

MITSUBISHI <DIGITAL ASSP> M5A26LS32AP/AFP

QUADRUPLE DIFFERENTIAL LINE RECEIVER

DESCRIPTION

The M5A26LS32AP/AFP is a semiconductor integrated circuit containing 4 line receivers for use with balanced and unbalanced digital data transmission, which meets EIA Standards RS-422-A and RS-423-A.

FEATURES

- Input characteristics meet EIA Standards RS-422-A and RS-423-A
- Differential input voltage range from -7 to $+7V$
- Input with hysteresis (A, A 50mV typ)
- Common mode input voltage range from -7 to $+7V$
- Input sensitivity of $\pm 200mV$
- High input impedance of $12k\Omega$ (min)
- Output control input (OC, \overline{OC} : Input characteristics are compatible with LSTTL level circuits)
- Output characteristics are compatible with LSTTL level circuits
- Three-state output
- Fail safe operation. Output always high when inputs are open
- Operated by single 5V power supply

APPLICATION

For use as a data transmission interface in digital equipment.

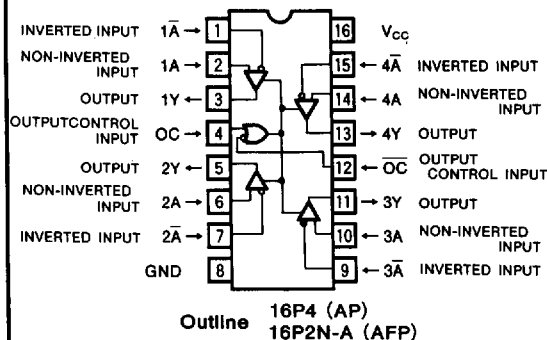
FUNCTIONAL DESCRIPTION

Within the common mode voltage range of -7 to $+7V$, the threshold voltage of A and \overline{A} is $\pm 200mV$. The hysteresis of A and \overline{A} is 50mV typ. and eliminates differential noise for a signal of long transition time. As the input impedance of A and \overline{A} is $12k\Omega$ (min), the device will be easy to use.

Output control inputs OC and \overline{OC} are common to all four circuits of the receiver. The input characteristics of OC and \overline{OC} are compatible with TTL circuits.

Output Y has three states and there will be a high impedance condition when OC is low and \overline{OC} is high. The Y output characteristics are compatible with LSTTL level circuits.

PIN CONFIGURATION (TOP VIEW)



circuits.

The M5A26LS32AP can be used as a receiver for balanced and unbalanced data transmission.

This integrated circuits is suitable for data transmission interface in digital equipment and the input characteristics meet EIA Standards RS-422-A and RS-423-A. Refer to Table 1, which shows these standards. Balanced transmission driver M5A26LS31P/FP meets RS-422-A, while unbalanced transmission driver M5A26LS29P meets RS-423-A. Refer to the TYPICAL APPLICATION for further information.

FUNCTION TABLE (Note1)

