MFC242
RFID Card Reader

Programmer’s Manual

Revision 1.0
Aug. 14, 2014

NOTICE

The issuer of this manual has made every effort to provide accurate information. The issuer will not be held liable for any technical and editorial omission or errors made herein; nor for incidental consequential damages resulting from the furnishing, performance or use of this material. This document contains proprietary information that is protected by copyright. All rights are reserved. No part of this document may be photocopied, reproduced, or translated without the prior written consent of the issuer. The information provided in this manual is subject to change without notice.

AGENCY APPROVED

- FCC class B
- CE class B

NOTE：This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures：

—Reorient or relocate the receiving antenna.
—Increase the separation between the equipment and receiver.
—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
—Consult the dealer or an experienced radio/ TV technician for help.

You are cautioned that any change or modifications to the equipment not expressly approve by the party responsible for compliance could void your authority to operate such equipment.

WARRANTY

This product is served under one-year warranty to the original purchaser. Within the warranty period, merchandise found to be defective would be repaired or replaced. This warranty applies to the products only under the normal use of the original purchaser, and in no circumstances covers incidental or consequential damages through consumers' misuse or modification of the products.

PREFACE

This manual provides detailed information relating to the overall operational, electrical, mechanical, environmental and functional aspects of the MFC242. This document should be read and understood prior to initial operation of the product.

For ease of installation and programming use, we have addressed everything from its attractive features to its various configurations.

When designing the MFC242, we selected what we feel are the most useful features and functions. If in some cases you find that your specific needs differ from our existing products, we welcome your comments and suggestions. Custom-designed models are also available.

If further questions do arise, please call for technical support, our FAE will assist you in any way we can.

General Description

This section presents general information about the basic characters of the MFC242.

1.1 Features

The MFC242 provides the following features：

1	Read Type A 13.56Mhz RFID Mifare card
2	Programmable illuminated color bezel
3	Support GDS protocol
4	Firmware upgradeable
5	USB interface, no external power supply required
6	Light weight：130g
7	Compact size：108.0 L x 75 W x 32 H mm

1.2 Application

This MFC242 card reader is designed to read RFIID Mifare card as well as performing programmable illuminated color bezel.
For the RFID module, it can read and decode Type A 13.56Mhz RFID Mifare card. This product communicates with a host computer or a terminal via GDS protocol using an USB 2.0 full speed interface. The reader is widely accepted in the financial industry applications as its transmitting protocol is highly reliable and easy to use.

1.3 Operation Behavior

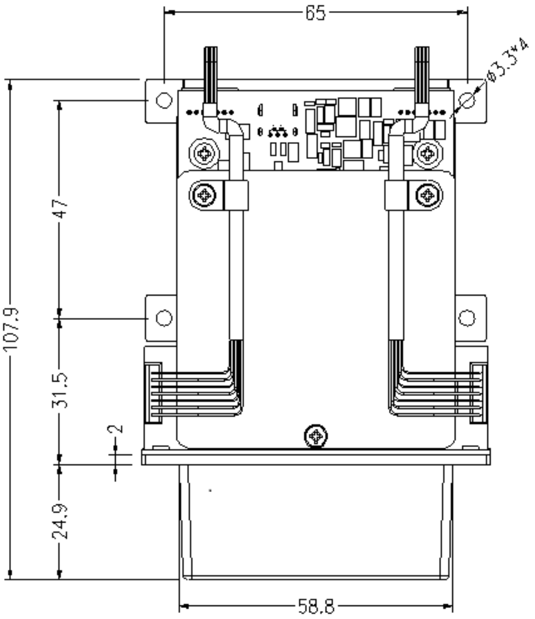
1.3.1 RFID Card read Operation:

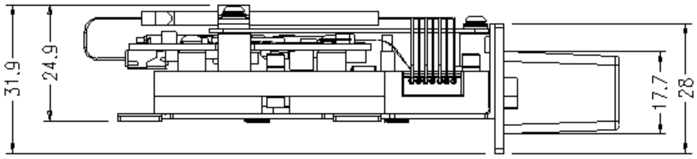
While operating, the MCU reads commands from host USB interface and send them to the RFID Reader IC PN512 for the control of reading contactless TAG, then getting the response from PN512 and send it back to host through USB interface.

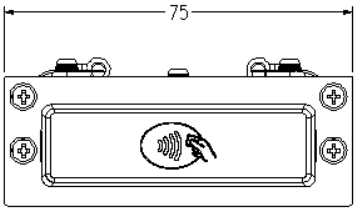
1.3.2 Illuminated color bezel Operation.

The MCU reads commands from host USB interface and send them to G5126TB1U circuitry. Then G5126TB1U circuitry will output the different output voltage to the 4 pieces of Red, Green and Blue color’s LED. In this way, LED components will have different color and emit to the bezel

1.4 Dimensions of MFC242







2 Technical Specifications

2.1 Magnetic Card Specifications

2.1.1 Card Type

Mifare Ultralight C and 4K Mifare DESFire EV1

2.1.2 Card Format

Mifare format

2.1.3 Card Operation

Test Card	Card reading distance from Bezel
Mifare Ultralight C	0 cm
Mifare Ultralight C	1 cm
Mifare Ultralight C	2 cm

2.2 Mechanical Specifications

2.2.1 Body Material

PC SABIC 945A

2.2.2 Dimension

Length：	108mm
Width：	75mm
Height：	32mm

2.2.3 Weight

Approx. 130g

2.3 Electrical Specifications

2.3.1 Power Required

DC 5V ± 5%

2.3.2 Power Consumption

Stand-by current <50mA
Max operating current <300mA

2.3.3 Communication

GDS Card Reader Communication Protocol Standard V1.04

2.3.4 Ripple

250mVp-p Max.

