



フラックスゲート式 / 電圧出力型  
Fluxgate system / Voltage-output type  
F02P SERIES



絶対最大定格 ABSOLUTE MAXIMUM RATINGS

| 仕様項目<br>Parameters  | 記号<br>Symbol    | 単位<br>Unit | 規格値<br>Value        | 備考<br>Comment    |
|---|-----------------|------------|---------------------|------------------|
| 電源電圧<br>Supply voltage  | V <sub>cc</sub> | V          | 7                   |                  |
| 一次側導体温度<br>Primary conductor temperature  | —               | °C         | 110                 |                  |
| 非繰り返し一次電流 (20 μS)<br>Non repetitive primary current pulse (20 μS), in powered or unpowered state. | I <sub>p</sub>  | A          | 20 × I <sub>f</sub> |                  |
| 静電耐圧 (HBM:人体モデル)<br>ESD (HBM: Human Body Model)   | —               | kV         | 4                   | C=100pF, R=1.5kΩ |

絶縁性能 ISOLATION CHARACTERISTICS

| 仕様項目<br>Parameters                                    | 記号<br>Symbol    | 単位<br>Unit | 規格値<br>Value   | 備考<br>Comment   |
|---|-----------------|------------|--|---|
| 絶縁耐圧<br>Insulation voltage                            | V <sub>d</sub>  | —          | AC4100V, 1分間(感応電流0.5mA)<br>AC4100V, for 1minute(Sensing current 0.5mA) | 一次 ⇔ 二次間<br>Primary ⇔ Secondary   |
| 絶縁抵抗<br>Insulation Resistance                         | R <sub>is</sub> | —          | ≥ 500MΩ (at DC500V)  | 一次 ⇔ 二次間<br>Primary ⇔ Secondary   |
| 絶縁距離<br>Clearance distance                            | d <sub>ci</sub> | —          | 7.5mm (TYP)  | 一次 ⇔ 二次間<br>Primary ⇔ Secondary   |
| 沿面距離<br>Creepage distance                             | d <sub>cp</sub> | —          | 7.5mm (TYP)  | 一次 ⇔ 二次間<br>Primary ⇔ Secondary   |
| ケース材料<br>Case material                                | —               | —          | UL94 V-0   |   |
| 比較トラッキング指数 (CTI)<br>Comparative Tracking Index: (CTI) | CTI             | V          | 600  |   |
| 適用例<br>Application example                            | —               | —          | 300V, CAT III, PD2   | 強化絶縁, 不均一電界<br>EN50178, EN61010による<br>Reinforced isolation, non<br>uniform field according to<br>EN50178, EN61010 |
|   | —               | —          | 600V, CAT III, PD2   | 基礎絶縁, 不均一電界<br>EN50178, EN61010による<br>Simple isolation, non<br>uniform field according to<br>EN50178, EN61010     |

環境及び機械的性能 ENVIRONMENTAL AND MECHANICAL CHARACTERISTICS

| 仕様項目<br>Parameters                      | 記号<br>Symbol   | 単位<br>Unit | 規格値<br>Value |     |      | 備考<br>Comment |
|---|----------------|------------|--------------|-----|------|---------------|
|   |                |            | MIN          | TYP | MAX  |               |
| 動作温度範囲<br>Ambient operating temperature | T <sub>a</sub> | °C         | -40          |     | +105 |               |
| 保存温度範囲<br>Ambient storage temperature   | T <sub>s</sub> | °C         | -40          |     | +105 |               |
| 製品重量<br>Mass                            | m              | g          |              | 12  |      |               |

