M5A26LS32AP/AFP

QUADRUPLE DIFFERENTIAL LINE RECEIVER

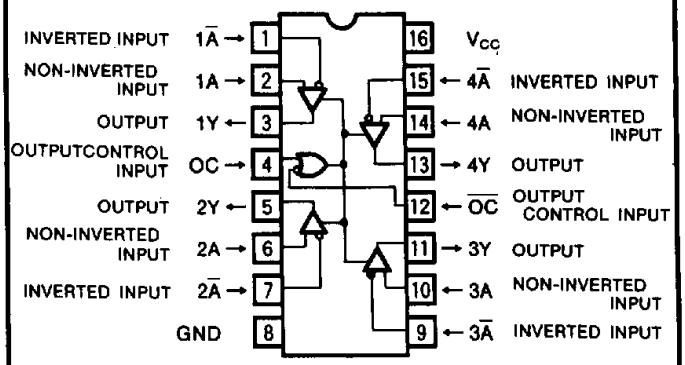
DESCRIPTION

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, $\overline{A}$ 50mV typ)
- Common mode input voltage range from −7 to +7V
- Input sensitivity of ±200mV
- High input impedance of 12kΩ (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

PIN CONFIGURATION (TOP VIEW)



Outline 16P4 (AP)
16P2N-A (AFP)

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 ±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 12kΩ (min), the device will be easy to use.

Output control inputs OC and $\overline{OC}$ are common to all four cirucits 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.

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	×	H
		×	L	H
$V_{TL}<V_{ID}<V_{TH}$		H	×	*
		×	L	*
$V_{ID}<V_{TL}$		H	×	L
		×	L	L
×		L	H	Z

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

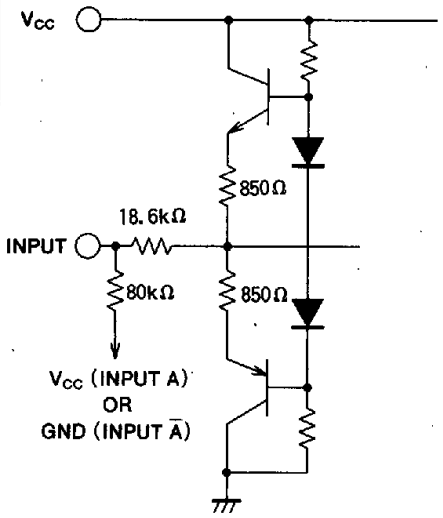
Table 1 Eia standards RS-422-A, RS-423-A

	Parameter	RS-422-A	RS-423-A	M5A26LS32AP Corresponding parameters (symbol)
Common	Transmission form	Balanced	Unbaranced	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)	±6 V	
	Minimum output voltage (loaded)	2 V (between outputs)	±3.6V	
	Minimum output resistance (power off)	100μA(−0.25V<V_O<+6 V)	100μA(−6 V<V_O<+6 V)	
	Maximum short-circuit output current	±150mA	±150mA	
	Slew rate	Control not required	Controllable	
Receiver	Input resistance	≧4 kΩ	≧4 kΩ	r_i
	Maximum input threshold	−0.2~+0.2V	−0.2~+0.2V	V_{TH}, V_{TL}
	Maximum input voltage	−12~+12V	−12~+12V	I_I

