

# EEPROM TELEPHONE CARD

## - 1ST GENERATION

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- Card life phases
- Security features
- Card commands

## EEPROM TELEPHONE CARD - GENERAL

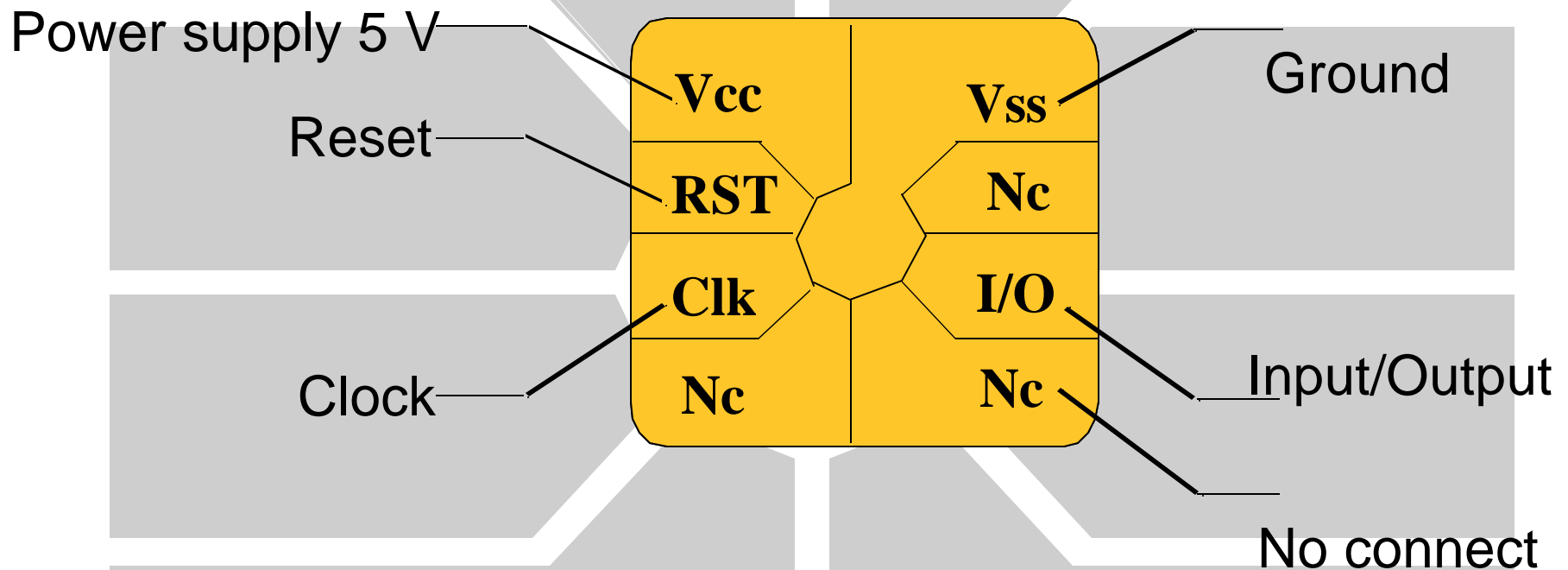
- silicon produced by SGS-Thomson, ST-1305
- silicon produced by Siemens, SLE-4406
- largest volume - few hundred millions card per year
- lowest price - approx US \$0.60 per card
- used by many telecom operators world-wide
- known as something 103 or 104 card eg GPM-103, FE-104
- other variations but downward compatible to 4406
  - ◆ 4403 for German telecom, 4409 for GPT

# SPECIFICATIONS

- EEPROM technology
- Memory divided into three areas:
  - ◆ A 24-bits protected **manufacturer** area
  - ◆ A 40-bits protected **issuer** area
  - ◆ A 5 stage 40-bits **abacus counter** for tokens
- Storage capacity : Up to 21 064 tokens (not reloadable)

