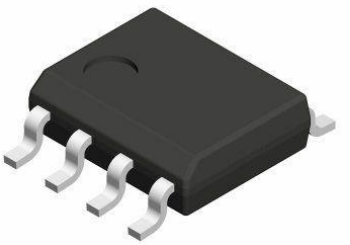
1. Introduction

This transceiver is a serial interface circuit used for diagnostic applications. It functions as the interface between a microcontroller and the serial K and L lines of an ISO diagnostic port. This transceiver is compatible with ISO 9141. The device is used to meet the requirements of industrial communication and information technology. It is a bidirectional single-wire bus serving data transfer between elements of a network in automobile technology. The special characteristic of this form of data communication is that this bus can also be operated unidirectionally when the L-line is used in addition to the K-line.

2. Features

- Maximum receiving and transmitting speed of 200 kHz
- Operating supply voltage range: 6 V to 26 V (can sustain 40 VDC)
- Bidirectional K-I/O pin with supply voltage dependent input threshold
- Wide input and output voltage range -40 V to V_S
- Overtemperature shutdown function
- Undervoltage shutdown function
- K output current limitation
- Input EMI filter
- Integrated pull-up resistor for TX
- Standby mode with very low current consumption $I_{S,SB} \leq 1$ µA at $V_{CC} \leq 0.5$ V
- Low quiescent current in off condition $I_{S,OFF} = 120$ µA
- TTL compatible TX input
- Defined OFF output status in under-voltage condition and V_S or GND interruption
- High input impedance for open V_S or GND connection
- Defined output ON status of LO or RX for open LI or K inputs
- Defined K output OFF for TX input open
- EMI robustness optimized



AS9637
8-PIN SOIC

3. Pin Configuration

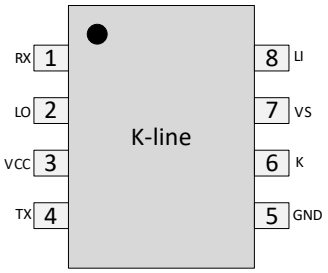


Figure 1: Pin configuration

PIN		Description
NO.	Name	
1	RX	Output for K as input
2	LO	Output L comparator
3	VCC	Stabilized voltage supply
4	TX	Input for K as output
5	GND	Common GND
6	K	Bidirectional I/O
7	VS	Supply voltage
8	LI	Input L comparator

4. Quick Reference

Symbol	Parameter	Condition	Min	Max	Unit
V_S	Supply voltage		6	26	V
V_{CC}	Digital supply voltage		4.5	5.5	V
$V_{LI, K}$	Bus voltage		-40	V_S	V
$V_{LO, RX, TX}$	Logic voltage		-0.3	V_{CC}	
$I_{S, ON}$	Supply V_S current	$V_S \leq 16$ V; V_{LI}, V_{TX} = 0 V	-	200	µA
$I_{S, OFF}$		$V_K \geq V_{K, HIGH}$; $V_{LI} \geq V_{LI, HIGH}$ $V_{TX} \geq V_{TX, HIGH}$ at $V_S \leq 12$ V	-	200	µA
$I_{S, SB}$		$V_{CC} \leq 0.5$ V at $V_S \leq 12$ V	-	1	µA
I_{CC}	Supply V_{CC} current	$V_{CC} \leq 5.5$ V; V_{LI}, V_{TX} = 0 V	-	0.7	mA
		$V_K \geq V_{K, HIGH}$; $V_{LI} \geq V_{LI, HIGH}$ $V_{TX} = V_{CC}$ at $V_{CC} \leq 5.5$ V	-5	5	µA
T_j	Junction temperature		-40	150	°C

5. Ordering Information

Part number	Package		
	Name	Description	Version
AS9637	SO-8	Plastic small outline package; 8 leads; body width 3.9 mm	-