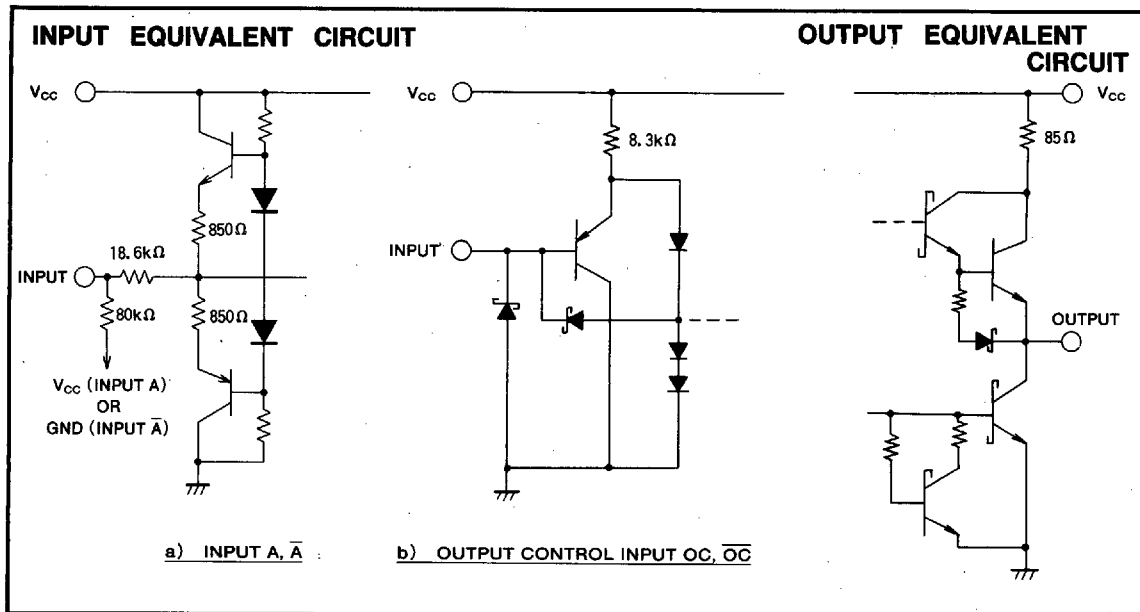
A	\overline{A}	OC	\overline{OC}	Y
$V_{ID} > V_{TH}$		H	X	H
		X	L	H
$V_{TL} < V_{ID} < V_{TH}$		H	X	*
		X	L	*
$V_{ID} < V_{TL}$		H	X	L
		X	L	L
X		L	H	Z

Note 1 : V_{ID} : (applied voltage A) - (applied voltage \overline{A})
 V_{TH} : 0.2V
 V_{TL} : -0.2V
 X : irrelevant
 * : indeterminate
 Z : high-impedance

Table 1 Eia standards RS-422-A, RS-423-A

Parameter		RS-422-A	RS-423-A	M5A26LS32AP Corresponding parameters (symbol)
Common	Transmission form	Balanced	Unbalanced	Input A, \overline{A}
	Maximum transmission distance	1200m	1200m	
	Maximum transmission speed	10Mbit/s	100Kbit/s	
Driver	Maximum output voltage (no load)	6 V (between outputs)	$\pm 6 V$	
	Minimum output voltage (loaded)	2 V (between outputs)	$\pm 3.6 V$	
	Minimum output resistance (power off)	$100\mu A (-0.25V < V_O < +6 V)$	$100\mu A (-6 V < V_O < +6 V)$	
	Maximum short-circuit output current	$\pm 150mA$	$\pm 150mA$	
	Slew rate	Control not required	Controllable	
Receiver	Input resistance	$\geq 4 k\Omega$	$\geq 4 k\Omega$	r_i
	Maximum input threshold	$-0.2 \sim +0.2V$	$-0.2 \sim +0.2V$	V_{TH}, V_{TL}
	Maximum input voltage	$-12 \sim +12V$	$-12 \sim +12V$	I_i

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ABSOLUTE MAXIMUM RATINGS ($T_a = -20 \sim +75^\circ\text{C}$, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		-0.5 ~ +7	V
V_I	Input voltage	A, \bar{A}	-25 ~ +25	V
V_{ID}	Voltage between Inputs	OC, \overline{OC}	-0.5 ~ +7	V
V_{ID}	Voltage between Inputs	A, \bar{A}	-25 ~ +25	V
I_{OL}	Low-level output current		0 ~ 50	mA
P_d	Power dissipation	DIP $T_a = 25^\circ\text{C}$ (Note 2)	1000	mW
		SOP $T_a = 25^\circ\text{C}$ (Note 3)	640	
T_{stg}	Storage temperature range		-65 ~ +150	$^\circ\text{C}$

Note 2 : A derating of 9 mW/ $^\circ\text{C}$ should be made when $T_a \geq 40^\circ\text{C}$

