

## Photo Modules for PCM Remote Control Systems

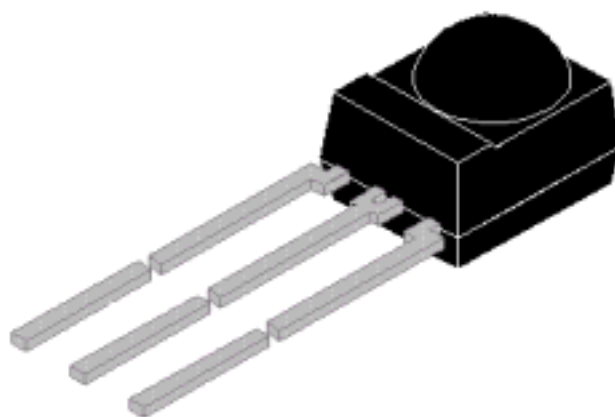
### ■ Available Types For Different Carrier Frequencies

| Type             | Fo            | Type             | Fo              |
|------------------|---------------|------------------|-----------------|
| <b>LTOP-2230</b> | <b>30 kHz</b> | <b>LTOP-2233</b> | <b>33 kHz</b>   |
| <b>LTOP-2236</b> | <b>36 kHz</b> | <b>LTOP-2237</b> | <b>36.7 kHz</b> |
| <b>LTOP-2238</b> | <b>38 kHz</b> | <b>LTOP-2240</b> | <b>40 kHz</b>   |
| <b>LTOP-2256</b> | <b>56 kHz</b> |                  |                 |

### ■ Description

The LTOP-22... series are miniaturized receivers for infrared remote control systems. PIN diode and preamplifier are assembled on lead frame, the epoxy package is designed as IR filter.

The demodulated output signal can directly be decoded by a microprocessor. The main benefit is the reliable function even in disturbed ambient and the protection against uncontrolled output pulses.



### ■ Features

- Photo detector and preamplifier in one package
- Internal filter for PCM frequency
- TTL and CMOS compatibility
- Output active low
- Improved shielding against electrical field disturbance
- Suitable burst length  $\geq 10$  cycle/burst

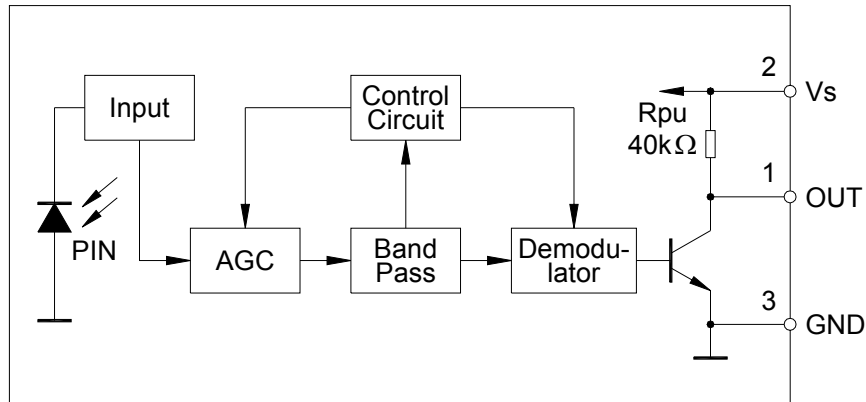
### ■ Special Features

- Small size package
- Enhanced immunity against all kinds of disturbance light
- No occurrence of disturbance pulses at the output
- Short settling time after power on
- Continuous data transmission possible (800 bit/s)

### ■ Applications

- TV sets
- Video recorders
- Sat receivers
- DVD
- Slide projectors
- Audio components
- Air conditioner
- Data communication
- Game equipment
- Sensors and light barrier systems for long distances

