July 1990
Edition 3.0

FUJITSU

DATA SHEET

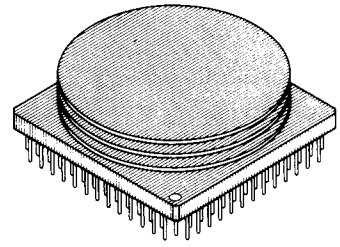
MB768

IBM INTERFACE LINE DRIVER/RECEIVER

IBM INTERFACE LINE DRIVER/RECEIVER (ECL↔IBM) 12 RECEIVER - 12 DRIVER CIRCUITS

The Fujitsu MB768 is a level translator to interface ECL level with IBM level. 12 driver-circuits to translate ECL level into IBM level and another 12 receiver-circuits to translate IBM level into ECL level, are housed in a 88-pin PGA ceramic package with fins.

- Propagation Delay Time – Small skew.
  Driver: $|t_{PLH} - t_{PHL}| \leq 10ns$
  Receiver: $|t_{PLH} - t_{PHL}| \leq 11ns$
  ($T_A = 25°C$)
- High Mounting Density:
  12 Driver/Receiver-circuits are mounted in a package.
- Driver for select-out:
  One of the 12 driver-circuits can use either 5V or 6V as V_{CC}, and can be used as a driver for select-out.
- Package Suffix: -CR.
- No driver output noise at power supply's ON&OFF:
  No noise occurs in driver output when V_{CC1} and V_{CC2} are ON from OFF or OFF from ON with the state that driver output is set to be low level.
- Driver output short protection circuit:
  Output short protection circuit is provided, so that when output pin is short-circuited to be 0V (GND) with the state that driver output is set to be high level, the IC can not be destroyed.



PGA-88C-A06

PIN ASSIGNMENT
(TOP VIEW)

34	33	32	31	30	29	28	27	26	25	24	23
35	72	71	70	69	68	67	66	65	64	63	22
36	73				86	85				62	21
37	74									61	20
38	75									60	19
39	76	87							84	59	18
40	77	88							83	58	17
41	78									57	16
42	79									56	15
43	80	O			81	82				55	14
44	45	46	47	48	49	50	51	52	53	54	13
1	2	3	4	5	6	7	8	9	10	11	12

Notes:
V_{CC1} : 6, 7, 28, 29, 55, 62, 73, 83, 84, 87, 88
(Applied except for driver D1)
V_{CC2} : 80 (Applied to driver D1)
GND : 1, 12, 14, 21, 23, 34, 36, 43, 81, 82, 85, 86
V_{EE} : 13, 22, 35, 44; 49, 50, 67, 68

