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## Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



## Description

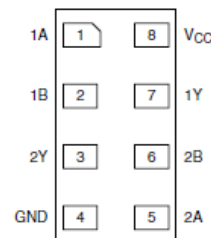
The Advanced Ultra Low Power (AUP) CMOS logic family is designed for low power and extended battery life in portable applications.

The 74AUP2G02 is a dual two-input NOR gate. Both gates have push-pull outputs designed for operation over a power supply range of 0.8 V to 3.6 V. The device is fully specified for partial power down applications using  $I_{OFF}$ . The  $I_{OFF}$  circuitry disables the output preventing damaging current backflow when the device is powered down. Each gate performs the positive Boolean function:

$$Y = \overline{A + B} \text{ or } Y = \overline{A} \bullet \overline{B}$$

## Pin Assignments

(Top View)



**X2-DFN1210-8**

## Features

- Advanced Ultra Low Power (AUP) CMOS
- Supply Voltage Range from 0.8V to 3.6V
- ±4mA Output Drive at 3.0V
- Low Static Power Consumption  
 $I_{CC} < 0.9\mu A$
- Low Dynamic Power Consumption  
 $C_{PD} = 6 \text{ pF}$  (Typical at 3.6V)
- Schmitt Trigger Action at all inputs makes the circuit tolerant for slower input rise and fall time. The hysteresis is typically 250 mV at  $V_{CC} = 3.0V$
- $I_{OFF}$  Supports Partial-Power-Down Mode Operation
- ESD Protection Exceeds JESD 22  
2000-V Human Body Model (A114)  
Exceeds 1000-V Charged Device Model (C101)
- Latch-Up Exceeds 100mA per JESD 78, Class I
- Leadless Packages Named per JESD30E
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

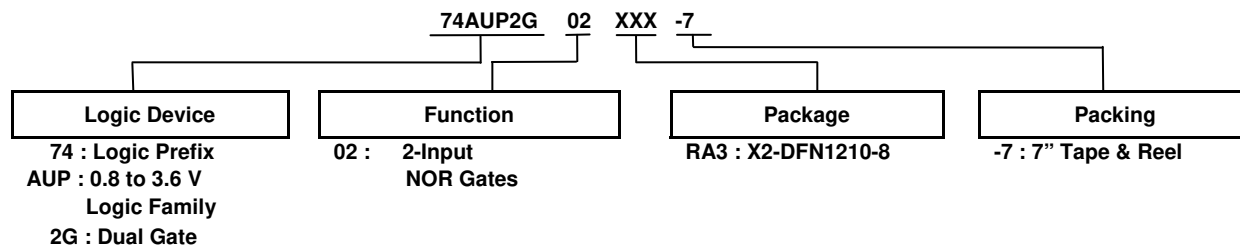
## Applications

- Suited for Battery and Low Power Needs
- Wide array of products such as:
  - Tablets, E-readers
  - Cell Phones, Personal Navigation / GPS
  - MP3 Players, Cameras, Video Recorders
  - PCs, Ultrabooks, Notebooks, Netbooks
  - Computer Peripherals, Hard Drives, SSD, CD/DVD ROM
  - TV, DVD, DVR, Set-Top Box

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/quality/lead\\_free.html](http://www.diodes.com/quality/lead_free.html) 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.

## Ordering Information



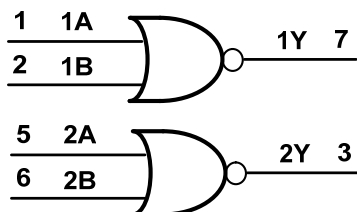
Device	Package Code	Package (Notes 4 & 5)	Package Size	7" Tape and Reel	
				Quantity	Part Number Suffix
74AUP2G02RA3-7	RA3	X2-DFN1210-8	1.2mm X 1.0mm X 0.35mm 0.3 mm lead pitch	5,000/Tape & Reel	-7

Notes: 4. Pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at <http://www.diodes.com/datasheets/ap02001.pdf>.  
5. The taping orientation is located on our website at <http://www.diodes.com/datasheets/ap02007.pdf>.

