

# OPTICAL ID IMAGE Decoder [ V1.5 ]

- two\_wire\_interface version

## 1. General Description

SN9P601FG is the lower cost version of OID decoder. It is designed for implementing SONiX newly developed D.H.R.T. Technology (Data Hiding & Retrieving Technology), which integrates the solution that includes CMOS sensor interface, image pattern recognizing engine, voltage regulator, RC oscillator and retrieved index output interface.

## 2. Feature of SN9P601FG

- Support dot pattern format : OID\_Code\_v1.5
- Core voltage operation range : 3.0V ~ 3.6V ( Reference design )
- Regulator input : 3.6V ~5.0V ( Reference design )
- Low power dissipation : 5mA (typ)
- Shot down current : <10uA
- Embedded 16 bit-DSP for sensor control and image pattern recognition
- Light source timing control
- Built-in voltage regulator
- Built-in 16Mhz RC type oscillator
- Built-in low battery detection
- Bi-directions communication in two wire serial interface
- Output Optical\_ID in two\_wire\_serial\_interface  
( Please refer to two\_wire\_interface\_v2.pdf )
- pin to pin compatible to SN9P701FG
- 48 pin LQFP package.

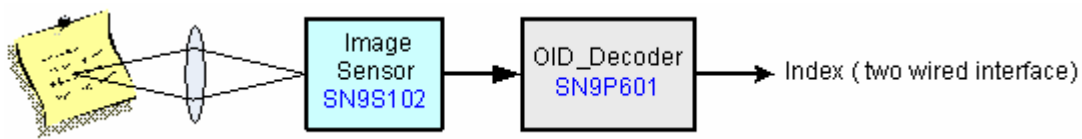
## 3. Feature of OID\_Code\_V1.5

OID\_Code\_V1.5 is the 1.5<sup>nd</sup> generation dot pattern used in OID system.

- Dimension of single dot pattern : ~ 1.0mm x 1.0mm
- Number of index : 15,000
- Low visual artifact
- Low visual fixed pattern noise
- Suggested paper type :art coated paper, [mid-grade paper\\*](#)

#### 4. Specification of 1.5<sup>nd</sup> generation OID decoding system

The 1.5<sup>nd</sup> generation OID decoding system is a low cost active detection module that provides a non-platform positioning engine for implementing Optical ID system, which reads the dot pattern on printed media by optically acquiring the surface image and translates the dot pattern into digits. The acquiring module includes the SONiX CMOS Image Sensor, an Image Decoder and a set of optical components ( a lens, two light sources, housing & case ) to provide a complete and compact Optical ID sensing engine. This sensing engine is a small stand alone module. It has no platform and requires no cable ( wireless version ) enabling it to be highly flexible and mobile.



- Supported dot pattern format: OID\_Code\_v1.5
- Hit rate : 98% (typ)
- Error rate : < 0.5% (typ)
- Illumination range of environment : 0 ~ 7,000 Lux
- Maximum scan speed : 2cm/sec
- Response time: 150ms(typ), controlled by internal firmware automatically.
- Tilt sensing range : - 40° ~ +40° (typ) / - 30° ~ +30° (guaranteed)
- Sensing distance between paper and tip of pen ( @ tilt angle= 0° ) : 0 ~ 1.5mm
- Support dot pattern printed by office-use 1200dpi laser printer for verification purpose (ex: Epson:N2120, HP 4000 series...)
- System power dissipation
  - operating current (off/on paper) : 2.5mA / 6mA (typ)
  - shot down current : < 30uA (typ)
- Low battery detection
- Supply voltage : 3.6V ~ 5.0V ( Reference design )
- Bi-directions communication via two\_wire\_interface\_v2
- Output Optical Index via two\_wire\_interface\_v2
- Selectable OSC type : RC type or X'tal type.

