DATA SHEET

# SKY77518-21 TX–RX iPAC™ FEM for Dual-Band GSM/GPRS

## Applications

- Dual-band cellular handsets encompassing
  - Class 4 GSM900
  - DCS1800
  - Class 12 GPRS multi-slot operation

## Features

- High efficiency
  - GSM900 48%
  - DCS 41%
- Low transmit supply current
  - GSM900 1.26 A
  - DCS1800 0.9 A
- Internal ICC sense resistor for iPAC
- Closed loop iPAC
- 50 Ω matched Input/Output
- TX–VCO-to-antenna and antenna-to-RX-SAW filter RF interface
- TX harmonics below –33 dBm
- PHEMT RF switches afford high linearity, low insertion loss, and less than 20 µA supply current in receive modes
- Small outline: 6 mm x 8 mm
- Low profile: 1.2 mm
- Compatible with multiple logic families
- Low APC current: 25 µA

NEW Skyworks offers lead (Pb)-free, RoHS (Restriction of Hazardous Substances)-compliant packaging.



## Description

The SKY77518-21 is a transmit and receive front-end module (FEM) with Integrated Power Amplifier Control (iPAC™) for dual-band cellular handsets comprising GSM900 and DCS1800 operation. Designed in a low profile, compact form factor, the SKY77518-21 offers a complete Transmit VCO-to-Antenna and Antenna-to-Receive SAW filter solution. The FEM also supports Class 12 General Packet Radio Service (GPRS) multi-slot operation.

The module consists of a GSM900 PA block and a DCS1800 PA block, impedance-matching circuitry for 50 Ω input and output impedances, TX harmonics filtering, high linearity and low insertion loss PHEMT RF switches, diplexer and a Power Amplifier Control (PAC) block with internal current sense resistor. A custom BiCMOS integrated circuit provides the internal PAC function and decoder circuitry to control the RF switches. The two Heterojunction Bipolar Transistor (HBT) PA blocks are fabricated onto a single Gallium Arsenide (GaAs) die. One PA block supports the GSM900 band and the other PA block supports the DCS1800 band. Both PA blocks share common power supply pads to distribute current. The output of each PA block and the outputs to the two receive pads are connected to the antenna pad through PHEMT RF switches and a diplexer. The GaAs die, PHEMT die, Silicon (Si) die and passive components are mounted on a multi-layer laminate substrate. The assembly is encapsulated with plastic overmold.

Band selection and control of transmit and receive modes are performed using two external control pads. Refer to the functional block diagram in Figure 1 below. The band select pad (BS) selects between GSM and DCS modes of operation. The transmit enable (TX_EN) pad controls receive or transmit mode of the respective RF switch (TX = logic 1). Proper timing between transmit enable (TX_EN) and Analog Power Control (VRAMP) allows for high isolation between the antenna and TX-VCO while the VCO is being tuned prior to the transmit burst.

The SKY77518-21 is compatible with logic levels from 1.2 V to VCC for BS and TX_EN pads, depending on the level applied to the VLOGIC pad. This feature provides additional flexibility for the designer in the selection of FEM interface control logic.

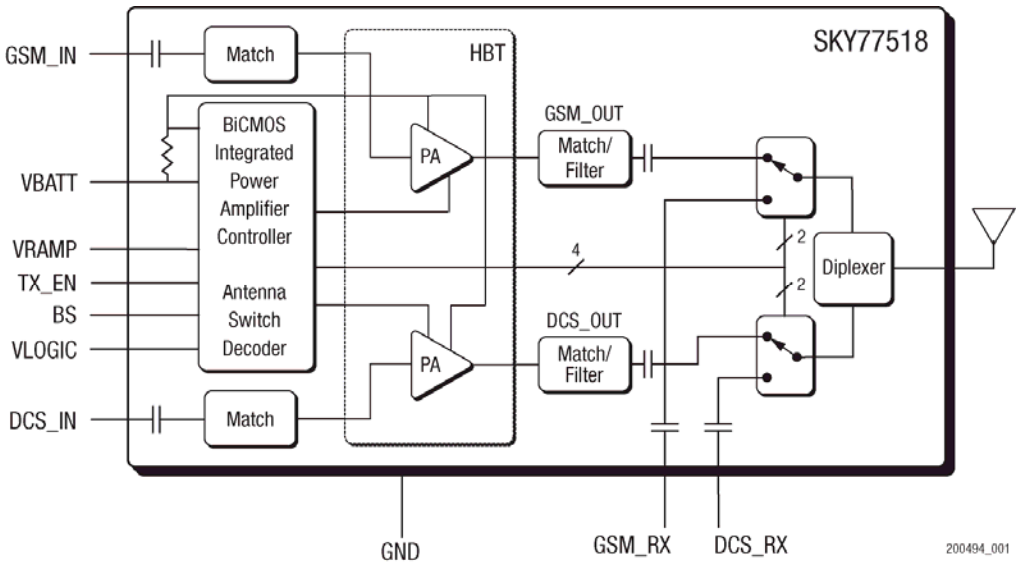



**Figure 1. Functional Block Diagram**

## Electrical Specifications

The following tables list the electrical characteristics of the SKY77518-21 Front-End Module. The absolute maximum ratings and recommended operating conditions for the SKY77518-21 are listed in Table 1 and Table 2, respectively. Table 3 specifies the mode control logic and Table 4 contains the electrical characteristics of the SKY77518-21 for modes GSM900 and DCS1800. Figure 2 presents an application schematic for the SKY77518-21.

The SKY77518-21 is a static-sensitive electronic device and should not be stored or operated near strong electrostatic fields. Detailed information on device dimensions, pad descriptions, packaging and handling can be found in later sections of this data sheet.

**Table 1. Absolute Maximum Ratings**

| Parameter | Minimum | Maximum | Unit |
|---|---|---|---|
| Input Power ($P_{IN}$) | — | 15 | dBm |
| Supply Voltage ($V_{CC}$), Standby<br>$V_{RAMP} \leq 0.3$ V<br>$V_{LOGIC} \leq 0.5$ V | — | 7 | V |
| Control Voltage ($V_{RAMP}$) | –0.5 | $V_{CC\_MAX}$ – 0.2 V<br>(See Table 4) | V |
| Storage Temperature | –55 | 150 | °C |

**Table 2. Recommended Operating Conditions**

| Parameter | | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|
| Supply Voltage ($V_{CC}$) | | 2.7 | 3.3 | 4.8 | V |
| Supply Current ($I_{CC}$) | | 0 | | 1.8 | A |
| Operating Case Temperature ($T_{CASE}$) [1] | 1-Slot (12.5% duty cycle) | –20 | | 85 | |
| | 2-Slot (25% duty cycle) | –20 | | 85 | |

[1] Case Operating Temperature refers to the temperature of the GROUND PAD on the underside of the package.

