



## 74VHC123A

# Dual Retriggerable Monostable Multivibrator

### Features

- High Speed:  $t_{PD} = 8.1\text{ns}$  (Typ.) at  $T_A = 25^\circ\text{C}$
- Low Power Dissipation:  $I_{CC} = 4\mu\text{A}$  (Max) at  $T_A = 25^\circ\text{C}$
- Active State:  $I_{CC} = 600\mu\text{A}$  (Max.) at  $T_A = 25^\circ\text{C}$
- High Noise Immunity:  $V_{NIH} = V_{NIL} = 28\%$   $V_{CC}$  (Min.)
- Power down protection is provided on all inputs
- Pin and function compatible with 74HC123A

### General Description

The VHC123A is an advanced high speed CMOS Monostable Multivibrator fabricated with silicon gate CMOS technology. It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation. Each multivibrator features both a negative, A, and a positive, B, transition triggered input, either of which can be used as an inhibit input. Also included is a clear input that when taken low resets the one-shot. The VHC123A can be triggered on the positive transition of the clear while A is held low and B is held high. The output pulse width is determined by the equation:  $PW = (R_x)(C_x)$ ; where PW is in seconds, R is in ohms, and C is in farads.

#### Limits for $R_x$ and $C_x$ are:

External capacitor,  $C_x$ : No limit

External resistors,  $R_x$ :  $V_{CC} = 2.0\text{V}$ ,  $5\text{k}\Omega$  min  
 $V_{CC} > 3.0\text{V}$ ,  $1\text{k}\Omega$  min

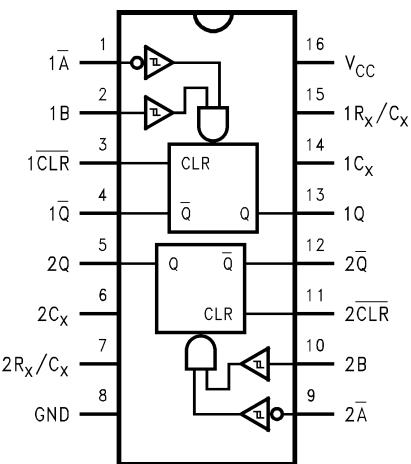
An input protection circuit ensures that 0 to 7V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5V to 3V systems and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.

### Ordering Information

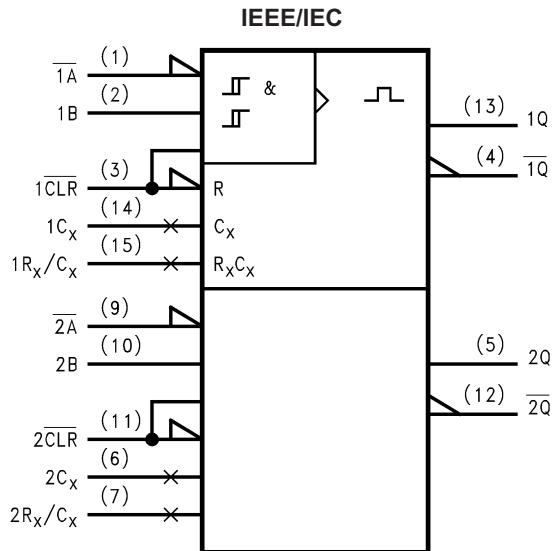
Order Number	Package Number	Package Description
74VHC123AM	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74VHC123ASJ	M16D	16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74VHC123AMTC	MTC16	16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

Surface mount packages are also available on Tape and Reel. Specify by appending the suffix letter "X" to the ordering number.

### Connection Diagram



### Logic Symbol



### Pin Description

Pin Names	Description
A	Trigger Inputs (Negative Edge)
B	Trigger Inputs (Positive Edge)
CLR	Reset Inputs
C <sub>x</sub>	External Capacitor
R <sub>x</sub>	External Resistor
Q, $\bar{Q}$	Outputs

### Truth Table

A	B	CLR	Outputs		Function
			Q	$\bar{Q}$	
$\sim$	H	H	$\bar{Q}$	Q	Output Enable
X	L	H	L	H	Inhibit
H	X	H	L	H	Inhibit
L	$\swarrow$	H	$\bar{Q}$	Q	Output Enable
L	H	$\swarrow$	$\bar{Q}$	Q	Output Enable
X	X	L	L	H	Reset

