PRELIMINARY DATA SHEET

SKY77643-11 Multimode Multiband Power Amplifier Module

Applications

- Multiband 3G / LTE handsets
- WCDMA Bands I, II, III, IV, V, VIII, IX
- TD-SCDMA Bands 34, 39
- FDD LTE Bands
  1, 2, 3, 4, 5, 7, 8, 9, 12, 13, 17, 20, 28, 30
- TDD LTE Band 38, 39, 40, 41

Features

- Hybrid PA architecture
- Two T/R (RX) ports and 14 outputs
- Industry-leading PAE for 3G/4G
- Optimized for APT DCDC operation
- Fully programmable Mobile Industry Processor Interface (MIPI) control
- MIPI programmable bias modes optimize best efficiency / linearity trade-off for 3G and 4G; minimizes DG09 for 3G.
- Small, low profile package:
  - 4.0 mm x 6.8 mm x 0.8 mm, Max.
  - 42-pad configuration

Skyworks Green™ products are compliant with all applicable legislation and are halogen-free. For additional information, refer to Skyworks *Definition of Green*™, document number SQ04-0074.

Description

Skyworks SKY77643-11 is a hybrid multimode multiband (MMMB) Power Amplifier Module (PAM) that supports 3G / 4G handsets and operates efficiently in WCDMA, TD-SCDMA, and LTE modes. The module is fully programmable through a Mobile Industry Processor Interface (MIPI®).

The PAM consists of a WCDMA / LTE block for low, high, and mid-bands, and a Multi-Function Control (MFC) block, RF input/output ports internally matched to 50 Ω to reduce the number of external components. A CMOS integrated circuit uses standard MIPI controls to provide the internal MFC interface and operation. Extremely low leakage current maximizes handset standby time.

The InGaP die and the silicon die and passive components are mounted on a multi-layer laminate substrate. The assembly is encapsulated in a 4.0 mm x 6.8 mm x 0.8 mm, 42-pad MCM, SMT package which allows for a highly manufacturable, low cost solution.

3G: The SKY77643-11 supports WCDMA, High-Speed Downlink Packet Access (HSDPA), High Speed Uplink Packet Access (HSUPA), High Speed Packet Access (HSPA+), and TD-SCDMA modulations. Varying the input power level provides output power control. V_{CC} is adjusted using a DCDC converter to maximize efficiency for each power level and modulation type.

4G: The SKY77643-11 supports 1.4, 3, 5, 10, 15, 20 MHz channel bandwidths. Similar to 3G operation, output power is controlled by varying the input power and V_{CC} is adjusted using a DCDC converter to maximize efficiency for each power level.

3G / 4G Modulation scheme includes:

- WCDMA Voice Release 99
- HSDPA categories
- HSUPA
- HSPA+
- TD-SCDMA
- LTE 1.4, 3, 5, 10, 15, 20 MHz Channel BW
- TDD-LTE

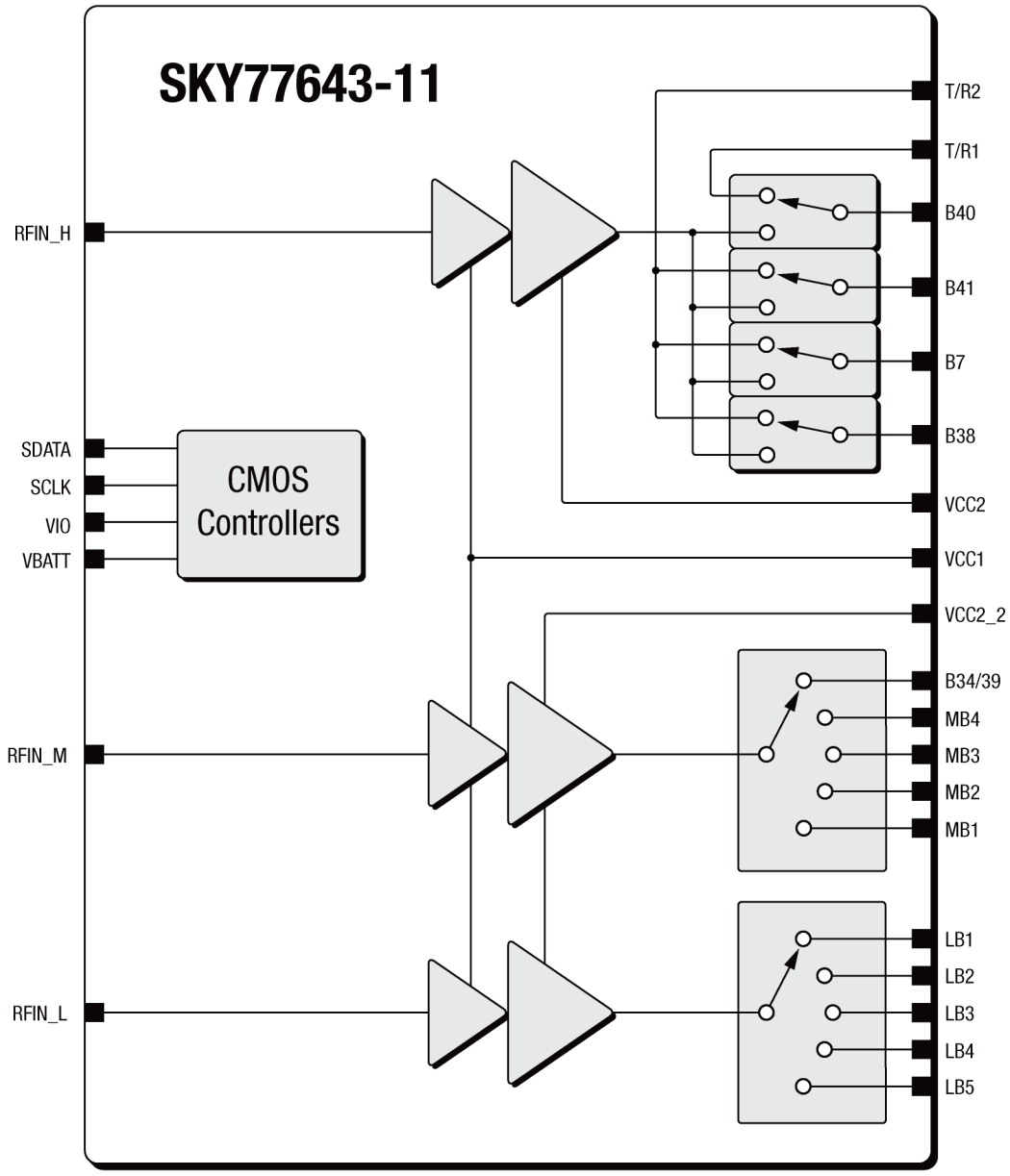


FIGURE 1. SKY77643-11 FUNCTIONAL BLOCK DIAGRAM

Electrical Specifications

The following tables list the electrical characteristics of the SKY77643-11 Power Amplifier Module. The absolute maximum conditions are provided in Table1; recommended operating conditions are specified in Table 2. Tables 3 through 17 contain the performance characteristics of the SKY77643-11.

The SKY77643-11 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. SKY77643-11 ABSOLUTE MAXIMUM CONDITIONS[1]

Parameter		Symbol	Minimum	Maximum	Units
RF Input Power		P_{IN}		10	dBm
Supply Voltage	No RF	V_{BATT}		6.0	V
	RF			5.2	
Digital Control Lines		VIO, SCLK, SDATA		2	V
Operating Temperature[2]	Case	T_{CASE}	–30	+100	°C
	Storage	T_{STG}	–40	+150	
ESD – Human Body Mode (HBM)		ESD	–1	1	kV

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.

2 Operating temperatures refer to the temperature at the ground pad on the underside of the package.

TABLE 2. SKY77643-11 RECOMMENDED OPERATING CONDITIONS

Parameter		Symbol	Minimum	Nominal	Maximum	Units
V_{BATT}		V_{BATT}	3.1[1]	3.4	4.6	V
V_{CC1},V_{CC2}, V_{CC2_2}		V_{CC}	NOTE[2]		3.8	V
Leakage Current	V_{BATT} = 3.4 V	$I_{\_BATT\_LK}$			10	µA
	V_{CC1},V_{CC2}, V_{CC2_2} = 3.4 V	$I_{\_CC\_LK}$			10	
MIPI Supply		VIO	1.7	1.8	1.9	V
MIPI Signal Levels	Low	V_{MIPI_LOW}	0		0.2 x VIO	V
	High	V_{MIPI_HIGH}	0.8 x VIO		10 x VIO	V
Case Operating Temperature		T_{RANGE}	–20	+25	+85	°C

1 Operation down to 3.0 V with additional 0.5 dB MPR.

2 Approximately 0.55 V. Operation of V_{BATT} < 0.50 V is not recommended. Bias Table can be provided upon request.

TABLE 3. MIPI RFFE STANDARD REGISTER MAP (1 OF 3)

Register 0, Address: 0x00 (PA_CTRL0)			
Register 0	**Description**	**Default**	**Notes**
[7]	Trigger Select	0	0 = Trigger 0, 1, 2 or' d together 1 = Trigger 0, 1, 2 fire independently
[6:3]	PA Band Select Control Mode	0000	Control Mode 0000 = PA's Disabled 0001 = B41_TX (HB) 0010 = B40_TX (HB) 0011 = B38_TX (HB) 1000 = B7_TX (HB) 0100 = LB1_TX (LB/MB) 0101 = LB2_TX (LB/MB) 0110 = LB3_TX (LB/MB) 0111 = LB4_TX (LB/MB) 1110 = LB5_TX (LB/MB) 1001 = MB1_TX (LB/MB) 1010 = MB2_TX (LB/MB) 1011 = MB3_TX (LB/MB) 1100 = MB4_TX (LB/MB) 1101 = MB5_TX (LB/MB) 1111 = PA's Disabled
[2]	PA Enable	0	PA Enable 0 = Off 1 = On
[1:0]	PA Mode	00	PA Mode 00 = HPM 01 = MPM – Not used 10 = LPM 11 = ULPM – Not used

