

Smart Energy Solutions

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Smart Energy Solutions

Applications

- ZigBee® (IEEE 802.15.4)
- Industrial and Control Unlicensed Band Radios
- Plug-in Hybrid Electric Vehicles (PHEVs)
- 802.15.4g
- Home Security and Automation

Products

- Front-end Modules (FEMs)
- Power Amplifiers (PAs) and Drivers
- Low Noise Amplifiers (LNAs)
- Power Management
- Switches
- Synthesizers
- Voltage Control Oscillators (VCOs)
- Diodes

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The Right Products for Your System Applications (Continued)

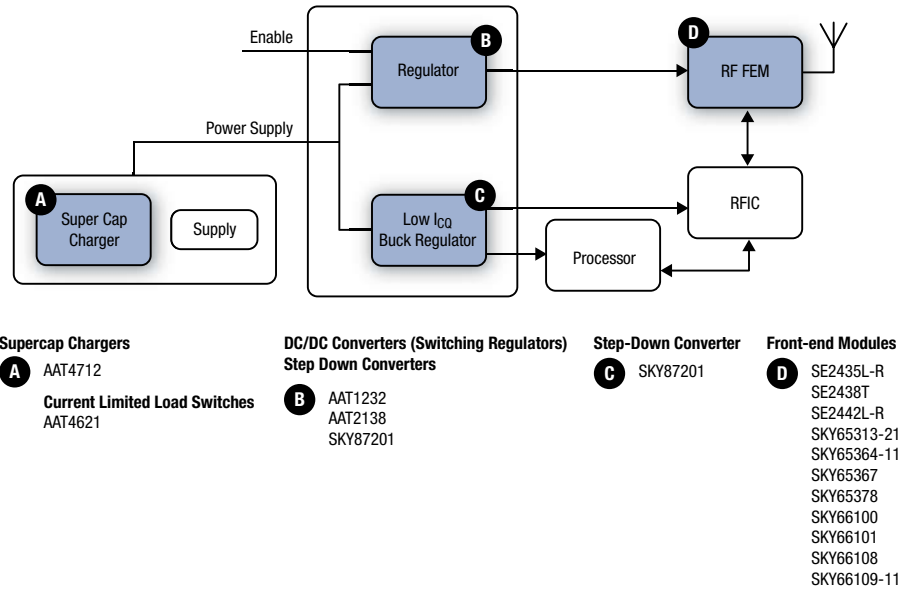


Figure 2. Smart Meter Communication Module (Simplified) Block Diagram

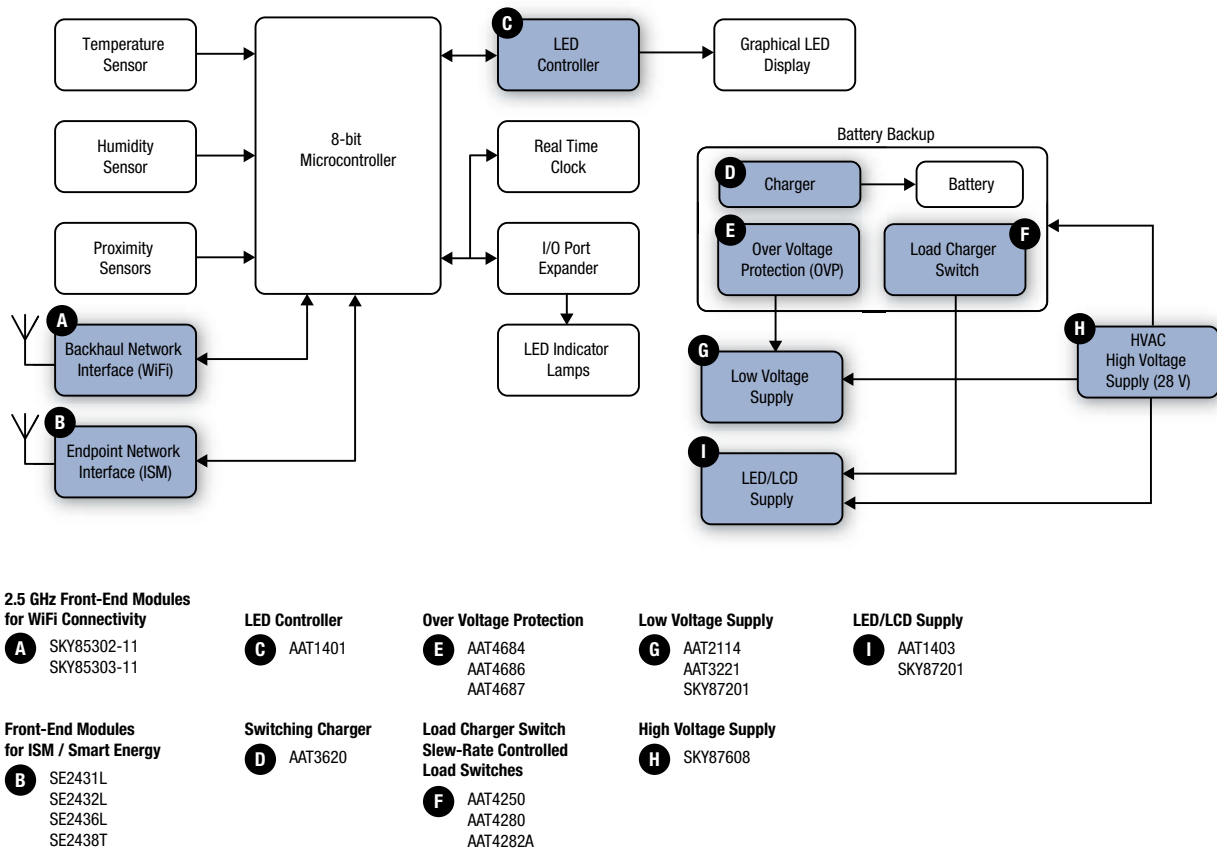


Figure 3. Thermostat Block Diagram

Custom Front-end Modules (FEMs)