## 仕様 SPECIFICATIONS

 $T_a=+25^{\circ}\text{C}$ ,  $R_L=10\text{k}\Omega$ ,  $V_{cc}=+5\text{V}$ 

| 仕様項目<br>Parameters  | 記号<br>Symbol | 単位<br>Unit      | 規格値<br>Value                    |         |             | 備考<br>Comment    |                                 |
|---|--------------|-----------------|---------------------------------|---------|-------------|------------------|---------------------------------|
|   |              |                 | MIN                             | TYP     | MAX         |                  |                                 |
| 定格電流<br>Rated Current   | F02P006S05   | If              | A                               |         | 6           |                  |                                 |
|   | F02P015S05   |                 |                                 |         | 15          |                  |                                 |
|   | F02P025S05   |                 |                                 |         | 25          |                  |                                 |
|   | F02P050S05   |                 |                                 |         | 50          |                  |                                 |
| 最大電流 (at $V_{cc}=+5\text{V}$ , $T_a=+105^{\circ}\text{C}$ )<br>Maximum current (at $V_{cc}=+5\text{V}$ , $T_a=+105^{\circ}\text{C}$ )                           | F02P006S05   | Ipmax           | A                               | -20     |             | 20               |                                 |
|   | F02P015S05   |                 |                                 | -51     |             | 51               |                                 |
|   | F02P025S05   |                 |                                 | -85     |             | 85               |                                 |
|   | F02P050S05   |                 |                                 | -150    |             | 150              |                                 |
| 供給電圧<br>Supply Voltage  |              | Vcc             | V                               | 4.75    | 5.00        | 5.25             |                                 |
| 一次側ターン数<br>Number of primary turns  |              | Np              | T                               | 1, 2, 3 |             |                  |                                 |
| 二次側ターン数<br>Number of secondary turns  | F02P006S05   | Ns              | T                               |         | 1816        |                  |                                 |
|   | F02P015S05   |                 |                                 |         | 1737        |                  |                                 |
|   | F02P025S05   |                 |                                 |         | 1764        |                  |                                 |
|   | F02P050S05   |                 |                                 |         | 1600        |                  |                                 |
| 定格消費電流(at If)<br>Consumption current (at If)  | F02P006S05   | Icc             | mA                              |         | 25          | Icc=15+Ip(mA)/Ns |                                 |
|   | F02P015S05   |                 |                                 |         | 30          |                  |                                 |
|   | F02P025S05   |                 |                                 |         | 35          |                  |                                 |
|   | F02P050S05   |                 |                                 |         | 55          |                  |                                 |
| 内部基準電圧(at Ip=0A)<br>Internal reference voltage(at Ip=0A)  |              | Vref1           | V                               | 2.495   | 2.500       | 2.505            | Ref OUT mode                    |
| 外部基準電圧<br>External reference voltage  |              | Vref2           | V                               | 0       |             | 4                | Ref IN mode                     |
| 出力電圧<br>Output voltage  |              | Vo              | V                               | 0.375   |             | 4.625            |                                 |
| 出力電圧(at Ip=0A)<br>Output voltage(at Ip=0A)  |              | Vo              | V                               |         | Vref1,Vref2 |                  |                                 |
| 電氣的オフセット電圧 *1<br>Electrical offset voltage  | F02P006S05   | Voe             | mV                              | -5.300  |             | 5.300            |                                 |
|   | F02P015S05   |                 |                                 | -2.210  |             | 2.210            |                                 |
|   | F02P025S05   |                 |                                 | -1.350  |             | 1.350            |                                 |
|   | F02P050S05   |                 |                                 | -0.725  |             | 0.725            |                                 |
| 一次側電氣的オフセット電流<br>Electrical offset current referred to primary  | F02P006S05   | Ioe             | mA                              | -51     |             | 51               |                                 |
|   | F02P015S05   |                 |                                 | -53     |             | 53               |                                 |
|   | F02P025S05   |                 |                                 | -54     |             | 54               |                                 |
|   | F02P050S05   |                 |                                 | -58     |             | 58               |                                 |
| 内部基準電圧温度係数<br>Temperature coefficient of Internal reference voltage   |              | TCVref1         | ppm/K                           |         | $\pm 5.0$   | $\pm 50$         |                                 |
| 出力電圧温度係数(at Ip=0A)<br>Temperature coefficient of Output voltage(at Ip=0A)   | F02P006S05   | TCVo            | ppm/K                           |         | $\pm 6.0$   | $\pm 14$         | ppm/K of 2.5V<br>(-40°C~+105°C) |
|   | F02P015S05   |                 |                                 |         | $\pm 2.3$   | $\pm 6$          |                                 |
|   | F02P025S05   |                 |                                 |         | $\pm 1.4$   | $\pm 4$          |                                 |
|   | F02P050S05   |                 |                                 |         | $\pm 0.7$   | $\pm 3$          |                                 |
| 感度 (理論値)<br>Sensitivity (Theoretical value)   | F02P006S05   | Gth             | mV/A                            |         | 104.2       |                  | 625mV/If                        |
|   | F02P015S05   |                 |                                 |         | 41.67       |                  |                                 |
|   | F02P025S05   |                 |                                 |         | 25          |                  |                                 |
|   | F02P050S05   |                 |                                 |         | 12.5        |                  |                                 |
| 感度誤差<br>Sensitivity error   |              | $\varepsilon_G$ | %                               | -0.7    |             | 0.7              |                                 |
| 感度温度係数 (at $T_a=-40^{\circ}\text{C}\sim+105^{\circ}\text{C}$ )<br>Temperature coefficient of Sensitivity(at $T_a=-40^{\circ}\text{C}\sim+105^{\circ}\text{C}$ ) |              | TCG             | ppm/K                           |         |             | $\pm 40$         |                                 |
| 出力直線性<br>Output Linearity   |              | $\varepsilon_L$ | %                               | -0.1    |             | 0.1              |                                 |
| 一次側磁氣的オフセット電流 (at $10\times I_f$ )<br>Magnetic offset current referred to primary(at $10\times I_f$ )   |              | I <sub>OM</sub> | A                               | -0.1    |             | 0.1              |                                 |
| 一次側入力換算ノイズ電流(at 100Hz~100kHz)<br>Output current noise referred to primary(at 100Hz~100kHz)  |              | I <sub>no</sub> | $\mu\text{A}/(\text{Hz})^{1/2}$ |         | 20          |                  | R <sub>L</sub> =1k $\Omega$     |

