DHA® QJ/DHA 01.25-2012 **LD33290**

Microcircuit ISO of K Line Interface

Description

The LD33290 (analog MC33290) is a serial link bus interface device designed to provide bidirectional half-duplex communication interfacing in automotive diagnostic applications. It is designed to interface between the vehicle's on-board micro controller and systems off-board the vehicle via the special ISO K line. The LD33290 is designed to meet the Diagnostic Systems ISO9141 specification. The device's K line bus driver's output is fully protected against bus shorts and over temperature conditions.

The LD33290 derives its robustness to temperature and voltage extremes by being built on a SMARTMOS process, incorporating CMOS logic, bipolar/MOS analog circuitry, and DMOS power FETs. Although the LD33290 was principally designed for automotive applications, it is suited for other serial communication applications. It is parametrically specified over an ambient temperature range of -40℃≤TA≤125℃ and 8.0V≤VBB≤18V supply. The economical SOP8 surface-mount plastic package makes the LD33290 very cost.

Features

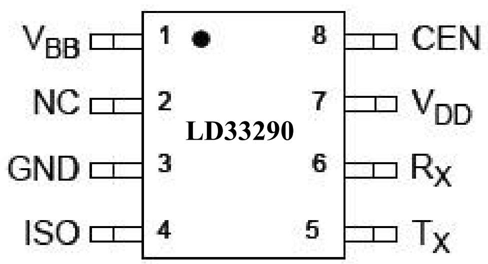
- Designed to Operate Over Wide Supply Voltage of 8.0 to 18 V
- Ambient Operating Temperature of -40 to 125℃
- Interfaces Directly to Standard CMOS Microprocessors
- ISO K Line Pin Protected Against Shorts to Ground
- Thermal Shutdown with Hysteresis
- ISO K Line Pin Capable of High Currents
- ISO K Line Can Be Driven with up to 10 nF of Parasitic Capacitance
- 8.0 kV ESD Protection Attainable with Few Additional Components
- Standby Mode: No VBat Current Drain with V_{DD} at 5.0 V
- Low Current Drain During Operation with V_{DD} at 5.0 V

Ordering Information

Package	Remarks
SOP8	Tubed, Reeled, Pb-free
DIP8	Tubed, Pb-free

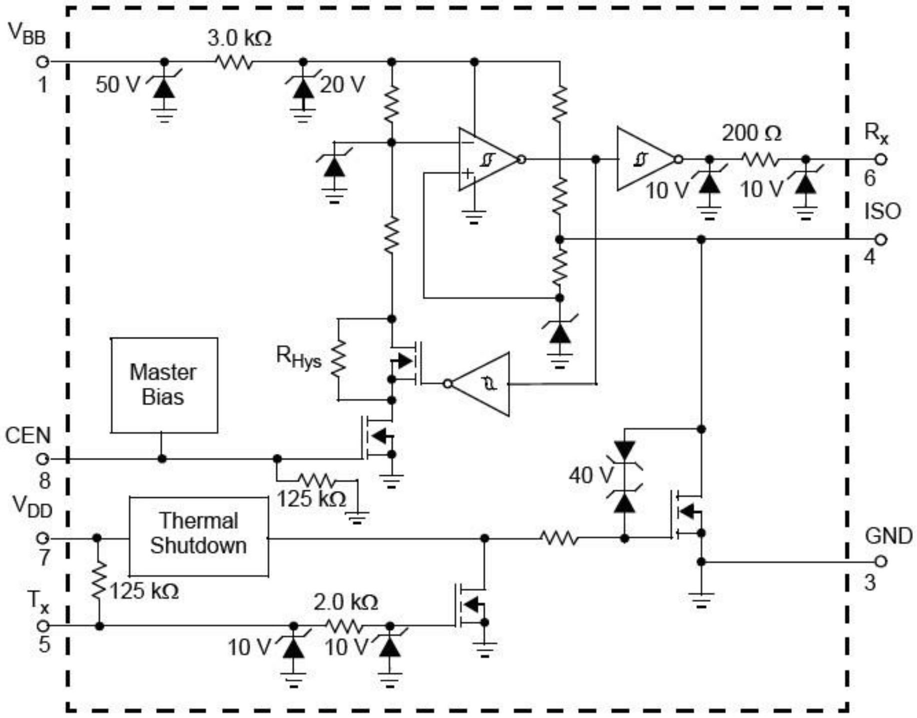
Pin Description

Pin	Symbol	Function
1	V_{BB}	Supply pin from battery
2	NC	Vacant pin
3	GND	Common pin
4	ISO	Connection pin to bus
5	Tx	Input of transferred data
6	Rx	Output of received data
7	V_{DD}	Logic supply pin
8	CEN	Microcircuit selection pin



Pinning

Block Diagram



Maximum Ratings

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

Note – All voltages are measured revative to the pin GND, if not stipulated otherwise.
Microcircuit retains serviceability during the voltage build-up at pin ISO up to 40 V during 10min, but during this the parameter values are not guaranteed.

