LITEON®
OPTOELECTRONICS

# Photocoupler

## Product Data Sheet

## 6N135-L / 6N136-L series

**Spec No.: DS70-2008-0032**

Effective Date: 04/12/2016

Revision: A

**LITE-ON DCC**

**RELEASE**

BNS-OD-FC001/A4

**LITE-ON Technology Corp. / Optoelectronics**
No.90,Chien 1 Road, Chung Ho, New Taipei City 23585, Taiwan, R.O.C.
Tel: 886-2-2222-6181 Fax: 886-2-2221-1948 / 886-2-2221-0660

# Photocoupler
# 6N135-L 6N136-L series

## 1. DESCRIPTION

The 6N135/ 6N136-L consists of a high efficient AlGaAs Light Emitting Diode and a high speed optical detector. This design provides excellent AC and DC isolation between the input and output sides of the Optocoupler. Connection for the bias of the photodiode improves the speed that of a conventional phototransistor coupler by reducing the base-collector capacitances. The internal shield ensures high common mode transient immunity. A guaranteed common mode transient immunity is up to 1KV/μsec.

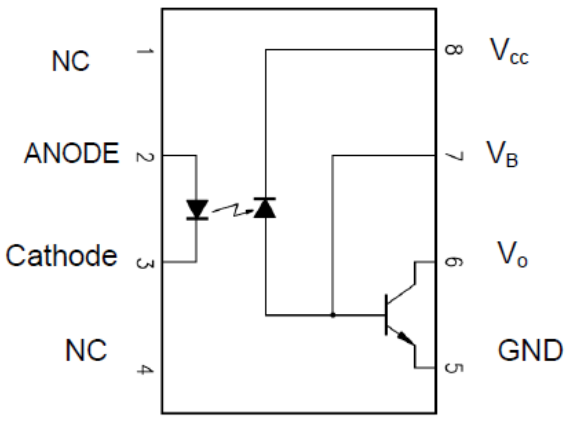
### 1.1 Features

- High speed – 1MBd typical
- Available in Dual-in-line, Wide lead spacing, Surface mounting package.
- Storable output.
- UL, CSA approval

### 1.2 Applications

- Isolation in line receivers
- Digital isolation for A/D, D/A conversion
- Ground loop elimination
- Feedback Element in Switching Mode Power Supplier
- Pulse transformer replacement
- Power transistor isolation in motor drives
- Interface between Microprocessor system, computer and their peripheral

### 1.3 Functional Diagram




Truth Table (Positive Logic)

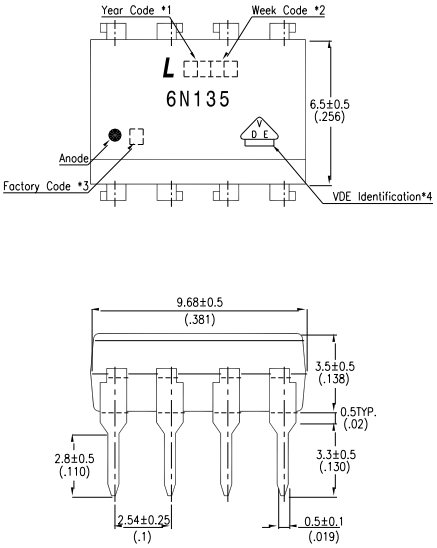
| LED | OUT |
|---|---|
| ON | L |
| OFF | H |