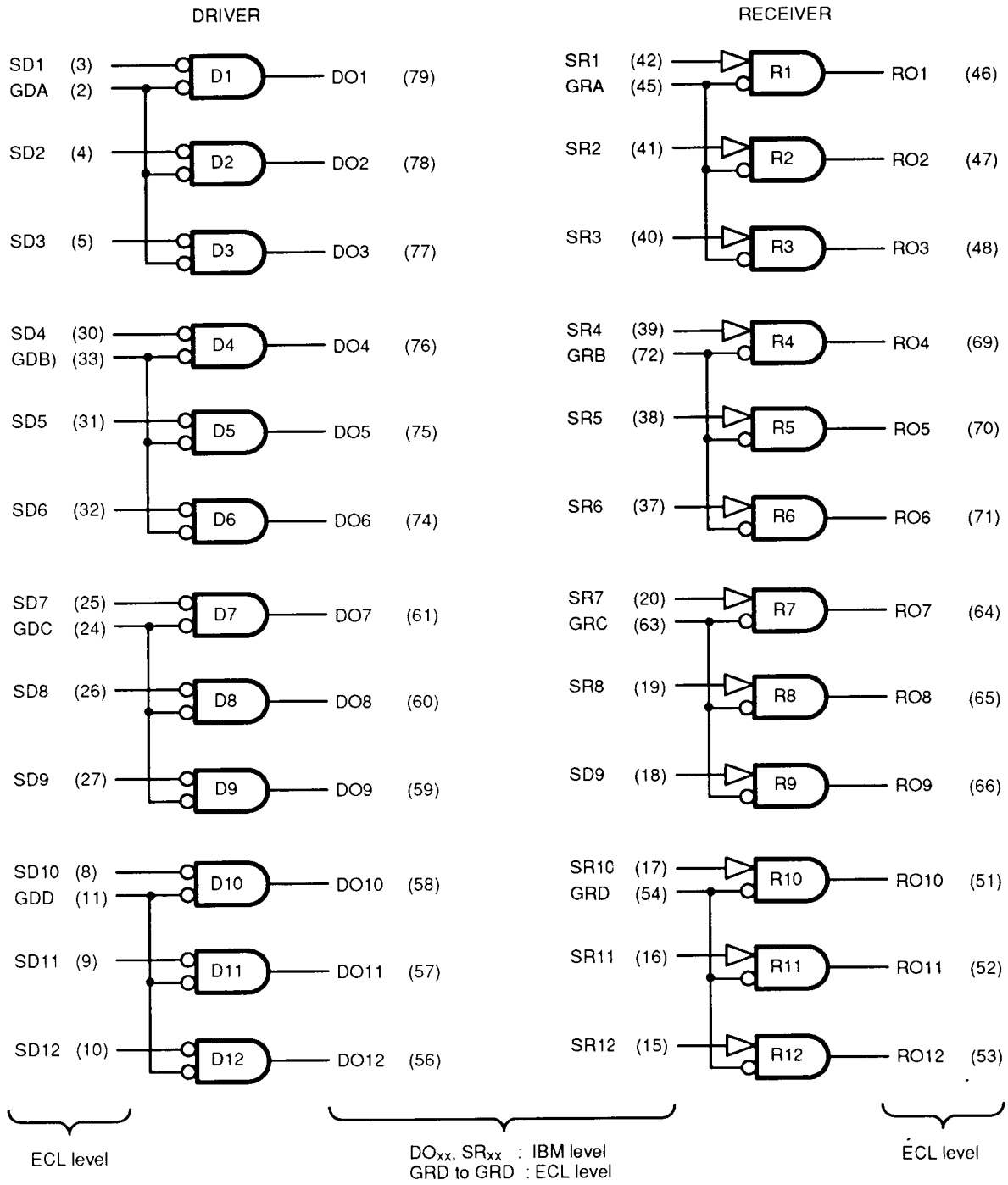
ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Power Supply Voltage	V_{CC1}	–0.5 to +7.0	V
	V_{CC2}	–0.5 to +7.0	V
	V_{EE}	–7.0 to +0.5	V
Driver Input Voltage	V_{ID}	V_{EE} to +0.5	V
Driver Output Voltage	V_{OD}	–0.5 to +7.0	V
Receiver Input Voltage	V_{ISR}	–0.5 to +7.0	V
	V_{IGR}	V_{EE} to +0.5	V
Receiver Output Current	I_{OR}	–40	mA
Operating Ambient Temperature	T_A	0 to 70	°C
Storage Temperature	T_{STG}	–55 to 150	°C

NOTE: Permanent device damage may occur if the above **Absolute Maximum Ratings** are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

Fig. 1 – LOGIC DIAGRAM



RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value	Unit
Power Supply Voltage	V_{CC1}	+5.0 ± 5%	V
	V_{CC2}	+5.0 ± 5% or +6.0 ± 5%	V
	V_{EE}	−5.2 ± 5%	V
Operating Ambient Temperature	T_A	0 to 70	°C
Cooling Condition	Vair	> 2.5	m/s

TRUTH TABLE

DRIVER

INPUT		OUTPUT
SD (ECL)	GD (ECL)	DO (IBM interface)
H	X	L
X	H	L
L	L	H

RECEIVER

INPUT		OUTPUT
SR (IBM interface)	GR (ECL)	RO (ECL)
H	L	H
L	X	L
X	H	L

Note X: Don't Care

ELECTRICAL CHARACTERISTICS

1.DC CHARACTERISTICS

Conditions: Power Supply Voltage; GND = 0V, V_{EE} = –5.2V
Cooling; Velocity of air-flow = 2.5m/s, Temperature T_A = 0 to 70°C