Electric Parameters

Symbol	Parameters	Conditions	Min	Max	Unit
Power supply and control					
$I_{DD(SS)}$	Current by pin V_{DD} in the stand-by mode	4.75 V< V_{DD} <5.25 V 8.0 V <V_{BB} <18.0 V V_{CEN} = 0.3V_{DD} VTx = 0.8V_{DD}	-	0.1	mA
$I_{DD(Q)}$	Static operating current by pin V_{DD}	4.75 V< V_{DD} <5.25 V 8.0 V <V_{BB} <18.0 V V_{CEN} = 0.7V_{DD} UTx = 0.2V_{DD}	-	1.0	mA
$I_{BB(SS)}$	Current by pin VBB in the stand-by mode	4.75 V< V_{DD} <5.25 V 8.0 V <V_{BB} <18.0 V; V_{CEN} = 0.3V_{DD} VTx = 0.8V_{DD}	-	50	µA
$I_{BB(Q)}$	Static operating current by pin V_{BB}	4.75 V< V_{DD} <5.25 V 8.0 V <V_{BB} <18.0 V V_{CEN} = 0.7V_{DD} VTx = 0.2V_{DD}	-	1.0	mA
$V_{IH(CEN)}$	High level input threshold voltage by pin CEN (Note 1)	4.75 V< V_{DD} <5.25 V 8.0 V < V_{BB} <18.0 V	0.7V_{DD}	-	V
$V_{IL(CEN)}$	Low level input threshold voltage by pin CEN (Note 2)	4.75 V< V_{DD} <5.25 V 8.0 V < V_{BB} <18.0 V	-	0.3V_{DD}	V
$I_{PD(CEN)}$	Step-down current by pin CEN (Note 3)	4.75 V< V_{DD} <5.25 V 8.0 V < V_{BB} <18.0 V V_{CEN} = 0.3V_{DD}	2.0	40	µA
$V_{IH(Tx)}$	High level input threshold voltage by pin Tx (Note 4)	4.75 V< V_{DD} <5.25 V 8.0 V < V_{BB} <18.0 V V_{CEN} = 0.7V_{DD} R_{ISO}=510Ω	0.7V_{DD}	-	V
$V_{IL(Tx)}$	Low level input threshold voltage by pin Tx (Note 5)	4.75 V< V_{DD} <5.25 V 8.0 V < VU_{BB} <18.0 V R_{ISO}=510Ω V_{CEN} = 0.7V_{DD}	-	0.3V_{DD}	V
$I_{PV(Tx)}$	Step-up current by pin Tx (Note 6)	4.75 V< V_{DD} <5.25 V 8.0V<V_{BB}<18.0V V_{CEN}=0.7V_{DD}	-40	-2.0	µA
$V_{OH(Rx)}$	High level output voltage by pin Rx	4.75 V< V_{DD} <5.25 V 8.0 V < V_{BB} <18.0 V R_{ISO}=510Ω V_{CEN} = 0.7V_{DD} VTx = 0.8V_{DD} Out passing current by pin Rx is equal to 250 µA	0.8V_{DD}	-	V