## Block Diagram



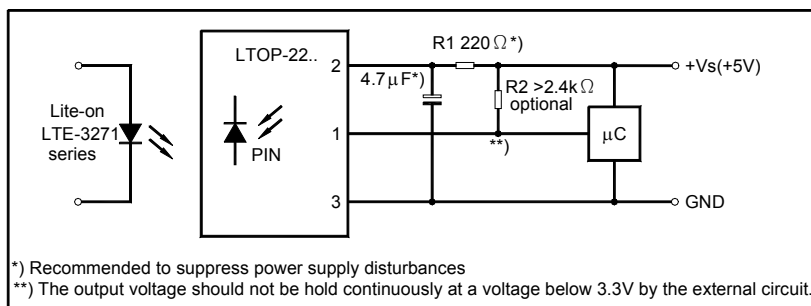
## Absolute Maximum Ratings (T<sub>amb</sub>=25°C)

| Parameter             | Test Conditions          | Symbol           | Value      | Unit |
|-----------------------|--------------------------|------------------|------------|------|
| Supply Voltage        |                          | V <sub>s</sub>   | -0.3...5.5 | V    |
| Supply Current        |                          | I <sub>s</sub>   | 5          | mA   |
| Output Voltage        |                          | V <sub>o</sub>   | -0.3...5.5 | V    |
| Output Current        |                          | I <sub>o</sub>   | 5          | mA   |
| Junction Temperature  |                          | T <sub>j</sub>   | 100        | °C   |
| Storage temperature   |                          | T <sub>stg</sub> | -25...+85  | °C   |
| Operating temperature |                          | T <sub>amb</sub> | -25...+85  | °C   |
| Power Consumption     | (T <sub>amb</sub> ≤85°C) | P <sub>tot</sub> | 50         | mW   |
| Soldering temperature | t≤10s, 1mm from case     | T <sub>sd</sub>  | 260        | °C   |

## Basic Characteristics (T<sub>amb</sub>=25°C)

| Parameter               | Test conditions                                                                                            | Symbol             | Min | Typ | Max  | Unit                |
|-------------------------|------------------------------------------------------------------------------------------------------------|--------------------|-----|-----|------|---------------------|
| Supply current (Pin2)   | V <sub>s</sub> =5V, E <sub>v</sub> =0                                                                      | I <sub>SD</sub>    | 0.8 | 1.1 | 1.5  | mA                  |
|                         | V <sub>s</sub> =5V, E <sub>v</sub> =40klx, sunlight                                                        | I <sub>SH</sub>    |     | 1.4 |      |                     |
| Supply voltage (Pin2)   |                                                                                                            | V <sub>S</sub>     | 4.5 |     | 5.5  | V                   |
| Output voltage low      | I <sub>osl</sub> =0.5mA, E <sub>e</sub> =0.7mW/m <sup>2</sup>                                              | V <sub>OSL</sub>   |     |     | 0.25 | V                   |
| Transmission distance   | E <sub>v</sub> =0, test signal see fig 7, IR diode LTE-3271, I <sub>F</sub> =250mA                         | L                  |     | 35  |      | m                   |
| Irradiance (30-40kHz)   | Pulse width tolerance: t <sub>pi</sub> -5/fo<t <sub>po</sub> <t <sub>pi</sub> +6/fo, test signal see fig.7 | E <sub>e min</sub> |     | 0.2 | 0.4  | mW / m <sup>2</sup> |
| Irradiance (56kHz)      | Pulse width tolerance: t <sub>pi</sub> -5/fo<t <sub>po</sub> <t <sub>pi</sub> +6/fo, test signal see fig.7 | E <sub>e min</sub> |     | 0.3 | 0.5  | mW / m <sup>2</sup> |
| Irradiance              |                                                                                                            | E <sub>e max</sub> | 30  |     |      | W / m <sup>2</sup>  |
| Directivity(horizontal) | Angle of half transmission distance                                                                        | φ <sub>H1/2</sub>  |     | ±60 |      | deg                 |
| Directivity(vertical)   | Angle of half transmission distance                                                                        | φ <sub>V1/2</sub>  |     | ±45 |      | deg                 |

## Application Circuit



## Suitable Data Format

The circuit of the LTOP-22.. is designed in that way that unexpected output pulses due to noise or disturbance signals are avoided. A bandpassfilter, an integrator stage and an automatic gain control are used to suppress such disturbances.

The distinguishing marks between data signal and disturbance signal are carrier frequency, burst length and duty cycle.

The data signal should fulfill the following condition:

- Carrier frequency should be close to center frequency of the bandpass (e.g. 38kHz)
- Burst length should be 10 cycles/burst or longer
- After each burst which is between 10 cycles and 70 cycles a gap time of at least 14 cycles is necessary
- For each burst which is longer than 1.8ms a corresponding gap time is necessary at some time in the data stream. This gap time should be at least 4 times longer than the burst.

