = V_{SS}$ or V_{DD} $V_I = V_{SS}$ or V_{DD}
		-	0.05	-	0.05	-	0.05	10	
		-	0.05	-	0.05	-	0.05	15	
Output voltage HIGH $ I_O < 1$ μA	V_{OH} (V)	4.95	-	4.95	-	4.95	-	5	$V_I = V_{SS}$ or V_{DD} $V_I = V_{SS}$ or V_{DD} $V_I = V_{SS}$ or V_{DD}
		9.95	-	9.95	-	9.95	-	10	
		14.95	-	14.95	-	14.95	-	15	
Input voltage LOW $ I_O < 1$ μA (buffered stages only)	V_{IL} (V)	-	1.5	-	1.5	-	1.5	5	$V_O = 0.5$ or $4.5V$ $V_O = 1.0$ or $9.0V$ $V_O = 1.5$ or $13.5V$
		-	3.0	-	3.0	-	3.0	10	
		-	4.0	-	4.0	-	4.0	15	
Input voltage HIGH $ I_O < 1$ μA (buffered stages only)	V_{IH} (V)	3.5	-	3.5	-	3.5	-	5	$V_O = 0.5$ or $4.5V$ $V_O = 1.0$ or $9.0V$ $V_O = 1.5$ or $13.5V$
		7.0	-	7.0	-	7.0	-	10	
		11.0	-	11.0	-	11.0	-	15	
Input voltage LOW $ I_O < 1$ μA (unbuffered stages only)	V_{IL} (V)	-	1.0	-	1.0	-	1.0	5	$V_O = 0.5$ or $4.5V$ $V_O = 1.0$ or $9V$ $V_O = 1.5$ or $13.5V$
		-	2.0	-	2.0	-	2.0	10	
		-	2.5	-	2.5	-	2.5	15	
Input voltage HIGH $ I_O < 1$ μA (unbuffered stages only)	V_{IH} (V)	4.0	-	4.0	-	4.0	-	5	$V_O = 0.5$ or $4.5V$ $V_O = 1.0$ or $9.0V$ $V_O = 1.5$ or $13.5V$
		8.0	-	8.0	-	8.0	-	10	
		12.5	-	12.5	-	12.5	-	15	
Output (sink) current LOW	I_{OL} (mA)	0.64	-	0.5	-	0.36	-	5	$V_O=0.4$; $V_I=0/5V$ $V_O=0.5$; $V_I=0/10V$ $V_O=1.5$; $V_I=0/15V$
		1.6	-	1.3	-	0.9	-	10	
		4.2	-	3.4	-	2.4	-	15	
Output (source) current HIGH	$-I_{OH}$ (mA)	0.64	-	0.5	-	0.36	-	5	$V_O=4.6$; $V_I=0/5V$ $V_O=9.5$; $V_I=0/10V$ $V_O=13.5$; $V_I=0/15V$
		1.6	-	1.3	-	0.9	-	10	
		4.2	-	3.4	-	2.4	-	15	
Output (source) current (HIGH)	$-I_{OH}$ (mA)	1.7	-	1.4	-	1.1	-	5	$V_O=2.5$; $V_I=0/5V$
Input leakage current	$\pm I_{IN}$ (μA)	-	0.3	-	0.3	-	1.0	15	$V_I = 0$ or 15 V
3-state output leakage current HIGH	I_{OZH} (μA)	-	1.6	-	1.6	-	12.0	15	output returned to V_{DD}
3-state output leakage current LOW	$-I_{OZL}$ (μA)	-	1.6	-	1.6	-	12.0	15	output returned to V_{SS}
Input capacitance per unit load	C_1 (pF)	-	-	-	7.5	-	-	-	digital inputs

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HE4000B SERIES		HEF	HEC
ARITHMETIC FUNCTIONS			
4008B	4-bit binary full adder	○	○
4531B	13-input parity checker/generator	○	○
BUFFERS			
4007UB	dual complementary pair and inverter	○	○
4041B	quadruple true/complement buffer	○	○
4049B	hex inverting buffers	○	○
4050B	hex non-inverting buffers	○	○
4502B	strobed hex inverter/buffer	○	○
40097B	3-state hex non-inverting buffer	○	○
40098B	3-state hex inverting buffer	○	○
40240B	octuple buffers with 3-state outputs	○	○
40244B	octal buffers with 3-state outputs	○	○
COMPARATORS			
4585B	4-bit magnitude comparator	○	○
COUNTERS			
4017B	5-stage Johnson counter	○	○
4018B	presettable divide-by-n counter	○	○
4020B	14-stage binary counter	○	○
4022B	4-stage divide-by-8 Johnson counter	○	○
4024B	7-stage binary counter	○	○
4029B	synchronous up/down counter, binary/decade counter	○	○
4040B	12-stage binary counter	○	○
4059B	programmable divide-by-n counter	○	○
4060B	14-stage ripple-carry binary counter/divider and oscillator	○	○
4510B	BCD up/down counter	○	○
4516B	binary up/down counter	○	○
4518B	dual BCD counter	○	○
4520B	dual binary counter	○	○
4521B	24-stage frequency divider	○	○
4522B	programmable 4-bit BCD down counter	○	○
4526B	programmable 4-bit binary down counter	○	○
4534B	real time 5-decade counter	○	○
4737B	quadruple static decade counter	○	○
4737V	quadruple static decade counter	○	○
4751V	universal divider	○	○
40160B	4-bit synchronous decade counter; asynchronous reset	○	○
40161B	4-bit synchronous binary counter; asynchronous reset	○	○
40162B	4-bit synchronous decade counter; synchronous reset	○	○
40163B	4-bit synchronous binary counter; synchronous reset	○	○
40192B	4-bit up/down decade counter	○	○
40193B	4-bit up/down binary counter	○	○
DECODERS/DEMULPLEXERS			
4028B	1-of-10 decoder	○	○
4511B	BCD to 7-segment latch/decoder/driver	○	○
4514B	1-of-16 decoder/demultiplexer with input latches	○	○
4515B	1-of-16 decoder/demultiplexer with input latches	○	○
4543B	BCD to 7-segment latch/decoder/driver	○	○
4555B	dual 1-of-4 decoder/demultiplexer	○	○
4556B	dual 1-of-4 decoder/demultiplexer	○	○

