

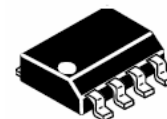
MICROCIRCUIT ISO of K Line INTERFACE

DESCRIPTION

IL33290D – microcircuit of the serial interface, intended for ensuring the dual direction semi-duplex connection in the automotive diagnostic applications. The microcircuit is designed to ensure communication between the vehicle-borne microcontroller of the transport means and the external systems via the special line ISO K. The microcircuit IL33290D is designed in compliance with Specification of the diagnostic systems ISO9141. The microcircuit output, controlling line K, is protected from short circuit and temperature overshoot.

Serviceability of the microcircuit in the wide range of temperatures and supply voltages is ensured by its fabrication under the BiCDMOS process, combining the CMOS logic, bipolar and MOS analogue circuit solutions and powerful DMOS transistors.

Microcircuit IL33290D is mainly intended for the automotive applications, but is also applicable in other applications with the serial connection. The microcircuit parameters are specified for the ambient temperature range of $-40\text{ C } T_A \text{ } 125\text{ C}$ and the supply battery voltage range of $8.0\text{ V } U_{BB} \text{ } 18\text{ V}$. The microcircuit IL33290D is fabricated in the economic mass production package MS-012AA.

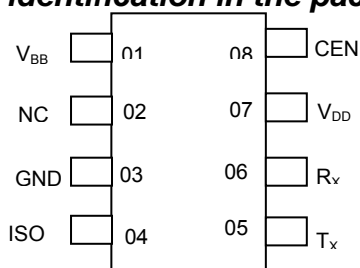


Plastic package
MS-012AA (SO-8)
– Identification of microcircuit
IL33290D in package

Main functional features:

- operational in the wide voltage range of the supply battery from 8 to 18 V;
- operating ambient temperature is from minus 40 to plus 125 C;
- compatible with the standard CMOS logic;
- ISO K line pin is protected from short circuit to the ground;
- heat protection with hysteresis;
- possibility of letting large value currents via the connection pin to the ISO K bus;
- possibility of controlling the bus with the parasitic capacitance up to 10 nF;
- protection from influence of the static electricity up to 8.0 kV, attained by application of the several additional components;
- in the mode “ stand-by ” non-availability of the current consumption from the battery at $U_{DD} = 5\text{ V}$;
- low current consumption in the process of operation at $U_{DD} = 5\text{ V}$.

