

## Current Sensor : F01P\*\*\*S05L



### Features:

- Backward compatible to F01PS05 series
- Anti-Surge current (4kAT, 8/20uS, single)
- Mounting area reduced ; pin compatible. Longitudinal dimension reduced
- Super precision & High Stability (low temperature, drift)
- Unipolar power voltage ; +5V
- Multi-range models
- F01P\*\*\*S05L series are designed by the pin compatibility as high-end models of S22P\*\*\*X05M2 series.

### Comparison of the main features of F\*\*\*\*\*S05L series

| Series      | Features  |
|-------------|---|
| F01P***S05L | No reference access   |
| F02P***S05L | No reference access. Ref In/Out   |
| F03P***S05L | No reference access. Ref In/Out. Higher creep age and clearance distance. |

\*\*\* = Rated Current Symbol

### Specification

|  | F01P***S05L   |
|--|---|
| Maximum Peak Current                         | 4kAT (2kAx2. Number of primary turns is two turns)        |
| Rated Current If (***= rated current symbol) | 6A(006) / 15A(015) / 25A(025) 50A(050)                    |
| Maximum Current                              | ±20A(If=6A) / ±51A(If=15A) / ±85A(If=25A) / ±150A(If=50A) |
| Existence of reference access                | 0   |
| Number of primary busbar                     | 3 pcs   |
| Clearance distance ; Primary ↔ Secondary     | 7.7 mm  |
| Standards                                    | UL508 (file#E243511) , EN501758, EN61010-1 , EN60950-1    |
| Ambient Operating Temperature                | -40°C ~ +105°C  |

### Mounting Area



The mounting area has been reduced more than the F01P series. However, F01P\*\*\*S05L series are 100% compatible with original footprint mounting.

The F02P/F03PxxxS05L series also similarly reduces the mounting area.

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### Absolute Maximum Rating

|                               | Symbol | Unit | Value | Notes   |
|-------------------------------|--------|------|-------|---|
| Supply Voltage                | Vcc    | V    | 7     |   |
| Primary Conductor Temperature | -      | °C   | 110   |   |
| ESD (HBM: Human Body Model)   | -      | kV   | 4     | C=100pF , R=1.5kΩ   |
| Maximum Peak Current          | -      | kAT  | 4     | Current Waveform :<br><ul style="list-style-type: none"> <li>• Front time 8μs</li> <li>• Time to half value 20μs</li> <li>• Single</li> </ul> |

### Isolation Characteristics

|                                  | Symbol | Unit | Value   | Notes   |
|----------------------------------|--------|------|---|---|
| Insulation Voltage               | Vd     | -    | AC4200V for 1 min.<br>(Sensing Current 0.5mA) | Primary↔Secondary   |
| Insulation Resistance            | Ris    | -    | ≥500mΩ (@DC500V)                              | Primary↔Secondary   |
| Clearance distance               | dCi    | -    | 7.7mm (TYP)                                   | Primary↔Secondary   |
| Creep age distance               | dCp    | -    | 7.7mm (TYP)                                   | Primary↔Secondary   |
| Case material                    | -      | -    | UL94 V-0                                      |   |
| Comparative Tracking Index (CTI) | CTI    | V    | 600   |   |
| Application Example              | -      | -    | 300V , CAT III , PD2                          | Reinforced Isolation<br>Non uniform field according to<br>EN50178 , EN61010 |
|                                  | -      | -    | 600V , CAT III , PD2                          | Simple isolation<br>Non uniform field according to<br>EN50178 , EN61010     |

### Environmental and Mechanical Characteristics

|                               | Symbol | Unit | Value |     |       |
|-------------------------------|--------|------|-------|-----|-------|
|                               |        |      | min   | typ | max   |
| Ambient Operating Temperature | Ta     | °C   | - 40  |     | + 105 |
| Ambient Storage Temperature   | Ts     | °C   | - 40  |     | +105  |
| Mass                          | -      | g    |       | 12  |       |

