

## Smart motor driver with embedded Hall sensor

### Features

- Motor driver with integrated Hall sensor
- Lock-shutdown protection & auto-restart function
- Precise magnetic switching thresholds
- “Soft-switch” phase-switching technique to reduce vibration and acoustic noise
- Thermal shutdown protection
- Available in SIP-4L packages
- For 12V systems


 Halogen Free

### General Description

FD1157H is a two coil motor driver with embedded Hall sensor. It integrates the motor driver with the Hall sensor, which simplifies the PCB(printed circuit board) design and make the fabrication of small-size motors possible. Lock-shutdown and auto-restart function keeps the motor from being over-heated and restarts the motor after being locked.

“Soft-switch” phase-switching technique is used to reduce the vibration and acoustic noise.

Thermal-shutdown protection ensures the motor driver to operate under specified temperature ranges.

All the protection mechanisms mentioned above combine to provide a complete protecting scenario for the motor system, keep the motor system from possible damages and guarantee correct operations.

### Block Diagram

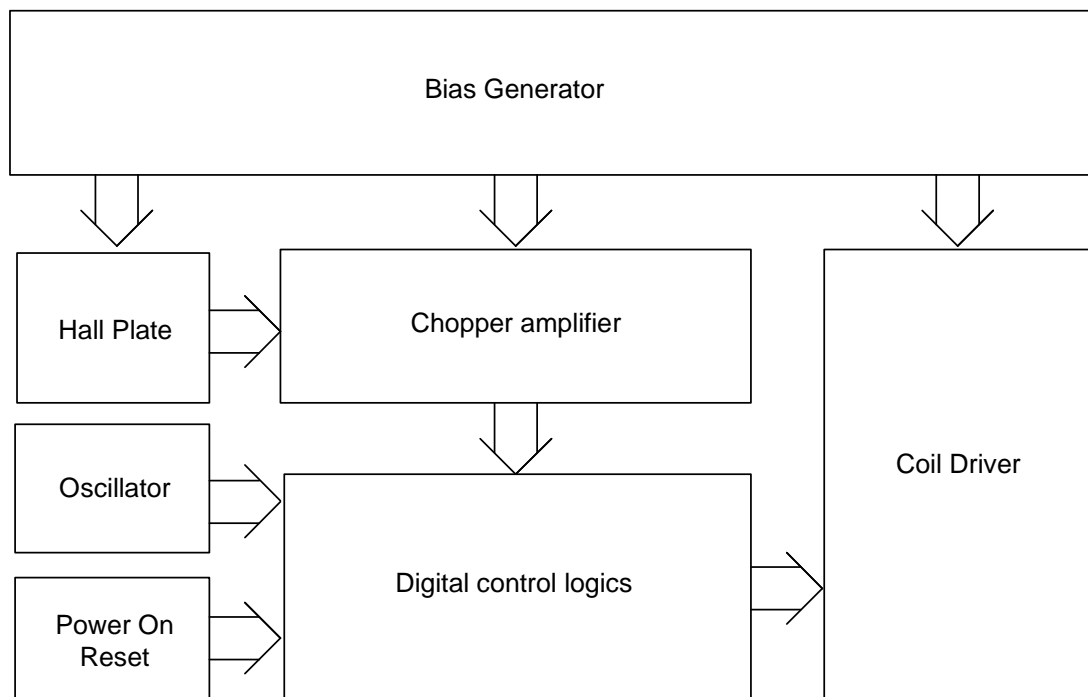
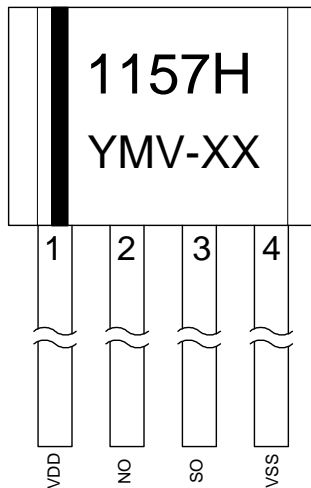
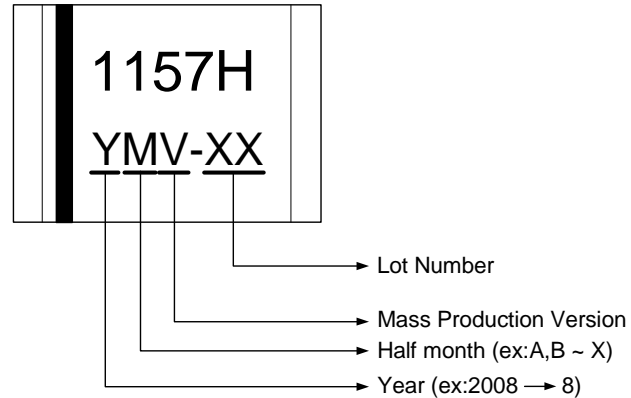


