

Single-Ended Bus Transceiver

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 x LSTTL load.

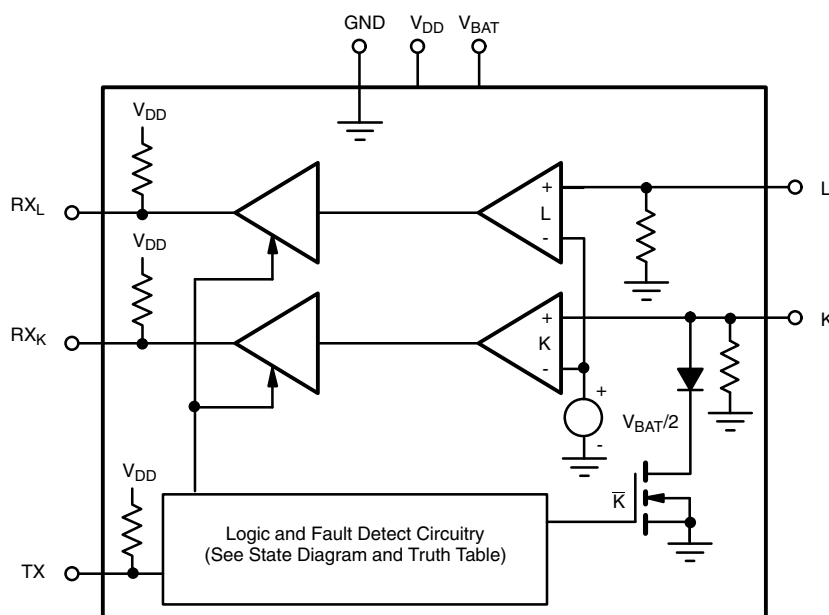
The Si9243AEY is built on the Vishay Siliconix BiC/DMOS process. This process supports bipolar transistors, CMOS, and DMOS. An epitaxial layer prevents latchup.

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

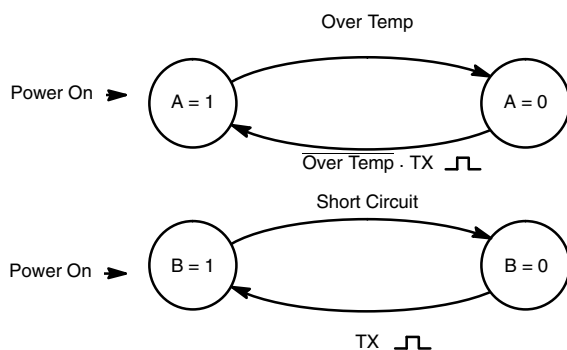
FEATURES

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

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			Comments
TX	L	A	B	K	RX _K	RX _L	
0	0	1	1	0	0	0	Over Temp Short Circuit
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	Receive Mode
0	L	1	0	HiZ	K	L	
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

Parameter	Limit	Unit
Voltages Referenced to Ground		
Voltage On V _{BAT}	- 24 to 45	V
Voltage K, L	- 16 to (V _{BAT} + 1)	
Voltage Difference V _(VBAT, K, L)	55	
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	
Thermal Impedance (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

Parameter	Limit	Unit
Voltages Referenced to Ground		
V _{DD}	4.5 to 5.5	V
V _{BAT}	6 to 36	
K, L	6 to 36	
Digital Inputs	0 to V _{DD}	

**SPECIFICATIONS**

Parameter	Symbol	Test Conditions Unless Specified V _{DD} = 4.5 V to 5.5 V V _{BAT} = 6 V to 36 V		Temp. ^a	Limits - 40 to 125 °C			Unit
					Min. ^b	Typ. ^c	Max. ^b	
Transmitter and Logic Levels								
TX Input Low Voltage	V _{ILT}			Full			1.5	V
TX Input High Voltage	V _{IHT}			Full	3.5			
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		Full			0.2 V _{BAT}	V
		R _L = 1 kΩ ± 5 %, V _{BAT} = 16 to 36		Full			0.2 V _{BAT}	
		R _L = 510 Ω ± 5 %, V _{BAT} = 4.5		Full			1.2	
K Output High Voltage	V _{OHK}	R _L = 510 Ω ± 5 %, V _{BAT} = 4.5 to 18		Full	0.95 V _{BAT}			
		R _L = 1 kΩ ± 5 %, V _{BAT} = 16 to 36		Full	0.95 V _{BAT}			
K Rise, Fall Times	t _{r, tf}	See Test Circuit		Full			9.6	μs
K Output Sink Resistance	R _{Si}	TX = 0 V		Full			110	Ω
K Output Capacitance ^d	C _O			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}		
L and K Input Currents	I _{IH}	TX = 4	V _{IH} = V _{BAT}	Full			20	μA
RX _L and RX _K Output Low Voltage	V _{OLR}		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 V to 18 V C _L = 10 nF, See Test Circuit		Full		3	10	μs
		R _L = 1 kΩ ± 5 %, V _{BAT} = 16 V 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 V to 18 V C _L = 10 nF, See Test Circuit		Full		3	10	
		R _L = 1 kΩ ± 5 %, V _{BAT} = 16 V 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	
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		
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 Hvsteresis ^c	T _{HYST}					30		