H = HIGH Voltage Level

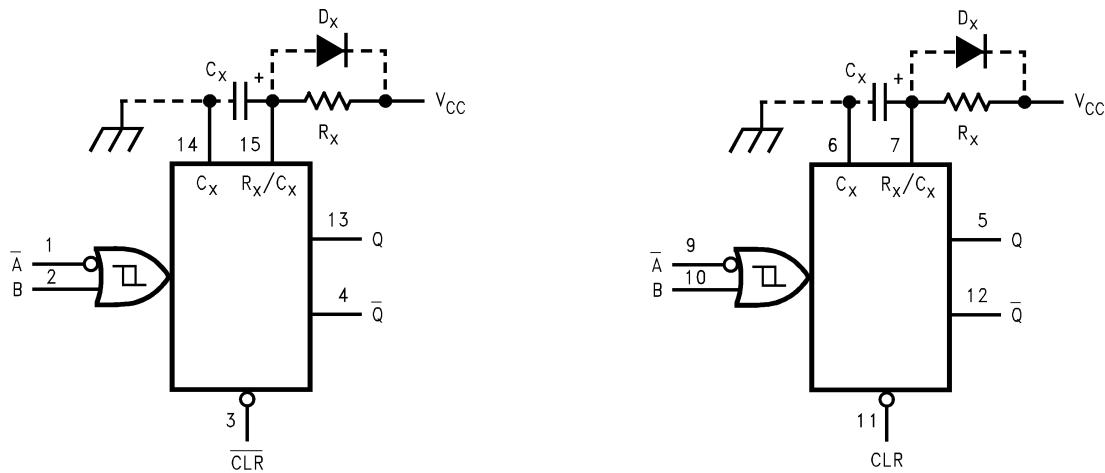
L = LOW Voltage Level

$\sim$  = HIGH-to-LOW Transition

$\swarrow$  = LOW-to-HIGH Transition

X = Don't Care

## Block Diagrams



**Note A:**  $C_x$ ,  $R_x$ ,  $D_x$  are external Capacitor, Resistor, and Diode, respectively.

**Note B:** External clamping diode,  $D_x$ ;

External capacitor is charged to  $V_{CC}$  level in the wait state, i.e. when no trigger is applied.

If the supply voltage is turned off,  $C_x$  discharges mainly through the internal (parasitic) diode. If  $C_x$  is sufficiently large and  $V_{CC}$  drops rapidly, there will be some possibility of damaging the IC through in rush current or latch-up. If the capacitance of the supply voltage filter is large enough and  $V_{CC}$  drops slowly, the in rush current is automatically limited and damage to the IC is avoided.

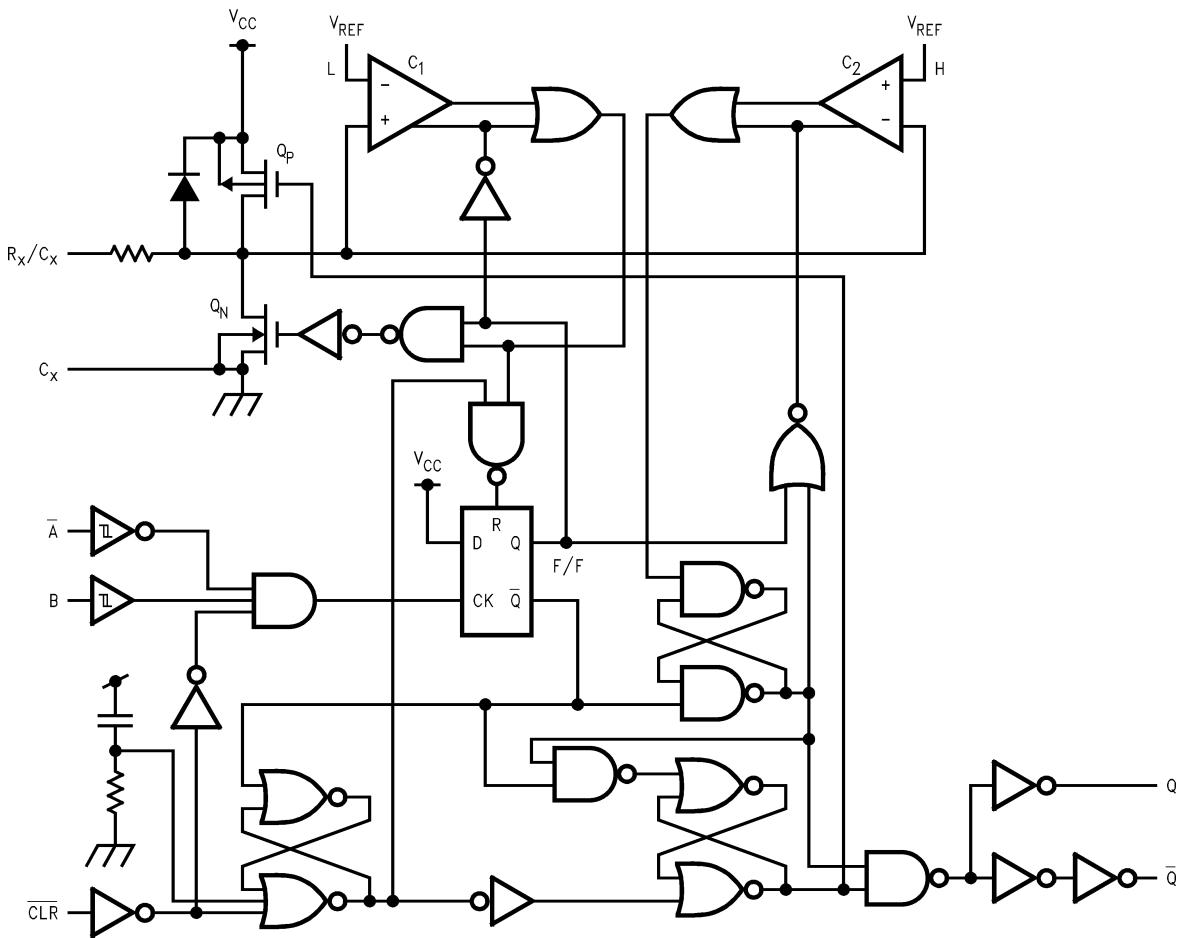
The maximum value of forward current through the parasitic diode is  $\pm 20\text{mA}$ . In the case of a large  $C_x$ , the limit of fall time of the supply voltage is determined as follows:

