

M59330P

LAN Transceiver

REJ03F0032-0100Z

Rev.1.0

Sep.16.2003

Description

The M59330P is an integrated circuit for two-line LAN transceivers, conforming to J1850 specifications.

The chip incorporates bus line anomaly detection functions; anomalous behavior causes the ERR signal to go to "L". A selector causes a normal bus signal to be output to R_X.

By setting the standby signal to "L", a low consumption current state is maintained. At this time, the drivers BUS (+) and BUS (-) are both turned off.

In standby mode, on input of "H" level to the ERR pin, error output reset occurs.

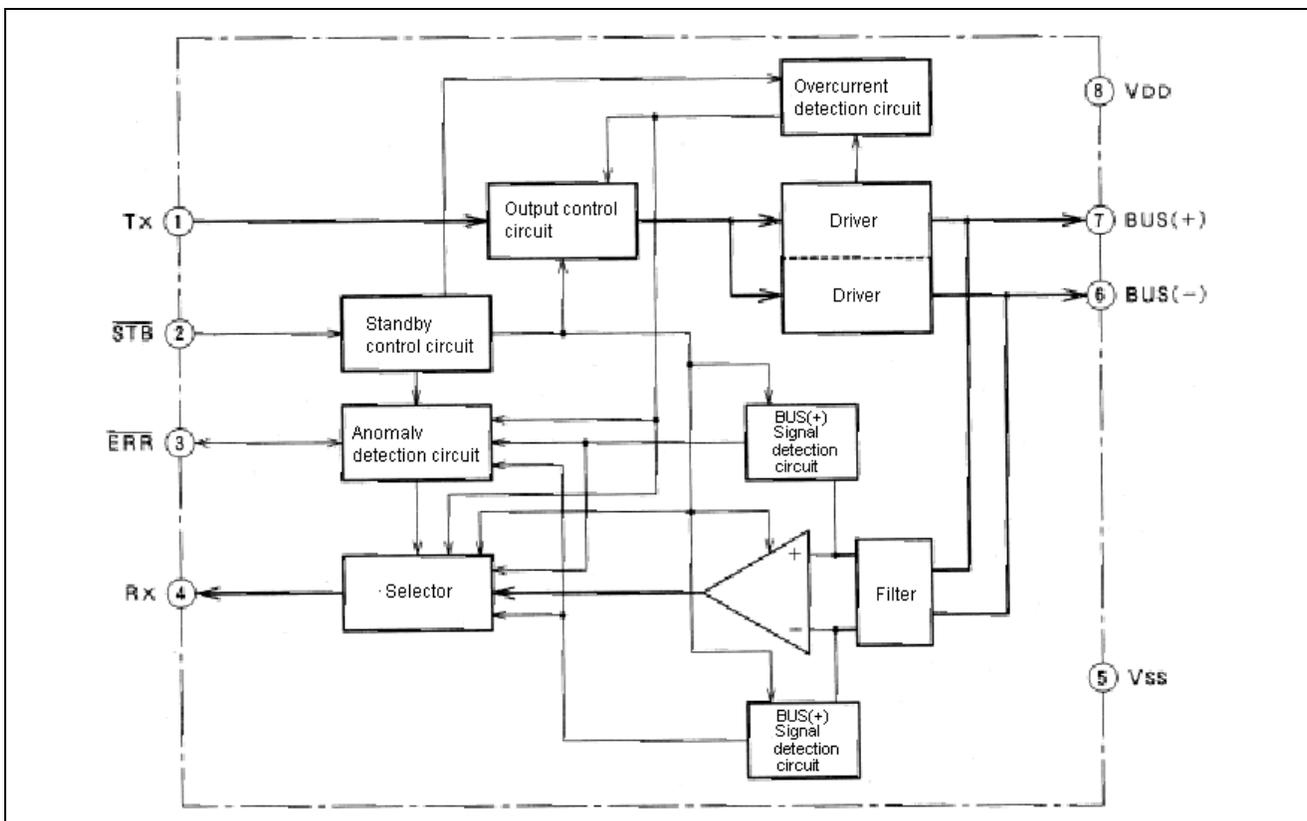
Features

- Conforms to SAE J1850 specifications
- Internal bus line anomaly detection function

