



FM1119C SP4T (Single Pole Four Throw Switch)

Features

- Low insertion loss: 0.4 dB at 1 GHz.
- High peak voltage handling.
- High linearity.
- Ultra small package: QFN, 11-pin, 1.6x1.6 mm.
No external DC blocking capacitor required (Unless external DC is applied to the RF ports).
- Wide VDD voltage range.
- 2 kV HBM ESD protection at all ports.

Applications

- Antenna Tuning
- Band Switching
- Impedance Tuning

Description

The FM1119C is a single-pole four-throw (SP4T) switch designed for static Antenna/impedance tuning applications which requires very low insertion loss and high power handling capability with a minimum of DC power consumption. The high linearity performance achieved by the FM1119C make it ideal for use in multi-mode GSM/GPRS/EDGE/WCDMA/LTE applications. The FM1119C is controlled by a standard GPIO interface for easy control. The FM1119C includes an integrated LDO (Low Drop Out) regulator, which enables operation over a very wide supply range. All pins are ESD protected to ensure 2kV HBM ESD tolerance. The FM1119C is packaged in an ultra compact 1.6 x 1.6 mm, 11-pin, QFN package.

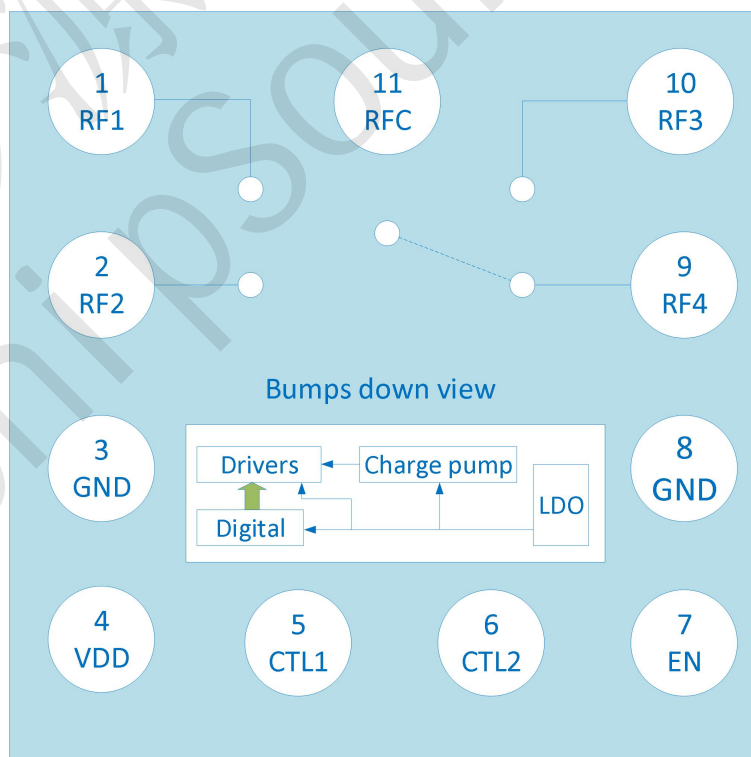


Figure 1. FM1119C Functional Schemat



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Table 1. FM1119C Absolute Maximum Ratings

Parameters	Rating	Unit
Power supply voltage VDD	5.0	V
Control Voltage VCTL	3.0	V
Enable voltage VEN	5.0	V
ESD voltage HBM VESD	2	kV
Storage temperature Tst	-40 to 150	°C
Operating temperature TOP	-30 to 85	°C
Max differential RF voltage between RFC and RF ports V _{RF}	39	VP
RF Input power 50Ω	41	dBm

