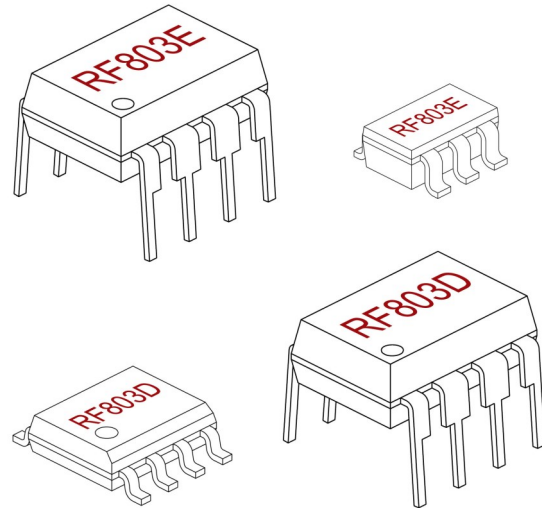# Encoder / Decoder IC's

Features

- 3 digital I/O
- Serial Data output
- Connects directly to ALPHAPLUS Modules
- Easy Enc / Dec Pairing Function
- Receiver Acknowledge Signal
- Minimal External Components Required
- Performs all encoding/decoding of data for Reliable Operation.
- Fast Activation / Deactivation Time
- Up to 30 Transmitter Pairings
- Sleep mode, for battery saving
- One to many / many to one relationship

Applications

- Remote control
- Radio Telemetry
- RFID

Description

The RF803 series are encoder and decoder devices. When combined with a Radio transmitter/receiver they may be used to create a remote control system with up to 3 I/O lines.

The decoder IC incorporates an 'easy learn' pairing procedure to create a relationship between encoder and decoder.

RF800 Series ICs perform all the necessary data manipulation and encoding/decoding of data for an optimum range reliable radio link whilst providing a simple user interface.

In addition all RF800 series chipsets compatible with the RF Solutions range of remote control transmitter or receiver meaning that custom designs using any RF800 part can be used with an off the shelf counterpart.

Ordering Information

| Part Number	Description	Packages available
RF803E	Encoder IC	6 PIN SOT23 8 PIN PDIP
RF803D	Decoder IC, 8 pin	8 PIN SOIC 8 PIN PDIP

FM76316

Encoder / Decoder IC's

Transmitter Encoder RF803E

Functional Description

The RF803E is a simple device to use. As shown in the application circuit below, it requires only the addition of input switches and RF circuitry for use as the transmitter in the end application. Transmission is automatic without user intervention.
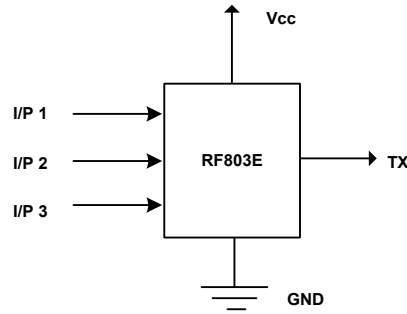
On detecting a switch closure The RF803E will wake up transmit a secure data packet on the TX output.
The RF803E uses a fully balanced Manchester encoded data protocol designed for optimum use of the radio transmission path.
Each RF803E is programmed at the time of manufacture with a unique 16-bit serial number, which provides a secure way of addressing RF800 series devices. This provides up to 65,536 possible addresses.

