Microcircuit HT3483A, HT3485A, HT3486A (functional equivalents of MAX3483/ MAX3485/ MAX3486 MAXIM (USA)) - interface transceiver of the serial data of the standard RS - 485/422.

Microcircuit is interface transceiver (transmitter-receiver) of serial data of RS - 485, RS – 422 standarts with low supply voltage (3V).

Microcircuit is purposed for application in low power telecom systems, that correspond to RS – 485, RS – 422 standards, level translators, transceiver units & E-field sensitive automation systems of industrial devices.

Functions and structure:

- Microcircuit contains 1 transmitter and 1 receivers of the serial data of the standards RS-485/422;

- Low dissipated power;

- One power supply voltage source U_{CC} = (3,0 – 3,6) V;.

- Maximum data transfer rate 0,25 Mbit/s (HT3483A); 12 Mbit/s (HT3485A); 2,5 Mbit/s (HT3486A);

- Temperature range -40 …+ 85 °C;

- Permissible value of static electricity potential:
  - for inputs of the transmitter and outputs of the receiver 2000 V;
  - for inputs of the receiver and outputs of the transmitter 4000 V;

- Latch current not less than 300 mA for normal climatic conditions and supply voltage 3,3 V.

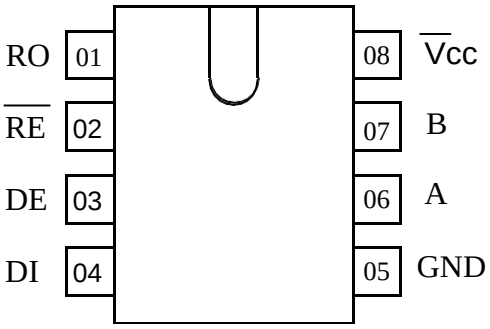


Fig. 2 – Pin configuration

Table 1 – Pin description

Pin number	Symbol	Description
01	RO	Receiver output
02	$\overline{RE}$	Receiver output enable pin
03	DE	Transmitter output enable pin
04	DI	Transmitter input
05	GND	Common pin
06	A	Receiver/transmitter uncomplemented I/O pin
07	$\overline{B}$	Receiver/transmitter complemented I/O pin
08	V_{CC}	Supply voltage pin

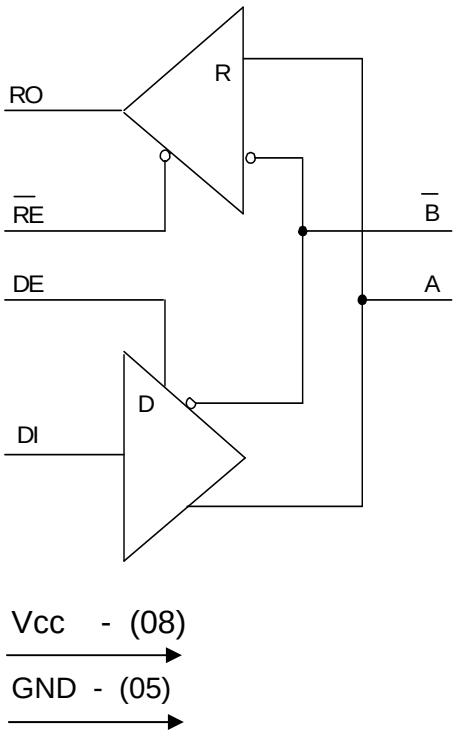


Fig. 3 – Block diagram

Table 2 – Transmitter truth table

Inputs			Outputs	
RE	DE	DI	$\overline{B}$	A
H or L	H	H	L	H
H or L	H	L	H	L
L	L	H or L	«OFF» state	«OFF» state
H*	L*	H or L	«OFF» state	«OFF» state

Note - H – high level voltage;
L – low level voltage.

$\overline{\text{RE}}$
* Shout-down mode

Table 3 – Receiver truth table

Inputs			Output
RE	DE	A-B	RO
L	L	≥ +0,2 V	H
L	L	≤ -0,2 V	L
L	L	Input not used	H
H*	L*	H or L	«OFF» state

Note - H – high level voltage;
L – low level voltage.

