

# Am2921

One-of-Eight Decoder with Three-State Outputs and Polarity Control

## DISTINCTIVE CHARACTERISTICS

- Three-state decoder outputs
- Buffered common output polarity control
- Inverting and non-inverting enable inputs
- AC parameters specified over operating temperature and power supply ranges.

## GENERAL DESCRIPTION

The Am2921 is a three-line to eight-line decoder/demultiplexer fabricated using advanced Low-Power Schottky technology. The decoder has three buffered select inputs A, B, and C, which are decoded to one-of-eight Y outputs. Two active-HIGH and two active-LOW enables can be used for gating the decoder or can be used with incoming data for demultiplexing applications.

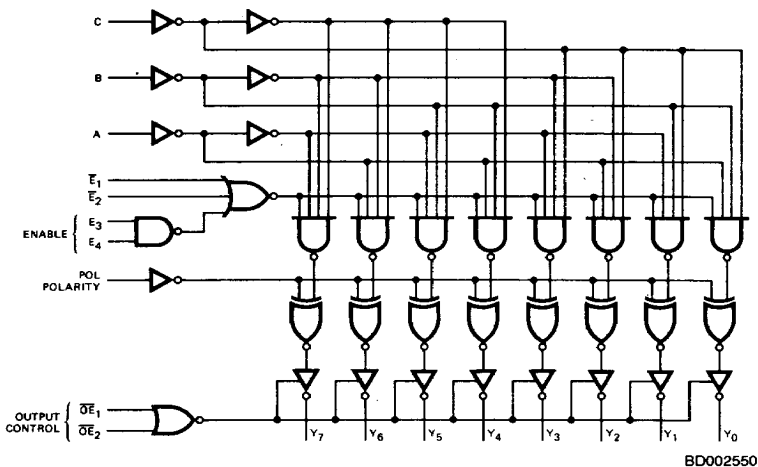
separate active-LOW output enables ( $\overline{OE}$ ) inputs are provided. If either  $\overline{OE}$  input is HIGH, the output is in the high impedance (off) state. When the POL input is LOW, the Y outputs are active-HIGH and when the POL input is HIGH, the Y outputs are active-LOW.

A separate polarity (POL) input can be used to force the function active-HIGH or active-LOW at the output. Two

The device is packaged in a space saving (0.3-inch row spacing) 20-pin package.

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## BLOCK DIAGRAM



## RELATED PRODUCTS

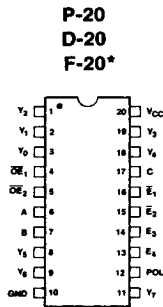
Part No.	Description
Am25LS2536	8-Bit Decoder
Am25LS2537	1 of 10 Decoder
Am25LS2538	1 of 8 Decoder
Am25LS2539	Dual 1 of 4 Decoder
Am2924	3 to 8 Line Decoder/ Demultiplexer

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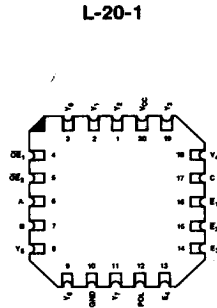
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Refer to Page 13-1 for Essential Information on Military Devices

### CONNECTION DIAGRAM Top View



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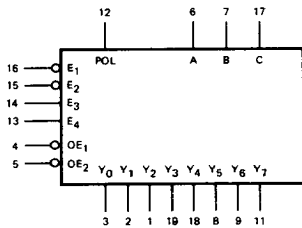


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\*F-20 pin configuration identical to D-20, P-20.

