SDFS051B - MARCH 1987 - REVISED JULY 1996

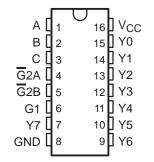
- Designed Specifically for High-Speed
   Memory Decoders and Data Transmission
   Systems
- Incorporates Three Enable Inputs to Simplify Cascading and/or Data Reception
- Package Options Include Plastic Small-Outline Packages, Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs

### description

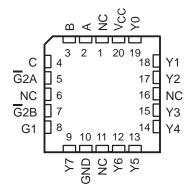
The 'F138 is designed to be used in high-performance memory-decoding or datarouting applications requiring very short propagation delay times. In high-performance memory systems, these decoders can be used to minimize the effects of system decoding. When employed with high-speed memories utilizing a 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 by the decoder is negligible.

The conditions at the binary-select inputs and the three enable inputs select one of eight output 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

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



SN54F138 . . . FK PACKAGE (TOP VIEW)



NC - No internal connection

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  $-55^{\circ}$ C to  $125^{\circ}$ C. The SN74F138 is characterized for operation from  $0^{\circ}$ C to  $70^{\circ}$ C.



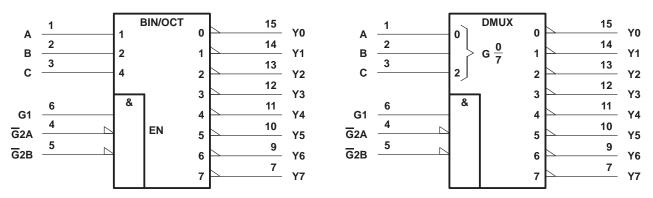
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.



#### **FUNCTION TABLE**

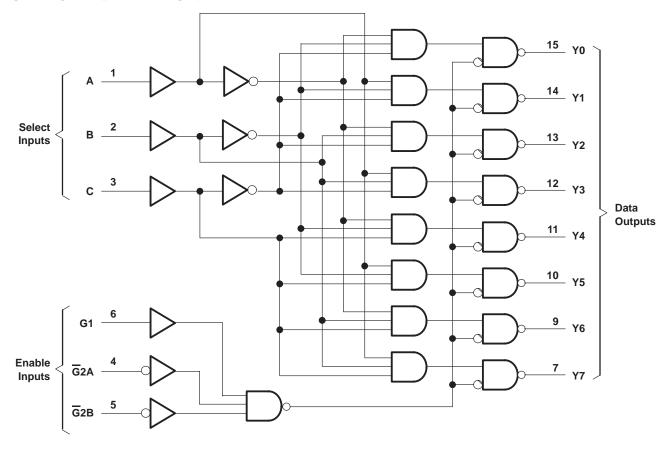
ENABLE INPUTS		SEL	SELECT INPUTS					OUTI	PUTS				
G1	G2A	G2B	С	В	Α	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
Х	Н	Х	Х	Χ	Х	Н	Н	Н	Н	Н	Н	Н	Н
Х	X	Н	Х	Χ	X	Н	Н	Н	Н	Н	Н	Н	Н
L	X	X	Х	Χ	X	Н	Н	Н	Н	Н	Н	Н	Н
Н	L	L	L	L	L	L	Н	Н	Н	Н	Н	Н	Н
Н	L	L	L	L	Н	Н	L	Н	Н	Н	Н	Н	Н
Н	L	L	L	Н	L	Н	Н	L	Н	Н	Н	Н	Н
Н	L	L	L	Н	Н	Н	Н	Н	L	Н	Н	Н	Н
Н	L	L	Н	L	L	Н	Н	Н	Н	L	Н	Н	Н
Н	L	L	Н	L	Н	Н	Н	Н	Н	Н	L	Н	Н
Н	L	L	Н	Н	L	Н	Н	Н	Н	Н	Н	L	Н
Н	L	L	Н	Н	Н	н	Н	Н	Н	Н	Н	Н	L

## logic symbols (alternatives)†



<sup>&</sup>lt;sup>†</sup> 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 the D, J, and N packages.