$\overline{\text{RE}}$
* Shout-down mode

Table 4 – Absolute maximum ratings

Symbol	Parameter	Norm		Unit
		Min	Max	
U_{CC}	Supply voltage	-	7,0	V
U_I	DI, DE, $\overline{RE}$ pins input voltage	-0,3	7,0	V
U_{OD}	Voltage applied to transmitter output	-7,5	12,5	V
U_{RIN}	Receiver input voltage	-7,5	12,5	V
U_{OR}	Voltage applied to receiver output	-0,3	U_{CC}+0,3	V

Table 5 – Recommended operating mode

Symbol	Parameter	Norm		Unit
		Min	Max	
U_{CC}	Supply voltage	3,0	3,6	V
U_{IL}	DI, DE, $\overline{RE}$ pins low level input voltage	0	0,8	V
U_{IH}	DI, DE, $\overline{RE}$ pins high level input voltage	2,0	U_{CC}	V
U_{OD}	Voltage applied to transmitter output	-7,0	12,0	V
U_{RIN}	Receiver input voltage	-7,0	12,0	V
U_{OR}	Voltage applied to receiver output	0	U_{CC}	V
U_{TH}	Receiver differential threshold voltage	-0,2	0,2	V

Table 6 – Electric parameters

Symbol	Parameter	Mode of measurement	Norm		T_A, °C	Unit
			Min	Max		
I_{ILL}	Low level input leakage current	$U_{DE}=U_{DI}=U_{RE}=0V$ U_{CC} = 3,6 V	-	-0,2	25 ± 10	uA
				-2,0	-40; 85	
I_{ILH}	High level input leakage current	$U_{DE}=U_{DI}=U_{RE}= U_{CC}$ U_{CC} = 3,6 V	-	0,2	25 ± 10	uA
				2,0	-40; 85	
I_{CC}	Supply current	U_{RE} = 0 V or U_{CC} U_{DI} = 0 V or U_{CC} U_{DE} = U_{CC} U_{CC} = 3,6 V	-	1,9	25 ± 10	mA
				2,2	-40; 85	
		U_{RE} = 0 V U_{DI} = 0 V or U_{CC} U_{DE} = 0 U_{CC} = 3,6 V		1,6	25 ± 10	
				1,9	-40; 85	
I_{SHDN}	Shutdown mode supply current	U_{DE} = 0 U_{RE} = U_{CC} U_{DI} = 0 V or U_{CC} U_{CC} = 3,6 V	–	0,7	25 ± 10	uA
				1,0	-40; 85	
t_{SHDN}	Time of transition to low power consumption mode	U_{CC} = 3,3 V	80	300	25 ± 10	ns
Receiver parameters						
U_{OL}	Low level output voltage	$U_{ID}=U_{TH}$=-190 mV I_{OL}= 2,5 mA	–	0,36	25 ± 10	V
		$U_{ID}=U_{TH}$=-200 mV I_{OL}= 2,5 mA		0,40	-40; 85	
U_{OH}	High level output voltage	U_{ID}= U_{TH}=190 mV I_{OH}= - 1,5 mA	U_{CC} –0,4	–	25 ± 10	V
		U_{ID}= U_{TH}=200 mV I_{OH}= - 1,5 mA			-40; 85	
R_{IN}	Receiver input resistance	- 7 V ≤ U_{RIN} ≤ 12 V	12	-	25±10; -40; 85	kΛ
I_{IN2}	Input current	U_{RIN}=12V; U_{DE} =0V, U_{CC} =3,6V	–	0,95	25 ± 10	mA
		U_{RIN} = -7V; U_{DE} =0V, U_{CC} =3,6V		-0,7		
		U_{RIN} =12V; U_{DE} =0V, U_{CC} =3,6V		1,0	-40; 85	
		U_{RIN} = -7V; U_{DE} =0V, U_{CC} =3,6V		-0,8		
I_{OZLR}	Low level output current for “OFF”state	U_{OR} = 0 V U_{CC}=3,6 V	–	-0,5	25 ± 10	uA
				-1,0	-40; 85	
I_{OZHR}	High level output current for “OFF”state	U_{OR} = U_{CC} U_{CC}=3,6 V	–	0,5	25 ± 10	uA
				1,0	-40; 85	
I_{OSHR}	High level short circuit output current	U_{IH} = 3,0 V; U_{IL} = 0 V U_{OR} =3,6V; U_{CC} =3,6V	9,0	50	25 ± 10	mA
			8,0	60	-40; 85	
I_{OSLR}	Low level short circuit output current	U_{IH} = 3,0 V; U_{IL} = 0 V U_{OR} = 0 V; U_{CC} = 3,6 V	-9,0	-50	25 ± 10	mA
			-8,0	-60	-40; 85	

