KT20xxQ Series

ISO/IEC 14443 Type A/B Contactless and ISO/IEC 7816 Contact Smartcard Reader IC

User Manual

Version 1.0

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Contents

1. Introduction

1.1. Product Overview

The KT20xxQ series reader ICs are highly integrated contact and contactless smart card reader ICs. KT20xxQ support both ISO/IEC 14443 and ISO/IEC 7816 protocols. KT2001Q has already passed the EMV LEVEL1 certification. KT20xxQ contains a low power card sensor that can detect the presence of card without turning on RF. The power consumption of the low power card sensor is only 6uA every 100ms.

1.2. Features

- **Fully integrated contact and contactless card reader solution**
- **Supports various contact and contactless smart cards communication protocols**
  - Contactless communication protocol：
    ISO/IEC 14443 TypeA/ TypeB
  - Contact communication protocol：
    ISO/IEC 7816 Class A/B/C (5V/3V/1.8V)
- **Contactless transceiver**
  - Operating distance 0~10cm
  - Supports all baud rates of ISO/IEC 14443 TYPEA/B（106KBPS, 212KBPS, 424KBPS, 848KBPS）
  - Integrated high precision ADC and efficient modulation demodulation circuit
  - Integrated antenna driver
  - Integrated collision detection circuit
  - Integrated adjustable oscillator as clock of wake-up timer
  - Integrated hardware card-sensor circuit
  - Flexible interrupt
  - Integrated 512 Bytes FIFO
  - Multiple sets of independent power supply
  - Supports 2.7V low-voltage power supply
  - **In compliance with EMVCo Level1 standard**
- **Contact transceiver**
  - Supports ISO/IEC 7816
  - Integrated activate/deactivate timer sequence creator
  - Resolves data communication automatically
  - Integrated card-insert and card-removal anti-shake detecting circuit
  - Integrated short-circuit, over-circuit, power-down, over-heating detecting functions
  - Flexible interrupt
  - Integrated two 264 Bytes FIFOs for storage of data that can be sent and received
  - **In compliance with EMVCo Level1 standards**
- **SPI Slave Communication Interface**
  Supports clock rates up to 10MHz
  Efficient and continuous read and write mode
- **Low power oscillator**

- **Flexible and efficient power-saving mode**
  - Power down
  - Stand by
  - Low power card sensor

  Contact mode：Detecting cards and creating interruptions

  Contactless mode：Entering operating mode automatically
- **Crystal oscillator circuit**

  27.12MHz crystal

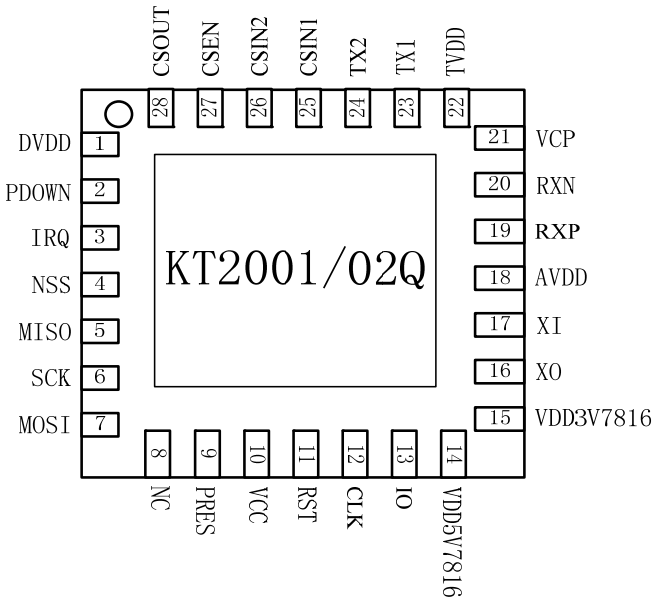
  External timer as clock
- **QFN28 package**

1.3. Difference

Mode	EMV level 1	Contactless Protocol	Contact Protocol	Low-power consumption
KT2001Q	√	**ISO14443 TYPE A/B**	**ISO7816**	√
KT2002Q		**ISO14443 TYPE A/B**	**ISO7816**	√
KT2003Q		**ISO14443 TYPE A**		√