(1) DRIVER

Parameter	Symbol	Condition						Value		Unit
		SD	GD	V_{CC1} (V)	V_{CC2} (V)			Min	Max	
High Level Output Voltage	V_{OH}	LA	L	4.75	4.75	I_{OH} = –59.3mA (T_A = 25°C)		3.11		V
		LA	L	5.25	5.25	I_{OH} = –78.1mA			4.10	V
		LA	L	5.0 ± 5%	5.70	I_{OH} = –41.0mA	Applied to D1	3.90		V
		LA	L	5.0 ± 5%	6.30	I_{OH} = –53.6mA			5.20	V
Low Level Output Voltage	V_{OL}	HA	L	5.25	5.25	I_{OL} = –0.24mA			0.15	V
		HA	L	5.0 ± 5%	6.30	I_{OH} = –1.0mA	Applied to D1		0.15	V
High Level Input Current	I_{IH}	H	L	5.00	5.00	Applied to SD1 to SD12	T_A = 25°C		260	µA
		L	H	5.00	5.00	Applied to GDA to GDD			520	µA
Low Level Input Current	I_{IL}	L	H	5.00	5.00	T_A = 25°C		0.50		µA
High Level Output Leak Current	I_{OH}	L	L	4.75	4.75	V_{OH} = 5V			100	µA
		H	L	4.75	4.75				100	µA
		Open	Open	0	0				100	µA
High Level Output Short-Circuit Current	I_{OS}	L	L	5.25	5.25	V_{OH} = 0V		–30		mA
		L	L	5.0 ± 5%	6.30	V_{OH} = 0V Applied to D1		–30	-	mA

Notes: Regarding SD/GD input value; H, L, HA, and LA, refer to ECL input & output voltage table on page 6 (ECL input/output voltage).

(2) RECEIVER

Parameter	Symbol	Condition					Value		Unit
		SR (V)	GR	V_{CC1} (V)	V_{CC2} (V)		Min	Max	
High Level Input Threshold Voltage	V_{ITH}		L	5.25	5.25	$V_O = V_{OL}$ max Applied to SR1 to SR12 $R_T = 50\Omega$ $V_T = -2.0V$		1.55	V
Low Level Input Threshold Voltage	V_{ITL}		L	4.75	4.75	$V_O = V_{OH}$ min Applied to SR1 to SR12 $R_T = 50\Omega$ $V_T = -2.0V$	1.15		V
High Level Input Current	I_{IH}	3.11	L	4.75	4.75	Applied to SR1 to SR12		0.42	mA
Low Level Input Current	I_{IL}	0.15	L	5.25	5.25	Applied to SR1 to SR12	–0.24	0.04	mA
Input Resistance	R_{IN}		OPEN	0	0	Applied to SR1 to SR12	7.4	20	kΩ
High Level Output Voltage	V_{OH}	4.50	LA	5.00	5.00	$R_T = 50\Omega$ $V_T = -2.0V$	V_{OH} min	V_{OH} max	V
Low Level Output Voltage	V_{OL}	4.50	HA	5.00	5.00	$R_T = 50\Omega$ $V_T = -2.0V$	V_{OL} min	V_{OL} max	V
		OPEN	LA	5.00	5.00				
High Level Input Current	I_{IHG}	4.50	H	5.00	5.00	Applied to GRA to GRD $T_A = 25°C$		520	µA
Low Level Input Current	I_{ILG}	OPEN	L	5.00	5.00	Applied to GRA to GRD $T_A = 25°C$	0.5		µA

Note: Regarding "V_{OH} min, V_{OH} max for V_{OH} value", "V_{OL} min, V_{OL} max for V_{OL} value", and "GR input H, L, HA, LA", refer to ECL input & output Voltage table on page 6 (ECL input/output Voltage).

