SPECIFICATION

ET6103

Magnetic Strip Reader Decoder

July 2002

Etrend Electronic, Inc.
3rd Floor, No.5, Nan-ke 3rd Road Tainan Science Based Industrial Park, Hsin-shi, Tainan County, Taiwan, R.O.C.
Tel: 886-6-5050170 Fax: 886-6-5050175

ET6103

Magnetic Strip Reader

GENERAL DESCRIPTION

The ET6103 F/2F decoder is a dedicated chip for three channels of magnetic strip card reader system. It has a built-in amplification circuitry and very wide data detection range of card swipe speeds from 200 to 12,000 bits per second. It is a multifunction chip with excellent performance and low cost for use in receiving and recovering F2F encoded data.

FEATURES

- Triple tracks for F/2F decoded magnetic stripe
- Speed range: 200 BPS to 12,000 BPS (bits per second)
- Built-in operational amplification circuitry
- Power down mode for stand-by control
- Supporting 75/210 BPI (bit per inch) recording density
- Low cost, high quality design
- Lower power consumption
- Three modes for RCP Active Duty Cycle Time select width: 25%, 50% and 75%
- Ignore start bit selectable for 4 or 8 bits
- Wide operation voltage range (V_{DD} : 2.5V ~5.0V)
- Wide operation temperature range (Ta : －10℃ ~ ＋75℃)
- Package: LQFP48

APPLICATIONS

- Magnetic stripe card reader (MSR)
- Credit Card Terminal
- Hand held device with card reader
- Boarding Pass Reader
- POS keyboard with card reader
- Access control and security control
- The ET6103 chip is suited for 1,2,3 channels of magnetic strip card reader system.

Etrend Electronic, Inc.
Proprietary & Confidential
3rd Floor, No.5, Nan-ke 3rd Road Tainan Science Based Industrial Park, Hsin-shi, Tainan County, Taiwan, R.O.C.
Tel: 886-6-5050170 Fax: 886-6-5050175

