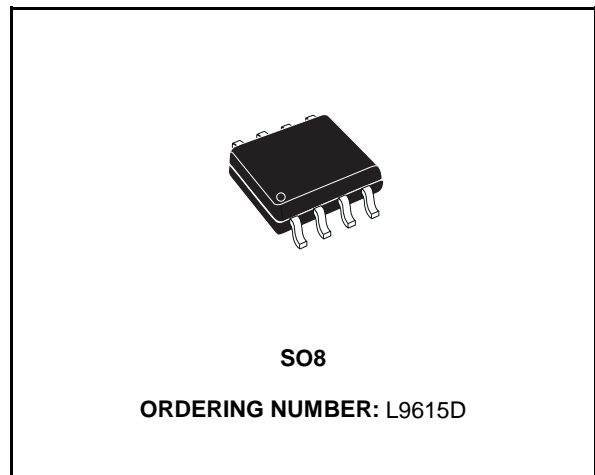


## CAN BUS TRANSCEIVER

- L9615 MEETS ISO/DIS 11898 UP TO 500KBAUD
- TRANSMITTER
  - GENERATION OF DIFFERENTIAL OUTPUT SIGNALS
  - SHORT CIRCUIT PROTECTED FROM -5V TO 36V, DETECTION & SHUTDOWN
  - SLOPE CONTROL TO REDUCE RFI AND EMI
  - TWO STATES ADJUSTABLE SLOPE CONTROL ( $\leq 500\text{KBAUD}/\leq 125\text{KBAUD}$ )
- RECEIVER
  - DIFFERENTIAL INPUT WITH HIGH INTERFERENCE SUPPRESSION
  - COMMON MODE INPUT VOLTAGE RANGE ( $V_{\text{COM}}$ ) FROM -2V TO  $V_{\text{S}}+3\text{V}$
- PACKAGE: SO 8

