1.3 GHz and 4 GHz Multiplexers

Overview

The National Instruments PXI-2590 and PXI-2591 are 4x1 high-frequency unterminated multiplexing switches. The NI SCXI-1190 and NI SCXI-1191 perform the same functions as the PXI-2590 and PXI-2591 but also offer a quad 4x1 multiplexing configuration. The switches are capable of switching signals from DC to 1.3 GHz (SCXI-1190 and PXI-2590) and DC to 4 GHz (SCXI-1191 and PXI-2591). The characteristic impedance of the channels is 50 Ohm.

For the SCXI-1190 and the PXI-2590, the maximum voltage rating of the switches is 24 Vrms with a maximum current of 1 A. For the SCXI-1191 and the PXI-2591, the maximum voltage rating is 30 Vrms with a maximum current of 330 mA. All are well suited for applications that require the routing of high-frequency signals inside automated test equipment (ATE) systems because they can switch signals with a very low insertion loss. In addition, the excellent voltage standing-wave ratio (VSWR) and isolation parameters make these modules the perfect choice in a system geared to high-frequency applications as shown in Table 1.

Extended Features and Specifications

National Instruments switch modules are built with a number of core features that are covered in detail in the Switch Overview section.

Ordering Information

NI SCXI-1190 ................................................................. 776572-90
NI PXI-2590 ................................................................. 777987-01
NI SCXI-1191 ................................................................. 776572-91
NI PXI-2591 ................................................................. 778339-01

Includes switch module and NI-SWITCH driver software.

For information on extended warranty and value added services, see page 20. See page 499 for accessory and cable information.

BUY ONLINE!
Visit ni.com/products and enter pxi2590, pxi2591, scxi1190, and/or scxi1191.

<table>
<thead>
<tr>
<th>Module</th>
<th>Insertion Loss</th>
<th>VSWR</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCXI-1190, PXI-2590 (3.3 GHz)</td>
<td>&lt; 1.5</td>
<td>&lt; 1.5</td>
</tr>
<tr>
<td>SCXI-1191, PXI-2591 (3.3 GHz)</td>
<td>&lt; 0.5</td>
<td>&lt; 1.5</td>
</tr>
</tbody>
</table>

Table 1. Parameters of High-Frequency Switching Modules

For additional information about the PXI-2590, PXI-2591, SCXI-1190, and SCXI-1191, including software, certifications and compliance, relay control, etc., please see page 20. For detailed specifications, please see page 504.
Switch Specifications

Specifications (continued)

Input Characteristics
Maximum switching voltage .................................................. 150 V, CAT I
Maximum switching current .................................................. 0.5 A (per channel)
Simultaneous channels at maximum current
PKI-2593 .................................................. 2, maximum
SCXI-1190 .................................................. 4, maximum
DC path resistance
Initial .......................................................... <1 Ω
End of life .................................................. ≥2.5 Ω

Dynamic Characteristics
Expected relay life:
Mechanical .................................................. 5x10^7 operations
Electrical .................................................. 3x10^5 operations (30 V, 0.3 ADC resistive)

Physical Characteristics
Relay type .................................................. Electromechanical, latching
Relay contact material ........................................ Silver palladium and gold
Dimensions
PKI-2593 .................................................. 10 by 16 by 4 cm (0.4 by 6.3 by 1.6 in.)
SCXI-1190 .................................................. 3.0 by 17.3 by 19.6 cm (1.2 by 6.7 by 7.6 in.)
I/O connectors
PKI-2593 .................................................. 18 MCX jacks
SCXI-1190 .................................................. 36 MCX jacks
Trigger connectors .................................................. 2 SMB jacks

Environment
Operating temperature .................................................. 0 to 50 °C
Storage temperature .................................................. -20 to 70 °C
Relative humidity .................................................. 5 to 85% noncondensing
Pollution degree .................................................. 2
Approved altitudes .................................................. Up to 2,000 m

