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LM161/LM361 High Speed Differential Comparators

General Description

The LM161/LM361 is a very high speed differential input, complementary TTL output voltage comparator with improved characteristics over the SE529/NE529 for which it is a pin-for-pin replacement. The device has been optimized for greater speed performance and lower input offset voltage. Typically delay varies only 3 ns for over-drive variations of 5 mV to 500 mV. It may be operated from op amp supplies ($\pm 15V$).

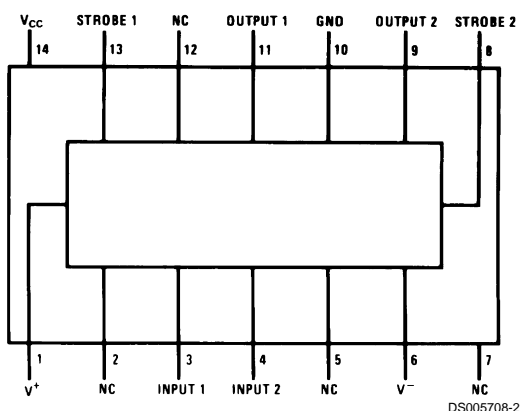
Complementary outputs having maximum skew are provided. Applications involve high speed analog to digital converters and zero-crossing detectors in disk file systems.

Features

- Independent strobes
- Guaranteed high speed: 20 ns max
- Tight delay matching on both outputs
- Complementary TTL outputs
- Operates from op amp supplies: $\pm 15V$
- Low speed variation with overdrive variation
- Low input offset voltage
- Versatile supply voltage range

Connection Diagrams

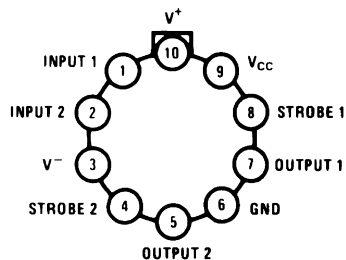
Dual-In-Line Package



Top View

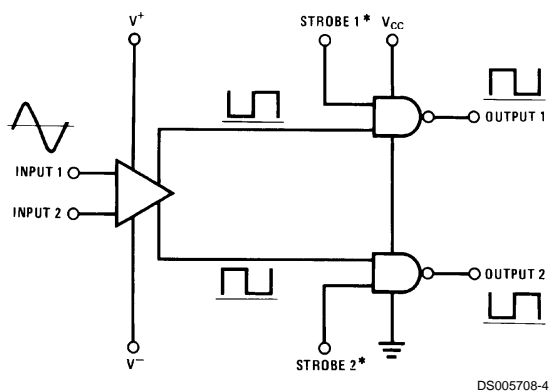
Order Number LM361M, LM361MX or LM361N
See NS Package Number M14A or N14A

Metal Can Package



Order Number LM161H/883 or LM361H
See NS Package Number H10C

Logic Diagram



*Output is low when current is drawn from strobe pin.

Absolute Maximum Ratings (Note 1)

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

Positive Supply Voltage, V^+	+16V
Negative Supply Voltage, V^-	-16V
Gate Supply Voltage, V_{CC}	+7V
Output Voltage	+7V
Differential Input Voltage	$\pm 5V$
Input Common Mode Voltage	$\pm 6V$
Power Dissipation	600 mW
Storage Temperature Range	-65°C to +150°C
Operating Temperature Range	T_{MIN} T_{MAX}
LM161	-55°C to +125°C
	-25°C to +85°C
LM361	0°C to +70°C
Lead Temp. (Soldering, 10 seconds)	260°C
For Any Device Lead Below V^-	0.3V

Operating Conditions

	Min	Typ	Max
Supply Voltage V^+			
LM161	5V		15V
LM361	5V		15V
Supply Voltage V^-			
LM161	-6V		-15V
LM361	-6V		-15V
Supply Voltage V_{CC}			
LM161	4.5V	5V	5.5V
LM361	4.75V	5V	5.25V
ESD Tolerance (Note 5)			1600V
Soldering Information			
Dual-In-Line Package			
Soldering (10 seconds)			260°C
Small Outline Package			
Vapor Phase (60 seconds)			215°C
Infrared (15 seconds)			220°C

See AN-450 "Surface Mounting Methods and Their Effect on Product Reliability" for other methods of soldering surface mount devices.

