Am54S/74S138

3-Line to 8-Line Decoder/Demultiplexer

Distinctive Characteristics

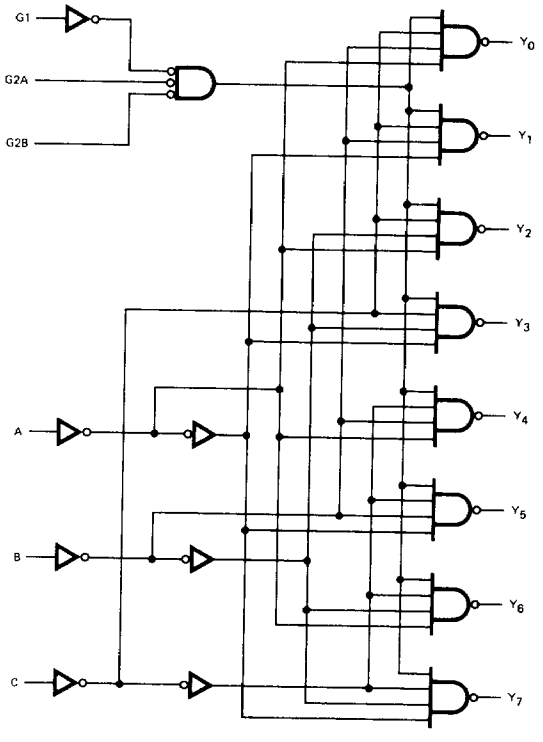
- Advanced Schottky technology
- Inverting and non-inverting enable inputs
- Useful in memory decoders and high-speed data transmission
- 100% reliability assurance testing in compliance with MIL-STD-883

FUNCTIONAL DESCRIPTION

The Am54S/74S138 is a 3-line to 8-line decoder/demultiplexer fabricated using advanced Schottky technology. The decoder has three buffered select inputs A, B and C that are decoded to one of eight Y outputs.

One active-HIGH and two active-LOW enables can be used for gating the decoder or can be used with incoming data for demultiplexing applications. When the enable input function is in the disable state, all eight Y outputs are HIGH regardless of the A, B and C select inputs.

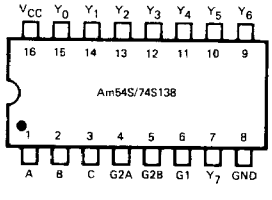
LOGIC DIAGRAM



ORDERING INFORMATION

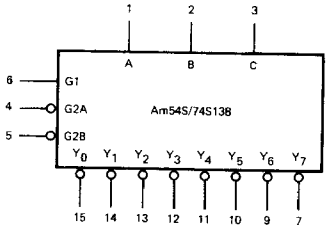
Package Type	Temperature Range	Order Number
Molded DIP	0°C to +70°C	SN74S138N
Hermetic DIP	0°C to +70°C	SN74S138J
Dice	0°C to +70°C	SN74S138X
Hermetic DIP	−55°C to +125°C	SN54S138J
Hermetic Flat Pak	−55°C to +125°C	SN54S138W
Dice	−55°C to +125°C	SN54S138X

CONNECTION DIAGRAM
Top View



Note: Pin 1 is marked for orientation.

LOGIC SYMBOL



V_{CC} = Pin 16
GND = Pin 8

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

Storage Temperature	−65°C to +150°C
Temperature (Ambient) Under Bias	−55°C to +125°C
Supply Voltage to Ground Potential (Pin 16 to Pin 8) Continuous	−0.5V to +7V
DC Voltage Applied to Outputs for HIGH Output State	−0.5V to +Vcc max.
DC Input Voltage	−0.5V to +5.5V
DC Output Current, Into Outputs	30mA
DC Input Current	−30mA to +5.0mA

ELECTRICAL CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (Unless Otherwise Noted)

Am74S138	T_A = 0°C to +70°C	V_{CC} = 5.0V ±5% (COM'L)	MIN. = 4.75V	MAX. = 5.25V
Am54S138	T_A = −55°C to +125°C	V_{CC} = 5.0V ±10% (MIL)	MIN. = 4.5V	MAX. = 5.5V

Parameters	Description	Test Conditions (Note 1)		Min.	Typ. (Note 2)	Max.	Units
V_{OH}	Output HIGH Voltage	V_{CC} = MIN., I_{OH} = −1mA V_{IN} = V_{IH} or V_{IL}	MIL	2.5	3.4		Volts
			COM'L	2.7	3.4		
V_{OL}	Output LOW Voltage	V_{CC} = MIN., I_{OL} = 20mA V_{IN} = V_{IH} or V_{IL}				0.5	Volts
V_{IH}	Input HIGH Level	Guaranteed input logical HIGH voltage for all inputs		2.0			Volts
V_{IL}	Input LOW Level	Guaranteed input logical LOW voltage for all inputs				0.8	Volts
V_I	Input Clamp Voltage	V_{CC} = MIN., I_{IN} = −18mA				−1.2	Volts
I_{IL} (Note 3)	Input LOW Current	V_{CC} = MAX., V_{IN} = 0.5V				−2	mA
I_{IH} (Note 3)	Input HIGH Current	V_{CC} = MAX., V_{IN} = 2.7V				50	µA
I_I	Input HIGH Current	V_{CC} = MAX., V_{IN} = 5.5V				1.0	mA
I_{SC}	Output Short Circuit Current (Note 4)	V_{CC} = MAX., V_{OUT} = 0.0V		−40		−100	mA
I_{CC}	Power Supply Current	V_{CC} = MAX. (Note 5)			49	74	mA

Notes: 1. For conditions shown as MIN. or MAX., use the appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical limits are at V_{CC} = 5.0 V, 25°C ambient and maximum loading.
3. Actual input currents = Unit Load Current x Input Load Factor (See Loading Rules).
4. Not more than one output should be shorted at a time. Duration of the short circuit test should not exceed one second.
5. Outputs enabled and open.

