Encryption IC DA128PF-15S

PROTECTION IC FROM ILLEGAL SYSTEM COPY

1. General Description

DA128PF-15S is specific IC for 'Anti-copy system'. This IC protects Main SoC system from illegal replications.

It can be used as the way of checking authenticity.

It enhances the protection of Intellectual Property Rights.

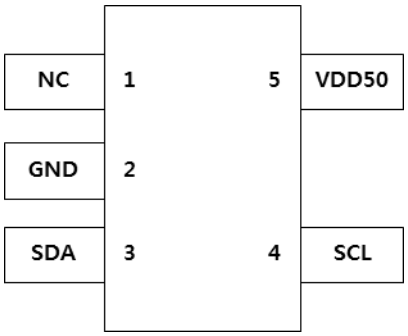
2. Features

- Embedded Power On Reset Block
- 64bit Encryption-decryption Algorithm
- 128 byte Key Value can be saved in internal EEPROM
- Unique Key Value Each Customer
- Hardware System Lock & Anti-system copy IC
- 1.8~5.0V Volt Operation
- SOT23-5 Small Size

3. Applications

- STB / DVR / DVDP / DMB / MP3 / PMP
  - Module Authorization
  - Authenticity check
  - Limitation of Production

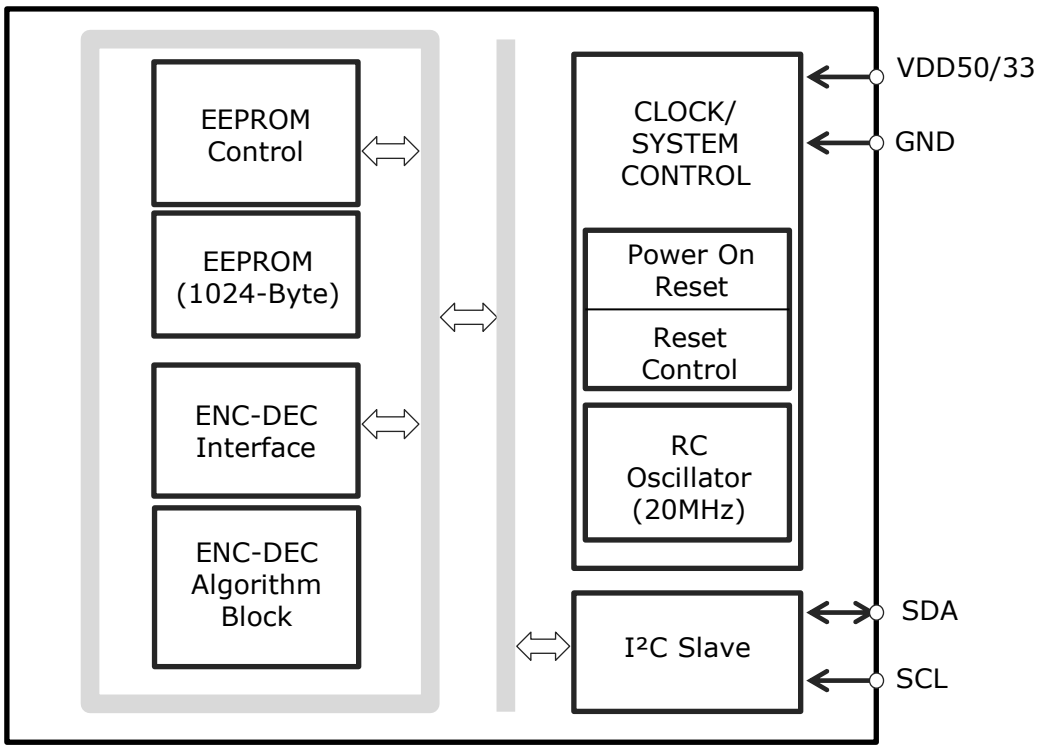
4. Pin Diagram (Top View)