3 : A derating of 5.1 mW/ $^\circ\text{C}$ should be made when $T_a \geq 25^\circ\text{C}$

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Limits			Unit
		Min	Typ	Max	
V_{CC}	Supply voltage	4.75	5	5.25	V
V_{IC}	Common mode input voltage (Note 4)	A, \bar{A}	-7	+7	V
I_{OH}	High-level output current	$V_{OH} \geq 2.7\text{V}$	0	-440	μA
I_{OL}	Low-level output current	$V_{OL} \leq 0.45\text{V}$	0	8	mA
T_{opr}	Operating free-air ambient temperature range		-20	+75	$^\circ\text{C}$

Note 4 : Common mode input voltages A, \bar{A} is the average value of the voltages applied on A, \bar{A} .

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ELECTRICAL CHARACTERISTICS ($V_{CC}=5V \pm 5\%$, $V_{IC}=-7 \sim +7V$, $T_a=-20 \sim +75^\circ C$, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit		
			Min	Typ*	Max			
V_{TH}	High threshold voltage	A, \bar{A}	$V_{OH}=2.7V$, $I_{OH}=-440\mu A$			0.2	V	
V_{TL}	Low threshold voltage	A, \bar{A}	$V_{OL}=0.45V$, $I_{OL}=8mA$			-0.2	V	
$V_{T+}-V_{T-}$	Hysteresis (Note 5)	A, \bar{A}				50	mV	
V_{IH}	High-level input voltage	OC, \bar{OC}				2	V	
V_{IL}	Low-level input voltage	OC, \bar{OC}				0.8	V	
V_{IK}	Input clamp voltage	OC, \bar{OC}	$V_{CC}=4.75V$, $I_i=-18mA$			-1.5	V	
V_{OH}	High-level output voltage		$V_{CC}=4.75V$, $V_{IO}=1V$, $V_{I(\bar{OC})}=0.8V$, $I_{OH}=-440\mu A$			2.7	3.5	V
V_{OL}	Low-level output voltage		$V_{CC}=4.75V$, $V_{IO}=-1V$			0.4	V	
			$V_{I(\bar{OC})}=0.8V$			0.45		
I_{OZH}	Off-state high-level output current		$V_{CC}=5.25V$, $V_O=2.4V$			20	μA	
I_{OZL}	Off-state low-level output current		$V_{CC}=5.25V$, $V_O=0.4V$			-20	μA	
I_i	Input current	A, \bar{A}	$V_i=15V$, other input at $-10 \sim +15V$			1.2	mA	
			$V_i=-15V$, other input at $-15 \sim +10V$			-1.7		
I_{IH}	High-level input current	OC, \bar{OC}	$V_i=5.5V$			100	μA	
			$V_i=2.7V$			20		
I_{IL}	Low-level input current	OC, \bar{OC}	$V_i=0.4V$			-0.36	mA	
r_i	Input resistance	A, \bar{A}	$V_{IC}=-15 \sim +15V$, other inputs are AC GND			11 (Note 6)	15	k Ω
I_{OS}	Short-circuit output current		$V_{CC}=5.25V$ (Note 7)			-15	-85	mA
I_{CC}	Supply current		$V_{CC}=5.25V$, A= \bar{A} =0 V, All outputs disabled			52	70	mA

* : Typical values are at $V_{CC}=5V$, $T_a=25^\circ C$, and $V_{IC}=0V$.

Note 5 : Hysteresis is the difference between the positive-going input threshold voltage, V_{T+} , and the negative-going input threshold voltage, V_{T-} .

6 : The minimum value is 12k Ω within the range of $T_a=0$ to $75^\circ C$.

7 : All measurements should be done quickly and not more than one output should be shorted at a time.

