Smarter Micro.

S5643 PRELIMINARY DATA SHEET

Multi-Mode Multi-Band Power Amplifier Module
for TD-SCDMA/WCDMA/CDMA2000/TDD-LTE/FDD-LTE
Bands 1/2/3/4/5/6/7/8/9/10/12/13/14/17/18/20/26/28/34/38/39/40/41

FEATURES

- MMMB PA Solution, TD-SCDMA, WCDMA, CDMA2000, HSPA+, TDD-LTE and FDD-LTE Compliant
- Support APT Solution
- Support Bias Control and Band Selection via MIPI Interface
- MIPI® 2.0/RFFE interface
- Cover TD-SCDMA/WCDMA/CDMA2000/LTE (FDD&TDD) Frequency bands: 1/2/3/4/5/6/7/8/9/10/12/13/14/17/18/20/26/28/34/38/39/40/41
- Small, Low Profile Package:
  - 4.0mm x 6.8mm x 0.846mm Package Size
  - 42-pad configuration

APPLICATIONS

- Multiband 3G/LTE Handsets
- Multiband 3G/LTE Data Cards
- 3G/LTE MIFI Devices

DESCRIPTION

The S5643 uses reconfigurable architecture to support TD-SCDMA,WCDMA, CDMA2000, High-Speed Downlink Packet Access (HSDPA), and High-Speed Uplink Packet Access (HSUPA) and LTE(FDD & TDD) modulations; covers multiple bands for 3GPP and LTE, including bands: 1/2/3/4/5/6/7/8/9/10/12/13/14/17/18/20/26/28/34/38/39/40/41. The module is fully controllable via MIPI interface. The S5643 meets spectral linearity requirements of LTE modulation with QPSK/16QAM up to 20 MHz bandwidth, including various resource block allocations, with high Power-Added Efficiency. S5643 contains two amplifier paths, thirteen TX switches and two HBRX switches, specifically developed for 3G/4G Bands. The S5643 Power Amplifier Module is configured for Average Power Tracking (APT) enabling higher 4G system efficiency. A MIPI RFFE interface controls all internal switches and amplifier configuration.

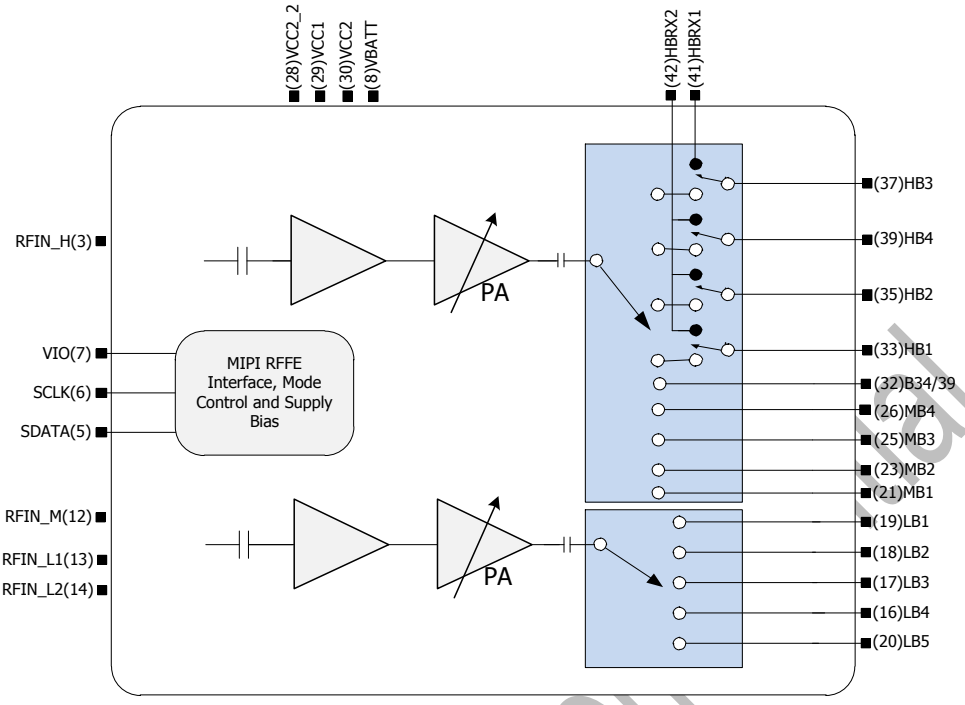

Figure1. S5643 Functional Block Diagram

ELECTRIAL SPECIFICATIONS

The following tables list the electrical characteristics of the S5643 Front-End Module. Table1 lists the absolute maximum ratings and Table2 lists the recommended operating conditions. Table3 through Table17 provide the electrical characteristics of the S5643 for multi-modes TD-SCDMA, WCDMA, CDMA2000, TDD-LTE and FDD-LTE, including control logic descriptions for the various modes. The S5643 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.

Table1. S5643 ABSOLUTE MAXIMUM RATING

Parameter	Rating	Unit
Power Supply	0.3 to 6.0	V
RF Input Power(Pin)	+10	dBm
MIPI Supply	-0.5 to +2	V
MIPI Signal Level	-0.5 to +2	V
Output Load VSWR	10:1	
Operating Temperature	-30 to +85	^{o}C
Storage Temperature	-40 to +150	^{o}C
ESD – Human Body Mode(HBM)	1.0	kV

Stresses in excess of the absolute ratings may cause permanent damage. Functional operation is not implied under these conditions. Exposure to absolute ratings for extended periods of time may adversely affect reliability. Specified typical performance of functional operation of the device under Absolute Maximum Rating conditions is not implied.

Table2. S5643 Recommended Operating Condition

Parameter	Specification			Unit
	Min	Typ	Max	
V_{BATT}	3.2	3.4	4.6	V
Vcc	0.6	3.4	3.8	V
MIPI Supply	1.65	1.8	1.95	V
MIPI Signal Levels				
Low	0		0.3 x V_{IO}	V
High	0.7 x V_{IO}		V_{IO}	V
VIO Rise Time	0.1		1000	µs
Current (MIPI Digital Inputs)			50	µA
Leakage Current			10	µA
Maximum Linear Output (HPM) [1]	+29			dBm
Maximum Linear Output (LPM)	+3			dBm
Case Temperature	-25	25	+85	°C

Note:
[1] Different application can be little variance

Table3. S5643 Electrical Specifications—Band1 WCDMA/LTE

Condition: Vcc=3.4V, Temp=+25°C, LTE Modulation: QPSK, 10MHz BW, 12 RB (MPR=0); unless otherwise defined