A 0.1μF bypass Capacitor must be connected between Pin8 and Pin5

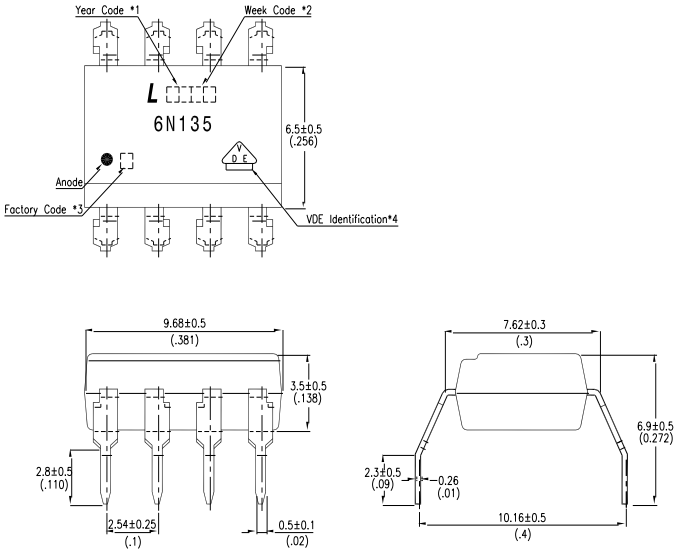
# Photocoupler
# 6N135-L 6N136-L series

## 2. PACKAGE DIMENSIONS

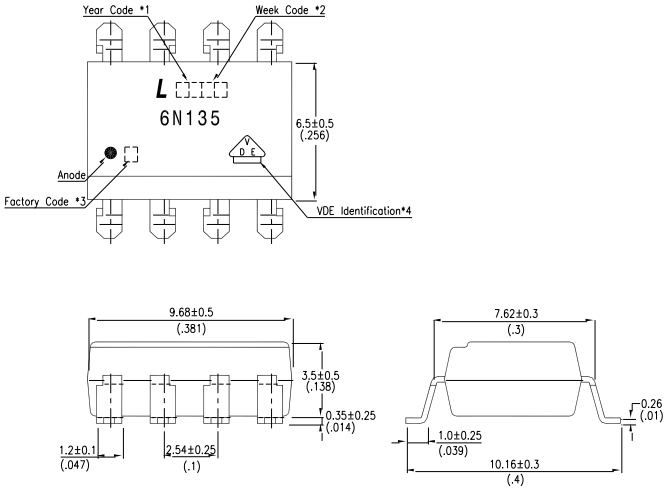
### 2.1 6N135-L




### 2.2 6N135M-L




### 2.3 6N135S-L



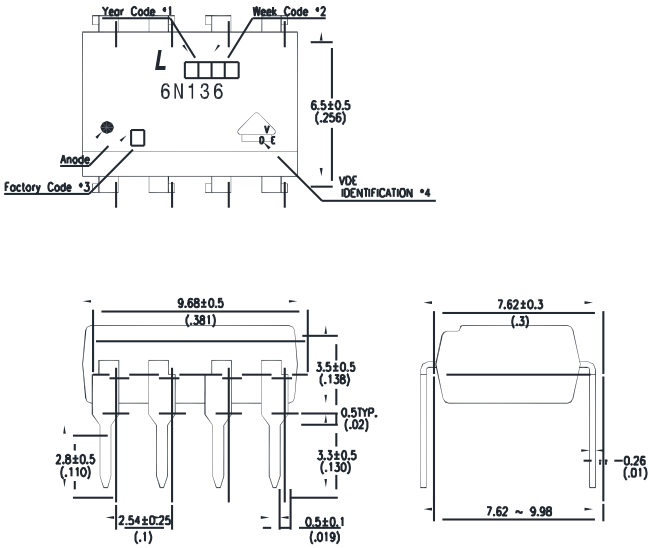

**Notes :**

1. Year date code.
2. 2-digit work week.
3. Factory identification mark shall be marked (Y: Thailand , W: China-CZ)
4. For VDE option.

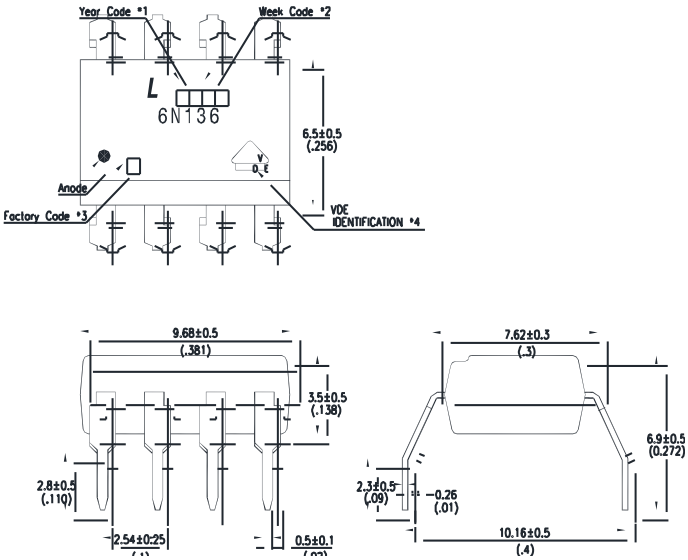
Dimensions in millimeters (inches).

