DS10.2m

Ultrafast DC-3.46MHz, Contactless, Galvanically Isolated, Bidirectional Current Sensor

Tell-i
Technologies Inc.

1. Description

Tell-i Technologies' ultrafast current sensor offers exceptionally high-frequency current sensing through contactless, lossless magnetic point-field detection using magnetoresistive technology. The sensor is optimized for power electronics applications on printed circuit boards where the sensor is placed above the trace carrying the current to be measured. Through patented circuitry, the Tell-i sensor responds to ac and dc currents while its contactless design gives circuit designers flexibility for isolation, thermal, and optimal layout design. In addition, the contactless design allows for measurement without altering the current trace, which can introduce inductance and other parasitic effects harming circuit performance at high switching frequencies.

The sensor is mounted directly above the current trace to be measured. The results are linear up to ±10A, with ±20A full range. Compared with Hall-effect and other magnetoresistive sensors, Tell-i sensor experiences minimal hysteresis (0.8%) and low temperature drift (-0.3 %/°C). It includes reset pins for calibration and resetting if needed. The sensor accepts up to 5V supply and outputs a differential voltage proportional to the measured magnetic field with an offset of 2.5V.

DS10.2m is specifically developed to address the need for ultrafast current sensing needs in high frequency power electronics circuits using wide bandgap semiconductor power devices such as GaN and SiC power devices. The high accuracy measurement with minimal propagation delays of 15nsec allows for high frequency (>500kHz) peak current-mode and average-current mode closed-loop control implementations.

2. Features

- DC-3.46MHz Bandwidth
- Contactless
- Isolated Output
- Low Hysteresis
- Linear ±10A, Full ±20A
- Low Temperature Drift

3. Applications

- Wide-Bandgap Power Electronics
- Aerospace
- Automotive
- Datacenters
- Solar PV Inverters
- Plasma Power Supplies
- Medical Power Supplies

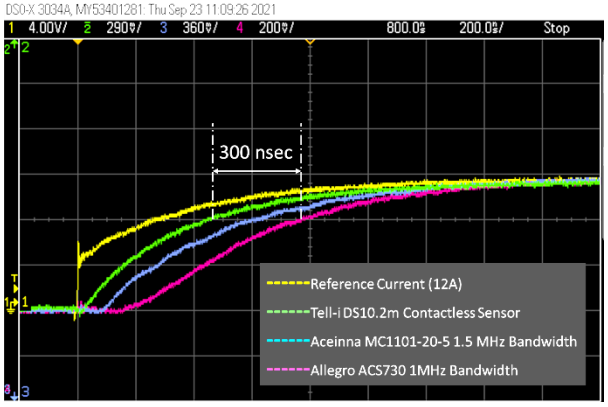

Figure 1. Comparison of DS10.2m vs other sensors

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Version updated on December 13, 2022.

4. Main Characteristics

Stresses above these ratings may cause permanent damage. In addition, exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation at these or other conditions beyond those specified is not implied.

Parameters	Conditions	Symbol	Value	Units
Supply Voltage		V_{dd}	5	V
Sensor Quiescent Current		I_{qc}	20	mA
Rise Time	Small signal	t_{rise}	<130	ns
Bandwidth (-3dB)	Calculated		>3.46	MHz
Propagation Delay		t_{pd}	15	ns
Large-signal Response Time	Step with 868 nsec rise time	$t_{response}$	45	ns
Large-signal Rise Time	Step with 868 nsec rise time	t_{rL}	913	ns
Linear Current Range	mounted on the current trace		±10	A
Full Current Range	mounted on the current trace		±20	A
Linearity Error	±10A		1	%
Output Offset Voltage	Output with no current		$V_{dd}/2$	V
Sensitivity	mounted on the current trace		70	mV/A
Hysteresis Error (Percent of full scale)			0.08	%Fs
Operating Temperature			-40-125	°C
Temperature Drift			-0.3	$\%/°C$