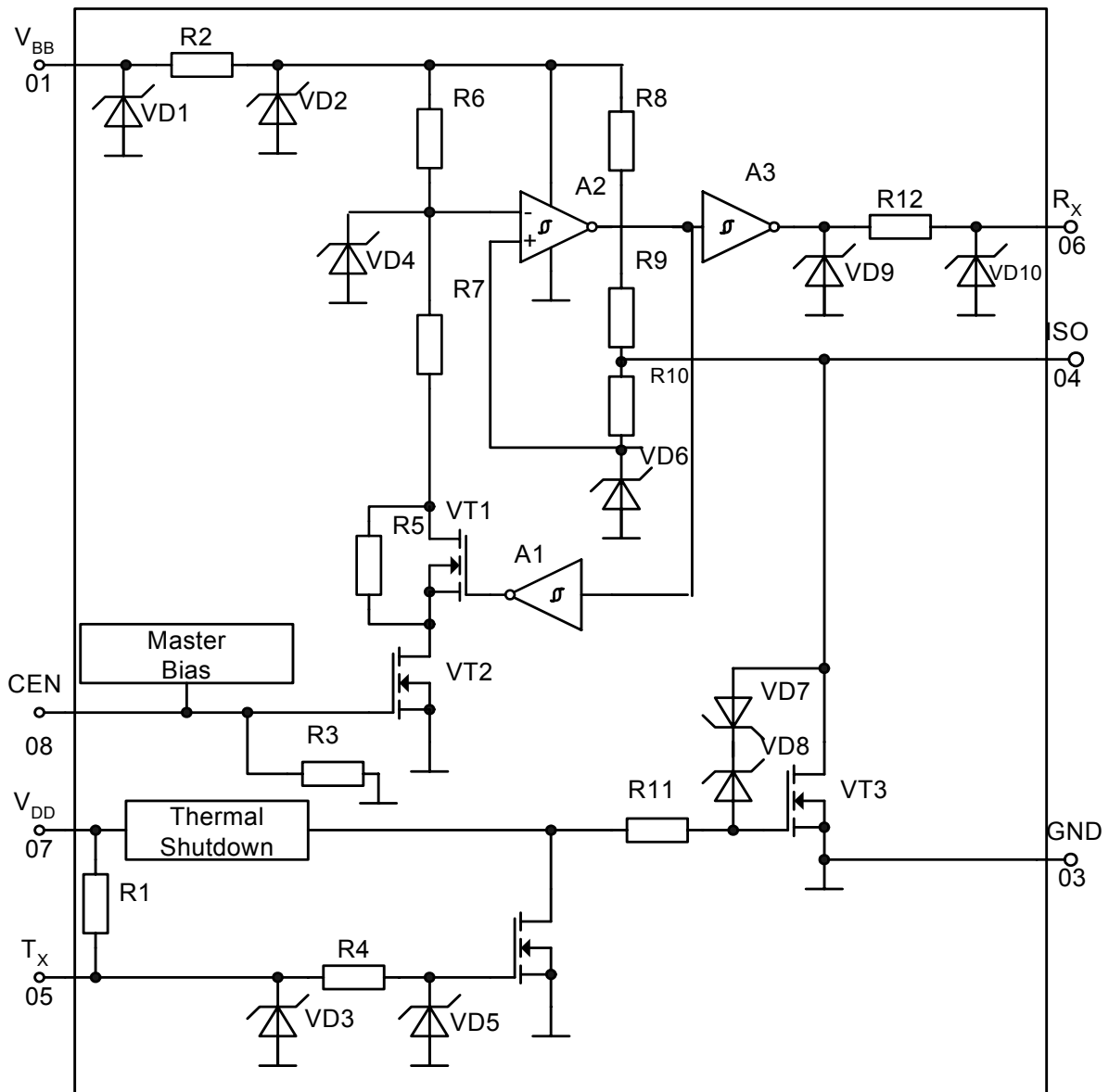
Pin identification in the package



PIN FUNCTION DESCRIPTION

Pin Number	Identification	Purpose
01	V_{BB}	Supply pin from battery
02	NC	Vacant pin
03	GND	Common pin
04	ISO	Connection pin to bus
05	Tx	Input of transferred data
06	Rx	Output of received data
07	V_{DD}	Logic supplu pin
08	CEN	Microcircuit selection pin

Simplified Block Diagram



- A1 – amplifier;
- A2, A3 – amplifiers;
- R1, R3 – resistors with resistance of 125 kOhm;
- R2 – resistor with resistance of 3.0 kOhm;
- R4 – resistor with resistance of 2.0 kOhm;
- R5 – resistor;
- R6 – R11 – resistors;
- R12 – resistor with resistance of 200 Ohm;
- VD1 – diode, 50 V;
- VD2 – diode, 20 V;
- VD3, VD5, VD9, VD10 – diodes, 10 V;
- VD4, VD6 – diodes;
- VD7, VD8 – diodes, 40 V;
- VT1 – VT3 – transistors

MAXIMUM RATINGS

Parameters, Unit	Symbol	Absolute Maximum Ratings		Maximum Ratings	
		Min	Max	Min	Max
Supply voltage, V	U_{DD}	4.75	5.25	-0.3	7.0
Battery supply voltage V_{BB} , V	$U_{BB(LD)}$	8.0	18	-	45
Voltage by pin ISO, V	U_{ISO}	-	18	-	40 ¹⁾
Short circuit current by pin ISO, A	$I_{ISO(LIM)}$	-	1.0	-	1.0
Storage temperature, C	T_{stg}	-	-	-55	150
Chip temperature ²⁾ , C	T_J	-	145	-	150
Heat protection actuating temperature ²⁾ , C	T_{LIM}	150	-	-	-
Dissipating power, Wt	P_D	-	-	-	0.8
Resistance chip – medium, C/Wt	R_{JA}	-	-	-	150

Note – All voltages are measured relative to the pin GND, if not stipulated otherwise.

