恒拓电子
HENGTUO ELECTRONICS

# *HT series*

## Photo Coupler
## Product Specification

# HT-6N138

# HT-6N139

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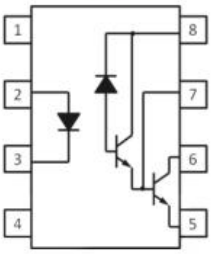
## ■ Package

Schematic




Pin Configuration
1. No Connection
2. Anode
3. Cathode
4. No Connection
5. Gnd
6. $V_{out}$
7. $V_B$
8. $V_{CC}$

## ■ Description

The 6N138 and 6N139 devices each consists of an infrared emitting diode, optically coupled to a high gain split Darlington photo detector. They provide extremely high current transfer ratio between input and output, with access to a base terminal to adjust the gain bandwidth.These devices are packaged in an 8-pin DIP package and available in wide-lead spacing and SMD options.

## ■ Features

- High current transfer ratio–2000% typical
- High isolation voltage between input and output (Viso=5000 Vrms )
- Guaranteed performance from 0°C to 70°C
- Pb free and RoHS compliant.
- UL and CUL approved
- CQC approved
- VDE approved

## ■ Applications

- Digital logic ground isolation
- RS-232C line receiver
- Low input current line receiver
- Microprocessor bus isolation
- Current loop receiver

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# ■ Product Nomenclature

The product name is designated as below:

HT-6N13X -X X- X X- XX
① ② ③ ④ ⑤

Designation:

HT =Hengtuo Technology Co.,LTD.
6N13X= Product Series
① = Lead form option(1)
② = Tape and Reel option(2)
③ = VDE order option(fixed code "V")
④ = Halogen free option(fixed code"G")
⑤= Customer code

Notes

1. Lead form option:

| Symbol | Description |
|---|---|
| S1 | DIP-S1 |
| M | DIP-M |
| NONE | DIP/SOP Normal |

2. Tape and Reel option:

| Symbol | Description |
|---|---|
| TP&TP1 | Tape and Reel Type |
| NONE | DIP&SOP Type |

# ■ Marking Information


Designation:

| | |
|---|---|
| HT | denotes Hengtuo |
| 6N138 | denotes Device |
| YY | denotes year code |
| WW | denotes week code |
| V | denotes VDE |

# ■ Maximum Ratings(Ta=25℃)

| Parameter | | Symbol | Values | Unit |
|---|---|---|---|---|
| Input | Forward Current | $I_F$ | 20 | mA |

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| | | | | | |
|---|---|---|---|---|---|
| | Peak forward current (50% duty, 1ms P.W) | | $I_{FP}$ | 40 | mA |
| | Peak transient Current (≤1μs P.W,300pps) | | IFtrans | 1 | A |
| | Reverse voltage | | $V_R$ | 5 | V |
| | Power dissipation | | $P_{IN}$ | 45 | mW |
| Output | Power dissipation | | $P_C$ | 85 | mW |
| | Output current | | $V_{ECO}$ | 50 | mA |
| | Emitter-Base Reverse Voltage | | VER | 0.5 | V |
| | Output voltage | 6N138 | $V_O$ | -0.5 to 7 | V |
| | | 6N139 | | -0.5 to 18 | |
| | Supply voltage | 6N138 | $V_{CC}$ | -0.5 to 7 | V |
| | | 6N139 | | -0.5 to 18 | |
| Isolation voltage(1) | | | $V_{ISO}$ | 5000 | V rms |
| Operating temperature | | | $T_{OPR}$ | -40 ~ +85 | °C |
| Storage temperature | | | $T_{STG}$ | -55 ~ +125 | °C |
| Soldering temperature (2) | | | $T_{SOL}$ | 260 | °C |

Notes:
(1). AC for 1 minute, R.H.= 40 ~ 60% R.H. In this test, pins 1, 2, 3 & 4 are shorted together, and pins 5, 6, 7 & 8 are shorted together.
(2).For 10 seconds

## ■ Electronic Optical Characteristics

**(TA = 0 to 70°C unless specified otherwise)**

| Parameter | | | Symbol | Min. | Typ. | Max. | Unit | Conditon |
|---|---|---|---|---|---|---|---|---|
| Input | Forward Voltage | | $V_F$ | - | 1.3 | 1.7 | V | $I_F$=1.6mA |
| | Reverse voltage | | $V_R$ | 5.0 | - | - | V | $I_R$=10μA, $T_A$=25°C |
| | Temperature coefficient of forward voltage | | ΔVF/ΔTA | - | -1.8 | - | mV/°C | IF =1.6mA |
| Output | Logic High Output Current | 6N138 | $I_{OH}$ | - | 0.01 | 100 | μA | IF=0mA, $V_O$=$V_{CC}$=18V |
| | | 6N139 | | - | - | 250 | | |
| | Logic Low Supply Current | 6N138 | $I_{CCL}$ | - | 0.6 | 1.5 | mA | IF=1.6mA, $V_O$=Open,VCC=18V |
| | | 6N139 | | | | | | |
| | Logic High Supply | 6N138 | $I_{CCH}$ | - | 0.05 | 10 | μA | IF=0mA , $V_O$=Open, |
| | | 6N139 | | | | | | |