**Table 3. SKY77518-21 Mode Control Logic**

| Mode | $V_{LOGIC}$ | Input Control Bits | |
|---|---|---|---|
| | | TX_En | BS |
| STANDBY | 0 | X [1] | X [1] |
| GSM_RX | 1 | 0 | 0 |
| DCS_RX | 1 | 0 | 1 |
| GSM_TX | 1 | 1 | 0 |
| DCS_TX | 1 | 1 | 1 |

[1] X = don't care

**Table 4. SKY77518-21 Electrical Specifications [1]** *(1 of 5)*

| General | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | | **Symbol** | **Test Condition** | **Minimum** | **Typical** | **Maximum** | **Units** |
| Supply voltage | | $V_{CC}$ | — | 2.7 | 3.3 | 4.8 | V |
| Power control impedance | | $Z_{VRAMP}$ | — | | 300 | | kΩ |
| VLOGIC control voltage | LOW | $V_{LOGIC\_LOW}$ | — | –0.1 | — | 0.5 | V |
| | HIGH | $V_{LOGIC\_HIGH}$ | | 1.2 | — | $V_{CC}$ | |
| VLOGIC current | | $I_{VLOGIC}$ | VLOGIC ≤ 2.7 V<br>TX_EN ≤ 0.4 V<br>BS ≤ 0.4 V | — | 1 | 20 | µA |
| Band Select control voltage | LOW | $V_{BS\_LOW}$ | — | –0.1 | — | 30% $V_{LOGIC}$ | V |
| | HIGH | $V_{BS\_HIGH}$ | | 70% $V_{LOGIC}$ | — | $V_{LOGIC}$ | |
| Band Select current | | $I_{BS}$ | BS ≤ 2.7 V | — | 8 | 20 | µA |
| TX_EN control voltage | LOW | $V_{TX\_EN\_LOW}$ | — | –0.1 | — | 30% $V_{LOGIC}$ | V |
| | HIGH | $V_{TX\_EN\_HIGH}$ | | 70% $V_{LOGIC}$ | — | $V_{LOGIC}$ | |
| TX_EN current | | $I_{TX\_EN}$ | TX_EN ≤ 2.7 V | — | 8 | 20 | µA |
| Leakage current | Standby Mode | $I_{QS}$ | $V_{CC}$ ≤ 4.8 V<br>$V_{LOGIC}$ = $V_{LOGIC\_LOW}$<br>$V_{RAMP}$ ≤ 0.1 V<br>TX_EN ≤ 0.4 V<br>BS ≤ 0.4 V<br>BS ≥ $V_{LOGIC}$ – 0.4 V<br>$T_{CASE}$ = 25 °C<br>$P_{IN}$ ≤ –60 dBm | — | 2 | 10 | µA |
| | Receive Mode | $I_{QRX}$ | $V_{CC}$ ≤ 4.8 V<br>1.2 V ≤ $V_{LOGIC}$ ≤ 2.7 V<br>$V_{RAMP}$ ≤ 0.1 V<br>TX_EN ≤ 0.4 V<br>BS ≤ 0.4 V<br>BS ≥ $V_{LOGIC}$ – 0.4 V<br>$T_{CASE}$ = 25 °C<br>$P_{IN}$ ≤ –60 dBm | — | 15 | 50 | |

**Table 4. SKY77518-21 Electrical Specifications [1]** *(2 of 5)*

| GSM900 Mode (f = 880 to 915 MHz and $P_{IN}$ = 0 to 6 dBm) | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Test Condition** | **Minimum** | **Typical** | **Maximum** | **Units** |
| Frequency range | F | — | 880 | — | 915 | MHz |
| Input power | $P_{IN}$ | — | 0 | — | 6 | dBm |
| Analog power control voltage | $V_{RAMP}$ | — | 0.2 | — | 1.8 | V |
| Power Added Efficiency | PAE | $V_{CC}$ = 3.3 V<br>$P_{OUT}$ = 33 dBm<br>TX_EN = $V_{TX\_EN\_HIGH}$<br>$V_{RAMP}$ set for $P_{OUT}$ = 33 dBm<br>pulse width 577 µs<br>duty cycle 1:8<br>$T_{CASE}$ = 25 °C | 41 | 48 | — | % |
| Supply Current @ Rated Power | $I_{CC}$_33 dBm | $V_{CC}$ = 3.3 V<br>$P_{OUT}$ = 33 dBm<br>$P_{IN}$ = 3 dBm<br>TX_EN = $V_{TX\_EN\_HIGH}$<br>$V_{RAMP}$ set for $P_{OUT}$ = 33 dBm<br>pulse width 577 µs<br>duty cycle 1:8<br>$T_{CASE}$ = 25 °C | — | 1.26 | 1.48 | A |
| Supply Current @ Minimum Power | $I_{CC}$_5 dBm | $V_{CC}$ = 3.3 V<br>$P_{OUT}$ = 5 dBm<br>$P_{IN}$ = 3 dBm<br>TX_EN = $V_{TX\_EN\_HIGH}$<br>$V_{RAMP}$ set for $P_{OUT}$ = 5 dBm<br>pulse width 577 µs<br>duty cycle 1:8<br>$T_{CASE}$ = 25 °C | — | 53 | 60 | mA |
| Harmonics 2nd to 13th | 2$f_0$ to 13$f_0$ | BW = 3 MHz<br>5 dBm ≤ $P_{OUT}$ ≤ 33 dBm<br>$V_{RAMP}$ controlled [6] | — | –40 | –33 | dBm |
| Output power | $P_{OUT}$ | $V_{CC}$ = 3.3 V<br>$T_{CASE}$ = 25 °C<br>$P_{IN}$ = 0 dBm | 33.0 | 33.5 | — | dBm |
| | $P_{OUT\_MAX\ LOW\ VOLTAGE}$ | $V_{CC}$ = 2.7 V<br>TX_EN = $V_{TX\_EN\_HIGH}$<br>$T_{CASE}$ = –20 °C to 85 °C<br>$P_{IN}$ = 0 dBm | 30.5 | 31.5 | — | |
| | $P_{OUT\_MAX\ HIGH\ VOLTAGE}$ | $V_{CC}$ = 4.8 V<br>TX_EN = $V_{TX\_EN\_HIGH}$<br>$T_{CASE}$ = –20 °C to 85 °C<br>$P_{IN}$ = 0 dBm | 30.5 | 34.5 | — | |
| Input VSWR | $\Gamma_{IN}$ | $P_{OUT}$ = 5 to 33 dBm<br>$V_{RAMP}$ controlled [6] | — | 1.5:1 | 2.5:1 | |
| Forward isolation 4 | $P_{OUT\_RX}$ | $P_{IN}$ = 6 dBm<br>$V_{RAMP}$ ≤ 0.1 V<br>$V_{LOGIC}$ = $V_{LOGIC\_HIGH}$<br>TX_EN = $V_{TX\_EN\_LOW}$<br>Mode = GSM_RX (see Table 3) | — | –65 | –45 | dBm |
| | $P_{OUT\_ENABLED\_TX}$ | $P_{IN}$ = 6 dBm<br>$V_{RAMP}$ ≤ 0.1 V<br>$V_{LOGIC}$ = $V_{LOGIC\_HIGH}$<br>TX_EN = $V_{TX\_EN\_HIGH}$<br>Mode = GSM_TX (see Table 3) | — | –40 | –5 | |
| Coupling of GSM900 TX output (f0) to GSM_RX output pad [4] | $CGHI_{TX\text{-}RX\_F0}$ | 5 dBm ≤ $P_{OUT}$ ≤ 33 dBm<br>Mode = GSM_TX (see Table 3) | — | 3 | 11 | dBm |
| Coupling of GSM900 TX output (2$f_0$, 3$f_0$) to DCS/PCS_RX output pad | $CGHI_{TX\text{-}DCS\_RX}$ | 5 dBm ≤ $P_{OUT}$ ≤ 33 dBm<br>Mode = GSM_TX (see Table 3) | — | –50 | –36 | dBm |

