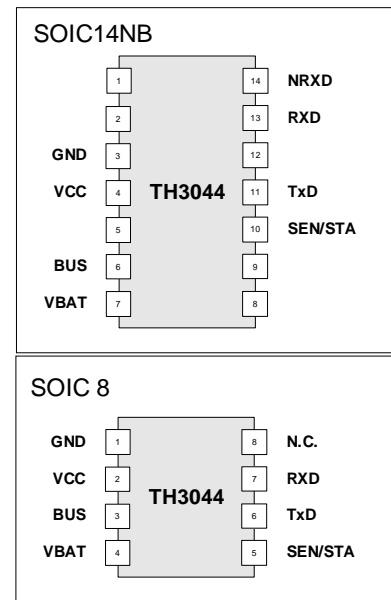


### Features and Benefits

- Open-emitter output with slew rate control
- Quiescent current < 50mA
- Bus voltage range -16 V .. +30 V
- ISO 9141 and OBDII compliant
- Wide temperature range -40 .. 125 °C
- SOIC14 and SOIC8 package
- Baudrate 9600
- Automotive applications

Pin Diagram



### Ordering Information

Part No.	Temperature Suffix	Package code
TH3044.2A	K ( -40°C to +125°C )	DC-14 ( SOIC14, 150mil )
TH3044	K ( -40°C to +125°C )	DC-8 ( SOIC8 , 150mil)

### General Description

The TH3044 is a bidirectional bus interface device for data transfer from 5V to 12V supply. For proper functionality control units are implemented.

This interface device was especially designed for automotive applications.

### Electrical Characteristics

All voltages are referenced to ground (GND). Positive currents flow into the IC. The absolute maximum ratings (in accordance with IEC 134) given in the table below are limiting values that do not lead to a permanent damage of the device but exceeding any of these limits may do

so. Long term exposure to limiting values may affect the reliability of the device. Reliable operation of the TH3044 is only specified within the limits shown in "Operating conditions"

### Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
Battery Voltage	$V_{BAT}$	6		16	V
Supply Voltage	$V_{CC}$	4.5		5.5	V
Operating Temperature	$T_A$	-40		125	°C

### Absolute maximum ratings

Parameter	Symbol	Condition	Min	Max	Unit
Battery Voltage	$V_{BAT}$		-0.3	30	V
		$T \leq 500$ ms		40	
Battery Current	$I_{BAT}$			20	mA
Supply Voltage	$V_{CC}$			7	V
Supply Current	$I_{CC}$			10	mA
Input Voltage SEN/STA, TxD	$V_{IN}$		-0.3	$V_{CC}+0.3$	V
Input Current SEN/STA, TxD	$I_{IN}$		-10	10	mA
Input Voltage BUS	$V_{INBUS}$		-16	30	V
		$T \leq 500$ ms		40	
Output Current RxD, NRxD	$I_{OUT}$		-10	10	mA
Operating Temperature	$T_A$		-40	125	°C

### Static Characteristics

$V_{DD} = 4.5$  to  $5.5V$ ,  $V_{Bat} = 6$  to  $16V$ ,  $T_{amb} = -40^{\circ}C$  to  $+125^{\circ}C$ , unless otherwise specified

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Supply</b>						
Power-on-reset Threshold VCC	$V_{CCPOR}$		3.0		4.0	V
Power-on-reset Threshold VBAT	$V_{BATPOR}$		3.0		4.5	V
Quiescent Current, ICC + IBAT	$I_{CCBAT}$	VCC = 5V, VBAT = 12V, BUS, TxD, SEN/STA, RxD and NRxD open			50	$\mu A$
<b>TxD, SEN/STA, RxD, NRxD</b>						
Pull-up Current TxD	$I_{pu}$		-330	-250	-170	$\mu A$
Pull-down Current SEN/STA	$I_{pdSEN}$		170	250	330	$\mu A$
Pull-up Current SEN/STA	$I_{puSEN}$		-330	-250	-170	$\mu A$
Input Voltage Low TxD, SEN/STA	$V_{IL}$				0.25	$V_{CC}$
Input Voltage High TxD, SEN/STA	$V_{IH}$		0.75			$V_{CC}$
Output Voltage Low RxD, NRxD	$V_{OL}$	$I_{OUT} = 1\text{ mA}$			1	V
Output Voltage High RxD, NRxD	$V_{OH}$	$I_{OUT} = 1\text{ mA}$	$V_{CC} - 1.0$			V
<b>BUS</b>						
Input Voltage Low BUS	$V_{IL}$				0.45	$V_{BAT}$
Input Voltage High BUS	$V_{IH}$		0.55			$V_{BAT}$
Hysteresis Input Voltage	$V_{HYS}$			50		mV
Input Resistance BUS	$R_{IN}$	$V_{BAT} = 0.40V$	400	600	1500	$k\Omega$
		$V_{BAT} = 0.40V, T_A = 85^{\circ}C$			1300	$k\Omega$
		$V_{BUS} = 12V$	60			$k\Omega$
Output Voltage BUS	$V_{BUS}$	VBAT = 12V, SEN/STA = Low, $I_{BUS} = 40mA$			1.2	V
		$I_{BUS} = 25mA$			1.0	V
Output Sinking Current BUS (current limiting)	$I_{LIM}$	$V_{BUS} > 3.5V$	40		110	mA
Output Sinking Current BUS (before fold back)	$I_{BUS}$				180	mA

