M75189AP/AFP

QUADRUPLE LINE RECEIVER

DESCRIPTION

The M75189AP/AFP is a semiconductor integrated circuit containing 4 line receivers for use with unbalanced digital data transmission, which meets EIA Standards RS-232-C.

FEATURES

- Input characteristics meet EIA Standards RS-232-C
- Input resistance of 3k to 7kΩ (V_I=−3 to −25V/3 to 25V)
- Input voltage range from −30 to +30V
- Input hysteresis is 1.0V typ.
- Response control provides :
  input threshold shifting,
  input noise filtering.
- Output characteristics are compatible with TTL circuits
- Operates from single 5V power supply

APPLICATION

For use as a data transmission interface in digital equipment.

FUNCTIONAL DESCRIPTION

A 4kΩ (typ) resistor is connected in series with input I and the input impedance is 3k to 7kΩ, (the applied input voltage V_I equalling −3 to −25V or 3 to 25V).

A resistor or a resistor and bias voltage can be connected between RC and GND to shift the input threshold voltage levels.

The input hysteresis is set to 1.0V (typ).

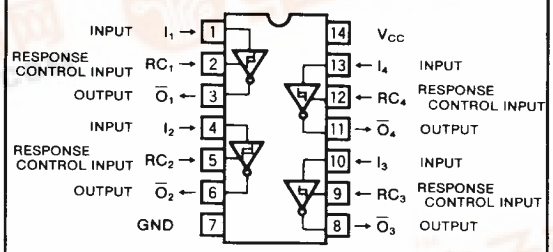
Input noise can be rejected by connecting a capacitor between RC and GND. Refer to TYPICAL APPLICATION b).

Output $\overline{O}$ is pulled up by 2kΩ resistor to V_{CC} so that the AND tie can be made, and can drive TTL circuits directly.

The supply voltage is from a single 5V power supply.

This integrated circuit is suitable for data transmission interface in digital equipment since the input characteristics meet EIA Standards RS-232-C. Refer to Table 1, which shows the EIA Standards RS-232-C. M75188P may be used as a driver which meets these standards. An unbalanced form of transmission is used. Refer to TYPICAL APPLICATION a) for further information.

PIN CONFIGURATION (TOP VIEW)



Outline 14P4
14P2N

CIRCUIT DIAGRAM (EACH CIRCUIT)

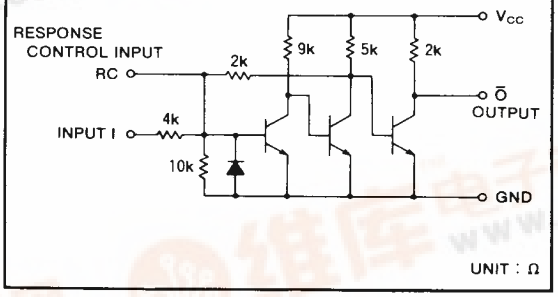


Table 1 Eia standards RS-232-C

Parameter		RS-232-C	M75189AP Corresponding Parameters (Symbol)
Common	Transmission form	Unbalanced	Input I
	Maximum transmission distance	15m	
	Maximum transmission speed	20kbit/s	
Driver	Maximum output voltage (no load)	±25V	
	Minimum output voltage (loaded)	±5～±15V	
	Minimum output resistance (power off)	R_O=300Ω	
	Maximum short-circuit output current	±500mA	
	Slew rate	Maximum 30V/μs	
Receiver	Input resistance	3k～7kΩ	
	Maximum input threshold	−3～+3V	V_{T+}, V_{T-}
	Maximum input voltage	−25～+25V	I_{IH}, I_{IL}

ABSOLUTE MAXIMUM RATINGS (T_a=0~75℃, unless otherwise noted)

Symbol	Parameter		Conditions	Ratings	Unit
V_{CC}	Supply voltage			−0.5~+10	V
V_I	Input voltage			−30~+30	V
I_O	Output current		When output is low	0~20	mA
P_d	Power dissipation	DIP	T_a=25℃ (Note 1)	1000	mW
		SOP	T_a=25℃ (Note 2)	570	
T_{stg}	Storage temperature range			−65~+150	℃

Note 1 : A derating of 9.1mW/℃ should be made when $T_a \geqq 40$℃
2 : A derating of 4.5mW/℃ 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_I	Input voltage	−15		15	V
T_{opr}	Operating free-air ambient temperature range	0		75	℃

ELECTRICAL CHARACTERISTICS (V_{CC}=5V, T_a=0~75℃, unless otherwise noted)

