RN8207C Product Brief

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Rev: 1.0

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CONTENTS

1 Introduction

1.1 Features

√ Measurement

- Two channels of Σ-△ ADC are provided.
- The active energy accuracy is less than 0.1% (< 0.1%) over a dynamic range of 8000:1 with the IEC62053-22: 2003 Standard supported.
- The reactive energy accuracy is less than 0.1% (< 0.1%) over a dynamic range of 8000:1 with the IEC62053-23: 2003 Standard supported.
- one-channel current and one-channel voltage RMS is provided, with the RMS accuracy <0.1% over the 1000:1 dynamic range.
- No-load threshold is adjustable.
- Reverse active power indication is provided.
- Provide voltage channel frequency measurement.
- Provide voltage channel zero-crossing detection.

√ Software meter calibration

- The meter constant (HFConst) is adjustable.
- Gain and phase calibration is provided.
- Offset calibration is provided for active, reactive and RMS.
- Reactive phase calibration is provided.
- Acceleration is provided for small-signal meter calibration.
- Automatic checksum is provided for configuration parameters.

√ UART interfaces are provided

√ Power supply monitoring is provided

√ 3~5.5 V power supply with the typical power consumption value of 15mW@5V, 8mW@3.3V

√ Built-in 1.25V ± 1% reference voltage, with typical temperature coefficient of 5ppm / ℃

√ SOP16L lead-free green package is adopted.

1.2 Functions

RN8207C can measure active power, reactive power, active energy and reactive energy, and can provide active power and RMS, voltage RMS, line frequency, zero-crossing interrupt, etc. to achieve flexible anti-tampering solutions.

RN8207C supports all-digital gain, phase and offset calibration, with the active and reactive energy pulses respectively output from the pins of PF and QF.

RN8207C provides serial interfaces uart, to facilitate communication with the external MCU.The baudrate is 4800.

The internal power supply monitoring circuit of RN8207C can ensure reliable operation of the chip when power on and off.