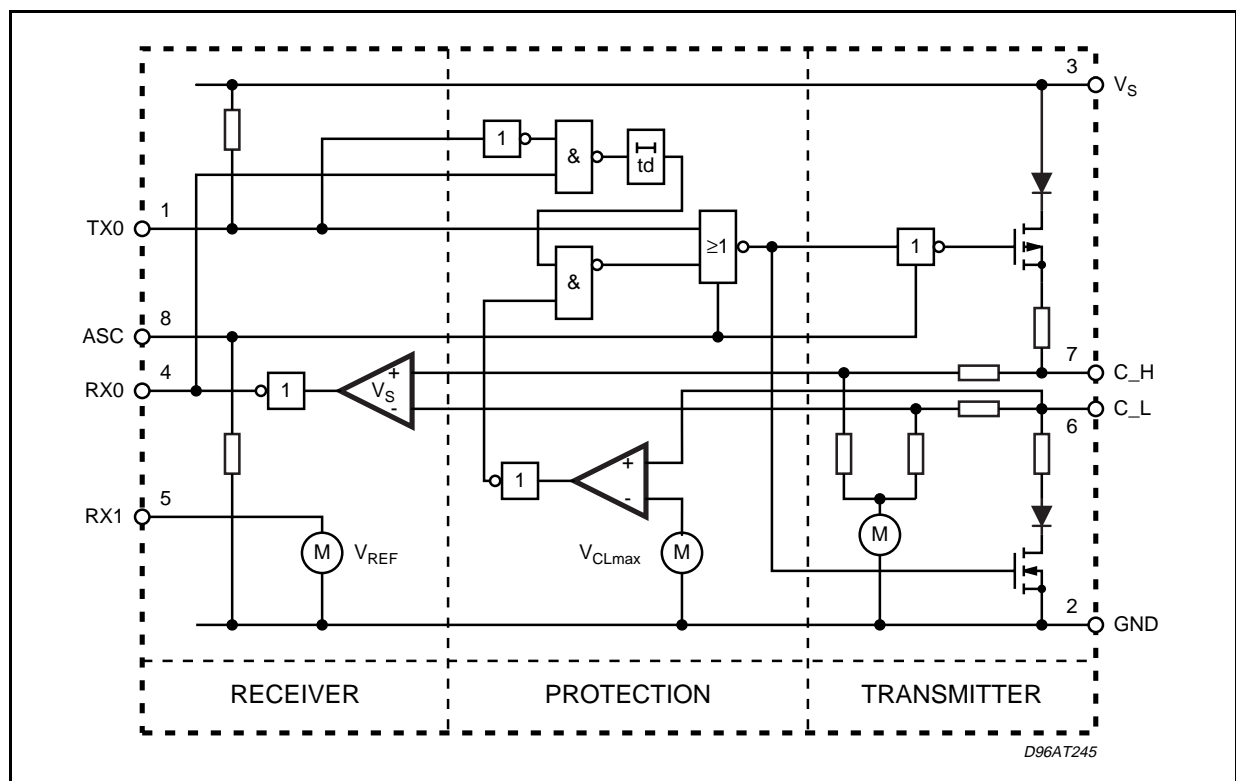


### DESCRIPTION

The L9615 is a bidirectional transceiver for signal

conditioning and processing in connection with a CAN controller. Data rates of up to 500KBAUD are supported using either shielded or non-shielded pair of lines.

### BLOCK DIAGRAM

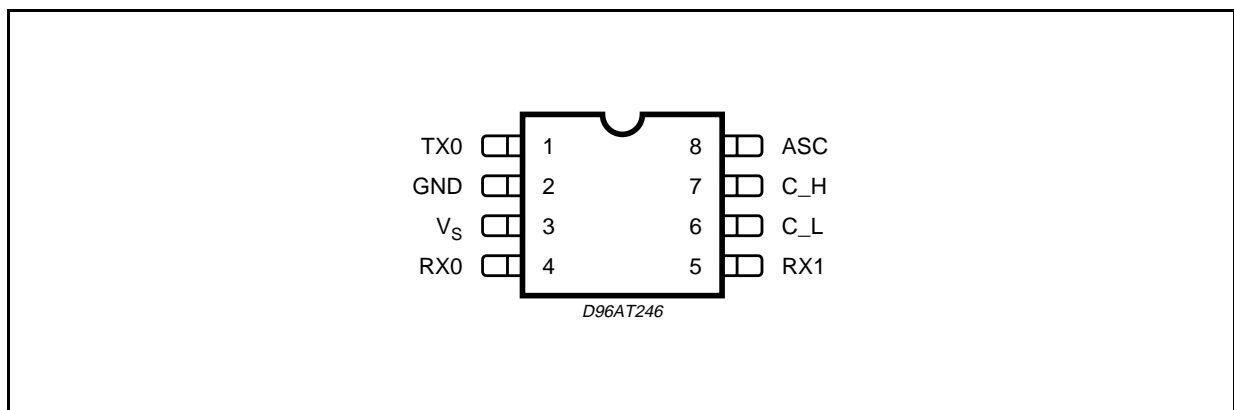


**ABSOLUTE MAXIMUM RATINGS**

| Symbol               | Parameter  | Value                   | Unit |
|----------------------|--|-------------------------|------|
| $V_S$                | Supply Voltage   | -0.3 to 7               | V    |
| $V_{C\_H}, V_{C\_L}$ | Bus Voltage at C_H, C_L (VS 0 to 5.5V)   | -5 to 36                | V    |
| $I_{C\_H}, I_{C\_L}$ | Off State Leakage Current at C_H, C_L ( VS =0 to 5.5V, $V_{C\_H} = -5$ to 36V, $V_{C\_L} = -5$ to 36 ) | -3 to 5                 | mA   |
| $V_{DC}$             | DC Voltage at TXO, ASC (VS 0 to 5.5V)  | GND -0.3 to $V_S + 0.3$ | V    |
| $I_{RXO}$            | Output Current at RXO (VS 0 to 5.5V)   | -0.3 to 1               | mA   |
| $T_{stg}, T_J$       | Storage and Junction Temperature Range   | -40 to 150              | °C   |
| $T_{op}$             | Operating Temperature Range  | -40 to 110              | °C   |

All voltages, except bus voltage, are defined with respect to pin 2  
 Positive currents flow into the IC.