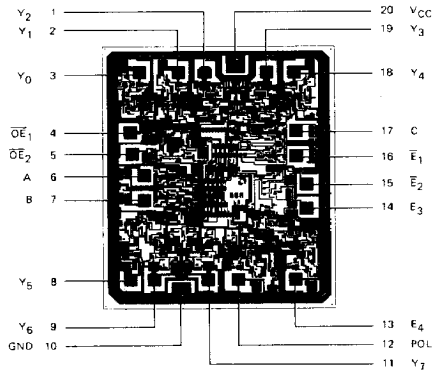
Note: Pin 1 is marked for orientation

### LOGIC SYMBOL



LS001070

### METALLIZATION AND PAD LAYOUT



DIE SIZE 0.081" x 0.096"

### ORDERING INFORMATION

AMD products are available in several packages and operating ranges. The order number is formed by a combination of the following: Device number, speed option (if applicable), package type, operating range and screening option (if desired).

Am2921

D

C

B

Screening Option  
Blank - Standard processing  
B - Burn-in

Temperature (See Operating Range)  
C - Commercial (0°C to +70°C)  
M - Military (-55°C to +125°C)

Package  
D- 20-pin CERDIP  
F- 20-pin flatpak  
L- 20-pin leadless chip carrier  
P- 20-pin plastic DIP  
X- Dice

Device type  
1-of-8 Decoder

#### Valid Combinations

Am2921	PC DC, DCB, DM, DMB FM, FMB LC, LCB, LM, LMB XC, XM
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#### Valid Combinations

Consult the AMD sales office in your area to determine if a device is currently available in the combination you wish.

**PIN DESCRIPTION**

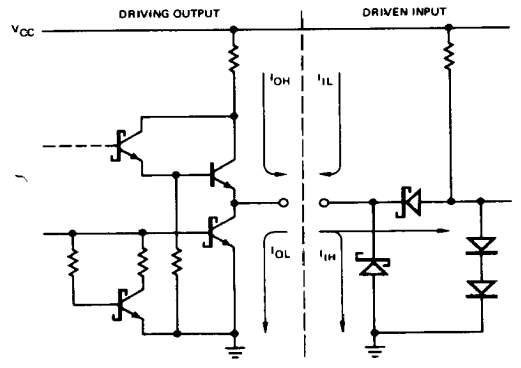
Pin No.	Name	I/O	Description
6, 7, 17	A, B, C	I	The three select inputs to the decoder/demultiplexer.
16, 15	$\bar{E}_1, \bar{E}_2$	I	The active LOW enable inputs. A HIGH on either the $\bar{E}_1$ or $\bar{E}_2$ input forces all decoded functions to be disabled.
14, 13	$E_3, E_4$	I	The active HIGH enable inputs. A LOW on either $E_3$ or $E_4$ inputs forces all the decoded functions to be inhibited.
12	POL	I	Polarity Control. A LOW on the polarity control input forces the output to the active-HIGH state while a HIGH on the polarity control input forces the Y outputs to the active-LOW state.
4, 5	$\bar{OE}_1, \bar{OE}_2$	I	Output Enable. When both the $\bar{OE}_1$ and $\bar{OE}_2$ inputs are LOW, the Y outputs are enabled. If either $\bar{OE}_1$ or $\bar{OE}_2$ input is HIGH, the Y outputs are in the high impedance state.
	$Y_1$	O	The eight outputs for the decoder/demultiplexer.

**GUARANTEED LOADING RULES  
OVER OPERATING RANGE (In Unit Loads)**

A Low-Power Schottky TTL Unit Load is defined as 20 $\mu$ A measured at 2.7V HIGH and -0.36mA measured at 0.4V LOW

Pin No.'s	Input/Output	Input Load	Output HIGH		Output LOW	
			MIL	COM'L	MIL	COM'L
1	Y <sub>2</sub>	-	50	130	33	33
2	Y <sub>1</sub>	-	50	130	33	33
3	Y <sub>0</sub>	-	50	130	33	33
4	$\bar{OE}_1$	1.0	-	-	-	-
5	$\bar{OE}_2$	1.0	-	-	-	-
6	A	1.0	-	-	-	-
7	B	1.0	-	-	-	-
8	Y <sub>5</sub>	-	50	130	33	33
9	Y <sub>6</sub>	-	50	130	33	33
10	GND	-	-	-	-	-
11	Y <sub>7</sub>	-	50	130	33	33
12	POL	1.0	-	-	-	-
13	E <sub>4</sub>	1.0	-	-	-	-
14	E <sub>3</sub>	1.0	-	-	-	-
15	$\bar{E}_2$	1.0	-	-	-	-
16	$\bar{E}_1$	1.0	-	-	-	-
17	C	1.0	-	-	-	-
18	Y <sub>4</sub>	-	50	130	33	33
19	Y <sub>3</sub>	-	50	130	33	33
20	V <sub>CC</sub>	-	-	-	-	-

