3 TO 8 LINE DECODER DEMULTIPLEXER

Description

The 74AHCT138 is an advanced high speed CMOS device that is designed to be pin compatable with 74LS low power Schottky types.

The device accepts a three bit binary weighted address on input pins A0, A1 and A2 and when enabled will produce one active low output with the remaining seven being high.

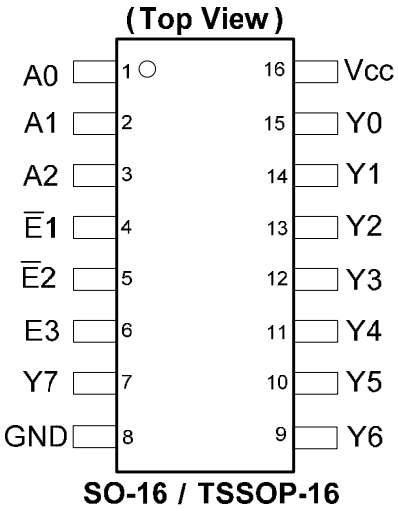
There are two active LOW enable inputs $\overline{E}1$ and $\overline{E}2$, and one active HIGH enable input E3. The disabled device state results in all outputs being high. The enable state occurs with $\overline{E}1$ and $\overline{E}2$ asserted low and E3 asserted high.

The multiple enable lines allow for the parallel expansion of decoders to create 4-to-16 line versions with no additional parts and 5-to-32 versions with the addition of a single inverter.

Features

- Supply Voltage Range from 4.5V to 5.5V
- Sinks or Sources 8mA at V_{CC} = 4.5V
- CMOS Low Power Consumption
- Schmitt Trigger Action at All Inputs
- Inputs Accept up to 6.0V
- ESD Protection Tested per JESD 22
- Exceeds 200-V Machine Model (A115-A)
- Exceeds 2000-V Human Body Model (A114-A)
- Exceeds 1000-V Charged Device Model (C101C)
- Latch-Up Exceeds 250mA per JESD 78, Class II
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

Pin Assignments



SO-16 / TSSOP-16

Applications

- Memory chip select decoding
- Demultiplexing
- Single line peripheral control
- Allow simple serial bit streams from a microcontroller to control as many peripheral lines as needed

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Click here for ordering information, located at the end of datasheet

