SKY65364-11: 900 MHz Transmit/Receive Front-End Module

Applications
- Automated meter reading
- Advanced metering infrastructure
- ISM systems

Features
- Transmit output power > +30.5 dBm
- High efficiency PA
- Analog power control
- Receive path NF <2.1 dB
- PA bypass mode
- LNA low current mode with external resistor
- LNA bypass mode
- Integrated control logic
- Internal RF match and bias circuits
- All RF ports internally DC blocked
- Shutdown mode
- Small footprint, MCM (28-pin, 6 x 6 mm) package (MSL3, 260 °C per JEDEC J-STD-020)

Description
Skyworks SKY65364-11 is a high performance, transmit/receive (T/R) Front-End Module (FEM). The device provides a complete T/R chain with T/R switches.

The device transmit chain features +30.5 dBm output power and a 40 percent Power Added Efficiency (PAE).

The device receive chain features a Low Noise Amplifier (LNA) with a 1.7 dB Noise Figure (NF) and 16.0 dB gain. The cascaded NF and gain, taking into account the 0.5 dB insertion loss transmit/receive antenna switch, are 2.2 dB and 15.5 dB, respectively, which makes the SKY65364-11 ideal for medium power microwave links such as 900 MHz Industrial, Scientific, and Medical (ISM) band applications.

The module also has a shut-down mode, PA bypass mode, and LNA bypass mode to minimize power consumption.

The device is mounted in a 28-pin, 6 x 6 mm Multi-Chip Module (MCM) Surface-Mounted Technology (SMT) package, which allows for a highly manufacturable low-cost solution.

The device package and pinout for the 28-pin MCM are shown in Figure 1. A block diagram of the SKY65364-11 is shown in Figure 2. Signal pin assignments and functional pin descriptions are provided in Table 1.
Figure 2. SKY65364-11 Block Diagram

Table 1. SKY65364-11 Signal Descriptions

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Name</th>
<th>Description</th>
<th>Pin #</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND</td>
<td>Ground</td>
<td>15</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>2</td>
<td>TR</td>
<td>Digital control input: transmit/receive mode</td>
<td>16</td>
<td>VDD1</td>
<td>3.3 V power supply</td>
</tr>
<tr>
<td>3</td>
<td>EN</td>
<td>Digital control input: shutdown mode</td>
<td>17</td>
<td>VCC_RX</td>
<td>3.3 V power supply</td>
</tr>
<tr>
<td>4</td>
<td>BYP</td>
<td>Digital control input: receive bypass mode</td>
<td>18</td>
<td>RXO</td>
<td>Receive output</td>
</tr>
<tr>
<td>5</td>
<td>VPC</td>
<td>Transmit output power adjustment</td>
<td>19</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>6</td>
<td>GND</td>
<td>Ground</td>
<td>20</td>
<td>TX</td>
<td>Transmit path input port. Internally matched to 50 Ω.</td>
</tr>
<tr>
<td>7</td>
<td>ANT</td>
<td>Antenna switch common port. Internally matched to 50 Ω.</td>
<td>21</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>8</td>
<td>GND</td>
<td>Ground</td>
<td>22</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>9</td>
<td>GND</td>
<td>Ground</td>
<td>23</td>
<td>VDD2</td>
<td>3.6 V power supply</td>
</tr>
<tr>
<td>10</td>
<td>RX1</td>
<td>Receive arm of antenna switch. Internally matched to 50 Ω.</td>
<td>24</td>
<td>VCC_TX1</td>
<td>3.6 V power supply</td>
</tr>
<tr>
<td>11</td>
<td>GND</td>
<td>Ground</td>
<td>25</td>
<td>VCC_TX2</td>
<td>3.6 V power supply</td>
</tr>
<tr>
<td>12</td>
<td>GND</td>
<td>Ground</td>
<td>26</td>
<td>VCC_TX3</td>
<td>3.6 V power supply</td>
</tr>
<tr>
<td>13</td>
<td>RX2</td>
<td>LNA and bypass switch output port. Internally matched to 50 Ω.</td>
<td>27</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>14</td>
<td>RBIAS</td>
<td>LNA bias setting resistor</td>
<td>28</td>
<td>GND</td>
<td>Ground</td>
</tr>
</tbody>
</table>
Technical Description

The SKY65364-11 consists of a complete T/R chain with T/R switches contained in the module. A Single-Pole Triple-Throw (SP3T) switch selects between the receive, transmit, and transmit bypass paths. The module has a shut-down mode to minimize power consumption.

