

## 1.0 Key Features

- Fully compatible with the "ISO 11898-2" standard
- Certified "Authentication on CAN Transceiver Conformance (d1.1)"
- High speed (up to 1 Mbaud)
- Ideally suited for 12V and 24V industrial and automotive applications
- Low Electromagnetic Emission (EME) common-mode-choke is no longer required
- Differential receiver with wide common-mode range for high Electro Magnetic Susceptibility (EMS) (+/- 35V)
- No disturbance of the bus lines with an unpowered node
- Transmit data (TXD) dominant time-out function
- Thermal protection
- Bus pins protected against transients in an automotive environment
- Power down mode in which the transmitter is disabled
- Input levels compatible with 3.3V devices
- Short-circuit proof to supply voltage & ground

## 2.0 General Description

The AMIS-30660 CAN transceiver is the interface between a Controller Area Network (CAN) protocol controller and the physical bus and may be used in both 12V and 24V systems. The transceiver provides differential transmit capability to the bus and differential receive capability to the CAN

controller. Due to the wide common mode voltage range of the receiver inputs, the AMIS-30660 is able to reach outstanding levels of electromagnetic susceptibility. Similarly, extremely low electromagnetic emission is achieved by the excellent matching of the output signals.

## 3.0 Important Characteristics

| Symbol                                              | Parameter                              | Conditions                                                     | Min  | Max  | Unit |
|-----------------------------------------------------|----------------------------------------|----------------------------------------------------------------|------|------|------|
| $V_{CANH}$                                          | DC voltage at pin CANH                 | $0 < V_{CC} < 5.25 \text{ V}$ ; no time limit                  | -45* | +45* | V    |
| $V_{CANL}$                                          | DC voltage at pin CANL                 | $0 < V_{CC} < 5.25 \text{ V}$ ; no time limit                  | -45* | +45* | V    |
| $V_i(\text{dif})(\text{bus\_dom})$                  | Differential bus output voltage        | Dominant $42.5 \Omega < R_{LT} < 60 \Omega$                    | 1.5  | 3    | V    |
| $T_{pd}(\text{rec-dom})$ & $T_{pd}(\text{dom-rec})$ | Propagation delay TxD to RxD           | See Fig. 7                                                     | 70   | 245  | ns   |
| CM-range                                            | Input common-mode range for comparator | Guaranteed differential receiver threshold and leakage current | -35  | +35  | V    |
| $V_{CM\text{-peak}}$                                | Common-mode peak                       | See Fig. 8 & Fig. 9 (Note)                                     | -500 | 500  | mV   |
| $V_{CM\text{-step}}$                                | Common-mode step                       | See Fig. 8 & Fig. 9 (Note)                                     | -150 | 150  | mV   |

Note : The parameters  $V_{CM\text{-peak}}$  and  $V_{CM\text{-step}}$  guarantee low electromagnetic emission.

\* -85V min & +60V max also possible, please contact your local sales representative for details.

