

Travelling Merchant: \_\_\_\_\_

# DATASHEET

Standard: CM65A-D129-10.00MHz

P/N: \_\_\_\_\_

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Drew	Audited	Approved	Stamp, please! Thanks!
Date: 2014.07.20			

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**Table of amendment**

Version	Revision contents	Prepared by	Revised date
1.0	The first issued	<i>Amway</i>	2012.03.16
1.1	“Holdover Capability- Test Condition” change	<i>Amway</i>	2013.12.13
1.2	“Mechanical Structure” and “Holdover Capability- Test Condition” change, “Holdover capability Reference” add	<i>Amway</i>	2013.12.30
1.3	“Holdover Capability” and “Phase Noise” change “Description” ,“Features” ,“Functional Block Diagram” ,“Applications” ,“Stability” , “Frequency Tolerance vs. Operating Temperature Range” ,“Frequency Tolerance vs. Supply Voltage” , “Retrace” , “Holdover Time” , “Warm up time” , “Phase Accuracy” , “Phase Accuracy (RMS) ” , “Typical Application” , “The Output Message Protocol” add	<i>Amway</i>	2014.02.28
1.4	“Workflow Diagram” add	<i>Amway</i>	2014.06.19
1.5	“Mechanical Structure” change	<i>Amway</i>	2014.07.20



## 1. Description

The CM65A-D129 is a high holdover performance, high integration, low noise clock module with patent compensated algorithm. After 2 days PRC level reference locking it can achieve better than  $1E-12$  frequency stability and holdover for 24 hours within  $\pm 1.5\mu s$  ( $\pm 5^{\circ}C$ ).

The CM65A-D129 provide many kinds of maintenance and alarm messages output to improve the reliability and maintainability of the network.

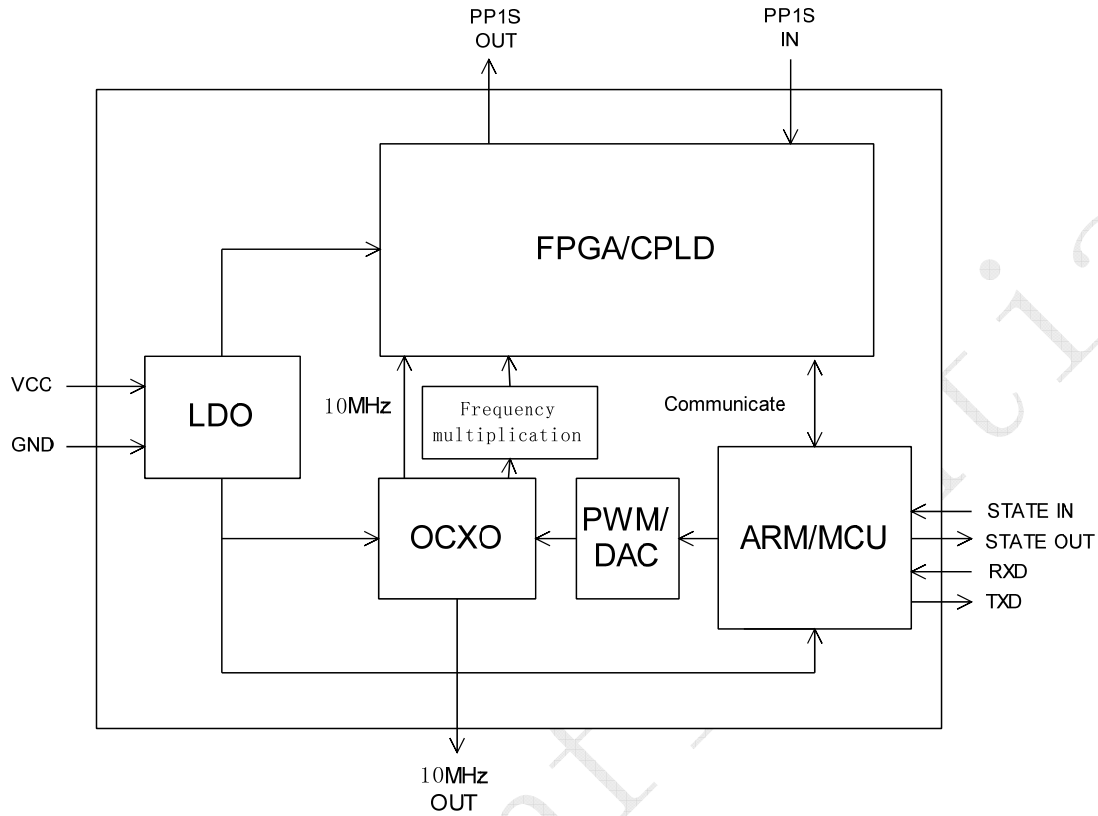
The CM65A-D129 is ideal for high performance frequency and time reference in wireline Telecommunications, wireless Telecommunications, substations, Test and Measurement Applications. It is the perfect replacement for rubidium clock.

