



## W83194AR-96

### 200MHZ CLOCK FOR WHITNEY CHIPSET

#### 1.0 GENERAL DESCRIPTION

The W83194AR-96 is a Clock Synthesizer for Intel Whitney chipset. W83194AR-96 provides all clocks required for high-speed RISC or CISC microprocessor and also provides 32 different frequencies of CPU, SDRAM, PCI, 3V66, IOAPIC clocks frequency setting. All clocks are externally selectable with smooth transitions.

The W83194AR-96 provides I<sup>2</sup>C serial bus interface to program the registers to enable or disable each clock outputs and provides 0.25% center and 0-0.5% down type spread spectrum to reduce EMI.

The W83194AR-96 accepts a 14.318 MHz reference crystal as its input and runs on a 3.3V supply. High drive PCI and SDRAM CLOCK outputs typically provide greater than 1 V/ns slew rate into 30 pF loads. CPU CLOCK outputs typically provide better than 1 V/ns slew rate into 20 pF loads as maintaining 50±5% duty cycle. The fixed frequency outputs as REF, 24MHz, and 48 MHz provide better than 0.5V/ns slew rate.

#### 1.0 PRODUCT FEATURES

- 2 CPU clocks
- 9 SDRAM clocks for 2 DIMMs
- 8 PCI synchronous clocks.
- Optional single or mixed supply:  
(VDDR = VDDP=VDDS = VDD48 = VDD3 = 3.3V, VDDA=VDDC=2.5V)
- Skew form CPU to PCI clock -1 to 4 ns, center 2.6 ns
- Smooth frequency switch with selections from 66.8 to 200MHz
- I<sup>2</sup>C 2-Wire serial interface and I<sup>2</sup>C read back
- 0.25% or 0.5% center type spread spectrum
- Programmable registers to enable/stop each output and select modes (mode as Tri-state or Normal )
- 48 MHz for USB
- 24 MHz for super I/O
- Packaged in 48-pin SSOP



## 3.0 PIN CONFIGURATION

REF1/*APIC_SEL	<input type="checkbox"/>	1	●	48	<input type="checkbox"/>	VddA
VDDR	<input type="checkbox"/>	2		47	<input type="checkbox"/>	IOAPIC
Xin	<input type="checkbox"/>	3		46	<input type="checkbox"/>	VDDC
Xout	<input type="checkbox"/>	4		45	<input type="checkbox"/>	CPUCLK0
VSS	<input type="checkbox"/>	5		44	<input type="checkbox"/>	CPUCLK1
VSS	<input type="checkbox"/>	6		43	<input type="checkbox"/>	VSS
3V66-0	<input type="checkbox"/>	7		42	<input type="checkbox"/>	VSS
3V66-1	<input type="checkbox"/>	8		41	<input type="checkbox"/>	SDRAM 0
VDD3	<input type="checkbox"/>	9		40	<input type="checkbox"/>	SDRAM 1
VDDP	<input type="checkbox"/>	10		39	<input type="checkbox"/>	SDRAM 2
PCICLK0/ FS0#	<input type="checkbox"/>	11		38	<input type="checkbox"/>	VDDS
PCICLK1/ FS1#	<input type="checkbox"/>	12		37	<input type="checkbox"/>	SDRAM 3
PCICLK2/*SEL24_48#	<input type="checkbox"/>	13		36	<input type="checkbox"/>	SDRAM 4
VSS	<input type="checkbox"/>	14		35	<input type="checkbox"/>	SDRAM 5
PCICLK3/ FS4#	<input type="checkbox"/>	15		34	<input type="checkbox"/>	VSS
PCICLK4	<input type="checkbox"/>	16		33	<input type="checkbox"/>	SDRAM 6
PCICLK5	<input type="checkbox"/>	17		32	<input type="checkbox"/>	SDRAM 7
VDDP	<input type="checkbox"/>	18		31	<input type="checkbox"/>	SDRAM_F
PCICLK6	<input type="checkbox"/>	19		30	<input type="checkbox"/>	VDDS
PCICLK7	<input type="checkbox"/>	20		29	<input type="checkbox"/>	VSS
VSS	<input type="checkbox"/>	21		28	<input type="checkbox"/>	24_48MHz/ FS2#
PD#	<input type="checkbox"/>	22		27	<input type="checkbox"/>	48MHz-0
*SDCLK	<input type="checkbox"/>	23		26	<input type="checkbox"/>	48MHz-1/ FS3#
*SDATA	<input type="checkbox"/>	24		25	<input type="checkbox"/>	VDD48