\*1 オフセット電圧はコアヒステリシス除去後の値とする。  
Offset voltage value is after removal of core hysteresis.

仕様 SPECIFICATIONS

Ta=+25°C, RL=10kΩ, Vcc=+5V

| 仕様項目<br>Parameters  | 記号<br>Symbol | 単位<br>Unit     | 規格値<br>Value |     |     | 備考<br>Comment |   |
|---|--------------|----------------|--------------|-----|-----|---------------|---|
|   |              |                | MIN          | TYP | MAX |               |   |
| 発振周波数における最大出力リップル (f typ=450kHz)<br>Peak to peak output ripple at oscillator frequency (f typ=450kHz) | F02P006S05   | —              | mV           |     | 40  | 160           | RL=1kΩ  |
|   | F02P015S05   |                |              |     | 15  | 60            |   |
|   | F02P025S05   |                |              |     | 10  | 40            |   |
|   | F02P050S05   |                |              |     | 5   | 20            |   |
| 遅延時間 (at 10% of If)<br>Reaction time (at 10% of If)   | F02P006S05   | tra            | μs           |     |     | 0.3           | RL=1kΩ, di/dt=18A/μs  |
|   | F02P015S05   |                |              |     |     | 0.3           | RL=1kΩ, di/dt=44A/μs  |
|   | F02P025S05   |                |              |     |     | 0.3           | RL=1kΩ, di/dt=68A/μs  |
|   | F02P050S05   |                |              |     |     | 0.3           | RL=1kΩ, di/dt=100A/μs   |
| 応答時間 1 (at 90% of If)<br>Response time 1 (at 90% of If)   | F02P006S05   | tr             | μs           |     |     | 0.3           | RL=1kΩ, di/dt=18A/μs  |
|   | F02P015S05   |                |              |     |     | 0.3           | RL=1kΩ, di/dt=44A/μs  |
|   | F02P025S05   |                |              |     |     | 0.3           | RL=1kΩ, di/dt=68A/μs  |
|   | F02P050S05   |                |              |     |     | 0.3           | RL=1kΩ, di/dt=100A/μs   |
| 応答時間 2 (at 10% of If to 90% of Vo)<br>Response time 2 (at 10% of If to 90% of Vo)                     |              | tr             | μs           |     |     | 0.6           | RL=1kΩ, di/dt=If/μs   |
| 周波数帯域幅 (±1dB)<br>Frequency bandwidth (±1dB)   |              | BW             | kHz          | 200 |     |               | RL=1kΩ  |
| 周波数帯域幅 (±3dB)<br>Frequency bandwidth (±3dB)   |              | BW             | kHz          | 300 |     |               | RL=1kΩ  |
| 出力電圧精度 (総合)<br>Output Voltage Accuracy (Overall)  | F02P006S05   | X <sub>G</sub> | %            |     |     | 1.7           | X <sub>G</sub> =(100×V <sub>oe</sub> /625)+ε <sub>G</sub> +ε <sub>L</sub> |
|   | F02P015S05   |                |              |     |     | 1.2           |   |
|   | F02P025S05   |                |              |     |     | 1.0           |   |
|   | F02P050S05   |                |              |     |     | 0.9           |   |