**Table 4. SKY77518-21 Electrical Specifications [1]** *(3 of 5)*

| **GSM900 Mode (f = 880 to 915 MHz and $P_{IN}$ = 0 to 6 dBm)** [continued] | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Test Condition** | **Minimum** | **Typical** | **Maximum** | **Units** |
| Spurious | Spur | All combinations of the following parameters:<br>$V_{RAMP}$ = controlled [2]<br>$P_{IN}$ = min. to max.<br>$V_{CC}$ = 2.7 V to 4.8 V<br>Load VSWR = 12:1, all phase angles | No parasitic oscillation > –36 dBm | | | |
| Load mismatch | Load | All combinations of the following parameters:<br>$V_{RAMP}$ = controlled [2]<br>$P_{IN}$ = min. to max.<br>$V_{CC}$ = 2.7 V to 4.8 V<br>Load VSWR = 20:1, all phase angles | No module damage or permanent degradation | | | |
| RX Band Spurious | $RX_{SPUR}$ | At $f_0$ + 20 MHz (935 to 960 MHz)<br>RBW = 100 kHz<br>$V_{CC}$ = 3.3 V<br>5 dBm ≤ $P_{OUT}$ ≤ 33 dBm<br>$T_{CASE}$ = 25 °C | — | –84 | –83 | dBm |
| | | At $f_0$ + 10 MHz (925 to 935 MHz)<br>RBW = 100 kHz<br>$V_{CC}$ = 3.3 V<br>$T_{CASE}$ = 25 °C<br>5 dBm ≤ $P_{OUT}$ ≤ 33 dBm | — | –80 | –76 | |
| | | At 1805 to 1880 MHz<br>RBW = 100 kHz<br>$V_{CC}$ = 3.3 V<br>$T_{CASE}$ = 25 °C<br>5 dBm ≤ $P_{OUT}$ ≤ 33 dBm | — | –101 | –84 | |
| Power control dynamic range | $PC_{DR}$ | | 30 | 50 | — | dB |
| Power control variation — Control level 5-15 ($V_{CC}$ ≥ 3.3 V) | $PC_V$ | $P_{OUT}$ 13 to 33 dBm<br>$T_{CASE}$ = 25 °C | –1.0 | — | 1.0 | dB |
| | | $P_{OUT}$ 13 to 33 dBm | –1.5 | — | 1.5 | |
| Power control variation — Control level 16-19 | | $P_{OUT}$ 5 to 11 dBm<br>$T_{CASE}$ = 25 °C | –2.0 | — | 2.0 | |
| | | $P_{OUT}$ 5 to 11 dBm | –3.5 | — | 3.5 | |
| Power control slope | $PC_S$ | 5 to 33 dBm | — | — | 150 | dB/V |
| **GSM900 RECEIVE (f = 925 to 960 MHz) Mode = GSM_RX** | | | | | | |
| **Parameter** | **Symbol** | **Test Condition** | **Minimum** | **Typical** | **Maximum** | **Units** |
| Frequency range | F | — | 925 | — | 960 | MHz |
| Insertion Loss, ANT to GSM_RX [4] | $IL_{GSM\_RX}$ | — | — | 1.0 | 1.3 | dB |
| VSWR ANT, GSM_RX [4] | $\Gamma_{IN}$, $\Gamma_{OUT}$ | — | — | 1.2:1 | 1.5:1 | |