**LOW-POWER SCHOTTKY INPUT/OUTPUT  
CURRENT INTERFACE CONDITIONS**



Note: Actual current flow direction shown.

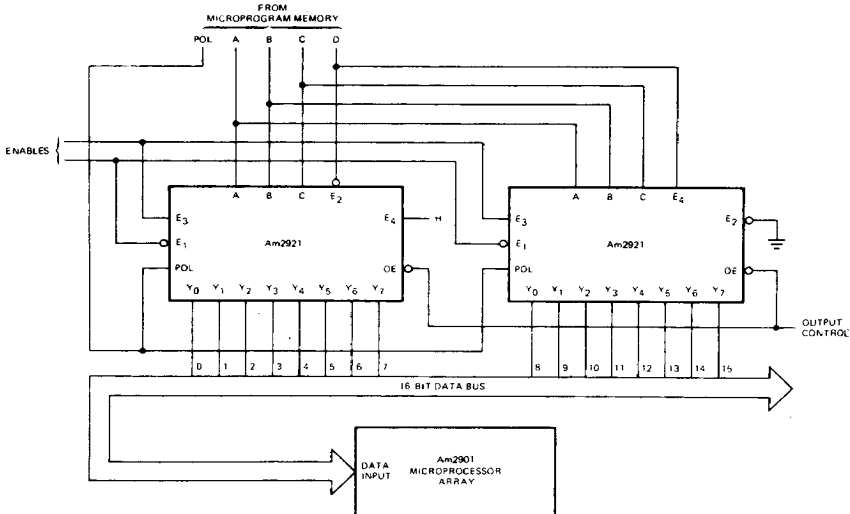
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**FUNCTION TABLE**

FUNCTION	INPUTS											OUTPUTS						
	OE <sub>1</sub>	OE <sub>2</sub>	E <sub>1</sub>	E <sub>2</sub>	E <sub>3</sub>	E <sub>4</sub>	POL	C	B	A	Y <sub>0</sub>	Y <sub>1</sub>	Y <sub>2</sub>	Y <sub>3</sub>	Y <sub>4</sub>	Y <sub>5</sub>	Y <sub>6</sub>	Y <sub>7</sub>
High-Impedance	H	X	X	X	X	X	X	X	X	X	Z	Z	Z	Z	Z	Z	Z	Z
Disable	L	L	H	X	X	X	L	X	X	L	L	L	L	L	L	L	L	L
	L	L	H	X	X	X	L	X	X	L	L	L	L	L	L	L	L	L
	L	L	X	H	X	X	L	X	X	L	L	L	L	L	L	L	L	L
	L	L	X	X	X	X	L	X	X	L	L	L	L	L	L	L	L	L
	L	L	X	X	X	X	L	X	X	L	L	L	L	L	L	L	L	L
Active-HIGH Output	L	L	L	L	H	H	L	L	L	L	L	L	L	L	L	L	L	L
	L	L	L	L	H	H	L	L	L	L	L	L	L	L	L	L	L	L
	L	L	L	L	H	H	L	L	L	L	L	L	L	L	L	L	L	L
	L	L	L	L	H	H	L	L	L	L	L	L	L	L	L	L	L	L
	L	L	L	L	H	H	L	L	L	L	L	L	L	L	L	L	L	L
Active-LOW Output	L	L	L	L	H	H	L	L	L	L	L	L	L	L	L	L	L	L
	L	L	L	L	H	H	L	L	L	L	L	L	L	L	L	L	L	L
	L	L	L	L	H	H	L	L	L	L	L	L	L	L	L	L	L	L
	L	L	L	L	H	H	L	L	L	L	L	L	L	L	L	L	L	L
	L	L	L	L	H	H	L	L	L	L	L	L	L	L	L	L	L	L

