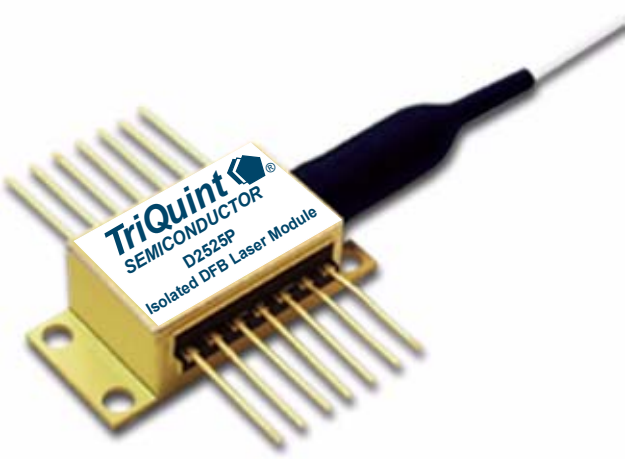
TriQuint SEMICONDUCTOR

TriQuint Optoelectronics

Data Sheet, Rev. 2
February 2003

Wavelength-Selected D2525P Isolated DFB Laser Module with PMF



The 1.5 µm D2525P Laser Module is available in a 14-pin, hermetic, butterfly package.

Features

- ITU wavelengths available from 1529.55 nm —1610.06 nm
- Integrated optical isolator
- High-performance, multiquantum-well (MQW), distributed-feedback (DFB) laser
- Industry-standard, 14-pin butterfly package
- Hermetic package
- InGaAs, PIN photodetector back-facet monitor
- Polarization-maintaining fiber pigtail
- For use with lithium niobate modulators
- High reliability
- Narrow linewidth
- High optical power available

Applications

- Telecommunications
  - — SONET/SDH OC-48/STM-16, OC-192/STM-64
  - — Extended and ultralong reach
  - — Undersea systems
  - — Dense WDM systems
- Digital video

Description

The D2525P family of DFB laser modules is designed to be used with a lithium niobate external modulator (see Table 5). The laser module features a polarization-maintaining fiber (PMF) pigtail, enabling it to be directly connected to a modulator without the need of a polarization controller. The PMF maintains the polarization of the output light to a consistent orientation. This allows the D2525P to be used as a CW light source for systems requiring extremely low chirp such as undersea or 10 Gb/s systems. The module contains a multiquantum-well (MQW), distributed-feedback (DFB) laser. This device nominally has an output power of 10 mW. The wavelength of the laser can be temperature-tuned for more precise wavelength selection by adjusting the temperature of the internal thermoelectric cooler.

Description (continued)

Controlled Feedback

The module contains an internal optical isolator that suppresses optical feedback in laser-based, fiber-optic systems. Light reflected back to the laser is attenuated a minimum of 30 dB.

Controlled Temperature

An integral thermoelectric cooler (TEC) provides stable thermal characteristics. The TEC allows for heating and cooling of the laser chip to maintain a temperature of 25 °C for case temperatures from –40 °C to +70 °C. The laser temperature is monitored by the internal thermistor, which can be used with external circuitry to control the laser chip temperature.

Controlled Power

An internal, InGaAs, PIN photodiode functions as the back-facet monitor. The photodiode monitors emission from the rear facet of the laser and, when used in conjunction with control circuitry, can control optical power launched into the fiber. Normally, this configuration is used in a feedback arrangement to maintain consistent laser output power.

Standard Package

The laser module is fabricated in a 14-pin, hermetic, metal/ceramic butterfly package that incorporates a bias tee that separates the dc-bias path from the RF input. The RF input has a nominal 25 Ω impedance.

The laser module is equipped with *Fujikura** polarization-maintaining fiber (PMF). The fiber is PANDA type and is the same fiber that is used on the TriQuint lithium niobate modulators. It has a mode field diameter of 10.5 μm, a cladding diameter of 125 μm ±3 μm, and a loose tube jacketed fiber 900 μm in diameter. The pigtail is terminated with an *ST*® ferrule†. Figure 1 shows the orientation of polarization in the fiber.

