



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.

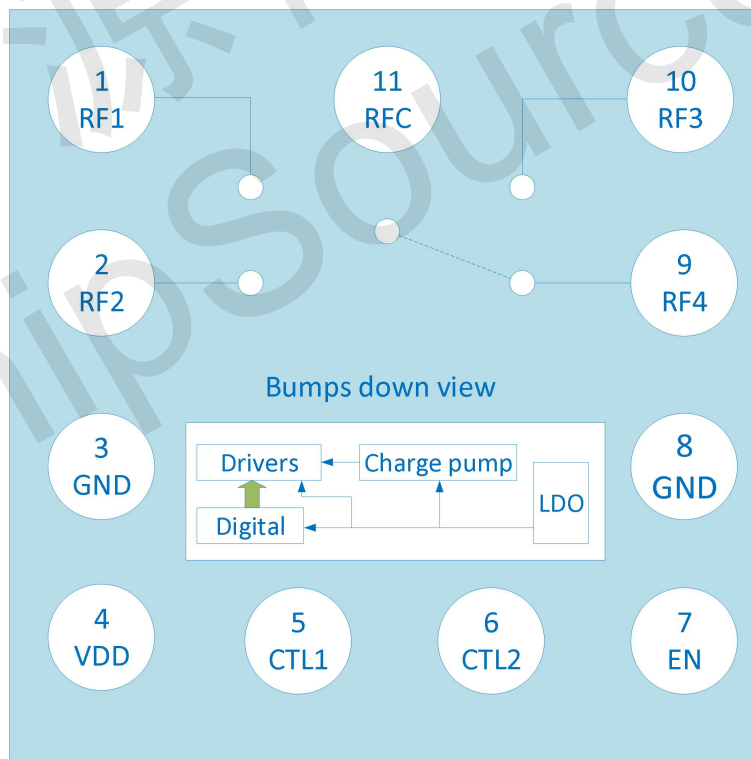


Figure 1. FM1119C Functional Schemat



FM1119C

SP4T (Single Pole Four Throw Switch)

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 _{CTL}	0.0	0.0	0.45	V	
Control current – High, I _{CTLH}	-	-	5	μA	
Control current – Low, I _{CTL}	-	-	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



FM1119C

SP4T (Single Pole Four Throw Switch)

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.



FM1119C

SP4T (Single Pole Four Throw Switch)

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 .

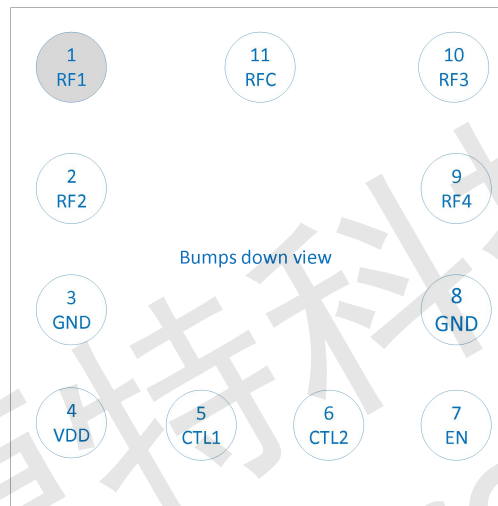


Figure 2. FM1119C Pin Out

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.



FM1119C

SP4T (Single Pole Four Throw Switch)