$$t_f \geq (V_{CC} - 0.7) C_x / 20\text{mA}$$

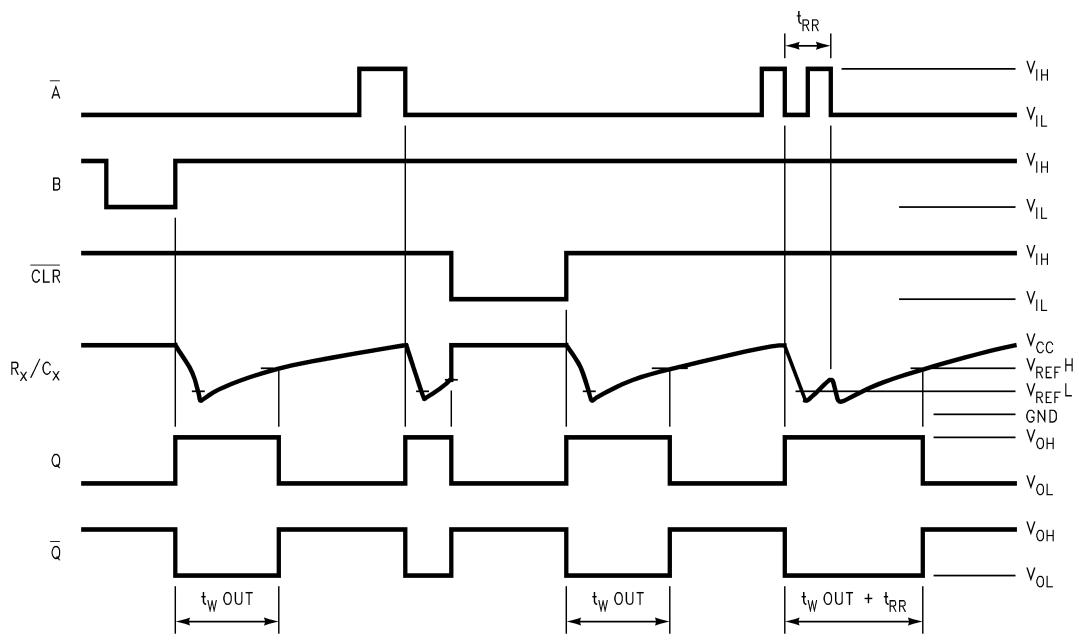
( $t_f$  is the time between the supply voltage turn off and the supply voltage reaching  $0.4 V_{CC}$ )

In the event a system does not satisfy the above condition, an external clamping diode ( $D_x$ ) is needed to protect the IC from rush current.

### System Diagram



### Timing Chart



## Functional Description

### 1. Stand-by State

The external capacitor ( $C_x$ ) is fully charged to  $V_{CC}$  in the Stand-by State. That means, before triggering, the  $Q_P$  and  $Q_N$  transistors which are connected to the  $R_x/C_x$  node are in the off state. Two comparators that relate to the timing of the output pulse, and two reference voltage supplies turn off. The total supply current is only leakage current.

### 2. Trigger Operation

Trigger operation is effective in any of the following three cases. First, the condition where the  $\bar{A}$  input is LOW, and B input has a rising signal; second, where the B input is HIGH, and the A input has a falling signal; and third, where the  $\bar{A}$  input is LOW and the B input is HIGH, and the  $\overline{CLR}$  input has a rising signal.

After a trigger becomes effective, comparators  $C_1$  and  $C_2$  start operating, and  $Q_N$  is turned on. The external capacitor discharges through  $Q_N$ . The voltage level at the  $R_x/C_x$  node drops. If the  $R_x/C_x$  voltage level falls to the internal reference voltage  $V_{refL}$ , the output of  $C_1$  becomes LOW. The flip-flop is then reset and  $Q_N$  turns off. At that moment  $C_1$  stops but  $C_2$  continues operating.

After  $Q_N$  turns off, the voltage at the  $R_x/C_x$  node starts rising at a rate determined by the time constant of external capacitor  $C_x$  and resistor  $R_x$ .

Upon triggering, output Q becomes HIGH, following some delay time of the internal F/F and gates. It stays HIGH even if the voltage of  $R_x/C_x$  changes from falling to rising. When  $R_x/C_x$  reaches the internal reference voltage  $V_{refH}$ , the output of  $C_2$  becomes LOW,

the output Q goes LOW and  $C_2$  stops its operation. That means, after triggering, when the voltage level of the  $R_x/C_x$  node reaches  $V_{refH}$ , the IC returns to its MONOSTABLE state.

With large values of  $C_x$  and  $R_x$ , and ignoring the discharge time of the capacitor and internal delays of the IC, the width of the output pulse,  $t_W$  (OUT), is as follows:

$$t_W(\text{OUT}) = 1.0 C_x R_x$$

### 3. Retrigger operation (74VHC123A)

When a new trigger is applied to either input  $\bar{A}$  or B while in the MONOSTABLE state, it is effective only if the IC is charging  $C_x$ . The voltage level of the  $R_x/C_x$  node then falls to  $V_{refL}$  level again. Therefore the Q output stays HIGH if the next trigger comes in before the time period set by  $C_x$  and  $R_x$ .

If the new trigger is very close to a previous trigger, such as an occurrence during the discharge cycle, it will have no effect.

The minimum time for a trigger to be effective 2nd trigger,  $t_{RR}$  (Min), depends on  $V_{CC}$  and  $C_x$ .

### 4. Reset Operation

In normal operation, the  $\overline{CLR}$  input is held HIGH. If  $\overline{CLR}$  is LOW, a trigger has no affect because the Q output is held LOW and the trigger control F/F is reset. Also,  $Q_P$  turns on and  $C_x$  is charged rapidly to  $V_{CC}$ .

This means if  $\overline{CLR}$  is set LOW, the IC goes into a wait state.

