益登科技

Approval Sheet

ITEM	**SKY77638-11 (Quanta P/N:AL077638000)**
BRAND	**SKYWORKS (vendor code: EDM-SWI)**
CUSTOMER	廣達電腦股份有限公司

零件代號	
機　　種	
承認印	
部　　門	
本承認書有效期間 自 2020 年 6 月 29 日起至　　年　　月　　日止	

EDOM
TECHNOLOGY CO.,LTD.

益登科技股份有限公司
EDOM TECHNOLOGY CO., LTD.
公司：台北市基湖路 10 巷 50 號 8 樓
TEL：(02) 2657-8811
FAX：(02) 2657-9090
統一編號：97099302

請 承 認 用 民 國　109 年　06 月　29　日

DATA SHEET

SKY77638-11 SkyLiTE™ Multimode Multiband Power Amplifier Module

Applications

- Multiband 3G / LTE handsets
- CDMA
  - Bands BC0, BC1, BC4, BC6, BC10, BC15
- WCDMA
  - Bands 1, 2, 3, 4, 5, 8
- TD-SCDMA Bands
  - Bands 34, 39
- FDD LTE
  - Bands 1, 2, 3, 4, 5, 7, 8, 9, 12, 13, 17, 20, 25, 26, 28, 30
- TDD LTE
  - Bands 34, 38, 39, 40, 41

Features

- Two T/R (RX) port and 12 outputs
- Industry-leading PAE for 3G/4G
- Optimized for APT DCDC operation
- Fully programmable Mobile Industry Processor Interface (MIPI) control
- Dual Low Band RF inputs support separate transceiver outputs or interstage filtering
- MIPI programmable bias modes optimize best efficiency / linearity trade-off for 3G and 4G; minimizes DG09 for 3G.
- Small, low profile package:
  - 4.0 x 6.8 x 0.71 mm
  - 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 SKY77638-11 SkyLiTE™ is a multimode multiband (MMMB) Power Amplifier Module (PAM) that supports 3G / 4G handsets and operates efficiently in CDMA, 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 0.71 mm, 42-pad MCM, SMT package which is a more highly manufacturable, low cost solution.

3G: The SKY77638-11 supports CDMA, 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 SKY77638-11 supports 1.4, 3, 5, 10, 15, 20, 30, 35, 40 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
- CDMA2000 1xRC1, 1xRC3
- CDMA2000 EVDO
- FDD LTE
- TDD LTE
- Uplink Carrier Aggregation (CA) support for Band 39 (up to 35 MHz) and Band 40/41 (up to 40 MHz)

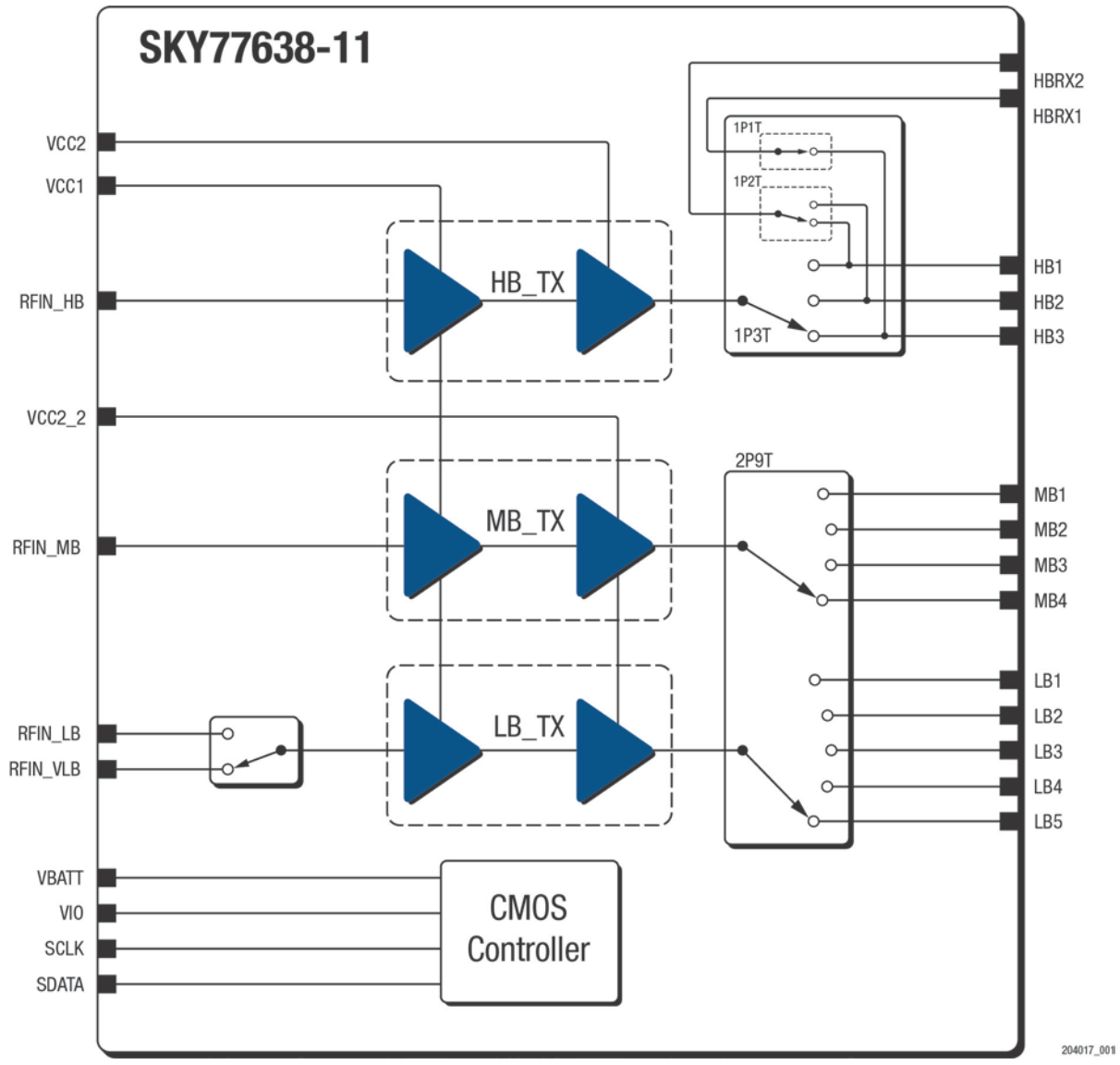


Figure 1. SKY77638-11 Functional Block Diagram

Electrical Specifications

The following tables list the electrical characteristics of the SKY77638-11 Power Amplifier Module. The absolute maximum conditions are provided in Table1; recommended operating conditions are specified in Table 2. Tables 3 through 18 contain the performance characteristics of the SKY77638-11.

The SKY77638-11 is a static-sensitive electronic device and should not be stored nor 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. SKY77638-11 Absolute Maximum Conditions[1]

Parameter		Symbol	Minimum	Nominal	Maximum	Unit
RF Input Power		P_{IN}		0	10	dBm
Supply Voltage	No RF	V_{BATT}	–1.2[2]	3.4	6.0	Volts
		V_{CC1}, V_{CC2}, V_{CC2_2}	0	3.4	6.0	
	With RF	V_{BATT}	0	3.4	6.0	
		V_{CC1}, V_{CC2}, V_{CC2_2}	0	3.4	5.5	
Digital Control Lines		VIO, SCLK, SDATA	0.5		2.2	Volts
Case Temperature[3]	Operating	T_{CASE}	–40	25	+110	°C
	Storage	T_{STG}	–40		+150	
ESD – Human Body Mode (HBM)		ESD_{HBM}	–1.5		1.5	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 *Pulsed for up to 100 µs*

3 *Case Operating Temperature (T_{CASE}) refers to the temperature of the GROUND PAD at the underside of the package.*

Table 2. SKY77638-11 Recommended Operating Conditions

Parameter		Symbol	Minimum	Nominal	Maximum	Unit
Supply Voltage		V_{CC1}	0.55	3.4	4.6	Volts
		V_{CC2}, V_{CC2_2}	0.55	3.4	4.6	
		V_{BATT}	3.0	3.4	4.8	
MIPI RFFE Supply		VIO	1.65	1.80	1.95	Volts
MIPI RFFE Signal Levels for SCLK, SDATA	Low	V_{MIPI_LOW}	0.0	0.0	0.2 x VIO	Volts
	High	V_{MIPI_HIGH}	0.8 x VIO	1.8	VIO	
Leakage Current	V_{BATT} = 3.4 V	I_{BATT_LK}			10	µA
	V_{CC1}, V_{CC2}, V_{CC2} = 3.4 V	I_{CC_LK}			10	
Case Operating Temperature Range		T_{RANGE}	–20	+25	+85	°C

Table 3. SKY77638-11 Electrical Specifications – General

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Turn On Time	T_{ON}	Gain settled to within 0.5 dB of $G_P(P_{OUT} = P_{OUT\_MAX})$			5	µs
Turn Off Time	T_{OFF}	Gain ≤ $G_P(P_{OUT} = P_{OUT\_MAX}) – 30$ dB			5	µs
Mode Switching Time	T_{MODE}	Time to transition from HPM to LPM, or LPM to HPM by changing state of Reg 0 [1]			2.5	µs
Switching Time	T_{SW}	Time to transition from Iso to RX, Iso to TX, TX to RX, RX to TX, RX to Iso, and TX to Iso			2.5	µs

Table 4. SKY77638-11 Electrical Specifications for Nominal Operating Conditions – FDD LTE Band 7

Unless otherwise specified: V_{BATT} = 3.8 V; T_{CASE} = +25 °C; LTE Signal = QPSK/10 MHz/12RB for MPR = 0 and QPSK/20 MHz/100 RB for MPR = 1.

Characteristics		Symbol	Condition	Min	Typ	Max	Unit
Operating Frequency		f_0		2500	2535	2570	MHz
Maximum Output Power		P_{OUT_MAX}	MPR = 0[1]	28.5			dBm
		$P_{OUT\_MAX\_RANGE}$	$V_{BATT} = V_{CC}$ = 3.0 V, $T_{CASE} = T_{RANGE}$	27.5			
Gain		G_{P_NTC}	$P_{OUT} = P_{OUT\_MAX}$, T_{CASE} = +25 °C	28.5	30.5	32.0	dB
		G_{P_RANGE}	$P_{OUT} = P_{OUT\_MAX}$, $T_{CASE} = T_{RANGE}$	26.5		33.0	
		G_{P_LOW}	P_{OUT} = 3 dBm, V_{CC} = 0.55 V	13.0		22.0	
Power Added Efficiency		PAE	$P_{OUT} = P_{OUT\_MAX}$		30		%
Total Supply Current[2]		$I_{\_TOT\_MAX}$	$P_{OUT} = P_{OUT\_MAX}$		650		mA
Adjacent Channel Leakage power Ratio	EUTRA	EUTRA_ACLR1	$P_{OUT} = P_{OUT\_MAX}$		–38	–35	dBc
			$P_{OUT} = P_{OUT\_MAX\_RANGE}$, $V_{BATT} = V_{CC}$ = 3.0 V, $T_{CASE} = T_{RANGE}$			–33	
	UTRA1	UTRA_ACLR1	$P_{OUT} = P_{OUT\_MAX}$		–40	–38	
			$P_{OUT} = P_{OUT\_MAX\_RANGE}$, $V_{BATT} = V_{CC}$ = 3.0 V, $T_{CASE} = T_{RANGE}$			–35	
	UTRA2	UTRA_ACLR2	$P_{OUT} = P_{OUT\_MAX}$		–43	–41	
			$P_{OUT} = P_{OUT\_MAX\_RANGE}$, $V_{BATT} = V_{CC}$ = 3.0 V, $T_{CASE} = T_{RANGE}$			–39	
Harmonic Suppression	Second	$2f_0$	$P_{OUT} \le P_{OUT\_MAX}$			–21	dBm
	Third	$3f_0$				–16	
	Fourth	$4f_0$				–26	
	Fifth	$5f_0$				–36	
Tx Noise in Rx Bands[3]	Rx Band	$PNRX_{\_LTE}$	2620 MHz–2690 MHz			–126	dBm/Hz
	GPS Rx	$PNRX_{\_GPS}$	1574 MHz–1577 MHz			–140	
	BT, WLAN	$PNRX_{\_BT}$	2400 MHz–2452 MHz			–108	
	WLAN	$PNRX_{\_5GHz}$	4900 MHz–5800 MHz			–140	
EVM		EVM	V_{BATT} = 3.0 V to 4.8 V, Load = 50 ohms, $T_{CASE} = T_{RANGE}$		3	5	%
Input Voltage Standing Wave Ratio		$VSWR_{\_IN}$			1.5:1		
Stability (Spurious output)		S	Load VSWR = 6:1, all phase angles, $P_{OUT} \le P_{OUT\_MAX}$, V_{BATT} = 3.0 V to 4.8 V, $T_{CASE} = T_{RANGE}$	All spurious below –36 dBm			
Ruggedness		Ru	Load VSWR = 10:1, all phase angles, $P_{OUT} \le P_{OUT\_MAX}$, constant forward power, closed loop operation, V_{BATT} = 4.8 V, V_{CC} = 4.6 V, T_{CASE} = +25 °C	No module damage or permanent degradation			

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

[2] $I_{\_TOT} = I_{BATT} + (I_{CC1} + I_{CC2})(V_{CC}/V_{BATT})(1/DC\_DC\_EFF)$. V_{CC} ~ 3.4 V, DC_DC_EFF ~ 96%.