| | |
|---|---|
| Current | VCC=18V |

## ■ Transfer Characteristics

**(Ta=0 to 70°C unless specified otherwise, $V_{CC}$=4.5V)**

| Parameter | | Symbol | Min. | Typ. | Max. | Unit | Conditon |
|---|---|---|---|---|---|---|---|
| Current Transfer Ratio | 6N139 | CTR | 400 | 2500 | - | % | $I_F$ = 0.5mA, $V_O$ = 0.4V, $V_{CC}$=4.5V |
| | | | 500 | 2000 | - | | $I_F$ = 1.6mA, $V_O$ = 0.4V, $V_{CC}$ =4.5V |
| | 6N138 | | 300 | 2000 | - | | |
| Logic Low Output Voltage | 6N139 | $V_{OL}$ | - | 0.05 | 0.4 | V | $I_F$ = 0.5mA, IO = 2mA, $V_{CC}$ =4.5V |
| | | | - | 0.09 | 0.4 | | $I_F$ = 1.6mA, $I_O$ = 8mA, $V_{CC}$ =4.5V |
| | | | - | 0.12 | 0.4 | | $I_F$ = 5mA, $I_O$ = 15mA, $V_{CC}$ =4.5V |
| | | | - | 0.17 | 0.4 | | $I_F$ = 12mA, $I_O$ = 24mA, $V_{CC}$ =4.5V |
| | 6N138 | | - | 0.06 | 0.4 | | $I_F$ = 1.6mA, $I_O$ = 4.8mA, $V_{CC}$ =4.5V |

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## ■ Switching Characteristics

**(Ta=0 to 70°C unless specified otherwise, $V_{CC}$=5V)**

| Parameter | | Symbol | Min. | Typ. | Max. | Unit | Conditon |
|---|---|---|---|---|---|---|---|
| Propagation Delay Time to Logic Low (Fig. 13) | 6N139 | $T_{PHL}$ | - | 5 | 25 | μs | $I_F$ = 0.5mA , $R_L$=4.7kΩ, $T_A$=25°C |
| | | | - | - | 30 | | $I_F$ = 0.5mA , $R_L$ =4.7kΩ |
| | | | - | 0.2 | 1 | | $I_F$ = 12mA , $R_L$ =270Ω, $T_A$ =25°C |
| | | | - | - | 2 | | $I_F$ = 12mA , $R_L$ =270Ω |
| | 6N138 | | - | 35 | 10 | | $I_F$ = 1.6mA , $R_L$ =2.2kΩ, $T_A$ =25°C |
| | | | | | 15 | | $I_F$ = 1.6mA , $R_L$ =2.2kΩ |
| Propagation Delay Time to Logic High (Fig. 13) | 6N139 | $T_{PLH}$ | - | 16 | 60 | μs | $I_F$ = 0.5mA , $R_L$ =4.7kΩ, $T_A$ =25°C |
| | | | - | - | 90 | | $I_F$ = 0.5mA , $R_L$ =4.7kΩ |
| | | | - | 1.7 | 7 | | $I_F$ = 12mA , $R_L$ =270Ω, $T_A$ =25°C |
| | | | - | - | 10 | | $I_F$ = 12mA , $R_L$ =270Ω |
| | 6N138 | | - | 8 | 35 | | $I_F$ = 1.6mA , $R_L$ =2.2kΩ, $T_A$ =25°C |
| | | | - | | 50 | | $I_F$ = 1.6mA , $R_L$ =2.2kΩ |
| Common Mode Transient Immunity at Logic High (Fig. 14) *3 | | $C_{MH}$ | 1000 | - | - | V/μs | $I_F$ = 0mA , $V_{CM}$ =10$V_{p-p}$, $R_L$ =2.2KΩ, $T_A$ =25°C |
| Common Mode Transient Immunity at Logic Low (Fig. 14) *3 | | $C_{ML}$ | 1000 | - | - | V/μs | $I_F$ = 1.6mA , $V_{CM}$=10$V_{p-p}$, $R_L$=2.2KΩ, $T_A$=25°C |

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* Typical values at Ta = 25°C