## Pin Descriptions

Pin Name	Pin No.	Function
1A	1	Data Input
1B	2	Data Input
2Y	3	Data Output
GND	4	Ground
2A	5	Data Input
2B	6	Data Input
1Y	7	Data Output
V <sub>CC</sub>	8	Supply Voltage

## Logic Diagram



## Function Table

Inputs		Output
A	B	Y
L	L	H
L	H	L
H	L	L
H	H	L

**Absolute Maximum Ratings** (Notes 6 & 7)

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 +4.6	V
$V_I$	Input Voltage Range	-0.5 to +4.6	V
$V_O$	Voltage Applied to Output in High or Low State	-0.5 to $V_{CC} + 0.5$	V
$I_{IK}$	Input Clamp Current $V_I < 0$	50	mA
$I_{OK}$	Output Clamp Current ( $V_O < 0$ )	50	mA
$I_O$	Continuous Output Current ( $V_O = 0$ to $V_{CC}$ )	$\pm 20$	mA
$I_{CC}$	Continuous Current Through $V_{CC}$	50	mA
$I_{GND}$	Continuous Current Through GND	-50	mA
$T_J$	Operating Junction Temperature	-40 to +150	$^{\circ}C$
$T_{STG}$	Storage Temperature	-65 to +150	$^{\circ}C$

- Notes:
- 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.
  - Forcing the maximum allowed voltage could cause a condition exceeding the maximum current or conversely forcing the maximum current could cause a condition exceeding the maximum voltage. The ratings of both current and voltage must be maintained within the controlled range.

**Recommended Operating Conditions** (Note 8)

Symbol	Parameter	Min	Max	Unit	
$V_{CC}$	Operating Voltage	0.8	3.6	V	
$V_I$	Input Voltage	0	3.6	V	
$V_O$	Output Voltage	0	$V_{CC}$	V	
$I_{OH}$	High-Level Output Current	$V_{CC} = 0.8V$	—	-20	$\mu A$
		$V_{CC} = 1.1V$	—	-1.1	mA
		$V_{CC} = 1.4V$	—	-1.7	
		$V_{CC} = 1.65V$	—	-1.9	
		$V_{CC} = 2.3V$	—	-3.1	
		$V_{CC} = 3.0V$	—	-4	
$I_{OL}$	Low-Level Output Current	$V_{CC} = 0.8V$	—	20	$\mu A$
		$V_{CC} = 1.1V$	—	1.1	mA
		$V_{CC} = 1.4V$	—	1.7	
		$V_{CC} = 1.65V$	—	1.9	
		$V_{CC} = 2.3V$	—	3.1	
		$V_{CC} = 3.0V$	—	4	
$\Delta t/\Delta V$	Input Transition Rise or Fall Rate	$V_{CC} = 0.8V$ to $3.6V$		200	ns/V
$T_A$	Operating Free-Air Temperature	-40	+125		$^{\circ}C$

- Note: 8. Unused inputs should be held at  $V_{CC}$  or Ground.