2.3.5 Dielectric Strength

250VDC for 1 minute

2.3.6 Insulation Resistance

10MΩ min. at 250VDC

2.4 Environmental Specifications

2.4.1 Temperature

Operating：	-10-55°C
Storage：	-30-70°C

2.4.2 Humidity

Operating：	10-90% (non-condensing)
Storage：	10-90% (non-condensing)

2.5 Pin Assignment

PIN NO.	DESCRIPTION
1	Power
2	Data -
3	Data +
4	NC
5	Ground

2.6 Software Specification

GDS® Card Reader: Communication Protocol v1.0.4
Universal Serial Bus (USB) Specification, v2.0
Device Class Definition for USB HID, v1.12
USB Engineering Change Notice – UNICODE UTF-16LE for String Descriptors
RFC 2781 (Unicode standard version 3.0) new REV 5.2

System Memory is divided into three parts:

Base addresses	Block	Size
0xFFFF 0xE800	Device Properties Block	6K Bytes
0xE7FF 0x3000	Application Program Block	46K Bytes
0x2FFF 0x0000	Boot Loader Block	12K Bytes

2.6.1 Boot Loader Block

The first 12Kbyte of memory is factory programmed with a boot loader. The boot loader is designed to update application program through USB communication per HID V1.12 with a predefined communication protocol. Please refer to the appendix section for more information.

Command and Response Format

Command Format:

<Header> <LEN_1><Command_1><LEN_2><Command_2><DATA><ADDLRC><XORLRC>

Response Format:

< Header><Length><DATA>

Note:

The <Header> of Command/Response must be 'C2' (Hex).
The <LEN 1> field indicates the length from <Command_1> to <XORLRC>, it is two bytes.
The <LEN 2> field indicates the length from < Command_2> to < ADDLRC>, it is two bytes.
The <Data> fields are command or response data. See following section "Command and Response Code" for details.

Response Format:

< Header>< Length><DATA>

Command_1	Command_2	Description
0x09	0x042 0x4C	Enter to Boot Loader Block
0x21	0x7E	CHECK Uniform produce
	0x057 0x46	Program Flash address data length (max size 1024)
	0x042 0x4E	Get previous command
	0x045 0x42 0x4C	Get Boot Loader Version
	0x45 0x4D	Erase Flash
0x39		Get Application Program Version
0x7F		Warm Reset

0x09 - Enter to Boot Loader Block

Command Length: 3 bytes
Response Data: = 06h, if success. Length is 1 byte.
= 15h, if failure. Length is 1 byte.

0x21 –

0x7E- CHECK UNIFORM Produce

Command Length: 2 bytes
Response Data: = UNIFORM XOR some data,
if success. Length is 8 bytes.
= 15h, if failure. Length is 1 byte.

0x057 0x46 - Program Flash address data length (max size 1024)

Command Length: 3 bytes
Response Data: = 06h, if success. Length is 1 byte.
= 15h, if failure. Length is 1 byte.

0x042 0x4E get previous command

Command Length: 3 bytes
Response Data: = "OK", if success. Length is 2 bytes.
= 15h, if failure. Length is 1 byte.

0x045 0x42 0x4C Get Boot Loader Version

Command Length: 4 bytes
Response Data: = [Version], if success. Length is 8 bytes.
= 15h, if failure. Length is 1 byte.

0x45 0x4d Erase Flash

Command Length: 3 bytes
Response Data: = "OK", if success. Length is 2 bytes.
= 15h, if failure. Length is 1 byte.

0x39 - Get Application Program Version

Command Length: 1 byte
Response Data: = [Version], if success. Length is 8 bytes.
= 15h, if failure. Length is 1 byte.

0x7F - Warm Reset

Command Length: 1 byte
Response Data: = 06h, if success. Length is 1 byte. Warm Reset will perform.
= 15h, if failure. Length is 1 byte. Warm Reset not allowed

2.6.2 Application Program Block

The 46Kbyte from 0x3000 to 0xE7FF is Application Program. It is the main application code held in the microprocessor. The microprocessor will execute it to perform related operation per USB HID V1.12. Please refer to the appendix section for more information.

HID COMMAD Response format

Byte 0	Page report ID
Byte 1	Data or length or states
Byte 2	Data or length

Commutation

Report ID	Usage ID	Name	Operation When Device Enabled	Operation When Device Disabled
0x02	0x41	Enable	Yes	Yes
0x03	0x42	Disable	Yes	Yes
0x04	0x43	Self Test	No	Yes
0x05	0x44	**(Not implemented)** Request GAT Report	No	Yes
0x08	0x47	Calculate CRC	No	Yes
0x5A	0x0610	Get CRD Configuration	No	Yes
0x5B	0x0611	Read Card Data	Yes	No
0x5C	0x0612	**(Not implemented)** Get ATR	Yes	No
0x5D	0x0613	**(Not implemented)** Transfer to ICC	Yes	No
0x5E	0x0614	**(Not implemented)** Release Latch	Yes	Yes
0x5F	0x0615	Light Control	Yes	Yes
0x60	0x0616	Clear Buffer	Yes	No
0x61	0x0617	**(Not implemented)** Get Count Status	Yes	Yes
0x68	0x061E	**(Not implemented)** Latch Mode	Yes	Yes
0x7F	User set feature	Dump Memory	Yes	Yes

0x5F 0x0615 Light Control

This command is used to control the LEDs of a reader.