# ■ Typical Electro-Optical Characteristics Curves

Fig.1 LED Forward Current vs. Forward Voltage

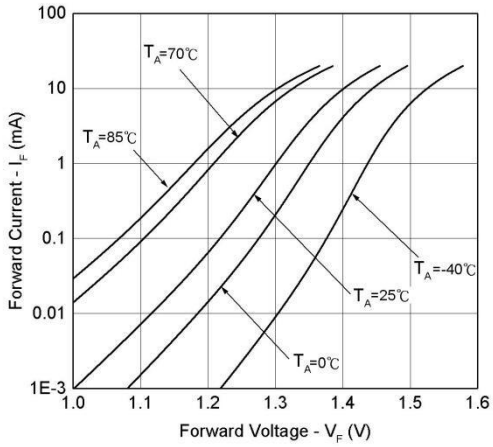



Fig.2 LED Forward Voltage vs. Temperature

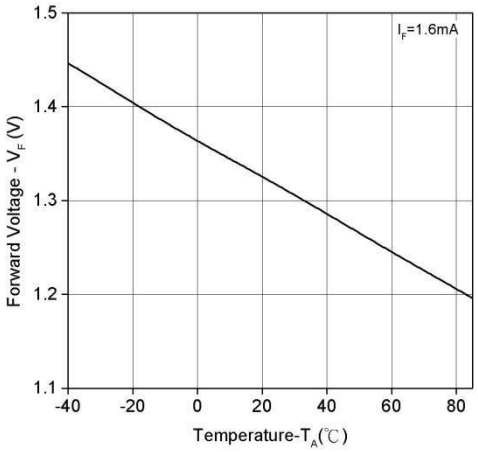



Fig.3 Output Current vs. Output Voltage

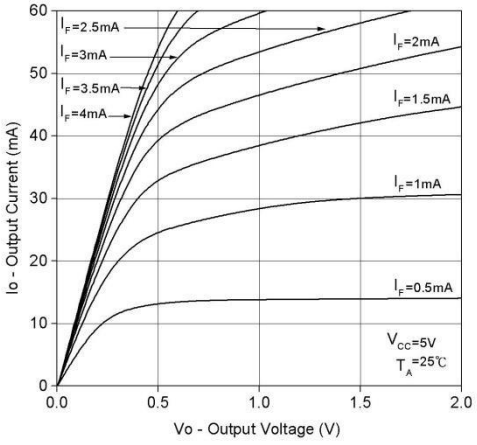



Fig.4 Output Current vs. Input Diode Forward Current

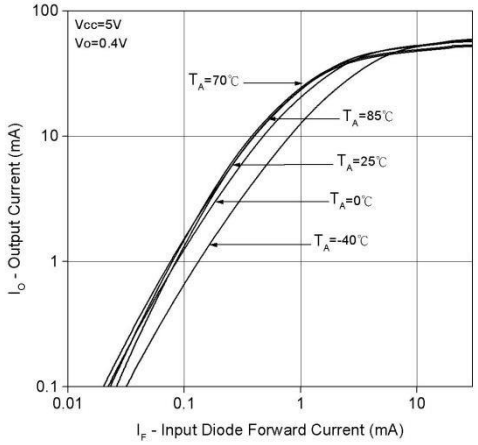



Fig.5 Current Transfer Ratio vs. Forward Current

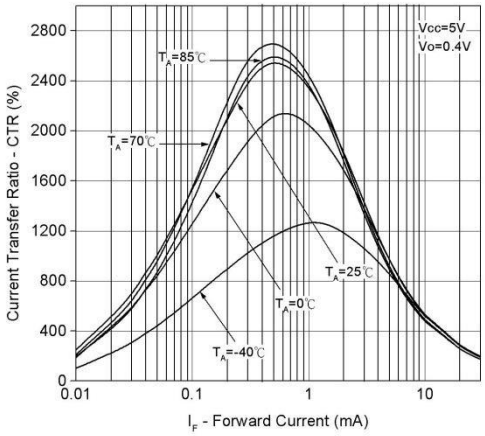



Fig.6 Current Transfer Ratio vs. Base-Emitter Resistance

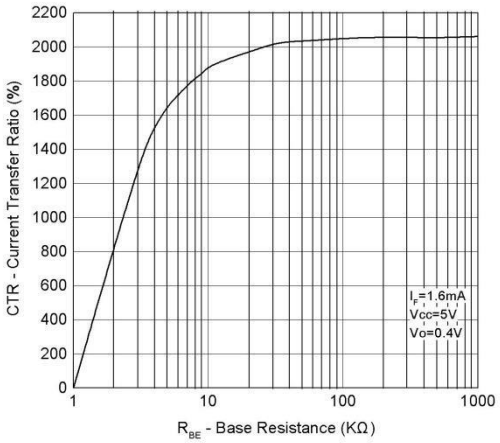


