ID-3/12/20LA-HE RFID Dual EM/HID Reader Datasheet

Advanced RFID Reader Technology

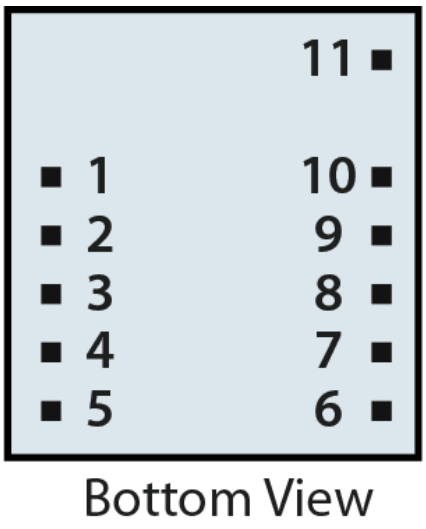
Provisional 1.2

1. Overview

The ID-Innovations ID-3/12/20LA-HE series are low cost dual-reader RFID modules that set new standards by being able to read HID (H10301) and EM4001 compatible cards. The ID-12HE measures just 26.5 x 25 x 6mm yet has an internal antenna and achieves a read range 9cm and 5cm with EM and HID cards respectively.

The ID-3/12/20LA-HE series provide an easy gateway to integrate these two popular system types. ID-3LA-EM modules support user external antennas. All ID-3/12/20LA-HE dual HID/EM modules are low power and low emission and ideal for fixed and portable applications.

2. Pin Out ID-3LA-HE, ID-12LA-HE and ID-20LA-HE



Bottom View

1. GND
2. RES (Reset Bar)
3. Do not connect(Antenna ID-3LA only)
4. Do not connect(Antenna ID-3LA only)
5. CP
6. Tag in Range
7. +/- (Format Selector)
8. D1 (Data Pin 1)
9. D0 (Data Pin 0)
10. Read (LED / Beeper)
11. +2.7-5V

3. Devices Operational and Physical Characteristics

Parameter	Function
Read Range ID-12HE	EM ISO card 9cm; HID clamshell card 5cm.
Read Range ID-20LA-HE	EM ISO card 15cm; HID clamshell card 5.5cm.
Frequency	125 kHz.
Card Formats	EM 4001 or compatible; HID or compatible.
Encoding and Modulation	Manchester 64-bit modulus 64; FSK 96bit.
Nominal Power Requirement	5 VDC @ 26mA (ID-12HE), 32mA (ID-20LA-HE)
Communication	5v CMOS Pseudo RS232 ASCII - 9600 Baud, No Parity, 1 stop bit
Voltage Supply Range	+2.7V through +5.4V
Certification	CE, C-TICK, ROHS, FCC

4. EM4001 and HID compatible cards

The EM card has 64 bits of data. This is comprised of a 9 bit header, 10 horizontal parity bits, 4 vertical parity bits, an always zero bit and 40 data bits. The cards are normally sequential and sometimes the first byte denotes a manufacturer key. It uses Manchester code amplitude modulation and they have relatively long read range. The detection is simple and the readers are generally inexpensive.

Manchester encoded HID H10301 and compatible card have 96 bits[1] of data. This is comprised of an 8 bit header followed by 44 pairs of bits arranged as 01 or 10 pairs to form Manchester code where an 01 pair represents a '0' bit of actual data and the 10 pair represents a '1' of actual data. The cards normally have a sequential portion for the ID but can also have parts reserved for site/facility code. The data is often tailor-made for clients.
The cards use FSK modulation and have reasonable read range but do not obtain as long a read range as equivalent amplitude modulated cards. The reader requires special detection and amplifier staged tend to be complex and expensive.

Note[1] The ID-3/12/20LA-HE series only read H10301 and similar cards that have 44 user bits. They will not read HID Long version 125khz cards that have 84bits user bits.

More about HID compatible cards
The 44 bits of user data obtained from these tags are often arranged in groups. The most popular HID compatible card is the so-called Wiegand 26 card. In this, data bits 1 through 26 arranged in a Wiegand fashion as below. Once the ID-3/12/20LA-HE module reads a card it sends bit 1 thru bit 44, starting with bit 1. The figure below shows the Wiegand data arrangement. Not shown are bits 27 thru 44 which are typically used to denote Company, Card Format, Facility and Site codes. The Wiegand portion is usually sequential.