**PIN CONNECTION**



**THERMAL DATA**

| Symbol | Parameter | Value | Unit |
|--------|-----------|-------|------|
|        |           |       |      |
|        |           |       |      |

**PIN FUNCTIONS**

| N. | Name  | Function                 |
|----|-------|--------------------------|
| 1  | TXO   | Transmitter Input        |
| 2  | GND   | Ground                   |
| 3  | $V_S$ | Supply Voltage           |
| 4  | RXO   | Receive Output           |
| 5  | RX1   | Reference Voltage        |
| 6  | C_L   | Low Side Bus Output      |
| 7  | C_H   | High Side Bus Output     |
| 8  | ASC   | Adjustable Slope Control |

**ELECTRICAL CHARACTERISTICS** ( $T_{OP} = -40$  to  $110^{\circ}\text{C}$ ;  $V_S = 4.5$  to  $5.5\text{V}$ ; Dominant:  $V_{TXO} = \text{GND}$ ; Recessive:  $V_{TXO} = V_S$ ; All voltages, except bus voltage, are defined with respect to pin 2. Positive currents flow into the IC unless otherwise specified.)

| Symbol  | Parameter  | Test Condition  | Min.       | Typ.      | Max.       | Unit             |
|---|--|---|------------|-----------|------------|------------------|
| $V_S$   | Supply Voltage   |   | 4.5        | 5         | 5.5        | V                |
| $I_S$   | Supply Current   | Dominant  |            |           | 80         | mA               |
|   |  | Recessive   |            |           | 20         | mA               |
| <b>TRANSMITTER SECTION</b> ( $R_A = 60\Omega$ between $C_H$ and $C_L$ ) |  |   |            |           |            |                  |
| $C_{TXO}$   | TXO Input Capacitance  | $0\text{V} < V_{TXO} < V_S$   |            | 25        |            | pF               |
| $V_{TXO}$   | TXO High Level Input Voltage   |   | $0.7 V_S$  |           | $V_S$      |                  |
|   | TXO Low Level Input Voltage  |   | 0          |           | $0.3 V_S$  |                  |
| $I_{TXO}$   | TXO High Level Input Current   | $V_{TXO} = V_S$   | -2         | 0         | 2          | $\mu\text{A}$    |
|   | TXO Low Level Input Current  | $V_{TXO} = \text{GND}$  | -275       | 0         | -25        | $\mu\text{A}$    |
| $C_{ASC}$   | ASC Input Capacitance  | $0\text{V} < V_{ASC} < V_S$   |            | 25        |            | pF               |
| $V_{ASC}$   | ASC Input Voltage for High Speed   |   | 0          |           | $0.1 V_S$  |                  |
|   | ASC Input Voltage for Low Speed  |   | $0.9 V_S$  |           | $V_S$      |                  |
| $I_{ASC}$   | ASC Input Current  | $V_{ASC} = V_S$   | 25         |           | 275        | $\mu\text{A}$    |
|   |  | $V_{ASC} = 0\text{V}$   | -2         | 0         | 2          | $\mu\text{A}$    |
| $V_{C_H}, V_{C_L}$  | Bus Voltage Recessive  | Recessive   | $0.4 V_S$  | $0.5 V_S$ | $0.6 V_S$  |                  |
| $I_{C_H}, I_{C_L}$  | Leakage Current Recessive  | $V_{C_L} = V_{C_H} = -2$ to $7\text{V}$   | -0.7       |           | 0.7        | mA               |
|   |  | $V_{C_L} = V_{C_H} = 1$ to $4\text{V}$  | -0.3       |           | 0.3        | mA               |
| $R_{IN}(C_H, C_L)$  | Input Resistance   | Recessive   | 5          |           | 50         | $\text{K}\Omega$ |
| $R_{DIFF}(C_H, C_L)$  | Differential Input Resistance  | Recessive   | 10         |           | 100        | $\text{K}\Omega$ |
| $V_{DIFF} = V_{C_H} - V_{C_L}$  | Differential Output Voltage  | Dominant, $R_A$   | 1.5        |           | 3          | V                |
| $V_{DIFF} = V_{C_H} - V_{C_L}$  | Differential Output Voltage  | Recessive   | -500       | 0         | 50         | mV               |
| $t_d$   | Short Circuit Detection Time<br>$C_H$ to $C_L$ ; $C_H$ to B                          | $R_{CS} < 1\Omega$  | 1          | 5         | 10         | $\mu\text{s}$    |
| $I_A$   | Supply Current in Case of Short Circuit, $C_H$ to $C_L$ , $C_H$ to B (time = $t_d$ ) |   |            | 150       |            | mA               |
| $V_{C_Lmax}$  | Overvoltage Protection Threshold on $C_L$  |   | 7          | 8         | 10         | V                |
| <b>RECEIVE SECTION</b>  |  |   |            |           |            |                  |
| $V_{RXO}$   | RXO High Level Output Voltage  | $V_{DIFF} < 0.5\text{V}$ ; $I_{RXO} = 0.3\text{mA}$ ; $V_{C_H} = -2$ to $7\text{V}$ ; $V_{C_L} = -2$ to $7\text{V}$ ; | $0.9 V_S$  |           | $V_S$      | V                |
|   | RXO Low Level Output Voltage   | $V_{DIFF} > 0.9\text{V}$ ; $I_{RXO} = 1\text{mA}$ ; $V_{C_H} = -2$ to $7\text{V}$ ; $V_{C_L} = -2$ to $7\text{V}$ ;   |            |           | 0.5        | V                |
| $V_S = V_{C_H} - V_{C_L}$   | Input Signal Threshold   | $V_{C_H} = -2$ to $7\text{V}$ ; $V_{C_L} = -2$ to $7\text{V}$ ;   | 500        | 700       | 900        | mV               |
| $V_{COM} = (V_{C_H} + V_{C_L})/2$                                       | Input Common Mode Voltage Range  |   | -2         |           | 7          | V                |
| $V_{HYS}$   | Differential Input Hysteresis  |   |            | 150       |            | mV               |
| <b>REFERENCE OUTPUT</b>   |  |   |            |           |            |                  |
| $V_{RX1}$   | Reference Voltage  | $I_{RX1} = 0$   | $0.45 V_S$ | $0.5 V_S$ | $0.55 V_S$ | V                |
| $R_{RX1}$   | Output Resistance  |   | 2          |           | 9          | $\text{K}\Omega$ |