Table 2. FM1119C Operating Conditions

Parameter & Description	Specification			Unit	Conditions
	Min	Typ	Max		
Nominal conditions unless otherwise specified.					
V _{DD} = 3.5 V, V _{CTL1} & V _{CTL2} = 1.8V / 0V, V _{EN} = 1.8V, Temp = 25°C, 50Ω.					
Supply and control signal characteristics					
Operating supply voltage, V _{DD}	2.4	3.5	4.5	V	
Supply current, I _{DD}	-	85	100	μA	
Enable voltage – High, V _{ENH}	1.2	1.8	V _{DD}	V	
Enable voltage – Low, V _{ENL}	0.0	0.0	0.45	V	
Control voltage – High, V _{CTLH}	1.2	1.8	2.8	V	
Control voltage – Low, V _{CTLL}	0.0	0.0	0.45	V	
Control current – High, I _{CTLH}	-	-	5	μA	
Control current – Low, I _{CTLL}	-	-	5	μA	
Switching time^[1]					
Start-up time, t _{start-up}	-	6	20	μs	50% V _{DD} to large signal fully compliant
ON Switching speed, t _{ON}	-	2	5	μs	50% control to 90% RF ON
OFF Switching speed, t _{OFF}	-	2	5	μs	50% control to 10% RF OFF



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Table 3. FM1119C Electrical Specifications – Linear Parameters

Parameter	Description	Specification			Unit	Conditions
		Min	Typ	Max		
Nominal conditions unless otherwise specified. All RF Ports $V_{DD} = 3.5\text{ V}$, V_{CTL1} & $V_{CTL2} = 1.8\text{ V} / 0\text{ V}$, $V_{EN} = 1.8\text{ V}$, Temp = 25°C, 50Ω.						
Insertion Loss – RFC to RFx Switch ON						
IL _L	Low band	-	0.4	0.45	dB	1000 MHz
IL _M	High band	-	0.45	0.55	dB	1910 MHz
IL _H	Ultra high band	-	0.55	0.70	dB	2700 MHz
Isolation – RFC to RFx Switch OFF						
ISO _{700MHz}	700 MHz	26	32	-	dB	700 MHz
ISO _L	Low band	25	32	-	dB	1000 MHz
ISO _M	High band	18	21	-	dB	1910 MHz
ISO _H	Ultra high band	16	19	-	dB	2700 MHz
Return Loss – RFC to RFx Switch ON						
RL	Switch ON	20	25	-	dB	1000 MHz

Table 4. FM1119C Electrical Specifications – Nonlinear Parameters

Parameter	Description	Specification			Unit	Conditions
		Min	Typ	Max		
Nominal conditions unless otherwise specified. All RF Ports $V_{DD} = 3.5\text{ V}$, V_{CTL1} & $V_{CTL2} = 1.8\text{ V} / 0\text{ V}$, $V_{EN} = 1.8\text{ V}$, Temp = 25°C, 50Ω.						
Harmonics – RFC to RFx Switch ON						
<i>Low Band</i>						
2f ₀	LB Second order harmonics	-80	-95	-	dBc	Pin=35dBm 915 MHz
3f ₀	LB Third order harmonics	-75	-90	-	dBc	Pin=35dBm 915 MHz
<i>High Band</i>						
2f ₀	HB Second order harmonics	-75	-94	-	dBc	Pin=33dBm 1910 MHz
3f ₀	HB Third order harmonics	-65	-80	-	dBc	Pin=33dBm 1910 MHz

Table 5. FM1119C Pin Names and Description

Pin	Function	Description
1	RF1	RF port 1.
2	RF2	RF port 2.
3	GND	Ground.
4	VDD	Voltage Supply.
5	CTL1	Control Voltage 1.



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6	CTL2	Control Voltage 2.
7	EN	Enable.
8	GND	Ground.
9	RF4	RF port 4.
10	RF3	RF port 3.
11	RFC	Common RF port .