5. Performance

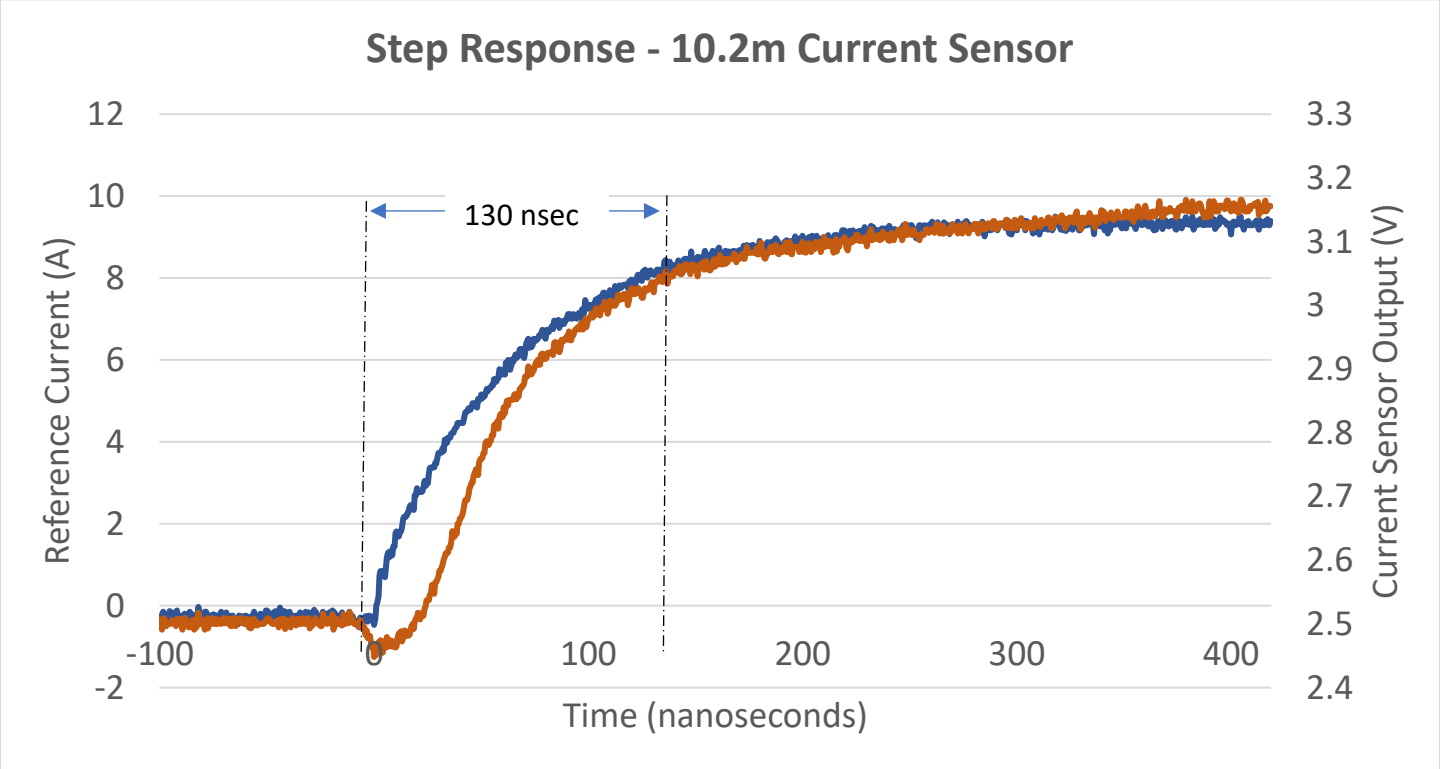


Figure 2. Step Response with 130 nanoseconds risetime.

