



# Low Power Schottky Logic – 54LS138

3-to-8 Line Decoder / Demultiplexer IC in bare die form

Rev 1.0  
21/11/17

## Description

The 54LS138 3-to-8 Line Decoder / Demultiplexer is fabricated on a 2µm 40V Bipolar process. The device decodes 1-of-8 lines, set by x3 binary select inputs & three enable inputs. Multiple Input Enables allow parallel expansion to a 24-line decoder using x3 54LS138 devices or a 32 line decoder using x4 54LS138 + inverter. The LS138 can be used as an 8-output demultiplexer by using one active LOW Enable input as data input & the other Enable inputs as strobes. Unused Enable inputs must be permanently tied to their appropriate active HIGH or active LOW state.

## Features:

- Demultiplexing capability
- Multiple Input Enables for parallel expansion
- Active Low Mutually Exclusive Outputs
- Input Clamp Diodes Limit High Speed Termination Effects
- Full Military Temperature Range.
- Direct drop in replacement for obsolete components in long term programs.

## Ordering Information

The following part suffixes apply:

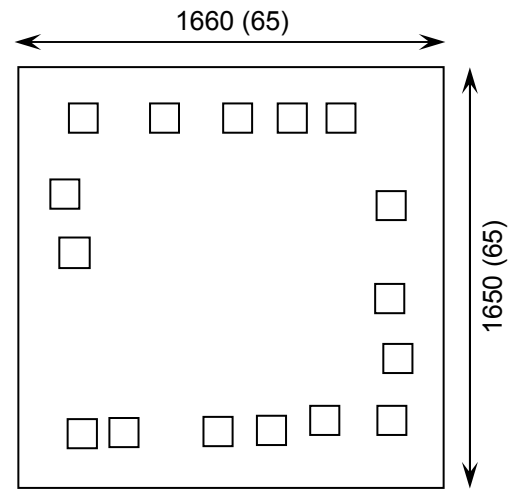
- No suffix - MIL-STD-883 /2010B Visual Inspection
- "H" - MIL-STD-883 /2010B Visual Inspection + MIL-PRF-38534 Class H LAT
- "K" - MIL-STD-883 /2010A Visual Inspection (Space) + MIL-PRF-38534 Class K LAT

LAT = Lot Acceptance Test.

For further information on LAT process flows see below.

[www.siliconsupplies.com/quality/bare-die-lot-qualification](http://www.siliconsupplies.com/quality/bare-die-lot-qualification)

## Die Dimensions in µm (mils)



## Supply Formats:

- Default – Die in Waffle Pack (100 per tray capacity)
- Sawn Wafer on Tape – On request
- Unsawn Wafer – On request
- Die Thickness <=> 350µm(14 Mils) – On request
- Assembled into Ceramic Package – On request

## Mechanical Specification

Die Size (Unsawn)	1660 x 1650 65 x 65	µm mils
Minimum Bond Pad Size	116 x 116 4.57 x 4.57	µm mils
Die Thickness	350 (±20) 13.78 (±0.79)	µm mils
Top Metal Composition	Al 1%Si 1.1µm	
Back Metal Composition	N/A – Bare Si	

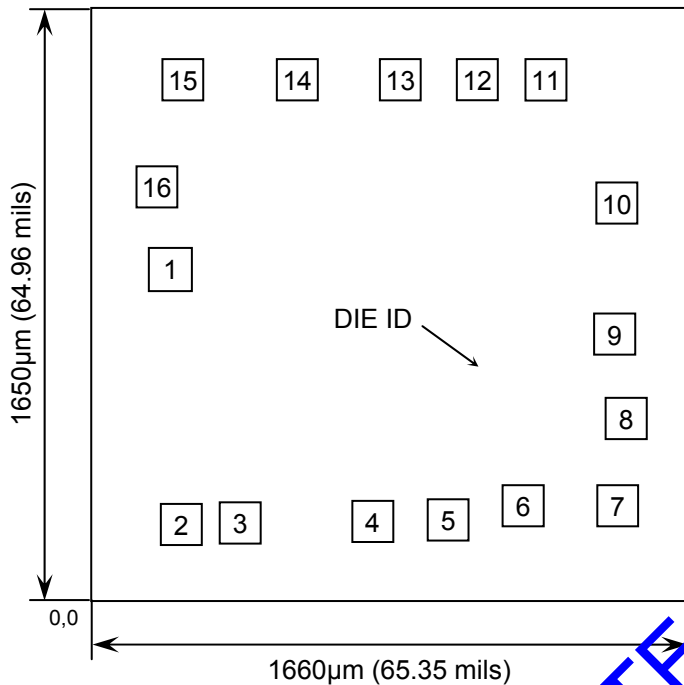




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## Pad Layout and Functions



PAD	FUNCTION	COORDINATES (mm)	
		X	Y
1	A	0.173	0.875
2	B	0.197	0.169
3	C	0.361	0.171
4	$\bar{G}2A$	0.725	0.176
5	$\bar{G}2B$	0.929	0.184
6	G1	1.141	0.220
7	Y7	1.405	0.221
8	GND	1.425	0.461
9	Y6	1.393	0.695
10	Y5	1.398	1.054
11	Y4	1.198	1.395
12	Y3	1.022	1.395
13	Y2	0.804	1.395
14	Y1	0.524	1.395
15	Y0	0.202	1.395
16	V <sub>CC</sub>	0.135	1.099

CONNECT CHIP BACK TO GND OR FLOAT

## Truth Table

INPUTS					OUTPUTS								
G1	$\bar{G}2A$	$\bar{G}2B$	C	B	A	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
X	X	H	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
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	L	H	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 level (steady state)  
L = Low level (steady state)  
X = Don't care





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## Absolute Maximum Ratings<sup>1</sup>

PARAMETER	SYMBOL	VALUE	UNIT
DC Supply Voltage	$V_{CC}$	7.0	V
DC Input Voltage	$V_{IN}$	7.0	V
Storage Temperature Range	$T_{STG}$	-65 to 150	°C

1. Operation above the absolute maximum rating may cause device failure. Operation at the absolute maximum ratings, for extended periods, may reduce device reliability.

