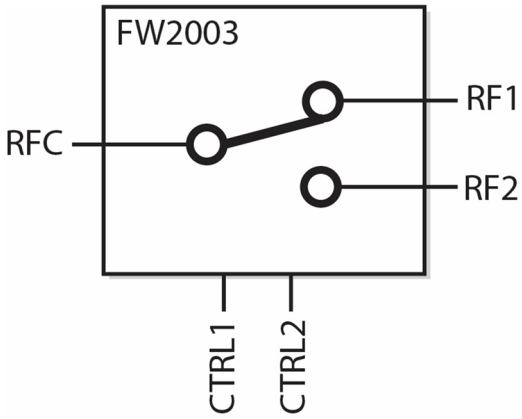
FW2003
Product Datasheet
GaN SPDT 60W RF Switch 30MHz – 6GHz

Features

- Wide bandwidth, high power SPDT
- 60 W Pulsed Power Handling
- 30 W CW Power Handling
- Extended low frequency operation to 9 kHz
- 290 ns Switching Time / 430 ns Settling Time
- Hot switching capable
- 3.0 mm x 3.0 mm QFN Package

Functional Block Diagram



Applications

- Test and Measurement systems
- L,S and C-Band radio and RADAR systems

Table 1: Electrical Specifications T_a = 25 °C, Z_0 = 50 Ω, V_{ctrl} = ± 5.0 V

Parameter	Conditions	Units	Min	Typical	Max
Frequency		GHz	0.03		6
RF Pulsed Input Power	10 us pulse, 1.0 % DC, 1.0 GHz	W			60
RF CW Input Power	1.0 GHz	W			30
Compression Point Pulsed	0.1 dB, 1.0 GHz	dBm		47.2	
Compression Point CW	0.1 dB, 1.0 GHz	dBm	44.8	45.6	
Input IP3	1.0 GHz, 20 dBm	dBm		70	
Switching Time	50 % of V_{CTRL} to 10%/ 90% of RF voltage	ns		290	
Settling Time	50 % of V_{CTRL} to within 0.1 dB final power	ns		430	
Insertion Loss (see also: "Use with External Matching")	30 MHz	dB		0.3	
	1.0 GHz			0.4	0.6
	3.0 GHz			0.8	
	5.0 GHz			1.2	
	6.0 GHz			1.3	

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Table 2: Electrical Specifications T_a = 25 °C, Z_0 = 50 Ω, V_{ctrl} = ± 5.0 V

Parameter	Conditions	Units	Min	Typical	Max
Video Feedthrough	50 Ω	mV_{pp}		45	
Return Loss	30 MHz	dB		30	
	1.0 GHz			19.5	
	3.0 GHz			23	
	5.0 GHz			11	
	6.0 GHz			11	
Isolation: RFC to RF1/RF2	30 MHz	dB		64	
	1.0 GHz		48	51	
	3.0 GHz			40	
	5.0 GHz			34	
	6.0 GHz			31.5	
Isolation: RF1/RF2 (ON port to OFF Port)	30 MHz	dB		64	
	1.0 GHz		40.5	43.5	
	3.0 GHz			34	
	5.0 GHz			29	
	6.0 GHz			26.5	

Table 3: Operational Conditions

Parameter	Conditions	Units	Min	Typical	Max
DC Control Voltage		V	-5.5		5.5
I_{CTRL} Positive Voltage		uA		180	250
I_{CTRL} Negative Voltage		nA	-500	-130	
Operating Temperature		˚C	-40		85
Operating Junction Temperature		˚C			150
Thermal Resistance	To Case Bottom	˚C /W		9	

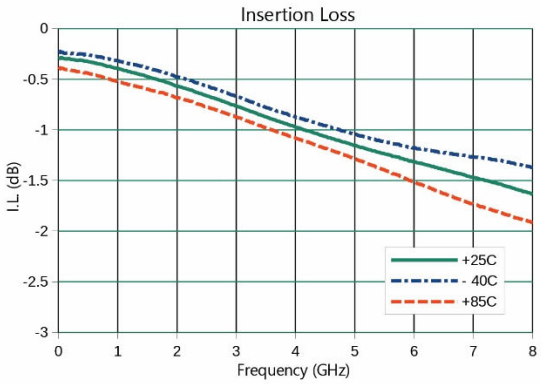
Table 4: Absolute Max Ratings

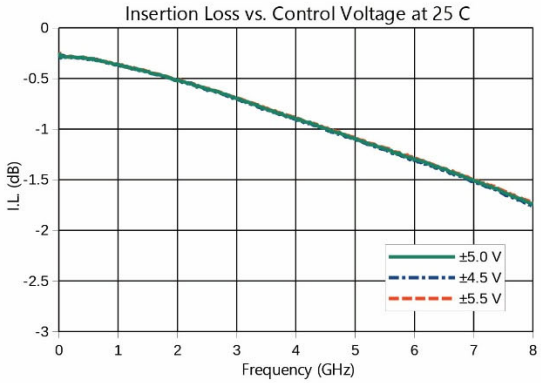
Parameter	Conditions	Units	Min	Max	Comment
DC Control Voltage		V	-10	10	
ESD RF Pins	HBM	V		250	
	CDM	V		100	
ESD non-RF Pins	HBM	V		1000	
	CDM	V		100	
Storage Temperature		˚C	-65	150	
Power Handling CW	1.0 GHz, see power handling table	dBm		45.6	
Pulsed Power Handling	10 us pulse, 1.0 % DC, 1.0 GHz	dBm		47.2	
RF Hot Switching	1.0 GHz, 10 kHz rate, RFC Input	dBm		44.8	