Compatibility with RF Solutions Receivers

The RF803 series are compatible with the FireFly/FireBlade series and 210-433/525/458 series of ready to operate receiver decoder units.
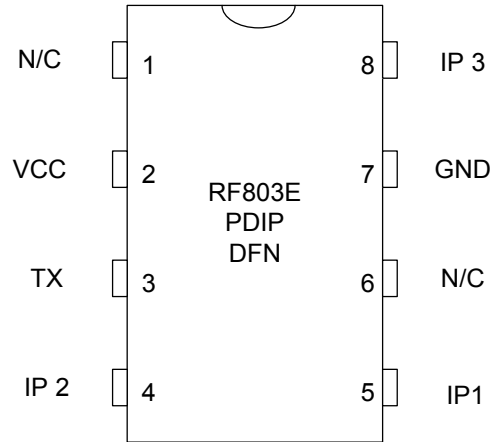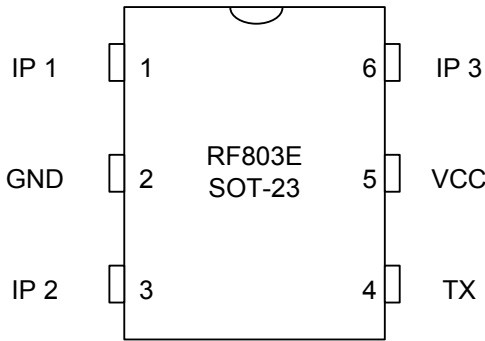This enables a designer to easily integrate a remote control function into an application using a ready made receiver

Encoder / Decoder IC's

Pin Descriptions RF803E

```
          RF803E
          SOT-23

IP 1   [1]         [6]   IP 3

GND    [2]         [5]   VCC

IP 2   [3]         [4]   TX
```

```
            RF803E
            PDIP
            DFN

N/C   [1]         [8]   IP 3

VCC   [2]         [7]   GND

TX    [3]         [6]   N/C

IP 2  [4]         [5]   IP1
```

SOT23

Pin Number	Name	Input / Output	Description
1	IP 1	IP	Switch input 1 (active low)
3	IP 2	IP	Switch input 2 (active low)
6	IP 3	IP	Switch input 3 (active low)
2	GND	IP	Supply GND
4	TX	OP	Data output
5	Vcc	IP	Supply Voltage

PDIP

Pin Number	Name	Input / Output	Description
1	-	-	Not Connected
2	Vcc	IP	Supply Voltage
3	TX	OP	Data output
4	IP 2	IP	Switch input 2 (active low)
5	IP1	IP	Switch Input 1 (active low)
6	-	-	Not Connected
7	GDN	OP	Ground Connection
8	IP3	IP	Switch Input 3 (active low)

IP 1-3
These are the switch inputs which when operated wake up the RF803E and cause transmission. They may be switched directly to Ground. Transmission occurs for the duration of the switch operation.

Vcc
The power supply needs to be a stable regulated voltage between 2.5 and 5.5V with <10mV ripple. Note that in idle mode the transmitter current drain is typically only 100nA.

GND
Ground connection

TX
Data Output, this is a standard CMOS / TTL output that may be connected directly to the data input pin of the RF Module. In the event that this represents a load to Vcc then a buffer stage between the data output and the RF module will be required.

Encoder / Decoder IC's

Receiver Decoder RF803D

Functional Description

The RF803D is simple to use. As shown in the typical application circuits, in the stand alone operation the RF803D has the capability to learn up to 15 unique RF803E transmitters.

.
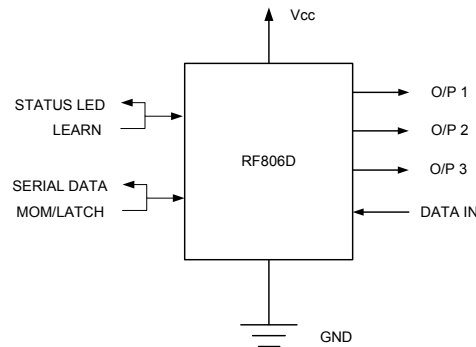
The RF803D is connected directly to the data output of a radio receiver module and upon detection of a valid data packet it will decode the data stream. The RF803D will then assert its digital outputs which will match the state of the RF803E encoders' learnt at the time of transmission.
The digital outputs may be configured as latching or momentary action.
Latch = the output will change state on each successive transmit of the encoder.
Momentary = the output will only operate for as long as the RF803E encoder is transmitting.

The RF803D requires only the addition of the following components
1. A 'Learn' switch which is used in the process of learning a transmitter/encoder to the decoder and also to initiate erasure of encoder information.
2. An LED which indicates the status of the learn process, the erase process and also data reception status.
3. An Option link which configures the action of the digital outputs. This input may simply be tied to Vcc or GND.