PIN ASSIGNMENT

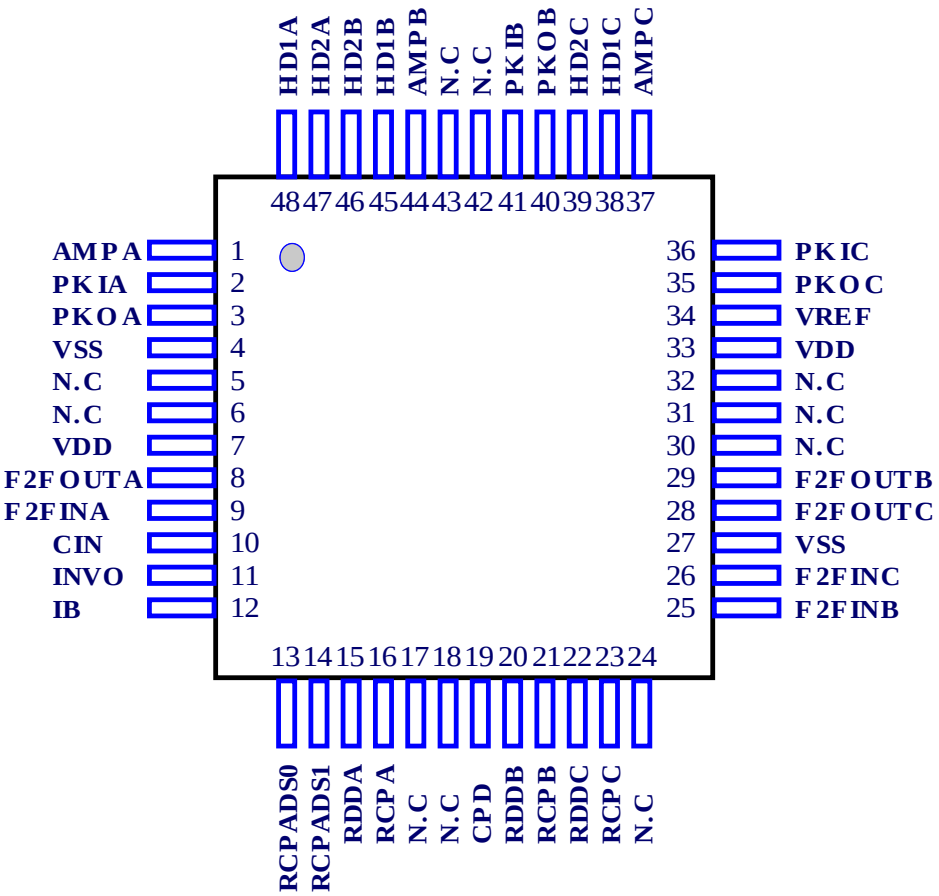


Figure 1: Pin assignment of ET6103

Package Type: LQFP48

Etrend Electronic, Inc.
3rd Floor, No.5, Nan-ke 3rd Road Tainan Science Based Industrial Park, Hsin-shi, Tainan County, Taiwan, R.O.C.
Tel: 886-6-5050170 Fax: 886-6-5050175

Pin Definition

NO	SYMBOL	I/O	DESCRIPTION	REMARK	
1	AMPA	AO	Track A Amplifier		
2	PKIA	AI	Track A Peak Detect Input		
3	PKOA	AO	Track A Peak Detect Output		
4	VSS	S	Negative Power Supply	GND	
5.6	N.C				
7	VDD	S	Digital Positive Power Supply	VDD	
8	F2FOUTA	DO	Track A F2F Output		
9	F2FINA	DI	Track A F2F Input		
10	CIN	AI	Reset Capacitance		
11	INVO	DI	Invert Digital Output Pins Select	L：Positive Logic H：Negative Logic	
12	IB	DI	Programmable CPD Delay Select	L：4 bits H：8 bits	
13	RCPADS0	DI	RCP Active Duty Select	RCPADS [1:0]	RCP Active Width
14	RCPADS1	DI	RCP Active Duty Select	00	25%
				01	50%
				10	75%
				11	75%
15	RDDA	DO	Track A Read Data	Data	
16	RCPA	DO	Track A Read Clock Pulse	Strobe	
17.18	N.C				
19	CPD	DO	Card Present Detect	Card Present	
20	RDDB	DO	Track B Read Data	Data	
21	RCPB	DO	Track B Read Clock Pulse	Strobe	
22	RDDC	DO	Track C Read Data	Data	
23	RCPC	DO	Track C Read Clock Pulse	Strobe	
24	N.C				
25	F2FINB	DI	Track B F2F Input		
26	F2FINC	DI	Track C F2F Input		
27	VSS	S	Negative Power Supply	GND	
28	F2FOUTC	DO	Track C F2F Output		
29	F2FOUTB	DO	Track B F2F Output		
30.31.32	N.C				
33	VDD	S	Analog Positive Power Supply	VDD	
34	VREF	AO	Reference Voltage (VDD/2)		
35	PKOC	AO	Track C Peak Detect Output		
36	PKIC	AI	Track C Peak Detect Input		
37	AMPC	AO	Track C Amplifier Output		

Etrend Electronic, Inc.

3rd Floor, No.5, Nan-ke 3rd Road Tainan Science Based Industrial Park, Hsin-shi, Tainan County, Taiwan, R.O.C.
Tel: 886-6-5050170 Fax: 886-6-5050175

38	HD1C	AI	Track C Head Input (-)	
39	HD2C	AI	Track C Head Input (+)	
40	PKOB	AO	Track B Peak Detect Output	
41	PKIB	AI	Track B Peak Detect Input	
42.43	N.C			
44	AMPB	AO	Track B Amplifier Output	
45	HD1B	AI	Track B Head Input (-)	
46	HD2B	AI	Track B Head Input (+)	
47	HD2A	AI	Track A Head Input (+)	
48	HD1A	AI	Track A Head Input (-)	

1) AI=Analog Input; AO=Analog Output; DI=Digital Input; DO=Digital Output; S=Supply.

Usage of ET6103

***OPERATIONAL AMPLIFIER for Input amplifier and filter (OP1,OP2)**

All parameters are valid at operating conditions unless otherwise specified.

Stability is ensured for all proposed applications but not in buffer configuration.