適用規格 STANDARDS

EN50178, EN61010-1, EN60950-1, UL508 (file No.E243511)

※UL承認条件につきましては、別紙を参照願います。  
※Please refer to the another sheet about conditions of UL Recognition.

特性曲線 (TYP) Characteristic curve (TYP)

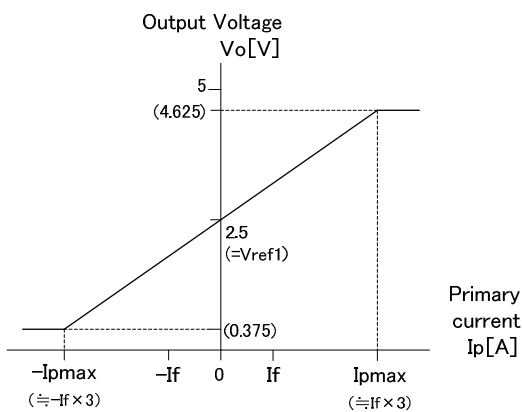


Figure 1: Linearity curve (Internal reference voltage)

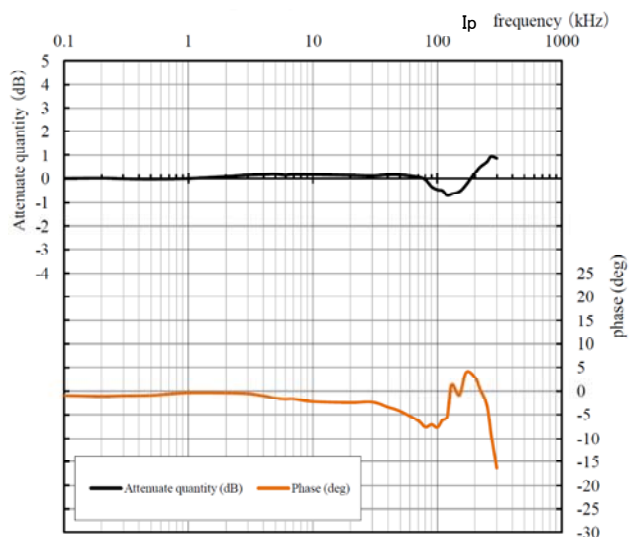


Figure 2: Frequency response curve  
ex) F02P025S05  
Measurement condition Ta=+25°C, RL=1kΩ, Ip=3A, Vcc=+5V