Skyworks’ custom FEMs allow for significant size and cost reduction. In addition, many of Skyworks’ FEMs are designed to allow for “plug and play” functionality, thus drastically reducing the design time for new products. Customized FEMs can be created depending on transceiver implementation requirements. Various modules are being targeted at < 170, 410–470, 868–930, and 2400–2500 MHz frequency bands. Figure 4 shows a custom FEM block diagram.

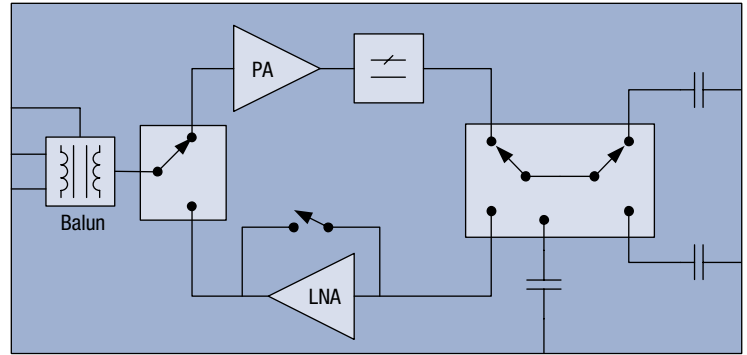


Figure 4. Custom Front-end Module (FEM)

Possibilities for Integration Include:

- T/R Switches
- Power Amplifiers
- Low Noise Amplifiers (LNAs)
- Mixers
- Harmonic Filters

Product Specifications

Specification tables for all of our latest Smart Energy products are provided on the following pages.