[3] Measured with 20 MHz/100RB LTE Waveform.

Table 5. SKY77638-11 Electrical Specifications for Nominal Operating Conditions – FDD LTE Band 30 (WCS)

Unless otherwise specified: V_{BATT} = 3.8 V; T_{CASE} = +25 °C; LTE Signal = QPSK/10 MHz/12RB for MPR = 0 and QPSK/10 MHz/50 RB for MPR = 1.

Characteristics		Symbol	Condition	Min	Typ	Max	Unit
Operating Frequency		f_0		2305	2310	2315	MHz
Maximum Output Power		P_{OUT_MAX}	MPR = 0[1]	28.5			dBm
		$P_{OUT\_MAX\_RANGE}$	V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}	27.5			
Gain		G_{P_NTC}	P_{OUT} = P_{OUT_MAX}, T_{CASE} = +25 °C	28.0	29.5	31.5	dB
		G_{P_RANGE}	P_{OUT} = P_{OUT_MAX}, T_{CASE} = T_{RANGE}	26.5		32.5	
		G_{P_LOW}	P_{OUT} = 3 dBm, V_{CC} = 0.55 V	13.0		22.0	
Power Added Efficiency		PAE	P_{OUT} = P_{OUT_MAX}		30		%
Total Supply Current[2]		I_{TOT_MAX}	P_{OUT} = P_{OUT_MAX}		635		mA
Adjacent Channel Leakage power Ratio	EUTRA	EUTRA_ACLR1	P_{OUT} = P_{OUT_MAX}		–38	–35	dBc
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–33	
	UTRA1	UTRA_ACLR1	P_{OUT} = P_{OUT_MAX}		–40	–38	
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–35	
	UTRA2	UTRA_ACLR2	P_{OUT} = P_{OUT_MAX}		–43	–41	
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–39	
Harmonic Suppression	Second	$2f_0$	$P_{OUT} \leq P_{OUT\_MAX}$			–15	dBm
	Third	$3f_0$				–15	
	Fourth	$4f_0$				–21	
	Fifth	$5f_0$				–33	
Tx Noise in Rx Bands[3]	GPS Rx	P_{NRX_GPS}	1574 MHz–1577 MHz			–140	dBm/Hz
	BT, WLAN	P_{NRX_BT}	2400 MHz–2483.5 MHz			–113	
	WLAN	P_{NRX_5GHz}	4900 MHz–5800 MHz			–140	
EVM		EVM	V_{BATT} = 3.0 V to 4.8 V, Load = 50 ohms, T_{CASE} = T_{RANGE}		3	5	%
Input Voltage Standing Wave Ratio		$VSWR_{IN}$			1.8:1		
Stability (Spurious output)		S	Load VSWR = 6:1, all phase angles, $P_{OUT} \leq P_{OUT\_MAX}$, V_{BATT} = 3.0 V to 4.8 V, T_{CASE} = T_{RANGE}	All spurious below –36 dBm			
Ruggedness		Ru	Load VSWR = 10:1, all phase angles, $P_{OUT} \leq P_{OUT\_MAX}$, constant forward power, closed loop operation, V_{BATT} = 4.8 V, V_{CC} = 4.6 V, T_{CASE} = +25 °C	No module damage or permanent degradation			

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

[2] *I_{TOT} = I_{BATT} + (I_{CC1} + I_{CC2})(V_{CC}/V_{BATT})(1/DC_DC_EFF). V_{CC} ~ 3.4 V, DC_DC_EFF ~ 96%.*

[3] *Measured with 10 MHz/50RB LTE Waveform.*

Table 6. SKY77638-11 Electrical Specifications for Nominal Operating Conditions – TDD LTE Band 38

Unless otherwise specified: V_{BATT} = 3.8 V; T_{CASE} = +25 °C; LTE Signal = QPSK/10 MHz/12RB for MPR = 0 and QPSK/20 MHz/100 RB for MPR = 1.

Characteristics		Symbol	Condition	Min	Typ	Max	Unit
Operating Frequency		f_0		2570	2595	2620	MHz
Maximum Output Power		P_{OUT_MAX}	MPR = 0[1]	28.5			dBm
		$P_{OUT\_MAX\_RANGE}$	V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}	27.5			
Gain		G_{P_NTC}	P_{OUT} = P_{OUT_MAX}, T_{CASE} = +25 °C	28.0	29.5	32.0	dB
		G_{P_RANGE}	P_{OUT} = P_{OUT_MAX}, T_{CASE} = T_{RANGE}	27.0		33.0	
		G_{P_LOW}	P_{OUT} = 3 dBm, V_{CC} = 0.55 V	13.0		22.0	
Power Added Efficiency		PAE	P_{OUT} = P_{OUT_MAX}		30		%
Total Supply Current[2]		I_{TOT_MAX}	P_{OUT} = P_{OUT_MAX}		635		mA
Adjacent Channel Leakage power Ratio	EUTRA	EUTRA_ACLR1	P_{OUT} = P_{OUT_MAX}		–38	–35	dBc
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–33	
		EUTRA_ACLR1_CA	P_{OUT} = P_{OUT_MAX}, Modulation = QPSK/40 MHz/200 RB		–37		
	UTRA1	UTRA_ACLR1	P_{OUT} = P_{OUT_MAX}		–40	–38	
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–35	
	UTRA2	UTRA_ACLR2	P_{OUT} = P_{OUT_MAX}		–43	–41	
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–39	
Harmonic Suppression	Second	$2f_0$	$P_{OUT} \le P_{OUT\_MAX}$			–21	dBm
	Third	$3f_0$				–16	
	Fourth	$4f_0$				–26	
	Fifth	$5f_0$				–36	
Tx Noise in Rx Bands[3]	GPS Rx	P_{NRX_GPS}	1574 MHz–1577 MHz			–140	dBm/Hz
	BT, WLAN	P_{NRX_BT}	2400 MHz–2483.5 MHz			–113	
	WLAN	P_{NRX_5GHz}	4900 MHz–5800 MHz			–140	
EVM		EVM	V_{BATT} = 3.0 V to 4.8 V, Load = 50 ohms, T_{CASE} = T_{RANGE}		3	5	%
Input Voltage Standing Wave Ratio		V_{SWR_IN}			1.5:1		
Stability (Spurious output)		S	Load VSWR = 6:1, all phase angles, $P_{OUT} \le P_{OUT\_MAX}$, V_{BATT} = 3.0 V to 4.8 V, T_{CASE} = T_{RANGE}	All spurious below –36 dBm			
Ruggedness		Ru	Load VSWR = 10:1, all phase angles, $P_{OUT} \le P_{OUT\_MAX}$, constant forward power, closed loop operation, V_{BATT} = 4.8 V, V_{CC} = 4.6 V, T_{CASE} = +25 °C	No module damage or permanent degradation			

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

[2] $I_{\_TOT}$ = I_{BATT} + (I_{CC1} + I_{CC2})(V_{CC}/V_{BATT})(1/DC_DC_EFF). V_{CC} ~ 3.4 V, DC_DC_EFF ~ 96%.

[3] Measured with 20 MHz/100RB LTE Waveform.

Table 7. SKY77638-11 Electrical Specifications for Nominal Operating Conditions – TDD LTE Band 40

Unless otherwise specified: VBATT = 3.8 V; TCASE = +25 °C; LTE Signal = QPSK/10 MHz/12RB for MPR = 0 and QPSK/20 MHz/100 RB for MPR = 1.

Characteristics		Symbol	Condition	Min	Typ	Max	Unit
Operating Frequency		f_0		2300	2350	2400	MHz
Maximum Output Power		POUT_MAX	MPR = 0[1]	28.5			dBm
		POUT_MAX_RANGE	VBATT = VCC = 3.0 V, TCASE = TRANGE	27.5			
Gain		GP_NTC	POUT = POUT_MAX, TCASE = +25 °C	28.0	29.5	32.0	dB
		GP_RANGE	POUT = POUT_MAX, TCASE = TRANGE	27.0		33.0	
		GP_LOW	POUT = 3 dBm, VCC = 0.55 V	13.0		22.0	
Power Added Efficiency		PAE	POUT = POUT_MAX		30		%
Total Supply Current[2]		I_TOT_MAX	POUT = POUT_MAX		640		mA
Adjacent Channel Leakage power Ratio	EUTRA	EUTRA_ACLR1	POUT = POUT_MAX		–38	–35	dBc
			POUT = POUT_MAX _RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			–33	
		EUTRA_ACLR1_CA	POUT = POUT_MAX, Modulation = QPSK/40 MHz/200 RB		–37		
	UTRA1	UTRA_ACLR1	POUT = POUT_MAX		–40	–38	
			POUT = POUT_MAX _RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			–35	
	UTRA2	UTRA_ACLR2	POUT = POUT_MAX		–43	–41	
			POUT = POUT_MAX _RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			–39	
Harmonic Suppression	Second	$2f_0$	POUT ≤ POUT_MAX			–15	dBm
	Third	$3f_0$				–15	
	Fourth	$4f_0$				–21	
	Fifth	$5f_0$				–33	
Tx Noise in Rx Bands[3]	GPS Rx	PNRX_GPS	1574 MHz–1577 MHz			–140	dBm/Hz
	BT, WLAN	PNRX_BT	2447 MHz–2483.5 MHz			–104	
	WLAN	PNRX_5GHz	4900 MHz–5800 MHz			–140	
EVM		EVM	VBATT = 3.0 V to 4.8 V, Load = 50 ohms, TCASE = TRANGE		3	5	%
Input Voltage Standing Wave Ratio		VSWR_IN			1.8:1		
Stability (Spurious output)		S	Load VSWR = 6:1, all phase angles, POUT ≤ POUT_MAX, VBATT = 3.0 V to 4.8 V, TCASE = TRANGE	All spurious below –36 dBm			
Ruggedness		Ru	Load VSWR = 10:1, all phase angles, POUT ≤ POUT_MAX, constant forward power, closed loop operation, VBATT = 4.8 V, VCC = 4.6 V, TCASE = +25 °C	No module damage or permanent degradation			

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

[2] I_TOT = IBATT + (ICC1 + ICC2)(VCC/VBATT)(1/DC_DC_EFF). VCC ~ 3.4 V, DC_DC_EFF ~ 96%.

[3] Measured with 20 MHz/100RB LTE Wave form.

Table 8. SKY77638-11 Electrical Specifications for Nominal Operating Conditions – TDD LTE Band 41, TDD AXGP Band

Unless otherwise specified: V_{BATT} = 3.8 V; T_{CASE} = +25 °C; LTE Signal = QPSK/10 MHz/12RB for MPR = 0 and QPSK/20 MHz/100 RB for MPR = 1.