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Rating
$V_{CC}$	Supply Voltage	−0.5V to +7.0V
$V_{IN}$	DC Input Voltage	−0.5V to +7.0V
$V_{OUT}$	DC Output Voltage	−0.5V to $V_{CC}$ + 0.5V
$I_{IK}$	Input Diode Current	−20mA
$I_{OK}$	Output Diode Current	±20mA
$I_{OUT}$	DC Output Current	±25mA
$I_{CC}$	DC $V_{CC}$ / GND Current	±50mA
$T_{STG}$	Storage Temperature	−65°C to +150°C
$T_L$	Lead Temperature (Soldering, 10 seconds)	260°C

## Recommended Operating Conditions<sup>(1)</sup>

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Rating
$V_{CC}$	Supply Voltage	2.0V to +5.5V
$V_{IN}$	Input Voltage	0V to +5.5V
$V_{OUT}$	Output Voltage	0V to $V_{CC}$
$T_{OPR}$	Operating Temperature	−40°C to +85°C
$t_r, t_f$	Input Rise and Fall Time (CLR only)	
	$V_{CC} = 3.3V \pm 0.3V$	0ns/V ~ 100ns/V
	$V_{CC} = 5.0V \pm 0.5V$	0ns/V ~ 20ns/V
	External Capacitor, $C_x$	No Limitation <sup>(2)</sup> F
	External Resistor, $R_x$	>5kΩ <sup>(2)</sup> ( $V_{CC} = 2.0V$ ) >1kΩ <sup>(2)</sup> ( $V_{CC} > 3.0V$ )

### Notes:

1. Unused inputs must be held HIGH or LOW. They may not float.
2. The maximum allowable values of  $C_x$  and  $R_x$  are a function of the leakage of capacitor  $C_x$ , the leakage of the device, and leakage due to board layout and surface resistance. Susceptibility to externally induced noise signals may occur for  $R_x > 1M\Omega$ .

## DC Electrical Characteristics

Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	T <sub>A</sub> = 25°C			T <sub>A</sub> = -40° to 85°C		Units
				Min.	Typ.	Max.	Min.	Max.	
V <sub>IH</sub>	HIGH Level Input Voltage	2.0		1.50			1.50		V
		3.0–5.5		0.7 × V <sub>CC</sub>			0.7 × V <sub>CC</sub>		
V <sub>IL</sub>	LOW Level Input Voltage	2.0				0.50		0.50	V
		3.0–5.5				0.3 × V <sub>CC</sub>		0.3 × V <sub>CC</sub>	
V <sub>OH</sub>	HIGH Level Output Voltage	2.0	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -50µA	1.9	2.0		1.9	V
		3.0			2.9	3.0		2.9	
		4.5			4.4	4.5		4.4	
		3.0		I <sub>OH</sub> = -4mA	2.58			2.48	
		4.5			3.94			3.80	
V <sub>OL</sub>	LOW Level Output Voltage	2.0	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 50µA		0.0	0.1		V
		3.0				0.0	0.1		
		4.5				0.0	0.1		
		3.0		I <sub>OL</sub> = 4mA			0.36		
		4.5					0.36		
I <sub>IN</sub>	Input Leakage Current	0–5.5	V <sub>IN</sub> = 5.5V or GND			±0.1		±1.0	µA
I <sub>IN</sub>	R <sub>x</sub> /C <sub>x</sub> Terminal Off-State Current	5.5	V <sub>IN</sub> = V <sub>CC</sub> or GND			±0.25		±2.50	µA
I <sub>CC</sub>	Quiescent Supply Current	5.5	V <sub>IN</sub> = V <sub>CC</sub> or GND			4.0		40.0	µA
I <sub>CC</sub>	Active—State <sup>(3)</sup> Supply Current	3.0	V <sub>IN</sub> = V <sub>CC</sub> or GND, R <sub>x</sub> /C <sub>x</sub> = 0.5 V <sub>CC</sub>		160	250		280	µA
		4.5			380	500		650	
		5.5			560	750		975	

## Note:

3. Per circuit.

AC Electrical Characteristics<sup>(4)</sup>

Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	T <sub>A</sub> = 25°C			T <sub>A</sub> = -40°C to +85°C		Units
				Min.	Typ.	Max.	Min.	Max.	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay Time (A, B-Q, $\bar{Q}$ )	3.3 ± 0.3	C <sub>L</sub> = 15 pF		13.4	20.6	1.0	24.0	ns
			C <sub>L</sub> = 50 pF		15.9	24.1	1.0	27.5	
		5.0 ± 0.5	C <sub>L</sub> = 15 pF		8.1	12.0	1.0	14.0	ns
			C <sub>L</sub> = 50 pF		9.6	14.0	1.0	16.0	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay Time ( $\bar{CLR}$ Trigger—Q, $\bar{Q}$ )	3.3 ± 0.3	C <sub>L</sub> = 15 pF		14.5	22.4	1.0	26.0	ns
			C <sub>L</sub> = 50 pF		17.0	25.9	1.0	29.5	
		5.0 ± 0.5	C <sub>L</sub> = 15 pF		8.7	12.9	1.0	15.0	ns
			C <sub>L</sub> = 50 pF		10.2	14.9	1.0	17.0	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay Time ( $\bar{CLR}$ —Q, $\bar{Q}$ )	3.3 ± 0.3	C <sub>L</sub> = 15 pF		10.3	15.8	1.0	18.5	ns
			C <sub>L</sub> = 50 pF		12.8	19.3	1.0	22.0	
		5.0 ± 0.5	C <sub>L</sub> = 15 pF		6.3	9.4	1.0	11.0	ns
			C <sub>L</sub> = 50 pF		7.8	11.4	1.0	13.0	
t <sub>WOUT</sub>	Output Pulse Width	3.3 ± 0.3	C <sub>L</sub> = 50pF, C <sub>x</sub> = 28pF, R <sub>x</sub> = 2kΩ		160	240		300	ns
		5.0 ± 0.5			133	200		240	
		3.3 ± 0.3	C <sub>L</sub> = 50pF, C <sub>x</sub> = 0.01μF, R <sub>x</sub> = 10kΩ	90	100	110	90	110	μs
		5.0 ± 0.5		90	100	110	90	110	
		3.3 ± 0.3	C <sub>L</sub> = 50pF, C <sub>x</sub> = 0.1μF, R <sub>x</sub> = 1kΩ	0.9	1.0	1.1	0.9	1.1	ms
		5.0 ± 0.5		0.9	1.0	1.1	0.9	1.1	
Δt <sub>WOUT</sub>	Output Pulse Width Error Between Circuits (In same Package)				±1				%
C <sub>IN</sub>	Input Capacitance		V <sub>CC</sub> = Open		4	10		10	pF
C <sub>PD</sub>	Power Dissipation Capacitance		(5)		73				pF