Figure.1

**Pin Connection**

**Figure.2**
**Marking Distinguish**

**Figure.3**
**Pin Descriptions**

| Name | I/O | FD1157H | Description           |
|------|-----|---------|-----------------------|
| VSS  | G   | 4       | Ground                |
| SO   | O   | 3       | Driver output         |
| NO   | O   | 2       | Driver output         |
| VDD  | P   | 1       | Positive power supply |

Legend: I=input, O=output, I/O=input/output, P=power supply, G=ground

**Functional Descriptions**

Refer to the block diagram (Figure.1), FD1157H is composed of the following building blocks:

- Bias generator

The bias generator provides precise, temperature- and process-insensitive bias references for the analog circuit blocks. These references guarantee proper operation of the IC under all conditions specified in this specification.

- Oscillator

The built-in oscillator provides the clock signal for the digital control logics

- Power-on Reset

Used to detect the power-up ramp and reset the digital circuits to achieve correct operation as soon as the power is ready.

- Chopper Amplifier

To achieve a higher magnetic sensitivity the chopper amplifier structure is adopted in this design. Use of this structure dynamically removes both the offset and flicker noise at the same time.

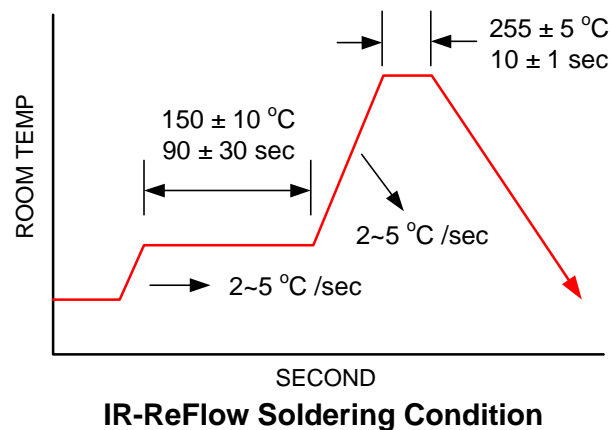
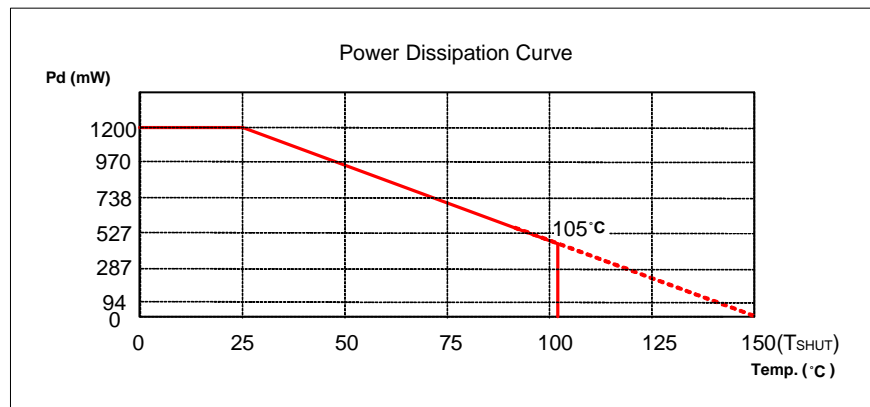
- Digital control logics

- Hall sensor part – generates controlling signals for the Hall sensor.
- Coil driver part – generates controlling signals for the Coil driver.