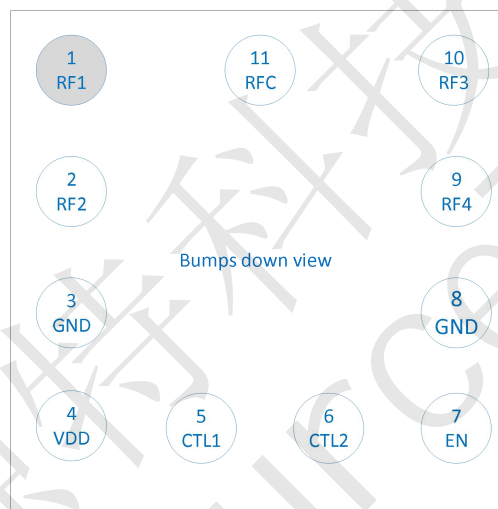


Figure 2. FM1119C Pin Out

Table 6. FM1119C Control Logic

State	VEN	VCTL1	VCTL2	RF Path
RF1	V _{HIGH}	V _{LOW}	V _{LOW}	RFC to RF1
RF2	V _{HIGH}	V _{LOW}	V _{HIGH}	RFC to RF2
RF3	V _{HIGH}	V _{HIGH}	V _{LOW}	RFC to RF3
RF4	V _{HIGH}	V _{HIGH}	V _{HIGH}	RFC to RF4
LPM ^[1]	V _{LOW}	X	X	Low power mode

Note: RF signal should not be applied in the low power mode.



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Package Drawing

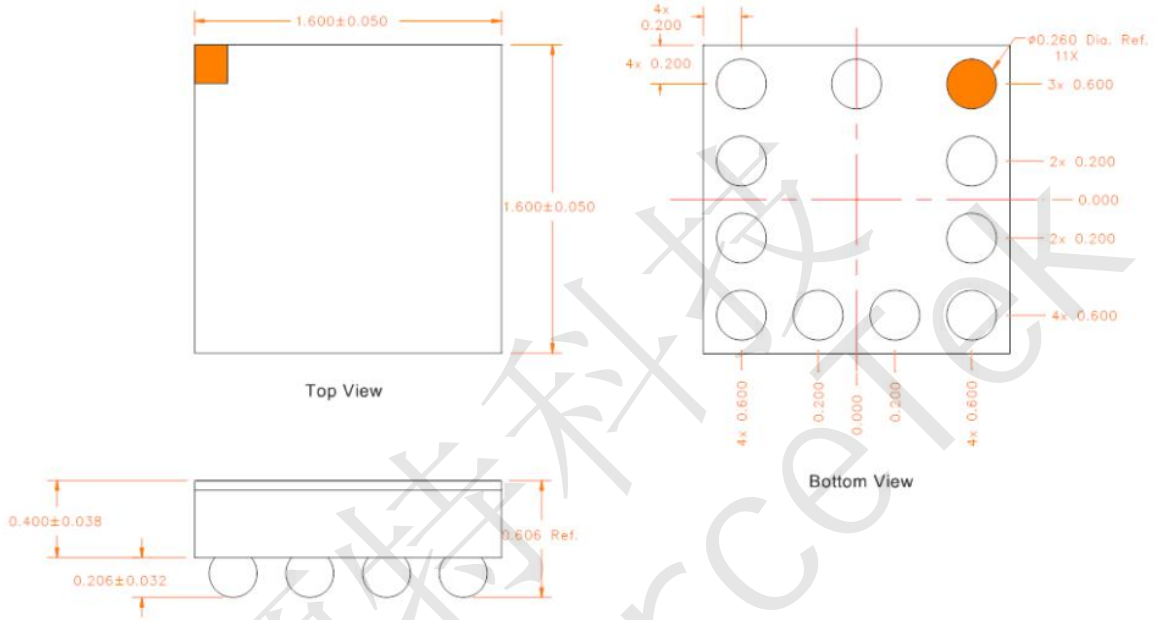


Figure 3.