Three digital input pins (EN, TR, and BYP) are used to select between transmit, transmit bypass, receive, receive bypass, or shutdown mode.

Transmit Path

The transmit path contains a Power Amplifier (PA) optimized for saturated performance. The PA output is internally matched for optimum output power and efficiency into a 50 Ω load impedance. The PA output is passed through an harmonic filter before being fed through the SP3T switch. The PA input provides a good return loss into a 50 Ω source impedance.

Transmit output power is controlled by the VPC pin, which is normally set to 2.25 V DC voltage. The nominal DC input impedance into the VPC pin is 50 kΩ.

Receive Path

The receive path contains an LNA with bypass switch. The LNA impedance matching networks are internal to the module and have been optimized for a low NF while maintaining good return losses into a 50 Ω source and load impedance. The receive arm of the SP3T switch and the LNA input are connected to module pins to allow an external filter to be inserted into the receive path. LNA biasing can be independently lowered with an external bias resistor between the RBIAS pin and ground.

Operation Mode Control

The five SKY65364-11 operating modes are controlled by the three digital pins TR, EN, and BYP (pins 2, 3, and 4, respectively). The control logic truth Table is provided in Table 2.

Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY65364-11 are provided in Table 3. Recommended operating conditions are specified in Table 4. Electrical specifications are provided in Tables 5, 6, and 7.

Typical performance characteristics of the SKY65364-11 are illustrated in Figures 3 through 17.

Table 2. SKY65364-11 Operating Modes Truth Table (Note 1)

<table>
<thead>
<tr>
<th>Operating Mode</th>
<th>Control Voltage</th>
<th>Internal States</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TR (Pin 2)</td>
<td>EN (Pin 3)</td>
</tr>
<tr>
<td>Transmit</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Transmit bypass</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Receive</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Receive Bypass</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Shutdown (Note 2)</td>
<td>X</td>
<td>0</td>
</tr>
</tbody>
</table>

Note 1: See Recommended Operating Conditions Table for logic 0 and 1 characteristics. “X” = don’t care state, defined as a valid state of logic 1 or 0.

Note 2: In the high state, EN, TR, and BYP have an input current of 33 μA due to an internal 100 kΩ pulldown resistance. For the lowest leakage current, the high state is not recommended for TR and BYP when the device is in shutdown mode (EN = 0).
### Table 3. SKY65364-11 Absolute Maximum Ratings (Note 1)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNA supply voltage</td>
<td>VCC_RX</td>
<td>–0.3</td>
<td>+5.0</td>
<td>V</td>
</tr>
<tr>
<td>LNA supply current</td>
<td>Icc_rx</td>
<td>20</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>PA supply voltage</td>
<td>VCC_TX1/2/3</td>
<td>–0.3</td>
<td>+6.0</td>
<td>V</td>
</tr>
<tr>
<td>PA supply current</td>
<td>Icc_tx</td>
<td>1.6</td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>Digital supply voltage</td>
<td>Vo1</td>
<td>–0.5</td>
<td>+5.5</td>
<td>V</td>
</tr>
<tr>
<td>Digital supply voltage</td>
<td>Vo2</td>
<td>–0.5</td>
<td>+5.5</td>
<td>V</td>
</tr>
<tr>
<td>Digital control voltage (EN, TR, BYP)</td>
<td>VCTL</td>
<td>–0.5</td>
<td>Vo1 + 0.3</td>
<td>V</td>
</tr>
<tr>
<td>Transmit output power control voltage</td>
<td>VPC</td>
<td>–0.3</td>
<td>+5.0</td>
<td>V</td>
</tr>
<tr>
<td>Receive RF input power (RX2)</td>
<td>Pn_RX2</td>
<td>+5</td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>Receive RF input power (ANT)</td>
<td>Pn_ANT</td>
<td>+33</td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>Transmit RF input power</td>
<td>Pn_TX</td>
<td>+15</td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>Transmit RF input power, bypass mode</td>
<td>Pn_TX_BYP</td>
<td>+20</td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>Operating case temperature (Note 2)</td>
<td>Tc</td>
<td>–40</td>
<td>+85</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>TSTG</td>
<td>–55</td>
<td>+150</td>
<td>°C</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>TJ</td>
<td></td>
<td>+150</td>
<td>°C</td>
</tr>
<tr>
<td>T/R port load VSWR in transmit mode</td>
<td>VSWR</td>
<td>10:1</td>
<td></td>
<td>–</td>
</tr>
</tbody>
</table>