### Dynamic Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Propagation Delay TxD -> RxD, NRxD	$t_{pd}$				20	$\mu s$
Threshold Voltage Fold-Back	$V_{FB}$				3.0	V
Slew Rate BUS	$dV/dT_{fall}$		-2.2	-1.6	-1.0	V/ $\mu s$
	$dV/dT_{rise}$		1.0	1.6	2.2	V/ $\mu s$
Symmetry of Slew Rate BUS	$dV/dT_{sym}$				0.3	V/ $\mu s$
Debouncing Time BUS	$t_{debH}$ $t_{debL}$	High or Low Pulse	1.5	2.8	4.0	$\mu s$
Symmetry of Debouncing Time BUS	$t_{debsym}$				0.5	$\mu s$
Bit-Compare Time BUS, SEN/STA, TxD	$t_{bc}$		35	52	70	$\mu s$
Recover Time BUS, TxD	$t_{rec}$		30	50	75	$\mu s$
Enable Time for transmit path BUS, TxD	$t_{ena}$		0.92	1.33	1.8	ms
Constant-Low Time BUS, TxD	$t_{low}$		3	6	12	ms

**Functional Diagram**

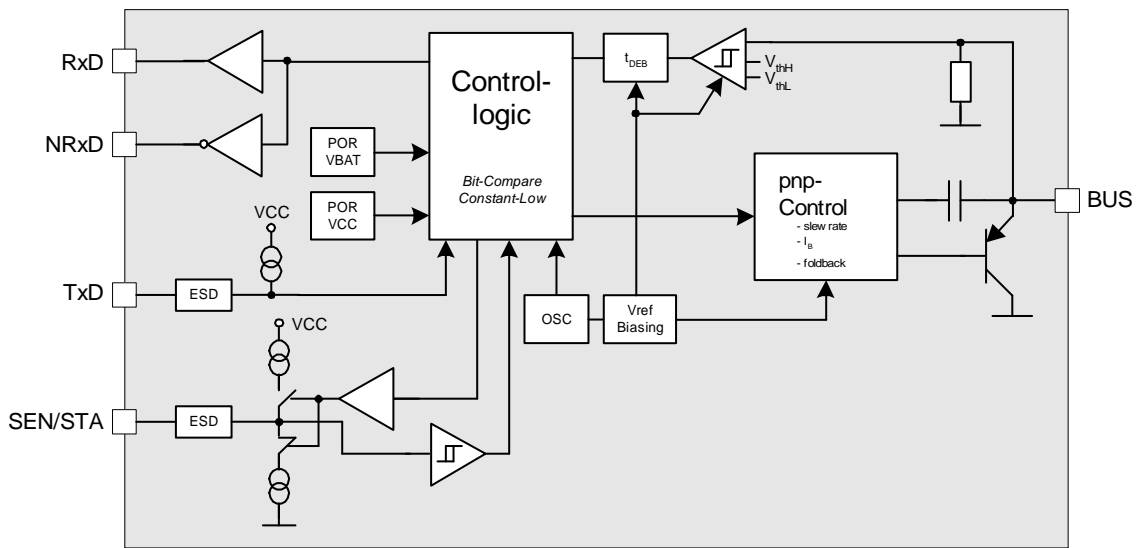


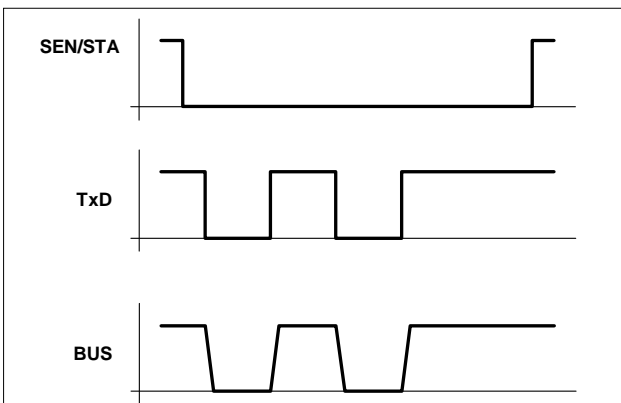
Figure 1 - Block Diagram

**Functional Description**

The TH3044 is used as a K-Bus interface. It builds the connection between the serial 5V bus line and the 12 V bus line. To avoid losses of data informations control functions are implemented.

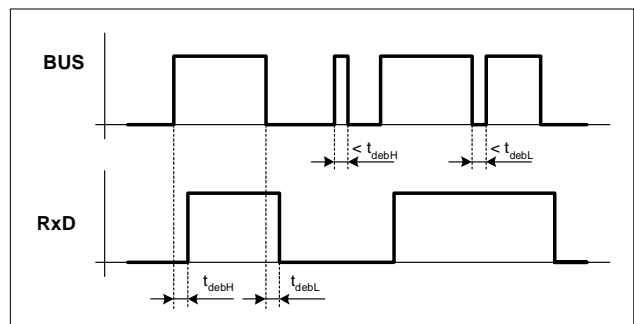
**Transmit**

During the transmission the data at the pin TxD will be transferred to the pin RxD (NRxD) as well as to the pin BUS.



**Receive**

The receiving path is always transparent. Independent of the mode the pin RxD and NRxD (inverted) are related to signal at the pin BUS. Voltage spikes on the bus signal are suppressed by the implemented debouncing circuit.