## 5. Comparison table of OID\_Decoding\_System v2 & v1.5

| ITEMS                                                            |                        | OID_Decoding_System V2                    | OID_Decoding_System V1.5                  |
|------------------------------------------------------------------|------------------------|-------------------------------------------|-------------------------------------------|
| Sensor module                                                    |                        | SNM9S102C2000A                            | SNM9S102C2000A                            |
| OID Decoder                                                      |                        | SN9P701F-005                              | SN9P601F-301                              |
| Sensor                                                           |                        | SN9S102CE                                 | SN9S102CE                                 |
| Graphic Code<br>( Dot Pattern )                                  | Version                | <a href="#">OID_Code_V2.0</a>             | <a href="#">OID_Code_V1.5</a>             |
|                                                                  | Indexes                | 0~ 65,535                                 | 0~ 15,000                                 |
|                                                                  | Graphic Code Size      | ~ 1.3mm x 1.3mm                           | ~ 1mm x 1mm                               |
|                                                                  | Visual Artifact Factor | 1.5%                                      | 2.7%                                      |
| Paper type                                                       | Art coated paper       | Yes                                       | Yes                                       |
|                                                                  | Mid- grade paper       | Yes<br>( ex: A4 grade paper for printer ) | Yes<br>( ex: A4 grade paper for printer ) |
|                                                                  | Low grade paper        | TBD                                       | NA                                        |
| Verified by Office-use laser printer                             |                        | Yes, ( ex:Epson, EPL-N2120)               | Yes, ( ex:Epson, EPL-N2120)               |
| Response Time (typical)                                          |                        | 100ms                                     | 150ms                                     |
| *Hit Rate (typical)                                              |                        | 98%                                       | 98%                                       |
| *Error Rate (typical)                                            |                        | < 0.1%                                    | < 0.5%                                    |
| *Illumination range of environment                               |                        | 0 ~ 10,000 Lux                            | 0 ~ 7,000 Lux                             |
| *Tilt angle (typical)                                            |                        | -45°~ +45°                                | -40°~ +40°                                |
| *Sensing range between paper and tip of pen ( @ tilt angle= 0° ) |                        | 0 ~ 2.0mm                                 | 0 ~ 1.5mm                                 |
| *System operating current ( off page )                           |                        | 1.5mA                                     | 2.5mA                                     |
| *System operating current ( on page )                            |                        | 4mA                                       | 6mA                                       |
| Shot down current                                                |                        | < 30uA                                    | < 30uA                                    |
| Linear regulator                                                 |                        | Built in                                  | Built in                                  |
| RC OSC / Crystal OSC                                             |                        | Built in / Built in                       | Built in / Built in                       |
| Low battery detection                                            |                        | Built in                                  | Built in                                  |
| Package                                                          |                        | LQFP 48 pin                               | LQFP 48 pin                               |

**Note:** \*Please check [SONiX](#) for detail test conditions

## 6. DC Electrical Characteristics

### a. Absolute maximum ratings

| Symbol   | Parameter           | Rating          | Units |
|----------|---------------------|-----------------|-------|
| VDD/VDD3 | Power Supply        | -0.3 to 3.6     | V     |
| VDD5     | 5V tolerance I/O    | -0.3 to 5       | V     |
| Vin      | Input Voltage       | -0.3 to Vcc+0.3 | V     |
| Vout     | Output Voltage      | -0.3 to Vcc+0.3 | V     |
| Tstg     | Storage Temperature | -55 to 150      | °C    |

### b. Recommended operating conditions

| Symbol | Parameter             | Min | Typ | Max | Units |
|--------|-----------------------|-----|-----|-----|-------|
| VDD3   | Power Supply          | 3.0 | 3.3 | 3.6 | V     |
| VDD5   | 5V tolerance I/O      | VDD |     | 5   | V     |
| Vin    | Input voltage         | 0   |     | Vcc | V     |
| Topr   | Operating Temperature | 0   |     | 50  | °C    |