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## 4.0 FREQUENCY SELECTION BY HARDWARE

FS4	FS3	FS2	FS1	FS0	CPU (MHz)	SDRAM (MHz)	CPU /SDRAM	3V66 (MHz)	PCI(MHz)	IOAPIC (MHz) APIC_SEL=1	IOAPIC (MHz) APIC_SEL=0
0	0	0	0	0	66.8	100.2	2/3	66.80	33.40	16.70	33.40
0	0	0	0	1	90	90	1	60.00	30.00	15.00	30.00
0	0	0	1	0	100.2	100.2	1	66.80	33.40	16.70	33.40
0	0	0	1	1	72	108	2/3	72.00	36.00	18.00	36.00
0	0	1	0	0	133.6	133.6	1	66.80	33.40	16.70	33.40
0	0	1	0	1	95.25	95.25	1	63.50	31.75	15.88	31.75
0	0	1	1	0	133.6	100.2	4/3	66.80	33.40	16.70	33.40
0	0	1	1	1	124	124	1	82.67	41.33	20.67	41.33
0	1	0	0	0	119	119	1	79.33	39.67	19.83	39.67
0	1	0	0	1	114	114	1	76.00	38.00	19.00	38.00
0	1	0	1	0	110	110	1	73.33	36.67	18.33	36.67
0	1	0	1	1	105	105	1	70.00	35.00	17.50	35.00
0	1	1	0	0	83.3	124.95	2/3	83.30	41.65	20.83	41.65
0	1	1	0	1	75	112.5	2/3	75.00	37.50	18.75	37.50
0	1	1	1	0	89.07	133.6	2/3	89.07	44.53	22.27	44.53
0	1	1	1	1	121	121	1	80.67	40.33	20.17	40.33
1	0	0	0	0	135	101.25	4/3	67.50	33.75	16.88	33.75
1	0	0	0	1	125	125	1	83.33	41.67	20.83	41.67
1	0	0	1	0	127	127	1	84.67	42.33	21.17	42.33
1	0	0	1	1	130	130	1	86.67	43.33	21.67	43.33
1	0	1	0	0	140	140	1	70.00	35.00	17.50	35.00
1	0	1	0	1	136	136	1	68.00	34.00	17.00	34.00
1	0	1	1	0	166	166	1	83.00	41.50	20.75	41.50
1	0	1	1	1	155	155	1	77.50	38.75	19.38	38.75
1	1	0	0	0	150	112.5	4/3	75.00	37.50	18.75	37.50
1	1	0	0	1	117	117	1	78.00	39.00	19.50	39.00
1	1	0	1	0	107	107	1	71.33	35.67	17.83	35.67
1	1	0	1	1	100.9	100.9	1	67.27	33.63	16.82	33.63
1	1	1	0	0	145	108.75	4/3	72.50	36.25	18.13	36.25
1	1	1	0	1	140	105	4/3	70.00	35.00	17.50	35.00
1	1	1	1	0	138	103.5	4/3	69.00	34.50	17.25	34.50
1	1	1	1	1	137	102.75	4/3	68.50	34.25	17.13	34.25

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## 5.0 SERIAL CONTROL 0REGISTERS

The Pin column lists the affected pin number and the @PowerUp column gives the state at true power up. Registers are set to the values shown only on true power up. "Command Code" byte and "Byte Count" byte must be sent following the acknowledge of the Address Byte. Although the data (bits) in these two bytes are considered "don't care", they must be sent and will be acknowledge. After that, the below described sequence (Register 0, Register 1, Register 2, ....) will be valid and acknowledged.