Register 1, Address: 0x01 (BIAS_CTRL)					
Register 1	**Description**	**Default**	**Notes**		
[7:4]	Stage 1 (Final) Bias Current Reference	0000	0000 = Disable		
			0001 = 0.60 mA	0110 = 1.60 mA	1011 = 2.60 mA
			0010 = 0.80 mA	0111 = 1.80 mA	1100 = 2.80 mA
			0011 = 1.00 mA	1000 = 2.00 mA	1101 = 3.00 mA
			0100 = 1.20 mA	1001 = 2.20 mA	1110 = 3.20 mA
			0101 = 1.40 mA	1010 = 2.40 mA	1111 = 3.40 mA
[3:0]	Stage 2 (Driver) Bias Current Reference	0000	0000 = Disable		
			0001 = 0.15 mA	0110 = 0.90 mA	1011 = 1.65 mA
			0010 = 0.30 mA	0111 = 1.05 mA	1100 = 1.80 mA
			0011 = 0.45 mA	1000 = 1.20 mA	1101 = 1.95 mA
			0100 = 0.60 mA	1001 = 1.35 mA	1110 = 2.10 mA
			0101 = 0.75 mA	1010 = 1.50 mA	1111 = 2.25 mA

TABLE 3. MIPI RFFE STANDARD REGISTER MAP (2 OF 3)

Register 2, Address: 0x02 (SWITCH_CTRL)			
Register 2	**Description**	**Default**	**Notes**
[7:4]	Band Switch Control Mode	0000	Control Mode 0000 = Switch Off (Standby) 0001 = High Isolation 0010 = LB1_TX 0011 = LB2_TX 0100 = LB3_TX 0101 = LB4_TX 0110 = LB5_TX 0111 = High Isolation 1000 = High Isolation 1001 = High Isolation 1010 = MB1_TX 1011 = MB2_TX 1100 = MB3_TX 1101 = MB4_TX 1110 = MB5_TX 1111 = High Isolation
[3:0]		0000	Control Mode 0000 = Switch Off (Standby) 0111 = B7_Rx 1000 = B7_Tx 1001 = B40_Tx 1010 = B38_Tx 1011 = B41_Tx 1100 = B40_Rx 1101 = B38_Rx 1110 = B41_Rx 1111 = High Isolation Rest = High Isolation
Register 3, Address: 0x03 (BIAS_CTRL)			
Register 3	**Description**	**Default**	**Notes**
[7:4]	Enable Boost Bias Current	0	Boost Bias Enable 1 = Boost bias enabled
[6:4]	Spare	000	
[3:0]	Boost Bias Current Reference	0000	0000 = Disable 0001 = 0.200 mA 0110 = 0.575 mA 1011 = 0.950 mA 0010 = 0.275 mA 0111 = 0.650 mA 1100 = 1.025 mA 0011 = 0.350 mA 1000 = 0.725 mA 1101 = 1.100 mA 0100 = 0.425 mA 1001 = 0.800 mA 1110 = 1.175 mA 0101 = 0.500 mA 1010 = 0.875 mA 1111 = 1.250 mA

TABLE 3. MIPI RFFE STANDARD REGISTER MAP (3 OF 3)

Register 28, Address: 0x1C (PM_TRIG)			
Register 28	**Description**	**Default**	**Notes**
[7:6]	PWR_MODE	00	00 = Normal Operation (ACTIVE) 01 = Default Settings (STARTUP) 10 = Low Power (LOW POWER) 11 = Reserved
[5]	Trigger Mask 2	0	Trigger Enable: 0 Trigger Disable: 1
[4]	Trigger Mask 1	0	Trigger Enable: 0 Trigger Disable: 1
[3]	Trigger Mask 0	0	Trigger Enable: 0 Trigger Disable: 1
[2]	Trigger Register 2	0	Not supported
[1]	Trigger Register 1	0	1 = Latch Register 2 contents
[0]	Trigger Register 0	0	1 = Latch Register 0, 1, 3 contents
Register 29, Address: 0x01D (PROD_ID)			
Register 29	**Description**	**Default**	**Notes**
[7:0]	Product ID	0x1B	Product ID = 0x1B
Register 30, Address: 0x01E (MAN_ID)			
Register 30	**Description**	**Default**	**Notes**
[7:0]	Manufacturer ID	0xA5	Manufacturer ID[7:0] = 0xA5
Register 31 Address: 0x01F (USID)			
Register 31	**Description**	**Default**	**Notes**
[7:6]	Spare	00	
[5:4]	Manufacturer ID	01	Manufacturer ID[9:8] = 0x01
[3:0]	User ID	1111	User ID = 1111

TABLE 4. SKY77643-11 ELECTRICAL SPECIFICATIONS FOR NOMINAL OPERATING CONDITIONS – FDD LTE BAND 7

UNLESS OTHERWISE SPECIFIED: VBATT = 3.4 V; TCASE= +25 °C; LTE SIGNAL = QPSK/10 MHz/12RB FOR MPR = 0 AND QPSK/20 MHz/100RB FOR MPR = 1.

Characteristics		Symbol	Condition	Minimum	Typical	Maximum	Unit
Operating Frequency		f_0		2500	2535	2570	MHz
Maximum Output Power		P_{OUT_MAX}	MPR = 0[1]	28.0			dBm
		$P_{OUT\_MAX\_ETC}$	V_{BATT} = 3.1 V to 4.6 V, V_{CC1} = V_{CC2} = 3.1 V, T_{CASE} = T_{RANGE}	27.5			
Gain		G_{HIGH}	P_{OUT} = P_{OUT_MAX} T_{CASE} = +25 °C	28	30	32	dB
		G_{HIGH_ETC}	V_{BATT} = 3.1 V to 4.6 V, V_{CC1} = V_{CC2} = 3.1 V, P_{OUT} = P_{OUT_MAX} T_{CASE} = T_{RANGE}	26			
		G_{LOW}	V_{CC} = 0.55 V, P_{OUT} = 3 dBm		15	20	
Power Added Efficiency[2]		PAE_{APT}	P_{OUT} = P_{OUT_MAX}		31.5		%
Total Supply Current[3]		$I_{\_TOT\_MAX}$	P_{OUT} = P_{OUT_MAX}, V_{BATT} = 3.8 V		560		mA
Adjacent Channel Leakage power Ratio[4]	EUTRA	$EUTRA_{\_ACLR1}$	P_{OUT} ≤ (P_{OUT_MAX} – MPR[1])		–38	–35	dBc
	UTRA1	$UTRA_{\_ACLR1}$			–40	–38	
	UTRA2	$UTRA_{\_ACLR2}$			–42	–41	
Harmonics	Second	$2f_0$	P_{OUT} ≤ P_{OUT_MAX}			–15	dBm
	Third and higher	$3f_0$–$5f_0$				–15	
Tx Noise in Rx Bands	Rx Band	$PNRX_{\_LTE}$	2620 MHz–2690 MHz[5]			–126	dBm/Hz
	GPS Rx	$PNRX_{\_GPS}$	1574 MHz–1577 MHz[5]			–140	
	BT, WLAN	$PNRX_{\_BT}$	2400 MHz–2452 MHz[5]			–108	
EVM		EVM	P_{OUT} ≤ P_{OUT_MAX}, T_{RANGE}, V_{BATT} = 3.1 V to 4.6 V, Load = 50 ohms		3	5	%
Turn On Time		T_{ON}	Gain settled to within P_{OUT_MAX} – 0.5 dB			5	µs
Turn Off Time		T_{OFF}	Gain settled to below P_{OUT_MAX} – 30 dB			5	µs
Input Voltage Standing Wave Ratio		VSWR	P_{OUT} ≤ P_{OUT_MAX}		1.8:1		
Stability		S	No oscillations, all spurious < –36 dBm, P_{OUT} ≤ P_{OUT_MAX}, V_{BATT} = 3.1 V to 4.6 V, T_{CASE} = T_{RANGE}	6:1			VSWR
Ruggedness		Ru	No permanent damage to module P_{OUT} ≤ P_{OUT_MAX}, V_{BATT} = 3.1 V to 4.6 V, T_{CASE} = T_{RANGE}	10:1			VSWR

1 MPR is the maximum power reduction as defined in 3GPP TS36.101

2 V_{CC} optimized for $ACLR1_{\_UTRA}$ = –40 dBc.

3 $I_{\_TOT}$ = I_{BATT} + (I_{CC1} + I_{CC2})(V_{CC}/V_{BATT})(1/DC_DC_EFF). See Table 18

4 $ACLR1_{\_EUTRA}$ Max = –33, $ACLR1_{\_UTRA}$ Max = –35, $ACLR2_{\_UTRA}$ Max = –39 for ETC.

5 Measured with 20 MHz/100RB LTE Waveform.

TABLE 5. SKY77643-11 ELECTRICAL SPECIFICATIONS FOR NOMINAL OPERATING CONDITIONS – FDD LTE BAND 30 (WCS) (RF OUTPUT ON PAD 37)

UNLESS OTHERWISE SPECIFIED: VBATT = 3.4 V; TCASE= +25 °C; LTE SIGNAL = QPSK/10 MHz/12RB FOR MPR = 0 AND QPSK/10 MHz/50RB FOR MPR = 1.