PARAMETER	MIN	TYP	MAX	NOTE
Input frequency	0.1Hz		6MHz	
Input offset voltage	-0.2mV	0mV	0.2mV	1)
Differential input voltage	10mV$_{pp}$			@V_{DD}=5V Amplifier configuration
Differential input voltage	10mV$_{pp}$			@V_{DD}=3V Amplifier configuration
Closed loop gain of OP	26	27	28	2)
Slew rate rising edge	15V/μs			3)
Slew rate falling edge	14V/μs			3)
Sink output current	8mA			V_{DD}=5V
Source output current	0.8mA			V_{DD}=5V

1) Not critical for OP1 because the following stage is AC coupled.

2) Tested with R_{fed}/R_{in}=108K / 4K and V_{DD}=5V

3) Tested with R_{load}=10K and C_{load}=20pF and $V_{in}=V_{DD}/2 \pm 0.5V_{pp}$ pulse.
Test limit=3V/μs

Etrend Electronic, Inc.
Proprietary & Confidential
3rd Floor, No.5, Nan-ke 3rd Road Tainan Science Based
Industrial Park, Hsin-shi, Tainan County, Taiwan, R.O.C.
Tel: 886-6-5050170 Fax: 886-6-5050175

***INTERNAL DISCRETE COMPONENTS**

PARAMETER	MIN	TYP	MAX	NOTE
R_{IN}		4K		Feedback resistance
R_{fed}		108K		Input series resistance
V_{pc}	0.7V	0.8V	0.9V	Positive clamp voltage
V_{nc}	0.7V	0.8V	0.9V	Negative clamp voltage

***COMPARATOR** (All Parameters measured @ V_{DD}=5V)

PARAMETER	MIN	TYP	MAX	NOTE
Input frequency	0.1Hz		10MHz	
Hysteresis	0.2V		0.3V	1)

1) The hysteresis is performed by positive feedback resistors , From ($V_{outhigh}$ – V_{outlow})

***ABSOLUTE MAXIMUM RATINGS (NON OPERATING)**

PARAMETER	SYMBOL	MIN	MAX	NOTE
DC Supply Voltage	V_{DD}	-0.5V	7.0V	
Input Pin Voltage	V_{in}	V_{SS}-0.5V	V_{DD}+0.5V	
Input Pin Capacitance	C_{in}		10pF	
Storage Temperature	T_{strg}	-55℃	150℃	
Lead Temperature	T_{lead}		260℃	
Lead Time			10 sec	
Humidity		5%	85%	
Electronic Discharge		±2000V		1)

1) Human Body Mode (MIL-STD-883C Method 3015.7)

3rd Floor, No.5, Nan-ke 3rd Road Tainan Science Based Industrial Park, Hsin-shi, Tainan County, Taiwan, R.O.C.
Tel: 886-6-5050170 Fax: 886-6-5050175

*RECOMMENDED OPERTING CONDITIONS

PARAMETER	SYMBOL	MIN	MAX	NOTE
DC Supply Voltage	V_{DD}	2.5V	7V	
Operation Supply Current	I_{DD}		12mA	1)
Standby Current	I_{DD} standby		3.5mA	2)
Circuit Ground	V_{SS}	0.0V	0.0V	
Ambient Temperature	Ta	-10℃	75℃	

1) Supply current is exclusive of input/output drive requirements and is measured at V_{DD}=5V

2) Standby current is defined with digital part=off, oscillator=off, analog part=on at V_{DD}=5V

*DC CHARACTERISTICS

1. DIGITAL INPUTS: (All parameters measured @ V_{DD}=5V)

PARAMETER	MIN	TYP	MAX	NOTE
V_{ih}	0.7*V_{DD}			
V_{il}			0.3*V_{DD}	
I_{ih}	-10μA		+10μA	1)
I_{il}	-10μA		+10μA	2)

1) Not valid for pin IB、RCPADS0、RCPADS1(pull down input pad)

2) Not valid for pins INVO (pull up input pads)

2. DIGITAL OUTPUTS：(All parameters measured @ V_{DD}=5V)
   Output type 1：Valid for RCP＊, RDD＊, F2FOUT＊

PARAMETER	MIN	TYP	MAX	NOTE
V_{oh}	4.5V			I_{oh}=10μA
V_{oh}	3.5V			I_{oh}=8mA
V_{ol}			0.1V	I_{ol}=10μA
V_{ol}			0.4V	I_{ol}=8mA

Note: In this manual, we use "＊" to represent the three tracks, for example: RCP＊ means RCPA、RCPB and RCPC.