### Frequency Table Setting by I2C (SEL5 ~ SEL0)

SSE L5	SS EL4	SS EL3	SS EL2	SS EL1	SS EL0	CPU (MHz)	SDRAM (MHz)	CPU/SD RAM	3V66 (MHz)	PCI (MHz)	IOAPIC (MHz) APIC_SEL=1	IOAPIC (MHz) APIC_SEL=0
0	0	0	0	0	0	66.8	100.2	2/3	66.80	33.40	16.70	33.40
0	0	0	0	0	1	90	90	1	60.00	30.00	15.00	30.00
0	0	0	0	1	0	100.2	100.2	1	66.80	33.40	16.70	33.40
0	0	0	0	1	1	72	108	2/3	72.00	36.00	18.00	36.00
0	0	0	1	0	0	133.6	133.6	1	66.80	33.40	16.70	33.40
0	0	0	1	0	1	95.25	95.25	1	63.50	31.75	15.88	31.75
0	0	0	1	1	0	133.6	100.2	4/3	66.80	33.40	16.70	33.40
0	0	0	1	1	1	124	124	1	82.67	41.33	20.67	41.33
0	0	1	0	0	0	119	119	1	79.33	39.67	19.83	39.67
0	0	1	0	0	1	114	114	1	76.00	38.00	19.00	38.00
0	0	1	0	1	0	110	110	1	73.33	36.67	18.33	36.67
0	0	1	0	1	1	105	105	1	70.00	35.00	17.50	35.00
0	0	1	1	0	0	83.3	124.95	2/3	83.30	41.65	20.83	41.65
0	0	1	1	0	1	75	112.5	2/3	75.00	37.50	18.75	37.50
0	0	1	1	1	0	89.07	133.6	2/3	89.07	44.53	22.27	44.53
0	0	1	1	1	1	121	121	1	80.67	40.33	20.17	40.33
0	1	0	0	0	0	135	101.25	4/3	67.50	33.75	16.88	33.75
0	1	0	0	0	1	125	125	1	83.33	41.67	20.83	41.67
0	1	0	0	1	0	127	127	1	84.67	42.33	21.17	42.33
0	1	0	0	1	1	130	130	1	86.67	43.33	21.67	43.33
0	1	0	1	0	0	140	140	1	70.00	35.00	17.50	35.00
0	1	0	1	0	1	136	136	1	68.00	34.00	17.00	34.00
0	1	0	1	1	0	166	166	1	83.00	41.50	20.75	41.50
0	1	0	1	1	1	155	155	1	77.50	38.75	19.38	38.75
0	1	1	0	0	0	150	112.5	4/3	75.00	37.50	18.75	37.50
0	1	1	0	0	1	117	117	1	78.00	39.00	19.50	39.00
0	1	1	0	1	0	107	107	1	71.33	35.67	17.83	35.67
0	1	1	0	1	1	100.9	100.9	1	67.27	33.63	16.82	33.63
0	1	1	1	0	0	145	108.75	4/3	72.50	36.25	18.13	36.25
0	1	1	1	0	1	140	105	4/3	70.00	35.00	17.50	35.00
0	1	1	1	1	0	138	103.5	4/3	69.00	34.50	17.25	34.50
0	1	1	1	1	1	137	102.75	4/3	68.50	34.25	17.13	34.25

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SSE L5	SS EL4	SS EL3	SS EL2	SS EL1	SS EL0	CPU (MHz)	SDRAM (MHz)	CPU/SD RAM	3V66 (MHz)	PCI (MHz)	IOAPIC (MHz) APIC_SEL=1	IOAPIC (MHz) APIC_SEL=0
1	0	0	0	0	0	136	102.00	4/3	68.00	34.00	17.00	34.00
1	0	0	0	0	1	138	138.00	1	69.00	34.50	17.25	34.50
1	0	0	0	1	0	139	104.25	4/3	69.50	34.75	17.38	34.75
1	0	0	0	1	1	141	141.00	1	70.50	35.25	17.63	35.25
1	0	0	1	0	0	142	142.00	1	71.00	35.50	17.75	35.50
1	0	0	1	0	1	142	106.50	4/3	71.00	35.50	17.75	35.50
1	0	0	1	1	0	143	143.00	1	71.50	35.75	17.88	35.75
1	0	0	1	1	1	143	107.25	4/3	71.50	35.75	17.88	35.75
1	0	1	0	0	0	144	144.00	1	72.00	36.00	18.00	36.00
1	0	1	0	0	1	144	108.00	4/3	72.00	36.00	18.00	36.00
1	0	1	0	1	0	146	146	1	73.00	36.50	18.25	36.50
1	0	1	0	1	1	146	109.50	4/3	73.00	36.50	18.25	36.50
1	0	1	1	0	0	147	147	1	73.50	36.75	18.38	36.75
1	0	1	1	0	1	147	110.25	4/3	73.50	36.75	18.38	36.75
1	0	1	1	1	0	148	148.00	1	74.00	37.00	18.50	37.00
1	0	1	1	1	1	148	111.00	4/3	74.00	37.00	18.50	37.00
1	1	0	0	0	0	149	111.75	4/3	74.50	37.25	18.63	37.25
1	1	0	0	0	1	152	152.00	1	76.00	38.00	19.00	38.00
1	1	0	0	1	0	153	114.75	4/3	76.50	38.25	19.13	38.25
1	1	0	0	1	1	156	156.00	1	78.00	39.00	19.50	39.00
1	1	0	1	0	0	157	117.75	4/3	78.50	39.25	19.63	39.25
1	1	0	1	0	1	158	158.00	1	79.00	39.50	19.75	39.50
1	1	0	1	1	0	159	119.25	4/3	79.50	39.75	19.88	39.75
1	1	0	1	1	1	160	160.00	1	80.00	40.00	20.00	40.00
1	1	1	0	0	0	162	121.5	4/3	81.00	40.50	20.25	40.50
1	1	1	0	0	1	164	164.00	1	82.00	41.00	20.50	41.00
1	1	1	0	1	0	170	170.00	1	85.00	42.50	21.25	42.50
1	1	1	0	1	1	175	175	1	87.5	43.75	21.88	43.75
1	1	1	1	0	0	180	120	2/3	60	30	15	30
1	1	1	1	0	1	185	92.5	2	61.67	30.83	15.42	30.83
1	1	1	1	1	0	190	126.67	3/2	63.33	31.67	15.83	31.67
1	1	1	1	1	1	200.4	133.60	3/2	66.80	33.40	16.70	33.40