**Electrical Characteristics**

Symbol	Parameter	Test Conditions	V <sub>CC</sub>	T <sub>A</sub> = +25°C		T <sub>A</sub> = -40°C to +85°C		Unit
				Min	Max	Min	Max	
V <sub>IH</sub>	High-Level Input Voltage	—	0.8V to 1.65V	0.80 X V <sub>CC</sub>	—	0.80 X V <sub>CC</sub>	—	V
		—	1.65V to 1.95V	0.65 X V <sub>CC</sub>	—	0.65 X V <sub>CC</sub>	—	
		—	2.3V to 2.7V	1.6	—	1.6	—	
		—	3.0V to 3.6V	2.0	—	2.0	—	
V <sub>IL</sub>	Low-Level Input Voltage	—	0.8V to 1.65V	—	0.30 X V <sub>CC</sub>	—	0.30 X V <sub>CC</sub>	V
		—	1.65V to 1.95V	—	0.35 X V <sub>CC</sub>	—	0.35 X V <sub>CC</sub>	
		—	2.3V to 2.7V	—	0.7	—	0.7	
		—	3.0V to 3.6V	—	0.9	—	0.9	
V <sub>OH</sub>	High-Level Output Voltage	I <sub>OH</sub> = -20μA	0.8V to 3.6V	V <sub>CC</sub> - 0.1	—	V <sub>CC</sub> - 0.1	—	V
		I <sub>OH</sub> = -1.1mA	1.1V	0.75 X V <sub>CC</sub>	—	0.7 X V <sub>CC</sub>	—	
		I <sub>OH</sub> = -1.7mA	1.4V	1.11	—	1.03	—	
		I <sub>OH</sub> = -1.9mA	1.65V	1.32	—	1.3	—	
		I <sub>OH</sub> = -2.3mA	2.3V	2.05	—	1.97	—	
		I <sub>OH</sub> = -3.1mA		1.9	—	1.85	—	
		I <sub>OH</sub> = -2.7mA	3V	2.72	—	2.67	—	
		I <sub>OH</sub> = -4mA		2.6	—	2.55	—	
V <sub>OL</sub>	Low-Level Input Voltage	I <sub>OL</sub> = 20μA	0.8V to 3.6V	—	0.1	—	0.1	V
		I <sub>OL</sub> = 1.1mA	1.1V	—	0.3 X V <sub>CC</sub>	—	0.3 X V <sub>CC</sub>	
		I <sub>OL</sub> = 1.7mA	1.4V	—	0.31	—	0.37	
		I <sub>OL</sub> = 1.9mA	1.65V	—	0.31	—	0.35	
		I <sub>OL</sub> = 2.3mA	2.3V	—	0.31	—	0.33	
		I <sub>OL</sub> = 3.1mA		—	0.44	—	0.45	
		I <sub>OL</sub> = 2.7mA	3V	—	0.31	—	0.33	
		I <sub>OL</sub> = 4mA		—	0.44	—	0.45	
I <sub>I</sub>	Input Current	A or B Input V <sub>I</sub> = GND to 3.6V	0V to 3.6V	—	± 0.1	—	± 0.5	μA
I <sub>OFF</sub>	Power Down Leakage Current	V <sub>I</sub> or V <sub>O</sub> = 0V to 3.6V	0V	—	± 0.2	—	± 0.6	μA
ΔI <sub>OFF</sub>	Delta Power Down Leakage Current	V <sub>I</sub> or V <sub>O</sub> = 0V to 3.6V	0V to 0.2V	—	± 0.2	—	± 0.6	μA
I <sub>CC</sub>	Supply Current	V <sub>I</sub> = GND or V <sub>CC</sub> , I <sub>O</sub> = 0	0.8V to 3.6V	—	0.5	—	0.9	μA
ΔI <sub>CC</sub>	Additional Supply Current	One Input at V <sub>CC</sub> - 0.6V Other Inputs at V <sub>CC</sub> or GND	3.3V	—	40	—	50	μA