SWITCHING CHARACTERISTICS ($V_{CC}=5V$, $T_a=25^\circ C$, unless otherwise noted)

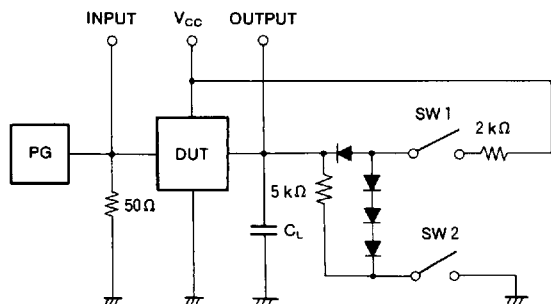
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
t_{PLH}	Low-to-high-level, high-to-low-level output propagation time, from input A, \bar{A} to output Y	$C_L=15pF$ (Note 8)				ns
t_{PHL}			14	35	ns	
t_{PZH}	Output enable time to high level	$C_L=15pF$ (Note 8)				ns
t_{PZL}	Output enable time to low level		18	22	ns	
t_{PHZ}	Output disable time from high level		20	25	ns	
t_{PLZ}	Output disable time from low level	$C_L=5pF$ (Note 8)	20	30	ns	
			24	40	ns	

TIMING REQUIREMENTS ($V_{CC}=5V$, $T_a=25^\circ C$)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
t_r , t_f	Control input rise, fall time	OC, \bar{OC}				μs
						1

Note 8 : Test circuits

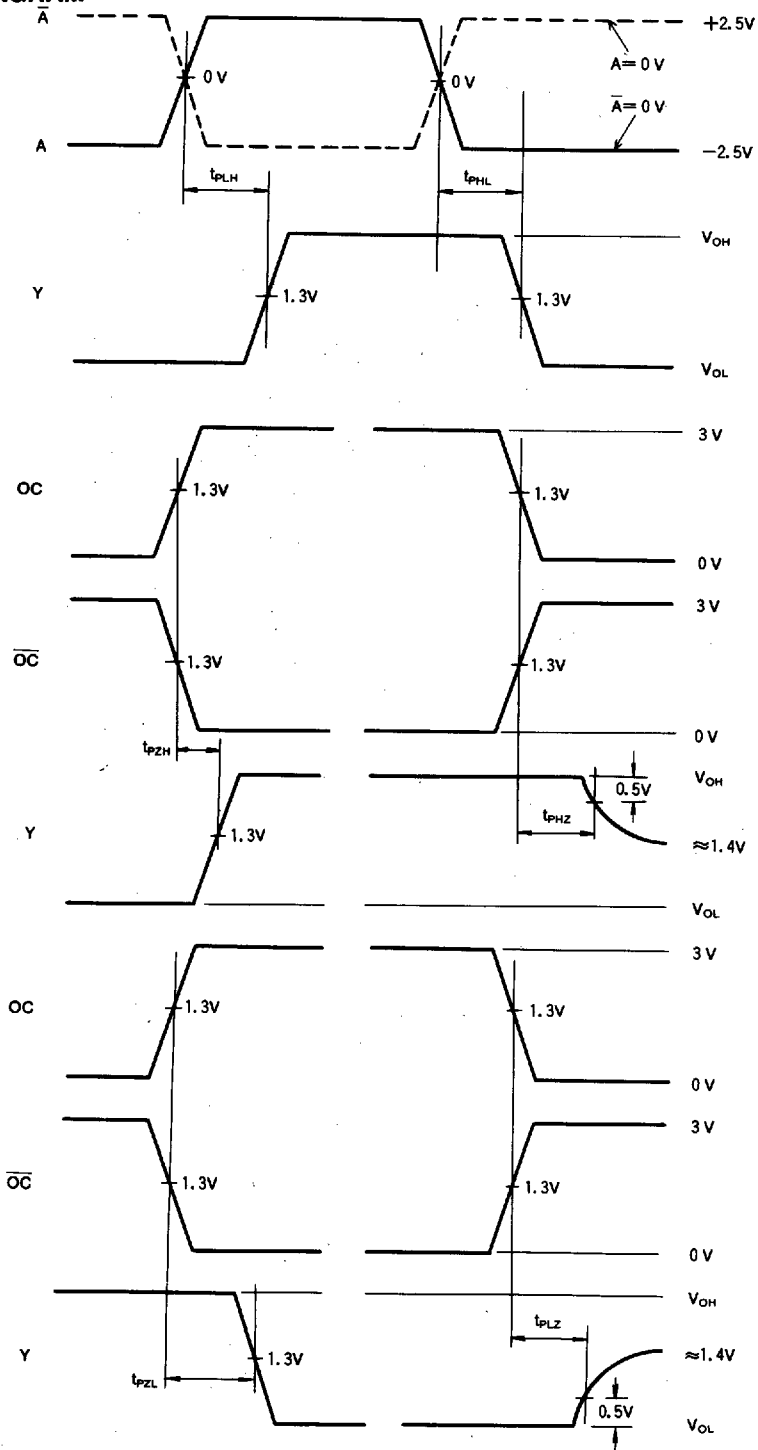
- (1) The pulse generator (PG) has the following characteristics :
PRR= 1 MHz, $t_w=500ns$, $t_r \leq 5ns$, $t_f \leq 5ns$, $Z_o=50\Omega$
- (2) All diodes are switching diodes ($t_r \leq 4ns$)
- (3) C_L includes probe and jig capacitance.
- (4) Output control OC is tested with \bar{OC} high; OC is tested with OC low.