Characteristics		Symbol	Condition	Min	Typ	Max	Unit
Operating Frequency		f_0		2496	2595	2690	MHz
Maximum Output Power		P_{OUT_MAX}	MPR = 0[1]	28.5			dBm
		$P_{OUT\_MAX\_RANGE}$	V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}	27.5			
Gain		G_{P_NTC}	P_{OUT} = P_{OUT_MAX}, T_{CASE} = +25 °C	28.0	29.5	32.0	dB
		G_{P_RANGE}	P_{OUT} = P_{OUT_MAX}, T_{CASE} = T_{RANGE}	27.0		33.5	
		G_{P_LOW}	P_{OUT} = 3 dBm, V_{CC} = 0.55 V	13.0		22.0	
Power Added Efficiency		PAE	P_{OUT} = P_{OUT_MAX}		30		%
Total Supply Current[2]		I_{TOT_MAX}	P_{OUT} = P_{OUT_MAX}		635		mA
Adjacent Channel Leakage power Ratio	EUTRA	EUTRA_ACLR1	P_{OUT} = P_{OUT_MAX}		–38	–35	dBc
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–33	
		EUTRA_ACLR1_CA	P_{OUT} = P_{OUT_MAX}, Modulation = QPSK/40 MHz/200 RB		–37		
	UTRA1	UTRA_ACLR1	P_{OUT} = P_{OUT_MAX}		–40	–38	
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–35	
	UTRA2	UTRA_ACLR2	P_{OUT} = P_{OUT_MAX}		–43	–41	
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–39	
Harmonic Suppression	Second	$2f_0$	$P_{OUT} \le P_{OUT\_MAX}$			–21	dBm
	Third	$3f_0$				–16	
	Fourth	$4f_0$				–26	
	Fifth	$5f_0$				–36	
Tx Noise in Rx Bands	GPS Rx	P_{NRX_GPS}	1574 MHz–1577 MHz[3]			–140	dBm/Hz
	BT, WLAN	P_{NRX_BT}	2400 MHz–2452 MHz[3]			–104	
	WLAN	P_{NRX_5GHz}	4900 MHz–5800 MHz[3]			–140	
EVM		EVM	V_{BATT} = 3.0 V to 4.8 V, Load = 50 ohms, T_{CASE} = T_{RANGE}		3	5	%
Input Voltage Standing Wave Ratio		$VSWR_{IN}$			1.5:1		
Stability (Spurious output)		S	Load VSWR = 6:1, all phase angles, $P_{OUT} \le P_{OUT\_MAX}$, V_{BATT} = 3.0 V to 4.8 V, T_{CASE} = T_{RANGE}	All spurious below –36 dBm			
Ruggedness		Ru	Load VSWR = 10:1, all phase angles, $P_{OUT} \le P_{OUT\_MAX}$, constant forward power, closed loop operation, V_{BATT} = 4.8 V, V_{CC} = 4.6 V, T_{CASE} = +25 °C	No module damage or permanent degradation			

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

[2] $I_{\_TOT}$ = I_{BATT} + (I_{CC1} + I_{CC2})(V_{CC}/V_{BATT})(1/DC_DC_EFF). V_{CC} ~ 3.4 V, DC_DC_EFF ~ 96%.

[3] Measured with 20 MHz/100RB LTE Wave form.

Table 9. SKY77638-11 Electrical Specifications – Transmit WCDMA Mid-Band

Unless otherwise specified: V_{BATT} = 3.8 V; T_{CASE} = +25 °C; Voice RMC 12.2 kbps

Parameter		Symbol	Conditions	Min	Typ	Max	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}		28.5			dBm
		$P_{OUT\_MAX\_RANGE}$	V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}	27.0			
	Bands 2, 3	P_{OUT_MAX}		29.0			
		$P_{OUT\_MAX\_RANGE}$	V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}	27.5			
Power Gain	Bands 1, 2	G_{P_NTC}	P_{OUT} = P_{OUT_MAX}	28.0		32.0	dB
		G_{P_RANGE}	P_{OUT} = P_{OUT_MAX}, T_{CASE} = T_{RANGE}	26.5		33.0	
	Bands 3, 4	G_{P_NTC}	P_{OUT} = P_{OUT_MAX}	28.0		32.0	
		G_{P_RANGE}	P_{OUT} = P_{OUT_MAX}, T_{CASE} = T_{RANGE}	26.5		33.0	
		G_{P_LOW}	P_{OUT} = 3 dBm, V_{CC} = 0.55 V			20.0	
Power Added Efficiency		PAE	P_{OUT} = P_{OUT_MAX}		38		%
Total Supply Current[1]		$I_{TOT\_MAX\_B4}$	P_{OUT} = P_{OUT_MAX}		515		mA
		$I_{TOT\_MAX\_B2,3}$			580		
		$I_{TOT\_MAX\_B1}$			570		
Adjacent Channel Leakage power Ratio	5 MHz offset	ACLR1	P_{OUT} = P_{OUT_MAX}		–40	–38	dBc
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–36	
	10 MHz offset	ACLR2	P_{OUT} = P_{OUT_MAX}		–52	–48	
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–46	
Modulation Accuracy		EVM	V_{BATT} = 3.0 V to 4.8 V, Load = 50 ohms, T_{CASE} = T_{RANGE}		2.5	5.0	%
Harmonics	Second	$2f_{0\_B1,2}$	$P_{OUT} \le P_{OUT\_MAX}$			–15	dBm
		$2f_{0\_B3,4}$				–12	
	Third	$3f_{0\_B1,2}$				–18	
		$3f_{0\_B3,4}$				–12	
	Fourth and higher	$4f_0$				–20	
Noise Power in Rx Band with WCDMA Modulated Tx[2]							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		
GPS Rx		P_{NOISE_GPS}	f_{RX} = 1574 MHz–1577 MHz		–134.0		
BT, WLAN		P_{NOISE_BT}	f_{RX} = 2400 MHz–2483.5 MHz		–141.0		
WLAN		P_{NOISE_5GHz}	f_{RX} = 4900 MHz–5800 MHz		–155.0		
Input Voltage Standing Wave Ratio		V_{SWR_IN}	$P_{OUT} \le P_{OUT\_MAX}$		1.3:1		
Stability		S	Load VSWR = 6:1, all phase angles, $P_{OUT} \le P_{OUT\_MAX}$, V_{BATT} = 3.0 V to 4.8 V, T_{CASE} = T_{RANGE}	All spurious below –36 dBm			
Ruggedness		Ru	Load VSWR = 10:1, all phase angles, $P_{OUT} \le P_{OUT\_MAX}$, constant forward power, closed loop operation, V_{BATT} = 4.8 V, V_{CC} = 4.6 V, T_{CASE} = +25 °C	No module damage or permanent degradation			

[1] *I_{TOT} = I_{BATT} + (I_{CC1} + I_{CC2})(V_{CC}/V_{BATT})(1/DC_DC_EFF). VCC ~ 3.3 V. DC_DC_EFF ~ 96%.*

[2] *Harmonically-related spurious excluded.*

Table 10. SKY77638-11 Electrical Specifications – Transmit WCDMA Low Band

Unless otherwise specified: V_{BATT} = 3.8 V; T_{CASE} = +25 °C; Voice RMC 12.2 kbps

Parameter		Symbol	Conditions	Min	Typ	Max	Units
Frequency	Band 5	f		824		849	MHz
	Band 8			880		915	
Maximum Output Power	Bands 5, 8	POUT_MAX		28.5			dBm
		POUT_MAX_RANGE	VBATT = VCC = 3.0 V, TCASE = TRANGE	27.0			
Power Gain		GP_NTC	POUT = POUT_MAX	27.5		32.5	dB
		GP_RANGE	POUT = POUT_MAX, TCASE = TRANGE	26.5		33.5	
		GP_LOW	POUT = 3 dBm, VCC = 0.6 V			20.0	
Power Added Efficiency		PAE_B5	POUT = POUT_MAX		42		%
		PAE_B8			41		
Total Supply Current[1]		I_TOT_MAX_B5	POUT = POUT_MAX		465		mA
		I_TOT_MAX_B8			480		
Adjacent Channel Leakage power Ratio	5 MHz offset	ACLR1	POUT = POUT_MAX		–40	–38	dBc
			POUT = POUT_MAX_RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			–36	
	10 MHz offset	ACLR2	POUT = POUT_MAX		–52	–48	
			POUT = POUT_MAX_RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			–46	
Modulation Accuracy		EVM	VBATT = 3.0 V to 4.8 V, Load = 50 ohms, TCASE = TRANGE		2.5	5.0	%
Harmonics	Second	$2f_0$	POUT ≤ POUT_MAX			–15	dBm
	Third	$3f_0$				–15	
	Fourth and higher	$4f_0$				–20	
Noise Power in Rx Band with WCDMA Modulated Tx[2]							dBm/Hz
	B5 f_{TX} = 824–849 MHz	PNOISE_DPX	f_{RX} = f_{TX} +45 MHz		–131.5		
	B8 f_{TX} = 880–915 MHz		f_{RX} = f_{TX} +45 MHz		–131.5		
	GPS Rx	PNOISE_GPS	f_{RX} = 1574 MHz–1577 MHz		–155.0		
	BT, WLAN	PNOISE_BT	f_{RX} = 2400 MHz–2483.5 MHz		–155.0		
	WLAN	PNOISE_5GHz	f_{RX} = 4900 MHz–5800 MHz		–155.0		
Input Voltage Standing Wave Ratio		VSWR_IN	POUT ≤ POUT_MAX		1.6:1		
Stability		S	Load VSWR = 5:1, all phase angles, POUT ≤ POUT_MAX, VBATT = 3.0 V to 4.8 V, TCASE = TRANGE	All spurious below –36 dBm			
Ruggedness		Ru	Load VSWR = 10:1, all phase angles, POUT ≤ POUT_MAX, constant forward power, closed loop operation, VBATT = 4.8 V, VCC = 4.6 V, TCASE = +25 °C	No module damage or permanent degradation			

[1] *I_TOT = IBATT + (ICC1 + ICC2)(VCC/VBATT)(1/DC_DC_EFF). VCC ~ 3.0 V. DC_DC_EFF ~ 96%.*

[2] *Harmonically-related spurious excluded.*

Table 11. SKY77638-11 Electrical Specifications – Transmit LTE Mid-Band

Unless otherwise specified: V_{BATT} = 3.8 V; T_{CASE} = +25 °C; LTE Signal = QPSK/10 MHz/12RB for MPR = 0 and QPSK/20 MHz/100 RB for MPR = 1.

Parameter		Symbol	Conditions	Min	Typ	Max	Units
Frequency	Band 1	f		1920		1980	MHz
	Band 2			1850		1910	
	Band 3			1710		1785	
	Band 4			1710		1755	
	Band 25			1850		1915	
Maximum Output Power	Band 1, 4	P_{OUT_MAX}		27.5			dBm
		$P_{OUT\_MAX\_RANGE}$	V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}	26.0			
	Bands 2, 3, 25	P_{OUT_MAX}		28.0			
		$P_{OUT\_MAX\_RANGE}$	V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}	26.5			
Power Gain		G_{P_NTC}	P_{OUT} = P_{OUT_MAX}	28.0		32.0	dB
		G_{P_RANGE}	P_{OUT} = P_{OUT_MAX}, T_{CASE} = T_{RANGE}	27.0		33.0	
		G_{P_LOW}	P_{OUT} = 3 dBm, V_{CC} = 0.55 V			22.0	dB
Power Added Efficiency		$PAE_{\_B1}$	P_{OUT} = P_{OUT_MAX}		31.0		%
		$PAE_{\_B2,3,4}$			34.5		
Total Supply Current[1]		$I_{\_TOT\_MAX\_B4}$	P_{OUT} = P_{OUT_MAX}		460		mA
		$I_{\_TOT\_MAX\_B2,3,25}$			515		
		$I_{\_TOT\_MAX\_B1}$			500		
Adjacent Channel Leakage power Ratio	EUTRA	EUTRA_ACLR1	P_{OUT} = P_{OUT_MAX}		–38	–36	dBc
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–33	
		EUTRA_ACLR1_CA	P_{OUT} = P_{OUT_MAX}, Modulation = QPSK/40 MHz/200 RB		–37		
	UTRA1	UTRA_ACLR1	P_{OUT} = P_{OUT_MAX}		–40	–37	
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–36	
	UTRA2	UTRA_ACLR2	P_{OUT} = P_{OUT_MAX}		–43	–41	
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–39	
Modulation Accuracy		EVM	V_{BATT} = 3.0 V to 4.8 V, Load = 50 ohms, T_{CASE} = T_{RANGE}		2.5	5.0	%
Harmonics	Second	$2f_{0\_B1,2}$	$P_{OUT} \le P_{OUT\_MAX}$			–20	dBm
		$2f_{0\_B3,4}$				–12	
	Third	$3f_{0\_B1,2}$				–15	
		$3f_{0\_B3,4}$				–12	
	Fourth and higher	$4f_0$				–20	
Noise Power in Rx Band with LTE[2]							dBm/Hz
B1 f_{TX} = 1920–1980 MHz		P_{NOISE_DPX}	f_{RX} = f_{TX} +190 MHz		–133.0		
B2 f_{TX} = 1850–1910 MHz			f_{RX} = f_{TX} +80 MHz		–131.5		
B25 f_{TX} = 1850–1915 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		
GPS Rx		P_{NOISE_GPS}	f_{RX} = 1574 MHz–1577 MHz		–133.0		
BT, WLAN		P_{NOISE_BT}	f_{RX} = 2400 MHz–2483.5 MHz		–141.0		
WLAN		P_{NOISE_5GHz}	f_{RX} = 4900 MHz–5800 MHz		–155.0		
Input Voltage Standing Wave Ratio		$VSWR_{IN}$	$P_{OUT} \le P_{OUT\_MAX}$		1.3:1		
Stability		S	Load VSWR = 6:1, all phase angles, $P_{OUT} \le P_{OUT\_MAX}$, V_{BATT} = 3.0 V to 4.8 V, T_{CASE} = T_{RANGE}	All spurious below –36 dBm			
Ruggedness		Ru	Load VSWR = 10:1, all phase angles, $P_{OUT} \le P_{OUT\_MAX}$, constant forward power, closed loop operation, V_{BATT} = 4.8 V, V_{CC} = 4.6 V, T_{CASE} = +25 °C	No module damage or permanent degradation			