5. Pin Description

No	Name	I/O Type	Function
1	NC	Open	Non Connection
2	GND	Ground	Ground
3	SDA	Input / Output	I2C DATA with Pull-up Resistor(50K) – Open drain
4	SCL	Input	I2C CLOCK with Pull-up Resistor(50K) – Open drain
5	VDD50	Power	Power Supply (1.8 ~ 5.0V)

6. Block Diagram



7. DC Characteristics

A. Absolute Maximum Ratings

Parameter	Symbol	Condition	Rating	Unit
Supply voltage	VDD50	-	-0.3 to +6.5	V
Input voltage	vi	SCL/SDA	-0.3 to VDD50+0.3	V
Output voltage	Vo	SDA	-0.3 to VDD50+0.3	V
Output Current High	Ioh	SDA / Pull-up Resistor	500	uA
Output Current Low	Iol	SDA	4	mA
Operating temperature	Ta	-	-40 to +85	°C
Storage temperature	Ts	-	-45 to +125	°C

B. D.C Electrical characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Operation voltage	VDD50	Interface Power supply	1.65	3.3	5.5	V
	VDD18	Internal Power supply	1.65	1.8	2.0	V
Input high voltage	Vih	SCL / SDA	0.8*VDD50	-	VDD50+ 0.3	V
Input low voltage	Vil	SCL / SDA	-	-	0.2*VDD	
Output High Voltage	Voh	SDA / Pull-up Resistor VDD50=5V Ioh=125uA	VDD50-0.2V	-	-	
Output Low Voltage	Vol	SDA VDD50=5V Iol=4mA	-	-	0.4V	
Supply Current	Idd1	Normal operation mode VDD50=3.3V ±10% Internal RC clock operation	-	-	2	mA
Pin Capacitance	CIO	ALL VDD = 3V		10		pF

8. Internal POR(Power On Reset)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
VDD	External Power		1.8	1.9	2.0	V
Vdet	Detection Voltage	VDD=rising	1.19	1.4	1.61	V
		VDD=falling	1.02	1.2	1.38	V