Compatibility with RF Solutions Transmitters:
The RF803 series are compatible with the FireFly/FireBlade series and 205 series of ready to operate transmitter encoders (when using FM)
This enables a designer to integrate a remote control function into an application easily, by using a ready made transmitter.
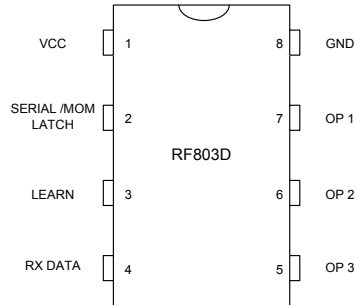
Encoder / Decoder IC's

Pin Descriptions RF803D
See Page 8 for application circuit example

```
        VCC ──┤ 1        8 ├── GND

SERIAL /MOM ──┤ 2        7 ├── OP 1
      LATCH
                  RF803D

      LEARN ──┤ 3        6 ├── OP 2

    RX DATA ──┤ 4        5 ├── OP 3
```

SOIC/PDIP

Pin Number	Name	Input / Output	Description
7	OP1	Out	Digital Output 1
6	OP2	Out	Digital Output 2
5	OP3	Out	Digital Output 3
1	Vcc	In	Supply Voltage
8	Vss	In	Supply GND
2	SD/ML	In/Out	Serial Data Output / Momentary / Latching setting
3	LRN	In/Out	Learn / Erase Function
4	Rx	In	Rx Data input

Vcc
2.5-5.5V DC input. The power supply needs to be a stable regulated voltage with <10mV ripple

GND
Ground connection.

OP1-3
These outputs are asserted LOW when the relevant inputs (S1 – S3) on the RF803E are asserted. (see latch/unlatch information under 'LKIN').

RX DATA
This is the data input to the decoder it may be connected directly to the RF receiver module.

LRN
This input is used to set the decoder module to 'Learn Mode' and for the 'Erase Function' and is also used to drive the Status LED.

SERIAL / OP TIMING
Multi-functional pin
This pin is read on power up to sets the action of outputs 1-3, Momentary action is set by a connection to ground through a 2K2 ohm resistor, latching is set using open circuit.
In normal run mode this pin outputs serial data on reception of a valid data string.

Encoder / Decoder IC's

System and Functional operation

Pairing a Transmitter to a Receiver

Each transmitter has a unique identity. Each time a switch is pressed, the transmitter emits a highly secure RF signal. The Receiver can learn this signal and allocate to an output.

Any transmitter switch may be paired to one or many of the receiver's outputs, or a transmitter single switch may be paired to any number of receiver's outputs to enable a powerful and flexible remote control system.

The only limitation is that each receiver has a maximum capacity of 15 pairings, these can be from the same or any number of transmitters.

Hint: the same transmitter may be taught to any number of receivers to create 'master keys'.

Learn Mode: Learn input activation is achieved by pulling this input to GND briefly

To learn a new transmitter switch follow this procedure (as application circuit)

Any Encoder input can be learnt to one or many of the receiver outputs.
Each input must be learnt to each output individually by following this procedure:

1. Select the receiver output to learn:
    a. Briefly operate the receiver Learn switch (SW1) once
    b. The Learn LED will flash once to indicate that output 1 is selected
    c. After the LED stops flashing, press the Learn switch again to select the next output channel
    d. Repeat step c until the required output is selected.
2. Operate whichever input on the encoder you want to learn to the selected decoder output.
3. The Learn LED will then illuminate, within 10secs, operate the same encoder input again.
4. The Learn LED will then flash to indicate learning is complete.

Erase Mode (As application circuit): is achieved by pulling this input to GND for >8 seconds. This causes the internal EEPROM to be erased of all pre-learnt RF803E encoders.
During Erase the Learn LED will activate, it will extinguish when erase is complete.

Mom / Latch

This high impedance input is used to set the digital outputs to momentary or latched actions

LKIN Status	Digital Outputs Function
Open	Latching
Closed	Momentary

Serial Data Output

The RF803D has a serial data output. This outputs the serial number, button and battery status of the transmitter encoder (RF803E). This data may be fed directly to a microcontroller or RS232 type driver circuit which may then be fed directly to a PC serial port.

