Am8216 • Am8226

Four-Bit Parallel Bidirectional Bus Driver

Distinctive Characteristics

- Data bus buffer driver for 8080 type CPU's
- Low input load current – 0.25mA maximum
- High output drive capability for driving system data bus – 50mA at 0.5V
- Am8216 has non-inverting outputs
- Output high voltage compatible with direct interface to MOS
- Three-state outputs
- Advanced Schottky processing
- Available in military and commercial temperature range
- Am8226 has inverting outputs

FUNCTIONAL DESCRIPTION

The Am8216 and Am8226 are four-bit, bi-directional bus drivers for use in bus oriented applications. The non-inverting Am8216, and inverting Am8226 drivers are provided for flexibility in system design.

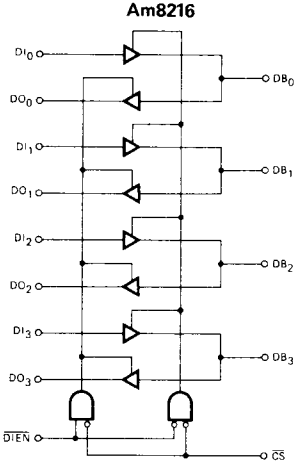
Each buffered line of the four bit driver consists of two separate buffers that are three-state to achieve direct bus interface and bi-directional capability. On one side of the driver the output of one buffer and the input of another are tied together (DB), this side is used to interface to the system side components such as memories, I/O, etc., because its interface is TTL compatible and it has high drive (50mA). On the other side of the driver the inputs and outputs are separated to provide maximum flexibility. Of course, they can be tied together so that the driver can be used to buffer a true bi-directional bus. The DO outputs on this side of the driver have a special high voltage output drive capability so that direct interface to the 8080 type CPUs is achieved with an adequate amount of noise immunity.

The $\overline{CS}$ input is a device enable. When it is "high" the output drivers are all forced to their high-impedance state. When it is a "LOW" the device is enabled and the direction of the data flow is determined by the $\overline{DIEN}$ input.

The $\overline{DIEN}$ input controls the direction of data flow which is accomplished by forcing one of the pair of buffers into its high impedance state and allowing the other to transmit its data. A simple two gate circuit is used for this function.

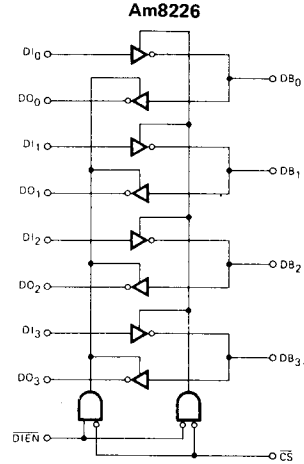
LOGIC DIAGRAMS

Am8216



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Am8226



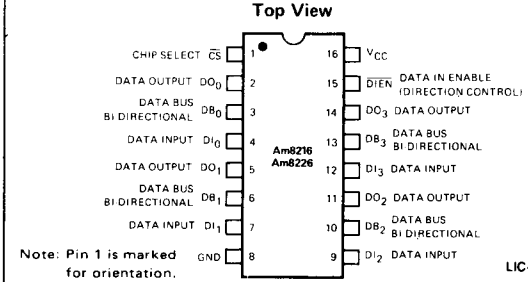
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ORDERING INFORMATION

Package Type	Temperature Range	Am8216 Order Number	Am8226 Order Number
Hermetic DIP	–55°C to +125°C	MD8216	MD8226
Hermetic DIP	0°C to +70°C	D8216	D8226
Molded DIP	0°C to +70°C	P8216	P8226
Dice	0°C to +70°C	AM8216XC	AM8226XC

CONNECTION DIAGRAM

Top View



Note: Pin 1 is marked for orientation.