¹⁾ Microcircuit retains serviceability during the voltage build-up at pin ISO up to 40 V during 10 min, but during this the parameter values are not guaranteed.

ELECTRIC PARAMETERS

Parameter, Unit	Symbol	Norm		Mode	Temperature, C	Note
		Min	Max			
Power supply and control						
Current by pin V_{DD} in the stand-by mode, mA	$I_{DD(SS)}$	-	0.1	4.75 V U_{DD} 5.25 V; 8.0 V U_{BB} 18.0 V; $U_{Tx} = 0.8 U_{DD}$; $U_{CEN} = 0.3 U_{DD}$	25 10 125 5 -40 3	
Static operating current by pin V_{DD} , mA	$I_{DD(Q)}$	-	1.0	4.75 V U_{DD} 5.25 V; 8.0 V U_{BB} 18.0 V; $U_{Tx} = 0.2 U_{DD}$; $U_{CEN} = 0.7 U_{DD}$		
Current by pin V_{BB} in the stand-by mode, μ A	$I_{BB(SS)}$	-	50	4.75 V U_{DD} 5.25 V; $U_{BB} = 16$ V; $U_{Tx} = 0.8 U_{DD}$; $U_{CEN} = 0.3 U_{DD}$		
Static operating current by pin V_{BB} , mA	$I_{BB(Q)}$	-	1.0	4.75 V U_{DD} 5.25 V; 8.0 V U_{BB} 18.0 V; $U_{Tx} = 0.2 U_{DD}$; $U_{CEN} = 0.7 U_{DD}$		
High level input threshold voltage by pin CEN, V	$U_{IH(CEN)}$	$0.7 U_{DD}$	-	4.75 V U_{DD} 5.25 V; 8.0 V U_{BB} 18.0 V		1
Low level input threshold voltage by pin CEN, V	$U_{IL(CEN)}$	-	$0.3 U_{DD}$	4.75 V U_{DD} 5.25 V; 8.0 V U_{BB} 18.0 V		2
Step-down current by pin CEN, μ A	$I_{PD(CEN)}$	2.0	40	4.75 V U_{DD} 5.25 V; 8.0 V U_{BB} 18.0 V; $U_{CEN} = 0.3 U_{DD}$		3

High level input threshold voltage by pin Tx, V	$U_{IH(Tx)}$	$0.7U_{DD}$	-	4.75 V U_{DD} 5.25 V; 8.0 V U_{BB} 18.0 V; $R_{ISO}=510$ Ohm; $U_{CEN} = 0.7U_{DD}$		4
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ELECTRIC PARAMETERS Continued