Package Drawing

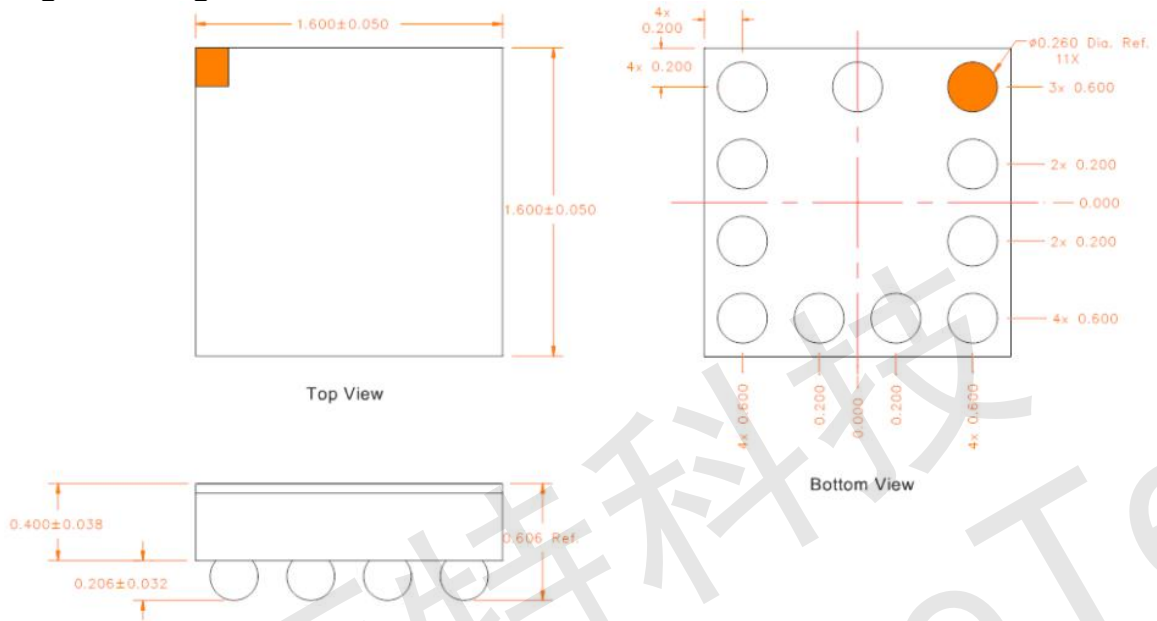


Figure 3.

PCB Pattern

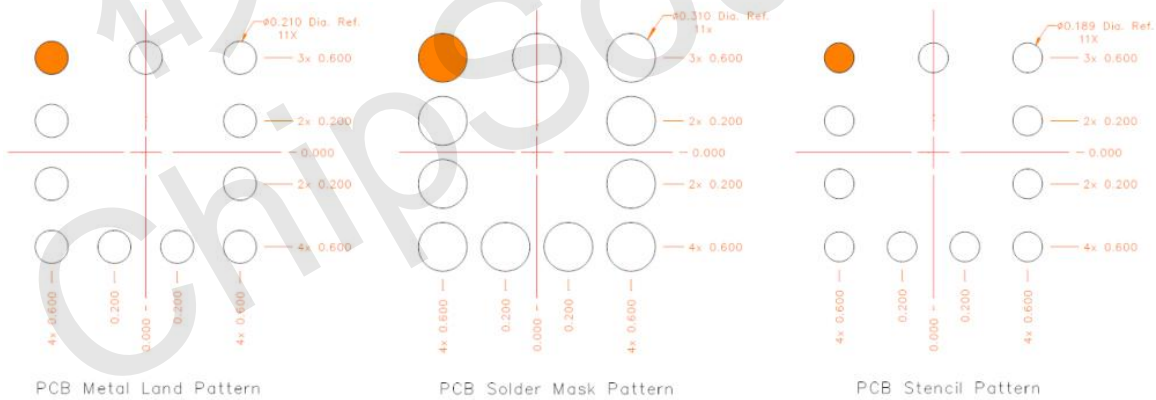


Figure 4.



FM1119C

SP4T (Single Pole Four Throw Switch)