To minimise the electromagnetic emission of the bus line, the slew rate of the rising and falling edges of the data signals are limited.

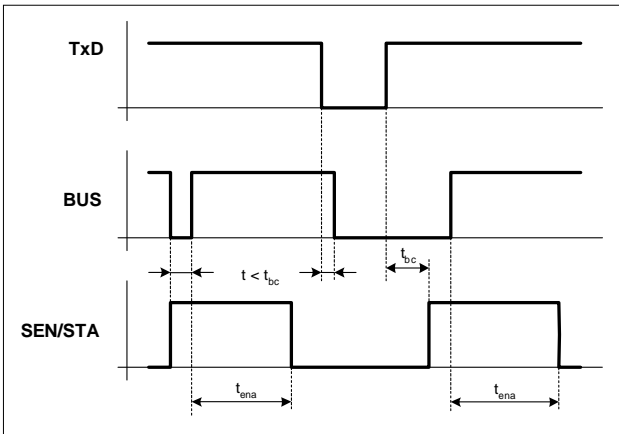
### Bit Compare

Are the signals at the pin TxD and the pin BUS within a specified time  $t_{bc}$  not identical, the transmission will be interrupted.

If both signals at TxD and BUS are "High" within the time  $t_{ena}$  the transmission will be enabled. To switch the TH3044 into the receive mode a low level "0" has to be applied to the pin Bus. If the TH3044 is part of a complex bus system the first device which transmits a low level "0" to the bus line forces all other TH3044 to switch into the receive mode. This state is valid until  $t_{ena}$ .

The bitcompare-function is frequently retriggered by every new bit-comparison of two different levels.

The bit-compare-function is activ when the pin SEN/STA is open (not overwritten).



### SEN/STA

The pin SEN/STA is bidirectional. Used as an output the pin indicates whether the transmit-path is enabled or disabled:

SEN/STA = "0"  
transmission path is enabled

SEN/STA = "1"  
transmission path is disabled

Using this pin as an input the transmission path can be overwritten (independent of bit-compare and constant-low function):