2. Pin

2.1. KT2001/02Qpinning information

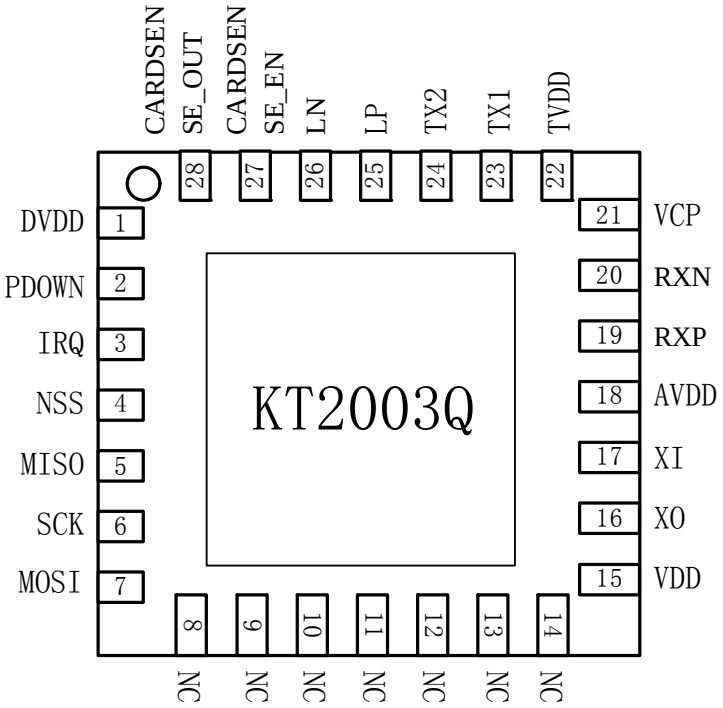


KT2001/02Q pinning assignments

2.2. Pin description

Pin number	Pin name	I/O type	Description
1	DVDD	Power	Digital power supply, 3.3V
2	PDOWN	I	Power down, controlled by host
3	IRQ	O	Interrupt request output
4	NSS	I	Serial Peripheral Interface enable
5	MISO	O	Serial Peripheral Interface data output
6	SCK	I	Serial Peripheral Interface clock
7	MOSI	I	Serial Peripheral Interface data input
8	NC	-	-
9	PRES	I	Card presence contact input (active LOW);
10	VCC	Power	Supply for the card (C1)
11	RST	O	Card reset (C2)
12	CLK	O	Clock to the card (C3)
13	IO	I/O	Data line to and from the card (C7)
14	VDD5V7816	Power	Class A contact 7816 smart card voltage supply，5V
15	VDD3V7816	Power	Class B/C contact 7816 smart card voltage supply，3.3V
16	XO	O	Crystal oscillator output: output of the inverting amplifier of the oscillator. This pin is also the input for an externally generated clock (fosc = 27.12 MHz)
17	XI	I	Crystal oscillator input: input to the inverting amplifier of the oscillator. This pin is also the input for an externally generated clock.
18	AVDD	Power	Analog power supply, 3.3V
19	RXP	I	Receiver input pin for the received RF signal
20	RXN	I	Receiver input pin for the received RF signal
21	VCP	O	Connect decouple CAP
22	TVDD	Power	Transmitter voltage supply 5V
23	TX1	O	Delivers the modulated 13.56 MHz carrier
24	TX2	O	Delivers the modulated 13.56 MHz carrier
25	LP	I	Card sense input
26	LN	I	Card sense input
27	CSEN	I	Card sense enable
28	CSOUT	O	Card sense output

