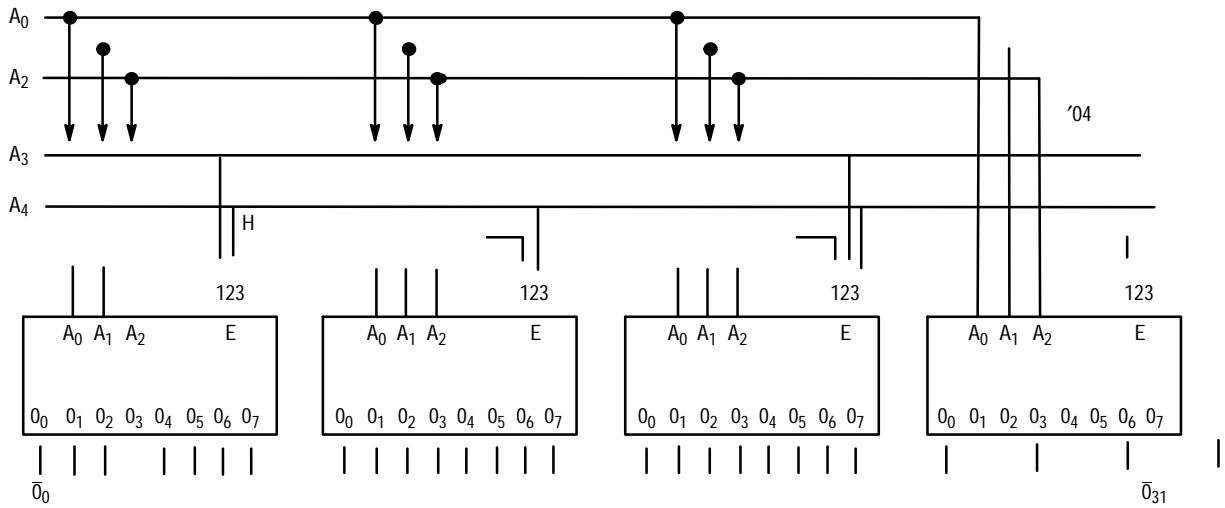# MC74AC138, MC74ACT138

FUNCTIONAL DESCRIPTION

The MC74AC138/74ACT138 high−speed 1−of−8 decoder/demultiplexer accepts three binary weighted inputs (A_0, A_1, A_2) and, when enabled, provides eight mutually exclusive active−LOW outputs ($\overline{O}_0$–$\overline{O}_7$). The MC74AC138/74ACT138 features three Enable inputs, two active−LOW ($\overline{E}_1$, $\overline{E}_2$) and one active−HIGH (E_3). All outputs will be HIGH unless $\overline{E}_1$ and $\overline{E}_2$ are LOW and E_3 is HIGH. This multiple enabled function allows easy parallel expansion of the device to a 1−of−32 (5 lines to 32 lines) decoder with just four MC74AC138/74ACT138 devices and one inverter (See Figure 4). The MC74AC138/74ACT138 can be used as an 8−output demultiplexer by using one of the active LOW Enable inputs as the data input and the other Enable inputs as strobes. The Enable inputs which are not used must be permanently tied to their appropriate active−HIGH or active−LOW state.

