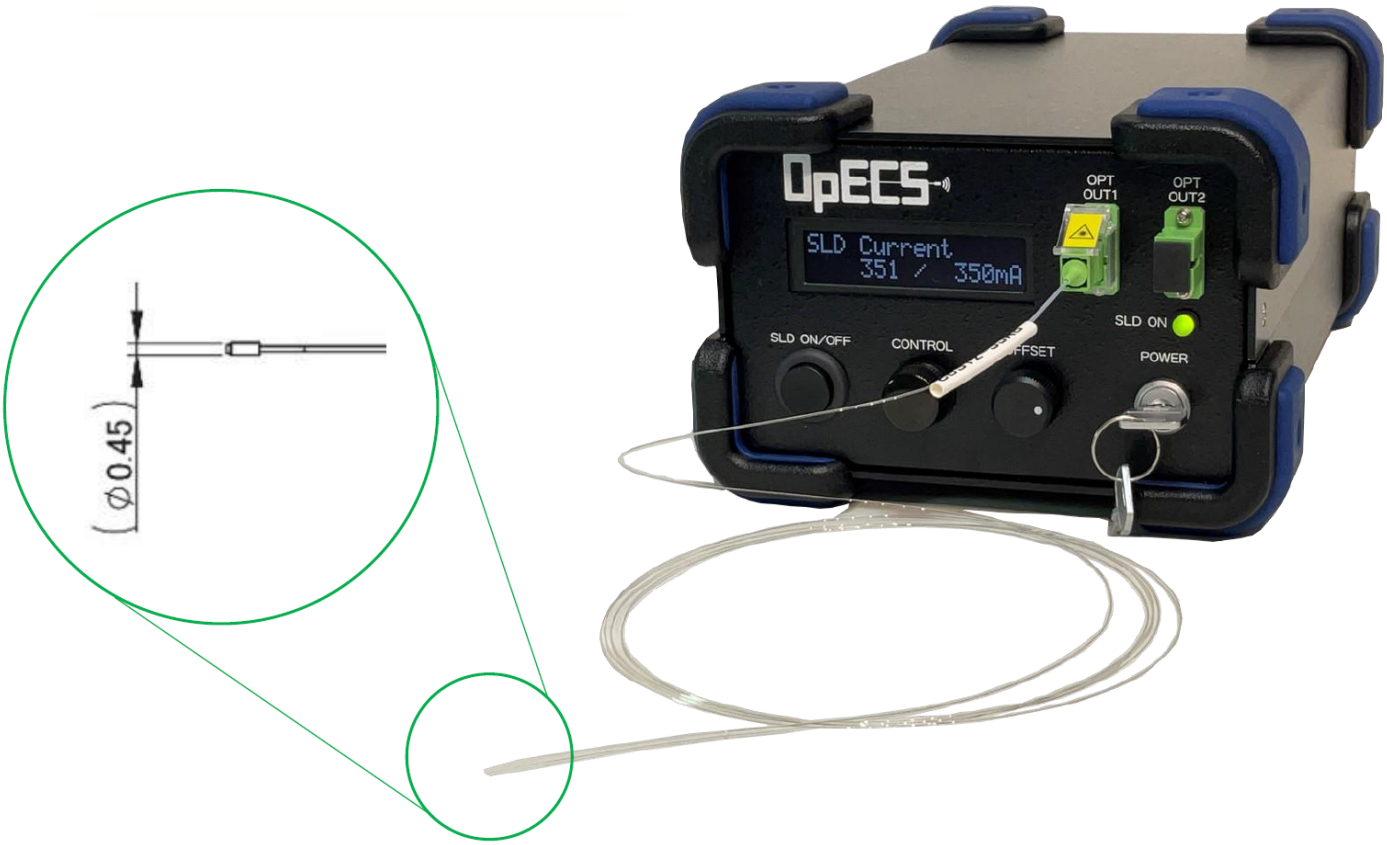
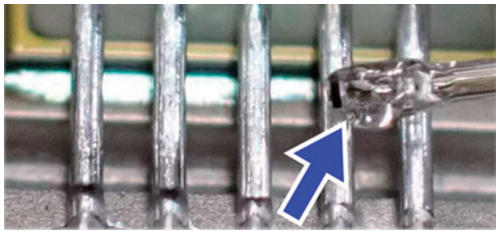
IWATSU