- Up to 800 short bursts per second can be received continuously.

Some examples for suitable data format are: NEC Code, Toshiba Micom Format, Sharp Code, RC5 Code, RC6 Code, R-2000 Code.

When a disturbance signal is applied to the LTOP-22.. it can still receive the data signal. However the sensitivity is reduced to that level that no unexpected pulses will occur.

Some examples for such disturbance signals which are suppressed by the LTOP-22.. are:

- DC light (e.g. from tungsten bulb or sunlight)
- Continuous signal at 38kHz or at any other frequency
- Signals from fluorescent lamps with electronic ballast with high or low modulation (see fig. A or fig. B)

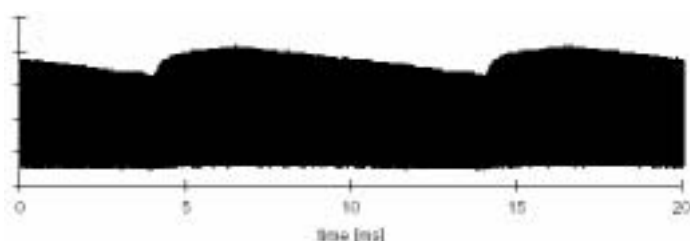


Figure A: IR Signal from Fluorescent Lamp with low Modulation

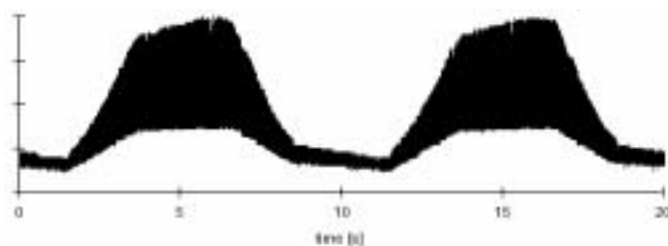


Figure B: IR Signal from Fluorescent Lamp with high Modulation

## Typical Characteristics (T<sub>amb</sub>=25°C unless otherwise specified)

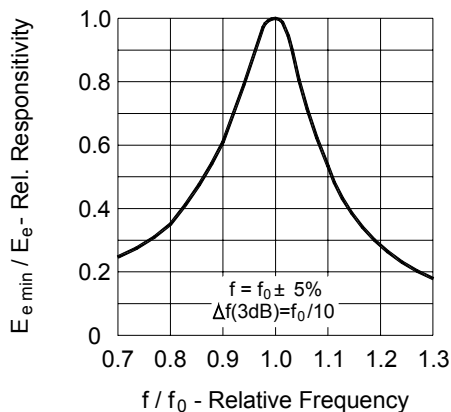


FIG.1 Frequency Dependence of Responsivity

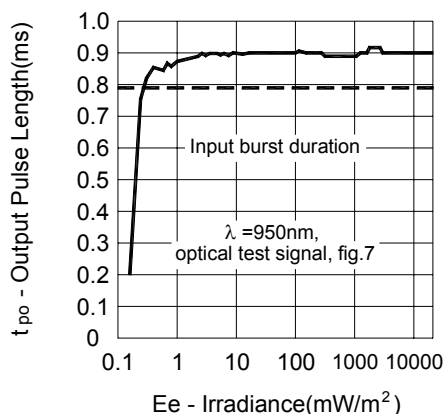


FIG.2 Sensitivity in Dark Ambient

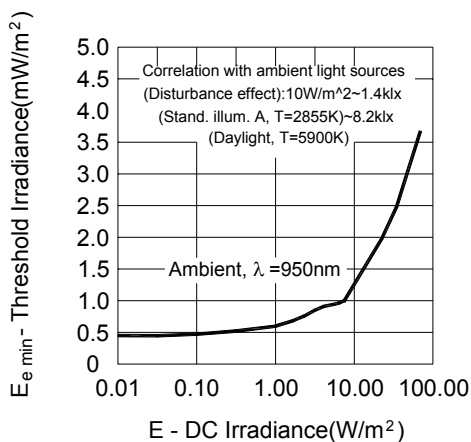


FIG.3 Sensitivity in Bright Ambient

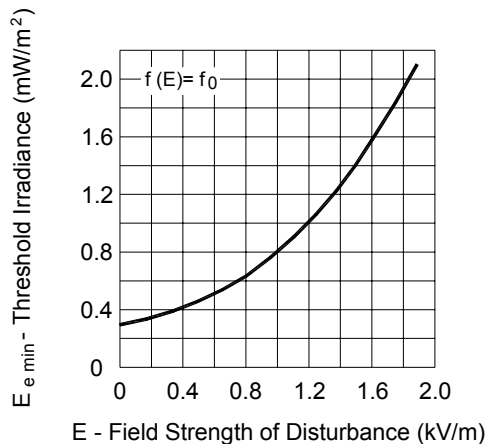


FIG.4 Sensitivity vs. Electric Field Disturbances

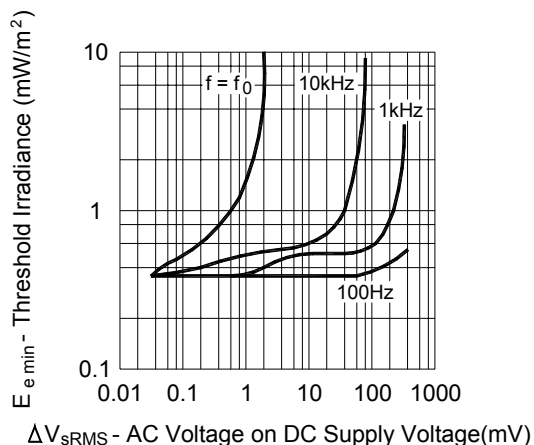


FIG.5 Sensitivity vs. Supply Voltage Disturbances

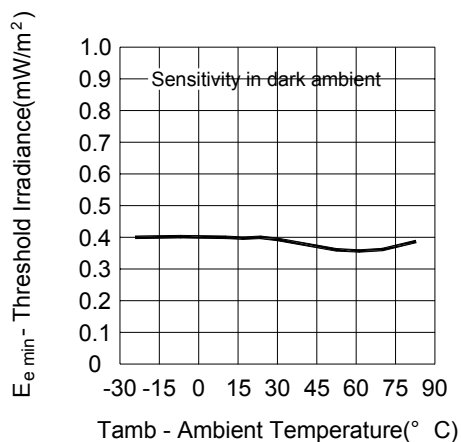


FIG.6 Sensitivity vs. Ambient Temperature

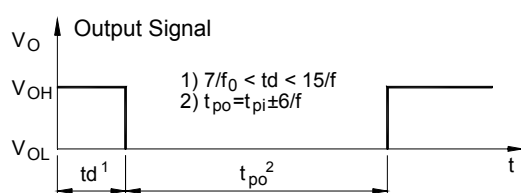
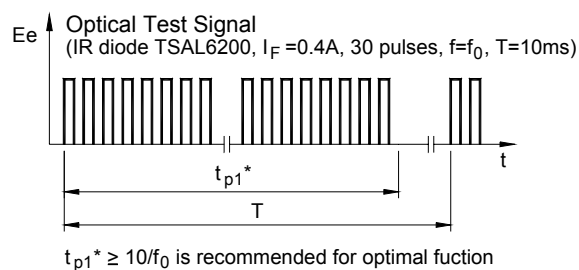