Parameter		Symbol	Condition	Minimum	Typical	Maximum	Unit
Operating Frequency		f_O		2305	2310	2315	MHz
Maximum Output Power		P_{OUT_MAX}	MPR = 0[1]	28.0			dBm
		$P_{OUT\_MAX\_ETC}$	V_{BATT} = 3.1 V to 4.6 V, $V_{CC1} = V_{CC2}$ = 3.1 V, $T_{CASE} = T_{RANGE}$	27.5			
Gain		G_{HIGH}	$P_{OUT} = P_{OUT\_MAX}$ T_{CASE} = +25 °C	27.5	29.0	30.5	dB
		G_{HIGH_ETC}	V_{BATT} = 3.1 V to 4.6 V, $V_{CC1} = V_{CC2}$ = 3.1 V, $P_{OUT} = P_{OUT\_MAX}$ $T_{CASE} = T_{RANGE}$	26.0			
		G_{LOW}	V_{CC} = 0.55 V, P_{OUT} = 3 dBm		15.0	20.0	
Power Added Efficiency2		PAE_{APT}	$P_{OUT} = P_{OUT\_MAX}$		30.5		%
Total Supply Current3		$I_{\_TOT\_MAX}$	$P_{OUT} = P_{OUT\_MAX}$, V_{BATT} = 3.8 V		570		mA
Adjacent Channel Leakage power Ratio[4]	EUTRA	$EUTRA_{\_ACLR1}$	$P_{OUT} \le (P_{OUT\_MAX} - MPR[1])$		–38	–35	dBc
	UTRA1	$UTRA_{\_ACLR1}$			–40	–38	
	UTRA2	$UTRA_{\_ACLR2}$			–42	–41	
Harmonics	Second	$2f_O$	$P_{OUT} \le P_{OUT\_MAX}$			–15	dBm
	Third and higher	$3f_O$–$5f_O$				–15	
Tx Noise in Rx Bands	GPS Rx	$PNRX_{\_GPS}$	1574 MHz–1577 MHz[5]			–140	dBm/Hz
	BT, WLAN	$PNRX_{\_BT}$	2400 MHz–2483.5 MHz[5]			–113	
EVM		EVM	$P_{OUT} \le P_{OUT\_MAX}$, T_{RANGE}, V_{BATT} = 3.1 V to 4.6 V, Load = 50 ohms		3	5	%
Turn On Time		T_{ON}	Gain settled to within P_{OUT_MAX} – 0.5 dB			5	µs
Turn Off Time		T_{OFF}	Gain settled to below P_{OUT_MAX} – 30 dB			5	µs
Input Voltage Standing Wave Ratio		VSWR	$P_{OUT} \le P_{OUT\_MAX}$		2.3:1		
Stability		S	No oscillations, all spurious < –36 dBm, $P_{OUT} \le P_{OUT\_MAX}$, V_{BATT} = 3.1 V to 4.6 V, $T_{CASE} = T_{RANGE}$	6:1			VSWR
Ruggedness		Ru	No permanent damage to module $P_{OUT} \le P_{OUT\_MAX}$, V_{BATT} = 3.1 V to 4.6 V, $T_{CASE} = T_{RANGE}$	10:1			VSWR

1 MPR is the maximum power reduction as defined in 3GPP TS36.101

2 V_{CC} optimized for $ACLR1_{\_UTRA}$ = –40 dBc.

3 $I_{\_TOT} = I_{BATT} + (I_{CC1} + I_{CC2})(V_{CC}/V_{BATT})(1/DC\_DC\_EFF)$. See Table 18

4 $ACLR1_{\_EUTRA}$ Max = –33, $ACLR1_{\_UTRA}$ Max = –35, $ACLR2_{\_UTRA}$ Max = –39 for ETC.

5 Measured with 10 MHz/50RB LTE Waveform.

TABLE 6. SKY77643-11 ELECTRICAL SPECIFICATIONS FOR NOMINAL OPERATING CONDITIONS – TDD BAND 38

UNLESS OTHERWISE SPECIFIED: VBATT = 3.4 V; TCASE = +25 °C; LTE SIGNAL = QPSK/10 MHz/12RB FOR MPR = 0 AND QPSK/20 MHz/100 RB FOR MPR = 1.

Parameter		Symbol	Condition	Minimum	Typical	Maximum	Unit
Operating Frequency		f_0		2570	2595	2620	MHz
Maximum Output Power		P_{OUT_MAX}	MPR = 0[1]	28.0			dBm
		$P_{OUT\_MAX\_ETC}$	V_{BATT} = 3.1 V to 4.6 V, $V_{CC1} = V_{CC2}$ = 3.1 V, $T_{CASE} = T_{RANGE}$	27.5			
Gain		G_{HIGH}	$P_{OUT} = P_{OUT\_MAX}$ T_{CASE} = +25 °C	27.5	29.5	31.5	dB
		G_{HIGH_ETC}	$P_{OUT} = P_{OUT\_MAX}$ $T_{CASE} = T_{RANGE}$	26.0			
		G_{LOW}	V_{CC} = 0.55 V, P_{OUT} = 3 dBm		16.0	20.0	
Power Added Efficiency[2]		PAE_{APT}	$P_{OUT} = P_{OUT\_MAX}$		31		%
Total Supply Current[3]		$I_{\_TOT\_MAX}$	$P_{OUT} = P_{OUT\_MAX}$, V_{BATT} = 3.8 V		560		mA
Adjacent Channel Leakage power Ratio[4]	EUTRA	$EUTRA_{\_ACLR1}$	$P_{OUT} \leq (P_{OUT\_MAX} – MPR[1])$		–38	–35	dBc
	UTRA1	$UTRA_{\_ACLR1}$			–40	–38	
	UTRA2	$UTRA_{\_ACLR2}$			–42	–41	
Harmonics	Second	$2f_0$	$P_{OUT} \leq P_{OUT\_MAX}$			–15	dBm
	Third and higher	$3f_0$–$5f_0$				–15	
Tx Noise in Rx Bands	GPS Rx	$PNRX_{\_GPS}$	1574 MHz–1577 MHz[5]			–140	dBm/Hz
	BT, WLAN	$PNRX_{\_BT}$	2400 MHz–2483.5 MHz[5]			–113	
EVM		EVM	$P_{OUT} \leq P_{OUT\_MAX}$, T_{RANGE}, V_{BATT} = 3.1 V to 4.6 V, Load = 50 ohms		3	5	%
Turn On Time		T_{ON}	Gain settled to within P_{OUT_MAX} – 0.5 dB			5	µs
Turn Off Time		T_{OFF}	Gain settled to below P_{OUT_MAX} – 30 dB			5	µs
Input Voltage Standing Wave Ratio		VSWR	$P_{OUT} \leq P_{OUT\_MAX}$		2.0:1		
Stability		S	No oscillations, all spurious < –36 dBm, $P_{OUT} \leq P_{OUT\_MAX}$, V_{BATT} = 3.1 V to 4.6 V, $T_{CASE} = T_{RANGE}$	6:1			VSWR
Ruggedness		Ru	No permanent damage to module $P_{OUT} \leq P_{OUT\_MAX}$, V_{BATT} = 3.1 V to 4.6 V, $T_{CASE} = T_{RANGE}$	10:1			VSWR

1 MPR is the maximum power reduction as defined in 3GPP TS36.101

2 V_{CC} optimized for $ACLR1_{\_UTRA}$ = –40 dBc.

3 $I_{\_TOT} = I_{BATT} + (I_{CC1} + I_{CC2})(V_{CC}/V_{BATT})(1/DC\_DC\_EFF)$. See Table 18

4 $ACLR1_{\_EUTRA}$ Max = –33, $ACLR1_{\_UTRA}$ Max = –35, $ACLR2_{\_UTRA}$ Max = –39 for ETC.

5 Measured with 20 MHz/100RB LTE Waveform.

TABLE 7. SKY77643-11 ELECTRICAL SPECIFICATIONS FOR NOMINAL OPERATING CONDITIONS – TDD BAND 40

UNLESS OTHERWISE SPECIFIED: VBATT = 3.4 V; TCASE = +25 °C; LTE SIGNAL = QPSK/10 MHz/12RB FOR MPR = 0 AND QPSK/20 MHz/100 RB FOR MPR = 1.

Parameter		Symbol	Condition	Minimum	Typical	Maximum	Unit
Operating Frequency		f_0		2300	2350	2400	MHz
Maximum Output Power		P_{OUT_MAX}	MPR = 0[1]	28.0			dBm
		$P_{OUT\_MAX\_ETC}$	V_{BATT} = 3.1 V to 4.6 V, V_{CC1} = V_{CC2} = 3.1 V, T_{CASE} = T_{RANGE}	27.5			
Gain		G_{HIGH}	P_{OUT} = P_{OUT_MAX} T_{CASE} = +25 °C	27.5	29.5	31.5	dB
		G_{HIGH_ETC}	V_{BATT} = 3.1 V to 4.6 V, V_{CC1} = V_{CC2} = 3.1 V, P_{OUT} = P_{OUT_MAX} T_{CASE} = T_{RANGE}	26.0			
		G_{LOW}	V_{CC} = 0.55 V, P_{OUT} = 3 dBm		16.0	20.0	
Power Added Efficiency[2]		PAE_{APT}	P_{OUT} = P_{OUT_MAX}		31		%
Total Supply Current[3]		$I_{\_TOT\_MAX}$	P_{OUT} = P_{OUT_MAX}, V_{BATT} = 3.8 V		560		mA
Adjacent Channel Leakage power Ratio[4]	EUTRA	$EUTRA_{\_ACLR1}$	P_{OUT} ≤ (P_{OUT_MAX} – MPR[1])		–38	–35	dBc
	UTRA1	$UTRA_{\_ACLR1}$			–40	–38	
	UTRA2	$UTRA_{\_ACLR2}$			–42	–41	
Harmonics	Second	$2f_0$	P_{OUT} ≤ P_{OUT_MAX}			–15	dBm
	Third to Fifth	$3f_0$–$5f_0$				–15	
Tx Noise in Rx Bands	GPS Rx	$PNRX_{\_GPS}$	1574 MHz–1577 MHz[5]			–140	dBm/Hz
	BT, WLAN	$PNRX_{\_BT}$	2447 MHz–2483.5 MHz[5]			–106	
EVM		EVM	P_{OUT} ≤ P_{OUT_MAX}, T_{RANGE}, V_{BATT} = 3.1 V to 4.6 V, Load = 50 ohms		3	5	%
Turn On Time		T_{ON}	Gain settled to within P_{OUT_MAX} – 0.5 dB			5	µs
Turn Off Time		T_{OFF}	Gain settled to below P_{OUT_MAX} – 30 dB			5	µs
Input Voltage Standing Wave Ratio		VSWR	P_{OUT} ≤ P_{OUT_MAX}		2.3:1		
Stability		S	No oscillations, all spurious < –36 dBm, P_{OUT} ≤ P_{OUT_MAX}, V_{BATT} = 3.1 V to 4.6 V, T_{CASE} = T_{RANGE}	6:1			VSWR
Ruggedness		Ru	No permanent damage to module P_{OUT} ≤ P_{OUT_MAX}, V_{BATT} = 3.1 V to 4.6 V, T_{CASE} = T_{RANGE}	10:1			VSWR

1 MPR is the maximum power reduction as defined in 3GPP TS36.101

2 V_{CC} optimized for $ACLR1\_UTRA$ = –40 dBc.

3 I_TOT = I_{BATT} + (I_{CC1} + I_{CC2})(V_{CC}/V_{BATT})(1/DC_DC_EFF). See Table 18

4 $ACLR1\_EUTRA$ Max = –33, $ACLR1\_UTRA$ Max = –35, $ACLR2\_UTRA$ Max = –39 for ETC.