(3) DRIVER/RECEIVER

Parameter	Symbol	Condition					Value		Unit
		SD	GD	V_{CC1} (V)	V_{CC2} (V)		Min	Max	
Power Supply Current (V_{CC1})	I_{CC1H}	L	L	5.25	5.25	DO1 to DO12, SRA to SRD: OPEN V_{EE} = –5.46V		210	mA
	I_{CC1L}	H	L	5.25	5.25			295	mA
Power Supply Current (V_{CC2})	I_{CC2H}	L	L	5.25	6.30			9	mA
	I_{CC2L}	H	L	5.25	6.30			20	mA
Power Supply Current (V_{EE})	IEE	L	L	5.25	5.25		–325		mA

Note: Refer to the table below regarding SD/GD input value; H and L.

(4) ECL INPUT/OUTPUT VOLTAGE

T_A (°C)	Input Voltage (V)				Output Voltage (V)			
	H	L	HA	LA	V_{OH} max	V_{OH} min	V_{OL} max	V_{OL} min
0	–0.840	–1.870	–1.150	–1.485		–1.020	–1.630	–1.950
25	–0.810	–1.850	–1.105	–1.475	–0.760	–0.980	–1.630	–1.950
70	–0.720	–1.830	–1.055	–1.450		–0.920	–1.605	–1.950

2. AC CHARACTERISTICS

Condition; Power Supply Voltage: GND = 0V, V_{EE} = −5.2V
Cooling : Velocity of air-flow = 2.5m/s, T_A = 25°C.

(1) DRIVER

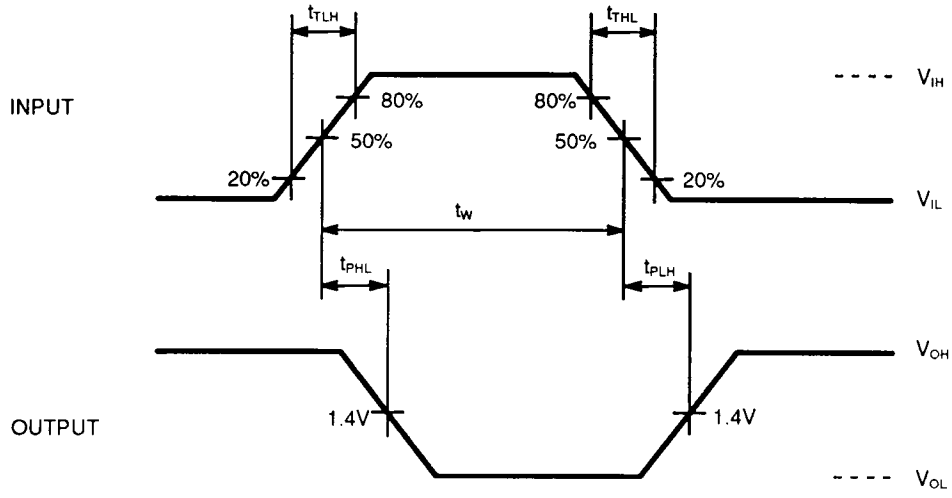
Parameter	Symbol	Condition			Value		Unit
		V_{CC1} (V)	V_{CC2} (V)		Min	Max	
Propagation Delay Time	t_{PLH}	5.00	5.00	SDn to DOn, GDx to DOn R_T = 50Ω to GND (Other input/output pins are open)	3.5	13.5	ns
	t_{PHL}	5.00	5.00		3.5	13.5	ns
Propagation Delay Time	t_{PLH}	5.00	6.00	Applied to SD1 to DO1, GD1 to DO1 R_T = 50Ω to GND (Other input/output pins are open)	3.0	13.0	ns
	t_{PHL}	5.00	6.00		3.0	13.0	ns