Bit	7	6	5	4	3	2	1	0
Byte 0	**0x5F**							
Byte 1	Pattern 1Red LSB							
Byte 2	Pattern 1Red MSB							
Byte 3	Pattern 1Green LSB							
Byte 4	Pattern 1Green MSB							
Byte 5	Pattern 1Blue LSB							
Byte 6	Pattern 1Blue MSB							
Byte 7	Pattern 2 Red LSB							
Byte 8	Pattern 2 Red MSB							
Byte 9	Pattern 2 Green LSB							
Byte 10	Pattern 2 Green MSB							
Byte 11	Pattern 2 Blue LSB							
Byte 12	Pattern 2 Blue MSB							
Byte 13	Flashing Frequency							

0x7F Dump Memory

This command is used to read the binary code of Boot Loader or Application Program. The parameter [EEPROM Address] must be in the range 0x0000 to 0xE7FF.

Command: 7F + EEPROM Address [2 bytes] + Dump Length [2 bytes, max 63]
Response: 7F + Dump content [max 63]

EVENT SUPPORT

Report ID	Usage ID	Event	Data
N/A	USB Defined	Connection	No
N/A	USB Defined	Disconnection	No
0x06	0x45	**(Not implemented)** Power Status	Yes
0x07	0x46	**(Not implemented)** GAT Data	Yes
0x09	0x48	CRC Data	Yes
0x0A	0x49	**(Not implemented)** Device State	Yes
0x62	0x0618	**(Not implemented)** Failure Status	Yes
0x63	0x0619	CRD Configuration Data	Yes
0x64	0x061A	Card Status	Yes
0x65	0x061B	Card Data	Yes
0x66	0x061C	**(Not implemented)** Error Data	Yes
0x67	0x061D	**(Not implemented)** Count Status	Yes

- N/A USB Defined Connection
- N/A USB Defined Disconnection
- 0x06 0x45 Power Status
- 0x07 0x46 GAT Data

TX:<none>	RX:[Index] [Size] [Byte 1] … [Byte 61]

- 0x09 0x48 CRC Data

Calculate CRC TX:[Seed 0 - LSB] [Seed 1] [Seed 2] [Seed 3 - MSB]	**CRC Data** RX:[Result 0 - LSB] [Result 1] [Result 2] [Result 3 - MSB]

- 0x0A 0x49 Device State

	7	6	5	4	3	2	1	0
Byte 0	0x0A							
Byte 1							Disable	Enable

- 0x62 0x0618 Failure Status

	7	6	5	4	3	2	1	0
Byte 0	0x062							
Byte 1							ICC Power Fail	Firmware Fail
Byte 2	Diagnostics							

- 0x63 0x0619 CRD Configuration

	7	6	5	4	3	2	1	0
Byte 0	0x63							
Byte 1					Track3	Track2	Track1	ICC

- 0x64 0x061A Card Status

	7	6	5	4	3	2	1	0
Byte 0	0x64							
Byte 1					Partially Inserted	Card Present	Removed	Inserted
Byte 2					Track3	Track2	Track1	ICC

- 0x65 0x061B Card Data

	7	6	5	4	3	2	1	0
Byte 0	0x65							
Byte 1	Index (LSB)							
Byte 2	Index (MSB)							
Byte 3	Size							
Byte 4	Type							
Byte 5	Data 1							
…	…							
Byte 63	Data 59							

- 0x66 0x061C Error Data

	7	6	5	4	3	2	1	0
Byte 0	0x63							
Byte 1	Error Code							

- 0x67 0x061D Count Status

	7	6	5	4	3	2	1	0
Byte 0	0x65							
Byte 1	Index (LSB)							
Byte 2	Index (MSB)							
Byte 3	Size							
Byte 4	Type							
Byte 5	Data 1							
…	…							
Byte 63	Data 59							

2.7 Device Properties

The final 6Kbyte of memory is called Device Properties block and contains a group of option bytes that allow the user to configure some device settings such as Serial Number, prefix, suffix and Preamble.
The details of device properties will be provided in next version.

3 Appendix A. Application Program Block Related Information

3.1 Device Descriptor

Field	Value
	GAME CONTROLS PAGE
Length	12
DescriptorType	01
USB	0200
DeviceClass	00
DeviceSubClass	00
DeviceProtocol	00
MaxPacketSize	08
Vendor	6352
Product	242B
Device	0103
Manufacturer	01
Product	02
SerialNumber	00
NumConfigurations	01

3.2 Report Configurations Descriptor

Field	Value	Description
Length	9	Configurations Descriptor size
Descriptor Type	2	Configuration
Total Length	34	Bytes returned
Num Interfaces	1	1 interface
Value	1	Configuration value
Configuration	03	Index of string descriptor describing
Attributes	80	BUS powered
Max Power		500 mA
Length	9	Interface Descriptor size
Descriptor Type	3	Interface
Interface Number	0	
Alternate Setting	0	Alternate setting
Num Endpoints	1	Usage (Card Encode Type)
Interface Class	3	HID
Interface Sub Class	0	no boot
Interface Protocol	0	0=none
Interface	0	string descriptor
Length: HID Descriptor size	9	HID Descriptor size
Descriptor Type	21	HID
BCD HID	1.12	HID Class Spec release number
Country Code	0	Taiwan
Num Descriptors	1	HID class descriptors to follow
Descriptor Type	22	HID
Item Length		Report descriptor
Length	7	Endpoint Descriptor size
Descriptor Type	05	Endpoint
Endpoint Address	81	
Attributes	3	Interrupt endpoint
Max Packet Size	8	
Interval	1	