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### Specification

(\*1) = Offset voltage value is after removal of core hysteresis

|  |             | Symbol | Unit | Value   |      |       | Notes              |
|--|-------------|--------|------|---------|------|-------|--------------------|
|  |             |        |      | min     | typ  | max   |                    |
| Rated Current                                    | F01P006S05L | If     | A    |         | 6    |       |                    |
|  | F01P015S05L |        |      |         | 15   |       |                    |
|  | F01P025S05L |        |      |         | 25   |       |                    |
|  | F01P050S05L |        |      |         | 50   |       |                    |
| Maximum Current<br>(@ Vcc : +5V , Ta : +105°C)   | F01P006S05L | Ipmax  | A    | - 20    |      | 20    |                    |
|  | F01P015S05L |        |      | - 51    |      | 51    |                    |
|  | F01P025S05L |        |      | - 85    |      | 85    |                    |
|  | F01P050S05L |        |      | - 150   |      | 150   |                    |
| Supply Voltage                                   |             | Vcc    | V    | 4.75    | 5.00 | 5.25  |                    |
| Number of primary turns                          |             | Np     | T    | 1,2,3   |      |       |                    |
| Number of secondary turns                        | F01P006S05L | Ns     | T    |         | 1816 |       |                    |
|  | F01P015S05L |        |      |         | 1737 |       |                    |
|  | F01P025S05L |        |      |         | 1764 |       |                    |
|  | F01P050S05L |        |      |         | 1600 |       |                    |
| Consumption current (at If)                      | F01P006S05L | Icc    | mA   |         | 25   |       | Icc=15+Ip(mA) / Ns |
|  | F01P015S05L |        |      |         | 30   |       |                    |
|  | F01P025S05L |        |      |         | 35   |       |                    |
|  | F01P050S05L |        |      |         | 55   |       |                    |
| Output Voltage                                   |             | Vo     | V    | 0.375   |      | 4.625 |                    |
| Output Voltage (Ip=0A)                           |             | Vo     | V    |         | 2.5  |       |                    |
| Electrical Offset Voltage (*1)                   | F01P006S05L | Voe    | mV   | - 10.40 |      | 10.40 |                    |
|  | F01P015S05L |        |      | - 7.10  |      | 7.10  |                    |
|  | F01P025S05L |        |      | - 6.25  |      | 6.25  |                    |
|  | F01P050S05L |        |      | - 5.80  |      | 5.80  |                    |
| Electrical Offset Current<br>referred to primary | F01P006S05L | loe    | A    | - 0.10  |      | 0.10  |                    |
|  | F01P015S05L |        |      | - 0.17  |      | 0.17  |                    |
|  | F01P025S05L |        |      | - 0.25  |      | 0.25  |                    |
|  | F01P050S05L |        |      | - 0.46  |      | 0.46  |                    |