Etrend Electronic, Inc.
Proprietary & Confidential
3rd Floor, No.5, Nan-ke 3rd Road Tainan Science Based Industrial Park, Hsin-shi, Tainan County, Taiwan, R.O.C.
Tel: 886-6-5050170 Fax: 886-6-5050175

Output type 2：Valid for CPD (open drain)

PARAMETER	MIN	TYP	MAX	NOTE
V_{ol}			0.1V	I_{ol}=10μA
V_{ol}			0.4V	I_{ol}=8mA

***REFERENCE VOLTAGE GENERATOR**

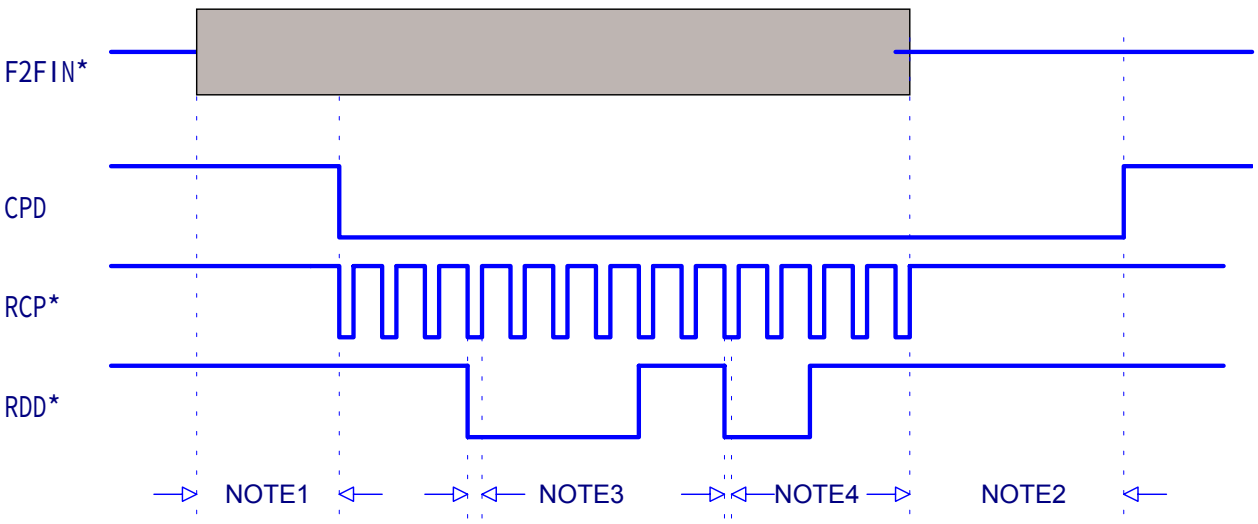
PARAMETER	MIN	TYP	MAX	NOTE
Reference Voltage	(V_{DD}/2)-2%	V_{DD}/2	(V_{DD}/2)+2%	
Output load：C			0.1μF	1)

1) External buffer capacitor.

***OSCILLATOR @** (V_{DD}=0.5V)

PARAMETER	MIN	TYP	MAX	NOTE
Oscillator frequency	2MHz	2.5MHz	3MHz	
Duty cycle	50%	50%	50%	

SIGNAL TIMING DIAGRAM



Etrend Electronic, Inc.
Proprietary & Confidential

3rd Floor, No.5, Nan-ke 3rd Road Tainan Science Based Industrial Park, Hsin-shi, Tainan County, Taiwan, R.O.C.
Tel: 886-6-5050170 Fax: 886-6-5050175

- CPD

When IB is set to low, CPD goes low after the 8（9）flux reversals. When IB is set to high, CPD goes low after the 16（17）flux reversals. CPD returns to high level approximately 50ms after RCP＊'s the last transition.

- RCP＊

The RCP＊ signal indicates RDD＊'s output is valid. The RDD＊ output should be loaded for further use when the RCP＊ signal goes low.（Negative edge）

- RDD＊

The data signal is valid when the RCP＊ is low, if the RDD＊ signal is high, the bit is zero（0）,and if low the bit is one（1）.

