

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 , $\bar{A}$ 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.

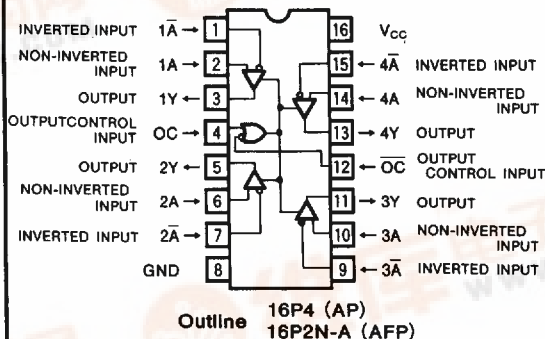
FUNCTIONAL DESCRIPTION

Within the common mode voltage range of -7 to $+7V$, the threshold voltage of A and $\bar{A}$ is $\pm 200mV$. The hysteresis of A and $\bar{A}$ is 50mV typ. and eliminates differential noise for a signal of long transition time. As the input impedance of A and $\bar{A}$ 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)



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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	$\bar{A}$	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 $\bar{A}$)

V_{TH} : 0.2V

V_{TL} : -0.2V

X: irrelevant

*: indeterminate

Z: high-impedance

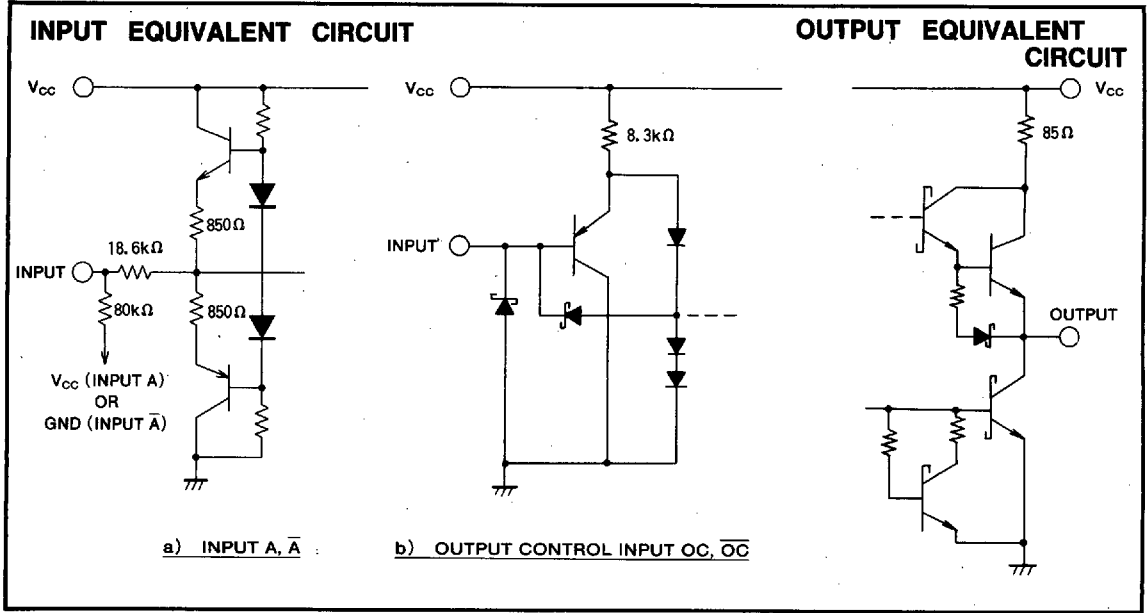
Table 1 Eia standards RS-422-A, RS-423-A

Parameter		RS-422-A	RS-423-A	M5A26LS32AP Corresponding parameters (symbol)
Common	Transmission form	Balanced	Unbalanced	Input A, $\bar{A}$
	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	$-0.2 \sim +0.2 V$	$-0.2 \sim +0.2 V$	V_{TH}, V_{TL}
	Maximum input voltage	$-12 \sim +12 V$	$-12 \sim +12 V$	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			$-0.5 \sim +7$	V
V_i	Input voltage	$A, \bar{A}$		$-25 \sim +25$	V
		OC, $\bar{OC}$		$-0.5 \sim +7$	V
V_{ID}	Voltage between inputs		$A, \bar{A}$	$-25 \sim +25$	V
I_{OL}	Low-level output current			$0 \sim 50$	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			$-65 \sim +150$	$^\circ\text{C}$

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)		-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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M5A26LS32AP/AFP