3.3 Report STRING Descriptor

Manufacturer index of string descriptor
Interface index of string descriptor
SerialNumber index of string descriptor

Manufacturer

- May be used to give a Unicode representation of the idVendor. This is assigned by each manufacturer and kept consistent with regards to case and spelling.
- For example:
- GSA Member Company Name

Interface

- A string must be returned in this format:
- <Protocol Level>,<Product Name>,<Firmware Issue>,<Build Version>, <Manufacturing Date>
- Unicode string made up of several comma-delimited sub-strings. Redundant, trailing commas may be omitted. Leading and trailing spaces within sub-strings will be ignored.
- For example:
- 1.1.1,ProductName,1.01,A,2004-01-01
- Only the first three items are compulsory. At a minimum we could have...
- 1.1.1,ProductName,1A2B3C, 1.01

SerialNumber

- Serial numbers must be returned as a Unicode string (126 character limit), such as 12345678.

Leading zeros are acceptable, for example 00000123.

3.4 HID Report Descriptor:

```
        0x05, 0x92,        // USAGE_PAGE (GSA Gaming Device)
        0x09, 0x16,        // USAGE (Card Reader)
        0xa1, 0x01,        // COLLECTION (Application)
// Enable
        0x09, 0x41,        // USAGE (Enable)
        0x85, 0x02,        // REPORT_ID (2)
        0x15, 0x00,        // LOGICAL_MINIMUM (0)
        0x25, 0x01,        // LOGICAL_MAXIMUM (1)
        0x75, 0x08,        // REPORT_SIZE (8)
        0x95, 0x01,        // REPORT_COUNT (1)
        0xb1, 0x03,        // FEATURE (Cnst, Var, Abs)
// Disable
        0x09, 0x42,        // USAGE (Disable)
        0x85, 0x03,        // REPORT_ID (3)
        0x75, 0x08,        // REPORT_SIZE (8)
        0x95, 0x01,        // REPORT_COUNT (1)
        0xb1, 0x03,        // FEATURE (Cnst, Var, Abs)
// Self Test
        0x09, 0x43,        // USAGE (Self Test)
        0x85, 0x04,        // REPORT_ID (4)
        0xa1, 0x02,        // COLLECTION (Logical)
        0x15, 0x00,        // LOGICAL_MINIMUM (0)
        0x25, 0x01,        // LOGICAL_MAXIMUM (1)
        0x75, 0x01,        // REPORT_SIZE (1)
        0x95, 0x01,        // REPORT_COUNT (1)
        0x09, 0x93,        // USAGE (NVM)
        0xb1, 0x02,        // FEATURE (Data, Var, Abs)
        0x95, 0x07,        // REPORT_COUNT (7)
        0xb1, 0x03,        // FEATURE (Cnst, Var, Abs)
        0xc0,              // END_COLLECTION
// Request GAT Report
        0x09, 0x44,        // USAGE (Request GAT Report)
        0x85, 0x05,        // REPORT_ID (5)
        0x75, 0x08,        // REPORT_SIZE (8)
        0x95, 0x01,        // REPORT_COUNT (1)
        0xb1, 0x03,        // FEATURE (Cnst, Var, Abs)
// Power Status
        0x09, 0x45,        // USAGE (Power Status)
        0x85, 0x06,        // REPORT_ID (6)
        0xa1, 0x02,        // COLLECTION (Logical)
        0x15, 0x00,        // LOGICAL_MINIMUM (0)
        0x25, 0x01,        // LOGICAL_MAXIMUM (1)
        0x75, 0x01,        // REPORT_SIZE (1)
        0x95, 0x01,        // REPORT_COUNT (1)
        0x09, 0x91,        // USAGE (Ext. Power)
        0x81, 0x02,        // INPUT (Data, Var, Abs)
        0x09, 0x92,        // USAGE (Need Reset)
        0x81, 0x02,        // INPUT (Data, Var, Abs)
        0x95, 0x06,        // REPORT_COUNT (6)
        0x81, 0x03,        // INPUT (Cnst,Var,Abs)
        0xc0,              // END_COLLECTION
// GAT Data
        0x09, 0x46,        // USAGE (GAT Data)
        0x85, 0x07,        // REPORT_ID (7)
        0xa1, 0x02,        // COLLECTION (Logical)
        0x15, 0x00,        // LOGICAL_MINIMUM (0)
        0x26, 0xff, 0x00, // LOGICAL_MAXIMUM (255)
        0x75, 0x08,        // REPORT_SIZE (8)
```

```
    0x95, 0x01,       // REPORT_COUNT (1)
    0x09, 0x61,       // USAGE (Index)
    0x81, 0x02,       // INPUT (Data, Var, Abs)
    0x25, 0x3d,       // LOGICAL_MAXIMUM (61)
    0x09, 0x62,       // USAGE (Length)
    0x81, 0x02,       // INPUT (Data, Var, Abs)
    0x26, 0xff, 0x00, // LOGICAL_MAXIMUM (255)
    0x95, 0x3d,       // REPORT_COUNT (61)
    0x09, 0xb0,       // USAGE (Miscellaneous data)
    0x81, 0x02,       // INPUT (Data, Var, Abs)