OpECS
Optical Electric Current Sensor

Optical-probe-Electric-Current-Sensor

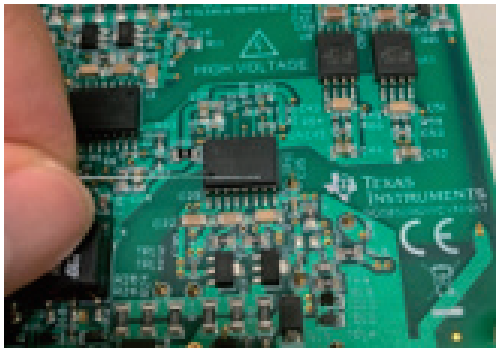


- **Ultra-small sensor head (Tip Φ0.45 mm)**
- **No clamping required for current detection**
- **Wide bandwidth 150 MHz**
- **Maximum measurement current ±140 A**



Recommend Applications:

- Current measurement on wire bonding packages of power semiconductors
- Current distribution verification of bus bars
- Current measurement on high-density mounted boards and inner layer patterns
- Switching waveform measurement of SiC/GaN devices
- Measurement of current flowing through wires in air-core coils, etc.



Optical-probe-Electric-Current-Sensor

OpECS is an optical current sensor that enables current measurement by capturing the magnetic field generated around the current. The sensor uses the Faraday effect (or magneto-optical effect). When a magnetic field exists at the sensor, the direction of oscillation of linearly polarized light changes under the influence of the magnetic field. The direction of oscillation follows an elliptical path according to the direction of the magnetic field, and the change in direction is proportional to the magnitude of the magnetic field (Figure 1). This information is sent to a control unit at a later stage, where it is converted from an optical signal to an electrical signal. The converted electrical signals can then be input to an oscilloscope or other device to measure the current.

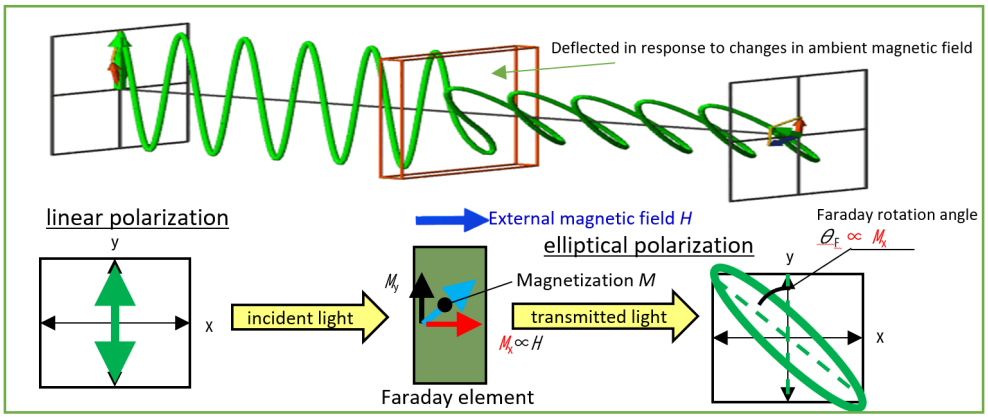


Fig.1. Principle of Optical Current Sensor

Examples of OpECS actual measurements

(1) Wire bonding current waveform of power device (between source and drain, φ300μm)

