M54654P

QUADRUPLE LINE RECEIVER

T-75-45-05

DESCRIPTION

The M54654P is a semiconductor integrated circuit containing a line receiver suitable for use as an interface between data terminals and data transmitters.

FEATURES

- Meets all the specifications set by JIS C 6361 and EIA Standard RS-232-C.
- Supply voltage can be either a 5V or 12V.
- Input resistance (R_I=5kΩ typ.)
- Wide output voltage range (V_I=−25~+25V)
- When input A is open, output Y is H (in case of Fail-safe Operation).
- Hysteresis possible when in normal operation
- Output can be directly connected to TTL.

APPLICATION

Interface between data terminal equipment and data transmitter equipment
Level converter

FUNCTION

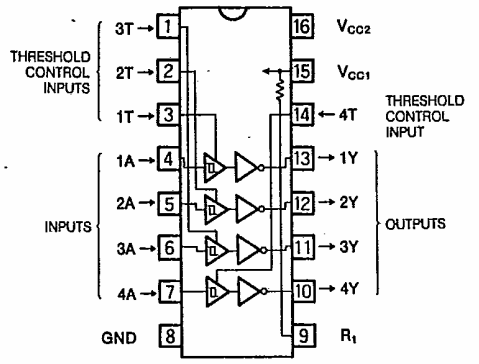
Containing 4 line receivers with Schmitt circuits and inverters, this unit is suitable, like the line driver M54650P, as an interface IC in data transmission systems. It meets the specifications of both JIS C 6361 and EIA Standard RS-232-C. It can also be used as a level converter.
This receiver can use a 5V voltage source but, as a constant-voltage circuit is included in the IC, it can operate on 12V also. In order to satisfy the above forementioned specifications it also has a fail-safe function. Hysteresis varies when in fail-safe operation and when in normal operation. Output can be connected directly with DTL and TTL.

FUNCTION TABLE

A	Y
L	H
H	L

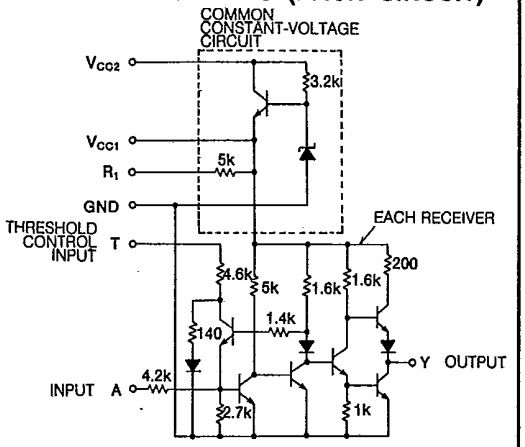
Note 1 : When using V_{CC1} (pin⑮), V_{CC2} (pin⑯) is either open or connected to V_{CC1}.
2 : When using V_{CC2}, V_{CC1} is either open or connected to threshold pin.

PIN CONFIGURATION (TOP VIEW)



Outline 16P4

CIRCUIT SCHEMATIC (EACH CIRCUIT)



UNIT : Ω

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

Symbol	Parameter	Conditions	Limits	Unit
V_{CC1}	Supply voltage		7	V
V_{CC2}	Supply voltage		14	V
V_I	Input voltage		±25	V
V_O	Output voltage		V_{CC1}	V
P_d	Power dissipation		500	mW
T_{opr}	Operating free-air ambient temperature range		0~75	℃
Tstg	Storage temperature range		−65~+150	℃

RECOMMENDED OPERATING CONDITIONS (T_a = 0~75℃, unless otherwise noted)

Symbol	Parameter	Limits			Unit
		Min	Typ	Max	
V_{CC1}	Supply voltage	4.5	5	5.5	V
V_{CC2}	Supply voltage	10.8	12	13.2	V
V_I	Input voltage			±15	V
F_O	Fan out			10	V

ELECTRICAL CHARACTERISTICS (T_a = 0~75℃, unless otherwise noted)