## 4.0 Ordering Information

Part N° **AMIS-30660**  
 Package **SO-8**  
 Temp. Range **-40°C...125°C**

## 5.0 Block Diagram

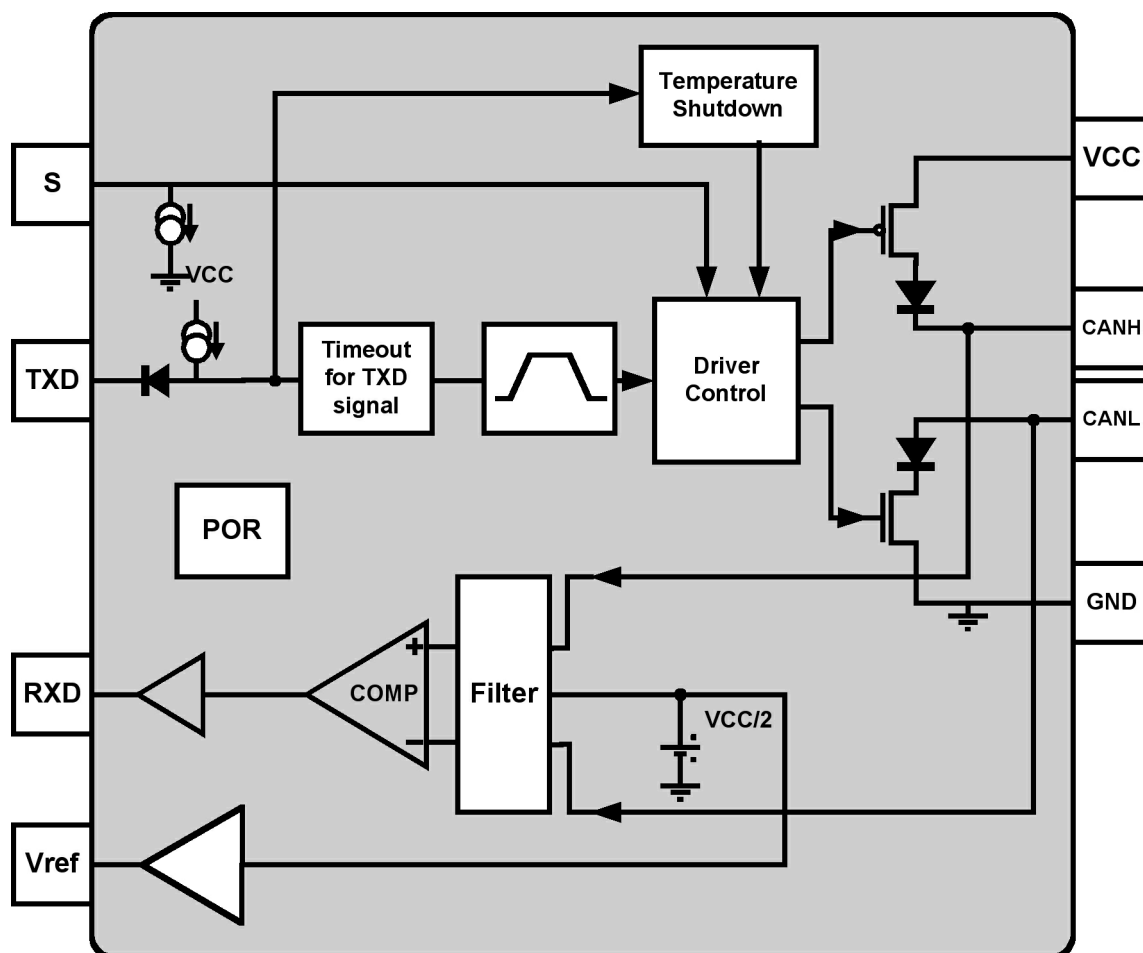


Figure 1 – Block Diagram

6.0 Typical Application Schematic

6.1 Application schematic

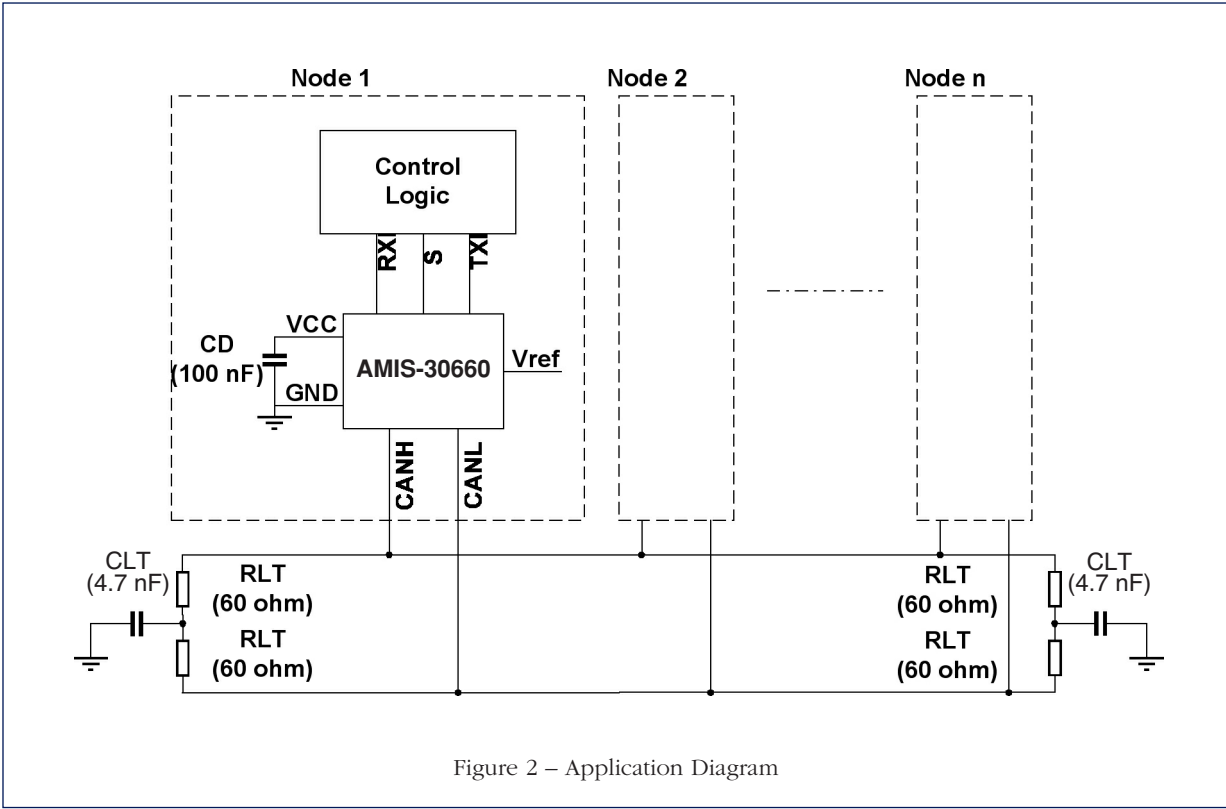


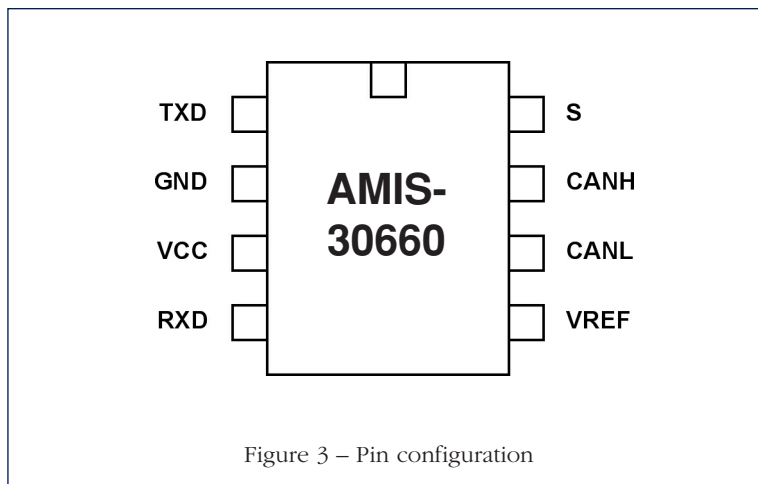
Figure 2 – Application Diagram

6.2 Typical external components

| Comp. | Function                   | Value | Units |
|-------|----------------------------|-------|-------|
| RLT   | Line termination resistor  | 60    | Ω     |
| CLT   | Line termination capacitor | 47    | nF    |
| CD    | Decoupling capacitor       | 100   | nF    |

## 6.3 Pin Description

### 6.3.1 Pin out (top view)



### 6.3.2 Pin Description

| Nr | Name | Type | Description                                                                                       |
|----|------|------|---------------------------------------------------------------------------------------------------|
| 1  | TXD  |      | Transmit data input; low input => dominant driver; internal pull-up current                       |
| 2  | GND  |      | Ground                                                                                            |
| 3  | VCC  |      | Supply voltage                                                                                    |
| 4  | RXD  |      | Receive data output; dominant transmitter => low output                                           |
| 5  | Vref |      | Reference voltage output                                                                          |
| 6  | CANL |      | LOW-level CAN bus line (low in dom. mode)                                                         |
| 7  | CANH |      | HIGH-level CAN bus line (high in dom. mode)                                                       |
| 8  | S    |      | Select input for high-speed mode or silent mode (high in silent mode); internal pull-down current |

## 7.0 Functional Description

The AMIS-30660 is the interface between the CAN protocol controller and the physical bus. It is intended for use in automotive and industrial applications requiring baud rates up to 1 Mbaud. It provides differential transmit capability to the bus and differential receiver capability to the CAN protocol controller. It is fully compatible to the "ISO 11898-2" standard.

A current-limiting circuit protects the transmitter output stage from damage caused by accidental short-circuit to either positive or negative supply voltage, although power dissipation increases during this fault condition.