Table 6 continued

Symbol	Parameter	Mode of measurement	Norm Min	Norm Max	T_A, °C	Unit
Receiver parameters						
t_{PHLR} (t_{PLHR})	OFF-ON switching propagation delay, HT3483A HT3485A, HT3486A	U_{IH} = 3,0 V; U_{IL} = 0 V t_{LH}=t_{HL}≤ 6 ns C_L = 15 pF U_{CC} = 3,3 V	 25 25	 120 90	25 ± 10	ns
t_{PZHR} (t_{PZLR})	Propagation delay time of transition from “OFF” state to high (low) level	U_{IH} = 3,0 V; U_{IL} = 0 V C_L = 15 pF R_L = 1 kΛ U_{CC} = 3,3 V	-	50	25 ± 10	ns
t_{PHZR} (t_{PLZR})	Receiver output disable time for transition from high (low) level state to “OFF” state	U_{IH} = 3,0 V; U_{IL} = 0 V C_L = 15 pF R_L = 1 kΛ U_{CC} = 3,3 V	-	45	25 ± 10	ns
t_{SKD}	OFF-ON switching propagation delays difference HT3483A HT3485A, HT3486A	U_{IH} = 3,0 V; U_{IL} = 0 V C_L = 15 pF; U_{CC} = 3,3V	-	 20 10	25 ± 10	ns
t_{PSLR}	Receiver transition time from shutdown to low level	U_{IH} = 3,0 V; U_{IL} = 0V C_L = 15 pF, R_L = 1kΛ U_{CC} = 3,3 V	-	1400	25 ± 10	us
t_{PSHR}	Receiver transition time from shutdown to high level	U_{IH} = 3,0 V; U_{IL} = 0V C_L = 15 pF, R_L = 1 kΛ U_{CC} = 3,3 V	-	1400	25 ± 10	us
Transmitter parameters						
U_{OD}	Low level differential output voltage	R_{L1} =54 Λ U_{CC}=3,0; 3,6 V R_{L1} =100 U_{CC}=3,0; 3,6 V R_{L2} = 60 Λ U_{CC}=3,3 V	1,56 1,50 2,08 2,00 1,56 1,50	-	25 ± 10 -40; 85 25 ± 10 -40; 85 25 ± 10 -40; 85	V
δU_{OD}	Change in value of differential output voltage for complementary output states	R_L = 54; 100 Λ U_{CC}=3,0 V; 3,6 V	–	0,18 0,20	25 ± 10 -40; 85	V
U_{OC}	Output bias voltage refer to common pin, V	R_L = 54; 100 Λ U_{CC}=3,0 V; 3,6 V	–	2,9 3,0	25 ± 10 -40; 85	V
δU_{OC}	Change in value of bias output voltage for complementary output states	R_L = 54; 100 Λ U_{CC}=3,0 V; 3,6 V	–	0,18 0,20	25 ± 10 -40; 85	V