Parameter	SW1	SW2
t_{PLH} , t_{PHL}	Closed	Closed
t_{PZH}	Open	Closed
t_{PZL}	Closed	Open
t_{PHZ}	Closed	Closed
t_{PLZ}	Closed	Closed

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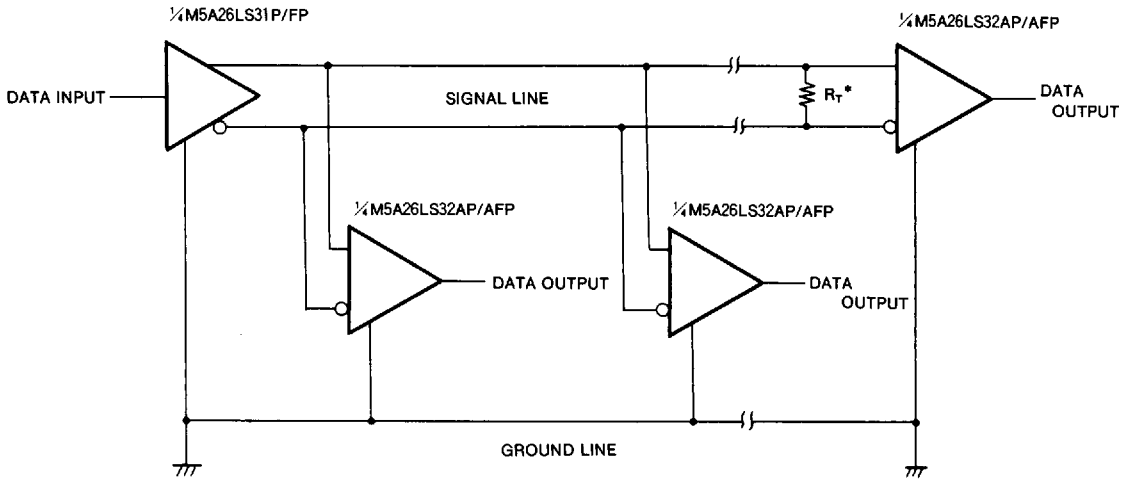
TIMING DIAGRAM



