NLSV22T244

Dual 2-Bit Dual-Supply Non-Inverting Level Translator

The NLSV22T244 is a dual 2−bit configurable dual−supply bus buffer level translator. The input ports A and the output ports B are designed to track two different power supply rails V_{CCA} and V_{CCB}. Both supply rails are configurable from 1.6 V to 3.6 V allowing universal low−voltage translations from the input port A to the output B port.

Features

- Wide V_{CCA} and V_{CCB} Operating Range: 1.6 V to 3.6 V
- High−Speed w/ Balanced Propagation Delay
- Inputs and Outputs have OVT Protection to 5.5 V
- Non−preferential V_{CCA} and V_{CCB} Sequencing
- Outputs at 3−State until Active V_{CC} is reached
- Power−Off Protection
- Ultra−Small packaging: 1.7mm x 2.0 mm UQFN−12
- This is a Pb−Free Device

Typical Applications

- Mobile Phones, PDAs, Other Portable Devices

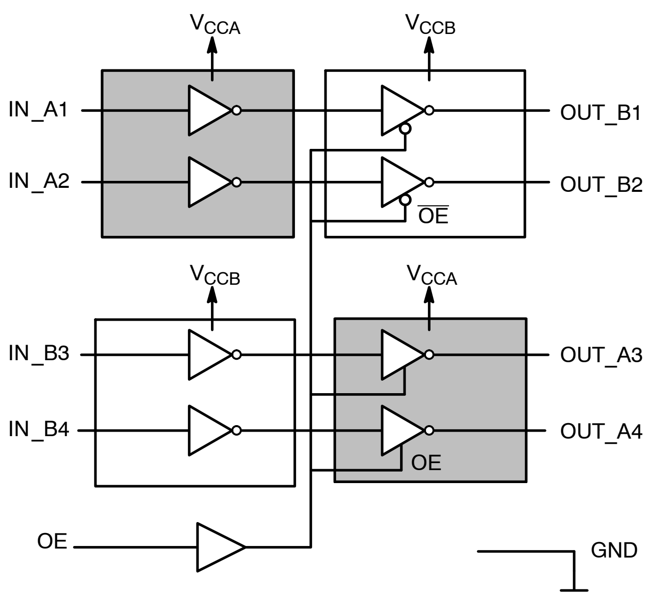

Figure 1. Logic Diagram

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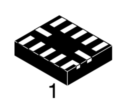
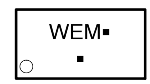


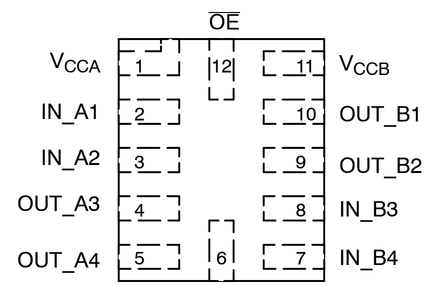
UQFN12
MU SUFFIX
CASE 523AE

MARKING DIAGRAM



WE = Specific Device Code
M = Date Code
▪ = Pb−Free Package
(Note: Microdot may be in either location)