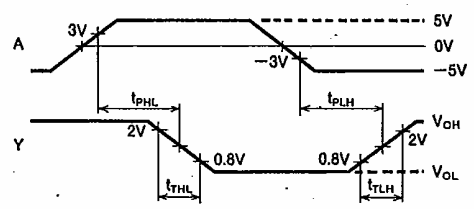
Symbol	Parameter		Test conditions	Limits			Unit	Test circuit
				Min	Typ	Max		
V_{IH}	High-level input voltage			3			V	1
V_{IL}	Low-level input voltage					−3	V	
V_{T+}	Positive-going threshold voltage	Normal						
		Fail-safe		0.8	2	3	V	
V_{T-}	Negative-going threshold voltage	Normal		−3	−1.2	0	V	2
		Fail-safe		0.4	1.1	2.6	V	
$V_{T+}-V_{T-}$	Hysteresis	Normal		0.8	3.3	6	V	
		Fail-safe		0	1.1	2.6	V	
V_{OH}	High-level output voltage		I_{OH} = −400μA, V_I = −3V	2.4	3.5		V	1
		Fail-safe	I_{OH} = −400μA, V_I : Open	2.4	3.5		V	
V_{OL}	Low-level output voltage		I_{OL} = 16mA, V_I = 3V		0.23	0.4	V	2
r_I, R_I	Input impedance		−25 ≦ V_I ≦ −14	3	5	7	kΩ	3
			−14 ≦ V_I ≦ −3	3	5	7	kΩ	
			−3 < V_I < 3	3	6	8	kΩ	
			3 ≦ V_I ≦ 14	3	5	7	kΩ	
			14 ≦ V_I ≦ 25	3	5	7	kΩ	
$V_{I(OPEN)}$	Open input voltage		I_I = 0mA	0	0.2	2	V	4
I_{OS}	Short-circuit output current (Note 3)		V_{CC1} = 5.5V, V_O = 0V	−10	−20	−40	mA	5
I_{CC1}	Supply current		V_{CC1} = 5.5V, T_a = 25℃		20	35	mA	6
I_{CC2}	Supply current		V_{CC2} = 13.2V, T_a = 25℃		23	40	mA	

* : All typical values are V_{CC1} = 5V, T_a=25℃. Note 3 : Test in as short a time as possible and do not test more than 2 outputs at same time.

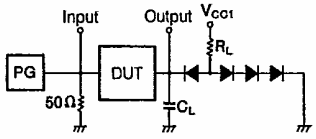
SWITCHING CHARACTERISTICS (V_{CC1} = 5V, T_a = 25℃, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit	Test circuit
			Min	Typ	Max		
t_{PLH}	Low-to-high-level, high-to-low-level output propagation time; from input A to output Y	C_L = 50pF, R_L = 390Ω		22		ns	Note 4
t_{PHL}				20		ns	
t_{TLH}	Low-to-high-level, high-to-low-level output transition time			9		ns	
t_{THL}				6		ns	

TIMING DIAGRAM (Reference level = 1.5V)



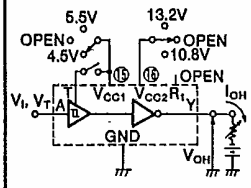
Note 4 : Test circuit



1. The pulse generator (PG) characteristics : t_r = 10ns, t_f = 10ns, PRR = 1MHz, t_{PW} = 200ns, V_P = 10V_{P-P}.
2. All diodes used are high-speed switching diodes (t_{rr} ≦ 4ns).
3. C_L includes probe and jig capacitance.

TEST CIRCUITS

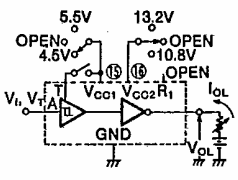
1



TEST PARAMETER		A	T	Y	V_{CC1} (PIN⑬)	V_{CC2} (PIN⑯)
INPUT OPEN	V_{OH}	OPEN	OPEN	I_{OH}	4.5V	OPEN
(Fail-safe)	V_{OH}	OPEN	OPEN	I_{OH}	OPEN	10.8V
V_{T+}-SMALLEST V_{T-}-SMALLEST (Fail-safe)	V_{OH}	0.8V	OPEN	I_{OH}	5.5V	OPEN
	V_{OH}	0.8V	OPEN	I_{OH}	OPEN	13.2V
V_{T+}-SMALLEST	V_{OH}	*	PIN⑬	I_{OH}	5.5V, T	OPEN
(Normal)	V_{OH}	*	PIN⑬	I_{OH}	T	13.2V
V_{IL} LARGEST V_{T-}-SMALLEST (Normal)	V_{OH}	−3V	PIN⑬	I_{OH}	5.5V, T	OPEN
	V_{OH}	−3V	PIN⑬	I_{OH}	T	13.2V

* : AFTER MOMENTARILY APPLYING −5V, APPLY 0.8V.

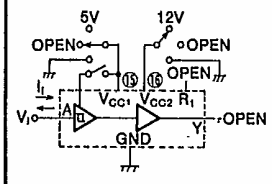
2



TEST PARAMETER		A	T	Y	V_{CC1} (PIN⑬)	V_{CC2} (PIN⑯)
V_{IH} SMALLEST V_{T+} LARGEST V_{T-} LARGEST (Fail-safe)	V_{OL}	3V	OPEN	I_{OL}	4.5V	OPEN
	V_{OL}	3V	OPEN	I_{OL}	OPEN	10.8V
V_{IH} SMALLEST V_{T+} LARGEST (Normal)	V_{OL}	3V	PIN⑬	I_{OL}	4.5V, T	OPEN
	V_{OL}	3V	PIN⑬	I_{OL}	T	10.8V
V_{T-} LARGEST	V_{OL}	*	PIN⑬	I_{OL}	5.5V, T	OPEN
(Normal)	V_{OL}	*	PIN⑬	I_{OL}	T	13.2V

* : AFTER MOMENTARILY APPLYING 5V, SHORT TO GROUND.