Parameter	Condition	Specification			Unit
		Min	Typ	Max	
Operating Frequency	Band 1	1920		1980	MHz
Maximum Output Power	WCDMA[1] waveform, HPM	28.5	-	-	dBm
	LTE MPR[2]=0 dB, HPM	27.5	-	-	dBm
	WCDMA/LTE, MPM	16	-	-	dBm
	WCDMA/LTE, LPM	3	-	-	dBm
Gain(G)	HPM,WCDMA		29		dB
	LTE MPR=0 dB, HPM		29		dB
	WCDMA/LTE, MPM		-		dB
	WCDMA/LTE, LPM		20		dB
Supply Current (Icc)	HPM,WCDMA		TBD		mA
	LTE MPR=0 dB, HPM		TBD		mA
	WCDMA/LTE, MPM		TBD		mA
	WCDMA/LTE, LPM		TBD		mA
WCDMA ACLR1(+/-5M)	± 5 MHz, POUT ≤ (maximum power)		-40	-37	dBc
WCDMA ACLR2(+/-10M)	± 10 MHz, POUT ≤ (maximum power)		-50	-47	dBc
LTE ACLR[3]	LTE to LTE, E-UTRA ACLR POUT ≤ (maximum power – MPR)	-	-38	-35	dBc
	UTRA ACLR1 POUT ≤ (maximum power – MPR)	-	-40	-37	dBc
	UTRA ACLR2 POUT ≤ (maximum power – MPR)	-	-42	-41	dBc
Harmonic	Second	-	-5	-	dBm
	Third and higher		-15	-	dBm
Rx band noise power[4]	$f_{RX} = f_{TX}$+190 MHz	-	-131	-	dBm/Hz
EVM	Pout ≤ (maximum power – MPR), Load=50 ohms	-	-	5	%
Input Voltage Standing Wave Ratio	Pout ≤ Pout_max	-	-	2.0:1	
Stability(all spurious)	VSWR=6:1, all phases, RBW=1MHz	-	-	-36	dBm
Ruggedness	10:1 No damage or degradation				

Notes:

[1] WCDMA HPM is the maximum power reduction as defined in Rel99

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

[3] $ACLR_{EUTRA}$ Max=-33, $ACLR1_{UTRA}$ Max=-36, $ACLR2_{UTRA}$ Max=-39 for ETC

[4] Measured with 20MHz/100RB LTE Waveform

Table4. S6543 Electrical Specifications—Band2 WCDMA/LTE

Condition: Vcc=3.4V, Temp=+25°C, LTE Modulation: QPSK, 10MHz BW, 12 RB (MPR=0); unless otherwise defined

Parameter	Condition	Specification			Unit
		Min	Typ	Max	
Operating Frequency	Band 2	1850		1910	MHz
Maximum Output Power	WCDMA[1] waveform, HPM	28.5	-	-	dBm
	LTE MPR[2]=0 dB, HPM	27.5	-	-	dBm
	WCDMA/LTE, MPM	16	-	-	dBm
	WCDMA/LTE, LPM	3	-	-	dBm
Gain(G)	HPM, WCDMA		30		dB
	LTE MPR=0 dB, HPM		30		dB
	WCDMA/LTE, MPM		-		dB
	WCDMA/LTE, LPM		20		dB
Supply Current (Icc)	HPM,WCDMA		TBD		mA
	LTE MPR=0 dB, HPM		TBD		mA
	WCDMA/LTE, MPM		TBD		mA
	WCDMA/LTE, LPM		TBD		mA
WCDMA ACLR1(+/-5M)	± 5 MHz, POUT ≤ (maximum power)		-40	-37	dBc
WCDMA ACLR2(+/-10M)	± 10 MHz, POUT ≤ (maximum power)		-50	-47	dBc
LTE ACLR[3]	LTE to LTE, E-UTRA ACLR POUT ≤ (maximum power – MPR)	-	-38	-35	dBc
	UTRA ACLR1 POUT ≤ (maximum power – MPR)	-	-40	-37	dBc
	UTRA ACLR2 POUT ≤ (maximum power – MPR)	-	-42	-41	dBc
Harmonic	Second	-	-8	-	dBm
	Third and higher		-15	-	dBm
Rx band noise power[4]	$f_{RX} = f_{TX}$+80 MHz	-	-118	-	dBm/Hz
EVM	Pout ≤ (maximum power – MPR), Load=50 ohms	-	-	5	%
Input Voltage Standing Wave Ratio	Pout ≤ Pout_max	-	-	2.0:1	-
Stability(all spurious)	VSWR=6:1, all phases, RBW=1MHz	-	-	-36	dBm
Ruggedness	10:1 No damage or degradation				

Notes:

[1] WCDMA HPM is the maximum power reduction as defined in Rel99

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

[3] $ACLR_{EUTRA}$ Max=-33, $ACLR1_{UTRA}$ Max=-36, $ACLR2_{UTRA}$ Max=-39 for ETC

[4] Measured with 20MHz/100RB LTE Waveform

Table5. S5643 Electrical Specifications—Band3/4/9/10 WCDMA/LTE

Condition: Vcc=3.4V, Temp=+25°C, LTE Modulation: QPSK, 10MHz BW, 12 RB (MPR=0); unless otherwise defined

Parameter	Condition	Specification			Unit
		Min	Typ	Max	
Operating Frequency	Band 3	1710		1785	MHz
	Band 4	1710		1755	MHz
	Band 9	1749.9		1784.9	MHz
	Band 10	1710		1770	MHz
Maximum Output Power	WCDMA[1] waveform, HPM	29			dBm
	LTE MPR[2]=0 dB, HPM	28			dBm
	WCDMA/LTE, MPM	16			dBm
	WCDMA/LTE, LPM	3			dBm
Gain(G)	HPM,WCDMA		30		dB
	LTE MPR=0 dB, HPM		30		dB
	WCDMA/LTE, MPM		-		dB
	WCDMA/LTE, LPM		20		dB
Gain Linearity	All modes	-1		+1	dB
Supply Current (Icc)	HPM,WCDMA		TBD		mA
	LTE MPR=0 dB, HPM		TBD		mA
	WCDMA/LTE, MPM		TBD		mA
	WCDMA/LTE, LPM		TBD		mA
WCDMA ACLR1(+/-5M)	± 5 MHz, POUT ≤ (maximum power)		-40	-37	dBc
WCDMA ACLR2(+/-10M)	± 10 MHz, POUT ≤ (maximum power)		-50	-47	dBc
LTE ACLR[3]	LTE to LTE, E-UTRA ACLR POUT ≤ (maximum power – MPR)		-38	-35	dBc
	UTRA ACLR1 POUT ≤ (maximum power – MPR)		-40	-37	dBc
	UTRA ACLR2 POUT ≤ (maximum power – MPR)		-42	-41	dBc
Harmonic	Second	-	-5	-	dBm
	Third and higher		-16	-	dBm
Rx band noise power[4]	B3 $f_{RX} = f_{TX} + 95MHz$	-	-124	-	dBm/Hz
	B4 $f_{RX} = f_{TX} + 400MHz$	-	-124	-	dBm/Hz
	B9 $f_{RX} = f_{TX} + 95MHz$	-	-124	-	dBm/Hz
	B10 $f_{RX} = f_{TX} + 400MHz$	-	-124	-	dBm/Hz
EVM	Pout ≤ (maximum power –	-	-	5	%

	MPR), Load=50 ohms				
Input Voltage Standing Wave Ratio	Pout ≤ Pout_max	-	-	2.0:1	-
Stability(all spurious)	VSWR=6:1, all phases, RBW=1MHz	-	-	-36	dBm
Ruggedness	10:1 No damage or degradation				

Notes:

[1] WCDMA HPM is the maximum power reduction as defined in Rel99

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

[3] $ACLR_{EUTRA}$ Max=-33, $ACLR1_{UTRA}$ Max=-36, $ACLR2_{UTRA}$ Max=-39 for ETC

