TS509-A85Z
December 1985

FUJITSU

MB412

DUAL DIFFERENTIAL LINE DRIVER WITH THREE-STATE OUTPUTS

<Outline>

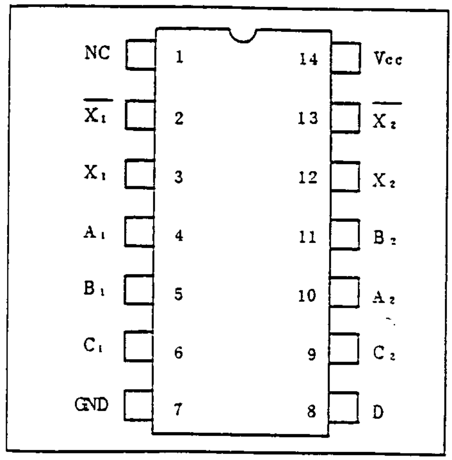
The Fujitsu MB412 is the balanced transmission driver with Schottky TTL technology and is designed to satisfy CCITT recommendation V11.

The three-state control brings output to high impedance state by giving low level to circuit-independent inhibit pin C or common inhibit pin D. Since input pin C has a pull-up resistor, it can be left open when not used.

<Features>

- o Differential output (Three states)
- o Independent and common inhibit pins
- o CCITT recommendation V11 is satisfied.
- o Schottky TTL
- o With input clamp diode
- o Low level output current: 40 mA
- o High level output current: 40 mA

PIN ASSIGNMENT (TOP VIEW)



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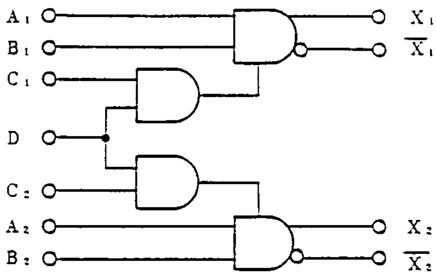
BLOCK DIAGRAM



FUNCTION TABLE

Input				Output	
A	B	C	D	X	X̄
H	H	H	H	H	L
H	L	H	H	L	H
L	H	H	H	L	H
L	L	H	H	L	H
※	※	L	※	HZ	HZ
※	※	※	L	HZ	HZ

[Note]
*: Irrelevant level
HZ: High impedance state

ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Supply Voltage	V_{cc}	+7.0	V
Input Voltage	V_I	+5.5	V
Output Voltage	V_O	+5.5	V
Operating Temperature	T_A	0～+70	℃
Storage Temperature	T_{stg}	−65～+150	℃

RECOMMENDED OPERATING CONDITIONS

Rating	Symbol	Value	Unit
Supply Voltage	V_{cc}	+4.75～+5.25	V
Output Current	I_{OH}	−40	mA
	I_{OL}	40	mA
Operating Temperature	T_A	0～+70	℃

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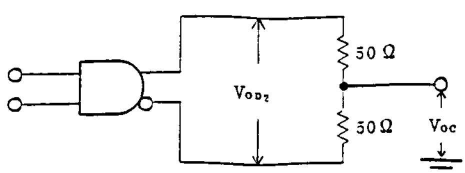
ELECTRICAL CHARACTERISTIC