FRONT-END MODULES

Table 1. Front-end Modules

Part Number	Function	P _{OUT} (dBm)	Tx Gain (dB)	Rx Gain (dB)	I _{CC} Tx (mA)	Package (mm)	Frequency Band (MHz)			
							< 170	410–470	868–930	2400–2500
SKY66100-11	Tx / Rx Front-end Module with Rx / Tx Bypass	20–27	30	-0.5	110–300	MCM 4 x 4	•			
SKY65367-11	High Power Tx / Rx Front-end Module with Rx / Tx Bypass	30	35	-0.5	600	MCM 4 x 4	•			
SKY65342-11	High Power Tx / Rx Front-end Module with Rx Bypass	27–30	34	-0.6	650	MCM 8 x 8		•		
SKY65366-21	High Performance Tx / Rx Front-end Module	30.5	22	22	728	MCM 6 x 6		•		
SKY65378-11	Low Power Front-end Module with Tx Bypass and LNA	–	–	14–17	3–7 ⁽¹⁾	QFN 4 x 4				•
SKY65346-21	Tx / Rx Front-end Module with LNA	26	35	13.7	200	MCM 5 x 5				•
SE2435L-R	High Power Tx / Rx Front-end Module with LNA	30	28	16	550	QFN 4 x 4				•
SE2442L-R	High Power Tx / Rx Front-end Module with Rx Bypass	30	28	-0.7	550	QFN 4 x 4				•
SKY65313-21	Tx / Rx Front-end Module with LNA	30.5	28	16.6	695	MCM 6 x 6				•
SKY65364-11	High Power Tx / Rx Front-end Module with LNA, PA, Tx / Rx Bypass, HD Filter	30.5	30	15	730	MCM 6 x 6				•
SKY66101-11	High Performance, Highly Integrated Front-end Module	31	25	16	670	MCM 6 x 6				•
SE2438T-R	Low Power Tx / Rx Front-end Module with LNA	10–14	16	12.3	20–33	QFN 3 x 3				•
SKY66108	Low Power Tx / Rx Front-end Module with LNA	10–14	16	12.3	20–33	QFN 3 x 3				•

1. SKY65378: I_{CC} Rx gain value shown.

FRONT-END MODULES (CONTINUED)

Table 1. Front-end Modules (Continued)

Part Number	Function	P _{OUT} (dBm)	Tx Gain (dB)	Rx Gain (dB)	I _{CC Tx} (mA)	Package (mm)	Frequency Band (MHz)			
							< 170	410–470	868–930	2400–2500
SKY85302-11	2.4 GHz, 256 QAM WLAN/Bluetooth® Front-end Module	19	26	14	–	QFN 2.5 x 2.5				•
SKY85303-11	2.4 GHz, 256 QAM WLAN/Bluetooth® Front-end Module	19	26	14	–	QFN 2.5 x 2.5				•
SE2431L-R	Tx / Rx Front-end Module with LNA	20	23	12	110	QFN 3 x 4				•
SE2432L-R	Tx / Rx Front-end Module with LNA	20	22	11.5	110	QFN 3 x 4				•
SE2436L-R	High Power Tx / Rx Front-end Module with LNA	27	28	11.5	400	QFN 4 x 4				•
SKY66109-11	High Performance, Highly Integrated Front-end Module	20–24	22	12	105	MCM 3 x 4				•