Fig.7 Non-saturated Rise nand Fall Times vs. Load Resistance

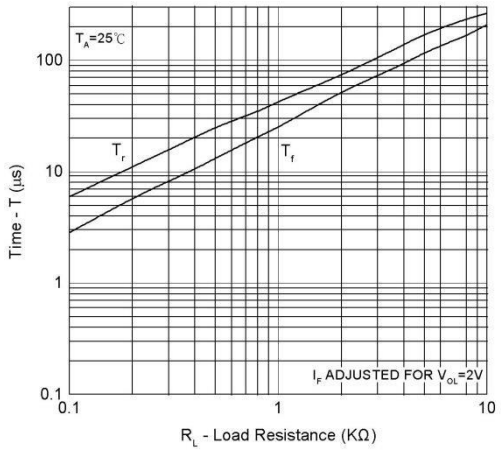



Fig.8 Propagation Delay To Logic Low vs. Base-Emitter Resistance

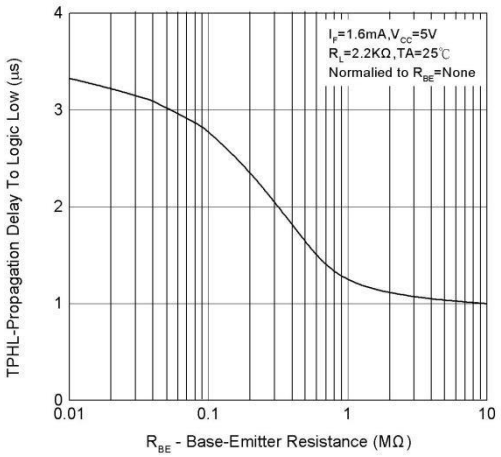



Fig.9 Propagation Delay vs. Input Diode Forward Current

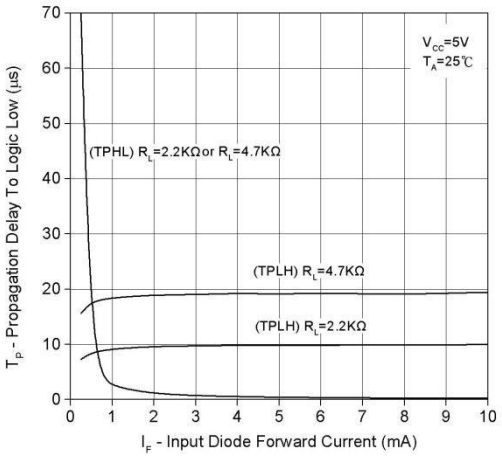



Fig.10 Propagation Delay to Logic Low vs. Pulse Period

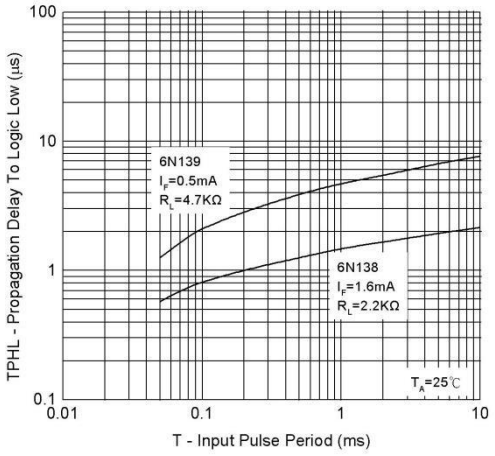



Fig.11 Propagation Delay vs. Temperature

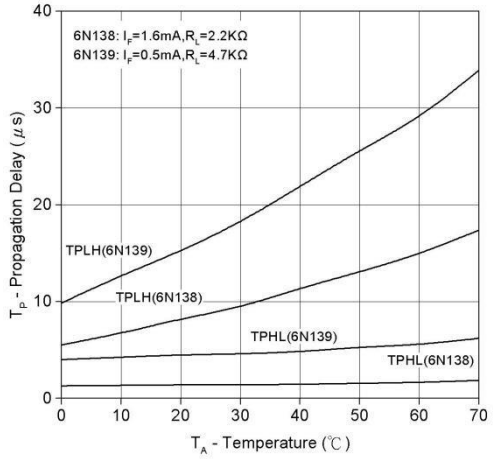



Fig.12 Logic Low Supply Current vs. Input Diode Forward Current

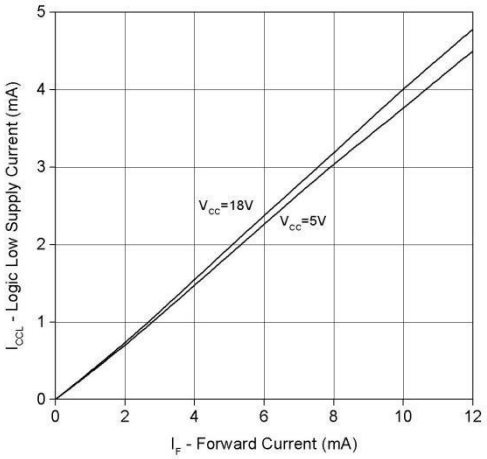



Fig. 13 Switching Time Test Circuit and Waveform