Parameter, Unit	Symbol	Norm		Mode	Temperature, C	Note
		Min	Max			
Low level input threshold voltage by pin Tx, V	$U_{IL(Tx)}$	-	$0.3U_{DD}$	4.75 V U_{DD} 5.25 V; 8.0 V U_{BB} 18.0 V; $R_{ISO}=510$ Ohm; $U_{CEN} = 0.7U_{DD}$		5
Step-up current by pin Tx, μ A	$I_{PU(Tx)}$	-40	-2.0	4.75 V U_{DD} 5.25 V; 8.0 V U_{BB} 18.0 V; $U_{CEN} = 0.7U_{DD}$		6
High level output voltage by pin Rx, V	$U_{OH(Rx)}$	$0.8U_{DD}$	-	4.75 V U_{DD} 5.25 V; 8.0 V U_{BB} 18.0 V; $R_{ISO} = 510$ Ohm; $U_{Tx} = 0.8U_{DD}$, $U_{CEN} = 0.7U_{DD}$, outpassing current by pin Rx is equal to 250 μ A	25 10 125 5 -40 3	-
Low level output voltage by pin Rx, V	$U_{OL(Rx)}$	-	$0.2U_{DD}$	4.75 V U_{DD} 5.25 V; 8.0 V U_{BB} 18.0 V; $R_{ISO} = 510$ Ohm; $U_{Tx} = 0.2U_{DD}$, $U_{CEN} = 0.7U_{DD}$, inpassing current by pin Rx is equal to 1.0 mA		
ISO input / output						
High level input threshold voltage, V	$U_{IH(ISO)}$	$0,7U_{BB}$	-	4.75 V U_{DD} 5.25 V; 8.0 V U_{BB} 18.0 V; $R_{ISO} = 0$ Ohm; $U_{Tx} = 0.8U_{DD}$	25 10 125 5 -40 3	7
Low level input threshold voltage, V	$U_{IL(ISO)}$	-	$0.4U_{BB}$	4.75 V U_{DD} 5.25 V; 8.0 V U_{BB} 18.0 V; $R_{ISO} = 0$ Ohm; $U_{Tx} = 0.8U_{DD}$		8
Input hysteresis, V	$U_{Hys(ISO)}$	$0.05U_{BB}$	$0.1U_{BB}$	4.75 V U_{DD} 5.25 V; 8.0 V U_{BB} 18.0 V		9
Internal step-up current, μ A	$I_{PU(ISO)}$	-5.0	-140	4.75 V U_{DD} 5.25 V; $U_{BB}=18$ V; $U_{Tx}=0.8U_{DD}$; $U_{ISO}=9.0$ V; $U_{CEN} = 0.3U_{DD}$, $R_{ISO} =$		-
Short circuit current, mA	$I_{SC(ISO)}$	50	1000	4.75 V U_{DD} 5.25 V; 8.0 V U_{BB} 18.0 V; $U_{Tx} = 0.4U_{DD}$; $U_{ISO} = U_{BB}$, $U_{CEN} = 0.7U_{DD}$; $R_{ISO} = 0$ Ohm		10

ELECTRIC PARAMETERS Continued

Parameter, Unit	Symbol	Norm		Mode	Temperature, C	Note
		Min	Max			
High level output voltage, V	$U_{OH(ISO)}$	$0.95U_{BB}$	-	4.75 V U_{DD} 5.25 V; 8.0 V U_{BB} 18.0 V; $U_{Tx} = 0.8U_{DD}$; $U_{CEN} = 0.7U_{DD}$; $R_{ISO} =$	25 10 125 5 -40 3	-
Low level output voltage, V	$U_{OL(ISO)}$	-	$0.1U_{BB}$	4.75 V U_{DD} 5.25 V; 8.0 V U_{BB} 18.0 V; $U_{Tx} = 0.2U_{DD}$; $U_{CEN} = 0.7U_{DD}$; $R_{ISO} = 510 \text{ Ohm}$	25 10 125 5 -40 3	
Dynamic parameters						
Drop time, usec	$t_{fall(ISO)}$	-	2.0	4.75 V U_{DD} 5.25 V; 8.0 V U_{BB} 18.0 V; $R_{ISO} = 510 \text{ Ohm to } V_{BB}$, $C_{ISO} = 10 \text{ nF to GND}$	25 10 125 5 -40 3	11
Transition time, usec	$t_{PD(ISO)}$	-	2.0	4.75 V U_{DD} 5.25 V; 8.0 B U_{BB} 18.0 V; $R_{ISO} = 510 \text{ Ohm}$; $C_{ISO} = 500 \text{ pF}$. Switch over from high level to low level		12, 13
		-	2.0	4.75 V U_{DD} 5.25 V; 8.0 V U_{BB} 18.0 V; $R_{ISO} = 510 \text{ Ohm}$; $C_{ISO} = 500 \text{ pF}$. Switch over from low level to high level		12, 14

Notes

- 1 On condition, when I_{BB} becomes over 100 μA .
- 2 On condition, when I_{BB} becomes less than 100 μA .
- 3 Permission pin has the internal current step-down. Step-down current by pin CEN is measured with the voltage of $0.3U_{DD}$ at it.
- 4 Voltage at pin Tx alters from $0.3U_{DD}$ to the moment, when the voltage at pin ISO becomes over $0.9U_{BB}$.

