

CD4528BM/CD4528BC Dual Monostable Multivibrator

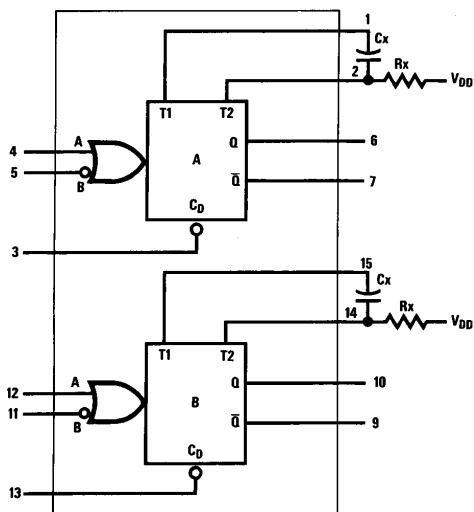
General Description

The CD4528B is a dual monostable multivibrator. Each device is retriggerable and resettable. Triggering can occur from either the rising or falling edge of an input pulse, resulting in an output pulse over a wide range of widths. Pulse duration and accuracy are determined by external timing components Rx and Cx.

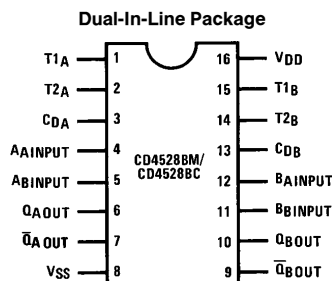
Features

- Wide supply voltage range 3.0V to 18V
- Separate reset available
- Quiescent current = 5.0 nA/package (typ.) at 5.0 V_{DC}
- Diode protection on all inputs
- Triggerable from leading or trailing edge pulse
- Capable of driving two low-power TTL loads or one low-power Schottky TTL load over the rated temperature range

Connection Diagrams



TL/F/5998-1



TL/F/5998-2

Top View
Order Number CD4528B

Truth Table

Inputs			Outputs	
Clear	A	B	Q	Q
L	X	X	L	H
X	H	X	L	H
X	X	L	L	H
H	L	↓	One High Level Pulse	One Low Level Pulse
H	↑	H	One Low Level Pulse	One High Level Pulse

H = High Level
L = Low Level
↑ = Transition from Low to High
↓ = Transition from High to Low
One High Level Pulse
One Low Level Pulse
X = Irrelevant

Absolute Maximum Ratings (Notes 1 & 2)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

DC Supply Voltage (V_{DD}) $-0.5 V_{DC}$ to $+18 V_{DC}$

Input Voltage, All Inputs (V_{IN}) $-0.5 V_{DC}$ to $V_{DD} + 0.5 V_{DC}$

Storage Temperature Range (T_S) -65°C to $+150^{\circ}\text{C}$

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 2)

DC Supply Voltage (V_{DD}) 3V to 15V

Input Voltage (V_{IN}) 0V to V_{DD}

Operating Temperature Range (T_A)
CD4528BM -55°C to $+125^{\circ}\text{C}$
CD4528BC -40°C to $+85^{\circ}\text{C}$

DC Electrical Characteristics CD4528BM (Note 2)