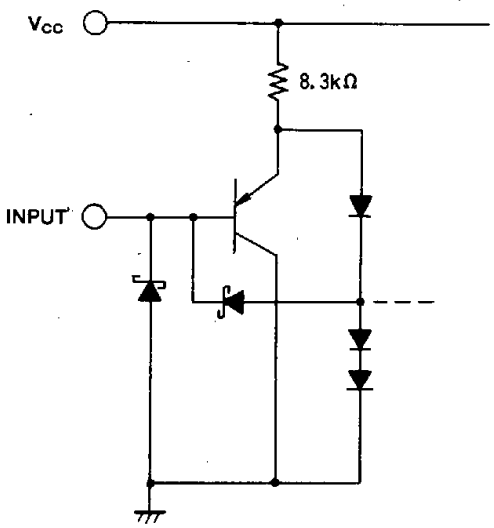
M5A26LS32AP/AFP

QUADRUPLE DIFFERENTIAL LINE RECEIVER

INPUT EQUIVALENT CIRCUIT

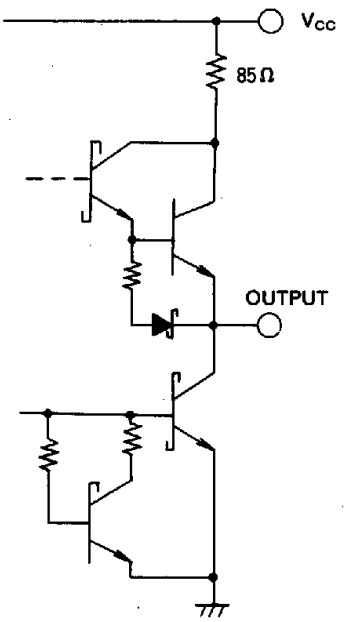


a) INPUT A, Ā



b) OUTPUT CONTROL INPUT OC, $\overline{OC}$

OUTPUT EQUIVALENT CIRCUIT



ABSOLUTE MAXIMUM RATINGS (T_a=−20∼+75℃, unless otherwise noted)

Symbol	Parameter		Conditions	Ratings	Unit
V_{CC}	Supply voltage			−0.5∼+7	V
V_I	Input voltage	A, Ā		−25∼+25	V
		OC, $\overline{OC}$		−0.5∼+7	V
V_{ID}	Voltage between inputs	A, Ā		−25∼+25	V
I_{OL}	Low-level output current			0∼50	mA
P_d	Power dissipation	DIP	T_a=25℃ (Note 2)	1000	mW
		SOP	T_a=25℃ (Note 3)	640	
Tstg	Storage temperature range			−65∼+150	℃

Note 2 : A derating of 9 mW/℃ should be made when $T_a \geqq 40$℃
3 : A derating of 5.1mW/℃ should be made when $T_a \geqq 25$℃

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, Ā	−7		+7	V
I_{OH}	High-level output current	$V_{OH} \geqq 2.7V$	0		−440	μA
I_{OL}	Low-level output current	$V_{OL} \leqq 0.45V$	0		8	mA
Topr	Operating free-air ambient temperature range		−20		+75	℃

Note 4 : Common mode input voltages A, Ā is the average value of the voltages applied on A, Ā.

M5A26LS32AP/AFP

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ELECTRICAL CHARACTERISTICS (V_{CC}=5V±5%, V_{IC}=−7∼+7V, T_a=−20∼+75℃, unless otherwise noted)

Symbol	Parameter		Test conditions	Limits			Unit
				Min	Typ*	Max	
V_{TH}	High threshold voltage	A, $\overline{A}$	V_{OH}=2.7V, I_{OH}=−440μA			0.2	V
V_{TL}	Low threshold voltage	A, $\overline{A}$	V_{OL}=0.45V, I_{OL}=8 mA	−0.2			V
$V_{T+}-V_{T-}$	Hysteresis (Note 5)	A, $\overline{A}$			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}=1V, $V_{I(\overline{OC})}$=0.8V, I_{OH}=−440μA	2.7	3.5		V
V_{OL}	Low-level output voltage		V_{CC}=4.75V, V_{ID}=−1V, $V_{I(\overline{OC})}$=0.8V, I_{OL}=4 mA			0.4	V
			V_{CC}=4.75V, V_{ID}=−1V, $V_{I(\overline{OC})}$=0.8V, I_{OL}=8 mA			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, $\overline{A}$	V_I=15V, other input at −10∼+15V			1.2	mA
			V_I=−15V, other input at −15∼+10V			−1.7	mA
I_{IH}	High-level input current	OC, $\overline{OC}$	V_I=5.5V			100	μA
			V_I=2.7V			20	μA
I_{IL}	Low-level input current	OC, $\overline{OC}$	V_I=0.4V			−0.36	mA
r_i	Input resistance	A, $\overline{A}$	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=$\overline{A}$=0V, All outputs disabled		52	70	mA

* : Typical values are at V_{CC}=5V, T_a=25℃, 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℃.

