MOTOROLA

MC3448A

Quad Bidirectional Instrumentation Bus (GPIB) Transceiver

QUAD THREE–STATE BUS TRANSCEIVER WITH TERMINATION NETWORKS

SEMICONDUCTOR TECHNICAL DATA

This bidirectional bus transceiver is intended as the interface between TTL or MOS logic and the IEEE Standard Instrumentation Bus (488–1978, often referred to as GPIB). The required bus termination is internally provided.

Each driver/receiver pair forms the complete interface between the bus and an instrument. Either the driver or the receiver of each channel is enabled by its corresponding Send/Receive input with the disabled output of the pair forced to a high impedance state. An additional option allows the driver outputs to be operated in an open collector* or active pull–up configuration. The receivers have input hysteresis to improve noise margin, and their input loading follows the bus standard specifications.

- Four Independent Driver/Receiver Pairs
- Three–State Outputs
- High Impedance Inputs
- Receiver Hysteresis – 600 mV (Typical)
- Fast Propagation Times – 15 to 20 ns (Typical)
- TTL Compatible Receiver Outputs
- Single 5.0 V Supply
- Open Collector Driver Output Option*
- Power Up/Power Down Protection (No Invalid Information Transmitted to Bus)
- No Bus Loading When Power Is Removed From Device
- Terminations Provided: Termination Removed When Device is Unpowered

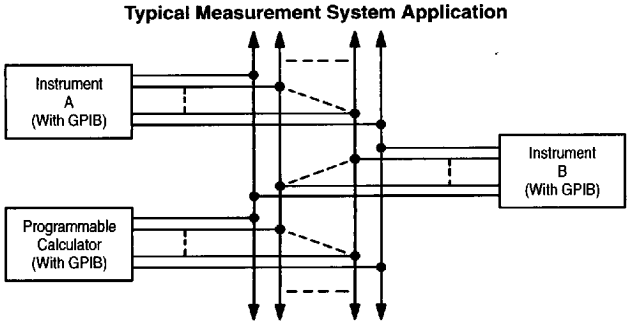
* Selection of the "Open Collector" configuration, in fact, selects an open collector device with a passive pull–up load/termination which conforms to Figure 7, IEEE 488–1978 Bus Standard.

TRUTH TABLE

Send/Rec.	Enable	Info. Flow	Comments
0	X	Bus Data	–
1	1	Data Bus	Active Pull–Up
1	0	Data Bus	Open Col.

X = Don't Care

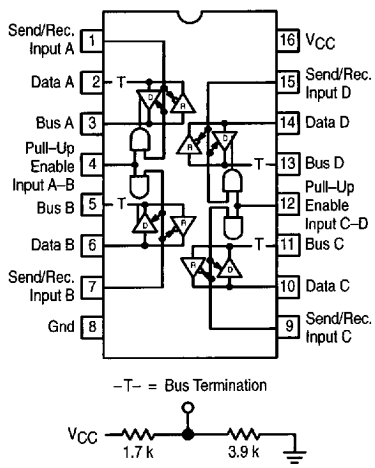
Typical Measurement System Application



D SUFFIX
PLASTIC PACKAGE
CASE 751B
(SO–16)

P SUFFIX
PLASTIC PACKAGE
CASE 648

PIN CONNECTIONS



ORDERING INFORMATION

Device	Operating Temperature Range	Package
MC3448AP	T_A = 0 to +70°C	Plastic DIP
MC3448AD		SO–16

MAXIMUM RATINGS (T_A = 25°C, unless otherwise noted)

Rating	Symbol	Value	Unit
Power Supply Voltage	V_{CC}	7.0	Vdc
Input Voltage	V_I	5.5	Vdc
Driver Output Current	$I_{O(D)}$	150	mA
Junction Temperature	T_J	150	°C
Operating Ambient Temperature Range	T_A	0 to +70	°C
Storage Temperature Range	T_{stg}	−65 to +150	°C

ELECTRICAL CHARACTERISTICS (Unless otherwise noted, 4.75 V ≤ V_{CC} ≤ 5.25 V and 0 ≤ T_A ≤ 70°C; typical values are at T_A = 25°C, V_{CC} = 5.0 V)