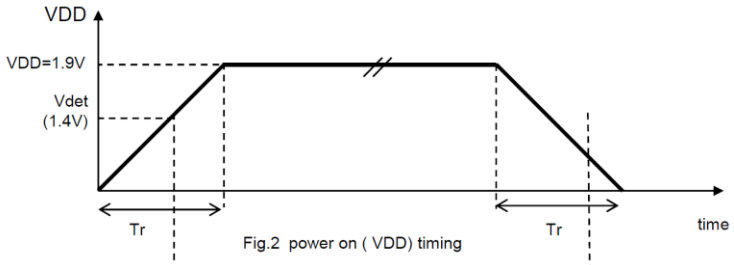


Fig.2 power on (VDD) timing

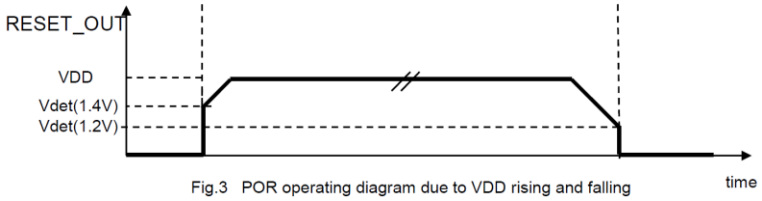


Fig.3 POR operating diagram due to VDD rising and falling

9. Internal RC Oscillator

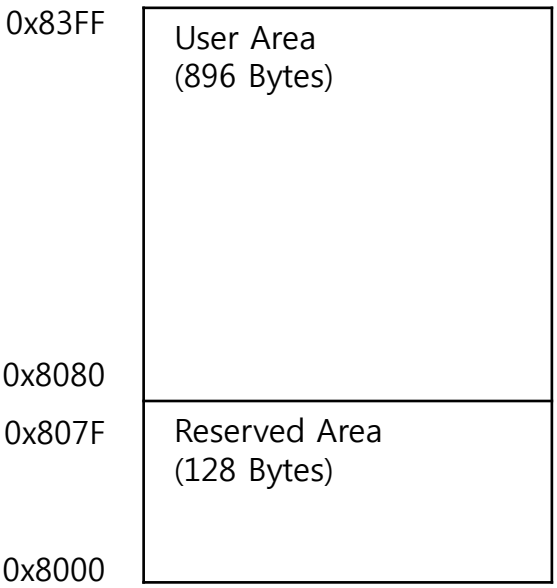
- Generated Frequency : 20MHz ± 20%

10. EEPROM

A. Features

- Supports Standard And Fast I²C Protocol
- 32-Byte Page Write Buffer
- Schmitt Triggers and Noise Suppression Filters on I²C Bus Inputs (SCL and SDA)
- Low active current : 2mA (Typ.) / 4mA (Max.)
- Low write current : 1.5mA (Typ.) / 8mA (Max.)
- Data retention : More than 10 years
- E/W Cycle : More than 30K

B. Memory Area



C. Reliability Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
N_{END}	Endurance		30,000			Program / Erase Cycles
T_{DR}	Data Retention		10			Years
I_{CC}	Read Current (Output Disabled by OEn=High)			2	4	mA
I_{WR}	Write Current	Byte or page Write		1.5	8	mA

D. A.C Characteristics

Symbol	Parameter	Standard		Fast		Units
		Min	Max	Min	Max	
F_{SCL}	Clock Frequency		100		400	kHz
$t_{HD:STA}$	START Condition Hold Time	4		1.0		μs
t_{LOW}	Low Period of SCL Clock	4.7		1.3		μs
t_{HIGH}	High Period of SCL Clock	4		1.0		μs
$t_{SU:STA}$	START Condition Setup Time	4.7		1.0		μs
$t_{HD:DAT}$	Data In Hold Time	0		0		μs
$t_{SU:DAT}$	Data In Setup Time	250		100		ns
t_R	SDA and SCL Rise Time		1000		300	ns
t_F	SDA and SCL Fall Time		300		300	ns
$t_{SU:STO}$	STOP Condition Setup Time	4		1.0		μs
t_{BUF}	Bus Free Time Between STOP and START	4.7		1.3		μs
t_{AA}	SCL Low to Data Out Valid		3.5		0.9	μs
t_{DH}	Data Out Hold Time	100		100		ns
T_i	Noise Pulse Filtered at SCL and SDA Inputs		100		100	ns
t_{WR}	Write Cycle Time		10		10	ms