NOTE：

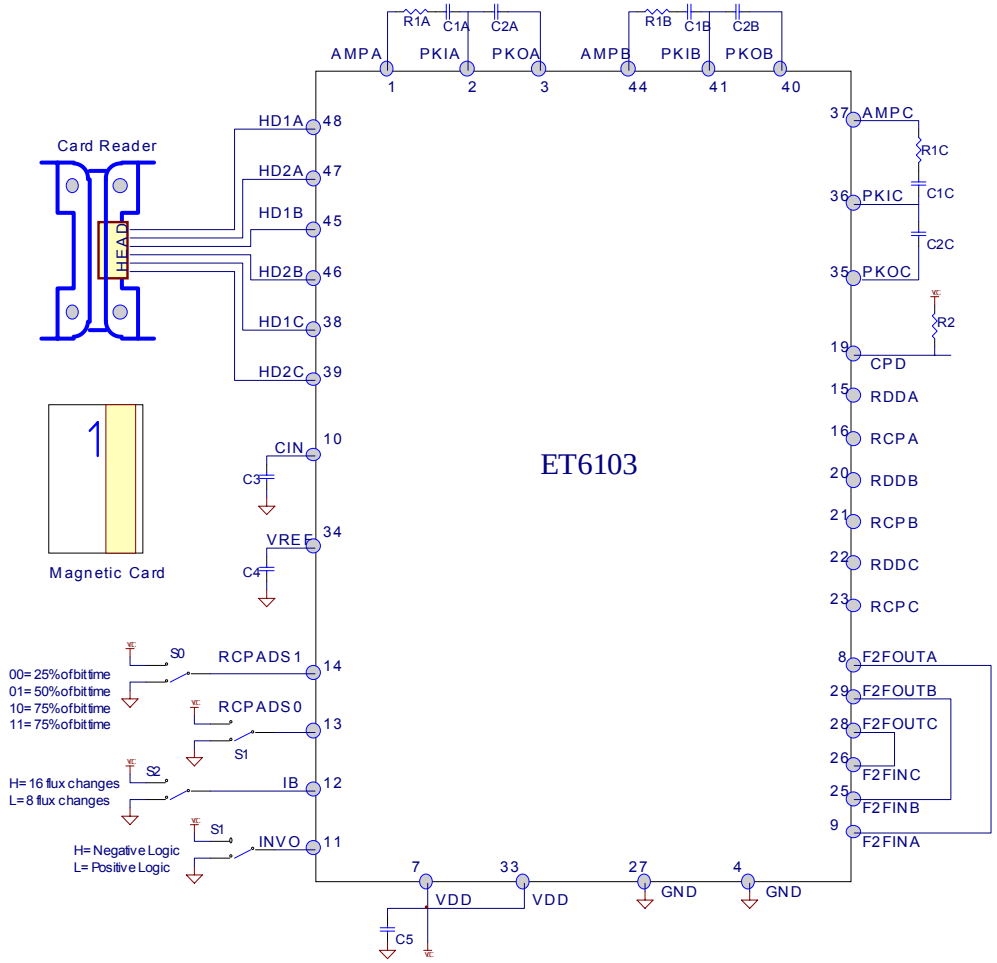
1. Programmable CPD delay (8 or 16 flux changes) for low-density configuration.
2. Timeout of CPD signal occurs Approx. 50ms（Clock=2.5MHz）after last flux transition
3. RCPADS[1:0] versus RCP＊ Active Duty Cycle Time select

RCPADS[1:0]	Active Duty Cycle Time
'00'B	Approx. 25% Bit time
'01'B	Approx. 50% Bit time
'10'B	Approx. 75% Bit time
'11'B	Approx. 75% Bit time

4. The RDD＊ is valid at 3.2μs（min）before the negative edge of the RCP＊.

3rd Floor, No.5, Nan-ke 3rd Road Tainan Science Based Industrial Park, Hsin-shi, Tainan County, Taiwan, R.O.C.
Tel: 886-6-5050170 Fax: 886-6-5050175