[1] *$I_{\_TOT} = I_{BATT} + (I_{CC1} + I_{CC2})(V_{CC}/V_{BATT})(1/DC\_DC\_EFF)$. V_{CC} ~3.3 V. DC_DC_EFF ~ 96%.*

[2] *QPSK/10 MHz/1RB; Harmonically-related spurious excluded.*

Table 12-1. SKY77638-11 Electrical Specifications – Transmit LTE Low Band

Unless otherwise specified: V_{BATT} = 3.8 V; T_{CASE} = +25 °C; LTE Signal = QPSK/10 MHz/12RB for MPR = 0 and QPSK/20 MHz/100 RB for MPR = 1.

Parameter		Symbol	Conditions	Min	Typ	Max	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 26			814		849	
	Band 28			703		748	
Maximum Output Power	Bands 5,8,20,26	P_{OUT_MAX}		27.5			dBm
		$P_{OUT\_MAX\_RANGE}$	V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}	26.0			
	Bands 12,13,17, 28	P_{OUT_MAX}		28.0			
		$P_{OUT\_MAX\_RANGE}$	V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}	26.5			
Power Gain	Bands 12,13,17,28	G_{P_NTC}	P_{OUT} = P_{OUT_MAX}	27.3		32.0	dB
		G_{P_RANGE}	P_{OUT} = P_{OUT_MAX}, T_{CASE} = T_{RANGE}	26.5		33.5	
	Bands 5,8,20,26	G_{P_NTC}	P_{OUT} = P_{OUT_MAX}	28.0		33.0	
		G_{P_RANGE}	P_{OUT} = P_{OUT_MAX}, T_{CASE} = T_{RANGE}	27.0		33.5	
		G_{P_LOW}	P_{OUT} = 3 dBm, V_{CC} = 0.6 V			22.0	
Power Added Efficiency	Bands 12,17,28	PAE	P_{OUT} = P_{OUT_MAX}		35		%
	Bands 5,8,13, 20,26				36		
Total Supply Current[1]		$I_{TOT\_MAX\_B12,17,28}$	P_{OUT} = P_{OUT_MAX}		500		mA
		$I_{TOT\_MAX\_B13}$			460		
		$I_{TOT\_MAX\_B5,8,20,26}$			430		
Adjacent Channel Leakage power Ratio	EUTRA	$EUTRA_{ACLR1}$	P_{OUT} = P_{OUT_MAX}		–39	–36	dBc
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–33	
	UTRA1	$UTRA_{ACLR1}$	P_{OUT} = P_{OUT_MAX}		–40	–37	
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–36	
	UTRA2	$UTRA_{ACLR2}$	P_{OUT} = P_{OUT_MAX}		–43	–41	
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–39	

Table 12-2. SKY77638-11 Electrical Specifications – Transmit LTE Low Band

Unless otherwise specified: V_{BATT} = 3.8 V; T_{CASE} = +25 °C; LTE Signal = QPSK/10 MHz/12RB for MPR = 0 and QPSK/20 MHz/100 RB for MPR = 1.

Parameter		Symbol	Conditions	Min	Typ	Max	Units
Modulation Accuracy		EVM	V_{BATT} = 3.0 V to 4.8 V, Load = 50 ohms, T_{CASE} = T_{RANGE}		2.5	5.0	%
Harmonics	Second Bands 12,17,28	$2f_0$	$P_{OUT} \le P_{OUT\_MAX}$			–5	dBm
	Second Bands 5,8,13,20,26					–14	
	Third	$3f_0$				–12	
	Fourth and higher	$4f_0$				–20	
Noise Power in Rx Band with LTE[2]							dBm/Hz
B26 f_{TX} = 814–849 MHz		P_{NOISE_DPX}	$f_{RX} = f_{TX}$ + 45 MHz		–133.5		
B5 f_{TX} = 824–849 MHz			$f_{RX} = f_{TX}$ + 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		–130.0		
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		
GPS Rx		P_{NOISE_GPS}	f_{RX} = 1574 MHz–1577 MHz		–155.0		
BT, WLAN		P_{NOISE_BT}	f_{RX} = 2400 MHz–2483.5 MHz		–155.0		
WLAN		P_{NOISE_5GHz}	f_{RX} = 4900 MHz–5800 MHz		–155.0		
Input Voltage Standing Wave Ratio		$VSWR_{IN}$	$P_{OUT} \le P_{OUT\_MAX}$		1.6:1		
Stability		S	Load VSWR = 6:1, all phase angles, $P_{OUT} \le P_{OUT\_MAX}$, V_{BATT} = 3.0 V to 4.8 V, T_{CASE} = T_{RANGE}	All spurious below –36 dBm			
Ruggedness		Ru	Load VSWR = 10:1, all phase angles, $P_{OUT} \le P_{OUT\_MAX}$, constant forward power, closed loop operation, V_{BATT} = 4.8 V, V_{CC} = 4.6 V, T_{CASE} = +25 °C	No module damage or permanent degradation			

[1] $I\_TOT = IBATT + (ICC1 + ICC2)(VCC/VBATT)(1/DC\_DC\_EFF)$. VCC ~ 3.2 V. DC_DC_EFF ~ 96%.

[2] QPSK/10 MHz/1RB; Harmonically-related spurious excluded.

Table 13. SKY77638-11 Electrical Specifications – TD-SCDMA Bands 34, 39

Unless otherwise specified: V_{BATT} = 3.8 V; T_{CASE}= +25 °C; Voice Modulation

Parameter		Symbol	Conditions	Min	Typ	Max	Units
Frequency	Band 34	f		2010		2025	MHz
	Band 39			1880		1920	
Maximum Output Power		P_{OUT_MAX}		28.5			dBm
		$P_{OUT\_MAX\_RANGE}$	V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}	27.0			
Power Gain		G_{P_NTC}	P_{OUT} = P_{OUT_MAX}	28.0		32.0	dB
		G_{P_RANGE}	P_{OUT} = P_{OUT_MAX}, T_{CASE} = T_{RANGE}	27.0		33.0	
		G_{P_LOW}	P_{OUT} = 3 dBm, V_{CC} = 0.55 V			20.0	dB
Power Added Efficiency		PAE_{B39}	P_{OUT} = P_{OUT_MAX}		39.0		%
		PAE_{B34}			36.0		
Total Supply Current[1]		$I_{TOT\_MAX\_B39}$	P_{OUT} = P_{OUT_MAX}		500		mA
		$I_{TOT\_MAX\_B34}$			535		
Adjacent Channel Leakage Power Ratio	1.6 MHz offset	ACLR1	P_{OUT} = P_{OUT_MAX}		–40	–38	dBc
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–36	
	3.2 MHz offset	ACLR2	P_{OUT} = P_{OUT_MAX}		–52	–48	
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–46	
Modulation Accuracy		EVM	V_{BATT} = 3.0 V to 4.8 V, Load = 50 ohms, T_{CASE} = T_{RANGE}		2.5	5.0	%
Harmonics	Second	$2f_0$	P_{OUT} ≤ P_{OUT_MAX}			–20	dBm
	Third	$3f_0$				–13	
	Fourth and higher	$4f_0$				–20	
Noise Power in Coexistence Bands[2]							dBm/Hz
	GPS Rx	P_{NOISE_GPS}	f_{RX} = 1574 MHz–1577 MHz		–133		
	BT, WLAN	P_{NOISE_BT}	f_{RX} = 2400 MHz–2483.5 MHz		–141		
	WLAN	P_{NOISE_5GHz}	f_{RX} = 4900 MHz–5800 MHz		–155		
Input Voltage Standing Wave Ratio		$VSWR_{IN}$	P_{OUT} ≤ P_{OUT_MAX}		1.3:1		
Stability		S	Load VSWR = 6:1, all phase angles, P_{OUT} ≤ P_{OUT_MAX}, V_{BATT} = 3.0 V to 4.8 V, T_{CASE} = T_{RANGE}	All spurious below –36 dBm			
Ruggedness		Ru	Load VSWR = 10:1, all phase angles, P_{OUT} ≤ P_{OUT_MAX}, constant forward power, closed loop operation, V_{BATT} = 4.8 V, V_{CC} = 4.6 V, T_{CASE} = +25 °C	No module damage or permanent degradation			

[1] *I_{TOT} = I_{BATT} + (I_{CC1} + I_{CC2})(V_{CC}/V_{BATT})(1/DC_DC_EFF). V_{CC} ~ 3.0 V. DC_DC_EFF ~ 96%.*

[2] *Harmonically-related spurious excluded.*

Table 14. SKY77638-11 Electrical Specifications – Transmit TDD LTE Band 39

Unless otherwise specified: V_{BATT} = 3.8 V; T_{CASE} = +25 °C; LTE Signal = QPSK/10 MHz/12RB for MPR = 0 and QPSK/20 MHz/100RB for MPR = 1.