Wiegand 26 Position in Card

Data bits 26-1

26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
EP																									
OP																									
User data																									
Parity Bits																									

5. Output Data Formats

The card output data is sent in two different formats. All EM4001 data is sent as 'Output Type 1'. HID card data is sent as 'Output Type 2'

Output Type 1 - Data Structure for EM4001 compatible cards.

STX (02h)	'1' (31h)	SPACE (20h)	DATA (10 ASCII)	CR	LF	ETX (03h)

Output Type '1' denotes the data is from an EM4001 compatible card. The 5 hexadecimal bytes of data are sent as 10 serial ASCII characters preceded by STX, an ASCII '1' and ending with checksum, CR, LF and ETX

Example for EM card

Output Type 1
Card Hex Data = FE18FFA00C
Complete ASCII String = 02 31 20 46 45 31 38 46 46 41 30 30 43 0D 0A 03
As seen on terminal 1 FE18FFA00C

Output Type 2 – Data Structure for HID compatible cards

STX (02h)	'2' (32h)	SPACE (20h)	DATA (24ASCII)	CR	LF	ETX (03h)

Output Type '2' denotes the data is from an HID compatible card. There are 44 data bits of resolved data. This actually works out to 5bytes and 1nibble. Computers normally use bytes so for simplification the data is sent as 6bytes with the last 4bits always as zero.

Example for HID card

Output Type 2
Card Hex Data = 0200646688B. Sent as 00200646688B
Complete ASCII String 02 32 20 30 30 32 30 30 36 34 36 36 38 38 42 0D 0A 03

As seen on terminal

2 00200646688B

6. Function Description

The ID-Innovations ID-3/12/20LA-HE series dual reader modules have been designed to allow easy integration between two popular 125khz RFID systems, namely the EM4001 and the HID (H10301) compatible systems. Two modules in the series use small internal antennas and obtain excellent read ranges while the third requires an antenna only. For antenna construction please see application note. The ID-3/12/20LA-HE series are low emission, low power modules intended for use in fixed and portable applications.

The RF driver circuit is efficient and protected against instantaneous shorting although sustained short circuits for (several seconds) can damage the device through over dissipation. The modules do not time share the EM-HID functions and both FSK and AM functions are monitored constantly. When either type of card is placed in the field it will start reading immediately. To prevent problems from spurious reads caused by interference and noise, all card data is read several times and crosschecked before it is sent.

The reader sends 2 different output packages denoted by a '1' or a '2'. The first is used only for EM data. The EM card has 64 bits of which 9 are the header, 10 are horizontal parity checks, 4 are vertical parity checks, 1 bit is an always zero bit and 40 bits are the data. The data package is sent according to Output Format 1., See section (4) 'Output Data Formats"

The HID card has 96 bits of which 8 bits are used for the header, and the 88 remaining bits are arranged in the card as 44 bit pairs, being either 01 or 10 to achieve Manchester encoding. The 01 pair is used to indicate a data 0 and a 10 pair is used to indicate a data 1. Thus the 88 card bits are actually resolved as 44 data bits. The package is sent according to Output Format 2.

In applications power consumption is critical the reset pin can be periodically grounded and this inhibits the RF and saves power.

The reader data outputs use 5volt CMOS and transmit serially using 9,6000 baud, no parity and one stop bit, (9600:N,8,1).