© Diodes Incorporated

Pin Descriptions

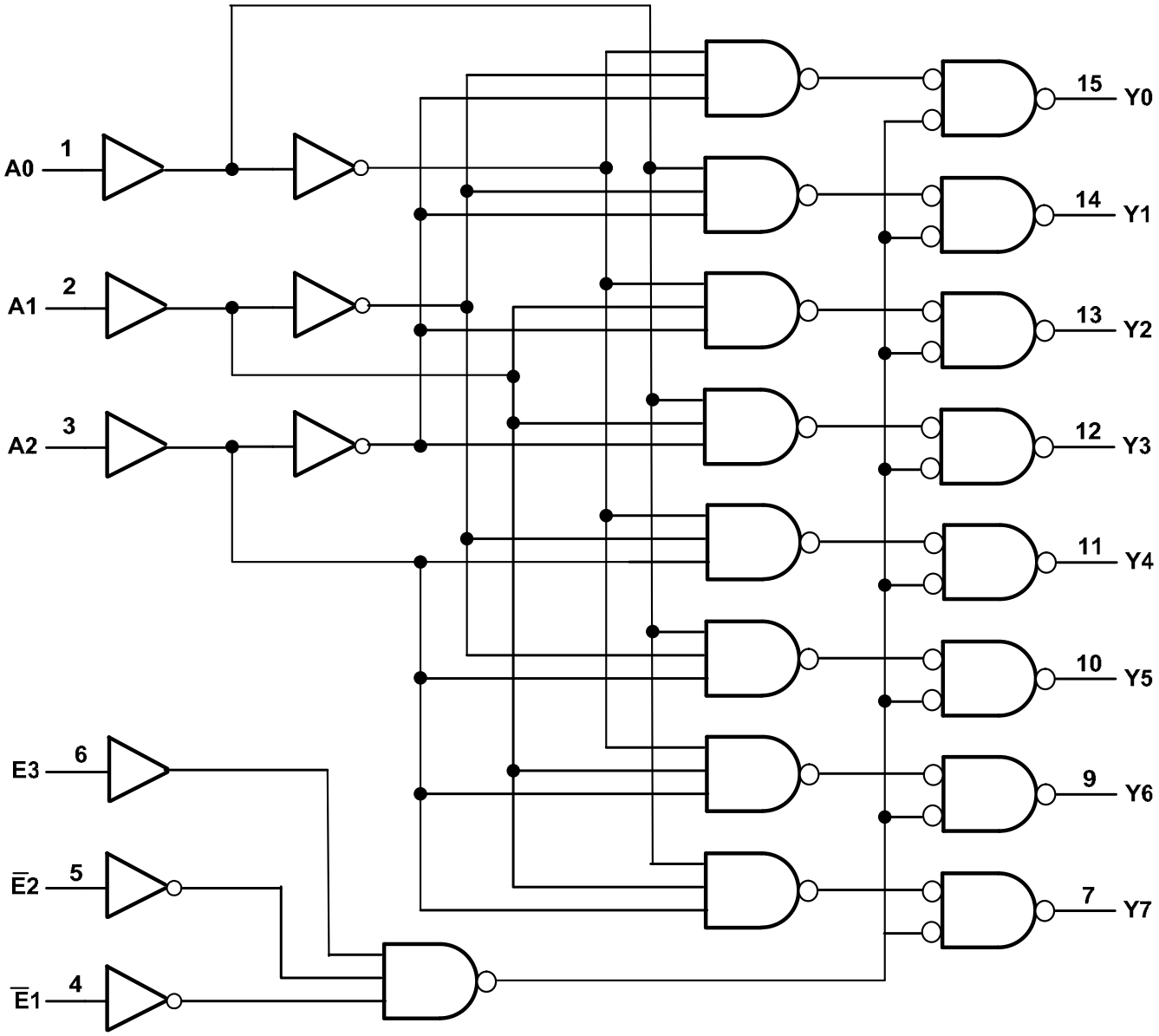
Pin Number	Pin Name	Description
1	A0	Address Input 0
2	A1	Address Input 1
3	A2	Address Input 2
4	$\overline{E}1$	Enable Input 1 (active LOW)
5	$\overline{E}2$	Enable Input 2 (active LOW)
6	E3	Enable Input 3 (active HIGH)
7	Y7	Output 7 (active LOW)
8	GND	Ground
9	Y6	Output 6 (active LOW)
10	Y5	Output 5 (active LOW)
11	Y4	Output 4 (active LOW)
12	Y3	Output 3 (active LOW)
13	Y2	Output 2 (active LOW)
14	Y1	Output 1 (active LOW)
15	Y0	Output o (active LOW)
16	V_{CC}	Supply Voltage

Function Table Diagram

Control			Input			Output							
$\overline{E}1$	$\overline{E}2$	E3	A2	A1	A0	$\overline{Y}7$	$\overline{Y}6$	$\overline{Y}5$	$\overline{Y}4$	$\overline{Y}3$	$\overline{Y}2$	$\overline{Y}1$	$\overline{Y}0$
H	X	X	X	X	X	H	H	H	H	H	H	H	H
X	H	X											
X	X	L											
L	L	H											
			L	L	L	H	H	H	H	H	H	H	L
			L	L	H	H	H	H	H	H	H	L	H
			L	H	L	H	H	H	H	H	L	H	H
			L	H	H	H	H	H	H	L	H	H	H
			H	L	L	H	H	H	L	H	H	H	H
			H	L	H	H	H	L	H	H	H	H	H
			H	H	L	H	L	H	H	H	H	H	H
			H	H	H	L	H	H	H	H	H	H	H

© Diodes Incorporated

Logic Diagram



© Diodes Incorporated

Absolute Maximum Ratings (Note 4) (@T_A = +25°C, unless otherwise specified.)