5 Measured with 20 MHz/100RB LTE Waveform.

TABLE 8. SKY77643-11 ELECTRICAL SPECIFICATIONS FOR NOMINAL OPERATING CONDITIONS – TDD BAND 41, TDD AXGP BAND

UNLESS OTHERWISE SPECIFIED: VBATT = 3.4 V; TCASE = +25 °C; LTE SIGNAL = QPSK/10 MHz/12RB FOR MPR = 0 AND QPSK/20 MHz/100 RB FOR MPR = 1.

Parameter		Symbol	Condition	Minimum	Typical	Maximum	Unit
Operating Frequency		f_0		2496	2595	2690	MHz
Maximum Output Power		P_{OUT_MAX}	MPR = 0[1]	28.0			dBm
		$P_{OUT\_MAX\_ETC}$	V_{BATT} = 3.1 V to 4.6 V, V_{CC1} = V_{CC2} = 3.1 V, T_{CASE} = T_{RANGE}	27.5			
Gain		G_{HIGH}	P_{OUT} = P_{OUT_MAX} T_{CASE} = +25 °C	27.5	29.5	31.5	dB
		G_{HIGH_ETC}	V_{BATT} = 3.1 V to 4.6 V, V_{CC1} = V_{CC2} = 3.1 V, P_{OUT} = P_{OUT_MAX} T_{CASE} = T_{RANGE}	26.0			
		G_{LOW}	V_{CC} = 0.55 V, P_{OUT} = 3 dBm		15.0	20.0	
Power Added Efficiency[2]		PAE_{APT}	P_{OUT} = P_{OUT_MAX}		31		%
Total Supply Current[3]		I_{TOT_MAX}	P_{OUT} = P_{OUT_MAX}, V_{BATT} = 3.8 V		560		mA
Adjacent Channel Leakage power Ratio[4]	EUTRA	$EUTRA_{ACLR1}$	P_{OUT} ≤ (P_{OUT_MAX} – MPR[1])		–38	–35	dBc
	UTRA1	$UTRA_{ACLR1}$			–40	–38	
	UTRA2	$UTRA_{ACLR2}$			–42	–41	
Harmonics	Second	$2f_0$	P_{OUT} ≤ P_{OUT_MAX}			–15	dBm
	Third to Fifth	$3f_0$–$5f_0$				–15	
Tx Noise in Rx Bands	GPS Rx	$PNRX_{GPS}$	1574 MHz–1577 MHz[5]			–140	dBm/Hz
	BT, WLAN	$PNRX_{BT}$	2400 MHz–2452 MHz[5]			–104	
EVM		EVM	P_{OUT} ≤ P_{OUT_MAX}, T_{RANGE}, V_{BATT} = 3.1 V to 4.6 V, Load = 50 ohms		3	5	%
Turn On Time		T_{ON}	Gain settled to within P_{OUT_MAX} – 0.5 dB			5	µs
Turn Off Time		T_{OFF}	Gain settled to below P_{OUT_MAX} – 30 dB			5	µs
Input Voltage Standing Wave Ratio		VSWR	P_{OUT} ≤ P_{OUT_MAX}		1.8:1		
Stability		S	No oscillations, all spurious < –36 dBm, P_{OUT} ≤ P_{OUT_MAX}, V_{BATT} = 3.1 V to 4.6 V, T_{CASE} = T_{RANGE}	6:1			VSWR
Ruggedness		Ru	No permanent damage to module P_{OUT} ≤ P_{OUT_MAX}, V_{BATT} = 3.1 V to 4.6 V, T_{CASE} = T_{RANGE}	10:1			VSWR

1 MPR is the maximum power reduction as defined in 3GPP TS36.101

2 V_{CC} optimized for $ACLR1_{UTRA}$ = –40 dBc.

3 I_{TOT} = I_{BATT} + (I_{CC1} + I_{CC2})(V_{CC}/V_{BATT})(1/DC_DC_EFF). See Table 18

4 $ACLR1_{EUTRA}$ Max = –33, $ACLR1_{UTRA}$ Max = –35, $ACLR2_{UTRA}$ Max = –39 for ETC.

5 Measured with 20 MHz/100RB LTE Waveform.

TABLE 9. SKY77643-11 ELECTRICAL SPECIFICATIONS – TRANSMIT WCDMA MID-BAND

Unless otherwise specified: V_{BATT} = 3.4 V; T_{CASE} = +25 °C; Voice RMC 12.2 kbps

Parameter		Symbol	Conditions	Minimum	Typical	Maximum	Units
Frequency	Band 1	f		1920		1980	MHz
	Band 2			1850		1910	
	Band 3			1710		1785	
	Band 4			1710		1755	
Maximum Output Power	Band 1, 4	P_{OUT_MAX}		28.0			dBm
		$P_{OUT\_MAX\_ETC}$	V_{CC} = 3.1 V, V_{BATT} = 3.1 V to 4.6 V, T_{CASE} = T_{RANGE}	27.5			
	Bands 2, 3	P_{OUT_MAX}		28.5			
		$P_{OUT\_MAX\_ETC}$	V_{CC} = 3.1 V, V_{BATT} = 3.1 V to 4.6 V, T_{CASE} = T_{RANGE}	28.0			
Power Gain		$G_{P\_NTC\_BANDS1,2}$	P_{OUT} = P_{OUT_MAX}	28.0		31.0	dB
		$G_{P\_NTC\_BANDS3,4}$	P_{OUT} = P_{OUT_MAX}	28.0		31.0	
		$G_{P\_ETC\_BANDS1,2}$	V_{CC} = 3.1 V, V_{BATT} = 3.1 V to 4.6 V, P_{OUT} = $P_{OUT\_MAX\_ETC}$, T_{CASE} = T_{RANGE}	26.0		32.5	
		$G_{P\_ETC\_BANDS3,4}$		26.0		32.5	
		G_{P_LOW}	V_{CC} = 0.55 V		15.0	20.0	dB
Power Added Efficiency[1]		$PAE_{\_APT}$	P_{OUT} = P_{OUT_MAX}		43		%
Total Supply Current[2]		$I_{\_TOT\_MAX}$	P_{OUT} = P_{OUT_MAX}, V_{BATT} = 3.8 V		TBD		mA
Adjacent Channel Leakage power Ratio	5 MHz offset	ACLR1	P_{OUT} = P_{OUT_MAX}		–40	–38	dBc
			P_{OUT} = $P_{OUT\_MAX\_ETC}$, V_{CC} = 3.1 V V_{BATT} = 3.1 V to 4.6 V, T_{CASE} = T_{RANGE}			–36	
	10 MHz offset	ACLR2	P_{OUT} = P_{OUT_MAX}		–52	–48	
			P_{OUT} = $P_{OUT\_MAX\_ETC}$, V_{CC} = 3.1 V, V_{BATT} = 3.1 V to 4.6 V, T_{CASE} = T_{RANGE}			–46	
Modulation Accuracy		EVM RMS	V_{CC} = 3.1 V, V_{BATT} = 3.1 V to 4.6 V, Load = 50 ohms, T_{CASE} = T_{RANGE}		2.5	5.0	%
Harmonics	Second	$f2$	$P_{OUT} \le P_{OUT\_MAX}$		–16	–12	dBm
	Third	$f3$			–23	–20	
	Fourth and higher	$4f$				–20	
Noise Power in Rx Band at Duplex Frequency with WCDMA Modulated Tx							dBm/Hz
B1 f_{TX} = 1920–1980 MHz		P_{NOISE_DPX}	f_{RX} = f_{TX} +190 MHz		–133.5		
B2 f_{TX} = 1850–1910 MHz			f_{RX} = f_{TX} +80 MHz		–133.0		
B3 f_{TX} = 1710–1785 MHz			f_{RX} = f_{TX} +95 MHz		–132.5		
B4 f_{TX} = 1710–1755 MHz			f_{RX} = f_{TX} +400 MHz		–137.0		
Input VSWR		V_{SWR_IN}	$P_{OUT} \le P_{OUT\_MAX}$		1.3:1	2:1	VSWR
Stability		S	No oscillations, all spurious < –36 dBm, $P_{OUT} \le P_{OUT\_MAX}$, V_{BATT} = 3.1 V to 4.6 V, T_{CASE} = T_{RANGE}	6:1			VSWR
Ruggedness		Ru	No permanent damage to module $P_{OUT} \le P_{OUT\_MAX}$, V_{BATT} = 3.1 V to 4.6 V, T_{CASE} = T_{RANGE}	10:1			VSWR

1 V_{CC} optimized for ACLR1 = –40 dBc.

2 $I_{\_TOT}$ = I_{BATT} + (I_{CC1} + I_{CC2})(V_{CC}/V_{BATT})(1/DC_DC_EFF). VCC = TBD. DC_DC_EFF ~ 96%.