## Notes:

- Refer to Timing Chart.
- C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation:

$$I_{CC} (\text{opr.}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}^1 \cdot \text{Duty} / 100 + I_{CC} / 2 \text{ (per Circuit)}$$

I<sub>CC</sub><sup>1</sup>: Active Supply Current

Duty: %

AC Operating Requirement<sup>(6)</sup>

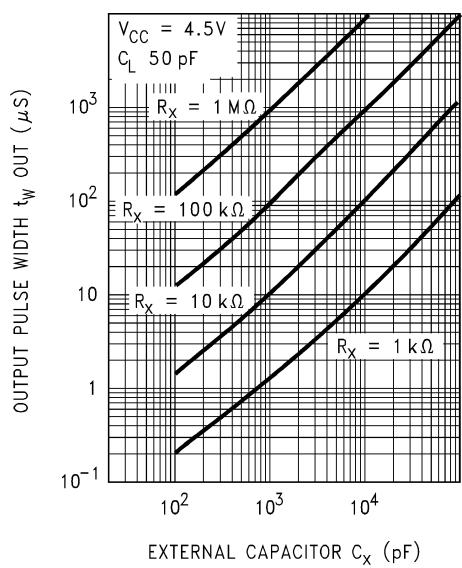
Symbol	Parameter	V <sub>cc</sub> (V)	Conditions	T <sub>A</sub> = 25°C			T <sub>A</sub> = -40°C to +85°C		Units
				Min.	Typ.	Max.	Min.	Max.	
t <sub>W</sub> (L), t <sub>W</sub> (H)	Minimum Trigger Pulse Width	3.3		5.0			5.0		ns
		5.0		5.0			5.0		
t <sub>W</sub> (L)	Minimum Clear Pulse Width	3.3		5.0			5.0		ns
		5.0		5.0			5.0		
t <sub>RR</sub>	Minimum Retrigger Time	3.3 ± 0.3	R <sub>x</sub> = 1kΩ, C <sub>x</sub> = 100pF		60				ns
		5.0 ± 0.5			39				
		3.3	R <sub>x</sub> = 1kΩ, C <sub>x</sub> = 0.01μF		1.5				μs
		5.0			1.2				

## Note:

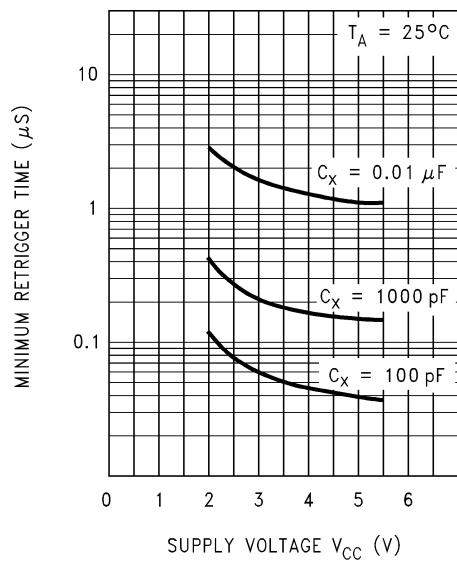
6. Refer to Timing Chart.

## Device Characteristics

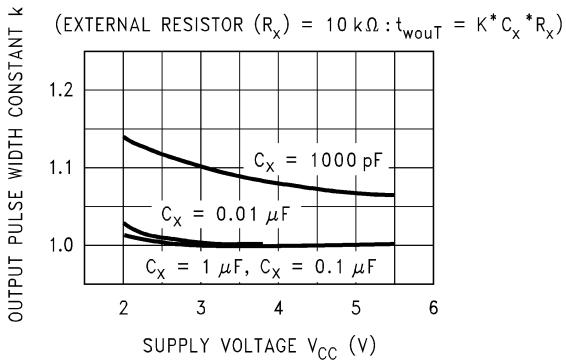
### $t_{wout} \cdot C_x$ Characteristics (Typ.)



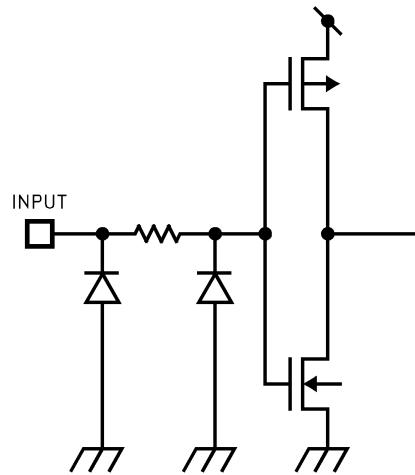
### $t_{RR} \cdot V_{CC}$ Characteristics (Typ.)