QUADRUPLE DIFFERENTIAL LINE RECEIVER

ELECTRICAL CHARACTERISTICS (V_{CC}=5V±5%, V_{IC}=-7~+7V, T_a=-20~+75°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} =-440μA			0.2	V
V _{TL}	Low threshold voltage	A, $\bar{A}$ V _{OL} =0.45V, I _{OL} =8 mA	-0.2			V
V _{T+} -V _{T-}	Hysteresis (Note 5)	A, $\bar{A}$		50		mV
V _{IH}	High-level input voltage	OC, $\overline{OC}$	2			V
V _{IL}	Low-level input voltage	OC, $\overline{OC}$			0.8	V
V _{IK}	Input clamp voltage	OC, $\overline{OC}$ V _{CC} =4.75V, I _I =-18mA			-1.5	V
V _{OH}	High-level output voltage	V _{CC} =4.75V, V _{ID} =1 V, V _{I(OC)} =0.8V, I _{OH} =-440μA	2.7	3.5		V
V _{OL}	Low-level output voltage	V _{CC} =4.75V, V _{ID} =-1 V I _{OL} =4 mA V _{I(OC)} =0.8V I _{OL} =8 mA			0.4 0.45	V
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~+15V V _I =-15V, other input at -15~+10V			1.2 -1.7	mA
I _{IH}	High-level input current	OC, $\overline{OC}$ V _I =5.5V V _I =2.7V			100 20	μA
I _{IL}	Low-level input current	OC, $\overline{OC}$ V _I =0.4V			-0.36	mA
r _I	Input resistance	A, $\bar{A}$ V _{IC} =-15~+15V, other inputs are AC GND	11 (Note 6)	15		kΩ
I _{OS}	Short-circuit output current	V _{CC} =5.25V (Note 7)	-15		-85	mA
I _{CC}	Supply current	V _{CC} =5.25V, A=A=0 V, All outputs disabled		52	70	mA

* : Typical values are at V_{CC}=5V, T_a=25°C, and V_{IC}=0 V.
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°C.
7 : All measurements should be done quickly and not more than one output should be shorted at a time.

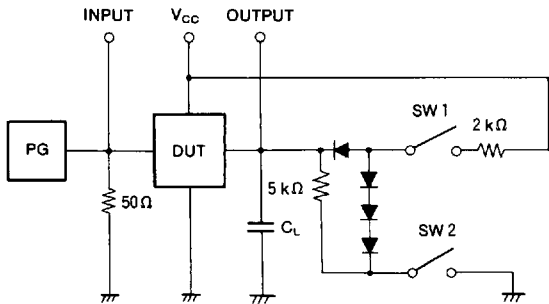
SWITCHING CHARACTERISTICS (V_{CC}=5 V, T_a=25°C, unless otherwise noted)

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)		14	35	ns
t _{PHL}	Output enable time to high level	C _L =15pF (Note 8)		22	35	ns
t _{PZH}	Output enable time to low level	C _L =15pF (Note 8)		18	22	ns
t _{PZL}	Output disable time from high level	C _L =5 pF (Note 8)		20	25	ns
t _{PHZ}	Output disable time from low level	C _L =5 pF (Note 8)		20	30	ns
t _{PLZ}				24	40	ns

TIMING REQUIREMENTS (V_{CC}=5 V, T_a=25°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
t _r , t _f	Control input rise, fall time	OC, $\overline{OC}$			1	μs

- Note 8 : Test circuits
- (1) The pulse generator (PG) has the following characteristics :
PRR=1 MHz, t_w=500ns, t_r≤5 ns, t_f≤5 ns, Z_o=50Ω
 - (2) All diodes are switching diodes (t_{rr}≤4 ns)
 - (3) C_L includes probe and jig capacitance.
 - (4) Output control OC is tested with $\overline{OC}$ high; OC is tested with OC low.

