New Low Noise Amplifiers & High Power PIN Diode Switches
Skyworks Solutions, Inc. is a vertically integrated provider of high performance analog and mixed signal semiconductors enabling wireless connectivity.

- Headquarters: Woburn, Massachusetts USA
- Web site: www.skyworksinc.com
- NASDAQ listing: SWKS
- Employees: 4500
- Sales: $1.5 B+ USD
- Primary Manufacturing Operations
  - Woburn MA – Silicon RF Diode & GaAs PHEMT Fab
  - Newbury Park CA – GaAs HBT Fab
  - Mexicali Mexico – Assembly and Test
Our RF Semiconductor Business

Enabling the Wireless World Through a Diverse Portfolio of Analog Solutions
Broad Market Products: Low Noise Amplifier’s

Paul Taylor – Product Marketing Manager
Low Noise Amplifier Portfolio Overview

- Large Portfolio of Discrete Broadmarket Amplifier Products
  - Broad Frequency Coverage: .03 – 6.0 GHz, pin compatible family based solutions
  - Ultra Low Noise Figure: Low as 0.5 dB
  - Wide Amplification Range: 12 → 38 dB
  - High Linearity Designs: 40 dBm OIP3
  - High Output Power Designs: 24 dBm OP1dB
  - Low Current/Voltage Designs: \( V_{DD} \) 1.8 – 5.0V, \( I_{DD} \) 5 mA - 15 mA
  - Small Industry Standard Footprints & Matching Circuit Layouts
  - Dedicated LNA Applications Engineering team to assist with design customization

Skyworks Amplifiers Support Hundreds of Cellular Infrastructure, Military, GPS, WLAN & General Purpose ISM Band Applications Globally - in a variety of configurations.
Sub 1.0 dB NF ISM Band Low Noise Amplifiers

- High Performance Low Noise Amplifiers are employed in the front end of a wireless receiver to enhance:
  - Sensitivity
  - Selectivity
  - Dynamic Range

- Skyworks now offers a full family of Highly Flexible Low Power LNA’s to service the growing ISM Band TRX market
  - SKY67015 - 396LF 30 – 300 MHz
  - SKY67012 - 396LF 300 – 600 MHz
  - SKY67013 - 396LF 600 – 1500 MHz
  - SKY67014 - 396LF 1500 – 3000 MHz
ISM Band pHEMT LNA Family Overview

- Wide operating frequency range: 30 – 3000 MHz coverage
- Low noise figure: <1.0dB  Enhances receiver sensitivity
- High gain: 12.5 - 16.5 dB  Extends receiver reception range
- High linearity: OIP3 ~25 dBm @ 15 mA.  Improves selectivity and sensitivity
- Low supply current options: 15mA → 5mA range  Long battery life
- Wide supply voltage range: 1.8 to 5.0 V  High level of design flexibility
- Stable Operation:  $\mu_1 & \mu_2 > 1.0$  Unconditional stability over -40C to +85C
- Simple external matching/bias network: 9 inexpensive passive components
- Small form factor: 2 x 2 mm DFN All four LNAs are pin & layout compatible
ISM Band pHEMT LNA Family Performance

- SKY67013-396LF S-parameter & Noise Figure Data @ 3.3V/15 mA
ISM Band pHEMT LNA Family Performance

- **Flexible Biasing & Matching Capabilities**
  - Adjustment of single external resistor (R1) allows the designer to optimize the tradeoff between supply current/voltage and amplifier linearity/output power
ISM Band pHEMT LNA Family Summary

- High level of RF performance and supply flexibility, in small cost effective form factor enabling enhanced receiver sensitivity, selectivity & battery life.

- Ideal for General Purpose Cellular, ISM, L band & VHF/UHF apps. such as AMR, Public Safety/Land Mobile Radio, Bluetooth®, Femto/Pico Cell & Wireless Sensors.

- Samples and evaluation boards available through our distribution partner Richardson RFPD.

- De-embedded S-Parameters, ADS design files, Gerber files and our Applications Engineering team is available to aide in your design effort.

For more information on our complete LNA product portfolio, please visit http://www.skyworksinc.com/
High Power PIN Diode Switches
Markets / Applications

Markets
- Infrastructure
- Military/Microwave Radios

Applications
- Failsafe Switching
- T / R Switching
- 50 & 100 + Watt Radio Applications
- 20 MHz – 4.0 GHz

Products
- SMP1302-085LF
- SMP1324-087LF
- SKY12207-478LF
- SKY12208-478LF
- SKY12210-478LF
New High Power Series and Shunt Packaged PIN Diodes

- PIN Diodes for high power T/R switch applications
  - Low loss, high power switching
  - Low distortion attenuators
- Features
  - SMP1324-087LF: Suitable for 35 W CW T/R switches
  - SMP1371-087LF: Suitable for 25 W CW T/R switches
  - SMP1345-087LF: Lowest capacitance
  - SMP1302-085LF: 100W CW Shunt configuration
- Low thermal resistance packaging
- Lower cost compared to ceramic MELF
- Many designs are available

Typical Applications Circuit

Need for up to 100 Watts in High Power Switching Applications;
Target LMR, Infrastructure (LTE) and Mil Comm and all other
High Power T/R Applications
### Description
- The New SKY12207-478LF broadband high power handling, high linearity, Single-Pole Double-Throw (SPDT) T/R switch is one in a series of High Power Switches.