Symbol	Parameters	Conditions	Min	Max	Unit
$V_{OL(Rx)}$	Low level output voltage by pin Rx	4.75 V< V_{DD} <5.25 V 8.0 V < V_{BB} <18.0 V R_{ISO}=510Ω V_{CEN} = 0.7V_{DD} VTx = 0.8V_{DD} in passing current by pin Rx is equal to 1.0 mA	-	0.2V_{DD}	V
ISO input / output					
$V_{IH(SIO)}$	High level input threshold voltage (Note 7)	4.75 V< V_{DD} <5.25 V 8.0 V < V_{BB} <18.0 V R_{ISO}=0Ω VTx = 0.8V_{DD}	0.2V_{BB}	-	V
$V_{IL(ISO)}$	Low level input threshold voltage (Note 8)	4.75 V< V_{DD} <5.25 V 8.0 V < V_{BB} <18.0 V R_{ISO}=0Ω VTx = 0.8V_{DD}	-	0.4V_{BB}	V
$V_{Hys(ISO)}$	Input hysteresis (Note 9)	4.75 V< V_{DD} <5.25 V 8.0 V < V_{BB} <18.0 V	0.05V_{BB}	0.1V_{BB}	V
$I_{PU(ISO)}$	Internal step-up current	4.75 V< V_{DD} <5.25 V V_{BB} =18.0 V VTx = 0.8V_{DD} V_{ISO}=9.0 V V_{CEN} = ,0.3V_{DD} R_{ISO}=∞Ω	-5.0	-140	uA
$I_{SC(ISO)}$	Short circuit current (Note 10)	4.75 V< V_{DD} <5.25 V 8.0 V < V_{BB} <18.0 V R_{ISO}=0 Ω VTx = 0.4V_{DD} V_{CEN} = 0.7V_{DD} V_{ISO} = V_{BB}	50	1000	mA
$V_{OH(ISO)}$	High level output voltage	4.75 V< V_{DD} <5.25 V 8.0 V < V_{BB} <18.0 V VTx = 0.8V_{DD} V_{CEN} = 0.7V_{DD} R_{ISO}=∞Ω	0.95V_{BB}	-	V
$V_{OL(ISO)}$	Low level output voltage	4.75 V< V_{DD} <5.25 V 8.0 V < V_{BB} <18.0 V VTx = 0.2V_{DD} V_{CEN} = 0.7V_{DD} R_{ISO}=510Ω	-	0.1V_{BB}	V

Symbol	Parameters	Conditions	Min	Max	Unit
Dynamic parameters					
$t_{fall(ISO)}$	Drop time (Note 11)	4.75 V< V_{DD} <5.25 V 8.0 V < V_{BB} <18.0 V R_{ISO}=510Ω to V_{BB} C_{ISO} = 10 nF to GND	-	2.0	us
$t_{PD(ISO)}$	Transition time (Note 12, 13)	4.75 V< V_{DD} <5.25 V 8.0 V < V_{BB} <18.0 V R_{ISO}=510Ω C_{ISO} = 500 pF Switch over from high level to low level	-	2.0	us
	(Note 12, 14)	4.75 V< V_{DD} <5.25 V 8.0 V < V_{BB} <18.0 V R_{ISO}=510Ω C_{ISO} = 500 pF Switch over from low level to high level	-	2.0	

Notes:

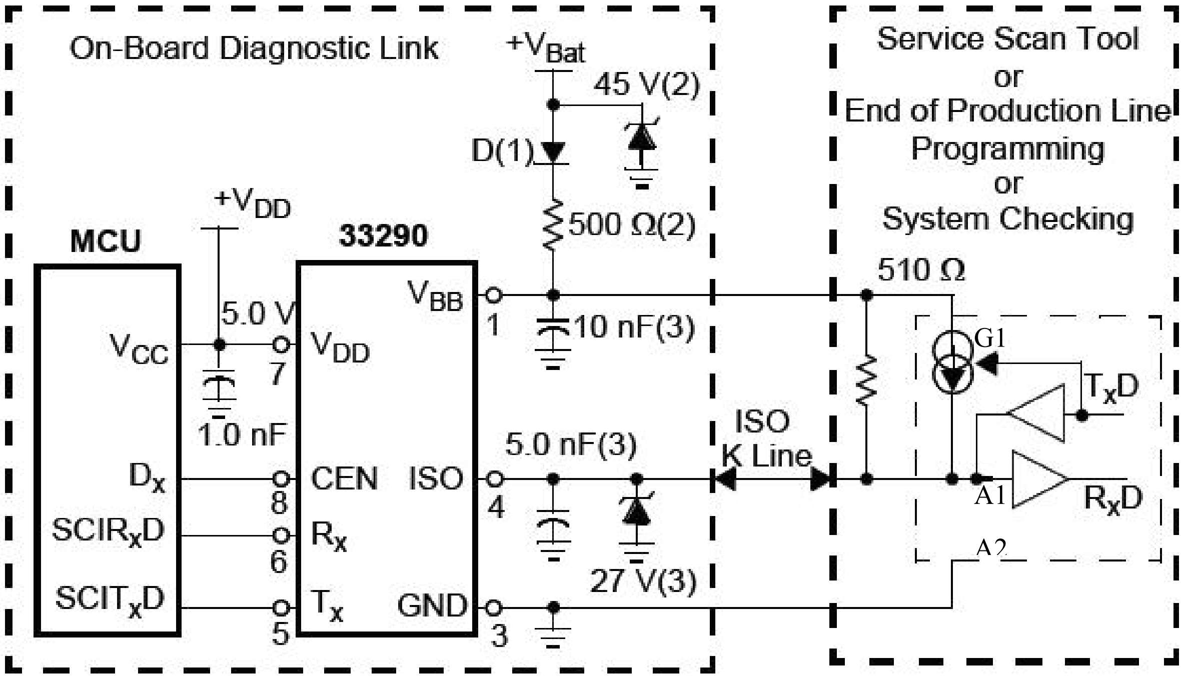
1. On condition, when I_{BB} becomes over 100 µA.
2. On condition, when I_{BB} becomes less than 100 µA.
3. Permission pin has the internal current step-down. Step-down current by pin CEN is measured with the voltage of 0.3V_{DD} at it.
4. Voltage at pin Tx alters from 0.3V_{DD} to the moment, when the voltage at pin ISO becomes over 0.9V_{BB}.
5. Voltage at pin Tx alters from the voltage, equal to 0.7V_{DD} until the moment, when the voltage at pin ISO drops below 0.2V_{BB}.
6. Pin Tx has the internal current build-up. The step up current is measured by pin Tx with the voltage of 0.7V_{DD} at it.
7. Voltage at pin ISO has ramp alteration from 0.4V_{BB} up to 0.8V_{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 0.7V_{DD}.
8. Voltage at pin ISO has ramp alteration from 0.8V_{BB} up to 0.4V_{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 0.3V_{DD}.
9. Input hysteresis $V_{Hys(ISO)}$, is determined by the formula $V_{Hys(ISO)} = V_{IH(ISO)} - V_{IL(ISO)}$, where $V_{IH(ISO)}$ – high level input threshold voltage by pin ISO, $V_{IL(ISO)}$ – low level input threshold voltage by pin ISO.
10. Pin ISO has the internal current limitation.
11. Time, required for the voltage transition at pin ISO from 0.8V_{BB} up to 0.2V_{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 0.8V_{DD} up to 0.2V_{DD}. Time is measured from the moment, when voltage at pin ISO corresponds to $V_{IH(ISO)}$, until the moment, when voltage at pin ISO reaches the value 0.3V_{BB}.