(2) RECEIVER

Parameter	Symbol	Condition			Value		Unit
		V_{CC1} (V)	V_{CC2} (V)		Min	Max	
Propagation Delay Time	t_{PLH}	5.00	5.00	SRn to ROn R_T = 50Ω, V_T=−2.0V (Other input/output pins are open)	6.0	14.0	ns
	t_{PHL}	5.00	5.00		6.0	14.0	ns
Propagation Delay Time	t_{PLH}	5.00	5.00	GRx to ROn, V_{ISRN} = 4.5V R_T = 50Ω, V_T=−2.0V (Other input/output pins are open)	1.0	4.0	ns
	t_{PHL}	5.00	5.00		1.0	4.0	ns

Fig. 2 – DRIVER INPUT/OUTPUT WAVEFORM

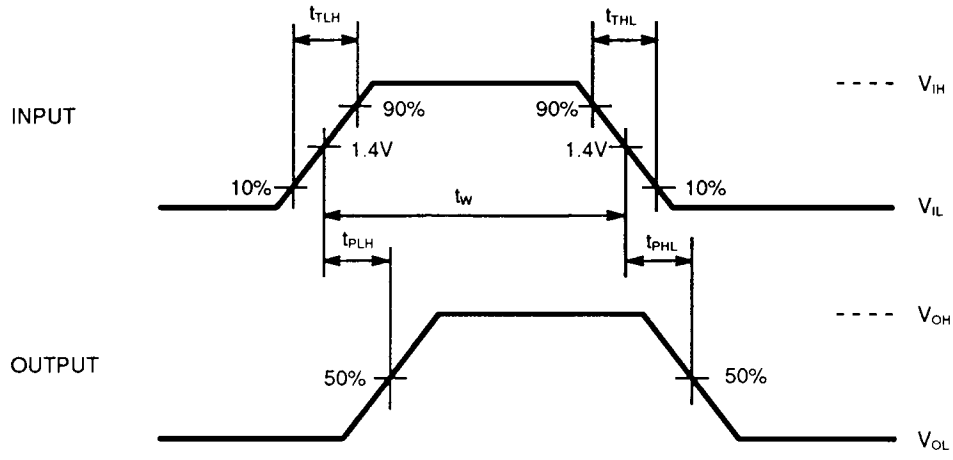
• SDn to DOn, GDx to DOn



(INPUT PULSE CONDITION): f = 1MHz, t_W = 500ns
$t_{TLH} = t_{THL}$ = 2ns
V_{IH} = –0.90V, V_{IL} = –1.70V

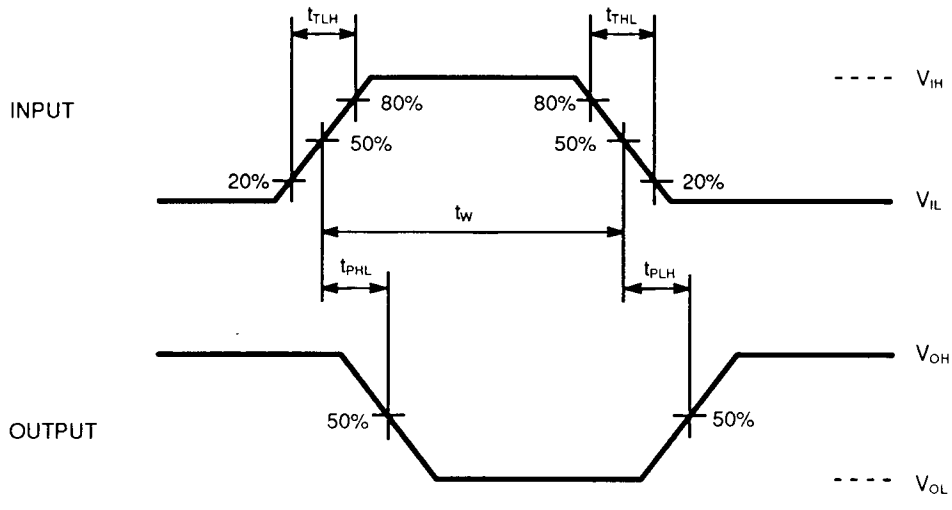
Fig. 3 – RECEIVER INPUT/OUTPUT WAVEFORM

• SRn to ROn



(INPUT PULSE CONDITION): f = 1MHz, t_W = 500ns
$t_{TLH} = t_{THL}$ = 10ns
V_{IH} = 3.0V, V_{IL} = 0V