### Key Features
- Low insertion loss; 0.4dB
- High isolation; 42dB
- High IIP3; +55dBm
- RF Power handling; 50W CW
- Control voltages; 0/5 V and 0/28 V

### Applications
- Failsafe receiver protection for TDD-LTE and UMTS base stations
- T/R Switch for TDD-LTE, TD-SCDMA and UMTS base stations

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<table>
<thead>
<tr>
<th>Part Number</th>
<th>Freq. (GHz)</th>
<th>Size (mm)</th>
<th>Ins Loss (ANT to TX) @ 2.6 GHz</th>
<th>Isolation (ANT to RX) @ 2.6 GHz</th>
<th>VSWR @2.5GHz</th>
<th>Max Rating CW RF Ant-TX Input Power @ 25C Base plate (28 V)</th>
<th>Max CW Ant-TX Input Power @ 85C Base Plate (28 V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKY12207-478LF</td>
<td>0.9 – 4.0</td>
<td>4 x 4</td>
<td>0.4 dB typ.</td>
<td>42 dB</td>
<td>1.25:1 max</td>
<td>50W</td>
<td>33W</td>
</tr>
</tbody>
</table>
100 Watt SPDT PIN Diode Switch
SKY12210-478LF

**Description**
- The New SKY12210-478LF broadband high power handling, high linearity, Single-Pole Double-Throw (SPDT) T/R switch is ideal for very high Power Switching.

**Key Features**
- Low ANT-RX insertion loss; 0.5dB
- High isolation; 44dB
- High IIP3; +55dBm
- RF Power handling; 100W CW
- Control voltages; 0/5 V and 0/28 V

**Applications**
- Failsafe receiver protection for TDD-LTE and UMTS base stations
- T/R Switch for TDD-LTE, TD-SCDMA and UMTS base stations

<table>
<thead>
<tr>
<th>Part Number</th>
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<th>Size (mm)</th>
<th>Ins Loss (ANT to TX) @ 2.6 GHz</th>
<th>Isolation (ANT to RX) @ 2.6 GHz</th>
<th>VSWR (@2.5GHz)</th>
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<td>0.5 dB typ.</td>
<td>44dB</td>
<td>1.25:1 max</td>
<td>100W</td>
<td>50W</td>
</tr>
</tbody>
</table>

**In Production**
50 Watt SPDT PIN Diode Switch
SKY12208-478LF

0.02-2.7 GHz 50 Watt High Power Silicon PIN Diode T/R SPDT Switch

Applications:
Transmit/receive switching and failsafe switching in land mobile radios, public safety radios and military UHF/VHF communications systems.

- High power handling: 50 W CW
- Low insertion loss: 0.4 dB typical
- 43 dB isolation ANT-RX isolation at 500 MHz
- Controlled with positive power supply
- Symmetrical common to output port configuration
- External tuning capable for high or low band operation

Samples Available
### Family of High Power T/R Switches (50W, 100W, and 200W)

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Freq. (GHz)</th>
<th>Size (mm)</th>
<th>Function</th>
<th>Ins Loss (ANT to TX) @500 MHz @ 2.6 GHz</th>
<th>Isolation (ANT to RX) @500 MHz @ 2.6 GHz</th>
<th>Max Rating CW RF Ant-TX Input Power @ 25°C Base plate (28 V)</th>
<th>Max CW Ant-TX Input Power @ 85°C Base Plate (28 V)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKY12207-306LF</td>
<td>0.9 – 4.0</td>
<td>4 x 4</td>
<td>SP2T</td>
<td>0.4 dB typ.</td>
<td>39 dB</td>
<td>50W</td>
<td>33W</td>
<td>In production</td>
</tr>
<tr>
<td>SKY12208-306LF</td>
<td>0.02 – 2.7</td>
<td>4 x 4</td>
<td>SP2T</td>
<td>0.3 dB typ.</td>
<td>39 dB</td>
<td>50W</td>
<td>33W</td>
<td>In production</td>
</tr>
<tr>
<td>SKY12207-478LF</td>
<td>0.9 – 4.0</td>
<td>4 x 4</td>
<td>SP2T</td>
<td>0.4 dB typ.</td>
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<td>50W</td>
<td>33W</td>
<td>In production</td>
</tr>
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<td>0.02 – 2.7</td>
<td>4 x 4</td>
<td>SP2T</td>
<td>0.3 dB typ.</td>
<td>43 dB</td>
<td>50W</td>
<td>33W</td>
<td>Release June</td>
</tr>
<tr>
<td>SKY12209-478LF</td>
<td>0.9 – 4.0</td>
<td>4 x 4</td>
<td>SP2T</td>
<td>0.4 dB typ.</td>
<td>42 dB</td>
<td>Symmetrical 40W</td>
<td>31W</td>
<td>Release June</td>
</tr>
<tr>
<td>SKY12210-478LF</td>
<td>0.9 – 4.0</td>
<td>4 x 4</td>
<td>SP2T</td>
<td>0.5 dB typ.</td>
<td>44 dB</td>
<td>100W</td>
<td>50W</td>
<td>In production</td>
</tr>
<tr>
<td>SKY12211-478LF</td>
<td>0.02 – 2.7</td>
<td>4 x 4</td>
<td>SP2T</td>
<td>0.3 dB typ.</td>
<td>45 dB</td>
<td>Symmetrical 40W</td>
<td>31W</td>
<td>Release June</td>
</tr>
<tr>
<td>SKY12212-478LF</td>
<td>0.02 – 2.7</td>
<td>4 x 4</td>
<td>SP2T</td>
<td>0.3 dB typ.</td>
<td>45 dB</td>
<td>100W</td>
<td>50W</td>
<td>Sept 2012</td>
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</tbody>
</table>
Driver Circuit for High Power PIN Diode Switches