Switching Characteristics (T_A = +25°C)

Parameters	Description	Test Conditions	Min.	Typ.	Max.	Units
t_{PLH}	Two Level Delay Select to Output	V_{CC} = 5V, C_L = 15pF, R_L = 280Ω		4.5	7	ns
t_{PHL}				7	10.5	
t_{PLH}	Three Level Delay Select to Output			7.5	12	ns
t_{PHL}				8	12	
t_{PLH}	G2A or G2B to Output			5	8	ns
t_{PHL}				7	11	
t_{PLH}	G1 to Output			7	11	ns
t_{PHL}				7	11	

FUNCTION TABLE

Inputs						Outputs							
Enable			Select										
G1	G2A	G2B	C	B	A	Y_0	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7
L	X	X	X	X	X	H	H	H	H	H	H	H	H
X	H	X	X	X	X	H	H	H	H	H	H	H	H
X	X	H	X	X	X	H	H	H	H	H	H	H	H
H	L	L	L	L	L	L	H	H	H	H	H	H	H
H	L	L	L	L	H	H	L	H	H	H	H	H	H
H	L	L	L	H	L	H	H	L	H	H	H	H	H
H	L	L	L	H	H	H	H	H	L	H	H	H	H
H	L	L	H	L	L	H	H	H	H	L	H	H	H
H	L	L	H	L	H	H	H	H	H	H	L	H	H
H	L	L	H	H	L	H	H	H	H	H	H	L	H
H	L	L	H	H	H	H	H	H	H	H	H	H	L

H = HIGH
L = LOW
X = Don't care

LOADING RULES (In Unit Loads)

Input/Output	Pin No.'s	Unit Load	Fan-out Output HIGH	Fan-out Output LOW
A	1	1	–	–
B	2	1	–	–
C	3	1	–	–
G2A	4	1	–	–
G2B	5	1	–	–
G1	6	1	–	–
Y_7	7	–	20	10
GND	8	–	–	–
Y_6	9	–	20	10
Y_5	10	–	20	10
Y_4	11	–	20	10
Y_3	12	–	20	10
Y_2	13	–	20	10
Y_1	14	–	20	10
Y_0	15	–	20	10
V_{CC}	16	–	–	–

A Schottky TTL Unit Load is defined as 50μA measured at 2.7V HIGH and −2.0mA measured at 0.5V LOW.

DEFINITION OF FUNCTIONAL TERMS:

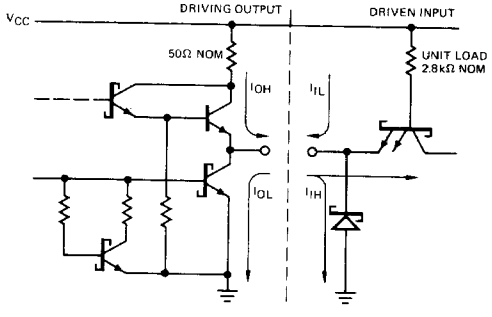
A, B, C Select. The three select inputs to the decoder.

G1 The active-HIGH enable input. A LOW on the G1 input forces all Y outputs HIGH regardless of any other inputs.

G2A, G2B The active-LOW enable input. A HIGH on either the G2A or G2B input forces all Y outputs HIGH regardless of any other inputs.

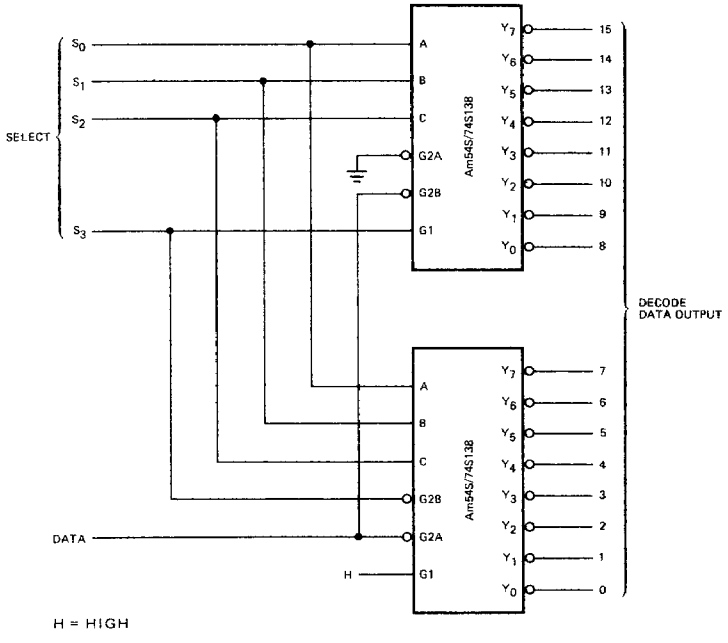
Y_0, Y_1, Y_2, Y_3, Y_4, Y_5, Y_6, Y_7 The eight decoder outputs.

SCHOTTKY INPUT/OUTPUT CURRENT INTERFACE CONDITIONS



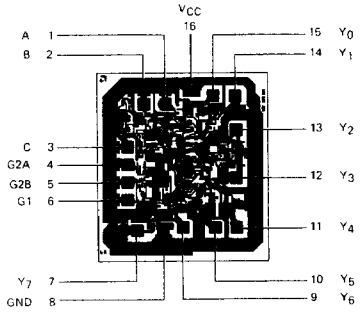
Note: Actual current flow direction shown.

APPLICATION



ONE-OF-SIXTEEN DEMULTIPLEXER

Metallization and Pad Layout



DIE SIZE 0.065" X 0.070"