TriQuint optoelectronic components are being qualified to rigorous internal standards that are consistent with *Telcordia Technologies* ‡ TR-NWT-000468. All design and manufacturing operations are *ISO*§ 9001 certified. The module is being fully qualified for central office applications.

* *Fujikura* is a registered trademark of Fujikura Ltd.
† The *ST* ferrule key is not aligned to slow axis of fiber. Connector is intended for testing purposes only.
‡ *Telcordia Technologies* is a trademark of Telcordia Technologies Inc.
§ *ISO* is a registered trademark of The International Organization for Standardization.

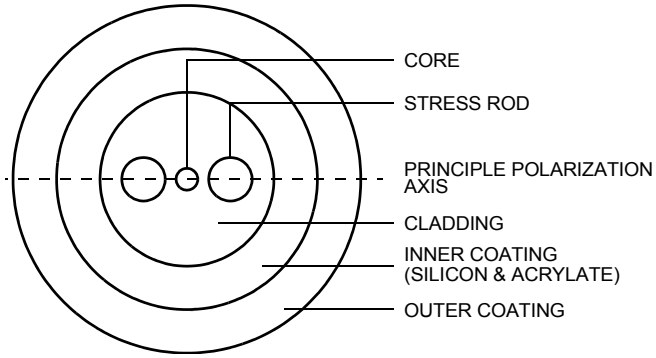


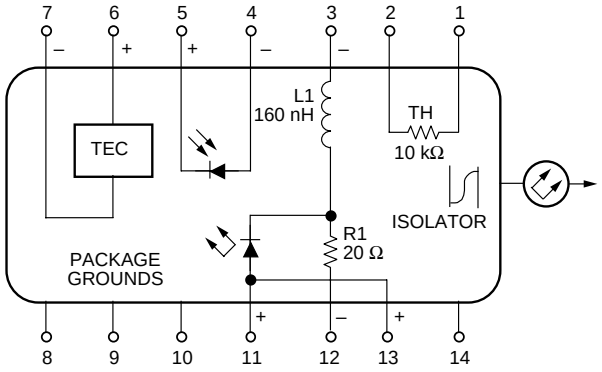
Figure 1. Polarization-Maintaining Fiber

Pin Information

Table 1. Pin Descriptions

Pin	Name
1	Thermistor
2	Thermistor
3	Laser dc Bias (Cathode) (–)
4	Back-facet Monitor Anode (–)
5	Back-facet Monitor Cathode (+)
6	Thermoelectric Cooler (+)[1]
7	Thermoelectric Cooler (–)[1]
8	Case Ground
9	Case Ground
10	Case Ground
11	Laser Anode (+)[2]
12	RF Laser Input Cathode (–)
13	Laser Anode (+)[2]
14	Case Ground

1. A positive current through the thermoelectric heat pump cools the laser.
2. Both leads should be grounded for optimum performance.



Top view.

1-567.b

Figure 2. Circuit Schematic

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operations sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter	Symbol	Min	Max	Unit
Laser Reverse Voltage	V_{RLMAX}	—	2	V
dc Forward Current	I_{FLMAX}	—	225	mA
Operating Case Temperature Range	T_C	–40	70	°C
Storage Case Temperature Range*	T_{stg}	–40	70	°C
Photodiode Reverse Voltage	V_{RPDMAX}	—	10	V
Photodiode Forward Current	I_{FPDMAX}	—	2	mA

* Does not apply to shipping container.

Handling Precautions

Power Sequencing

To avoid the possibility of damage to the laser module from power supply switching transients, follow this turn-on sequence:

1. All ground connections
2. Most negative supply
3. Most positive supply
4. All remaining connections

Reverse the order for the proper turn-off sequence.

Electrostatic Discharge

CAUTION: This device is susceptible to damage as a result of electrostatic discharge. Take proper precautions during both handling and testing. Follow guidelines such as JEDEC Publication No. 108-A (Dec. 1988).