**Note 1:** Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value.

**Note 2:** Nominal thermal resistance, junction to case, is 18 °C/W.

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**CAUTION:** Although this device is designed to be as robust as possible, Electrostatic Discharge (ESD) can damage this device. This device must be protected at all times from ESD. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD precautions should be used at all times.

### Table 4. SKY65364-11 Recommended Operating Conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmit frequency range</td>
<td>f</td>
<td>890</td>
<td>960</td>
<td>960</td>
<td>MHz</td>
</tr>
<tr>
<td>Receive frequency range</td>
<td>f</td>
<td>900</td>
<td></td>
<td>960</td>
<td>MHz</td>
</tr>
<tr>
<td>LNA supply voltage</td>
<td>VCC_RX</td>
<td>3.00</td>
<td>3.30</td>
<td>3.45</td>
<td>V</td>
</tr>
<tr>
<td>Digital supply voltage</td>
<td>VDD1</td>
<td>3.00</td>
<td>VCC_RX</td>
<td>3.45</td>
<td>V</td>
</tr>
<tr>
<td>Digital supply voltage</td>
<td>VDD2</td>
<td>3.40</td>
<td>VCC_TX1/2/3</td>
<td>3.80</td>
<td>V</td>
</tr>
<tr>
<td>PA supply voltage</td>
<td>VCC_TX1/2/3</td>
<td>3.40</td>
<td>3.60</td>
<td>3.80</td>
<td>V</td>
</tr>
<tr>
<td>Digital input voltage, logic 1 (EN, TR, BYP)</td>
<td>Vih</td>
<td>1.6</td>
<td></td>
<td>VDD1</td>
<td>V</td>
</tr>
<tr>
<td>Digital input voltage, logic 0 (EN, TR, BYP)</td>
<td>VIl</td>
<td>0</td>
<td></td>
<td>0.7</td>
<td>V</td>
</tr>
<tr>
<td>Transmit output power control voltage</td>
<td>VPC</td>
<td>0</td>
<td>2.25</td>
<td>2.50</td>
<td>V</td>
</tr>
<tr>
<td>Receive RF input power (RX2)</td>
<td>Pn_RX2</td>
<td>+5</td>
<td>–15</td>
<td>dBm</td>
<td></td>
</tr>
<tr>
<td>Transmit RF input power (TX)</td>
<td>Pn_TX</td>
<td>+10</td>
<td>+13</td>
<td>dBm</td>
<td></td>
</tr>
</tbody>
</table>
Table 5. SKY65364-11 DC Electrical Specifications (Note 1)
(VCC_RX = VDD1 = 3.0 V to 3.45 V, VCC_TX1/2/3 = VDD2 = 3.4 V to 3.8 V, TC = –40 °C to +85 °C, RBIAS = 0 Ω, No RF Input Power, Unless Otherwise Noted)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>Min</th>
<th>Typical</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quiescent current, receive mode (Note 2)</td>
<td>IQ_RX</td>
<td></td>
<td>20</td>
<td>mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quiescent current, receive low current mode (Note 2) (Note 3)</td>
<td>IQ_RX_LC</td>
<td>RBIAS = 3.8 kΩ</td>
<td>5</td>
<td>mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quiescent current, receive bypass mode (Note 2)</td>
<td>IQ_BYP</td>
<td></td>
<td>34</td>
<td>76</td>
<td>µA</td>
<td></td>
</tr>
<tr>
<td>VDD1 quiescent current, transmit mode</td>
<td>IQ_VCO1</td>
<td></td>
<td>25</td>
<td>30</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>VCC_TX1/2/3 quiescent current, transmit mode</td>
<td>IQ_TX</td>
<td>TC = 25 °C, VCC_TX1/2/3 = 3.6 V, VCC_RX = 3.3 V</td>
<td>55</td>
<td>mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VCC_TX1/2/3 operating current, transmit mode</td>
<td>IOP_TX</td>
<td>Pn = +10 dBm</td>
<td>730</td>
<td>880</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>VDD1 quiescent current, transmit bypass mode (Note 3)</td>
<td>IDD1</td>
<td></td>
<td>10</td>
<td>µA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VCC_TX1/2/3 quiescent current, transmit bypass mode (Note 3)</td>
<td>IQ_TXB</td>
<td>0.030</td>
<td>µA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VCC_RX quiescent current, shutdown mode (Note 3)</td>
<td>IQ_SD_RX</td>
<td></td>
<td>0.025</td>
<td>µA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VCC_TX1/2/3 quiescent current, shutdown mode (Note 3)</td>
<td>IQ_SD_TX</td>
<td>0.030</td>
<td>µA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital input current, logic 1 (Note 3)</td>
<td>I_H</td>
<td></td>
<td>33</td>
<td>µA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital input current, logic 0 (Note 3)</td>
<td>I_L</td>
<td></td>
<td>0</td>
<td>µA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note 1: Performance is guaranteed only under the conditions listed in this Table. Modes are established as indicated in Table 2.