**Table 4. SKY77518-21 Electrical Specifications [1]** *(4 of 5)*

| DCS1800 Mode ( f = 1710 to 1785 MHz and $P_{IN}$ = 0 to 6 dBm) | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Test Condition** | **Minimum** | **Typical** | **Maximum** | **Units** |
| Frequency range | f | — | 1710 | — | 1785 | MHz |
| Input power | $P_{IN}$ | — | 0 | — | 6 | dBm |
| Analog power control voltage | $V_{RAMP}$ | — | 0.2 | — | 1.8 | V |
| Power Added Efficiency | PAE | $V_{CC}$ = 3.3 V<br>$P_{OUT}$ = 31 dBm<br>TX_EN = $V_{TX\_EN\_HIGH}$<br>$V_{RAMP}$ set for $P_{OUT}$ = 31 dBm<br>pulse width 577 µs<br>duty cycle 1:8<br>$T_{CASE}$ = 25 °C | 35 | 41 | — | % |
| Supply Current @ Rated Power | $I_{CC}$_31 dBm | $V_{CC}$ = 3.3 V<br>$P_{OUT}$ = 31 dBm<br>$P_{IN}$ = 3 dBm<br>TX_EN = $V_{TX\_EN\_HIGH}$<br>$V_{RAMP}$ set for $P_{OUT}$ = 31 dBm<br>pulse width 577 µs<br>duty cycle 1:8<br>$T_{CASE}$ = 25 °C | — | 0.93 | 1.04 | A |
| Supply Current @ Minimum Power | $I_{CC}$_0 dBm | $V_{CC}$ = 3.3 V<br>$P_{OUT}$ = 0 dBm<br>$P_{IN}$ = 3 dBm<br>TX_EN = $V_{TX\_EN\_HIGH}$<br>$V_{RAMP}$ set for $P_{OUT}$ = 0 dBm<br>pulse width 577 µs<br>duty cycle 1:8<br>$T_{CASE}$ = 25 °C | — | 40 | 55 | mA |
| Harmonics 2nd to 4th, 7th | 2f0 to 4f0, 7f0 | BW = 3 MHz,<br>0 dBm ≤ $P_{OUT}$ ≤ 31 dBm<br>$V_{RAMP}$ controlled [5] | — | –40 | –33 | dBm |
| Harmonics 5th, 6th | 5f0, 6f0 | | — | –35 | –25 | dBm |
| Output power | $P_{OUT}$ | $V_{CC}$ = 3.3 V<br>$T_{CASE}$ = 25 °C<br>$P_{IN}$ = 0 dBm | 31.0 | 32.0 | — | dBm |
| | $P_{OUT\_MAX\ LOW\ VOLTAGE}$ | $V_{CC}$ = 2.7 V<br>TX_EN = $V_{TX\_EN\_HIGH}$<br>$T_{CASE}$ = –20 °C to 85 °C<br>$P_{IN}$ = 0 dBm | 28.5 | 30.0 | — | dBm |
| | $P_{OUT\_MAX\ HIGH\ VOLTAGE}$ | $V_{CC}$ = 4.8 V<br>TX_EN = $V_{TX\_EN\_HIGH}$<br>$T_{CASE}$ = –20 °C to 85 °C<br>$P_{IN}$ = 0 dBm | 28.5 | 32.5 | — | dBm |
| Input VSWR | $\Gamma_{IN}$ | $P_{OUT}$ = 0 to 31 dBm<br>$V_{RAMP}$ controlled [5] | — | 1.5:1 | 2.5:1 | — |
| Forward isolation [4] | $P_{OUT\ RX}$ | $P_{IN}$ = 6 dBm<br>$V_{RAMP}$ ≤ 0.1 V<br>$V_{LOGIC}$ = $V_{TX\_EN\_HIGH}$<br>TX_EN = $V_{TX\_EN\_LOW}$<br>Mode = DCS_RX (see Table 3) | — | –65 | –53 | dBm |
| | $P_{OUT\_ENABLED\_TX}$ | $P_{IN}$ = 6 dBm<br>$V_{RAMP}$ ≤ 0.1 V<br>$V_{LOGIC}$ = $V_{LOGIC\_HIGH}$<br>TX_EN = $V_{TX\_EN\_HIGH}$<br>Mode = DCS_TX (see Table 3) | — | –35 | –5 | dBm |
| Coupling of DCS TX output to Receive RF output pad [4] | $C_{DCS\_TX\text{-}RX\_F0}$ | 0 dBm ≤ $P_{OUT}$ ≤ 31 dBm<br>Mode = DCS_TX (see Table 3) | — | 2 | 9 | dBm |

**Table 4. SKY77518-21 Electrical Specifications [1]** *(5 of 5)*

| DCS1800 Mode (f = 1710 to 1785 MHz and $P_{IN}$ = 0 to 6 dBm) [continued] | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | | **Symbol** | **Test Condition** | **Minimum** | **Typical** | **Maximum** | **Units** |
| Spurious | | Spur | All combinations of the following parameters:<br>$V_{RAMP}$ = controlled [3]<br>$P_{IN}$ = min. to max.<br>$V_{CC}$ = 2.7 V to 4.8 V<br>Load VSWR = 12:1, all phase angles | No parasitic oscillation > –36 dBm | | | |
| Load mismatch | | Load | All combinations of the following parameters:<br>$V_{RAMP}$ = controlled [3]<br>$P_{IN}$ = min. to max.<br>$V_{CC}$ = 2.7 V to 4.8 V<br>Load VSWR = 20:1, all phase angles | No module damage or permanent degradation | | | |
| RX Band Spurious | | $RX_{SPUR}$ | At $f_0$ + 20 MHz (1805 to 1880 MHz)<br>RBW = 100 kHz<br>$V_{CC}$ = 3.3 V<br>$T_{CASE}$ = 25 °C<br>0 dBm ≤ $P_{OUT}$ ≤ 31 dBm | — | –83 | –78 | dBm |
| | | | 925 to 960 MHz<br>RBW = 100 kHz<br>$V_{CC}$ = 3.3 V<br>$T_{CASE}$ = 25 °C<br>0 dBm ≤ $P_{OUT}$ ≤ 31 dBm | — | — | –87 | |
| Power control dynamic range | | $PC_{DR}$ | | 35 | 50 | — | dB |
| Power control variation | Control level 0-8<br>$V_{CC}$ ≥ 3.3 V | $PC_V$ | $P_{OUT}$ 14 to 31 dBm<br>$T_{CASE}$ = 25 °C | –1.5 | — | 1.5 | dB |
| | | | $P_{OUT}$ 14 to 31 dBm | –2.0 | — | 2.0 | |
| | Control level 9-13 | | $P_{OUT}$ 4 to 12 dBm<br>$T_{CASE}$ = 25 °C | –2.5 | — | 2.5 | |
| | | | $P_{OUT}$ 4 to 12 dBm | –3.5 | — | 3.5 | |
| | Control level 14-15 | | $P_{OUT}$ 0 to 2 dBm<br>$T_{CASE}$ = 25 °C | –3.0 | — | 3.0 | |
| | | | $P_{OUT}$ 0 to 2 dBm | –4.5 | — | 4.5 | |
| Power control slope | | $PC_S$ | 0 to 30 dBm | — | — | 150 | dB/V |
| **DCS 1800 RECEIVE (f =1805 to 1880 MHz) Mode = DCS_RX** | | | | | | | |
| **Parameter** | | **Symbol** | **Test Condition** | **Minimum** | **Typical** | **Maximum** | **Units** |
| Frequency range | | f | — | 1805 | — | 1880 | MHz |
| Insertion Loss, ANT to DCS_RX [4] | | $IL_{DCS\_RX}$ | — | — | 1.2 | 1.5 | dB |
| VSWR ANT, DCS_RX [4] | | $\Gamma_{IN}$, $\Gamma_{OUT}$ | — | — | 1.2:1 | 1.5:1 | |

[1] Unless specified otherwise:
$T_{CASE}$ = –20 °C to max. operating temperature (see Table 2), RL = 50 Ω, pulsed operation with pulse width ≤ 1154 µs and duty cycle ≤ 2:8, $V_{CC}$ = 2.7 V to 4.8 V.