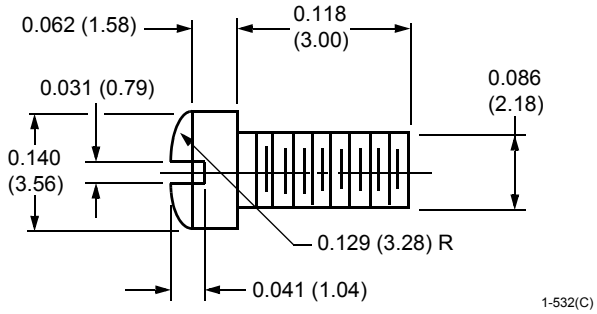
TriQuint employs a human-body model (HBM) for ESD-susceptibility testing and protection-design evaluation. ESD voltage thresholds are dependent on the critical parameters used to define the model. A standard HBM (resistance = 1.5 kΩ, capacitance = 100 pF) is widely used and, therefore, can be used for comparison purposes.

Mounting Instructions

The minimum fiber bend radius is 1.0 in.(25.4 mm)

To avoid degradation in performance, mount the module on the board as follows:

1. Place the bottom flange of the module on a flat heat sink at least 0.5 in. x 1.180 in. (12.7 mm x 30 mm) in size. The surface finish of the heat sink should be better than 32 μin. (0.8 μm), and the surface flatness must be better than 0.001 in. (25.4 μm). Using thermal conductive grease is optional; however, thermal performance can be improved by up to 5% if conductive grease is applied between the bottom flange and the heat sink.
2. Mount four #2-56 screws with Fillister heads (M2-3 mm) at the four screw hole locations (see Outline Diagram). The Fillister head diameter must not exceed 0.140 in. (3.55 mm). Do not apply more than 1 in.-lb. of torque to the screws.



Note: Dimensions are in inches and (millimeters).

Figure 3. Fillister Head Screw

Characteristics

Table 2. Electrical Characteristics (at 25 °C laser temperature)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Threshold Current	I_{TH}	—	—	15	35	mA
Drive Current Above Threshold	—	L_F = 10 mW	—	—	110	mA
Laser Forward Voltage	V_{LF}	L_F = 10 mW (CW)	—	1.3	1.8	V
Laser Submount Temperature	T_{LASER}	—	20	—	30	°C
Monitor Reverse-bias Voltage*	V_{RMON}	—	3	5	10	V
Monitor Current	I_{RMON}	P_O = 10 mW (CW)	0.2	—	—	mA
Monitor Dark Current	I_D	I_F = 0, V_{RMON} = 5 V	—	0.01	0.1	μA
Input Impedance	Z_{IN}	—	—	25	—	Ω
Thermistor Current	I_{TC}	—	10	—	100	μA
Resistance Ratio†	—	—	9.1	9.6	10.1	—
Thermistor Resistance	R_{TH}	T_L = 25 °C	9.5	—	10.5	kΩ
TEC Current	I_{TEC}	T_L = 25 °C, T_C = 70 °C	—	—	1.0	A
TEC Voltage	V_{TEC}	T_L = 25 °C, T_C = 70 °C	—	—	2.0	V
TEC Capacity	ΔT	T_C = 70 °C	—	—	50	°C

* Standard operating condition is 5.0 V reverse bias.
† Ratio of thermistor resistance at 0 °C to thermistor resistance at 50 °C.

Table 3. Optical Characteristics (at 25 °C laser temperature)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Peak Optical Output Power	P_P	—	10.0	—	—	mW
Center Wavelength* (See Table 4.)	λC	T_L = 25 °C CW Wavelength	1529.55	—	1610.06	nm
Line Width (3 dB full width)	Δλ	CW, P_F = 10.0 mW	—	2	10	MHz
Relative Intensity Noise	RIN	CW, P_F = 10.0 mW, 200 MHz < f < 10 GHz	—	—	–135	dB/Hz
Side-mode Suppression Ratio	SMSR	CW	35	45	—	dB
Optical Isolation	—	T_C = 0 °C to 75 °C	30	—	—	dB
Optical Polarization Extinction Ratio†	—	0 °C to 75 °C	20	—	—	dB
Wavelength Drift (EOL)	Δλ	Tested over 25 yr. lifetime			±0.1	nm
Wavelength Drift vs. Case Temperature	—	—	—	—	±1	pm/°C