Table 6 continued

Symbol	Parameter	Mode of measurement	Norm Min	Norm Max	T_A, °C	Unit
Transmitter parameters						
I_{OSLD}	Low level receiver short circuit output current	U_{OD} = 12 V; U_{IL} = 0V U_{IH} = 3,0V; U_{CC}=3,6V	–	240 250	25 ± 10 -40; 85	mA
I_{OSHD}	High level receiver short circuit output current	U_{OD} = -7 V; U_{IL} = 0 V U_{IH} =3,0V; U_{CC}= 3,6V	–	-240 -250	25 ± 10 -40; 85	mA
t_{PHL} (t_{PLH})	ON/OFF switching propagation delay HT3483A HT3485A HT3486A	C_L = 15 pF R_L = 27 ∧ U_{IL} = 0 V U_{IH} = 3,0 V U_{CC}= 3,3 V	 700 7 20	 1500 35 70	25 ± 10	ns
t_{SKEW}	OFF-ON switching propagation delays difference, HT3483A HT3485A HT3486A	C_L = 15 pF R_L = 27 ∧ U_{IL} = 0 V U_{IH} = 3,0 V U_{CC}= 3,3 V	–	 100 8 11	25 ± 10	ns
t_{PZH}	Output transition time OFF state to high level, HT3483A HT3485A HT3486A	C_L = 50 pF R_L = 110 ∧ U_{CC}= 3,3 V	–	 800 90 100	25 ± 10	ns
t_{PZL}	Output enable time for transition transition from “OFF” state to low level, HT3483A HT3485A HT3486A	C_L = 50 pF R_L = 110 ∧ U_{CC}= 3,3 V	–	 1300 90 100	25 ± 10	ns
t_{PHZ} (t_{PLZ})	Output disable time for transition high (low) level to “OFF” state	C_L = 50 pF R_L = 110 ∧ U_{CC}= 3,3 V	–	80	25 ± 10	ns
t_{TD}	Differential output transition (fall/rise) time HT3483A HT3485A HT3486A	C_L = 15 pF R_L = 60 ∧ U_{CC}= 3,3 V	 400 3,0 15	 1200 25 60	25 ± 10	ns
ST	Maximum data transfer rate, HT3483A HT3485A HT3486A	C_L = 15 pF R_L = 27 ∧ U_{IL} = 0 V U_{IH} = 3,0 V Q ≥ 2; U_{CC}= 3,3 V	 0,25 12 2,5	–	25 ± 10	Mbit/s

Table 6 continued

Symbol	Parameter	Mode of measurement	Norm		T_A, °C	Unit
			Min	Max		
Transmitter parameters						
t_{DD}	Differential output delay time,	C_L = 15 pF R_L = 60 ∧ U_{CC}= 3,3 V			25 ± 10	ns
	HT3483A		600	1400		
	HT3485A		1,0	35		
	HT3486A		24	70		
t_{PSL}	Output enable time from shut-down to low level,	C_L = 50 pF R_L = 110 ∧ U_{CC}= 3,3 V	–		25 ± 10	ns
	HT3483A			2700		
	HT3485A			900		
	HT3486A			1000		
t_{PSH}	Output enable time from shut-down to high level,	C_L = 50 pF R_L = 110 ∧ U_{CC}= 3,3 V	–		25 ± 10	ns
	HT3483A			3000		
	HT3485A			900		
	HT3486A			1000		

Operation description

The microcircuit consist of two main units: transmitter and receiver. Inputs of the receiver are connected to outputs of the transmitter that provides a half-duplex mode data transfer. The microcircuit provide function of switching to shutdown mode with consumption current not more 1 uA.

Switching to shutdown mode performed at simultaneous transition of the receiver and the transmitter to the third state after certain hold time which provides dynamic noise immunity.