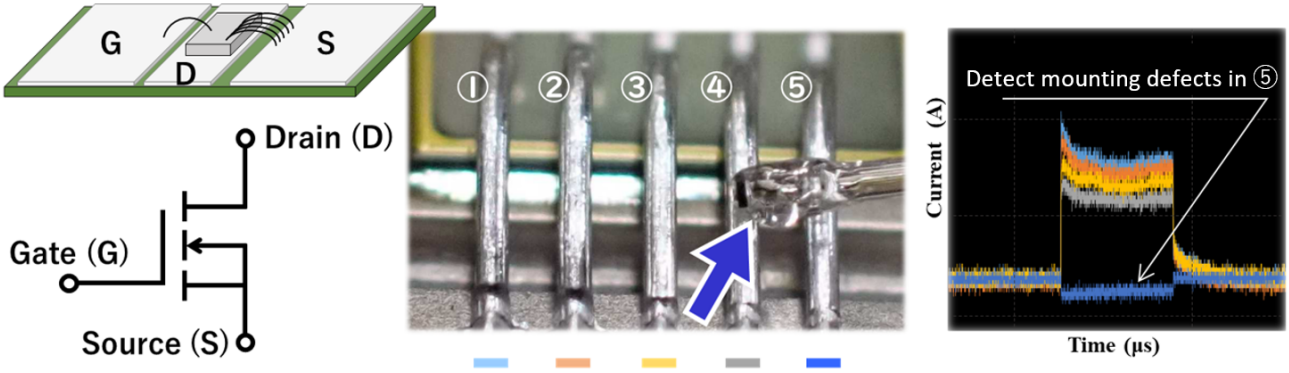
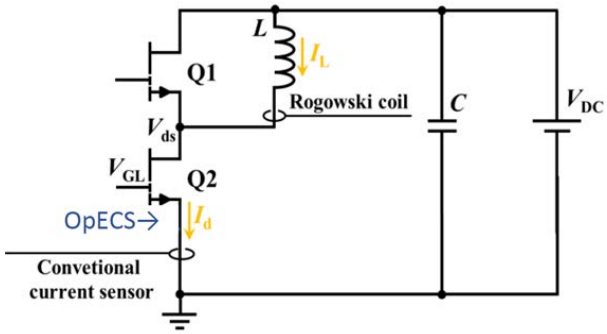
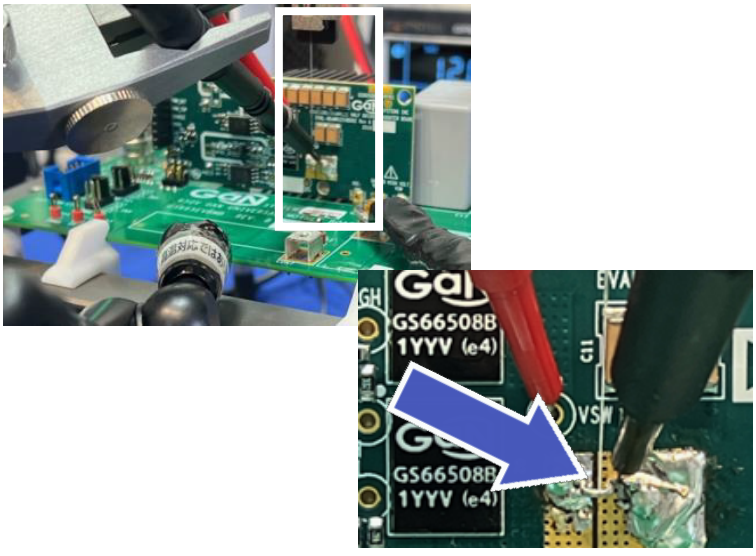


