



Is Now Part of



**ON Semiconductor®**

To learn more about ON Semiconductor, please visit our website at  
[www.onsemi.com](http://www.onsemi.com)

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## CD4047BC Low Power Monostable/Astable Multivibrator

### General Description

The CD4047B is capable of operating in either the monostable or astable mode. It requires an external capacitor (between pins 1 and 3) and an external resistor (between pins 2 and 3) to determine the output pulse width in the monostable mode, and the output frequency in the astable mode.

Astable operation is enabled by a high level on the astable input or low level on the astable input. The output frequency (at 50% duty cycle) at Q and  $\bar{Q}$  outputs is determined by the timing components. A frequency twice that of Q is available at the Oscillator Output; a 50% duty cycle is not guaranteed.

Monostable operation is obtained when the device is triggered by LOW-to-HIGH transition at + trigger input or HIGH-to-LOW transition at - trigger input. The device can be retriggered by applying a simultaneous LOW-to-HIGH transition to both the + trigger and retrigger inputs.

A high level on Reset input resets the outputs Q to LOW,  $\bar{Q}$  to HIGH.

### Features

- Wide supply voltage range: 3.0V to 15V
- High noise immunity:  $0.45 V_{DD}$  (typ.)
- Low power TTL compatibility: Fan out of 2 driving 74L or 1 driving 74LS

### Special Features

- Low power consumption: special CMOS oscillator configuration
- Monostable (one-shot) or astable (free-running) operation
- True and complemented buffered outputs
- Only one external R and C required

### Monostable Multivibrator Features

- Positive- or negative-edge trigger
- Output pulse width independent of trigger pulse duration
- Retriggerable option for pulse width expansion
- Long pulse widths possible using small RC components by means of external counter provision
- Fast recovery time essentially independent of pulse width
- Pulse-width accuracy maintained at duty cycles approaching 100%

### Astable Multivibrator Features

- Free-running or gatable operating modes
- 50% duty cycle
- Oscillator output available
- Good astable frequency stability  
typical =  $\pm 2\% + 0.03\%/^{\circ}\text{C}$  @ 100 kHz  
frequency =  $\pm 0.5\% + 0.015\%/^{\circ}\text{C}$  @ 10 kHz  
deviation (circuits trimmed to frequency  $V_{DD} = 10\text{V}$   $\pm 10\%$ )

### Applications

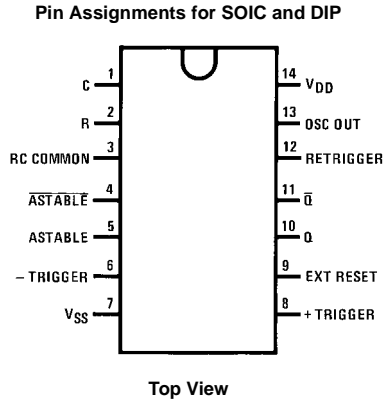
- Frequency discriminators
- Timing circuits
- Time-delay applications
- Envelope detection
- Frequency multiplication
- Frequency division

### Ordering Code:

Order Number	Package Number	Package Description
CD4047BCM	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
CD4047BCN	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