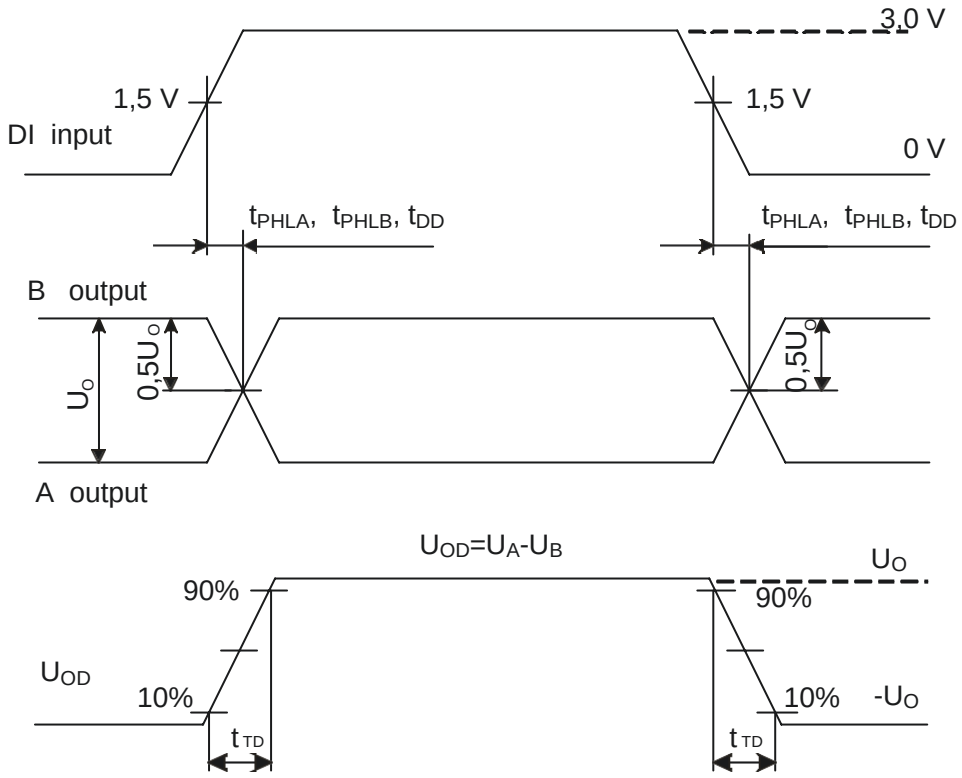
RS-485/422 transmitter

CMOS/TTL levels signals come to transmitter input DI, splited inside the microcircuit on complement and uncomplemented, converted to RS-485/422 standard levels, after that signals transmitted in a long line through output ports with high load capacity. The differential signal has high level of noise immunity on background of common-mode interference that provides high reliability in a mode of signal transmitting in a long line. The microcircuit has some levels of protection against a overload of the power output stage for case of occurrence of a strong disturbation in a line. At voltage increase in a line load capacity of the output stage of the transmitter is reduced.

RS-485/422 receiver

The receiver processes reverse conversion of RS-485/422 levels to CMOS/TTL levels. The minimum differential input voltage of the receiver is + 200 mV for bias voltage range -7 … +12V , simulating an in-phase component of a noise in a line. In a limiting (extrime) mode the level of an inphase noise changes in a range -8 … +12,5 V. Operation stability of the microcircuit in case of receiving from a line signals with flat fronts is provided by a 40 - 70 mV hysteresis. According to requirements of standard RS-485/422 the input impedance of the receiver is not more than 12 k∧. At absence of a signal on a differential input of the receiver the output of the receiver is switched in the state corresponding to a level of logical one.

Fig. 4, 5 display time diagrams of the microcircuit operating.



U_O – differential output voltage on condition UA low level
$-U_O$ – differential output voltage on condition UA high level