FIG.7 Output Function

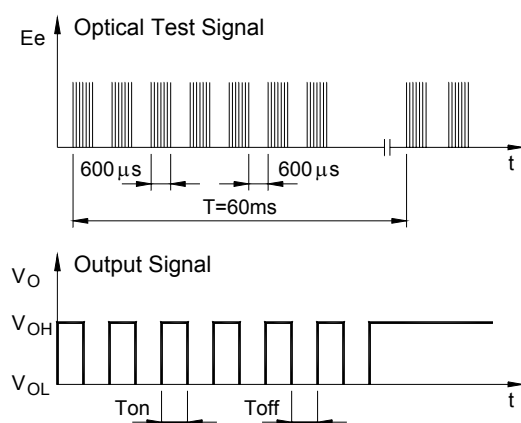


FIG.8 Output Function

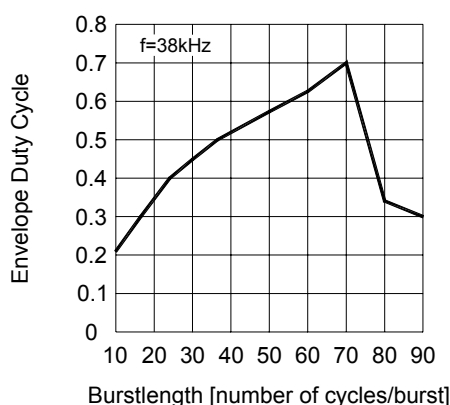


FIG.9 Max. Envelope Duty Cycle vs. Burstlength

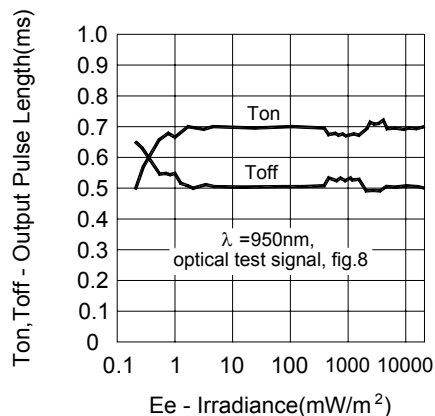