6. Block Diagram

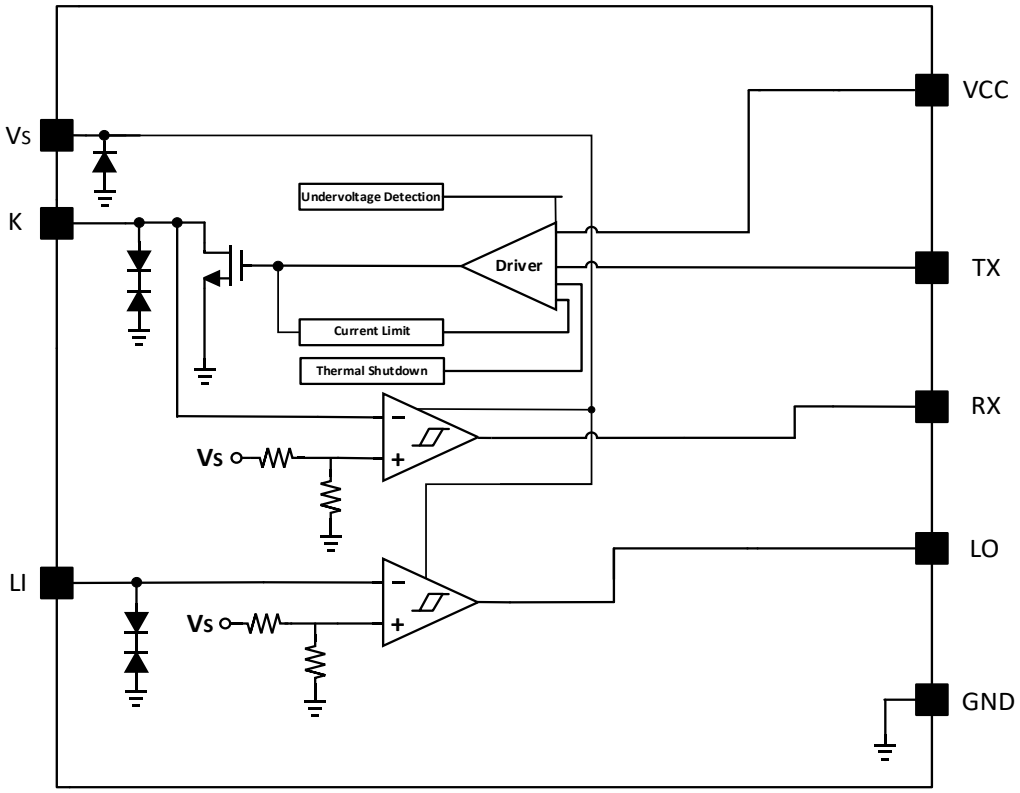


Figure 2: Block diagram

7. Absolute Maximum Ratings

All voltages are with respect to ground unless otherwise noted. Exceeding these ratings may cause a malfunction or permanent damage to the device.

Symbol	Parameter	Value	Unit
V_S	Supply voltage (DC)	-0.3 to 40	V
V_S	Supply voltage (t=400 ms)	-24 to 40	V
V_{CC}	Digital supply voltage	-0.3 to +5.5	V
V_{CC}	Digital supply voltage (without aging consideration)	-0.3 to +7	V
$\Delta V_S/d_t$	Supply voltage transient	-10 to +10	V/µs
$V_{LI, K}$	Bus voltage	-40 to V_S	V
$V_{LO, RX, TX}$	Logic voltage (DC)	-0.3 to V_{CC}	
$V_{LO, RX, TX}$	Logic voltage (t=400 ms)	-24 to V_{CC}	
ESD[1]	LI	±8	kV
	K	±4	
	TX, RX, LO	±4	
	V_{CC}, V_s	±15	

[1] ESD model according to IEC 61000-4-2 with C=150 pF and R=330 Ω

8. Thermal Characteristics

Symbol	Parameter	Min	Typ	Max	Unit
T_{JSDon}	Temperature K shutdown switch-on threshold	160	-	200	°C
T_{JSDoff}	Temperature K shutdown switch-off threshold	150	-	200	°C

9. Electrical Characteristics

All electrical characteristics are valid for the -40 °C ≤ T_a ≤ +125 °C, 6 V ≤ V_S ≤ 26 V conditions unless otherwise noted.