PIN ASSIGNMENT

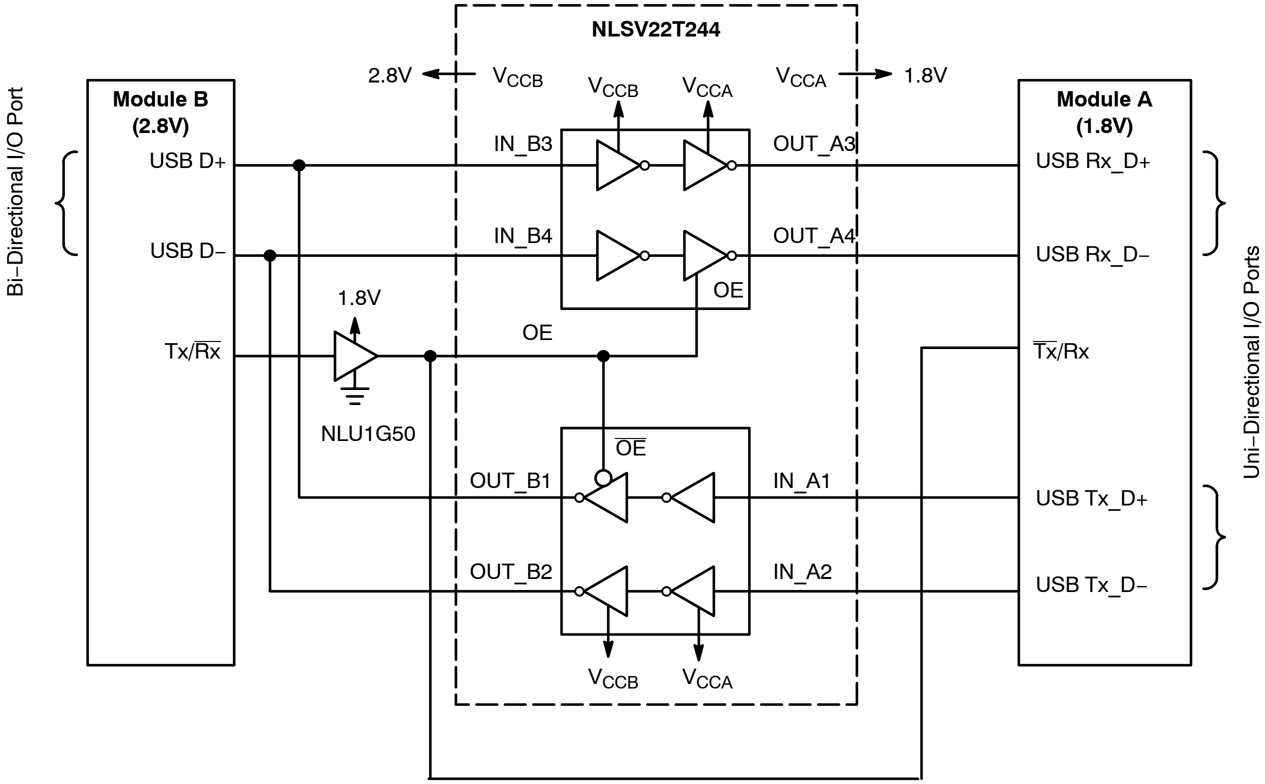


(Top View)

ORDERING INFORMATION

Device	Package	Shipping†
NLSV22T244MUTAG	UQFN12 (Pb−Free)	3000 / Tape & Reel

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



OE = High, Module B Transmits, Module A Receives = B → A

OE = Low, Module A Transmits, Module B Receives = A → B

Figure 2. Typical Application Bi−Directional to Uni−Directional Logic Level Translator

PIN ASSIGNMENT

Pin	Function
V_{CCA}	A DC Power Supply
V_{CCB}	B DC Power Supply
GND	Ground
IN_A1, IN_A2, IN_B3, IN_B4	Inputs
OUT_B1, OUT_B2, OUT_A3, OUT_A4	Outputs
OE	Output Enable

Inputs			Outputs	
OE	**IN_A1 IN_A2**	**IN_B3, IN_B4**	**OUT_B1, OUT_B2**	**OUT_A3 OUT_A4**
H	X	L	3−State	L
	L	H		H
L	L	X	L	3−State
	H		H	