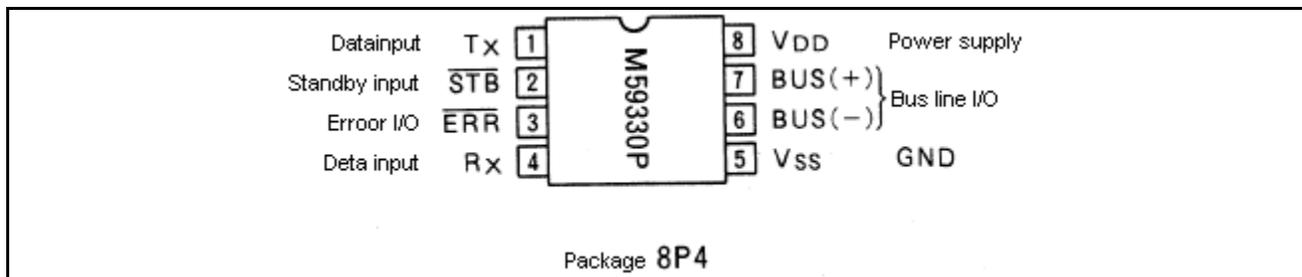
Applications

- LAN transceiver for automotive use, generic LAN transceiver, transceiver for other communication applications

Block Diagram



Pin Configuration (Top View)



Explanation of Functions

Pin Description

| Pin no. | Pin name | I/O | Function |
|---------|-----------------|-----|---|
| 1 | Tx | I | Data signal input pin |
| 2 | STB | I | Standby signal input pin; L: standby mode, H: normal operation |
| 3 | ERR | I/O | Error signal output pin and error reset input pin; on detection of anomaly in transmission channel, outputs "L" level; in standby mode, error reset on input of "H" level |
| 4 | Rx | O | Pin for output of signal from transmission channel |
| 5 | Vss | I | Clamping pin |
| 6 | Bus(-) | I/O | Pin for signal output to transmission channel and for input of signal from transmission channel (negative logic) |
| 7 | Bus(+) | I/O | Pin for signal output to transmission channel and for input of signal from transmission channel (positive logic) |
| 8 | V _{DD} | I | Power supply pin |

Transmission Channel Anomaly Detection and Communication Functions

The M59330P uses driver overcurrent detection functions and transmission signal logic error detection functions to detect anomalies in the transmission channel, and outputs an error signal (ERR (pin 3) = "L") accordingly. Also, by switching the signal output to pin R_x (pin 4) according to the anomalous state, communication is possible after anomaly occurrence.

(1) Overcurrent detection

The drivers of the BUS(+) pin (pin 7) and BUS(-) pin (pin 6) of the M59330P are provided with overcurrent detection circuits. When excessive current flows in a driver, the driver is turned off, and an error signal (ERR (pin 3) = "L") is output. When overcurrent is detected, the driver is maintained in the off state until error reset.

The drivers for the BUS(+) pin (pin 7) and the BUS(-) pin (pin 6) are independent; depending on the circumstances of the anomaly, both may be turned off.

A filter is incorporated to prevent erroneous operation due to transient currents when a driver is turned on, and an overcurrent state is not detected for a short period of time (several hundred ns). The detection current is set at approx. 180 mA.

(2) Logical anomaly detection

M59330P transmission signals operate at opposite phases, and by comparing the signals, anomalies in the transmission channel are detected. The signals are compared at a preset time relative to an edge of the signals of the transmission channels (BUS(+) , BUS(-)), and if they do not coincide, it is assumed that an anomaly has occurred in one of the transmission channels, and an error signal (ERR (pin 3) = "L") is output. When the next edge is detected within the preset time, this edge is taken as a new reference for timing, and if noncoincidence continues for longer than the preset time, an anomaly is detected. The time is set to approx. 4.2 μs.

Logical anomaly detection does not support multiple error modes.

When only a logical anomaly is detected, the driver is not turned off. A driver is turned off upon anomaly detection only when overcurrent is detected.

(3) Communication functions

The M59330P normally outputs differential signals on BUS (+) (pin 7) and BUS (-) (pin 6), but when an anomaly is detected, switches signal output to the R_X pin (pin 4) according to the anomaly state.

When overcurrent is detected, an anomaly with the driver or transmission channel for which the overcurrent was detected is assumed, and an error signal is output; at the same time, the signal for the other transmission channel is output to the R_X output (pin 4). As explained in (1) above, in some cases both drivers may be turned off; in such cases, the R_X output (pin 4) is fixed at "L".