9.1 DC Specifications

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_S	Supply voltage		6	-	26	V
V_{CC}	Digital supply voltage		4.5	5	5.5	V
I_{CC}	Supply V_{CC} current	V_{CC} ≤ 5.5 V; V_{LI}, V_{TX} = 0 V	-	0.4	0.7	mA
		V_K ≥ $V_{K, HIGH}$; V_{LI} ≥ $V_{LI, HIGH}$ V_{TX} = V_{CC} at V_{CC} ≤ 5.5 V	-5	< 1	5	µA
$I_{S, ON}$	Supply V_S current	V_S ≤ 16 V; V_{LI}, V_{TX} = 0 V	80	-	200	µA
$I_{S, OFF}$		V_K ≥ $V_{K, HIGH}$; V_{LI} ≥ $V_{LI, HIGH}$ V_{TX} ≥ $V_{TX, HIGH}$ at V_S ≤ 12 V	80	-	200	µA
$I_{S, SB}$		V_{CC} ≤ 0.5 V at V_S ≤ 12 V	-	< 1	-	µA
$V_{TX, LOW}$	TX input voltage low state		-	-	0.8	V
$V_{TX, HIGH}$	TX input voltage high state		2	-	-	V
R_{TX}	Input pull-up resistance	-0.15 V ≤ V_{TX} ≤ V_{CC} + 0.15 V	10	20	40	kΩ
$V_{K, LOW}$	K input voltage low state	V_{TX} = 0 V	0.4	0.45	0.5	V_S
$V_{K, HIGH}$	K input voltage high state	V_{TX} = V_{CC}	0.5	0.55	0.6	V_S
$V_{K, HYS}$	K input threshold hysteresis	$V_{K, HIGH}$ - $V_{K, LOW}$	0.07	0.1	0.13	V_S
$V_{O\_DOM\_K}$	K output voltage	V_{TX} = 0 V I_K = 40 mA	-	-	1.2	V
$I_{K, OFF}$	K input current	at V_{TX} ≥ $V_{TX, HIGH}$ V_K ≤ V_S; V_S, V_{CC} ≥ 0 or V_S, V_{CC} = open	-	-	25	µA
$R_{K, ON}$	Output on impedance	V_{TX} ≤ $V_{TX, LOW}$	-	-	46	Ω
I_{LIM_K}	Short circuit current		50	70	100	mA
$V_{LI, LOW}$	LI input voltage low state	V_{TX} = 0 V	0.4	0.45	0.5	V_S
$V_{LI, HIGH}$	LI input voltage high state	V_{TX} = V_{CC}	0.5	0.55	0.6	V_S
$V_{LI, HYS}$	LI input threshold hysteresis	$V_{LI, HIGH}$ - $V_{LI, LOW}$	0.07	0.1	0.13	V_S
I_{LI}	Input current	V_{LI} ≤ V_S V_S, V_{CC} ≥ 0 or V_S, V_{CC} = open	-	-	25	µA
$V_{RX, LOW}$ $V_{LO, LOW}$	Output low voltage	I_{LOAD} = 2 mA	0	-	0.4	V
$V_{RX, HIGH}$ $V_{LO, HIGH}$	Output high voltage	I_{LOAD} = -0.5 mA	V_{CC} -0.6	-	V_{CC}	V
$R_{RX, ON}$ $R_{LO, ON}$	Output on impedance	V_K ≤ $V_{K, LOW}$; V_{LI} ≤ $V_{LI, LOW}$	-	-	200	Ω

$I_{RX, SC}$ $I_{LO, SC}$	Output short circuit current		-	-	20	mA
Symbol	**Parameter**	**Conditions**	**Min**	**Typ**	**Max**	**Unit**
C_{Ki}	K input capacitance		-	39	100	pF
T_J	Junction temperature		-40	-	150	°C
T_{JSD_K}	Thermal shutdown		160	-	200	°C