A thermal protection circuit protects the IC from damage by switching off the transmitter if the junction temperature exceeds a value of approximately 160°C. Because the transmitter dissipates most of the power, the power dissipation and temperature of the IC is reduced. All other IC functions continue to operate. The transmitter off-state resets when pin TXD goes HIGH. The thermal protection circuit is particularly needed when a bus line short-circuits.

The pins CANH and CANL are protected from automotive electrical transients (according to "ISO 7637"; see Fig.4). Control pin S allows two operating modes to be selected: high-speed mode or silent mode.

The high-speed mode is the normal operating mode and is selected by connecting pin S to ground. It is the default mode if pin S is not connected.

In the silent mode, the transmitter is disabled. All other IC functions continue to operate. The silent mode is selected by connecting pin S to VCC and can be used to prevent network communication from being blocked, due to a CAN controller which is out of control.

A 'TXD dominant time-out' timer circuit prevents the bus lines being driven to a permanent dominant state (blocking all network communication) if pin TXD is forced permanently LOW by a hardware and/or software application failure. The timer is triggered by a negative edge on pin TXD. If the duration of the LOW-level on pin TXD exceeds the internal timer value, the transmitter is disabled, driving the bus into a recessive state. The timer is reset by a positive edge on pin TXD.

Table 1: Function table of the CAN transceiver; X = don't care

| VCC                                       | TXD             | S               | CANH             | CANL             | BUS State | RXD |
|-------------------------------------------|-----------------|-----------------|------------------|------------------|-----------|-----|
| 4.75 to 5.25V                             | 0               | 0 (or floating) | HIGH             | LOW              | Dominant  | 0   |
| 4.75 to 5.25V                             | X               | 1               | 0.5VCC           | 0.5VCC           | Recessive | 1   |
| 4.75 to 5.25V                             | 1 (or floating) | X               | 0.5VCC           | 0.5VCC           | Recessive | 1   |
| VCC < PORL<br>(POR-level;<br>not powered) | X               | X               | 0V < VCANH < VCC | 0V < VCANL < VCC | Recessive | 1   |
| PORL < VCC < 4.75V                        | >2V             | X               | 0V < VCANH < VCC | 0V < VCANL < VCC | Recessive | 1   |

## 8.0 Electrical Characteristics

### 8.1 Definitions

All voltages are referenced to GND (pin 2).

Positive currents flow into the IC. Sinking current means that the current is flowing into the pin. Sourcing current means that the current is flowing out of the pin.