• GRx to ROn



(INPUT PULSE CONDITION): f = 1MHz, t_W = 500ns
$t_{TLH} = t_{THL}$ = 2ns
V_{IH} = –0.90V, V_{IL} = –1.70V

TYPICAL CHARACTERISTICS CURVES

Fig. 4 – OUTPUT CURRENT vs. OUTPUT VOLTAGE (FOR DRIVER)

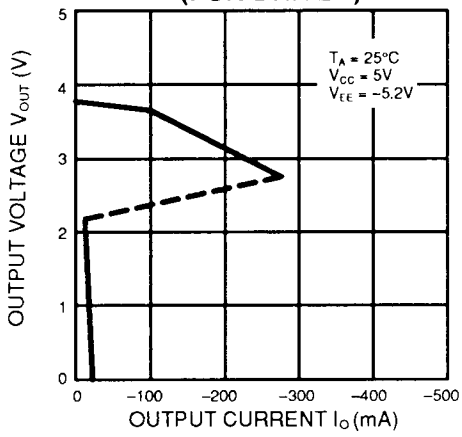


Fig. 5 – INPUT VOLTAGE vs. OUTPUT VOLTAGE (FOR DRIVER)

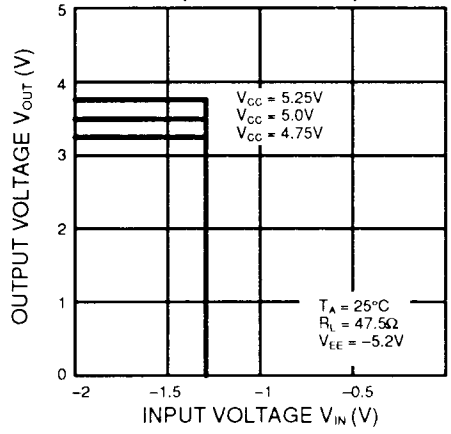


Fig. 6 – INPUT VOLTAGE vs. OUTPUT VOLTAGE (FOR RECEIVER) (SRn→Ron)

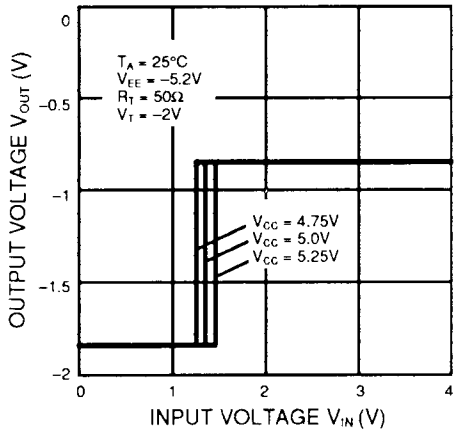


Fig. 7 – INPUT VOLTAGE vs. OUTPUT VOLTAGE (FOR RECEIVER) (GRx→Ron)

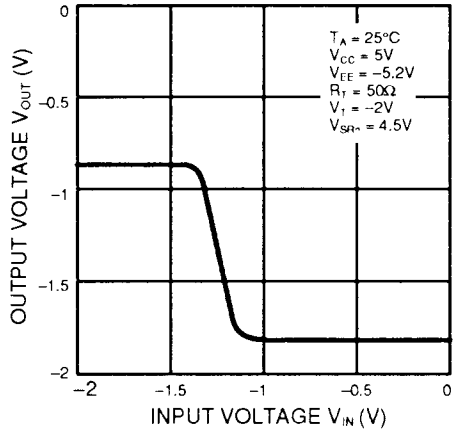
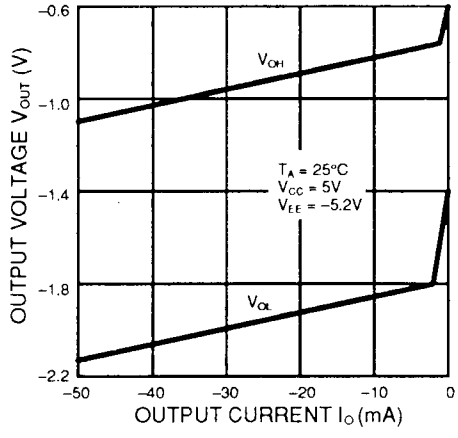