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MAXIMUM RATINGS (Above which the useful life may be impaired)

Temperature (Ambient) Under Bias	−55°C to +125°C
Storage Temperature	−65°C to +150°C
All Output and Supply Voltages	−0.5 V to +7.0 V
All Input Voltages	−1.0 V to +5.5 V
Output Currents	125 mA

Am8216 AND Am8226 MILITARY ELECTRICAL CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (−55°C to +125°C)

The following conditions apply unless otherwise specified:

MD8216, MD8226 (MIL) $T_A = -55°C$ to $+125°C$ $V_{CC} = 5.0V \pm 10\%$

DC CHARACTERISTICS

Parameters	Description		Test Conditions		Min.	Typ. (Note 1)	Max.	Units
I_{F1}	Input Load Current $\overline{DIEN}$, $\overline{CS}$		$V_F = 0.45$			−0.15	−0.5	mA
I_{F2}	Input Load Current All Other Inputs		$V_F = 0.45$			−0.08	−0.25	mA
I_{R1}	Input Leakage Current $\overline{DIEN}$, $\overline{CS}$		$V_R = 5.5V$				80	μA
I_{R2}	Input Leakage Current DI Inputs		$V_R = 5.5V$				40	μA
V_C	Input Forward Voltage Clamp		$I_C = -5.0mA$				−1.2	Volts
V_{IL}	Input LOW Voltage	Am8216					0.95	Volts
		Am8226					0.9	
V_{IH}	Input HIGH Voltage				2.0			Volts
I_O	Output Leakage Current (Three-State)	DO	$V_O = 0.45V/5.5V$				20	μA
		DB					100	
I_{CC}	Power Supply Current	Am8216				95	130	mA
		Am8226				85	120	
V_{OL1}	Output LOW Voltage		DO Outputs $I_{OL} = 15mA$ DB Outputs $I_{OL} = 25mA$			0.3	0.45	Volts
V_{OL2}	Output LOW Voltage		DB Outputs $I_{OL} = 45mA$			0.5	0.6	Volts
V_{OH1}	Output HIGH Voltage		DO Outputs	$I_{OH} = -0.5mA$	3.4	4.0		Volts
				$I_{OH} = -2.0mA$	2.4			
V_{OH2}	Output HIGH Voltage		DB Outputs $I_{OH} = -5.0mA$		2.4	3.0		Volts
I_{OS}	Output Short Circuit Current		DO Outputs = 0V, $V_{CC} = 5.0V$		−15	−35	−65	mA
			DB Outputs = 0V, $V_{CC} = 5.0V$		−30	−75	−120	

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AC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (−55°C to +125°C)

Parameters	Description		Test Conditions	Min.	Typ. (Note 1)	Max.	Units
t_{PD1}	Input to Output Delay DO Outputs		$C_L = 30pF$, $R_1 = 300\Omega$, $R_2 = 600\Omega$		15	25	ns
t_{PD2}	Input to Output Delay DB Outputs	Am8216	$C_L = 300pF$, $R_1 = 90\Omega$, $R_2 = 180\Omega$		20	33	ns
		Am8226			16	25	
t_E	Output Enable Time	Am8216	Note 2		45	75	ns
		Am8226	Note 3		35	62	
t_D	Output Disable Time	Am8216	Note 4		20	40	ns
		Am8226			16	38	

Am8216 AND Am8226 COMMERCIAL ELECTRICAL CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (0°C to +70°C)

The following conditions apply unless otherwise specified:

D8216, D8226, P8216, P8226 (COM'L) $T_A = 0°C$ to $+70°C$ $V_{CC} = 5.0V \pm 5\%$