2.3. KT2003Qpinning information



KT2003Q Pinning assignments

2.4. Pin

Description

Pin number	Pin name	I/O type	Description
1	DVDD	Power	Digital power supply, 3.3V
2	PDOWN	I	Power down, controlled by host
3	IRQ	O	Interrupt request output
4	NSS	I	Serial Peripheral Interface enable
5	MISO	O	Serial Peripheral Interface data output
6	SCK	I	Serial Peripheral Interface clock
7	MOSI	I	Serial Peripheral Interface data input
8-14	-	-	-
15	VDD	Power	Class B/C contact 7816 smart card voltage supply
16	XO	O	Crystal oscillator output: output of the inverting amplifier of the oscillator. This pin is also the input for an externally generated clock (fosc = 27.12 MHz)
17	XI	I	Crystal oscillator input: input to the inverting amplifier of the oscillator. This pin is also the input for an externally generated clock.
18	AVDD	Power	Analog power supply
19	RXP	I	Receiver input pin for the received RF signal
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23	TX1	O	Delivers the modulated 13.56 MHz carrier
24	TX2	O	Delivers the modulated 13.56 MHz carrier
25	LP	I	Card sense input
26	LN	I	Card sense input
27	CARDSENSE_EN	I	Card sense enable
28	CARDSENSE_OUT	O	Card sense output

3. Electronic characteristics

3.1. Work condition

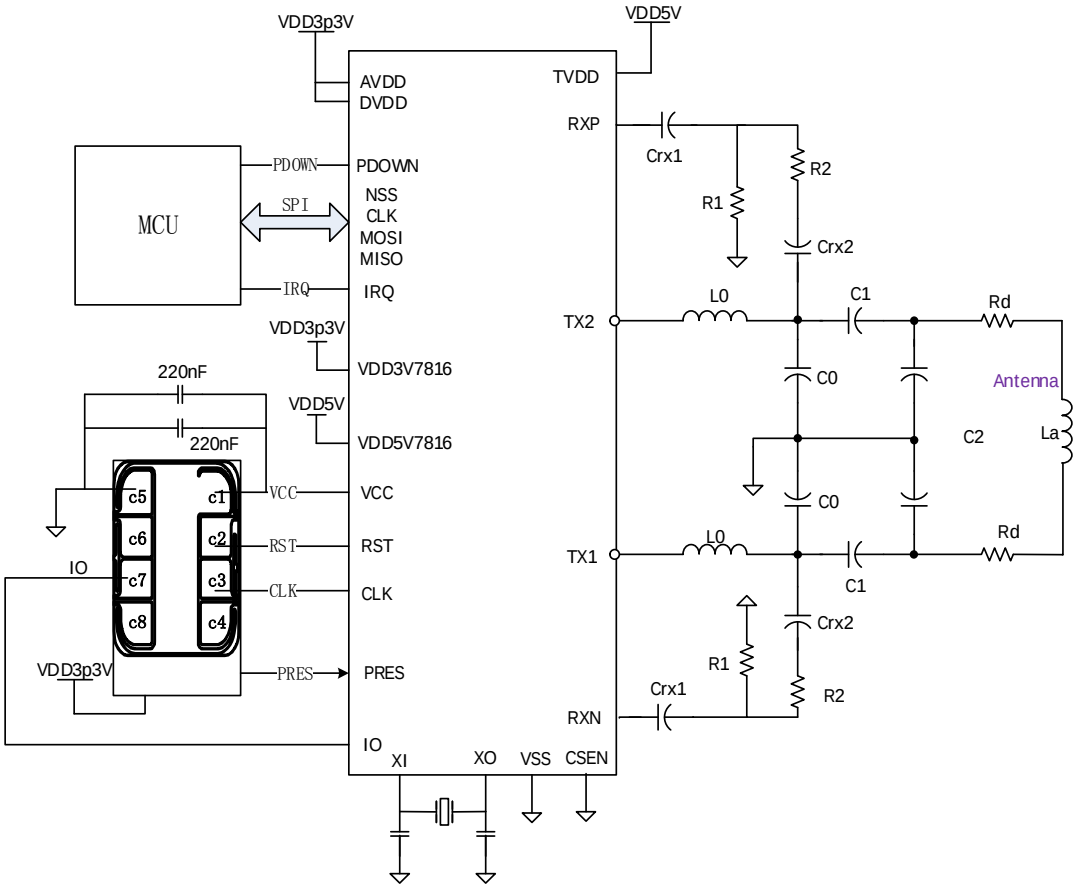
Parameter	Symbol	Condition	Min	Typical value	Max	Unit
Analog power voltage	AVDD	Relative to GND	3.0	3.3	3.6	V
Digital power voltage	DVDD	Relative to GND	3.0	3.3	3.6	V
PA voltage	TVDD	Relative to GND	4.75	5.0	5.25	V
		Distance <4cm	2.7	-	4.75	V
Class A 5V	VDD5V7816	Relative to GND	4.75	5.0	5.25	V
Class B/C3V	VDD3V7816	Relative to GND	3.0	3.3	3.6	V
Ripple	-	Relative to GND	-	-	40	mV
Operating Temp	Tj	-	-10	50	110	°C
Ambient Temp	T_{amb}	-	-25	25	85	°C
Storage Temp	T_{stg}	-	-40	25	100	°C