### c. DC electrical characteristics

(Under Recommended Operating Conditions and Vcc=3.0 ~ 3.6V , Tj=0 to +115 °C )

| Symbol | Parameter                         | Conditions              | Min  | Typ | Max     | Units |
|--------|-----------------------------------|-------------------------|------|-----|---------|-------|
| Vil    | Input low voltage                 | LVTTL                   | -0.3 |     | 0.8     | V     |
| Vih    | Input high voltage                | LVTTL                   | 2.0  |     | Vcc+0.3 | V     |
| Iil    | Input low current                 | no pull-up or pull-down | -1   |     | 1       | uA    |
| Iih    | Input high current                | no pull-up or pull-down | -1   |     | 1       | uA    |
| Ioz    | Tri-state leakage current         |                         | -1   |     | 1       | uA    |
| Vol    | Output Low voltage                | *                       |      |     | 0.4     | V     |
| Voh    | Output high voltage               | *                       | 2.4  |     |         | V     |
| Cin    | Input capacitance                 |                         |      | 2.8 |         | pF    |
| Cout   | Output capacitance                |                         | 2.7  |     | 4.9     | pF    |
| Cbid   | Bi-directional buffer Capacitance |                         | 2.7  |     | 4.9     | pF    |

\* : Maximum output current 4mA I/O pin .

## 6. Pin Assignment

| LQFP<br>48 | PIN NAME | Type | Description                                                                                                                          |
|------------|----------|------|--------------------------------------------------------------------------------------------------------------------------------------|
| 1          | KEY1     | I    | KEY1 input ( internal pull down ) , connect to ground if no used                                                                     |
| 2          | GPIO0    | B    | General purpose I/O                                                                                                                  |
| 3          | GPIO1    | B    | General purpose I/O                                                                                                                  |
| 4          | GPIO2    | B    | General purpose I/O                                                                                                                  |
| 5          | VDD3     | P    | Digital VDD, 3.3V                                                                                                                    |
| 6          | GND      | P    | Digital ground                                                                                                                       |
| 7          | GPIO3    | B    | General purpose I/O                                                                                                                  |
| 8          | ADIO2    | B    | ADIO2/ADO_SDIO/IR_TRAN/RF_TRAN                                                                                                       |
| 9          | ADIO0    | B    | ADIO0/ADO_CLK                                                                                                                        |
| 10         | VSSD_OSC | P    | GND for oscillator                                                                                                                   |
| 11         | RC_BIAS  | P    | RC oscillator bias, using an external "R" to set frequency.<br>Recommended "R" = $29K\Omega \pm 1\%$ for $16MHz \pm 10\%$ frequency. |
| 12         | VDD_OSC  | P    | VDD for oscillator, 3.3V                                                                                                             |
| 13         | XIN      | I    | Crystal OSC input                                                                                                                    |
| 14         | XOUT     | B    | Crystal OSC output                                                                                                                   |
| 15         | XTAL_SEL | I    | OSC type selection ( 1:Crystal, 0:RC )                                                                                               |
| 16         | VDD3     | P    | Digital VDD, 3.3V                                                                                                                    |
| 17         | GND      | P    | GND for I/O and core                                                                                                                 |
| 18         | TAVSS    | P    | Reserved, please connect to digital GND                                                                                              |
| 19         | DN       | B    | Reserved, please connect $5K\Omega$ to digital GND                                                                                   |
| 20         | DP       | B    | Reserved, please connect $5K\Omega$ to digital VDD, 3.3V                                                                             |
| 21         | TAVDD    | P    | Reserved, please connect to digital VDD, 3.3V                                                                                        |
| 22         | VRO_S    | O    | Regulator 3.3 v switch output, controlled by internal firmware                                                                       |
| 23         | VRO_P    | O    | Regulator 3.3 v output, controlled by REG_EN                                                                                         |
| 24         | GND_A    | P    | Analog ground                                                                                                                        |
| 25         | REG_IN   | P    | Regulator input , 3.6V~5V                                                                                                            |
| 26         | REG_EN   | I    | Regulator enable                                                                                                                     |
| 27         | PWR_CTL  | O    | Output for power control                                                                                                             |
| 28         | VDD5D    | P    | Digital VDD, VDD3 ~ 5V, please do not connect to VRO_P                                                                               |
| 29         | ADIO1    | B    | ADIO1/ADO_SCK                                                                                                                        |
| 30         | USB_DET  | I    | Reserved, please connect to ground                                                                                                   |