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

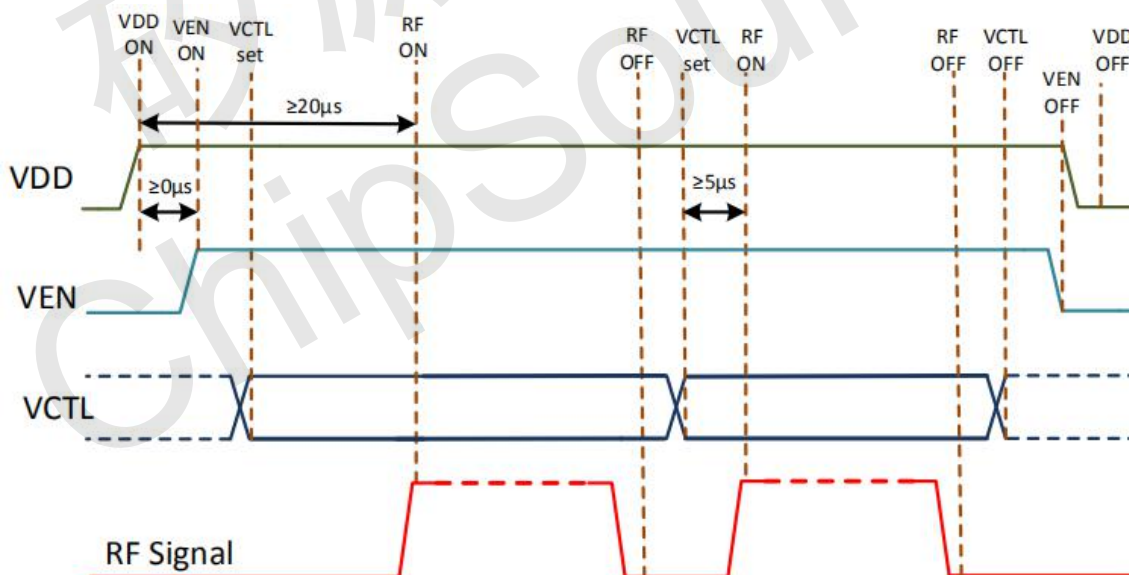


Figure 5.



FM1119C

SP4T (Single Pole Four Throw Switch)

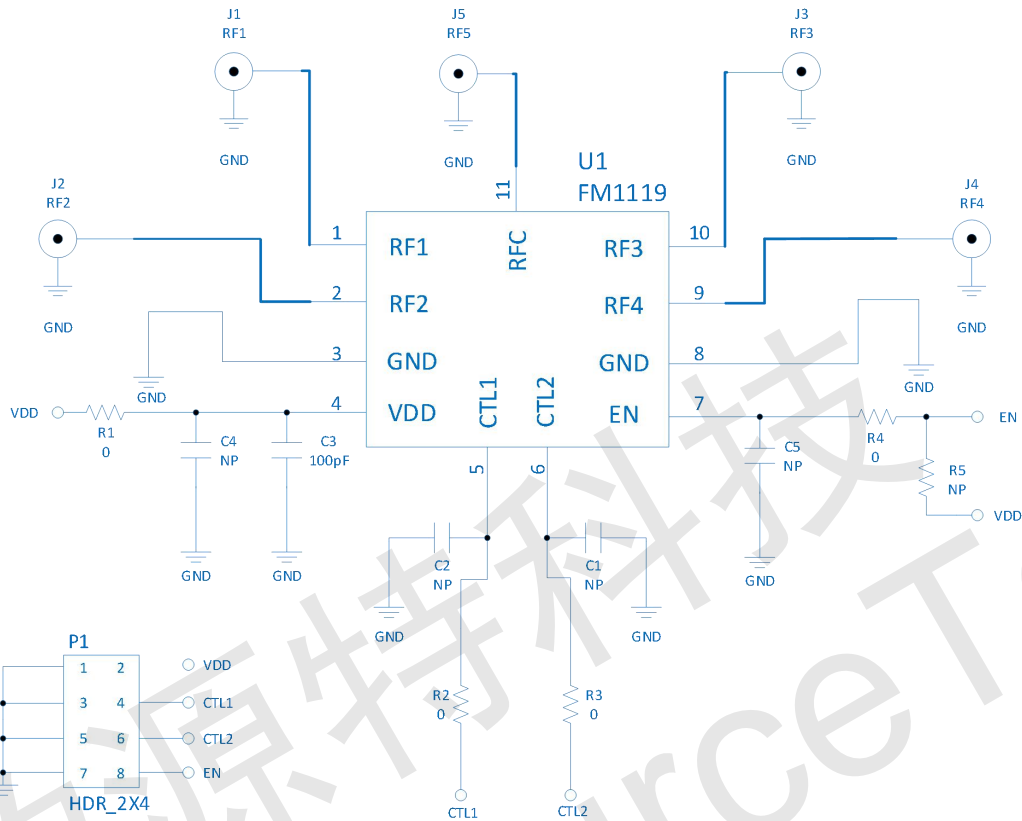


Figure 5. FM1119C Evaluation Board Schematic

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.