AMPLIFIERS

Table 2. Power Amplifiers

Part Number	Function	P _{OUT} (dBm)	Gain (dB)	P _{1dB} (dBm)	I _{CO} (mA)	Package (mm)	Frequency Band (MHz)		
							450	915	2400
SE2433T-R	2-Stage Power Amplifier	24	22	24	–	QFN 2.5 x 2			•
SKY65116	2-Stage Power Amplifier	–	33	33	320	MCM 8 x 8	•		
SKY65111-348LF	3-Stage Power Amplifier	–	39.5	29.5	250	QFN 3 x 3		•	
SKY65006-348LF	3-Stage Power Amplifier	–	27.5	23.4	50	QFN 3 x 3			•
SKY65131	2-Stage Power Amplifier	–	26	28	150	MCM 4 x 4			•
SKY65132	3-Stage Power Amplifier	–	33	30	330	MCM 6 x 6			•
SKY65009-70LF	Single Stage Driver	–	17	25	110	SOT-89 4.5 x 2.4	•	•	•
SKY65045-70LF	Single Stage Driver	–	14 dB @ 900 MHz	25	60	SOT-89 4.5 x 2.4	•	•	
SKY65162-70LF	Single Stage Driver	–	20	29	185	SOT-89 4.5 x 2.4	•	•	•
SKY65152-11	3-Stage Power Amplifier	–	32	33	490	MCM 6 x 6			•
SKY67130-396LF	Single Stage Driver	–	13	16	22	DFN 2 x 2	•	•	•

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AMPLIFIERS (CONTINUED)

Table 3. Low Noise Amplifiers

Part Number	Function	Gain (dB)	NF (dB)	I _{CC} (mA)	IP _{1 dB} (dBm)	Package (mm)	Frequency Band (MHz)		
							450	915	2400
SKY65050-372LF	LNA, Discrete (250–6000 MHz)	16 dB @ 900 MHz	0.6	10	-9	SC-70 2.2 x 1.35	•	•	•
SKY65047-360LF	LNA with Shutdown Mode	16.5 dB @ 915 MHz	0.85	7.8	-7	QFN 2 x 2	•	•	•
SKY65405-21	LNA with Shutdown Mode	14	1	12	-3	QFN 1.5 x 1.5			•
SKY67012-396LF	LNA, Discrete (300–600 MHz)	16	0.9	15	-1	DFN 2 x 2	•		
SKY67013-396LF	LNA, Discrete (600–1500 MHz)	14.5	0.85	15	2.5	DFN 2 x 2		•	
SKY67014-396LF	LNA, Discrete (1500–3000 MHz)	12	0.95	5	5	DFN 2 x 2			•
SKY67110-396LF	LNA, High Linearity	21	0.65	77	2	DFN 2 x 2	•		
SKY67101-396LF	LNA, High Linearity	17.9	0.5	56	2.6	DFN 2 x 2		•	
SKY67102-396LF	LNA, High Linearity	17.2	0.8	50	-1	QFN 2 x 2			•

POWER MANAGEMENT

Battery Chargers

Table 4. Linear Chargers

Part Number	Function	Max. Charge Current (mA)	V _{IN} (V)	Package (mm)
AAT3663	Linear Li-Ion Battery Charger for Single and Dual Cell Applications	1000	4.0–13.2	TDFN 14L 3 x 3
AAT3681	USB Port or AC Adapter Lithium-Ion/Polymer Battery Charger	300	4.0–6.5	SC70JW 8L 2.0 x 2.1

Table 5. Switching Charger

Part Number	Function	Switching Frequency (kHz)	V _{IN} (V)	Package (mm)
AAT3620	Cell Li+ Switch Mode Battery Charger	1500	4.3–6.0	TDFN 14L 3 x 3

Table 6. Supercapacitor Chargers

Part Number	Function	Fault Flag	V _{IN} (V)	Package (mm)
AAT4712	Supercapacitor Charger with Input Current Limit	POK; RDY	2.5–5.5	TDFN34 16L 3 x 4
AAT4621	PC Card Current Limit Interface and Capacitor Charger	Yes	3.0–3.5	TDFN 14L 3 x 3

POWER MANAGEMENT (CONTINUED)**Voltage Regulation—DC/DC Converters (Switching Regulators)****Table 7. Step Up Converter**

Part Number	Function	V_{OUT} (V)	Typ. I_Q (μ A)	I_{OUT} (mA)	Package (mm)
AAT1219	Step Up Converter	2.4 to $V_{OUT} + 0.25$	58	1200	TDFN33 12L 3 x 3