SEN/STA="0"  
forcing the transmission path free

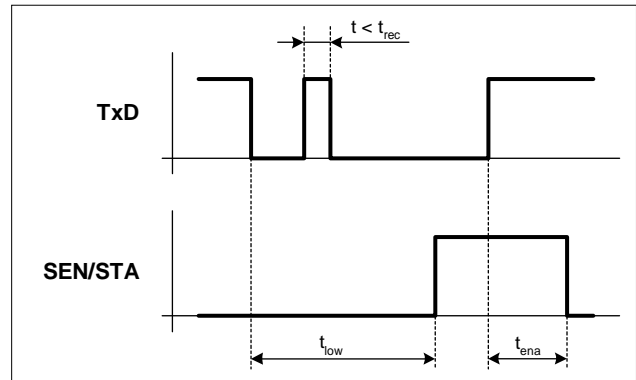
SEN/STA="1"  
disable the transmission path

### Constant Low

A falling edge at pin TxD (from "1" to "0") starts the internal constant low timer.

If the low level "0" is valid for the time  $t_{low}$  the transmission unit of the TH3044 will be disabled.

The receive unit is still active. A high level "1" at TxD with a minimum pulse width of  $t_{rec}$  resets the constant low timer.



### Undervoltage

Undervoltage at pin VBAT or pin VCC doesn't occur an unwanted low level at pin Bus (see chapter "Transmit")

## Application Information

### Connecting Supply Pin's

Connecting VBAT, VCC and GND in random sequence does not cause damaging of the device. The absence of VBAT-, VCC- or GND-connection either alone or in any combination does not influence or disturb the bus.

### Reset

The pin BUS remains in tri-state, until internal RESET state is released.

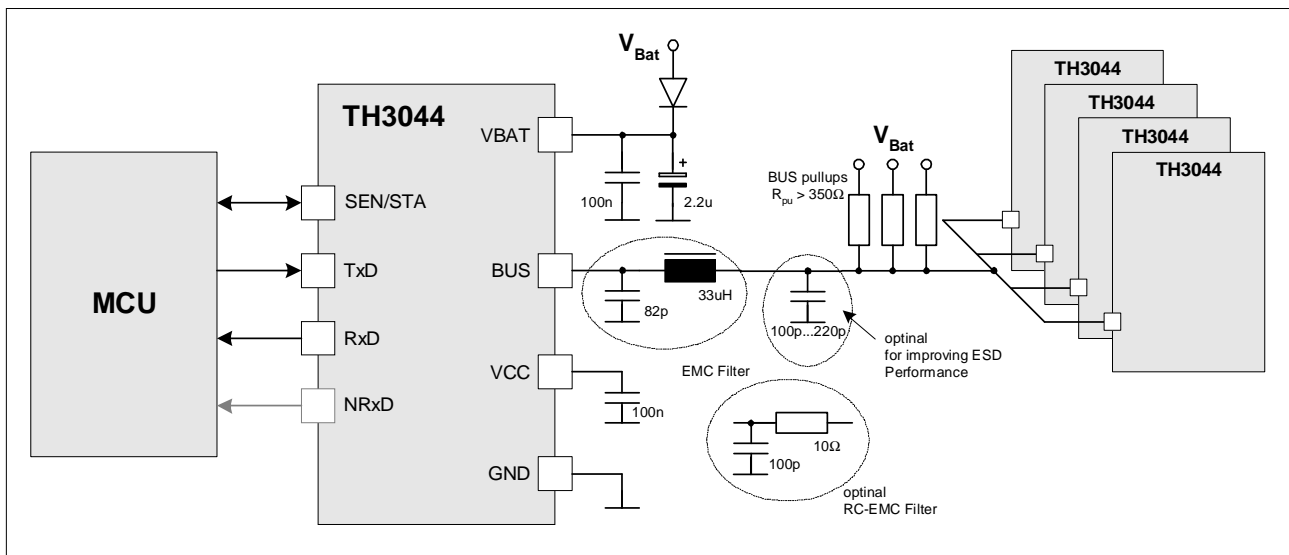
### Reverse Protection

To protect the TH3044 from reverse voltages, evers protection diode needs to be connected to pin VBAT.