Serial data is output initially and again every ½ second whilst data is being received from the RF803E transmitter. i.e. this output is valid regardless of whether the RF803E encoder has been learnt to the RF803D decoder or not. The serial data packet contains a learn bit to show if an encoder input is learnt.
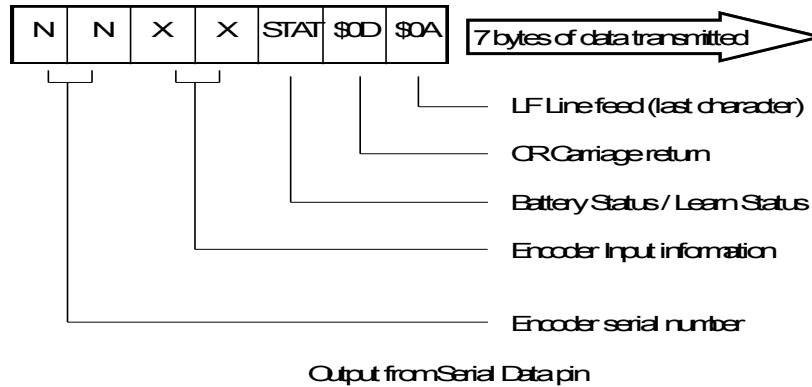
Encoder / Decoder IC's

Serial Data Format

Serial Data is sent every 1/2 second as a stream of 7 bytes at 9.6K baud. The serial data format is: 8 data bits with 1 stop bit, no parity.

Serial data is output form the Decoder chip whenever a valid data packet from an RF80n or other compatible RF Solutions transmitter is received regardless of learn

| N | N | X | X | STAT | $0D | $0A |

7 bytes of data transmitted

LF Line feed (last character)

CR Carriage return

Battery Status / Learn Status

Encoder Input information

Encoder serial number

Output from Serial Data pin

Encoder Serial Number [NN]: made up of two 8-bit bytes where the most significant byte is transmitted first. This provides a total of 65,536 possible serial numbers.

Example: 12AB (hexadecimal) or 0001 0010 1010 1011 (binary)

Encoder Input Information [XX]: made up of two 8-bit bytes.

The high order byte is sent first representing inputs 16 down to 9 where the MSb is input 16 and the LSb is input 9.

The low order byte is sent next representing inputs 8 down to 1 where the MSb is input 8 and the LSb is input 1.

A bit at state 1 represents an encoder input as active.

Using this method inputs can be multiplexed giving maximum versatility.

Example: 00000000 00001000 - Shows input 4 active.
00000001 00000000 – Shows input 9 active
10000001 00000001 – Shows inputs 16, 9 and 1 active

Status [STAT]: The status byte is made up of an 8-bit byte as follows:

BIT	Description	Details
Bit-7 down to 2	Reserved	For future usage
Bit 1	Learn status	1 = encoder has been learnt
Bit 0	Battery status	0 = encoder battery is OK 1 = encoder battery is low

Example: 00000010 = encoder battery ok, encoder has been learnt
00000001 = encoder battery low, encoder has not been learnt

Carriage Return [CR] and Line feed [LF]

To mark the end of the serial packet ascii characters for carriage return (hex 0D) are sent followed by LF (hex 0A).

Custom Versions
Custom versions of the RF803E / RF803D chipset are available to provide a bespoke remote chipset for OEM applications. Please contact our sales department for further information.