FIG.10 Output Pulse Diagram

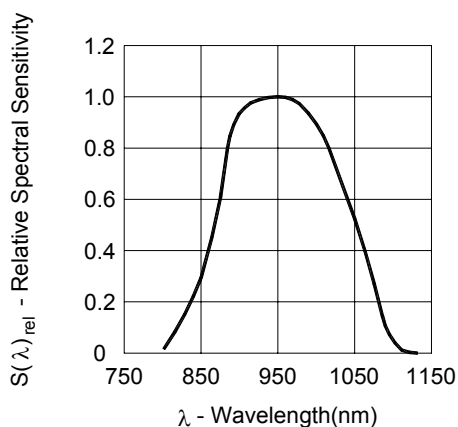


FIG.11 Relative Spectral Sensitivity vs. Wavelength

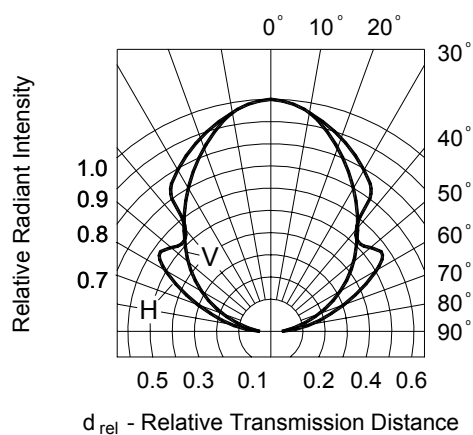
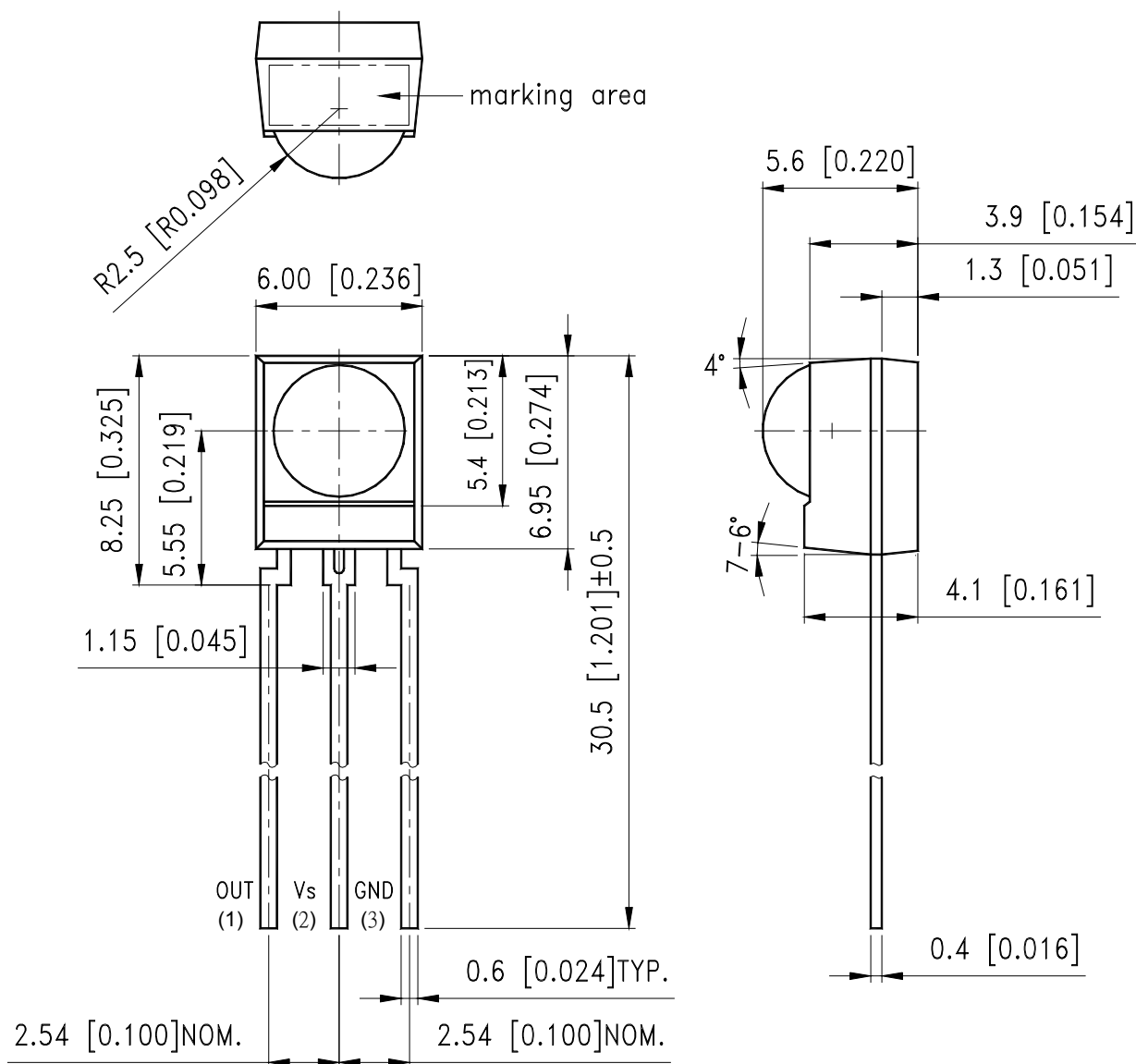


