Single-Ended Bus Transceiver

FEATURES

- Operating Power Supply Range 6 V $\leq$ V_{BAT} $\leq$ 36 V
- Reverse Battery Protection Down to V_{BAT} $\geq$ −24 V
- Standby Mode With Very Low Current Consumption $I_{BAT(SB)}$ = 1 μA @ V_{DD} = 0.5 V
- Low Quiescent Current in OFF Condition I_{BAT} = 120 μA and I_{DD} $\leq$ 10 μA
- ISO 9141 Compatible
- Overtemperature Shutdown Function For K Output
- Defined K Output OFF for Open GND
- Defined Receive Output Status for Open L or K Inputs
- Defined K Output OFF for TX Input Open
- 2-kV ESD
- Typical Transmit Speeds of 200 kBaud

DESCRIPTION

The Si9243AEY is a monolithic bus transceiver designed to provide bidirectional serial communication in automotive diagnostic applications.

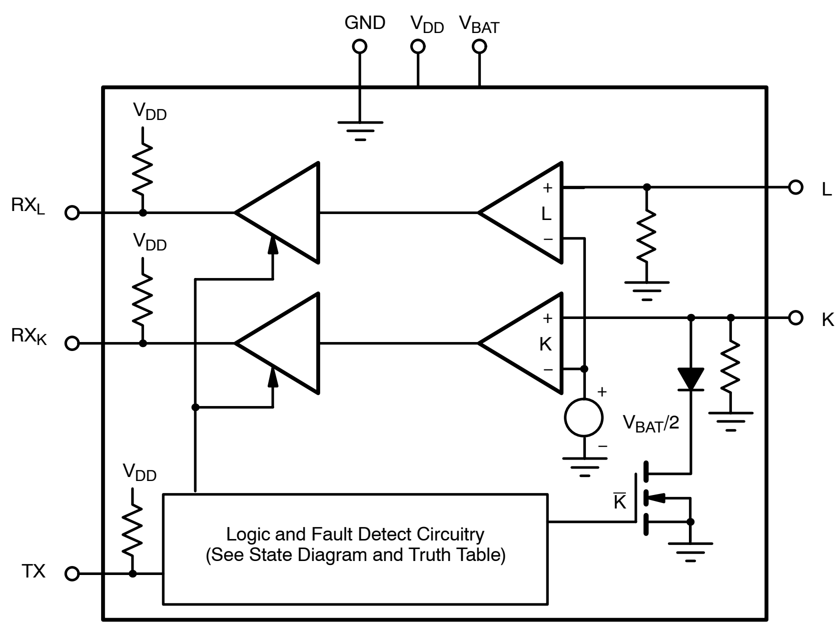
The device incorporates protection against overvoltages and short circuits to V_{BAT}. The transceiver pin is protected and can be driven beyond the V_{BAT} voltage.

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

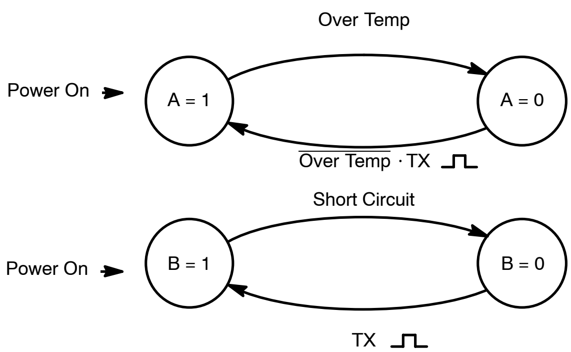
The Si9243AEY is built on the Vishay Siliconix BiC/DMOS process. This process supports bipolar transistors, CMOS, and DMOS. An epitaxial layer prevents latchup.

The Si9243AEY is available in a 8-pin SO package and operates over the automotive temperature range (−40 to 125°C). The Si9243AEY is available in both standard and lead (Pb)-free packages.

PIN CONFIGURATION AND FUNCTIONAL BLOCK DIAGRAM



OUTPUT TABLE AND STATE DIAGRAMS



Note: Over Temp is an internal condition, not meant to be a logic signal.