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

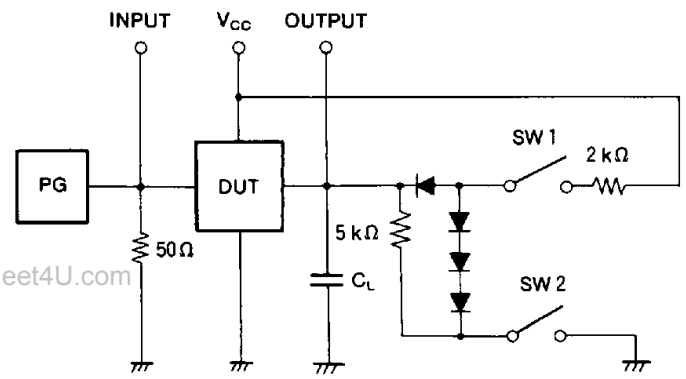
SWITICHING CHARACTERISTICS (V_{CC}= 5 V, T_a=25℃, unless otherwise noted)

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, $\overline{A}$ to output Y	C_L=15pF (Note 8)		14	35	ns
t_{PHL}				22	35	ns
t_{PZH}	Output enable time to high level	C_L=15pF (Note 8)		18	22	ns
t_{PZL}	Output enable time to low level			20	25	ns
t_{PHZ}	Output disable time from high level	C_L=5 pF (Note 8)		20	30	ns
t_{PLZ}	Output disable time from low level			24	40	ns

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

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

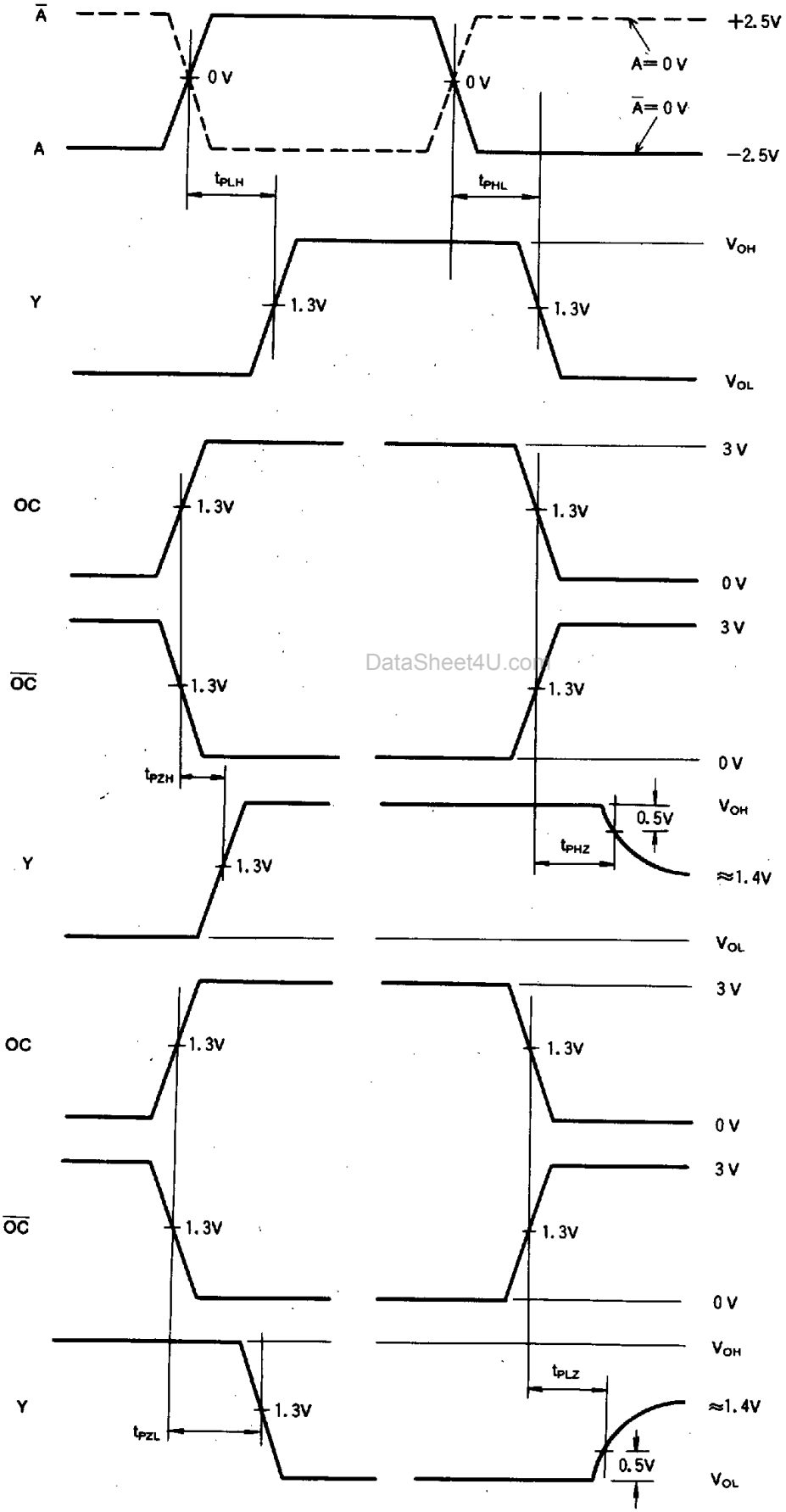
(2) All diodes are switching diodes (t_{rr}≦4 ns)

(3) C_L includes probe and jig capacitance.

