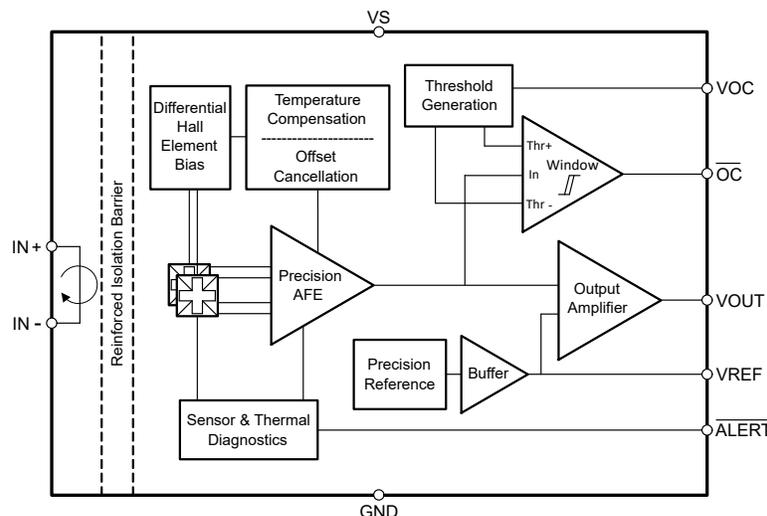


# Current Sensing With Isolated Magnetic Hall-Effect Current Sensors



The magnetic current sensor uses the physics principle that current flowing through a conductor creates a magnetic b-field. Based on this principle, the TMCS1123 uses Hall-effect sensors that sense the amount of current that passes through the lead frame of the device and provide a proportional voltage output to an input current. Magnetic current sensors are isolated current-sensing designs – the TMCS1123 can support reinforced working voltages up to **1.1 kV<sub>DC</sub>** and basic working voltages up to **2.0 kV<sub>DC</sub>**. Hall-effect sensors are notorious for drifting across temperature and lifetime, manifesting as an output error. However, with Texas Instruments' signal chain expertise, the TMCS1123 has the best-in-class drift parameters of **0.5% maximum over lifetime and temperature**.



TMCS1123 Functional Block Diagram

## Design Considerations

### What does TMCS1123 provide to a system?

- Excellent voltage isolation characteristics with capabilities of **1.1 kV<sub>DC</sub>** of reinforced isolation working voltage, **2.0 kV<sub>DC</sub>** of basic working voltage, **5 kV<sub>RMS</sub>** withstand isolation voltage, and **8.1 mm** of creepage and clearance, allowing for safe usage in high-voltage systems.
- Industry-leading accuracy performance of **1.75% maximum total error** from across temperature, lifetime, and other sources of error.
- Capability to carry continuous currents of **75 A<sub>RMS</sub> at 25°C** and **40 A<sub>RMS</sub> at 125°C**
- Active ambient field rejection of **0.1 A/mT**, which significantly reduces magnetic interference from neighboring conductors or other sources of stray magnetic fields
- Fast response times with a **fast overcurrent detection response of 500 ns**, coupled with a device bandwidth of **250 kHz**, supporting fast systems to enable precise control and monitoring. Higher bandwidth devices in development.
- The device is equipped with a precision reference voltage output to enable more precise conversion with analog-to-digital converters by creating a quasi-differential output.
- Unique to the TMCS1123 is the Alert output, which provides a thermal alert if the junction exceeds 165°C and a sensor alert if the sensitivity or offset is out of range of the factory limits

Part Number	Automotive Qualified	Features	Maximum Continuous Current at 25°C	Applications
TMCS1123	Automotive version in development	1.1-kV <sub>DC</sub> reinforced working voltage isolation, 500-ns overcurrent detection, Alert for device performance	75 A <sub>RMS</sub>	Motor control, inverter and H-bridge current measurements, power factor correction, overcurrent protection, DC and AC power monitoring, EV charging stations

Need additional assistance? Ask our engineers a question on the [TI E2E™ amplifier support forum](#).

## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on [ti.com](https://www.ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2023, Texas Instruments Incorporated