INPUTS		STATE VARIABLE		OUTPUT TABLE			
TX	L	A	B	K	RX_K	RX_L	Comments
0	0	1	1	0	0	0	
1	1	1	1	1	1	1	
0	1	1	1	0	0	1	
1	0	1	1	1	1	0	
X	L	0	1	HiZ	K	L	Over Temp
0	L	1	0	HiZ	K	L	Short Circuit
1	1	1	1	1	1	1	Receive Mode
1	0	1	1	0	0	0	

X = “1” or “0”
HiZ = High Impedance State

ABSOLUTE MAXIMUM RATINGS

Voltage Referenced to Ground
Voltage On V_{BAT} . . . . . . −24 V to 45 V
Voltage K , L . . . . . . −16 V to (V_{BAT} + 1 V)
Voltage Difference $V_{(VBAT, K, L)}$ . . . . . . 55 V
Voltage On Any Pin (Except V_{BAT}, K, L)
or Max. Current . . . . . . −0.3 V to (V_{DD} + 0.3 V) or 10 mA

Voltage on V_{DD} . . . . . . 7 V
K Pin Only, 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 Θ_{JA} . . . . . . 125°C/W

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING RANGE

Voltage Referenced to Ground
V_{DD} . . . . . . 4.5 V to 5.5 V
V_{BAT} . . . . . . 6 V to 36 V

K, L . . . . . . 6 V to 36 V
Digital Inputs . . . . . . 0 to V_{DD}

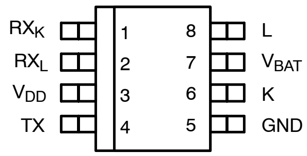
SPECIFICATIONS

Parameter	Symbol	Test Conditions Unless Specified V_{DD} = 4.5 to 5.5 V V_{BAT} = 6 to 36 V	Temp[a]	Limits −40 to 125°C Min[b]	Typ[c]	Max[b]	Unit
Transmitter and Logic Levels							
TX Input Low Voltage	V_{ILT}		Full			1.5	V
TX Input High Voltage	V_{IHT}		Full	3.5			V
TX Input Capacitance[d]	C_{INT}		Full			10	pF
TX Input Pull-up Resistance	R_{TX}	V_{DD} = 5.5 V, TX = 1.5 V, 3.5 V	Full	10	20	40	kΩ
K Transmit							
K Output Low Voltage	V_{OLK}	R_L = 510 Ω ±5%, V_{BAT} = 6 to 18 V	Full			0.2 V_{BAT}	V
		R_L = 1 kΩ ±5%, V_{BAT} = 16 to 36 V	Full			0.2 V_{BAT}	
		R_L = 510 Ω ±5%, V_{BAT} = 4.5 V	Full			1.2	
K Output High Voltage	V_{OHK}	R_L = 510 Ω ±5%, V_{BAT} = 4.5 to 18 V	Full	0.95 V_{BAT}			
		R_L = 1 kΩ ±5%, V_{BAT} = 16 to 36 V	Full	0.95 V_{BAT}			
K Rise, Fall Times	t_r, t_f	See Test Circuit	Full			9.6	µs
K Output Sink Resistance	Rsi	TX = 0 V	Full			110	Ω
K Output Capacitance[d]	C_O	TX = 0 V	Full			20	pF
Receiver							
L and K Input High Voltage	V_{IH}		Full	0.65 V_{BAT}			V
L and K Input Hysteresis[c, d]	V_{HYS}		Full		0.05 V_{BAT}		V
L and K Input Currents	I_{IH}	TX = 4 V, V_{IH} = V_{BAT}	Full			20	µA
RX_L and RX_K Output Low Voltage	V_{OLR}	TX = 4 V, V_{ILK}, V_{ILL} = 0.35 V_{BAT} I_{OLR} = 1 mA	Full			0.4	V
RX_L and RX_K Pull-up Resistance	R_{RX}		Full	5		20	kΩ
RX_K Turn On Delay	$t_{d(on)}$	R_L = 510 Ω ±5%, V_{BAT} = 6 to 18 V C_L = 10 nF, See Test Circuit	Full		3	10	µs
		R_L = 1 kΩ ±5%, V_{BAT} = 16 to 36 V C_L = 4.7 nF, See Test Circuit	Full		3	10	
RX_K Turn Off Delay	$t_{d(off)}$	R_L = 510 Ω ±5%, V_{BAT} = 6 to 18 V C_L = 10 nF, See Test Circuit	Full		3	10	
		R_L = 1 kΩ ±5%, V_{BAT} = 16 to 36 V C_L = 4.7 nF, See Test Circuit	Full		3	10	
Supplies							
Bat Supply Current On	$I_{BAT(on)}$	TX = 0 V, V_{BAT} ≤ 16 V	Full		1.2	3	mA
Bat Supply Current Off	$I_{BAT(off)}$	V_{IHT} ≤ V_{TX}, V_{IHK} ≤ V_K, V_{IHL} ≤ V_L V_{BAT} ≤ 12 V	Full		120	220	µA
Bat Supply Current Standby	$I_{BAT(SB)}$	V_{DD} ≤ 0.5 V, V_{BAT} ≤ 12 V	Full		<1	10	µA
Logic Supply Current On	$I_{DD(on)}$	V_{DD} ≤ 5.5 V, TX = 0 V	Full		1.4	2.3	mA
Logic Supply Current Off	$I_{DD(off)}$	V_{IHT} ≤ V_{TX}, V_{IHK} ≤ V_K, V_{IHL} ≤ V_L V_{BAT} ≤ 12 V	Full			10	µA
Miscellaneous							
TX Transmit Baud Rate	BR_T	R_L = 510 Ω, C_L = 10 nF	Full	10.4			kBaud
RX_L and RX_K Receive Baud Rate[c]	BR_R	6 V < V_{BAT} < 16 V, C_{RX} = 20 pF	Full		200		kBaud
Transmission Frequency	f_{K-RXK}	6 V < V_{BAT} < 16 V, R_K = 510 Ω, C_K ≤ 1.3 nF	Full	50	200		kHz
TX Minimum Pulse Width[d, e]	t_{TX}		Full	1			µs
Over Temperature Shutdown[d]	T_{SHUT}	Temperature Rising		160	180		°C
Temperature Shutdown Hysteresis[c]	T_{HYST}				30		°C