# L9615

**DINAMIC CHARACTERISTICS** ( $C_A = 47\text{pF}$  between  $C_H$  and  $C_L$ ;  $V_S = 5\text{V}$ ;  $t_R < 5\text{ns}$ ;  $C_{RXO} = 20\text{pF}$  between  $R_XO$  and  $B$ ;  $R_A = 60\Omega$  between  $C_H$  and  $C_L$ )

| Symbol    | Parameter                                   | Test Condition        | Min. | Typ. | Max. | Unit                   |
|-----------|---|-----------------------|------|------|------|------------------------|
| $t_{OT}$  | Signal Delay TXO to $C_H$ , $C_L$           |                       |      |      | 50   | ns                     |
| SR        | Differential Output Slew Rate (Transmitter) | $V_{ASC} = 0\text{V}$ | 20   |      | 50   | $\text{V}/\mu\text{s}$ |
|           |   | $V_{ASC} = V_S$       | 5    |      | 20   | $\text{V}/\mu\text{s}$ |
| $t_{OR}$  | Signal Delay $C_H$ , $C_L$ to $R_XO$        | $V_{ASC} = 0\text{V}$ |      |      | 150  | ns                     |
| $t_{OTR}$ | Signal Delay Txo to Rxo                     | $V_{ASC} = 0\text{V}$ |      |      | 300  | ns                     |

## FUNCTIONAL DESCRIPTION

The L9615 is used as an interface between a CAN controller and the physical bus. The device provides transmitting capability to the CAN controller.

The transmitter outputs  $C_H$  and  $C_L$  are protected against short circuits and electrical transients which may occur in an automotive environment. In case of short circuit ( $C_H$  to  $C_L$ ,  $C_H$  to B) the protection circuit recognizes this fault condition and the transmitter output stages are disabled with a delay of max.  $10\mu\text{s}$  to prevent destruction of the IC and high consumption of supply current  $I_S$ . If  $V_{C_L} > V_{C_{Lmax}}$  the transmitter output stages would be disabled immediately.