Symbol	Description	Rating	Unit
ESD HBM	Human Body Model ESD Protection	2	KV
ESD CDM	Charged Device Model ESD Protection	1	KV
ESD MM	Machine Model ESD Protection	200	V
V_{CC}	Supply Voltage Range	-0.5 to +7.0	V
V_I	Input Voltage Range	-0.5 to +7.0	V
V_o	Voltage applied to output in high or low state	-0.3 to V_{CC} +0.5	V
I_{IK}	Input Clamp Current V_I< -0.5V	-20	mA
I_{OK}	Output Clamp Current V_O<-0.5V	-20	mA
I_{OK}	Output Clamp Current V_O> V_{CC} + 0.5V	25	mA
I_O	Continuous output current	+/- 25	mA
I_{CC}	Continuous current through V_{DD} or GND	75	mA
I_{GND}	Continuous current through V_{DD} or GND	-75	mA
T_J	Operating Junction Temperature	-40 to +150	°C
T_{STG}	Storage Temperature	-65 to +150	°C
P_{TOT}	Total Power Dissipation	500	mW

Notes: 4. Stresses beyond the absolute maximum may result in immediate failure or reduced reliability. These are stress values and device operation should be within recommend values.

Recommended Operating Conditions (Note 5) (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	Supply Voltage		4.5	5.5	V
V_I	Input Voltage		0	5.5	V
V_O	Output Voltage	Active Mode	0	V_{CC}	V
$\Delta t/\Delta V$	Input transition Rise or Fall Rate	V_{CC} = 4.5V to 5.5V		20	ns/V
T_A	Operating Free-Air Temperature		-40	+125	°C

Note: 5. Unused inputs should be held at V_{CC} or Ground.

Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Test Conditions	V_{CC}	T_A = +25°C			T_A = -40°C to +85°C		T_A = -40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
V_{IH}	High-level Input Voltage		4.5V to 5.5V	2.0	–	–	2.0	–	2.0	–	V
V_{IL}	Low-level input voltage		4.5V to 5.5V	–	–	0.8	–	0.8	–	0.8	V
V_{OH}	High Level Output Voltage	I_{OH} = -50µA	4.5V	4.4	4.5	–	4.4	–	4.4	–	V
		I_{OH} = -8mA	4.5V	3.94	–	–	3.80	–	3.70	–	
V_{OL}	Low-level Output Voltage	I_{OL} = 50µA	4.5V	–	0	0.1	–	0.1	–	0.1	V
		I_{OL} = 8mA	4.5V	–	–	0.36	–	0.44	–	0.55	
I_I	Input Current	V_I = GND or 5.5V	0V to 5.5V	–	0.1	±0.1	–	± 1	–	± 2	µA
I_{CC}	Supply Current	V_I = GND or V_{CC} I_O = 0	5.5V	–	–	4.0	–	40	–	80	µA
ΔI_{CC}	Additional Supply Current per Input	V_I = Vcc -2.1V I_O = 0	4.5V to 5.5V	–	–	1.35	–	1.5	–	1.5	mA
C_i	Input Capacitance	V_i = V_{CC} or GND	5.5V	–	4	10	–	10	–	10	pF

© Diodes Incorporated

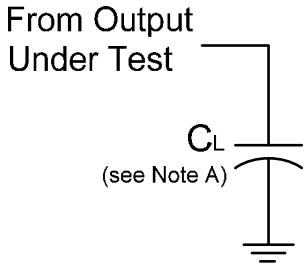
Switching Characteristics

Symbol	Parameter	Test Conditions	V_{CC}	T_A = +25°C			-40°C to +85°C		-40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t_{PD}	Propagation Delay An to $\overline{Y}$n	Figure 2 C_L =15pF	4.5V to 5.5V	0.5	4.4	10.4	1.0	12.0	1.0	13.0	ns
		Figure 2 C_L = 50pF	4.5V to 5.5V	0.5	6.2	11.4	1.0	13.0	1.0	14.5	
	Propagation Delay E3 to $\overline{Y}$n	Figure 2 C_L = 15pF	4.5V to 5.5V	0.5	4.3	9.1	1.0	10.5	1.0	11.5	ns
		Figure 2 C_L = 50pF	4.5V to 5.5V	0.5	6.2	10.1	1.0	11.5	1.0	13.0	
	Propagation Delay $\overline{E}$n to $\overline{Y}$n	Figure 2 C_L = 15pF	4.5V to 5.5V	0.5	4.3	9.6	1.0	11.0	1.0	12.0	ns
		Figure 2 C_L = 50pF	4.5V to 5.5V	0.5	6.2	10.6	1.0	12.0	1.0	13.5	