Electrical Characteristics

($V^+ = +10V$, $V_{CC} = +5V$, $V^- = -10V$, $T_{MIN} \leq T_A \leq T_{MAX}$, unless noted)

Parameter	Conditions	Limits						Units
		LM161			LM361			
		Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage			1	3		1	5	mV
Input Bias Current	T _A =25°C		5	20		10	30	μA
Input Offset Current	T _A =25°C		2	3		2	5	μA
Voltage Gain	T _A =25°C		3			3		V/mV
Input Resistance	T _A =25°C, f=1 kHz		20			20		kΩ
Logical “1” Output Voltage	V _{CC} =4.75V, I _{SOURCE} =−0.5 mA	2.4	3.3		2.4	3.3		V
Logical “0” Output Voltage	V _{CC} =4.75V, I _{SINK} =6.4 mA			0.4			0.4	V
Strobe Input “1” Current (Output Enabled)	V _{CC} =5.25V, V _{STROBE} =2.4V			200			200	μA
Strobe Input “0” Current (Output Disabled)	V _{CC} =5.25V, V _{STROBE} =0.4V			−1.6			−1.6	mA
Strobe Input “0” Voltage	V _{CC} =4.75V			0.8			0.8	V
Strobe Input “1” Voltage	V _{CC} =4.75V	2			2			V
Output Short Circuit Current	V _{CC} =5.25V, V _{OUT} =0V	−18		−55	−18		−55	mA
Supply Current I ⁺	V ⁺ =10V, V [−] =−10V, V _{CC} =5.25V, −55°C≤T _A ≤125°C			4.5				mA
Supply Current I ⁺	V ⁺ =10V, V [−] =−10V, V _{CC} =5.25V, 0°C≤T _A ≤70°C						5	mA
Supply Current I [−]	V ⁺ =10V, V [−] =−10V, V _{CC} =5.25V, −55°C≤T _A ≤125°C			10				mA

Electrical Characteristics (Continued)

($V^+ = +10V$, $V_{CC} = +5V$, $V^- = -10V$, $T_{MIN} \leq T_A \leq T_{MAX}$, unless noted)

Parameter	Conditions	Limits						Units
		LM161			LM361			
		Min	Typ	Max	Min	Typ	Max	
Supply Current I ⁻	V ⁺ =10V, V ⁻ =-10V,V _{CC} =5.25V, 0°C≤T _A ≤70°C						10	mA
Supply Current I _{CC}	V ⁺ =10V, V ⁻ =-10V, V _{CC} =5.25V, -55°C≤T _A ≤125°C			18				mA
Supply Current I _{CC}	V ⁺ =10V, V ⁻ =-10V, V _{CC} =5.25V, 0°C≤T _A ≤70°C						20	mA
Transient Response	V _{IN} = 50 mV overdrive (Note 3)							
Propagation Delay Time (t _{pd(0)})	T _A =25°C		14	20		14	20	ns
Propagation Delay Time (t _{pd(1)})	T _A =25°C		14	20		14	20	ns
Delay Between Output A and B	T _A =25°C		2	5		2	5	ns
Strobe Delay Time (t _{pd(0)})	T _A =25°C		8			8		ns
Strobe Delay Time (t _{pd(1)})	T _A =25°C		8			8		ns

Note 1: The device may be damaged by use beyond the maximum ratings.