Table 8. Step Down Converter

Part Number	Min. V_{IN} (V)	Max. V_{IN} (V)	Min. V_{OUT} (V)	Max. V_{OUT} (V)	I_{OUT} (mA)	f_{OSC} (kHz)	Typ. I_Q (μ A)	Package (mm)
AAT2114A	2.7	5.5	1	V_{IN}	2500	3000	70	QFN 16L 3 x 3
AAT2138	2.7	5.5	3	V_{IN}	2500	2800	90	TDFN 14L 3 x 3 x 0.75
SKY87201-11	2.7	5.5	0.6	V_{IN}	600	2000	37	SC70JW 8L 2 x 2.1
SKY87608	4.5	28	0.9	$0.8 \cdot V_{IN}$	3000	450	1600	SOP-8L 5 x 6 x 1.55

Low Drop-Out (LDO) Linear Regulator**Table 9. Low Drop-Out (LDO) Linear Regulator**

Part Number	Function	V_{IN} (V)	Typ. I_Q (μ A)	Max. I_{OUT} (mA)	Package (mm)
AAT3221	Ultra Low IQ LDO	$V_{OUT} - 5.5$	1.1	150	SOT-23 5L 2.85 x 2.8 SC70JW 8L 2.2 x 2.0

Display and Lighting**White LED Driver****Table 10. Serial Boost White LED Backlight Driver**

Part Number	Number of LEDs	LED Channels	LED(s) per/Ch	Min. V_{IN} (V)	Max. V_{IN} (V)	Interface	Typ. I_Q (μ A)	Peak Efficiency	Current Accuracy (%)	Current Matching (%)	Max. I_{OUT} per/Ch (mA)	Package (mm)
AAT1401	6	1	6	2.7	5.5	S2Cwire™, Filtered PWM	0.43	85%	±10%	N/A	31	WLCSF 10L 1.545 x 1.145 x 0.62
AAT1403	10	1	10	2.7	5.5	S2Cwire™, Filtered PWM	0.43	81%	±10%	N/A	31	WLCSF 10L 1.545 x 1.145 x 0.62

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POWER MANAGEMENT (CONTINUED)**Display and Lighting (Continued)****Table 11. Over Voltage Protection**

Part Number	Number of Channels	Enable	Fault Flag	I_{LIM}	Typ. $R_{DS(ON)}$ (m Ω)	V_{IN} (V)	Typ. I_Q (μ A)	Package (mm)
AAT4684	1	Yes	Yes	1.8 A	100	3.0–14.0	30	TSOPJW 12L 3.0 x 2.85 x 1.02
AAT4686	1	Yes	Yes	N/A	N/A	3.0–14.0	30	SC70JW 8L 2.0 x 2.1 x 1.05
AAT4687	1	Yes	Yes	N/A	130	3.0–14.0	30	SC70JW 10L 2.0 x 2.0 x 1.1

Port Protection and Power Distribution**Table 12. Slew Rate Controlled**

Part Number	Number of Channels	Enable	Turn On Rise Time (T_r)	Typ. $R_{DS(ON)}$ (m Ω)	V_{IN} (V)	Typ. I_Q (μ A)	Package (mm)
AAT4250	1	Yes	1.5 ms	120	1.8–5.5	2	SOT-23 5L, (SOT25) 2.85 x 2.80 x 1.20 SC70JW 8L 2.0 x 2.1 x 1.05
AAT4280	1	Yes	0.5 μ s 0.1 ms 1.0 ms	80	1.8–5.5	2	SOT-23 6L 2.85 x 2.80 x 1.20 SC70JW8L 2.2 x 2.0 x 1.05
AAT4282A	2	Yes	0.5 μ s 0.1 ms 1.0 ms	60	1.5–6.5	1	FTDFN22-8 2.0 x 2.0 x 0.75 SC70JW 8L 2.2 x 2.0 x 1.05
AAT4282B	2	Yes	0.065 ms 0.75 ms	67	1.5–6.5	0.04	TDFN22-8 2.0 x 2.0 x 0.75