# Photocoupler
# 6N135-L 6N136-L series

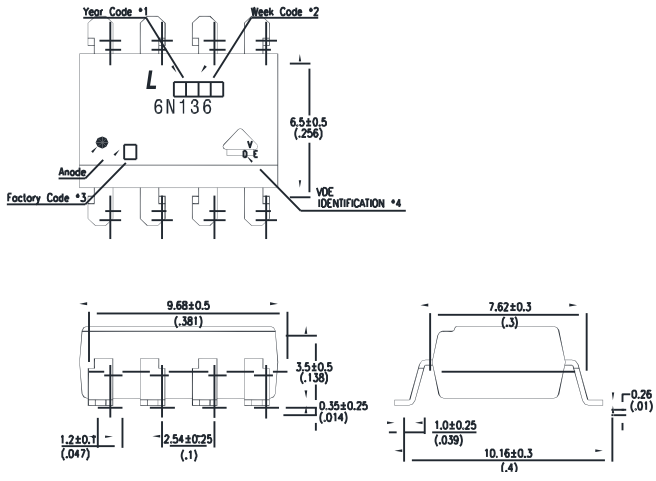
## 2.4 6N136-L




## 2.5 6N136M-L




## 2.6 6N136S-L



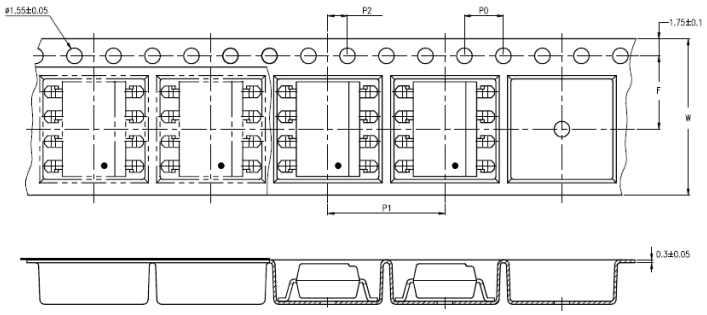

**Notes :**

1. Year date code.
2. 2-digit work week.
3. Factory identification mark shall be marked
   (Y: Thailand , W: China-CZ)
4. For VDE option.

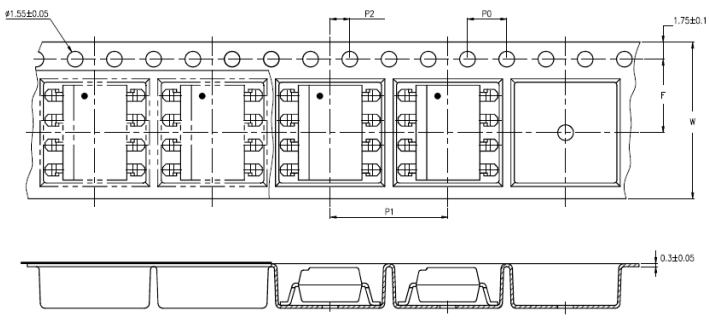
Dimensions in millimeters (inches).

## 3. TAPING DIMENSIONS

### 3.1 6N135S-TA-L/ 6N136S-TA-L




### 3.2 6N135S-TA1-L/ 6N136S-TA1-L




| Description | Symbol | Dimension in mm (inch) |
|---|---|---|
| Tape wide | W | 16±0.3 (0.63) |
| Pitch of sprocket holes | $P_0$ | 4±0.1 (0.15) |
| Distance of compartment | F | 7.5±0.1 (0.295) |
| | $P_2$ | 2±0.1 (0.079) |
| Distance of compartment to compartment | $P_1$ | 12±0.1 (0.472) |

### 3.3 Quantities Per Reel

| Package Type | TA / TA1 |
|---|---|
| Quantities (pcs) | 1000 |

# 4. RATING AND CHARACTERISTICS

## 4.1 Absolute Maximum Ratings at Ta=25°C *1

| | Parameter | Symbol | Rating | Unit | Note |
|---|---|---|---|---|---|
| Input | Average Forward Input Current | $I_F$ | 25 | mA | 2 |
| | Reverse Input Voltage | $V_R$ | 5 | V | |
| | Power Dissipation | $P_I$ | 45 | mW | |
| | Junction temperature | $T_J$ | 125 | °C | |
| Output | Output Collector Current | $I_O$ | 8 | mA | |
| | Output Collector Voltage | $V_O$ | 20 | V | |
| | Output Collector Power Dissipation | $P_o$ | 100 | mW | |
| | Junction temperature | $T_J$ | 125 | °C | |
| | Isolation Voltage | $V_{ISO}$ | 5000 | $V_{rms}$ | |
| | Supply Voltage | $V_{CC}$ | 15 | V | |
| | Operating Temperature | $T_{opr}$ | -40 ~ +85 | °C | |
| | Storage Temperature | $T_{stg}$ | -55 ~ +125 | °C | |
| | Lead Solder Temperature *2 | $T_{sol}$ | 260 | °C | |

1. Ambient temperature = 25°C, unless otherwise specified. Stresses exceeding the absolute maximum ratings can cause permanent damage to the device. Exposure to absolute maximum ratings for long periods of time can adversely affect reliability.

2. 260°C for 10 seconds. Refer to Lead Free Reflow Profile.