Note 2: Typical thermal impedances are as follows:

	H Package	J Package	N Package
θ_{JA}	165°C/W (Still Air) 67°C/W (400 LF/Min Air Flow)	112°C/W	105°C/W
θ_{JC}	25°C/W		

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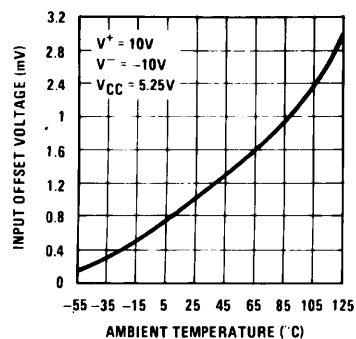
Note 3: Measurements using AC Test circuit, Fanout = 1. The devices are faster at low supply voltages.

Note 4: Refer to RETS161X for LM161H and LM161J military specifications.

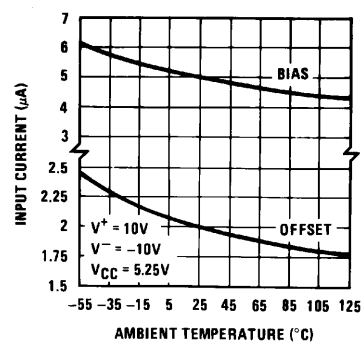
Note 5: Human body model, 1.5 k Ω in series with 100 pF.

Typical Performance Characteristics

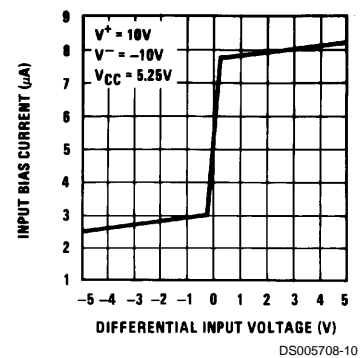
Offset Voltage



Input Currents vs Ambient Temperature

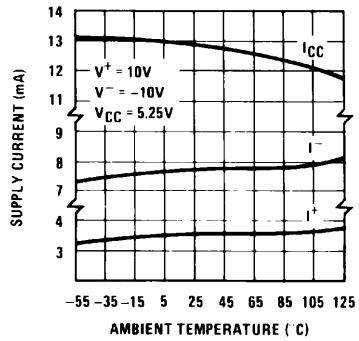


Input Characteristics



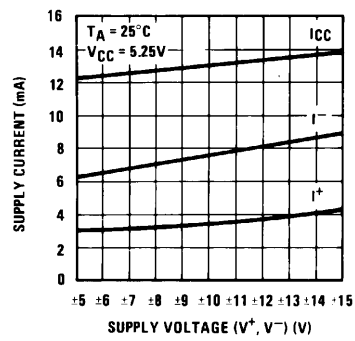
Typical Performance Characteristics (Continued)

Supply Current vs Ambient Temperature



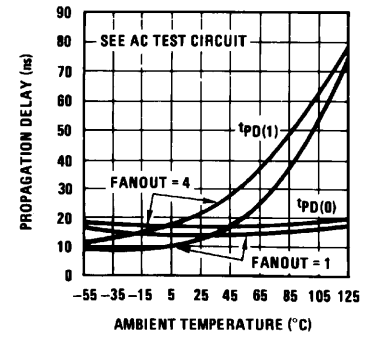
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Supply Current vs Supply Voltage



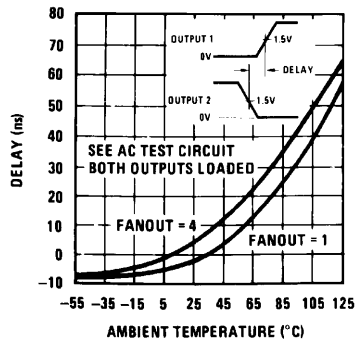
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Propagation Delay vs Ambient Temperature



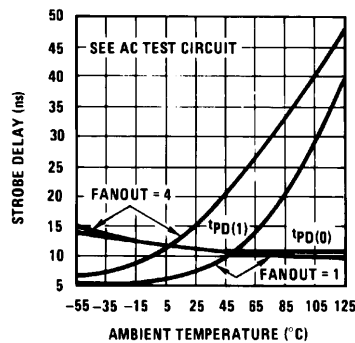
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Delay of Output 1 With Respect to Output 2 vs Ambient Temperature