TABLE 10. SKY77643-11 ELECTRICAL SPECIFICATIONS – TRANSMIT WCDMA LOW BAND

Unless otherwise specified: V_{BATT} = 3.4 V; T_{CASE} = +25 °C; Voice RMC 12.2 kbps

Parameter		Symbol	Conditions	Minimum	Typical	Maximum	Units
Frequency	Band 5	f		824		849	MHz
	Band 8			880		915	
Maximum Output Power	Bands 5, 8	P_{OUT_MAX}		28.0			dBm
		$P_{OUT\_MAX\_ETC}$	V_{CC} = 3.1 V, V_{BATT} = 3.1 V to 4.6 V, T_{CASE} = T_{RANGE}	27.5			
Power Gain		G_{P_NTC}	P_{OUT} = P_{OUT_MAX}	28.0		31.5	dB
		G_{P_ETC}	P_{OUT} = $P_{OUT\_MAX\_ETC}$	26.0		33.0	
		G_{P_LOW}	V_{CC} = 0.55 V		15.0	20.0	dB
Power Added Efficiency[1]		PAE_{APT}	P_{OUT} = P_{OUT_MAX}		46		%
Total Supply Current[2]		I_{TOT_MAX}	P_{OUT} = P_{OUT_MAX}, V_{BATT} = 3.8 V		TBD		mA
Adjacent Channel Leakage power Ratio	5 MHz offset	ACLR1	P_{OUT} = P_{OUT_MAX}		–40	–38	dBc
			P_{OUT} = $P_{OUT\_MAX\_ETC}$, V_{CC} = 3.1 V V_{BATT} = 3.1 V to 4.6 V, T_{CASE} = T_{RANGE}			–36	
	10 MHz offset	ACLR2	P_{OUT} = P_{OUT_MAX}		–52	–48	
			P_{OUT} = $P_{OUT\_MAX\_ETC}$, V_{CC} = 3.1 V, V_{BATT} = 3.1 V to 4.6 V, T_{CASE} = T_{RANGE}			–46	
Modulation Accuracy		EVM	V_{CC} = 3.1 V, V_{BATT} = 3.1 V to 4.6 V, Load = 50 ohms, T_{CASE} = T_{RANGE}		2.5	5.0	%
Harmonics	Second	$f2$	P_{OUT} ≤ P_{OUT_MAX}		–16	–13	dBm
	Third	$f3$			–23	–17	
	Fourth and higher	$4f$				–20	
Noise Power in Rx Band at Duplex Frequency with WCDMA Modulated Tx							dBm/Hz
B5 f_{TX} = 824–849 MHz		P_{NOISE_DPX}	f_{RX} = f_{TX} +45 MHz		–133		
B8 f_{TX} = 880–915 MHz			f_{RX} = f_{TX} +45 MHz		–133		
Input VSWR		$VSWR_{IN}$	P_{OUT} ≤ P_{OUT_MAX}		1.6:1	2:1	VSWR
Stability		S	No oscillations, all spurious < –36 dBm, P_{OUT} ≤ P_{OUT_MAX}, V_{BATT} = 3.1 V to 4.6 V, T_{CASE} = T_{RANGE}	6:1			VSWR
Ruggedness		Ru	No permanent damage to module P_{OUT} ≤ P_{OUT_MAX}, V_{BATT} = 3.1 V to 4.6 V, T_{CASE} = T_{RANGE}	10:1			VSWR

1 V_{CC} optimized for ACLR1 = –40 dBc.

2 I_{TOT} = I_{BATT} + (I_{CC1} + I_{CC2})(V_{CC}/V_{BATT})(1/DC_DC_EFF). VCC = TBD. DC_DC_EFF ~ 96%.

TABLE 11. SKY77643-11 ELECTRICAL SPECIFICATIONS – TRANSMIT LTE MID-BAND

UNLESS OTHERWISE SPECIFIED: VBATT = 3.4 V; TCASE= +25 °C; LTE SIGNAL = QPSK/10 MHz/12RB FOR MPR = 0 AND QPSK/20 MHz/100RB FOR MPR = 1.

Parameter		Symbol	Conditions	Minimum	Typical	Maximum	Units
Frequency	Band 1	f		1920		1980	MHz
	Band 2			1850		1910	
	Band 3			1710		1785	
	Band 4			1710		1755	
Maximum Output Power	Band 1, 4	POUT_MAX		27.0			dBm
		POUT_MAX_ETC	VCC = 3.1 V, VBATT = 3.1 V to 4.6 V, TCASE = TRANGE	26.5			
	Bands 2, 3	POUT_MAX		27.5			
		POUT_MAX_ETC	VCC = 3.1 V, VBATT = 3.1 V to 4.6 V, TCASE = TRANGE	27.0			
Power Gain		GP_NTC_BANDS1,2	POUT = POUT_MAX	28.5		31.5	dB
		GP_NTC_BANDS3,4	POUT = POUT_MAX	28.5		31.5	
		GP_ETC_BANDS1,2	VCC = 3.1 V, VBATT = 3.1 V to 4.6 V, POUT = POUT_MAX_ETC, TCASE = TRANGE	26.5		33.0	
		GP_ETC_BANDS3,4		26.5		33.0	
		GP_LOW	VCC = 0.55 V		15.0	20.0	dB
Power Added Efficiency[1]	Band 1, 3, 4	PAE_APT	POUT_MAX		36.0		%
	Band 2				37.5		
Total Supply Current[2]		I_TOT_MAX	POUT = POUT_MAX, VBATT = 3.8 V		TBD		mA
Adjacent Channel Leakage power Ratio	EUTRA	EUTRA_ACLR1	POUT = POUT_MAX		–39	–36	dBc
			POUT = POUT_MAX_ETC, VCC = 3.1 V VBATT = 3.1 V to 4.6 V, TCASE = TRANGE			–33	
	UTRA1	UTRA_ACLR1	POUT = POUT_MAX		–40	–37	
			POUT = POUT_MAX_ETC, VCC = 3.1 V VBATT = 3.1 V to 4.6 V, TCASE = TRANGE			–36	
	UTRA2	UTRA_ACLR2	POUT = POUT_MAX		–43	–41	dBc
			POUT = POUT_MAX_ETC, VCC = 3.1 V VBATT = 3.1 V to 4.6 V, TCASE = TRANGE			–39	
Modulation Accuracy		EVM_QPSK_16QAM	VCC = 3.1 V, VBATT = 3.1 V to 4.6 V, Load = 50 ohms, TCASE = TRANGE		2.5	5.0	%
Harmonics	Second	$f2$	POUT ≤ POUT_MAX		–15	–12	dBm
	Third	$f3$			–23	–20	
	Fourth and higher	$4f$				–20	
Noise Power in Rx Band at Duplex Frequency with LTE[3]							dBm/Hz
B1 f_{TX} = 1920–1980 MHz		PNOISE_DPX	$f_{RX} = f_{TX}$ +190 MHz		–133.0		
B2 f_{TX} = 1850–1910 MHz			$f_{RX} = f_{TX}$ +80 MHz		–131.5		
B3 f_{TX} = 1710–1785 MHz			$f_{RX} = f_{TX}$ +95 MHz		–132.6		
B4 f_{TX} = 1710–1755 MHz			$f_{RX} = f_{TX}$ +400 MHz		–136.0		
Input VSWR		VSWR_IN	POUT ≤ POUT_MAX		1.3:1	2:1	VSWR
Stability		S	No oscillations, all spurious < –36 dBm, POUT ≤ POUT_MAX, VBATT = 3.1 V to 4.6 V, TCASE = TRANGE	6:1			VSWR
Ruggedness		Ru	No permanent damage to module POUT ≤ POUT_MAX, VBATT = 3.1 V to 4.6 V, TCASE = TRANGE	10:1			VSWR

1 VCC optimized for ACLR1_UTRA = –40 dBc.

2 I_TOT = IBATT + (ICC1 + ICC2)(VCC/VBATT)(1/DC_DC_EFF). VCC = TBD. DC_DC_EFF ~ 96%.

3 Measured with 20 MHz/100RB LTE Waveform.

TABLE 12. SKY77643-11 ELECTRICAL SPECIFICATIONS – TRANSMIT LTE LOW BAND (1 OF 2)

UNLESS OTHERWISE SPECIFIED: VBATT = 3.4 V; TCASE= +25 °C; LTE SIGNAL = QPSK/10 MHz/12RB FOR MPR = 0 AND QPSK/20 MHz/100RB FOR MPR = 1.

Parameter		Symbol	Conditions	Minimum	Typical	Maximum	Units
Frequency	Band 5	*f*		824		849	MHz
	Band 8			880		915	
	Band 12			699		716	
	Band 13			777		787	
	Band 17			704		716	
	Band 20			832		862	
	Band 28			703		748	
Maximum Output Power	Bands 20, 28	POUT_MAX		27.5			dBm
		POUT_MAX_ETC	VCC = 3.1 V, VBATT = 3.1 V to 4.6 V, TCASE = TRANGE	27.0			
	Bands 5, 8, 12, 13, 17	POUT_MAX		27.0			
		POUT_MAX_ETC	VCC = 3.1 V, VBATT = 3.1 V to 4.6 V, TCASE = TRANGE	26.5			
Power Gain		GP_NTC	POUT = POUT_MAX	28.0		32.0	dB
		GP_ETC	VCC = 3.1 V, VBATT = 3.1 V to 4.6 V, POUT = POUT_MAX_ETC, TCASE = TRANGE	25.7		33.3	
		GP_LOW	VCC = 0.55 V		15.0	20.0	dB
Power Added Efficiency[1]	Band 17	PAE_APT	POUT_MAX		38		%
	Bands 13, 5, 20				40		
	Bands 8				39		
Total Supply Current[2]		I_TOT_MAX	POUT = POUT_MAX, VBATT = 3.8 V		TBD		mA
Adjacent Channel Leakage power Ratio	EUTRA	EUTRA_ACLR1	POUT = POUT_MAX		–39	–36	dBc
			POUT = POUT_MAX_ETC, VCC = 3.1 V, VBATT = 3.1 V to 4.6 V, TCASE = TRANGE			–33	
	UTRA1	UTRA_ACLR1	POUT = POUT_MAX		–40	–37	
			POUT = POUT_MAX_ETC, VCC = 3.1 V, VBATT = 3.1 V to 4.6 V, TCASE = TRANGE			–36	
	UTRA2	UTRA_ACLR2	POUT = POUT_MAX		–43	–41	
			POUT = POUT_MAX_ETC, VCC = 3.1 V, VBATT = 3.1 V to 4.6 V, TCASE = TRANGE			–39	

TABLE 12. SKY77643-11 ELECTRICAL SPECIFICATIONS – TRANSMIT LTE LOW BAND (2 OF 2)

UNLESS OTHERWISE SPECIFIED: VBATT = 3.4 V; TCASE= +25 °C; LTE SIGNAL = QPSK/10 MHz/12RB FOR MPR = 0 AND QPSK/20 MHz/100RB FOR MPR = 1.