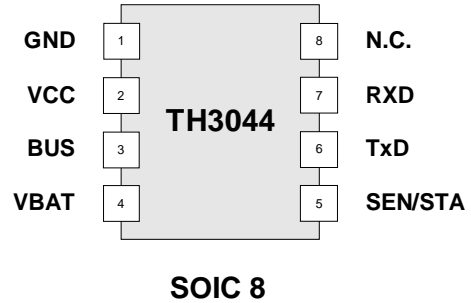
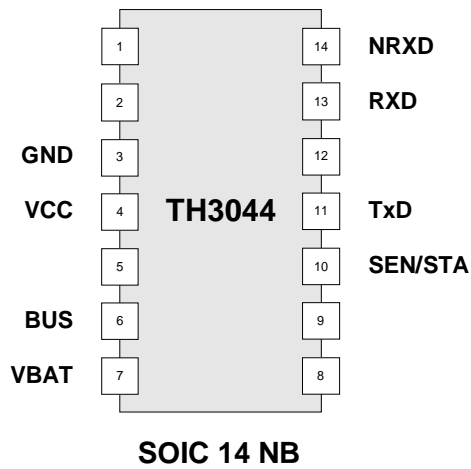
### EMC Filter

In order to minimise EMC radiation a LC filter (33 uH, 82 pF) is recommended. As an option a RC filter (10  $\Omega$ , 100 pF) can be also used.

## Application Circuit



**Pin Description**

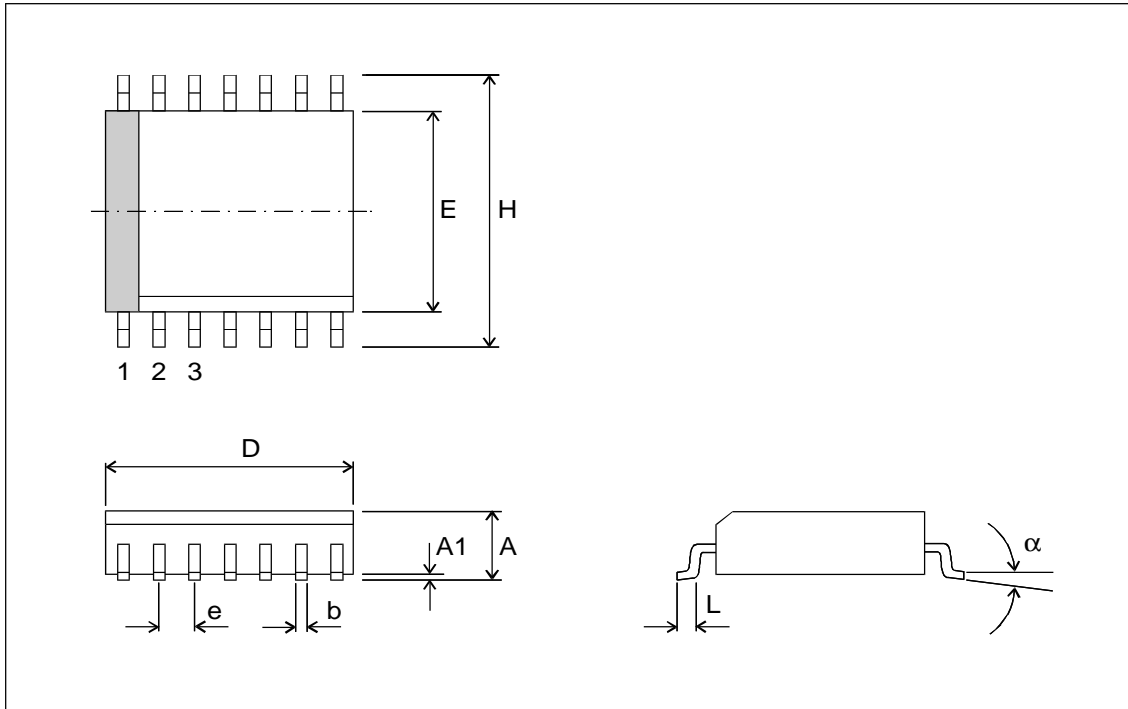


Pin SOIC14	Pin SOIC 8	Name	I/O	Function
3	1	GND	P	Ground
4	2	VCC	I	Supply Voltage 5V
6	3	BUS	I/O	K-Bus
7	4	VBAT	P	Battery Voltage
10	5	SEN/STA	I/O	Transmit Status
11	6	TXD	I	Transmit Input
13	7	RXD	O	Receive Output
14		NRXD	O	Inverted Receive Output