Notes
a. Room = 25°C, Cold and Hot = as determined by the operating temperature suffix.
b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
c. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
d. Guaranteed by design, not subject to production test.
e. Minimum pulse width to reset a fault condition.

PIN CONFIGURATION

Narrow Body
SO Package



Top View

ORDERING INFORMATION	
Part Number	**Temperature Range**
Si9243AEY-T1	–40 to 125°C
Si9243AEY-T1—E3 (Lead (Pb)-Free)	

PIN DESCRIPTION

Pin Number	Symbol	Description
1	RX_K	K Receiver, Output
2	RX_L	L Receiver, Output
3	V_{DD}	Positive Power Supply
4	TX	Transmit, Input
5	GND	Ground Connection
6	K	K Transmit/Receive, Bidirectional
7	V_{BAT}	Battery Power Supply
8	L	L Transmit, Input

FUNCTIONAL DESCRIPTION

The Si9243AEY can be either in transmit or receive mode and it contains over temperature, and short circuit V_{BAT} fault detection circuits.

The voltage on the K and L pins are internally compared to $V_{BAT/2}$. If the voltage on the K or L pin is less than $V_{BAT/2}$ then RX_K or RX_L output will be "low." If the voltage on the K or L pin is greater than $V_{BAT/2}$ then RX_K or RX_L output will be "high.

In order to be in transmit mode, TX must be set "low." The TX signal is then internally inverted and turns the MOSFET on, causing the K pin to be "low." In transmit mode, the processor monitors the RX_K and TX. When the two mirror each other there is no fault. In the event of over temperature, or short circuit to V_{BAT}, the Si9243AEY will turn off the K output to protect the IC. The K pin will stay in high impedance and RX_K will follow the K pin. The fault will be reset when TX is toggled high. RX_K, RX_L and TX pins have internal pull up resistor to V_{DD} while K and L pins have internal pull down resistors. When any one of the TX, V_{BAT} or GND pins is open the K output is off.

When the TX pin is set "high" the Si9243AEY is in receive mode and the internal MOSFET is turned off. RX_L and RX_K outputs will follow L and K inputs respectively.