*NOTE: Serial Data output is common across the entire RF80n range, therefore up to 16 inputs states are sent. When using encoders with lower numbers of inputs the un-used bits are set to 0.
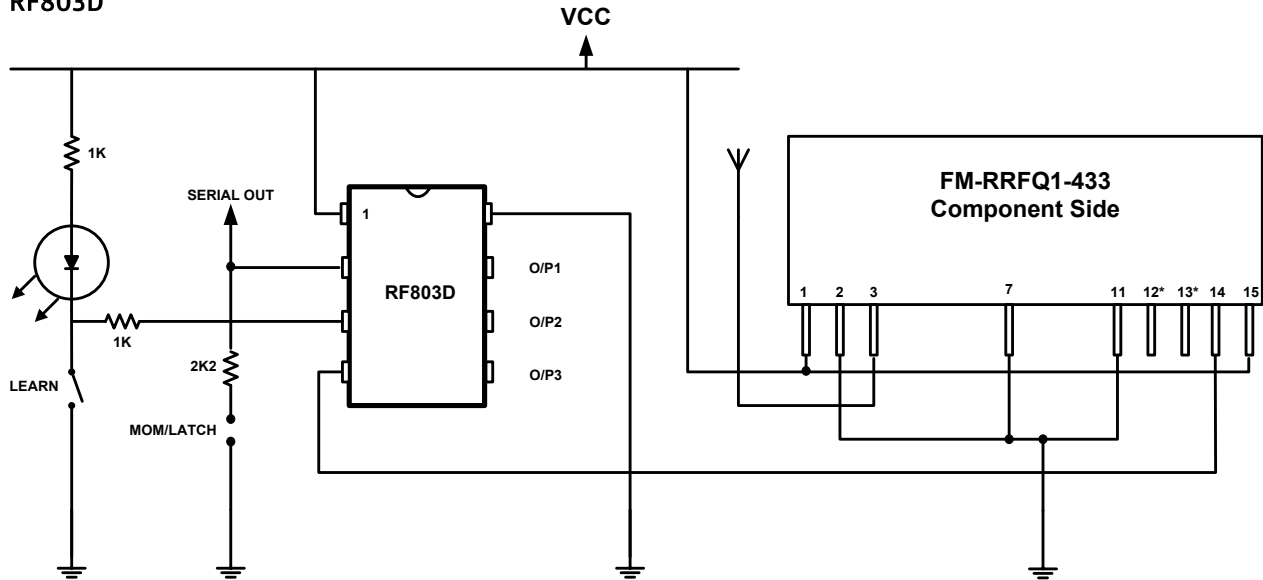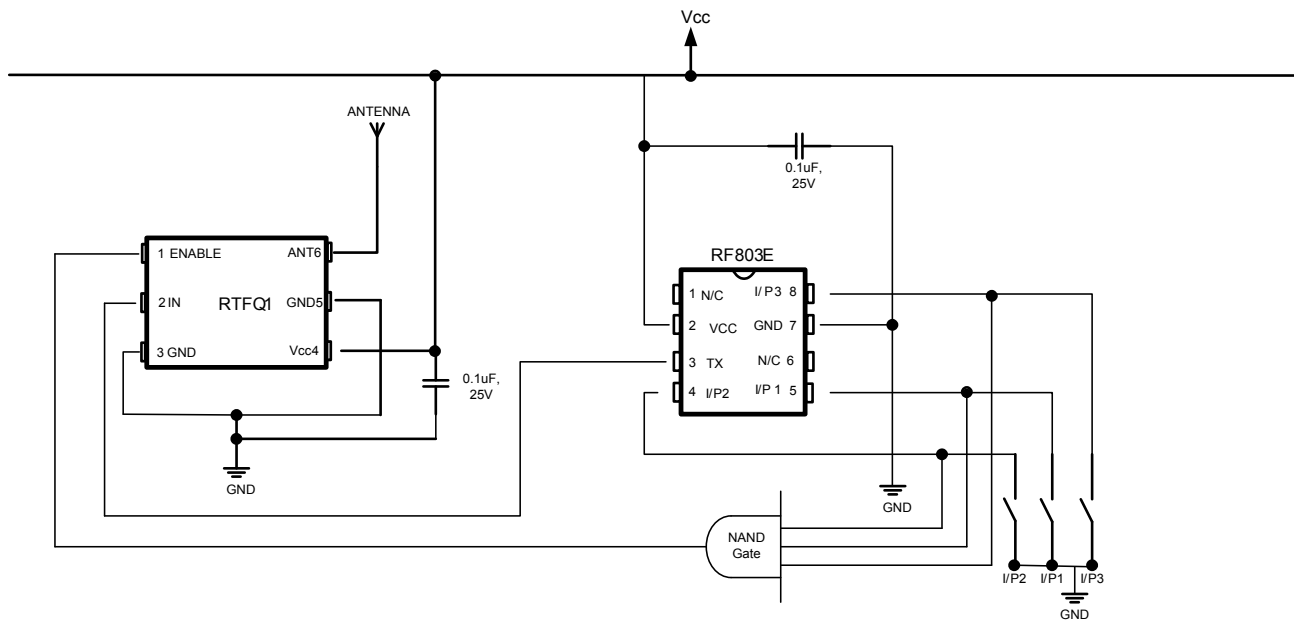
Encoder / Decoder IC's