Introduction
Skyworks Solutions High Power Pin Diode Switch Driver Circuit is a TTL/DTL compatible, DC coupled, high speed PIN diode bias controller. Part No. EN33-X273

This driver reference design is designed to operate with the Skyworks series of high power SPDT PIN diode switches. These include:

SKY12207-305LF
SKY12207-475LF
SKY12208-305LF
SKY12208-475LF
SKY12209-475LF
SKY12210-475LF
SKY12211-475LF
SKY12212-475LF

This driver is designed to provide forward currents up to 100 mA for each diode, and 28 V reverse bias. It is designed for SPDT switches operating with a CW input power up to 100 W. The driver utilizes fast switching NPN transistors and Skyworks discrete PIN diodes. The driver is designed to utilize a VDD set to +28 V, but could operate with voltages as low as +5 V.

Features
- High Drive Current Capability (± 50 mA)
- 28 V Back Bias in Off State
- Switching Speed Approximately 146 nS
- Low Current Consumption
- Single TTL Logic input

Table 2. Pin Description (INPUT CONNECTOR)

<table>
<thead>
<tr>
<th>PIN</th>
<th>Conditions</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>GND</td>
<td>Ground</td>
<td>GROUND</td>
</tr>
<tr>
<td>ANT</td>
<td>5V</td>
<td>INPUT</td>
</tr>
<tr>
<td>RXTX</td>
<td>28V</td>
<td>INPUT</td>
</tr>
<tr>
<td>VLGC</td>
<td>Logic Control/5V</td>
<td>INPUT</td>
</tr>
<tr>
<td>NC</td>
<td>No Connect</td>
<td></td>
</tr>
<tr>
<td>NC</td>
<td>No Connect</td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Pin Description (OUTPUT CONNECTOR)

<table>
<thead>
<tr>
<th>PIN</th>
<th>Conditions</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>GND</td>
<td>Ground</td>
<td>OUTPUT</td>
</tr>
<tr>
<td>ANT</td>
<td>5V</td>
<td>OUTPUT</td>
</tr>
<tr>
<td>TX</td>
<td>0V/28V</td>
<td>OUTPUT</td>
</tr>
<tr>
<td>DC1</td>
<td>28V/0V</td>
<td>OUTPUT</td>
</tr>
<tr>
<td>DC2</td>
<td>0V/28V</td>
<td>OUTPUT</td>
</tr>
<tr>
<td>RX</td>
<td>28V/0V</td>
<td>OUTPUT</td>
</tr>
</tbody>
</table>

Table 4. Truth Table (Switch)

<table>
<thead>
<tr>
<th>Logic Control</th>
<th>State</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLGC</td>
<td>ANT-TX</td>
<td>ANT-RX</td>
</tr>
</tbody>
</table>
High Power Switch Family Summary

- This series of Integrated 50 & 100 Watt Switches provide Excellent Power Handling and Isolation with Broadband performance from 20 MHz- 4 GHz.

- The Combination of Very Low Insertion Loss (0.4 dB) of these switches in the antenna to Rx mode minimizes the affect on receiver noise figure.

- Ideal for Failsafe Switching in TDD-LTE Base Station, Repeater, UHF/VHF Radio, Public Safety/Land Mobile Radio and General purpose High Power TR Switching applications.

- Samples and evaluation boards available through our distribution partner Richardson RFPD, local Representatives or direct from Skyworks

- For more information on our complete Diode and Switch product portfolio, please visit  http://www.skyworksinc.com/