## 4.2 ELECTRICAL OPTICAL CHARACTERISTICS at $T_A$ = 25°C

| Parameters | Test Condition | Symbol | Device | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| **Input** | | | | | | | |
| Input Forward Voltage | $I_F$ =16mA, $T_A$=25℃ | $V_F$ | 6N135 6N136 | | 1.4 | 1.7 | V |
| Input Reverse Voltage | $I_R$ = 10μA $T_A$=25℃ | $BV_R$ | | 5 | - | - | V |
| **Detector** | | | | | | | |
| Current transfer ratio | $I_F$=16mA; Vo=0.4V; $V_{CC}$=4.5V; $T_A$=25℃ | CTR | 6N135 | 7 | 18 | 50 | % |
| | | | 6N136 | 19 | 24 | 50 | |
| Logic low output voltage | $I_F$=16mA;Vcc=4.5V; $I_o$=1.1mA; $T_A$=25℃ | $V_{OL}$ | 6N135 | - | 0.18 | 0.4 | V |
| | $I_F$=16mA;Vcc=4.5V; $I_o$=3mA; $T_A$=25℃ | | 6N136 | - | 0.25 | 0.4 | |
| Logic high output current | $I_F$=0mA, Vo=Vcc=5.5V; $T_A$=25℃ | $I_{OH}$ | 6N135 | - | - | 0.5 | μA |
| | $I_F$=0mA, Vo=Vcc=15V; $T_A$=25℃ | | 6N136 | - | - | 1 | |
| Logic low supply current | $I_F$=16mA, $V_o$=open (Vcc=15V) | $I_{ccL}$ | 6N135 6N136 | - | 400 | - | μA |
| Logic high supply current | $I_F$=0mA, $V_o$=open ; $T_A$=25℃ (Vcc=15V) | $I_{ccH}$ | 6N135 6N136 | - | - | 1 | μA |

* All Typical at $T_A$=25°C

## 5. SWITCHING SPECIFICATION

| Parameter | Test Condition | Symbol | Device | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| Propagation Delay Time to Low Output Level | $T_A$=25℃ ($R_L$=4.1KΩ, $I_F$=16mA) | $t_{PHL}$ | 6N135 | - | 0.09 | 1.5 | μs |
| | $T_A$=25℃ ($R_L$=1.9KΩ, $I_F$=16mA) | | 6N136 | - | 0.1 | 0.8 | |
| Propagation Delay Time to High Output Level | $T_A$=25℃ ($R_L$=4.1KΩ, $I_F$=16mA) | $t_{PLH}$ | 6N135 | - | 0.8 | 1.5 | μs |
| | $T_A$=25℃ ($R_L$=1.9KΩ, $I_F$=16mA) | | 6N136 | - | 0.4 | 0.8 | |
| Logic High Common Mode Transient Immunity | $I_F$=0mA;$V_{CM}$=10Vp-p; $R_L$=4.1KΩ; $T_A$=25C | $\|CM_H\|$ | 6N135 | 1 | 10 | - | KV/μs |
| | $I_F$=0mA;$V_{CM}$=10Vp-p; $R_L$=1.9KΩ; $T_A$=25C | | 6N136 | | | | KV/μs |
| Logic Low Common Mode Transient Immunity | $I_F$=0mA;$V_{CM}$=10Vp-p; $R_L$=4.1KΩ; $T_A$=25C | $\|CM_L\|$ | 6N135 | 1 | 10 | - | KV/μs |
| | $I_F$=0mA;$V_{CM}$=10Vp-p; $R_L$=1.9KΩ; $T_A$=25C | | 6N136 | | | | KV/μs |

* $T_A$=0~70℃, Vcc=5V, unless otherwise specified.

* All Typical at $T_A$=25°C

## 6. ISOLATION CHARACTERISTIC

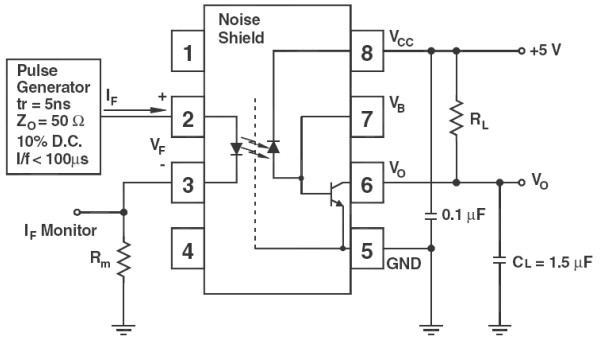
| Parameter | Symbol | Min. | Typ. | Max. | Unit | Test Condition |
|---|---|---|---|---|---|---|
| Input-Output Insulation Leakage Current | $I_{I-O}$ | — | — | 1.0 | μA | 45% RH, t = 5s, $V_{I-O}$ = 3kV DC, $T_A$ =25°C |
| Withstand Insulation Test Voltage | $V_{ISO}$ | 5000 | — | — | $V_{RMS}$ | RH ≤ 50%, t = 1min, $T_A$ = 25°C |
| Input-Output Resistance | $R_{I-O}$ | — | $10^{12}$ | — | Ω | $V_{I-O}$ = 500V DC |

*All Typical at $T_A$ =25°C

**Notes**

1. A 0.1μF or bigger bypass capacitor for $V_{CC}$ is needed as shown in Fig.1
2. Current Transfer Ratio is defined as the ratio of output collector current Io , to the forward LED input current IF, times 100.
3. The 1.9KΩ load represents 1TTL unit load of 1.6mA and the 5.6KΩ pull-up resistor.
4. The 4.1KΩ load represents 1LSTTL unit load of 0.36mA and the 6.1KΩ pull-up resistor.