### Connection Diagram

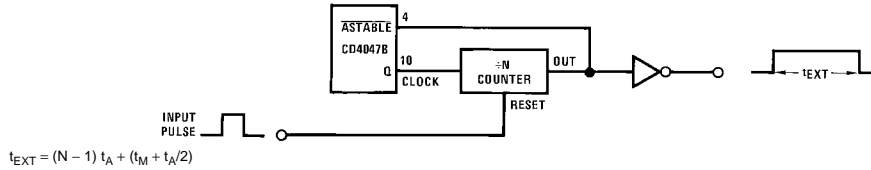


### Function Table

Function	Terminal Connections			Output Pulse From	Typical Output Period or Pulse Width
	To V <sub>DD</sub>	To V <sub>SS</sub>	Input Pulse To		
Astable Multivibrator					
Free-Running	4, 5, 6, 14	7, 8, 9, 12		10, 11, 13	$t_A(10, 11) = 4.40 RC$
True Gating	4, 6, 14	7, 8, 9, 12	5	10, 11, 13	$t_A(13) = 2.20 RC$
Complement Gating	6, 14	5, 7, 8, 9, 12	4	10, 11, 13	
Monostable Multivibrator					
Positive-Edge Trigger	4, 14	5, 6, 7, 9, 12	8	10, 11	$t_M(10, 11) = 2.48 RC$
Negative-Edge Trigger	4, 8, 14	5, 7, 9, 12	6	10, 11	
Retriggerable	4, 14	5, 6, 7, 9	8, 12	10, 11	
External Countdown (Note 1)	14	5, 6, 7, 8, 9, 12	Figure 1	Figure 1	Figure 1

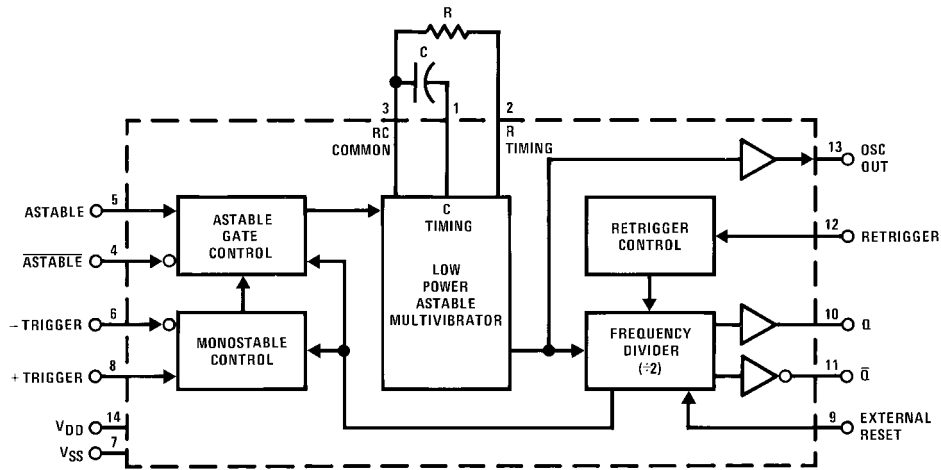
Note 1: External resistor between terminals 2 and 3. External capacitor between terminals 1 and 3.

### Typical Implementation of External Countdown Option

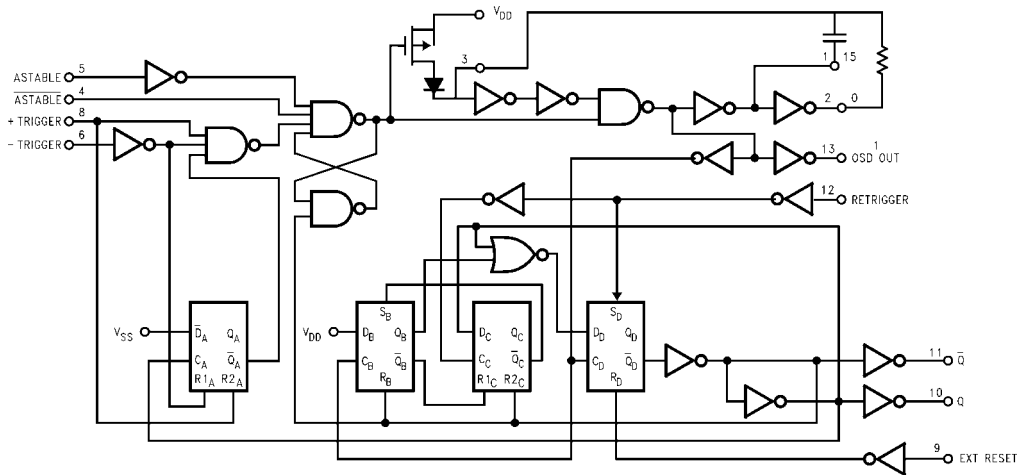


$$t_{EXT} = (N - 1) t_A + (t_M + t_A/2)$$

**Block Diagram**



**Logic Diagram**



\*Special input protection circuit to permit larger input-voltage swings.