3.2. Performance description

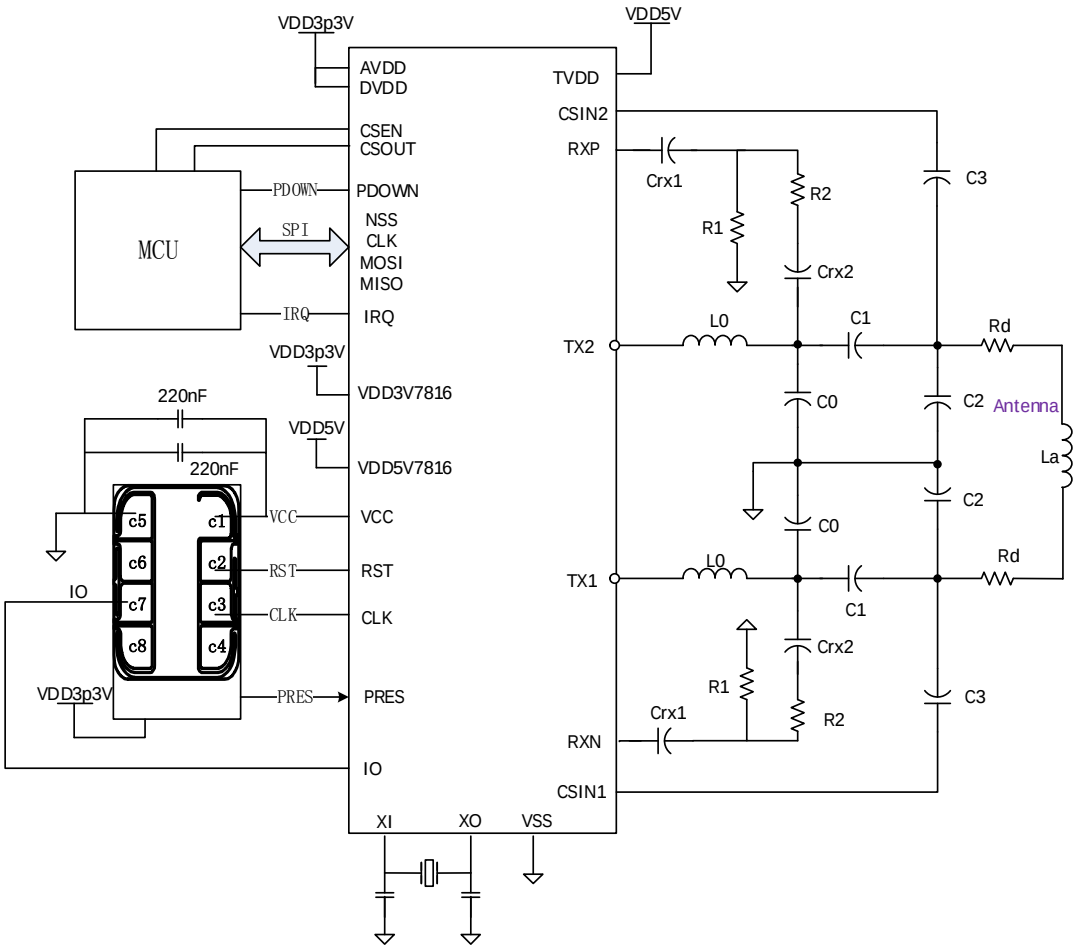
Parameter			Min	Typical value	Max	Unit
Contactless（14443）power consumption		TX operating current（TX）	-	100	200	mA
		Operating current（Rx）	-	35	37	mA
		Power down current	-	1	2	uA
		Standby current	-	54	100	uA
Contactless（14443）RF		Frequency range	13.553	13.56	13.567	MHz
Contact（7816）	Providing voltage to cards	5V Card	4.75	5	5.25	V
		3V Card	2.85	3	3.15	V
		1.8V Card	1.71	1.8	1.89	V
	Current under different voltage	5V Card			65	mA
		3V Card			65	mA
		1.8V Card			35	mA