Typical Applications

RF803D

VCC

1K

SERIAL OUT

1K

2K2

LEARN

MOM/LATCH

RF803D

O/P1

O/P2

O/P3

FM-RRFQ1-433
Component Side

1 2 3   7   11 12* 13* 14 15

*NO Connection on pins 12 and 13 of RRFQ1 is required.

RF803E

Vcc

ANTENNA

1 ENABLE   ANT6

2 IN   RTFQ1   GND5

3 GND   Vcc4

0.1uF,
25V

GND

RF803E

0.1uF,
25V

1 N/C   I/ P3 8

2 VCC   GND 7

3 TX   N/C 6

4 I/P2   I/P 1 5

GND

NAND
Gate

I/P2 I/P1 I/P3

GND

Encoder / Decoder IC's

Technical Specifications

Absolute Maximum Ratings 803E and 803D
Note: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device.

Item	Rating	Units
Supply voltage	2.0 – 5.5	V
Max output current	80	mA
Storage temperature	-65 to +150	°C (Note)
Lead soldering temp		°C (Note)
ESD rating		V
Max O/P current sunk by any I/O pin	25	mA
Max O/P current sourced by any I/O pin	25	mA

RF803E

Electrical Characteristics	Min	Typical	Max	Unit
Operating current(average) Vdd = 5V	603	645	689	µA
Standby current		.1		µA
High level Input voltage	2.0		VDD	V
Low level input voltage	VSS		0.8	V
High level output voltage	VDD - .7			V
Low level output voltage			0.6	V
Output Pin Current rating			25	mA
LED sink current			75	mA

RF803D

Electrical Characteristics	Min	Typical	Max	Unit
Operating current(average) Vdd = 2V		1		mA
Standby current		-		µA
High level Input voltage	2.0			V
Low level input voltage	VSS		0.8	V
High level output voltage	VDD - .7			V
Low level output voltage			0.6	V
Output Pin Current rating			25	mA
LED sink current			75	mA