**Mechanical Specifications**

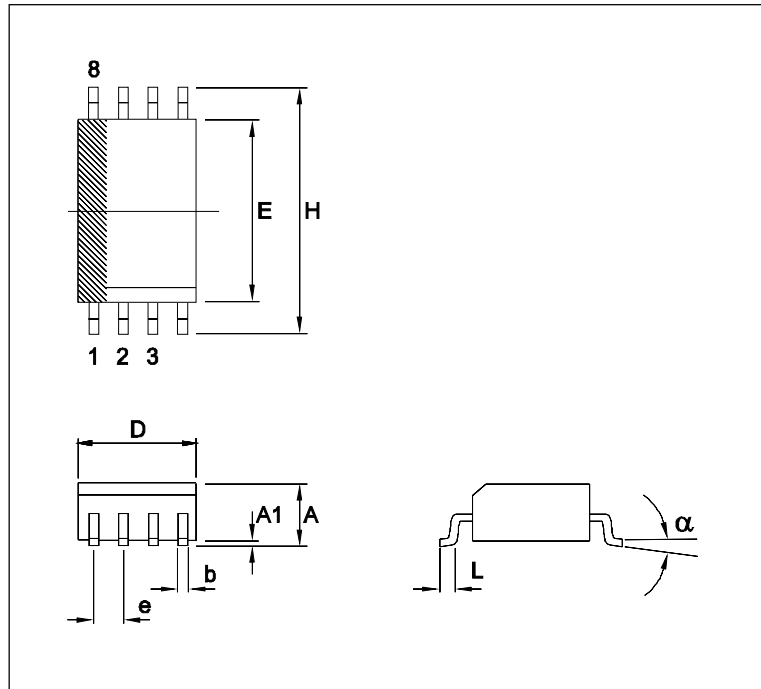
**DC ( SOIC14NB) Package Dimensions**



**Small Outline Integrated Circuit (SOIC),**

All Dimension in mm, coplanarity < 0.1 mm										
		D	E	H	A	A1	e	b	L	α
SOIC 14 150 mil	min	8.55	3.80	5.80	1.35	0.10	1.27	0.33	0.40	0°
	max	8.75	4.00	6.20	1.75	0.25				8°
All Dimension in inch, coplanarity < 0.004"										
SOIC 14 150 mil	min	0.337	0.150	0.228	0.053	0.004	0.050	0.013	0.016	0°
	max	0.334	0.157	0.224	0.069	0.010				8°

**SOIC8 Package Dimensions**



**Small Outline Integrated Circuit (SOIC), DC (SOIC 8, 150 mil)**

All Dimension in mm, coplanarity < 0.1 mm									
	<b>D</b>	<b>E</b>	<b>H</b>	<b>A</b>	<b>A1</b>	<b>e</b>	<b>b</b>	<b>L</b>	<b><math>\alpha</math></b>
min	4.8	3.80	5.80	1.35	0.10	1.27	0.33	0.40	0°
max	5.00	4.00	6.20	1.75	0.25		0.51	1.27	8°
All Dimension in inch, coplanarity < 0.004"									
min	0.189	0.150	0.228	0.053	0.004	0.050	0.013	0.016	0°
max	0.197	0.157	0.244	0.069	0.010		0.020	0.050	8°

### **Reliability Information**

Melexis devices are classified and qualified regarding suitability for infrared, vapor phase and wave soldering with usual (63/37 SnPb-) solder (melting point at 183degC).

The following test methods are applied:

IPC/JEDEC J-STD-020A (issue April 1999)  
Moisture/Reflow Sensitivity Classification For Nonhermetic Solid State Surface Mount Devices  
CECC00802 (issue 1994)  
Standard Method For The Specification of Surface Mounting Components (SMDs) of Assessed Quality  
MIL 883 Method 2003 / JEDEC-STD-22 Test Method B102  
Solderability

For all soldering technologies deviating from above mentioned standard conditions (regarding peak temperature, temperature gradient, temperature profile etc) additional classification and qualification tests have to be agreed upon with Melexis.

The application of Wave Soldering for SMD's is allowed only after consulting Melexis regarding assurance of adhesive strength between device and board.

For more information on manufacturability/solderability see quality page at our website:  
<http://www.melexis.com/>

### **ESD Precautions**

Electronic semiconductor products are sensitive to Electro Static Discharge (ESD).  
Always observe Electro Static Discharge control procedures whenever handling semiconductor products.

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Or for additional information contact Melexis Direct:

Europe and Japan: All other locations:

Phone: +32 13 67 04 95

Phone: +1 603 223 2362

E-mail: [sales\\_europe@melexis.com](mailto:sales_europe@melexis.com)

E-mail: [sales\\_usa@melexis.com](mailto:sales_usa@melexis.com)

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