**Absolute Maximum Ratings** (Note 2)

(Note 3)

DC Supply Voltage ( $V_{DD}$ )	-0.5V to +18V <sub>DC</sub>
Input Voltage ( $V_{IN}$ )	-0.5V to $V_{DD}$ +0.5V <sub>DC</sub>
Storage Temperature Range ( $T_S$ )	-65°C to +150°C
Power Dissipation ( $P_D$ )	
Dual-In-Line	700 mW
Small Outline	500 mW
Lead Temperature ( $T_L$ )	
(Soldering, 10 seconds)	260°C

**Recommended Operating Conditions** (Note 3)

DC Supply Voltage ( $V_{DD}$ )	3V to 15V <sub>DC</sub>
Input Voltage ( $V_{IN}$ )	0 to $V_{DD}$ V <sub>DC</sub>
Operating Temperature Range ( $T_A$ )	-55°C to +125°C

**Note 2:** "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The table of "Recommended Operating Conditions" and "Electrical Characteristics" provides conditions for actual device operation.

**Note 3:**  $V_{SS} = 0V$  unless otherwise specified.

**DC Electrical Characteristics** (Note 3)

Symbol	Parameter	Conditions	-55°C		25°C			125°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
$I_{DD}$	Quiescent Device Current	$V_{DD} = 5V$ $V_{DD} = 10V$ $V_{DD} = 15V$		5 10 20			5 10 20		150 300 600	$\mu A$
$V_{OL}$	LOW Level Output Voltage	$ I_{O}  < 1 \mu A$ $V_{DD} = 5V$ $V_{DD} = 10V$ $V_{DD} = 15V$		0.05 0.05 0.05		0 0 0	0.05 0.05 0.05		0.05 0.05 0.05	V
$V_{OH}$	HIGH Level Output Voltage	$ I_{O}  < 1 \mu A$ $V_{DD} = 5V$ $V_{DD} = 10V$ $V_{DD} = 15V$	4.95 9.95 14.95		4.95 9.95 14.95	5 10 15		4.95 9.95 14.95		V
$V_{IL}$	LOW Level Input Voltage	$V_{DD} = 5V, V_O = 0.5V$ or 4.5V $V_{DD} = 10V, V_O = 1V$ or 9V $V_{DD} = 15V, V_O = 1.5V$ or 13.5V		1.5 3.0 4.0		2.25 4.5 6.75	1.5 3.0 4.0		1.5 3.0 4.0	V
$V_{IH}$	HIGH Level Input Voltage	$V_{DD} = 5V, V_O = 0.5V$ or 4.5V $V_{DD} = 10V, V_O = 1V$ or 9V $V_{DD} = 15V, V_O = 1.5V$ or 13.5V	3.5 7.0 11.0		3.5 7.0 11.0	2.75 5.5 8.25		3.5 7.0 11.0		V
$I_{OL}$	LOW Level Output Current (Note 4)	$V_{DD} = 5V, V_O = 0.4V$ $V_{DD} = 10V, V_O = 0.5V$ $V_{DD} = 15V, V_O = 1.5V$	0.64 1.6 4.2		0.51 1.3 3.4	0.88 2.25 8.8		0.36 0.9 2.4		mA
$I_{OH}$	HIGH Level Output Current (Note 4)	$V_{DD} = 5V, V_O = 4.6V$ $V_{DD} = 10V, V_O = 9.5V$ $V_{DD} = 15V, V_O = 13.5V$	-0.64 -1.6 -4.2		-0.51 -1.3 -3.4	-0.88 -2.25 -8.8		-0.36 -0.9 -2.4		mA
$I_{IN}$	Input Current	$V_{DD} = 15V, V_{IN} = 0V$ $V_{DD} = 15V, V_{IN} = 15V$		-0.1 0.1		$-10^{-5}$ $10^{-5}$	-0.1 0.1		-1.0 1.0	$\mu A$