Symbol	Parameter	Conditions	-55°C		$+25^{\circ}\text{C}$			$+125^{\circ}\text{C}$		Units
			Min	Max	Min	Typ	Max	Min	Max	
I_{DD}	Quiescent Device Current	$V_{DD} = 5\text{V}$		5	0.005		5		150	μA
		$V_{DD} = 10\text{V}$		10	0.010		10		300	μA
		$V_{DD} = 15\text{V}$		20	0.015		20		600	μA
V_{OL}	Low Level Output Voltage	$V_{DD} = 5\text{V}$		0.05			0.05		0.05	V
		$V_{DD} = 10\text{V}$		0.05			0.05		0.05	V
		$V_{DD} = 15\text{V}$		0.05			0.05		0.05	V
V_{OH}	High Level Output Voltage	$V_{DD} = 5\text{V}$	4.95		4.95	5.0		4.95		V
		$V_{DD} = 10\text{V}$	9.95		9.95	10.0		9.95		V
		$V_{DD} = 15\text{V}$	14.95		14.95	15.0		14.95		V
V_{IL}	Low Level Input Voltage	$V_{DD} = 5\text{V}, V_O = 0.5\text{V}$ or 4.5V		1.5		2.25	1.5		1.5	V
		$V_{DD} = 10\text{V}, V_O = 1\text{V}$ or 9V		3.0		4.50	3.0		3.0	V
		$V_{DD} = 15\text{V}, V_O = 1.5\text{V}$ or 13.5V		4.0		6.75	4.0		4.0	V
V_{IH}	High Level Input Voltage	$V_{DD} = 5\text{V}, V_O = 0.5\text{V}$ or 4.5V	3.5		3.5	2.75		3.5		V
		$V_{DD} = 10\text{V}, V_O = 1\text{V}$ or 9V	7.0		7.0	5.50		7.0		V
		$V_{DD} = 15\text{V}, V_O = 1.5\text{V}$ or 13.5V	11.0		11.0	8.25		11.0		V
I_{OL}	Low Level Output Current (Note 3)	$V_{DD} = 5\text{V}, V_O = 0.4\text{V}$	0.64		0.51	0.88		0.36		mA
		$V_{DD} = 10\text{V}, V_O = 0.5\text{V}$	1.6		1.3	2.25		0.9		mA
		$V_{DD} = 15\text{V}, V_O = 1.5\text{V}$	4.2		3.4	8.8		2.4		mA
I_{OH}	High Level Output Current (Note 3)	$V_{DD} = 5\text{V}, V_O = 4.6\text{V}$	-0.25		-0.2	-0.36		-0.14		mA
		$V_{DD} = 10\text{V}, V_O = 9.5\text{V}$	-0.62		-0.5	-0.9		-0.35		mA
		$V_{DD} = 15\text{V}, V_O = 13.5\text{V}$	-1.8		-1.5	-3.5		-1.1		mA
I_{IN}	Input Current	$V_{DD} = 15\text{V}, V_{IN} = 0\text{V}$		-0.1		-10^{-5}	-0.1		-1.0	μA
		$V_{DD} = 15\text{V}, V_{IN} = 15\text{V}$		0.1		10^{-5}	0.1		1.0	μA

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range", they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

Note 2: $V_{SS} = 0\text{V}$ unless otherwise specified.

Note 3: I_{OH} and I_{OL} are tested one output at a time.

DC Electrical Characteristics CD4528BC (Note 2)

Symbol	Parameter	Conditions	− 40°C		+ 25°C			+ 85°C		Units
			Min	Max	Min	Typ	Max	Min	Max	
I _{DD}	Quiescent Device Current	V _{DD} = 5V		20		0.005	20		150	μA
		V _{DD} = 10V		40		0.010	40		300	μA
		V _{DD} = 15V		80		0.015	80		600	μA
V _{OL}	Low Level Output Voltage	V _{DD} = 5V		0.05			0.05		0.05	V
		V _{DD} = 10V		0.05			0.05		0.05	V
		V _{DD} = 15V		0.05			0.05		0.05	V
V _{OH}	High Level Output Voltage	V _{DD} = 5V	4.95		4.95	5.0		4.95		V
		V _{DD} = 10V	9.95		9.95	10.0		9.95		V
		V _{DD} = 15V	14.95		14.95	15.0		14.95		V
V _{IL}	Low Level Input Voltage	V _{DD} = 5V, V _O = 0.5V or 4.5V		1.5		2.25	1.5		1.5	V
		V _{DD} = 10V, V _O = 1V or 9V		3.0		4.50	3.0		3.0	V
		V _{DD} = 15V, V _O = 1.5V or 13.5V		4.0		6.75	4.0		4.0	V
V _{IH}	High Level Input Voltage	V _{DD} = 5V, V _O = 0.5V or 4.5V	3.5		3.5	2.75		3.5		V
		V _{DD} = 10V, V _O = 1V or 9V	7.0		7.0	5.50		7.0		V
		V _{DD} = 15V, V _O = 1.5V or 13.5V	11.0		11.0	8.25		11.0		V
I _{OL}	Low Level Output Current (Note 3)	V _{DD} = 5V, V _O = 0.4V	0.52		0.44	0.88		0.36		mA
		V _{DD} = 10V, V _O = 0.5V	1.3		1.1	2.25		0.9		mA
		V _{DD} = 15V, V _O = 1.5V	3.6		3.0	8.8		2.4		mA
I _{OH}	High Level Output Current (Note 3)	V _{DD} = 5V, V _O = 4.6V	−0.2		−0.16	−0.36		−0.12		mA
		V _{DD} = 10V, V _O = 9.5V	−0.5		−0.4	−0.9		−0.3		mA
		V _{DD} = 15V, V _O = 13.5V	−1.4		−1.2	−3.5		−1.0		mA
I _{IN}	Input Current	V _{DD} = 15V, V _{IN} = 0V		−0.3		−10 ^{−5}	−0.3		−1.0	μA
		V _{DD} = 15V, V _{IN} = 15V		0.3		10 ^{−5}	0.3		1.0	μA