[4] Measured with 20MHz/100RB LTE Waveform

Table6. S5643 Electrical Specifications—Band5/6/18/20/26 WCDMA/LTE

Condition: Vcc=3.4V, Temp=+25°C, LTE Modulation: QPSK, 10MHz BW, 12 RB (MPR=0); unless otherwise defined

Parameter	Condition	Specification			Unit
		Min	Typ	Max	
Operating Frequency	Band 5	824		849	MHz
	Band 6	830		840	MHz
	Band 18	815		830	MHz
	Band 20	832		862	MHz
	Band 26	814		849	MHz
Maximum Output Power	WCDMA[1] waveform, HPM	28.5			dBm
	LTE MPR[2]=0 dB, HPM	27.5			dBm
	WCDMA/LTE, MPM	20			dBm
	WCDMA/LTE, LPM	3			dBm
Gain(G)	HPM,WCDMA		30		dB
	LTE MPR=0 dB, HPM		30		dB
	WCDMA/LTE, MPM				dB
	WCDMA/LTE, LPM		20		dB
Supply Current (Icc)	HPM,WCDMA		TBD		mA
	LTE MPR=0 dB, HPM		TBD		mA
	WCDMA/LTE, MPM		TBD		mA
	WCDMA/LTE, LPM		TBD		mA
WCDMA ACLR1(+/-5M)	± 5 MHz, POUT ≤ (maximum power)		-40	-37	dBc
WCDMA ACLR2(+/-10M)	± 10 MHz, POUT ≤ (maximum power)		-50	-47	dBc
LTE ACLR[3]	LTE to LTE, E-UTRA ACLR POUT ≤ (maximum power – MPR)		-38	-35	dBc
	UTRA ACLR1 POUT ≤ (maximum power – MPR)		-40	-37	dBc
	UTRA ACLR2 POUT ≤ (maximum power – MPR)		-42	-41	dBc
Harmonic	Second	-	-4	-	dBm
	Third and higher		-23	-	dBm
Rx band noise power[4]	B5 $f_{RX} = f_{TX} + 45MHz$	-	-134	-	dBm/Hz
	B6 $f_{RX} = f_{TX} + 35MHz$	-	-134	-	dBm/Hz
	B18 $f_{RX} = f_{TX} + 45MHz$	-	-134	-	dBm/Hz
	B20 $f_{RX} = f_{TX} - 41MHz$	-	-134	-	dBm/Hz
	B26 $f_{RX} = f_{TX} + 45MHz$	-	-134	-	dBm/Hz
EVM	Pout ≤ (maximum power –	-	-	5	%

	MPR), Load=50 ohms				
Input Voltage Standing Wave Ratio	Pout ≤ Pout_max	-	-	2.0:1	-
Stability(all spurious)	VSWR=6:1, all phases, RBW=1MHz	-	-	-36	dBm
Ruggedness	10:1 No damage or degradation				

Notes:

[1] WCDMA HPM is the maximum power reduction as defined in Rel99

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

[3] $ACLR_{EUTRA}$ Max=-33, $ACLR1_{UTRA}$ Max=-36, $ACLR2_{UTRA}$ Max=-39 for ETC

[4] Measured with 10MHz/1RB LTE Waveform

Table7. S5643 Electrical Specifications—Band8 WCDMA/LTE

Condition: Vcc=3.4V, Temp=+25°C, LTE Modulation: QPSK, 10MHz BW, 12 RB (MPR=0); unless otherwise defined

Parameter	Condition	Specification			Unit
		Min	Typ	Max	
Operating Frequency	Band 8	880		915	MHz
Maximum Output Power	WCDMA[1] waveform, HPM	28.5			dBm
	LTE MPR[2]=0 dB, HPM	27.5			dBm
	WCDMA/LTE, MPM	20			dBm
	WCDMA/LTE, LPM	3			dBm
Gain(G)	HPM, WCDMA		29		dB
	LTE MPR=0 dB, HPM		30		dB
	WCDMA/LTE, MPM		-		dB
	WCDMA/LTE, LPM		20		dB
Supply Current (Icc)	HPM,WCDMA		TBD		mA
	LTE MPR=0 dB, HPM		TBD		mA
	WCDMA/LTE, MPM		TBD		mA
	WCDMA/LTE, LPM		TBD		mA
WCDMA ACLR1(+/-5M)	± 5 MHz, POUT ≤ (maximum power)		-40	-37	dBc
WCDMA ACLR2(+/-10M)	± 10 MHz, POUT ≤ (maximum power)		-50	-47	dBc
LTE ACLR[3]	LTE to LTE, E-UTRA ACLR POUT ≤ (maximum power – MPR)	-	-38	-35	dBc
	UTRA ACLR1 POUT ≤ (maximum power – MPR)	-	-40	-37	dBc
	UTRA ACLR2 POUT ≤ (maximum power – MPR)	-	-42	-41	dBc
Harmonic	Second	-	-4	-	dBm
	Third and higher		-29	-	dBm
Rx band noise power[4]	B8 $f_{RX} = f_{TX} + 45MHz$	-	-132	-	dBm/Hz
EVM	Pout ≤ (maximum power – MPR), Load=50 ohms	-	-	5	%
Input Voltage Standing Wave Ratio	Pout ≤ Pout_max	-	-	2.0:1	-
Stability(all spurious)	VSWR=6:1, all phases, RBW=1MHz	-	-	-36	dBm
Ruggedness	10:1 No damage or degradation				

Notes:

[1] WCDMA HPM is the maximum power reduction as defined in Rel99

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

[3] $ACLR_{EUTRA}$ Max=-33, $ACLR1_{UTRA}$ Max=-36, $ACLR2_{UTRA}$ Max=-39 for ETC

[4] Measured with 20MHz/1RB LTE Waveform

Table8. S5643 Electrical Specifications—Band12/17 LTE

Condition: Vcc=3.4V, Temp=+25°C, Modulation: QPSK, 10MHz BW, 12 RB (MPR=0); unless otherwise defined

Parameter	Condition	Specification			Unit
		Min	Typ	Max	
Operating Frequency	Band 12	698		716	MHz
	Band 17	704		716	MHz
Maximum Output Power	LTE MPR[1]=0 dB, HPM	27.5	-	-	dBm
	LTE MPR=0 dB, MPM	16	-	-	dBm
	LTE MPR=0 dB, LPM	3	-	-	dBm
Gain(G)	HPM		32		dB
	MPM		-		dB
	LPM		20		dB
Supply Current (Icc)	HPM		TBD		mA
	MPM		TBD		mA
	LPM		TBD		mA
LTE ACLR[2]	LTE to LTE, E-UTRA ACLR POUT ≤ (maximum power – MPR)		-38	-35	dBc
	UTRA ACLR1 POUT ≤ (maximum power – MPR)		-40	-37	dBc
	UTRA ACLR2 POUT ≤ (maximum power – MPR)		-42	-41	dBc
Harmonic	Second	-	3	-	dBm
	Third and higher		-22	-	dBm
Rx band noise power[3]	B12 $f_{RX} = f_{TX} + 30MHz$	-	-125	-	dBm/Hz
	B17 $f_{RX} = f_{TX} + 30MHz$	-	-125	-	dBm/Hz
EVM	Pout ≤ (maximum power – MPR), Load=50 ohms	-	-	5	%
Input Voltage Standing Wave Ratio	Pout ≤ Pout_max	-	-	2.0:1	-
Stability(all spurious)	VSWR=6:1, all phases, RBW=1MHz	-	-	-36	dBm
Ruggedness	10:1 No damage or degradation				