Fig. 8 – OUTPUT CURRENT vs. OUTPUT VOLTAGE (FOR RECEIVER)



TYPICAL CHARACTERISTICS CURVES (Continued)

Fig. 9 – OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE (FOR RECEIVER)

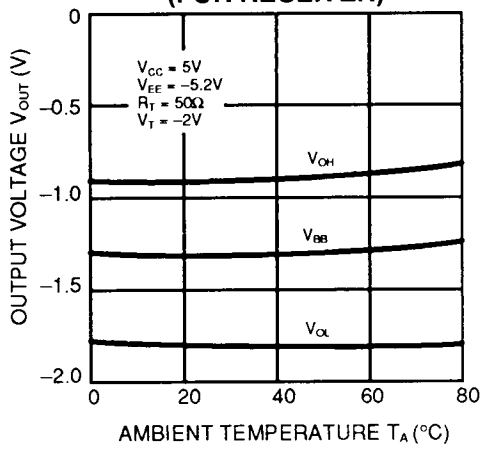


Fig. 10 – PROPAGATION DELAY TIME vs. AMBIENT TEMPERATURE (FOR DRIVER)

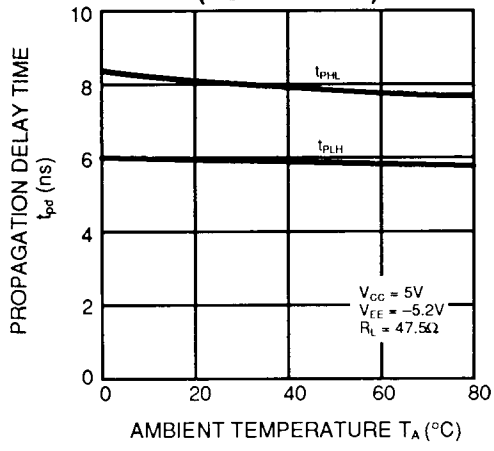


Fig. 11 – PROPAGATION DELAY TIME vs. AMBIENT TEMPERATURE (FOR RECEIVER)(SRn→Ron)