## 2. Features

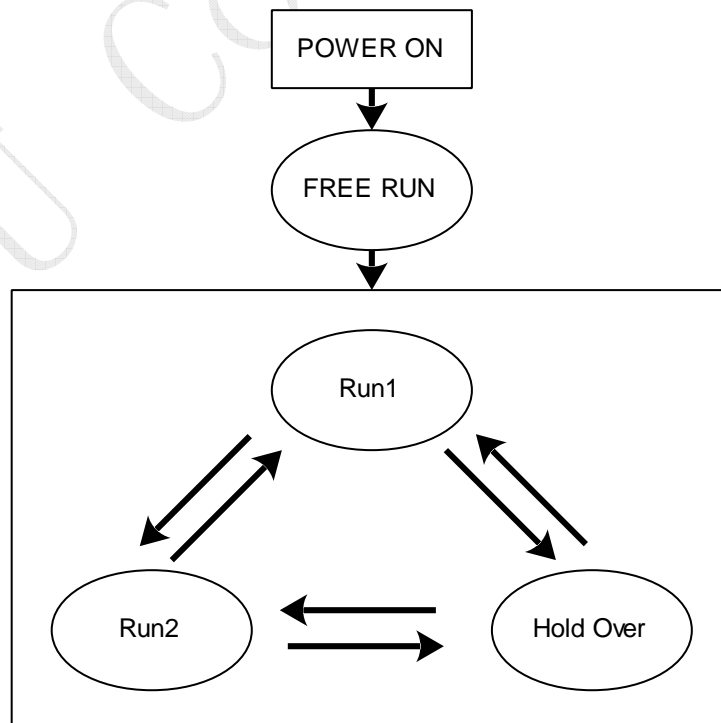
- Support all kinds of satellite receiver (GPS/GLONASS/BEIDOU/GALILEO) 1PPS output to be reference
- Ultra-Low phase noise output
  - 140 dBc/Hz (100Hz)
  - 148 dBc/Hz (1kHz)
- Ultra-High holdover ability close to Rubidium Clock
  - Better than  $\pm 1.5\mu s@24$  hours ( $\pm 5^{\circ}C$ ) holdover
  - Better than  $\pm 2.4\mu s@24$  hours ( $\pm 10^{\circ}C$ ) holdover
  - Better than  $\pm 4.1\mu s@24$  hours ( $\pm 20^{\circ}C$ ) holdover
- Combine high stability OCXO and patent compensated algorithm
- High integration and small size (65mm×65mm×19mm)
- Various kinds of maintenance and alarm messages output
- 5V operation and low power consumption



### 3. Functional Block Diagram



### 4. Workflow Diagram





Run1: Fast track. Adjust the OCXO 10MHz output frequency quickly to track the PP1S of 10MHz with PP1S reference.

Run2: Slow track. Adjust the OCXO 10MHz output frequency slowly when the phase error is in the define range.

Hold Over: GPS PP1S reference miss, an algorithm has been developed which enables adaptive modeling of the frequency stability of an OCXO with reference to a GPS timing signal.

Free Run: Clock module power on without PP1S reference anyway.