Notes:

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

[2] $ACLR_{EUTRA}$ Max=-33, $ACLR1_{UTRA}$ Max=-36, $ACLR2_{UTRA}$ Max=-39 for ETC

[3] Measured with 10MHz/1RB LTE Waveform

Table9. S5643 Electrical Specifications—Band13/14 LTE

Condition: Vcc=3.4V, Temp=+25°C, Modulation: QPSK, 10MHz BW, 12 RB (MPR=0); unless otherwise defined

Parameter	Condition	Specification			Unit
		Min	Typ	Max	
Operating Frequency	Band 13	777		787	MHz
	Band 14	788		798	MHz
Maximum Output Power	LTE MPR[1]=0 dB, HPM	27.5	-	-	dBm
	LTE MPR=0 dB, MPM	16	-	-	dBm
	LTE MPR=0 dB, LPM	3	-	-	dBm
Gain(G)	HPM		32		dB
	MPM		-		dB
	LPM		20		dB
Supply Current (Icc)	HPM		TBD		mA
	MPM		TBD		mA
	LPM		TBD		mA
LTE ACLR[2]	LTE to LTE, E-UTRA ACLR POUT ≤ (maximum power – MPR)		-38	-35	dBc
	UTRA ACLR1 POUT ≤ (maximum power – MPR)		-40	-37	dBc
	UTRA ACLR2 POUT ≤ (maximum power – MPR)		-42	-41	dBc
Harmonic	Second	-	-3	-	dBm
	Third and higher		-22	-	dBm
Rx band noise power[3]	B13 $f_{RX} = f_{TX} - 31MHz$	-	-121	-	dBm/Hz
	B14 $f_{RX} = f_{TX} - 30MHz$	-	-121	-	dBm/Hz
EVM	Pout ≤ (maximum power – MPR), Load=50 ohms	-	-	5	%
Input Voltage Standing Wave Ratio	Pout ≤ Pout_max	-	-	2.0:1	
Stability(all spurious)	VSWR=6:1, all phases, RBW=1MHz	-	-	-36	dBm
Ruggedness	10:1 No damage or degradation				

Notes:

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

[2] $ACLR_{EUTRA}$ Max=-33, $ACLR1_{UTRA}$ Max=-36, $ACLR2_{UTRA}$ Max=-39 for ETC

[3] Measured with 10MHz/1RB LTE Waveform

Table10. S5643 Electrical Specifications—Band 28 LTE

Condition: Vcc=3.4V, Temp=+25°C, Modulation: QPSK, 10MHz BW, 12 RB (MPR=0); unless otherwise defined

Parameter	Condition	Specification			Unit
		Min	Typ	Max	
Operating Frequency	Band 28	703		748	MHz
Maximum Output Power	LTE MPR[1]=0 dB, HPM	27.5	-	-	dBm
	LTE MPR=0 dB, MPM	16	-	-	dBm
	LTE MPR=0 dB, LPM	3	-	-	dBm
Gain(G)	HPM		32		dB
	MPM		-		dB
	LPM		20		dB
Supply Current (Icc)	HPM		TBD		mA
	MPM		TBD		mA
	LPM		TBD		mA
LTE ACLR[2]	LTE to LTE, E-UTRA ACLR POUT ≤ (maximum power – MPR)		-38	-35	dBc
	UTRA ACLR1 POUT ≤ (maximum power – MPR)		-40	-37	dBc
	UTRA ACLR2 POUT ≤ (maximum power – MPR)		-42	-41	dBc
Harmonic	Second	-	3	-	dBm
	Third and higher		-22	-	dBm
Rx band noise power[3]	B13 $f_{RX} = f_{TX} + 55MHz$	-	-127	-	dBm/Hz
EVM	Pout ≤ (maximum power – MPR), Load=50 ohms	-	-	5	%
Input Voltage Standing Wave Ratio	Pout ≤ Pout_max	-	-	2.0:1	-
Stability(all spurious)	VSWR=6:1, all phases, RBW=1MHz	-	-	-36	dBm
Ruggedness	10:1 No damage or degradation				

Notes:

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

[2] $ACLR_{EUTRA}$ Max=-33, $ACLR1_{UTRA}$ Max=-36, $ACLR2_{UTRA}$ Max=-39 for ETC

[3] Measured with 10MHz/1RB LTE Waveform

Table11. S5643 Electrical Specifications—Band7 LTE

Condition: Vcc=3.4V, Temp=+25°C, Modulation: QPSK, 10MHz BW, 12 RB (MPR=0); unless otherwise defined

Parameter	Condition	Specification			Unit
		Min	Typ	Max	
Operating Frequency		2500		2570	MHz
Maximum Output Power	LTE MPR[1]=0 dB, HPM	27.5			dBm
	LTE MPR=0 dB, MPM	16			dBm
	LTE MPR=0 dB, LPM	3			dBm
Gain(G)	HPM		30		dB
	MPM		-		dB
	LPM		20		dB
Supply Current (Icc)	HPM		TBD		mA
	MPM		TBD		mA
	LPM		TBD		mA
LTE ACLR[2]	LTE to LTE, E-UTRA ACLR POUT ≤ (maximum power – MPR)		-38	-35	dBc
	UTRA ACLR1 POUT ≤ (maximum power – MPR)		-40	-37	dBc
	UTRA ACLR2 POUT ≤ (maximum power – MPR)		-42	-41	dBc
Harmonic	Second	-	-11	-	dBm
	Third and higher		-11	-	dBm
Rx band noise power[3]	120MHz offset from Tx at all powers	-	-125	-	dBm/Hz
GPS noise[3]	1574 – 1577 MHz	-	-142	-	dBm/Hz
ISM noise[3]	2400 – 2452MHz	-	-98		dBm/Hz
EVM	Pout ≤ (maximum power – MPR), Load=50 ohms	-	-	5	%
Input Voltage Standing Wave Ratio	Pout ≤ Pout_max	-	-	2.0:1	
Stability(all spurious)	VSWR=6:1, all phases, RBW=1MHz	-	-	-36	dBm
Ruggedness	10:1 No damage or degradation				

Notes:

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

[2] $ACLR_{EUTRA}$ Max=-33, $ACLR1_{UTRA}$ Max=-36, $ACLR2_{UTRA}$ Max=-39 for ETC

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

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

Table12. S5643 Electrical Specifications—Band34/39 TD-SCDMA

Condition: Vcc=3.4V, Temp=+25°C, Modulation: TDSCDMA; Duty Cycle=14%, unless otherwise defined

Parameter	Condition	Specification			Unit
		Min	Typ	Max	
Operating Frequency	Band 39	1880		1920	MHz
	Band 34	2010		2025	MHz
Maximum Output Power	HPM	28.5			dBm
	MPM	16			dBm
	LPM	3			dBm
Gain(G)	HPM		32		dB
	MPM		-		dB
	LPM		20		dB
Supply Current (Icc)	HPM		TBD		mA
	MPM		TBD		mA
	LPM		TBD		mA
ACLR1 - 1.6M Offset	± 1.6 MHz, POUT ≤ (maximum power)		-40	-37	dBc
ACLR2 - 3.2M Offset	± 3.2 MHz, POUT ≤ (maximum power)		-52	-48	dBc
Harmonic	Second	-	-12	-	dBm
	Third and higher		-36	-	dBm
EVM	Pout ≤ (maximum power – MPR), Load=50 ohms	-	-	5	%
Input Voltage Standing Wave Ratio	Pout ≤ Pout_max	-	-	2.0:1	
Stability(all spurious)	VSWR=6:1, all phases, RBW=1MHz	-	-	-36	dBm
Ruggedness	10:1 No damage or degradation				

