



# LA2333T

## Monolithic Linear IC Automotive LAN Transceiver IC

ON Semiconductor®

<http://onsemi.com>

### Overview

In addition to 5V power supply support, the LA2333T contributes to miniaturization and lower costs in end products such as car navigation system by providing seven comparators integrated on the same chip.

### Features

- Transceiver
  - 1. Communication speed: 20kbps.
  - 2. 3.3V I/O control interface.
  - 3. High bus input voltage handling capability (Maximum rating: 18V).
  - 4. Built-in protection circuits.
  - 5. Dual 5.0/3.3V power supply systems.
- Comparators
  - 1. Seven built-in comparator circuits.
  - 2. High input voltage handling capability (Maximum rating: 18V).
  - 3. Reference input shared by all 7 channels.
  - 4. Open-collector outputs.

### Functions

- Transceiver
  - a. Transmitter (Current output type driver (3.8mA typical)).
  - b. Receiver (Reception amplifier, waveshaper hysteresis comparator).
  - c. Standby function.
- Comparators
  - a. Noninverting comparator function.
  - b. External reference input.

## Specifications

**Maximum Ratings** at  $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings		Unit
Maximum supply voltage (pin 24, $V_{CC}$ )	$V_{CC\ max}$		7.0		V
Maximum supply voltage (pin 4, $IV_{DD}$ )	$V_{DD\ max}$		7.0		V
Logic input voltage (pins 1, 2, and 5)	$V_{lgc\ max}$		$IV_{DD}+0.3$		V
Bus input voltage (pins 22 and 23)	$V_{bus\ max}$		18		V
Comparator input voltage (pins 13 to 20)	$V_{cmpl\ max}$		18		V
Comparator output voltage handling (pins 6 to 12)	$V_{cmpl\ max}$		$V_{CC}$		V
Comparator output current (pins 6 to 12)	$I_{cmpl\ max}$	$V_{CC} = 5\text{V}$	5.0		mA/ch
Allowable power dissipation	$P_d\ max$		100		mW
Operating temperature	$T_{opr}$		-40 to +85		°C
Storage temperature	$T_{stg}$		-50 to +125		°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

**Recommended Operating Supply Voltages** at  $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Operating supply voltage (pin 24, $V_{CC}$ )	$V_{CC\ op}$		4.75	5.0	5.25	V
Operating supply voltage (pin 4, $IV_{DD}$ )	$V_{DD\ op}$		3.0	3.3	3.6	V

**Operating Characteristics** at  $T_a = 25^\circ\text{C}$ ,  $V_{CC} = 5\text{V}$ ,  $IV_{DD} = 3.3\text{V}$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
<b><math>V_{CC}</math> Supply Current</b>						
When the bus is at the high level	$I_{CC1}$	ITXD1 : H, CMPI1 to 7 : L	6.0	10.0	13.0	mA
When the bus is at the low level	$I_{CC3}$	ITXD1 : L, CMPI1 to 7 : L	2.5	4.0	5.5	mA
In bus standby mode	$I_{CCSTB}$	ISTBN : L, CMPI1 to 7 : L	1.6	2.6	4.0	mA
Quiescent current	$I_{CCNSG}$	With the signal input pins open (no connections)	0.6	1.0	1.6	mA
<b><math>IV_{DD}</math> Supply Current</b>						
When at the high level	$I_{DDH}$	ITXD1 : H, CMPI1 to 7 : L	100	150	200	μA
When at the low level	$I_{DDL}$	ITXD1 : L, CMPI1 to 7 : L	200	400	800	μA
<b>Transceiver Block: Transmitter</b>						
High-level input voltage	$V_{IHD}$	Driver differential output: 120 mV or higher	2.4	3.3		V
Low-level input voltage	$V_{ILD}$	Driver differential output: 20 mV or lower	0		0.5	V
Bus (+) output voltage	$V_{OHD+}$	ITXD1 : H, ITXD2 : L	1.5		3.5	V
Bus (-) output voltage	$V_{OHD-}$	ITXD1 : H, ITXD2 : L	1.5		3.5	V
BUS (+) reference operating voltage	$V_{OP+}$	ITXD1 : L, ITXD2 : L	2.30	2.45	2.70	V
BUS (-) reference operating voltage	$V_{OP-}$	ITXD1 : L, ITXD2 : L	2.30	2.45	2.70	V
High-level output current	$V_{HDOUT}$	ITXD1 : H, ITXD2 : L	2.7	3.8	5.0	mA
Low-level output leakage current	$V_{LDOUT}$	ITXD1 : H, ITXD2 : L			1	μA
<b>Transceiver Block: Receiver</b>						
High-level differential input	$V_{IHR}$	[IBUS+] - [IBUS-]	65	80	120	mV
Low-level differential input	$V_{ILR}$	[IBUS-] - [IBUS+]	20	40	60	mV
High-level output voltage	$V_{OHR}$	Load: 47kΩ, 18pF	2.4	3.3		V
Low-level output voltage	$V_{OLR}$	Load: 47kΩ, 18pF	0		0.5	V
Input hysteresis	$V_{IHYS}$	$V_{IHR} - V_{ILR}$	20	40	60	mV