## 5. Applications

- Wireless base station
- Telecom Synchronization Network
- Power Grid Substation
- Test and Measurement
- Military/Aerospace



## 6. Electrical Parameters

1 PPS Reference Input	Parameters	Min.	Typ.	Max.	Unit.	Test Condition
	Waveform	HCMOS				
	High-Level Output Voltage (V <sub>IH</sub> )	2.7			V	50Ω
	Low-Level Output Voltage (V <sub>IL</sub> )			0.4	V	
	Pulse Width	10			μs	
	Stability			200	ns	
	Connector	Pin 10				
State Input	Parameters	Min.	Typ.	Max.	Unit.	Test Condition
	Lock Enable	2.7			V	<5mA Load
	Lock Disable			0.4	V	<5mA Load
	Connector	Pin 8				
10M Output	Parameters	Min.	Typ.	Max.	Unit.	Test Condition
	Nominal Frequency	10.00			MHz	
	Waveform	HCMOS				
	High-level Output Voltage (VOH)	2.7			V	<5mA Load
	Low-level Output Voltage (VOL)			0.4	V	<5mA Load
	Rise/Fall Time			8	ns	<5mA Load
	Duty Cycle	45	50	55	%	<5mA Load
	Frequency Tolerance vs. Operating Temperature Range	-0.05		+0.05	×10 <sup>-9</sup>	TA varied from -20°C to 75°C, measurement referenced to frequency observed with TA=25°C, V <sub>cc</sub> =5.0V, O <sub>Load</sub> =15pF. Temperature rise speed less than 1°C per minute.
	Frequency Tolerance vs. Supply Voltage	-0.01		+0.01	×10 <sup>-9</sup>	measurement referenced to frequency observed T <sub>A</sub> =25°C, V <sub>cc</sub> varied from 4.75V to 5.25V, and O <sub>Load</sub> =15pF.
	Retrace	-5		+5	×10 <sup>-9</sup>	@25°C, frequency variation measured after 48 hours power off and 3 hours power on, referred to stable frequency before power off.
	Accuracy	-1		+1	×10 <sup>-12</sup>	24 hours average when locked to 1 PPS
	Short-term Stability			5	×10 <sup>-12</sup>	Temperature stability, no EMI/EMC or other interference, test after power for 1 hour ref. to 25°C; 1s, using PN9000 equipment.



	Aging Tolerance Per Day	-0.2		+0.2	$\times 10^{-9}$	V <sub>cc</sub> ,T <sub>A</sub> constant measurement referenced to frequency observed with T <sub>A</sub> =25°C,V <sub>cc</sub> =5.0V, in FREE RUN condition and after 30 days of operation.	
	Aging Tolerance 1 Year	-0.01		+0.01	$\times 10^{-6}$		
	Phase Noise (All conditions)			-125	-120	dBc/Hz	10Hz
				-140	-135		100Hz
				-148	-143		1KHz
				-152	-147		10KHz
				-155	-150		100KHz
		-155	-150	1MHz			
Connector	Pin 2						
CONFIDENTIAL							
Holdover Capability	Holdover Time	Min.	Typ.	Max.	Unit.	Test Condition	
	24 Hours	-1.5		+1.5	$\mu$ s	$\Delta T = \pm 5^{\circ}\text{C}$ , 24 hours holdover after turn on 7days and lock 2days. Temperature variable speed less than 1°C per minute	
		-2.4		+2.4		$\Delta T = \pm 10^{\circ}\text{C}$ , 24 hours holdover after turn on 7days and lock 2days. Temperature variable speed less than 1°C per minute	
		-4.1		+4.1		$\Delta T = \pm 20^{\circ}\text{C}$ , 24 hours holdover after turn on 7days and lock 2days. Temperature variable speed less than 1°C per minute	
		-3.0		+3.0		$\Delta T = \pm 5^{\circ}\text{C}$ , 24 hours holdover after turn on 4~6days and lock 2days. Temperature variable speed less than 1°C per minute	
		-3.9		+3.9		$\Delta T = \pm 10^{\circ}\text{C}$ , 24 hours holdover after turn on 4~6days and lock 2days. Temperature variable speed less than 1°C per minute	
		-5.6		+5.6		$\Delta T = \pm 20^{\circ}\text{C}$ , 24 hours holdover after turn on 4~6days and lock 2days. Temperature variable speed less than 1°C per minute	