When a logical anomaly is detected, an error signal (ERR (pin 3) = "L") is output, and at the same time the R_X output (pin 4) is driven to "L". After error signal output, a transmission channel for which a transmission signal edge is detected is regarded as normal, and the signal for the channel is output to the R_X output (pin 4).

Overcurrent detection takes precedence over logical anomaly detection in operations to switch the error signal output and R_X output.

Table 1. Anomaly modes and anomaly detection functions

| | Anomaly mode | | Error output | Communication after anomaly detection | Method of anomaly detection |
|---|----------------------|-----------|--------------|---------------------------------------|-----------------------------|
| 1 | Bus(+) | GND short | Y | Y | (2) |
| 2 | | VDD short | Y | Y | (1), (2) |
| 3 | | Open | Y | Y | (2) |
| 4 | Bus(-) | GND short | Y | Y | (1), (2) |
| 5 | | VDD short | Y | Y | (2) |
| 6 | | Open | Y | Y | (2) |
| 6 | BUS(+), BUS(-) short | | Y | N | (1) |

Error Reset

After standby mode is entered (the STB pin (pin 2) = "L"), the M59330P error output is reset by inputting level "H" to the ERR pin (pin 3). In this case, all operations relating to anomaly detection, such as overcurrent detection and R_X output switching, are canceled.