Characteristic	Symbol	Min	Typ	Max	Unit
Bus Voltage (Bus Pin Open) ($V_{I(S/R)}$ = 0.8 V) ($I_{(BUS)}$ = −12 mA)	 $V_{(BUS)}$ $V_{IC(BUS)}$	 2.75 –	 – –	 3.7 −1.5	V
Bus Current (5.0 V ≤ $V_{(BUS)}$ ≤ 5.5 V) ($V_{(BUS)}$ = 0.5 V) (V_{CC} = 0 V, 0 V ≤ $V_{(BUS)}$ ≤ 2.75 V)	$I_{(BUS)}$	 0.7 1.3 –	 – – –	 2.5 −3.2 +0.04	mA
Receiver Input Hysteresis ($V_{I(S/R)}$ = 0.8 V)	–	400	600	–	mV
Receiver Input Threshold ($V_{I(S/R)}$ = 0.8 V, Low to High) ($V_{I(S/R)}$ = 0.8 V, High to Low)	 $V_{ILH(R)}$ $V_{IHL(R)}$	 – 0.8	 1.6 1.0	 1.8 –	V
Receiver Output Voltage – High Logic State ($V_{I(S/R)}$ = 0.8 V, $I_{OH(R)}$ = −800 µA, $V_{(BUS)}$ = 2.0 V)	$V_{OH(R)}$	2.7	–	–	V
Receiver Output Voltage – Low Logic State ($V_{I(S/R)}$ = 0.8 V, $I_{OL(R)}$ = 16 mA, $V_{(BUS)}$ = 0.8 V)	$V_{OL(R)}$	–	–	0.5	V
Receiver Output Short Circuit Current ($V_{I(S/R)}$ = 0.8 V, $V_{(Bus)}$ = 2.0 V)	$I_{OS(R)}$	−15	–	−75	mA
Driver Input Voltage – High Logic State ($V_{I(S/R)}$ = 2.0 V)	$V_{IH(D)}$	2.0	–	–	V
Driver Input Voltage – Low Logic State ($V_{I(S/R)}$ = 2.0 V)	$V_{IL(D)}$	–	–	0.8	V
Driver Input Current – Data Pins ($V_{I(S/R)}$ = $V_{I(E)}$ = 2.0 V) (0.5 ≤ $V_{I(D)}$ ≤ 2.7 V) ($V_{I(D)}$ = 5.5 V)	 $I_{I(D)}$ $I_{IB(D)}$	 −200 –	 – –	 40 200	µA
Input Current – Send/Receive (0.5 ≤ $V_{I(S/R)}$ ≤ 2.7 V) ($V_{I(S/R)}$ = 5.5 V)	 $I_{I(S/R)}$ $I_{IB(S/R)}$	 −100 –	 – –	 20 100	µA
Input Current – Enable (0.5 ≤ $V_{I(E)}$ ≤ 2.7 V) ($V_{I(E)}$ = 5.5 V)	 $I_{I(E)}$ $I_{IB(E)}$	 −200 –	 – –	 20 100	µA
Driver Input Clamp Voltage ($V_{I(S/R)}$ = 2.0 V, $I_{IC(D)}$ = −18 mA)	$V_{IC(D)}$	–	–	−1.5	V
Driver Output Voltage – High Logic State ($V_{I(S/R)}$ = 2.0 V, $V_{IH(D)}$ = 2.0 V, $V_{IH(E)}$ = 2.0 V, I_{OH} = −5.2 mA)	$V_{OH(D)}$	2.5	–	–	V
Driver Output Voltage – Low Logic State (Note 1) ($V_{I(S/R)}$ = 2.0 V, $I_{OL(D)}$ = 48 mA)	$V_{OL(D)}$	–	–	0.5	V
Output Short Circuit Current ($V_{I(S/R)}$ = 2.0 V, $V_{IH(D)}$ = 2.0 V, $V_{IH(E)}$ = 2.0 V)	$I_{OS(D)}$	−30	–	−120	mA
Power Supply Current (Listening Mode – All Receivers On) (Talking Mode – All Drivers On)	 I_{CCL} I_{CCH}	 – –	 63 106	 85 125	mA

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SWITCHING CHARACTERISTICS (V_{CC} = 5.0 V, T_A = 25°C, unless otherwise noted)

Propagation Delay of Driver					ns
(Output Low to High)	$t_{PLH(D)}$	–	–	15	
(Output High to Low)	$t_{PHL(D)}$	–	–	17	
Propagation Delay of Receiver					ns
(Output Low to High)	$t_{PLH(R)}$	–	–	25	
(Output High to Low)	$t_{PHL(R)}$	–	–	23	

NOTE: 1. A modification of the IEEE-488–1978 Bus Standard changes $V_{OL(D)}$ from 0.4 to 0.5 V maximum to permit the use of Schottky technology.