Holdover Time	Holdover Capability	Min.	Typ.	Max.	Unit.	Test Condition	
	±1.5μs				15	hours	ΔT = ±10°C, holdover after turn on 7days and lock 2days. Temperature variable speed less than 1°C per minute
					9		ΔT = ±20°C, holdover after turn on 7days and lock 2days. Temperature variable speed less than 1°C per minute
					9		ΔT = ±10°C, holdover after turn on 4~6days and lock 2days. Temperature variable speed less than 1°C per minute
					6		ΔT = ±20°C, holdover after turn on 4~6days and lock 2days. Temperature variable speed less than 1°C per minute
Parameters	Min.	Typ.	Max.	Unit.	Test Condition		
Supply Voltage	4.75	5.0	5.25	V			
Warm up time			15	mins			
Current Consumption			2500	mA	During Warm-up		
			1000	mA	During steady state operation @25°C		
AC Ripple			50	mVpk-pk	10Hz to 1MHz		
Connector	Pin 12						
Parameters	Min.	Typ.	Max.	Unit.	Test Condition		
Waveform	HCMOS						
High-Level Output Voltage(V <sub>OH</sub> )	2.7			V	50Ω		
Low-level Output voltage (V <sub>OL</sub> )			0.4	V			
Pulse Width		100		ms			
1 PPS Output Waveform Characteristics	Phase Accuracy	-200		+200	ns	Initial lock status (the first 30mins after the fist time the CM65 got locked to the 1PPS )	
		-80		+80	ns	lock status ( locked time ≥ 30mins, under the condition of 1PPS reference RMS ≤ 30ns)	
	Phase Accuracy (RMS)			25	ns	Steady lock status ( locked time ≥ 24hours, under the condition of 1PPS reference RMS ≤ 30ns)	
Connector	Pin 3						





State Output	Parameters	Min.	Typ.	Max.	Unit.	Test Condition
	Lock	2.7			V	<5mA Load
	Free run/Holdover			0.4	V	<5mA Load
	Connector	Pin 5				

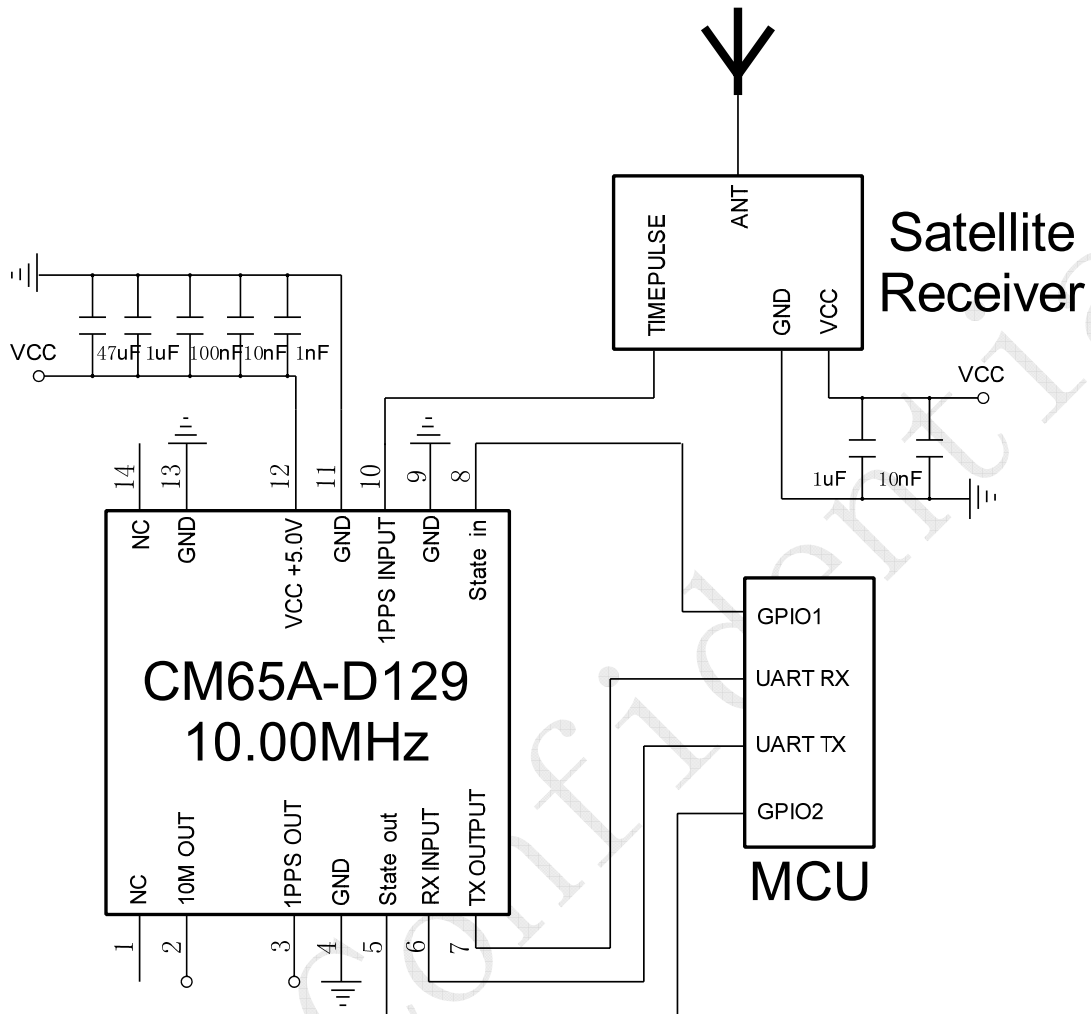
Serial Interfaces	Parameters	Min.	Typ.	Max.	Unit.	Test Condition
	Rx high-level Input Voltage (VH )	2.7			V	
	Rx low-level Input Voltage (VL)			0.4	V	
	Tx high-level Output Voltage (VH )	2.7			V	
	Tx low-level Output Voltage (VL)			0.4	V	
	Serial Protocol	9600-N-8-1				
	Connector	Pin6 and Pin7				