Pin ASC makes it possible to select two different

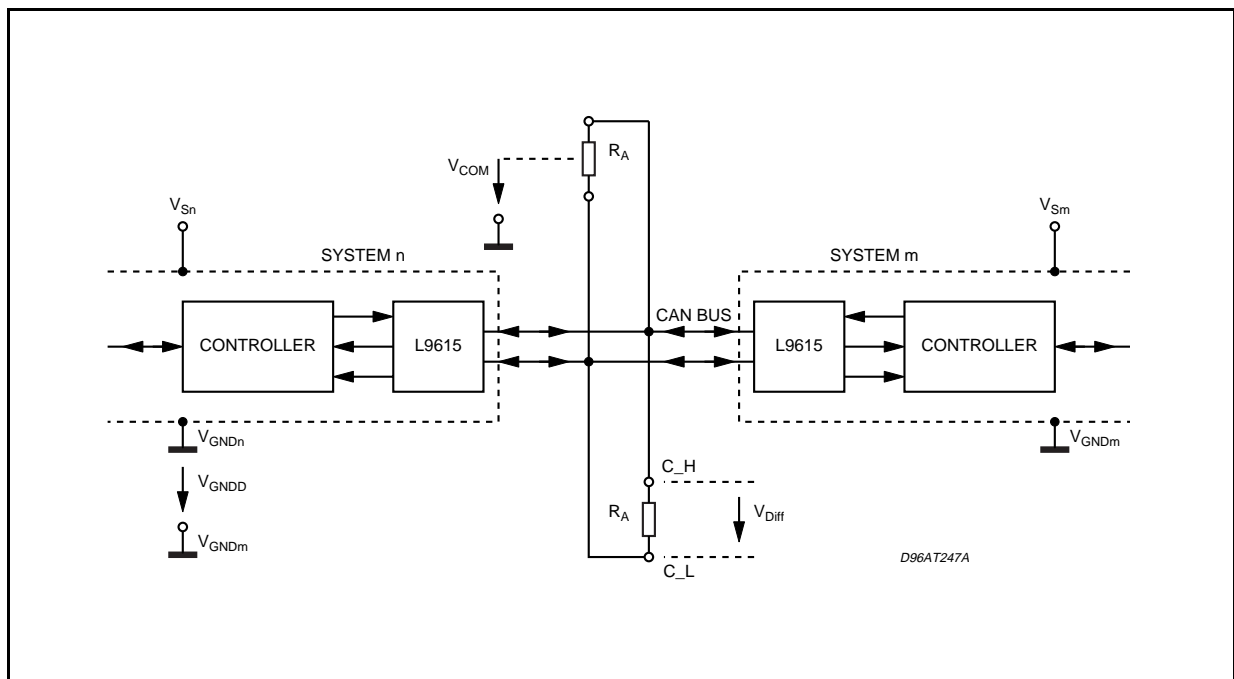
modes of operation: High speed ( $\leq 500\text{kBaud}$ ) and low speed ( $\leq 125\text{kBaud}$ ).

The ASC pin is tied to GND for normal operation at  $\leq 500\text{kBaud}$ . For slower speed operation at  $\leq 125\text{kBaud}$  the rise and fall slope of the bus output can be decreased to reduce EMI by connecting the ASC pin to  $V_S$ .

## FUNCTIONAL TABLE

| TXO           | $C_H$            | $C_L$            | Bus State | $R_XO$ |
|---------------|------------------|------------------|-----------|--------|
| L             | H                | L                | Dominant  | L      |
| H or Floating | Floating $V_S/2$ | Floating $V_S/2$ | Recessive | H      |