ELECTRIC PARAMETERS Continued

5 Voltage at pin Tx alters from the voltage, equal to $0.7U_{DD}$ until the moment, when the voltage at pin ISO drops below $0.2U_{BB}$.

6 Pin Tx has the internal current build-up. The step up current is measured by pin Tx with the voltage of $0.7U_{DD}$ at it.

7 Voltage at pin ISO has ramp alteration from $0.4U_{BB}$ up to $0.8U_{BB}$, pin Rx is under control; the voltage level at pin ISO is considered as threshold, at which the voltage at pin Rx rises up to $0.7U_{DD}$.

8 Voltage at pin ISO has ramp alteration from $0.8U_{BB}$ up to $0.4U_{BB}$, the pin Rx is under control; the voltage level at pin ISO is considered as threshold, at which voltage at pin Rx drops down to $0.3U_{DD}$.

9 Input hysteresis $U_{Hys(ISO)}$, V, is determined by the formula

$$U_{Hys(ISO)} = U_{IH(ISO)} - U_{IL(ISO)}, \quad (1)$$

where $U_{IH(ISO)}$ – high level input threshold voltage by pin ISO, V;

$U_{IL(ISO)}$ – low level; input threshold voltage by pin ISO, V.

10 Pin ISO has the internal current limitation.

11 Time, required for the voltage transition at pin ISO from $0.8U_{BB}$ up to $0.2U_{BB}$.

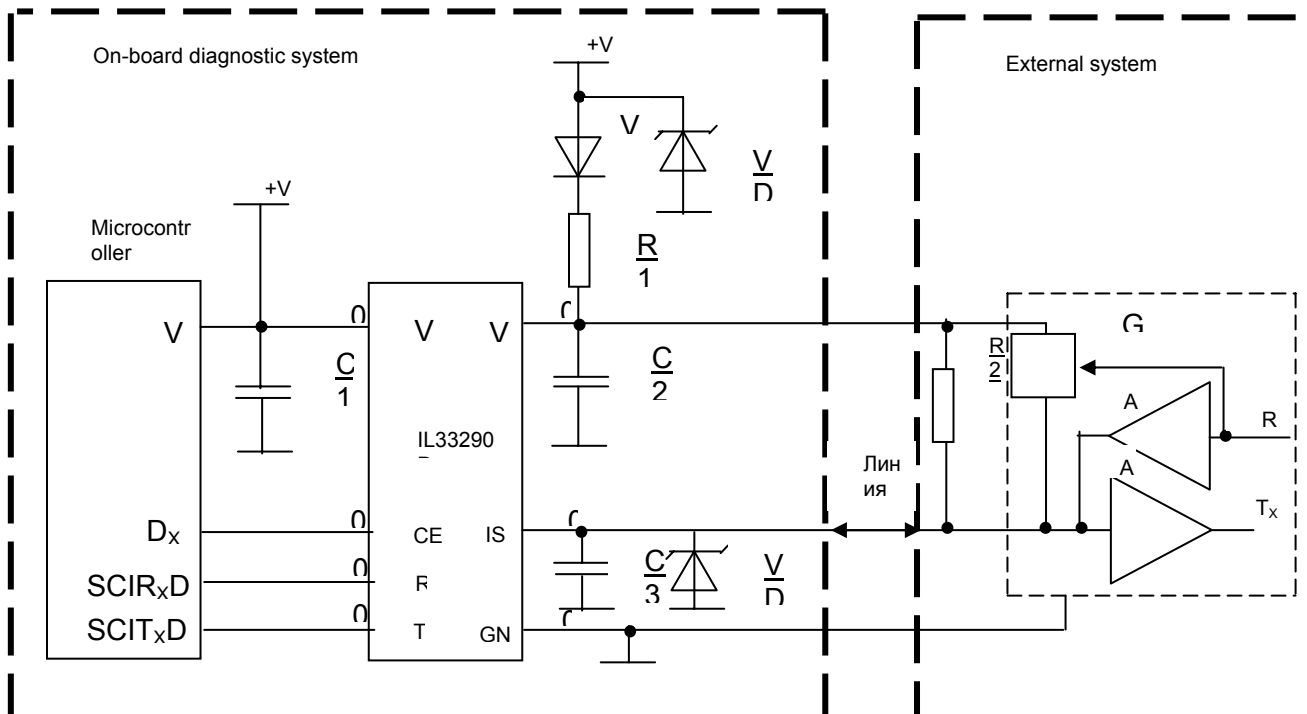
12 Alteration of value C_{ISO} has effect on duration of front and drop, but has the minimum influence on the spread delay time.

