MC74VHCT240A

Octal Bus Buffer/Line Driver

Inverting with 3−State Outputs

The MC74VHCT240A is an advanced high speed CMOS octal bus buffer fabricated with silicon gate CMOS technology. It achieves high speed operation similar to equivalent Bipolar Schottky TTL while maintaining CMOS low power dissipation.

The MC74VHCT240A is an inverting 3−state buffer, and has two active−low output enables. This device is designed to be used with 3−state memory address drivers, etc.

The VHCT inputs are compatible with TTL levels. This device can be used as a level converter for interfacing 3.3 V to 5.0 V, because it has full 5.0 V CMOS level output swings.

The VHCT240A input and output (when disabled) structures provide protection when voltages between 0 V and 5.5 V are applied, regardless of the supply voltage. These input and output structures help prevent device destruction caused by supply voltage−input/output voltage mismatch, battery backup, hot insertion, etc.

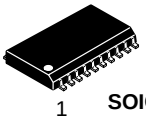
Features

- High Speed: t_{PD} = 5.6 ns (Typ) at V_{CC} = 5.0 V
- Low Power Dissipation: I_{CC} = 4 μA (Max) at T_A = 25°C
- TTL−Compatible Inputs: V_{IL} = 0.8 V; V_{IH} = 2.0 V
- Power Down Protection Provided on Inputs and Outputs
- Balanced Propagation Delays
- Designed for 4.5 V to 5.5 V Operating Range
- Low Noise: V_{OLP} = 1.1 V (Max)
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 300 mA
- ESD Performance:
  Human Body Model > 2000 V;
  Machine Model > 200 V
- Chip Complexity: 110 FETs or 27.5 Equivalent Gates
- These Devices are Pb−Free and are RoHS Compliant

ON Semiconductor®

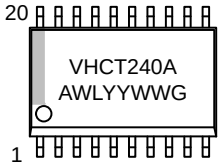
http://onsemi.com

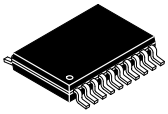
MARKING DIAGRAMS



1

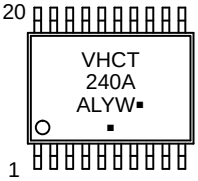
SOIC−20WB
SUFFIX DW
CASE 751D





1

TSSOP−20
SUFFIX DT
CASE 948E



A	=	Assembly Location
WL, L	=	Wafer Lot
YY, Y	=	Year
WW, W	=	Work Week
G or ▪	=	Pb−Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

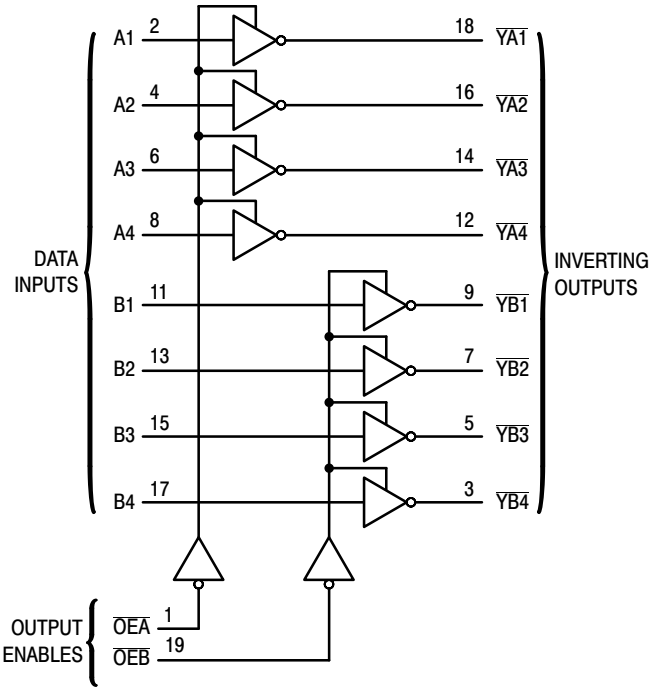


Figure 1. Logic Diagram

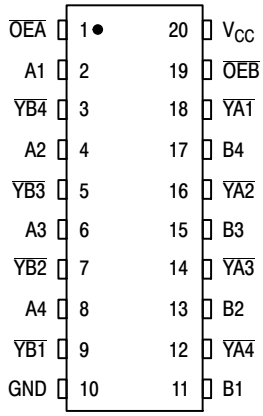


Figure 2. Pin Assignment

FUNCTION TABLE

INPUTS		OUTPUTS
$\overline{OEA}$, $\overline{OEB}$	A, B	$\overline{YA}$, $\overline{YB}$
L	L	H
L	H	L
H	X	Z

MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	DC Supply Voltage	– 0.5 to + 7.0	V
V_{in}	DC Input Voltage	– 0.5 to + 7.0	V
V_{out}	DC Output Voltage Output in 3−State High or Low State	– 0.5 to + 7.0 – 0.5 to V_{CC} + 0.5	V
I_{IK}	Input Diode Current	− 20	mA
I_{OK}	Output Diode Current (V_{OUT} < GND; V_{OUT} > V_{CC})	± 20	mA
I_{out}	DC Output Current, per Pin	± 25	mA
I_{CC}	DC Supply Current, V_{CC} and GND Pins	± 75	mA
P_D	Power Dissipation in Still Air, SOIC Package† TSSOP Package†	500 450	mW
T_{stg}	Storage Temperature	– 65 to + 150	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

†Derating − SOIC Package: – 7 mW/°C from 65° to 125°C
TSSOP Package: − 6.1 mW/°C from 65° to 125°C

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high−impedance circuit. For proper operation, V_{in} and V_{out} should be constrained to the range GND ≤ (V_{in} or V_{out}) ≤ V_{CC}.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V_{CC}). Unused outputs must be left open.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V_{CC}	DC Supply Voltage	4.5	5.5	V
V_{in}	DC Input Voltage	0	5.5	V
V_{out}	DC Output Voltage Output in 3−State High or Low State	0 0	5.5 V_{CC}	V
T_A	Operating Temperature	− 40	+ 85	°C
t_r, t_f	Input Rise and Fall Time V_{CC} =5.0V ±0.5V	0	20	ns/V

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V_{CC} V	T_A = 25°C			T_A = − 40 to 85°C		Unit
				Min	Typ	Max	Min	Max	
V_{IH}	Minimum High−Level Input Voltage		4.5 to 5.5	2.0			2.0		V
V_{IL}	Maximum Low−Level Input Voltage		4.5 to 5.5			0.8		0.8	V
V_{OH}	Minimum High−Level Output Voltage V_{in} = V_{IH} or V_{IL}	I_{OH} = − 50μA	4.5	4.4	4.5		4.4		V
		I_{OH} = − 8mA	4.5	3.94			3.80		
V_{OL}	Maximum Low−Level Output Voltage V_{in} = V_{IH} or V_{IL}	I_{OL} = 50μA	4.5		0.0	0.1		0.1	V
		I_{OL} = 8mA	4.5			0.36		0.44	
I_{in}	Maximum Input Leakage Current	V_{in} = 5.5 V or GND	0 to 5.5			± 0.1		± 1.0	μA
I_{OZ}	Maximum 3−State Leakage Current	V_{in} = V_{IL} or V_{IH} V_{out} = V_{CC} or GND	5.5			± 0.25		± 2.5	μA
I_{CC}	Maximum Quiescent Supply Current	V_{in} = V_{CC} or GND	5.5			4.0		40.0	μA
I_{CCT}	Quiescent Supply Current	Per Input: V_{IN} = 3.4V Other Input: V_{CC} or GND	5.5			1.35		1.50	mA
I_{OPD}	Output Leakage Current	V_{OUT} = 5.5V	0			0.5		5.0	μA

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

AC ELECTRICAL CHARACTERISTICS (Input t_r = t_f = 3.0ns)