補足資料 SUPPORT DOCUMENTATION

最大繰り返し一次電流 Maximum continuous DC primary current

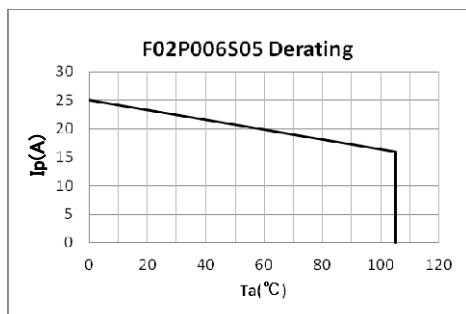


Figure 3: Ip vs Ta for F02P006S05

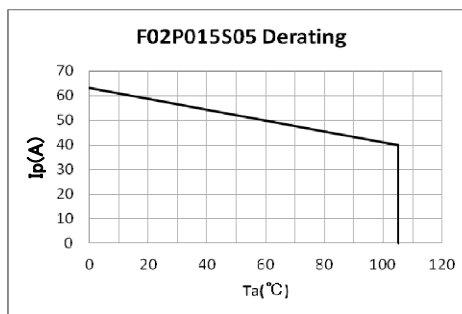


Figure 4: Ip vs Ta for F02P015S05

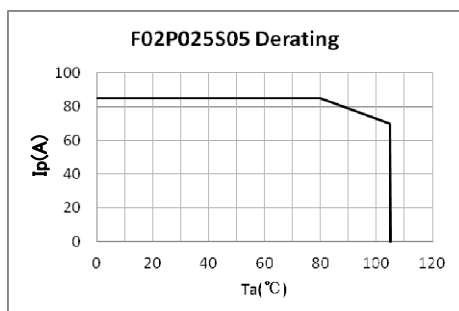


Figure 5: Ip vs Ta for F02P025S05

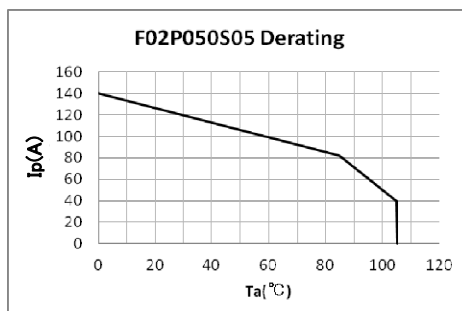


Figure 6: Ip vs Ta for F02P050S05

最大繰り返し一次電流は、次のすべての条件を満たします。

According to which the following conditions are true the maximum continuous DC primary current plot shows the boundary of the area.

- ①  $I_p < I_{pmax}$
- ② ジャンクション温度 Junction temperature  $T_j < 125^\circ\text{C}$
- ③ 一次側導体温度 Primary conductor temperature  $< 110^\circ\text{C}$
- ④ 内部抵抗消費電力 Resistor power dissipation  $< 0.5 \times \text{rated power}$

周波数によるディレーティング Frequency derating

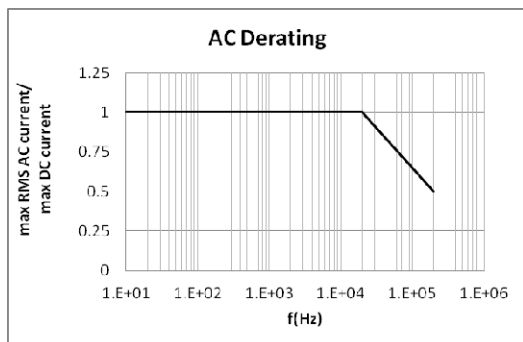


Figure 7: Maximum RMS AC primary current/maximum DC primary current vs frequency

**基準電圧 Reference voltage**

Refピンは、Ref IN と Ref OUT の二種類のモードがあります。

The Ref pin has two modes Ref IN and Ref OUT:

<Ref OUT mode>

高精度の2.5V内部リファレンスを両極性の電流検出の基準として使用します。

The 2.5V internal precision reference is used by the transducer as the reference point for bipolar measurements;

<Ref IN mode>

外部基準電圧をRefピンに接続します。外部基準電圧は0~4Vまで供給可能です。

供給した電圧は、測定時の基準電圧となります。

An external reference voltage is connected to the Ref pin; this voltage is specified in the range 0 to 4 V , its voltage is used as the reference voltage at the time of measurement.

ソース電流  $(V_{ref2}-2.5)/680$  最大値は、 $V_{ref2}=4V$ の際に 2.2mA となります。

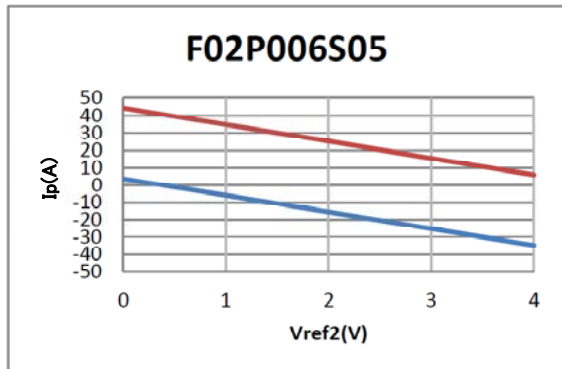
-either to source a typical current of  $(V_{ref2}-2.5)/680$ ,the maximum value will be 2.2mA typ.when  $V_{ref2}=4V$ .

シンク電流  $(2.5-V_{ref2})/680$  最大値は、 $V_{ref2}=0V$ の際に 3.68mA となります。

-or to sink a typical current of  $(2.5-V_{ref2})/680$ ,the maximum value will be 3.68mA typ.when  $V_{ref2}=0V$ .