7. Pin Description & Output Data Formats

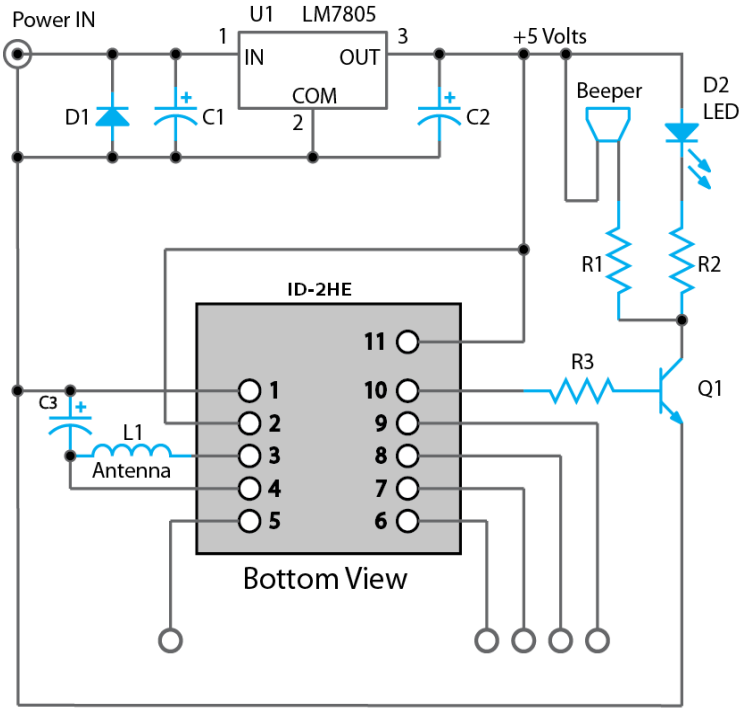
Pin #	Description	ASCII
Pin 1	Zero Volts	GND 0V
Pin 2	Strap to +5V	Reset Bar
Pin 3	DNC	Antenna
Pin 4	DNC	Antenna
Pin 5	Card Present	No function
Pin 6	Tag in Range	Tag in Range
Pin 7	Format Selector (+/-)	Strap to GND
Pin 8	Data 1	CMOS
Pin 9	Data 0	TTL Data (inverted)
Pin 10	3.1 kHz Logic	Beeper / LED
Pin 11	DC Voltage Supply	+2.7 to +5V

8. Absolute Maximum Ratings

Maximum voltage applied to Pin 2	(Vcc)	5.7volt
Maximum voltage applied to Pin 2	(Reset)	Vcc + 0.7v, -0.7v
Maximum current drawn from Pin 5	(Card Present)	+/- 5mA
Maximum current drawn from Pin 6	(Tag in Range)	+/- 5mA
Maximum Voltage at Pin 7	(Format Selector)	Vcc + 0.7v, -0.7v
Maximum current drawn from Pin 8	(Data1)	+/- 5mA
Maximum current drawn from Pin 9	(Data0)	+/- 5mA
Maximum current drawn from Pin 10	(Beeper)	+/- 10mA
Additionally, Pins 5, 6, 7, 8, 9 & 10 may not have a voltage exceeding		Vcc + 0.7v, -0.7v

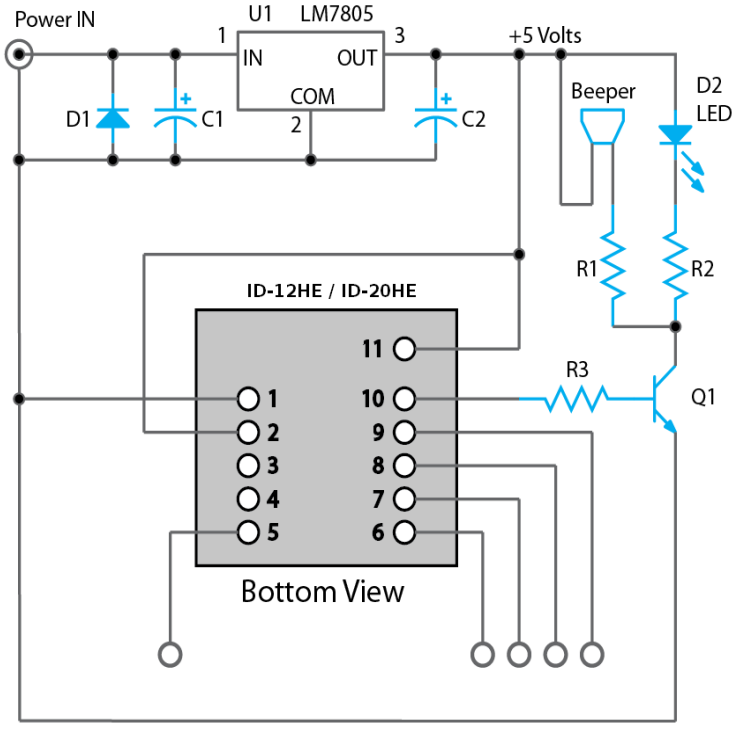
These ratings are absolute maximums and operation at or near the maximums may cause stress and eventual damage or unpredictable behaviour.