Parameter		Symbol	Conditions	Min	Typ	Max	Units
Frequency	Band 39	f		1880		1920	MHz
Maximum Output Power		P_{OUT_MAX}		27.5			dBm
		$P_{OUT\_MAX\_RANGE}$	V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}	26.0			
Power Gain		G_{P_NTC}	P_{OUT} = P_{OUT_MAX}	28.0		32.0	dB
		G_{P_RANGE}	P_{OUT} = P_{OUT_MAX}, T_{CASE} = T_{RANGE}	27.0		33.0	
		G_{P_LOW}	P_{OUT} = 3 dBm, V_{CC} = 0.55 V			20.0	
Power Added Efficiency		PAE	P_{OUT} = P_{OUT_MAX}		33		%
Total Supply Current[1]		I_{TOT_MAX}	P_{OUT} = P_{OUT_MAX}		465		mA
Adjacent Channel Leakage power Ratio	EUTRA	EUTRA_ACLR1	P_{OUT} = P_{OUT_MAX}		–39	–36	dBc
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–33	
		EUTRA_ACLR1_CA	P_{OUT} = P_{OUT_MAX}, Modulation = QPSK/35 MHz/175 RB		–37		
	UTRA1	UTRA_ACLR1	P_{OUT} = P_{OUT_MAX}		–40	–37	
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–36	
	UTRA2	UTRA_ACLR2	P_{OUT} = P_{OUT_MAX}		–43	–41	
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–39	
Modulation Accuracy		EVM	V_{BATT} = 3.0 V to 4.8 V, Load = 50 ohms, T_{CASE} = T_{RANGE}		2.5	5.0	%
Harmonics	Second	$2f_0$	P_{OUT} = P_{OUT_MAX}			–20	dBm
	Third	$3f_0$				–15	
	Fourth and higher	$4f_0$				–20	
Noise Power in Coexistence Bands[2]							dBm/Hz
	GPS Rx	P_{NOISE_GPS}	f_{RX} = 1574 MHz–1577 MHz		–133		
	BT, WLAN	P_{NOISE_BT}	f_{RX} = 2400 MHz–2483.5 MHz		–141		
	WLAN	P_{NOISE_5GHz}	f_{RX} = 4900 MHz–5800 MHz		–155		
Input Voltage Standing Wave Ratio		$VSWR_{IN}$	$P_{OUT} \leq P_{OUT\_MAX}$		1.3:1		
Stability		S	Load VSWR = 6:1, all phase angles, $P_{OUT} \leq P_{OUT\_MAX}$, V_{BATT} = 3.0 V to 4.8 V, T_{CASE} = T_{RANGE}	All spurious below –36 dBm			
Ruggedness		Ru	Load VSWR = 10:1, all phase angles, $P_{OUT} \leq P_{OUT\_MAX}$, constant forward power, closed loop operation, V_{BATT} = 4.8 V, V_{CC} = 4.6 V, T_{CASE} = +25 °C	No module damage or permanent degradation			

[1] *I_{TOT} = I_{BATT} + (I_{CC1} + I_{CC2})(V_{CC}/V_{BATT})(1/DC_DC_EFF). VCC ~ 3.4 V. DC_DC_EFF ~ 96%.*

[2] *QPSK/10 MHz/1RB; Harmonically-related spurious excluded.*

Table 15. SKY77638-11 Electrical Specifications – Transmit TDD-LTE Band 34

Unless otherwise specified: VBATT = 3.8 V; TCASE = +25 °C; LTE Signal = QPSK/10 MHz/12RB for MPR = 0, QPSK/15 MHz/75RB for MPR = 1.

Parameter		Symbol	Conditions	Min	Typ	Max	Units
Frequency	Band 39	f		2010		2025	MHz
Maximum Output Power		P_{OUT_MAX}		27.5			dBm
		$P_{OUT\_MAX\_RANGE}$	V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}	26.0			
Power Gain		G_{P_NTC}	P_{OUT} = P_{OUT_MAX}	28.0		31.5	dB
		G_{P_RANGE}	P_{OUT} = P_{OUT_MAX}, T_{CASE} = T_{RANGE}	27.0		33.0	
		G_{P_LOW}	P_{OUT} = 3 dBm, V_{CC} = 0.6 V			22.0	
Power Added Efficiency		PAE	P_{OUT} = P_{OUT_MAX}		31		%
Total Supply Current[1]		$I_{\_TOT\_MAX}$	P_{OUT} = P_{OUT_MAX}		505		mA
Adjacent Channel Leakage power Ratio	EUTRA	$EUTRA_{\_ACLR1}$	P_{OUT} = P_{OUT_MAX}		–37.0	–34.5	dBc
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–33.0	
	UTRA1	$UTRA_{\_ACLR1}$	P_{OUT} = P_{OUT_MAX}		–40.0	–37.0	
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–36.0	
	UTRA2	$UTRA_{\_ACLR2}$	P_{OUT} = P_{OUT_MAX}		–43.0	–41.0	
			P_{OUT} = $P_{OUT\_MAX\_RANGE}$, V_{BATT} = V_{CC} = 3.0 V, T_{CASE} = T_{RANGE}			–39.0	
Modulation Accuracy		EVM	V_{BATT} = 3.0 to 4.8 V, Load = 50 ohms, T_{CASE} = T_{RANGE}		2.5	5.0	%
Harmonics	Second	$2fo$	P_{OUT} = P_{OUT_MAX}			–20	dBm
	Third	$3fo$				–12	
	Fourth and higher	$4fo$				–20	
Noise Power in Coexistence Bands[2]							dBm/Hz
	GPS Rx	P_{NOISE_GPS}	f_{RX} = 1574 MHz–1577 MHz		–133		
	BT, WLAN	P_{NOISE_BT}	f_{RX} = 2400 MHz–2483.5 MHz		–141		
	WLAN	P_{NOISE_5GHz}	f_{RX} = 4900 MHz–5800 MHz		–155		
Input Voltage Standing Wave Ratio		$VSWR_{\_IN}$	P_{OUT} ≤ P_{OUT_MAX}		1.3:1		
Stability		S	Load VSWR = 6:1, all phase angles, P_{OUT} ≤ P_{OUT_MAX}, V_{BATT} = 3.0 V to 4.6 V, T_{CASE} = T_{RANGE}	All spurious below –36 dBm			
Ruggedness		Ru	Load VSWR = 10:1, all phase angles, P_{OUT} ≤ P_{OUT_MAX}, V_{BATT} = 4.5 V, V_{CC} = 4.5 V, T_{CASE} = +25 °C	No module damage or permanent degradation			

[1] *$I_{\_TOT}$ = IBATT + (I_{CC1} + I_{CC2})(V_{CC}/V_{BATT})(1/DC_DC_EFF). VCC ~ 3.4 V. DC_DC_EFF ~ 96%.*

[2] *Measured with 10 MHz/1RB LTE waveform, harmonically-related spurious excluded.*

Table 16. SKY77638-11 Electrical Specifications – Transmit CDMA2000 Low Band

Unless otherwise specified: VBATT = 3.8 V; TCASE = +25 °C; 1x RC1

Parameter		Symbol	Conditions	Min	Typ	Max	Units
Frequency	Band BC0	f		815		849	MHz
	Band BC10			806		901	
Maximum Output Power		POUT_MAX		28.0			dBm
		POUT_MAX_ RANGE	VBATT = VCC = 3.0 V, TCASE = TRANGE	26.5			
Power Gain		GP_NTC	POUT = POUT_MAX	28.0		32.5	dB
		GP_ RANGE	POUT = POUT_MAX, TCASE = TRANGE,	26.5		33.5	
		GP_LOW	POUT = 3 dBm, VCC = 0.6 V			20.0	dB
Power Added Efficiency		PAE	POUT = POUT_MAX		36		%
Total Supply Current[1]		I_TOT_MAX	POUT = POUT_MAX		470		mA
Adjacent Channel Leakage power Ratio	885 kHz offset	ACLR1	POUT = POUT_MAX		–50	–47	dBc
			POUT = POUT_MAX_ RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			–45	
	1.98 MHz offset	ACLR2	POUT = POUT_MAX		–60	–58	
			POUT = POUT_MAX_ RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			–57	
Modulation Accuracy		EVM	VBATT = 3.0 V to 4.8 V, Load = 50 ohms, TCASE = TRANGE		2.5	5.0	%
Harmonics	Second	$2fo$	POUT ≤ POUT_MAX, MBW = 1 MHz			–12	dBm
	Third	$3fo$				–9	
	Fourth and higher	$4fo$				–20	
Noise Power in Rx Band[2]							dBm/Hz
BC0 f_{TX} = 815 MHz –849 MHz		PNOISE_DPX	$f_{RX} = f_{TX}$ +45 MHz		–133		
BC10 f_{TX} = 806 MHz –901 MHz			$f_{RX} = f_{TX}$ +45 MHz		–133		
GPS Rx		PNOISE_GPS	f_{RX} = 1574 MHz–1577 MHz		–155		
BT, WLAN		PNOISE_BT	f_{RX} = 2400 MHz–2483.5 MHz		–155		
WLAN		PNOISE_5GHz	f_{RX} = 4900 MHz–5800 MHz		–155		
Input Voltage Standing Wave Ratio		VSWR_IN	POUT ≤ POUT_MAX		1.6:1		
Stability		S	Load VSWR = 6:1, all phase angles, POUT ≤ POUT_MAX, VBATT = 3.0 V to 4.8 V, TCASE = TRANGE	All spurious below –36 dBm			
Ruggedness		Ru	Load VSWR = 10:1, all phase angles, POUT ≤ POUT_MAX, constant forward power, closed loop operation, VBATT = 4.8 V, VCC = 4.6 V, TCASE = +25 °C	No module damage or permanent degradation			

[1] I_TOT = IBATT + (ICC1 + ICC2)(VCC/VBATT)(1/DC_DC_EFF). VCC = 3.4 V. DC_DC_EFF ~ 96%.

[3] Harmonically-related spurious excluded.

Table 17. SKY77638-11 Electrical Specifications – Transmit CDMA2000 Mid-Band

Unless otherwise specified: VBATT = 3.8 V; TCASE = +25 °C; 1x RC1

Parameter		Symbol	Conditions	Min	Typ	Max	Units
Frequency	Band BC15	f		1710		1755	MHz
	Band BC4			1750		1780	
	Band BC1			1850		1910	
	Band BC6			1920		1980	
Maximum Output Power	Band BC6	POUT_MAX		28.0			dBm
		POUT_MAX_ RANGE	VBATT = VCC = 3.0 V, TCASE = TRANGE	26.5			
	Band BC15	POUT_MAX		28.5			
		POUT_MAX_ RANGE	VBATT = VCC = 3.0 V, TCASE = TRANGE	27.0			
	Bands BC1, BC4	POUT_MAX		28.75			
		POUT_MAX_ RANGE	VBATT = VCC = 3.0 V, TCASE = TRANGE	27.25			
Power Gain	BC1, BC6	GP_NTC	POUT = POUT_MAX	28.0		31.5	dB
		GP_ RANGE	POUT = POUT_MAX_ETC, TCASE = TRANGE	26.5		32.5	
	BC4, BC15	GP_NTC	POUT = POUT_MAX	28.0		31.5	
		GP_RANGE	POUT = POUT_MAX_ETC, TCASE = TRANGE	26.5		32.5	
		GP_LOW	POUT = 3 dBm, VCC = 0.55 V			20.0	
Power Added Efficiency		PAE	POUT = POUT_MAX		37		%
Total Supply Current[1]		I_TOT_MAX_BC15	POUT = POUT_MAX		550		mA
		I_TOT_MAX_BC6			540		
		I_TOT_MAX_BC1_BC4			560		
Adjacent Channel Leakage power Ratio	885 kHz offset	ACLR1	POUT = POUT_MAX		–50	–47	dBc
			POUT = POUT_MAX_ RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			–45	
	1.98 MHz offset	ACLR2	POUT = POUT_MAX		–60	–56	
			POUT = POUT_MAX_ RANGE, VBATT = VCC = 3.0 V, TCASE = TRANGE			–55	
Modulation Accuracy		EVM	VBATT = 3.0 V to 4.8 V, Load = 50 ohms, TCASE = TRANGE		2.5	5.0	%
Harmonics	Second	$2fo_{BC1,6}$	POUT ≤ POUT_MAX, MBW = 1 MHz			–15	dBm
		$2fo_{BC4,15}$				–12	
	Third	$3fo_{BC1,6}$				–12	
		$3fo_{BC4,15}$				–10	
	Fourth and higher	$4fo$				–20	
Noise Power in Rx Band[2]							dBm/Hz
BC15 fTx = 1710 MHz–1755 MHz		PNOISE_DPX	$f_{RX} = f_{TX}$ +400 MHz		–137.0		
BC4 fTx = 1750 MHz–1780 MHz			$f_{RX} = f_{TX}$ +90 MHz		–133.0		
BC1 fTx = 1850 MHz–1910 MHz			$f_{RX} = f_{TX}$ +80 MHz		–133.0		
BC6 fTx = 1920 MHz–1980 MHz			$f_{RX} = f_{TX}$ +190 MHz		–133.5		
	GPS Rx	PNOISE_GPS	f_{RX} = 1574 MHz–1577 MHz		–133.0		
	BT, WLAN	PNOISE_BT	f_{RX} = 2400 MHz–2483.5 MHz		–141.0		
	WLAN	PNOISE_5GHz	f_{RX} = 4900 MHz–5800 MHz		–155.0		
Input Voltage Standing Wave Ratio		VSWR_IN	POUT ≤ POUT_MAX		1.3:1		
Stability		S	Load VSWR = 6:1, all phase angles, POUT ≤ POUT_MAX, VBATT = 3.0 V to 4.8 V, TCASE = TRANGE	All spurious below –36 dBm			
Ruggedness		Ru	Load VSWR = 10:1, all phase angles, POUT ≤ POUT_MAX, constant forward power, closed loop operation, VBATT = 4.8 V, VCC = 4.6 V, TCASE = +25 °C	No module damage or permanent degradation			

[1] I_TOT = IBATT + (ICC1 + ICC2)(VCC/VBATT)(1/DC_DC_EFF). VCC = 3.4 V DC_DC_EFF ~ 96%.