TRUTH TABLE

Inputs	Outputs
$\overline{E}_1$	

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A_0

A_2

A_3

A_4

'04

H

123   123   123   123

A_0 A_1 A_2	E
0_0 0_1 0_2 0_3 0_4 0_5 0_6 0_7	

$\overline{0}_0$

$\overline{0}_{31}$

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MAXIMUM RATINGS

Symbol	Parameter		Value	Unit
V_{CC}	DC Supply Voltage		-0.5 to $+6.5$	V
V_I	DC Input Voltage		$-0.5 \leq V_I \leq V_{CC} + 0.5$	V
V_O	DC Output Voltage	(Note 1)	$-0.5 \leq V_O \leq V_{CC} + 0.5$	V
I_{IK}	DC Input Diode Current		± 20	mA
I_{OK}	DC Output Diode Current		± 50	mA
I_O	DC Output Sink/Source Current		± 50	mA
I_{CC}	DC Supply Current per Output Pin		± 50	mA
I_{GND}	DC Ground Current per Output Pin		± 50	mA
T_{STG}	Storage Temperature Range		-65 to $+150$	C
T_L	Lead temperature, 1 mm from Case for 10 Seconds		260	C
T_J	Junction temperature under Bias		$+150$	C
θ_{JA}	Thermal Resistance (Note 2)	SOIC TSSOP	126 159	C/W
P_D	Power Dissipation in Still Air at 25 C (Note 3)	SOIC TSSOP	995 787	mW
MSL	Moisture Sensitivity		Level 1	
F_R	Flammability Rating	Oxygen Index: 30% – 35%	UL 94 V–0 @ 0.125 in	
V_{ESD}	ESD Withstand Voltage	Human Body Model (Note 4) Charged Device Model (Note 5)	> 2000 > 1000	V
$I_{Latch-Up}$	Latch–Up Performance Above V_{CC} and Below GND at 85 C (Note 6)		± 100	mA

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.
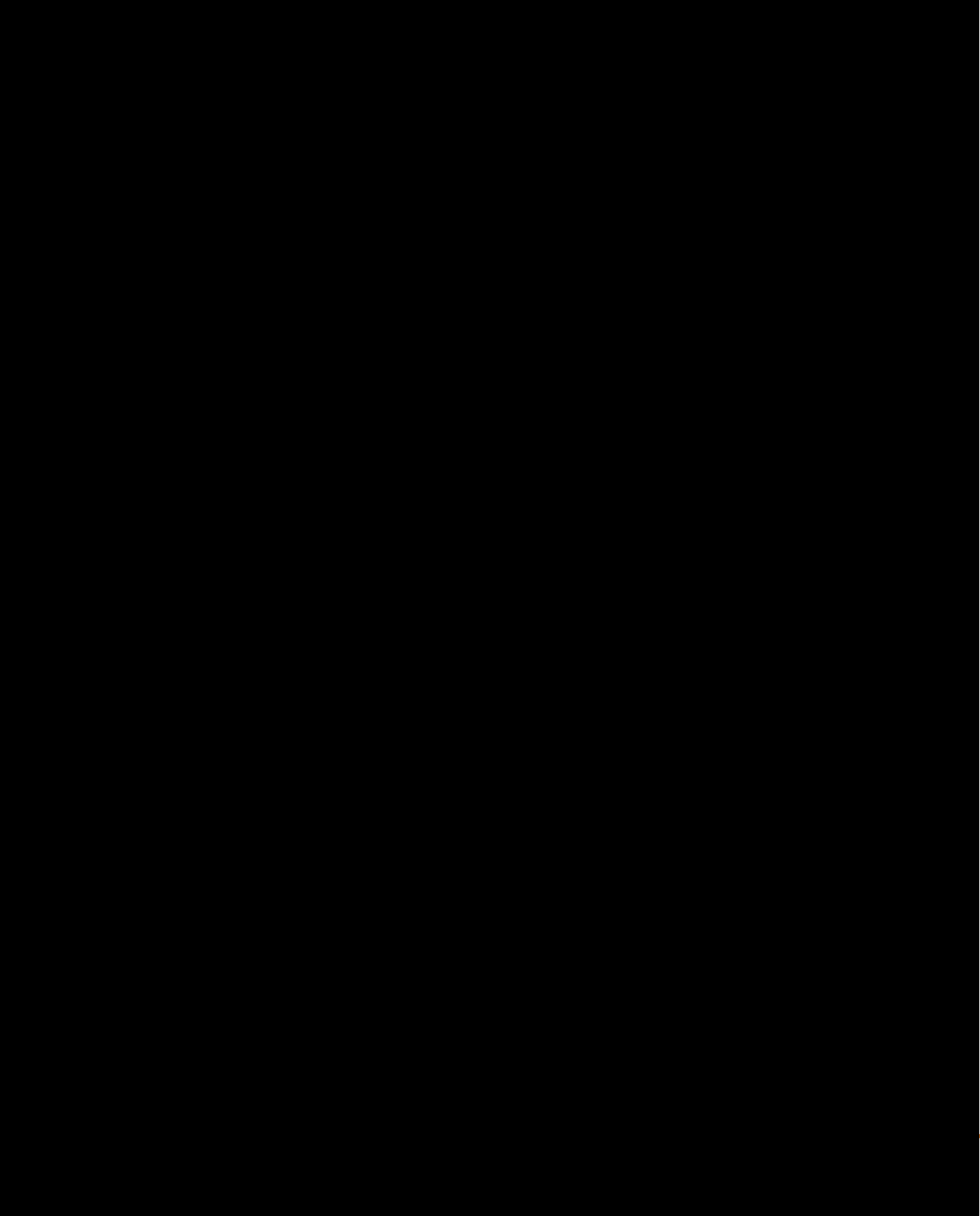1. I_O absolute maximum rating must be observed.
2. The package thermal impedance is calculated in accordance with JESD51–7.
3. 500 mW at 65 C; derate to 300 mW by 10 mW/ from 65 C to 85 C.
4. Tested to EIA/JESD22–A114–A.
5. Tested to JESD22–C101–A.
6. Tested to EIA/JESD78.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Typ	Max	Unit
V_{CC}	Supply Voltage	'AC	2.0	5.0	6.0	V
		'ACT	4.5	5.0	5.5	
V_{IN}, V_{OUT}	DC Input Voltage, Output Voltage (Ref. to GND)		0	–	V_{CC}	V
t_r, t_f	Input Rise and Fall Time (Note 1) 'AC Devices except Schmitt Inputs	V_{CC} @ 3.0 V	–	150	–	ns/V
		V_{CC} @ 4.5 V	–	40	–	
		V_{CC} @ 5.5 V	–	25	–	
t_r, t_f	Input Rise and Fall Time (Note 2) 'ACT Devices except Schmitt Inputs	V_{CC} @ 4.5 V	–	10	–	ns/V
		V_{CC} @ 5.5 V	–	8.0	–	
T_A	Operating Ambient Temperature Range		–40	25	85	C
I_{OH}	Output Current – High		–	–	–24	mA
I_{OL}	Output Current – Low		–	–	24	mA