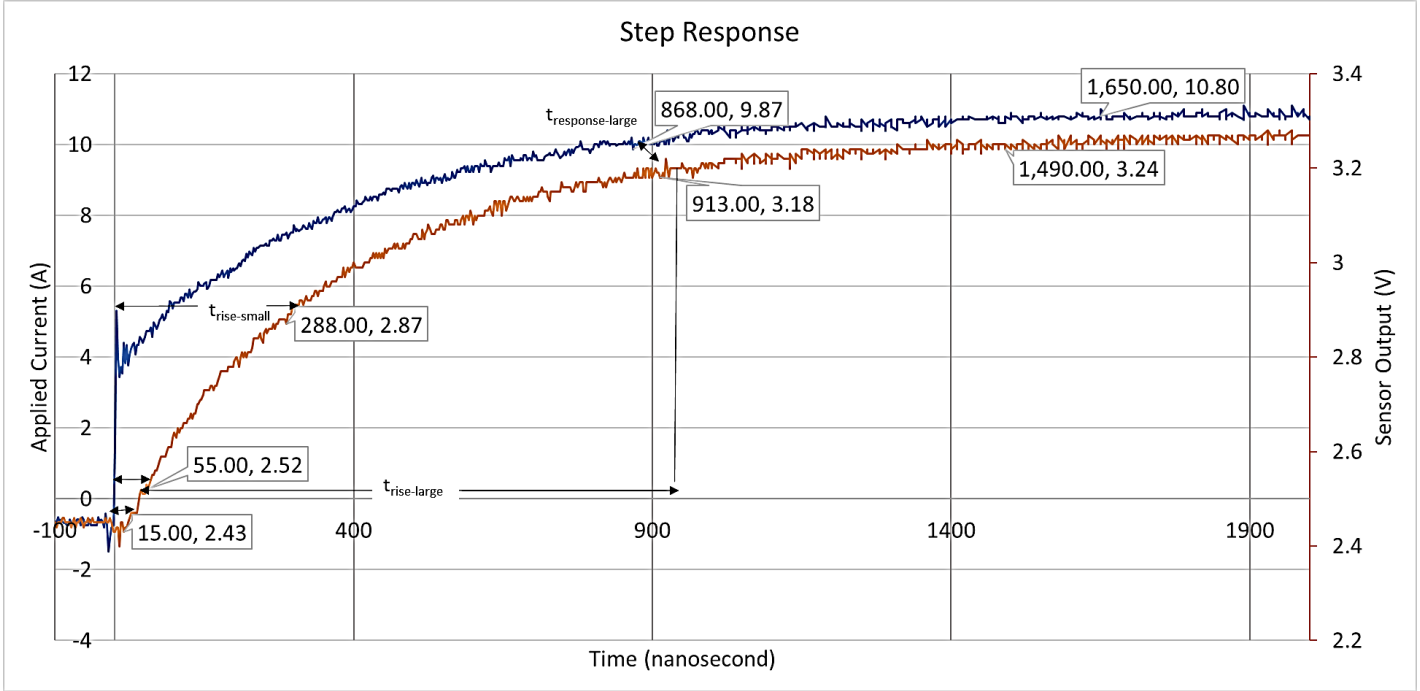


Figure 3. – DS10.2m step response with 868 microsecond rise time – voltage measurement including the line inductance.