DC CHARACTERISTICS

Parameters	Description		Test Conditions	Min.	Typ. (Note 1)	Max.	Units
I_{F1}	Input Load Current $\overline{DIEN}$, $\overline{CS}$		$V_F = 0.45$		−0.15	−0.5	mA
I_{F2}	Input Load Current All Other Inputs		$V_F = 0.45$		−0.08	−0.25	mA
I_{R1}	Input Leakage Current $\overline{DIEN}$, $\overline{CS}$		$V_R = 5.25V$			20	μA
I_{R2}	Input Leakage Current DI Inputs		$V_R = 5.25V$			10	μA
V_C	Input Forward Voltage Clamp		$I_C = -5.0mA$			−1.0	Volts
V_{IL}	Input LOW Voltage					0.95	Volts
V_{IH}	Input HIGH Voltage			2.0			Volts
$\|I_{OL}\|$	Output Leakge Current (Three-State)	DO	$V_O = 0.45V/5.5V$			20	μA
		DB				100	
I_{CC}	Power Supply Current	Am8216			95	130	mA
		Am8226			85	120	
V_{OL1}	Output LOW Voltage		DB Outputs $I_{OL} = 15mA$ DB Outputs $I_{OL} = 25mA$		0.3	0.45	Volts
V_{OL2}	Output LOW Voltage	Am8216	DB Outputs $I_{OL} = 55mA$		0.5	0.6	Volts
		Am8226	DB Outputs $I_{OL} = 50mA$		0.5	0.6	
V_{OH1}	Output HIGH Voltage		DO Outputs $I_{OH} = -1.0mA$ COM'L	3.65	4.0		Volts
V_{OH2}	Output HIGH Voltage		DB Outputs $I_{OH} = -10mA$	2.4	3.0		Volts
I_{OS}	Output Short Circuit Current		DO Outputs ≅ 0V	−15	−35	−65	mA
			DB Outputs $V_{CC} = 5.0V$	−30	−75	−120	

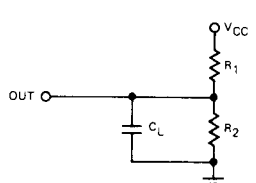
AC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (0°C to +70°C)

Parameters	Description		Test Conditions	Min.	Typ. (Note 1)	Max.	Units
t_{PD1}	Input to Output Delay DO Outputs		$C_L = 30pF$, $R_1 = 300\Omega$, $R_2 = 600\Omega$		15	25	ns
t_{PD2}	Input to Output Delay DB Outputs	Am8216	$C_L = 300pF$, $R_1 = 90\Omega$, $R_2 = 180\Omega$		20	30	ns
		Am8226			16	25	
t_E	Output Enable Time	Am8216	Note 2		45	65	ns
		Am8226	Note 3		35	54	
t_D	Output Disable Time		Note 4		20	35	ns

TEST CONDITIONS

Input pulse amplitude of 2.5V.
Input rise and fall times of 5.0ns between 1.0 and 2.0 volts.
Output loading is 5.0mA and 10pF.
Speed measurements are made at 1.5V levels.

TEST LOAD CIRCUIT



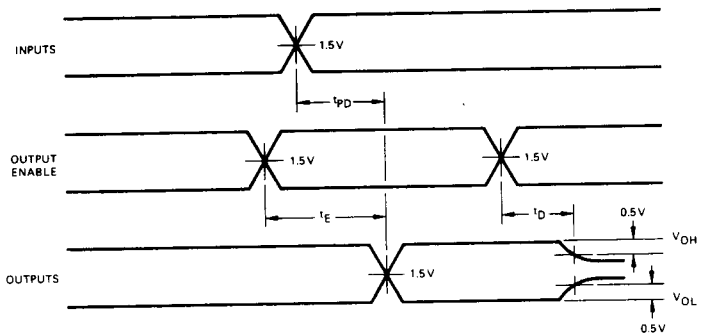
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CAPACITANCE (Note 5)

Parameters	Description	Test Conditions	Min.	Typ. (Note 1)	Max.	Units
C_{IN}	Input Capacitance	V_{BIAS} = 2.5V, V_{CC} = 5.0V T_A = 25°C, f = 1.0MHz		4.0	8.0	pF
C_{OUT1}	Output Capacitance			6.0	10	pF
C_{OUT2}	Output Capacitance			13	18	pF

