Siliconix

# Si9241

## Single-Ended Bus Driver

### Features

- Single-Ended Transceiver
- Survives Shorts and Transients on Automotive Bus
- Wide Power Supply Voltage Range
- Fault Detection
- ISO 9141 Compatible

### Benefits

- Single-Wire Multiplexer Interface
- ISO Diagnosis Bus

### Applications

- Automobiles
- Trucks
- Tractors

## Description

The Si9241 is a monolithic bus driver designed to provide bidirectional serial communication in automotive diagnostic applications.

The device incorporates protection against overvoltages and short circuits to GND or $V_B$. The transceiver pin is protected and can be driven beyond the $V_B$ voltage.

A fault detector provides an active low in case of short circuit to $V_B$ or an open load prevent proper data transmission. The open drain Fault output can be wire or-ed. The $\overline{CS}$ input can be tied high for receive only interfaces.

In the event of an over temperature condition, the output is immediately switched off and a fault indicated. This condition can only be reset once the over temperature condition is removed, and $\overline{CS}$ is toggled high.

The Si9241 is built on the Siliconix BiC/DMOS process. This process supports bipolar transistors, CMOS and DMOS. An epitaxial layer prevents latchup.

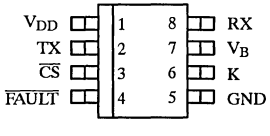
The RX output is capable of driving CMOS or 1 × LSTTL load.

The Si9241 is available in a space efficient 8-pin SO package. It operates reliably over the automotive temperature range (−40 to 125°C).



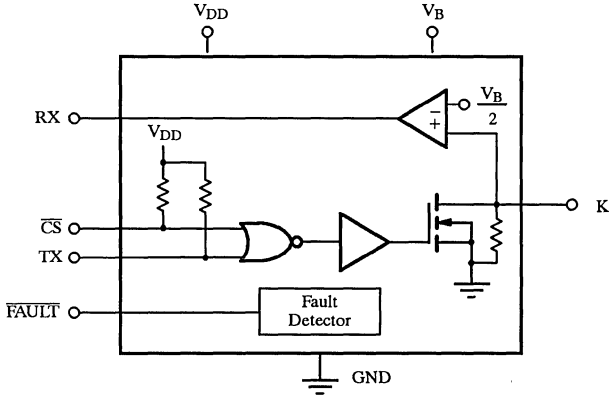
## Pin Configurations and Functional Block Diagram

Narrow Body
SO Package

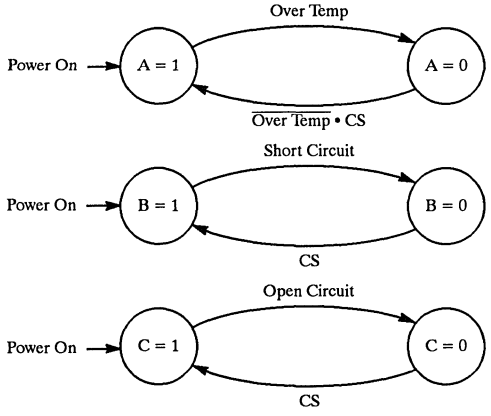



Top View

Order Number:
Si9241EY



## Output Table and State Diagrams




Note: Over Temp is a condition and not meant to be a logic signal.

| Inputs | | State Variable | | | Output Table | | | |
|---|---|---|---|---|---|---|---|---|
| $\overline{CS}$ | TX | A | B | C | RXK | K | $\overline{FAULT}$ | Comments |
| 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | |
| 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| x | x | 0 | 1 | 1 | K | HiZ | 0 | Over Temp |
| 0 | x | 1 | 0 | 1 | K | HiZ | 0 | Short Circuit |
| 0 | x | 1 | 1 | 0 | K | HiZ | 0 | Open Circuit |
| 1 | x | 1 | 1 | 1 | 0 | 0 | 1 | Receive Mode |
| 1 | x | 1 | 1 | 1 | 1 | 1 | 1 | |

X = "1" or "0"
HiZ = High Impedance State

## Absolute Maximum Ratings

Voltage Referenced to Ground
Voltage On $V_{BAT}$ ..... 45 V
Voltage K ..... $-3$ to $V_{BAT} + 1$ V
Voltage or Max. Current On Any Pin
(Except $V_{BAT}$, K) ..... $-0.3$ to $V_{DD} + 0.3$ V or 10 mA

Voltage on $V_{DD}$ ..... 7 V
Short Circuit Duration (to $V_{BAT}$ or GND) ..... Continuous
Operating Temperature ($T_A$) ..... $-40$ to 125°C
Junction and Storage Temperature ..... -55 to 150°C
Thermal Resistance $\Theta_{JA}$ ..... TBD