Safety
This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control and laboratory use:
• IEC 61010-1, EN 61010-1
• UL 61010-1, UL 61010 B-1
• CAN/CSA C22.2 No. 1010.1

CE Compliance
This product meets the essential requirements of applicable European Directives, as amended for CE Marking, as follows:
Low-voltage Directive (safety) ........................................ 73/23/EEC
Electromagnetic Compatibility Directive (EMC) ............. 89/336/EEC

SCXI-1190, PXI-2590

Input Characteristics
Number of channels per bank ............................................ 4
Number of banks
SCXI-1190 .................................................. 4
PXI-2590 .................................................. 1
Input voltage
Channel-to-earth .................................................. 24 V DC
Maximum switching voltage
AC .................................................. 24 Vrms
DC .................................................. 24 V DC
Maximum switching capacity per channel
AC .................................................. 1 A at 24 Vrms
DC .................................................. 1 A at 24 V DC
Maximum switching power per channel ................................ 24 W
Contact resistance (initial) ........................................... 100 mΩ maximum
Contact material .................................................. Gold-clad silver

RF Performance Characteristics
Characteristic impedance (Z0) ........................................... 50 Ω
Insertion loss
100 MHz .................................................. <0.4 dB
500 MHz .................................................. <0.9 dB
1.3 GHz .................................................. <1.5 dB
2 GHz .................................................. <3 dB
VSWR
100 MHz .................................................. <1.15
500 MHz .................................................. <1.35
1.3 GHz .................................................. <1.5
2 GHz .................................................. <2.5
Isolation
500 MHz .................................................. >60 dB
1.3 GHz .................................................. >50 dB
2 GHz .................................................. >30 dB
Rise time .................................................. <300 ps
Signal delay .................................................. <3 ms
Maximum RF carrier power at 900 MHz ................................ 10 W

Dynamic Characteristics
Relay operate time (at 20 °C) ........................................... 15 ms
Typical .................................................. 15 ms
Expected life
Mechanical (no load) ........................................... 5x10^7 operations
Electrical at maximum switching capacity ......... 10^6 operations
Caution: Exceeding the maximum switching capability decreases expected life.

Power Requirement
+5 VDC .................................................. 600 mA maximum (all relays closed)

Physical
Dimensions
SCXI-1190 .................................................. 17.3 by 19.6 by 3.0 cm (6.81 by 7.70 by 1.19 in.)
PXI-2590 .................................................. 10 by 16 by 4 cm (3.9 by 6.3 by 1.6 in.)
I/O connectors .................................................. 5.5x0.8 female per bank

Environment
Operating temperature .................................................. 0 to 50 °C
Storage temperature .................................................. -20 to 70 °C
Relative humidity .................................................. 5 to 85% noncondensing
Pollution degree .................................................. 2
Approved altitudes .................................................. Up to 2,000 m
### Switch Specifications

**SCXI-1191, PXI-2591**

**Input Characteristics**
- Number of channels per bank: 4
- Number of banks: 4
- PXI-2591: 1

**Physical**
- Dimensions (SCXI-1191): 17.3 by 19.6 by 3.0 cm (6.81 by 7.70 by 1.19 in.)
- Dimensions (PXI-2591): 10 by 16 by 4 cm (3.9 by 6.3 by 1.6 in.)
- I/O connector: 5 SMA female per bank

**Environment**
- Operating temperature: 0 to 50 °C
- Storage temperature: 20 to 70 °C
- Relative humidity: 5 to 85% noncondensing

**Input Characteristic**
- Channel impedance (DC): 50 Ω
- Insertion loss: 2.5 GHz: <0.6 dB
- VSWR: 2.5 GHz: <1.3
- Isolation: 2.5 GHz: >60 dB
- Maximum RF carry power at 900 MHz: 10 W