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### 5.1 Register 0: CPU Frequency Select Register

Bit	@PowerUp	Pin	Description
7	0	-	SSEL3 (Frequency table selection by software via I <sup>2</sup> C)
6	0	-	SSEL2 (Frequency table selection by software via I <sup>2</sup> C)
5	0	-	SSEL1 (Frequency table selection by software via I <sup>2</sup> C)
4	0	-	SSEL0 (Frequency table selection by software via I <sup>2</sup> C)
3	0	-	0 = Selection by hardware 1 = Selection by software I <sup>2</sup> C - Bit (2, 7:4), <b>Register1 Bit1</b>
2	0	-	SSEL4 (Frequency table selection by software via I <sup>2</sup> C)
1	0	-	SSEL5 (Frequency table selection by software via I <sup>2</sup> C)
0	0	-	0 = Running 1 = Tristate all outputs

### 5.2 Register 1 : CPU Clock Register (1 = Active, 0 = Inactive)

Bit	@PowerUp	Pin	Description
7	X	-	FS3#
6	X	-	FS0#
5	X	-	FS2#
4	1	28	24_48MHz(Active / Inactive)
3	1	27	48MHz-0(Active / Inactive)
2	1	26	48MHz-1(Active / Inactive)
1	1	-	1 = ±0.25% Center type Spread Spectrum Modulation 0 = ±0.5% Center type Spread Spectrum Modulation
0	0	-	0 = Normal 1 = Spread Spectrum enabled

### 5.3 Register 2: SDRAM Clock Register (1 = Active, 0 = Inactive)

Bit	@PowerUp	Pin	Description
7	1	32	SDRAM7 (Active / Inactive)
6	1	33	SDRAM6 (Active / Inactive)
5	1	35	SDRAM5 (Active / Inactive)
4	1	36	SDRAM4 (Active / Inactive)
3	1	37	SDRAM3 (Active / Inactive)
2	1	39	SDRAM2 (Active / Inactive)
1	1	40	SDRAM1 (Active / Inactive)
0	1	41	SDRAM0 (Active / Inactive)

#### 5.4 Register 3: PCI Clock Register (1 = Active, 0 = Inactive)

Bit	@PowerUp	Pin	Description
7	1	20	PCICLK7 (Active / Inactive)
6	1	19	PCICLK6 (Active / Inactive)
5	1	17	PCICLK5 (Active / Inactive)
4	1	16	PCICLK4 (Active / Inactive)
3	1	15	PCICLK3 (Active / Inactive)
2	1	13	PCICLK2 (Active / Inactive)
1	1	12	PCICLK1 (Active / Inactive)
0	1	11	PCICLK0 (Active / Inactive)

#### 5.5 Register 4: Additional Register (1 = Active, 0 = Inactive)

Bit	@PowerUp	Pin	Description
7	X	-	APIC_SEL#
6	1	7	3V66_0(Active / Inactive)
5	1	8	3V66_1(Active / Inactive)
4	X	-	FS4#
3	1	47	IOAPIC (Active / Inactive)
2	X	-	FS1#
1	1	44	CPUCLK1(Active / Inactive)
0	1	45	CPUCLK0(Active / Inactive)