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range", they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

Note 2: V_{SS} = 0V unless otherwise specified.

Note 3: I_{OH} and I_{OL} are tested one output at a time.

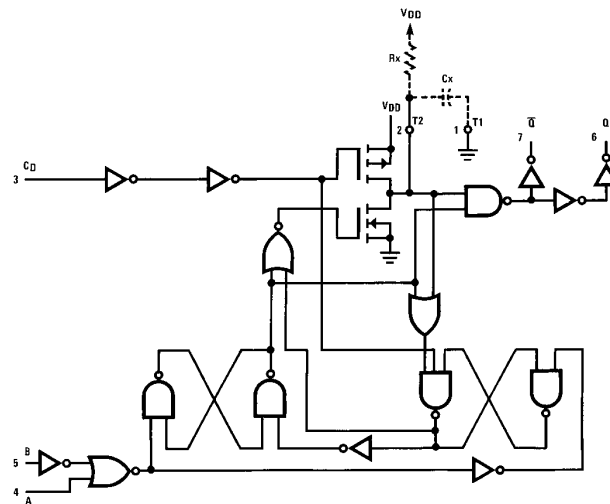
AC Electrical Characteristics* CD4528BM

T_A = 25°C, C_L = 50 pF, R_L = 200 kΩ, Input t_r = t_f = 20 ns, unless otherwise specified