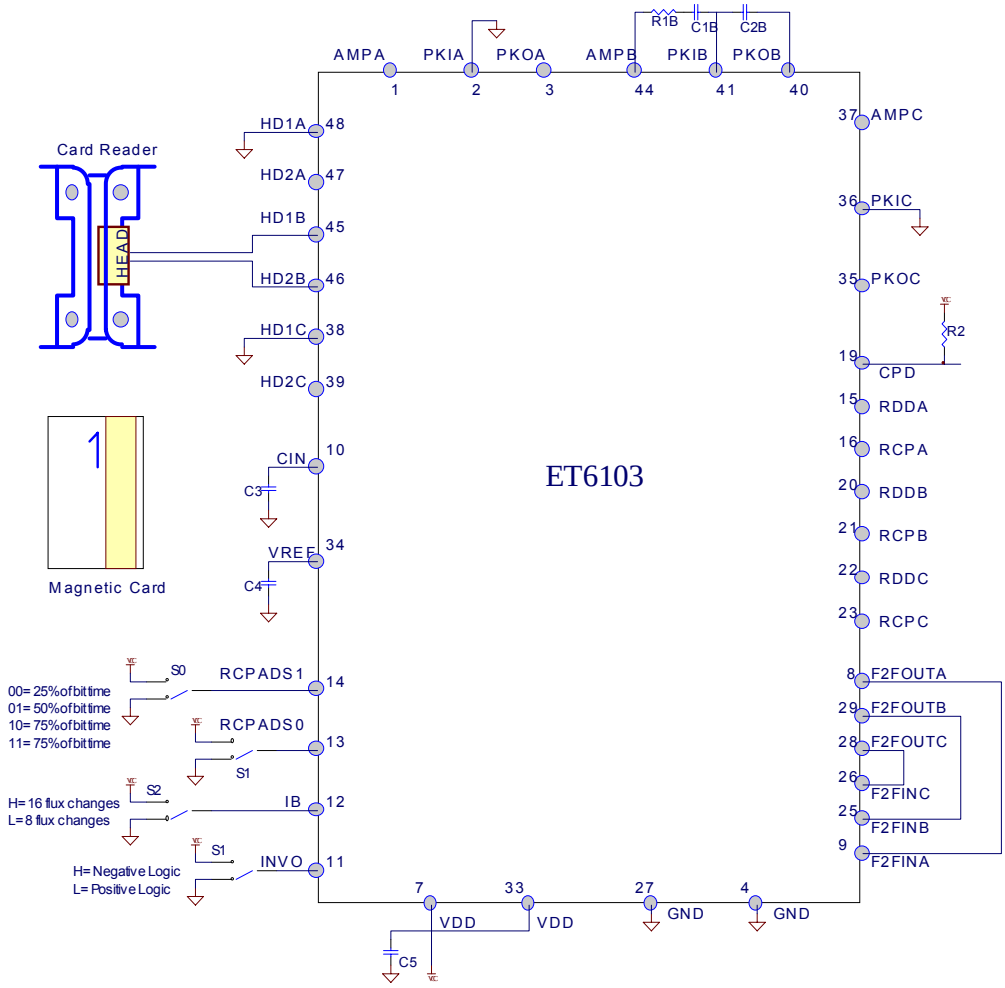
Application Example 1 :For three channels of magnetic strip card reader



RECOMMENDED OPERATION CONDITIONS		
	75 BPI	210 BPI
R1A、R1B、R1C	3.0 K	2.0 K
R2	10 K	10 K
C1A、C1B、C1C	0.022 μF	0.01 μF
C2A、C2B、C2C	1000 PF	470 PF
C3	0.022 μF	0.022 μF
C4	0.1 μF	0.1 μF
C5	1 μF	1 μF

Etrend Electronic, Inc.
Proprietary & Confidential
3rd Floor, No.5, Nan-ke 3rd Road Tainan Science Based
Industrial Park, Hsin-shi, Tainan County, Taiwan, R.O.C.
Tel: 886-6-5050170 Fax: 886-6-5050175