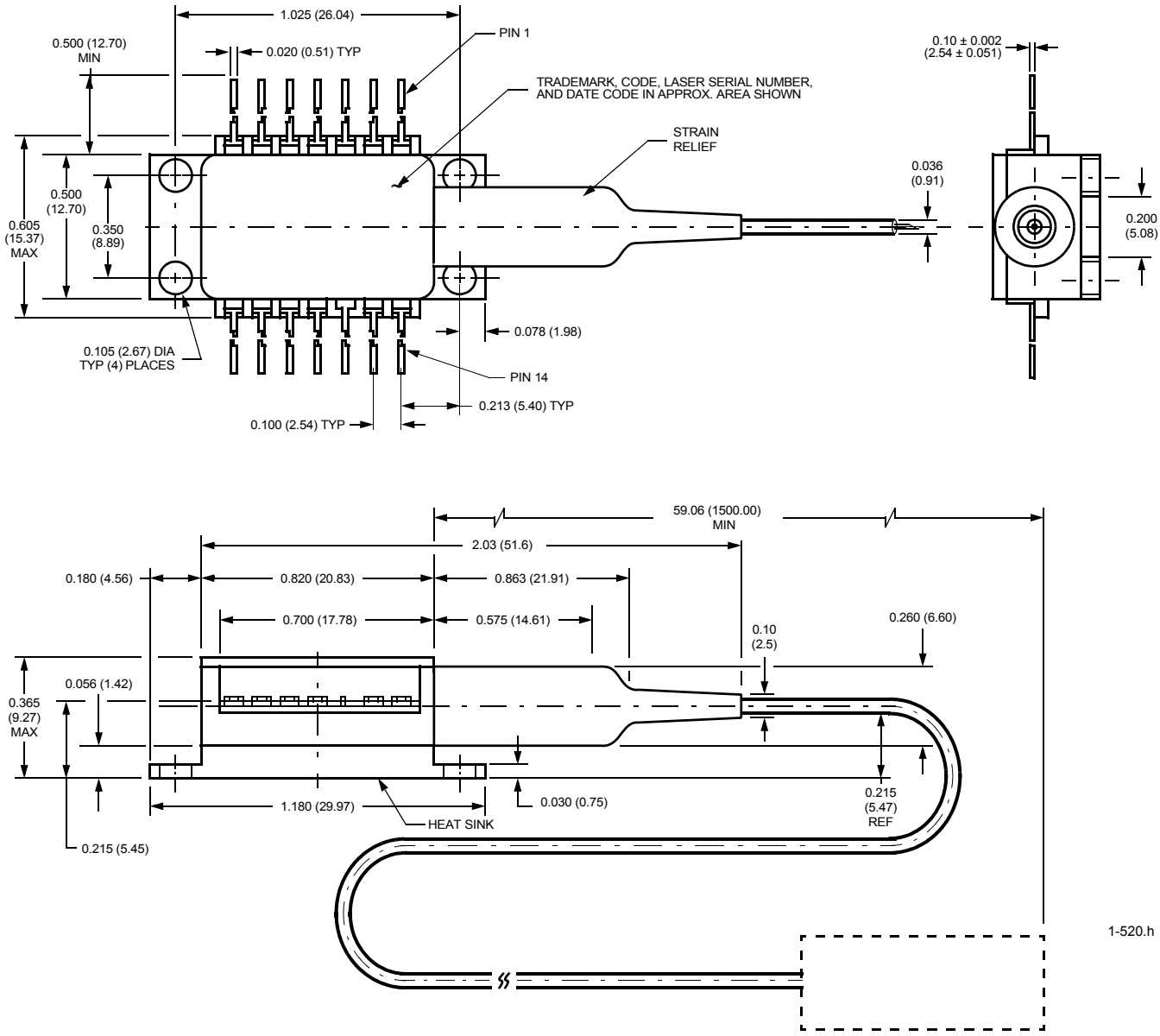
* Custom wavelengths available.
† The *ST* ferrule key is not aligned to slow axis of fiber. Connector is intended for testing purposes only.