### 8.2 Absolute maximum ratings

Stresses above those listed in the following table may cause permanent device failure. Exposure to absolute maximum ratings for extended periods may effect device reliability.

Table 2 : Absolute maximum ratings

| Symbol      | Parameter                                      | Conditions                        | Min           | Max           | Unit |
|-------------|------------------------------------------------|-----------------------------------|---------------|---------------|------|
| VCC         | Supply voltage                                 |                                   | -0.3          | +7            | V    |
| VCANH       | DC voltage at pin CANH                         | 0 < VCC < 5.25V;<br>no time limit | -45*          | +45*          | V    |
| VCANL       | DC voltage at pin CANL                         | 0 < VCC < 5.25V;<br>no time limit | -45*          | +45*          | V    |
| VTXD        | DC voltage at pin TXD                          |                                   | -0.3          | VCC + 0.3     | V    |
| VRXD        | DC voltage at pin RXD                          |                                   | -0.3          | VCC + 0.3     | V    |
| Vref        | DC voltage at pin Vref                         |                                   | -0.3          | VCC + 0.3     | V    |
| VS          | DC voltage at pin S                            |                                   | -0.3          | VCC + 0.3     | V    |
| Vtran(CANH) | Transient voltage at pin CANH                  | Note 1                            | -150          | +150          | V    |
| Vtran(CANL) | Transient voltage at pin CANL                  | Note 1                            | -150          | +150          | V    |
| Vesd        | Electrostatic discharge voltage<br>at all pins | Note 2<br>Note 4                  | -4000<br>-500 | +4000<br>+500 | V    |
| Latch-up    | Static latch-up at all pins                    | Note 3                            |               | 100           | mA   |
| Tstg        | Storage temperature                            |                                   | -55           | +150          | °C   |
| Tamb        | Ambient temperature                            |                                   | -40           | +125          | °C   |
| Tjunc       | Maximum junction temperature                   | -40                               | +150          |               | °C   |

\* -85V min & +60V max also possible, please contact your local sales representative for details.

Notes

Note 1) Applied transient waveforms in accordance with “ISO 7637 part 3”, test pulses 1, 2, 3a and 3b (see Fig.4).

Note 2) Standardized Human Body Model ESD pulses in accordance to MIL883 method 3015.

Note 3) Static latch-up immunity: Static latch-up protection level when tested according to EIA/JESD78.

Note 4) Standardized Charged Device Model ESD pulses when tested according to EOS/ESD DS5.3-1993.

### Thermal Characteristics

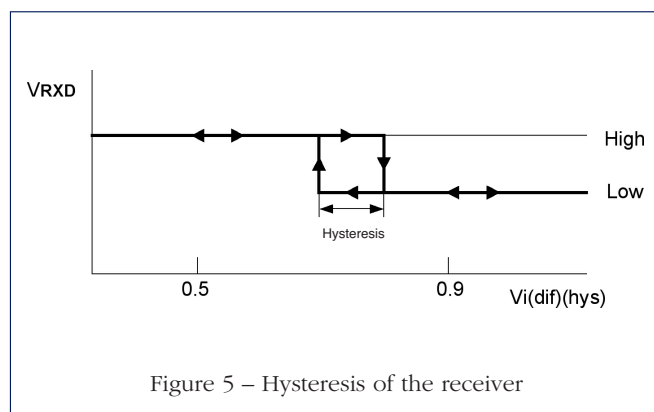
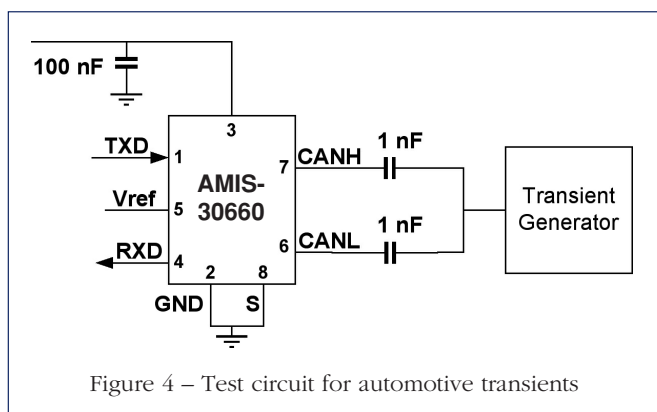
| Symbol    | Parameter                                                                | Conditions  | Value | Unit |
|-----------|--------------------------------------------------------------------------|-------------|-------|------|
| Rth(vj-a) | Thermal resistance from junction to ambient in SO8 package (2 layer PCB) | In free air | 150   | K/W  |
| Rth(vj-s) | Thermal resistance from junction to substrate of bare die                | In free air | 45    | K/W  |

