XMC-651
PMC-651
5/8/12-Port Gigabit Ethernet Switch

Overview
The XMC-651 and PMC-651 are Gigabit Ethernet switches packaged in the industry-standard XMC and PMC form factors. They are designed to support "in-chassis" networks with managed Layer-2 switching capabilities. Part of a family of Gigabit Ethernet switching/routing products from Curtiss-Wright Controls Embedded Computing, the 651 family offers a zero-slot Ethernet switching solution that can be added to most basecards with an XMC or PMC mezzanine slot. These switches are designed for rugged applications with backplane I/O and are offered in a full range of ruggedized air- and conduction-cooled versions.

Ethernet Switching
Both the XMC-651 and PMC-651 implement Ethernet switching functions via Broadcom® 10th generation switching technology. A single integrated switching fabric provides non-blocking wire-speed Ethernet switching for up to 12 Gigabit Ethernet ports.

Ethernet Port Flexibility
The XMC-651 and PMC-651 both offer 8 ports of Gigabit Ethernet supporting tri-speed 10/100/1000Base-T with auto-negotiation and auto-MDI/MDIX crossover support. For some XMC variants, an additional 4 ports are offered, supporting SerDes (1000Base-X) GbE, providing flexibility when connecting in-chassis devices.

Features
- 12-port Gigabit Ethernet switch
  - Supports 8-port 10/100/1000Base-T plus 4 ports SerDes (1000Base-X)
- Non-blocking line-speed Ethernet switching
- Supports jumbo packets up to 9K bytes
- IEEE 802.3 compliant
- Managed Layer-2 features include VLAN, L2 multicast, QoS services
- Support for port mirroring and link aggregation
- Flexible I/O on Pn4 and Pn6
  - XMC or PMC with Pn4 I/O supports 8 ports Base-T
  - XMC with Pn6 I/O supports 5 ports Base-T
  - XMC with Pn4/Pn6 I/O supports 8 ports Base-T on Pn4 plus 4 ports SerDes on Pn6
- No software required, only power and I/O from basecard
- Range of air and conduction-cooled ruggedization levels available
**PMC-651**

The PMC-651 model offers 8 ports of 10/100/1000Base-T through the PMC's Pn4 connector.

**XMC-651**

For XMC-651 models with only Pn4 for Ethernet I/O, the XMC-651 offers 8 ports of 10/100/1000Base-T through the Pn4 connector. For XMC modules without Pn4, 5 Base-T ports are routed through the Pn6 connector.

For XMC-651 configurations using both Pn4 and Pn6 for Ethernet I/O, a total of 12 ports are offered: 8 ports Base-T on Pn4, and 4 ports 1000Base-X (SerDes) on Pn6. This configuration is very useful when building systems populated with a mix of Base-T and SerDes payload modules, or for cascading multiple XMC-651 switches to architect a larger distributed switching system.

**Layer-2 Switching Functionality**

The 651 family supports full wire-speed Ethernet switching performance on all ports and features an 8K entry MAC address table with automatic learning, advanced flow-control and head of line blocking prevention.

**Virtual LANs (VLAN)**

VLANs are supported, with standard IEEE 802.1Q support for VLANs. Automatic double-tagging is also supported.
Multicast

The 651 family supports Layer-2 multicast, where a single source device can send data to multiple destination devices. This technique is extremely powerful when distributing data such as video and telemetry information. Receiving devices issue requests to join a multicast group, and the 651 switch performs the data duplication and distribution, easing the load on the source device. Up to 256 L2 multicast groups are supported, and IGMP snooping provides automatic switch learning of multicast members.

Jumbo Frames

The 651 family offers full support for jumbo frames up to 9K bytes.

Quality of Service (QoS)

Packet classification is supported using IEEE 802.1p Quality of Service (QoS) or DiffServ/TOS priority queuing.

Link Aggregation

Link aggregation per IEEE 802.3ad provides increased bandwidth and link redundancy when used to connect multiple ports to the same endpoint device. This can also be used when cascading multiple 651 switches into a larger distributed switching system. For example, if two Ethernet ports are connected and aggregated between multiple 651’s, this creates a single 2Gbps trunk which distributes the traffic load across both links. In the event of a link failure, the other link remains operational.

Port Mirroring

Port mirroring is also offered, allowing one monitoring port to receive a copy of all ingress, egress, or both from any or all other ports. This is an extremely powerful feature when used for system development, debug and diagnostics.

Switch Management

All 651 models provide a serial RS232 port for configuration. Air-cooled variants support a micro-DB9 serial connection on the front panel. Conduction-cooled variants provide serial port access using an innovative Back-Entry access header on the rear of the PWB using a serial cable available from Curtiss-Wright.