Symbol	Parameter	Test conditions		Limits			Unit	Measurement circuit
				Min	Typ*	Max		
V_{T+}	Positive-going theshold voltage	T_a=25℃		1		1.5	V	1
				0.9		1.6		
V_{T-}	Negative-going theshold voltage	T_a=25℃		0.75		1.25	V	1
				0.65		1.25		
$V_{T+}-V_{T-}$	Hysteresis	T_a=25℃		0	0.25	0.75	V	1
V_{OH}	High-level output voltage	V_I=0.75V, I_{OH}=−0.5mA		2.6	4	5	V	1
		V_I : Open, I_{OH}=−0.5mA		2.6	4	5		
V_{OL}	Low-level output voltage	V_I=3V, I_{OL}=10mA			0.2	0.45	V	1
I_{IH}	High-level input current	V_I=25V	DIP	3.6		8.3	mA	2
		V_I=15V	SOP			5.0		
		V_I=3V		0.43				
I_{IL}	Low-level input current	V_I=−25V	DIP	−3.6		−8.3	mA	2
		V_I=−15V	SOP			−5.0		
		V_I=−3V		−0.43				
I_{OS}	Short-circuit output current	V_I=0V, V_O=0V		−1.6	−2.5	−5	mA	3
I_{CC}	Supply current	V_{CC}=5V, V_I=5V			20	26	mA	2

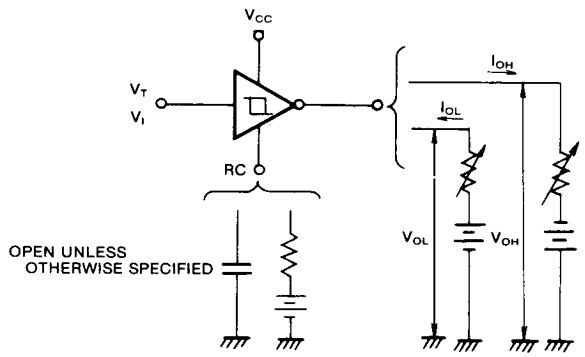
* : All typical values are at V_{CC}=5V, T_a=25℃.

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

Symbol	Parameter	Test conditions	Limits			Unit	Measurement circuit
			Min	Typ	Max		
t_{PLH}	Low-to-high-level, high-to-low-level output propagation time, from input I to output O	C_L=15pF, R_L=3.9KΩ		25	85	ns	4
t_{PHL}		C_L=15pF, R_L=390Ω		25	50	ns	
t_{TLH}	Low-to-high-level output transition time	C_L=15pF, R_L=3.9kΩ		120	175	ns	
t_{THL}	High-to-low-level output transition time	C_L=15pF, R_L=390Ω		10	20	ns	

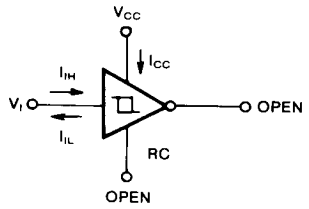
MEASUREMENT CIRCUITS

1



Measurement Circuit for V_{T+}, V_{T-}, V_{OH}, V_{OL}

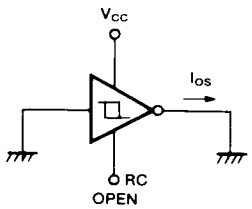
2



Note : I_{CC} is measure for all 4 circuits simultaneously.

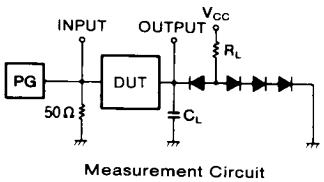
Measurement Circuit for I_{CC}, I_{IH}, I_{IL}

3

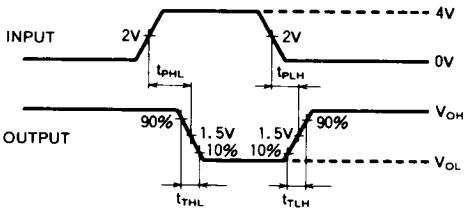


Measurement Circuit for I_{OS}

4



Measurement Circuit



VOLTAGE WAVEFROM

1. The pulse generator (PG) has the following characteristics : PRR=1MHz, $t_r \leqq 10$ns, $t_f \leqq 10$ns, $t_{PW}=500$ns, $V_P=4V_{P-P}$, $Z_O=50\Omega$
2. All diodes are high- speed switching diodes ($t_{rr} \leqq 4$ns)
3. C_L includes probe and jig capacitance.
4. RC is open.

Measurement Circuit for switching characteristics and voltage waveform.

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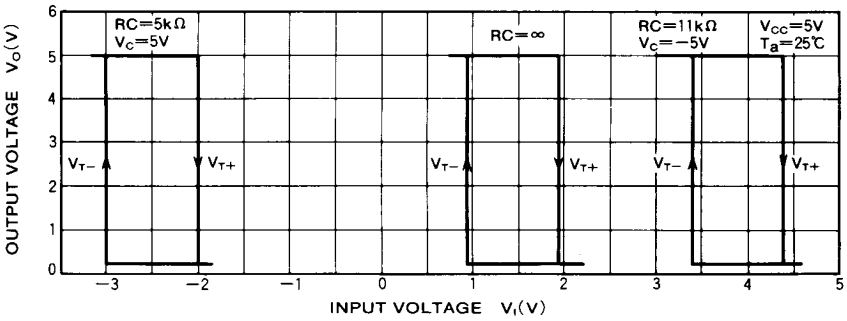
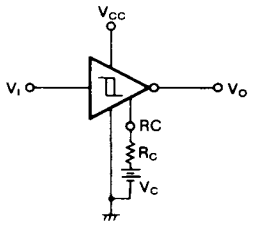
TYPICAL CHARACTERISTICS