(4) Output control OC is tested with $\overline{OC}$ high; $\overline{OC}$ is tested with OC low.

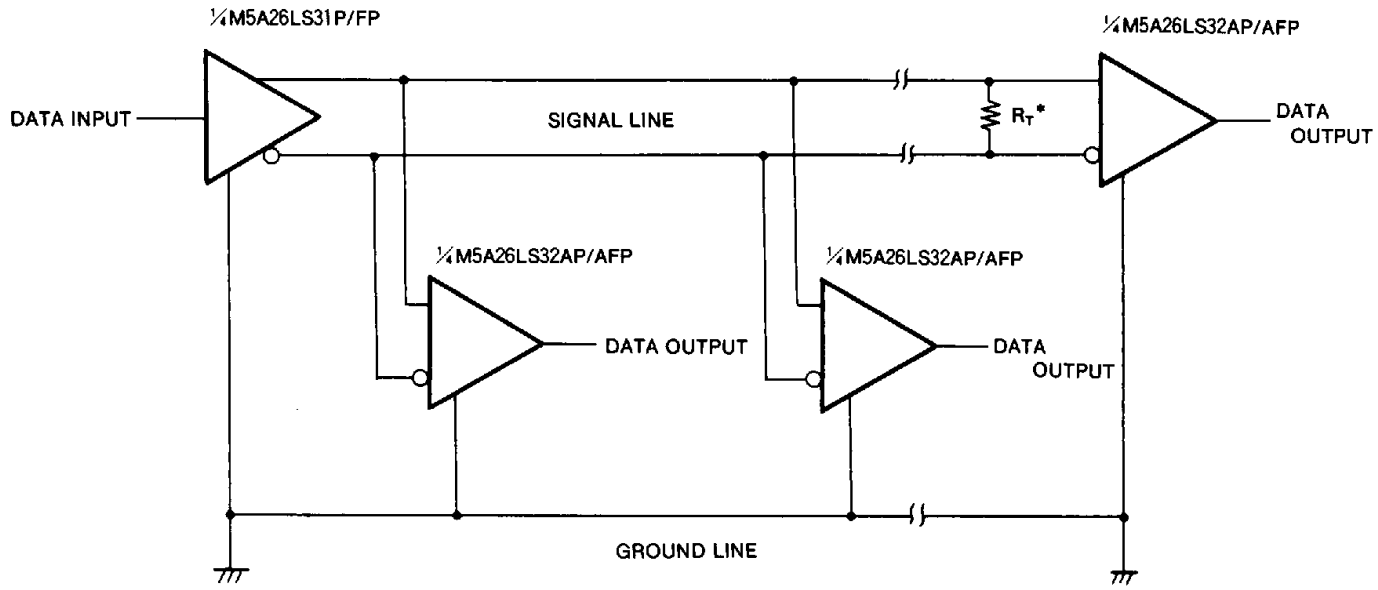
Parameter	SW1	SW2
t_{PLH}, t_{PHL}	Closed	Closed
t_{PZH}	Open	Closed
t_{PZL}	Closed	Open
t_{PHZ}	Closed	Closed
t_{PLZ}	Closed	Closed