Symbol	Parameter	Test Conditions		T_A = 25°C			T_A = − 40 to 85°C		Unit
				Min	Typ	Max	Min	Max	
t_{PLH}, t_{PHL}	Maximum Propagation Delay A to $\overline{YA}$ or B to $\overline{YB}$	V_{CC} = 5.0 ± 0.5V	C_L = 15pF C_L = 50pF		5.6 6.1	7.8 8.8	1.0 1.0	9.0 10.0	ns
t_{PZL}, t_{PZH}	Output Enable Time $\overline{OEA}$ to $\overline{YA}$ or $\overline{OEB}$ to $\overline{YB}$	V_{CC} = 5.0 ± 0.5V R_L = 1kΩ	C_L = 15pF C_L = 50pF		7.7 8.2	10.4 11.4	1.0 1.0	12.0 13.0	ns
t_{PLZ}, t_{PHZ}	Output Disable Time $\overline{OEA}$ to $\overline{YA}$ or $\overline{OEB}$ to $\overline{YB}$	V_{CC} = 5.0 ± 0.5V R_L = 1kΩ	C_L = 50pF		8.8	11.4	1.0	13.0	ns
t_{OSLH}, t_{OSHL}	Output to Output Skew	V_{CC} = 5.0 ± 0.5V (Note 1)	C_L = 50pF			1.0		1.0	ns
C_{in}	Maximum Input Capacitance				4	10		10	pF
C_{out}	Maximum Three−State Output Capacitance (Output in High−Impedance State)				9				pF

		Typical @ 25°C, V_{CC} = 5.0V	
C_{PD}	Power Dissipation Capacitance (Note 2)	19	pF

1. Parameter guaranteed by design. t_{OSLH} = $|t_{PLHm} - t_{PLHn}|$, t_{OSHL} = $|t_{PHLm} - t_{PHLn}|$.
2. C_{PD} 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: $I_{CC(OPR)} = C_{PD} \bullet V_{CC} \bullet f_{in} + I_{CC}/8$ (per bit). C_{PD} is used to determine the no−load dynamic power consumption; $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$.

NOISE CHARACTERISTICS (Input t_r = t_f = 3.0ns, C_L = 50pF, V_{CC} = 5.0V)

Symbol	Parameter	T_A = 25°C		Unit
		Typ	Max	
V_{OLP}	Quiet Output Maximum Dynamic V_{OL}	0.9	1.1	V
V_{OLV}	Quiet Output Minimum Dynamic V_{OL}	− 0.9	− 1.1	V
V_{IHD}	Minimum High Level Dynamic Input Voltage		2.0	V
V_{ILD}	Maximum Low Level Dynamic Input Voltage		0.8	V

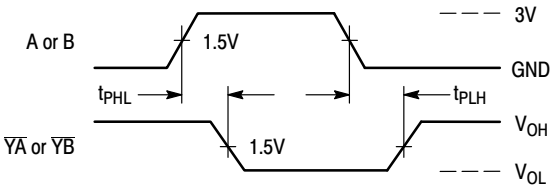


Figure 3. Switching Waveform

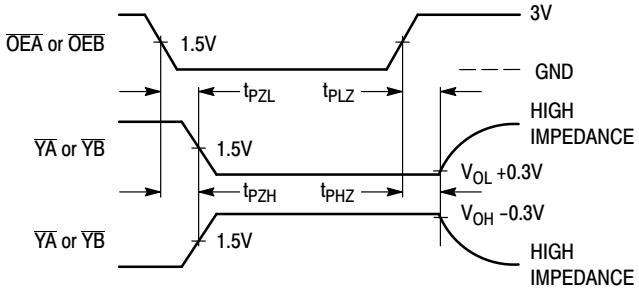
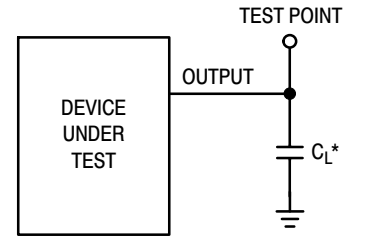
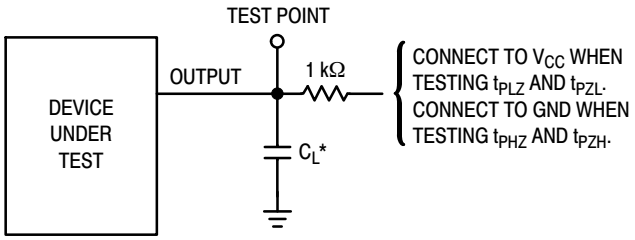