Note 2: Total current drawn from VCC_RX and VDD1 supplies.

Note 3: Not production tested.

Table 6. SKY65364-11 Electrical Specifications: Receive and Receive Bypass Mode (1 of 2) (Note 1)
(VCC_RX = VDD1 = 3.0 V to 3.45 V, VCC_TX1/2/3 = VDD2 = 3.4 V to 3.8 V, TC = –40 °C to +85 °C, f = 900 to 960 MHz, 50 Ω Source and Load Impedance, CW Input, RBIAS = 0 Ω, Unless Otherwise Noted)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>Min</th>
<th>Typical</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receive Mode: RX2 to Receive Output Path</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small signal gain</td>
<td>G</td>
<td></td>
<td>13.5</td>
<td>16.5</td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td>Noise Figure</td>
<td>NF</td>
<td>TC = 25 °C, VCC_RX = 3.3 V</td>
<td>1.7</td>
<td>2.1</td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td>Noise Figure variation over temperature</td>
<td>NF_TEMP</td>
<td></td>
<td>±0.15</td>
<td></td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td>1 dB Input Compression Point</td>
<td>IP1dB</td>
<td>1 dB gain compression</td>
<td>–16.5</td>
<td>–11.5</td>
<td>dBm</td>
<td></td>
</tr>
<tr>
<td>3rd Order Input Intercept Point</td>
<td>IIP3</td>
<td>Pn = –30 dBm/tone, 200 kHz spacing</td>
<td>–5.0</td>
<td>–1.7</td>
<td>dBm</td>
<td></td>
</tr>
<tr>
<td>Input return loss</td>
<td></td>
<td></td>
<td>8</td>
<td></td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td>Output return loss</td>
<td></td>
<td></td>
<td>8</td>
<td></td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td>Reverse isolation</td>
<td></td>
<td></td>
<td>16</td>
<td>22</td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td>Non-harmonic spurious (Note 2) (Note 3)</td>
<td>PSPUR</td>
<td>VSWR 10:1, all phases</td>
<td></td>
<td>–50</td>
<td>dBm</td>
<td></td>
</tr>
<tr>
<td>Transition time (Note 2)</td>
<td>t</td>
<td></td>
<td>0.5</td>
<td></td>
<td>µs</td>
<td></td>
</tr>
</tbody>
</table>
Table 6. SKY65364-11 Electrical Specifications: Receive and Receive Bypass Mode (2 of 2) (Note 1)