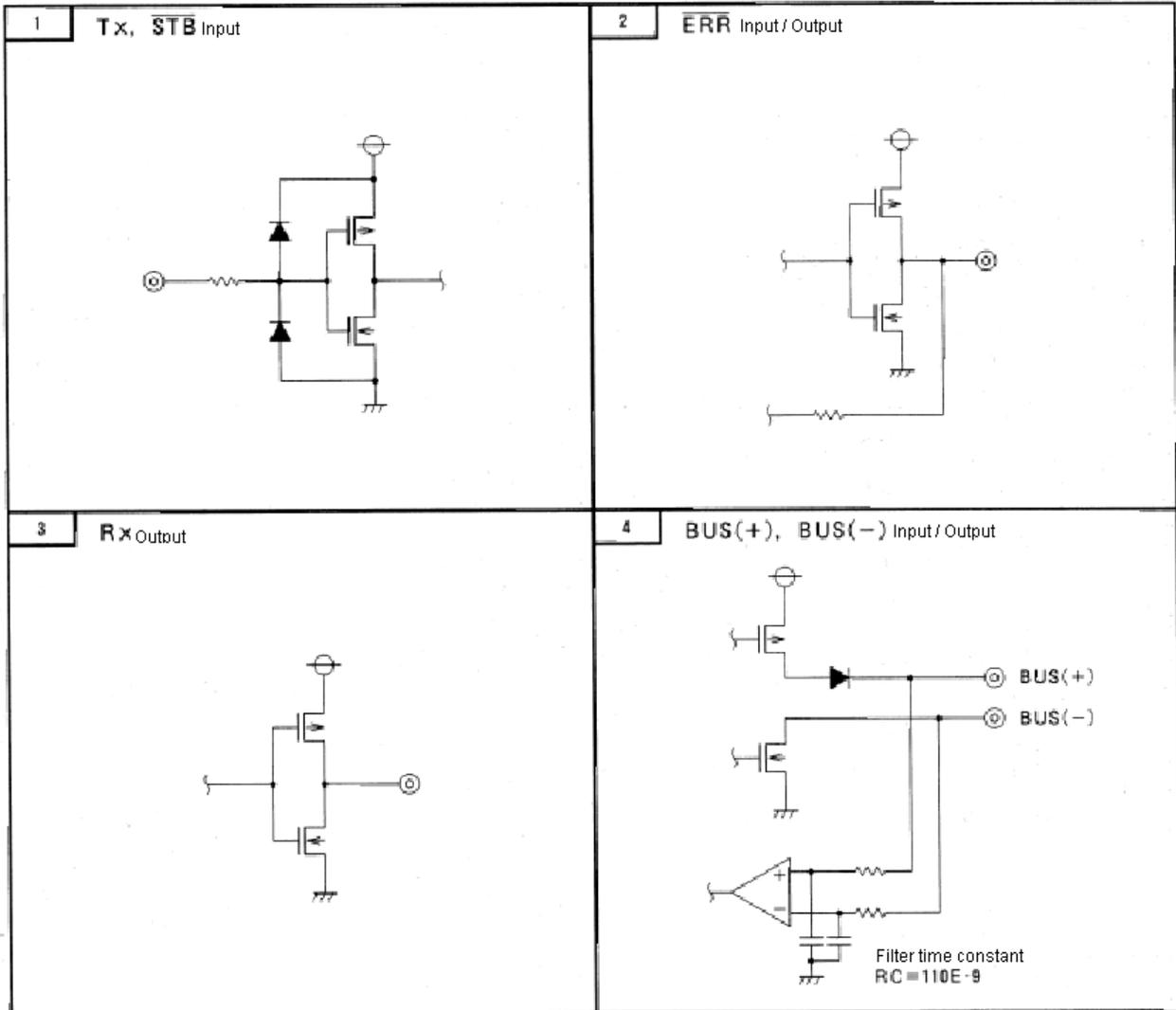
Standby Mode

By driving the STB pin (pin 2) to "L" level, the M59330P can be put into a low consumption current mode.

In standby mode, the driver and overcurrent detection functions do not operate, but the logical anomaly detection function continues to operate, and except for overcurrent detection, detection of anomalies is possible. However, there is only error signal output, and R_X output signal switching is not performed.

In standby mode, the R_X output is the logical sum of the BUS(+) signal and the BUS(-) signal.

Input/Output Equivalent Circuits



Electrical Characteristics

(unless otherwise noted, Ta=-40 to 85°C)

| Symbol | Quantity | Conditions | Rated value | | | Unit |
|--------------------|-------------------------------|--|-----------------|------|----------------------|------|
| | | | Min. | Typ. | Max. | |
| I _{DD1} | Power supply current 1 | RBUS = 105 Ω, Tx = "L", STB = "H" | | | 5.0 | mA |
| I _{DD2} | Power supply current 2 | RBUS = 105 Ω, Tx = "H", STB = "H" | | | 55 | mA |
| I _{DD3} | Power supply current 3 | RBUS = 105 Ω, Tx = STB = "H" | | | 200 | μA |
| V _{TH1} | "H" input threshold voltage 1 | ERR | 2.2 | | 3.2 | V |
| V _{TH2} | "H" input threshold voltage 2 | Tx, STB | 2.3 | | 3.5 | V |
| V _{TL} | "L" input threshold voltage | Tx, STB | 1.6 | | 2.8 | V |
| V _{HYSL} | Hysteresis width | Tx, STB | 0.4 | | 1.0 | V |
| V _{CIN} | BUS input voltage range | BUS(+), BUS(-) | V _{SS} | | V _{DD} -2.0 | V |
| V _{HYS8} | Input hysteresis width | BUS(+), BUS(-) differential input | 70 | | 300 | mV |
| I _{IPP1} | BUS(+) leakage current 1 | with power supply off (V _{DD} = 0V), BUS(+) = 0V | | | 100 | μA |
| I _{IPP1} | BUS(+) leakage current 2 | with power supply off (V _{DD} = 0V), BUS(+) = 5V | | | 100 | μA |
| I _{IPP2} | BUS(+) leakage current 3 | with power supply on BUS(-) = 5V | -20 | | | μA |
| I _{IDP2} | BUS(+) leakage current 4 | with power supply on BUS(-) = 0V | | | 100 | μA |
| I _{IPM1} | BUS(-) leakage current 1 | with power supply off -50mA | | | 100 | μA |
| I _{IDM1} | BUS(-) leakage current 2 | with power supply off +50mA | | | 100 | μA |
| I _{IPM2} | BUS(-) leakage current 3 | with power supply on | | | 20 | μA |
| V _{IDM2} | BUS(-) leakage current 4 | with power supply on | | | 100 | μA |
| V _{DROP1} | Driver drop voltage | IBUS(+) = -50mA | | | 1.0 | V |
| V _{DROP2} | | IBUS(-) = +50mA | | | 0.6 | |
| V _{OH1} | "H" output voltage 1 | R _X pin I _{OH} = -1mA | 4.5 | | 5.0 | V |
| V _{OL1} | "L" output voltage 1 | R _X pin I _{OL} = +1mA | | | 0.6 | V |
| V _{OH2} | "H" output voltage 2 | ERR pin I _{OH} = -1mA | 4.5 | | 5.0 | V |
| IPD | ERR pull-down current | ERR pin V _{OH} = 3.0V | | 350 | 700 | μA |
| C _{I1} | Input capacitance 1 | power supply OFF (V _{DD} = 0V) | | | 150 | pF |
| C _{I2} | Input capacitance 2 | power supply ON | | | 150 | pF |
| V _{TH1} | Ground offset voltage | across two nodes | | | 1.0 | V |