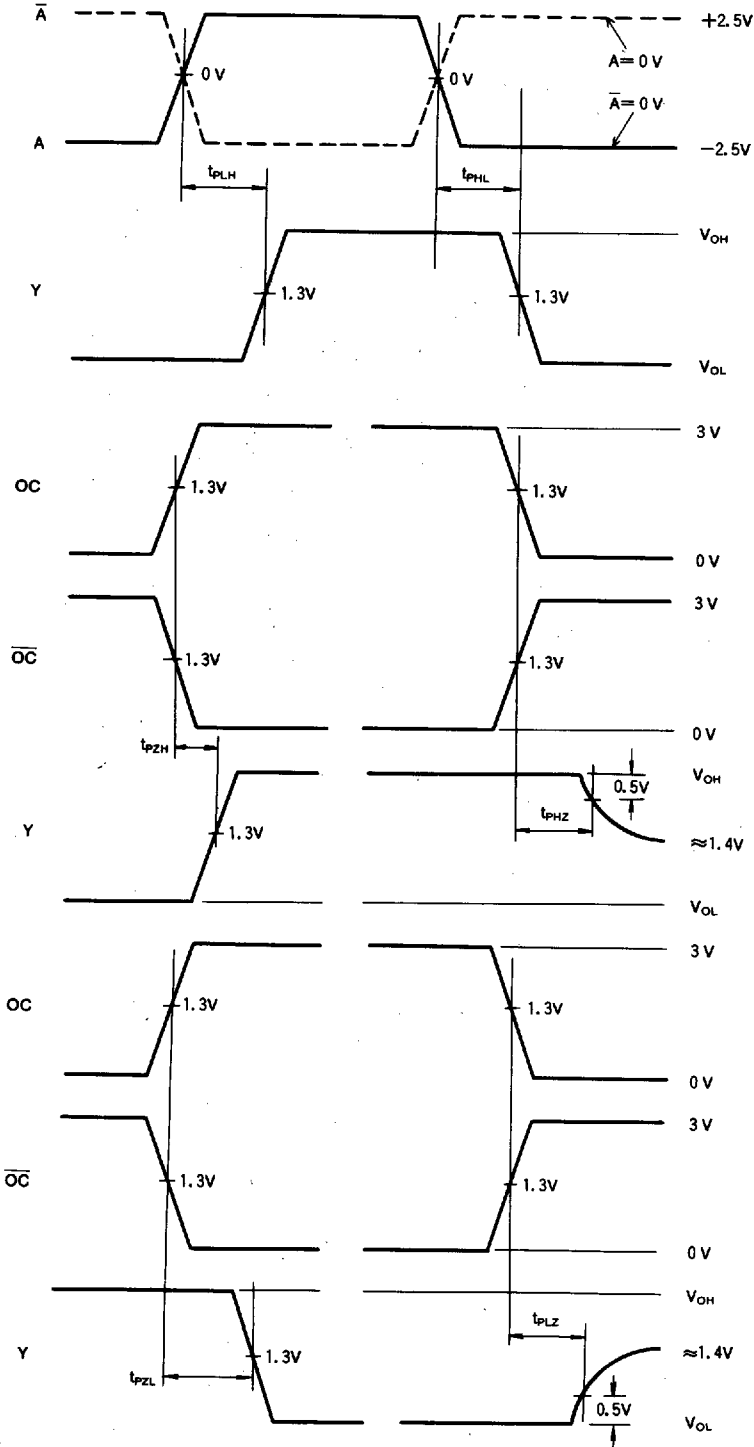


Parameter	SW1	SW2
t _{PLH} , t _{PHL}	Closed	Closed
t _{PZH}	Open	Closed
t _{PZL}	Closed	Open
t _{PHZ}	Closed	Closed
t _{PLZ}	Closed	Closed