**Absolute Maximum Ratings**

| Parameter                  | Symbol               | Conditions | Values |      |                   | Unit  |
|----------------------------|----------------------|------------|--------|------|-------------------|-------|
|                            |                      |            | min.   | Typ. | max.              |       |
| Operating Temperature      | T <sub>OP</sub>      | -          | -20    |      | 105               | °C    |
| Storage Temperature        | T <sub>ST</sub>      | -          | -40    |      | 150               | °C    |
| Output clamp Voltage       | V <sub>C</sub>       |            | 25     |      | 27                | V     |
| DC Supply Voltage          | V <sub>DD</sub>      | -          |        |      | 18 <sup>(1)</sup> | V     |
| Supply Current             | I <sub>DD</sub>      | -          |        |      | 6                 | mA    |
| Continuous Current         | I <sub>O(CONT)</sub> |            |        |      | 600               | mA    |
| Hold Current               | I <sub>O(HOLD)</sub> |            |        |      | 900               | mA    |
| Peak Current               | I <sub>O(PEAK)</sub> | <100μs     |        |      | 1200              | mA    |
| Junction temperature       | T <sub>J</sub>       |            |        |      | 180               | °C    |
| Power Dissipation          | P <sub>D</sub>       | SIP-4L     |        |      | 1200              | mW    |
| Thermal Resistance         | θ <sub>JC</sub>      | SIP-4L     |        | 62   |                   | °C/W  |
| Thermal Resistance         | θ <sub>Ja</sub>      | SIP-4L     |        | 104  |                   | °C/W  |
| Magnetic Flux Density      | B                    |            |        |      | Unlimited         | Gauss |
| IR-Reflow Lead Temperature |                      | 10sec      |        |      | 260               | °C    |

**Note 1:** V<sub>DD</sub>=18V, If V<sub>BEMF</sub> is lower than the output clamp voltage (V<sub>C</sub>).



**Recommended Operating Conditions**

| Parameter                   | Symbol   | Conditions | Values |      |                   | Unit |
|-----------------------------|----------|------------|--------|------|-------------------|------|
|                             |          |            | min.   | typ. | max.              |      |
| Supply Voltage              | $V_{DD}$ | -          | 3.0    |      | 16 <sup>(1)</sup> | V    |
| Operating Temperature Range | $T_A$    | -          | -20    |      | 85                | °C   |

**Note 1:**  $V_{DD}=16V$ , If  $V_{BEMF}$  is lower than the output clamp voltage ( $V_c$ ).

**Electrical Characteristics  $V_{DD}=12.0V$ ,  $T_A=25^\circ C$  (unless otherwise specified)**

| Parameter                       | Symbol     | Conditions                                       | Values |      |      | Unit |
|---------------------------------|------------|--|--------|------|------|------|
|                                 |            |  | min.   | typ. | max. |      |
| Average Supply Current(no load) | $I_{DD}$   |  |        | 2.5  |      | mA   |
| On resistance (NO, SO pin)      | $R_{DSON}$ | $V_{DD}=5V$ , $T_A=25^\circ C$ , $I_{out}=300mA$ |        | 1    |      | Ohm  |
| Thermal Shutdown Threshold      | $T_{SHUT}$ |  | 150    |      |      | °C   |
| Locked Rotor Period             | $T_{ON}$   |  |        | 0.4  |      | s    |
| Locked Rotor Period             | $T_{OFF}$  |  |        | 2.8  |      | s    |