4. Typical circuit

4.1. Circuit without low-power card sensor

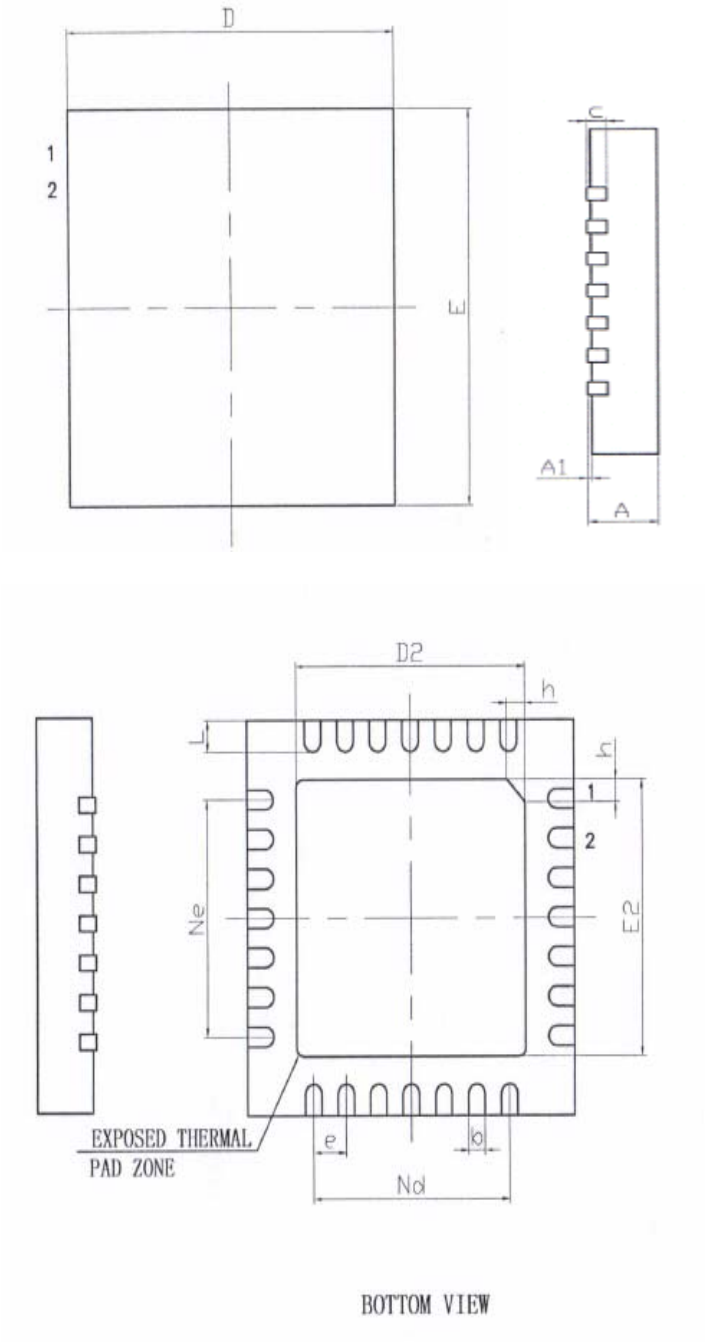


4.2. Circuit with contactless low-power card sensor



5. Package size

QFN28（Quad Flat No-leadPackage，square flatpackage without pin），SMT type encapsulation，28 terminals，body 5*5*0.75-0.5 mm。