1. DC Characteristics (T_A = 0°C - +70°C)

Parameter	Symbol	Conditions	Value Min.	Value Typ.	Value Max.	Unit
Low Level Output Voltage	V_{OL}	V_{CC} = 4.75 V, I_{OL} = 40 mA, V_{IH} = 2 V, V_{IL} = 0.8 V	–	0.4	0.5	V
High Level Output Voltage	V_{OH}	V_{CC} = 4.75 V, I_{OH} = −40 mA, V_{IH} = 2 V, V_{IL} = 0.8 V	2.5	3.0	–	V
Output Clamp Voltage	V_{OK}	V_{CC} = 5.25 V, I_O = −40 mA	–	–	−1.5	V
Differential Output Voltage	V_{OD1}	V_{CC} = 5.25 V, I_O = 0 mA	–	3.8	2V_{OD2}	V
Complementary Output Terminal Voltage	V_{OD2}	V_{CC} = 4.75 V	2	2.5	–	V
	$\Delta\lvert V_{OD}\rvert$	V_{CC} = 4.75 V	–	0.03	0.4	
Complementary Output Terminal Middle Point Voltage	V_{OC}	V_{CC} = 5.25 V	–	–	3	V
		V_{CC} = 4.75 V	–	–	3	
	$\Delta\lvert V_{OC}\rvert$	V_{CC} = 5.25 V	–	–	0.4	
		V_{CC} = 4.75 V	–	–	0.4	
Output Leakage Current (Power Off)	I_O	V_{CC} = 0 V, V_O = 6 V	–	–	100	µA
		V_{CC} = 0 V, V_O = −0.25 V	–	–	−100	
		V_{CC} = 0 V, −0.25 V ≦ V_O ≦ 6 V	–	–	±100	
Output Leakage Current (High Impedance)	I_{OZ}	V_{CC} = 5.25 V, 0 V ≦ V_O ≦ 5.25 V, T_A = 25 °C	–	–	±10	µA
		V_{CC} = 5.25 V, V_O = 0 V, T_A = 70 °C	–	–	−20	
		V_{CC} = 5.25 V, V_O = 0.4 V, T_A = 70 °C	–	–	±20	
		V_{CC} = 5.25 V, V_O = 2.4 V, T_A = 70 °C	–	–	±20	
		V_{CC} = 5.25 V, V_O = 5.25 V, T_A = 70 °C	–	–	20	
Input Current — Input A, B, C	I_I	V_{CC} = 5.25 V, V_I = 5.5 V	–	–	1	mA
Input Current — Input D			–	–	2	
Input Current — Input A, B, C	I_{IH}	V_{CC} = 5.25 V, V_I = 2.4 V	–	–	40	µA
Input Current — Input D			–	–	−300	
Input Current — Input A, B, C	I_{IL}	V_{CC} = 5.25 V, V_I = 0.4 V	–	–	−1.6	mA
Input Current — Input D			–	–	−1.8	
Input Clamp Voltage	V_{IK}	V_{CC} = 4.75 V, I_I = −12 mA	–	–	−1.5	V
Output Short Current	I_{OS}	V_{CC} = 5.25 V	−40	–	−150	mA
Power Current (All Input, GND)	I_{CC}	V_{CC} = 5.25 V, T_A = 25 °C	–	31	65	mA

[Note]

1. V_{OD1}: Potential difference between complementary output X and $\overline{X}$
2. $\Delta\lvert V_{OD}\rvert$: V_{OD2} difference when X is set to high and $\overline{X}$ is set to low.
   $\Delta\lvert V_{OC}\rvert$: V_{OC} difference when X is set to high and $\overline{X}$ is set to low.

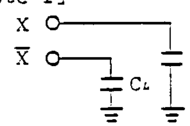


3. Standard value is obtained when V_{CC} = +5.0 V and T_A = 25°C.

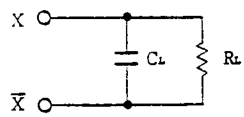
2. Switching Characteristics (V_{CC} = +5.0 V, T_A = 25°C)

Parameter	Symbol	Conditions	Measurement Circuit	Value Min.	Value Typ.	Value Max.	Unit
Delay Time	t_{PLH}	C_L = 15 pF, [Note 1]	Fig. 1	–	13.0	20	ns
	t_{PHL}			–	10.2	15	
Delay Time	t_{PLH}	C_L = 30 pF, R_L = 100 Ω [Note 2]	Fig. 1	–	13.6	25	ns
	t_{PHL}			–	10.5	20	
Output Rise Time	t_{TLH}			–	10	20	
Output Fall Time	t_{THL}			–	7.1	20	
Output Enable Time	t_{PZH}	C_L = 30 pF, R_L = 180 Ω	Fig. 2	–	7.5	20	ns
	t_{PZL}	C_L = 30 pF, R_L = 250 Ω	Fig. 3	–	18	40	
Output Disable Time	t_{PHZ}	C_L = 30 pF, R_L = 180 Ω	Fig. 2	–	7.4	30	
	t_{PLZ}	C_L = 30 pF, R_L = 250 Ω	Fig. 3	–	8.9	35	
Overshoot Rate		R_L = 100 Ω, [Note 3]	Fig. 1	–	–	10	%

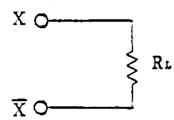
[Note 1]



[Note 2]



[Note 3]