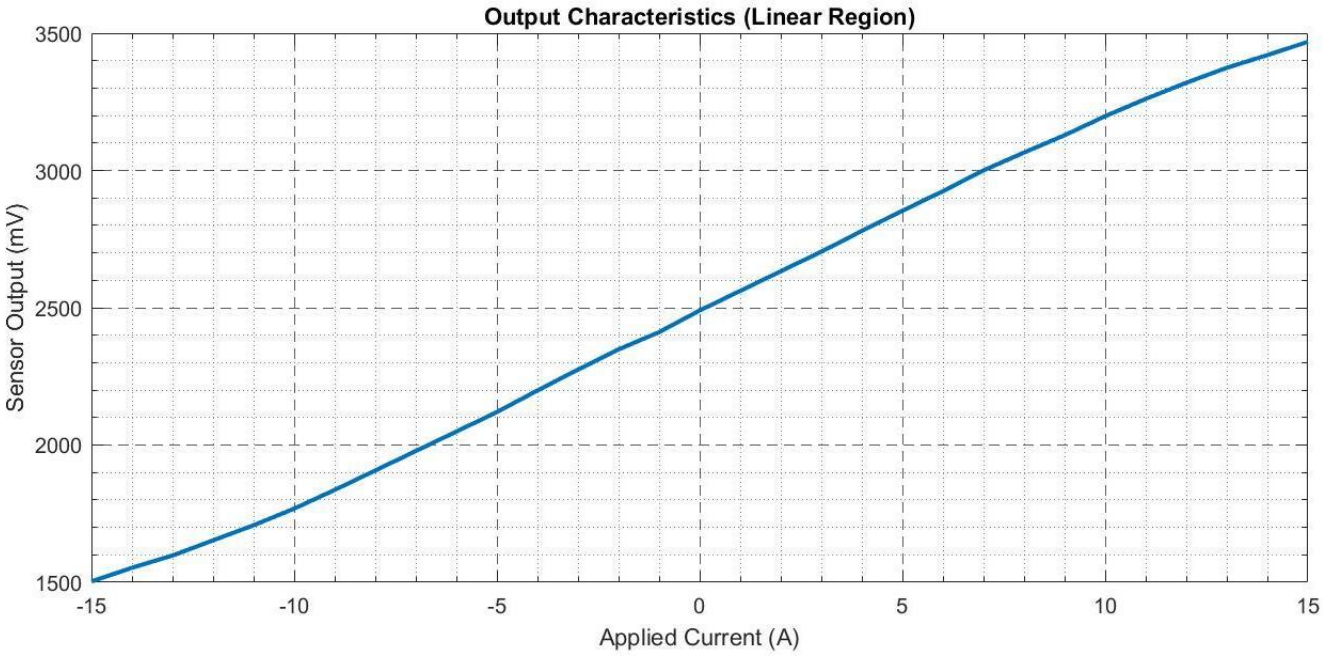


Figure 4. Output Characteristics of the sensor DS10.2m

6. Examples of Performance

Tell-i DS10.2m ultrafast contactless sensor was evaluated and tested in several high frequency converters. Figure 5 presents an example of the sensor performance in a 1.5MHz GaN DC-DC switching converter. Figure 6 presents another

example of the sensor performance in an isolated dual active bridge (DAB) 500kHz switching power converter. As can be seen, the current is captured with a very high resolution and accuracy that enables seamless closed-loop control implementation.

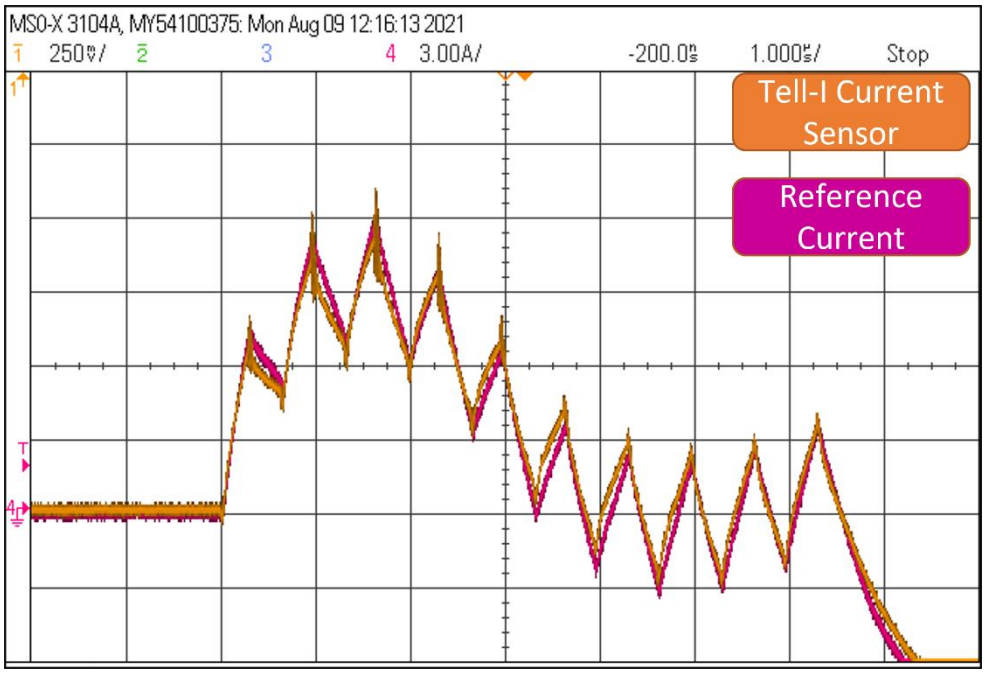


Figure 5. Performance of Tell-i DS10.2m current sensor in a 1.5MHz DC/DC switching converter.