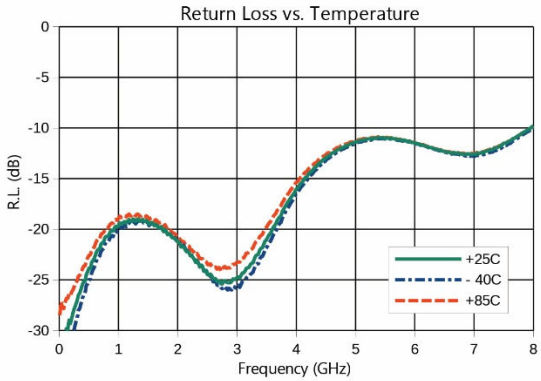
Table 5: Control Logic

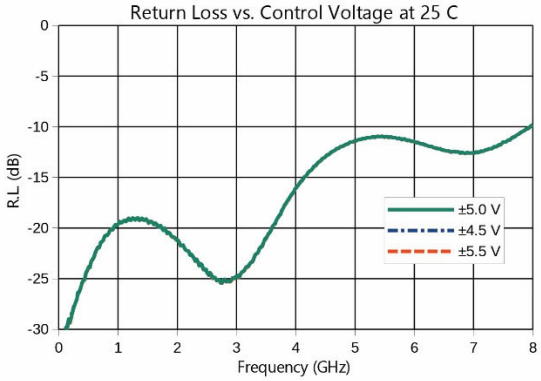
Switch State	CTRL1	CTRL2
RFC - RF1 ON	5.0 V	-5.0 V
RFC - RF2 ON	-5.0 V	5.0 V

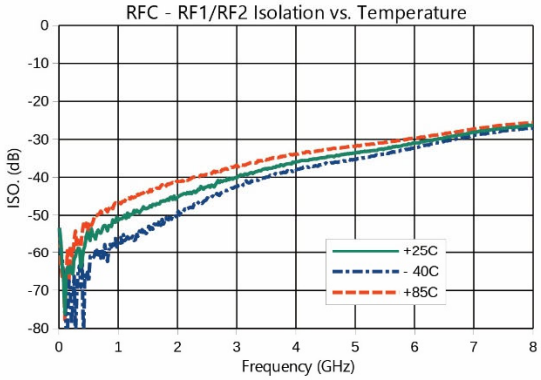
Typical Performance Data: Ta = 25 °C, Z_0 = 50 Ω, Vctrl = ± 5.0 V