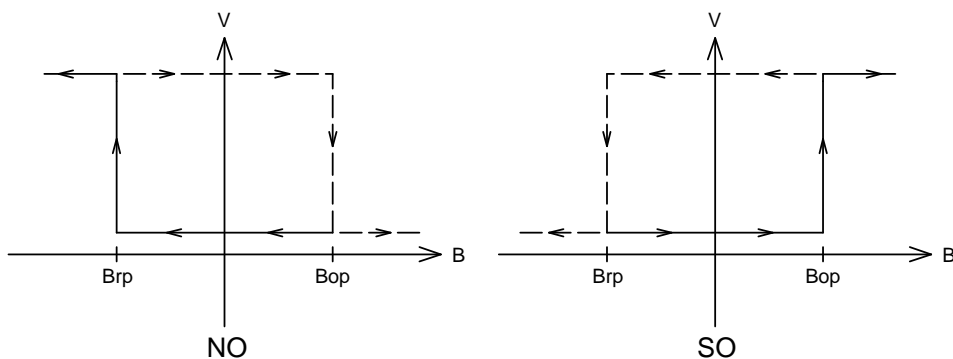
**Magnetic Characteristics**

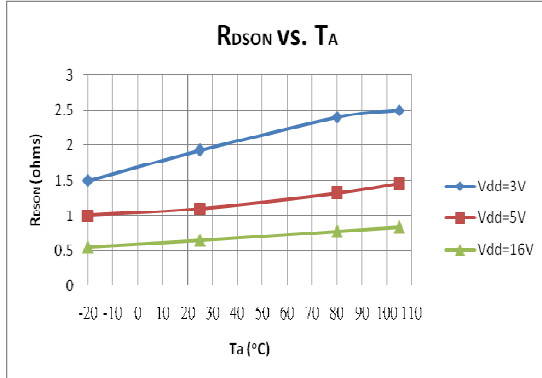
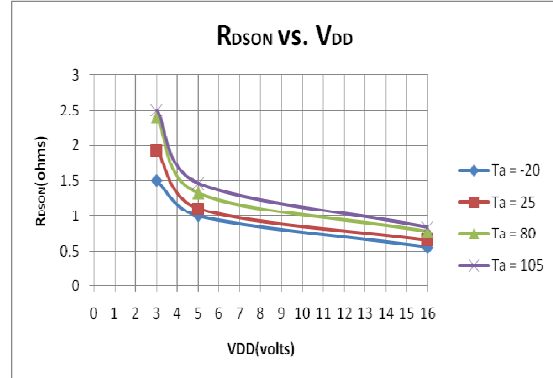
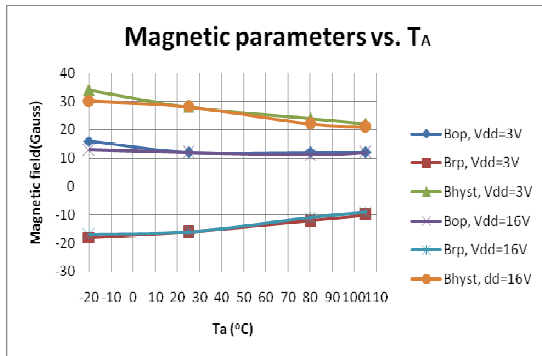
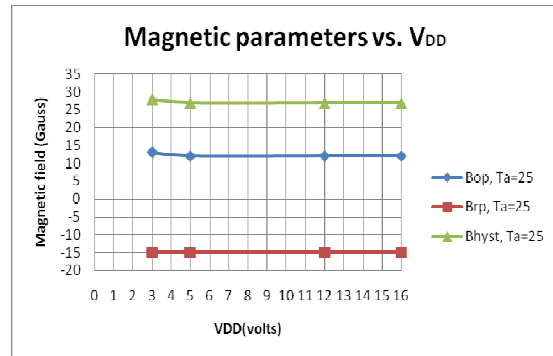
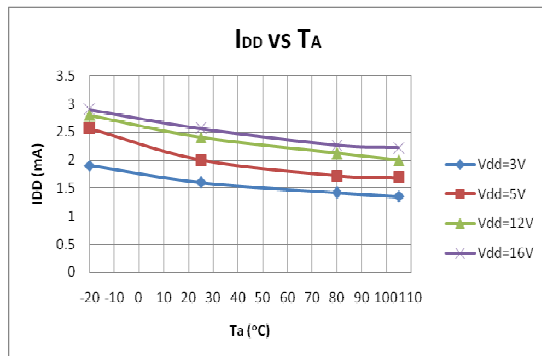
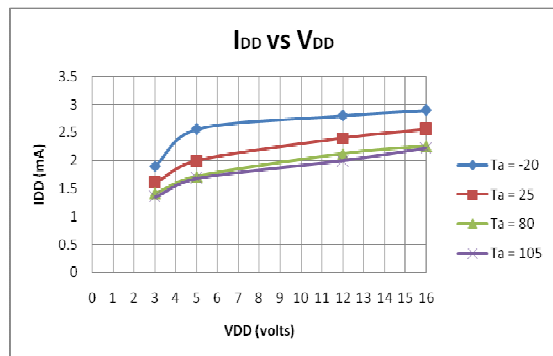
| Parameter      | Symbol   | Conditions | Values |      |      | Unit |
|----------------|----------|------------|--------|------|------|------|
|                |          |            | min.   | typ. | max. |      |
| Operate Points | $B_{OP}$ |            | 5      | 20   | 40   | G    |
| Release Points | $B_{RP}$ |            | -5     | -20  | -40  | G    |