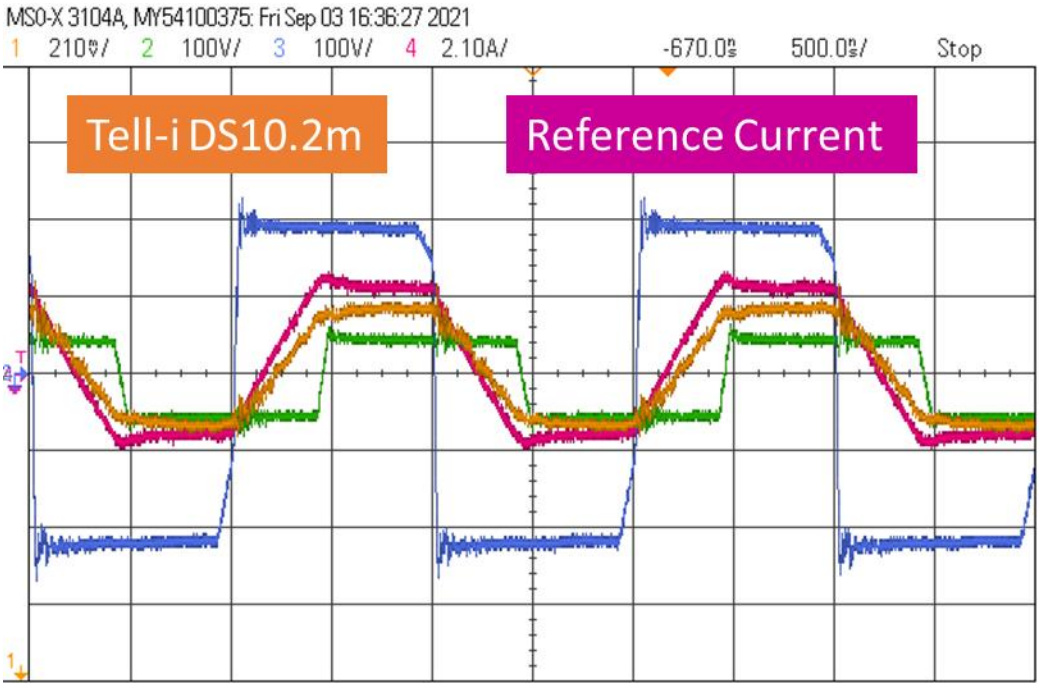
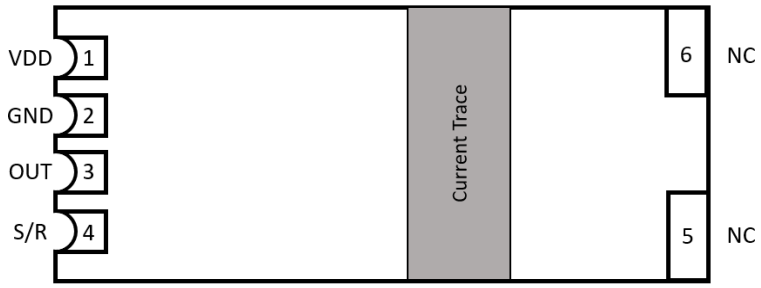


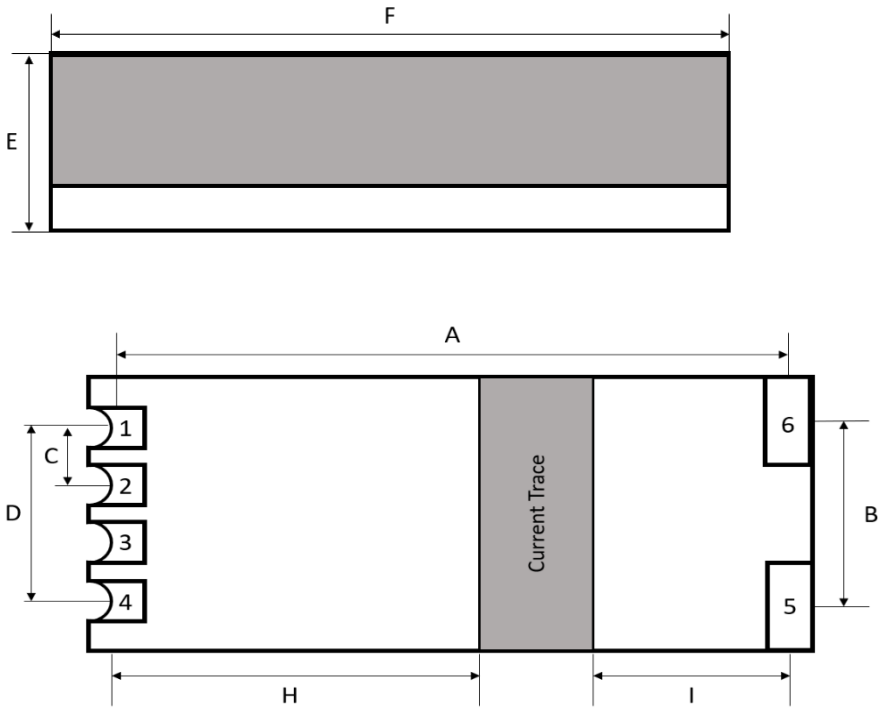
Figure 6. Performance of Tell-i DS10.2m current sensor in a 500kHz isolated Dual Active Bridge (DAB) DC/DC power converter.