SWITCHING CHARACTERISTICS (continued) (V_{CC} = 5.0 V, T_A = 25°C, unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Propagation Delay Time – Send/Receive to Data					ns
Logic High to Third State	$t_{PHZ(R)}$	–	–	30	
Third State to Logic High	$t_{PZH(R)}$	–	–	30	
Logic Low to Third State	$t_{PLZ(R)}$	–	–	30	
Third State to Logic Low	$t_{PZL(R)}$	–	–	30	
Propagation Delay Time – Send/Receive to Bus					ns
Logic High to Third State	$t_{PHZ(D)}$	–	–	30	
Third State to Logic High	$t_{PZH(D)}$	–	–	30	
Logic Low to Third State	$t_{PLZ(D)}$	–	–	30	
Third State to Logic Low	$t_{PZL(D)}$	–	–	30	
Turn–On Time – Enable to Bus					ns
Pull–Up Enable to Open Collector	$t_{POFF(E)}$	–	–	30	
Open Collector to Pull–Up Enable	$t_{PON(E)}$	–	–	20	

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PROPAGATION DELAY TEST CIRCUITS AND WAVEFORMS

Figure 1. Bus Input to Data Output (Receiver)

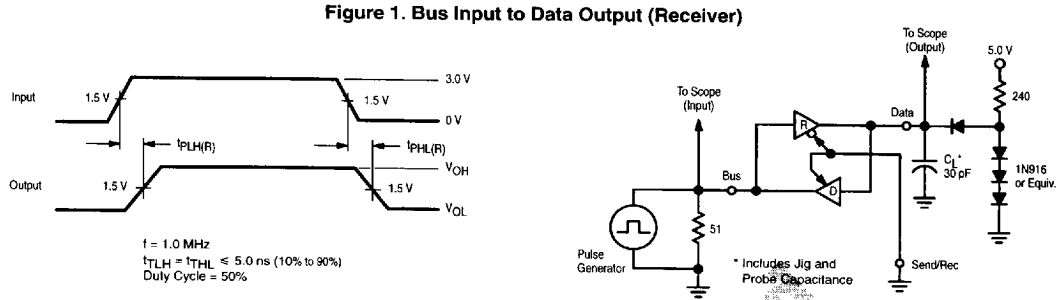


Figure 2. Data Input to Bus Output (Driver)

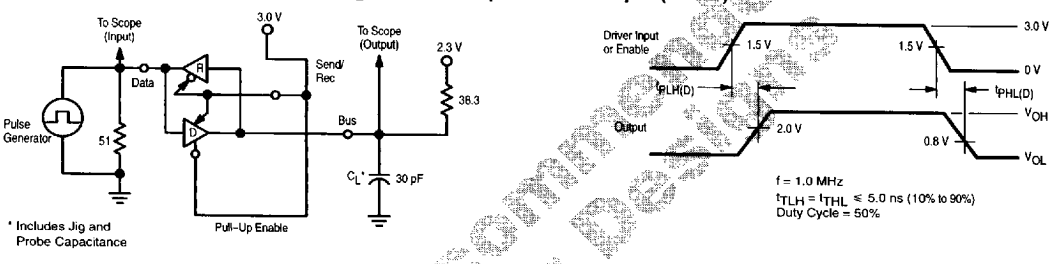


Figure 3. Send/Receive Input to Bus Output (Driver)