13 Voltage at pin Tx alters from $0.8U_{DD}$ up to $0.2U_{DD}$. Time is measured from the moment, when voltage at pin ISO corresponds to $U_{IH(ISO)}$, until the moment, when voltage at pin ISO reaches the value $0.3U_{BB}$.

14 Voltage at pin Tx alters from $0.2U_{DD}$ until $0.8U_{DD}$. Time is measured from the moment, when voltage at pin ISO corresponds to $U_{IL(ISO)}$, until the moment, when voltage at pin ISO reaches the value $0.7U_{BB}$.

15 Composition of controlled parameters, norms and modes are specified in the progress of fabrication of the pilot lot.

Application Diagram



A1, A2 – amplifiers;
 G1 – current source;
 VD1 – VD3 – diodes

Note – For protection of the battery reverse switch-on the diode VD1 is required, temporary voltage overshoot – diode VD2, resistor R1, and protection from static electricity up to 8000 V – capacitors C2, C3, diode VD3, located in the metal package of the module.

INFORMATION ON APPLICATION

IL33290D – this is a microcircuit of the serial interface, corresponding to the Specification of the physical bus ISO9141, line ISO K. Microcircuit does not operate with the line ISO L. It ensures the dual directional semi-duplex match of the microcontroller with the communication bus. Microcircuit IL33290D converts the logic levels of the microcontroller voltages with the supply voltage of 5.0 V to the battery voltage levels and battery voltage levels to the logic levels of the microcontroller.

Microcircuit IL33290D converts the microcontroller's logic signals with the supply voltage of 5.0 V into the logic signals with the battery voltage level and vice versa. Maximum rate of the data transfer is determined by the transition times. Transition time (switch-over from the high level to the low level) is determined by the output transistor. Transition time (switch-over from the low level to the high level) – by the bus capacitance and pull-up resistor on the bus. Transition time (switch-over from the high level to the low one) makes it possible for the microcircuit IL33290D to transfer the data at the rate up to 150 kBit/sec while using the bit duration equal to 30% from the maximum. The serial interface retains its serviceability within the battery voltage range from 6 to 18 V. The microcircuit parameters are specified for the voltage range U_{BB} from 8 V to 18 V.