|    |           |   |                                                                                                                                                                             |
|----|-----------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 31 | KEY0      | I | KEY0 input ( internal pull down )                                                                                                                                           |
| 32 | BAT_SW    | O | Switch for battery voltage detection                                                                                                                                        |
| 33 | BAT_DET   | I | Low voltage detection input.<br>Voltage applied to pin BAT_DET is compared with internal threshold level $(VDD3)/3$ and reports result via two wire interface every 10 sec. |
| 34 | RST       | B | Chip reset ( internal pull down )                                                                                                                                           |
| 35 | TEST      | I | Test pin for IC test, please connect to ground                                                                                                                              |
| 36 | KEY2      | I | KEY2 input ( internal pull down ) , connect to ground if not used                                                                                                           |
| 37 | VDD       | I | Digital VDD, 3.3V                                                                                                                                                           |
| 38 | GND       | P | Digital ground                                                                                                                                                              |
| 39 | SEN_CMD   | B | Sensor control interface, connect to SN9S102C directly                                                                                                                      |
| 40 | SEN_CLK   | O | Sensor clock, connect to SN9S102C directly                                                                                                                                  |
| 41 | SEN_D0    | I | Sensor image data input, connect to SN9S102C directly                                                                                                                       |
| 42 | SEN_D1    | I | Sensor image data input, connect to SN9S102C directly                                                                                                                       |
| 43 | OP_GND    | P | Analog ground                                                                                                                                                               |
| 44 | IRED1     | O | Output for IRED_1 control                                                                                                                                                   |
| 45 | IRED_FEB1 | I | Voltage feedback for IRED1 control                                                                                                                                          |
| 46 | IRED_FEB0 | I | Voltage feedback for IRED0 control                                                                                                                                          |
| 47 | IRED0     | O | Output for IRED_0 control                                                                                                                                                   |
| 48 | OP_VDD    | P | Analog VDD, 3.3V                                                                                                                                                            |

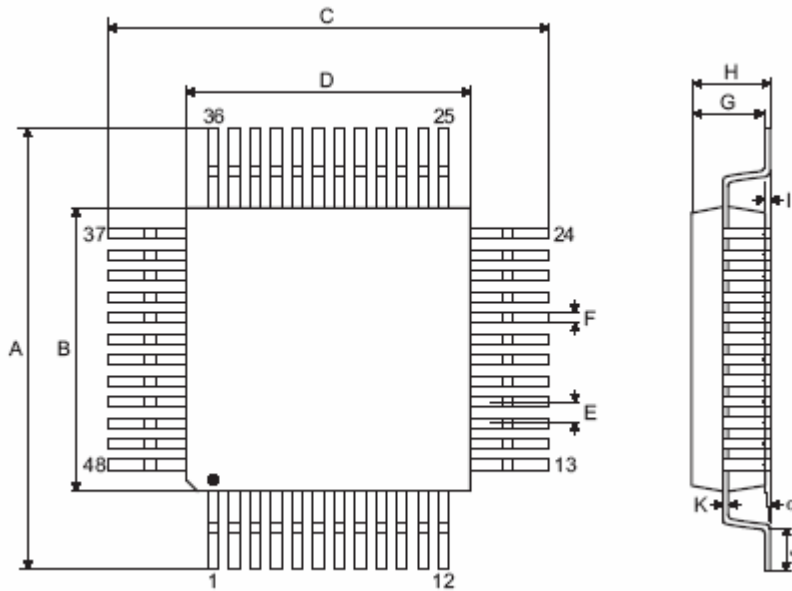
## **7. Built-in Regulator**

- Input voltage range : 3.6V~5.5V
- Output voltage :  $3.25V \pm 7\%$  @ REG\_IN = 4V
- Low Voltage drop :  $< 0.1V$  @ 30mA
- Shutdown supply current :  $< 10\mu A$
- Regulator with enable/shutdown control by pin REG\_EN
- Regulator enabled (REG\_EN > 0.9V) / Regulator disabled : (REG\_EN < 0.2V)

## **8. Built-in RC Oscillator**

- Supply voltage range : 3.0 ~ 3.6 V
- Recommended “R” =  $29K\Omega \pm 1\%$  for  $16MHz \pm 10\%$  frequency setting
- Mode selected by XTAL\_SEL , H : X’TAL , L : RC OSC