**The card when in used is in Countdown Mode**

# PIN ASSIGNMENTS



ISO 7816-1 / -2 compatible

# ELECTRICAL CHARACTERISTICS

- 5V supply voltage (VCC)
- Access Time :
  - ◆ 10 ms to write
  - ◆ 10 ms to erase
- Low power consumption
- Operating range : 0°C to +50°C
- Ten years minimum data retention

# 104 Card Memory Organisation

Byte		TSC=0	TSC=1
0	Manufacturer Area	Read	R/W
1			
2	Issuer Area	Read	R/W
3			
4			
5			
6	Fuse	Read	R/W
7			
8	Presentation Counter	R/W	R/W
9			
10	Transport	None	R/W
11	Secret		
12	Code		Erase

# CARD LIFE PHASES

**Manufacturing**



**Personalization**



**Logical blow fuse**

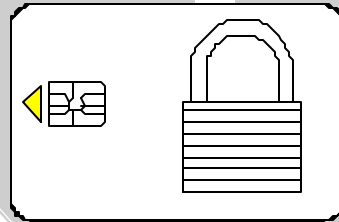


**Down Counting**

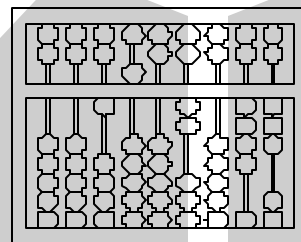
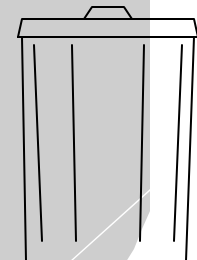
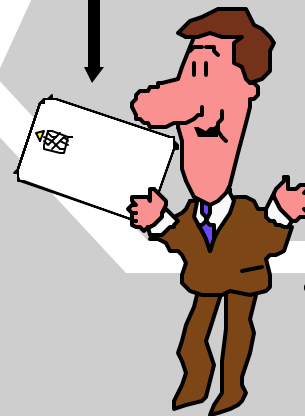
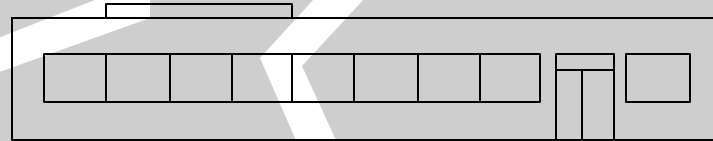


Card Empty

manufacturer



Transport  
Code



# MANUFACTURER AREA (read-only)

Bit

0

Chip Type

Chip Version

7

8

Chip  
Manufacturer

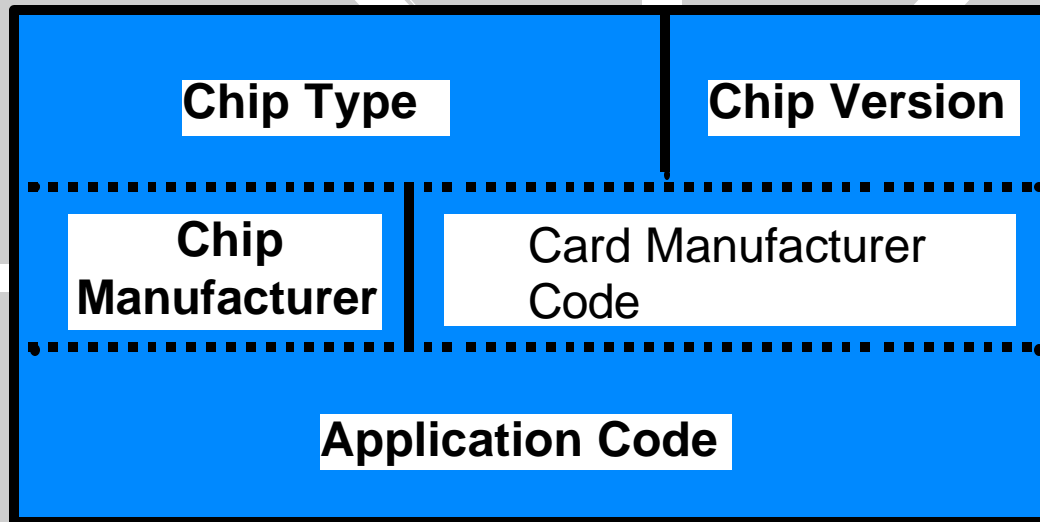
Card Manufacturer  
Code

15

16

Application Code

23





# **PERSONALIZATION**

**(done by card manufacturer)**

- **Present Transport code**
- **Write Issuer Area**
- **Clear counters**
- **Blow logical fuse**
- **Set initial value**