Appendix – Package types

6 PIN SOT-23 PACKAGE
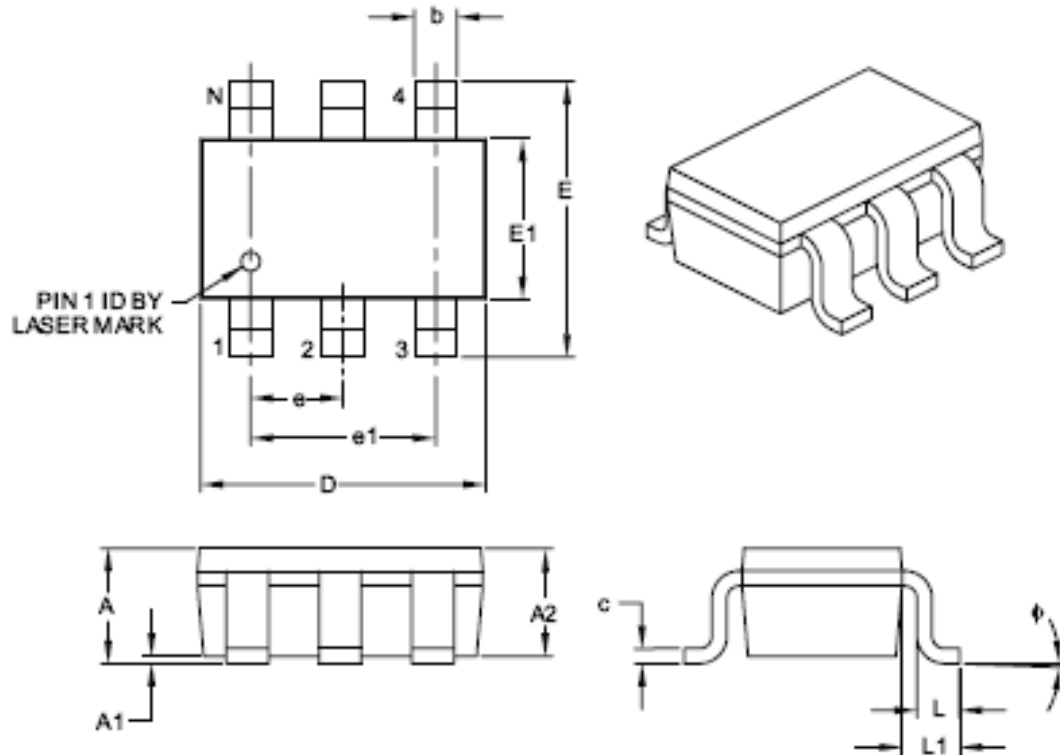
	Units	MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		6	
Pitch	e		0.95 BSC	
Outside Lead Pitch	e1		1.90 BSC	
Overall Height	A	0.90	–	1.45
Molded Package Thickness	A2	0.89	–	1.30
Standoff	A1	0.00	–	0.15
Overall Width	E	2.20	–	3.20
Molded Package Width	E1	1.30	–	1.80
Overall Length	D	2.70	–	3.10
Foot Length	L	0.10	–	0.60
Footprint	L1	0.35	–	0.80
Foot Angle	ϕ	0°	–	30°
Lead Thickness	c	0.08	–	0.26
Lead Width	b	0.20	–	0.51

Notes:

1. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.127 mm per side.
2. Dimensioning and tolerancing per ASME Y14.5M.
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

8 PIN SOIC PACKAGE
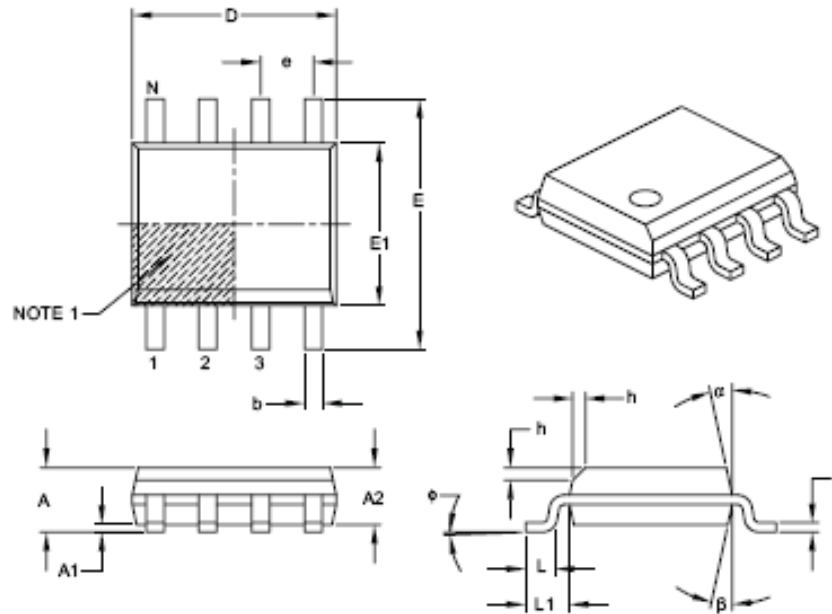
	Units	MILLIMETERS		
	Dimension Limits	MIN	NOM	MAX
Number of Pins	N		8	
Pitch	e		1.27 BSC	
Overall Height	A	–	–	1.75
Molded Package Thickness	A2	1.25	–	–
Standoff §	A1	0.10	–	0.25
Overall Width	E		6.00 BSC	
Molded Package Width	E1		3.90 BSC	
Overall Length	D		4.90 BSC	
Chamfer (optional)	h	0.25	–	0.50
Foot Length	L	0.40	–	1.27
Footprint	L1		1.04 REF	
Foot Angle	φ	0°	–	8°
Lead Thickness	c	0.17	–	0.25
Lead Width	b	0.31	–	0.51
Mold Draft Angle Top	α	5°	–	15°
Mold Draft Angle Bottom	β	5°	–	15°

Notes:
1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. § Significant Characteristic.
3. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15 mm per side.
4. Dimensioning and tolerancing per ASME Y14.5M.