    0xc0,             // END_COLLECTION
// Calculate CRC
    0x09, 0x47,       // USAGE (Calculate CRC)
    0x85, 0x08,       // REPORT_ID (8)
    0xa1, 0x02,       // COLLECTION (Logical)
    0x15, 0x00,       // LOGICAL_MINIMUM (0)
    0x26, 0xff, 0x00, // LOGICAL_MAXIMUM (255)
    0x75, 0x08,       // REPORT_SIZE (8)
    0x95, 0x04,       // REPORT_COUNT (4)
    0x09, 0x63,       // USAGE (Seed)
    0xb1, 0x02,       // FEATURE (Data, Var, Abs)
    0xc0,             // END_COLLECTION
// CRC Data
    0x09, 0x48,       // USAGE (CRC Data)
    0x85, 0x09,       // REPORT_ID (9)
    0xa1, 0x02,       // COLLECTION (Logical)
    0x15, 0x00,       // LOGICAL_MINIMUM (0)
    0x26, 0xff, 0x00, // LOGICAL_MAXIMUM (255)
    0x75, 0x08,       // REPORT_SIZE (8)
    0x95, 0x04,       // REPORT_COUNT (4)
    0x09, 0x64,       // USAGE (Result)
    0x81, 0x02,       // INPUT (Data, Var, Abs)
    0xc0,             // END_COLLECTION
// Device State
    0x09, 0x49,       // USAGE (Device State)
    0x85, 0x0a,       // REPORT_ID (10)
    0xa1, 0x02,       // COLLECTION (Logical)
    0x15, 0x00,       // LOGICAL_MINIMUM (0)
    0x25, 0x01,       // LOGICAL_MAXIMUM (1)
    0x75, 0x01,       // REPORT_SIZE (1)
    0x95, 0x01,       // REPORT_COUNT (1)
    0x09, 0x94,       // USAGE (Enable)
    0x81, 0x02,       // INPUT (Data, Var, Abs)
    0x09, 0x95,       // USAGE (Disable)
    0x81, 0x02,       // INPUT (Data, Var, Abs)
    0x95, 0x06,       // REPORT_COUNT (6)
    0x81, 0x03,       // INPUT (Cnst,Var,Abs)
    0xc0,             // END_COLLECTION
// Get CRD Config
    0x0a, 0x10, 0x06, // USAGE (Get CRD Config)
    0x85, 0x5a,       // REPORT_ID (90)
    0x75, 0x08,       // REPORT_SIZE (8)
    0x95, 0x01,       // REPORT_COUNT (1)
    0xb1, 0x03,       // FEATURE (Cnst, Var, Abs)
// Read Card Data
    0x0a, 0x11, 0x06, // USAGE (Read Card Data)
    0x85, 0x5b,       // REPORT_ID (91)
    0xa1, 0x02,       // COLLECTION (Logical)
    0x15, 0x00,       // LOGICAL_MINIMUM (0)
    0x25, 0x01,       // LOGICAL_MAXIMUM (1)
    0x75, 0x01,       // REPORT_SIZE (1)
    0x95, 0x01,       // REPORT_COUNT (1)
```

```
        0x0a, 0x60, 0x06, // USAGE (Track1)
        0xb1, 0x02,       // FEATURE (Data, Var, Abs)
        0x0a, 0x61, 0x06, // USAGE (Track2)
        0xb1, 0x02,       // FEATURE (Data, Var, Abs)
        0x0a, 0x62, 0x06, // USAGE (Track3)
        0xb1, 0x02,       // FEATURE (Data, Var, Abs)
        0x95, 0x05,       // REPORT_COUNT (5)
        0xb1, 0x03,       // FEATURE (Cnst, Var, Abs)
        0xc0,             // END_COLLECTION
// Get ATR;not implemented
        0x0a, 0x12, 0x06, // USAGE (Get ATR)
        0x85, 0x5c,       // REPORT_ID (92)
        0x75, 0x08,       // REPORT_SIZE (8)
        0x95, 0x01,       // REPORT_COUNT (1)
        0xb1, 0x03,       // FEATURE (Cnst, Var, Abs)
// Transfer to ICC        ;not implemented
        0x0a, 0x13, 0x06, // USAGE (Transfer to ICC)
        0x85, 0x5d,       // REPORT_ID (93)
        0xa1, 0x02,       // COLLECTION (Logical)
        0x15, 0x00,       // LOGICAL_MINIMUM (0)
        GDSR Card Reader:
        0x26, 0xff, 0x00, // LOGICAL_MAXIMUM (255)
        0x75, 0x08,       // REPORT_SIZE (8)
        0x95, 0x02,       // REPORT_COUNT (2)
        0x0a, 0x30, 0x06, // USAGE (Index)
        0xb1, 0x02,       // Feature (Data, Var, Abs)
        0x25, 0x3d,       // LOGICAL_MAXIMUM (61)
        0x95, 0x01,       // REPORT_COUNT (1)
        0x0a, 0x31, 0x06, // USAGE (Size)
        0xb1, 0x02,       // FEATURE (Data, Var, Abs)
        0x26, 0xff, 0x00, // LOGICAL_MAXIMUM (255)
        0x95, 0x3c,       // REPORT_COUNT (60)
        0x0a, 0x80, 0x06, // USAGE (Data)
        0xb2, 0x02, 0x01, // FEATURE (Data, Var, Abs, Buf)
        0xc0,             // END_COLLECTION
// Release Latch          ;not implemented
        0x0a, 0x14, 0x06, // USAGE (Release Latch)
        0x85, 0x5e,       // REPORT_ID (94)
        0x75, 0x08,       // REPORT_SIZE (8)
        0x95, 0x01,       // REPORT_COUNT (1)
        0xb1, 0x03,       // FEATURE (Cnst, Var, Abs)
// Light Control   ;not implemented
        0x0a, 0x15, 0x06, // USAGE (Light Control)