#### 5.6 Register 5: Reserve Register

Bit	@PowerUp	Pin	Description
7	1	-	SKEW2(SDRAM to CPU Skew programming bit)
6	0	-	SKEW1(SDRAM to CPU Skew programming bit)
5	0	-	SKEW0(SDRAM to CPU Skew programming bit)
4	1	-	SDRAM_F
3	0	-	Reserve
2	0	-	Reserve
1	0	-	Reserve
0	0	-	Reserve



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## 5.7 Register 6: Winbond Chip ID Register (Read Only)

Bit	@PowerUp	Pin	Description
7	1	-	Winbond Chip ID
6	0	-	Winbond Chip ID
5	0	-	Winbond Chip ID
4	1	-	Winbond Chip ID
3	1	-	Winbond Chip ID
2	0	-	Winbond Chip ID
1	0	-	Winbond Chip ID
0	0	-	Winbond Chip ID

## 5.8 Register 7: Winbond Chip ID Register (Read Only)

Bit	@PowerUp	Pin	Description
7	<b>0</b>	-	<b>Winbond Chip ID</b>
6	<b>0</b>	-	<b>Winbond Chip ID</b>
5	<b>1</b>	-	<b>Winbond Chip ID</b>
4	<b>0</b>	-	<b>Winbond Chip ID</b>
3	<b>0</b>	-	<b>Winbond Chip ID</b>
2	<b>0</b>	-	<b>Winbond Version ID</b>
1	<b>0</b>	-	<b>Winbond Version ID</b>
0	<b>1</b>	-	<b>Winbond Version ID</b>





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## 6.0 SPECIFICATIONS

### 6.1 ABSOLUTE MAXIMUM RATINGS

Stresses greater than those listed in this table may cause permanent damage to the device. Precautions should be taken to avoid application of any voltage higher than the maximum rated voltages to this circuit. Subjection to maximum conditions for extended periods may affect reliability. Unused inputs must always be tied to an appropriate logic voltage level (Ground or Vdd).

Symbol	Parameter	Rating
Vdd , V <sub>IN</sub>	Voltage on any pin with respect to GND	- 0.5 V to + 7.0 V
T <sub>STG</sub>	Storage Temperature	- 65°C to + 150°C
T <sub>B</sub>	Ambient Temperature	- 55°C to + 125°C
T <sub>A</sub>	Operating Temperature	0°C to + 70°C

### 6.2 AC CHARACTERISTICS

<i>VddR=Vdd3=VddP=VddS=3.3V - 5%, VddC = VddA= 2.375V~2.9V, T<sub>A</sub> = 0° C to +70° C</i>						
Parameter	Symbol	Min	Typ	Max	Units	Test Conditions
Output Duty Cycle		45	50	55	%	Measured at 1.5V
CPU/SDRAM to PCI Offset	t <sub>OFF</sub>	1		4	ns	15 pF Load Measured at 1.5V
Skew (CPU-CPU), (PCI-PCI), (SDRAM-SDRAM)	t <sub>SKEW</sub>			250	ps	15 pF Load Measured at 1.5V
CPU/SDRAM Cycle to Cycle Jitter	t <sub>CCJ</sub>			±250	ps	
CPU/SDRAM Absolute Jitter	t <sub>JA</sub>			500	ps	
Jitter Spectrum 20 dB Bandwidth from Center	BW <sub>J</sub>			500	KHz	
Output Rise (0.4V ~ 2.0V) & Fall (2.0V ~0.4V) Time	t <sub>TLH</sub> t <sub>THL</sub>	0.4		1.6	ns	15 pF Load on CPU and PCI outputs
Overshoot/Undershoot Beyond Power Rails	V <sub>over</sub>	0.7		1.5	V	22 Ω at source of 8 inch PCB run to 15 pF load
Ring Back Exclusion	V <sub>RBE</sub>	0.7		2.1	V	Ring Back must not enter this range.