Figure 4. Switching Waveform



*Includes all probe and jig capacitance

Figure 5. Test Circuit



*Includes all probe and jig capacitance

Figure 6. Test Circuit

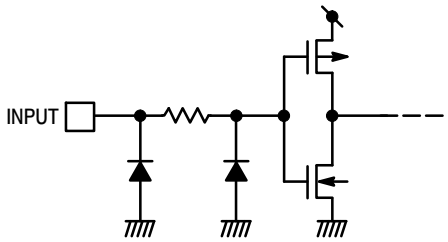


Figure 7. Input Equivalent Circuit

ORDERING INFORMATION

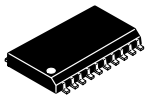
Device	Package	Shipping†
MC74VHCT240ADWRG	SOIC−20WB (Pb−Free)	1000 / Tape & Reel
MC74VHCT240ADTRG	TSSOP−20 (Pb−Free)	2500 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

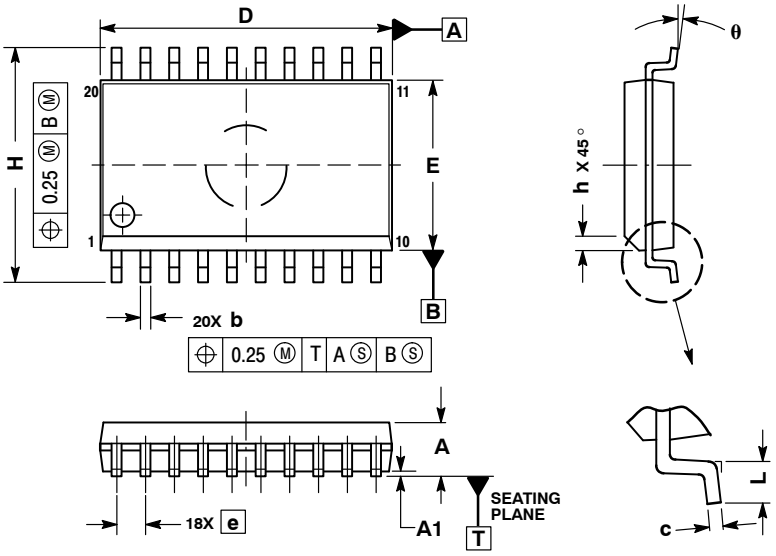
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

SOIC−20 WB
CASE 751D−05
ISSUE H

DATE 22 APR 2015



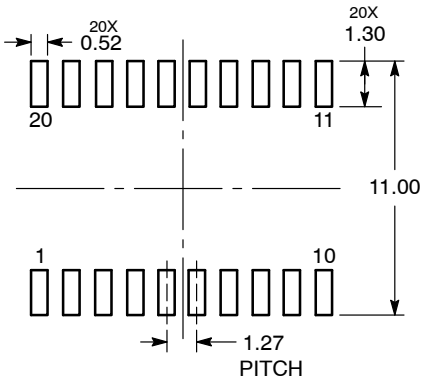
SCALE 1:1



NOTES:
1. DIMENSIONS ARE IN MILLIMETERS.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF B DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS	
DIM	MIN	MAX
A	2.35	2.65
A1	0.10	0.25
b	0.35	0.49
c	0.23	0.32
D	12.65	12.95
E	7.40	7.60
e	1.27 BSC	
H	10.05	10.55
h	0.25	0.75
L	0.50	0.90
θ	0°	7°

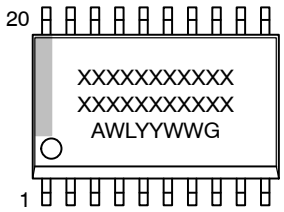
RECOMMENDED SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

GENERIC MARKING DIAGRAM*



XXXXX = Specific Device Code
A = Assembly Location
WL = Wafer Lot
YY = Year
WW = Work Week
G = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “▪”, may or may not be present. Some products may not follow the Generic Marking.