**Driver output vs. Magnetic Pole**

| Parameter  | Test Conditions | NO   | SO   |
|------------|-----------------|------|------|
| North pole | $B < B_{rp}$    | High | Low  |
| South pole | $B > B_{op}$    | Low  | High |

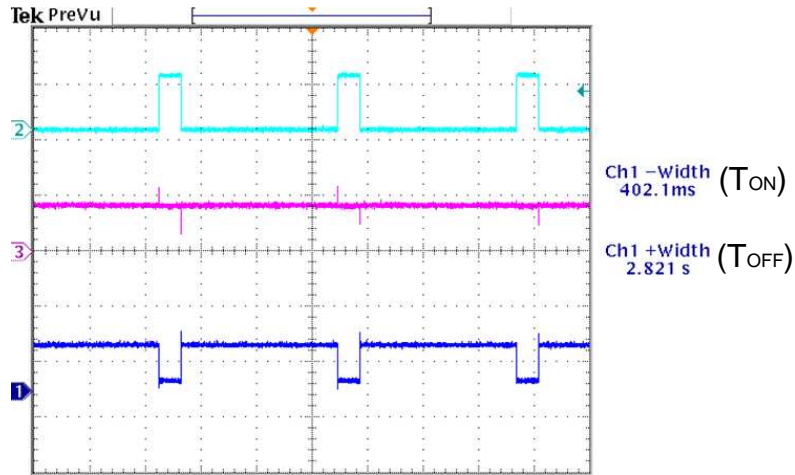
**Note:** The magnetic pole is applied facing the branded side of the package

**Hysteresis Characteristics**


**Performance Graphs**

**Figure.4**

**Figure.5**

**Figure.6**

**Figure.7**

**Figure.8**

**Figure.9**



## Lock shutdown – Restart Timing Description:



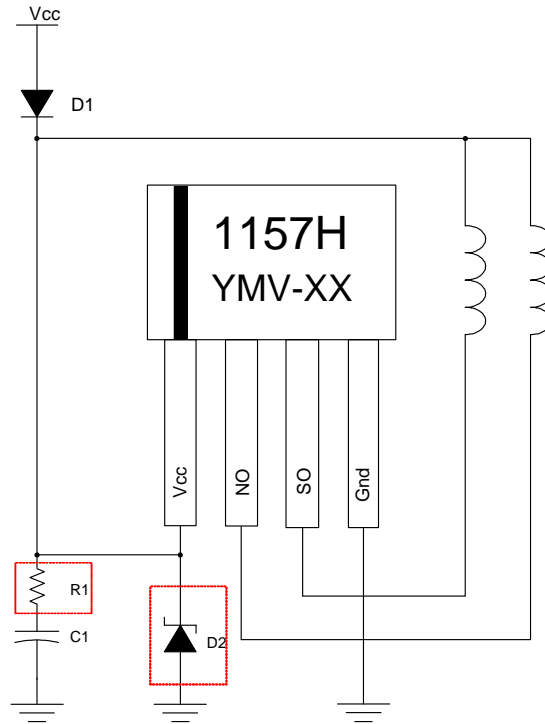
Channel2: V<sub>DD</sub> pin current waveform