## Specifications[a]

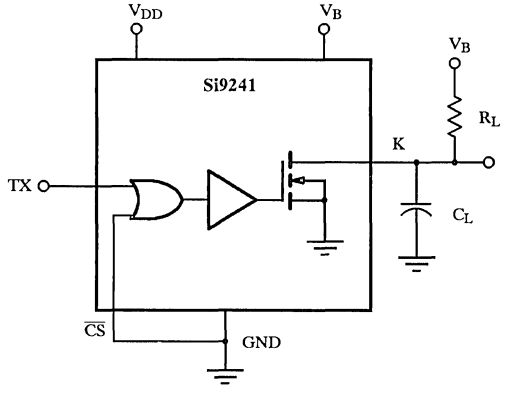
| Parameter | Symbol | Test Conditions Unless Otherwise Specified $V_{DD}$ = 4.5 to 5.5 V, $V_{BAT}$ = 8 to 35 V | Temp[b] | Limits E Suffix: $-40$ to 125°C Min[c] | Typ[d] | Max[c] | Unit |
|---|---|---|---|---|---|---|---|
| **Transmitter and Logic Levels** | | | | | | | |
| $\overline{CS}$, TX Input Low Voltage | $V_{ILT}$ | | Full | | | 1.5 | V |
| $\overline{CS}$, TX Input High Voltage | $V_{IHT}$ | | Full | 3.5 | | | |
| K Output Low Voltage | $V_{OLK}$ | $R_L$ = 510 Ω, $C_L$ = 10 nF See Test Circuit | Full | | | 0.2 $V_{BAT}$ | |
| K Output High Voltage | $V_{OHK}$ | | Full | 0.91 $V_{BAT}$ | | | |
| K Rise, Fall Times | $t_r$, $t_f$ | | Full | | | 9.6 | µs |
| K Output Sink Resistance | Rsi | $\overline{CS}$ = 0 V, TX = 0 V | Full | | | 110 | Ω |
| K Output Capacitance[e] | $C_O$ | $\overline{CS}$ = 0 V | Full | | | 20 | pF |
| TX Input Capacitance[e] | $C_{INT}$ | | Full | | | 10 | |
| $\overline{CS}$, TX Input Current | $I_{INT}$ | | Full | −60 | | −4 | µA |

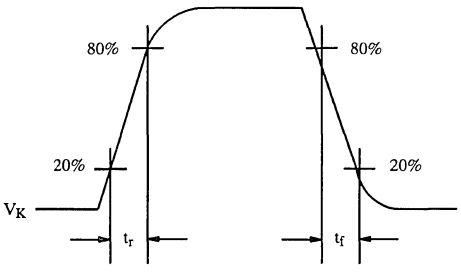
## Specifications[a]

| Parameter | Symbol | Test Conditions Unless Otherwise Specified $V_{DD}$ = 4.5 to 5 5 V, $V_{BAT}$ = 8 to 35 V | | Temp[b] | Limits E Suffix: −40 to 125°C Min[c] | Typ[d] | Max[c] | Unit |
|---|---|---|---|---|---|---|---|---|
| **Receiver** | | | | | | | | |
| K Input Low Voltage[f] | $V_{ILK}$ | | | Full | | 0.4 $V_{BAT}$ | 0.30 $V_{BAT}$ | V |
| K Input High Voltage[f] | $V_{IHK}$ | | | Full | 0.70 $V_{BAT}$ | 0.6 $V_{BAT}$ | | V |
| RX Output Low Voltage | $V_{OLR}$ | $\overline{CS}$ = 4 V | $V_{ILK}$, $V_{ILL}$ = 0.30 $V_{BAT}$ $I_{OLR}$ = 1 mA | Full | | | 0.4 | V |
| RX High Voltage | $V_{OHR}$ | $\overline{CS}$ = 4 V | $V_{IHK}$, $V_{IHL}$ = 0.70 $V_{BAT}$ $I_{OHR}$ = −40 µA | Full | 2.8 | | | V |
| K Input Currents | $I_{IHK}$ | $\overline{CS}$ = 4 V | $V_{IHK}$ = $V_{BAT}$ | Full | 1 5 | | 20 | µA |
| **Supplies** | | | | | | | | |
| Bat Supply Current | $I_{BAT}$ | CS, TX = 1.5 V K Open | | Full | | 2.7 | 5.0 | mA |
| Logic Supply Current | $I_{DD}$ | CS, TX = 1.5 V K Open | | Full | | 1 | 3.0 | mA |
| **Miscellaneous** | | | | | | | | |
| Baud Rate | BR | $R_L$ = 510 Ω, $C_L$ = 10 nF | | Full | 10.4 | | | k Baud |
| Fault Output Low Voltage | $V_{OLF}$ | $V_{ILT}$ = 0V, $V_K$ = $V_B$, $I_{OLF}$ = 1 mA | | Full | | | 0.4 | V |

Notes
a. Refer to PROCESS OPTION FLOWCHART for additional information.
b. Room = 25°C, Cold and Hot = as determined by the operating temperature suffix.
c. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
d. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
e. Guaranteed by design, not subject to production test
f. Hysterisis 0.2 $V_{BAT}$ typical.

## Test Circuit



## Application