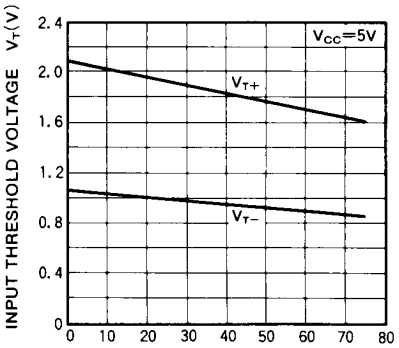
OUTPUT VOLTAGE VS INPUT VOLTAGE



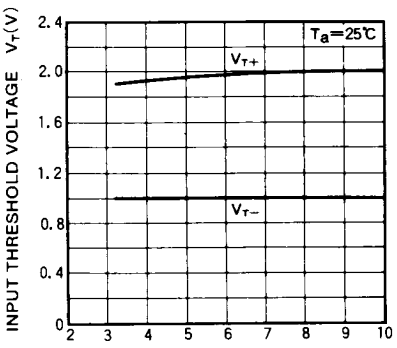
MEASUREMENT CIRCUIT



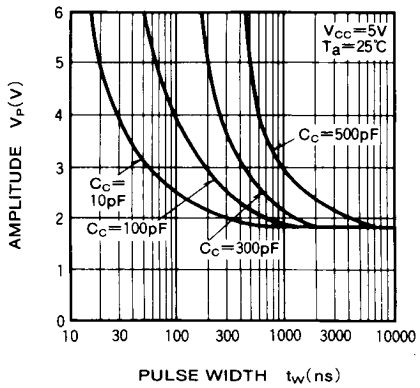
INPUT THRESHOLD VOLTAGE VS FREE-AIR TEMPERATURE



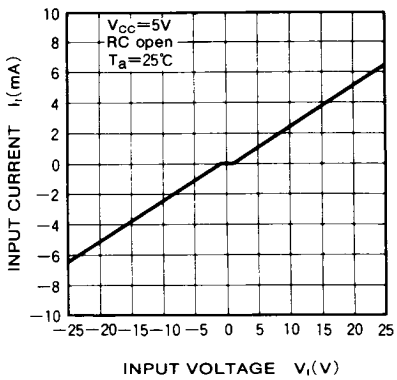
INPUT THRESHOLD VOLTAGE VS SUPPLY VOLTAGE



NOISE REJECTION CHARACTERISTICS

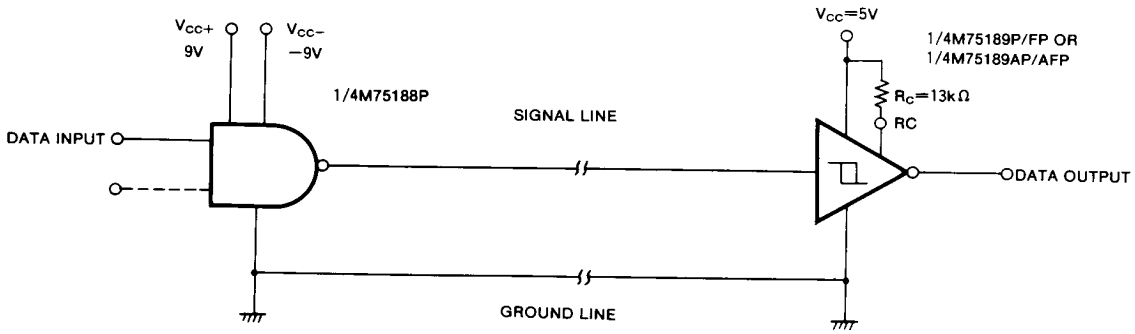


INPUT CURRENT VS INPUT VOLTAGE

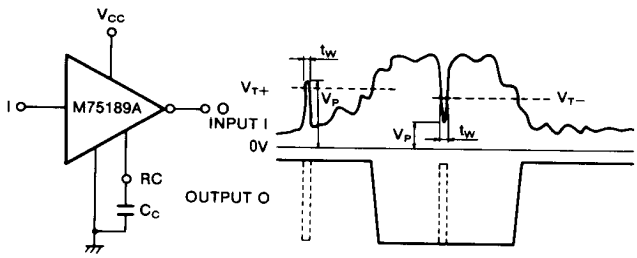


TYPICAL APPLICATION

a) COMBINATION OF DRIVER AND RECEIVER



b) WAVEFORM RESTORATION AND NOISE REJECTION



As in the above diagram, in preventing inversion of output O by input pulse, whose width t_W and amplitude greater than V_{T+} or less than V_{T-}, connect capacitor C_C, the value of which can be obtained from a noise rejection characteristics table. Shorten the rise and fall time of input I if C_C is connected.