E. Functional Description

Figure 1. Bus Timing

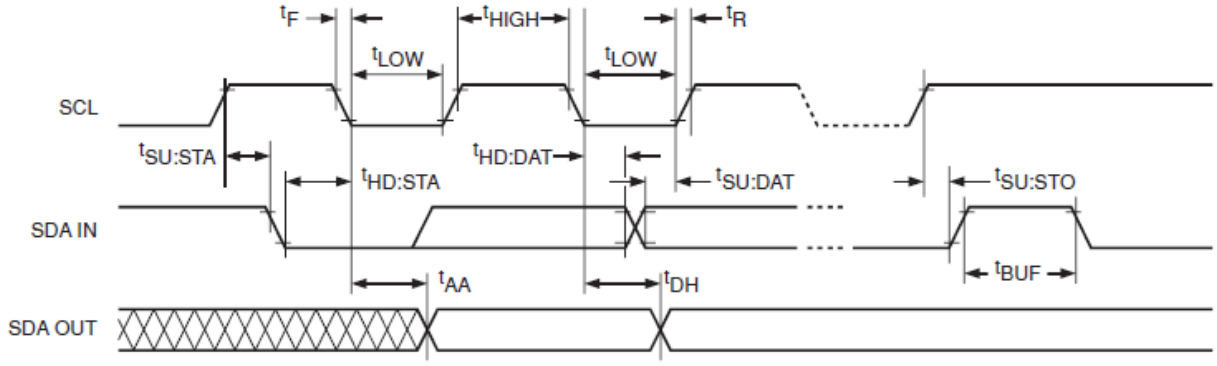
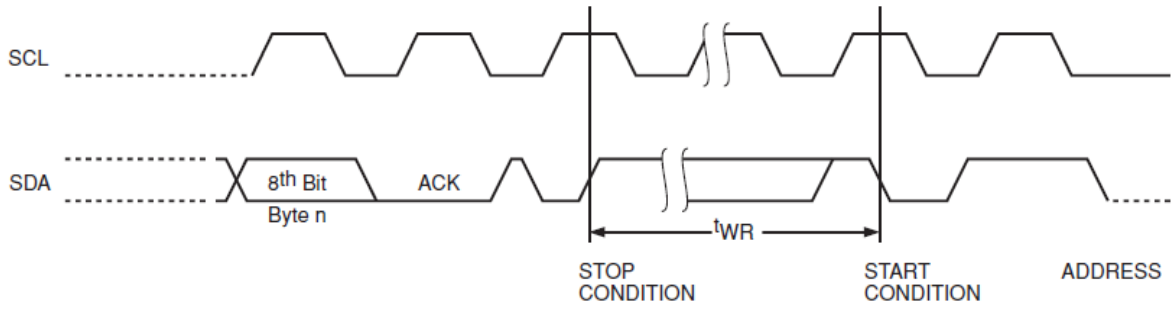
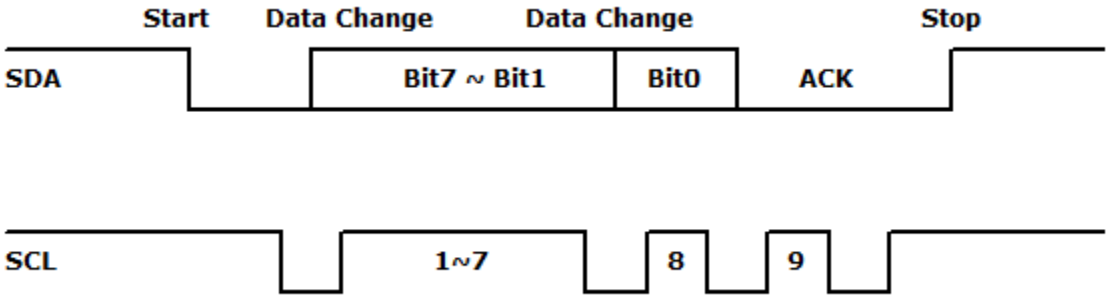


Figure 2. Write Cycle Timing



11. I²C Protocol

I²C Protocol is same as general I²C communication format.



S : Start Condition	A : Acknowledge(to Master)	P : Stop Condition
Slave Address : 7-bit(0x14h)	Bit0(R/W) : "0" Write / "1" Read	

First Byte = Slave Address + R/W Bit = 0x28(Write) or 0x29(Read)

A. I²C Write

(1) Page Write Sequence

S	Slave Address	W	A	Address High	A	Address Low	A	Write Data 0	A	···	Write Data N	A	P

The page address is latched, and as long as the master keeps sending data,
the internal byte address is incremented up to the end page.

Start → 0x28 →0x80 → 0xA0 → Write Data-0 → ..... → Write Data-N → Stop

(2) Byte Write Sequence

S	Slave Address	W	A	Address High	A	Address Low	A	Write Data	A	P

Start → 0x28 →0x80 → 0xA0 → 0xAA → Stop

B. I²C Read

(1) Sequential Read

S	Slave Address	W	A	Address High	A	Address Low	A		
Sr	Slave Address	R	A	Read Data 0	A	…..	Read Data N	NA	P

During sequential, read the internal byte address is automatically,

incremented up to the end of memory.