**Note 4:**  $I_{OH}$  and  $I_{OL}$  are tested one output at a time.

**AC Electrical Characteristics** (Note 5)

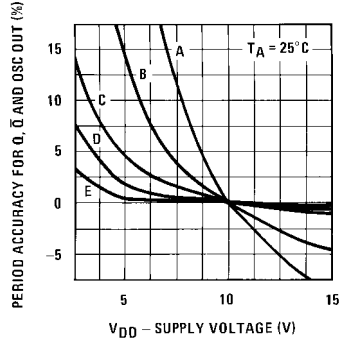
$T_A = 25^\circ\text{C}$ ,  $C_L = 50\text{ pF}$ ,  $R_L = 200\text{ k}$ , input  $t_r = t_f = 20\text{ ns}$ , unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Units
$t_{PHL}$ , $t_{PLH}$	Propagation Delay Time Astable, Astable to Osc Out	$V_{DD} = 5\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$		200 100 80	400 200 160	ns
$t_{PHL}$ , $t_{PLH}$	Astable, Astable to Q, $\bar{Q}$	$V_{DD} = 5\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$		550 250 200	900 500 400	ns
$t_{PHL}$ , $t_{PLH}$	+ Trigger, - Trigger to $\bar{Q}$	$V_{DD} = 5\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$		700 300 240	1200 600 480	ns
$t_{PHL}$ , $t_{PLH}$	+ Trigger, Retrigger to $\bar{Q}$	$V_{DD} = 5\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$		300 175 150	600 300 250	ns
$t_{PHL}$ , $t_{PLH}$	Reset to Q, $\bar{Q}$	$V_{DD} = 5\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$		300 125 100	600 250 200	ns
$t_{THL}$ , $t_{TLH}$	Transition Time Q, $\bar{Q}$ , Osc Out	$V_{DD} = 5\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$		100 50 40	200 100 80	ns
$t_{WL}$ , $t_{WH}$	Minimum Input Pulse Duration	Any Input $V_{DD} = 5\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$		500 200 160	1000 400 320	ns
$t_{RCL}$ , $t_{FCL}$	+ Trigger, Retrigger, Rise and Fall Time	$V_{DD} = 5\text{V}$ $V_{DD} = 10\text{V}$ $V_{DD} = 15\text{V}$			15 5 5	$\mu\text{s}$
$C_{IN}$	Average Input Capacitance	Any Input		5	7.5	pF

**Note 5:** AC Parameters are guaranteed by DC correlated testing.

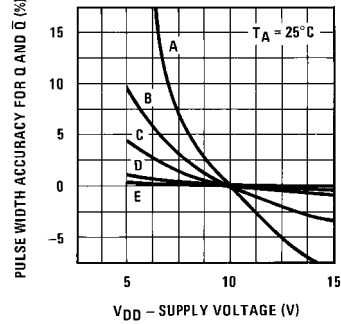
## Typical Performance Characteristics

Typical Q,  $\bar{Q}$ , Osc Out Period Accuracy vs Supply Voltage (Astable Mode Operation)



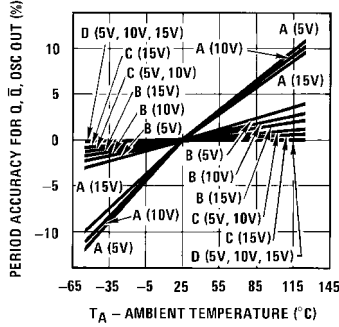
$f_{Q, \bar{Q}}$	R	C
A 1000 kHz	22k	10 pF
B 100 kHz	22k	100 pF
C 10 kHz	220k	100 pF
D 1 kHz	220k	1000 pF
E 100 Hz	2.2M	1000 pF