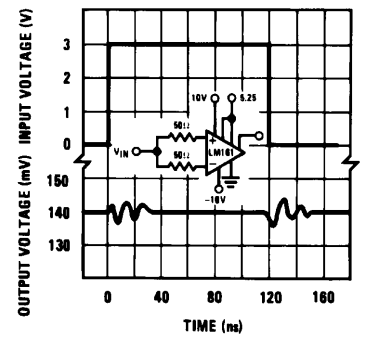
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Strobe Delay vs Ambient Temperature



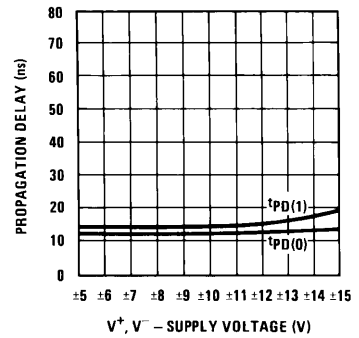
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Common-Mode Pulse Response



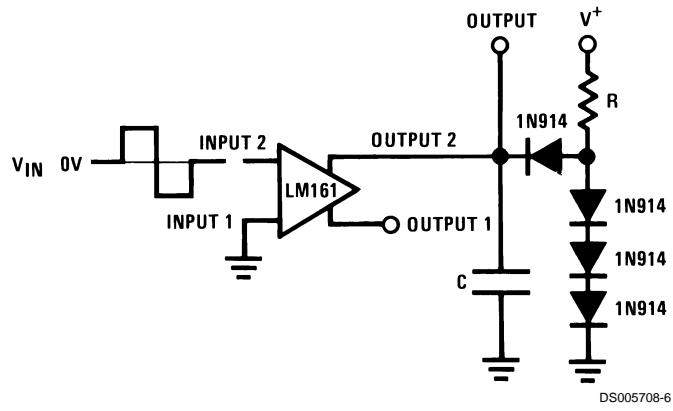
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Propagation Delay vs Supply Voltage