PCB Pattern

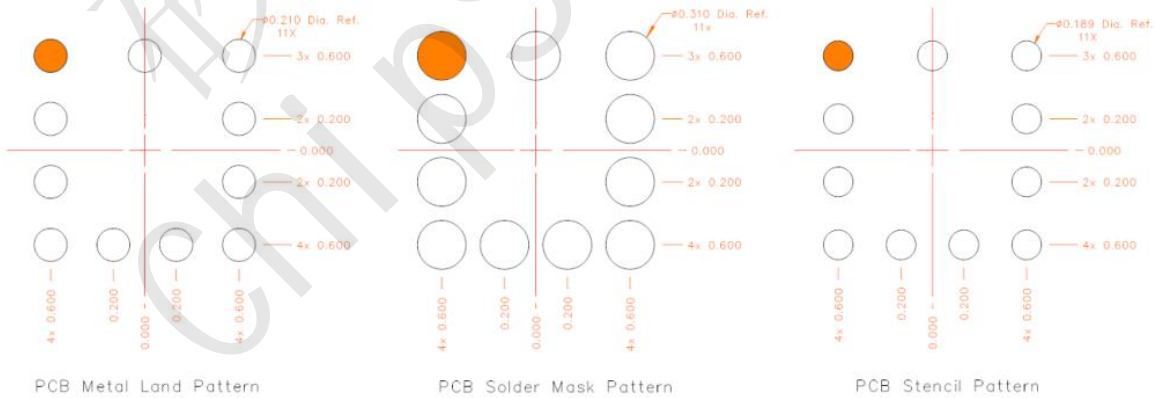


Figure 4.



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Power ON and OFF sequence

- It is very important that the user adheres to the correct power-on/off sequence in order to avoid damaging the device. The control signals CTL1 and CTL2 should be set to 0V unless VDD & EN are set in the operating voltage range.
- RF signal should not be applied on any of the RF ports when the VDD is below 2.4V and the EN is set below VENH.
- Power ON –
 - 1) Apply voltage supply - VDD
 - 2) Apply Enable - VEN (VEN can be connected to VDD and applied at the same time)
 - 3) Apply controls - CTL1 and CTL2
 - 4) Wait 20 μ s or greater and then apply RF
- Change switch position from one RF port to another –
 - 1) Remove RF
 - 2) Change controls CTL1 and CTL2 to set the switch to desired RF port
 - 5) Wait 5 μ s or greater and then apply RF
- Power OFF –
 - 1) Remove RF
 - 2) Remove controls - CTL1 & CTL2
 - 3) Remove VEN
 - 4) Remove VDD

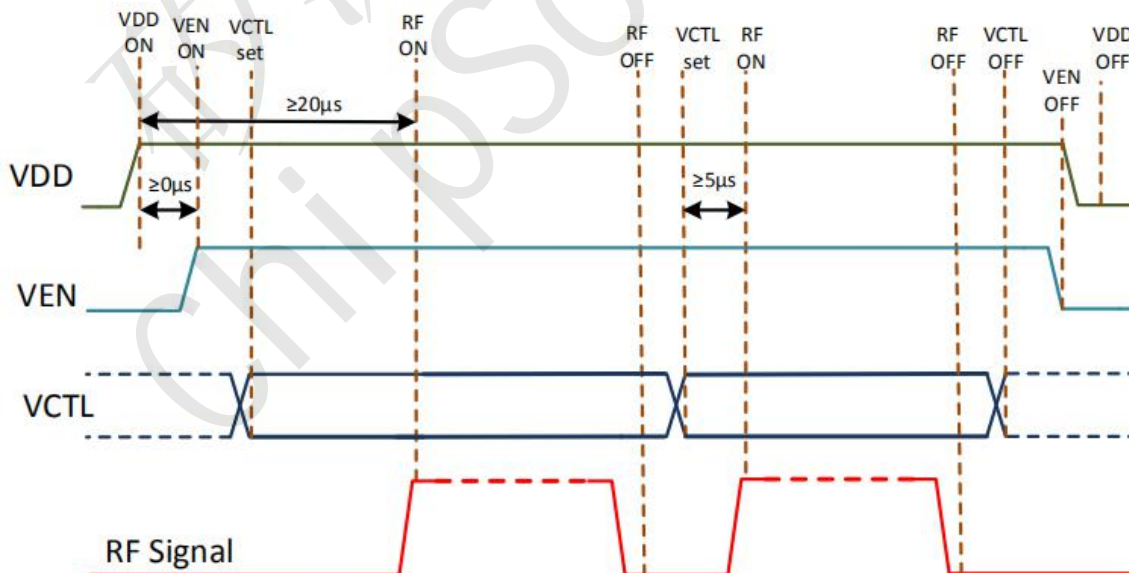


Figure 5.