Parameter	Conditions	Min	Typ	Max	Units
Output Rise Time	t _r = (3.0 ns/pF) C _L + 30 ns, V _{DD} = 5.0V		180	400	ns
	t _r = (1.5 ns/pF) C _L + 15 ns, V _{DD} = 10.0V		90	200	ns
	t _r = (1.1 ns/pF) C _L + 10 ns, V _{DD} = 15.0V		65	160	ns
Output Fall Time	t _f = (1.5 ns/pF) C _L + 25 ns, V _{DD} = 5.0V		100	200	ns
	t _f = (0.75 ns/pF) C _L + 12.5 ns, V _{DD} = 10V		50	100	ns
	t _f = (0.55 ns/pF) C _L + 9.5 ns, V _{DD} = 15.0V		35	80	ns
Turn-Off, Turn-On Delay A or B to Q or \bar{Q} C _x = 15 pF, R _x = 5.0 kΩ	t _{PLH} , t _{PHL} = (1.7 ns/pF) C _L + 240 ns, V _{DD} = 5.0V		230	500	ns
	t _{PLH} , t _{PHL} = (0.66 ns/pF) C _L + 8 ns, V _{DD} = 10.0V		100	250	ns
	t _{PLH} , t _{PHL} = (0.5 ns/pF) C _L + 65 ns, V _{DD} = 15.0V		65	150	ns
Turn-Off, Turn-On Delay A or B to Q or \bar{Q} C _x = 100 pF, R _x = 10 kΩ	t _{PLH} , t _{PHL} = (1.7 ns/pF) C _L + 620 ns, V _{DD} = 5.0V		230	500	ns
	t _{PLH} , t _{PHL} = (0.66 ns/pF) C _L + 257 ns, V _{DD} = 10.0V		100	250	ns
	t _{PLH} , t _{PHL} = (0.5 ns/pF) C _L + 185 ns, V _{DD} = 15.0V		65	150	ns
Minimum Input Pulse Width A or B C _x = 15 pF, R _x = 5.0 kΩ	V _{DD} = 5.0V		60	150	ns
	V _{DD} = 10.0V		20	50	ns
	V _{DD} = 15V		20	50	ns
C _x = 1000 pF, R _x = 10 kΩ	V _{DD} = 5.0V		60	150	ns
	V _{DD} = 10.0V		20	50	ns
	V _{DD} = 15.0V		20	50	ns
Output Pulse Width Q or \bar{Q} For C _x < 0.01 μF (See Graph for Appropriate V _{DD} Level) C _x = 15 pF, R _x = 5.0 kΩ	V _{DD} = 5.0V		550		ns
	V _{DD} = 10.0V		350		ns
	V _{DD} = 15.0V		300		ns
For C _x > 0.01 μF Use PW _{out} = 0.2 R _x C _x ln [V _{DD} - V _{SS}] C _x = 10,000 pF, R _x = 10 kΩ	V _{DD} = 5.0V	15	29	45	μs
	V _{DD} = 10.0V	10	37	90	μs
	V _{DD} = 15.0V	15	42	95	μs
Pulse Width Match between Circuits in the Same Package C _x = 10,000 pF, R _x = 10 kΩ	V _{DD} = 5.0V		6	25	%
	V _{DD} = 10.0V		8	35	%
	V _{DD} = 15.0V		8	35	%
Reset Propagation Delay, t _{PLH} , t _{PHL} C _x = 15 pF, R _x = 5.0 kΩ	V _{DD} = 5.0V		325	600	ns
	V _{DD} = 10.0V		90	225	ns
	V _{DD} = 15.0V		60	170	ns
C _x = 1000 pF, R _x = 10 kΩ	V _{DD} = 5.0V		7.0		μs
	V _{DD} = 10.0V		6.7		μs
	V _{DD} = 15.0V		6.7		μs
Minimum Retrigger Time C _x = 15 pF, R _x = 5.0 kΩ C _x = 1000 pF, R _x = 10 kΩ	V _{DD} = 5.0V		0		ns
	V _{DD} = 10.0V		0		ns
	V _{DD} = 15.0V		0		ns
	V _{DD} = 5.0V		0		ns
	V _{DD} = 10.0V		0		ns
	V _{DD} = 15.0V		0		ns

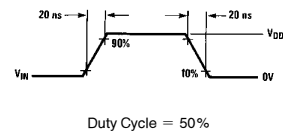
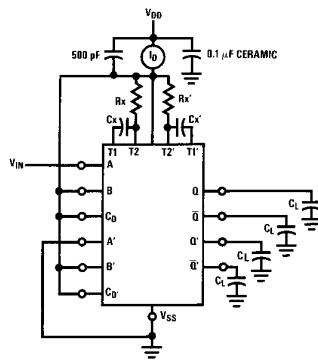
*AC parameters are guaranteed by DC correlated testing.

Logic Diagrams (1/2 of Device Shown)



Note: Externally ground pins 1 and 15 to pin 8.

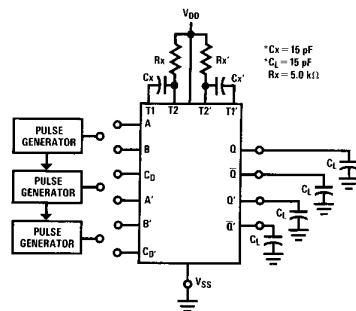
TL/F/5998-3



TL/F/5998-10

TL/F/5998-4

FIGURE 1. Power Dissipation Test Circuit and Waveforms



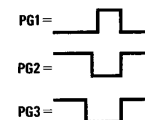
TL/F/5998-5

Input Connections

Characteristics	C _D	A	B
t _{PLH} , t _{PHL} , t _r , t _f , PW _{out} , PW _{in}	V _{DD}	PG1	V _{DD}
t _{PLH} , t _{PHL} , t _r , t _f , PW _{out} , PW _{in}	V _{DD}	V _{SS}	PG2
t _{PLH(R)} , t _{PHL(R)} , PW _{in}	PG3	PG1	PG2

*Includes capacitance of probes, wiring, and fixture parasitic.