[2] $I_{CC}$ = 0A to xA, where x = current at $P_{OUT}$ = 33 dBm, 50 Ω load, and $V_{CC}$ = 3.3 V.

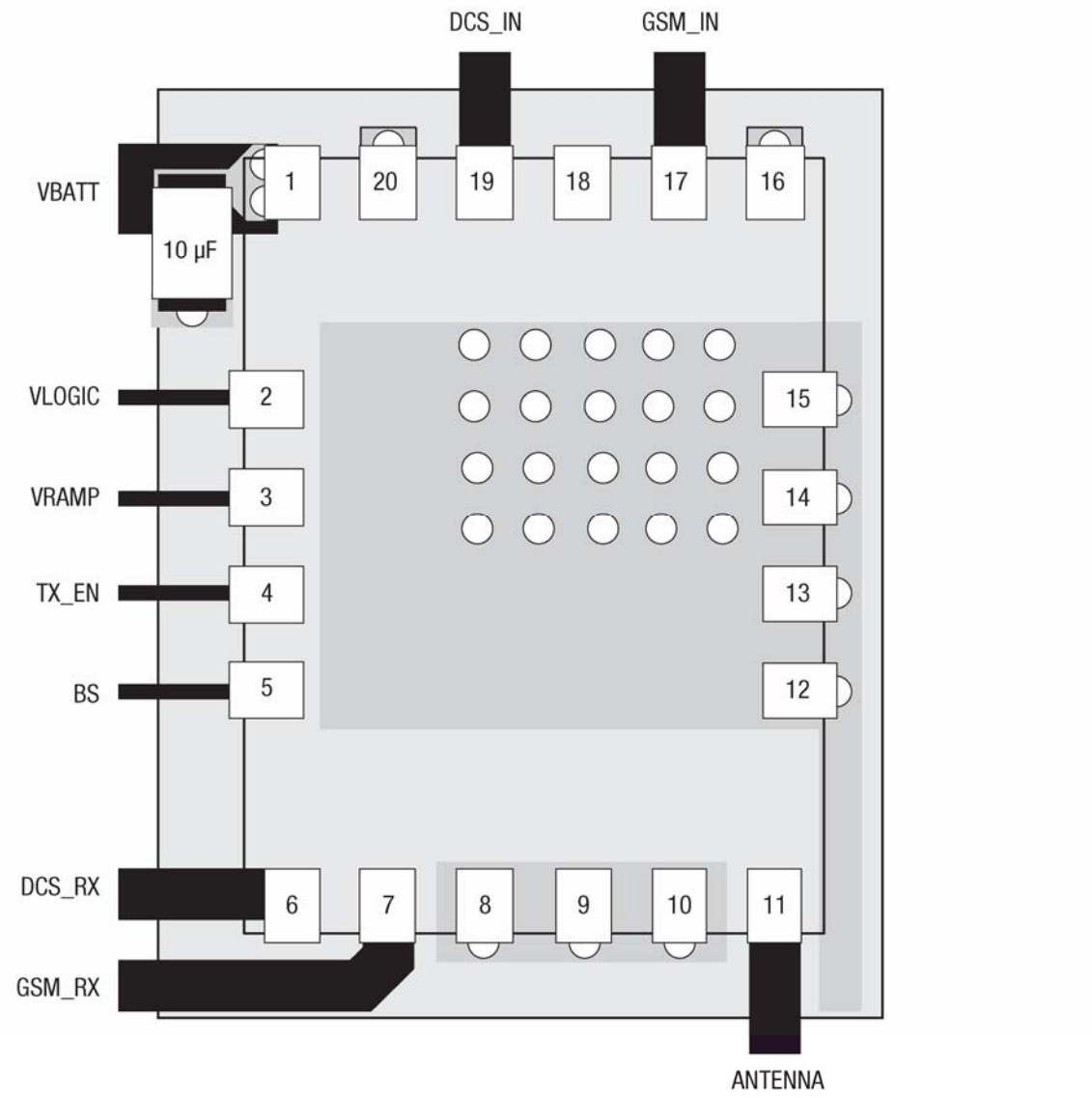
[3] $I_{CC}$ = 0A to xA, where x = current at $P_{OUT}$ = 31 dBm, 50 Ω load, and $V_{CC}$ = 3.3 V



[4] Terminate all unused RF ports with 50 Ω loads

[5] Max $V_{RAMP}$ = $V_{RAMP}$ @ $P_{OUT}$ =31 dBm, 50 Ω load, $T_{CASE}$ 25 °C, $P_{IN}$ = 3 dBm

[6] Max $V_{RAMP}$ = $V_{RAMP}$ @ $P_{OUT}$ =33 dBm, 50 Ω load, $T_{CASE}$ 25 °C, $P_{IN}$ = 3 dBm




NOTES:
1. The value of 10 µF cap is dependent on the noise level on the phone board.
2. Ensure sufficient number of vias to supply battery current to Vbatt.
3. VBATT trace width should be ≥ 1 mm.
4. Ground terminal of bypass capacitor connected to ground plane with vias.
5. Layer 2 should be solid ground plane under SKY77518 and any RF trace interconnect.