FIG.12 Directivity

## ■ Dimensions



### NOTES:

1. All dimensions are in millimeters (inches).
2. Tolerance is : ±0.3mm (0.012") unless otherwise noted.

## ■ Reliability Test Items And Conditions

| Test Items                       | Test Conditions                                                                 | Failure Judgment Criteria                                                      | Samples(N) /Defective(C) |
|----------------------------------|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------------|
| High Temperature Storage         | Ta:85°C<br>Test Time:1000hrs                                                    | Performance test requirement and criteria given in page 2 should be satisfied. | N=22<br>C=0              |
| Low Temperature Storage          | Ta:-25°C±5°C<br>Test Time:1000hrs                                               |                                                                                | N=22<br>C=0              |
| Operation Life                   | Ta: 85°C<br>Vcc=5V<br>Test Time:240hrs                                          |                                                                                | N=22<br>C=0              |
| High Temp. & High Humid. Storage | Ta:40°C±5°C<br>RH:90%±5<br>Test Time:240hrs                                     |                                                                                | N=22<br>C=0              |
| Temperature Cycling              | -25°C~25°C~85°C~25°C<br>30min 5min 30min 5min<br>Test Cycles: 20cycles          |                                                                                | N=22<br>C=0              |
| Vibration                        | 10 to 55 Hz/sweep 1min<br>Overall amplitude:1.5mm<br>X,Y,Z direction, 2hrs each |                                                                                | N=11<br>C=0              |
| Soldering Heat                   | T. Sol:260°C±5°C<br>Dwell Time:5±1sec/ 2 times                                  |                                                                                | N=11<br>C=0              |
| Solderability                    | T. Sol:230°C±5°C<br>Dwell Time:5±1sec                                           |                                                                                | N=11<br>C=0              |
| Lead Pull                        | Weight:500g,<br>direction axial<br>Test Time:30secs                             |                                                                                | N=11<br>C=0              |
| Lead Bend                        | Weight:250g,<br>bend each lead 0-90-0,<br>2 times                               |                                                                                | N=11<br>C=0              |
| Mechanical shock                 | Weight:100g,<br>6ms/3 directions/3 times                                        |                                                                                | N=11<br>C=0              |

■ Product Designation And Selection Type Designation Code

