- ● Designed Specifically for High-Speed Memory Decoders and Data Transmission Systems

- ● Incorporates 3 Enable Inputs to Simplify Cascading and/or Data Reception

- ● Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs

- ● Dependable Texas Instruments Quality and Reliability

description

The SN54F138 and SN74F138 circuits are designed to be used in high-performance memory-decoding or data-routing applications requiring very short propagation delay times. In high-performance memory systems this decoder can be used to minimize the effects of system decoding. When employed with high-speed memories utilizing a fast enable circuit, the delay times of this decoder and the enable time of the memory are usually less than the typical access time of the memory. This means that the effective system delay introduced is negligible.

The conditions at the binary select inputs and the three enable inputs select one of eight input lines. Two active-low and one active-high enable inputs reduce the need for external gates or inverters when expanding. A 24-line decoder can be implemented without external inverters and a 32-line decoder requires only one inverter. An enable input can be used as a data input for demultiplexing applications.

The SN54F138 is characterized for operation over the full military temperature range of −55 °C to 125 °C. The SN74F138 is characterized for operation 0 °C to 70 °C.

SN54F138 . . . J PACKAGE
SN74F138 . . . D OR N PACKAGE
(TOP VIEW)

A	1	16	VCC
B	2	15	Y0
C	3	14	Y1
G̅2A	4	13	Y2
G̅2B	5	12	Y3
G1	6	11	Y4
Y7	7	10	Y5
GND	8	9	Y6
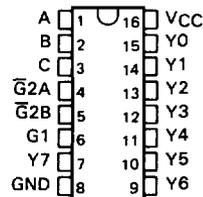
SN54F138 . . . FK PACKAGE
(TOP VIEW)

Top pins: B, A, NC, VCC, Y0 (3 2 1 20 19)

C	4	18	Y1
G̅2A	5	17	Y2
NC	6	16	NC
G̅2B	7	15	Y3
G1	8	14	Y4

Bottom pins: Y7, GND, NC, Y6, Y5 (9 10 11 12 13)
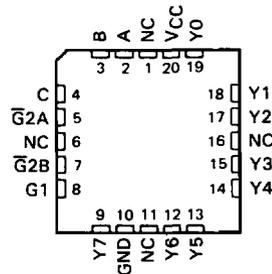
NC – No internal connection

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Data Sheets

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FUNCTION TABLE

ENABLE INPUTS			SELECT INPUTS			OUTPUTS							
G1	G2A	G2B	C	B	A	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
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
L	X	X	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

logic symbols (alternatives)[†]
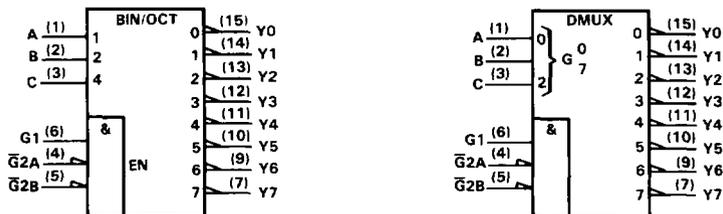
[†] These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)
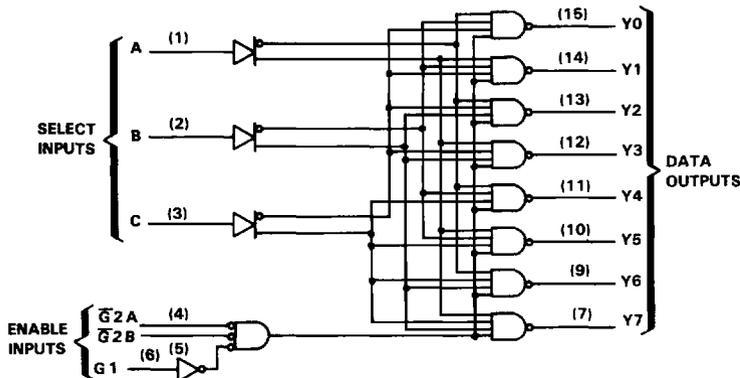
Pin numbers shown are for D, J, and N packages.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, V_{CC}	-0.5 V to 7 V
Input voltage[†]	-1.2 V to 7 V
Input current	-30 mA to 5 mA
Voltage applied to any output in the high state	-0.5 V to V_{CC}
Current into any output in the low state	40 mA
Operating free-air temperature range: SN54F138	$-65\,°C$ to $150\,°C$
SN74F138	$0\,°C$ to $70\,°C$
Storage temperature range	$-65\,°C$ to $150\,°C$