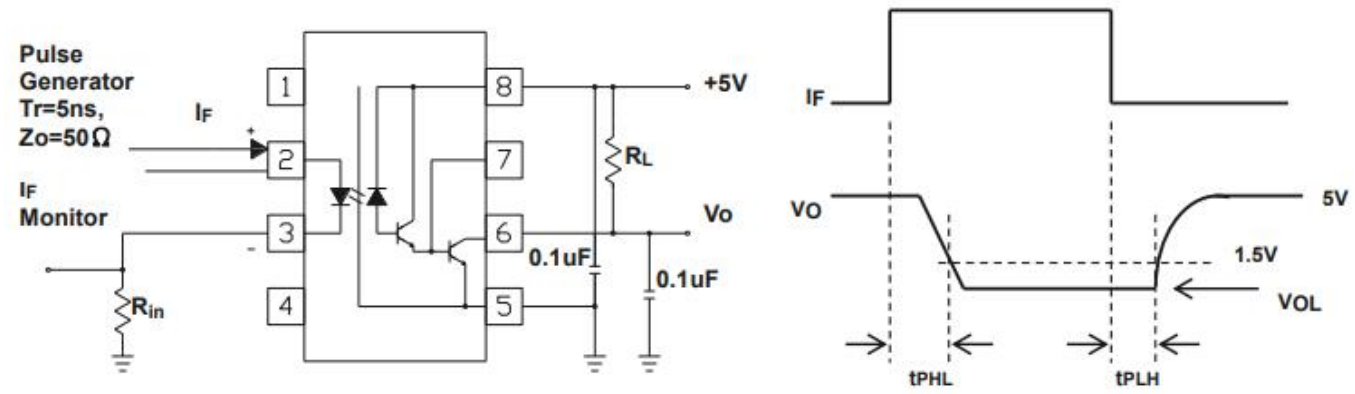
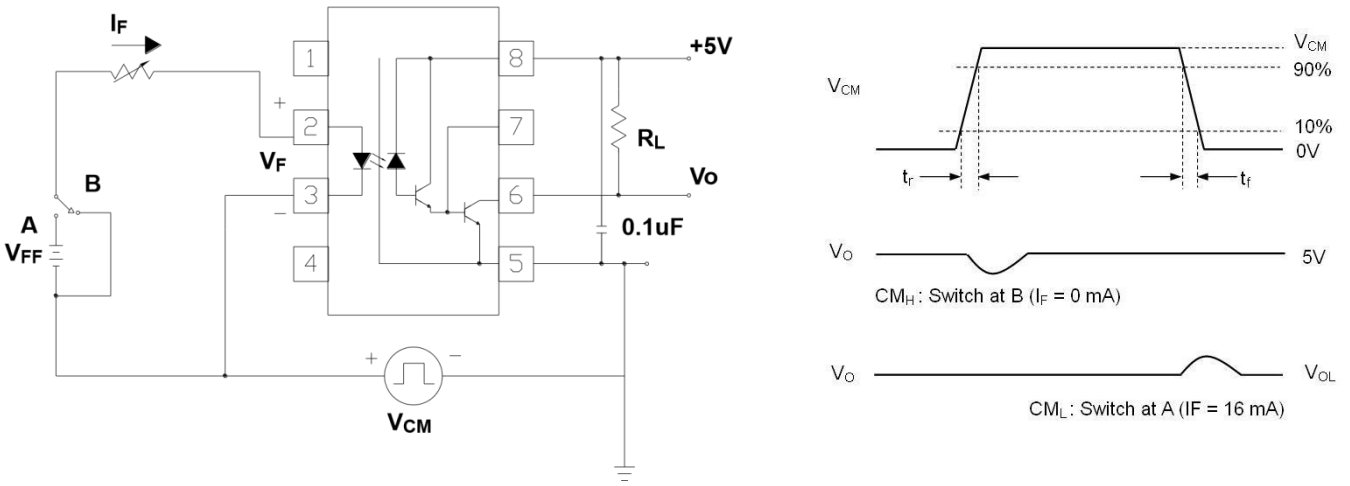



Fig. 14 Common Mode Transient Immunity Test Circuit and Waveform




**Note:**

*3 Common mode transient immunity in logic high level is the maximum tolerable (positive) dVcm/dt on the leading edge of the common mode pulse signal VCM, to assure that the output will remain in a logic high state (i.e., VO > 2.0V).

Common mode transient immunity in logic low level is the maximum tolerable (negative) dVcm/dt on the trailing edge of the common mode pulse signal, VCM, to assure that the output will remain in a logic low state (i.e., VO < 0.8V).