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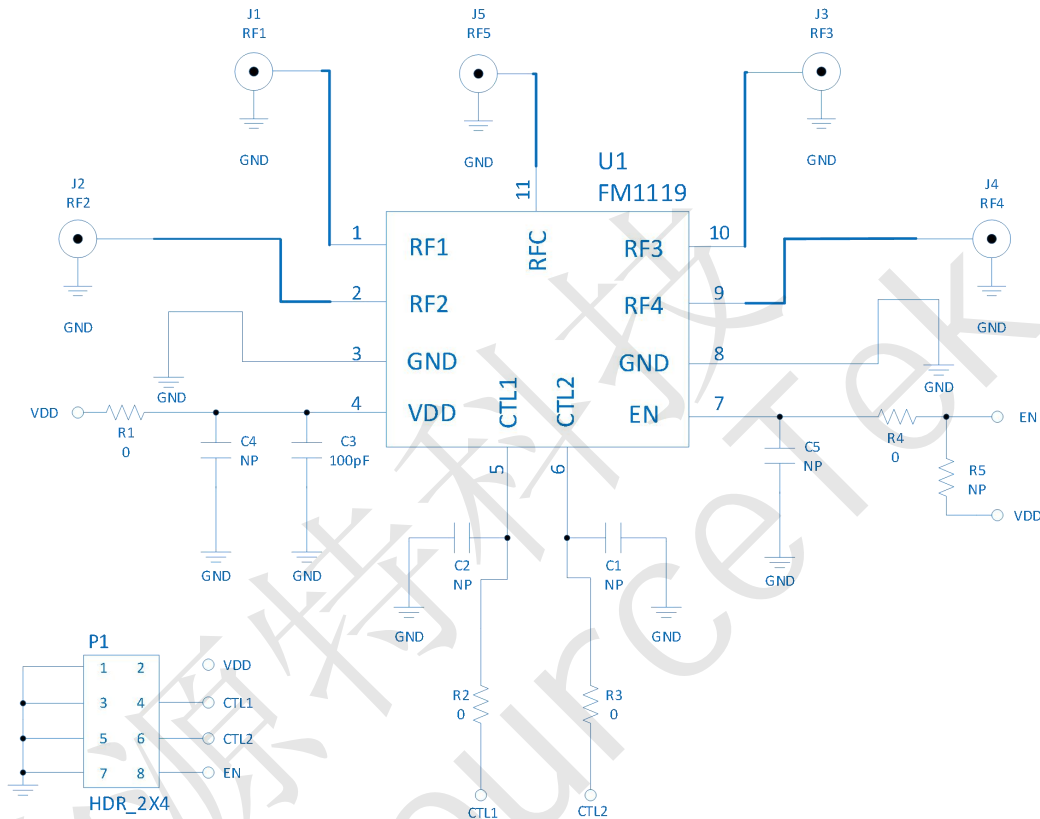


Figure 5. FM1119C Evaluation Board Schematic

Table 9. FM1119C Pin Names and Description

Part Number	Part	Part Description
U1	FM1119C	FM1119C, SP4T Switch
J1,J2,J3,J4&J5	SMA connector	Edge mount 0.068" SMA connector
C3	100 pF capacitor	(0402) 100 pF de-coupling capacitor
C1,C2,C4&C5	NP	No Placement - Do not populate
R1,R2,R3&R4	0Ω jumper	(0402) 0Ω resistor
R5	NP	No Placement - Do not populate
P1	2X4 RA header	2X4 right angled header with 0.1" spacing

Application Guidelines

Decoupling Capacitors = A decoupling capacitors on VDD, CTL1, CTL2 and EN may be used for noise reduction. The value of the decoupling capacitor should be selected based on the application.

DC Blocking Capacitors = DC blocking capacitor is not required on an RF port if no DC voltage exists on that port.