**Electrical Characteristics** (continued)

Symbol	Parameter	Test Conditions	V <sub>CC</sub>	T <sub>A</sub> = -40°C to +125°C		Unit
				Min	Max	
V <sub>IH</sub>	High-Level Input Voltage	—	0.8V to 1.65V	0.80 X V <sub>CC</sub>	—	V
		—	1.65V to 1.95V	0.70 X V <sub>CC</sub>	—	
		—	2.3V to 2.7V	1.6	—	
		—	3.0V to 3.6V	2.0	—	
V <sub>IL</sub>	Low-Level Input Voltage	—	0.8V to 1.65V	—	0.25 X V <sub>CC</sub>	V
		—	1.65V to 1.95V	—	0.30 X V <sub>CC</sub>	
		—	2.3V to 2.7V	—	0.7	
		—	3.0V to 3.6V	—	0.9	
V <sub>OH</sub>	High-Level Output Voltage	I <sub>OH</sub> = -20μA	0.8V to 3.6V	V <sub>CC</sub> - 0.11	—	V
		I <sub>OH</sub> = -1.1mA	1.1V	0.6 X V <sub>CC</sub>	—	
		I <sub>OH</sub> = -1.7mA	1.4V	0.93	—	
		I <sub>OH</sub> = -1.9mA	1.65V	1.17	—	
		I <sub>OH</sub> = -2.3mA	2.3V	1.77	—	
		I <sub>OH</sub> = -3.1mA		1.67	—	
		I <sub>OH</sub> = -2.7mA	3V	2.40	—	
		I <sub>OH</sub> = -4mA		2.30	—	
V <sub>OL</sub>	Low-Level Input Voltage	I <sub>OL</sub> = 20μA	0.8V to 3.6V	—	0.11	V
		I <sub>OL</sub> = 1.1mA	1.1V	—	0.33 X V <sub>CC</sub>	
		I <sub>OL</sub> = 1.7mA	1.4V	—	0.41	
		I <sub>OL</sub> = 1.9mA	1.65V	—	0.39	
		I <sub>OL</sub> = 2.3mA	2.3V	—	0.36	
		I <sub>OL</sub> = 3.1mA		—	0.50	
		I <sub>OL</sub> = 2.7mA	3V	—	0.36	
		I <sub>OL</sub> = 4mA		—	0.50	
I <sub>I</sub>	Input Current	A or B Input, V <sub>I</sub> = GND to 3.6V	0V to 3.6V	—	± 0.75	μA
I <sub>OFF</sub>	Power Down Leakage Current	V <sub>I</sub> or V <sub>O</sub> = 0V to 3.6V	0V	—	± 1.0	μA
ΔI <sub>OFF</sub>	Delta Power Down Leakage Current	V <sub>I</sub> or V <sub>O</sub> = 0V to 3.6V	0V to 0.2V	—	± 2.5	μA
I <sub>CC</sub>	Supply Current	V <sub>I</sub> = GND or V <sub>CC</sub> , I <sub>O</sub> = 0	0.8V to 3.6V	—	3.0	μA
ΔI <sub>CC</sub>	Additional Supply Current	Input at V <sub>CC</sub> - 0.6V Other Inputs at V <sub>CC</sub> or GND	3.3V	—	75	μA

**Operating and Package Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Parameter		Test Conditions		V <sub>CC</sub>	Typ	Unit
C <sub>pd</sub>	Power Dissipation Capacitance	f = 1MHz No Load		0.8V	5.1	pF
				1.2V ± 0.1V	5.2	
				1.5V ± 0.1V	5.2	
				1.8V ± 0.15V	5.5	
				2.5V ± 0.2V	5.7	
				3.3V ± 0.3V	6.0	
C <sub>i</sub>	Input Capacitance	V <sub>I</sub> = V <sub>CC</sub> or GND		0V or 3.3V	2.0	pF
θ <sub>JA</sub>	Thermal Resistance Junction-to-Ambient	X2-DFN1210-8	(Note 9)	—	+395	°C/W
θ <sub>JC</sub>	Thermal Resistance Junction-to-Case	X2-DFN1210-8	(Note 9)	—	+236	°C/W

Note: 9. Test condition, X2-DFN1210-8 device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.

**Switching Characteristics**
 $C_L = 5\text{pF}$ , See Figure 1

Parameter	From Input	To Output	V <sub>CC</sub>	T <sub>A</sub> = +25°C			T <sub>A</sub> = -40°C to +85°C		T <sub>A</sub> = -40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t <sub>pd</sub>	A or B	Y	0.8V	—	19.6	—	—	—	—	—	ns
			1.2V ± 0.1V	2.5	5.1	11.9	2.1	13.3	2.1	14.7	
			1.5V ± 0.1V	1.6	3.7	6.7	1.4	7.8	1.4	8.6	
			1.8V ± 0.15V	1.3	3.0	5.3	1.1	6.2	1.1	6.9	
			2.5V ± 0.2V	1.0	2.4	3.9	0.9	4.6	0.9	5.1	
			3.3V ± 0.3V	1.0	2.2	3.4	0.8	4.0	0.8	4.4	