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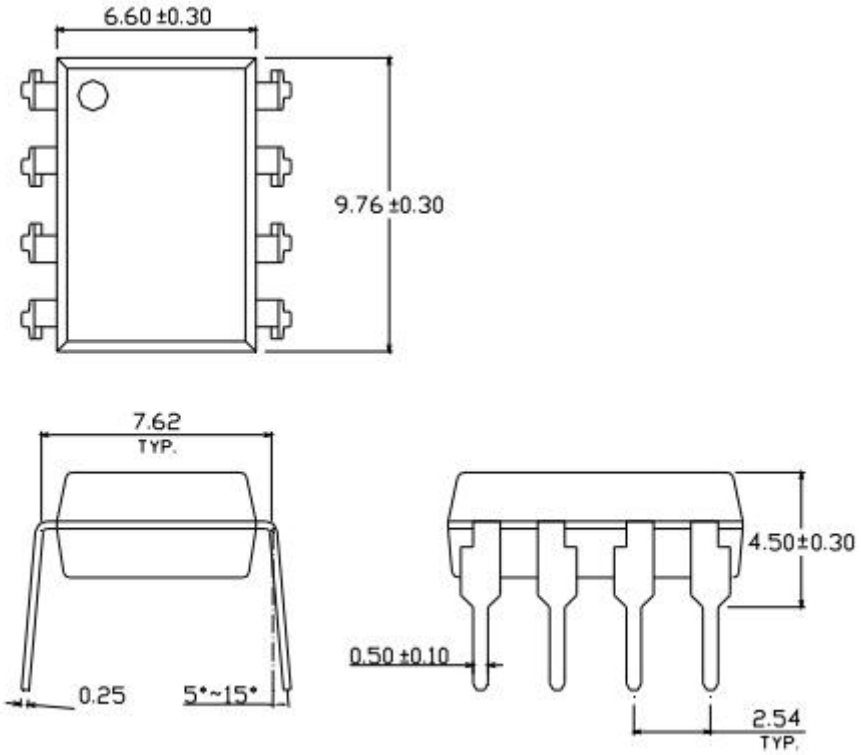
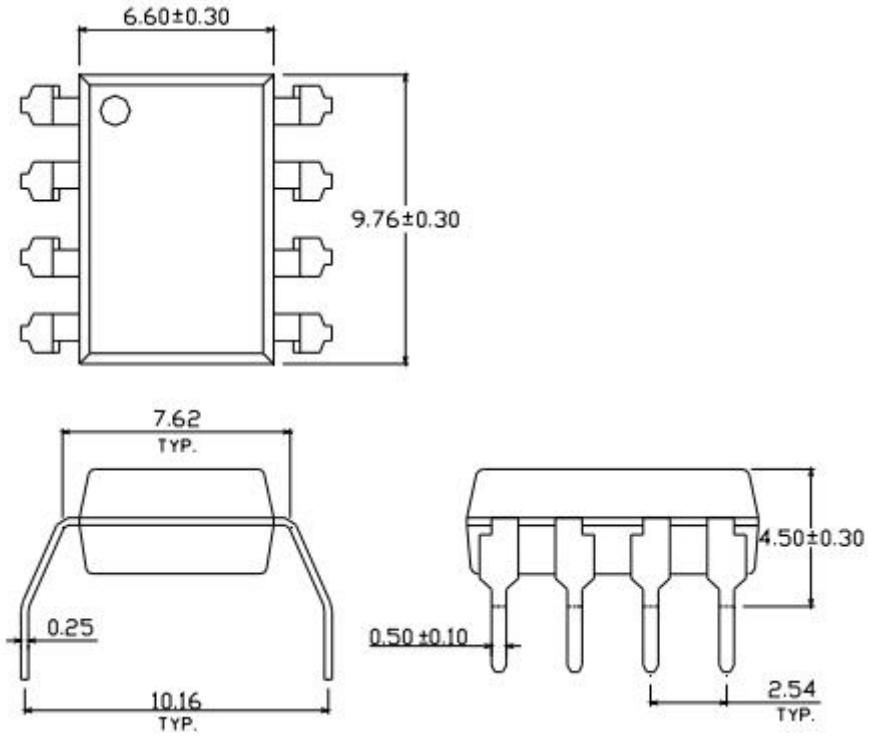
# ■ Outline Dimension