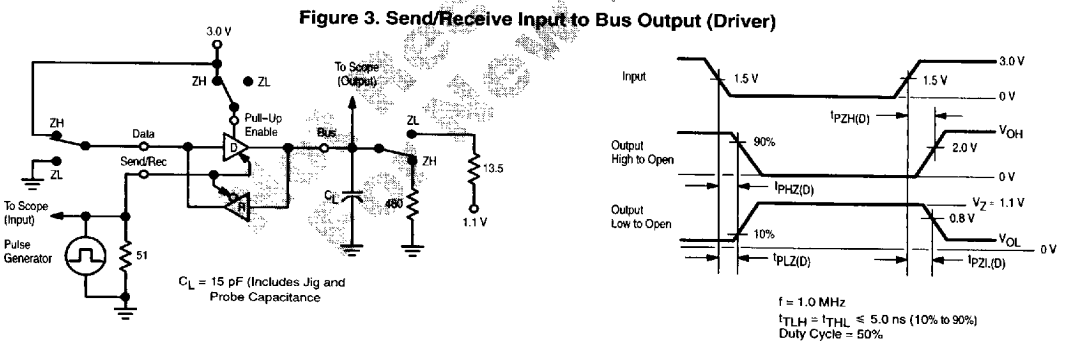
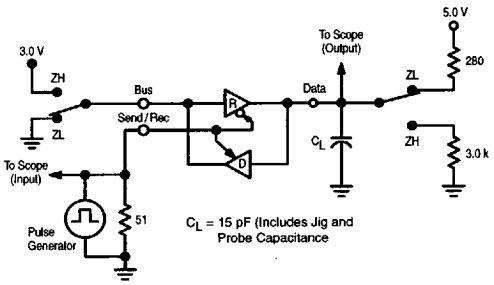


Figure 4. Send/Receive Input to Data Output (Receiver)



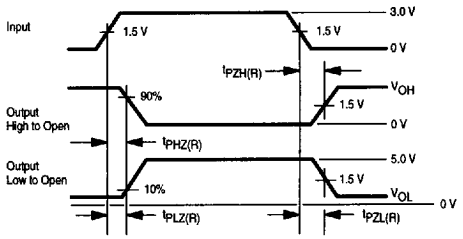
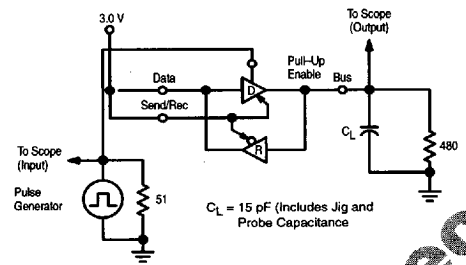


Figure 5. Enable Input to Bus Output (Driver)