1.3 Block Diagram of Functions

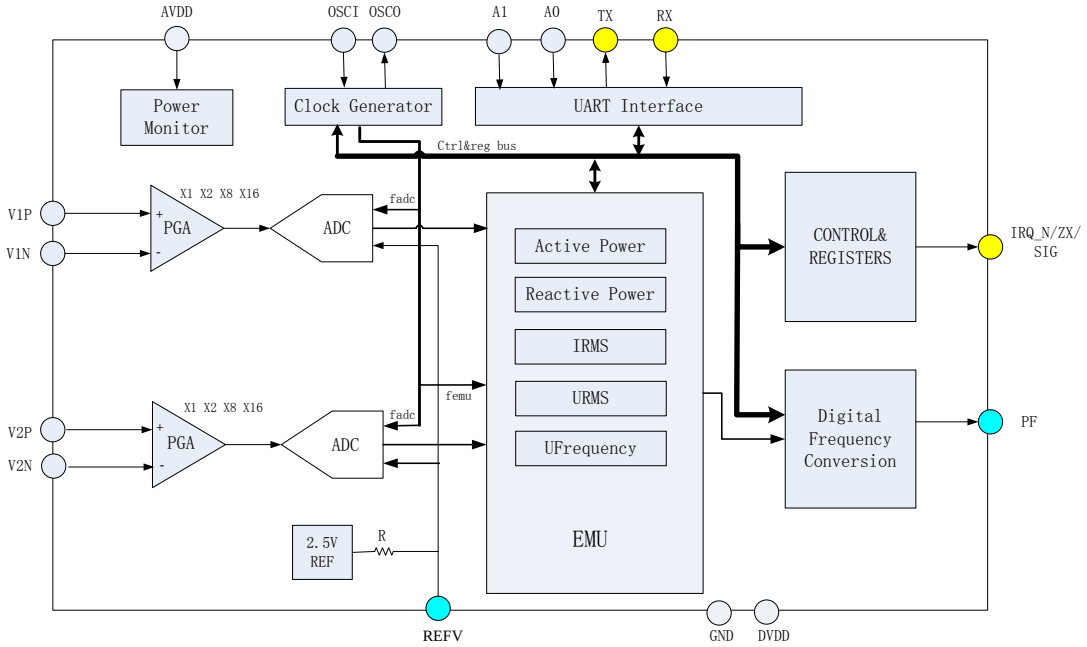


Figure 1-1 Block Diagram of system

1.4 Pin Definitions

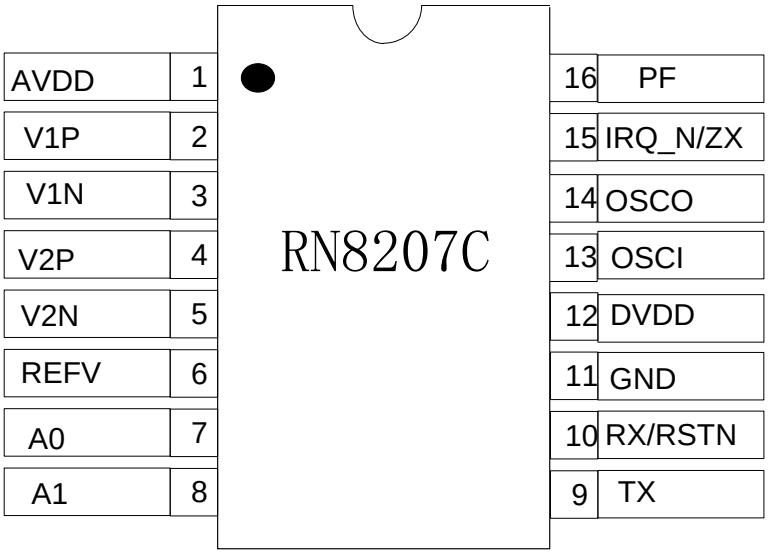


Figure 1-2 Pin Assignment

Table 1-1 RN8207C Pin Functions

Pins	Signs	Features	Function Descriptions
1	AVDD	Power supply	The pin of analog power supply is used to provide power supply to the analog portion of the chip. This pin should use an external 10μF capacitor and a 0.1μF capacitor paralleled for decoupling. The normal application range should be: 3V-5.5V.
2,3	V1P, V1N	Input	Positive and negative analog input pins of current Channel, - A fully differential input mode is adopted, the maximum input in normal operation Vpp is ± 1000mV, and the maximum withstand voltage is ± 6V.
4,5	V2P,V2N	Input	Positive and negative analog input pins of the voltage channel - A fully differential input mode is adopted, the maximum input in normal operation Vpp is ± 1000mV, and the maximum withstand voltage is ± 6V.
6	REFV	Input/Output	1.25V reference voltage input and output pins – The external reference source can be directly connected to this pin. Whether internal or external reference source is adopted, this pin should use a 10μF capacitor and a 0.1μF capacitor paralleled for decoupling.
7	A0	Input	Serial communication type selection pin – it is used to determine the communication interface type of the chip. {A1,A0}=11 No use / {A1,A0}=10 UART, addr 2 {A1,A0}=01 UART, addr is 1 / {A1,A0}=00 UART, addr 0
8	A1		See A0
9	TX	Output	This pin is the TX of uart.
10	RX/RSTN	Input	This pin is the RX of uart. Also, this pin is the reset pin if 0 input last for more than 20ms.
11	DGND	Power supply	Digital ground
12	DVDD	Power supply	Digital power supply pin - Used to provide power supply to the digital part. This pin should have an external 10μF capacitor and a 0.1μF capacitor paralleled for decoupling. The normal application range should be: 3V-5.5V.
13	OSCI	Input	Input terminal of external crystal or external clock input – The crystal frequency is typically 3.579545MHz.
14	OSCO	Output	Output terminal of external crystal - The OSCO pin can drive one CMOS load when OSCI has an external clock connected.
15	IRQ_N /ZX	Output	Interrupt / zero-crossing detection - After reset, it will serve as an interrupt pin. When Zxcfg = 0 (EMUCON-bit7), it will serve as an interrupt request IRQ_N. When Zxcfg = 1 (EMUCON-bit7), it will serve as ZX: voltage channel zero-crossing output.
16	PF	Output	Pulse output of active energy, low-level output by default. It's frequency will indicate the size of transient active power, able to achieve a 5mA output and current sinking.