## 7. SWITCHING TIME TEST CIRCUIT



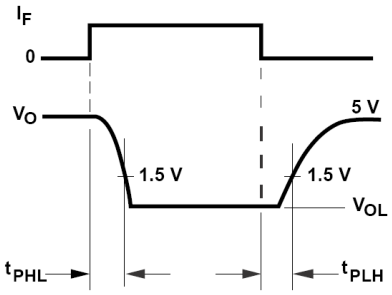
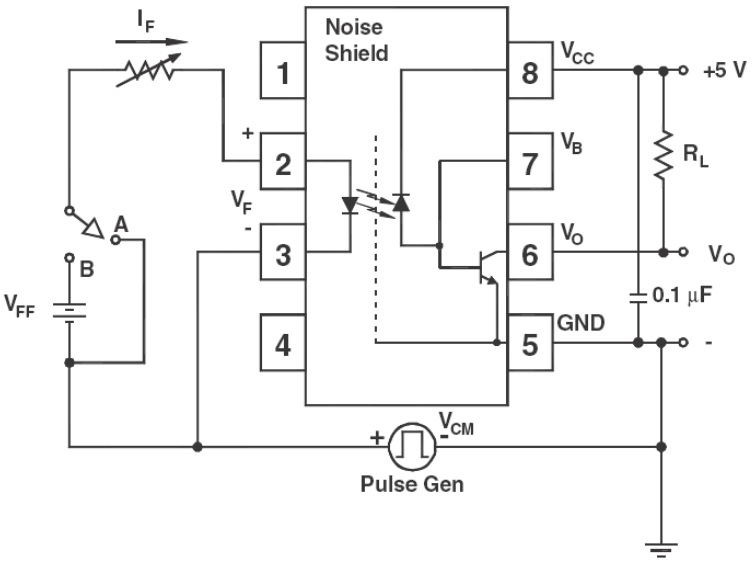