MAXIMUM RATINGS

Symbol	Rating	Value	Condition	Unit
V_{CCA}, V_{CCB}	DC Supply Voltage	−0.5 to +5.5		V
V_I	DC Input Voltage IN_X_n	−0.5 to +5.5		V
V_C	Control Input OE	−0.5 to +5.5		V
V_O	DC Output Voltage (Power Down) OUT_X_n	−0.5 to +5.5	$V_{CCA} = V_{CCB} = 0$	V
	(Active Mode) OUT_X_n	−0.5 to +5.5		
	(Tri−State Mode) OUT_X_n	−0.5 to +5.5		
I_{IK}	DC Input Diode Current	−20	V_I < GND	mA
I_{OK}	DC Output Diode Current	−50	V_O < GND	mA
I_O	DC Output Source/Sink Current	±50		mA
I_{CCA}, I_{CCB}	DC Supply Current Per Supply Pin	±100		mA
I_{GND}	DC Ground Current per Ground Pin	±100		mA
T_{STG}	Storage Temperature	−65 to +150		°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V_{CCA}, V_{CCB}	Positive DC Supply Voltage	1.6	3.6	V
V_I	Bus Input Voltage	GND	3.6	V
V_C	Control Input OE	GND	3.6	V
V_{IO}	Bus Output Voltage (Power Down Mode) OUT_X_n	GND	3.6	V
	(Active Mode) OUT_X_n	GND	3.6	V
	(Tri−State Mode) OUT_X_n	GND	3.6	V
T_A	Operating Temperature Range	−40	+85	°C
$\Delta t / \Delta V$	Input Transition Rise or Rate V_I, from 30% to 70% of V_{CC}; V_{CC} = 3.3 V ±0.3 V	0	10	nS

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V_{CCA} (V)	V_{CCB} (V)	−40°C to +85°C Min	−40°C to +85°C Max	Unit
V_{IH}	Input HIGH Voltage		2.7 – 3.6	1.6 – 3.6	2.0	–	V
			2.3 – 2.7		1.6	–	
			1.4 – 2.3		0.65 * V_{CCA}	–	
V_{IL}	Input LOW Voltage		2.7 – 3.6	1.6 – 3.6	–	0.8	V
			2.3 – 2.7		–	0.7	
			1.6 – 2.3		–	0.35 * V_{CCA}	
V_{OH}	Output HIGH Voltage	I_{OH} = −100 μA; V_I = V_{IH}	1.6 – 3.6	1.6 – 3.6	V_{CCB} – 0.2	–	V
		I_{OH} = −6 mA; V_I = V_{IH}	1.6	1.6	1.25	–	
			2.3	2.3	2.0	–	
		I_{OH} = −12 mA; V_I = V_{IH}	2.3	2.3	1.8	–	
			2.7	2.7	2.2	–	
		I_{OH} = −18 mA; V_I = V_{IH}	2.3	2.3	1.7	–	
			3.0	3.0	2.4	–	
		I_{OH} = −24 mA; V_I = V_{IH}	3.0	3.0	2.2	–	
V_{OL}	Output LOW Voltage	I_{OL} = 100 μA; V_I = V_{IL}	1.6 – 3.6	1.6 – 3.6	–	0.2	V
		I_{OL} = 6 mA; V_I = V_{IL}	1.6	1.6	–	0.3	
		I_{OL} = 12 mA; V_I = V_{IL}	2.3	2.3	–	0.4	
			2.7	2.7	–	0.4	
		I_{OL} = 18 mA; V_I = V_{IL}	2.3	2.3	–	0.6	
			3.0	3.0	–	0.5	
		I_{OL} = 24 mA; V_I = V_{IL}	3.0	3.0	–	0.6	
I_I	Input Leakage Current	V_I = V_{CCA} or GND	1.6 – 3.6	1.6 – 3.6	−1.0	+1.0	μA
I_{OZ}	I/O Tri−State Output Leakage Current	T_A = 25°C, OE = GND	1.6 – 3.6	1.6 – 3.6	–	2.0	μA
I_{CCA}	Quiescent Supply Current	V_I = V_{CCA} or GND; I_O = 0	1.6 – 3.6	1.6 – 3.6	–	2.0	μA
I_{CCB}	Quiescent Supply Current	V_I = V_{CCA} or GND; I_O = 0	1.6 – 3.6	1.6 – 3.6	–	2.0	μA
I_{CCA} + I_{CCB}	Quiescent Supply Current	V_I = V_{CCA} or GND; I_O = 0	1.6 – 3.6	1.6 – 3.6	–	4.0	μA

TOTAL STATIC POWER CONSUMPTION (I_{CCA} + I_{CCB})

	−40°C to +85°C						
	V_{CCB} (V)						
	3.6		2.8		1.6		
V_{CCA} (V)	Min	Max	Min	Max	Min	Max	Unit
3.6		2		2		2	μA
2.8		< 1		< 1		< 0.5	μA
1.6		< 1		< 1		< 0.5	μA

NOTE: Connect ground before applying supply voltage V_{CCA} or V_{CCB}. This device is designed with the feature that the power−up sequence of V_{CCA} and V_{CCB} will not damage the IC.

AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V_{CCA} (V)	−40°C to +85°C						Unit
			V_{CCB} (V)						
			3.6		2.8		1.6		
			Min	Max	Min	Max	Min	Max	
t_{PLH}, t_{PHL}	Propagation Delay, A_n to B_n	3.6		3.4		3.6		3.8	nS
		2.8		3.6		3.8		4.0	
		1.6		3.9		4.0		4.5	
t_{PZH}, t_{PZL}	Output Enable, OE to OUT_X_n	3.6		5.8		6.0		6.2	nS
		2.8		6.0		6.2		6.4	
		1.6		8.2		8.4		8.6	
t_{PHZ}, t_{PLZ}	Output Disable, OE to OUT_X_n	3.6		5.8		6.0		6.2	nS
		2.8		6.0		6.2		6.4	
		1.6		8.2		8.4		8.6	
t_{OSHL}, t_{OSLH}	Output−to−Output Skew, Data−to−Output	3.6		0.15		0.15		0.15	nS
		2.8		0.15		0.15		0.15	
		1.6		0.15		0.15		0.15	

1. Propagation delays defined per Figure 3.

CAPACITANCE

Symbol	Parameter	Test Conditions	**Typ** (Note 2)	Unit
C_{IN}	Control Pin Input Capacitance	$V_{CCA} = V_{CCB} = 3.3$ V, $V_I = 0$ V or $V_{CCA/B}$	3.5	pF
$C_{I/O}$	I/O Pin Input Capacitance	$V_{CCA} = V_{CCB} = 3.3$ V, $V_I = 0$ V or $V_{CCA/B}$	5.0	pF
C_{PD}	Power Dissipation Capacitance	$V_{CCA} = V_{CCB} = 3.3$ V, $V_I = 0$ V or V_{CCA}, f = 10 MHz	10	pF

2. Typical values are at T_A = +25°C.
3. C_{PD} is defined as the value of the IC's equivalent capacitance from which the operating current can be calculated from: $I_{CC(operating)} \cong C_{PD} \times V_{CC} \times f_{IN} \times N_{SW}$ where $I_{CC} = I_{CCA} + I_{CCB}$ and N_{SW} = total number of outputs switching.

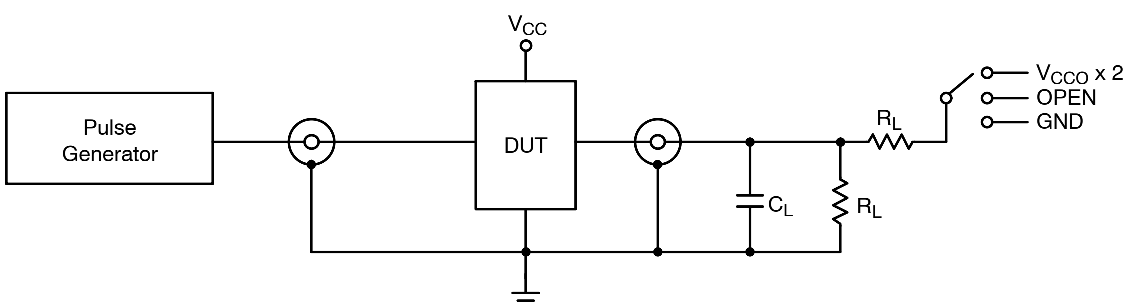
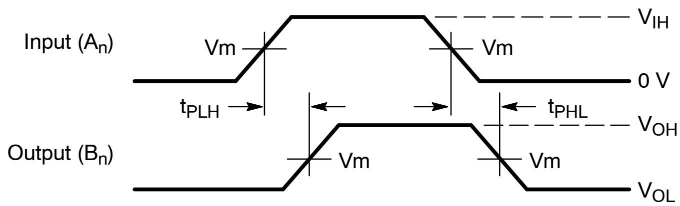