        0x85, 0x5f,       // REPORT_ID (95)
        0xa1, 0x02,       // COLLECTION (Logical)
        0x15, 0x00,       // LOGICAL_MINIMUM (0)
        0x25, 0x01,       // LOGICAL_MAXIMUM (1)
        0x75, 0x01,       // REPORT_SIZE (1)
        0x95, 0x01,       // REPORT_COUNT (1)
        0xb1, 0x03,       // FEATURE (Cnst, Var, Abs)
        0x0a, 0x63, 0x06, // USAGE (Red)
        0xb1, 0x02,       // FEATURE (Data, Var, Abs)
        0x0a, 0x64, 0x06, // USAGE (Green)
        0xb1, 0x02,       // FEATURE (Data, Var, Abs)
        0x0a, 0x65, 0x06, // USAGE (Yellow)
        0xb1, 0x02,       // FEATURE (Data, Var, Abs)
        0x95, 0x04,       // REPORT_COUNT (4)
        0xb1, 0x03,       // FEATURE (Cnst, Var, Abs)
        0x26, 0xff, 0x00, // LOGICAL_MAXIMUM (255)
        0x75, 0x08,       // REPORT_SIZE (8)
        0x95, 0x01,       // REPORT_COUNT (1)
        0x0a, 0x32, 0x06, // USAGE (LED Timer)
        0xb1, 0x02,        // FEATURE (Data, Var, Abs)
        0xc0,              // END_COLLECTION
// Clear Buffer
        0x0a, 0x16, 0x06, // USAGE (Clear Buffer)
        0x85, 0x60,        // REPORT_ID (96)
        0x75, 0x08,        // REPORT_SIZE (8)
        0x95, 0x01,        // REPORT_COUNT (1)
        0xb1, 0x03,        // FEATURE (Cnst, Var, Abs)
// Get Count Status
        0x0a, 0x17, 0x06, // USAGE (Get Count Status)
        0x85, 0x61,        // REPORT_ID (97)
        0x75, 0x08,        // REPORT_SIZE (8)
        0x95, 0x01,        // REPORT_COUNT (1)
        0xb1, 0x03,        // FEATURE (Cnst, Var, Abs)
// Failure Status
        0x0a, 0x18, 0x06, // USAGE (Failure Status)
        0x85, 0x62,        // REPORT_ID (98)
        0xa1, 0x02,        // COLLECTION (Logical)
        0x15, 0x00,        // LOGICAL_MINIMUM (0)
        0x25, 0x01,        // LOGICAL_MAXIMUM (1)
        0x75, 0x01,        // REPORT_SIZE (1)
        0x95, 0x01,        // REPORT_COUNT (1)
        0x0a, 0x66, 0x06, // USAGE (Firmware)
        0x81, 0x02,        // INPUT (Data, Var, Abs)
        0x0a, 0x67, 0x06, // USAGE (ICC Power Fail)
        0x81, 0x02,        // INPUT (Data, Var, Abs)
        0x95, 0x05,        // REPORT_COUNT (5)
        0x81, 0x03,        // INPUT (Cnst,Var,Abs)
        0x95, 0x01,        // REPORT_COUNT (1)
        0x0a, 0x68, 0x06, // USAGE (Other)
        0x81, 0x02,        // INPUT (Data, Var, Abs)
        0x26, 0xff, 0x00, // LOGICAL_MAXIMUM (255)
        0x75, 0x08,        // REPORT_SIZE (8)
        0x95, 0x01,        // REPORT_COUNT (1)
        0x0a, 0x33, 0x06, // USAGE (Diagnostics)
        0x81, 0x02,        // INPUT (Data, Var, Abs)
        0xc0,              // END_COLLECTION
// CRD Configuration Data
        0x0a, 0x19, 0x06, // USAGE (CRD Config Data)
        0x85, 0x63,        // REPORT_ID (99)
        0xa1, 0x02,        // COLLECTION (Logical)
        0x15, 0x00,        // LOGICAL_MINIMUM (0)
        0x25, 0x01,        // LOGICAL_MAXIMUM (1)
        0x75, 0x01,        // REPORT_SIZE (1)
        0x95, 0x01,        // REPORT_COUNT (1)
        0x0a, 0x69, 0x06, // USAGE (ICC)
        0x81, 0x02,        // INPUT (Data, Var, Abs)
        0x0a, 0x60, 0x06, // USAGE (Track1)
        0x81, 0x02,        // INPUT (Data, Var, Abs)
        0x0a, 0x61, 0x06, // USAGE (Track2)
        0x81, 0x02,        // INPUT (Data, Var, Abs)
        0x0a, 0x62, 0x06, // USAGE (Track3)
        0x81, 0x02,        // INPUT (Data, Var, Abs)
        0x95, 0x04,        // REPORT_COUNT (4)
        0x81, 0x03,        // INPUT (Cnst, Var, Abs)
        0xc0,              // END_COLLECTION
// Card Status
        0x0a, 0x1a, 0x06, // USAGE (Card Status)
        0x85, 0x64,        // REPORT_ID (100)
        0xa1, 0x02,        // COLLECTION (Logical)
        0x15, 0x00,        // LOGICAL_MINIMUM (0)
        0x25, 0x01,        // LOGICAL_MAXIMUM (1)
        0x75, 0x01,       // REPORT_SIZE (1)
        0x95, 0x01,       // REPORT_COUNT (1)
        0x0a, 0x6a, 0x06, // USAGE (Inserted)
        0x81, 0x02,       // INPUT (Data, Var, Abs)
        0x0a, 0x6b, 0x06, // USAGE (Removed)
        0x81, 0x02,       // INPUT (Data, Var, Abs)
        0x0a, 0x6c, 0x06, // USAGE (Card Present)