<table>
<thead>
<tr>
<th>Parameter Description</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>Min</th>
<th>Typical</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Receive Low Current Mode (Note 2)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small signal gain</td>
<td>G</td>
<td>RBIAS = 3.8 kΩ</td>
<td>15</td>
<td>dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise Figure</td>
<td>NF</td>
<td>Tc = 25 °C, VCC_RX = 3.3 V, RBIAS = 3.8 kΩ</td>
<td>1.7</td>
<td>dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 dB Input Compression Point</td>
<td>IP1dB</td>
<td>1 dB gain compression, RBIAS = 3.8 kΩ</td>
<td>–23</td>
<td>dBm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd Order Input Intercept Point</td>
<td>IIP3</td>
<td>PN = –30 dBm/tone, 200 kHz spacing, RBIAS = 3.8 kΩ</td>
<td>–13.5</td>
<td>dBm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input return loss</td>
<td></td>
<td>RBIAS = 3.8 kΩ</td>
<td>8</td>
<td>dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output return loss</td>
<td></td>
<td>RBIAS = 3.8 kΩ</td>
<td>8</td>
<td>dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-harmonic spurious (Note 3)</td>
<td></td>
<td>VSWR 10:1, all phases, RBIAS = 3.8 kΩ</td>
<td>–50</td>
<td>dBm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transition time</td>
<td>t</td>
<td>RBIAS = 3.8 kΩ</td>
<td>0.5</td>
<td>μs</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Receive Bypass Mode: RX2 to Receive Output Path</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insertion loss</td>
<td>IL</td>
<td></td>
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<td>1 dB gain compression</td>
<td>+14.0</td>
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<td>3rd Order Input Intercept Point</td>
<td>IIP3</td>
<td>PN = –30 dBm/tone, 200 kHz spacing</td>
<td>+30</td>
<td>dBm</td>
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<tr>
<td>Input return loss</td>
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<td>dB</td>
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<td>dB</td>
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<td>μs</td>
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<td><strong>Receive and Receive Bypass Mode: ANT to RX1 Path</strong></td>
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<td>PN = –10 dBm/tone, 200 kHz spacing</td>
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<td>dBm</td>
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<td>Input return loss</td>
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<td>10</td>
<td>13</td>
<td>dB</td>
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<td>Output return loss</td>
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<td></td>
<td>10</td>
<td>13</td>
<td>dB</td>
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<td>Transition time (Note 2)</td>
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<td></td>
<td>0.5</td>
<td>μs</td>
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**Note 1:** Performance is guaranteed only under the conditions listed in this Table. Modes are established as indicated in Table 2.

**Note 2:** Not production tested.

**Note 3:** Measurement performed with spectrum analyzer RBW = 100 kHz for frequencies < 1 GHz and RBW = 1 MHz for frequencies between 1 GHz and 10 GHz.
Table 7. SKY65364-11 Electrical Specifications: Transmit Mode (Note 1)
(VCC_RX = VDD1 = 3.0 V to 3.45 V, VCC_TX1/2/3 = VDD2 = 3.4 V to 3.8 V, Pin = +10 dBm, VPC = 2.25 V, Tc = −40 °C to +85 °C, f = 890 to 960 MHz, 50 Ω Source and Load Impedance, CW Input, Unless Otherwise Noted)

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<th>Test Condition</th>
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<th>Max</th>
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<td>Output power (Note 2)</td>
<td>POUT</td>
<td>Tc = 25 °C, VCC_TX1/2/3 = 3.6 V</td>
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<tr>
<td>Output power variation over supply voltage</td>
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<td>Tc = 25 °C</td>
<td>±0.4</td>
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<td>dB</td>
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<td>Output power variation over temperature</td>
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<td>VCC_TX1/2/3 = 3.6 V</td>
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<td>PCTL</td>
<td>VPC = 0 V to 2.25 V (Note 3)</td>
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<td>Small signal transmit PA gain</td>
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<td>Pin input @ ~30 dBm</td>
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<td>3rd to 10th harmonic (Note 4)</td>
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<td>Non-harmonic spurious (Note 5) (Note 6)</td>
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<td>dBm</td>
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<td>Pin = +12 dBm</td>
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<td>Pin = +12 dBm</td>
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<td>Input return loss</td>
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<td>8</td>
<td></td>
<td>dB</td>
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<tr>
<td>Output return loss</td>
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<td></td>
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<td>10</td>
<td></td>
<td>dB</td>
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<tr>
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<td>Isolation</td>
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<td>ANT to RX1 Path, Transmit Bypass Mode</td>
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<td>Isolation</td>
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</table>