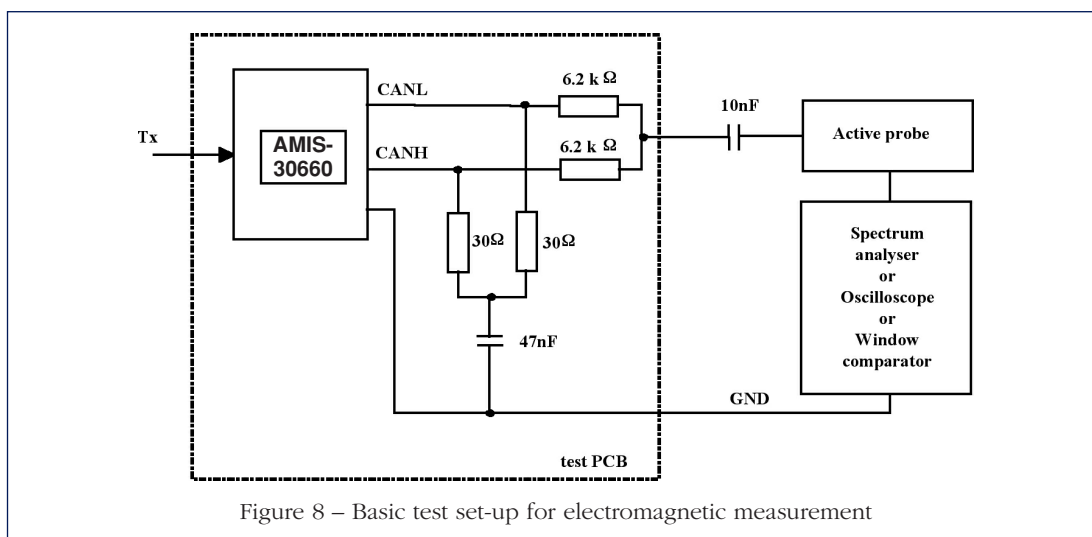
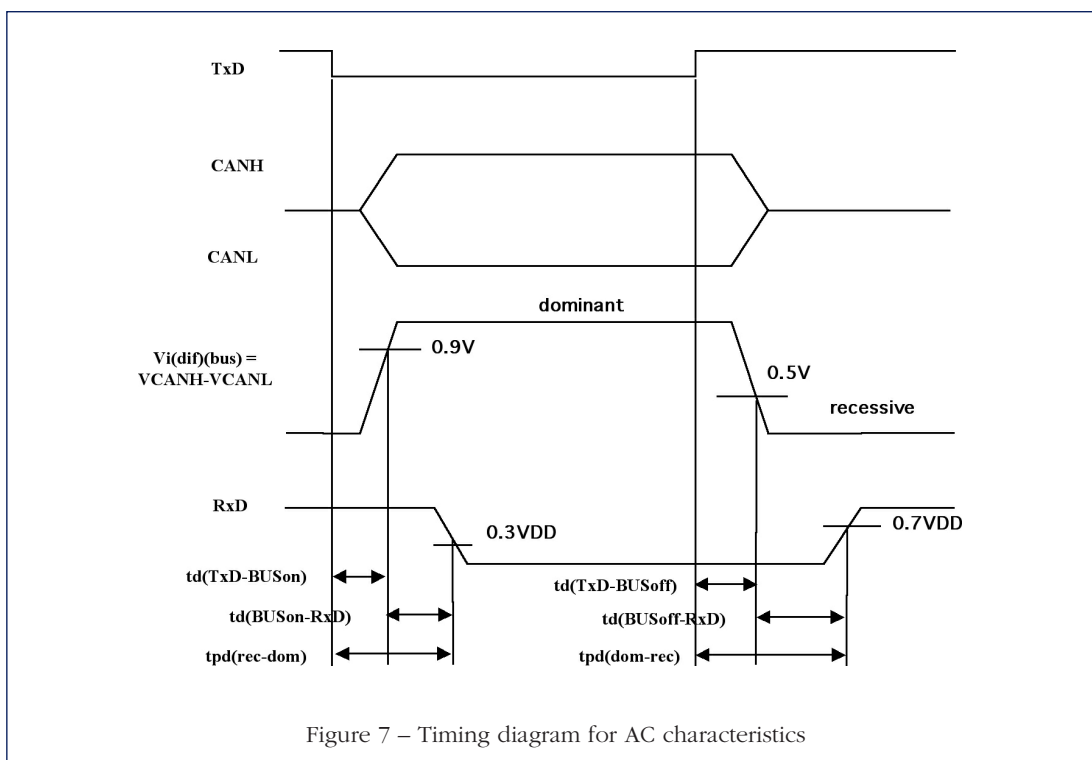
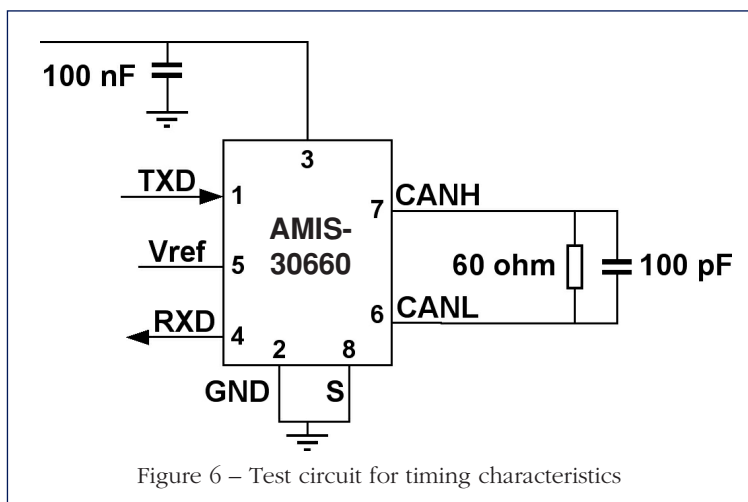
## Characteristics