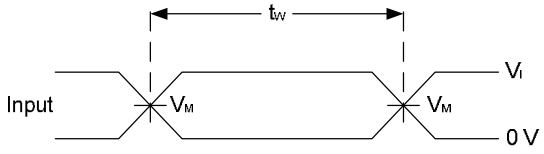
Operating Characteristics (@T_A = +25°C, unless otherwise specified.)

Parameter		Test Conditions	V_{CC} = 5V	Unit
			Typ	
C_{pd}	Power dissipation capacitance	f = 1 MHz all outputs switching-no load	23	pF

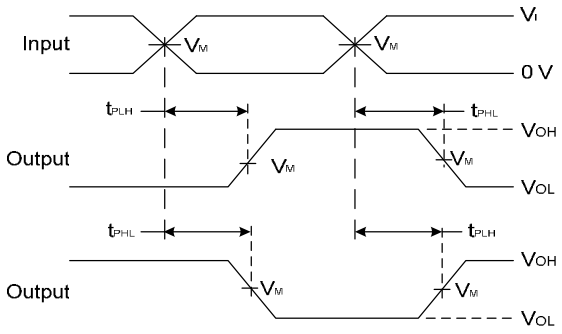
Parameter Measurement Information



V_{CC}	Inputs		V_M		C_L
	V_I	t_r/t_f	Input	Output	
4.5V to 5.5V	3.0 V	3ns	1.5 V	$V_{CC}/2$	15pF, 50pF



Voltage Waveform
Pulse Duration



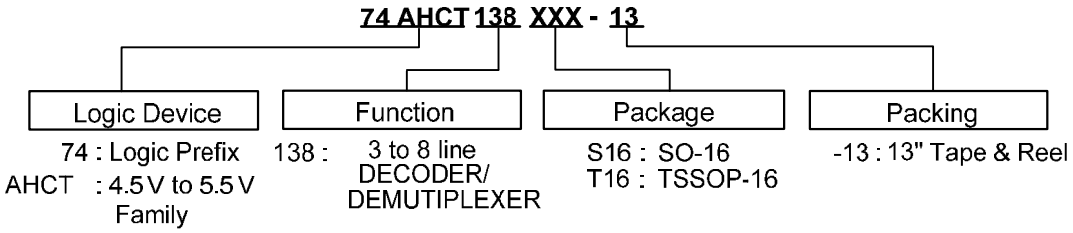
Voltage Waveform
Propagation Delay Times
Inverting and Non Inverting Outputs

Notes: A. Includes test lead and test apparatus capacitance.
B. All pulses are supplied at pulse repetition rate ≤ 10 MHz.
C. Inputs are measured separately one transition per measurement.
D. t_{PLH} and t_{PHL} are the same as t_{PD}.

© Diodes Incorporated

Figure 1. Load Circuit and Voltage Waveforms

Ordering Information

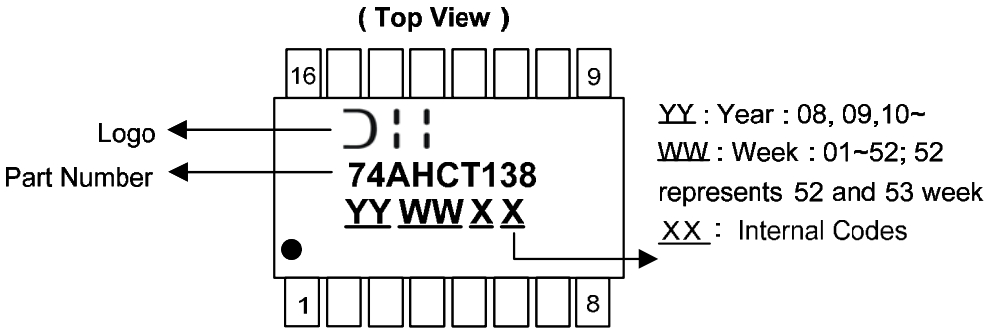


Part Number	Package Code	Packaging	7" Tape and Reel (Note 7)	
			Quantity	Part Number Suffix
74AHCT138S16-13	S16	SO-16	2500/Tape & Reel	-13
74AHCT138T16-13	T16	TSSOP-16	2500/Tape & Reel	-13