Parameter		Symbol	Conditions	Minimum	Typical	Maximum	Units
Modulation Accuracy		EVM_QPSK_16QAM	VCC = 3.1 V, VBATT = 3.1 V to 4.6 V, Load = 50 ohms, TCASE = TRANGE		2.5	5.0	%
Harmonics	Second Bands 12, 17, 28	$f2$	POUT ≤ POUT_MAX		–13	–8	dBm
	Second Bands 5, 8, 20				–20	–13	
	Third	$f3$			–23	–17	
	Fourth and higher	$4f$				–20	
Noise Power in Rx Band at Duplex Frequency with LTE[3]							dBm/Hz
	B5 f_{TX} = 824–849 MHz	PNOISE_DPX	$f_{RX} = f_{TX}$ + 45 MHz		–133.5		
	B8 f_{TX} = 880–915 MHz		$f_{RX} = f_{TX}$ + 45 MHz		–133.3		
	B13 f_{TX} = 777–787 MHz		$f_{RX} = f_{TX}$ – 31 MHz		–132.7		
	B17 f_{TX} = 704–716 MHz		$f_{RX} = f_{TX}$ + 30 MHz		–131.0		
	B20 f_{TX} = 832–862 MHz		$f_{RX} = f_{TX}$ – 41 MHz		–133.0		
	B28 f_{TX} = 703–748 MHz		f_{RX} = 758–803 MHz		–134.0		
Input VSWR		VSWR_IN	POUT ≤ POUT_MAX		1.6:1	2:1	VSWR
Stability		S	No oscillations, all spurious < –36 dBm, POUT ≤ POUT_MAX, VBATT = 3.1 V to 4.6 V, TCASE = TRANGE	6:1			VSWR
Ruggedness		Ru	No permanent damage to module POUT ≤ POUT_MAX, VBATT = 3.1 V to 4.6 V, TCASE = TRANGE	10:1			VSWR

1 VCC optimized for ACLR1_UTRA = –40 dBc.

2 I_TOT = IBATT + (ICC1 + ICC2)(VCC/VBATT)(1/DC_DC_EFF). VCC = TBD. DC_DC_EFF ~ 96%.

3 Measured with 20 MHz/100RB LTE Waveform.

TABLE 13. SKY77643-11 ELECTRICAL SPECIFICATIONS – TD-SCDMA BANDS 34, 39

Unless otherwise specified: V_{BATT} = 3.4 V; T_{CASE} = +25 °C; Voice Modulation

Parameter		Symbol	Conditions	Minimum	Typical	Maximum	Units
Frequency	Band 34	f		2010		2025	MHz
	Band 39			1880		1920	
Maximum Output Power		P_{OUT_MAX}		28.0			dBm
		$P_{OUT\_MAX\_ETC}$	V_{CC} = 3.1 V, V_{BATT} = 3.1 V to 4.6 V, T_{CASE} = T_{RANGE}	27.5			
Power Gain		G_{P_NTC}	P_{OUT} = P_{OUT_MAX}	28.0	30.0	31.0	dB
		G_{P_ETC}	V_{CC} = 3.1 V, V_{BATT} = 3.1 V to 4.6 V, P_{OUT} = $P_{OUT\_MAX\_ETC}$, T_{CASE} = T_{RANGE}	26.0		32.5	
		G_{P_LOW}	V_{CC} = 0.55 V		15.0	20.0	dB
Power Added Efficiency[1]	Band 34	PAE_{APT}	P_{OUT} = P_{OUT_MAX}		38.5		%
	Band 39				41.0		
Total Supply Current[2]		I_{TOT_MAX}	P_{OUT} = P_{OUT_MAX}, V_{BATT} = 3.8 V		TBD		mA
Adjacent Channel Leakage Power Ratio	1.6 MHz offset	ACLR1	P_{OUT} = P_{OUT_MAX}		–40	–38	dBc
			P_{OUT} = $P_{OUT\_MAX\_ETC}$, V_{CC} = 3.1 V, V_{BATT} = 3.1 V to 4.6 V, T_{CASE} = T_{RANGE}			–36	
	3.2 MHz offset	ACLR2	P_{OUT} = P_{OUT_MAX}		–52	–48	
			P_{OUT} = $P_{OUT\_MAX\_ETC}$, V_{CC} = 3.1 V, V_{BATT} = 3.1 V to 4.6 V, T_{CASE} = T_{RANGE}			–46	
Modulation Accuracy		EVM RMS	V_{CC} = 3.1 V, V_{BATT} = 3.1 V to 4.6 V, Load = 50 ohms, T_{CASE} = T_{RANGE}		2.5	5.0	%
Harmonics	Second	$f2$	$P_{OUT} \leq P_{OUT\_MAX}$		–16	–13	dBm
	Third	$f3$			–23	–20	
	Fourth and higher	$4f$				–20	
Input VSWR		$VSWR_{IN}$	$P_{OUT} \leq P_{OUT\_MAX}$		1.3:1	2:1	VSWR
Stability		S	No oscillations, all spurious < –36 dBm, $P_{OUT} \leq P_{OUT\_MAX}$, V_{BATT} = 3.1 V to 4.6 V, T_{CASE} = T_{RANGE}	6:1			VSWR
Ruggedness		Ru	No permanent damage to module $P_{OUT} \leq P_{OUT\_MAX}$, V_{BATT} = 3.1 V to 4.6 V, T_{CASE} = T_{RANGE}	10:1			VSWR

1 VCC optimized for ACLR1 = –40 dBc.

2 $I_{TOT} = I_{BATT} + (I_{CC1} + I_{CC2})(V_{CC}/V_{BATT})(1/DC\_DC\_EFF)$. V_{CC} = TBD. DC_DC_EFF ~ 96%.

TABLE 14. SKY77643-11 ELECTRICAL SPECIFICATIONS – TRANSMIT TDD-LTE BAND 39

UNLESS OTHERWISE SPECIFIED: VBATT = 3.4 V; TCASE= +25 °C; LTE SIGNAL = QPSK/10 MHz/12RB FOR MPR = 0 AND QPSK/20 MHz/100RB FOR MPR = 1.

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Units
Frequency Band 39	f		1880		1920	MHz
Maximum Output Power	POUT_MAX		27.0			dBm
	POUT_MAX_ETC	VCC = 3.1 V, VBATT = 3.1 to 4.6 V, TCASE = TRANGE	26.5			
Power Gain	GP_NTC	POUT = POUT_MAX	28.0		31.0	dB
	GP_ETC	VCC = 3.1 V, VBATT = 3.1 to 4.6 V, POUT = POUT_MAX_ETC, TCASE = TRANGE	26.0		32.5	
	GP_LOW	VCC = 0.55 V		15.0	20.0	dB
Power Added Efficiency[1]	PAE_APT	POUT = POUT_MAX		35.5		%
Total Supply Current[2]	I_TOT_MAX	POUT = POUT_MAX, VBATT = 3.8 V		TBD		mA
Adjacent Channel Leakage power Ratio	EUTRA_ACLR1	POUT = POUT_MAX		–39	–36	dBc
		POUT = POUT_MAX_ETC, VCC = 3.1 V, VBATT = 3.1 to 4.6 V, TCASE = TRANGE			–33	
	UTRA_ACLR1	POUT = POUT_MAX		–40	–37	
		POUT = POUT_MAX_ETC, VCC = 3.1 V, VBATT = 3.1 to 4.6 V, TCASE = TRANGE			–36	
	UTRA_ACLR2	POUT = POUT_MAX		–43	–41	
		POUT = POUT_MAX_ETC, VCC = 3.1 V, VBATT = 3.1 to 4.6 V, TCASE = TRANGE			–39	
Modulation Accuracy	EVM	VCC = 3.1 V, VBATT = 3.1 to 4.6 V, Load = 50 ohms, TCASE = TRANGE		2.5	5.0	%
Harmonics Second	$f2$	POUT = POUT_MAX		–16	–13	dBm
Third	$f3$			–23	–20	
Fourth and higher	$4f$				–20	
Input VSWR	VSWR_IN	POUT ≤ POUT_MAX		1.3:1	2:1	VSWR
Stability	S	No oscillations, all spurious < –36 dBm, POUT ≤ POUT_MAX, VBATT = 3.1 V to 4.6 V, TCASE = TRANGE	6:1			VSWR
Ruggedness	Ru	No permanent damage to module POUT ≤ POUT_MAX, VBATT = 3.1 V to 4.6 V, TCASE = TRANGE	10:1			VSWR