Fig. 4 –Transmitter I/O signals time diagram

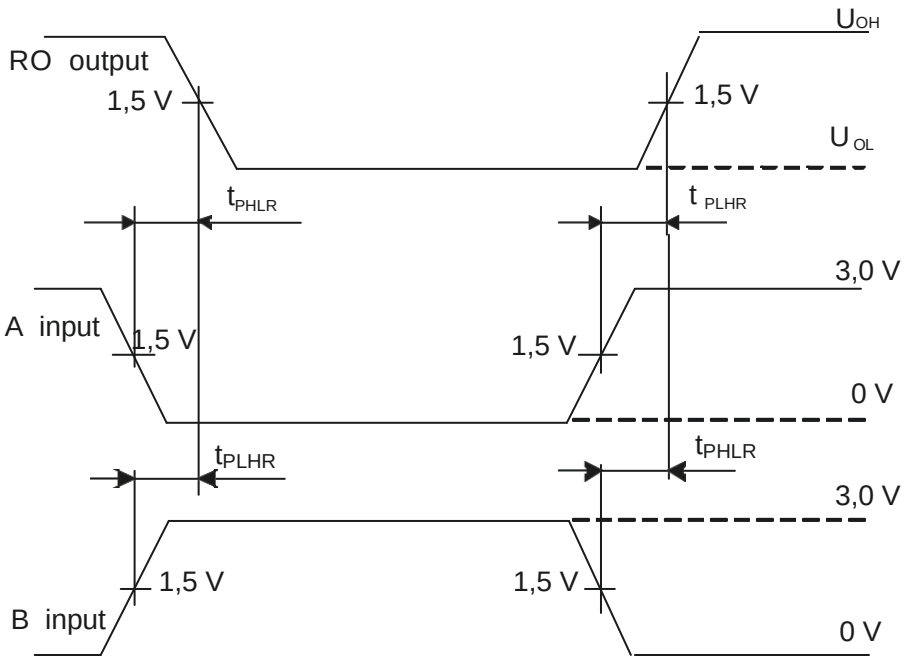


Fig. 5 – Receiver I/O signals time diagram

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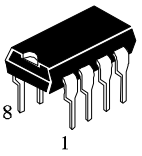
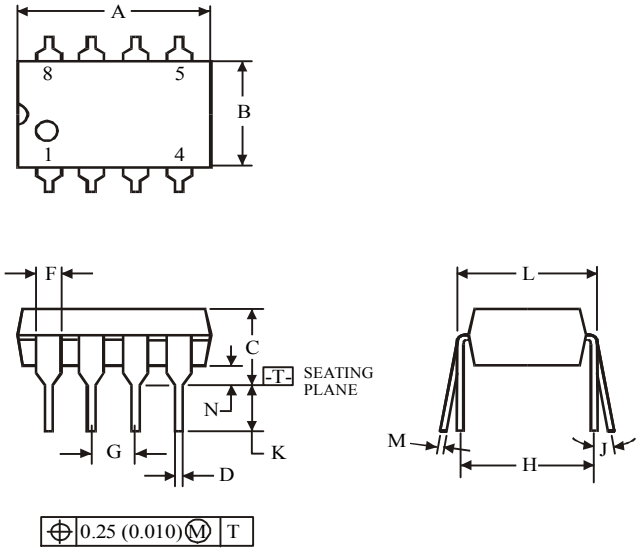


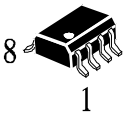


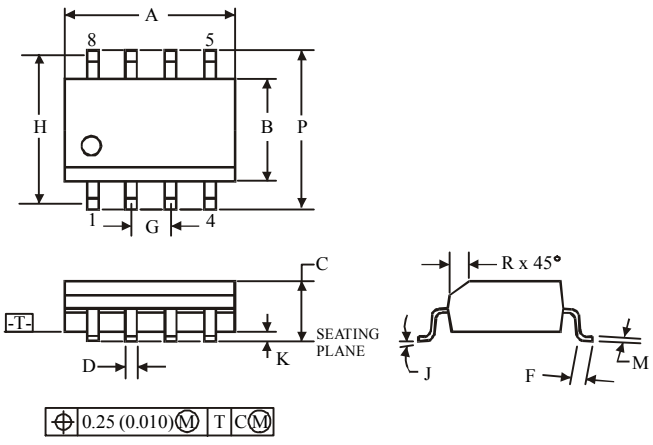
	Dimension, mm	
Symbol	**MIN**	**MAX**
A	8.51	10.16
B	6.1	7.11
C		5.33
D	0.36	0.56
F	1.14	1.78
G	2.54	
H	7.62	
J	0°	10°
K	2.92	3.81
L	7.62	8.26
M	0.2	0.36
N	0.38	

NOTES:

1. Dimensions “A”, “B” do not include mold flash or protrusions.
   Maximum mold flash or protrusions 0.25 mm (0.010) per side.

(SOP8)





	Dimension, mm	
Symbol	**MIN**	**MAX**
A	4.8	5
B	3.8	4
C	1.35	1.75
D	0.33	0.51
F	0.4	1.27
G	1.27	
H	5.72	
J	0°	8°
K	0.1	0.25
M	0.19	0.25
P	5.8	6.2
R	0.25	0.5

NOTES:

1. Dimensions A and B do not include mold flash or protrusion.
2. Maximum mold flash or protrusion 0.15 mm (0.006) per side for A; for B – 0.25 mm (0.010) per side.