## Standard DIP Type




## Option M Type




## Option S Type

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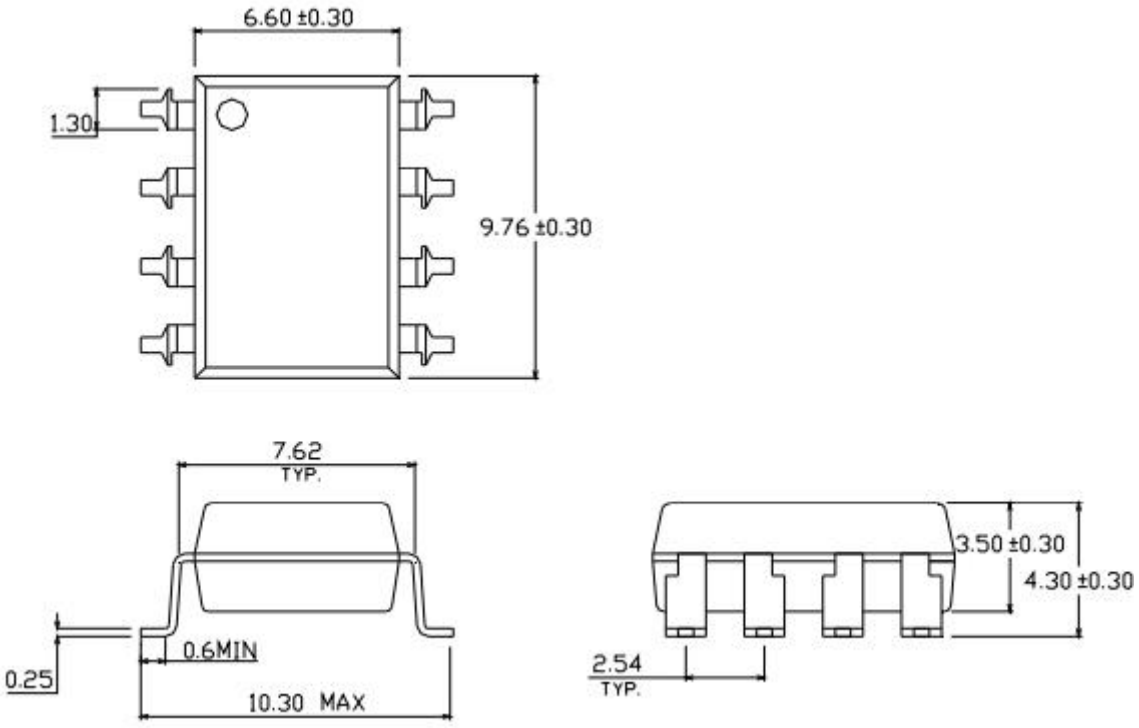
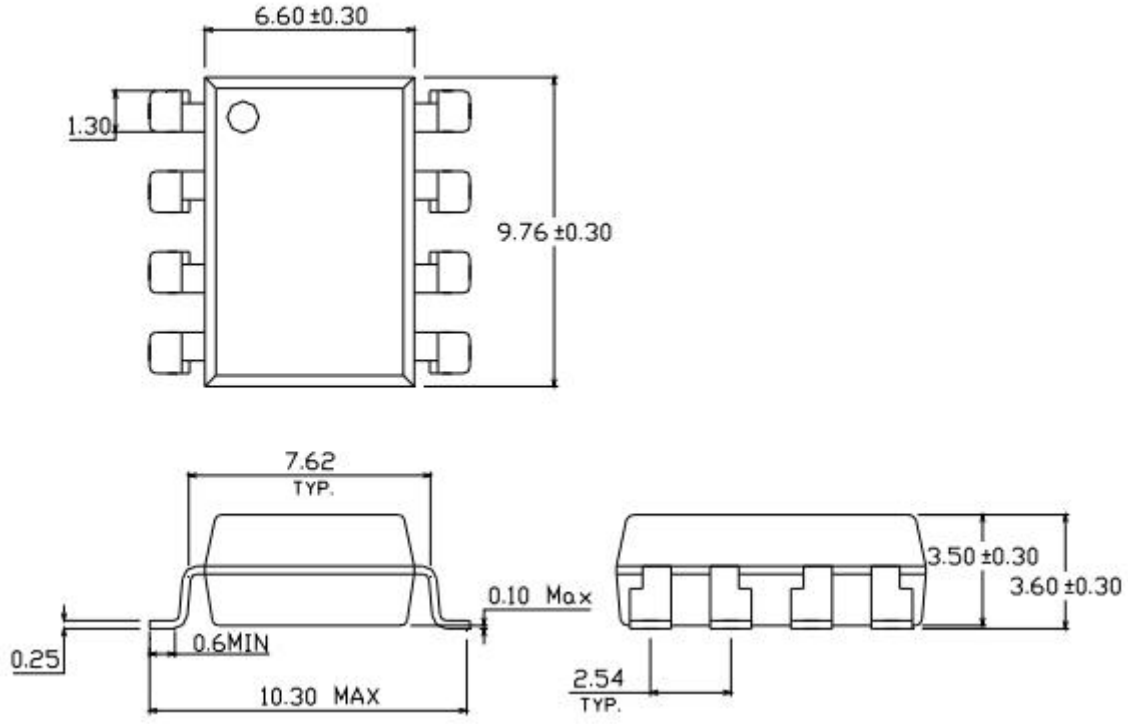



## Option S1 Type




Unit: mm
Tolerance: ±0.1mm

# ■ Recommended solder pad Design

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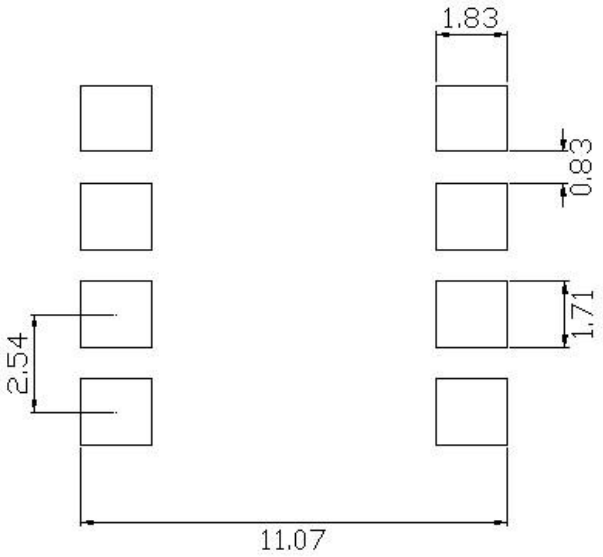