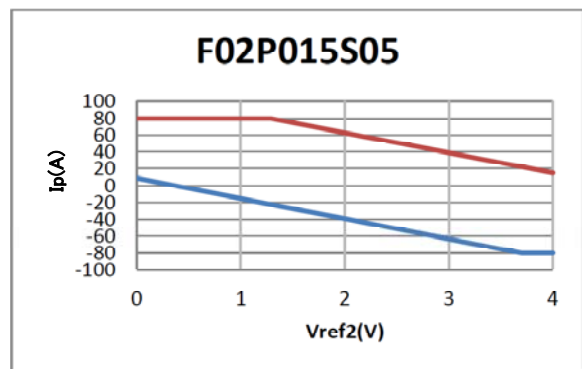
以下のグラフは、外部基準電圧値 $V_{ref2}$ 変化による測定範囲を示します。

The following graphs show how the measuring range of each transducer version depends on external reference voltage value  $V_{ref2}$ .



測定範囲上限 Upper limit:  $I_p = -9.6 \times V_{ref2} + 44.4$  ( $V_{ref2}=0...4V$ )

測定範囲下限 Lower limit:  $I_p = -9.6 \times V_{ref2} + 3.6$  ( $V_{ref2}=0...4V$ )

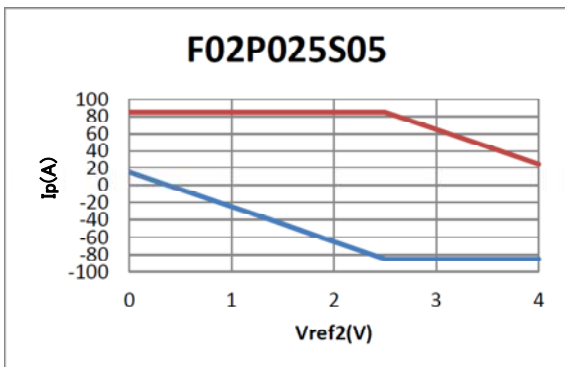


測定範囲上限 Upper limit:  $I_p = 80$  ( $V_{ref2}=0...1.29V$ )

$I_p = -24 \times V_{ref2} + 11$  ( $V_{ref2}=1.29...4V$ )

測定範囲下限 Lower limit:  $I_p = -24 \times V_{ref2} + 9$  ( $V_{ref2}=0...3.7V$ )

$I_p = -80$  ( $V_{ref2}=3.7...4V$ )

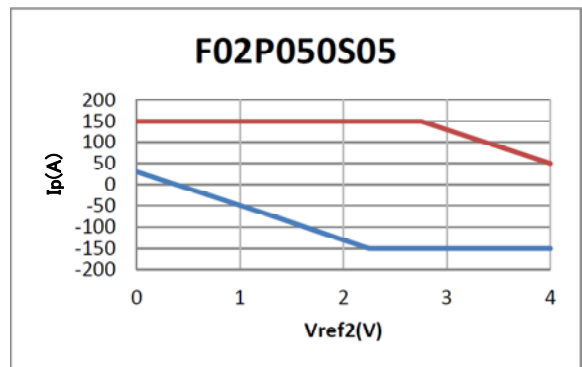


測定範囲上限 Upper limit:  $I_p = 85$  ( $V_{ref2}=0...2.5V$ )

$I_p = -40 \times V_{ref2} + 185$  ( $V_{ref2}=2.5...4V$ )

測定範囲下限 Lower limit:  $I_p = -40 \times V_{ref2} + 15$  ( $V_{ref2}=0...2.5V$ )

$I_p = -85$  ( $V_{ref2}=2.5...4V$ )



測定範囲上限 Upper limit:  $I_p = 150$  ( $V_{ref2}=0...2.75V$ )

$I_p = -80 \times V_{ref2} + 370$  ( $V_{ref2}=2.75...4V$ )