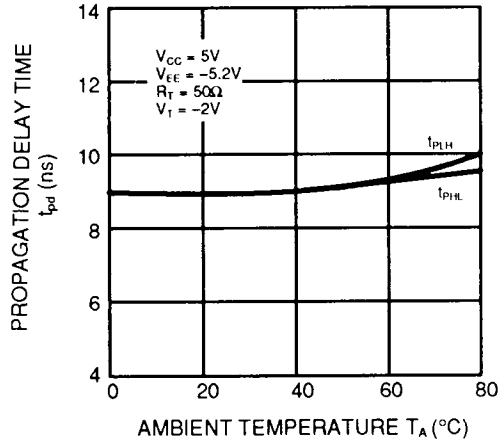
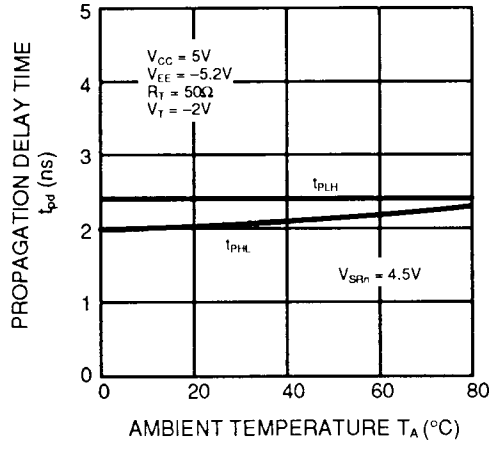
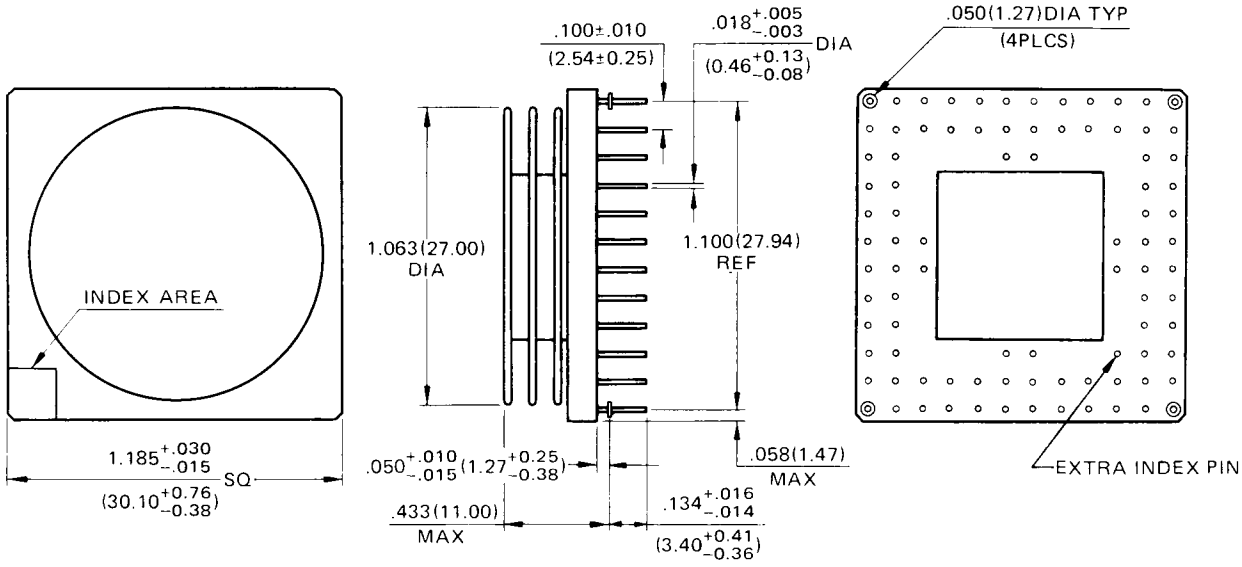


Fig. 12 – PROPAGATION DELAY TIME vs. AMBIENT TEMPERATURE (FOR RECEIVER)(GRx→Ron)



PACKAGE DIMENSIONS

88-LEAD CERAMIC (METAL SEAL) PIN GRID ARRAY PACKAGE
(CASE No.: PGA-88C-A06)



Dimensions in
inches (millimeters)

FUJITSU LIMITED

For further information please contact:

Japan
FUJITSU LIMITED
Integrated Circuits and Semiconductor Marketing
Furukawa Sogo Bldg., 6–1, Marunouchi 2–chome
Chiyoda–ku, Tokyo 100, Japan
Tel: (03) 216–3211
Telex: 781–2224361
FAX: (03) 216–9771

North and South America
FUJITSU MICROELECTRONICS, INC.
Integrated Circuits Division
3545 North First Street
San Jose, CA 95134–1804 USA
Tel: 408–922–9000
Telex: 910–338–0190
FAX: 408–432–9044

Europe
FUJITSU MIKROELEKTRONIK GmbH
Arabella Centre 9. OG
Lyoner Strasse 44–48
D–6000 Frankfurt 71
F.R. Germany
Tel: (069) 66320
Telex: 411963
FAX: (069) 6632122

Asia
FUJITSU MICROELECTRONICS ASIA PTE LIMITED
#06–04 to #06–07
Plaza By The Park
No. 51 Bras Basah Road
Singapore 0719
Tel: 336–1600
Telex: 55573
FAX: 336–1609

Printed in Japan PV0069–907A3