1.5 Typical Application

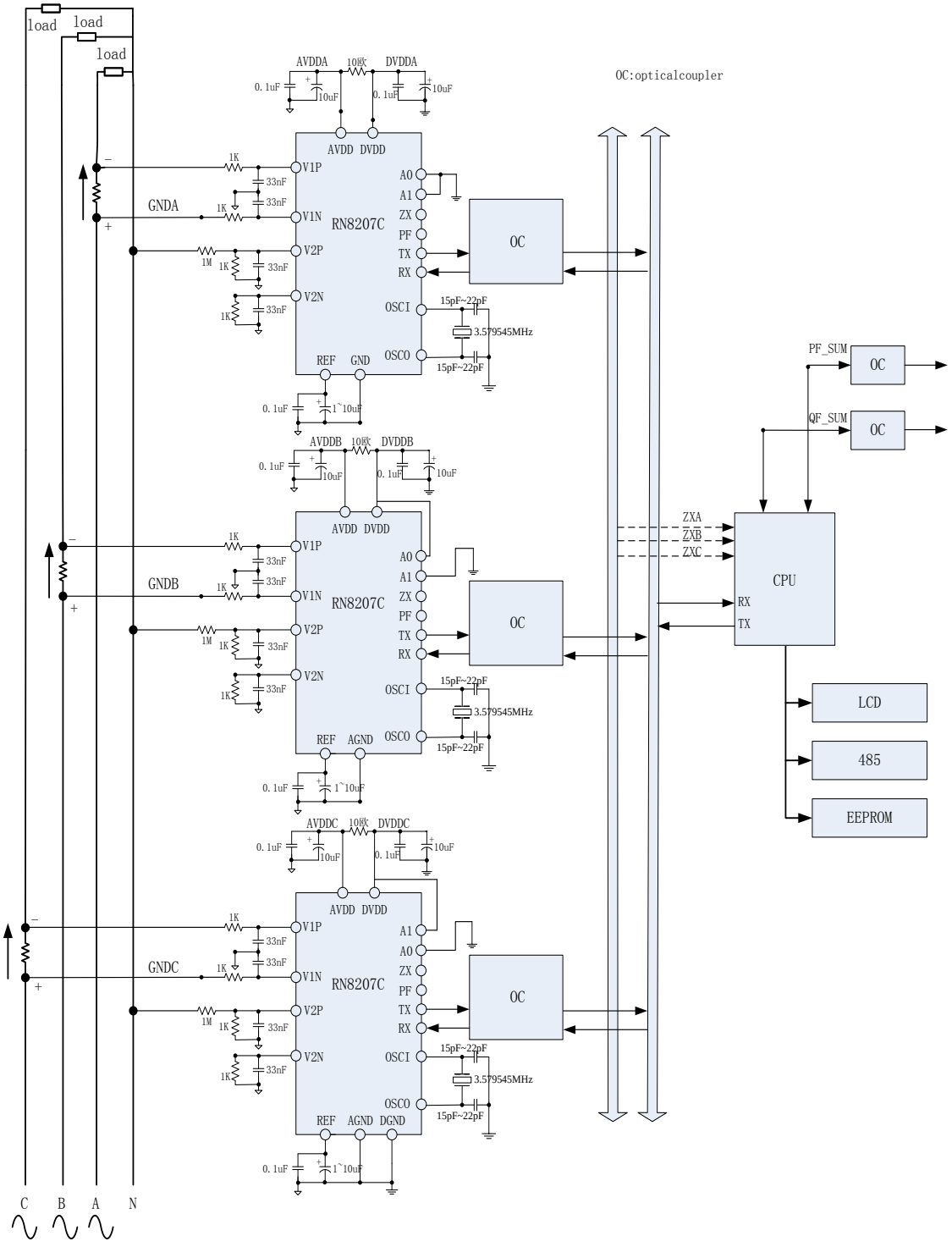


Figure 1-3 Typical Application of RN8207C

2 System Functions

2.1 Power Supply Monitoring

The RN8207C includes an internal power supply monitoring circuit, able to continuously monitor the analog supply (AVDD). When the power supply is lower than 2.6V ± 0.1V, the chip will be reset, and when the supply is higher than 2.75V ± 0.1V, the chip will work normally.

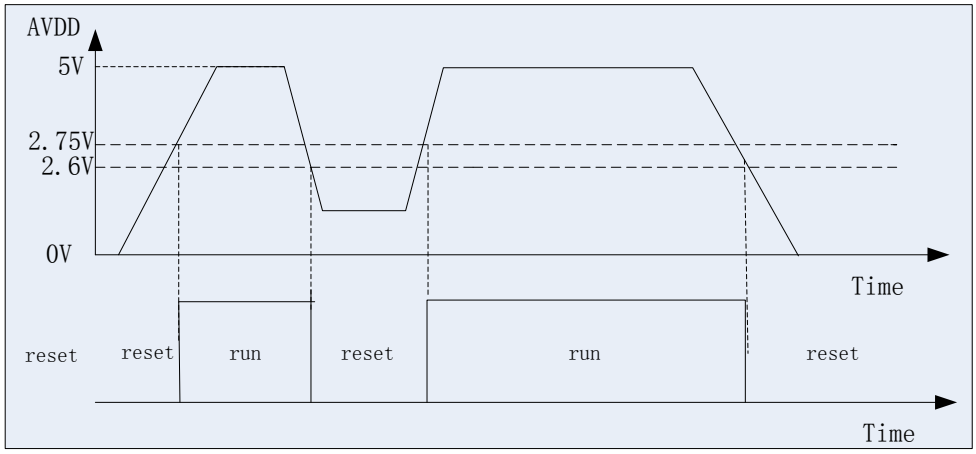


Figure 2-1 Power Detection Features

To ensure normal work of the chip, the AVDD fluctuations should not exceed 5V ± 5% or 3.3± 5%

2.2 System Reset

RN8207C supports two global reset methods:

- Power ON/OFF
- External pin reset

When any global reset occurs, the register will be restored to its reset initial value, and the external pins will have the level back to the initial state.

Relevant register:

In the system status register, RST is a reset sign: when the external RST_N pin or the power-on reset has ended, this bit will be set as 1, cleared after read and can be used as a meter calibration data request after reset.

2.3 Analog-digital conversion

RN8207C includes two channels of ADC, respectively used for phase current sampling and voltage sampling.

ADC uses a fully differential input. The current and voltage channels have the maximum signal input amplitude at 800mv of the peak.

By configuring bit5 ~ bit0 in the system control register (SYSCON 0x00H), the two channels of ADC can have the gain magnification configured separately as 1, 2, 8 or 16.