Start → 0x28 →0x80 → 0xA0 → Start → 0x29 → Read Data-0 → … → Read Data-N → Stop

(2) Selective Read Sequence

S	Slave Address	W	A	Address High	A	Address Low	A	
Sr	Slave Address	R	A	Read Data		NA	P	

Start → 0x28 →0x80 → 0xA0 → Start → 0x29 → Read Data → Stop

C. I²C Address & EEPROM

Slave Address : Write=0x28 / Read=0x29

9	8	7	6	5	4	3	2	1	0
Page Address					0	0	0	0	0

Address	Page Address
8000 ~ 801F	0
8020 ~ 803F	1
8040 ~ 805F	2
:	:
83E0 ~ 83FF	31

D. I²C Write Examples

```
Void EEPROM_ByteWrite(unsigned short  EEP_Address, unsigned char EEP_Data)
{
        unsigned char Buffer[32];
        unsigned short Address;

        Address = (EEP_Address /32)*32;
        DA128_NVMSetup_Init(0,'R');
        DA128_recv(0, 0x28,  Address, Buffer, 32);
        DA128_NVMSetup_Read(0);
        //Delay_10ms;
        Buffer[EEP_Address %32]= EEP_Data;
        DA128_NVMSetup_Init(0,'W');
        DA128_send(0, 0x28, Address, Buffer, 32);
        DA128_NVMSetup_Write(0);
        //Delay_10ms;
        DA128_NVMSetup_DeInit(0);
}
```

- **Case 1**

Address	Page Address
81E0 ~ 81FF	15

EEPROM 0x81E0~0x81FF Area Write :
Function Call : DA128_NVMSetup_Init('W');
Start → 0x28 → 0x81 → 0xE0 → 32Byte Data → Stop
Function Call : DA128_NVMSetup_Write();
Wait 10ms

EEPROM 0x81E0~0x81FF Area Read :
Function Call : DA128_NVMSetup_Init('R');
Start → 0x28 → 0x81 → 0xE0 → Start → 0x29 → 32Byte Read → Stop
Function Call : DA128_NVMSetup_Read();

- **Case 2**

Address	Page Address
81C0 ~ 81DF	14
81E0 ~ 81FF	15

EEPROM 0x81D0~0x81EF Area Write :
Function Call : DA128_NVMSetup_Init('W');
Start → 0x28 → 0x81 → 0xD0 → 16Byte Data → Stop
Function Call : DA128_NVMSetup_Write();
Wait 10ms

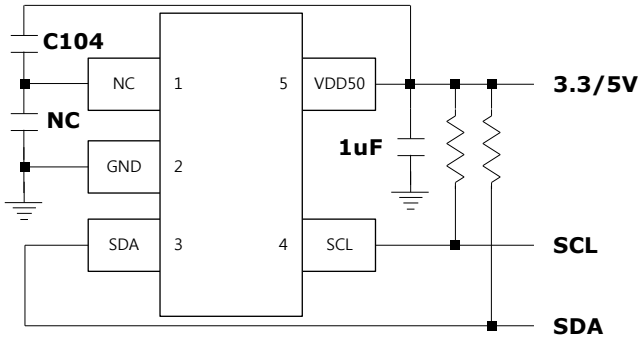
Function Call : DA128_NVMSetup_Init('W');
Start → 0x28 → 0x81 → 0xE0 → 16Byte Data → Stop
Function Call : DA128_NVMSetup_Write();
Wait 10ms

EEPROM 0x81D0~81EF Area Read :
Function Call : DA128_NVMSetup_Init('R');
Start → 0x28 → 0x81 → 0xD0 → Start → 0x29 → 32Byte Read → Stop
Function Call : DA128_NVMSetup_Read();

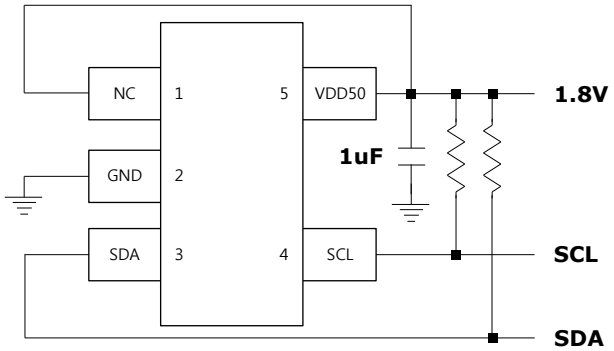
EEPROM END COMMAND :
Function Call : DA128_NVMSetup_DeInit();