# 104 Card Memory Organisation

Byte

0

1

2

3

4

5

6

7

8

9

10

11

12

**Manufacturer Area**

**Issuer Area**

**0 C4096 0 0 0**

**C512**

**C64**

**C8**

**C1**

**Read - Only**

**Read - Only**

**Abacus  
Counters  
(Read/Write)**

## FUSE BLOW

8 64

1

71



8 64

0

71

Writing to the Logical Fuse (**Bit 64**) changes the 4406 from  
Personalization Mode to Count Down Mode  
**This is irreversible**

# BEFORE AND AFTER FUSE BLOW

## ■ Before (**Personalization Mode**)

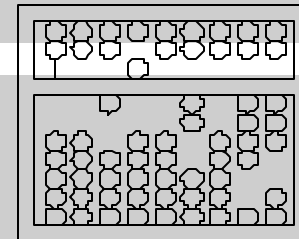
- ◆ 24-bits Manufacturing information (read only)
- ◆ Blank One time write 80-bits Issuer Area
- ◆ Protected by 24-bits transport code
- ◆ 7 attempts to present transport code then the card is useless
- ◆ Loadable counter with value 0-21,064

## ■ After (**Count Down Mode**)

- ◆ Down Counter from loaded value to zero
- ◆ Issuer and manufacturer information is read only

## COUNT DOWN PHASE

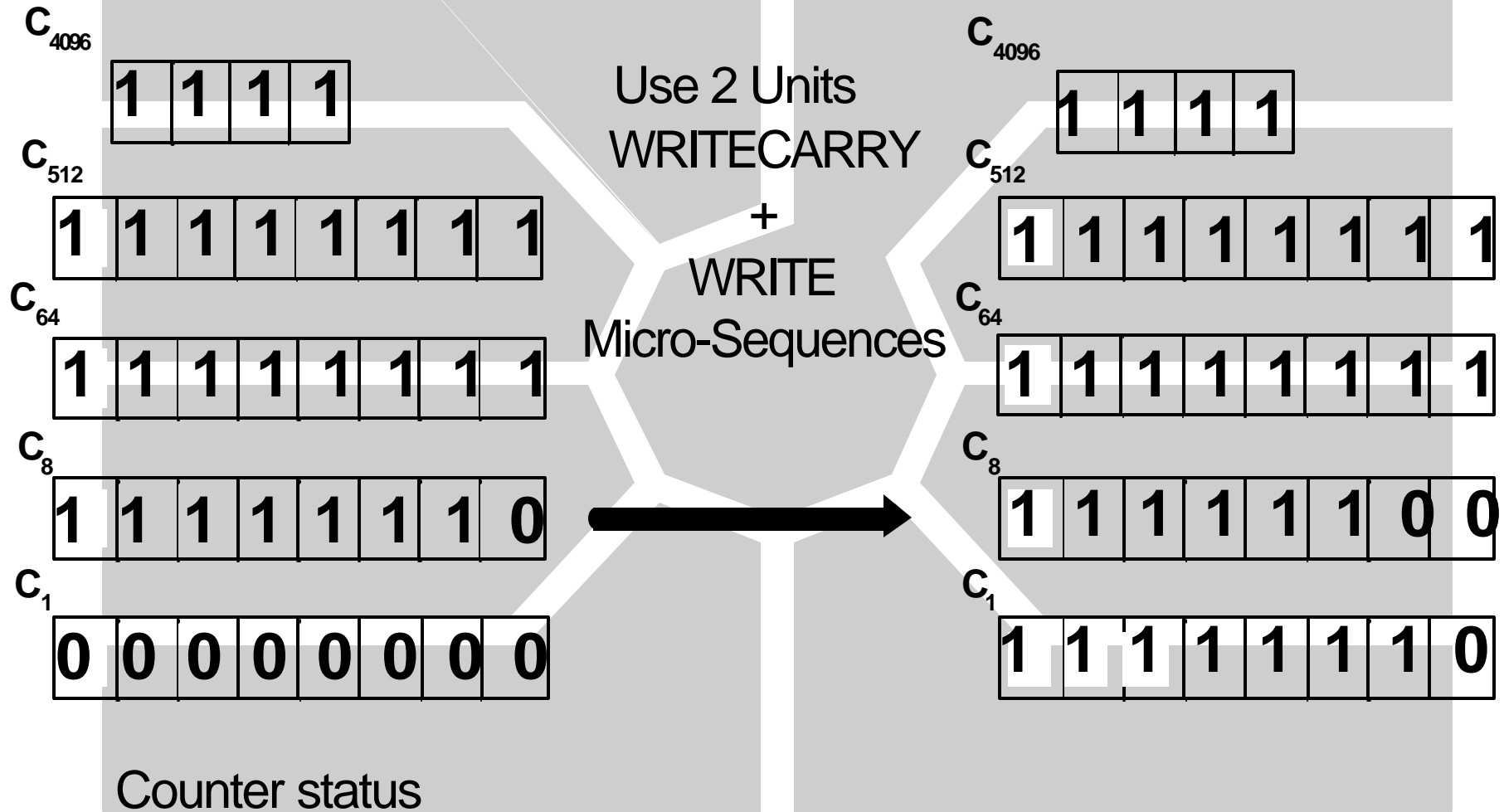
- **Verify Issuer Data and Manufacturer Data for valid card**
- **Count down units, Issue Service**
- **If Empty, Throw away**