[2] Harmonically-related spurious excluded.

Table 18. SKY77638-11 Electrical Specification – Band Select Switch

Parameter		Symbol	Conditions	Min	Typ	Max	Unit
Frequency Range		ƒ_LB		699		915	MHz
		ƒ_MB		1710		1980	
		ƒ_HB		2300		2690	
Insertion Loss		IL	HB1 to HBRx2		0.5		dB
			HB2 to HBRx2		0.5		
			HB3 to HBRx1		0.5		
Voltage Standing Wave Ratio		SWR	Any RF port tested in Rx mode			1.8:1	
Isolation	Tx Mode	ISO_Tx	Tx output at HB1, Isolation to HB3, HBRx1, HBRx2		35		dB
			Tx output at HB1, Isolation to HB2		33		
			Tx output at HB2, Isolation to HB3, HBRx1, HBRx2		35		
			Tx output at HB2, Isolation to HB1		31		
			Tx output at HB3, Isolation to HB1, HB2, HBRx1, HBRx2		34		
			Tx output at any LB output, Isolation to any other LB output		35		
			Tx output at any MB output, Isolation to any other MB output		30		
	Rx Mode	ISO_Rx	Rx Path: HB1 to HBRx2, Isolation to HB2, HB3, HBRx1		25		
			Rx Path: HB2 to HBRx2, Isolation to HB1, HB3, HBRx1		25		
			Rx Path: HB3 to HBRx1, Isolation to HB1, HB2, HBRx2		25		

Table 19. SKY77638-11 LTE Maximum Power Reduction (MPR)

Modulation	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	5 MHz + 10 MHz	10 MHz + 10 MHz	5 MHz + 20 MHz	10 MHz + 20 MHz	15 MHz + 15 MHz	15 MHz + 20 MHz	20 MHz + 20 MHz	MPR (dB)
QPSK	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	8 < RB ≤ 25	12 < RB ≤ 50	8 < RB ≤ 25	12 < RB ≤ 50	16 < RB ≤ 75	16 < RB ≤ 75	18 < RB ≤ 100	≤ 1
16QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 8	≤ 12	≤ 8	≤ 12	≤ 16	≤ 16	≤ 18	≤ 1
QPSK	N/A	N/A	N/A	N/A	N/A	N/A	> 25	> 50	> 25	> 50	> 75	> 75	> 100	≤ 2
16QAM	> 5	> 4	> 8	> 12	> 16	> 18	8 < RB ≤ 25	12 < RB ≤ 50	8 < RB ≤ 25	12 < RB ≤ 50	16 < RB ≤ 75	16 < RB ≤ 75	18 < RB ≤ 100	≤ 2
64QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 8 and one CC	≤ 12 and one CC	≤ 8 and one CC	≤ 12 and one CC	≤ 16 and one CC	≤16 and one CC	≤ 18 and one CC	≤ 2
16QAM	N/A	N/A	N/A	N/A	N/A	N/A	>25	> 50	> 25	> 50	> 75	> 75	> 100	≤ 3
64QAM	> 5	> 4	> 8	> 12	> 16	> 18	> 8 or two CC's	> 12 or two CC's	> 8 or two CC's	> 12 or two CC's	> 16 or two CC's	> 16 or two CC's	> 18 or two CC's	≤ 3

Table 20. SKY77638-11 Power vs. Modulation

Band	WCDMA				
		3GGP HS Test Cases			
	R99	HSDPA ST 1, 2 HSUPA ST 1, 5	HSDPA ST 3, 4	HSUPA ST 3	HSUPA ST 2, 4
1	28.5	27.5	27.0	26.5	25.5
2, 25	29.0	28.0	27.5	27.0	26.0
3	29.0	28.0	27.5	27.0	26.0
4	28.5	27.5	27.0	26.5	25.5
5, 26	28.5	27.5	27.0	26.5	25.5
8	28.5	27.5	27.0	26.5	25.5

Band	LTE							
	3GGP Test Cases: QPSK			3GGP Test Cases: 16QAM			3GGP Test Cases: 64QAM	
	5 MHz 8RB 10 MHz 12RB 20 MHz 18RB	5 MHz 25RB 10 MHz 50RB 15 MHz 75RB 20 MHz 100RB	35 MHz 175RB 40 MHz 200RB	5 MHz 8RB 10 MHz 12RB 20 MHz 18RB	5 MHz 25RB 10 MHz 50RB 15 MHz 75RB 20 MHz 100RB	35 MHz 175RB 40 MHz 200RB	5 MHz 8RB 10 MHz 12RB 20 MHz 18RB	5 MHz 25RB 10 MHz 50RB 15 MHz 75RB 20 MHz 100RB 35 MHz 175RB 40 MHz 200RB
1	27.5	27.0	26.0	26.5	25.5	24.5	25.5	24.5
2, 25	28.0	27.0	26.0	27.0	26.0	25.0	26.0	25.0
3	28.0	27.0	26.0	27.0	26.0	25.0	26.0	25.0
4	27.5	26.5	25.5	26.5	25.5	24.5	25.5	24.5
5, 26	27.5	26.5	N/A	26.5	25.5	N/A	25.5	24.5
8	27.5	26.5	N/A	26.5	25.5	N/A	25.5	24.5
12	28.0	27.0	N/A	27.0	26.0	N/A	26.0	25.0
13	28.0	27.0	N/A	27.0	26.0	N/A	26.0	25.0
17	28.0	27.0	N/A	27.0	26.0	N/A	26.0	25.0
20	27.5	26.5	N/A	26.5	25.5	N/A	25.5	24.5
28	28.0	27.0	N/A	27.0	26.0	N/A	26.0	25.0
34	27.5	26.5	N/A	26.5	25.5	N/A	25.5	24.5
39	27.5	26.5	25.5	26.5	25.5	24.5	25.5	24.5
38	28.5	27.5	26.5	27.5	26.5	25.5	26.5	25.5
40	28.5	27.5	26.5	27.5	26.5	25.5	26.5	25.5
41	28.5	27.5	26.5	27.5	26.5	25.5	26.5	25.5
7	28.5	27.5	26.5	27.5	26.5	25.5	26.5	25.5
30	28.5	27.5	N/A	27.5	26.5	N/A	26.5	25.5
AXGP	28.5	27.5	N/A	27.5	26.5	N/A	26.5	25.5

MIPI RFFE Information

Table 21-1. MIPI RFFE Standard Register Map

Bit Fields	Description	Trigger Support	R/W	Default	Notes
Register 0, Address 0x00 (PA_CTRL0)					
[7]	Trigger Select	Trigger0	R/W	0	0 = Trigger 0,1,2 or' d together 1 = Trigger 0,1,2 fire independently
[6:3]	PA Band Select Control Mode		R/W	0000	Control Mode 0000 = PA's Disabled 0001 = LB1_TX 0010 = LB2_TX 0011 = LB3_TX 0100 = LB4_TX 0101 = LB5_TX 0110 = MB1_TX 0111 = MB2_TX 1000 = MB3_TX 1001 = MB4_TX 1010 = Reserved 1011 = HB1_TX 1100 = HB2_TX 1101 = HB3_TX 1110 = Reserved 1111 = PA's Disabled (High switch isolation)
[2]	PA Enable		R/W	0	PA Enable 0 = PA Off 1 = PA On
[1]	PA Mode		R/W	0	PA Mode 0 = HPM 1 = LPM
[0]	LB Input Switch		R/W	0	LB Input 0 = RFIN_L (default for MB/HB operation) 1 = RFIN_VL
Register 1, Address 0x01 (BIAS_CTRL1)					
[7:0]	Primary PA Bias	Trigger0	R/W	00000000	See Lookup Table for appropriate bias words for each band and mode.
Register 2, Address 0x02 (HB_Switch_RX_CTRL)					
[7:4]	Spare	Trigger0	R/W	0000	Spare
[3:0]	HB_Switch_RX_CTRL		R/W	0000	Control Mode 0000 = Switch Off (Standby) 0001 = HB1 → HBRX2 0010 = HB2 → HBRX2 0011 = HB3 → HBRX1 Other States = High Isolation
Register 3, Address 0x03 (BIAS_CTRL3)					
[7]	Bias Mode	Trigger0	R/W	0	0 = limited bias 1 = standard bias
[6:4]	Temperature Compensation		R/W	000	Bias Temperature Compensation
[3:0]	Secondary PA Bias		R/W	0000	Secondary PA Bias Adjustment
Register 4, Address 0x04 (Spare)					
[7:0]	Spare	Trigger0	R/W	00000000	Spare

Table 21-2. MIPI RFFE Standard Register Map

Bit Fields	Description	Trigger Support	R/W	Default	Notes
Register 28, Address 0x1C (PM_TRIG)					
[7:6]	PWR_MODE[1:0]	No	R/W	10	00 = Normal Operation (ACTIVE) 01 = Default Settings (STARTUP) 10 = Low Power (LOW POWER) 11 = Reserved
[5]	TRIGGER_MASK_2			0	0 = Trigger Enable 1 = Trigger Disable
[4]	TRIGGER_MASK_1			0	0 = Trigger Enable 1 = Trigger Disable
[3]	TRIGGER_MASK_0			0	0 = Trigger Enable 1 = Trigger Disable
[2]	TRIGGER_2			0	1 = Load Trigger 2 registers
[1]	TRIGGER_1			0	1 = Load Trigger 1 registers
[0]	TRIGGER_0			0	1 = Load Trigger 0 registers
Register 29, Address 0x1D (PROD_ID)					
[7:0]	Product ID	No	R	00011100	Product ID = 0x1C
Register 30, Address 0x1E (MAN_ID)					
[7:0]	Manufacturer ID	No	R	10100101	Manufacturer ID = 0xA5
Register 31, Address 0x01F (USID)					
[7:6]	Reserved	No	R	0	
[5:4]	MANUFACTURER_ID[9:8]		R	01	
[3:0]	USID		R/W	1111	USID = 0xF
Register 32, Address 0x20 (EXT_PRODUCT_ID)					
[7:0]	EXT_PRODUCT_ID	No	R	00000100	Extended Product ID = 0x04
Register 33, Address 0x021 (REVISION_ID)					
[7:6]	MAJOR REV	No	R	00	
[5:4]	MINOR REV		R	00	
[3:0]	MISC VARIANTS		R	0000	
Register 34, Address 0x22 (GROUP_SID)					
[7:4]	GSID[3:0]	No	R/W	0000	Primary Group Slave ID
[3:0]	Reserved		R/W	0000	Reserved for secondary Group Slave ID. Set all to zero.
Register 35, Address 0x23 (SW_RST)					
[7]	SOFTWARE RESET	No	R/W	0	
[6:0]	Reserved		R	0000000	
Register 43, Address 0x2B (BUS_LOAD)					
[7:4]	Reserved	No	R/W	0000	Reserved for Future Use
[3:0]	BUS_LD			0000	
Register 44, Address 0x2C (TEST_PATTERN)					
[7:0]	TEST_PATT	No	R	11010010	A read to this register address will trigger the slave to transmit a fixed test pattern of 0xD2

Evaluation Board Description

The evaluation board is a platform for testing and interfacing design circuitry. To accommodate the interface testing of the SKY77638-11, 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. Table 22 is the Bill of Material.