## TYPICAL APPLICATION



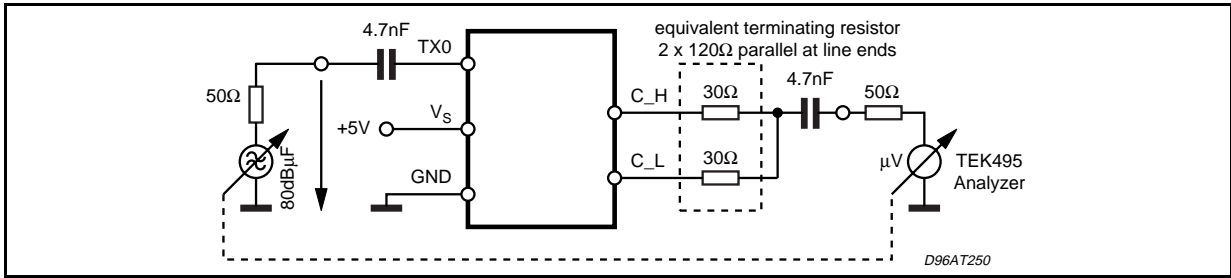
**TIMING DIAGRAM**



**EMC PERFORMANCE (RECEIVER)**

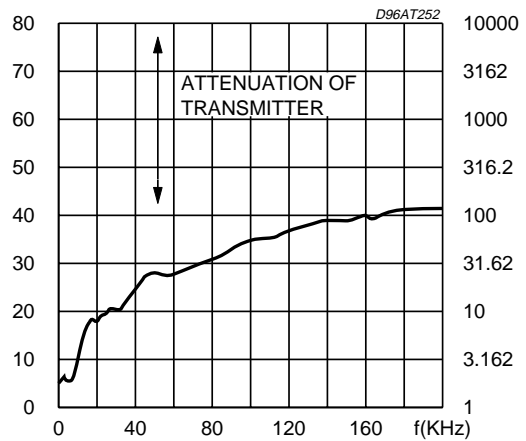
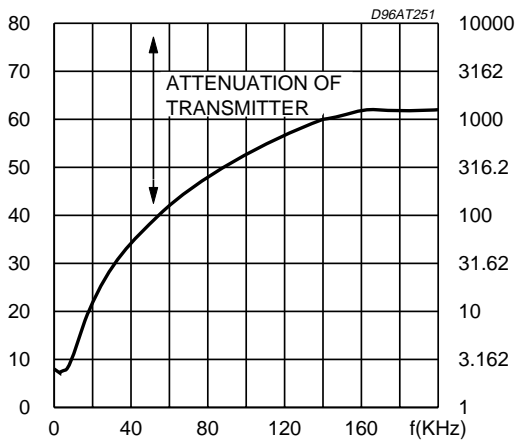


EMC PERFORMANCE (TRANSMITTER)

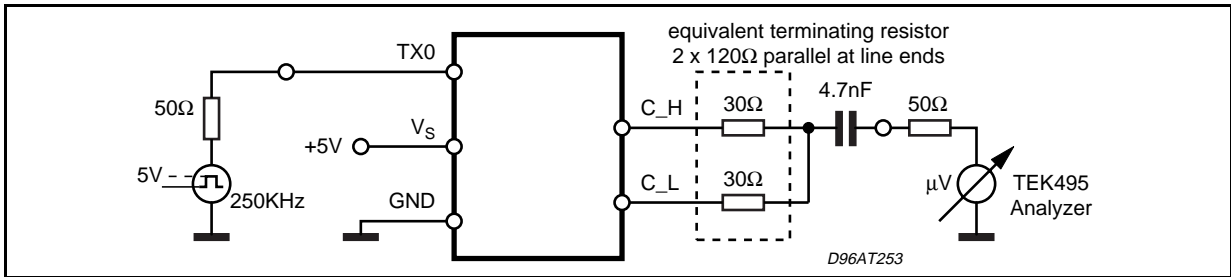


Transceiver Without Emc Reducing Measures

Transceiver With Emc Reducing Measures

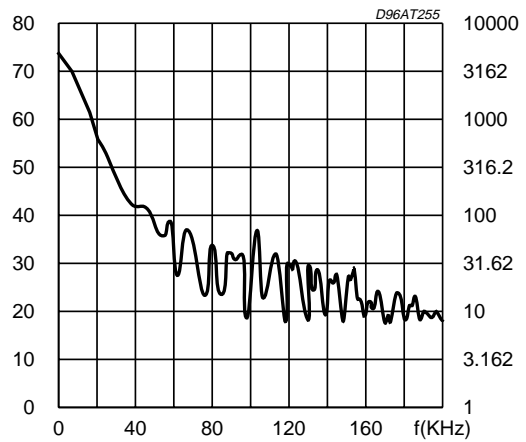
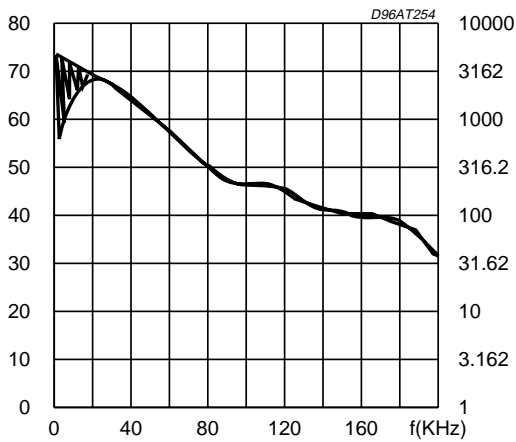