9.2 AC Specifications

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
f_{LI-LO} f_{K-RX} f_{TX-K}	Transmission frequency	R_K = 510 Ω , C_K ≤ 470 pF	-	-	200	kHz
T_{RISE_RX}	RX rise time	20pF load, 20%-80%	-	-	0.5	µs
T_{FALL_RX}	RX fall time	20pF load, 20%-80%	-	-	0.5	µs
T_{PD_ILTX}	Propagation delay transmitter	V_{TX} high to low to V_K = 20% * V_s R_K = 510 Ω, C_K = 470 pF	-	-	1.5	µs
T_{PD_IHTX}		V_{TX} low to high to V_K = 80% * V_s R_K = 510 Ω, C_K = 470 pF	-	-	1.5	µs
T_{PD_ILRX}	Propagation delay receiver	V_K = 80%*Vs to RX high to low R_K = 510 Ω, C_K = 470 pF	-	-	1.5	µs
T_{PD_IHRX}		V_K = 20%*Vs to RX low to high R_K = 510 Ω, C_K = 470 pF	-	-	1.5	µs
T_{RISE_K}	K rise time	20% to 80% R_K = 510 Ω, C_K = 470 pF	-	-	1.5	µs
T_{FALL_K}	K fall time	80% to 20% R_K = 510 Ω, C_K = 470 pF	-	-	1.5	µs

10. Functional Description

The device provides a bidirectional link, called K, to the V_{Bat} related diagnosis bus. It also includes a separate comparator L which is also able to be linked to the V_{Bat} bus. The input TX is related to V_{CC} with integrated pull-up resistance.

All V_{Bat} bus defined inputs LI and K have supply voltage dependent thresholds together with sufficient hysteresis to suppress line spikes.

The thermal shut down function switches OFF the K output if the chip temperature increases above the thermal shut down threshold. To reactivate K again the temperature must decrease below the K switch ON temperature. To achieve no fault for V_S under-voltage conditions the outputs will be switched OFF and stay at high impedance.

All these features together with a high possible baud rate > 50Kbaud provide a wide power supply voltage range and a very small quiescent current during OFF (TX LI K=High) condition $I_{S, OFF(typ)}$ ≤ 120 µA and a real standby function with zero power consumption $I_{S,SB(typ)}$ ≤ 1 µA during system de powering V_{CC} ≤ 0.5 V make this device high efficient for the automotive bus system.