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### Specification

|   |             | Symbol | Unit                   | Value |       |       | Notes                        |
|---|-------------|--------|------------------------|-------|-------|-------|------------------------------|
|   |             |        |                        | min   | typ   | max   |                              |
| Temperature coefficient of Output voltage (@ Ip=0A)               | F01P006S05L | TCVo   | ppm/K                  |       | ±10.0 | ±80.0 | ppm/K of 2.5V (-40°C~+105°C) |
|   | F01P015S05L |        |                        |       | ±7.5  | ±70.0 |                              |
|   | F01P025S05L |        |                        |       | ±6.5  | ±60.0 |                              |
|   | F01P050S05L |        |                        |       | ±6.0  | ±60.0 |                              |
| Sensitivity (Theoretical value)                                   | F01P006S05L | Gth    | mV/A                   |       | 104.2 |       | 625mV/If                     |
|   | F01P015S05L |        |                        |       | 41.67 |       |                              |
|   | F01P025S05L |        |                        |       | 25    |       |                              |
|   | F01P050S05L |        |                        |       | 12.5  |       |                              |
| Sensitivity Error   |             | εG     | %                      | - 0.7 |       | 0.7   |                              |
| Temperature coefficient of Sensitivity (@Ta=-40°C~+105°C)         |             | TCG    | ppm/K                  |       |       | ±40   |                              |
| Output Linearity  |             | εL     | %                      | - 0.1 |       | 0.1   |                              |
| Magnetic offset current referred to primary (@ 10xf)              |             | Iom    | A                      | - 0.1 |       | 0.1   |                              |
| Output current noise referred to primary (@ 100Hz~100kHz)         | F01P006S05L | Ino    | μA/(Hz) <sup>1/2</sup> |       | 36    |       | RL=1kΩ                       |
|   | F01P015S05L |        |                        |       | 90    |       |                              |
|   | F01P025S05L |        |                        |       | 150   |       |                              |
|   | F01P050S05L |        |                        |       | 300   |       |                              |
| Peak to peak output ripple at oscillator frequency (f typ=450kHz) | F01P006S05L | -      | mV                     |       | 40    | 160   | RL=1kΩ                       |
|   | F01P015S05L |        |                        |       | 15    | 60    |                              |
|   | F01P025S05L |        |                        |       | 10    | 40    |                              |
|   | F01P050S05L |        |                        |       | 5     | 20    |                              |
| Reaction time (@ 10% of If)                                       | F01P006S05L | tra    | μs                     |       |       | 0.3   | RL=1kΩ, di/dt=18A/μs         |
|   | F01P015S05L |        |                        |       |       | 0.3   | RL=1kΩ, di/dt=44A/μs         |
|   | F01P025S05L |        |                        |       |       | 0.3   | RL=1kΩ, di/dt=68A/μs         |
|   | F01P050S05L |        |                        |       |       | 0.3   | RL=1kΩ, di/dt=100/μs         |
| Response time (@90% of If)  | F01P006S05L | tr     | μs                     |       |       | 0.3   | RL=1kΩ, di/dt=18A/μs         |
|   | F01P015S05L |        |                        |       |       | 0.3   | RL=1kΩ, di/dt=44A/μs         |
|   | F01P025S05L |        |                        |       |       | 0.3   | RL=1kΩ, di/dt=68A/μs         |
|   | F01P050S05L |        |                        |       |       | 0.3   | RL=1kΩ, di/dt=100/μs         |

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|  |             | Symbol | Unit    | Value |     |     | Comment   |
|--|-------------|--------|---------|-------|-----|-----|---|
|  |             |        |         | min   | typ | max |   |
| Response time 2<br>(@ 10% of $I_f$ to 90% of $V_o$ ) |             | $t_r$  | $\mu s$ |       |     | 0.6 | $R_L=1k\Omega$  |
| Frequency bandwidth<br>( $\pm 1dB$ )                 |             | BW     | kHz     | 200   |     |     | $R_L=1k\Omega$  |
| Frequency bandwidth<br>( $\pm 3dB$ )                 |             | BW     | kHz     | 300   |     |     | $R_L=1k\Omega$  |
| Output Voltage Accuracy<br>(Overall)                 | F01P006S05L | $X_G$  | %       |       |     | 2.5 | $X_G=(100 \times V_{oe}/625) + \epsilon_G + \epsilon_L$ |
|  | F01P015S05L |        |         |       |     | 1.9 |   |
|  | F01P025S05L |        |         |       |     | 1.8 |   |
|  | F01P050S05L |        |         |       |     | 1.7 |   |

## Standards

EN 50178; EN 61010-1 ; EN 60950-1 ; UL 508 (file no. E243511)

## Characteristic Curve (TYP)



Figure 1: Linearity curve



Figure 2: Frequency response curve

ex) F01P025S05L

Measurement condition  $T_a=+25^\circ C$ ,  $R_L=1k\Omega$ ,  $I_p=3A$ ,  $V_{cc}=+5V$

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## Maximum Continuous DC primary current

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. Junction temperature  $T_j < 125^\circ\text{C}$
3. Primary conductor temperature  $< 110^\circ\text{C}$
4. Resistor power dissipation  $< 0.5 \times \text{rated power}$