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.
1. V_{IN} from 30% to 70% V_{CC}; see individual Data Sheets for devices that differ from the typical input rise and fall times.
2. V_{IN} from 0.8 V to 2.0 V; see individual Data Sheets for devices that differ from the typical input rise and fall times.

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DC CHARACTERISTICS

Symbol	Parameter	V_{CC} (V)	74AC T_A = +25 C		74AC T_A = −40 C to +85 C	Unit	Conditions
			Typ	Guaranteed Limits			
V_{IH}	Minimum High Level Input Voltage	3.0 4.5 5.5	1.5 2.25 2.75	2.1 3.15 3.85	2.1 3.15 3.85	V	V_{OUT} = 0.1 V or V_{CC} − 0.1 V
V_{IL}	Maximum Low Level Input Voltage	3.0	1.5	0.9	0.9		V_{OUT} = 0.1 V

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DC CHARACTERISTICS

Symbol	Parameter	V_{CC} (V)	74ACT T_A = +25 C	74ACT T_A = −40 C to +85 C	Unit	Conditions
			Typ	Guaranteed Limits		
V_{IH}	Minimum High Level Input Voltage	4.5 5.5	1.5 1.5	2.0 2.0 / 2.0 2.0	V	V_{OUT} = 0.1 V or V_{CC} − 0.1 V
V_{IL}	Maximum Low Level Input Voltage	4.5 5.5	1.5 1.5	0.8 0.8 / 0.8 0.8	V	V_{OUT} = 0.1 V or V_{CC} − 0.1 V
V_{OH}	Minimum High Level Output Voltage	4.5 5.5	4.49 5.49	4.4 5.4 / 4.4 5.4	V	I_{OUT} = −50 µA