Environmental Conditions	Parameter	Conditions
	Operating temperature	-20°C to +75°C
	Storage Temperature	-55°C to +105°C
	Storage humidity	30%~80%
	ESD Level	Human Body Model,class2: 2000V to 4000V; ANSI/ESDA/JEDEC JS-001-2010.
		Machine Model, class B: 200V to 400V; ANSI/ESDA/JEDEC JS-001-2010.
	Moisture Sensitivity Level	Not humidity sensitive.
	Vibration	Test Condition: 0.75mm ;acceleration:10g;10Hz~500Hz, one cycle per 30 min, test 2 hour. (3 times for each 3 directions X ,Y , Z), IEC 68-2-06 Test Fc.
	Shock	50g; 11ms; half sine wave (3 times for each 3 directions X ,Y , Z ),IEC 68-2-27 Test Ea/Severity 50A.

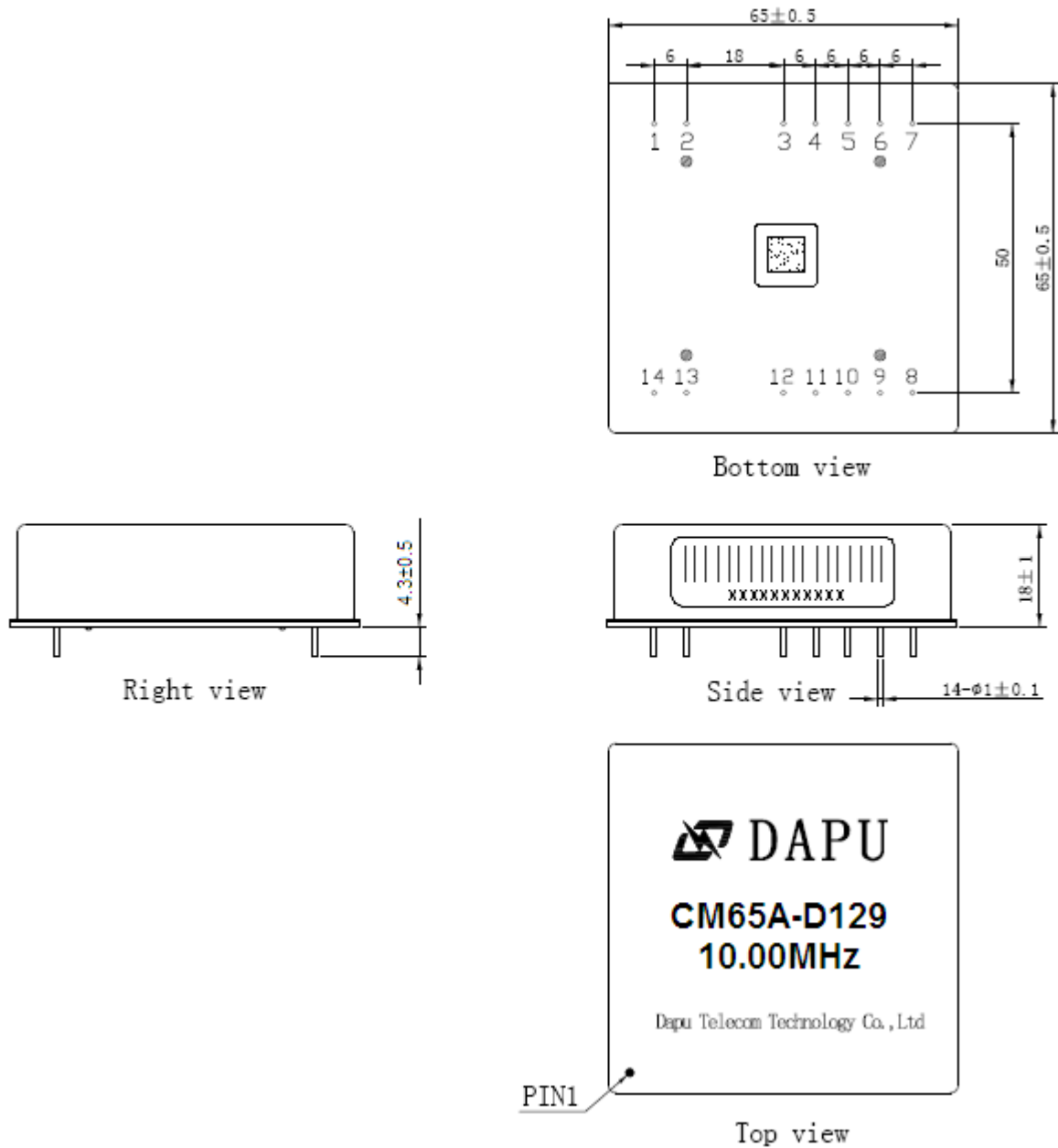


## 7. Typical Application





### 8. Mechanical Structure(mm)



**Note1:** Tolerance  $\pm 0.2$ mm without mark

**Note2:** Referential Weight  $135 \pm 15$ g

**PIN DEFINITION**

PIN	Name	DESCRIPTION	
2	10M OUTPUT	10MHz OCXO frequency output.	
3	1PPS OUTPUT	The clock module 1PPS output.	
5	State OUTPUT	State output. Output high level when the CM is locked and stable, others low level.	
6	RX INPUT	Asynchronous serial data input.9600-N-8-1.	