## 6.3 DC CHARACTERISTICS

$V_{ddR}=V_{dd3}=V_{ddP}=V_{ddS}=3.3V - 5\%, V_{ddC} = V_{ddA}= 2.375V\sim 2.9V, T_A = 0^\circ C \text{ to } +70^\circ C$						
Parameter	Symbol	Min	Typ	Max	Units	Test Conditions
Input Low Voltage	$V_{IL}$	$V_{SS}-0.3$		0.8	$V_{dc}$	
Input High Voltage	$V_{IH}$	2.0		$V_{dd}+0.3$	$V_{dc}$	
Input Low Current (no pull-up Resistors)	$I_{IL}$	-5	2.0		$\mu A$	
Input Low Current (pull-up Resistors)	$I_{IL}$	-200	-100		$\mu A$	
Input High Current	$I_{IH}$	-5		5	$\mu A$	
Operating Current	$I_{DD}$		60	100	mA	@66M
Power Down Current	$I_{DDPD}$		400	600	$\mu A$	$C_L=0pF$
Input Frequency	$F_i$		14.318		MHz	$V_{dd}=3.3V$
Pin Inductance	$L_{pin}$		7		nH	
Input Capacitance	$C_{IN}$			5	pF	Logic Inputs
	$C_{OUT}$		6		pF	Output pins capacitance
	$C_{INX}$	13.5		22.5	pF	X1 & X2 pins
Transition Time	$T_{Tra}$			3	mS	
Disable/Enable Delay	$T$	1		10	nS	
Clock stabilization	$T_{STA}$			3	mS	

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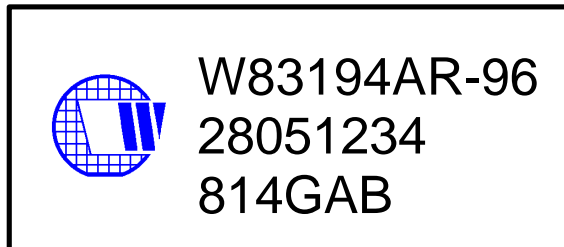


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## 7.0 ORDERING INFORMATION

Part Number	Package Type	Production Flow
W83194AR-96	48 PIN SSOP	Commercial, 0°C to +70°C

## 8.0 HOW TO READ THE TOP MARKING



1st line: Winbond logo and the type number: W83194AR-96

2nd line: Tracking code 2 8051234

2: wafers manufactured in Winbond FAB 2

8051234: wafer production series lot number

3rd line: Tracking code 814 G B B

814: packages made in '98, week 14

G: assembly house ID; O means OSE, G means GR

A: Internal use code

B: IC revision

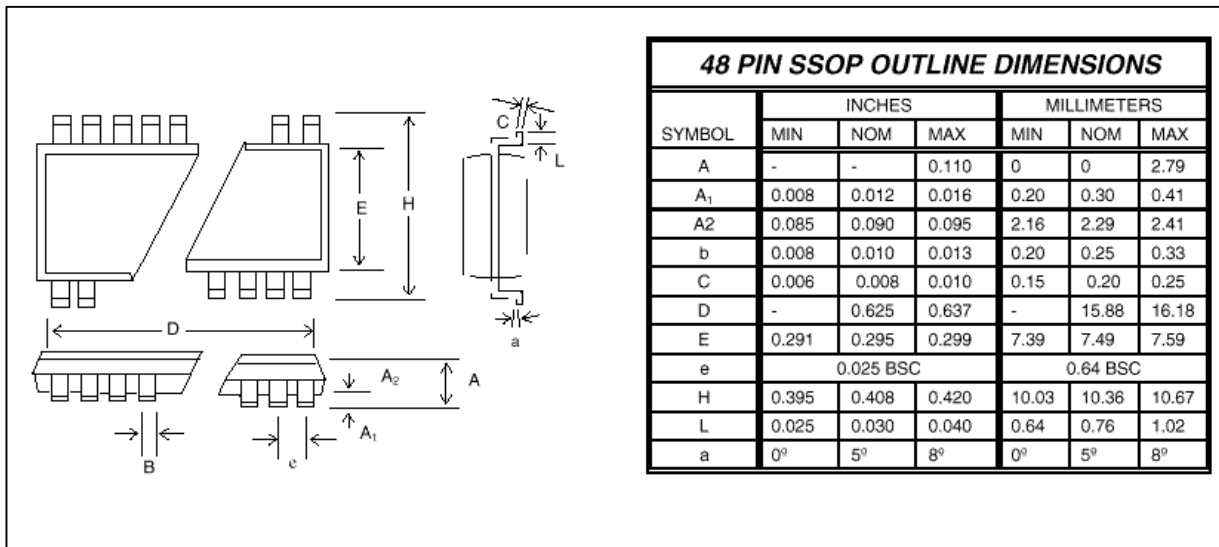
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## 9.0 PACKAGE DRAWING AND DIMENSIONS



**Headquarters**  
 No. 4, Creation Rd. III  
 Science-Based Industrial Park  
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