Table 4. D2525P Fiber Pigtail and Connector Characteristics

Parameter	Symbol	Description	Min	Typ	Max	Unit
Pigtail Length	L	*Fujikura* PANDA or equivalent polarization-maintaining fiber	1.5	—	—	m
Connector Type	—	*ST* Plug	—	—	—	—

Outline Diagram

Dimensions are in inches and (millimeters). Tolerances are ±0.005 in. (±0.127 mm).



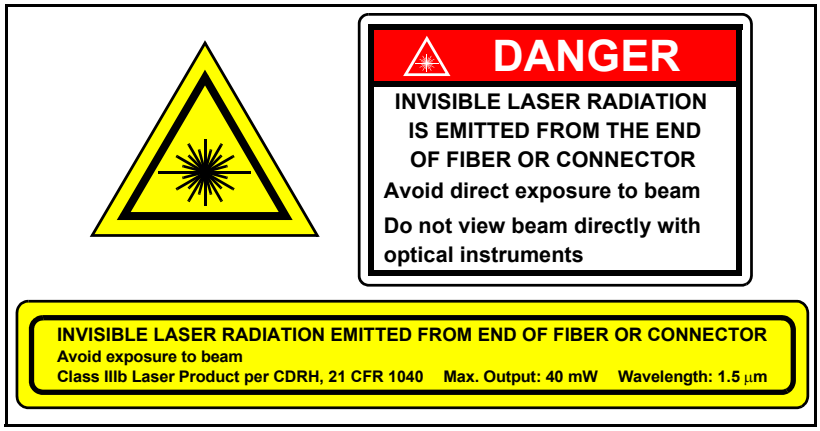
High-Power Product

Class IIIb Laser Product

FDA/CDRH Class IIIb laser product. All versions are Class IIIb laser products per CDRH, 21 CFR 1040 Laser Safety requirements. All versions are classified Class 3B laser products consistent with *IEC*® 60825-1: 1993. This device family has been classified with the FDA under accession number 8720010. Measurements were made to classify the product per *IEC* 60825-1: 1993.

This product complies with 21 CFR 1040.10 and 1040.11.
8 μm/125 μm ±3 μm single-mode fiber with 900 μm loose-tube jacketed fiber and connector
Wavelength = 1.5 μm
Maximum power = 40 mW
Because of size constraints, laser safety labeling (including an FDA Class IIIb label) is not affixed to the module but attached to the outside of the shipping carton.
Product is not shipped with power supply.

Caution: Use of controls, adjustments, and procedures other than those specified herein may result in hazardous laser radiation exposure.



* *IEC* is a registered trademark of The International Electrotechnical Commission.

Ordering Information

Table 5. Ordering Information

Device Code	ITU Frequency	Wavelength	Comcode
D2525P862	186.2	1610.06	108575085
D2525P863	186.3	1609.19	108575093
D2525P864	186.4	1608.33	108575119
D2525P865	186.5	1607.47	108575127
D2525P866	186.6	1606.60	108575135
D2525P867	186.7	1605.74	108575143
D2525P868	186.8	1604.88	108575150
D2525P869	186.9	1604.33	108575168
D2525P870	187.0	1603.17	108575184
D2525P871	187.1	1602.31	108476227
D2525P872	187.2	1601.45	108476235
D2525P873	187.3	1600.60	108476243
D2525P874	187.4	1599.75	108476250
D2525P875	187.5	1598.89	108476268
D2525P876	187.6	1598.04	108476276
D2525P877	187.7	1597.19	108476284
D2525P878	187.8	1596.34	108476292
D2525P879	187.9	1595.49	108476300
D2525P880	188.0	1594.64	108476318
D2525P881	188.1	1593.79	108476326
D2525P882	188.2	1592.95	108476334
D2525P883	188.3	1592.10	108476342
D2525P884	188.4	1591.25	108476359
D2525P885	188.5	1590.41	108476367
D2525P886	188.6	1589.57	108476375
D2525P887	188.7	1588.72	108476383
D2525P888	188.8	1587.88	108476391
D2525P889	188.9	1587.04	108476409
D2525P890	189.0	1586.20	108476417
D2525P891	189.1	1585.36	108476425
D2525P892	189.2	1584.53	108476433
D2525P893	189.3	1583.69	108476441
D2525P894	189.4	1582.85	108476458
D2525P895	189.5	1582.02	108476516
D2525P896	189.6	1581.18	108476524
D2525P897	189.7	1580.35	108476540
D2525P898	189.8	1579.52	108476557
D2525P899	189.9	1578.69	108476573