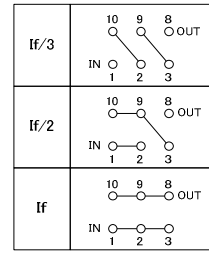
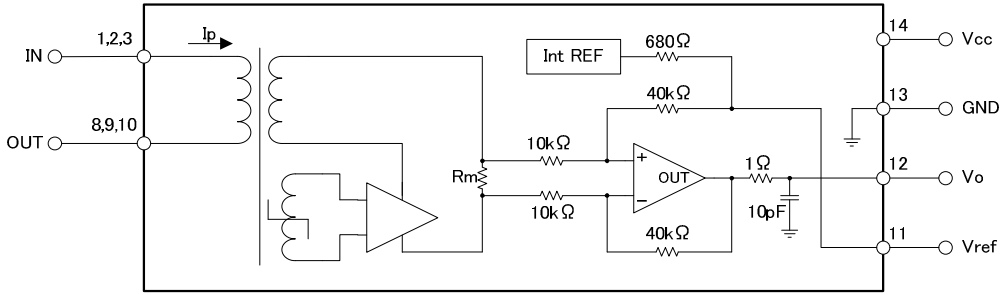
測定範囲下限 Lower limit:  $I_p = -80 \times V_{ref2} + 30$  ( $V_{ref2}=0...2.25V$ )

$I_p = -150$  ( $V_{ref2}=2.25...4V$ )

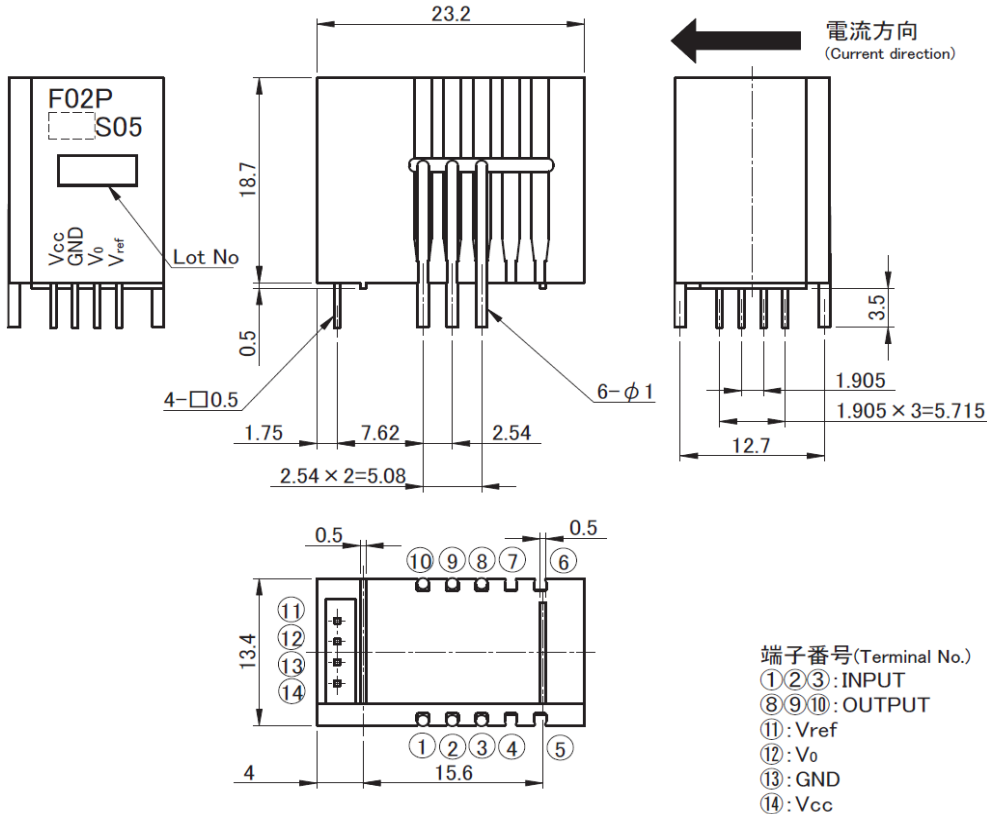
Refピンを使用しない場合、未接続として下さい。

If you do not want to use the Ref pin, please unconnected.

接続図 CONNECTION



外形図 DIMENSIONS(mm)



※指示無き寸法公差は±0.5とする。  
(Unless otherwise specified tolerances shall be ±0.5)

推奨穴径 RECOMMENDED HOLE DIAMETER(mm)