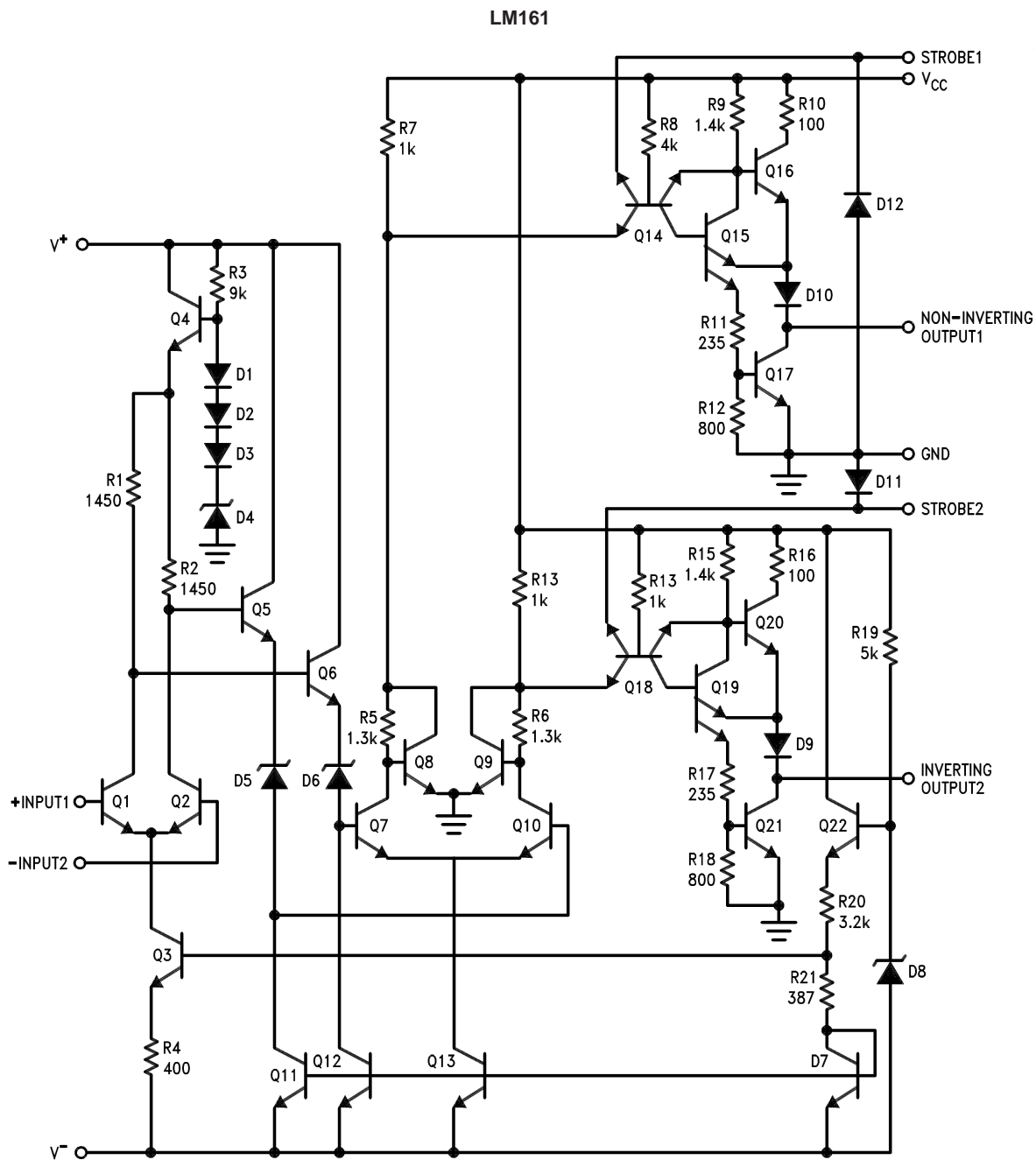
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AC Test Circuit



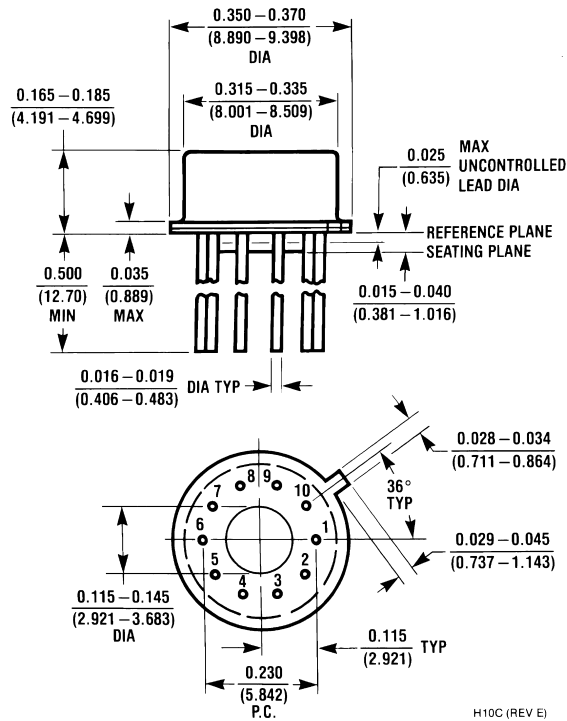
$V_{IN} = \pm 50 \text{ mV}$	FANOUT = 1	FANOUT = 4
$V^+ = +10\text{V}$	$R = 2.4\text{k}$	$R = 680\Omega$
$V^- = -10\text{V}$	$C = 15 \text{ pF}$	$C = 30 \text{ pF}$
$V_{CC} = 5.25\text{V}$		