Absolute Maximum Ratings

(unless otherwise noted, Ta = -40 to 85°C)

| Symbol | Quantity | Conditions | Rated value | | | Unit |
|------------------|-----------------------------|------------|-------------|----------------------|------|------|
| | | | Min. | Typ. | Max. | |
| V _{DD} | Power supply voltage | | -0.3 | 6.5 | | V |
| V _I | Input voltage | | -0.3 | V _{DD} +0.3 | | V |
| V _O | Output voltage | | -0.3 | V _{DD} +0.3 | | V |
| I _O | Driver output current | BUS(+) | | | 50 | mA |
| | | BUS(-) | -50 | | | |
| P _{max} | Allowable power consumption | | | | 200 | mW |
| T _{stg} | Storage temperature | | -50 | | 125 | °C |

Note: All voltages use the circuit V_{SS} pin as reference; maximum and minimum values are absolute values; and currents are positive when flowing into a circuit, and negative (preceded by a minus sign) when flowing outward.

Recommended Operating Conditions

(unless otherwise noted, Ta = -40 to 85°C)

| Symbol | Quantity | Conditions | Rated value | | | Unit |
|-----------------|-------------------------------|--|-------------|------|-------|------|
| | | | Min. | Typ. | Max. | |
| V _{DD} | Power supply voltage | | 4.75 | | 5.25 | V |
| RBUS | BUS resistance | transmission rate = 41.6Kbps | 105 | | | Ω |
| | | transmission rate = 125Kbps | 105 | | | |
| CBUS | BUS capacitance | transmission rate = 41.6Kbps RBUS = 378 Ω | | | 10000 | pF |
| | | transmission rate = 125Kbps, RBUS = 378 Ω | | | 3000 | |
| Topr | Operating ambient temperature | | -40 | | 85 | °C |

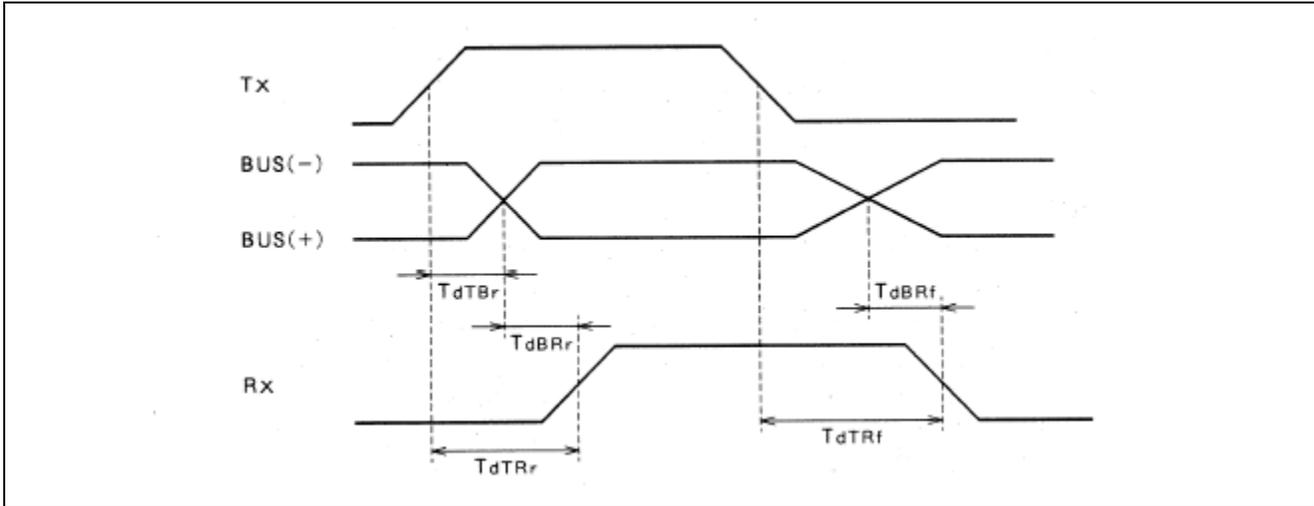
Timing Characteristics

(unless otherwise noted, Ta = 25°C, V_{DD}=5.0 V, during normal operation)