VCC = 4.75 to 5.25 V; Tjunc = -40 to +150 °C; RLT = 60Ω  
unless specified otherwise.

| Symbol<br>Supply (pin VCC)                 | Parameter                                                       | Conditions                                                                       | Min         | Type      | Max        | Unit     |
|--------------------------------------------|-----------------------------------------------------------------|----------------------------------------------------------------------------------|-------------|-----------|------------|----------|
| ICC                                        | Supply current                                                  | Dominant; VTXD = 0V<br>Recessive; VTXD = VCC                                     |             | 44<br>5   | 65<br>8    | mA<br>mA |
| <b>Transmitter data input (pin TXD)</b>    |                                                                 |                                                                                  |             |           |            |          |
| VIH                                        | HIGH-level input voltage                                        | Output recessive                                                                 | 2.0         | -         | VCC + 0.3  | V        |
| VIL                                        | LOW-level input voltage                                         | Output dominant                                                                  | -0.3        | -         | +0.8       | V        |
| IIH                                        | HIGH-level input current                                        | VTXD = VCC                                                                       | -5          | 0         | +5         | μA       |
| IIL                                        | LOW-level input current                                         | VTXD = 0V                                                                        | -75         | -200      | -350       | μA       |
| Ci                                         | Input capacitance                                               | Not tested                                                                       | -           | 5         | 10         | pF       |
| <b>Mode select input (pin S)</b>           |                                                                 |                                                                                  |             |           |            |          |
| VIH                                        | HIGH-level input voltage                                        | Silent mode                                                                      | 2.0         | -         | VCC + 0.3  | V        |
| VIL                                        | LOW-level input voltage                                         | High-speed mode                                                                  | -0.3        | -         | +0.8       | V        |
| IIH                                        | HIGH-level input current                                        | VS = 2V                                                                          | 20          | 30        | 50         | μA       |
| IIL                                        | LOW-level input current                                         | VS = 0.8V                                                                        | 15          | 30        | 45         | μA       |
| <b>Receiver data output (pin RXD)</b>      |                                                                 |                                                                                  |             |           |            |          |
| VOH                                        | HIGH-level output voltage                                       | IRXD = -10mA                                                                     | 0.6         | 0.75      |            | VCC      |
| VOL                                        | LOW-level output voltage                                        | IRXD = 6mA                                                                       |             | 0.25      | 0.45       | V        |
| <b>Reference voltage output (pin Vref)</b> |                                                                 |                                                                                  |             |           |            |          |
| Vref                                       | Reference output voltage<br>at pin Vref                         | -50μA < IVref < +50μA                                                            | 0.45        | 0.5       | 0.55       | VCC      |
| Vref_CM                                    | Reference output voltage at pin<br>Vref for full CM range       | -35V < VCANH < +35V<br>-35V < VCANL < +35V                                       | 0.4         | 0.5       | 0.6        | VCC      |
| <b>Bus lines (pins CANH and CANL)</b>      |                                                                 |                                                                                  |             |           |            |          |
| Vo(reces)<br>(CANH)                        | Recessive bus voltage<br>at pin CANH                            | VTXD = VCC; no load                                                              | 2.0         | 2.5       | 3.0        | V        |
| Vo(reces)<br>(CANL)                        | Recessive bus voltage<br>at pin CANL                            | VTXD = VCC; no load                                                              | 2.0         | 2.5       | 3.0        | V        |
| Io(reces)<br>(CANH)                        | Recessive output current<br>at pin CANH                         | -35V < VCANH < +35V;<br>0 V < VCC < 5.25V                                        | -2.5        | -         | +2.5       | mA       |
| Io(reces)<br>(CANL)                        | Recessive output current<br>at pin CANL                         | -35V < VCANL < +35V;<br>0 V < VCC < 5.25V                                        | -2.5        | -         | +2.5       | mA       |
| Vo(dom)<br>(CANH)                          | Dominant output voltage<br>at pin CANH                          | VTXD = 0V                                                                        | 3.0         | 3.6       | 4.25       | V        |
| Vo(dom)<br>(CANL)                          | Dominant output voltage<br>at pin CANL                          | VTXD = 0V                                                                        | 0.5         | 1.4       | 1.75       | V        |
| Vi(dif) (bus)                              | Differential bus input<br>voltage (VCANH - VCANL)               | VTXD = 0V; dominant;<br>42.5 Ω < RLT < 60 Ω<br>VTXD = VCC; recessive;<br>no load | 1.5<br>-120 | 2.25<br>0 | 3.0<br>+50 | V<br>mV  |
| Io(sc)<br>(CANH)                           | Short-circuit output current at<br>pin CANH                     | VCANH = 0V; VTXD = 0V                                                            | -45         | -70       | -95        | mA       |
| Io(sc)<br>(CANL)                           | Short-circuit output current<br>at pin CANL                     | VCANL = 36V;<br>VTXD = 0V                                                        | 45          | 70        | 120        | mA       |
| Vi(dif)(th)                                | Differential receiver threshold<br>voltage                      | -5V < VCANL < +12V;<br>-5V < VCANH < +12V;<br>see Fig.5                          | 0.5         | 0.7       | 0.9        | V        |
| Vihcm(dif)(th)                             | Differential receiver threshold<br>voltage for high common-mode | -35V < VCANL < +35V;<br>-35V < VCANH < +35V;<br>see Fig.5                        | 0.30        | 0.7       | 1.05       | V        |
| Vi(dif)<br>(hys)                           | Differential receiver input<br>voltage hysteresis               | -5V < VCANL < +12V;<br>-5V < VCANH < +12V;<br>see Fig.5                          | 50          | 70        | 100        | mV       |
| Ri(cm)<br>(CANH)                           | Common mode input<br>resistance at pin CANH                     |                                                                                  | 15          | 25        | 37         | KΩ       |
| Ri(cm)<br>(CANL)                           | Common mode input<br>resistance at pin CANL                     |                                                                                  | 15          | 25        | 37         | KΩ       |