        0x81, 0x02,       // INPUT (Data, Var, Abs)
        0x0a, 0x6d, 0x06, // USAGE (Partially Inserted)
        0x81, 0x02,       // INPUT (Data, Var, Abs)
        0x95, 0x04,       // REPORT_COUNT (4)
        0x81, 0x03,       // INPUT (Cnst,Var,Abs)
        0x95, 0x01,       // REPORT_COUNT (1)
        0x0a, 0x69, 0x06, // USAGE (ICC)
        0x81, 0x02,       // INPUT (Data, Var, Abs)
        0x0a, 0x60, 0x06, // USAGE (Track1)
        0x81, 0x02,       // INPUT (Data, Var, Abs)
        0x0a, 0x61, 0x06, // USAGE (Track2)
        0x81, 0x02,       // INPUT (Data, Var, Abs)
        0x0a, 0x62, 0x06, // USAGE (Track3)
        0x81, 0x02,       // INPUT (Data, Var, Abs)
        0x95, 0x04,       // REPORT_COUNT (4)
        0x81, 0x03,       // INPUT (Cnst,Var,Abs)
        0xc0,             // END_COLLECTION
// Card Data
        0x0a, 0x1b, 0x06, // USAGE (Card Data)
        0x85, 0x65,       // REPORT_ID (101)
        0xa1, 0x02,       // COLLECTION (Logical)
        0x15, 0x00,       // LOGICAL_MINIMUM (0)
        0x26, 0xff, 0x00, // LOGICAL_MAXIMUM (255)
        0x75, 0x08,       // REPORT_SIZE (8)
        0x95, 0x02,       // REORT COUNT (2)
        0x0a, 0x30, 0x06, // USAGE (Index)
        0x81, 0x02,       // INPUT (Data, Var, Abs)
        0x25, 0x3b,       // LOGICAL_MAXIMUM (59)
        0x95, 0x01,       // REPORT_COUNT (1)
        0x0a, 0x31, 0x06, // USAGE (Size)
        0x81, 0x02,       // INPUT (Data, Var, Abs)
        0x25, 0x04,       // LOGICAL_MAXIMUM (4)
        0x0a, 0x34, 0x06, // USAGE (Type)
        0x81, 0x02,       // INPUT (Data, Var, Abs)
        0x26, 0xff, 0x00, // LOGICAL_MAXIMUM (255)
        0x95, 0x3b,       // REPORT_COUNT (59)
        0x0a, 0x81, 0x06, // USAGE (Data)
        0x82, 0x02, 0x01, // INPUT (Data, Var, Abs, Buf)
        0xc0,             // END_COLLECTION
// Error Data
        0x0a, 0x1c, 0x06, // USAGE (Error Data)
        0x85, 0x66,       // REPORT_ID (102)
        0xa1, 0x02,       // COLLECTION (Logical)
        0x15, 0x00,       // LOGICAL_MINIMUM (0)
        0x26, 0xff, 0x00, // LOGICAL_MAXIMUM (255)
        0x75, 0x08,       // REPORT_SIZE (8)
        0x95, 0x01,       // REPORT_COUNT (1)
        0x0a, 0x35, 0x06, // USAGE (Error Code)
        0x81, 0x02,       // INPUT (Data, Var, Abs)
        0xc0,             // END_COLLECTION
// Count Status
        0x0a, 0x1d, 0x06, // USAGE (Count Status)
        0x85, 0x67,       // REPORT_ID (103)
        0xa1, 0x02,       // COLLECTION (Logical)
        0x15, 0x00,       // LOGICAL_MINIMUM (0)
        0x26, 0xff, 0x00, // LOGICAL_MAXIMUM (255)
        0x75, 0x08,       // REPORT_SIZE (8)
        0x95, 0x03,       // REPORT_COUNT (3)
        0x0a, 0x36, 0x06, // USAGE (Mag. Pass Count)
        0x81, 0x02,       // INPUT (Data, Var, Abs)
        0x0a, 0x37, 0x06, // USAGE (Mag. Error Count Track1)
        0x81, 0x02,       // INPUT (Data, Var, Abs)
        0x0a, 0x38, 0x06, // USAGE (Mag. Error Count Track2)
        0x81, 0x02,       // INPUT (Data, Var, Abs)
        0x0a, 0x39, 0x06, // USAGE (Mag. Error Count Track3)
        0x81, 0x02,       // INPUT (Data, Var, Abs)
        0x0a, 0x3a, 0x06, // USAGE (IC Try Count)
        0x81, 0x02,       // INPUT (Data, Var, Abs)
        0x0a, 0x3b, 0x06, // USAGE (IC Error Count)
        0x81, 0x02,       // INPUT (Data, Var, Abs)
        0xc0,             // END_COLLECTION
// Latch Mode    ;not implemented
        0x0a, 0x1e, 0x06, // USAGE (Latch Mode)
        0x85, 0x68,       // REPORT_ID (104)
        0xa1, 0x02,       // COLLECTION (Logical)
        0x15, 0x00,       // LOGICAL_MINIMUM (0)
        0x25, 0x01,       // LOGICAL_MAXIMUM (1)
        0x75, 0x01,       // REPORT_SIZE (1)
        0x95, 0x01,       // REPORT_COUNT (1)
        0x0a, 0x6e, 0x06, // USAGE (Lock)
        0xb1, 0x02,       // FEATURE (Data, Var, Abs)
        0x0a, 0x6f, 0x06, // USAGE (Release)
        0xb1, 0x02,       // FEATURE (Data, Var, Abs)
        0x95, 0x06,       // REPORT_COUNT (6)
        0xb1, 0x03,       // FEATURE (Cnst, Var, Abs)
        0xc0,             // END_COLLECTION
        0xc0,             // END_COLLECTION
```