2.4 Register

Table2-1 List of RN8207C Registers

Address	Name	R/W	Word Length	Reset Value	Descriptions

Calibration Parameter and Measurement Control Registers					
00H	SYSCON	R/W	2	0003h	System control register, write-protect
01H	EMUCON	R/W	2	0003h	Energy measure control register, write-protect
02H	HFConst	R/W	2	1000h	High frequency impulse const register, write-protect
03H	PStart	R/W	2	0060h	Active power start threshold setup register, write-protect
04H	QStart	R/W	2	0120h	Reactive power start threshold setup register, write-protect
05H	GPQ	R/W	2	0000h	power gain register, write-protect
07H	Phs	R/W	1	00h	phase calibration register, write-protect
09H	QPhsCal	R/W	2	0000h	Reactive power phase calibration, write-protect
0AH	APOS	R/W	2	0000h	active power offset register, write-protect
0CH	RPOS	R/W	2	0000h	reactive power offset register, write-protect
0EH	IRMSOS	R/W	2	0000h	Current RMS offset calibration, write-protect
Measurement Parameter and Status Registers					
20H	PFCnt	R/W	2	0000h	Active energy counter register, write-protect
21H	QFCnt	R/W	2	0000h	Reactive energy counter register, write-protect
22H	IRMS	R	3	000000h	Current RMS
24H	URMS	R	3	000000h	Voltage RMS
25H	UFreq	R	2	0000h	Voltage frequency
26H	PowerP	R	4	00000000h	Active Power
28H	PowerQ	R	4	00000000h	Reactive power
29H	EnergyP	R	3	000000h	Active energy, not cleared after read
2AH	EnergyP2	R	3	000000h	Active energy, cleared after read
2BH	EnergyQ	R	3	000000h	Reactive energy, not cleared after read
2CH	EnergyQ2	R	3	000000h	Reactive energy, cleared after read
2DH	EMUStatus	R	3	00EE79h	Energy measurement status and checksum register
Interrupt Registers					
40H	IE	R/W	1	00h	Interrupt enable register, write-protect
41H	IF	R	1	00h	Interrupt flag register, cleared after read
42H	RIF	R	1	00h	Reset interrupt flag register, cleared after read
System Status Registers					
43H	SysStatus	R	1	--	System status register

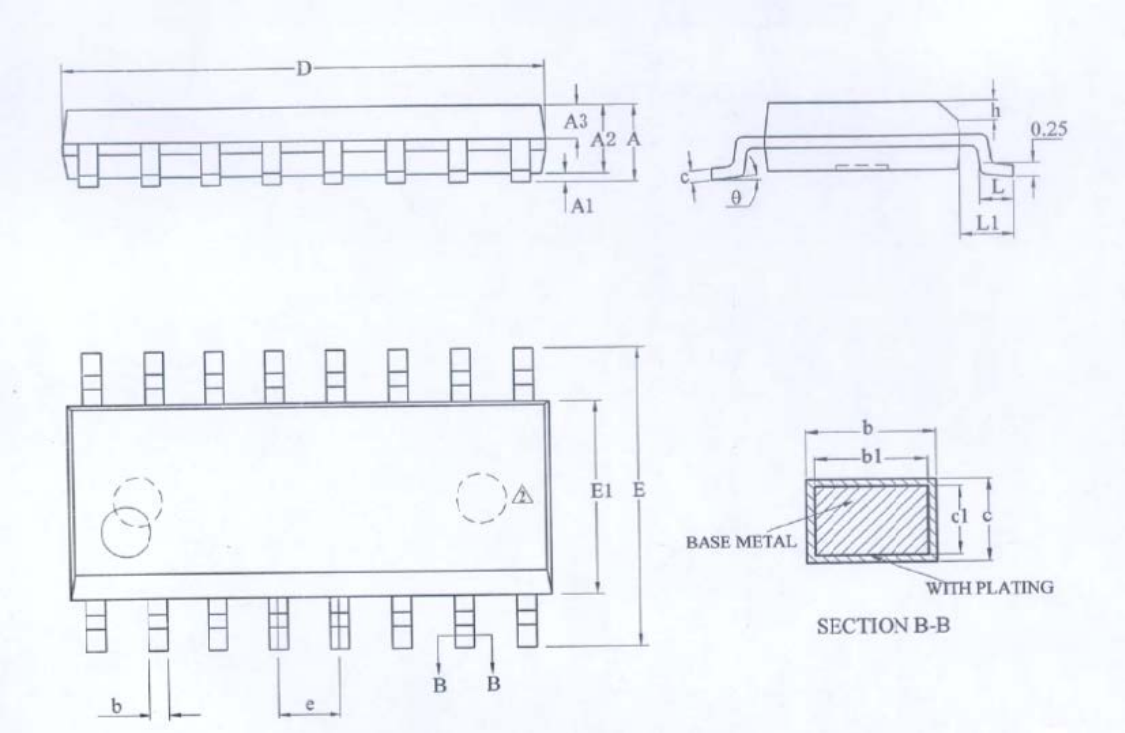
44H	RData	R	4	--	Previous SPI / RSIO data read out
45H	WData	R	2	--	Previous SPI / RSIO data written
7FH	DeviceID	R	3	820700h	RN8207C Device ID