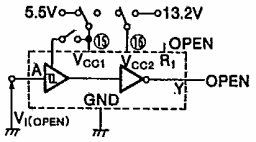
3



$$-R_I = \frac{V_I}{I_I},\ r_I = \frac{\Delta V_I}{\Delta I_I}$$

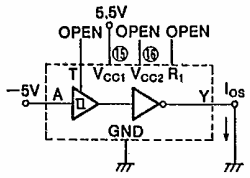
T	V_{CC1}(PIN⑬)	V_{CC2}(PIN⑯)
OPEN	5V	OPEN
OPEN	GND	OPEN
OPEN	OPEN	OPEN
PIN⑬	T, 5V	OPEN
GND	GND	OPEN
OPEN	OPEN	12V
OPEN	OPEN	GND
PIN⑬	T	12V
PIN⑬	T	GND
PIN⑬	T	OPEN

4



T	V_{CC1} (PIN⑬)	V_{CC2} (PIN⑯)
OPEN	5.5V	OPEN
PIN⑬	5.5V	OPEN
OPEN	OPEN	13.2V
PIN⑬	T	13.2V

5



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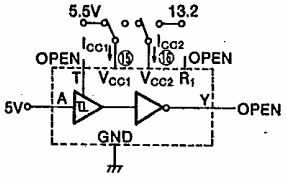
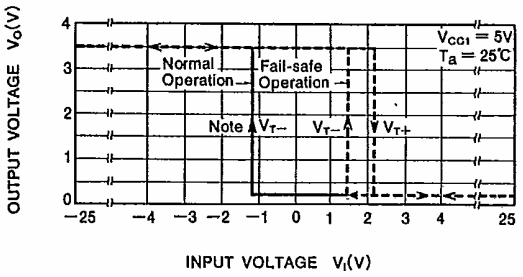


MEASURE ALL FOUR CIRCUITS AT SAME TIME.

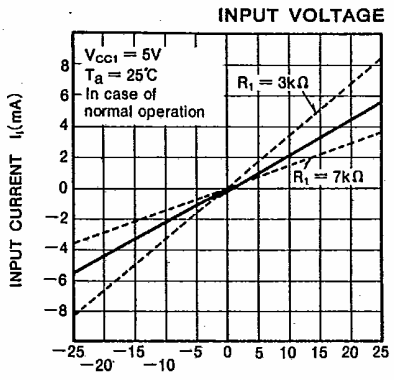
MITSUBISHI ELECTRIC

TYPICAL CHARACTERISTICS

INPUT/OUTPUT TRANSFER CHARCTERISTICS



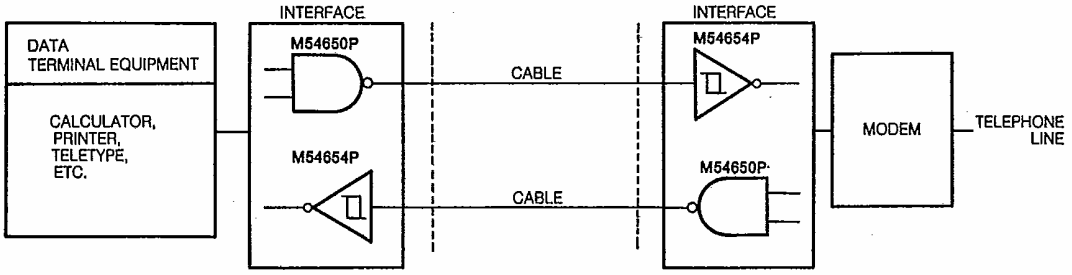
INPUT CURRENT VS INPUT VOLTAGE



Note 4 : In case of normal operation, connect all threshold pins to V_{CC1}.
5 : In case of fail-safe operation, leave all threshold pins open.

APPLICATION EXAMPLES

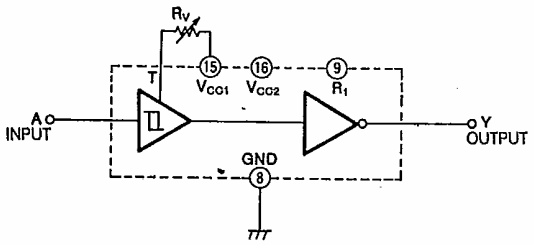
DATA TRANSMISSION SYSTEM



TRANSMISSION SPEED : 20k BITS/SEC (IN CASE OF CABLE WITH EQUIVALENT FULL 2500pF LOAD)

HYSTERESIS REDUCTION

In normal operation it is possible to reduce the width of hysteresis by decreasing negative going threshold voltage $|V_{T-}|$. $|V_{T-}|$ can be decreased by externally placing a resistor between threshold control pin (T) and V_{CC1}. The larger the resistor the smaller $|V_{T-}|$. Included in the IC is a 5kΩ (connected to R_I pin) which can be used as R_V.



INPUT/OUTPUT TRANSFER CHARACTERISTICS