Notes: 1. Typical values are for T_A = 25°C, V_{CC} = 5.0V.
2. DO outputs, C_L = 30pF, R_1 = 300/10kΩ, R_2 = 180/1.0kΩ; DB outputs, C_L = 300pF, R_1 = 90/10kΩ, R_2 = 180/1.0kΩ.
3. DO outputs, C_L = 30pF, R_1 = 300/10kΩ, R_2 = 600/1.0kΩ; DB outputs, C_L = 300pF, R_1 = 90/10kΩ, R_2 = 180/1.0kΩ.
4. DO outputs, C_L = 5.0pF, R_1 = 300/10kΩ, R_2 = 600/1.0kΩ; DB outputs, C_L = 5.0pF, R_1 = 90/10kΩ, R_2 = 180/1.0kΩ.
5. This parameter is periodically sampled and not 100% tested.

SWITCHING WAVEFORMS



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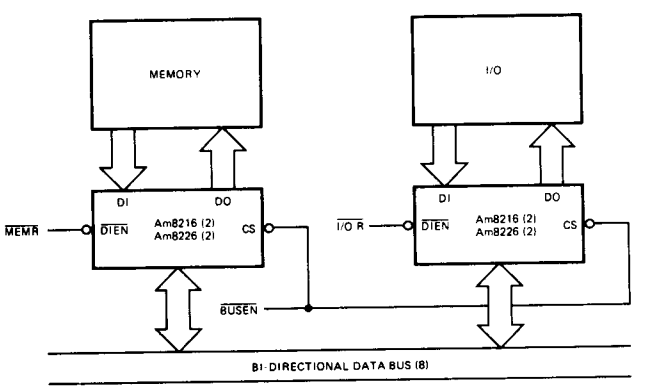
FUNCTION TABLE

$\overline{DIEN}$	$\overline{CS}$		8216 DB	8216 DO	8226 DB	8226 DO
L	L	DI ⇒ DB	DI	Z	$\overline{DI}$	Z
H	L	DB ⇒ DO	Z	DB	Z	$\overline{DB}$
L	H		Z	Z	Z	Z
H	H		Z	Z	Z	Z

H = HIGH
L = LOW

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TYPICAL APPLICATION



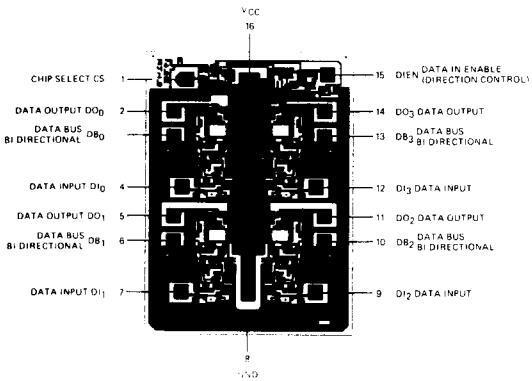
MEMORY AND I/O INTERFACE TO A BI-DIRECTIONAL BUS

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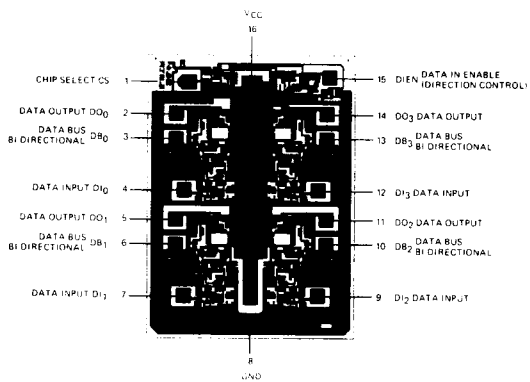
Metallization and Pad Layout

Am8216



DIE SIZE 0.066" X 0.090"

Am8226



DIE SIZE 0.066" X 0.090"