SWITCHES

Table 13. SPDT (SP2T), SP3T, and DPDT RF Switches

Part Number	Function	Insertion Loss (dB)	Isolation (dB)	P _{1dB} (dBm)	Input IP3 (dBm)	Package (mm)	Frequency Band (MHz)		
							450	915	2400
SKY13268-344LF	SPDT Switch, Low Loss	0.3	25	30	50	SOT-666 1.5 x 1.2	•	•	•
SKY13309-370LF	SP3T Switch, Low Loss	0.5	25	29	–	QFN 2 x 2	•	•	•
AS179-92LF	SPDT Switch, Low Loss	0.3	25	30	48	SC-88 2.2 x 2	•	•	•
SKY13270-92LF	SPDT Switch, Low Loss	0.35	24	>37	56	SC-88 2.1 x 2.0	•	•	•
AS193-73LF	SPDT Switch, Low Loss	0.35	24	37	55	SOT-6 2.8 x 2.9	•	•	•
SKY13348-374LF	SPDT Switch	0.6	27	37	52	DFN 1.5 x 1.5	•	•	•
SKY13370-374LF	SPDT Switch	0.7	31	39	55	DFN 1.5 x 1.5	•	•	•
SKY13299-321LF	SPDT Switch	0.3–0.75	30–22	39	57	QFN 3 x 3	•	•	•
SKY13318-321LF	DPDT Switch	0.95–1.15	22–15	34	57	QFN 3 x 3	•	•	•

SYNTHESIZERS

Table 14. Dual and Single Fractional-N Synthesizers

Part Number	Function	Phase Noise (dBc/Hz)	Direct Modulation	I _{DD} (mA)	Package (mm)	Frequency Band (MHz)		
						450	915	2400
SKY72300-21	Dual Frac-N Synthesizer	-91	FSK, FM, GMSK	12.5	TSSOP 9.7 x 6.4	•	•	
SKY72300-362	Dual Frac-N Synthesizer	-91	FSK, FM, GMSK	12.5	QFN 4 x 4	•	•	
SKY72301-22	Dual Frac-N Synthesizer	-96	FSK, FM, GMSK	11	TSSOP 9.7 x 6.4	•	•	
SKY72310-362LF	Single Frac-N Synthesizer	-91	FSK, FM, GMSK	12.5	QFN 4 x 4	•	•	

VOLTAGE CONTROLLED OSCILLATORS (VCOs)

Table 15. Voltage Controlled Oscillators (VCOs)

Part Number	Function	Phase Noise (dBc/Hz)	Direct Modulation	I _{DD} (mA)	Package (mm)	Frequency Band (MHz)		
						450	915	2400
SKY73120	CMOS VCO	-110 @ 25 kHz Offset	0	26	MCM 6 x 6		•	