Note: AC test waveforms for PG1, PG2, and PG3 on next page.



TL/F/5998-6

FIGURE 2. AC Test Circuit

Logic Diagrams (1/2 of Device Shown) (Continued)

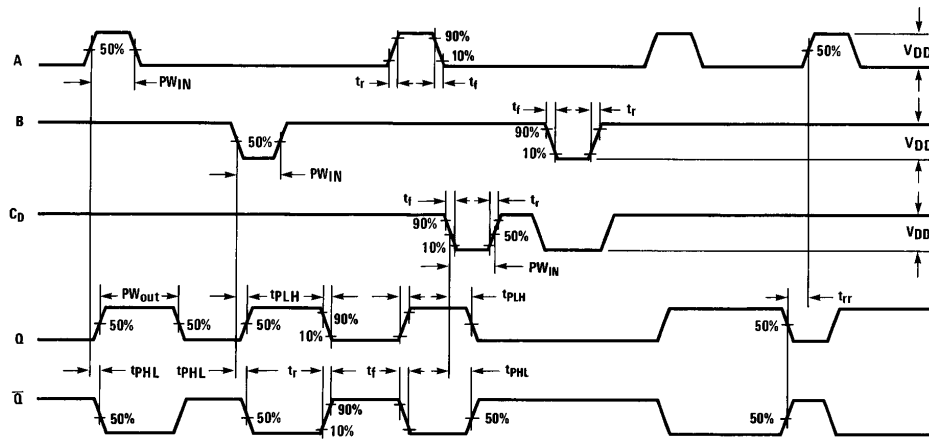


FIGURE 3. AC Test Waveforms

TL/F/5998-7

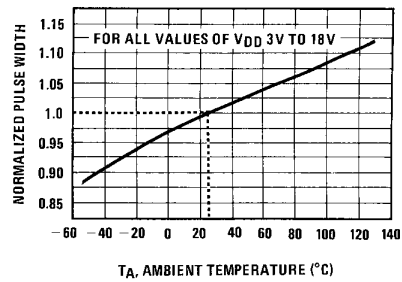


FIGURE 4. Normalized Pulse Width vs Temperature

TL/F/5998-8

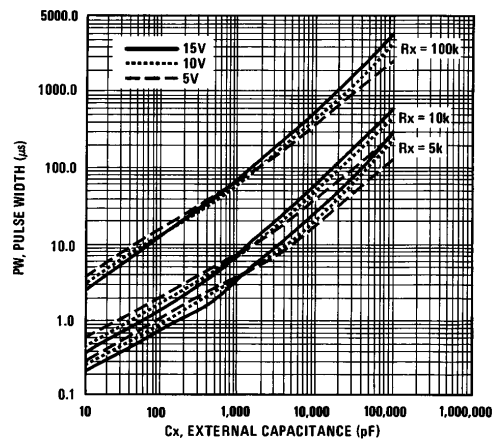


FIGURE 5. Pulse Width vs C_x

TL/F/5998-9

The drawing illustrates the mechanical specifications of the J16A package. The top view shows a rectangular body with 16 pins (8 on each long side) and a maximum length of 0.785 inches [19.94 mm]. The side view shows a height of 0.220 to 0.310 inches [5.59 to 7.87 mm] and a pin height of 0.037 ± 0.005 inches [0.94 ± 0.13 mm]. The detail view shows a pin diameter of 0.010 ± 0.002 inches [0.25 ± 0.05 mm] and a pin angle of 95° ± 5° TYP. The package is sealed with glass sealant.