| Symbol                                           | Parameter                                                                              | Conditions                                    | Min  | Type | Max | Unit        |
|--------------------------------------------------|----------------------------------------------------------------------------------------|-----------------------------------------------|------|------|-----|-------------|
| $Ri(cm)(m)$                                      | Matching between pin CANH and pin CANL common mode input resistance                    | $V_{CANH} = V_{CANL}$                         | -3   | 0    | +3  | %           |
| $Ri(dif)$                                        | Differential input resistance                                                          |                                               | 25   | 50   | 75  | $K\Omega$   |
| $Ci(CANH)$                                       | Input capacitance at pin CANH                                                          | $V_{TXD} = V_{CC}$ ; not tested               |      | 7.5  | 20  | pF          |
| $Ci(CANL)$                                       | Input capacitance at pin CANL                                                          | $V_{TXD} = V_{CC}$ ; not tested               |      | 7.5  | 20  | pF          |
| $Ci(dif)$                                        | Differential input capacitance                                                         | $V_{TXD} = V_{CC}$ ; not tested               |      | 3.75 | 10  | pF          |
| $ILI(CANH)$                                      | Input leakage current at pin CANH                                                      | $V_{CC} = 0V$ ; $V_{CANH} = 5V$               | 10   | 170  | 250 | $\mu A$     |
| $ILI(CANL)$                                      | Input leakage current at pin CANL                                                      | $V_{CC} = 0V$ ; $V_{CANL} = 5V$               | 10   | 170  | 250 | $\mu A$     |
| $V_{CM-peak}$                                    | Common-mode peak during transition from dom $\rightarrow$ rec or rec $\rightarrow$ dom | See Fig. 8 & Fig. 9                           | -500 |      | 500 | mV          |
| $V_{CM-step}$                                    | Difference in common-mode between dom and recessive state                              | See Fig. 8 & Fig. 9                           | -150 |      | 150 | mV          |
| <b>Power On Reset</b>                            |                                                                                        |                                               |      |      |     |             |
| PORL                                             | POR level                                                                              | CANH, CANL, Vref in tri-state below POR level | 2.2  | 3.5  | 4.7 | V           |
| <b>Thermal shutdown</b>                          |                                                                                        |                                               |      |      |     |             |
| $Tj(sd)$                                         | Shutdown junction temperature                                                          |                                               | 150  | 160  | 180 | $^{\circ}C$ |
| <b>Timing characteristics (see Figs.6 and 7)</b> |                                                                                        |                                               |      |      |     |             |
| $t_d(TXD-BUSon)$                                 | Delay TXD to bus active                                                                | $V_S = 0V$                                    | 40   | 85   | 110 | ns          |
| $t_d(TXD-BUSoff)$                                | Delay TXD to bus inactive                                                              | $V_S = 0V$                                    | 30   | 60   | 110 | ns          |
| $t_d(BUSon-RXD)$                                 | Delay bus active to RXD                                                                | $V_S = 0V$                                    | 25   | 55   | 110 | ns          |
| $t_d(BUSoff-RXD)$                                | Delay bus inactive to RXD                                                              | $V_S = 0V$                                    | 65   | 110  | 135 | ns          |
| $t_{pd}(rec-dom)$                                | Propagation delay TXD to RXD from recessive to dominant                                | $V_S = 0V$                                    | 100  |      | 230 | ns          |
| $t_d(dom-rec)$                                   | Propagation delay TXD to RXD from dominant to recessive                                | $V_S = 0V$                                    | 100  |      | 245 | ns          |