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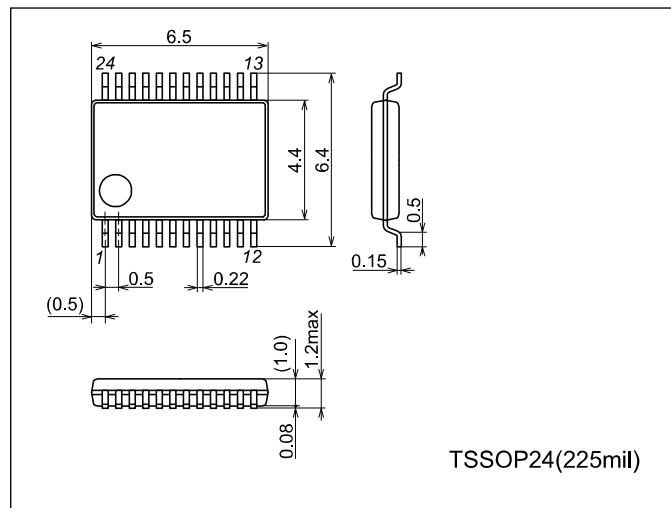
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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Transceiver Block: Total Delay Time						
L → H	T <sub>TD1</sub>	Compared at the points where ITXD and IRXD are at the 90% value		500	800	ns
H → L	T <sub>TD2</sub>	Compared at the points where ITXD and IRXD are at the 10% value		500	800	ns
Transceiver Block : Standby						
On	V <sub>ILSTB</sub>		0		0.5	V
Off	V <sub>IHSTB</sub>		2.4	3.3		V
Comparator Block : Inputs						
High-level input voltage	V <sub>SIH</sub>	V <sub>REF</sub> = 1/2 V <sub>CC</sub>	V <sub>REF</sub> +0.1		V <sub>CC</sub>	V
Low-level input voltage	V <sub>SIL</sub>	V <sub>REF</sub> = 1/2 V <sub>CC</sub>			V <sub>REF</sub> -0.1	V
V <sub>REF</sub> input voltage	V <sub>SVREF</sub>			1/2 V <sub>CC</sub>		V
Comparator Block : Outputs						
High-level output leakage current	I <sub>SOH</sub>	V <sub>OUT</sub> = 3.3V, R <sub>L</sub> = 0Ω				μA/ch
Low-level output saturation voltage	V <sub>SOL</sub>	I <sub>SINK</sub> = 500μA, R <sub>L</sub> = 0Ω				V
Comparator Block						
Turn on time	T <sub>SON</sub>	V <sub>OUT</sub> = 3.3V, R <sub>L</sub> = 2kΩ		400		ns
Turn off time	T <sub>SOFF</sub>	V <sub>OUT</sub> = 3.3V, R <sub>L</sub> = 2kΩ		100		ns