C_L: Including probe and measurement jig capacity

3. Switching Characteristic Measurement Circuit and Switching Waveform

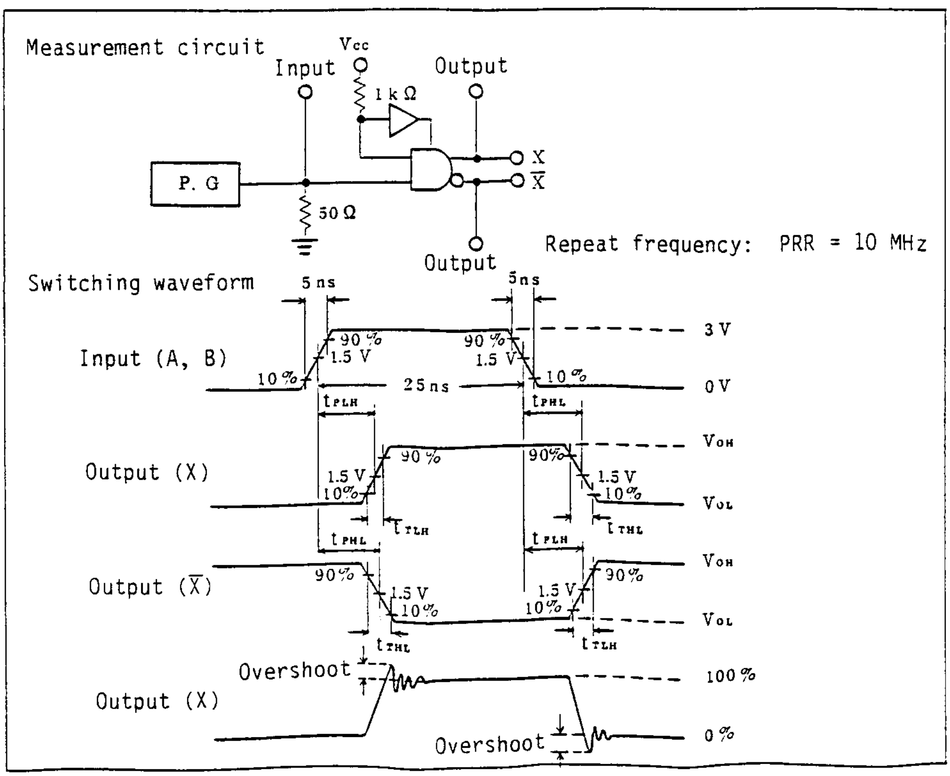


Fig. 1

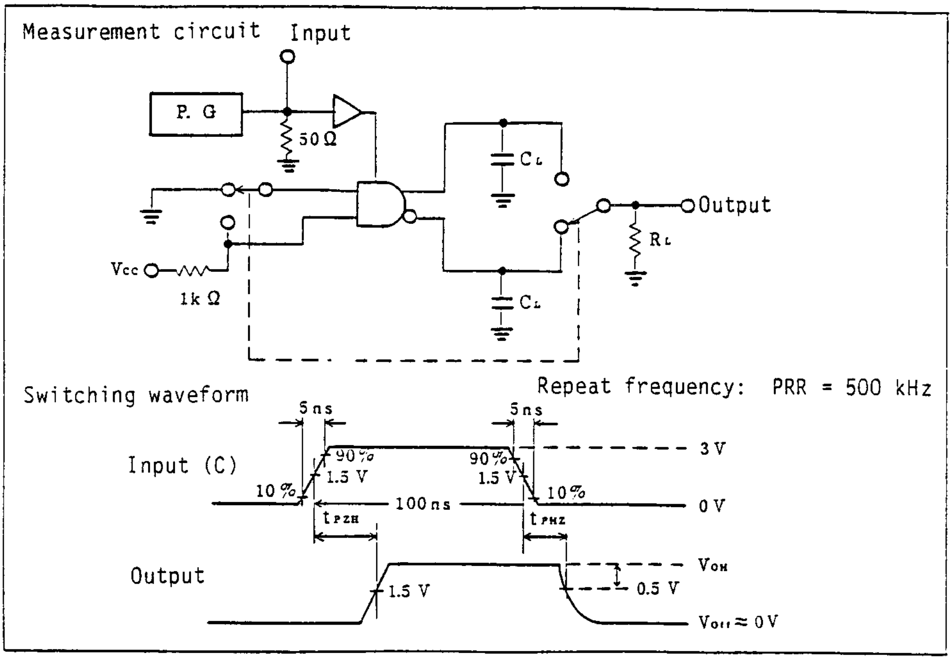

Measurement circuit
Input
P. G
50Ω
CL
Output
RL
Vcc
1k Ω
CL
Switching waveform
Repeat frequency: PRR = 500 kHz
5ns
5ns
Input (C)
90%
1.5 V
10%
90%
1.5 V
10%
3 V
100ns
0 V
tPZH
tPHZ
Output
1.5 V
VOH
0.5 V
VOH ≈ 0 V