4 Appendix B. Boot Loader Block Related Information

- Go-Into-Bootloader mode command: **<7E><C2><00><05><09><00><02><42><4C>**

4.1 Device Descriptor

Field	Value
Length	12
DescriptorType	01
USB	0200
DeviceClass	00
DeviceSubClass	00
DeviceProtocol	00
MaxPacketSize	40
Vendor	6352
Product	242B
Device	0103
Manufacturer	01
Product	02
SerialNumber	03
NumConfigurations	01

4.2 Report Configurations Descriptor

Field	Value	Description
Length	9	Configurations Descriptor size
Descriptor Type	2	Configuration
Total Length	34	Bytes returned
Num Interfaces	1	1 interface
Value	1	Configuration value
Configuration	03	Index of string descriptor describing
Attributes	80	BUS powered
Max Power		500 mA
Length	9	Interface Descriptor size
Descriptor Type	3	Interface
Interface Number	0	
Alternate Setting	0	Alternate setting
Num Endpoints	1	Usage (Card Encode Type)
Interface Class	3	HID
Interface Sub Class	0	no boot
Interface Protocol	0	0=none
Interface	0	string descriptor
Length: HID Descriptor size	9	HID Descriptor size
Descriptor Type	21	HID
BCD HID	1.12	HID Class Spec release number
Country Code	0	Taiwan
Num Descriptors	1	HID class descriptors to follow
Descriptor Type	22	HID
Item Length		Report descriptor
Length	7	Endpoint Descriptor size
Descriptor Type	05	Endpoint
Endpoint Address	81	
Attributes	3	Interrupt endpoint
Max Packet Size	8	
Interval	A	

4.3 Report STRING Descriptor

Manufacturer index of string descriptor
Interface index of string descriptor
SerialNumber index of string descriptor

Manufacturer

- May be used to give a Unicode representation of the idVendor. This is assigned by each manufacturer and kept consistent with regards to case and spelling.
- For example:
- GSA Member Company Name

Interface

- A string must be returned in this format:
- <Protocol Level>,<Product Name>,<Firmware Issue>,<Build Version>, <Manufacturing Date>
- Unicode string made up of several comma-delimited sub-strings. Redundant, trailing commas may be omitted. Leading and trailing spaces within sub-strings will be ignored.
- For example:
- 1.1.1,ProductName,1.01,A,2004-01-01
- Only the first three items are compulsory. At a minimum we could have...
- 1.1.1,ProductName,1A2B3C, 1.01

SerialNumber

- Serial numbers must be returned as a Unicode string (126 character limit), such as 12345678.
- Leading zeros are acceptable, for example 00000123.

4.4 HID Report Descriptor:

```
0x06, 0x00,0Xff,         //  Usage Page (MSR)

0x09, 0x01,              //  Usage (Decoding Reader)
0xA1, 0x01,              //  Collection (application)

0x15, 0x00,              //  Logical Minimum
0x26, 0xff, 0x00,        //  Logical Maximum
/*12*/
0x75, 0x08,              //  Report Size
0x09, 0x20,              //  Usage (Tk1 Decode Status)
0x09, 0x21,              //  Usage (Tk2 Decode Status)
0x09, 0x22,              //  Usage (Tk3 Decode Status)
0x09, 0x28,              //  Usage (Tk1 Data Length)
0x09, 0x29,              //  Usage (Tk2 Data Length)
0x09, 0x2A,              //  Usage (Tk3 Data Length)

0x09, 0x38,              //  Usage (Card Encode Type)
/*28*/
0x95, 0x07,              //  Report count (7)
0x81, 0x02,              //  Input (Data, Var., Abs, Bit Field)

0x09, 0x30,              //  Usage (Total Sending Length)
0x95, 0x02,              //  Input (Data, Var., Abs, Bit Field
/*34*/
0x82, 0x02, 0x01,        //  Usage (Output Data)
0x09, 0x31,              //  Report Count (328*)
0x96, 0x10, 0x02,        //  Input (Data, Var., Abs, Bit Field)
0x82, 0x02, 0x01,
0x09, 0x20,              //  Usage (Command Message)
0x96, 0x50, 0x03,        //  Report count (520 bytes)
0xb2, 0x02, 0x01,        //  Feature (Data, Var., Abs, Buffered Bytes)
0xa4, 0xb4,
0xc0,                    //  End collection
```