## 9. Package Information



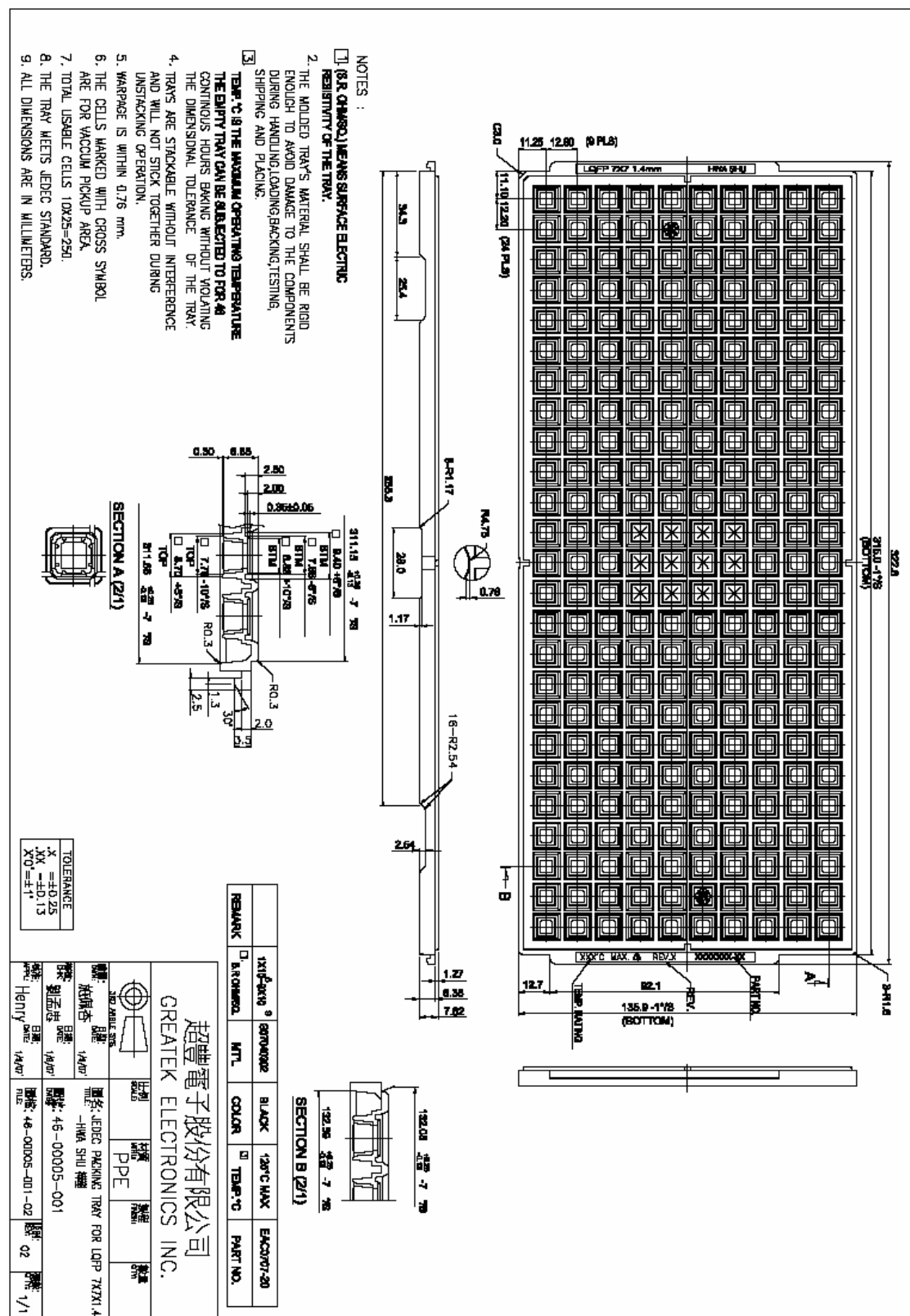
| Symbol   | Dimensions in mm |      |      |
|----------|------------------|------|------|
|          | Min.             | Nom. | Max. |
| A        | 8.9              | —    | 9.1  |
| B        | 6.9              | —    | 7.1  |
| C        | 8.9              | —    | 9.1  |
| D        | 6.9              | —    | 7.1  |
| E        | —                | 0.5  | —    |
| F        | —                | 0.2  | —    |
| G        | 1.35             | —    | 1.45 |
| H        | —                | —    | 1.6  |
| I        | —                | 0.1  | —    |
| J        | 0.45             | —    | 0.75 |
| K        | 0.1              | —    | 0.2  |
| $\alpha$ | 0°               | —    | 7°   |