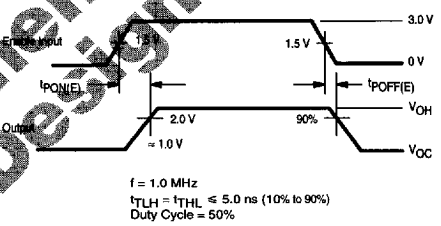


Figure 6. Typical Receiver Hysteresis Characteristics

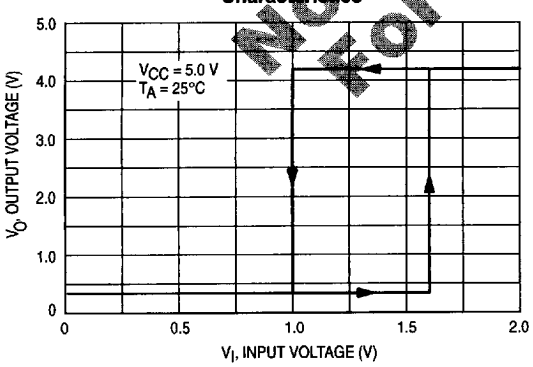


Figure 7. Typical Bus Load Line

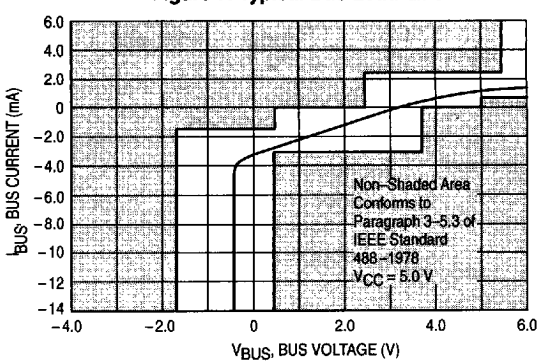
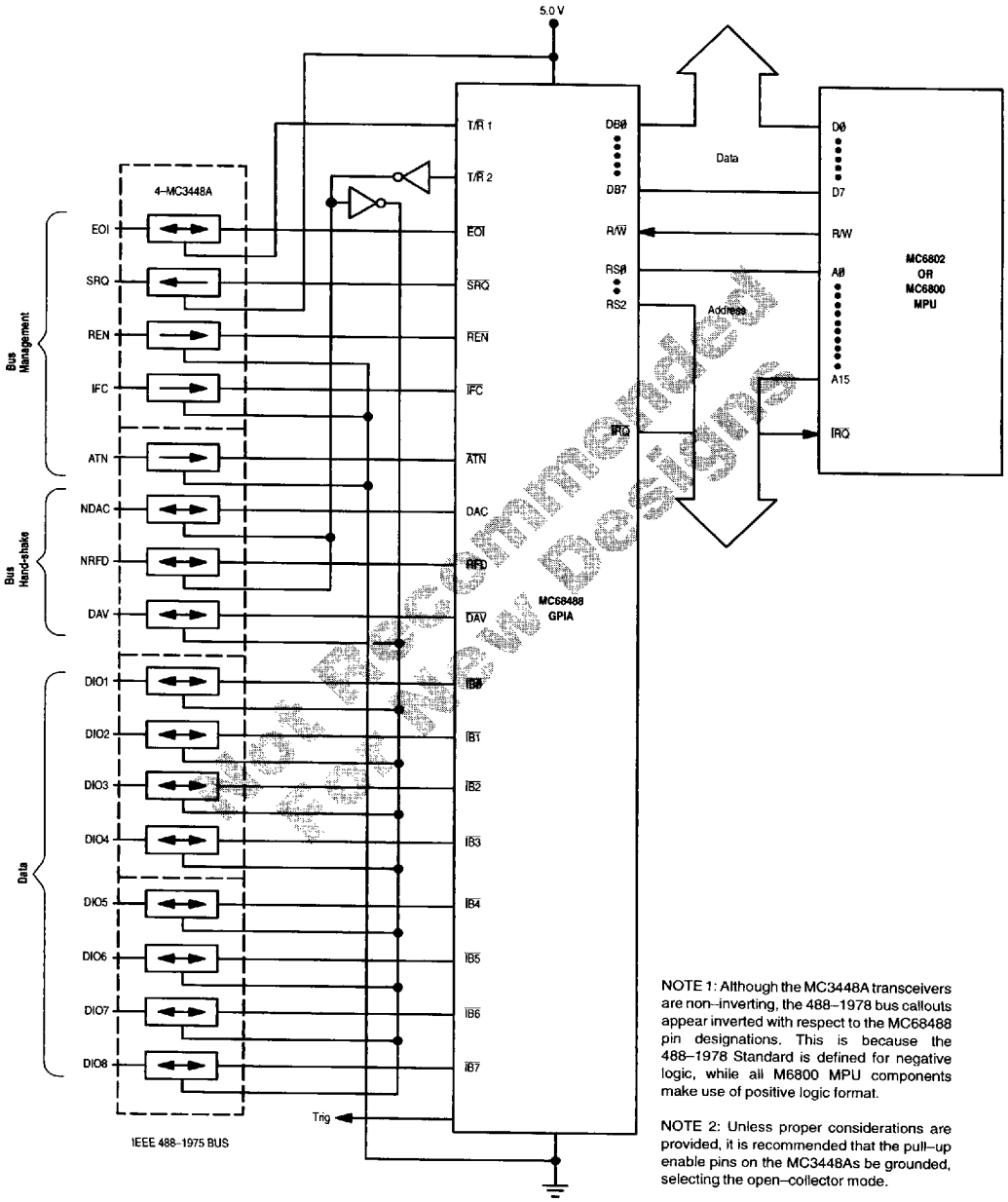


Figure 8. Simple System Configuration



NOTE 1: Although the MC3448A transceivers are non–inverting, the 488–1978 bus callouts appear inverted with respect to the MC68488 pin designations. This is because the 488–1978 Standard is defined for negative logic, while all M6800 MPU components make use of positive logic format.

NOTE 2: Unless proper considerations are provided, it is recommended that the pull–up enable pins on the MC3448As be grounded, selecting the open–collector mode.