Base-card Compatibility

The 651 family connects only to the XMC and PMC connectors to obtain power and for Ethernet I/O connections. No software driver is needed.

Cascading 651 Switches

In order to create larger networks, multiple 651 switches can be connected to increase the system’s available port count. Base-T or Base-X (SerDes) ports can be used between switches, and the ports can be Link Aggregated to operate as a single higher-capacity backbone interconnect.

In Figure 3, two XMC-651 switches are cascaded to create a 12-port 1000Base-T switch. Six ports from each switch (two Base-T + four Base-X) are cross-connected between the switches, where they are link aggregated into a single logical 6Gbps connection. This is a fully non-blocked switch architecture, as all ports from both switches can communicate without bottlenecks or throughput limitations.

Figure 3: 12-Port 1000Base-T Switch using 2x Cascaded XMC-651 Switches

![Figure 3: 12-Port 1000Base-T Switch using 2x Cascaded XMC-651 Switches](image-url)
In Figure 4, only the four Base-X ports are cross-connected between the switches, resulting in a 16-port 1000Base-T switch architecture. In this example the switch-to-switch bandwidth is 4Gbps. This is a blocking architecture if traffic between switch #1 and switch #2 exceeds 4Gbps. In this case, the switch will drop excess packets. However, this architecture can satisfy a vast number of system configurations, if implemented with a careful understanding of the system communications throughput.

Figure 4: 16-Port 1000Base-T Switch using 2x Cascaded XMC-651 Switches

In Figure 5, a 24-port 1000Base-T switch is configured with 2Gbps interconnects between the switches. Again, this is a blocking architecture if data transfers between the switches exceeds 2Gbps.

Figure 5: 24-Port 1000Base-T Switch using 3x Cascaded XMC-651 Switches
<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switching Fabric</td>
<td>Broadcom BCM5331x Switching Processor</td>
</tr>
<tr>
<td>Management/Control Processor</td>
<td>Integrated 32-bit MIPS processor for management functions</td>
</tr>
<tr>
<td>Ethernet Port Specifications</td>
<td>• 5 or 8 ports 10/100/1000Base-T &lt;br&gt;• 10Base-T interfaces per IEEE 802.3 &lt;br&gt;• 100Base-T interfaces per IEEE 802.3u &lt;br&gt;• 1000Base-T interfaces per IEEE 802.3ab &lt;br&gt;• Tri-speed auto-negotiation &lt;br&gt;• Auto MDI/MDIX crossover &lt;br&gt;• Max 100m segment length &lt;br&gt;• Optional 4 ports 1000Base-X (SerDes) per IEEE 802.3ap on some variants</td>
</tr>
<tr>
<td>Maintenance Ports</td>
<td>• Front panel serial RS-232 on micro-D9 (AC models only) &lt;br&gt;• Back-entry access via rear-board header for serial RS-232 also available on all models</td>
</tr>
<tr>
<td>Layer-2 Switching Performance</td>
<td>Non-blocking wire-speed performance on all ports</td>
</tr>
<tr>
<td>Capacity</td>
<td>• 512KB packet buffer memory with dynamic buffer management &lt;br&gt;• Support for Jumbo Packets up to 9k bytes &lt;br&gt;• Up to 4K Layer-2 MAC addresses &lt;br&gt;• Up to &lt;TBD&gt; VLANs &lt;br&gt;• Up to 256 Layer-2 Multicast groups</td>
</tr>
<tr>
<td>Layer 2 Switching Features</td>
<td>• VLAN routing and support &lt;br&gt;• VLAN broadcast, 802.1Q VLAN tagging and double-tagging &lt;br&gt;• Priority Based Switching (802.1p) &lt;br&gt;• Link Aggregation (802.3ad, 802.1ax) for increased bandwidth and load sharing &lt;br&gt;• Port mirroring &lt;br&gt;• Port or byte-based rate limiting on a per-port basis &lt;br&gt;• IEEE 802.3x flow control and back-pressure support &lt;br&gt;• Broadcast Storm Control</td>
</tr>
<tr>
<td>Other Features</td>
<td>• Ethernet switch configuration save and restore &lt;br&gt;• Management by CLI (serial port) with context-sensitive help &lt;br&gt;• User Privileges and Login Authentication &lt;br&gt;• Declassification (secure memory/configuration erase and restore to factory defaults)</td>
</tr>
<tr>
<td>Built-in Test</td>
<td>PBIT for powerup self-test</td>
</tr>
<tr>
<td>Power</td>
<td>• +5.0VDC, +/- 5% &lt;br&gt;• Typical power: 10 watts &lt;br&gt;• Maximum power: 12 watts</td>
</tr>
</tbody>
</table>

**Table 1: Hardware Specifications**

**Ordering Information**

Ordering information for the XMC-651 and PMC-651 is provided below.