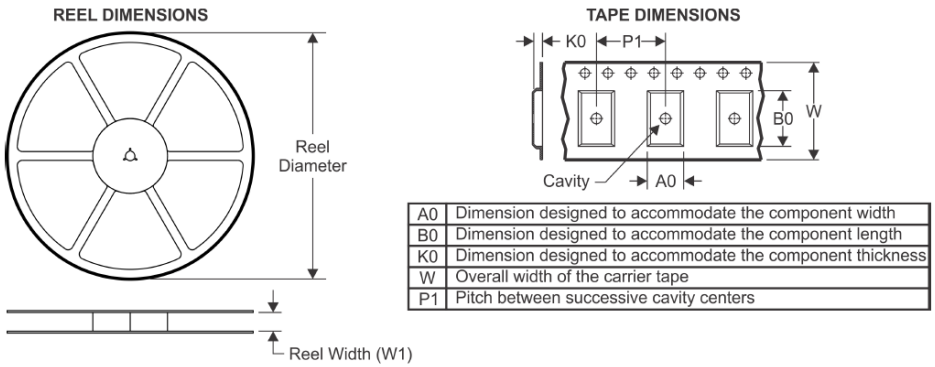


unit：mm

SYMBOL	MIN	NOM	MAX	L/F carrier size
A	0.70	0.75	0.80	150*150
A1	--	0.02	0.05	
b	0.18	0.25	0.30	
C	0.18	0.20	0.25	
D	4.90	5.00	5.10	
D2	3.40	3.50	3.60	
e	0.50 BSC			
Ne	3.00 BSC			
Nd	3.00 BSC			
E	4.90	5.00	5.10	
E2	3.40	3.50	3.60	
L	0.35	0.40	0.45	
h	0.30	0.35	0.40	

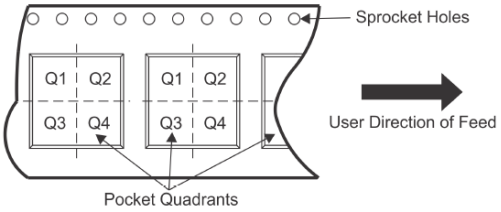
6. Ordering guide

TAPE AND REEL INFORMATION



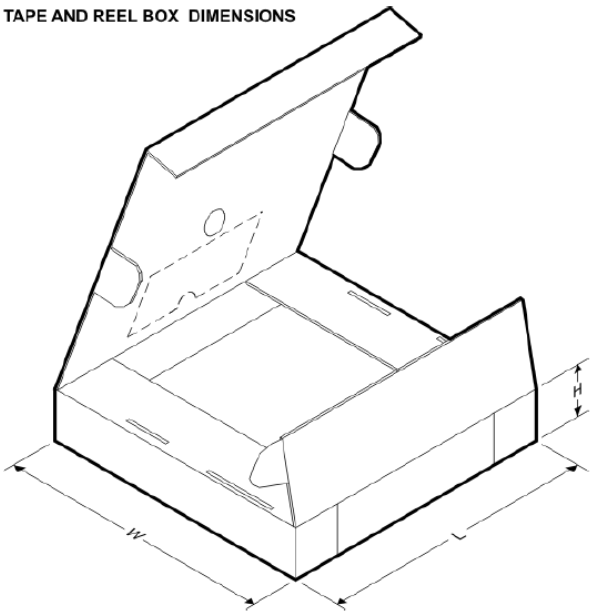
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



Device	Package Type	Pins	SPQ	Reel Diameter (mm)	Reel Width W1(mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
KT200xQ	QFN5x5	28	1000	177.8	12.8	5.3	5.3	1.3	8	12	Q1

TAPE AND REEL BOX DIMENSIONS



Device	Package Type	Pins	SPQ	Length(mm)	Width(mm)	Height(mm)
KT200xQ	QFN5x5	28	1000	225(Inner Box) 480(Outer Box)	145(Inner Box) 310(Outer Box)	215(Inner Box) 235(Outer Box)

*__Inner Box:__ 5 (Reel) x 1000 (pcs/Reel) = 5,000 pcs;

*__Outer Box__: 4 (Inner box) * 5,000 (pcs/box) = 20,000 pcs;