DIODES

Table 16. Varactor Diodes for Tuning Applications

Part Number	Function	Capacitance (C _v)	Capacitance Ratio (C _r)	Series Resistance (R _s)/ Quality Factor	Package (mm)	Frequency Band (MHz)		
						450	915	2400
SMV1405-079LF	VCO Tuning	1.8 pF @ 1 V	C _{T0} /C _{T30} = 4.1	Q @ 4 V 50 MHz = 3200	SC-79 1.6 x 0.8	•	•	•
SMV1405-040LF	VCO Tuning	1.8 pF @ 1 V	C _{T0} /C _{T30} = 4.1	Q @ 4 V 50 MHz = 3200	0402 1.0 x 0.6	•	•	•
SMV1413-079LF	VCO Tuning	6.4 pF @ 1 V	C _{T0} /C _{T30} = 4.2	Q @ 4 V 50 MHz = 2400	SC-79 1.6 x 0.8	•	•	•
SMV1408-001LF	VCO Tuning	2.9 pF @ 1 V	C _{T0} /C _{T30} = 4.1	Q @ 4 V 50 MHz = 2900	SOT-23 2.9 x 2.35	•	•	•
SMV1247-011LF	VCO Tuning	7 pF @ 0.3 V	C _{T0.3} /C _{T4.7} = 10	Q @ 3 V 50 MHz = 1500	SOD-323 2.5 x 1.25	•	•	•
SMV1247-040LF	VCO Tuning	7 pF @ 0.3 V	C _{T0.3} /C _{T4.7} = 10	Q @ 3 V 50 MHz = 1500	0402 1.0 x 0.6	•	•	•
SMV1249-040LF	VCO Tuning	31 pF @ 0.3 V	C _{T0.3} /C _{T4.7} = 12.1	R _s @ 3 V 500 MHz = 1.2 Ω	0402 1.0 x 0.6	•	•	•
SMV1249-079LF	VCO Tuning	31 pF @ 0.3 V	C _{T0.3} /C _{T4.7} = 12.1	R _s @ 3 V 500 MHz = 2.2 Ω	SC-79 1.6 x 0.8	•	•	•
SMV1251-001LF	VCO Tuning	42 pF @ 0.3 V	C _{T0.3} /C _{T4.7} = 12.2	R _s @ 3 V 500 MHz = 1.6 Ω	SOT-23 2.9 x 2.35	•	•	•
SMV1253-079LF	VCO Tuning	53 pF @ 0.3 V	C _{T0.3} /C _{T4.7} = 12.3	R _s @ 3 V 500 MHz = 1.4 Ω	SC-79 1.6 x 0.8	•	•	•
SMV1255-011LF	VCO Tuning	64 pF @ 0.3 V	C _{T0.3} /C _{T4.7} = 12.3	R _s @ 3 V 500 MHz = 1.3 Ω	SOD-323 2.5 x 1.25	•	•	•
SMV1233-011LF	VCO Tuning	3.3 pF @ 1 V	C _{T1} /C _{T3} = 1.5	R _s @ 3 V 500 MHz = 1.2 Ω	SOD-323 2.5 x 1.25	•	•	•
SMV1236-004LF	VCO Tuning	17 pF @ 1 V	C _{T1} /C _{T3} = 1.6	R _s @ 3 V 500 MHz = 0.5 Ω	SOT-23 2.9 x 2.35	•	•	•
SMV1763-040LF	VCO Tuning	5.2 pF @ 1 V	C _{T0.5} /C _{T2.5} = 2.3	R _s @ 1 V 900 MHz = 0.7 Ω	0402 1.0 x 0.6	•	•	•
SMV1763-079LF	VCO Tuning	5.2 pF @ 1 V	C _{T0.5} /C _{T2.5} = 2.5	R _s @ 1 V 500 MHz = 0.7 Ω	SC-79 1.6 x 0.8	•	•	•
SMV1142-011LF	VCO Tuning	8.2 pF @ 1 V	C _{T1} /C _{T3} = 1.5	R _s @ 3 V 500 MHz = 0.7 Ω	SOD-323 2.5 x 1.25	•	•	•
SMV1235-079LF	VCO Tuning	11.5 pF @ 1 V	C _{T1} /C _{T3} = 1.8	R _s @ 3 V 500 MHz = 0.6 Ω	SC-79 1.6 x 0.8	•	•	•
SMV1235-040LF	VCO Tuning	11.5 pF @ 1 V	C _{T1} /C _{T3} = 1.8	R _s @ 3 V 500 MHz = 0.6 Ω	0402 1.0 x 0.6	•	•	•

DIODES (CONTINUED)