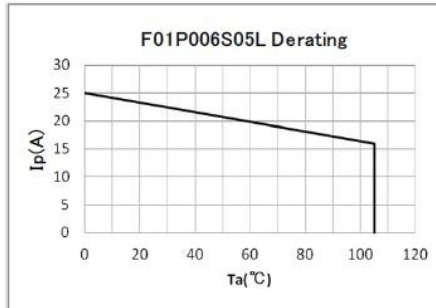


Figure 3: Ip vs Ta for F01P006S05L

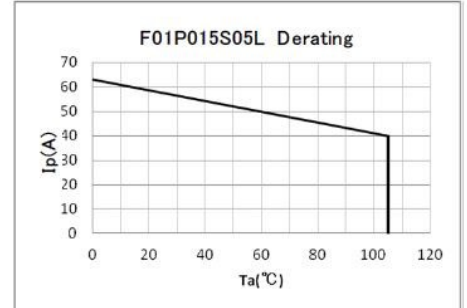


Figure 4: Ip vs Ta for F01P015S05L

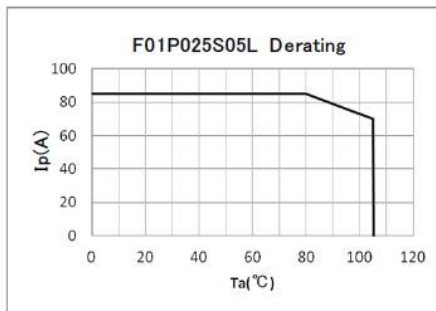


Figure 5: Ip vs Ta for F01P025S05L

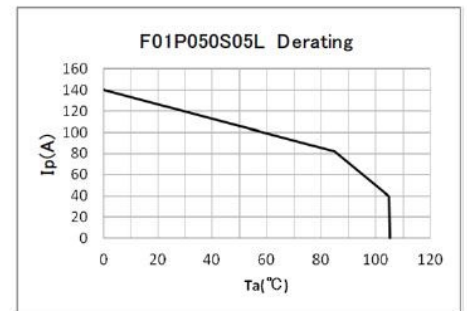


Figure 6: Ip vs Ta for F01P050S05L

## Frequency Derating



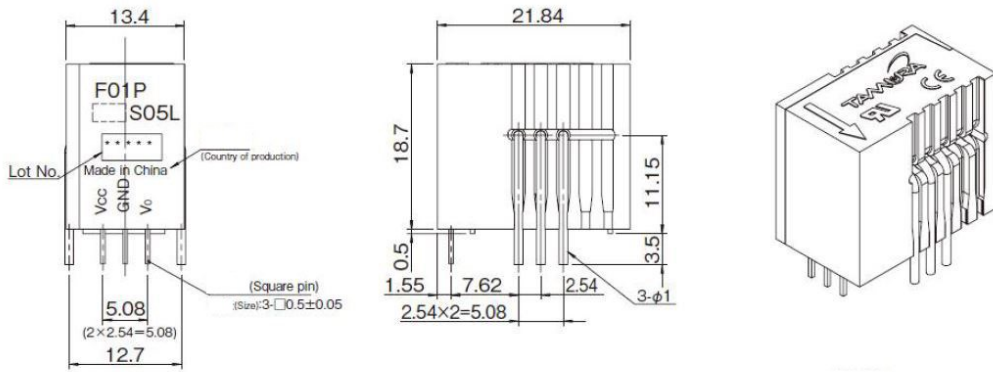
Figure 7 : Maximum RMS AC primary current / maximum DC primary current vs frequency

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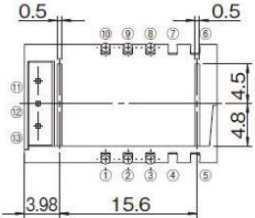
## Connection



## Dimension (mm)



| Terminal number |                   |
|-----------------|-------------------|
| ① Input         | ⑧ Output          |
| ② Input         | ⑨ Output          |
| ③ Input         | ⑩ Output          |
| ④ -             | ⑪ V <sub>o</sub>  |
| ⑤ -             | ⑫ GND             |
| ⑥ -             | ⑬ V <sub>cc</sub> |
| ⑦ -             |                   |



**Note**

- Unless otherwise specified, tolerances shall be  $\pm 0.25\text{mm}$
- Unit is [mm]

## Recommended Hole Diameter (mm)