[†]The input voltage ratings may be exceeded provided the input current ratings are observed.

recommended operating conditions

		SN54F138			SN74F138			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage	4.5	5	5.5	4.5	5	5.5	V
V_{IH}	High-level input voltage	2			2			V
V_{IL}	Low-level input voltage			0.8			0.8	V
I_{IK}	Input clamp current			-18			-18	mA
I_{OH}	High-level output current			-1			-1	mA
I_{OL}	Low-level output current			20			20	mA
T_A	Operating free-air temperature	-55		125	0		70	°C

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS		SN54F138			SN74F138			UNIT
			MIN	TYP[§]	MAX	MIN	TYP[§]	MAX	
V_{IK}	$V_{CC} = 4.5$ V,	$I_I = -18$ mA			-1.2			-1.2	V
V_{OH}[#]	$V_{CC} = 4.5$ V,	$I_{OH} = -1$ mA	2.5	3.4		2.5	3.4		V
V_{OL}	$V_{CC} = 4.5$ V,	$I_{OL} = 20$ mA		0.3	0.5		0.3	0.5	V
I_I	$V_{CC} = 5.5$ V,	$V_I = 7$ V			0.1			0.1	mA
I_{IH}	$V_{CC} = 5.5$ V,	$V_I = 2.7$ V			20			20	µA
I_{IL}	$V_{CC} = 5.5$ V,	$V_I = 0.5$ V			-0.6			-0.6	mA
I_{OS}[¶]	$V_{CC} = 5.5$ V,	$V_O = 0$	-60		-150	-60		-150	mA
I_{CC}	$V_{CC} = 5.5$ V,	See Note 1		13	20		13	20	mA

For conditions shown as MIN or MAX, use the appropriate value specified under Recommended Operating Conditions.

[§] All typical values are at $V_{CC} = 5$ V, $T_A = 25\,°C$.

[¶] Not more than one output should be shorted at a time and the duration of the short circuit should not exceed one second.

[#] For the SN74F138 at $V_{CC} = 4.75$ V and $I_{OH} = -1$ mA, V_{OH} min $= 2.7$ V.

NOTE 1: I_{CC} is measured with outputs enabled and open.

switching characteristics (see Note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC} = 5 V, C_L = 50 pF, R_L = 500 Ω, T_A = 25°C			V_{CC} = 4.5 V to 5.5 V, C_L = 50 pF, R_L = 500 Ω, T_A = MIN to MAX†				UNIT
			'F138			SN54F138		SN74F138		
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A, B, or C	Y	2.7	5.2	7.5	2.7	12	2.7	8.5	ns
t_{PHL}			3.2	5.7	8	3.2	9.5	3.2	9	
t_{PLH}	$\overline{G}$2A or $\overline{G}$2B	Y	2.7	5	7	2.7	11	2.7	8	ns
t_{PHL}			2.2	4.9	7	2.2	8	2.2	7.5	
t_{PLH}	G1	Y	3.2	5.8	8	3.2	12.5	3.2	9	ns
t_{PHL}			2.7	5.2	7.5	2.7	8.5	2.7	8.5	

† For conditions shown as MIN or MAX, use the appropriate value specified under Recommended Operating Conditions.

NOTE 2: See General Information for load circuits and waveforms.

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