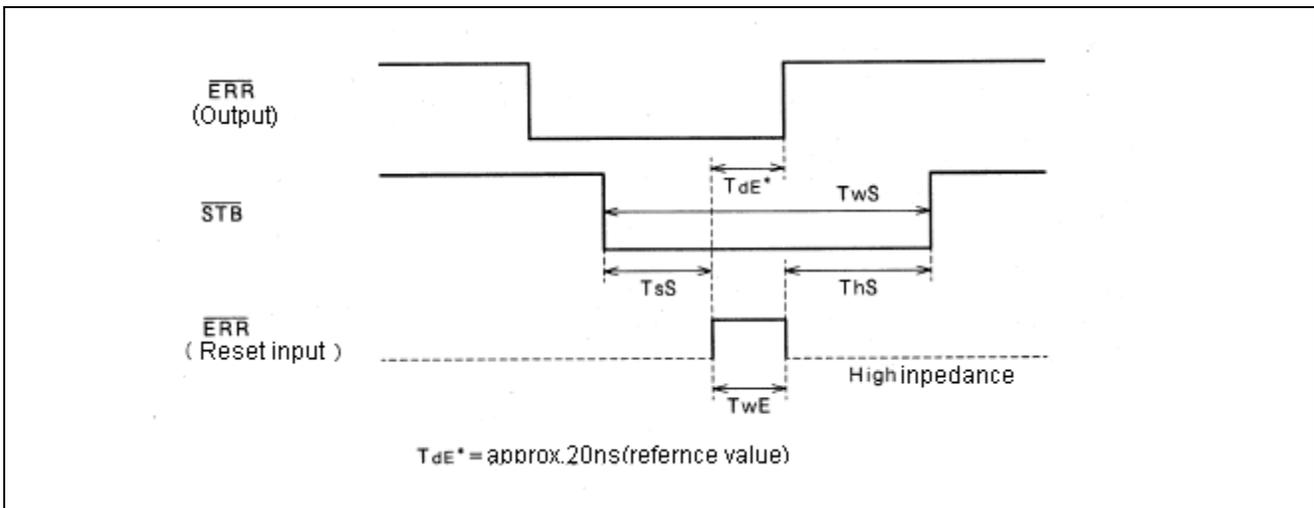
| Symbol | Quantity | Conditions | Rated value | | | Unit |
|-------------------|---|--|-------------|------|------|------|
| | | | Min. | Typ. | Max. | |
| T _{dTBr} | T _X → BUS output delay time | CBUS = 10000pF, RBUS = 378 Ω transmission rate =41.6Kbps | | 0.25 | | μs |
| T _{dTRr} | T _X → R _X rise delay time | CBUS = 10000pF, RBUS = 378 Ω transmission rate =41.6Kbps | | 0.6 | | μs |
| T _{dBRf} | T _X → R _X fall delay time | CBUS = 10000pF, RBUS = 378 Ω transmission rate =41.6Kbps | | 3.0 | | μs |
| T _{dBRr} | BUS → R _X rise delay time | transmission rate = 41.6Kbps | | 0.35 | | μs |
| T _{dBRf} | BUS → R _X fall delay time | transmission rate = 41.6Kbps | | 0.33 | | μs |
| T _{WS} | Minimum STB input pulse width | standby mode | 3.0 | | | μs |
| T _{sS} | STB input setup time | on error reset | 1.0 | | | μs |
| T _{hS} | STB input hold time | on error reset | 100 | | | ns |
| T _{WE} | ERR input pulse width | on error reset | 200 | | | ns |