7. PACKAGE OUTLINE & RECOMMENDED LAND PATTERN INFORMATION

Tell-i DS10.2m contactless current sensor is placed on top of current-carrying trace on printed circuit board.



Pin	Function
1	VDD (5V)
2	GND
3	Sensor Out
4	Set/Reset
5	NC/MOUNT
6	NC/MOUNT



Symbol	Inches	Millimeters
A	0.914	23.22
B	0.225	5.72
C	0.079	2.01
D	0.236	5.99
E	0.263	6.68
F	0.933	23.70
G	0.317	8.05
H *	0.570	14.48
I *	0.200	5.08

** - Measurement from Pin-to-Trace Current Trace Width = 0.140" (3.56mm)*

Figure 7. Component dimension

PCB Footprint

Tell-is' DS10.2m uses castellated holes to become an SMD component. The position of the Tell-i sensor on the current trace is very important. The castellated holes are small and need specific PCB footprint for soldering. Recommendation of hand soldering and oven/reflow soldering is shown below. The recommended current trace under the sensor is 0.14" (3.56mm) wide.

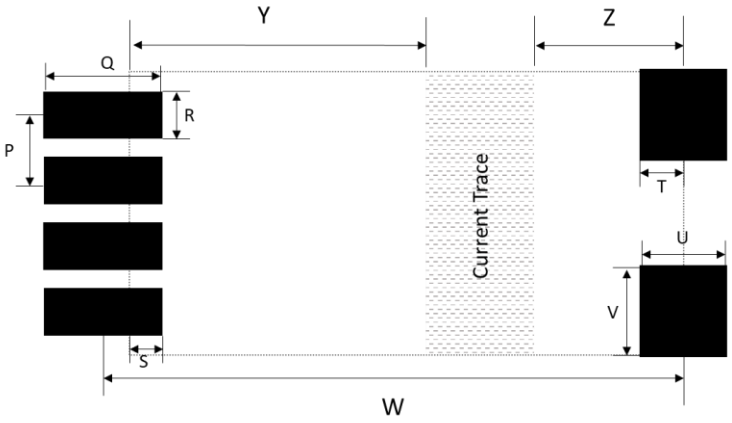


Figure 8 – Recommended Hand Soldering PCB Footprint. The recommended Current Trace underneath – NO CONTACT- the sensor is 0.14" (3.56mm) wide.

Symbol	Inches	Millimeters
L	0.025	0.64
M	0.045	1.14
N	0.030	0.76
O	0.090	2.29
P	0.079	2.01
Q	0.150	3.81
R	0.045	1.14
S	0.040	1.02
T	0.040	1.02
U	0.100	2.54
V	0.090	2.29
W	0.995	25.27
X	0.914	23.22
Y	0.578	14.7
Z	0.216	5.5

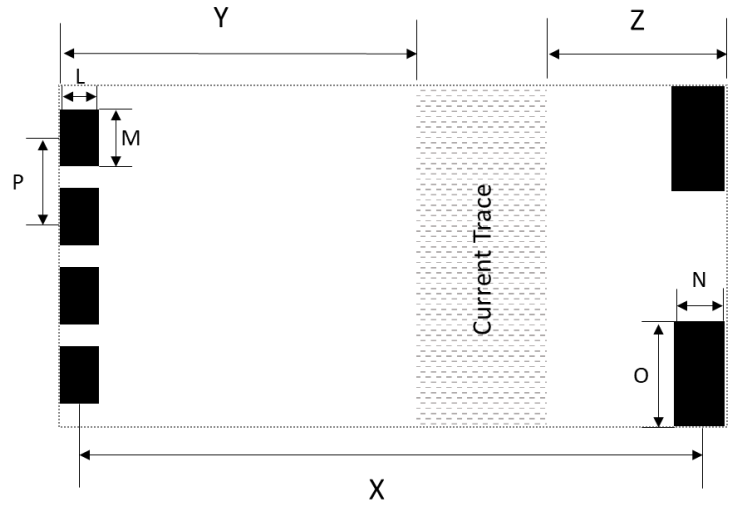


Figure 9 – Recommended Oven/Reflow Soldering PCB Footprint.
The recommended Current Trace underneath – NO CONTACT- the sensor is 0.14" (3.56mm) wide.