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TIMING DIAGRAM

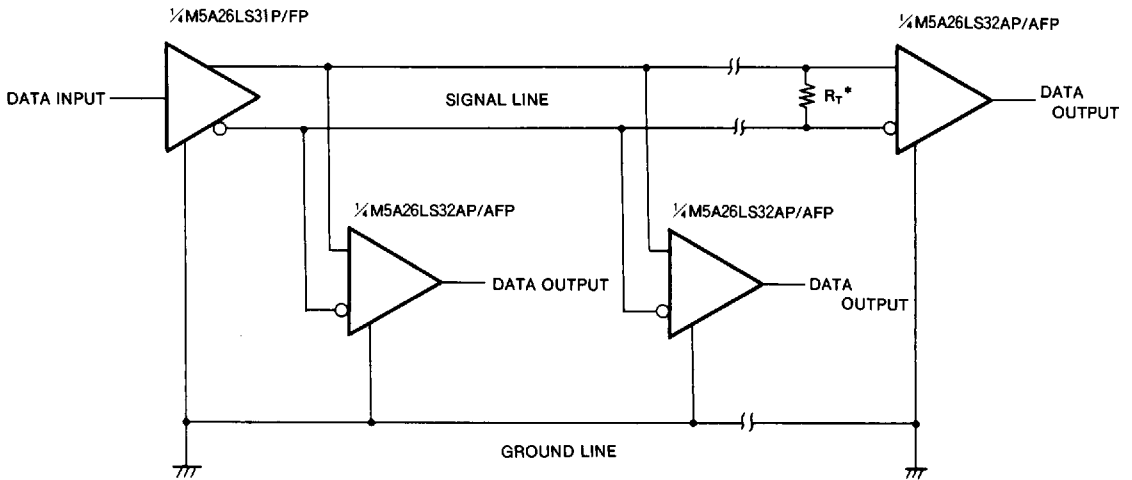


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TYPICAL APPLICATION

a) BALANCED

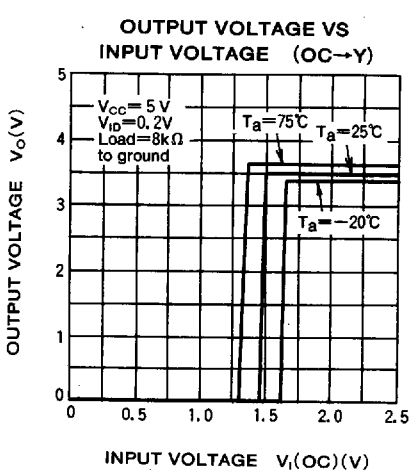
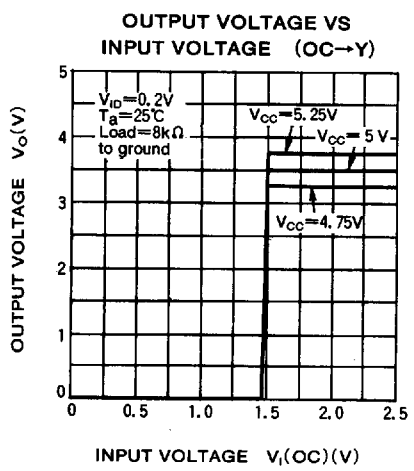
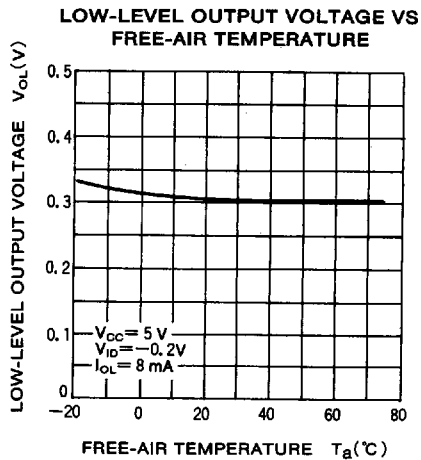
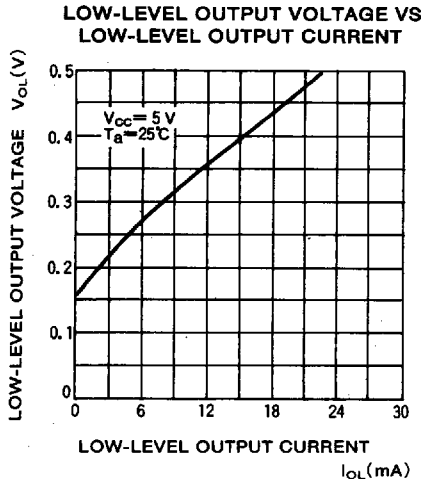
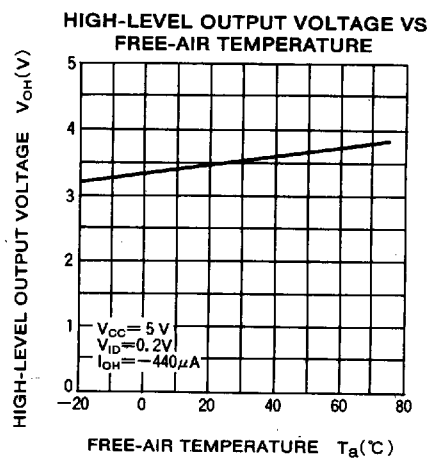
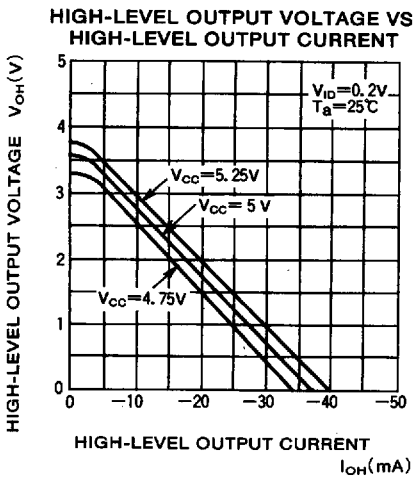


R_T^* = Characteristic impedance of transmission line.

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QUADRUPLE DIFFERENTIAL LINE RECEIVER

TYPICAL CHARACTERISTICS



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