**Figure 1: Test Circuit for $t_{PHL}$ and $t_{PLH}$**



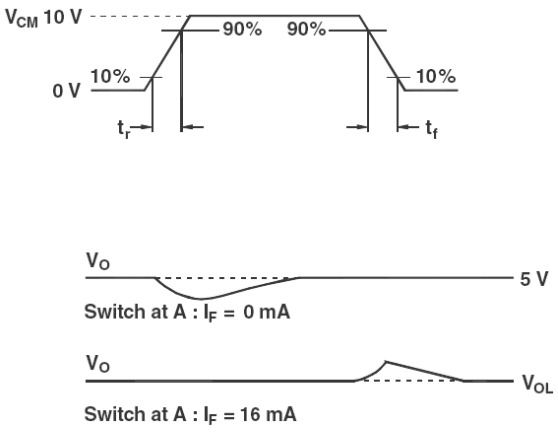




**Figure 2: Single Channel Test Circuit for Common Mode Transient Immunity**

## 8. CHARACTERISTIC CURVES

Figure 3: DC and pulsed transfer characteristics

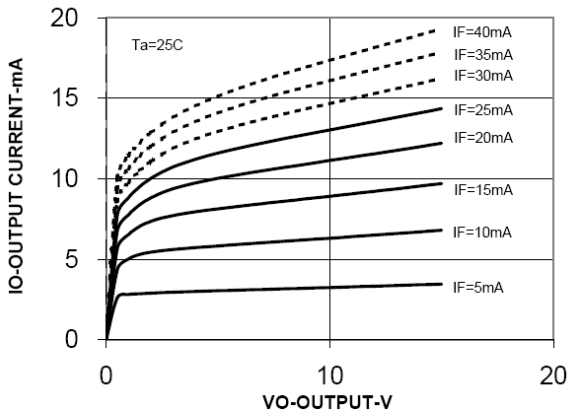



Figure 4: Input current vs. forward voltage

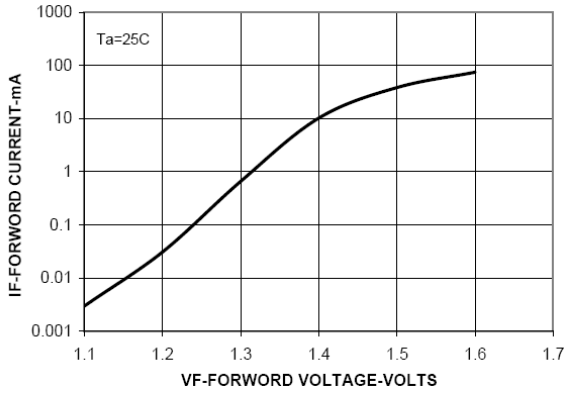



Figure 5: Logic high output current vs. temperature

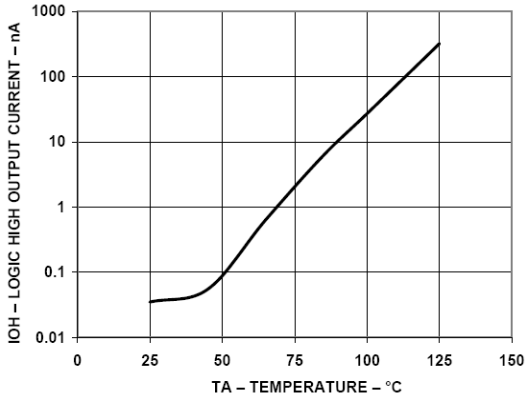



Figure 6: Current transfer ratio vs. input current

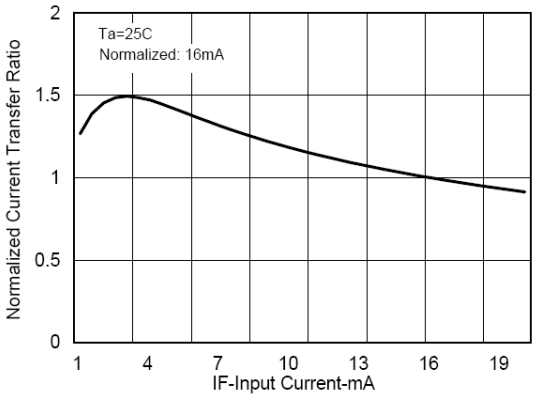



Figure 7: Current transfer ratio vs. temperature

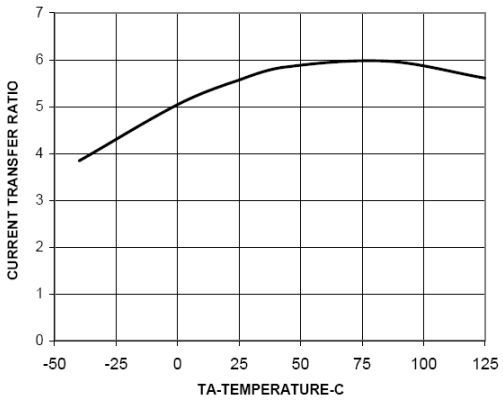



Figure 8: Small-signal current transfer ratio vs. quiescent current

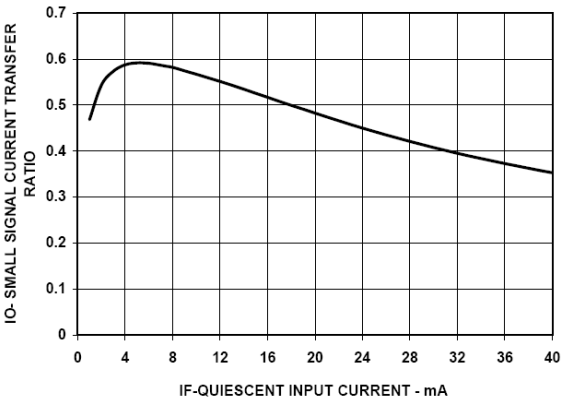


Figure 9: Propagation delay time vs. temperature

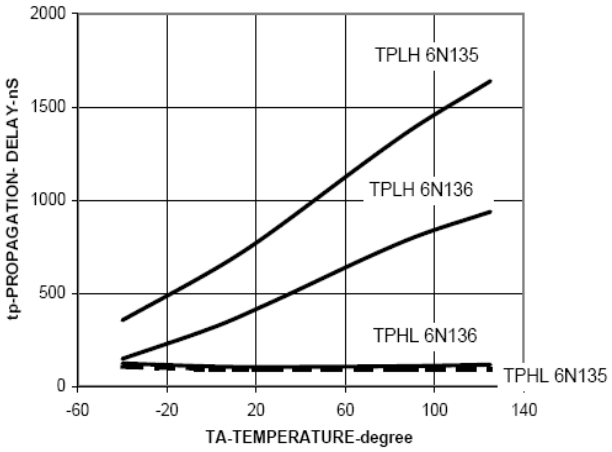
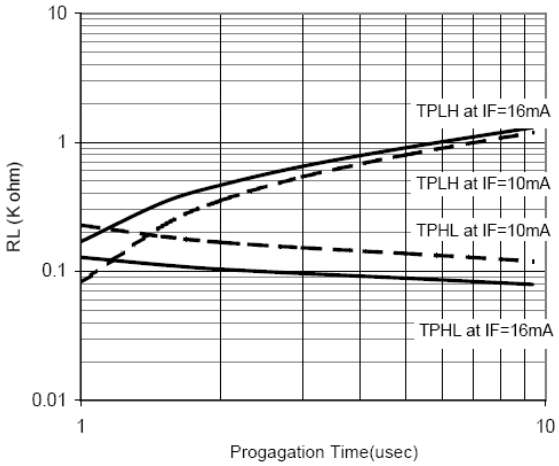