Notes: 7. The taping orientation is located on our website at http://www.diodes.com/datasheets/ap02007.pdf

Marking Information

(1) SO-16, TSSOP16



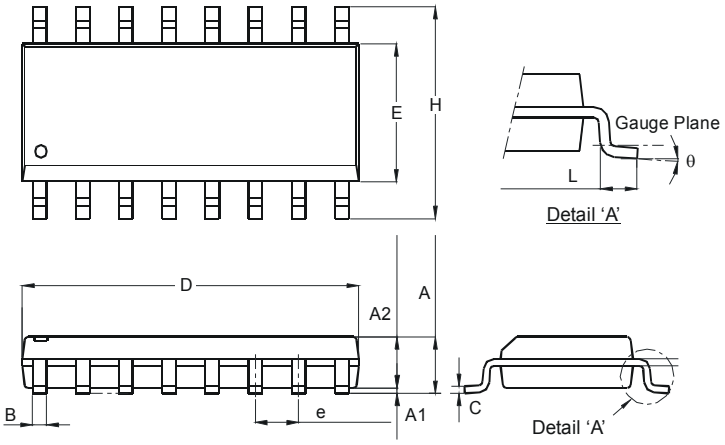
Part Number	Package
74AHCT138S16	SO-16
74AHCT138T16	TSSOP-16

© Diodes Incorporated

Package Outline Dimensions (All dimensions in mm.)

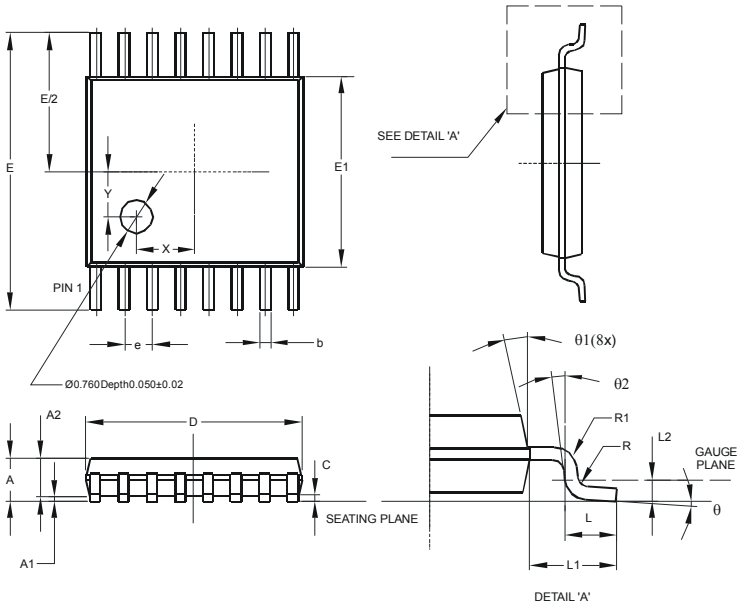
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for latest version.