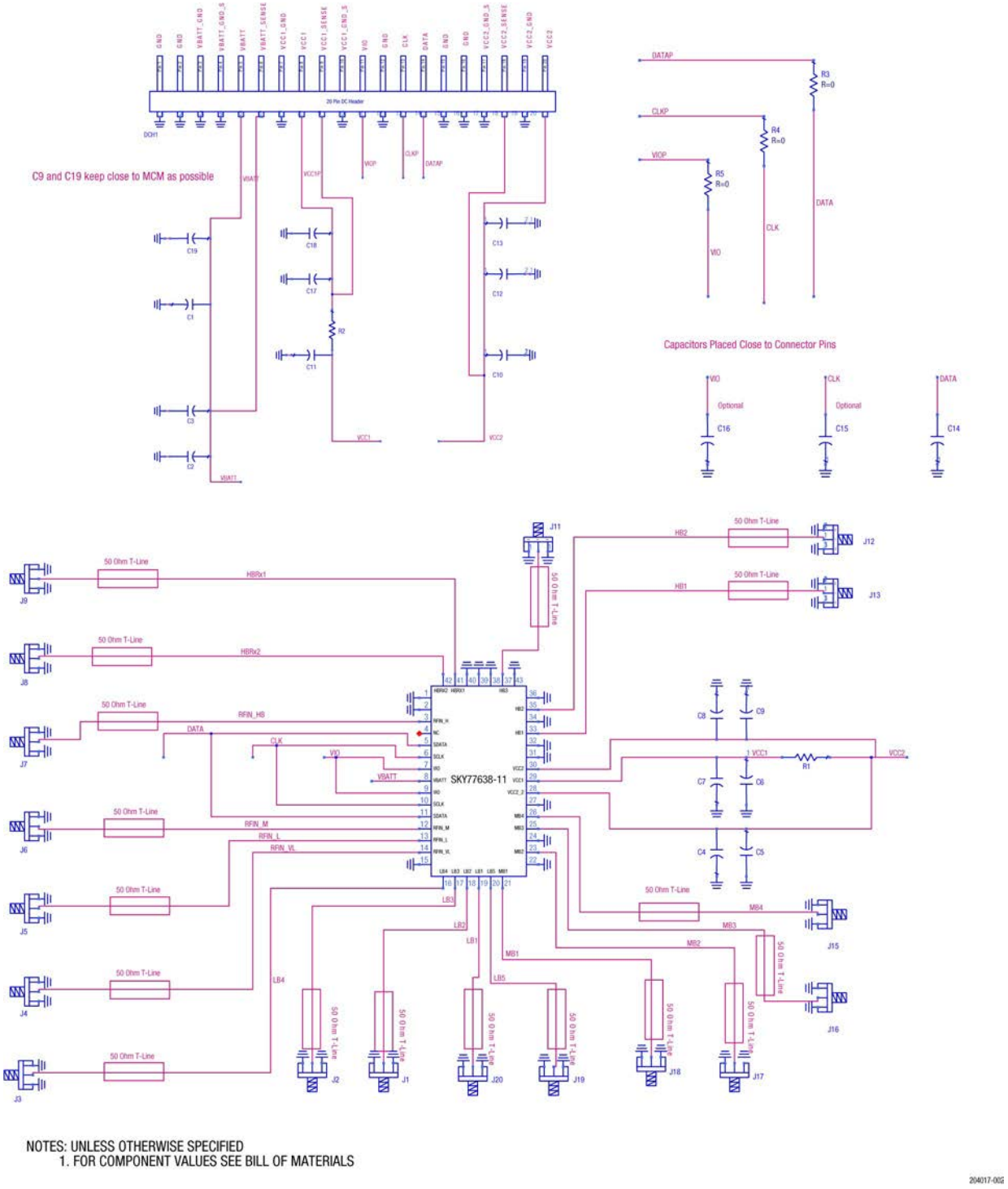


Figure 2. SKY77638-11 Evaluation Board Schematic Diagram

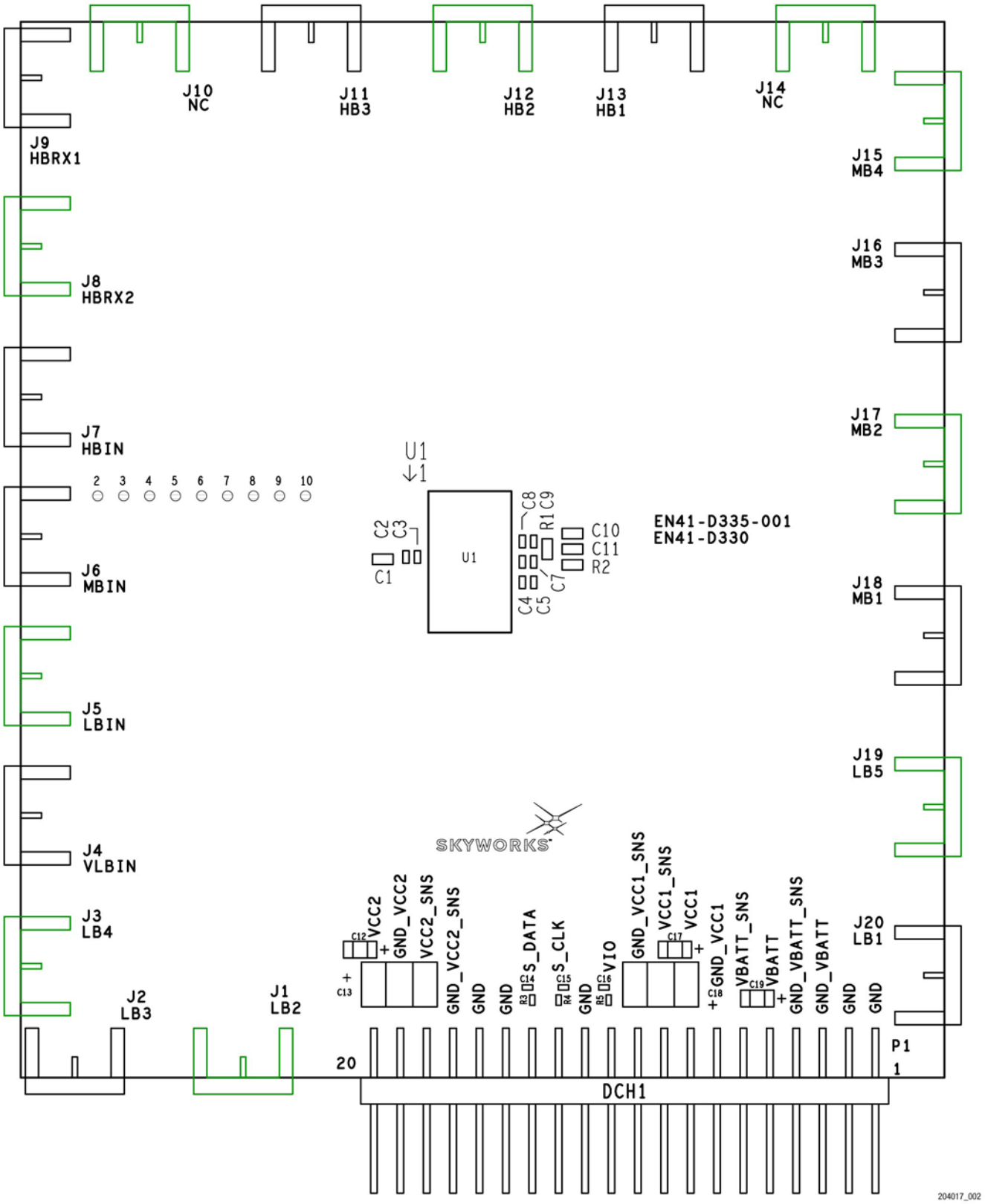


Figure 3. SKY77638-11 Evaluation Board Assembly Diagram

Table 22. SKY77638-11 Evaluation Board Bill of Material

ITEM	QTY	REFERENCE DESIGNATORS	PART DESCRIPTION
1	1	P1	CONNECTOR, 20 PINPOST LENGTH = 0.53"
2	20	J1 thru J20	CONNECTOR, SMA END LAUNCH JACK TAB CONTACT GOLD, .062
3	4	C2, C4, C6, C8	CAPACITOR, CERAMIC, 100 pF, 10%, X7R, 16 V, 0201 (RSI)
4	4	C3, C5, C7, C9	CAPACITOR, CERAMIC, 0.1 µF, 10%, X5R, 10 V, 0201 (RSI)
5	4	C12, C17, C19, C21	CAPACITOR, TANTALUM MOLDED 10 µF, 16 V, ±10%, 1206
6	3	C13, C18, C20	CAPACITOR, 220 µF, TANT, LOW ESR, CASE D, AVX
7	1	C16	CAPACITOR, CERAMIC, 270 pF, 10%, X7R, 50 V, 0402
8	4	R2, R3, R4, R5	RESISTOR, 0 OHM, JUMPER, 0.063 W, 0402
9	6	C1, C10, C11, C14, C15, R1	DO NOT PLACE (DNP)

NOTE: Highlighted items are not used in this EVB configuration.

Package Dimensions

Figure 4 is a mechanical drawing of the pad layout for the SKY77638-11, 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.

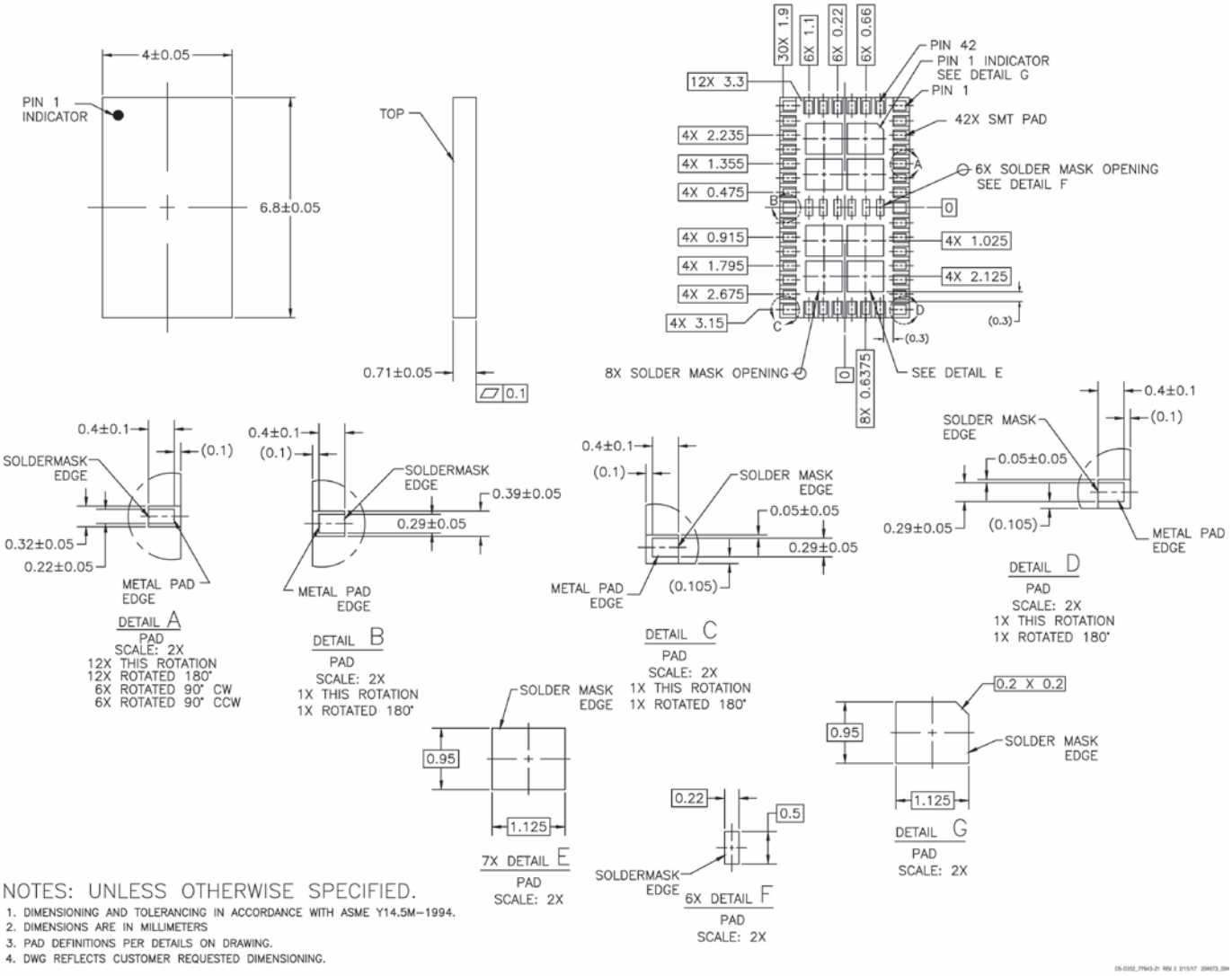


Figure 4. Dimensional Diagram for 4.0 mm x 6.8 mm x 0.71 mm, 42-Pad MCM Package – SKY77638-11