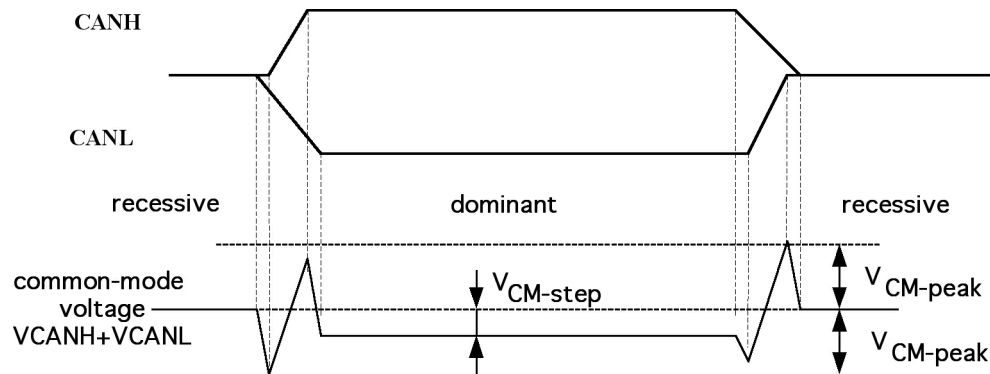


Figure 9 – Common-mode voltage peaks (see measurement setup Fig. 8.)

## Soldering

Introduction to soldering surface mount packages  
This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our "Data Handbook IC26; Integrated Circuit Packages" (document order number 9398 652 90011).

There is no soldering method that is ideal for all surface mount IC packages. Wave soldering is not always suitable for surface mount ICs, or for printed-circuit boards with high population densities. In these situations reflow soldering is often used.

## Reflow soldering

Reflow soldering requires solder paste (a suspension of fine solder particles, flux and binding agent) to be applied to the printed-circuit board by screen printing, stencilling or pressure-syringe dispensing before package placement.

Several methods exist for reflowing; for example, infrared/convection heating in a conveyor type oven. Throughput times (preheating, soldering and cooling) vary between 100 and 200 seconds depending on heating method.

Typical reflow peak temperatures range from 215 to 250°C. The top-surface temperature of the packages should preferably be kept below 230 °C.

## Wave soldering

Conventional single wave soldering is not recommended for surface mount devices (SMDs) or printed-circuit boards with a high component density, as solder bridging and non-wetting can present major problems.

To overcome these problems the double-wave soldering method was specifically developed.

If wave soldering is used the following conditions must be observed for optimal results:

- Use a double-wave soldering method comprising a turbulent wave with high upward pressure followed by a smooth laminar wave.
- For packages with leads on two sides and a pitch (e):  
– larger than or equal to 1.27mm, the footprint longitudinal axis is preferred to be parallel to the transport direction of the printed-circuit board;  
– smaller than 1.27mm, the footprint longitudinal axis must be parallel to the transport direction of the printed-circuit board. The footprint must incorporate solder thieves at the downstream end.
- For packages with leads on four sides, the footprint must be placed at a 45° angle to the transport direction of the printed-circuit board. The footprint must incorporate solder thieves downstream and at the side corners.

During placement and before soldering, the package must be fixed with a droplet of adhesive. The adhesive can be applied by screen printing, pin transfer or syringe dispensing. The package can be soldered after the adhesive is cured.

Typical dwell time is 4 seconds at 250°C. A mildly-activated flux will eliminate the need for removal of corrosive residues in most applications.

## Manual soldering

Fix the component by first soldering two diagonally-opposite end leads. Use a low voltage (24 V or less) soldering iron applied to the flat part of the lead. Contact time must be limited to 10 seconds at up to 300°C. When using a dedicated tool, all other leads can be soldered in one operation within 2 to 5 seconds between 270 and 320°C.

Suitability of surface mount IC packages for wave and reflow soldering methods

| Package                            | Soldering Method       |            |
|------------------------------------|------------------------|------------|
|                                    | Wave                   | Reflow (1) |
| BGA, SQFP                          | Not suitable           | Suitable   |
| HLQFP, HSQFP,<br>HSOP, HTSSOP, SMS | Not suitable (2)       | Suitable   |
| PLCC (3) , SO, SOJ                 | Suitable               | Suitable   |
| LQFP, QFP, TQFP                    | Not recommended (3)(4) | Suitable   |
| SSOP, TSSOP, VSO                   | Not recommended (5)    | Suitable   |

## Notes

1. All surface mount (SMD) packages are moisture sensitive. Depending upon the moisture content, the maximum temperature (with respect to time) and body size of the package, there is a risk that internal or external package cracks may occur due to vaporization of the moisture in them (the so called popcorn effect). For details, refer to the Drypack information in the "Data Handbook IC26; Integrated Circuit Packages; Section: Packing Methods".

2. These packages are not suitable for wave soldering as a solder joint between the printed-circuit board and heatsink (at bottom version) can not be achieved, and as solder may stick to the heatsink (on top version).

3. If wave soldering is considered, then the package must be placed at a 45° angle to the solder wave direction. The package footprint must incorporate solder thieves downstream and at the side corners.

4. Wave soldering is only suitable for LQFP, TQFP and QFP packages with a pitch (e) equal to or larger than 0.8mm; it is definitely not suitable for packages with a pitch (e) equal to or smaller than 0.65mm.

5. Wave soldering is only suitable for SSOP and TSSOP packages with a pitch (e) equal to or larger than 0.65mm; it is definitely not suitable for packages with a pitch (e) equal to or smaller than 0.5mm.

| Revision Number | Changes on page |
|-----------------|-----------------|
| Version 1       |                 |
| Revision 1.1    | 1 and 6         |
| Revision 1.2    | 8               |