Ordering Information (continued)

Table 5. Ordering Information (continued)

Device Code	ITU Frequency	Wavelength	Comcode
D2525P900	190.0	1577.85	108476581
D2525P901	190.1	1577.02	108476599
D2525P902	190.2	1576.20	108476615
D2525P903	190.3	1575.37	108476623
D2525P904	190.4	1574.54	108476631
D2525P905	190.5	1573.71	108476649
D2525P906	190.6	1572.89	108476656
D2525P907	190.7	1572.06	108476664
D2525P908	190.8	1571.24	108476672
D2525P909	190.9	1570.42	108476680
D2525P910	191.0	1569.59	108476698
D2525P911	191.1	1568.77	108476706
D2525P912	191.2	1567.95	108476714
D2525P913	191.3	1567.13	108476722
D2525P914	191.4	1566.31	108476730
D2525P915	191.5	1565.50	108512534
D2525P916	191.6	1564.68	108512542
D2525P17	191.7	1563.86	108196098
D2525P18	191.8	1563.05	108196106
D2525P19	191.9	1562.23	108002452
D2525P20	192.0	1561.42	108002460
D2525P21	192.1	1560.61	108002478
D2525P22	192.2	1559.79	108002486
D2525P23	192.3	1558.98	108002494
D2525P24	192.4	1558.17	108002502
D2525P25	192.5	1557.36	108002510
D2525P26	192.6	1556.55	108002528
D2525P27	192.7	1555.75	108002536
D2525P28	192.8	1554.94	108002544
D2525P29	192.9	1554.13	108002551
D2525P30	193.0	1553.33	108002569
D2525P31	193.1	1552.52	108002577
D2525P32	193.2	1551.72	108002585
D2525P33	193.3	1550.92	108002593
D2525P34	193.4	1550.12	108002601
D2525P35	193.5	1549.32	108003039
D2525P36	193.6	1548.51	108003047
D2525P37	193.7	1547.72	108003054
D2525P38	193.8	1546.92	108003062
D2525P39	193.9	1546.12	108003070

Ordering Information (continued)

Table 5. Ordering Information (continued)

Device Code	ITU Frequency	Wavelength	Comcode
D2525P40	194.0	1545.32	108003088
D2525P41	194.1	1544.53	108003096
D2525P42	194.2	1543.73	108003104
D2525P43	194.3	1542.94	108003112
D2525P44	194.4	1542.14	108003120
D2525P45	194.5	1541.35	108003138
D2525P46	194.6	1540.56	108003146
D2525P47	194.7	1539.77	108003153
D2525P48	194.8	1538.98	108003161
D2525P49	194.9	1538.19	108003179
D2525P50	195.0	1537.40	108003187
D2525P51	195.1	1536.61	108003195
D2525P52	195.2	1535.82	108003203
D2525P53	195.3	1535.04	108003211
D2525P54	195.4	1534.25	108003229
D2525P55	195.5	1533.47	108003237
D2525P56	195.6	1532.68	108003245
D2525P57	195.7	1531.90	108196114
D2525P58	195.8	1531.12	108196122
D2525P59	195.9	1530.33	108196130
D2525P60	196.0	1529.55	108196148

Additional Information

For the latest specifications, additional product information, worldwide sales and distribution locations, and information about TriQuint:

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