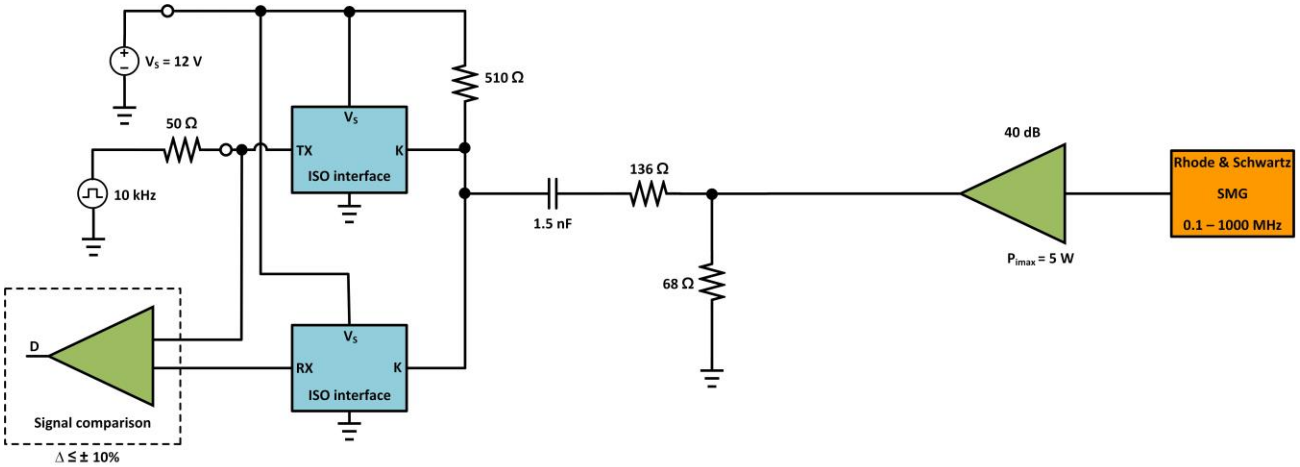


Figure 3: EMI performance (ISO 9141 bus system)

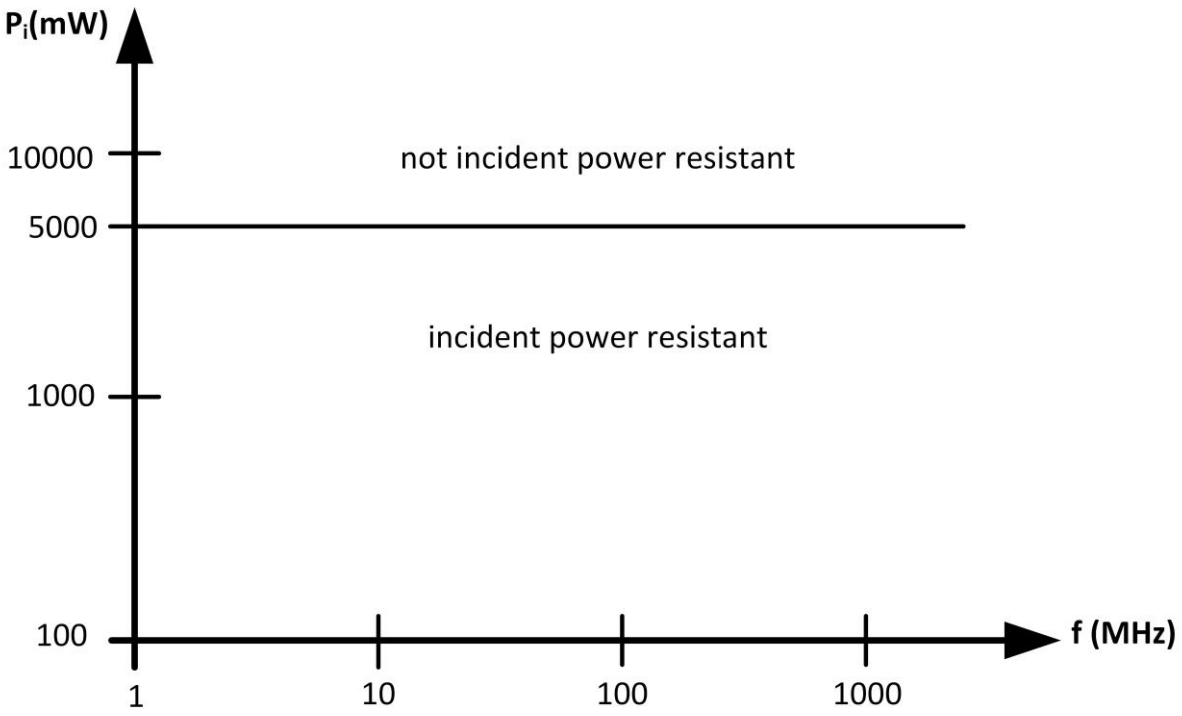


Figure 4: Input power vs. frequency diagram

11. Packaging

11.1 Summary

Terminal position code	D (double)
Package type descriptive code	SO8
Package type industry code	SO8
Package style descriptive code	SO (small outline)
Package body material type	P (plastic)
Mounting method type	S (surface mount)

Symbol	Parameter	Min	Nom	Max	Unit
A	Seated height		1.75	1.75	mm
A_2	Package height	1.25	1.35	1.45	mm
D	Package length	4.8	4.9	5	mm
e	Nominal pitch		1.27		mm
E	Package width	3.8	3.9	4	mm
n_2	Actual quantity of termination		8		