1 VCC optimized for ACLR1_UTRA = –40 dBc.

2 I_TOT = IBATT + (ICC1 + ICC2)(VCC/VBATT)(1/DC_DC_EFF). VCC = TBD. DC_DC_EFF ~ 96%.

TABLE 15. SKY77643-11 ELECTRICAL SPECIFICATION – BAND SELECT SWITCH

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Frequency Range	*f*		2300		2690	MHz
Insertion Loss	IL	B40 to T/R1		0.65		dB
		B38 to T/R2		0.75		
		B41 to T/R2		0.80		
		B7 to T/R2		0.75		
VSWR		Any RF port tested in Rx mode			2.0:1	
Isolation		B7 Tx to B38 Tx	30			dB
		B7 Tx to B40 Tx	25			
		B7 Tx to B41 Tx	35			
		B40 Tx to T/R1	25			
		B38 Tx to T/R2	25			
		B41 Tx to T/R2	25			
		B40 Tx to T/R2	25			
		B38 Tx to T/R1	25			
		B41 Tx to T/R1	25			
Switching Time		Isolation to Rx, Isolation to Tx, Tx to Rx, Rx to Tx, Rx to Isolation, and Tx to Isolation			2.5	µS

TABLE 16. SKY77643-11 LTE MAXIMUM POWER REDUCTION (MPR)

Modulation	Bandwidth (BW)	Resource Block (RB)	MPR
QPSK	1.4 MHz	≤ 5	0
	3.0 MHz	≤ 4	0
	5.0 MHz	≤ 8	0
	10.0 MHz	≤ 12	0
	15.0 MHz	≤ 16	0
	20.0 MHz	≤ 18	0
QPSK	1.4 MHz	> 5	1
	3.0 MHz	> 4	1
	5.0 MHz	> 8	1
	10.0 MHz	> 12	1
	15.0 MHz	> 16	1
	20.0 MHz	> 18	1
16 QAM	1.4 MHz	≤ 5	1
	3.0 MHz	≤ 4	1
	5.0 MHz	≤ 8	1
	10.0 MHz	≤ 12	1
	15.0 MHz	≤ 16	1
	20.0 MHz	≤ 18	1
16 QAM	1.4 MHz	> 5	2
	3.0 MHz	> 4	2
	5.0 MHz	> 8	2
	10.0 MHz	> 12	2
	15.0 MHz	> 16	2
	20.0 MHz	> 18	2

TABLE 17. SKY77643-11 POWER VS. MODULATION

	WCDMA					LTE		
		3GGP HS Test Cases				3GGP Test Cases: QPSK		3GGP Test Cases: 16QAM
Band	R99	HSDPA ST 1, 2 HSUPA ST 1, 5	HSDPA ST 3, 4	HSUPA ST 3	HSUPA ST 2, 4	5 MHz 8RB 10 MHz 12RB 20 MHz 18RB	5 MHz 25RB 10 MHz 50RB 20 MHz 100RB	5 MHz 25RB 10 MHz 50RB 20 MHz 100RB
1	28.0	27.0	26.5	26.0	25.0	27.0	26.0	25.0
2	28.5	27.5	27.0	26.5	25.5	27.5	26.5	25.5
3	28.5	27.5	27.0	26.5	25.5	27.5	26.5	25.5
4	28.0	27.0	26.5	26.0	25.0	27.0	26.0	25.0
5	28.0	28.0	27.5	27.0	26.0	27.0	26.0	25.0
8	28.0	28.0	27.5	27.0	26.0	27.0	26.0	25.0
12						27.0	26.0	25.0
13						27.0	26.0	25.0
17						27.0	26.0	25.0
20						27.5	26.5	25.5
28						27.5	26.5	25.5
39						27.0	26.0	25.0
38						28.0	27.0	26.0
40						28.0	27.0	26.0
41						28.0	27.0	26.0
7						28.0	27.0	26.0
30						28.0	27.0	26.0
AXGP						28.0	27.0	26.0

TABLE 18. SKY77643-11 VCC AND DC_DC EFFICIENCIES AND MIPI RFFE REGISTER SETTING

Band[1]	POUT (dBm)	Modulation Case	VCC1 (V)	VCC2 (V)	DC_DC Efficiency (%)	MIPI RFFE Interface Register Settings (Hex) Register 0 : Register 1
7	28	LTE QPSK 10 MHz, 12RB	3.40	3.40	96	TBD
7	27	LTE QPSK 20 MHz, 100RB	3.40	3.40	96	TBD
7	13	LTE QPSK 10 MHz, 12RB	0.93	0.93	80	TBD
7	3	LTE QPSK 10 MHz, 12RB	0.57	0.57	75	TBD
30	28	LTE QPSK 10 MHz, 12RB	3.40	3.40	96	TBD
30	27	LTE QPSK 10 MHz, 50RB	3.40	3.40	96	TBD
30	13	LTE QPSK 10 MHz, 12RB	0.93	0.93	80	TBD
30	3	LTE QPSK 10 MHz, 12RB	0.57	0.57	75	TBD
38	28	LTE QPSK 10 MHz, 12RB	3.40	3.40	96	TBD
38	27	LTE QPSK 20 MHz, 100RB	3.40	3.40	96	TBD
38	13	LTE QPSK 10 MHz, 12RB	0.93	0.93	80	TBD
38	3	LTE QPSK 10 MHz, 12RB	0.57	0.57	75	TBD
40	28	LTE QPSK 10 MHz, 12RB	3.40	3.40	96	TBD
40	27	LTE QPSK 20 MHz, 100RB	3.40	3.40	96	TBD
40	13	LTE QPSK 10 MHz, 12RB	0.93	0.93	80	TBD
40	3	LTE QPSK 10 MHz, 12RB	0.57	0.57	75	TBD
41	28	LTE QPSK 10 MHz, 12RB	3.40	3.40	96	TBD
41	27	LTE QPSK 20 MHz, 100RB	3.40	3.40	96	TBD
41	13	LTE QPSK 10 MHz, 12RB	0.93	0.93	80	TBD
41	3	LTE QPSK 10 MHz, 12RB	0.57	0.57	75	TBD

[1] The settings shown for Band 41 are optimized for center of the band. Optimized settings for Band edge are available on request.

Evaluation Board Description

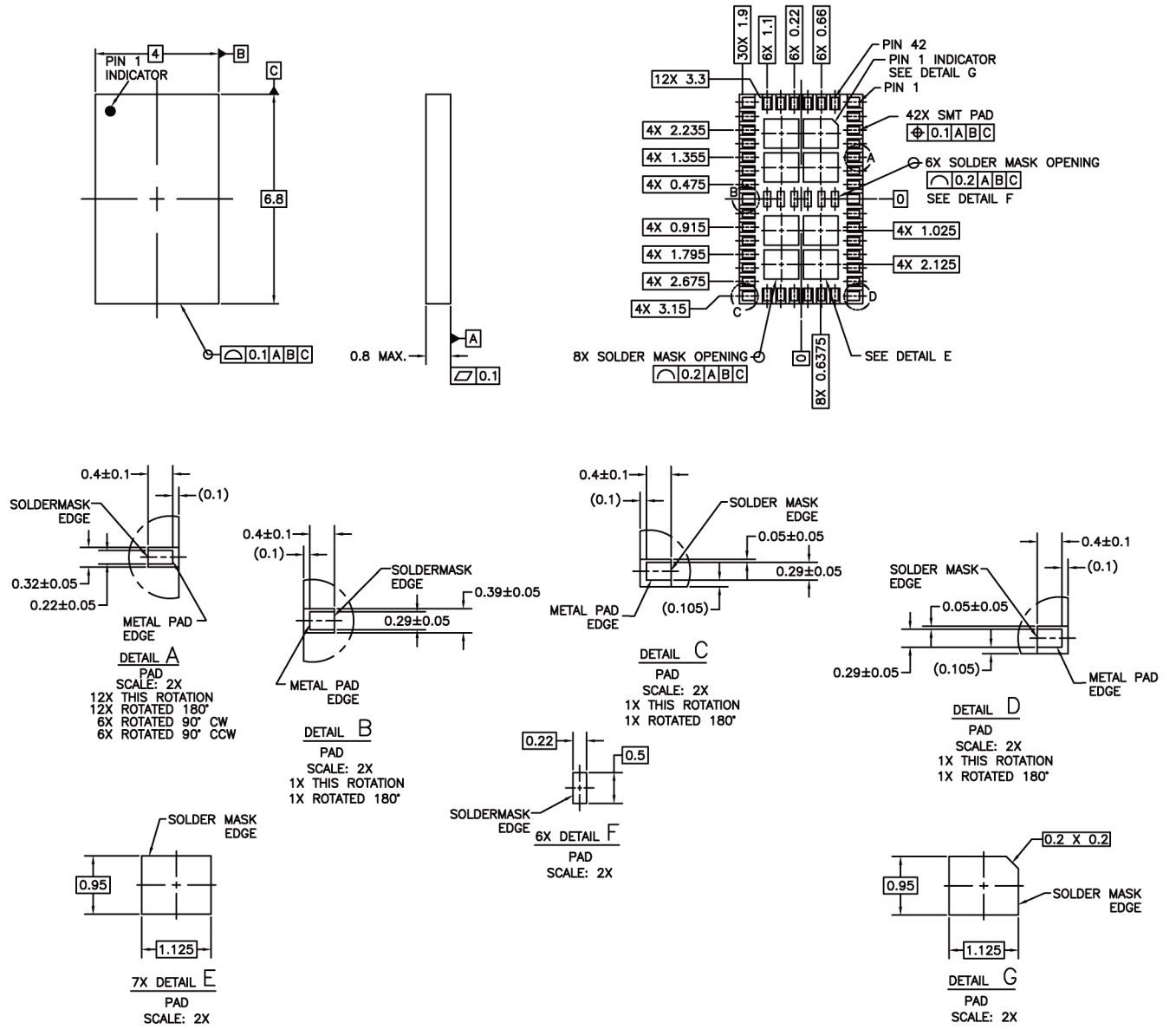
The evaluation board is a platform for testing and interfacing design circuitry. To accommodate the interface testing of the SKY77643-11, the evaluation board schematic and assembly diagrams are included for preliminary analysis and design. The basic EVB schematic is shown in Figure 2 and the assembly diagram in Figure 3. Figure 4 is a recommended application diagram.