Table13. S5643 Electrical Specifications—Band39/34 TDD-LTE

Condition: Vcc=3.4V, Temp=+25°C, Modulation: QPSK, 10MHz BW, 12 RB (MPR=0); Duty Cycle=40%, unless otherwise defined

Parameter	Condition	Specification			Unit
		Min	Typ	Max	
Operating Frequency	Band 39	1880		1920	MHz
	Band 34	2010		2025	MHz
Maximum Output Power	LTE MPR[1]=0 dB, HPM	27.5	-	-	dBm
	LTE MPR=0 dB, MPM	16			dBm
	LTE MPR=0 dB, LPM	3			dBm
Gain(G)	HPM		30		dB
	MPM		-		dB
	LPM		20		dB
Supply Current (Icc)	HPM		TBD		mA
	MPM		TBD		mA
	LPM		TBD		mA
LTE ACLR[2]	LTE to LTE, E-UTRA ACLR POUT ≤ (maximum power – MPR)		-38	-35	dBc
	UTRA ACLR1 POUT ≤ (maximum power – MPR)		-40	-37	dBc
	UTRA ACLR2 POUT ≤ (maximum power – MPR)		-42	-41	dBc
Harmonic	Second	-	-13	-	dBm
	Third and higher		-23	-	dBm
GPS noise[3]	1574 – 1577 MHz	-	-133		dBm/Hz
ISM noise[3]	2400 – 2483.5 MHz	-	-133		dBm/Hz
EVM	Pout ≤ (maximum power – MPR), Load=50 ohms	-	-	5	%
Input Voltage Standing Wave Ratio	Pout ≤ Pout_max	-	-	2.0:1	
Stability(all spurious)	VSWR=6:1, all phases, RBW=1MHz	-	-	-36	dBm
Ruggedness	10:1 No damage or degradation				

Notes:

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

[2] $ACLR_{EUTRA}$ Max=-33, $ACLR1_{UTRA}$ Max=-36, $ACLR2_{UTRA}$ Max=-39 for ETC

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

Table14. S5643 Electrical Specifications—Band38 TDD-LTE

Condition: Vcc=3.4V, Temp=+25°C, Modulation: QPSK, 10MHz BW, 12 RB (MPR=0); Duty Cycle=40%, unless otherwise defined

Parameter	Condition	Specification			Unit
		Min	Typ	Max	
Operating Frequency		2570		2620	MHz
Maximum Output Power	LTE MPR[1]=0 dB, HPM	27.5	-	-	dBm
	LTE MPR=0 dB, MPM	16			dBm
	LTE MPR=0 dB, LPM	3			dBm
Gain(G)	HPM		29		dB
	MPM		-		dB
	LPM		20		dB
Supply Current (Icc)	HPM		TBD	-	mA
	MPM		TBD		mA
	LPM		TBD		mA
LTE ACLR[2]	LTE to LTE, E-UTRA ACLR POUT ≤ (maximum power – MPR)		-38	-35	dBc
	UTRA ACLR1 POUT ≤ (maximum power – MPR)		-40	-37	dBc
	UTRA ACLR2 POUT ≤ (maximum power – MPR)		-42	-41	dBc
Harmonic	Second	-	-10	-	dBm
	Third and higher		-6	-	dBm
GPS noise[3]	1574 – 1577 MHz	-	-147		dBm/Hz
ISM noise[3]	2400 – 2483.5 MHz	-	-136		dBm/Hz
EVM	Pout ≤ (maximum power – MPR), Load=50 ohms	-	-	5	%
Input Voltage Standing Wave Ratio	Pout ≤ Pout_max	-	-	2.0:1	
Stability(all spurious)	VSWR=6:1, all phases, RBW=1MHz	-	-	-36	dBm
Ruggedness	10:1 No damage or degradation				

Notes:

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

[2] $ACLR_{EUTRA}$ Max=-33, $ACLR1_{UTRA}$ Max=-36, $ACLR2_{UTRA}$ Max=-39 for ETC

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

Table15. S5643 Electrical Specifications—Band40 TDD-LTE

Condition: Vcc=3.4V, Temp=+25°C, Modulation: QPSK, 10MHz BW, 12 RB (MPR=0); Duty Cycle=40%, unless otherwise defined

Parameter	Condition	Specification			Unit
		Min	Typ	Max	
Operating Frequency		2300		2400	MHz
Maximum Output Power	LTE MPR[1]=0 dB, HPM	27.5	-	-	dBm
	LTE MPR=0 dB, MPM	16			dBm
	LTE MPR=0 dB, LPM	3			dBm
Gain(G)	HPM		29		dB
	MPM		-		dB
	LPM		20		dB
Supply Current (Icc)	HPM		TBD	-	mA
	MPM		TBD		mA
	LPM		TBD		mA
LTE ACLR[2]	LTE to LTE, E-UTRA ACLR POUT ≤ (maximum power – MPR)		-38	-35	dBc
	UTRA ACLR1 POUT ≤ (maximum power – MPR)		-40	-37	dBc
	UTRA ACLR2 POUT ≤ (maximum power – MPR)		-42	-41	dBc
Harmonic	Second	-	-4	-	dBm
	Third and higher		-14	-	dBm
GPS noise[3]	1574 – 1577 MHz	-	-143		dBm/Hz
ISM noise[3]	2420-2440MHz	-		-94.5	dBm/Hz
	2440-2460MHz			-108.5	dBm/Hz
	2460-2480MHz			-122.5	dBm/Hz
EVM	Pout ≤ (maximum power – MPR), Load=50 ohms	-	-	5	%
Input Voltage Standing Wave Ratio	Pout ≤ Pout_max	-	-	2.0:1	
Stability(all spurious)	VSWR=6:1, all phases, RBW=1MHz	-	-	-36	dBm
Ruggedness	10:1 No damage or degradation				

Notes:

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

[2] $ACLR_{EUTRA}$ Max=-33, $ACLR1_{UTRA}$ Max=-36, $ACLR2_{UTRA}$ Max=-39 for ETC

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

Table16. S5643 Electrical Specifications—Band41 TDD-LTE

Condition: Vcc=3.4V, Temp=+25°C, Modulation: QPSK, 10MHz BW, 12 RB (MPR=0); Duty Cycle=40%, unless otherwise defined