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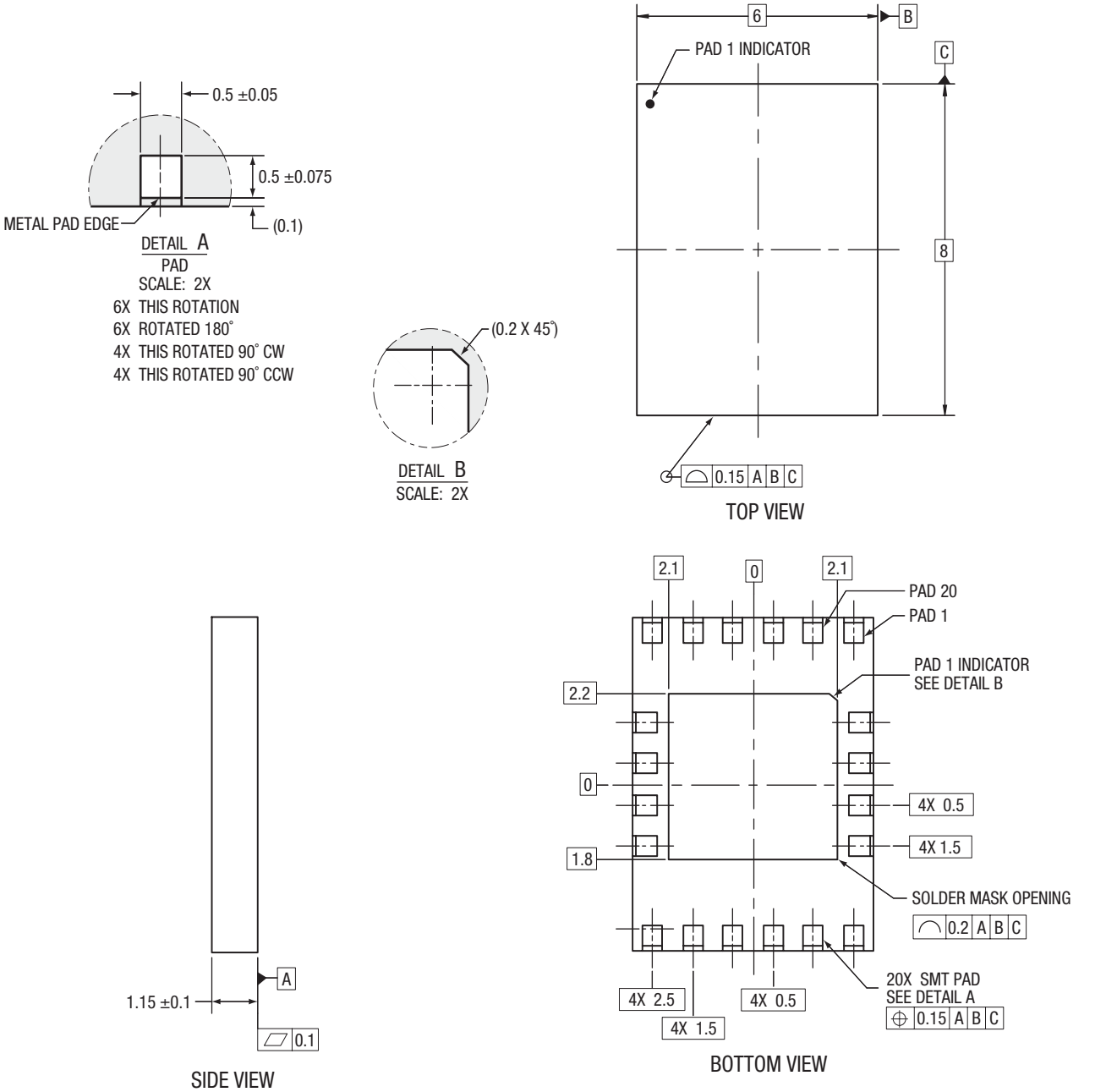
**Figure 2. SKY77518-21 Application Schematic Diagram**

## Package Dimensions and Pad Descriptions

Figure 3 is a mechanical diagram of the pad layout for the SKY77518-21, a 20-pad leadless dual-band FEM. Figure 4 provides a recommended phone board layout footprint for the FEM to help the designer attain optimum thermal conductivity, good grounding, and minimum RF discontinuity for the 50-ohm terminals. Figure 5 illustrates the device pad configuration and the numbering convention which starts with pad 1 at the upper left, as indicated, and increments counter-clockwise around the package. Table 5 lists the pad names and the associated signal descriptions. Figure 6 interprets typical case markings.






NOTES: UNLESS OTHERWISE SPECIFIED.

1. Dimensioning and Tolerancing in accordance with ASME Y14.5-1994.
2. Pads are solder mask defined on 3 edges.
3. All dimensions are in millimeters.

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**Figure 3. SKY77518-21 FEM Package Dimensions – 20-Pad Leadless (All Views)**