Figure 10: Propagation delay time vs. load resistance

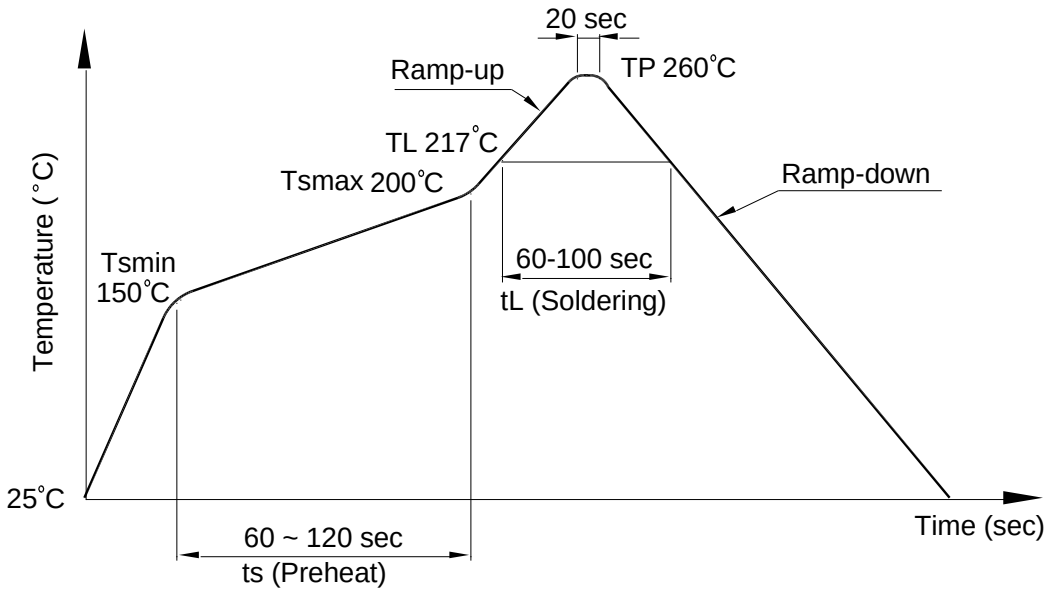


# 9. TEMPERATURE PROFILE OF SOLDERING

## 9.1 IR Reflow soldering (JEDEC-STD-020C compliant)

One time soldering reflow is recommended within the condition of temperature and time profile shown below. Do not solder more than three times.

| Profile item | Conditions |
|---|---|
| Preheat | |
| - Temperature Min ($T_{Smin}$) | 150˚C |
| - Temperature Max ($T_{Smax}$) | 200˚C |
| - Time (min to max) (ts) | 90±30 sec |
| Soldering zone | |
| - Temperature ($T_L$) | 217˚C |
| - Time ($t_L$) | 60 ~ 100 sec |
| Peak Temperature ($T_P$) | 260˚C |
| Ramp-up rate | 3˚C / sec max. |
| Ramp-down rate | 3~6˚C / sec |



## 9.2 Wave soldering (JEDEC22A111 compliant)

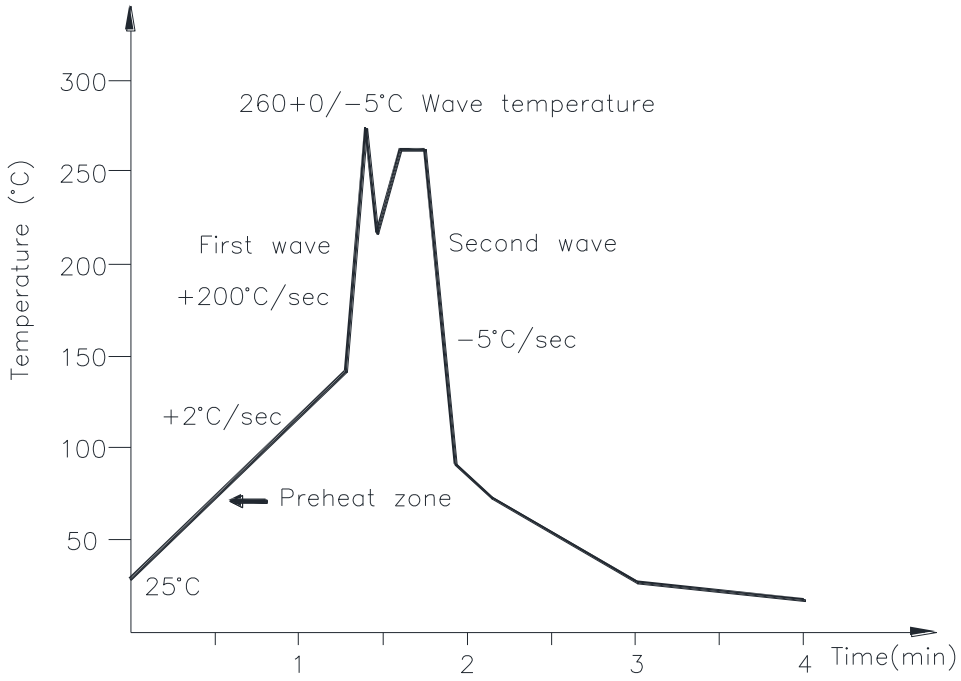
One time soldering is recommended within the condition of temperature.