Parameter	Condition	Specification			Unit
		Min	Typ	Max	
Operating Frequency	Band 41	2496		2690	MHz
Maximum Output Power	LTE MPR[1]=0 dB, HPM	28	-	-	dBm
	LTE MPR=0 dB, MPM	16			dBm
	LTE MPR=0 dB, LPM	3			dBm
Gain(G)	HPM		28		dB
	MPM		-		dB
	LPM		20		dB
Supply Current (Icc)	HPM		TBD		mA
	MPM		TBD		mA
	LPM		TBD		mA
LTE ACLR[2]	LTE to LTE, E-UTRA ACLR POUT ≤ (maximum power – MPR)		-38	-35	dBc
	UTRA ACLR1 POUT ≤ (maximum power – MPR)		-40	-37	dBc
	UTRA ACLR2 POUT ≤ (maximum power – MPR)		-42	-41	dBc
Harmonic	Second		-10		dBm
	Third and higher		-23		dBm
GPS noise [4]	1574 – 1577 MHz	-	143	-	dBm/Hz
ISM noise [4]	2420 – 2440MHz			-94.5	dBm/Hz
	2440 – 2460MHz			-108.5	dBm/Hz
	2460 – 2480MHz			-122.5	dBm/Hz
EVM	Pout≤ (maximum power – MPR), Load=50 ohms	-	-	5	%
Input Voltage Standing Wave Ratio	Pout ≤ Pout_max	-	-	2.0:1	
Stability(all spurious)	VSWR=6:1, all phases, RBW=1MHz	-	-	-36	dBm
Ruggedness	10:1 No damage or degradation				

Notes:

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

[2] $ACLR_{EUTRA}$ Max=-33, $ACLR1_{UTRA}$ Max=-36, $ACLR2_{UTRA}$ Max=-39 for ETC

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

Table17. S5643 Electrical Specifications—CDMA2000 BC0/BC10

Condition: Vcc=3.4V, Temp=+25°C; 1*RC1, unless otherwise defined

Parameter	Condition	Specification			Unit
		Min	Typ	Max	
Operating Frequency	BC0	815		849	MHz
	BC10	806		901	MHz
Maximum Output Power	HPM	28	-	-	dBm
	MPM	16			dBm
	LPM	3			dBm
Gain(G)	HPM		30		dB
	MPM		-		dB
	LPM		20		dB
Supply Current (Icc)	HPM		TBD		mA
	MPM		TBD		mA
	LPM		TBD		mA
ACLR1 – 885K Offset	± 885 KHz, POUT ≤ (maximum power)		-50	-47	dBc
ACLR2 – 1.98M Offset	± 1.98 MHz, POUT ≤ (maximum power)		-60	-58	dBc
Harmonic	Second		-5		dBm
	Third and higher		-23		dBm
Noise Power In Rx Band at duplex frequency	$f_{RX} = f_{TX}$+45 MHz for BC0		-133		dBm/Hz
	$f_{RX} = f_{TX}$+45 MHz for BC10		-133		dBm/Hz
EVM	Pout≤ (maximum power – MPR), Load=50 ohms	-	-	5	%
Input Voltage Standing Wave Ratio	Pout ≤ Pout_max	-	-	2.0:1	
Stability(all spurious)	VSWR=6:1, all phases, RBW=1MHz	-	-	-36	dBm
Ruggedness	10:1 No damage or degradation				

Table18. S5643 Electrical Specifications—CDMA2000 BC1/BC4/BC6/BC15

Condition: Vcc=3.4V, Temp=+25°C; 1*RC1, unless otherwise defined

Parameter	Condition		Specification			Unit
			Min	Typ	Max	
Operating Frequency	BC15[1]		1710		1755	MHz
	BC4		1750		1780	MHz
	BC1		1850		1910	MHz
	BC6		1920		1980	MHz
Maximum Output Power	HPM[1]	BC4/BC15	29	-	-	dBm
		BC1/BC6	28	-		dBm
	MPM		16			dBm
	LPM		3			dBm
Gain(G)	HPM			30		dB
	MPM			-		dB
	LPM			20		dB
Supply Current (Icc)	HPM	BC4/BC15		TBD		mA
		BC1		TBD		mA
		BC6		TBD		mA
	MPM			TBD		mA
	LPM			TBD		mA
ACLR1 – 1.23M Offset	± 1.23 MHz, POUT ≤ (maximum power)			-50	-47	dBc
ACLR2 – 1.98M Offset	± 1.98 MHz, POUT ≤ (maximum power)			-58	-56	dBc
Harmonic	Second			-5		dBm
	Third and higher			-15		dBm
Noise Power In Rx Band at duplex frequency	$f_{RX} = f_{TX}$+400 MHz for BC15			-137		dBm/Hz
	$f_{RX} = f_{TX}$+90 MHz for BC4			-133		dBm/Hz
	$f_{RX} = f_{TX}$+80 MHz for BC1			-133		dBm/Hz
	$f_{RX} = f_{TX}$+190 MHz for BC6			-133		dBm/Hz
EVM	Pout≤ (maximum power – MPR), Load=50 ohms		-	-	5	%
Input Voltage Standing Wave Ratio	Pout ≤ Pout_max		-	-	2.0:1	
Stability(all spurious)	VSWR=6:1, all phases, RBW=1MHz		-	-	-36	dBm
Ruggedness	10:1 No damage or degradation					

Notes:
BC15[1] HPM[1] is 29dBm

Table19. S5643 Electrical Specifications—RF Switch

Condition: All unused ports terminated in 50Ω; Logic State given in condition; Vcc=3.4V, Temp=+25°C; Duty Cycle=100%

Parameter	Condition	Specification			Unit
		Min	Typ	Max	
Frequency Range		1880	-	2690	MHz
Insertion Loss	HB1 to HBRx2	-	0.8	-	dB
	HB2 to HBRx2	-	0.7		
	HB3 to HBRx1	-	0.7		
	HB4 to HBRx2	-	0.7		
Input VSWR, HBn/RXn	Any RF port tested in Rx mode	1.0:1		1.5:1	
Isolation	HB1-Any HBn port		25		dB
	HB2(B7)- Any HBn port		27		dB
	HB3- Any HBn port		29		dB
	HB4- Any HBn port		27		dB
	HB1-Any HBRXn port		40		dB
	HB2-Any HBRXn port		39		dB
	HB3-Any HBRXn port		37		dB
	HB4-Any HBRXn port		24		dB
Turn On Time	From application of Vdd and VIO	-	-	20	us
Switching Speed	Port to Port	-	2	5	us

Table20. S5643 POWER VS MODULATION

Power vs Modulation Table				WCDMA	LTE-QPSK		CDMA2K	TD-SCDMA
Band	Band	Freq	Freq	R99	PRB	FRB		
1	MB	1920	1980	28.5	27.5	26.5	28.5	
2	MB	1850	1910	28.5	27.5	26.5	28.5	
3	MB	1710	1785	29	28	27	29	
4	MB	1710	1755	29	28	27	29	
25	MB	1850	1915		27.5	26.5	28.5	
34	MB	2010	2025		27.5	26.5		28.5
39	MB	1880	1920		27.5	26.5		28.5
5	LB	824	849	28.5	27.5	26.5	28	
6	LB	830	840	28.5	27.5	26.5		
8	LB	880	915	28.5	27.5	26.5		
12	LB	699	716		27.5	26.5		
13	LB	777	787		27.5	26.5		
14	LB	788	798		27.5	26.5		
17	LB	704	716		27.5	26.5		
18	LB	815	830	28.5	27.5	26.5		
20	LB	832	862	28.5	27.5	26.5		
28	LB	703	748		27.5	26.5		
6	LB	830	840		27.5	26.5		
26	LB	814	849	28.5	27.5	26.5	28	
38	HB	2570	2620		28	27		
40	HB	2300	2400		27.5	26.5		
41	HB	2496	2690		27.5	26.5		
7	HB	2500	2570		27.5	26.5		