Table 17. PIN Diodes for Switching Applications













Part Number	Function	Voltage Breakdown (V_B)	Capacitance (C_T)	Series Resistance (R_S)	Package (mm)	Frequency Band (MHz)		
						450	915	2400
SMP1345-518	Antenna Switch	50 V @ 10 μ A	0.18 pF @ 5 V	R_S @ 10 mA = 1.5 Ω	LGA 1.2 x 1.4	•	•	•
 SMP1340-040LF	T/R Switch	50 V @ 10 μ A	0.20 pF @ 5 V	R_S @ 10 mA = 0.9 Ω	0402 1.0 x 0.6	•	•	•
 SMP1340-079LF	Antenna Switch	50 V @ 10 μ A	0.20 pF @ 5 V	R_S @ 10 mA = 0.9 Ω	SC-79 1.6 x 0.8	•	•	•
 SMP1320-040LF	T/R Switch	50 V @ 10 μ A	0.25 pF @ 30 V	R_S @ 10 mA = 0.9 Ω	0402 1.0 x 0.6	•	•	•
 SMP1320-079LF	T/R Switch	50 V @ 10 μ A	0.30 pF @ 30 V	R_S @ 10 mA = 0.9 Ω	SC-79 1.6 x 0.8	•	•	•
 SMP1302-079LF	Attenuator Switch	200 V @ 10 μ A	0.30 pF @ 30 V	R_S @ 10 mA = 3.0 Ω	SC-79 1.6 x 0.8	•	•	•
 SMP1302-040LF	T/R Switch	50 V @ 10 μ A	0.30 pF @ 30 V	R_S @ 10 mA = 0.9 Ω	0402 1.0 x 0.6	•	•	•

Table 18. Schottky Diodes for Detector and Mixer Applications

Part Number	Function	Voltage Breakdown (V_B)	Capacitance (C_T)	Forward Voltage (V_F)	Package (mm)	Frequency Band (MHz)		
						450	915	2400
 SMS7630-040LF	Detector	1 V @ 10 μ A	0.30 pF @ 0.15 V	V_F @ 0.1 mA = 60–120 mV	SC-79 1.6 x 0.8	•	•	•
 SMS7630-079LF	Detector	1 V @ 10 μ A	0.30 pF @ 0.15 V	V_F @ 0.1 mA = 60–120 mV	0402 1.0 x 0.6	•	•	•
 SMS7630-061	Detector	1 V @ 10 μ A	0.30 pF @ 0.15 V	V_F @ 0.1 mA = 60–120 mV	0201 0.60 x 0.30	•	•	•
 SMS7621-040LF	Detector/Mixer	2 V @ 10 μ A	0.18 pF @ 0.15 V	V_F @ 1.0 mA = 260–320 mV	0402 1.0 x 0.6	•	•	•
 SMS7621-079LF	Detector/Mixer	2 V @ 10 μ A	0.18 pF @ 0.15 V	V_F @ 1.0 mA = 260–320 mV	SC-79 1.6 x 0.8	•	•	•
 SMS7621-060	Detector/Mixer	2 V @ 10 μ A	0.18 pF @ 0.15 V	V_F @ 1.0 mA = 260–320 mV	0201 0.60 x 0.30	•	•	•
SMS3926-023LF	Low Drive Mixer	2 V @ 10 μ A	0.30 pF @ 0 V	V_F @ 1.0 mA = 200–270 mV	SOT-143 2.37 x 2.92	•	•	•
SMS3927-023LF	Medium Drive Mixer	2 V @ 10 μ A	0.30 pF @ 0 V	V_F @ 1.0 mA = 310–370 mV	SOT-143 2.37 x 2.92	•	•	•
SMS3928-023LF	High Drive Mixer	4 V @ 10 μ A	0.30 pF @ 0 V	V_F @ 1.0 mA = 520–580 mV	SOT-143 2.37 x 2.92	•	•	•

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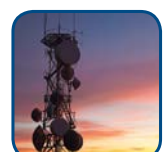
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