Temperature: 260+0/-5˚C

Time: 10 sec.

Preheat temperature:25 to 140˚C

Preheat time: 30 to 80 sec.



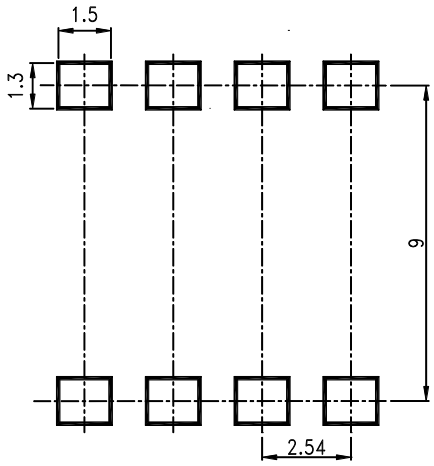

## 9.3 Hand soldering by soldering iron

Allow single lead soldering in every single process. One time soldering is recommended.

Temperature: 380+0/-5˚C

Time: 3 sec max.

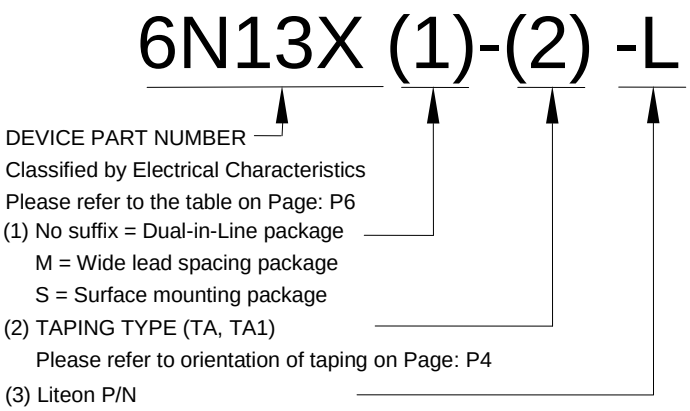
## 10. RECOMMENDED FOOT PRINT PATTERNS (MOUNT PAD)



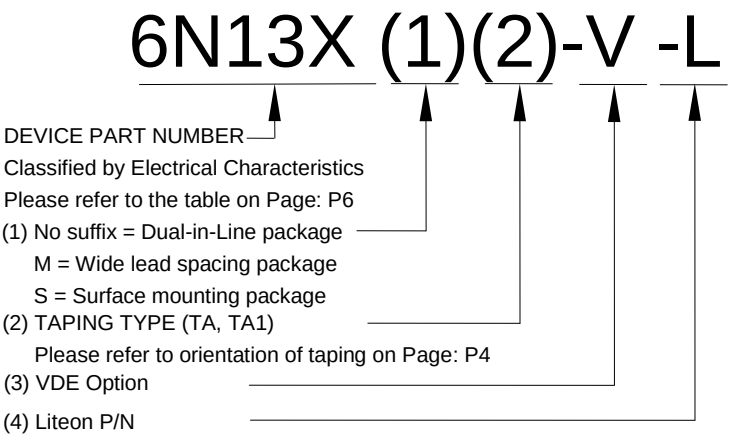

**Note :**

Dimensions in millimeters.

## 11. NAMING RULE




Example : 6N135S-TA1-L, 6N136S-TA1-L




Example : 6N135STA1-V-L, 6N136STA1-V-L

## 12. NOTES

- LiteOn is continually improving the quality, reliability, function or design and LiteOn reserves the right to make changes without further notices.
- The products shown in this publication are designed for the general use in electronic applications such as office automation equipment, communications devices, audio/visual equipment, electrical application and instrumentation.
- For equipment/devices where high reliability or safety is required, such as space applications, nuclear power control equipment, medical equipment, etc, please contact our sales representatives.
- When requiring a device for any “specific” application, please contact our sales in advice.
- If there are any questions about the contents of this publication, please contact us at your convenience.
- The contents described herein are subject to change without prior notice.
- Immerge unit’s body in solder paste is not recommended.