Package Type: SO-16



SO-16		
Dim	**Min**	**Max**
A	1.40	1.75
A1	0.10	0.25
A2	1.30	1.50
B	0.33	0.51
C	0.19	0.25
D	9.80	10.00
E	3.80	4.00
e	1.27 Typ	
H	5.80	6.20
L	0.38	1.27
θ	0°	8°
All Dimensions in mm		

Package Type: TSSOP-16



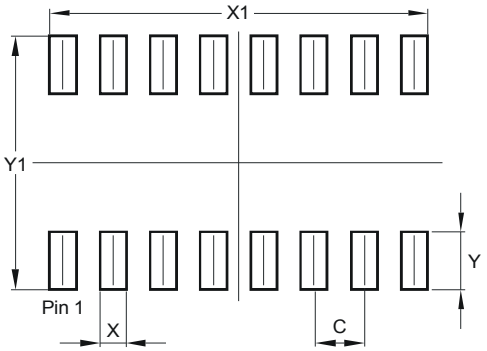
TSSOP-16			
Dim	**Min**	**Max**	**Typ**
A	-	1.08	-
A1	0.05	0.15	-
A2	0.80	0.93	-
b	0.19	0.30	-
c	0.09	0.20	-
D	4.90	5.10	-
E	6.40 BSC		
E1	4.30	4.50	-
e	0.65 BSC		
L	0.45	0.75	-
L1	1.00 REF		
L2	0.25 BSC		
R	0.09	-	-
R1	0.09	-	-
X	-	-	1.350
Y	-	-	1.050
θ	0°	8°	-
θ1	5°	15°	-
θ2	0°	-	-
All Dimensions in mm			

© Diodes Incorporated

Suggested Pad Layout

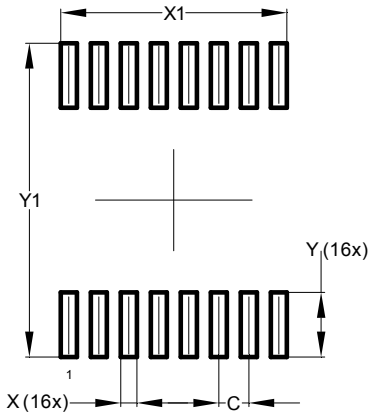
Please see AP02001 at http://www.diodes.com/datasheets/ap02001.pdf for the latest version.

Package Type: SO-16



Dimensions	Value (in mm)
C	1.270
X	0.670
X1	9.560
Y	1.450
Y1	6.400

Package Type: TSSOP-16



Dimensions	Value (in mm)
C	0.650
X	0.350
X1	4.900
Y	1.400
Y1	6.800

© Diodes Incorporated

IMPORTANT NOTICE

DIODES INCORPORATED MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARDS TO THIS DOCUMENT, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION).

Diodes Incorporated and its subsidiaries reserve the right to make modifications, enhancements, improvements, corrections or other changes without further notice to this document and any product described herein. Diodes Incorporated does not assume any liability arising out of the application or use of this document or any product described herein; neither does Diodes Incorporated convey any license under its patent or trademark rights, nor the rights of others. Any Customer or user of this document or products described herein in such applications shall assume all risks of such use and will agree to hold Diodes Incorporated and all the companies whose products are represented on Diodes Incorporated website, harmless against all damages.

Diodes Incorporated does not warrant or accept any liability whatsoever in respect of any products purchased through unauthorized sales channel.
Should Customers purchase or use Diodes Incorporated products for any unintended or unauthorized application, Customers shall indemnify and hold Diodes Incorporated and its representatives harmless against all claims, damages, expenses, and attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized application.

Products described herein may be covered by one or more United States, international or foreign patents pending. Product names and markings noted herein may also be covered by one or more United States, international or foreign trademarks.

This document is written in English but may be translated into multiple languages for reference. Only the English version of this document is the final and determinative format released by Diodes Incorporated.

LIFE SUPPORT

Diodes Incorporated products are specifically not authorized for use as critical components in life support devices or systems without the express written approval of the Chief Executive Officer of Diodes Incorporated. As used herein:

A. Life support devices or systems are devices or systems which:

1. are intended to implant into the body, or

2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

B. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

Customers represent that they have all necessary expertise in the safety and regulatory ramifications of their life support devices or systems, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of Diodes Incorporated products in such safety-critical, life support devices or systems, notwithstanding any devices- or systems-related information or support that may be provided by Diodes Incorporated. Further, Customers must fully indemnify Diodes Incorporated and its representatives against any damages arising out of the use of Diodes Incorporated products in such safety-critical, life support devices or systems.

Copyright © 2013, Diodes Incorporated

www.diodes.com