12. Application Circuit

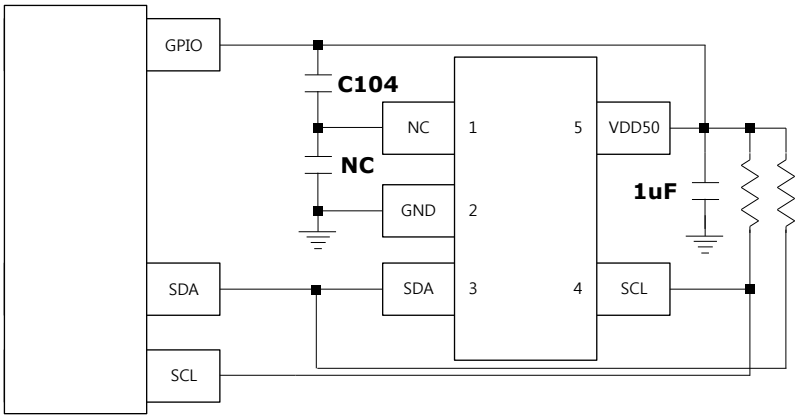
A. I2C Interface Voltage = 3.3V or 5.0V



B. I2C Interface Voltage = 1.8V



C. Power Switching

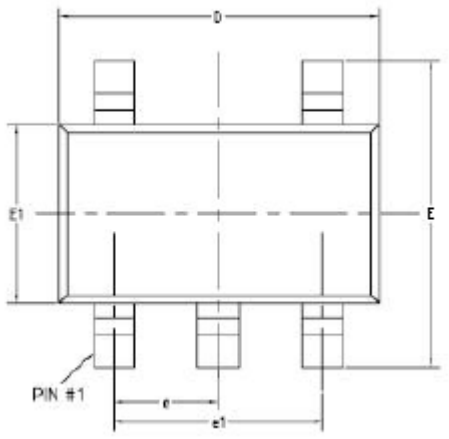


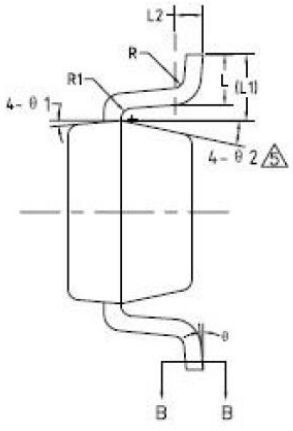
Ex)

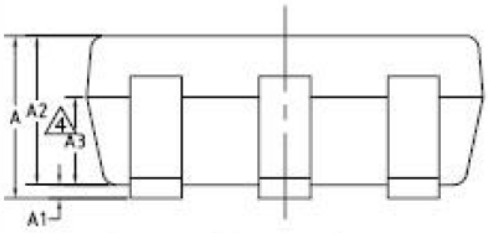
Run	Power Off
GPIO 'H' SCL, SDA → I²C	GPIO 'L' SCL 'L' SDA 'L'

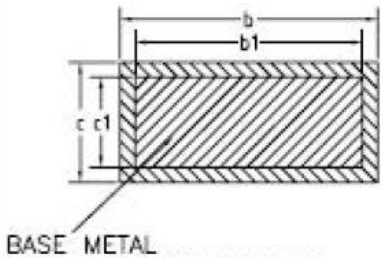
* Notice : GPIO output Current should be Min 10mA

13. Physical Dimensions









COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

	SYMBOL	MIN	NOM	MAX
	A	–	–	1.25
3	A1	0	–	0.15
	A2	1.00	1.10	1.20
	A3	0.60	0.65	0.70
	b	0.36	–	0.50
	b1	0.36	0.38	0.45
	c	0.14	–	0.20
	c1	0.14	0.15	0.16
	D	2.826	2.926	3.026
	E	2.60	2.80	3.00
	E1	1.526	1.626	1.726
5	e	0.90	0.95	1.00
5	e1	1.80	1.90	2.00
	L	0.35	0.45	0.60
	L1		0.59REF	
	L2		0.25BSC	
	R	0.10	–	–
	R1	0.10	–	0.25
	θ	0°	–	8°
	θ 1	3°	5°	7°
5	θ 2	6°	–	14°