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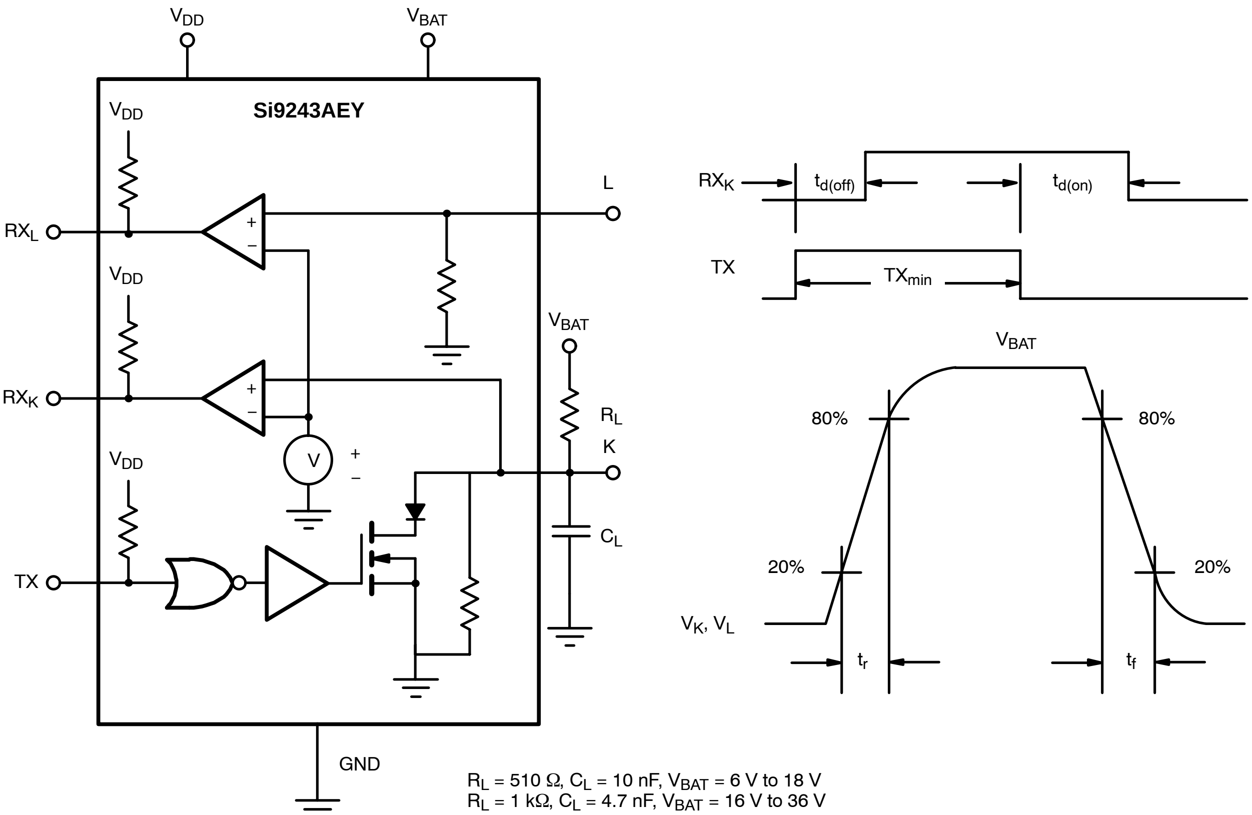
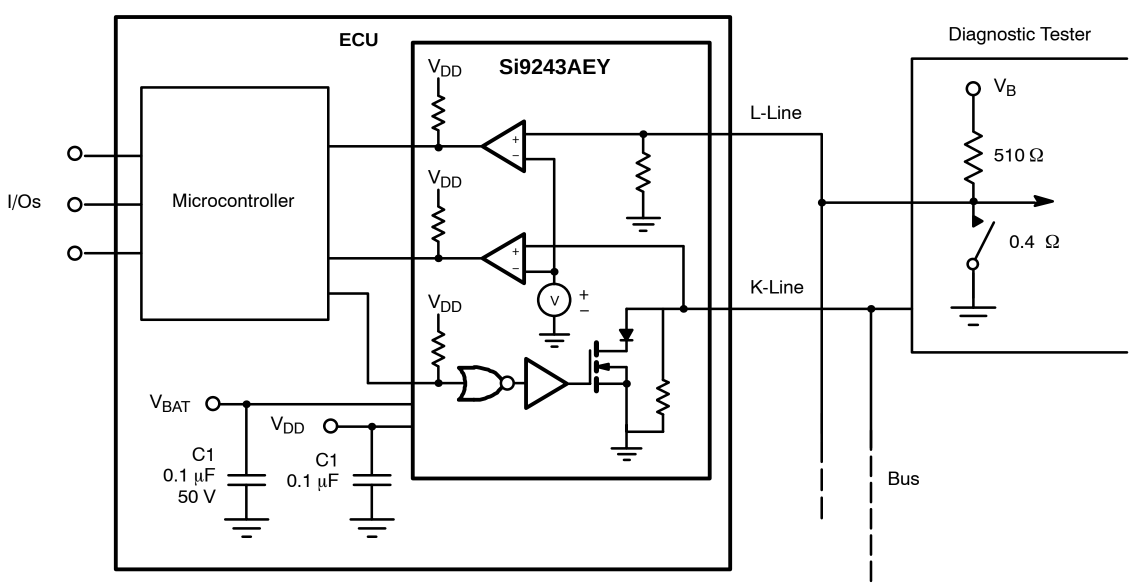
TEST CIRCUIT AND TIMING DIAGRAMS (TRANSMIT ONLY)



APPLICATION CIRCUIT



ECU = Electronic Control Unit

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