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TYPICAL APPLICATION

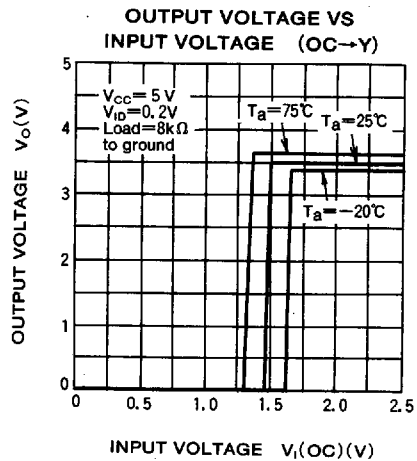
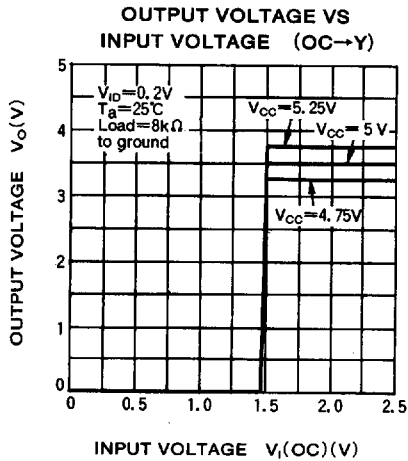
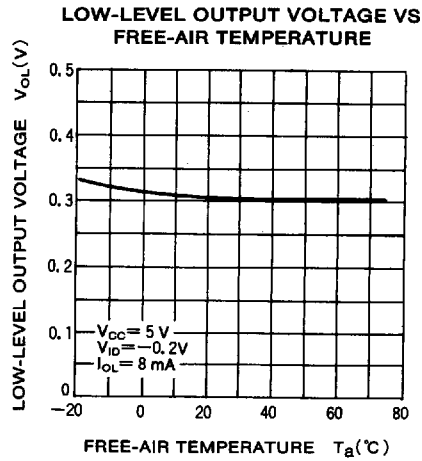
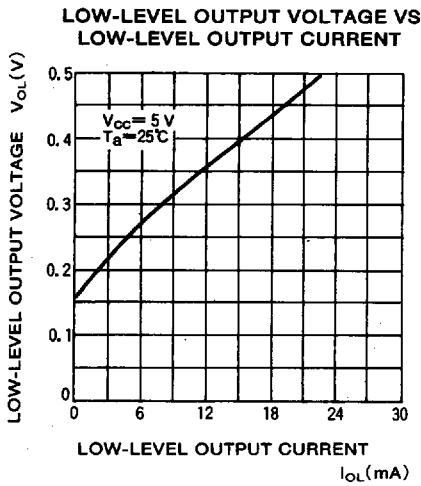
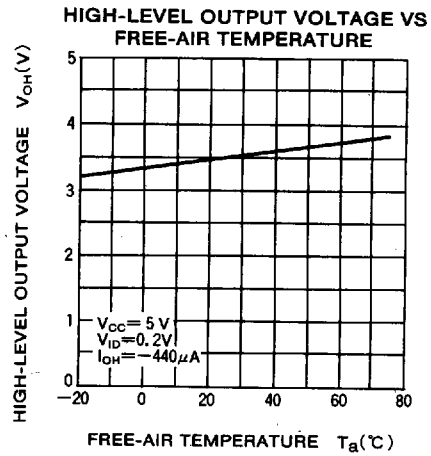
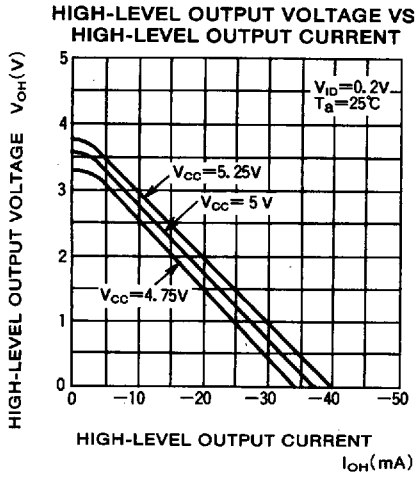
a) BALANCED



R_T^* = Characteristic impedance of transmission line.

QUADRUPLE DIFFERENTIAL LINE RECEIVER

TYPICAL CHARACTERISTICS



QUADRUPLE DIFFERENTIAL LINE RECEIVER

