September 1986 Revised February 2000

FAIRCHILD

SEMICONDUCTOR

DM74ALS138 3 to 8 Line Decoder/Demultiplexer

General Description

These Schottky-clamped 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 these decoders can be used to minimize the effects of system decoding. When used with high-speed memories, the delay times of these decoders 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 DM74ALS138 decodes one-of-eight lines, based upon the conditions at the three binary select inputs and the three enable inputs. 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 with no external inverters, and 32-line decoder requires only one inverter. An enable input can be used as a data input for demultiplexing applications.

This decoder/demultiplexer features fully buffered inputs, presenting only one normalized load to its driving circuit. All inputs are clamped with high-performance Schottky diodes to suppress line-ringing and simplify system design.

Features

- Designed specifically for high speed: Memory decoders
 - Data transmission systems
- 3- to 8-line decoder incorporates 3 enable inputs to simplify cascading and/or data reception
- Low power dissipation...23 mW typ
- \blacksquare Switching specifications guaranteed over full temperature and V_{CC} range
- Advanced oxide-isolated, ion-implanted Schottky TTL process

Ordering Code:

Order Number	Package Number	Package Description					
DM74ALS138M	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow					
DM74ALS138SJ	M16D	16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide					
DM74ALS138N	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide					

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Connection Diagram



Function Table

Enable Inputs		Select Inputs		Outputs								
G1	G2 (Note 1)	С	в	A	Y0	Y1	Y2	Y3	Y4	Y5	Y6	¥7
Х	Н	Х	Х	Х	Н	Н	Н	Н	Н	Н	Н	Н
L	х	Х	Х	Х	н	Н	Н	Н	Н	Н	Н	Н
н	L	L	L	L	L	Н	Н	Н	Н	Н	Н	Н
н	L	L	L	Н	н	L	Н	Н	Н	Н	Н	Н
н	L	L	н	L	н	н	L	н	н	н	н	н
н	L	L	н	н	н	н	н	L	н	н	н	н
н	L	н	L	L	н	н	н	н	L	н	н	н
н	L	н	L	н	н	н	н	н	н	L	н	н
н	L	н	н	L	н	н	н	н	н	н	L	н
н	L	н	н	н	н	н	н	н	н	н	н	L
Note	Note 1: $\overline{G}2 = \overline{G}2A + \overline{G}2B$											



Absolute Maximum Ratings(Note 2)

Supply Voltage	7V
Input Voltage	7V
Operating Free Air Temperature Range	$0^{\circ}C$ to $+70^{\circ}C$
Storage Temperature Range	$-65^{\circ}C$ to $+150^{\circ}C$
Typical θ_{JA}	
N Package	75.5°C/W
M Package	104.0°C/W

Note 2: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Recommended Operating Conditions

Symbol	Parameter	Min	Nom	Max	Units
/ _{cc}	Supply Voltage	4.5	5	5.5	V
/ _{IH}	HIGH Level Input Voltage	2			V
/IL	LOW Level Input Voltage			0.8	V
ЭН	HIGH Level Output Current			-0.4	mA
OL	LOW Level Output Current			8	mA
A	Free Air Operating Temperature	0		70	°C

Electrical Characteristics

over recommended operating free air temperature range. All typical values are measured at $V_{CC} = 5V$, $T_A = 25^{\circ}C$.

Symbol	Parameter	Con	Conditions		Тур	Max	Units
V _{IK}	Input Clamp Voltage	$V_{CC} = 4.5V, I_I = -18$	$V_{CC} = 4.5V, I_1 = -18 \text{ mA}$			-1.5	V
V _{OH}	HIGH Level	I _{OH} = -0.4 mA	$I_{OH} = -0.4 \text{ mA}$ $V_{CC} = 4.5 \text{V to } 5.5 \text{V}$				V
	Output Voltage	$V_{CC} = 4.5V$ to $5.5V$					
V _{OL}	LOW Level	V _{CC} = 4.5V			0.35	0.5	V
	Output Voltage	v _{CC} = 4.5v	I _{OL} = 8 mA		0.35	0.5	v
I _I	Input Current @ Max.		,				
	Input Voltage	$V_{CC} = 5.5V, V_{IH} = 7V$	V			0.1	mA
I _{IH}	HIGH Level Input Current	$V_{CC} = 5.5V, V_{IH} = 2.$	7V			20	μA
IIL	LOW Level Input Current	$V_{CC} = 5.5V, V_{IL} = 0.4$	4V			-0.1	mA
I _O	Output Drive Current	$V_{CC} = 5.5V$	$V_0 = 2.25V$	-30		-112	mA
I _{CC}	Supply Current	$V_{CC} = 5.5V$	•		5	10	mA

Switching Characteristics

Symbol	Parameter	Conditions	From (Input) To (Output)	Min	Max	Units
t _{PLH}	Propagation Delay Time LOW-to-HIGH Level Output	$V_{CC} = 4.5V$ to 5.5V $R_L = 500\Omega$	A, B, C to Y	6	22	ns
t _{PHL}	Propagation Delay Time HIGH-to-LOW Level Output	C _L = 50 pF	A, B, C to Y	6	18	ns
t _{PLH}	Propagation Delay Time LOW-to-HIGH Level Output		Enable to Y	4	17	ns
t _{PHL}	Propagation Delay Time HIGH-to-LOW Level Output		Enable to Y	5	17	ns

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