TIMING DIAGRAM



TYPICAL APPLICATION

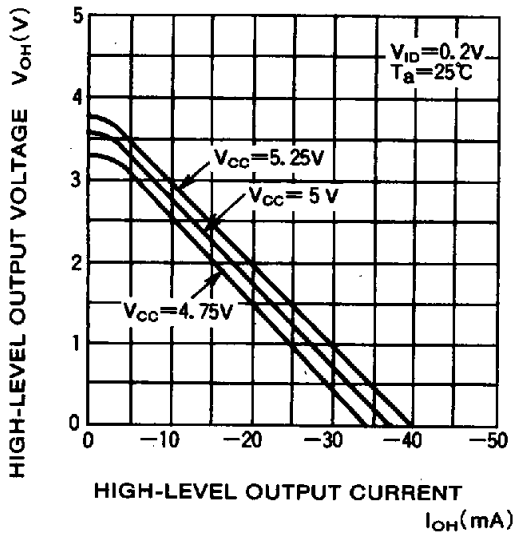
a) BALANCED



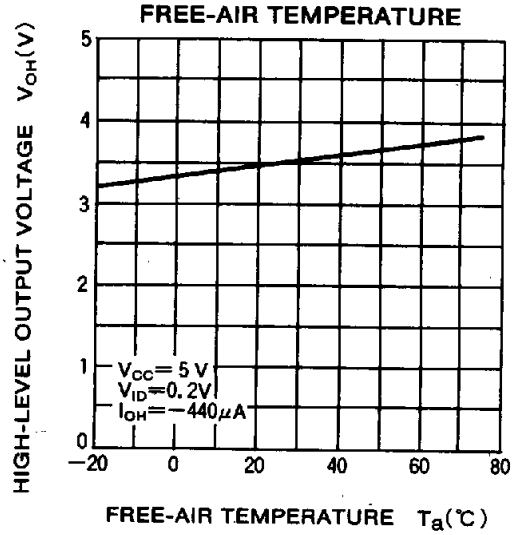
R_T* = Characteristic impedance of transmission line.

TYPICAL CHARACTERISTICS

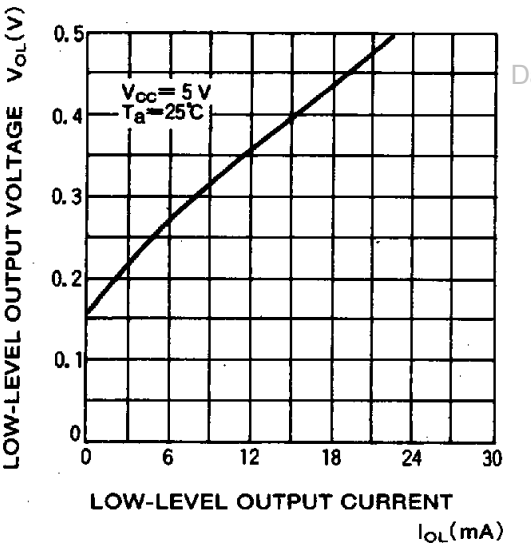
HIGH-LEVEL OUTPUT VOLTAGE VS HIGH-LEVEL OUTPUT CURRENT



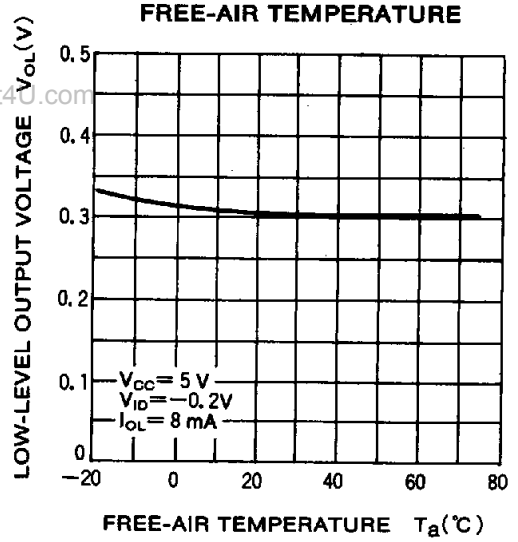
HIGH-LEVEL OUTPUT VOLTAGE VS FREE-AIR TEMPERATURE



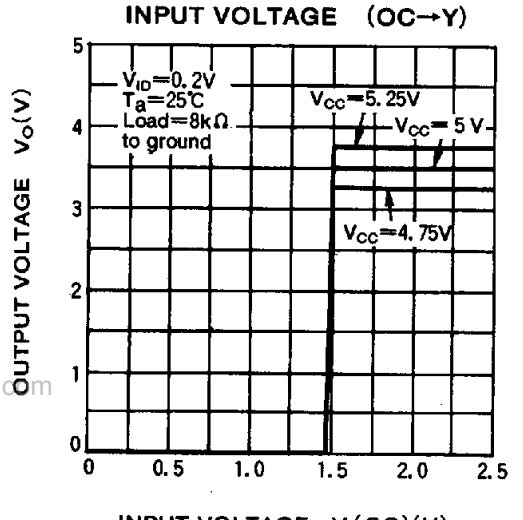
LOW-LEVEL OUTPUT VOLTAGE VS LOW-LEVEL OUTPUT CURRENT