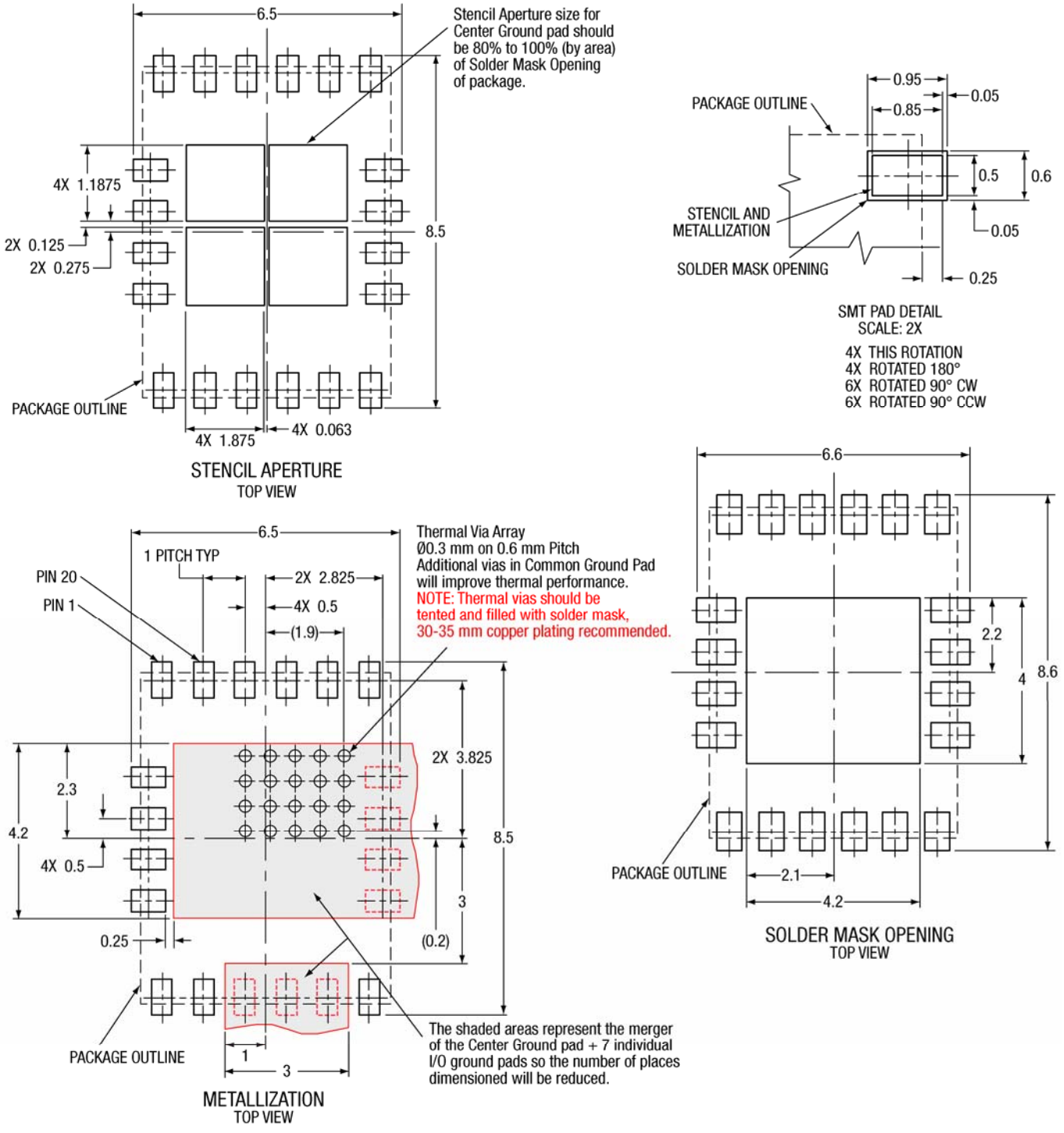
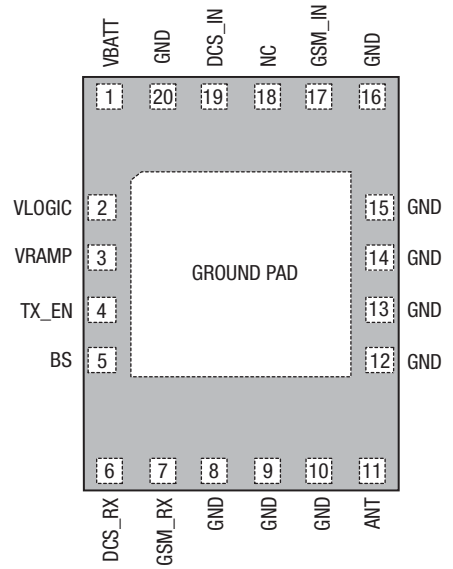





**Figure 4. Phone PCB Layout Footprint for 6 x 8 mm, 20-Pad Package with Grid-Bottom Solder Mask – SKY77518-21 Specific.**




Pin layout as seen from top view looking through the package.

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**Figure 5. SKY77518-21 FEM Package Pad Configuration – 20-Pad Leadless (Top View)**

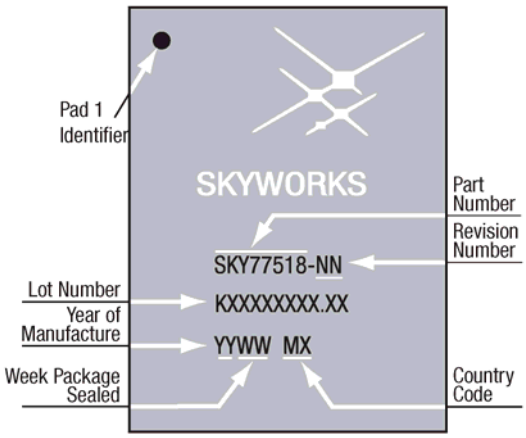


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**Figure 6. Typical Case Markings**

**Table 5. SKY77518-21 Pad Names and Signal Descriptions**

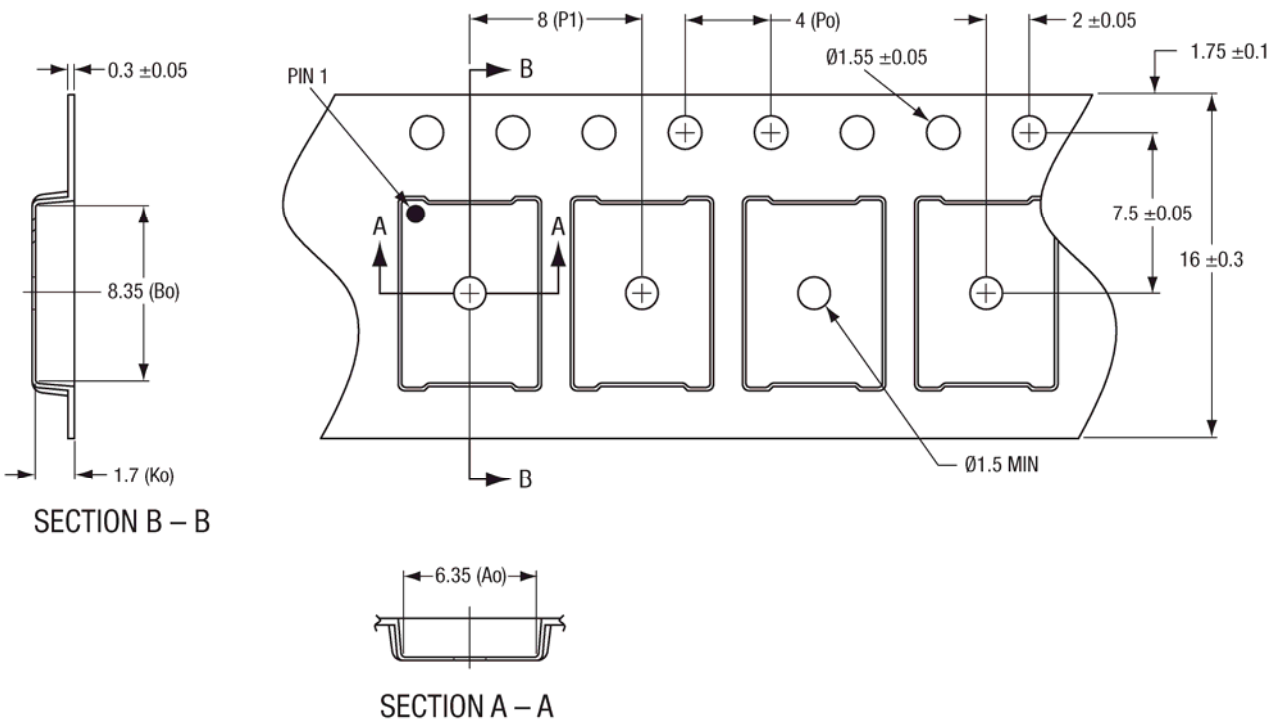
| Pad | Name | Description |
|---|---|---|
| 1 | VBATT | Battery input voltage |
| 2 | VLOGIC | Control logic level selection/Standby control |
| 3 | VRAMP | Analog power control voltage input |
| 4 | TX_EN | TX / RX select (mode control) |
| 5 | BS | Band Select (mode control) |
| 6 | DCS_RX | DCS Receive RF Output (1805-1880 MHz) |
| 7 | GSM_RX | GSM Receive RF Output (920-960 MHz) |
| 8 | GND | RF and DC Ground |
| 9 | GND | RF and DC Ground |
| 10 | GND | RF and DC Ground |
| 11 | ANT | RF_IN / RF_OUT to Antenna |
| 12 | GND | RF and DC Ground |
| 13 | GND | RF and DC Ground |
| 14 | GND | RF and DC Ground |
| 15 | GND | RF and DC Ground |
| 16 | GND | RF and DC Ground |
| 17 | GSM_IN | RF input 880–915 MHz |
| 18 | NC | No Connect |
| 19 | DCS_IN | RF input 1710–1785 MHz |
| 20 | GND | RF and DC Ground |
| GND PADS | GROUND GRID | Ground Pads, module underside |