ORDERING INFORMATION

Device Order Number	Marking	Package	Shipping†
MC74AC138DG	AC138	SOIC–16 (Pb–Free)	48 Units / Rail
MC74AC138DR2G	AC138	SOIC–16 (Pb–Free)	2500 Tape & Reel
MC74AC138DTR2G	AC 138	TSSOP–16 (Pb–Free)	2500 Tape & Reel
MC74ACT138DG	ACT138	SOIC–16 (Pb–Free)	48 Units / Rail
MC74ACT138DR2G	ACT138	SOIC–16 (Pb–Free)	2500 Tape & Reel
MC74ACT138DR2G–Q*	ACT138	SOIC–16 (Pb–Free)	2500 Tape & Reel
MC74ACT138DTR2G	ACT 138	TSSOP–16 (Pb–Free)	2500 Tape & Reel

3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15

nm TOTAL IN EXCESS OF THE
b DIMENSION AT MAXIMUM MATE
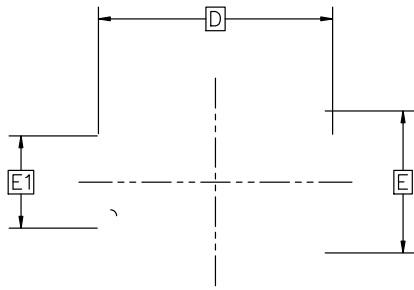
TOP VIEW

**GENERIC
MARKING DIAGRAM***
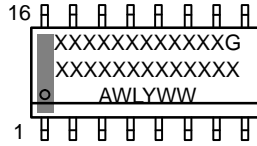
XXXXX = Specific Device Code
A   = Assembly Location
WL   = Wafer Lot
Y   = Year
WW   = Work Week
G   = Pb Free Package

*This information is generic. Please refer to
device data sheet for actual part marking.
Pb Free indicator, "G" or microdot "▪", may
or may not be present. Some products may
not follow the Generic Marking.
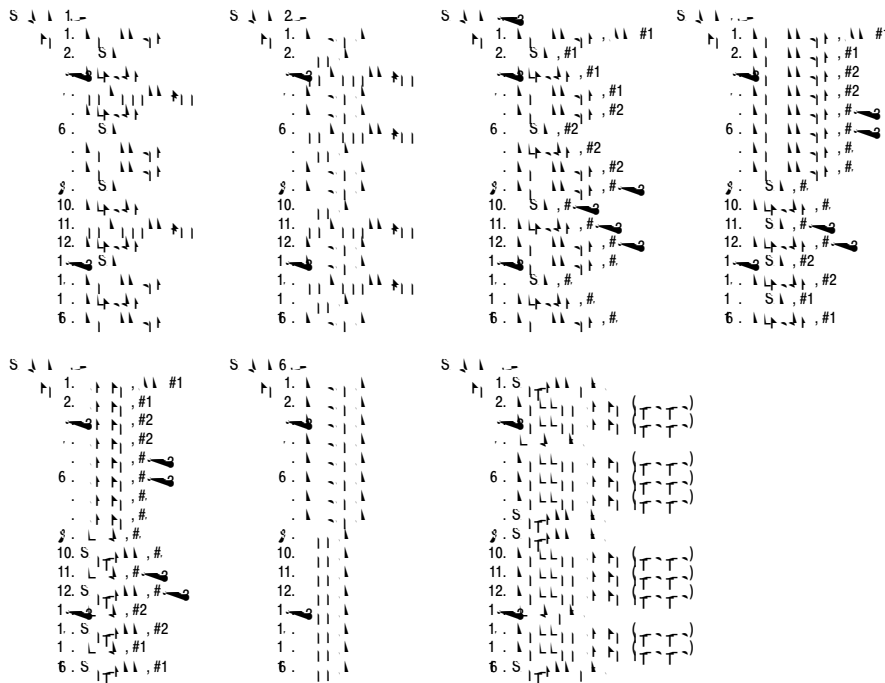
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TSSOP−16 WB
CASE 948F
ISSUE B

DATE 19 OCT 2006

SCALE 2:1