9. Circuit Diagram for ID-3LA-HE



Parts List	
Part #	**Value**
R1	100R
R2	4K7
R3	2K2
C1	10uF 25v electrolytic
C2	1000uF 10v electrolytic
C3	Only used if L1 is not 1.07mH*
Q1	BC457 or similar
D1	1N4001
D2	Red or Green LED
L1	1.07mH
Beeper	3kHz 5v PKPK AC beeper

10. Circuit Diagram for ID-12/20LA-HE



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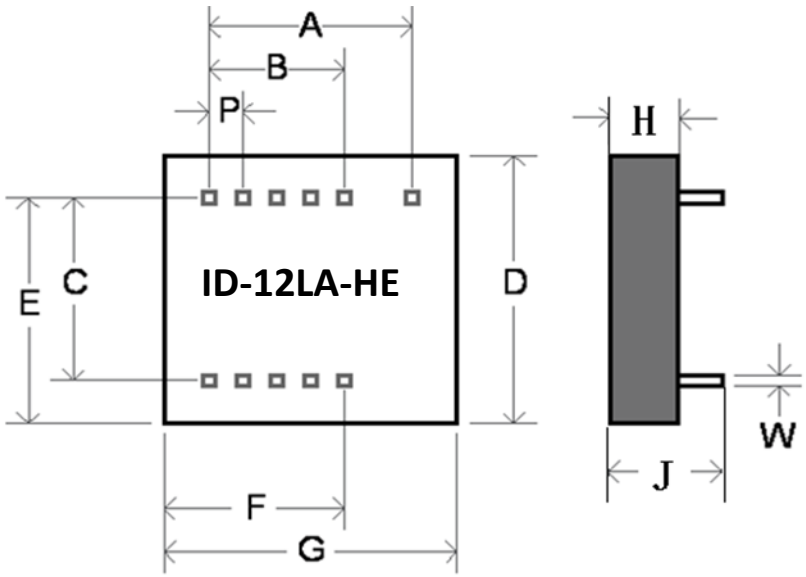
11. Case Dimensions for ID-3/12/20LA-HE



	ID-3LA-HE			ID-12LA-HE			ID-20LA-HE		
	Nom	Min	Max	Nom	Min	Max	Nom	Min	Max
A	12.0	11.6	12.4	12.0	11.6	12.4	12.0	11.6	12.4
B	8.0	7.6	8.4	8.0	7.6	8.4	8.0	7.6	8.4
C	15.0	14.6	15.4	15.0	14.6	15.4	15.0	14.6	15.4
D	20.5	20.0	21.5	25.3	24.9	25.9	40.3	40.0	41.0
E	18.5	18.0	19.2	20.3	19.8	20.9	27.8	27.5	28.5
F	14.0	13.0	14.8	16.3	15.8	16.9	22.2	21.9	23.1
G	22.0	21.6	22.4	26.4	26.1	27.1	38.5	38.2	39.2
P	2.0	1.8	2.2	2.0	1.8	2.2	2.0	1.8	2.2
H	5.92	5.85	6.6	6.0	5.8	6.6	6.8	6.7	7.0
J	9.85	9.0	10.5	9.9	9.40	10.5	9.85	9.4	10.6
W	0.66	0.62	0.67	0.66	0.62	0.67	0.66	0.62	0.67

All Dimensions in mm

12. Connection direct to a computer

Direct connection to a computer RS232 can be made by connecting Pin8 to a 1k series resistor and connecting the other end of the resistor to the computer RS232 input. The mode is called pseudo RS232. On a standard D9 socket, connect the output of the ID-3/12/20LA via the series 1k to pin 2 of the D-type. Connect the ground to Pin5 on the D-type. Leave the TX pin3 open. See “Useful Information” below for free terminal download information.

12.1 Connection to a Processor UART

Direct connection can be made to a UART RX input from Pin9 of the ID-3/12/20LA module. There is no need for a 1k protection resistor, but a 1k resistor will make the circuit safer for testing and reduce EM noise.

12.2 Connecting a Read LED

Sometimes the user may not want to drive a beeper but may still need to drive an LED. In this case a driver transistor may not be necessary because the Beeper Output Pin can supply 5mA continuously. Connect a 1k5 resistor to the Beeper Pin. This will limit the current. Connect the other end of the resistor to the LED anode and con nect the cathode to ground.

13. Useful information

For general testing we suggest the user downloads a terminal program free from the internet. Here is one particularly good one to consider:
http://braypp.googlepages.com/terminal - Truly an excellent piece of software, the best terminal we have ever seen.
If you have any technical queries please contact your local distributor, they have all the technical resources to help you and support you. Where no local distributor exists, our technical helpline may be contacted by writing to **help@ID-Innovations.com**

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