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

Supply voltage range, V<sub>CC</sub> ..... –0.5 V to 7 V Voltage range applied to any output in the high state  $\dots -0.5 \text{ V}$  to  $V_{CC}$ SN74F138 ...... 0°C to 70°C Storage temperature range ...... –65°C to 150°C

#### recommended operating conditions

		S	N54F138	3	S	UNIT		
		MIN	NOM	MAX	MIN	NOM	MAX	UNIT
VCC	Supply voltage	4.5	5	5.5	4.5	5	5.5	V
VIH	High-level input voltage	2			2			V
V <sub>I</sub> L	Low-level input voltage			0.8			0.8	V
ΙΙΚ	Input clamp current			-18			-18	mA
IOH	High-level output current			<b>–</b> 1			-1	mA
l <sub>OL</sub>	Low-level output current			20			20	mA
TA	Operating free-air temperature	-55		125	0		70	°C

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

PARAMETER	TEST CONDITIONS			N54F13	3	SN74F138			UNIT
PARAMETER				TYP‡	MAX	MIN	TYP‡	MAX	UNIT
VIK	$V_{CC} = 4.5 \text{ V},$	$I_{I} = -18 \text{ mA}$			-1.2			-1.2	V
Vo.,	$V_{CC} = 4.5 \text{ V},$	$I_{OH} = -1 \text{ mA}$	2.5	3.4		2.5	3.4		V
VOH	$V_{CC} = 4.75 \text{ V},$	I <sub>OH</sub> = – 1 mA				2.7			
VOL	$V_{CC} = 4.5 \text{ V},$	$I_{OL} = 20 \text{ mA}$		0.3	0.5		0.3	0.5	V
lį	$V_{CC} = 5.5 \text{ V},$	V <sub>I</sub> = 7 V			0.1			0.1	mA
lіН	$V_{CC} = 5.5 \text{ V},$	V <sub>I</sub> = 2.7 V			20			20	μΑ
I <sub>Ι</sub> Γ	V <sub>CC</sub> = 5.5 V,	V <sub>I</sub> = 0.5 V			- 0.6			- 0.6	mA
I <sub>OS</sub> §	V <sub>CC</sub> = 5.5 V,	V <sub>O</sub> = 0	-60		-150	-60		-150	mA
ICC	V <sub>CC</sub> = 5.5 V,	See Note 2		13	20		13	20	mA

 $<sup>\</sup>ddagger$  All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

NOTE 2: ICC is measured with outputs enabled and open.



<sup>†</sup> Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: The input voltage ratings may be exceeded provided the input current ratings are observed.

<sup>§</sup> Not more than one output should be shorted at a time, and the duration of the short circuit should not exceed one second.

# SN54F138, SN74F138 3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS

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## switching characteristics (see Note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 5 \text{ V},$ $C_L = 50 \text{ PF},$ $R_L = 500 \Omega,$ $T_A = 25^{\circ}\text{C}$			$V_{CC}$ = 4.5 V TO 5.5 V, $C_L$ = 50 PF, $R_L$ = 500 $\Omega$ , $T_A$ = MIN TO MAX $^{\dagger}$				UNIT
				′F138		SN54F138		SN74F138		1
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
<sup>t</sup> PLH	A, B, or C	A, B, or C	2.7	5.2	7.5	2.7	12	2.7	8.5	ns
t <sub>PHL</sub>			3.2	5.7	8	3.2	9.5	3.2	9	
<sup>t</sup> PLH	G2A or G2B	2B Y	2.7	5	7	2.7	11	2.7	8	
t <sub>PHL</sub>			2.2	4.9	7	2.2	8	2.2	7.5	ns
<sup>t</sup> PLH	G1 Y	V	3.2	5.8	8	3.2	12.5	3.2	9	no
<sup>t</sup> PHL		ſ	2.7	5.2	7.5	2.7	8.5	2.7	8.5	ns

<sup>†</sup> For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions. NOTE 3: Load circuits and waveforms are shown in Section 1.



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