Fig. 2

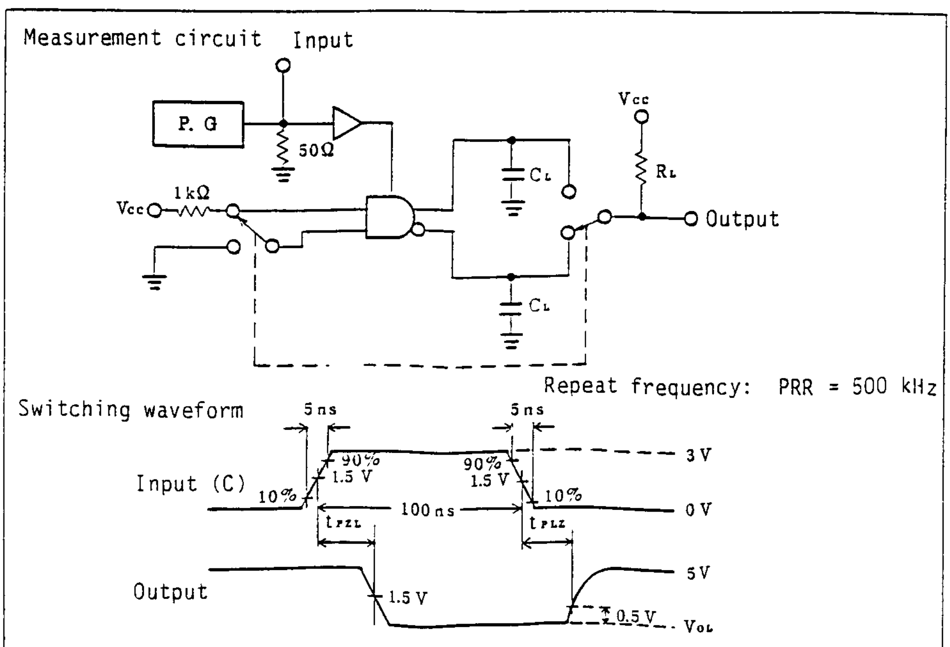
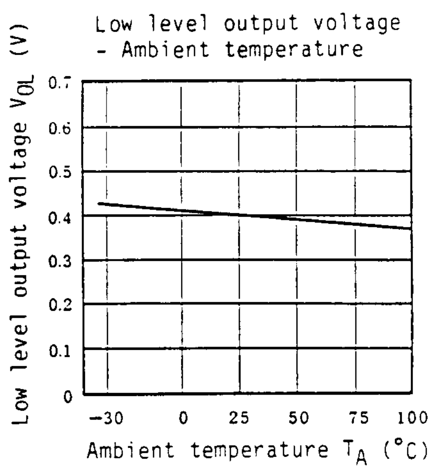
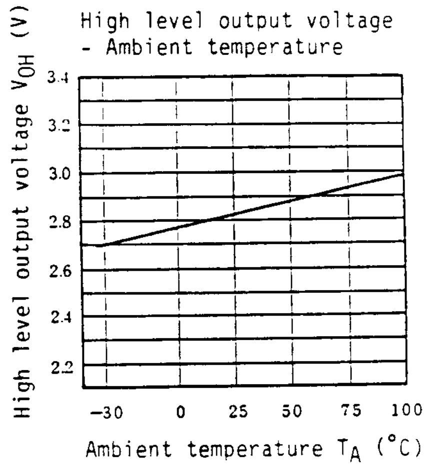
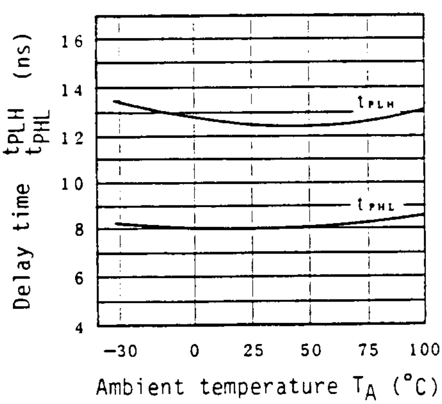

Measurement circuit
Input
P. G
50Ω
Vcc
RL
1kΩ
Vcc
CL
Output
CL
Switching waveform
Repeat frequency: PRR = 500 kHz
5ns
5ns
Input (C)
90%
1.5 V
10%
90%
1.5 V
10%
3 V
100ns
0 V
tPZL
tPLZ
Output
5 V
1.5 V
0.5 V
VOL

Fig. 3

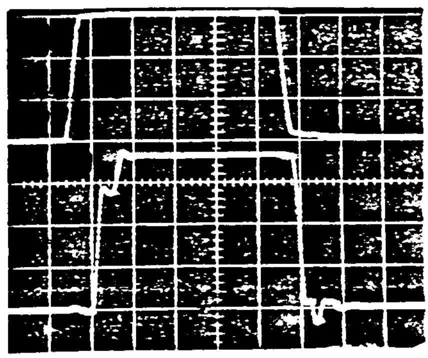
TYPICAL CHARACTERISTIC CURVE







Switching waveform
Input A - Output X



H: 20ns/DIV
V: 1V/DIV

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14–LEAD CERAMIC PACKAGE (CERDIP) DUAL IN–LINE PACKAGE
(CASE No. : DIP–14C–C02

NOT RELEASED