11.2 Package Outline

Parameter	Min	Max	Unit
D[1]	4.8	5	mm
y	0.1	0.1	mm

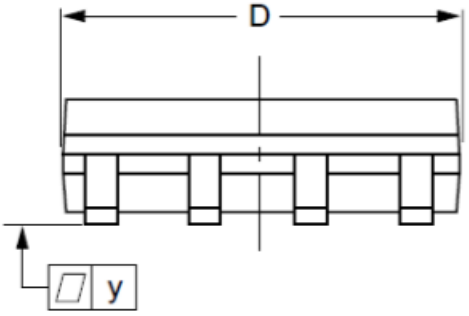


Figure 5

Parameter	Min	Max	Unit
A_{MAX}	1.75	1.75	mm
A_1	0.1	0.25	mm
A_2	1.25	1.45	mm
A_3	0.25	0.25	mm
L	1.05	1.05	mm
L_p	0.4	1.0	mm
Q	0.6	0.7	mm
θ	0°	8°	mm

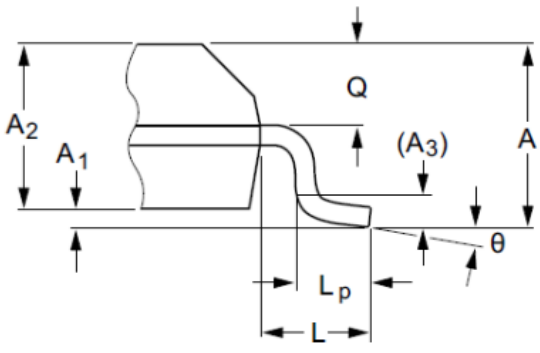


Figure 6

[1] Plastic or metal protrusions of 0.15 mm maximum per side are not included.

Parameter	Min	Max	Unit
c	0.19	0.25	mm
E[1]	3.8	4.0	mm
H_E	5.8	6.2	mm
v	0.25	0.25	mm

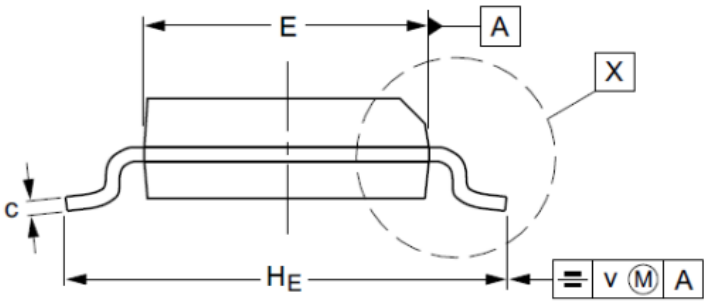


Figure 7

Parameter	Min	Max	Unit
b_p	0.36	0.49	mm
e	1.27	1.27	mm
w	0.25	0.25	mm
Z[1]	0.3	0.7	mm

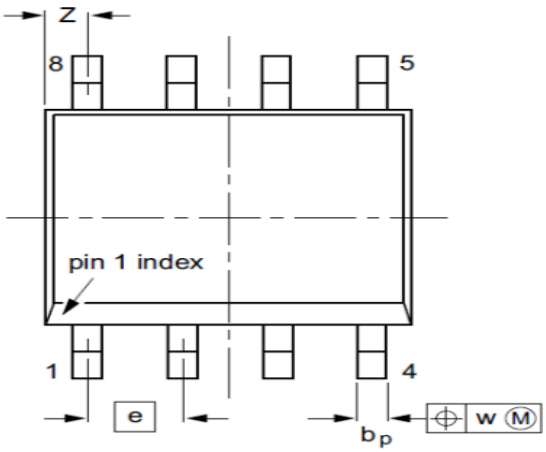


Figure 8

[1] Plastic or metal protrusions of 0.25 mm maximum per side are not included.