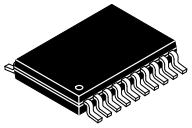
DOCUMENT NUMBER:	**98ASB42343B**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red.
DESCRIPTION:	**SOIC−20 WB**	**PAGE 1 OF 1**

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

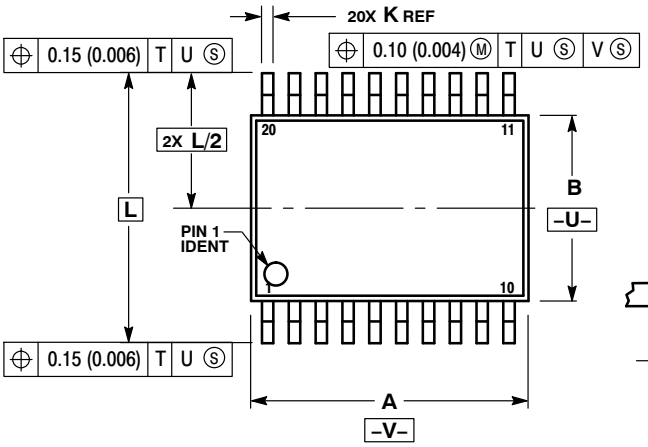
ON Semiconductor®

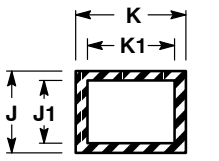
TSSOP−20 WB
CASE 948E
ISSUE D

DATE 17 FEB 2016

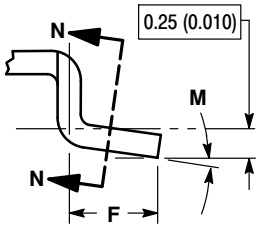


SCALE 2:1

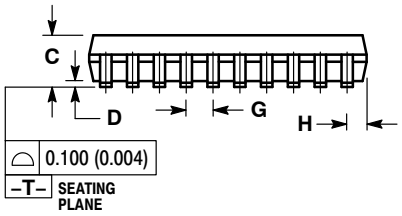


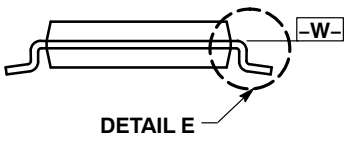


SECTION N−N



DETAIL E

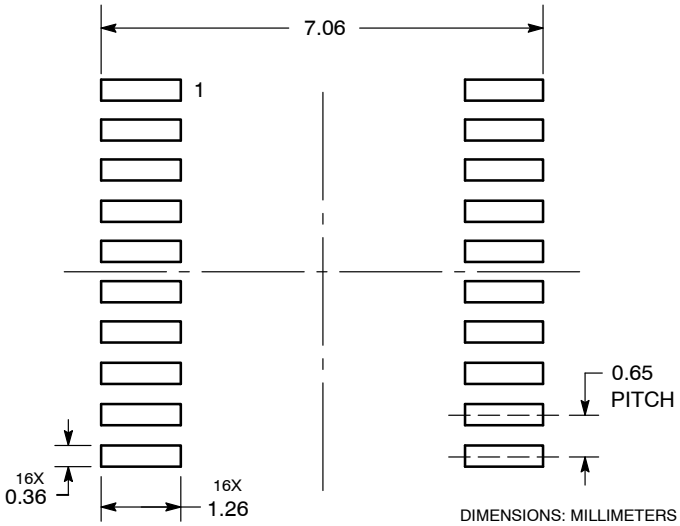




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE −W−.

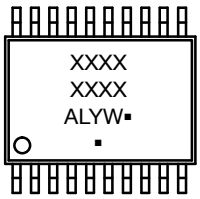
	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	6.40	6.60	0.252	0.260
B	4.30	4.50	0.169	0.177
C	---	1.20	---	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.27	0.37	0.011	0.015
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0°	8°	0°	8°

SOLDERING FOOTPRINT



DIMENSIONS: MILLIMETERS

GENERIC MARKING DIAGRAM*



A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
▪ = Pb−Free Package

(Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “ ▪”, may or may not be present.

DOCUMENT NUMBER:	98ASH70169A	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red.
DESCRIPTION:	TSSOP−20 WB	PAGE 1 OF 1

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Email Requests to: orderlit@onsemi.com

onsemi Website: www.onsemi.com

TECHNICAL SUPPORT
North American Technical Support:
Voice Mail: 1 800−282−9855 Toll Free USA/Canada
Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support:
Phone: 00421 33 790 2910
For additional information, please contact your local Sales Representative

◊