

Gross Margin

Products and Services gross margin and gross margin percentage for 2023, 2022 and 2021 were as follows (dollars in millions):

	2023	2022	2021
Gross margin:			
Products	\$ 108,803	\$ 114,728	\$ 105,126
Services	60,345	56,054	47,710
Total gross margin	<u>\$ 169,148</u>	<u>\$ 170,782</u>	<u>\$ 152,836</u>

Gross margin percentage:

Products	36.5 %	36.3 %	35.3 %
Services	70.8 %	71.7 %	69.7 %
Total gross margin percentage	44.1 %	43.3 %	41.8 %

Products Gross Margin

Products gross margin decreased during 2023 compared to 2022 due to the weakness in foreign currencies relative to the U.S. dollar and lower Products volume, partially offset by cost savings and a different Products mix.

Products gross margin percentage increased during 2023 compared to 2022 due to cost savings and a different Products mix, partially offset by the weakness in foreign currencies relative to the U.S. dollar and decreased leverage.

Services Gross Margin

Services gross margin increased during 2023 compared to 2022 due primarily to higher Services net sales, partially offset by the weakness in foreign currencies relative to the U.S. dollar and higher Services costs.

Services gross margin percentage decreased during 2023 compared to 2022 due to higher Services costs and the weakness in foreign currencies relative to the U.S. dollar, partially offset by a different Services mix.

The Company's future gross margins can be impacted by a variety of factors, as discussed in Part I, Item 1A of this Form 10-K under the heading "Risk Factors." As a result, the Company believes, in general, gross margins will be subject to volatility and downward pressure.

Operating Expenses

Operating expenses for 2023, 2022 and 2021 were as follows (dollars in millions):

	2023	Change	2022	Change	2021
Research and development	\$ 29,915	14 %	\$ 26,251	20 %	\$ 21,914
Percentage of total net sales	8 %		7 %		6 %
Selling, general and administrative	\$ 24,932	(1) %	\$ 25,094	14 %	\$ 21,973
Percentage of total net sales	7 %		6 %		6 %
Total operating expenses	\$ 54,847	7 %	\$ 51,345	17 %	\$ 43,887
Percentage of total net sales	14 %		13 %		12 %

Research and Development

The year-over-year growth in R&D expense in 2023 was driven primarily by increases in headcount-related expenses.

Selling, General and Administrative

Selling, general and administrative expense was relatively flat in 2023 compared to 2022.