7	TX OUTPUT	Asynchronous serial data output.9600-N-8-1.	
8	State INPUT	H: Lock Enable	The work state is set to normal operation when the state input is high level.
		L: Lock Disable	The module cannot be locked when the state input is low level.
10	1PPS INPUT	1PPS reference input.	
12	VCC	Power supply input, 4.75V to 5.25V.	
1、14	NC	Not connected.	
4、9、11、13	GND	GND	

**9. Holdover capability Reference**

First holdover time	$\pm 1.5\mu\text{S}$ Holdover capability(hour) after GPS recover 1~47hours	
X(hour)	Training time $\geq 7$ days	Training time =4~6days
1	$\geq 23$	$\geq 12$
2	$\geq 23$	$\geq 12$
3	$\geq 22$	$\geq 11$
4	$\geq 21$	$\geq 10$
5	$\geq 21$	$\geq 10$
6	$\geq 20$	$\geq 10$
7	$\geq 19$	$\geq 9$
8	$\geq 19$	$\geq 9$
9	$\geq 18$	$\geq 9$
10	$\geq 17$	$\geq 8$
11	$\geq 16$	$\geq 8$
12	$\geq 16$	$\geq 8$
13	$\geq 15$	$\geq 7$
14	$\geq 15$	$\geq 7$
15	$\geq 14$	$\geq 7$
16	$\geq 13$	$\geq 6$
17	$\geq 12$	$\geq 6$
18	$\geq 12$	$\geq 6$
19	$\geq 11$	$\geq 5$
20	$\geq 10$	$\geq 5$
21	$\geq 9$	$\geq 4$



22	≥9	≥4
23	≥8	≥4
24	≥8	≥4
25	≥7	≥3
26	≥6	≥3
27	≥5	≥2
28	≥5	≥2

±1.5μS holdover capability after locked for 4~6days: ≥12hours .