FOOTPRINT AND PIN DESCRIPTION:

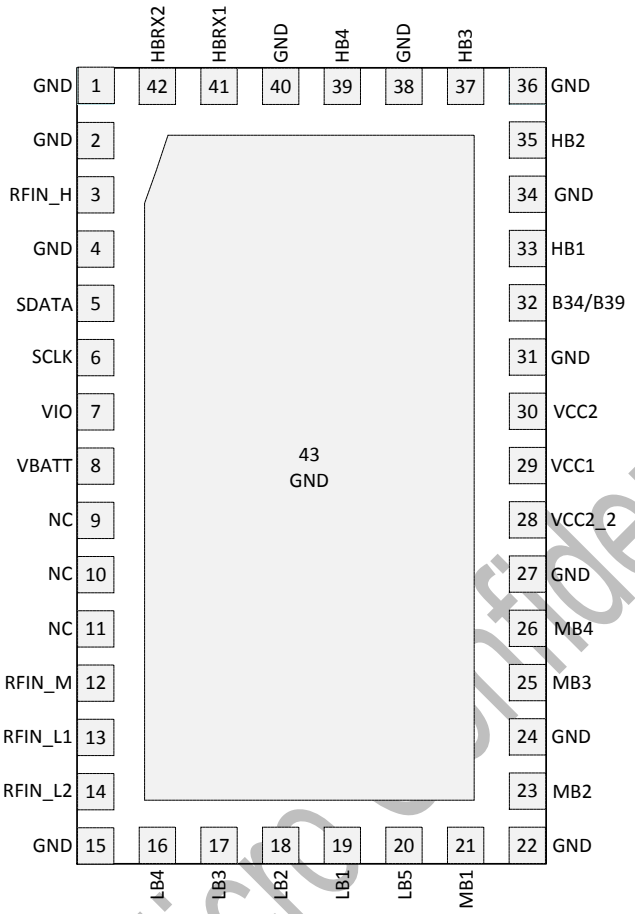

Figure2. S5643 Footprint and Pad Name

Table18. S5643 Pin Description

Pin	Name	Description
1	GND	Module Ground
2	GND	No Connection
3	RFIN_H	HB 3G/4G RF Input, matching to 50 Ω（Bands 7/38/40/41)
4	GND	Module Ground
5	SDATA	MIPI Data Bus
6	SCLK	MIPI Clock Bus
7	VIO	MIPI Supply
8	VBATT	Power Supply
9~11	NC	No Connection
12	RFIN_M	MB 3G/4G RF Input, matching to 50 Ω（Bands 1/2/3/4/9/10/34/39)
13	RFIN_L1	LB 3G/4G RF Input, matching to 50 Ω（Bands 5/6/8/12/13/14/17/18/20/26/28)
14	RFIN_L2	LB 3G/4G RF Input, matching to 50 Ω（Bands 5/6/8/12/13/14/17/18/20/26/28)
15	GND	Module Ground
16	LB4	LB 3G/4G RF Output, matching to 50 Ω（Bands 5/6/8/12/13/14/17/18/20/26/28)
17	LB3	LB 3G/4G RF Output, matching to 50 Ω（Bands 5/6/8/12/13/14/17/18/20/26/28)
18	LB2	LB 3G/4G RF Output, matching to 50 Ω（Bands 5/6/8/12/13/14/17/18/20/26/28)
19	LB1	LB 3G/4G RF Output, matching to 50 Ω（Bands 5/6/8/12/13/14/17/18/20/26/28)
20	GND	Module Ground, it also can be configured by LB5.
21	MB1	MB 3G/4G RF Output, matching to 50 Ω（Bands 1/2/3/4/9/10/34/39)
22	GND	Module Ground
23	MB2	MB 3G/4G RF Output, matching to 50 Ω（Bands 1/2/3/4/9/10/34/39)
24	GND	Module Ground
25	MB3	MB 3G/4G RF Output, matching to 50 Ω（Bands 1/2/3/4/9/10/34/39)
26	MB4	MB 3G/4G RF Output, matching to 50 Ω（Bands 1/2/3/4/9/10/34/39)
27	GND	Module Ground
28	VCC2_2	Supply voltage for the final stage of the LB/MB power amplifier
29	VCC1	Supply voltage for the first stage of the power amplifier
30	VCC2	Supply voltage for the final stage of the HB power amplifier

31	GND	Module Ground
32	B34/39	MB 3G/4G RF Output, matching to 50 Ω（Bands 34/39)
33	HB1	HB 3G/4G RF Output, matching to 50 Ω（Bands 7/38/40/41)
34	GND	Module Ground
35	HB2	HB 3G/4G RF Output, matching to 50 Ω（Bands 7/38/40/41)
36	GND	Module Ground
37	HB3	HB 3G/4G RF Output, matching to 50 Ω（Bands 7/38/40/41)
38	GND	Module Ground
39	HB4	HB 3G/4G RF Output, matching to 50 Ω（Bands 7/38/40/41)
40	GND	Module Ground
41	HBRX1	One of the two high band receive ports. The switch connects this port to HB3
42	HBRX2	One of the two high band receive ports. The switch connects this port to HB1,HB2 or HB4

Note: If both input pin and output pin aren't used, they can be connected with GND or NC.

APPLICATION INFORMATIONS:

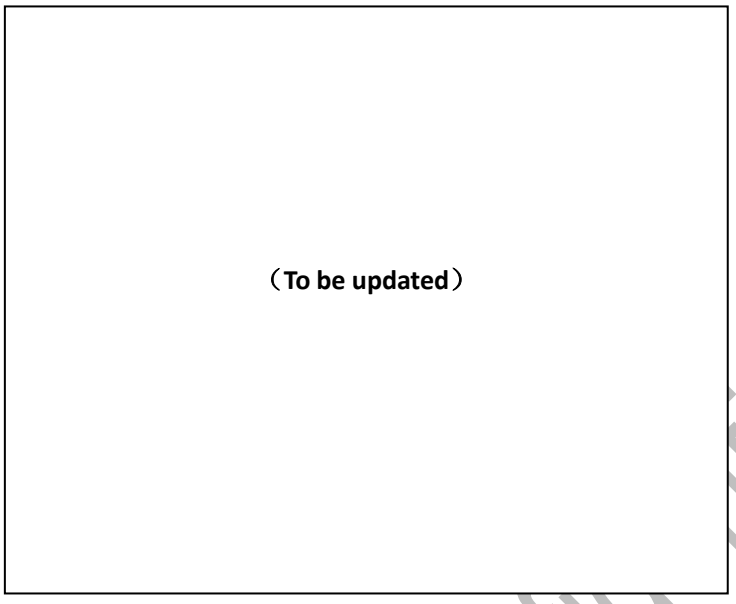

Figure3. S5643 Application Schematic

Notes:

1. All input, output and antenna traces are 50Ω microstrips.
2. No blocking capacitors are needed on all TRx ports for they are already integrated in the module.
3. Place Vbatt capacitors as close to the part as possible.
4. Vbatt capacitor value may change depending on application.
5. DNP = DO NOT Place

PACKAGE DIMENSIONS

The S5643 is a 4mm x 6.8mm x 0.846mm, 42-pad, leadless package. Figure4 is a three-view mechanical drawing of the pad configuration with layout dimensions.

