

# Temperature sensors for optical modules



Temperature sensors are critical for thermal monitoring and protection for optical modules to enable system diagnostics, improve performance and extend module reliability.

Thermal rise may result in data loss during the electrical to optical (E2O) conversion. Monitoring temperature allows the system to predict when a module needs to re-transmit information.

Premature failure can occur if the system operates above a critical temperature for long periods of time. Temperature feedback enables the module to perform its own diagnostic and maintenance to improve overall system performance and reliability.

As optical transmission rates increase to hundreds of gigabits per second, adding a high precision temperature sensor can significantly augment the module's performance. An accurate temperature measurement reduces guard bands and helps the module operate closer to its maximum thermal limits.

[TMP235](#) and [LM20](#) are commonly used local analog output temperature sensors in optical modules. They are available in leaded and chip scale packages. Both of these devices are designed to seamlessly interface with an ADC of a standard MCU in an optical module. The TMP235 provides a high accuracy option.

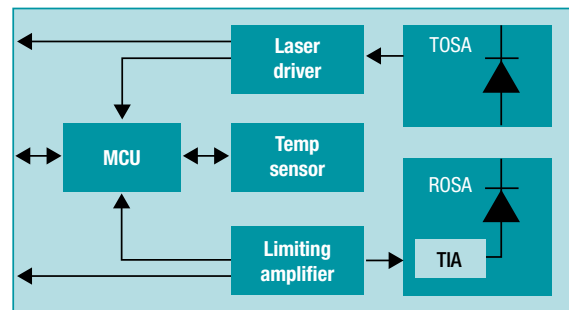


Figure 1. Optical module block diagram

In addition to analog output sensors, digital output sensors including [TMP102](#), [TMP108](#) and [TMP116](#) can be used in this application. All of these digital sensors are available in small footprints with low power consumption and an I<sup>2</sup>C interface. These sensors also include a programmable alert output to trigger the MCU in the event of an over-temperature condition, eliminating polling.

TMP116 provides the highest accuracy at  $\pm 0.2^{\circ}\text{C}$  and includes non-volatile memory.

TI offers a complete portfolio of temperature sensors with ultra-low power and small footprints designed to meet demanding optical module cost and performance needs. Please refer to table 1 for a detailed temperature sensing selection.

Part number	Interface	Accuracy (max)	Operating range	Supply range	Quiescent / shutdown current (max)	Package type	Package footprint
<a href="#">LM20</a>	Analog	$\pm 2.5^{\circ}\text{C}$	$-55^{\circ}\text{C}$ to $130^{\circ}\text{C}$	2.7 V to 5.5 V	10 $\mu\text{A}$	SC70 DSBGA	1.25 x 2.00 mm 1.00 x 1.00 mm
<a href="#">TMP235</a>	Analog	$\pm 1^{\circ}\text{C}$ / $\pm 2^{\circ}\text{C}$	$0^{\circ}\text{C}$ to $70^{\circ}\text{C}$ / $-40^{\circ}\text{C}$ to $125^{\circ}\text{C}$	1.6 V to 5.5 V	12 $\mu\text{A}$	SC70	2.00 x 1.25 mm
<a href="#">TMP108</a>	I <sup>2</sup> C / SMBUS	$\pm 75^{\circ}\text{C}$	$-40^{\circ}\text{C}$ to $125^{\circ}\text{C}$	1.4 V to 3.6 V	8 $\mu\text{A}$ / 1 $\mu\text{A}$	DSBGA	0.80 x 1.20 mm
<a href="#">TMP102</a>	I <sup>2</sup> C / SMBUS	$\pm 2^{\circ}\text{C}$	$-40^{\circ}\text{C}$ to $125^{\circ}\text{C}$	1.4 V to 3.6 V	10 $\mu\text{A}$ / 1 $\mu\text{A}$	SOT-563	1.60 x 1.60 mm
<a href="#">TMP116</a>	I <sup>2</sup> C / SMBUS	$\pm 0.2^{\circ}\text{C}$	$-55^{\circ}\text{C}$ to $125^{\circ}\text{C}$	1.9 V to 5.5 V	4.5 $\mu\text{A}$ / 0.5 $\mu\text{A}$	WSO	2.00 x 2.00 mm

## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), 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, 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 ([www.ti.com/legal/termsofsale.html](http://www.ti.com/legal/termsofsale.html)) or other applicable terms available either on [ti.com](http://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.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2018, Texas Instruments Incorporated