±1.5μS holdover capability after GPS recover over 48hours: ≥24hours (Power on time≥7days)

≥12hours (Power on time=5~6days) .

## 10.The Output Message Protocol

In the Format column, c stand for char ,d stand for digit, s stand for sign.

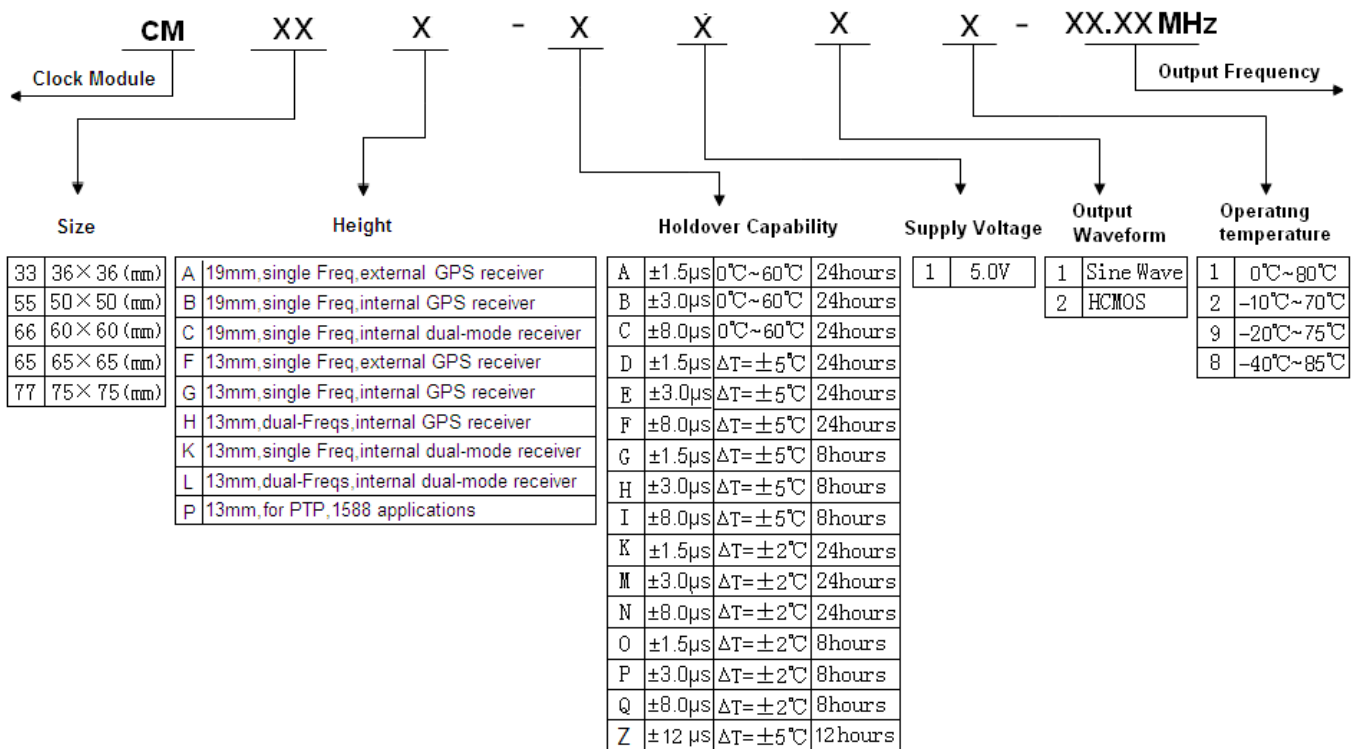
Field No.	Name	Format	Description	Length (byte)
0	\$PDP	\$ccc	Message ID, DAPU Telecom Technology protocol header	4
1	No	dd	Message No.	2
2	TxRxFlag	d	The transmit and receive flag.(0: upper computer transmit; 1: upper computer receive)	1
3	CStatus	c	Current status.(F: warm-up; L: Lock; H: Hold over)	1
4	TrackStatus	d	Track status (Q: fast track;S: slow track)	1
5	cPHDiff	sdddd	Current phase difference, 1 unit stand for 6.25ns	5
6	cPWM1	dddd.dddd	Current PWM1 (Voltage-controlled value1)	10
7	cPWM2	dddd.dddd	Current PWM2 (Voltage-controlled value2), not used, output 32769.0000 as default.	10
8	SYNCNT	ddd	The synchronous times	3
9	HCNT	ddd	Power on hours count	3
10	HPAVG	dddd.dddd	The average of the PWM in the last half hour	10
11	VCH1	dddd.dddd	Voltage-controlled compensation value every half hour	10
12	HPMOD	dddd.dddd	The Module PWM Value	
13	VCM10	dddd.dddd	Voltage-controlled compensation value every 10 minutes	10
14	POS	d-dd	The position of the product.(Layer-No), just for the inner test.	4