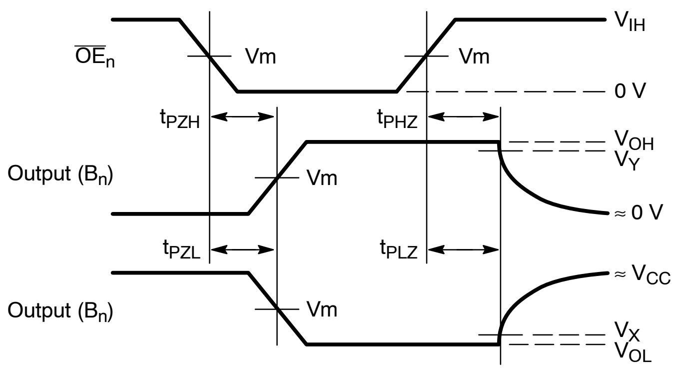
Figure 3. AC (Propagation Delay) Test Circuit

Test	Switch
t_{PLH}, t_{PHL}	OPEN
t_{PLZ}, t_{PZL}	V_{CCO} x 2 at VCCB = 3.0 V − 3.6 mV, 2.3 V − 2.7 V, 1.6 V − 1.95 V
t_{PHZ}, t_{PZH}	GND
C_L = 15 pF or equivalent (includes probe and jig capacitance) R_L = 2 kΩ or equivalent Z_{OUT} of pulse generator = 50 Ω	



Waveform 1 – Propagation Delays

$t_R = t_F = 2.0$ ns, 10% to 90%; f = 1 MHz; $t_W = 500$ ns



Waveform 2 – Output Enable and Disable Times

$t_R = t_F = 2.0$ ns, 10% to 90%; f = 1 MHz; $t_W = 500$ ns

Figure 4. AC (Propagation Delay) Test Circuit Waveforms

Symbol	V_{CC}
	3.0 V – 3.6 V
V_{mA}	$V_{CCA}/2$
V_{mB}	$V_{CCB}/2$
V_X	V_{OL} x 0.1
V_Y	V_{OH} x 0.9

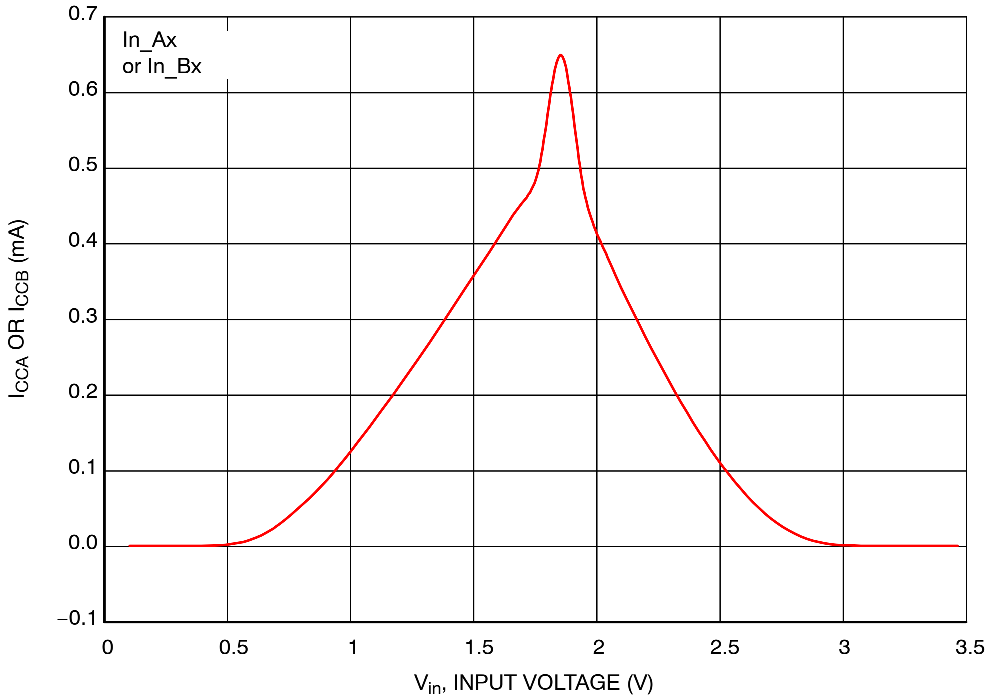
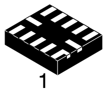