## Package and Handling Information

Because of its sensitivity to moisture absorption, this device package is baked and vacuum-packed prior to shipment. Instructions on the shipping container label must be followed regarding exposure to moisture after the container seal is broken, otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

The SKY77518-21 is capable of withstanding an MSL3/250 °C solder reflow. Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. If the part is attached in a reflow oven, the temperature ramp rate should not exceed 3 °C per second; maximum temperature should not exceed 250 °C. If the part is manually attached, precaution should be taken to insure that the part is not subjected to temperatures exceeding 250 °C for more than 10 seconds. For details on attachment techniques, precautions, and handling procedures recommended by Skyworks, please refer to Skyworks Application Note: *PCB Design and SMT Assembly/Rework*, Document Number 101752. Additional information on standard SMT reflow profiles can also be found in the JEDEC *Joint Industry Standard J-STD-020*.

Production quantities of this product are shipped in the standard tape-and-reel format (see Figure 7). For additional packaging details, refer to Skyworks Application Note: *Tape and Reel Information – RF Modules*, Document Number 101568.




NOTES:
1. CARRIER TAPES MUST MEET ALL REQUIREMENTS OF SKYWORKS GP01–D232 PROCUREMENT SPEC FOR TAPE AND REEL SHIPPING.
2. CARRIER TAPE SHALL BE BLACK CONDUCTIVE POLYSTYRENE.
3. COVER TAPE SHALL BE TRANSPARENT CONDUCTIVE PRESSURE SENSITIVE ADHESIVE (PSA) MATERIAL W/13.3 mm WIDTH.
4. ESD-SURFACE RESISTIVITY SHALL BE ≤ 1 X $10^{10}$ OHMS/SQUARE PER EIA, JEDEC TNR SPECIFICATION.
5. Po / P1, 10 PITCHES CUMULATIVE TOLERANCE ON TAPE: ±0.2 mm.
6. Ao & Bo MEASUREMENT POINT TO BE 0.3 mm FROM BOTTOM POCKET.
7. ALL DIMENSIONS ARE IN MILLIMETERS.
8. PART NO.: eC3-MCM0608-16-8-F1-L REV. 0. PLEASE INDICATE ON PURCHASE ORDER.
9. NUMBER OF PARTS per 13 inch (DIAMETER) x 16 mm wide REEL: 2500.

ePAK CARRIER TAPE

CARRIER TAPE OVERMOLD MCM 6 x 8 x 1.4 mm BODY SIZE GP01-D232-081C
101568_019

**Figure 7. Tape and Reel Dimensional Diagram for 6 x 8 x 1.2 mm Package SKY77518-21 Specific**

## Electrostatic Discharge Sensitivity

The SKY77518-21 is a Class 1 device. The ESD testing was performed in compliance with JEDEC JESD22-A114B Human Body Model (HBM) and JEDEC JESD22-A115B Machine Model (MM) requirements.

Various failure criteria can be utilized when performing ESD testing. Many vendors employ relaxed ESD failure standards that fail devices only after "the pad fails the electrical specification limits" or "the pad becomes completely non-functional". Skyworks employs stringent criteria, rejecting devices as soon as the pad begins to show any degradation on a curve tracer.

To avoid ESD damage, both latent and visible, it is very important that the product assembly and test areas follow the Class 1 ESD handling precautions listed below.

- Personnel Grounding
  - Wrist Straps
  - Conductive Smocks, Gloves and Finger Cots
  - Antistatic ID Badges
- Protective Workstation
  - Dissipative Table Top
  - Protective Test Equipment (Properly Grounded)
  - Grounded Tip Soldering Irons
  - Solder Conductive Suckers
  - Static Sensors
- Facility
  - Relative Humidity Control and Air Ionizers
  - Dissipative Floors (less than $10^9$ Ω to GND)
- Protective Packaging and Transportation
  - Bags and Pouches (Faraday Shield)
  - Protective Tote Boxes (Conductive Static Shielding)
  - Protective Trays
  - Grounded Carts
  - Protective Work Order Holders

## Ordering Information

| Model Number | Manufacturing Part Number | Product Revision | Package | Operating Temperature |
|---|---|---|---|---|
| SKY77518-21 | SKY77518-21 | | 6x8 MCM–20 | –20 °C to +85 °C |

## Revision History

| Revision | Level | Date | Description |
|---|---|---|---|
| A | | November 6, 2007 | Initial Issue |

## References

Application Note: PCB Design and SMT Assembly/Rework, Document Number 101752

Application Note: Tape and Reel Information – RF Modules, Document Number 101568

Application Note: BiCMOS iPAC™ Front-End Modules Implementation, Document Number 200576

Application Note: SKY77517 / SKY77518 Evaluation Board Information, Document Number 200574

Standard SMT Reflow Profiles: JEDEC Standard J-STD-020

JEDEC JESD22-A114B Human Body Model (HBM)

JEDEC JESD22-A115B Machine Model (MM)



Additional information, posted at www.skyworksinc.com, is incorporated by reference.