Top View Dimensions:

- Overall Length: 0.785 [19.94] MAX
- Pin Pitch: 0.025 [0.64]
- Pin 1 Indicator: 0.005-0.020 TYP [0.13-0.51]

Side View Dimensions:

- Package Height: 0.220-0.310 [5.59-7.87]
- Pin Height: 0.037 ± 0.005 TYP [0.94 ± 0.13]
- Pin Spacing: 0.055 ± 0.005 TYP [1.40 ± 0.13]

Detail View Dimensions:

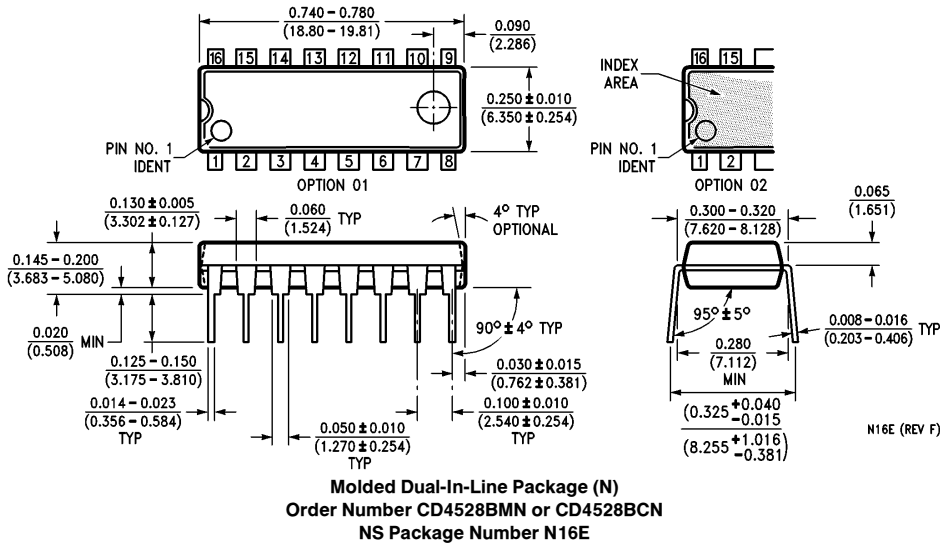
- Pin Diameter: 0.010 ± 0.002 [0.25 ± 0.05]
- Pin Angle: 95° ± 5° TYP
- Glass Sealant Thickness: 0.020-0.060 TYP [0.51-1.52]

Other Dimensions:

- Pin 1 Radius: R 0.025 [0.64]
- Pin 16 Radius: R 0.005-0.020 TYP [0.13-0.51]
- Pin 16 Height: 0.125-0.200 TYP [3.18-5.08]
- Pin 16 Spacing: 0.080 [2.03] MAX BOTH ENDS
- Pin 16 Angle: 90° ± 4° TYP
- Pin 16 Diameter: 0.018 ± 0.003 TYP [0.46 ± 0.08]
- Pin 16 Length: 0.100 ± 0.010 TYP [2.54 ± 0.25]
- Pin 16 Width: 0.150 [3.81] MIN TYP
- Pin 16 Thickness: 0.010 ± 0.002 TYP [0.25 ± 0.05]
- Pin 16 Angle: 95° ± 5° TYP
- Pin 16 Length: 0.310-0.410 [7.87-10.41]
- Pin 16 Width: 0.290-0.320 [7.37-8.13]
- Pin 16 Thickness: 0.180 [4.57] MAX

J16A (REV L)

J16A (REV L)

Physical Dimensions inches (millimeters) (Continued)**LIFE SUPPORT POLICY**

NATIONAL'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 NATIONAL 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 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 is 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.



National Semiconductor Corporation
 1111 West Bardin Road
 Arlington, TX 76017
 Tel: 1(800) 272-9959
 Fax: 1(800) 737-7018

National Semiconductor Europe
 Fax: (+49) 0-180-530 85 86
 Email: cnjwge@tevm2.nsc.com
 Deutsch Tel: (+49) 0-180-530 85 85
 English Tel: (+49) 0-180-532 78 32
 Français Tel: (+49) 0-180-532 93 58
 Italiano Tel: (+49) 0-180-534 16 80

National Semiconductor Hong Kong Ltd.
 13th Floor, Straight Block,
 Ocean Centre, 5 Canton Rd.
 Tsimshatsui, Kowloon
 Hong Kong
 Tel: (852) 2737-1600
 Fax: (852) 2736-9960

National Semiconductor Japan Ltd.
 Tel: 81-043-299-2309
 Fax: 81-043-299-2408

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