Figure 5. Delta I_{CC}
Increase in I_{CC} per Input Voltage, Other Inputs at V_{CCA} / V_{CCB} or GND

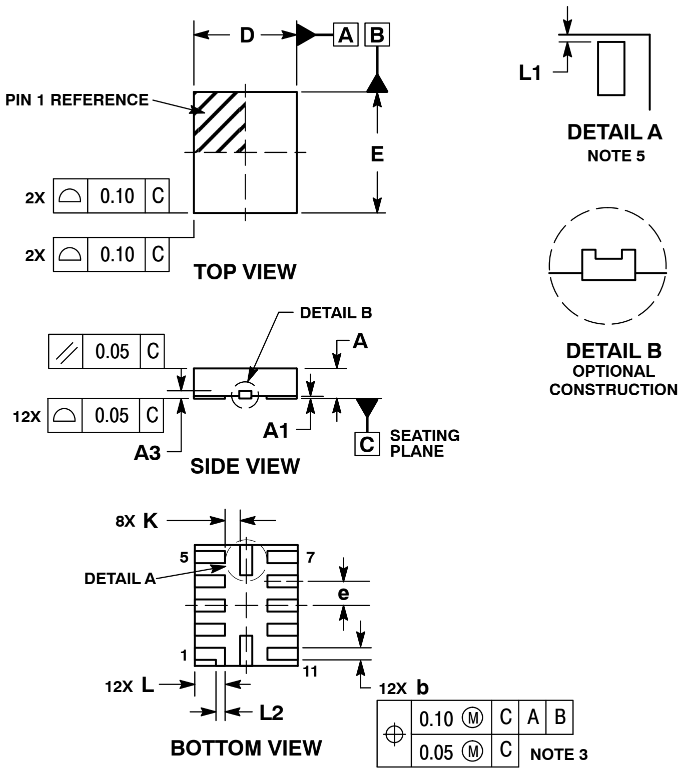
UQFN12 1.7x2.0, 0.4P

CASE 523AE−01
ISSUE A

DATE 11 JUN 2007



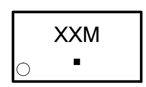
SCALE 4:1



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 MM FROM TERMINAL TIP.
4. MOLD FLASH ALLOWED ON TERMINALS ALONG EDGE OF PACKAGE. FLASH 0.03 MAX ON BOTTOM SURFACE OF TERMINALS.
5. DETAIL A SHOWS OPTIONAL CONSTRUCTION FOR TERMINALS.

	MILLIMETERS	
DIM	MIN	MAX
A	0.45	0.55
A1	0.00	0.05
A3	0.127 REF	
b	0.15	0.25
D	1.70 BSC	
E	2.00 BSC	
e	0.40 BSC	
K	0.20	----
L	0.45	0.55
L1	0.00	0.03
L2	0.15 REF	

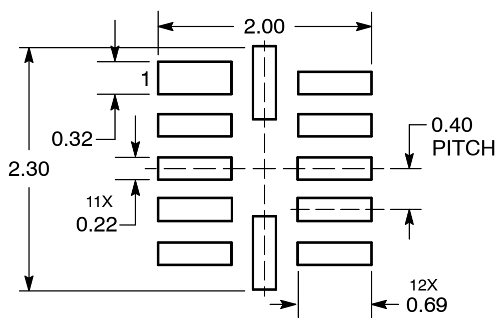
GENERIC MARKING DIAGRAM*



XX = Specific Device Code
M = Date Code
▪ = 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.

MOUNTING FOOTPRINT SOLDERMASK DEFINED



DIMENSIONS: MILLIMETERS

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DESCRIPTION:	UQFN12 1.7 X 2.0, 0.4P	PAGE 1 OF 1

PUBLICATION ORDERING INFORMATION

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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:
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