### Output Pulse Width Constant K-Supply Voltage (Typ.)

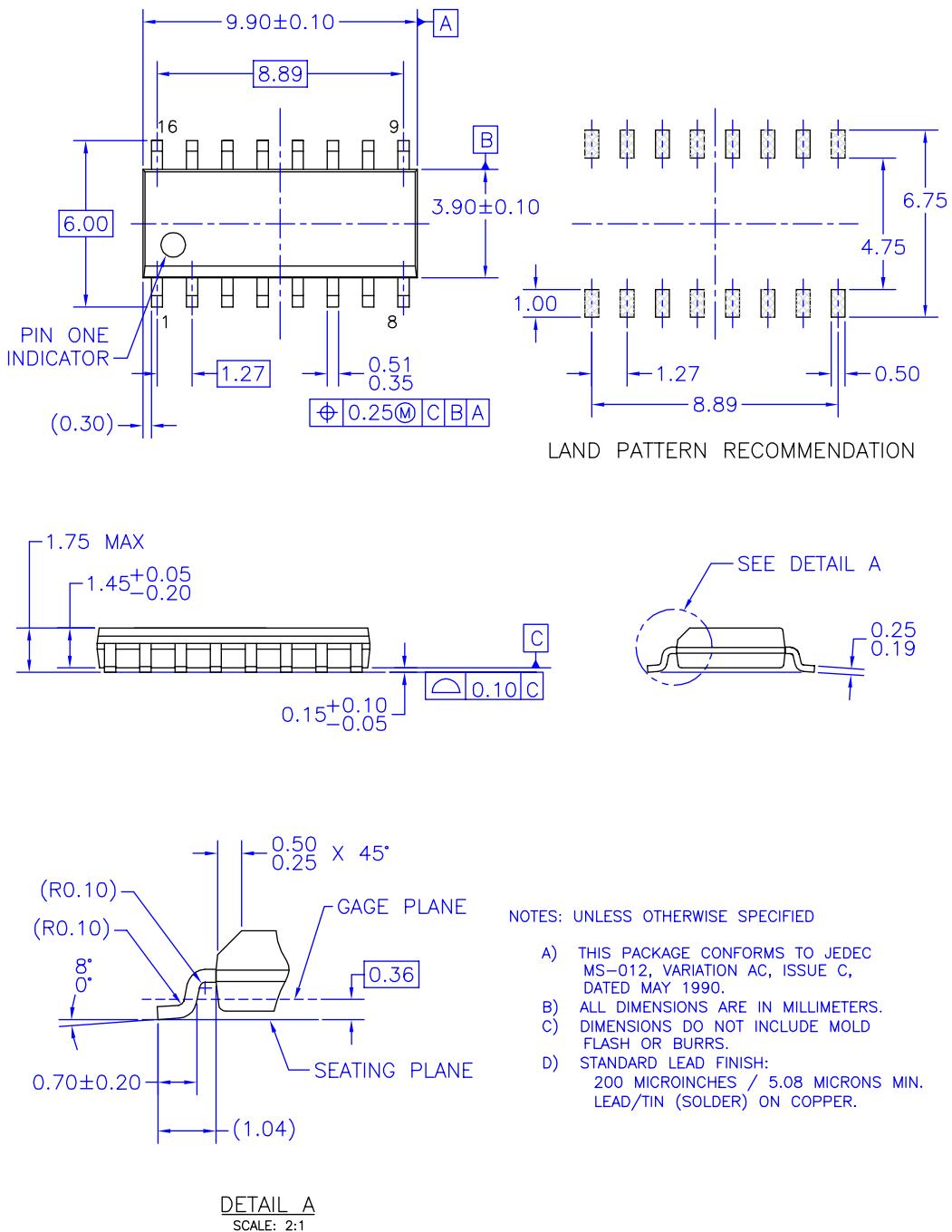


### Input Equivalent Circuit



## Physical Dimensions

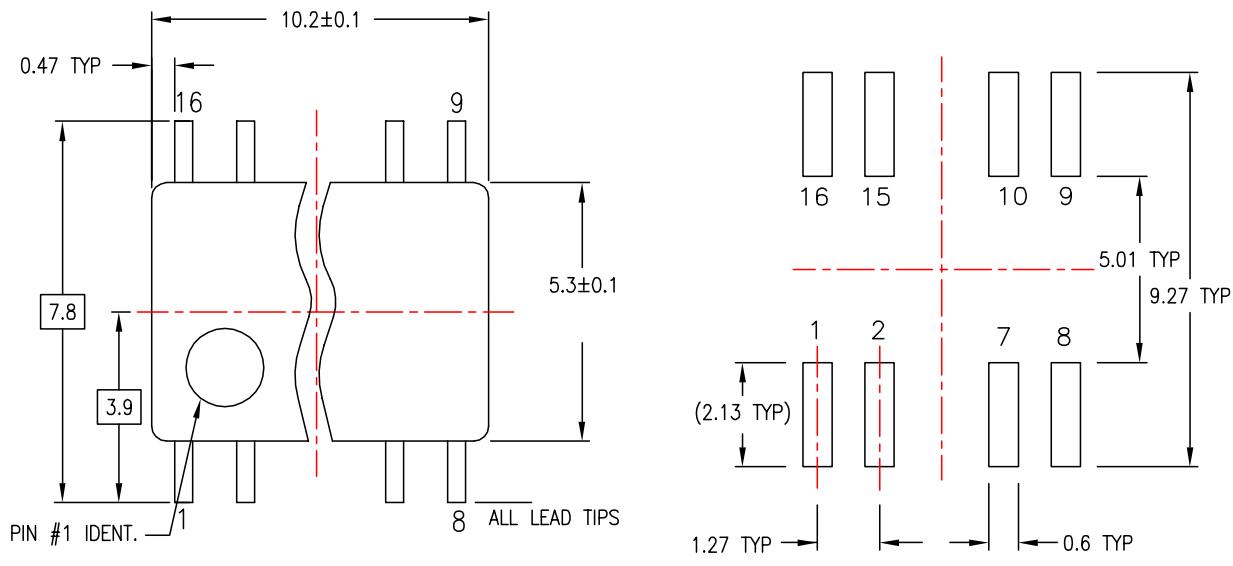
Dimensions are in millimeters unless otherwise noted.