 $C_L = 10\text{pF}$ , See Figure 1

Parameter	From Input	To Output	V <sub>CC</sub>	T <sub>A</sub> = +25°C			T <sub>A</sub> = -40°C to +85°C		T <sub>A</sub> = -40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t <sub>pd</sub>	A or B	Y	0.8V	—	23.5	—	—	—	—	—	ns
			1.2V ± 0.1V	2.4	6.0	14.1	2.2	15.7	2.2	17.4	
			1.5V ± 0.1V	1.9	4.3	7.9	1.7	9.2	1.7	10.2	
			1.8V ± 0.15V	1.6	3.6	6.2	1.5	7.3	1.5	8.1	
			2.5V ± 0.2V	1.4	3.0	4.7	1.2	5.6	1.2	6.2	
			3.3V ± 0.3V	1.3	2.7	4.2	1.2	5.0	1.2	5.5	

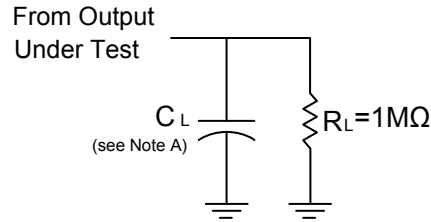
 $C_L = 15\text{pF}$ , See Figure 1

Parameter	From Input	To Output	V <sub>CC</sub>	T <sub>A</sub> = +25°C			T <sub>A</sub> = -40°C to +85°C		T <sub>A</sub> = -40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t <sub>pd</sub>	A or B	Y	0.8V	—	27.5	—	—	—	—	—	ns
			1.2V ± 0.1V	3.4	6.8	16.1	3.1	20.2	3.1	20.4	
			1.5V ± 0.1V	2.3	4.8	8.9	2.0	10.4	2.0	11.5	
			1.8V ± 0.15V	1.9	4.0	7.0	1.7	8.3	1.7	9.2	
			2.5V ± 0.2V	1.7	3.4	5.4	1.5	6.3	1.5	7.0	
			3.3V ± 0.3V	1.4	3.2	4.8	1.3	5.7	1.3	6.3	

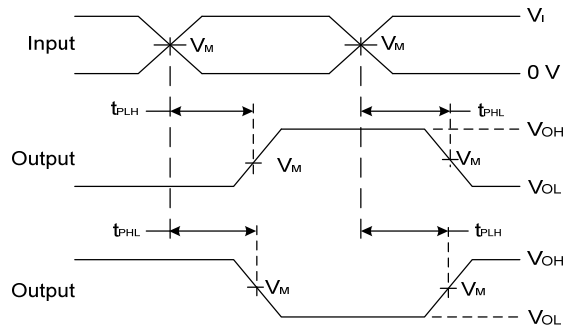
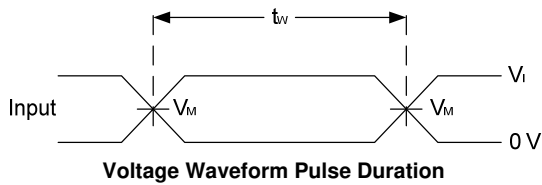
 $C_L = 30\text{pF}$ , See Figure 1

Parameter	From Input	To Output	V <sub>CC</sub>	T <sub>A</sub> = +25°C			T <sub>A</sub> = -40°C to +85°C		T <sub>A</sub> = -40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t <sub>pd</sub>	A or B	Y	0.8V	—	39.3	—	—	—	—	—	ns
			1.2V ± 0.1V	4.6	9.0	21.9	4.1	27.6	4.1	27.8	
			1.5V ± 0.1V	3.4	6.4	11.8	2.9	13.9	2.9	15.3	
			1.8V ± 0.15V	2.6	5.3	9.3	2.3	11.1	2.3	12.3	
			2.5V ± 0.2V	2.4	4.5	7.1	2.1	8.5	2.1	9.4	
			3.3V ± 0.3V	2.0	4.2	6.4	1.8	7.7	1.8	8.5	