FIGURE 2. SKY77643-11 EVALUATION BOARD SCHEMATIC DIAGRAM

FIGURE 3. SKY77643-11 EVALUATION BOARD ASSEMBLY DIAGRAM

Package Dimensions

Figure 4 is a mechanical drawing of the pad layout for the SKY77643-11, a 42-pad leadless quad-band power amplifier module. Figure 5 provides a recommended PC board layout footprint of the module to help the designer attain optimum thermal conductivity, good grounding, and minimum RF discontinuity for the 50-ohm terminals.



NOTES: UNLESS OTHERWISE SPECIFIED.

1. DIMENSIONING AND TOLERANCING IN ACCORDANCE WITH ASME Y14.5M–1994.
2. DIMENSIONS ARE IN MILLIMETERS
3. PAD DEFINITIONS PER DETAILS ON DRAWING.

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FIGURE 4. DIMENSIONAL DIAGRAM FOR 4.0 mm x 6.8 mm x 0.8 mm MAX., 42-PAD MCM PACKAGE – SKY77643-11

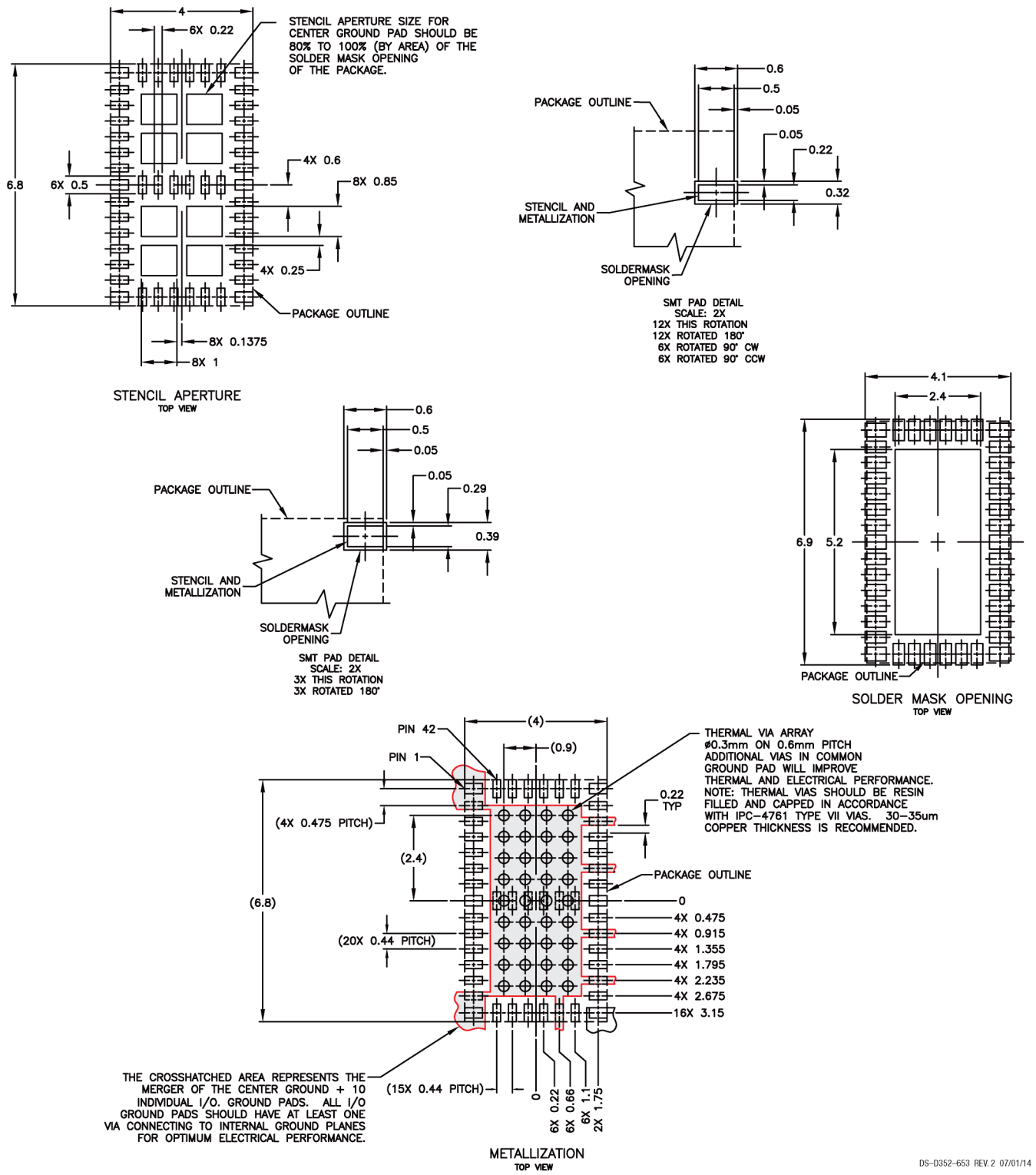
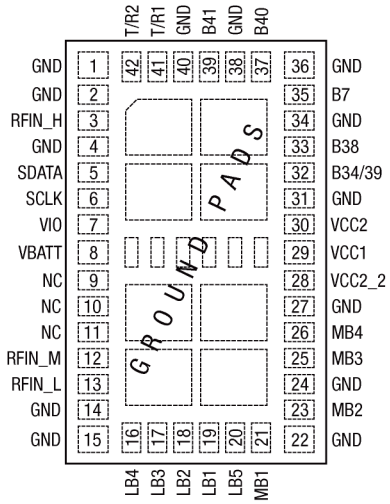


FIGURE 5. PCB LAYOUT FOOTPRINT FOR 4.0 mm x 6.8 mm, 42-PAD PACKAGE – SKY77643-11

Package Description

Figure 6 shows the device pad configuration and the pad numbering convention, which starts with pad 1 in the upper left corner and increments counter-clockwise around the package. Table 19 lists the pad names and signal descriptions. Figure 7 shows typical case markings for the SKY77643-11.



Pad layout as seen from Top View looking through package.
GROUND PAD is package underside

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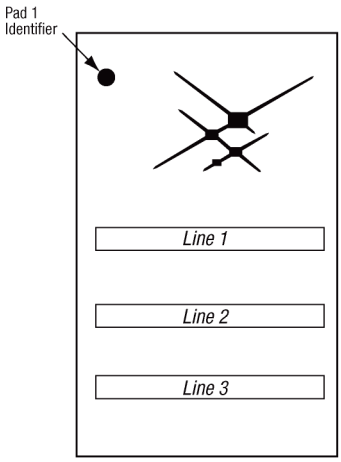
FIGURE 6. SKY77643-11 PAD CONFIGURATION – 42-PAD MCM (TOP VIEW)



NOTE: Lines 1, 2, 3 have a maximum of 12 characters
Line 1 = Part Number and Version
Line 2 = Lot Number
Line 3 = Year–Week–Country Code (MX)

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FIGURE 7. TYPICAL CASE MARKINGS (TOP VIEW)

TABLE 19. SKY77643-11 PAD NAMES AND SIGNAL DESCRIPTIONS

Pad	Name	Description
3	RFIN_H	High Band (HB) Input
4	NC	Not Used (float or connect to GND)
5	SDATA	MIPI Data Bus
6	SCLK	MIPI Clock Bus
7	VIO	MIPI Supply
8	VBATT	Battery Supply
9	NC	Not Used (float or connect to GND)
10	NC	Not Used (float or connect to GND)
11	NC	Not Used (float or connect to GND)
12	RFIN_M	Mid Band (MB) Input
13	RFIN_L	Low Band (LB) Input
16	LB4	LB 4 RF OUT
17	LB3	LB 3 RF OUT
18	LB2	LB 2 RF OUT
19	LB1	LB 1 RF OUT
20	LB5	LB 5 RF OUT
21	MB1	MB 1 RF OUT
23	MB2	MB 2 RF OUT
25	MB3	MB 3 RF OUT
26	MB4	MB 4 RF OUT
28	VCC2_2	MB/LB 2nd Stage PA Collector Supply
29	VCC1	HB/MB/LB 1st Stage PA Collector Supply
30	VCC2	HB 2nd Stage PA Collector Supply
32	B34/39	Bands 34/39 RF OUT
33	B38	Band 38 RF OUT
35	B7	Band 7 RF OUT
37	B40	Band 40 RF OUT (Band 30 supported)
39	B41	Band 41 RF OUT (AXGP band supported)
41	T/R1	Band 40 RX
42	T/R2	Bands 7, 38, 41 RX

[1] Pads 1, 2, 14, 15, 22, 24, 27, 31, 34, 36, 38, and 40 are GROUND pads.

Package 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 SKY77643-11 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 8).

Electrostatic Discharge (ESD) Sensitivity

Attention: Observe Precautions for Handling Electrostatic Sensitive Devices

Electrostatic Discharge (ESD) can damage this device, which must be protected from ESD at all times. 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.

The SKY77643-11 is a static-sensitive electronic device. Do not operate or store near strong electrostatic fields. Take proper ESD precautions.

To avoid ESD damage, both latent and visible, it is very important that the product assembly and test areas follow the 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 1,000 MΩ 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

TBD

FIGURE 8. CARRIER TAPE DIMENSIONAL DIAGRAM FOR BODY SIZE 4 mm x 6.8 mm x 0.85–1.05 mm – OVERMOLD MCM

Ordering Information

Product Name	Order Number	Evaluation Board Part Number
SKY77643-11 Multimode Multiband Power Amplifier Module	SKY77643-11	TBD

Revision History

Revision	Date	Description
A	October 10, 2014	Initial Release – Preliminary Information
B	October 16, 2014	Revise: Page 5, Table 3 (2 of 3), Reg. 2, Notes: High Isolation, LB1_TX thru LB5_TX

References

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

Electrostatic Discharge Sensitivity (ESD) Testing: *JEDEC Standard, JESD22-A114 Human Body Model (HBM)*