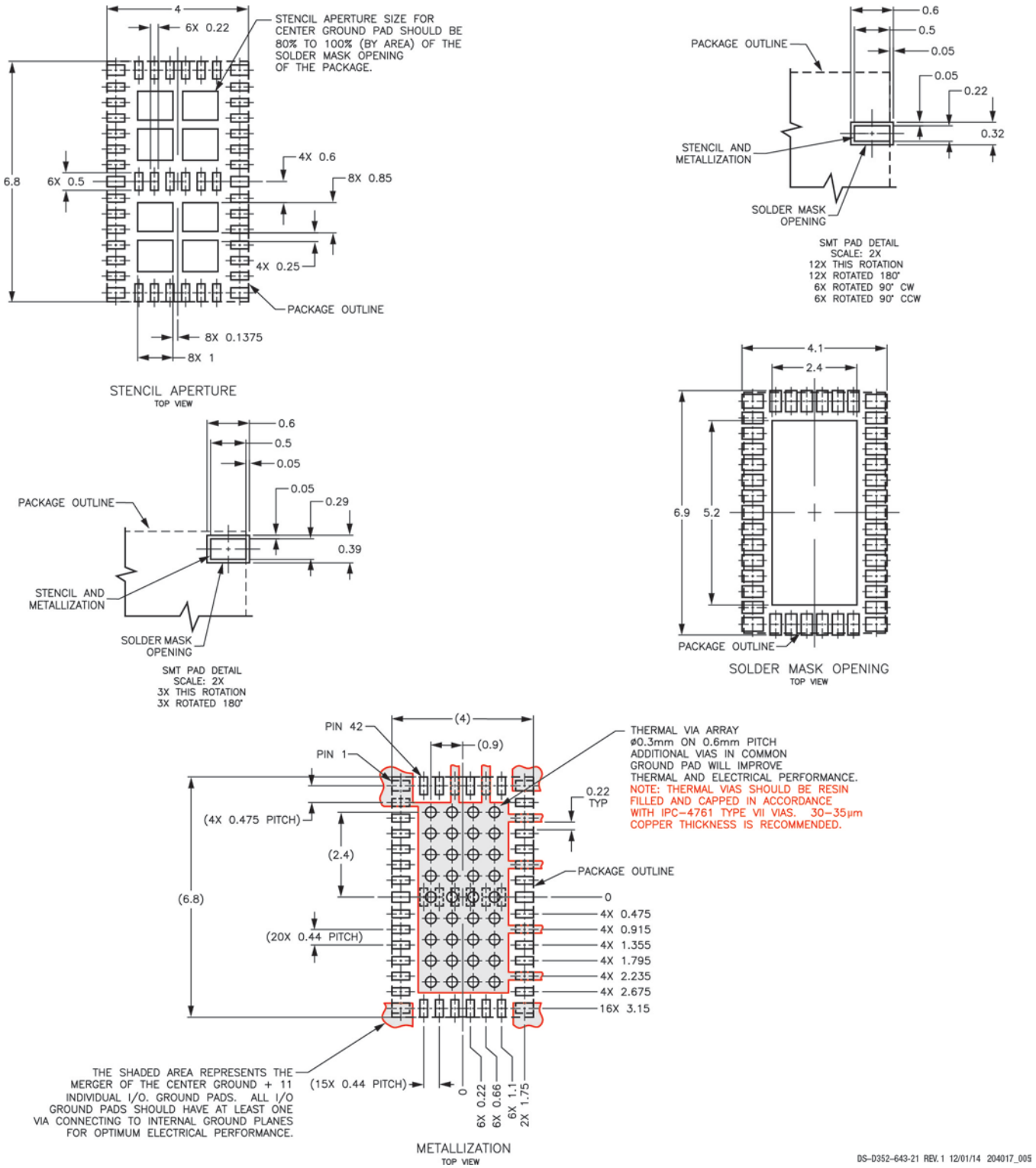
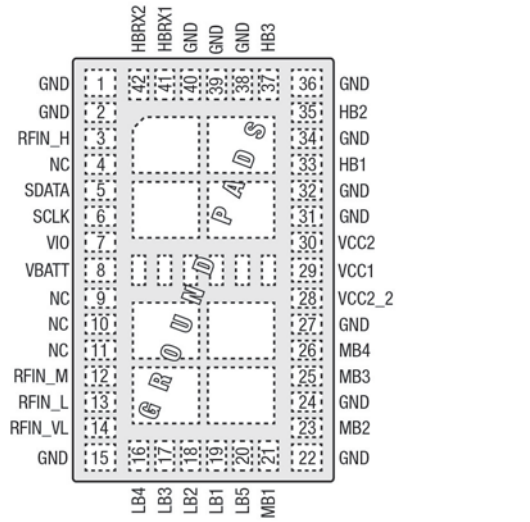


Figure 5. PCB Layout Footprint for 4.0 mm x 6.8 mm, 42-Pad Package – SKY77638-11

Package Description

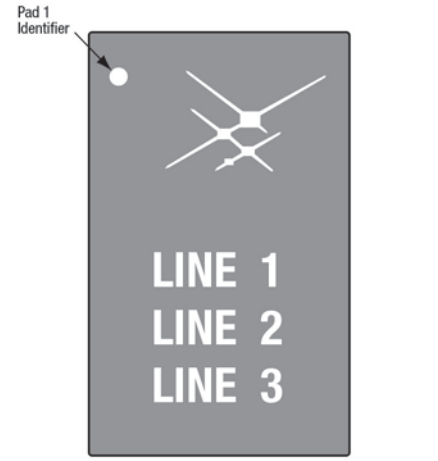
Figure 6 shows the device pad configuration and the pad numbering convention, which starts with pad 1 in the upper left corner and increments counter-clockwise around the package. Table 23 lists the pad names and signal descriptions. Figure 7 shows typical case markings for the SKY77638-11.



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

204017_00E

Figure 6. SKY77638-11 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)

204017_007

Figure 7. Typical Case Markings (Top View)

Table 23. SKY77638-11 Pad Names and Signal Descriptions

Pad No.	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
14	RFIN_VL	Alternate Low Band (LB) Input, Bands 12,17,13,28
16	LB4	Low Band (LB) 4 RF Output
17	LB3	Low Band (LB) 3 RF Output
18	LB2	Low Band (LB) 2 RF Output
19	LB1	Low Band (LB) 1 RF Output
20	LB5	Low Band (LB) 5 RF Output
21	MB1	Mid Band (MB) 1 RF Output
23	MB2	Mid Band (MB) 2 RF Output
25	MB3	Mid Band (MB) 3 RF Output
26	MB4	Mid Band (MB) 4 RF Output
28	VCC2_2	Mid/Low Band 2nd Stage PA Collector Supply
29	VCC1	High/Mid/Low Band 1st Stage PA Collector Supply
30	VCC2	High Band 2nd Stage PA Collector Supply
33	HB1	High Band (HB) 1 RF Output
35	HB2	High Band (HB) 2 RF Output
37	HB3	High Band (HB) 3 RF Output
41	HBRX1	RX RF Output, Switches to HB3
42	HBRX2	RX RF Output, Switches to HB1 or HB2
GROUND PADS		Ground pads are device underside.

[1] *Pads 1, 2, 15, 22, 24, 27, 31, 32, 34, 36, 38, 39 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 SKY77638-11 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 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 SKY77638-11 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

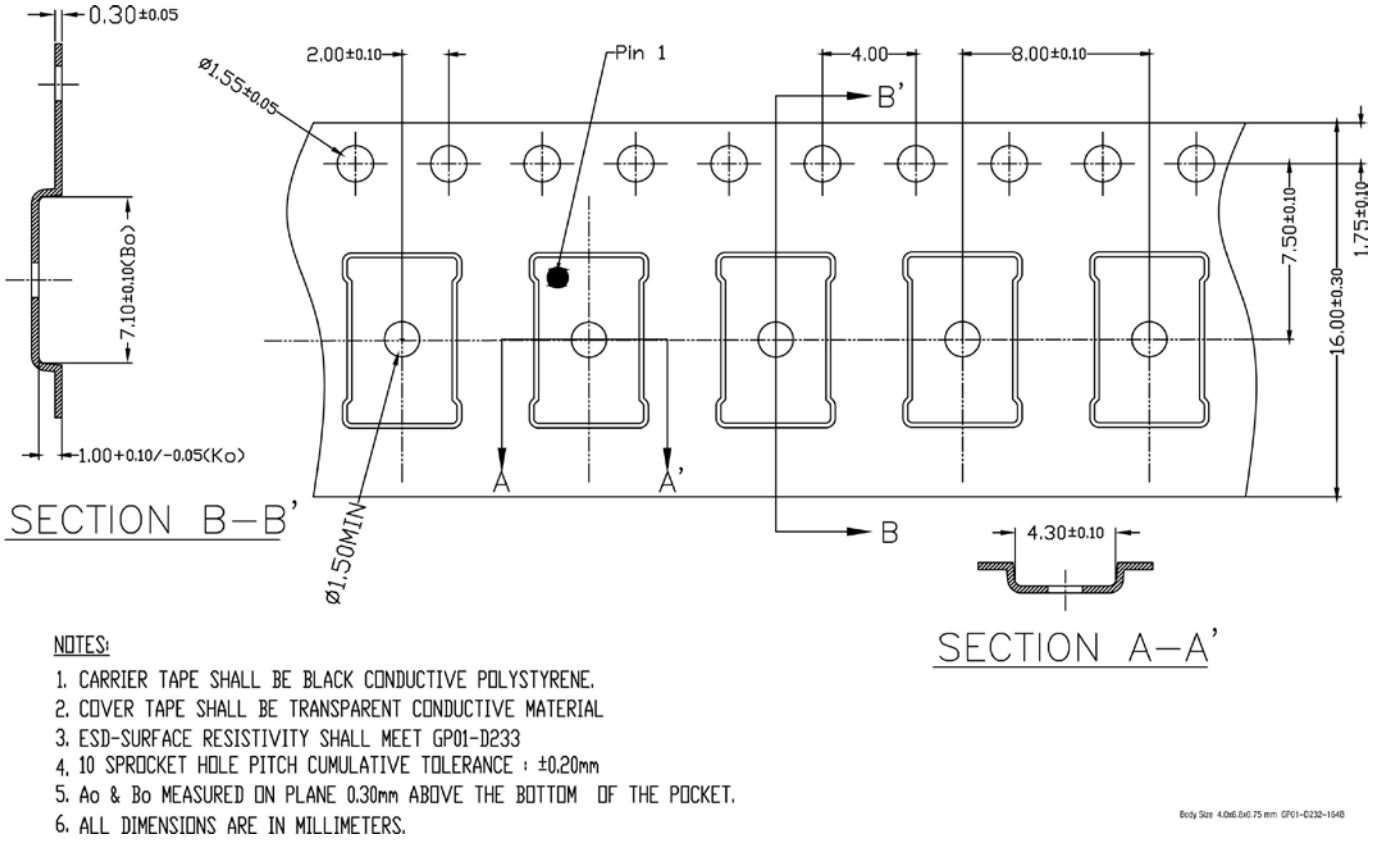


Figure 8. Carrier Tape Dimensional Diagram for Body Size 4.0 mm x 6.8 mm x 0.85–1.05 mm – Overmold MCM

Ordering Information

Product Name	Order Number	Evaluation Board Part Number
SKY77638-11 SkyLiTE™ Multimode Multiband Power Amplifier Module	SKY77638-11	EN41-D335-001

Revision History

Revision	Date	Description
A	May 17, 2016	Initial Release – Preliminary Information CO 277
B	January 11, 2017	Revise: Applications list (p1); Tables 1, 4–20, 22 Add: Table 21; Figures 2, 3 CN 10500
C	March 24, 2017	Revise: Change Data Sheet status to FINAL from PRELIMINARY; Applications and Features lists (p1); Tables 2, 5–14, 16–18, 20; Figures 2–4. CN 13842 Add: Table 15 (TDD LTE Band 34)
D	August 28, 2017	Revise: Figure 8 (Carrier Tape) CN 16708

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)*