Channel3: Output (SO pin) voltage waveform

Channel1: Output (NO pin) voltage waveform

**Note:** The North pole (B > Bop) is applied facing the branded side of the package.

**Application Circuit Reference**

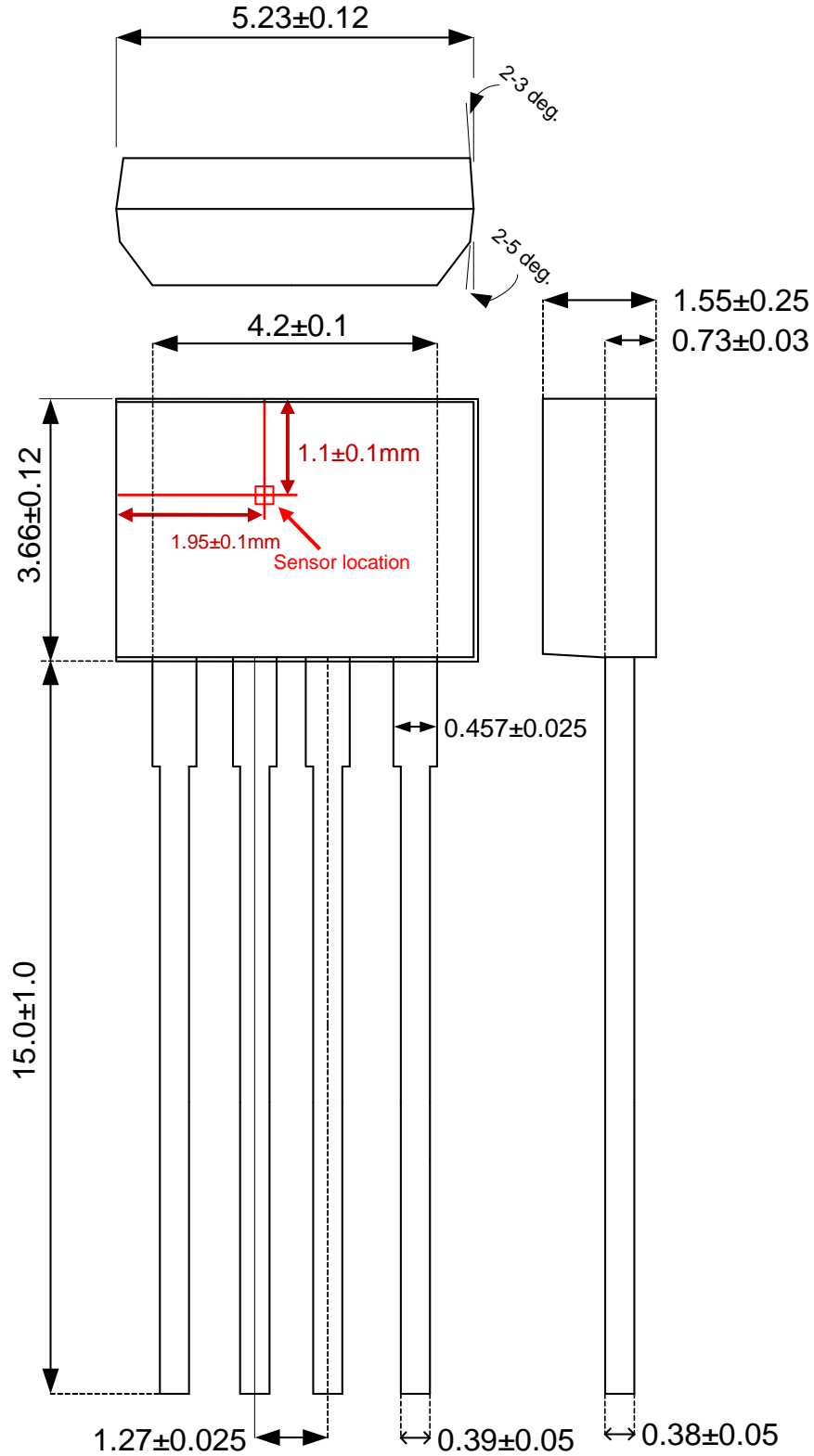


**Figure.10**

**Note:**  $C1=1\mu F$ ,  $R1=2\sim 5\text{ ohm(option)}$ ,  $D2(\text{option})$  breakdown voltage 16V

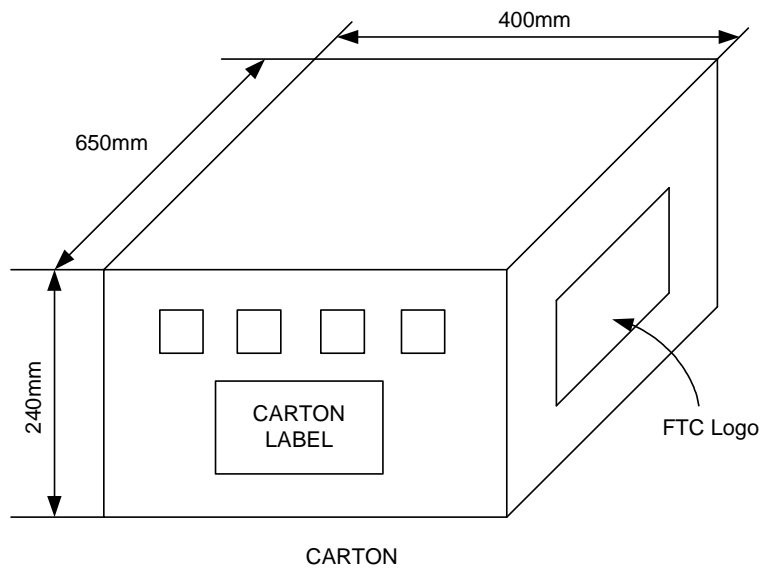
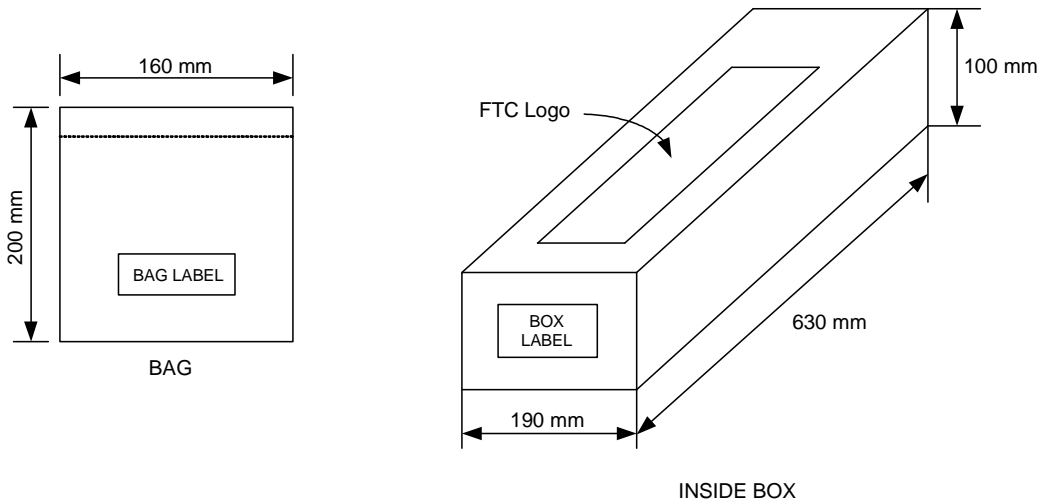


Package Dimension (Unit: mm)  
SIP-4L(Halogen Free)





**Packing Specification**  
BAG & BOX DIMANSION



**Packing Quantity Specifications**

1000 EA / 1 BAG

25 BAGS / 1 INSIDE BOX

4 INSIDE BOXES / 1 CARTON

**Order Information**

| Part Number | Operating Temperature | Package | Description | Marking |
|-------------|-----------------------|---------|-------------|---------|
| FD1157H-G1  | -20 °C to +85 °C      | SIP-4L  | ±20G (B)    | -       |