**Parameter Measurement Information**



$V_{CC}$	Inputs		$V_M$	$C_L$
	$V_I$	$t_r/t_f$		
0.8V	$V_{CC}$	$\leq 3ns$	$V_{CC}/2$	5, 10, 15, 30pF
$1.2V \pm 0.1V$	$V_{CC}$	$\leq 3ns$	$V_{CC}/2$	5, 10, 15, 30pF
$1.5V \pm 0.1V$	$V_{CC}$	$\leq 3ns$	$V_{CC}/2$	5, 10, 15, 30pF
$1.8V \pm 0.15V$	$V_{CC}$	$\leq 3ns$	$V_{CC}/2$	5, 10, 15, 30pF
$2.5V \pm 0.2V$	$V_{CC}$	$\leq 3ns$	$V_{CC}/2$	5, 10, 15, 30pF
$3.3V \pm 0.3V$	$V_{CC}$	$\leq 3ns$	$V_{CC}/2$	5, 10, 15, 30pF



**Figure 1 Load Circuit and Voltage Waveforms**

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



## Marking Information

### X2-DFN1210-8

( Top View )


XX : Identification Code

Y : Year : 0~9

W : week : A~Z : 1~26 week

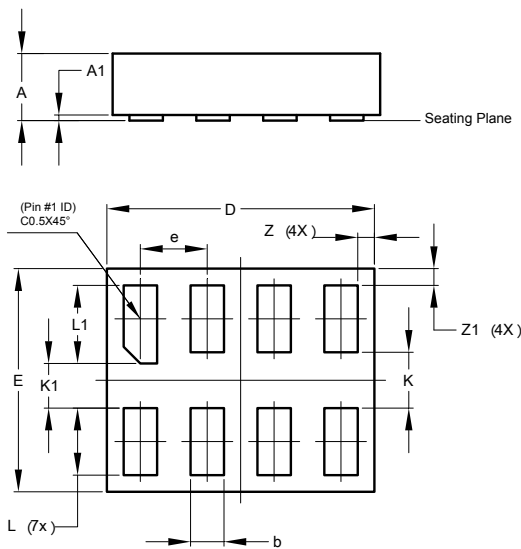
a~z : 27-52 week

z represents 52 and 53 week

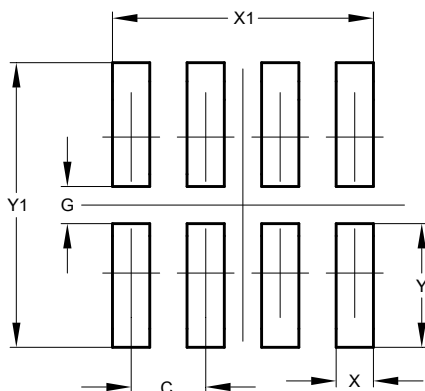
X : week : A~Z : Internal code

Part Number	Package	Identification Code
74AUP2G02RA3-7	X2-DFN1210-8	BT

## X2-DFN1210-8 Package Outline Dimensions and Suggested Pad Layout

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


X2-DFN1210-8			
Dim	Min	Max	Typ
A	-	0.35	0.30
A1	0	0.03	0.02
b	0.10	0.20	0.15
D	1.15	1.25	1.20
E	0.95	1.05	1.00
e	-	-	0.30
K	-	-	0.25
K1	-	-	0.20
L	0.25	0.35	0.30
L1	0.30	0.40	0.35
Z	0.050	0.100	0.075
Z1	0.050	0.100	0.075
All Dimensions in mm			



Dimensions	Value (in mm)
C	0.300
G	0.150
X	0.150
X1	1.050
Y	0.500
Y1	1.150

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