15	TEMP	sddd.dddd	The temperature monitored inside the module	9
16	AlarmFlag	sddd	The first 4 bytes are invalid, only the last 1 byte indicate Alarm flag(0: Normal; 1:OCXO heat up abnormal; 2:OCXO output abnormal; 3:The inside temperature sensor abnormal)	5
17	Website		www.dptel.com	13
18	Version	d.d	version	3
19	Date	dddd-dd-dd	Date	10
20		dd	55	2
21	END		<CR><LF>	2

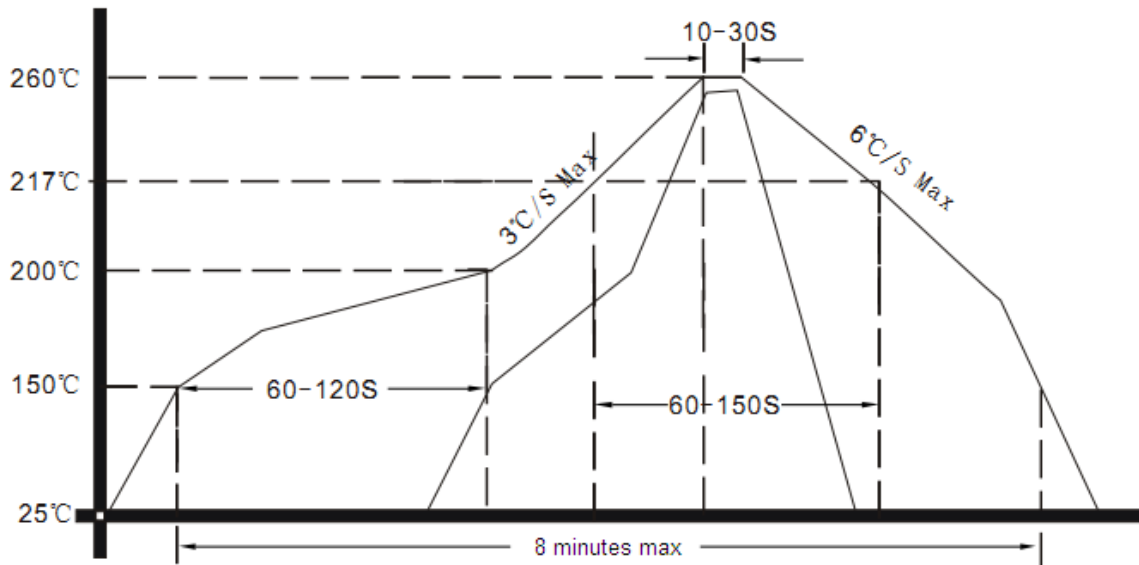
The message output from Tx(PIN7), 9600 baud rate, data bits 8, stop bit 1, parity bit none, flow control bit none.

### 11.Coding Rules





### 12.Reflow Soldering Curve (RoHS)



### 13.Package (mm)