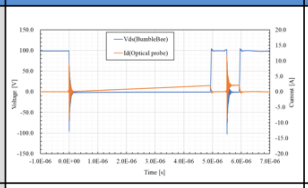
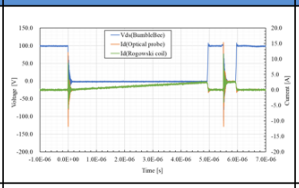
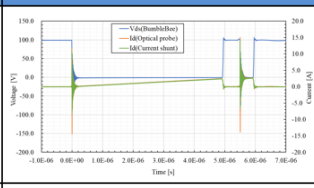
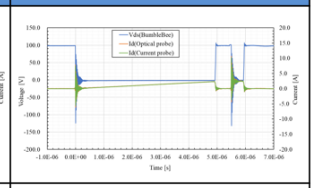
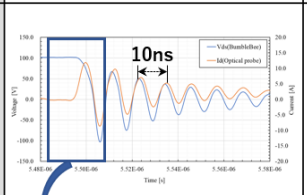
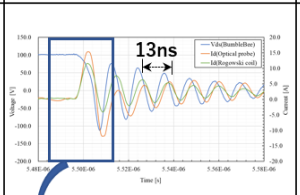
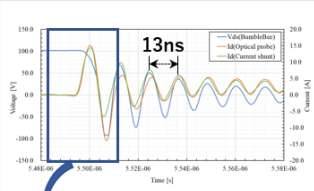
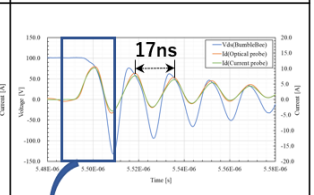
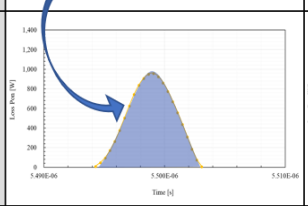
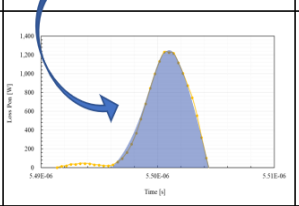
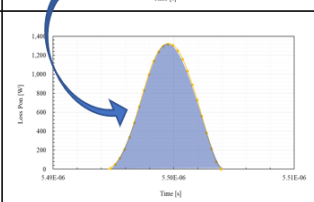
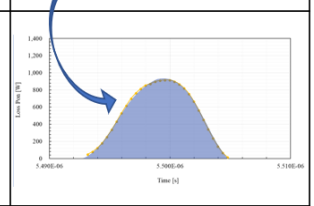
Fig. 3. Measurement of current flowing in five Φ300μm wires

(2) Double-pulse test of a GaN half-bridge circuit (Vds = 100 V)





Features and results of each measurement method (CITIZEN FINE DEVICE CO.,LTD.)

	OpECS	Rogowski coil	Coaxial shunt resistor	Current Probe
Double Pulse Waveform				
Turn On Voltage/Current				
Turn Off Loss				
Calculation Results of Loss	4.54μJ	5.57μJ	6.55μJ	6.43μJ
Head shape	◎	○	○	×
Bandwidth	DC～150MHz	～100MHz	DC～1GHz	DC～120MHz
Ls	◎	○	△	×
Measurable Current	～140A	～6000A	～70A	～30A

Sensitivity and measuring current range of OpECS

(1) Positional relation between wire and sensor

Maximum sensitivity is obtained when the sensor part contacts the center of the wire, as shown in Figure 5, ①. When placed as in ①, a positive output is obtained in relation to the direction of the current flowing through the wire, and when placed as in ②, an inverted output is obtained. When the wire is placed far from the center of the wire as in ③, the magnetic field weakens, and the sensitivity changes as shown in the graph in Fig. 6. Therefore, by maintaining an appropriate distance, it is possible to measure a current greater than the measurable current. Also, if the distance between the center of the wire and the sensor remains constant, the sensitivity will not change even if the diameter of the wire is changed, as shown in Figure 7.