## Recommended Operating Conditions

PARAMETER	SYMBOL	MIN	MAX	UNITS
Supply Voltage	$V_{CC}$	4.5	5.5	V
High-Level Input Voltage	$V_{IH}$	2	-	V
Low-Level Input Voltage	$V_{IL}$	-	0.7	V
High-Level Output Current	$I_{OH}$	-	-0.4	mA
Low-Level Output Current	$I_{OL}$	-	4	mA
Operating Temperature Range	$T_J$	-55	+125	°C

## DC Electrical Characteristics<sup>2</sup> $T_J = -55^{\circ}\text{C}$ to $125^{\circ}\text{C}$ unless otherwise specified

PARAMETER	SYMBOL	CONDITIONS	LIMITS			UNITS
			MIN	TYP	MAX	
Minimum High-Level Input Voltage	$V_{IH}$	-	2	-	-	V
Maximum Low-Level Input Voltage	$V_{IL}$	-	-	-	0.7	V
Input Clamp Diode Voltage	$V_{IK}$	$V_{CC} = \text{MIN}$ $I_{IN} = -18\text{mA}$	-	-0.65	-1.5	V
Output Voltage High	$V_{OH}$	$V_{CC} = \text{MIN}, I_{OH} = \text{MAX}$ $V_{IN} = V_{IL}$ or $V_{IH}$ per Function Table	2.5	3.4	-	V
Output Voltage Low	$V_{OL}$	$V_{CC} = \text{MIN}$ $I_{OH} = \text{MAX}$ $V_{IN} = V_{IL}$ or $V_{IH}$ per Truth Table $I_{OL} = 4\text{mA}$	-	0.25	0.4	V
Input High Current	$I_{IH}$	$V_{CC} = \text{MAX}, V_{IN} = 2.7\text{V}$	-	-	20	$\mu\text{A}$
		$V_{CC} = \text{MAX}, V_{IN} = 7.0\text{V}$	-	-	0.1	mA
Input Low Current	$I_{IL}$	$V_{CC} = \text{MAX}, V_{IN} = 0.4\text{V}$	-	-	-0.4	mA
Short Circuit Current <sup>3</sup>	$I_{OS}$	$V_{CC} = \text{MAX}$	-20	-	-100	mA
Power Supply Current (Total)	$I_{CC}$	$V_{CC} = \text{MAX}$	-	6.3	10	mA

2. All typical values @  $V_{CC} = 5\text{V}$ ,  $T_J = 25^{\circ}\text{C}$ . 3. Not more than one output should be shorted at a time, nor for more than 1 second.





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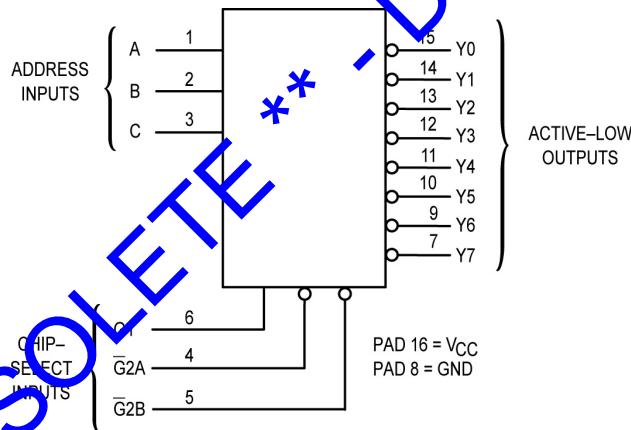
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## AC Electrical Characteristics<sup>4</sup>

PARAMETER	SYMBOL	CONDITIONS	DELAY LEVELS	LIMITS			UNITS
				MIN	TYP	MAX	
Propagation Delay, Address to Output	$t_{PLH}$	$V_{CC} = 5V, C_L = 15pF$	2	-	13	20	ns
	$t_{PHL}$		2	-	27	41	
Propagation Delay, Other Input High	$t_{PLH}$	$V_{CC} = 5V, C_L = 15pF$	3	-	18	27	ns
	$t_{PHL}$		3	-	26	39	
Propagation Delay, G2B or G2A Enable to Output	$t_{PLH}$	$V_{CC} = 5V, C_L = 15pF$	2	-	12	18	ns
	$t_{PHL}$		2	-	24	32	
Propagation Delay, G1 Enable to Output	$t_{PLH}$	$V_{CC} = 5V, C_L = 15pF$	3	-	17	26	ns
	$t_{PHL}$		3	-	25	38	

4. Not production tested in die form, characterized by chip design and tested in package.

## Logic Diagram



## Switching Waveforms



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