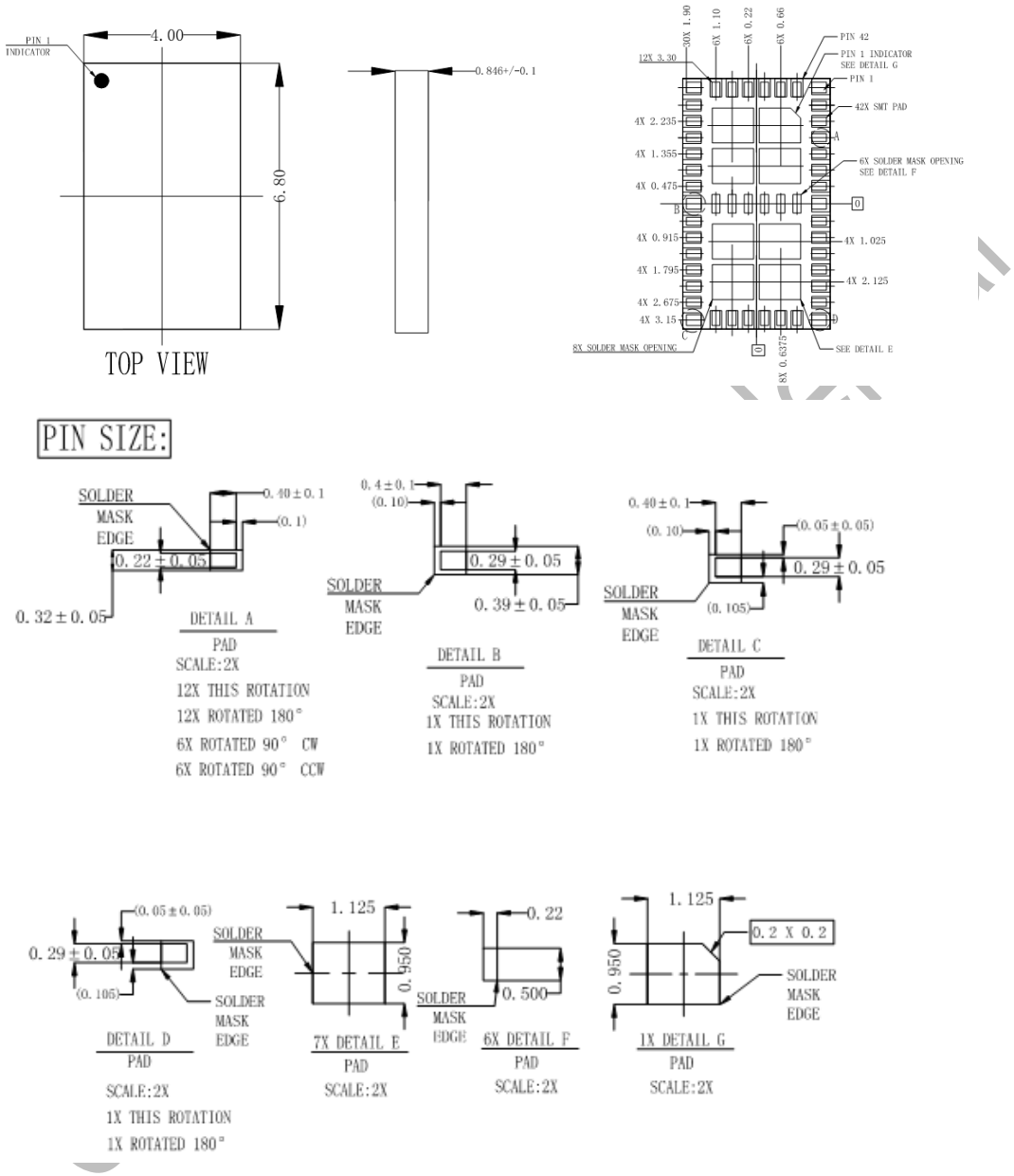

Figure4. S5643 Package Dimension

Notes: Unless otherwise specified
1. All dimensions in millimeters
2. Pad definitions per details on drawing

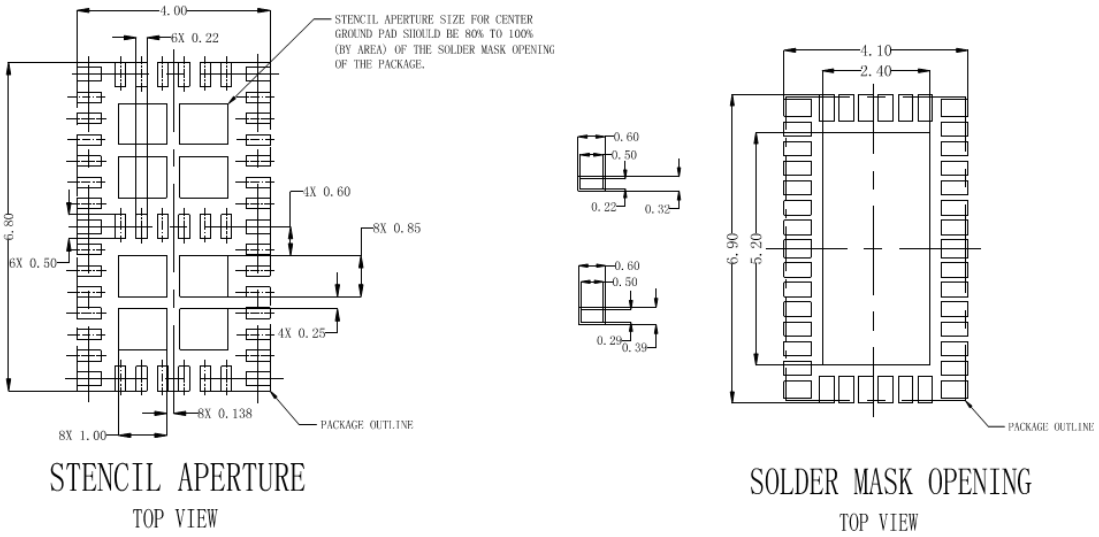

Figure5. PCB Layout Footprint for S5643 Package

Notes: Unless otherwise specified
1. All dimensions in millimeters
2. Pad definitions per details on drawing

ELECTROSTATIC DISCHARGE SENSITIVITY

The S5643 is Class 1C device per JESD22-A14 Human Body Model (HBM), and a Class M1 device per JESD22-A115 Machine Model (MM).

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

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

Facility

- Relative Humidity Control and Air lionizers
- Dissipative Floors(less than 1000 Ohm to GND).

Protective Packaging and Transportation

- Bags and Pouches(Faraday Shield)
- Protective Tote Boxes(Conductive Static Shielding)
- Protective Trays
- Grounded Carts
- Protective Work Order Holders

ORDERING INFORMATION

PRODUCT NAME	ORDER NUMBER	PACKAGE DESCRIPTION	COMPONENT PACKAGING
S5643 Power Amplifier Module	S5643	RoHS Compliant 42-Pin 4mmx6.8mmx0.846mm Surface Mount Module	-

REVISION HISTORY

Revision	Date	Description
Rev0p86	Apr.24th, 2017	Preliminary Release

REFERENCES

Smarter Micro MIPI Instruction

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