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HE4000B SERIES		HEF	HEC
DRIVERS			
4511B	BCD to 7-segment latch/decoder/driver		
4543B	BCD to 7-segment latch/decoder/driver		
ENCODERS			
4532B	8-input priority encoder		
D-type FLIP-FLOPS			
4013B	dual D-type flip-flop		
40174B	hex D-type flip-flop		
40175B	quadruple D-type flip-flop		
40374B	octal D-type flip-flop with 3-state outputs		
JK FLIP-FLOPS			
4027B	dual JK flip-flop		
AND GATES			
4073B	triple 3-input AND gate		
4081B	quadruple 2-input AND gate		
4082B	dual 4-input AND gate		
Complex GATES			
4085B	dual 2-wide 2-input AND-OR-invert gate		
4086B	4-wide 2-input AND-OR-invert gate		
EXCLUSIVE-OR GATES			
4030B	quadruple EXCLUSIVE-OR gate		
4070B	quadruple EXCLUSIVE-OR gate		
EXCLUSIVE-NOR GATES			
4077B	quadruple EXCLUSIVE-NOR gate		
NAND GATES			
4011B	quadruple 2-input NAND gate		
4011UB	quadruple 2-input NAND gate; unbuffered		
4012B	dual 4-input NAND gate		
4023B	triple 3-input NAND gate		
4068B	8-input NAND gate		
NOR GATES			
4000B	dual 3-input NOR gate and inverter		
4001B	quadruple 2-input NOR gate		
4001UB	quadruple 2-input NOR gate; unbuffered		
4002B	dual 4-input NOR gate		
4025B	triple 3-input NOR gate		
4078B	8-input NOR gate		
OR GATES			
4071B	quadruple 2-input OR gate		
4072B	dual 4-input OR gate		
4075B	triple 3-input OR gate		
INVERTERS			
4007UB	dual complementary pair and inverter		
4069UB	hex inverter		
7069UB	hex inverter; open drain		

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HE4000B SERIES

HEF HEC

LATCHES

4042B	quadruple D-latch	
4043B	quadruple R/S latch with 3-state outputs	
4044B	quadruple R/S latch with 3-state outputs	
4508B	dual 4-bit latch	
4511B	BCD to 7-segment latch/decoder/driver	
4543B	BCD to 7-segment latch/decoder/driver	
4724B	8-bit addressable latch	
40373B	octal transparent latch with 3-state output	

MEMORIES

4505B	64-bit, 1-bit per word static read/write RAM	
4720B	256-bit, 1-bit per word RAM	
4720V	256-bit, 1-bit per word RAM	

MULTIPLEXERS/DEMULTIPLEXERS

4019B	quadruple 2-input multiplexer	
4051B	8-channel analog multiplexer/demultiplexer	
4052B	dual 4-channel analog multiplexer/demultiplexer	
4053B	triple 2-channel analog multiplexer/demultiplexer	
4067B	16-channel analog multiplexer/demultiplexer	
4512B	8-input multiplexer with 3-state output	
4519B	quadruple 2-input multiplexer	
4539B	dual 4-input multiplexer	

MULTIVIBRATORS

4047B	monostable/astable multivibrator	
4528B	dual monostable multivibrator	
4538B	dual precision monostable multivibrator	
4938B	dual precision monostable multivibrator	

REGISTERS

4006B	18-stage static shift register	
4014B	8-bit static shift register	
4015B	dual 4-bit static shift register	
4021B	8-bit static shift register	
4031B	64-stage static shift register	
4035B	4-bit universal shift register	
4076B	quadruple D-type register with 3-state outputs	
4094B	8-stage shift-and-store bus register	
4517B	dual 64-bit static shift register	
4557B	1-to-64 bit variable length shift register	
4731B	quadruple 64-bit static shift register	
4731V	quadruple 64-bit static shift register	
4794B	8-stage shift-and-store register LED driver	
4894B	8-stage shift-and-store register LED driver	
40194B	4-bit bidirectional universal shift register	
40195B	4-bit universal shift register	

SCHMITT TRIGGERS

4093B	quadruple 2-input NAND Schmitt trigger	
40106B	hex inverting Schmitt trigger	










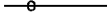
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HEF HEC

SPECIAL FUNCTIONS

4046B	phase-locked loop	
4104B	quadruple low-to-high voltage translator with 3-state outputs	
4527B	BCD rate multiplier	
4738V	IEC/IEEE bus interface	
4750V	frequency synthesizer	
4752V	AC motor control circuit	
4754V	18-element bar graph LCD driver	
4755V	transceiver for serial data communication	


SWITCHES

4016B	quadruple bilateral switches	
4066B	quadruple bilateral switches	

TIMING CIRCUITS

4541B	programmable timer	
4753B	universal timer module	
4753V	universal timer module	

TRANSCEIVERS

40245B	octuple bus transceiver with 3-state outputs	
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