Typical Q,  $\bar{Q}$ , Pulse Width Accuracy vs Supply Voltage Monostable Mode Operation



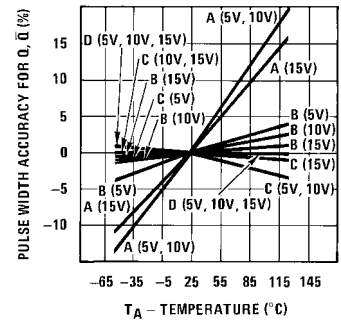
$t_M$	R	C
A 2 $\mu$ s	22k	10 pF
B 7 $\mu$ s	22k	100 pF
C 60 $\mu$ s	220k	100 pF
D 550 $\mu$ s	220k	1000 pF
E 5.5 ms	2.2M	1000 pF

Typical Q,  $\bar{Q}$  and Osc Out Period Accuracy vs Temperature Astable Mode Operation



$f_{Q, \bar{Q}}$	R	C
A 1000 kHz	22k	10 pF
B 100 kHz	22k	100 pF
C 10 kHz	220k	100 pF
D 1 kHz	220k	1000 pF

Typical Q and  $\bar{Q}$  Pulse Width Accuracy vs Temperature Monostable Mode Operation

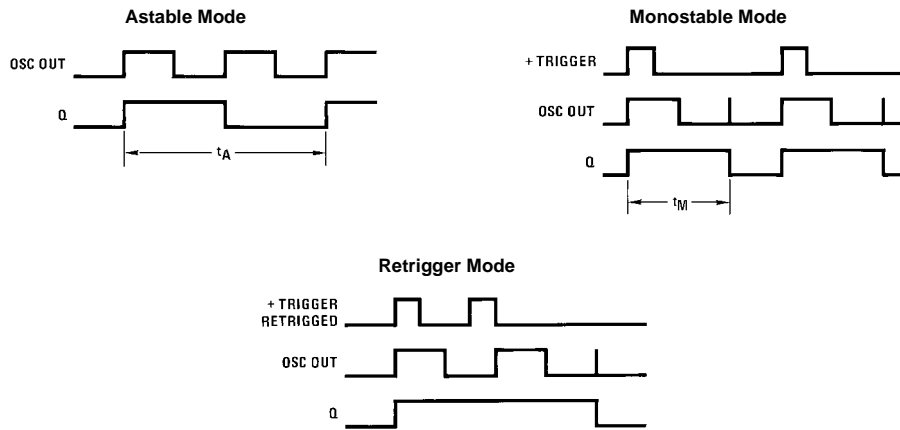


$t_M$	R	C
A 2 $\mu$ s	22k	10 pF
B 7 $\mu$ s	22k	100 pF
C 60 $\mu$ s	220k	100 pF
D 550 $\mu$ s	220k	1000 pF

**Note:** Minimum Value of R: 10 K  $\Omega$   
 Maximum Value of R: 1 Meg  $\Omega$   
 Minimum Value of C for Astable Mode: 100 pF  
 Minimum Value of C for Monostable Mode: 1000 pF