14. Voltage at pin Tx alters from 0.2V_{DD} until 0.8V_{DD}. Time is measured from the moment, when voltage at pin ISO corresponds to $V_{IL(ISO)}$, until the moment, when voltage at pin ISO reaches the value 0.7V_{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 R2, 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

LD33290 – 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 micro controller with the communication bus. Microcircuit LD33290 converts the logic levels of the micro controller voltages with the supply voltage of 5.0V to the battery voltage levels and battery voltage levels to the logic levels of the micro controller.

Microcircuit LD33290 converts the micro controller'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 LD33290 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 to18V. The microcircuit parameters are specified for the voltage range V_{BB} from 8V to 18V.

The required input levels from the micro controller are referred to the voltage V_{DD}, which is used for the micro controller power supply. The control pins Rx and Tx are compatible with the standard CMOS – logic with the supply voltage of 5V. 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.

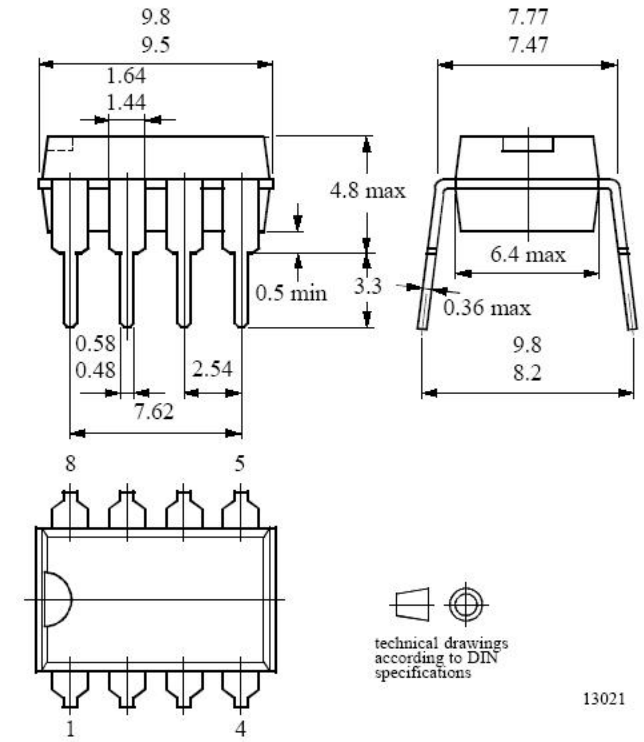
The internal step-down circuit is protected from the short circuit to the battery, the circuit incorporates also the heat protection. The type application envisages protection from the reverse switch-on of the battery owing to application of the external step-up resistor of 510Ω and the diode, connected 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 500Ω , 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.

Package Information

DIP8

Dimensions in mm



SOP8

Dimensions in mm