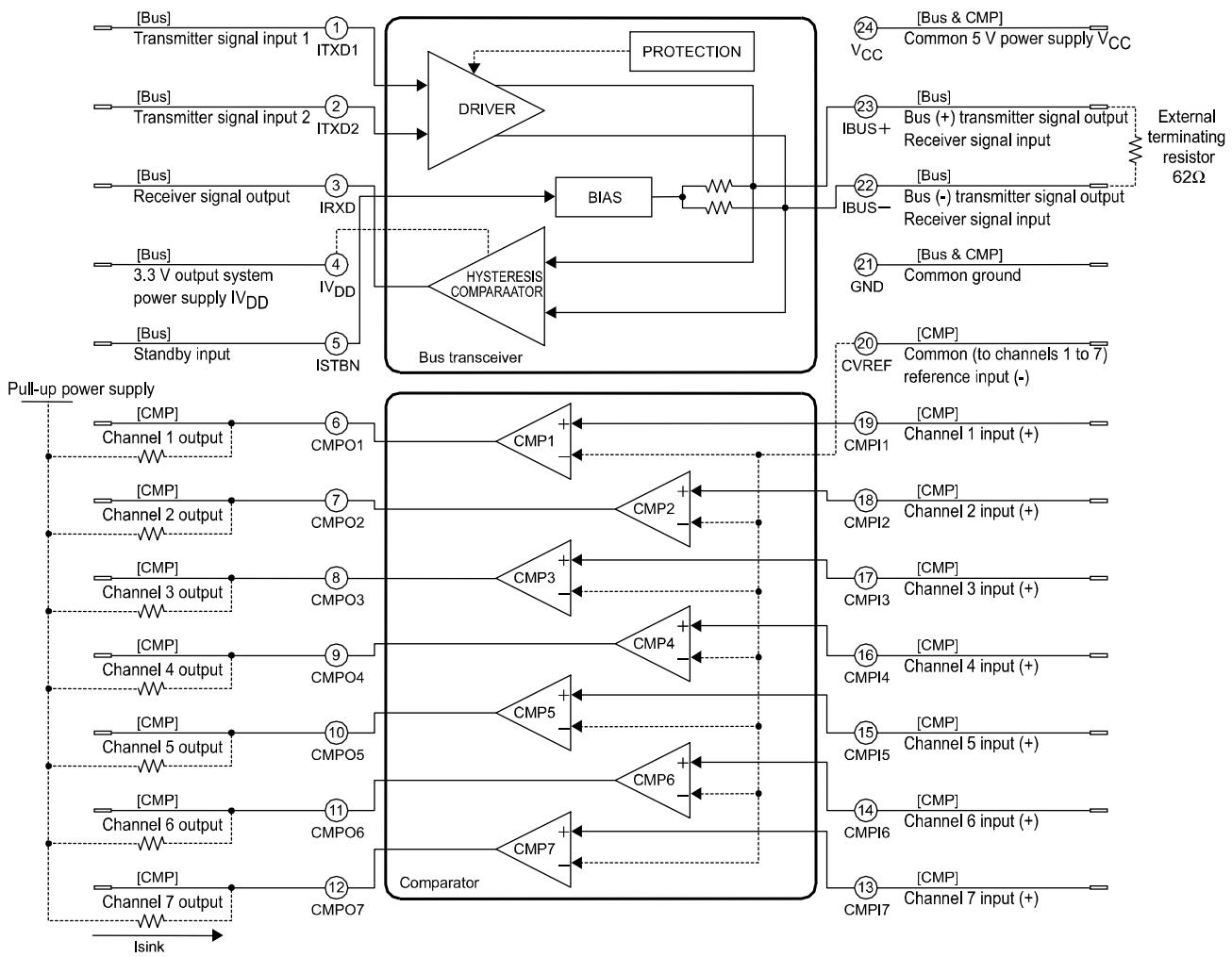
## Package Dimensions

unit : mm

3260A



## System Block Diagram



Item	Pin	Description
Transmitter	1 pin, 2 pin	Two-input OR logic
	22 pin, 23 pin	Inter-pin potentials High : $[\text{IBUS+}] - [\text{IBUS-}] \geq 120\text{mV}$ Low : $[\text{IBUS+}] - [\text{IBUS-}] \geq 20\text{mV}$
		The transmitter must be used with an external terminating resistor ( $62\Omega$ ) connected between pins 22 and 23.
		Protection circuit operating condition $[\text{IBUS+}] - [\text{IBUS-}] \geq 8.5\text{V}$ (pin 22 = GND)
	5 pin	Input voltage handling capacity: 18V.  Standby High : Standby mode off Low : Standby mode on
Comparators	20 pin	Common reference input for CMPI1 to CMPI7
	13 to 20 pin	Input voltage handling capacity: 18V
	6 to 12 pin	We recommend $6.8\text{k}\Omega$ as the value for the open collector pull-up resistors (Pull-up power supply $3.3\text{V}/I_{\text{SINK}} = 500\mu\text{A}$ at $R_{\text{L}} = 6.8\text{k}\Omega$ )

## Pin Functions

Item	Pin No.	Pin	I/O	Description
Bus pins (1)	1	ITXD1	I	Transmission signal input from controller
	2	ITXD2	I	Transmission signal OR input from controller
	3	IRXD	O	Reception signal output to controller
	4	IVDD	P	3.3V output system power supply
	5	ISTBN	I	High : Standby off, Low : Standby on
Comparator pins	6	CMPO1	O	Channel 1 noninverting output (open collector)
	7	CMPO2	O	Channel 2 noninverting output (open collector)
	8	CMPO3	O	Channel 3 noninverting output (open collector)
	9	CMPO4	O	Channel 4 noninverting output (open collector)
	10	CMPO5	O	Channel 5 noninverting output (open collector)
	11	CMPO6	O	Channel 6 noninverting output (open collector)
	12	CMPO7	O	Channel 7 noninverting output (open collector)
	13	CMPI7	I	Channel 7 input (+)
	14	CMPI6	I	Channel 6 input (+)
	15	CMPI5	I	Channel 5 input (+)
	16	CMPI4	I	Channel 4 input (+)
	17	CMPI3	I	Channel 3 input (+)
	18	CMPI2	I	Channel 2 input (+)
	19	CMPI1	I	Channel 1 input (+)
	20	CVREF	I	Common (to channels 1 to 7) reference input (-)
Bus pins (2)	21	GND	P	Common ground for the bus and comparator blocks
	22	IBUS-	I/O	Bus (-) transmission signal output/reception signal input
	23	IBUS+	I/O	Bus (+) transmission signal output/reception signal input
	24	VCC	P	Common 5 V power supply for the bus and comparator blocks

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