## COUNT MODE

- Any unwritten counter bit can be written at any time
- **WRITE** Micro-Sequence
- Counter can be loaded with any value at personalization
- A new value can be given to counter without stepping through all intermediate values
- Counters  $C_1$ ,  $C_8$ ,  $C_{64}$  and  $C_{512}$  can be erased (refilled) by writing an unwritten bit in the next level counter
- **WRITECARRY** Micro-Sequence
- Counter  $C_{4096}$  cannot be erased
- Card does not propagate carries between counters
- Carry propagation must be performed by the reader with additional **WRITECARRY** instructions

# COUNT MODE SCHEME



## ERASING COUNTER WITH WRITECARRY

To Erase counter	WRITECARRY in
C1	C8
C8	C64
C64	C512
C512	C4096 or Logical Fuse
C4096	Impossible

**The WRITECARRY micro-sequence must be performed on an unwritten bit to erase a counter**



# SECURITY FEATURES

- The manufacturer area contains information unique to one application (for large orders) and are only sold to a specific customer
- The Manufacturer Area cannot be modified
- The manufacture of ICs and cards is controlled by strict security
  - ◆ Secured transfer
  - ◆ All materials are traced
  - ◆ Rejects destroyed
- Protected by Transport Code from silicon to card manufacturer
- Impossibility to reload counter

# CARD COMMANDS

- Reset Address Counter (**RESET**)
- Increment Address Counter and Read Bit (**INCREMENT**)
- Write Bit (**WRITE**)
- Present Transport Code (**PRESENT**)
- Write Carry and Erase Counter Stage (**WRITECARRY**)

## 104 CARD COMMENTS

- 104 card is among the lowest priced card, but security offered is very limited
- Security relies on procedural control of chip and card manufacturers
- application not limited to telephone prepaid card application but designer's creativity
- issuer must have control of the terminals to prevent card emulation
- tokens may be lost if card is pulled out between write and write-carry
- this card, will in the mid-term be obsoleted