H = HIGH L = LOW X = Don't Care Z = High Impedance

**APPLICATIONS**



AF001860

Two Am2921's can be used to perform a bit set, bit clear, bit toggle or bit test on any of sixteen bits in a microprocessor system. Examples of the operations performed are as follows:

Microprogram Control	16-Bit Field From Am2921																Am2901 ALU Function	Bit Function Performed On Selected Register					
	D	C	B	A	POL	0	1	2	3	4	5	6	7	8	9	10			11	12	13	14	15
0 0 1 1 0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	OR	BIT SET
1 1 0 0 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	AND	BIT TEST
0 1 1 0 1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	AND	BIT CLEAR
1 0 1 0 1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	EX NOR	BIT TOGGLE
1 0 1 0 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	EX OR	BIT TOGGLE

Note: Bit test is performed using F = 0 output of Am2901.

**ABSOLUTE MAXIMUM RATINGS**

Storage Temperature ..... -65°C to +150°C  
 (Ambient) Temperature Under Bias ..... -55°C to +125°C  
 Supply Voltage to Ground Potential  
   Continuous ..... -0.5V to +7.0V  
 DC Voltage Applied to Outputs For  
   High Output State ..... -0.5V to +V<sub>CC</sub> max  
 DC Input Voltage ..... -0.5V to +7.0V  
 DC Output Current, Into Outputs ..... 30mA  
 DC Input Current ..... -30mA to +5.0mA

**OPERATING RANGES**

Commercial (C) Devices  
 Temperature ..... 0°C to +70°C  
 Supply Voltage ..... +4.75V to +5.25V  
 Military (M) Devices  
 Temperature ..... -55°C to +125°C  
 Supply Voltage ..... +4.5V to +5.5V  
*Operating ranges define those limits over which the functionality of the device is guaranteed.*

*Stresses above those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent device failure. Functionality at or above these limits is not implied. Exposure to absolute maximum ratings for extended periods may affect device reliability.*

**DC CHARACTERISTICS** over operating range unless otherwise specified

Parameters	Description	Test Conditions (Note 2)		Min	Typ (Note 1)	Max	Units
V <sub>OH</sub>	Output HIGH Voltage	V <sub>CC</sub> = MIN V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = 1.0mA (MIL) I <sub>OH</sub> = -2.6mA (COM'L)	2.4	3.4		Volts
V <sub>OL</sub>	Output LOW Voltage	V <sub>CC</sub> = MIN V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 4.0mA I <sub>OL</sub> = 8.0mA I <sub>OL</sub> = 12mA			0.4 0.45 0.5	
V <sub>IH</sub>	Input HIGH Level	Guaranteed input logical HIGH voltage for all inputs		2.0			Volts
V <sub>IL</sub>	Input LOW Level	Guaranteed input logical LOW voltage for all inputs				0.7 0.8	Volts
V <sub>I</sub>	Input Clamp Voltage	V <sub>CC</sub> = MIN, I <sub>IN</sub> = -18mA				-1.5	
I <sub>IL</sub>	Input LOW Current	V <sub>CC</sub> = MAX, V <sub>IN</sub> = 0.4V				-0.36	mA
I <sub>IH</sub>	Input HIGH Current	V <sub>CC</sub> = MAX, V <sub>IN</sub> = 2.7V				20	µA
I <sub>I</sub>	Input HIGH Current	V <sub>CC</sub> = MAX, V <sub>IN</sub> = 7.0V				0.1	mA
I <sub>O</sub>	Off-State (High-Impedance) Output Current	V <sub>CC</sub> = MAX	V <sub>O</sub> = 0.4V V <sub>O</sub> = 2.4V			-20 20	µA
I <sub>SC</sub>	Output Short Circuit Current (Note 3)	V <sub>CC</sub> = MAX		-15		-85	mA
I <sub>CC</sub>	Power Supply Current (Note 4)	V <sub>CC</sub> = MAX			21	34	<sup>A</sup> mA