Timing Charts

Timing Waveforms

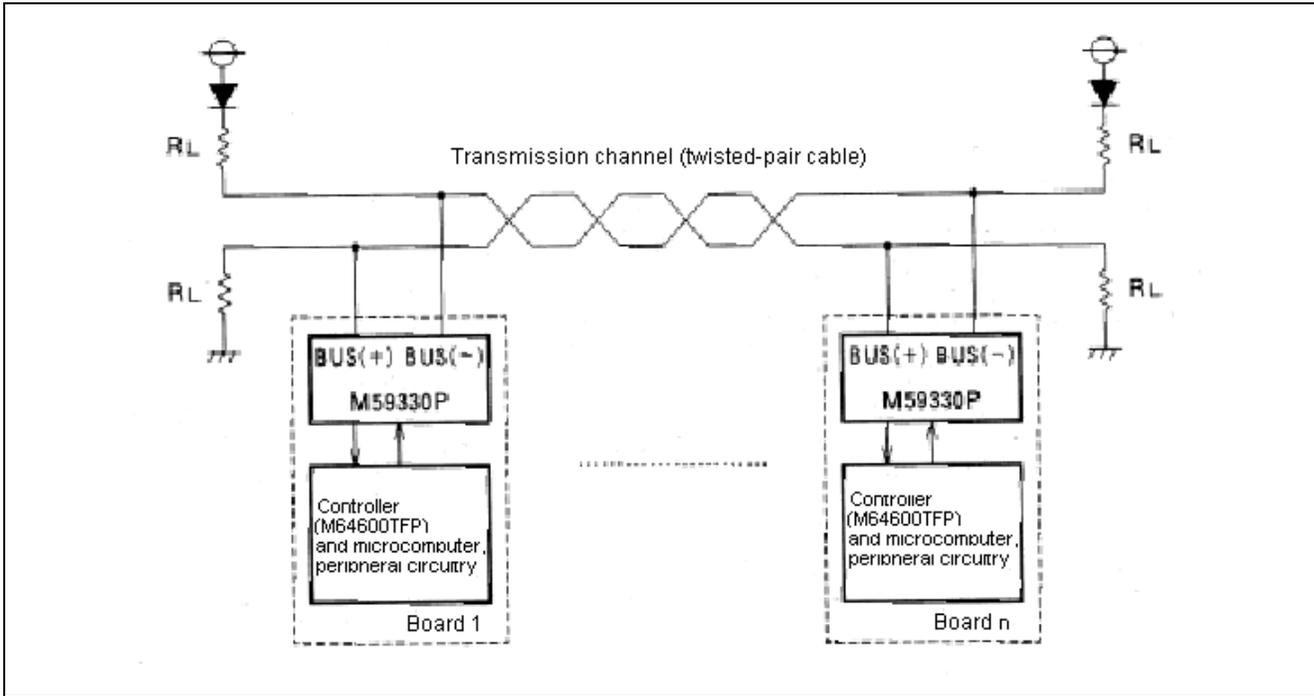


Error Reset Timing

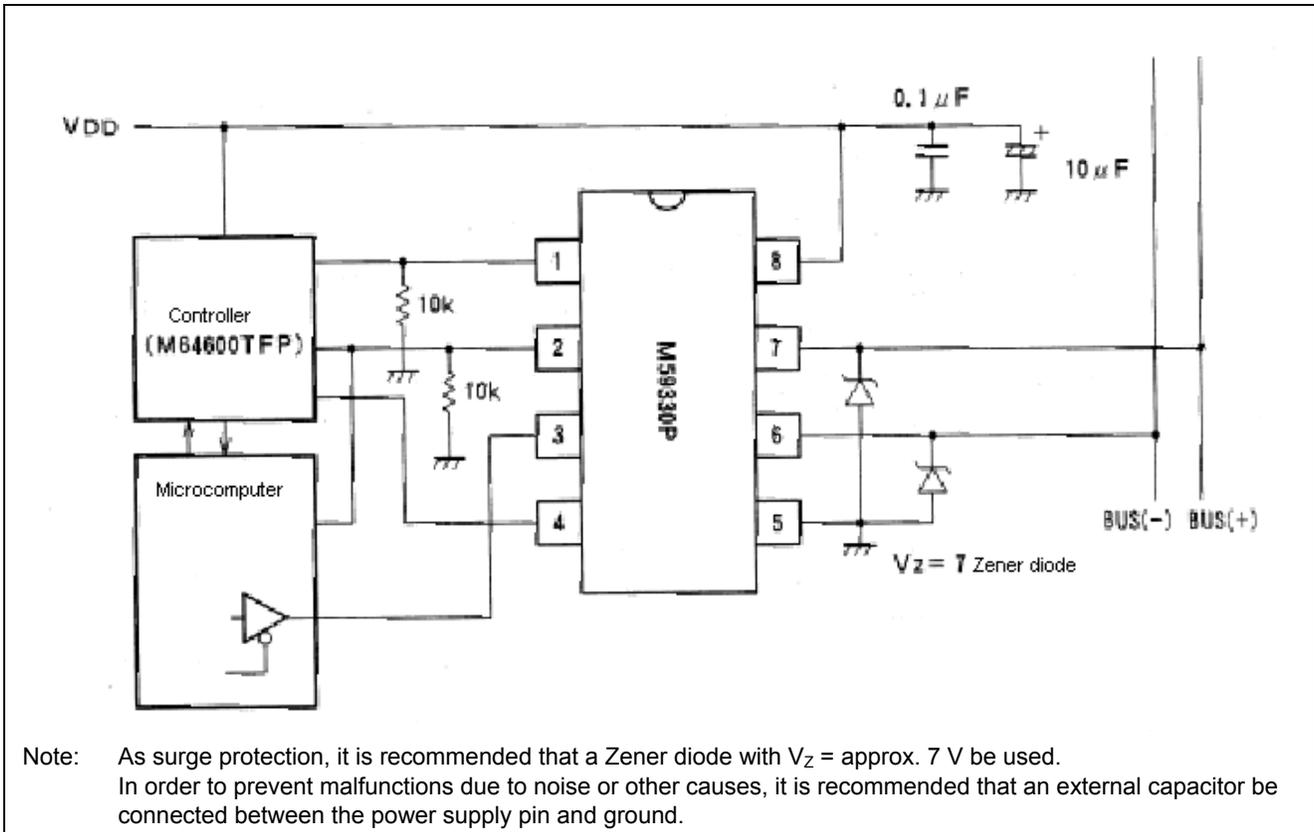


Application Circuit Example (One implementation example, which should be studied carefully)

Example Of Transmission Channel Connection



Peripheral Circuit Example



Note: As surge protection, it is recommended that a Zener diode with $V_z =$ approx. 7 V be used. In order to prevent malfunctions due to noise or other causes, it is recommended that an external capacitor be connected between the power supply pin and ground.

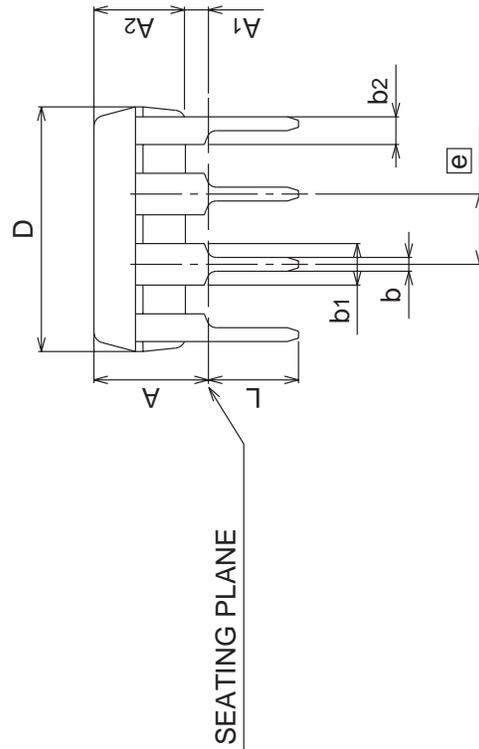
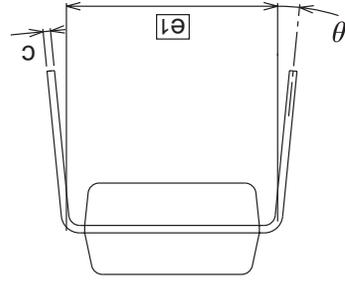
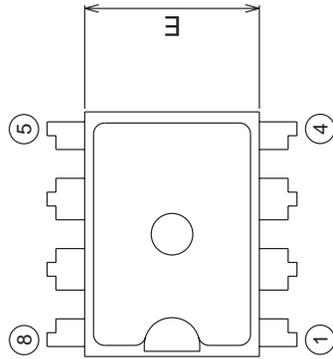
Package Dimensions

Plastic 8pin 300mil DIP

(MMP)

8P4

| | | | |
|--------------------------------------|-----------------|------------------|---------------------------|
| EIAJ Package Code DIP8-P-300-2.54 | JEDEC Code - | Weight(g) 0.5 | Lead Material Cu Alloy |
|--------------------------------------|-----------------|------------------|---------------------------|



| Symbol | Dimension in Millimeters | | |
|--------|--------------------------|------|------|
| | Min | Nom | Max |
| A | - | - | 4.5 |
| A1 | 0.51 | - | - |
| A2 | - | 3.3 | - |
| b | 0.4 | 0.5 | 0.59 |
| b1 | 1.4 | 1.5 | 1.8 |
| b2 | 0.9 | 1.0 | 1.3 |
| c | 0.23 | 0.25 | 0.35 |
| D | 8.7 | 8.9 | 9.1 |
| E | 6.15 | 6.3 | 6.45 |
| e | - | 2.45 | - |
| e1 | - | 7.62 | - |
| L | 3.0 | - | - |
| θ | 0° | - | 15° |

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