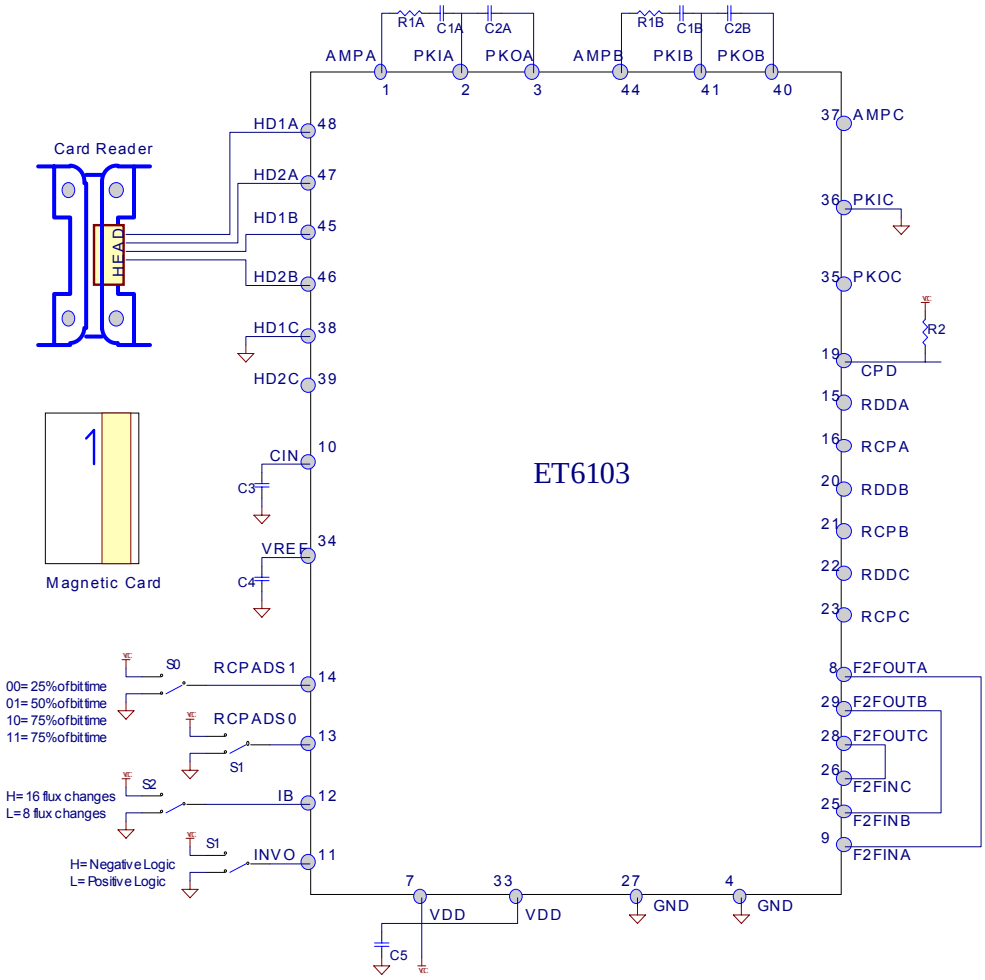
Application Example 2 : For one channel of magnetic strip card reader



RECOMMENDED OPERATION CONDITIONS		
	75 BPI	210 BPI
R1B	3.0 K	2.0 K
R2	10 K	10 K
C1B	0.022 μF	0.01 μF
C2B	1000 PF	470 PF
C3	0.022 μF	0.022 μF
C4	0.1 μF	0.1 μF
C5	1 μF	1 μF

Etrend Electronic, Inc.
Proprietary & Confidential
3rd Floor, No.5, Nan-ke 3rd Road Tainan Science Based Industrial Park, Hsin-shi, Tainan County, Taiwan, R.O.C.
Tel: 886-6-5050170 Fax: 886-6-5050175