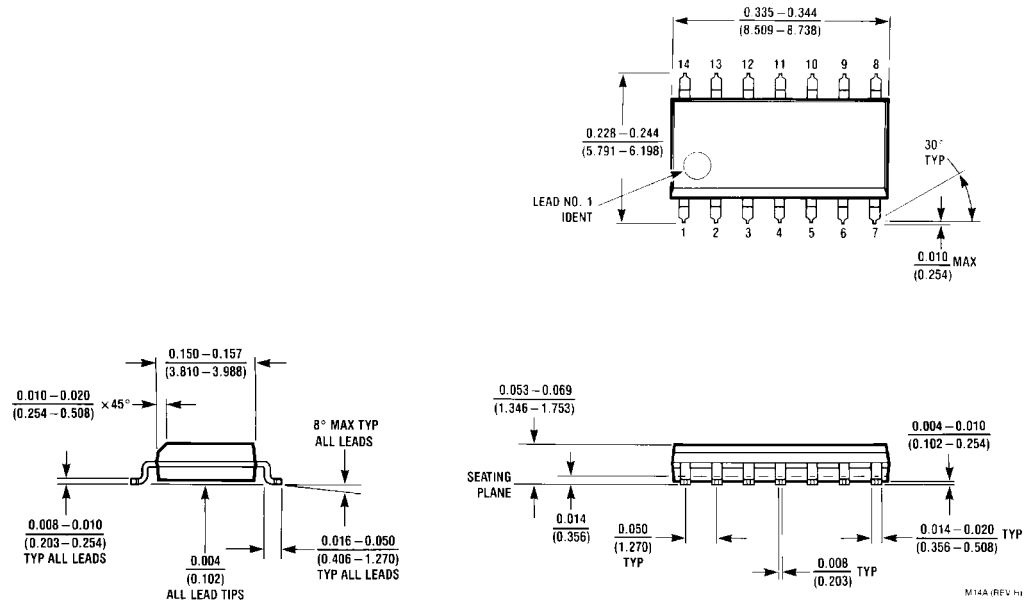
**Typical Performance Characteristics** (Continued)

**Timing Diagrams**



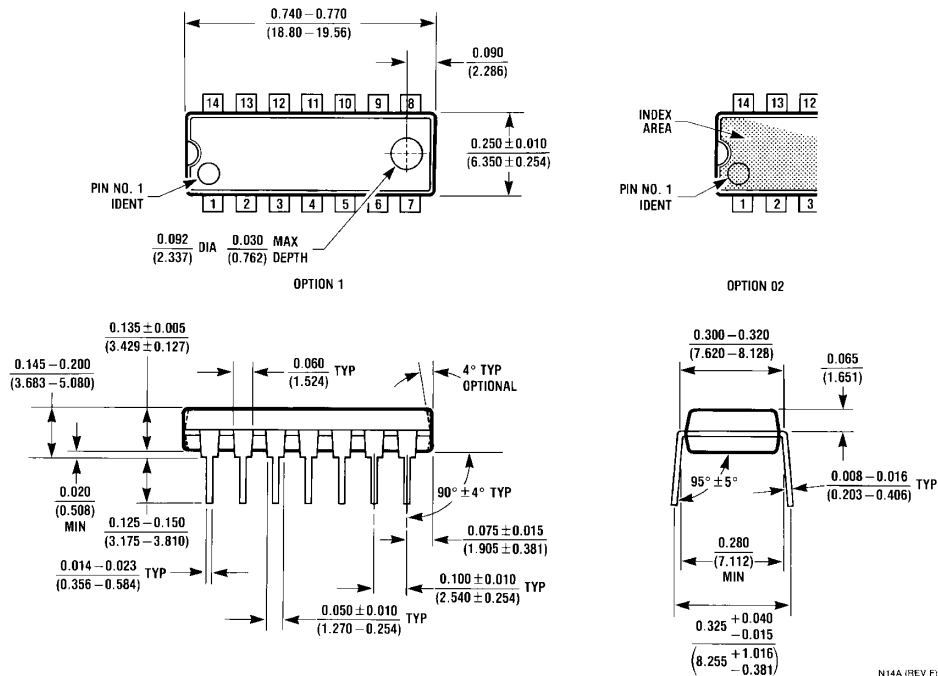


**Physical Dimensions** inches (millimeters) unless otherwise noted



**14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow  
Package Number M14A**

**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



**14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide Package Number N14A**

N14A (REV F)

Fairchild does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and Fairchild reserves the right at any time without notice to change said circuitry and specifications.

**LIFE SUPPORT POLICY**

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF FAIRCHILD SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

[www.fairchildsemi.com](http://www.fairchildsemi.com)

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor  
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910  
**Japan Customer Focus Center**  
Phone: 81-3-5817-1050

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>  
For additional information, please contact your local  
Sales Representative