3 Electrical Specification

Accuracy (V_{dd}=AV_{dd}=5V±5%, room temperature)						
Measured Items	**Symbol**	Min.	Typical	Max.	Unit	Test Conditions and Notes
Active energy measurement error	Err			±0.1%		At room temperature 8000:1 dynamic range
Active energy measurement bandwidth	BW		14		kHz	OSCI=3.579545MHz
Reactive energy measurement error	Err			±0.1%		At room temperature 8000:1 dynamic range
RMS measurement error	Err			±0.1%		At room temperature 1000:1 dynamic range
Analog Input						
Maximum signal level	V_{xn}			±1000	mV	
DC input impedance	Z_{DC}	300			kΩ	
ADC offset error	DC_{off}		10		mV	
-3dB bandwidth	B_{-3dB}		14		kHz	OSCI=3.579545MHz
Reference Voltage (V_{dd}=AV_{dd}=5V±5%, temperature range: -40 ℃ ~ +85 ℃)						
Output voltage	Vref	1.23	1.25	1.27	V	
Temperature coefficient	Tc		5		ppm/ ℃	
Input impedance			4		kΩ	
Clock Input						
Range of input clock frequency	OSCI	1	3.58	4	MHz	
Interface speed						
uart speed			4800		Hz	
Power Supply						
Analog power	AVDD	3		5.5	V	5V±10% or 3.3V±10%
Digital power	DVDD	3		5.5	V	5V±10% or 3.3V±10%
Analog Current	AIdd1		1.5		mA	
Digital current	DIdd		1.3		mA	OSCI=3.579545MHz
Absolute Maxium Ratings						
Digital supply voltage	DVDD	-0.3	--	＋7	V	

Analog supply voltage	AVDD	-0.3	--	＋7	V	
DVDD to DGND		-0.3	--	＋7	V	
DVDD to AVDD		-0.3		+0.3	V	
V1P,V1N,V2P,V2N		-6		+6	V	
Digital input voltage relative to GND	V_{IND}	-0.3	--	DV_{DD} +0.3	V	
Digital output voltage relative to GND	V_{outD}	-0.3	--	DV_{DD} +0.3	V	
Analog input voltage to AGND	V_{INA}	-0.3	--	AV_{DD} +0.3	V	
Range of operating temperature	T_A	-40	--	85	℃	
Range of storage temperature	T_{stg}	-65	--	150	℃	

4. Package Size



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	---	---	1.75
A1	0.05	---	0.225
A2	1.30	1.40	1.50
A3	0.6	0.65	0.70
b	0.39	---	0.48
b1	0.38	0.41	0.43
c	0.21	---	0.26
c1	0.19	0.20	0.21
D	9.70	9.90	10.10
E	5.80	6.00	6.20
E1	3.70	3.90	4.10
e	1.27BSC		
h	0.25	---	0.5
L	0. 5	---	0.8
L1	1.05BSC		
θ	0	-----	8°

5.Package Information

Lower left quarter: PIN1 flag
Left: Company Trademark
Right Line1: Corporate name
Right Line2: Product Name
Right Line3: Product Lot number
The Product Lot number consists of 10 characters including number and letter.
The first 5 characters shows production code of WAFER, in which:

The 1st character shows the wafer out year, showed by numbers 1 to 9 and letters which A indicates 2010 and the like, pls see details in follower "Year Code Table".