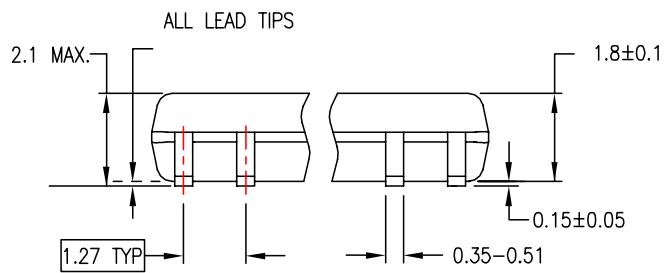
**Figure 1. 16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow Package Number M16A**

**Physical Dimensions (Continued)**

Dimensions are in millimeters unless otherwise noted.



LAND PATTERN RECOMMENDATION

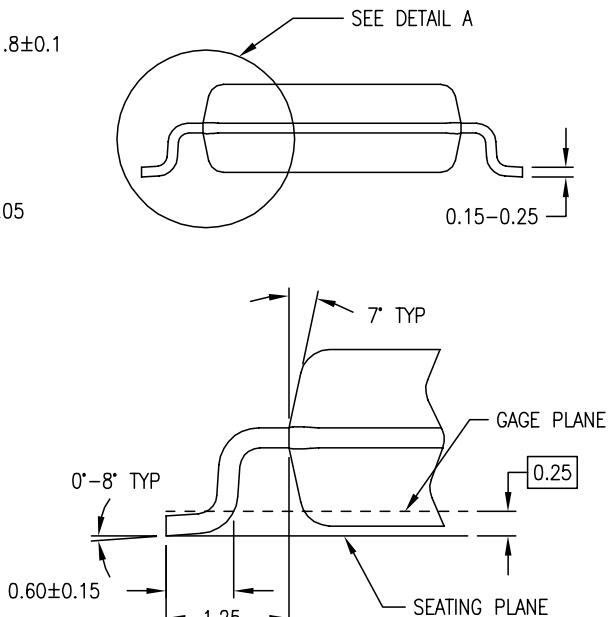


DIMENSIONS ARE IN MILLIMETERS

NOTES:

- A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

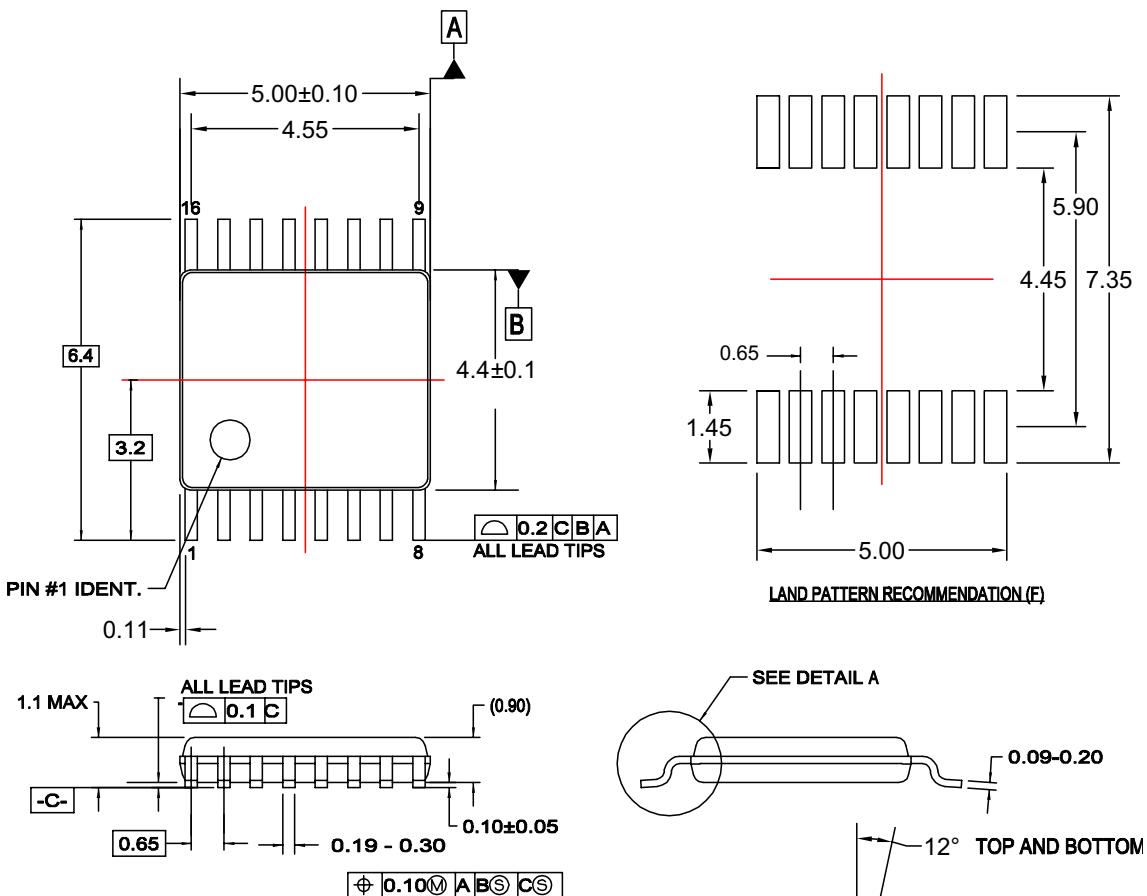
M16DREVC



DETAIL A

**Figure 2. 16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide  
Package Number M16D**

**Physical Dimensions** (Continued)  
Dimensions are in millimeters unless otherwise noted.

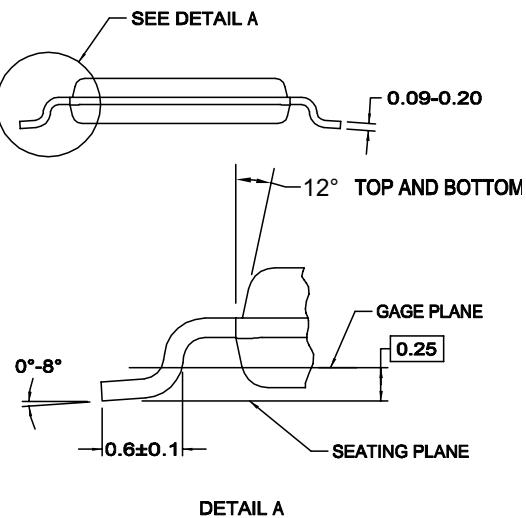


**NOTES:**

- CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB
- DIMENSIONS ARE IN MILLIMETERS
- DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS
- DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 1994
- DRAWING FILE NAME: MTC16REV4
- LAND PATTERN RECOMMENDATION PER IPC7351 - ID# TSOP65P640X110-16N

MTC16rev4

**Figure 3. 16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide Package Number MTC16**





## TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

ACE <sup>®</sup>	i-Lo <sup>™</sup>	Power-SPM <sup>™</sup>	TinyBoost <sup>™</sup>
Across the board. Around the world. <sup>™</sup>	ImpliedDisconnect <sup>™</sup>	PowerTrench <sup>®</sup>	TinyBuck <sup>™</sup>
ActiveArray <sup>™</sup>	IntelliMAX <sup>™</sup>	Programmable Active Droop <sup>™</sup>	TinyLogic <sup>®</sup>
Bottomless <sup>™</sup>	ISOPLANAR <sup>™</sup>	QFET <sup>®</sup>	TINYOPTO <sup>™</sup>
Build it Now <sup>™</sup>	MICROCOUPLER <sup>™</sup>	QS <sup>™</sup>	TinyPower <sup>™</sup>
CoolFET <sup>™</sup>	MicroPak <sup>™</sup>	QT Optoelectronics <sup>™</sup>	TinyWire <sup>™</sup>
CROSSVOLT <sup>™</sup>	MICROWIRE <sup>™</sup>	Quiet Series <sup>™</sup>	TruTranslation <sup>™</sup>
CTL <sup>™</sup>	Motion-SPM <sup>™</sup>	RapidConfigure <sup>™</sup>	μSerDes <sup>™</sup>
Current Transfer Logic <sup>™</sup>	MSX <sup>™</sup>	RapidConnect <sup>™</sup>	UHC <sup>®</sup>
DOME <sup>™</sup>	MSXPro <sup>™</sup>	ScalarPump <sup>™</sup>	UniFET <sup>™</sup>
E <sup>2</sup> CMOS <sup>™</sup>	OCX <sup>™</sup>	SMART START <sup>™</sup>	VCX <sup>™</sup>
EcoSPARK <sup>®</sup>	OCXPro <sup>™</sup>	SPM <sup>®</sup>	Wire <sup>™</sup>
EnSign <sup>™</sup>	OPTOLOGIC <sup>®</sup>	STEALTH <sup>™</sup>	
FACT Quiet Series <sup>™</sup>	OPTOPLANAR <sup>®</sup>	SuperFET <sup>™</sup>	
FACT <sup>®</sup>	PACMAN <sup>™</sup>	SuperSOT <sup>™</sup> -3	
FAST <sup>®</sup>	PDP-SPM <sup>™</sup>	SuperSOT <sup>™</sup> -6	
FASTr <sup>™</sup>	POP <sup>™</sup>	SuperSOT <sup>™</sup> -8	
FPS <sup>™</sup>	Power220 <sup>®</sup>	SyncFET <sup>™</sup>	
FRFET <sup>®</sup>	Power247 <sup>®</sup>	TCM <sup>™</sup>	
GlobalOptoisolator <sup>™</sup>	PowerEdge <sup>™</sup>	The Power Franchise <sup>®</sup>	
GTO <sup>™</sup>	PowerSaver <sup>™</sup>		
HiSeC <sup>™</sup>			

## DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

## 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 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 of 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.

## PRODUCT STATUS DEFINITIONS

### Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild Semiconductor. The datasheet is printed for reference information only.

Rev. I26

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