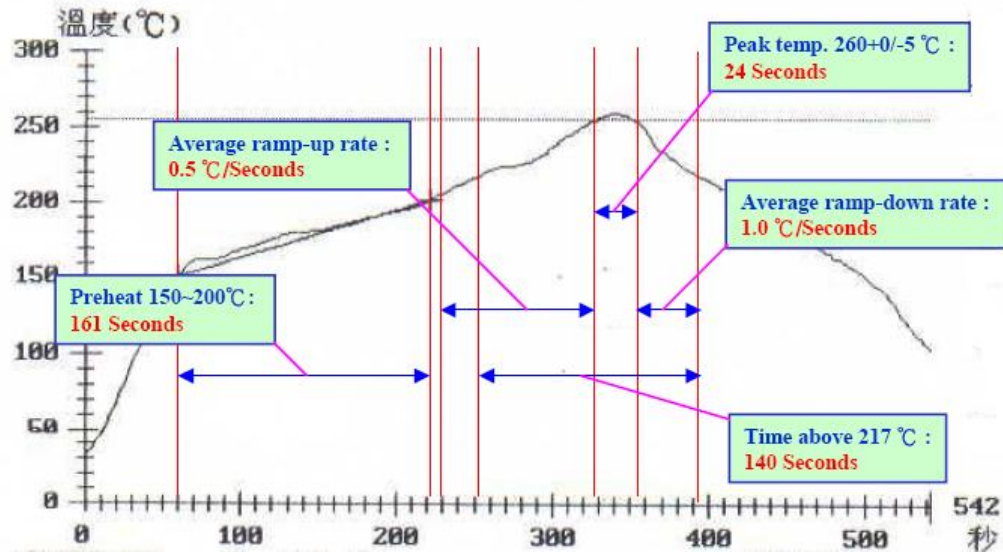
## **10.Reference Design ( for reference purposes only )**

Please refer to schematic of SN9P701FG.

## 11.Package Tray



## 12. Recommended re-flow condition



### 13. Packing Specifiction

#### 1. Inner box and Carton label

|            |       |           |                                                                                                              |
|------------|-------|-----------|--------------------------------------------------------------------------------------------------------------|
| LOGO       | SONiX |           | <div>RoHS</div> <div></div> |
| DEVICE     |       |           |                                                                                                              |
| LOT#       |       |           |                                                                                                              |
| P.O.#      |       |           |                                                                                                              |
| CUST PART# |       |           |                                                                                                              |
| TYPE       |       | DATE CODE |                                                                                                              |
| BIN        |       | PKG. TYPE |                                                                                                              |
| Q'TY       |       | QA.       |                                                                                                              |

Plating code:  
e1- SnAgCu  
e3-Pure Sn

#### 2. Tray Packing and Quantity summary



Indication label

Tray use AL bag  
vacuum packing

| Type | Pin count | EA/Per Tray | Tray/Per Inner Box | Quantity/Per Inner Box | Carry | Inner box/Per Carton | Quantity/Per Carton |
|------|-----------|-------------|--------------------|------------------------|-------|----------------------|---------------------|
| LQFP | 48        | 250         | 10                 | 2500                   | Tray  | 6                    | 15000               |

#### 3. Inner Box and Carton Dimension

| Box type  | Dimension(mm)        |
|-----------|----------------------|
| Inner Box | (L)360*(W)152*(H)90  |
| Carton    | (L)470*(W)370*(H)210 |