The 2nd character shows the wafer out month, showed by numbers 1 to 9 and letters which A indicates 10 and the like, pls see details in follower "Month Code Table".

The 3rd to 5th characters show the serial number of wafer lot (begin with 001 and increase by one).

The 6th character is reserved.

The 7th and 8th characters shows the chip packaging company and production line.

The 9th character shows the month for chip packaging, showed by numbers 1 to 9 and letters which A indicates 10 and the like, pls see details in follower "Month Code Table".

The 10th character shows the date for chip packaging, showed by numbers 1 to 9 and letters which A indicates 10 and the like, pls see details in follower "Date Code Table".

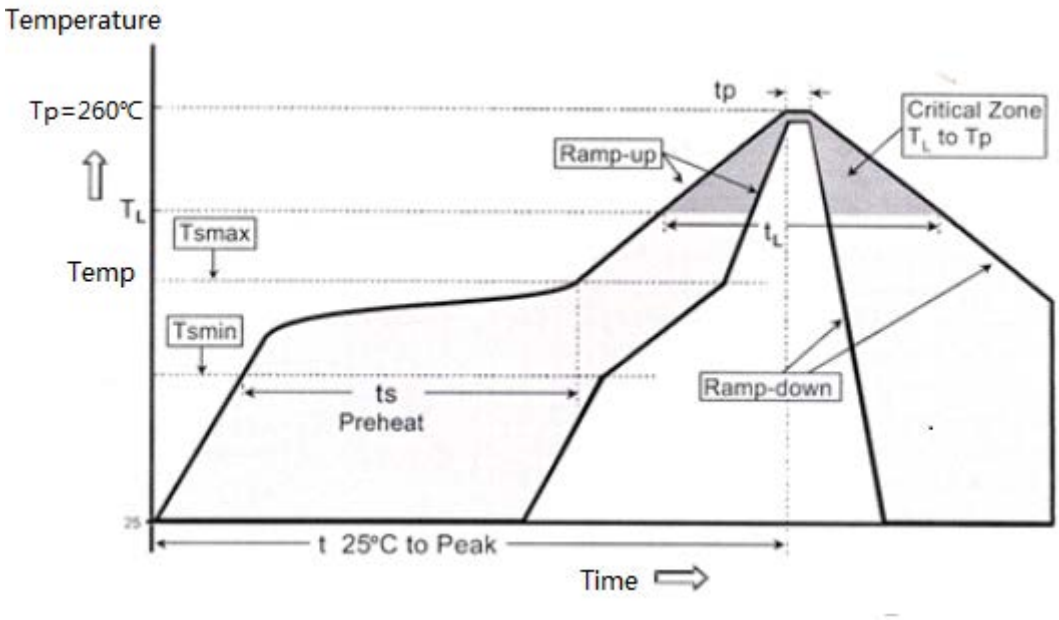
Lower left quarter: PIN1 flag

Year Code Table										
Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Code	1	2	3	4	5	6	7	8	9	A
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Code	B	C	D	E	F	G	H	J	K	L
Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	
Code	M	N	P	R	S	T	U	V	W	

Month Code Table												
Month	1	2	3	4	5	6	7	8	9	10	11	12
Code	1	2	3	4	5	6	7	8	9	A	B	C

Date Code Table										
Date	1	2	3	4	5	6	7	8	9	10
Code	1	2	3	4	5	6	7	8	9	A
Date	11	12	13	14	15	16	17	18	19	20
Code	B	C	D	E	F	G	H	J	K	L
Date	21	22	23	24	25	26	27	28	29	30
Code	M	N	P	R	S	T	U	V	W	X
Date	31									
Code	Y									

6.Temperature Setting Conditions of SMT



parameter	value
TL Tp (TL to Tp)	217℃ 260℃ Max 3℃/second
Ts min Ts max Time（max-min）（ts）	150℃ 200℃ 60-180 second
Ts max - (Ts max to TL)	Max 3℃/ second