**Power Requirement**
- +5 VDC: 950 mW maximum (all relays closed)

**RF Performance Characteristics**
- Insertion loss: 2.5 GHz: <0.6 dB, 4 GHz: <0.9 dB
- VSWR: 2.5 GHz: <1.3, 4 GHz: <1.5
- Isolation: 2.5 GHz: >60 dB, 4 GHz: >55 dB

**Dynamic Characteristics**
- Relay operate time (at 20 °C): Typical 15 ms
- Relay release time (at 20 °C): Typical 15 ms

**Mechanical**
- Electrical (no load): 5x10^6 operations
- Electrical (maximum switching capacity): 10^6 operations

**Contact Specifications**
- Contact material: Gold plate
- Contact resistance (initial): 100 mΩ maximum

**Power-on state**: Relays open

**Relay reset time**: 0.1 ms

**Relay set time**: 0.6 ms

**Relay flip time**: 0.1 ms

**Relay power-on time**: Relays open

### SCXI-1192

**Input Characteristics**
- Number of relays: 32 organized as 8 optically isolated banks of 4 relays each
- Relay type: Normally open (Form A), solid-state relays
- Maximum switching voltage: AC: 240 VAC, DC: 240 VDC
- Maximum switching capacity: 200 mA

**Commonmode isolation**: 250 Vrms between banks, and bank to ground

**On-resistance**: 8 Ω

**Output capacitance**: 110 pF at 50 V, 1 MHz

**Leakage current**: 1 µA maximum

**Transfer rate in serial mode**:
- (1 word = 32 bits): 750 words/s

**Relay set time**: 0.6 ms

**Relay reset time**: 0.1 ms

**Power-on state**: Relays open

The total input power for all relays combined should not exceed the preceding specifications. When using multiple relays, refer to table below for adjusted maximum input power.

<table>
<thead>
<tr>
<th>Active Relays</th>
<th>1 to 3 GHz</th>
<th>3 to 6 GHz</th>
<th>6 to 12 GHz</th>
<th>12.4 to 18 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>120 W</td>
<td>80 W</td>
<td>60 W</td>
<td>50 W</td>
</tr>
<tr>
<td>2</td>
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<td>40 W</td>
<td>30 W</td>
<td>25 W</td>
</tr>
<tr>
<td>4</td>
<td>30 W</td>
<td>20 W</td>
<td>15 W</td>
<td>12.5 W</td>
</tr>
<tr>
<td>8</td>
<td>15 W</td>
<td>10 W</td>
<td>7.5 W</td>
<td>6.25 W</td>
</tr>
</tbody>
</table>

**Contact material**: Gold plate

**Environment**
- Operating temperature: 0 to 50 °C
- Storage temperature: -20 to 70 °C
- Relative humidity: 5 to 85% noncondensing

### SCXI-1163R

**Input Characteristics**
- Number of relays: 32 organized as 8 optically isolated banks of 4 relays each
- Relay type: Normally open (Form A), solid-state relays
- Maximum switching voltage: AC: 240 VAC, DC: 240 VDC
- Maximum switching capacity: 200 mA

**Commonmode isolation**: 250 Vrms between banks, and bank to ground

**On-resistance**: 8 Ω

**Output capacitance**: 110 pF at 50 V, 1 MHz

**Leakage current**: 1 µA maximum

**Transfer rate in serial mode**:
- (1 word = 32 bits): 750 words/s

**Relay set time**: 0.6 ms

**Relay reset time**: 0.1 ms

**Power-on state**: Relays open

The total input power for all relays combined should not exceed the preceding specifications. When using multiple relays, refer to table below for adjusted maximum input power.

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<td>20 W</td>
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<td>15 W</td>
<td>10 W</td>
<td>7.5 W</td>
<td>6.25 W</td>
</tr>
</tbody>
</table>

**Contact resistance (initial)**: 100 mΩ maximum

**Reference**: Gold plate

**Environment**
- Operating temperature: 0 to 50 °C
- Storage temperature: -20 to 70 °C
- Relative humidity: 5 to 85% noncondensing