Schematic Diagram

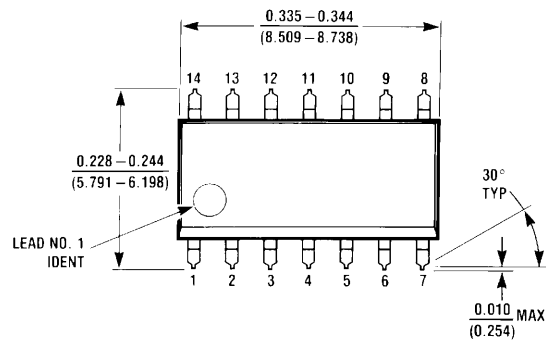


R10, R16: 85
R11, R17: 205

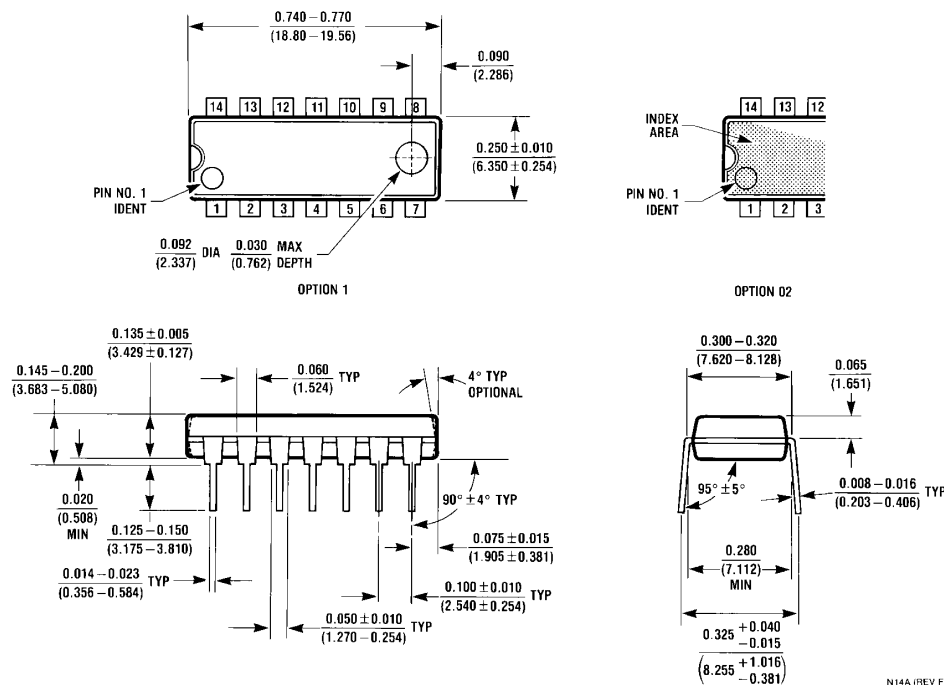
DS005708-1



Metal Can Package (H)
Order Number LM161H/883, or LM361H
NS Package Number H10C



Order Number LM361M or LM361MX
NS Package Number M14A

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

Molded Dual-In-Line Package (N)
Order Number LM361N
NS Package Number N14A

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National Semiconductor Corporation
Americas
Tel: 1-800-272-9959
Fax: 1-800-737-7018
Email: support@nsc.com
www.national.com

National Semiconductor Europe
Fax: +49 (0) 180-530 85 86
Email: europe.support@nsc.com
Deutsch Tel: +49 (0) 69 9508 6208
English Tel: +44 (0) 870 24 0 2171
Français Tel: +33 (0) 1 41 91 8790

National Semiconductor Asia Pacific Customer Response Group
Tel: 65-2544466
Fax: 65-2504466
Email: ap.support@nsc.com

National Semiconductor Japan Ltd.
Tel: 81-3-5639-7560
Fax: 81-3-5639-7507