**XMC-651- UVWXYY**  
**SPMC-651- UVWXYY**  
**DPMC-651- UVWXYY**

- **YY** = Total number of Ethernet ports  
  - 05: 5 ports Base-T  
  - 08: 8 ports Base-T  
  - 12: 8 ports Base-T + 4 ports SerDes

- **X** = Number of Base-T ports

- **W** = Connector option  
  - 1: PMC connectors Pn1/2/4  
  - 2: XMC connectors Pn5/6  
  - 3: XMC connectors Pn4/5  
  - 4: XMC connectors Pn4/5/6

- **V** = Ruggedization Level  
  - 0: Level 0, 0 to +50°C  
  - 1: Level 100, -40 to +71°C  
  - 2: Level 200, -40 to +85°C

- **U** = Cooling method  
  - A: Air-cooled  
  - C: Conduction-cooled
Table 2: Recommended PMC Variants

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Ruggedization</th>
<th>Connectors Installed</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPMC-651-A01808</td>
<td>AC L0</td>
<td>Pn1, Pn2</td>
<td>8-port PMC Mezzanine Ethernet switch module, 8 ports 10/100/1000Base-T on Pn4, Layer-2 managed features: VLAN, QoS, L2 multicast, link aggregation, port mirroring.</td>
</tr>
<tr>
<td>SPMC-651-A11808</td>
<td>AC L100</td>
<td>Pn4</td>
<td></td>
</tr>
<tr>
<td>DPMC-651-C21808</td>
<td>CC L200</td>
<td></td>
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</tr>
</tbody>
</table>

Table 3: Recommended XMC Variants

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Ruggedization</th>
<th>Connectors Installed</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>XMC-651-A02505</td>
<td>AC L0</td>
<td>Pn5</td>
<td>5-port XMC Mezzanine Ethernet switch module, 5 ports 10/100/1000Base-T on Pn6, Layer-2 managed features: VLAN, QoS, L2 multicast, link aggregation, port mirroring.</td>
</tr>
<tr>
<td>XMC-651-A12505</td>
<td>AC L100</td>
<td>Pn5</td>
<td></td>
</tr>
<tr>
<td>XMC-651-C22505</td>
<td>CC L200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>XMC-651-A03808</td>
<td>AC L0</td>
<td>Pn4</td>
<td>8-port XMC Mezzanine Ethernet switch module, 8 ports 10/100/1000Base-T on Pn4, Layer-2 managed features: VLAN, QoS, L2 multicast, link aggregation, port mirroring.</td>
</tr>
<tr>
<td>XMC-651-A13808</td>
<td>AC L100</td>
<td>Pn4</td>
<td></td>
</tr>
<tr>
<td>XMC-651-C23808</td>
<td>CC L200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>XMC-651-A04812</td>
<td>AC L0</td>
<td>Pn4</td>
<td>12-port XMC Mezzanine Ethernet switch module, 8 ports 10/100/1000Base-T on Pn4 + 4 ports 1000Base-X (SerDes) on Pn6, Layer-2 managed features: VLAN, QoS, L2 multicast, link aggregation, port mirroring.</td>
</tr>
<tr>
<td>XMC-651-A14812</td>
<td>AC L100</td>
<td>Pn5</td>
<td></td>
</tr>
<tr>
<td>XMC-651-C24812</td>
<td>CC L200</td>
<td>Pn6</td>
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Table 4: Cables and Support

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBL-651-BEN-000</td>
<td>Back-Entry serial port cable for PMC/XMC-651. Approx 0.5m length. Back-Entry header to the 651 and female DB9 for RS-232 port on the other end. For use with AC or CC modules. Lab use only.</td>
</tr>
<tr>
<td>CBL-651-FPL-000</td>
<td>Front panel serial port cable for PMC/XMC-651. Approx 1m length. Male micro-DB9 to the 651 and female DB9 for RS-232 port on the other end. For use with AC modules only. Lab use only.</td>
</tr>
<tr>
<td>CBL-651-RTM-000</td>
<td>Breakout cable assembly for 185/187 RTM. Connects to 185/187 RTM’s PMC/XMC I/O connector and brings out 8 ports 1000Base-T to RJ45 jacks. Approx 0.5m length. For lab use only.</td>
</tr>
</tbody>
</table>

Warranty

This product has a one year warranty.

Contact Information

To find your appropriate sales representative:

Website: [www.cwcembedded.com.sales](http://www.cwcembedded.com.sales)

Email: sales@cwcembedded.com

Technical Support

For technical support:

Website: [www.cwcembedded.com/support](http://www.cwcembedded.com/support)

Email: support1@cwcembedded.com

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