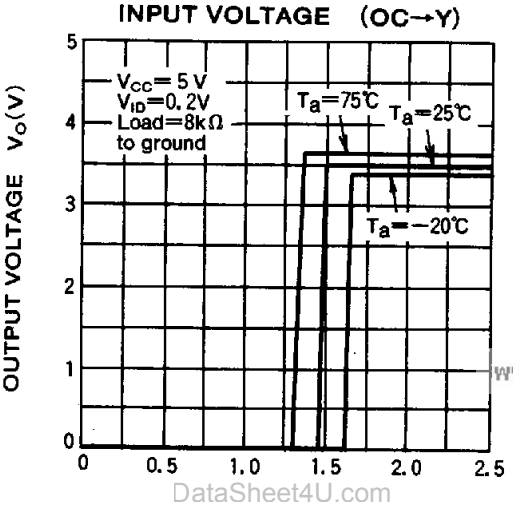
LOW-LEVEL OUTPUT VOLTAGE VS FREE-AIR TEMPERATURE



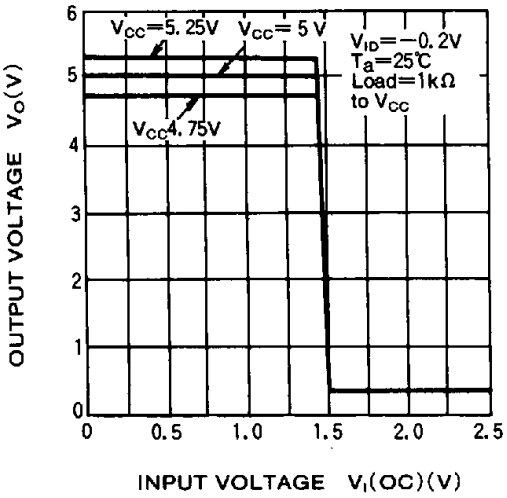
OUTPUT VOLTAGE VS INPUT VOLTAGE (OC→Y)



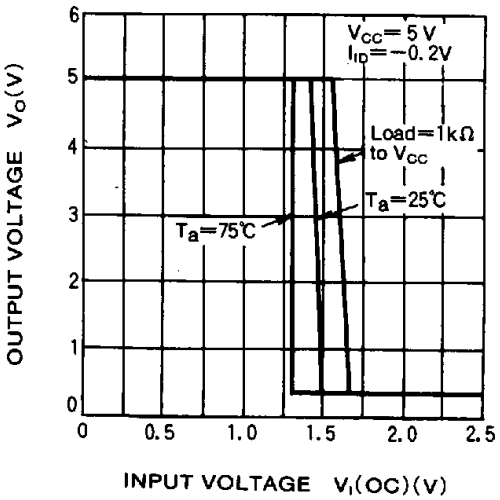
OUTPUT VOLTAGE VS INPUT VOLTAGE (OC→Y)



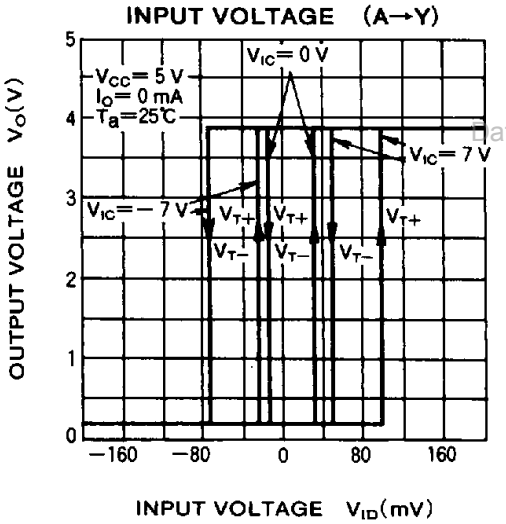
OUTPUT VOLTAGE VS INPUT VOLTAGE (OC→Y)



OUTPUT VOLTAGE VS INPUT VOLTAGE (OC→Y)



OUTPUT VOLTAGE VS INPUT VOLTAGE (A→Y)



INPUT CURRENT VS INPUT VOLTAGE (A)