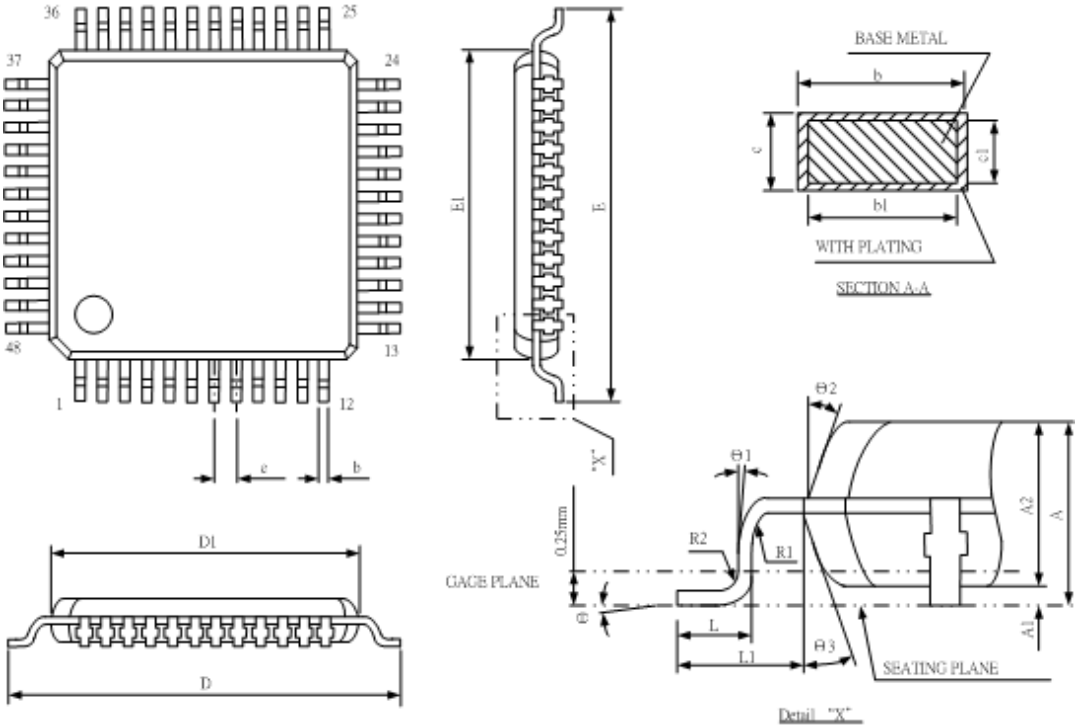
Application Example 3 : For two channels of magnetic strip card reader



RECOMMENDED OPERATION CONDITIONS		
	75 BPI	210 BPI
R1A、R1B	3.0 K	2.0 K
R2	10 K	10 K
C1A、C1B	0.022 μF	0.01 μF
C2A、C2B	1000 PF	470 PF
C3	0.022 μF	0.022 μF
C4	0.1 μF	0.1 μF
C5	1 μF	1 μF

Etrend Electronic, Inc.
Proprietary & Confidential
3rd Floor, No.5, Nan-ke 3rd Road Tainan Science Based Industrial Park, Hsin-shi, Tainan County, Taiwan, R.O.C.
Tel: 886-6-5050170 Fax: 886-6-5050175

Package Outline



SYMBOL	DIMENSION (MM)			DIMENSION (MIL)		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A			1.60			63
A1	0.05		0.15	2		6
A2	1.35	1.40	1.45	53	55	57
b	0.17	0.22	0.27	7	9	11
b1	0.17	0.20	0.23	7	8	12
c	0.09		0.20	4		8
c1	0.09		0.16	4		6
D	9.00 BSC			354 BSC		
D1	7.00 BSC			276 BSC		
E	9.00 BSC			354 BSC		
E1	7.00 BSC			276 BSC		
e	0.5 BSC			20 BSC		
L	0.40	0.60	0.75	18	24	30
L1	1.00 REF			39 REF		

Etrend Electronic, Inc.
3rd Floor, No.5, Nan-ke 3rd Road Tainan Science Based Industrial Park, Hsin-shi, Tainan County, Taiwan, R.O.C.
Tel: 886-6-5050170 Fax: 886-6-5050175

SYMBOL	DIMENSION (MM)			DIMENSION (MIL)		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
R1	0.08			3		
R2	0.08		0.20	3		8
θ	0°	3.5°	7°	0°	3.5°	7°
θ1	0°			0°		
θ2	11°	12°	13°	11°	12°	13°
θ3	11°	12°	13°	11°	12°	13°

Etrend Electronic, Inc.
Proprietary & Confidential
3rd Floor, No.5, Nan-ke 3rd Road Tainan Science Based
Industrial Park, Hsin-shi, Tainan County, Taiwan, R.O.C.
Tel: 886-6-5050170 Fax: 886-6-5050175