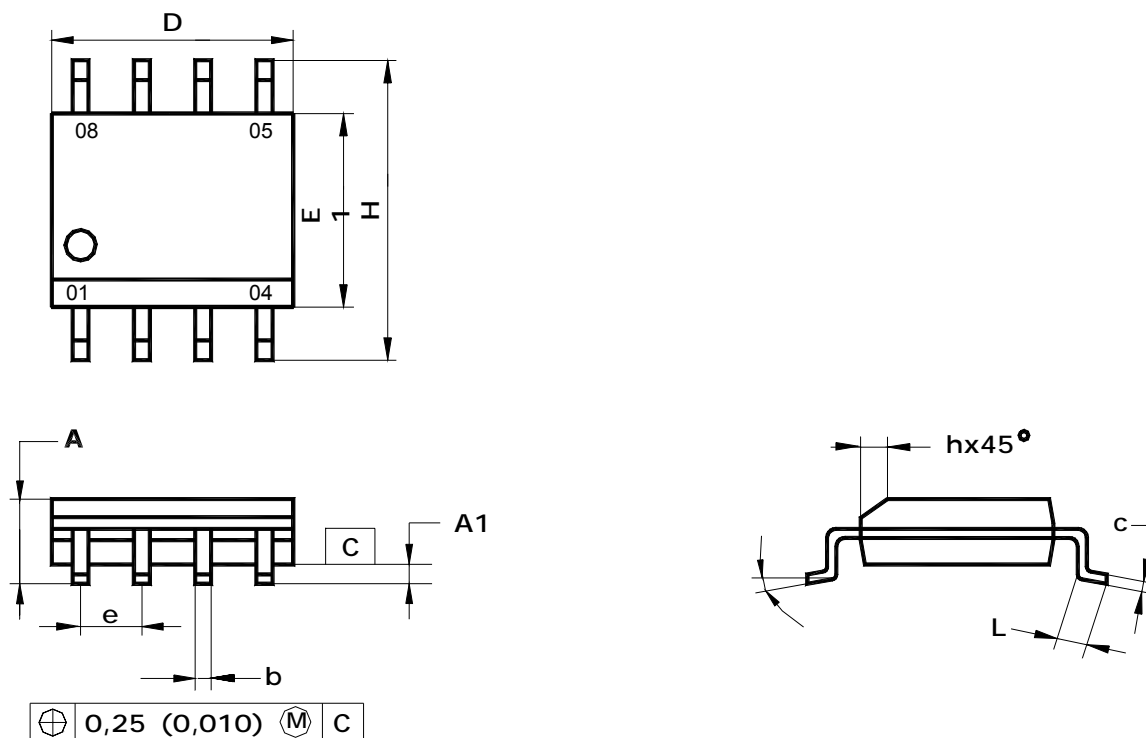
The required input levels from the microcontroller are referred to the voltage U_{DD} , which is used for the microcontroller power supply. The control pins Rx and Tx are compatible with the standard CMOS – logic with the supply voltage of 5 V. In order to enhance the failure resistance, the input Tx has the internal step-up resistor, connected to V_{DD} , input CEN has the internal step-down resistor, connected to GND.

The internal step-down circuit is protected from the short circuit to the battery, the circuit incorporates also the heat protection. The type application envisages protection from the reverse switch-on of the battery owing to application of the external step-up resistor of 510 Ohm and the diode, connected to the battery.

Microcircuit protection from the battery reverse switch-on is ensured by means of application of the interlocking diode VD1. Protection from surges in the supply line from the battery is ensured by application of the Zener diode for 45 V and the resistor with the resistance value of 500 Ohm, connected to V_{BB} . Protection from the static electricity of the communications lines, outgoing from the module is ensured by application of the capacitor, connected to the pin V_{BB} of the microcircuit and the parallel connection of the capacitor and the Zener diode for 27 V to the pin ISO.

Dimensional sizes of the package MS-012AA

**D SUFFIX PLASTIK SOP
(MS-012AA)**



Note - Dimensions D, E1 do not include the value of fin, which should not exceed 0.25 mm (0.010) per a side.

	D	E1	H	b	e		A	A1	c	L	h
Millimeters											
min	4.80	3.80	5.80	0.33	1.27	0	1.35	0.10	0.19	0.41	0.25
max	5.00	4.00	6.20	0.51		8	1.75	0.25	0.25	1.27	0.50
Inches											
min	0.1890	0.1497	0.2284	0.013	0.05	0	0.0532	0.0040	0.0075	0.016	0.0099
max	0.1968	0.1574	0.2440	0.020		8	0.0688	0.0098	0.0098	0.050	0.0196