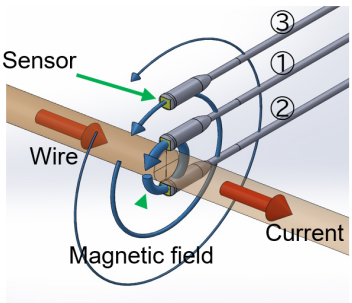


Fig. 5. Position between wire and sensor

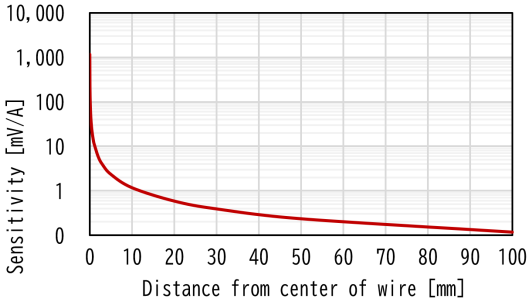


Fig. 6. distance from center of wire and sensitivity

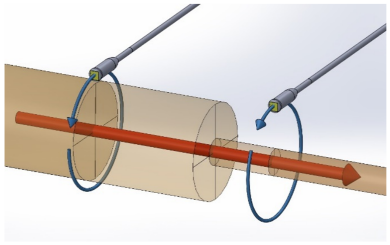
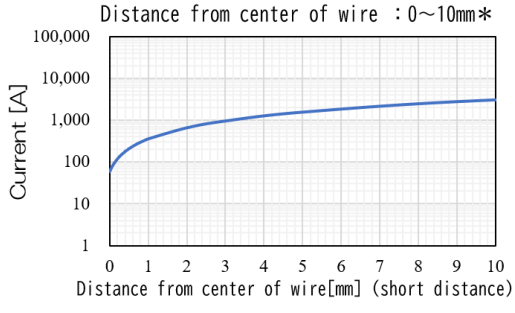


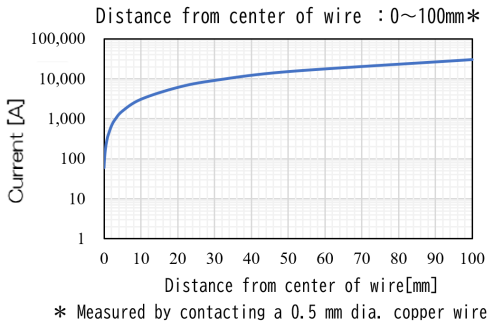
Fig. 7. Relation between sensing distance and wire diameter

(2)Sensor linearity

The linearity of the OpECS current sensor is ±1% and it is maintained up to ±140A.

(3)Measurable Current range

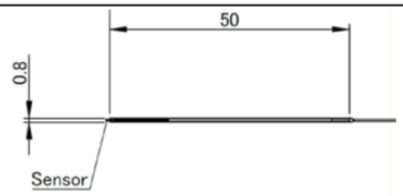
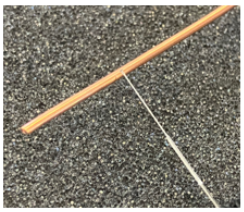
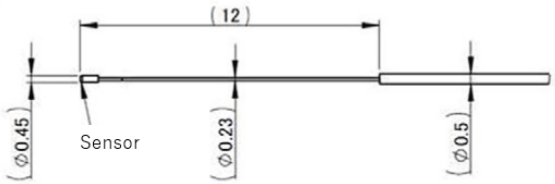
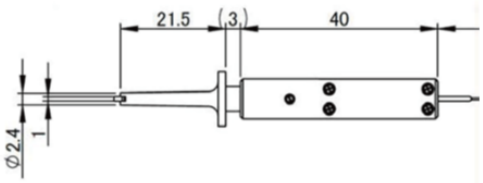




＊ Measured by contacting a 0.5 mm dia. copper wire

Items	Specification	Note
【Main unit】		
Frequency Bandwidth	DC ～ 150 MHz (-3dB)	-
Measurable current	±140 A ※	When making measurements that exceed the measurable current shown at left, see the graph of measurable current on page 3.※Measured by contacting φ0.5mm copper wire
Sensitivity	25.78 mV/A ※1 (0.073 mV/A・m-1)	※Measured by contacting φ0.5mm copper wire
Output Voltage Range	±4.7 V	-
Noise	6.3 mVrms	With no input, at 200MHz bandwidth instrument
Linearity	±1 %	※Measured by contacting φ0.5mm copper wire
Output Connector	BNC (50ΩTermination)	-
Operating Temperature Range	-10 ～ 50 ℃	Sensor Head part
Operating Temperature Range	15 ～ 35 ℃	Control unit part
Power input range	AC100 ～ 240V (50/60 Hz)	-
Power consumption	11 W	-
【Sensor Head】		
Tip shape（φ×L）	φ0.45 × 1 mm	(Typical)
Weight	About 5 g	-
【Control Unit】		
Dimensions（W×L×H）	158.0 × 254.0 × 108.0 mm	(excluding protruding components)
Weight	About 2 kg	-

Order Information

Main unit		
Sensor Head		
	Guided Vertical Head	 
	Horizontal Head	 
	IC Clip Head	 

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