   BSC: Basic Dimension. Theoretically exact value shown without tolerances.
   REF: Reference Dimension, usually without tolerance, for information purposes only.

8 PIN PDIP PACKAGE
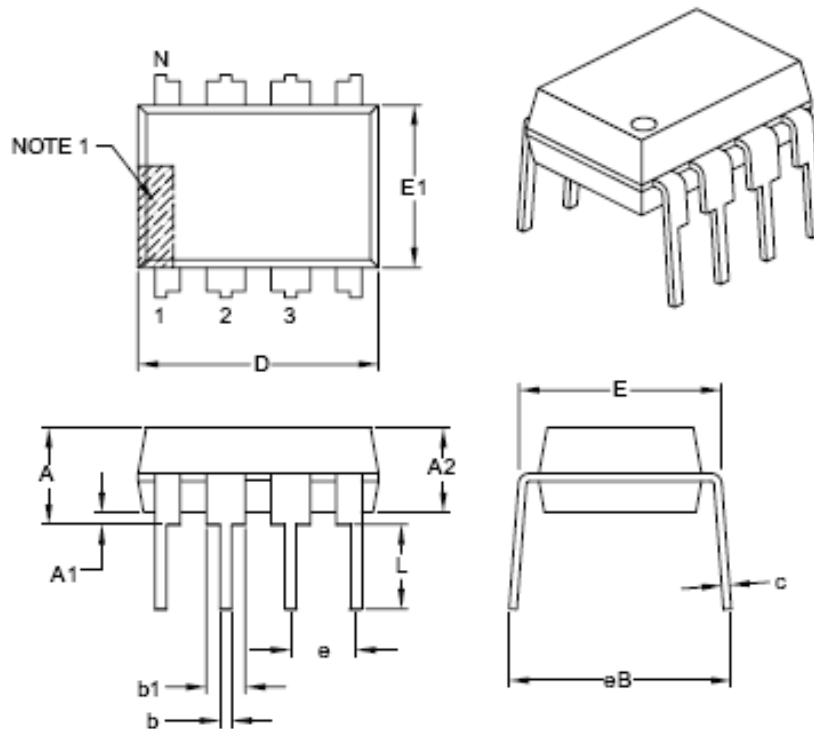
	Units	INCHES		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		8	
Pitch	e		.100 BSC	
Top to Seating Plane	A	–	–	.210
Molded Package Thickness	A2	.115	.130	.195
Base to Seating Plane	A1	.015	–	–
Shoulder to Shoulder Width	E	.290	.310	.325
Molded Package Width	E1	.240	.250	.280
Overall Length	D	.348	.365	.400
Tip to Seating Plane	L	.115	.130	.150
Lead Thickness	c	.008	.010	.015
Upper Lead Width	b1	.040	.060	.070
Lower Lead Width	b	.014	.018	.022
Overall Row Spacing §	eB	–	–	.430

Notes:
1. Pin 1 visual index feature may vary, but must be located with the hatched area.
2. § Significant Characteristic.
3. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" per side.
4. Dimensioning and tolerancing per ASME Y14.5M.
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Encoder / Decoder IC's

RF Solutions Ltd. Recycling Notice
Meets the following EC Directives:

DO NOT
Discard with normal waste, please recycle.

ROHS Directive 2002/95/EC
Specifies certain limits for hazardous substances.

WEEE Directive 2002/96/EC
Waste electrical & electronic equipment. This product must be disposed of through a licensed WEEE collection point. RF Solutions Ltd., fulfills its WEEE obligations by membership of an approved compliance scheme.

Waste Batteries and Accumulators Directive 2006/66/EC
Where batteries are fitted, before recycling the product, the batteries must be removed and disposed of at a licensed collection point.

Environment Agency producer registration number:
WEE/JB0104WV.

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