- Notes: 1. Typical limits are at V<sub>CC</sub> = 5.0V, 25°C ambient and maximum loading.  
 2. For conditions shown as MIN or MAX, use the appropriate value specified under Operating Ranges for the applicable device type.  
 3. Not more than one output should be shorted at a time. Duration of the short circuit test should not exceed one second.  
 4. Test conditions: A = B = C = E<sub>1</sub> = E<sub>2</sub> = GND; E<sub>3</sub> = E<sub>4</sub> = POL = OE<sub>1</sub> = OE<sub>2</sub> = 4.5V.

**SWITCHING CHARACTERISTICS** (T<sub>A</sub> = +25°C, V<sub>CC</sub> = 5.0V)

Parameters	Description	Test Conditions	Min	Typ	Max	Units
t <sub>PLH</sub>	A, B, C to Y <sub>i</sub>	C <sub>L</sub> = 15pF R <sub>L</sub> = 2.0kΩ		20	30	ns
t <sub>PHL</sub>				15	22	
t <sub>PLH</sub>	E <sub>1</sub> , E <sub>2</sub> to Y <sub>i</sub>			19	28	ns
t <sub>PHL</sub>				20	30	
t <sub>PLH</sub>	E <sub>3</sub> , E <sub>4</sub> to Y <sub>i</sub>			21	31	ns
t <sub>PHL</sub>				23	34	
t <sub>PLH</sub>	POL to Y <sub>i</sub>			16	24	ns
t <sub>PHL</sub>				20	30	
t <sub>ZH</sub>	OE <sub>1</sub> , OE <sub>2</sub> to Y <sub>i</sub>			17	25	ns
t <sub>ZL</sub>				14	21	
t <sub>HZ</sub>	OE <sub>1</sub> , OE <sub>2</sub> to Y <sub>i</sub>	C <sub>L</sub> = 5.0pF R <sub>L</sub> = 2.0kΩ		17	25	ns
t <sub>LZ</sub>				20	30	

**SWITCHING CHARACTERISTICS** over operating range unless otherwise specified\*

Parameters	Description	Test Conditions	COMMERCIAL Am2921		MILITARY Am2921		Units
			Min	Max	Min	Max	
t <sub>PLH</sub>	A, B, C to Y <sub>i</sub>	C <sub>L</sub> = 50pF R <sub>L</sub> = 2.0kΩ		36		42	ns
t <sub>PHL</sub>				29		37	
t <sub>PLH</sub>	E <sub>1</sub> , E <sub>2</sub> to Y <sub>i</sub>			34		39	ns
t <sub>PHL</sub>				38		45	
t <sub>PLH</sub>	E <sub>3</sub> , E <sub>4</sub> to Y <sub>i</sub>			38		45	ns
t <sub>PHL</sub>				43		52	
t <sub>PLH</sub>	POL to Y <sub>i</sub>			29		34	ns
t <sub>PHL</sub>				39		49	
t <sub>ZH</sub>	OE <sub>1</sub> , OE <sub>2</sub> to Y <sub>i</sub>			38		45	ns
t <sub>ZL</sub>				23		25	
t <sub>HZ</sub>	OE <sub>1</sub> , OE <sub>2</sub> to Y <sub>i</sub>	C <sub>L</sub> = 5.0pF		29		33	ns
t <sub>LZ</sub>		R <sub>L</sub> = 2.0kΩ		33		36	

\*Switching Characteristics' performance over the operating temperature range is guaranteed by testing defined in Group A, Subgroup 9.