EMC PERFORMANCE (Transceiver Sending)



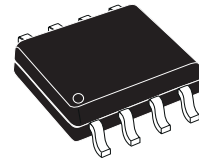
Transceiver Without Emc Reducing Measures

Transceiver With Emc Reducing Measures



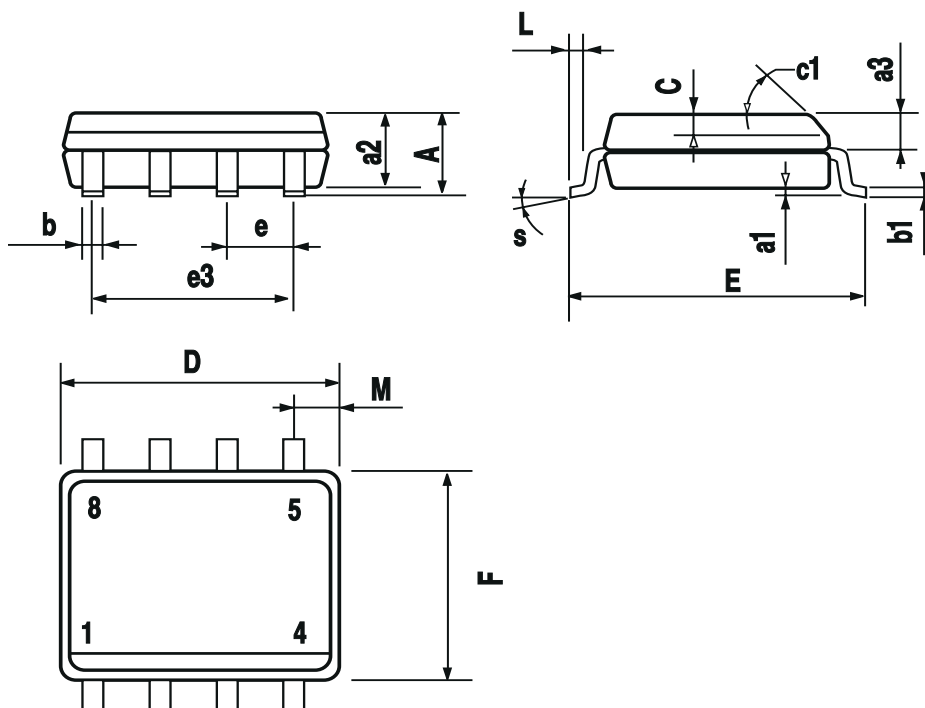
| DIM.  | mm         |      |      | inch  |       |       |
|-------|------------|------|------|-------|-------|-------|
|       | MIN.       | TYP. | MAX. | MIN.  | TYP.  | MAX.  |
| A     |            |      | 1.75 |       |       | 0.069 |
| a1    | 0.1        |      | 0.25 | 0.004 |       | 0.010 |
| a2    |            |      | 1.65 |       |       | 0.065 |
| a3    | 0.65       |      | 0.85 | 0.026 |       | 0.033 |
| b     | 0.35       |      | 0.48 | 0.014 |       | 0.019 |
| b1    | 0.19       |      | 0.25 | 0.007 |       | 0.010 |
| C     | 0.25       |      | 0.5  | 0.010 |       | 0.020 |
| c1    | 45° (typ.) |      |      |       |       |       |
| D (1) | 4.8        |      | 5.0  | 0.189 |       | 0.197 |
| E     | 5.8        |      | 6.2  | 0.228 |       | 0.244 |
| e     |            | 1.27 |      |       | 0.050 |       |
| e3    |            | 3.81 |      |       | 0.150 |       |
| F (1) | 3.8        |      | 4.0  | 0.15  |       | 0.157 |
| L     | 0.4        |      | 1.27 | 0.016 |       | 0.050 |
| M     |            |      | 0.6  |       |       | 0.024 |
| S     | 8° (max.)  |      |      |       |       |       |

## OUTLINE AND MECHANICAL DATA



**SO8**

(1) D and F do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm (.006inch).



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Тел: +7 (812) 336 43 04 (многоканальный)  
Email: [org@lifeelectronics.ru](mailto:org@lifeelectronics.ru)