Notes:

a. Room = 25 °C, Cold and Hot = as determined by the operating temperature suffix.

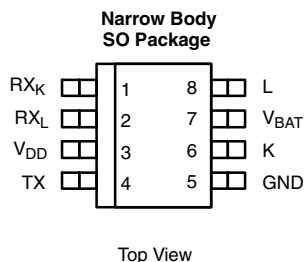
b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.

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



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.

Si9243AEY

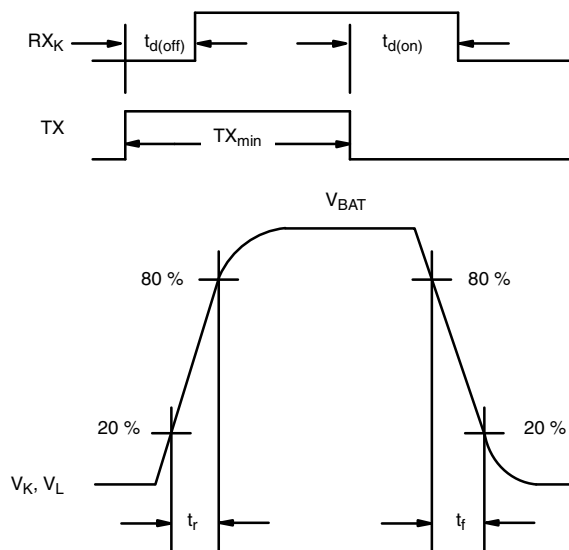
V_{DD}
 V_{BAT}
 GND

R_X
 R_K
 TX

L
 K

V_{DD}
 V_{BAT}
 GND

$R_L = 510 \Omega$, $C_L = 1$
 $R_L = 1 \text{ k}\Omega$, $C_L = 4.7$


$$R_L = 510 \, \Omega, C_L = 10 \, \text{nF}, V_{\text{BAT}} = 6 \, \text{V to } 18 \, \text{V}$$

$$R_I = 1 \, \text{k}\Omega, C_I = 4.7 \, \text{nF}, V_{\text{BAT}} = 16 \, \text{V to } 36 \, \text{V}$$

The diagram illustrates the electrical connection between an ECU (Electronic Control Unit) and a Diagnostic Tester. The ECU is shown as a large box containing a Microcontroller, a Si9243AEY transceiver, and various power and signal components. The Diagnostic Tester is shown as a separate box connected to the ECU's L-Line and K-Line. The ECU's power supply is V_{BAT}, which is connected to the Microcontroller and the Si9243AEY. The Si9243AEY is connected to the L-Line and K-Line. The Diagnostic Tester is connected to the L-Line and K-Line through a 510 Ω resistor and a 0.4 Ω switch. The ECU's I/Os are connected to the Microcontroller. The ECU's power supply is V_{BAT}, which is connected to the Microcontroller and the Si9243AEY. The Si9243AEY is connected to the L-Line and K-Line. The Diagnostic Tester is connected to the L-Line and K-Line through a 510 Ω resistor and a 0.4 Ω switch. The ECU's I/Os are connected to the Microcontroller.

ECU = Electronic Control Unit

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SOIC (NARROW): 8-LEAD

JEDEC Part Number: MS-012



DIM	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	1.35	1.75	0.053	0.069
A ₁	0.10	0.20	0.004	0.008
B	0.35	0.51	0.014	0.020
C	0.19	0.25	0.0075	0.010
D	4.80	5.00	0.189	0.196
E	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
H	5.80	6.20	0.228	0.244
h	0.25	0.50	0.010	0.020
L	0.50	0.93	0.020	0.037
q	0°	8°	0°	8°
S	0.44	0.64	0.018	0.026

ECN: C-06527-Rev. I, 11-Sep-06
DWG: 5498



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