Unit: mm
Tolerance: ±0.1mm

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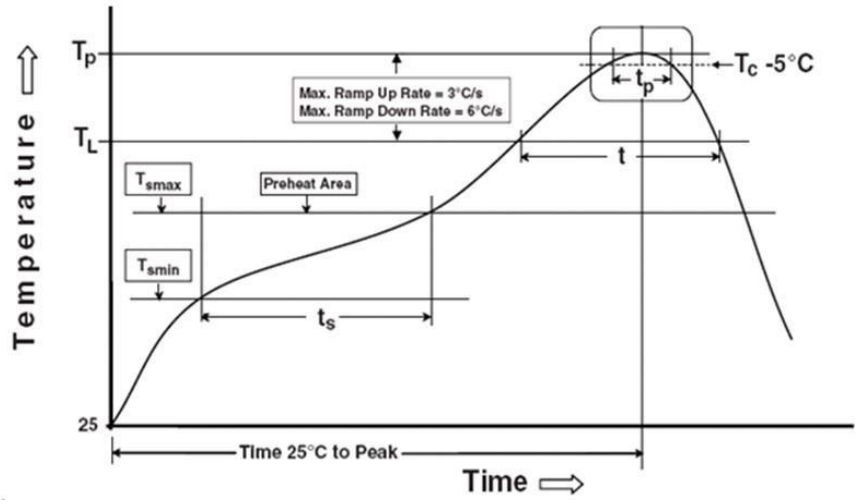
# ■ Temperature Profile Of Soldering

## 1. IR Reflow soldering
## *(IPC/JEDEC J-STD-020D compliant)*

| Profile item | Conditon |
|---|---|
| **Preheat** | |
| Temperature min ($T_{smin}$) | 150 °C |
| Temperature max ($T_{smax}$) | 200°C |
| Time ($T_{smin}$ to $T_{smax}$) ($t_s$) | 60-120 seconds |
| Average ramp-up rate ($T_{smax}$ to $T_p$) | 3 °C/second max |
| **Other** | |
| Liquidus Temperature ($T_L$) | 217 °C |
| Time above Liquidus Temperature ($t_L$) | 60-100 sec |
| Peak Temperature ($T_P$) | 260°C |
| Time within 5 °C of Actual Peak Temperature: $T_P$ - 5°C | 30 s |
| Ramp- Down Rate from Peak Temperature | 6°C /second max. |
| Time 25°C to peak temperature | 8 minutes max. |
| Reflow times | 3 times |




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

# ■ Packing

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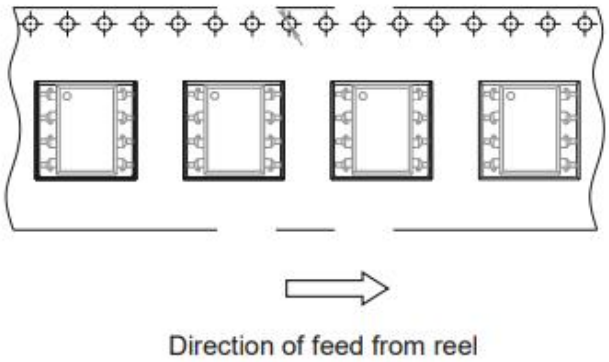
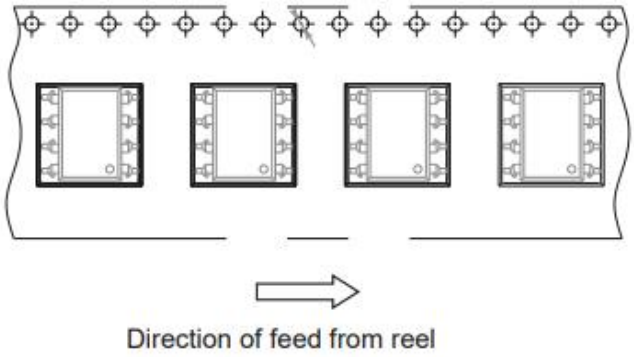
## Tape and Reel

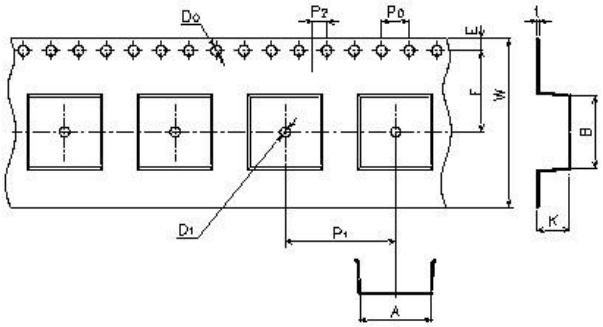
### Option TP:




### Option TP1:




## Tape dimension




| Demension/mm | A | B | Do | D1 | E | F |
|---|---|---|---|---|---|---|
| Packagetype:S | 10.4±0.1 | 10.0±0.1 | 1.5+0.1/-0 | 1.5±0.25 | 1.75±0.1 | 7.5±0.1 |

| Demension/mm | Po | P1 | P2 | t | W | K |
|---|---|---|---|---|---|---|
| Packagetype:S | 4.0±0.1 | 12.0±0.1 | 2.0±0.05 | 0.4±0.05 | 16.0±0.3 | 4.5±0.1 |

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- 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.
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- 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.