Note 1: Performance is guaranteed only under the conditions listed in this Table. Modes are established as indicated in Table 2.
Note 2: Output power rated at the antenna output. PA output power is actually 1.5 dB higher or +32 dBm for a POUT of +30.5 dBm.
Note 3: Output power control is the difference between the output power at VPC = 2.25 V and VPC = 0 V.
Note 4: Only the 2nd to 5th harmonics have been production tested. The 6th to 10th harmonics are characterized only.
Note 5: Not production tested.
Note 6: Measurement performed with spectrum analyzer RBW = 100 kHz for frequencies < 1 GHz and RBW = 1 MHz for frequencies between 1 GHz and 10 GHz.
Typical Performance Characteristics

Figure 3. Receive Mode (RX2 to RX0) Small Signal Gain vs Frequency Over Temperature

Figure 4. Receive Mode (RX2 to RX2) Noise Figure vs Frequency Over Temperature

Figure 5. Receive Mode (RX2 to RX0) IIP3 vs Frequency Over Temperature

Figure 6. Receive Bypass Mode (RX2 to RX0) Insertion Loss vs Frequency Over Temperature

Figure 7. Receive Bypass Mode (RX2 to RX0) IP1dB vs Frequency Over Temperature

Figure 8. Receive Bypass Mode (RX2 to RX0) IIP3 vs Frequency Over Temperature
Figure 9. Receive Bypass Mode (ANT to RX1) Insertion Loss vs Frequency Over Temperature

Figure 10. Transmit Mode (TX to ANT) Output Power vs Frequency Over Temperature

Figure 11. Transmit Bypass Mode (TX to ANT) Insertion Loss vs Frequency Over Temperature

Figure 12. Transmit Bypass Mode (TX to ANT) 2nd Harmonic vs Frequency Over Temperature

Figure 13. Transmit Bypass Mode (TX to ANT) 3rd Harmonic vs Frequency Over Temperature

Figure 14. Transmit Bypass Path Rejection vs Frequency Over Temperature
Figure 15. Transmit Bypass Path Rejection vs Frequency Over Temperature

Figure 16. Transmit Mode (ANT to RX1) Isolation vs Frequency Over Temperature

Figure 17. Transmit Bypass Mode (ANT to RX1) Isolation vs Frequency Over Temperature
Evaluation Board Description

The SKY65364-11 Evaluation Board is used to test the performance of the SKY65364-11 T/R FEM. A typical application schematic diagram is provided in Figure 18. An Evaluation Board schematic diagram is provided in Figure 19. An assembly drawing for the Evaluation Board is shown in Figure 20 and the layer is provided in Figure 21.

Package Dimensions

Package dimensions for the 28-pin MCM are shown in Figure 22, and tape and reel dimensions are provided in Figure 23.

Package and Handling Information

Since the device package is sensitive to moisture absorption, it is baked and vacuum packed before shipping. Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

The SKY65364-11 is rated to Moisture Sensitivity Level 3 (MSL3) at 260 °C. It can be used for lead or lead-free soldering. For additional information, refer to Skyworks Application Note, PCB Design and SMT Assembly/Rework Guidelines for MCM-L Packages, document number 101752.

Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.

Figure 18. SKY65364-11 Typical Application Schematic
Figure 19. SKY65364-11 Evaluation Board Schematic
Figure 20. SKY65364-11 Evaluation Board Assembly Diagram
Layer 1: Top – Metal

Layer 2: Ground

Layer 3: Ground

Layer 4: Solid Ground Plane

Figure 21. SKY65364-11 Evaluation Board Layer Detail
Figure 22. SKY65364-11 28-Pin MCM Package Dimensions
Figure 23. SKY65364-11 28-Pin MCM Tape and Reel Dimensions
## Ordering Information

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<th>Model Name</th>
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<th>Evaluation Board Part Number</th>
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<td>SKY65364-11</td>
<td>TW19-D900</td>
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