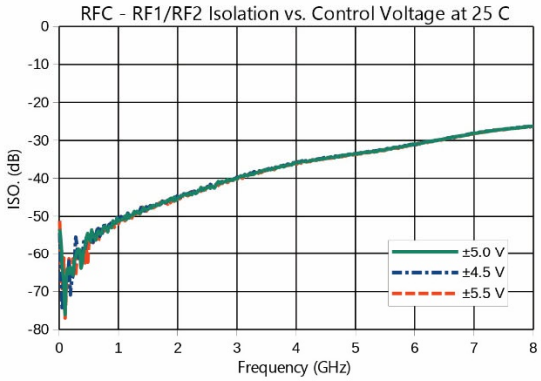


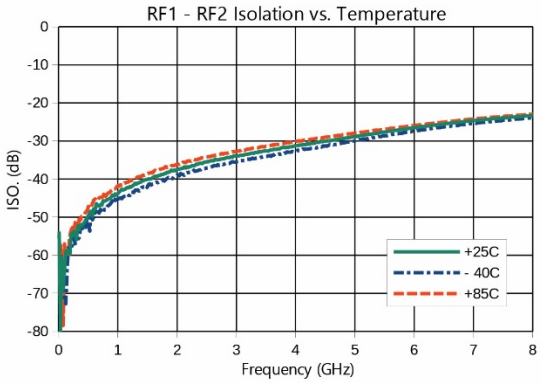


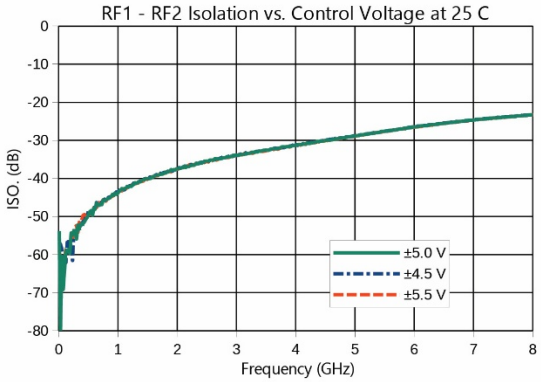




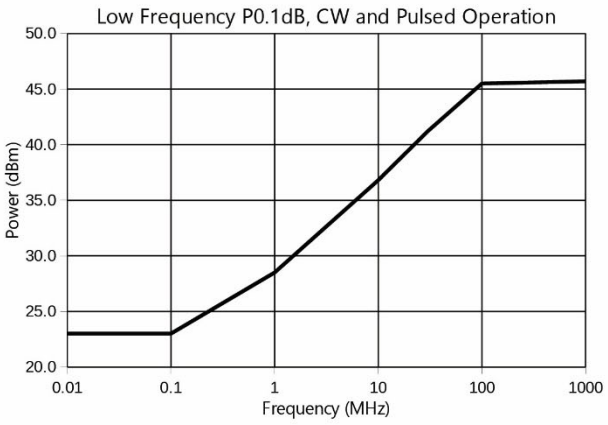


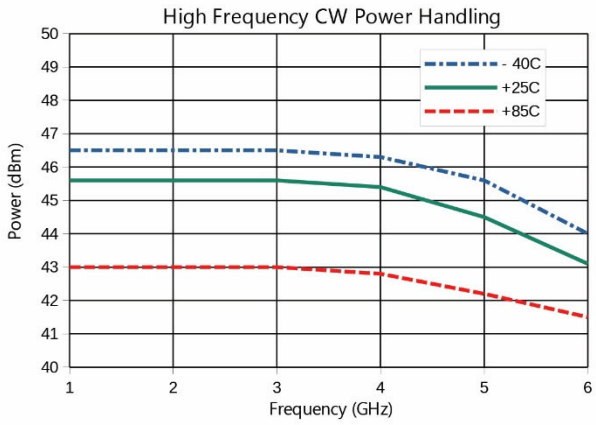






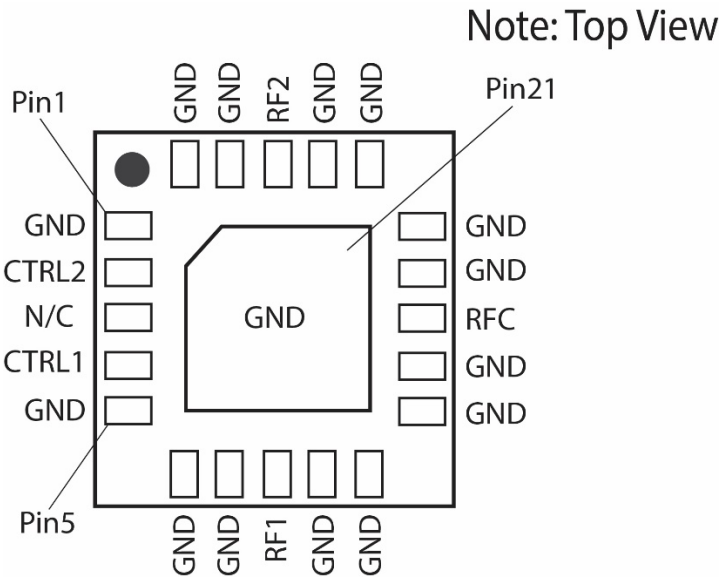
Power Handling vs. Temperature and Frequency





Note: This device is capable of extended low frequency operation down to 9 kHz at reduced power. Operating below the $P_{0.1}$ dB shown above is recommended. For high frequency operation, power handling is de-rated vs. frequency and temperature. For high power operation thermal management techniques must be used.

Pin Configuration



Pin Function Descriptions

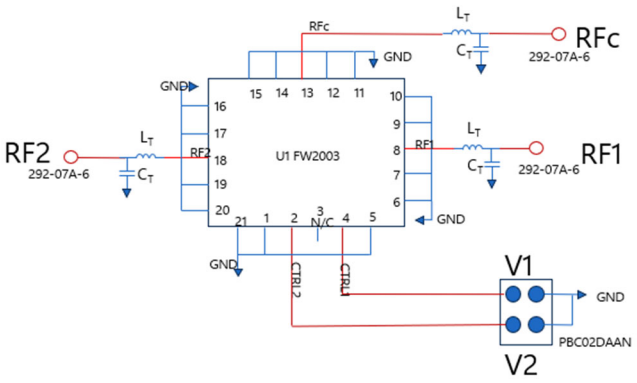
Table 6: Pin Function Descriptions

Pin	Pin Name	Description
1	GND	RF Ground
2	CTRL2	Control Signal 2, see table 5
3	N/C	Not Connected, may be routed to GND
4	CTRL1	Control Signal 1, see table 5
5	GND	RF Ground
6	GND	RF Ground
7	GND	RF Ground
8	RF1	RF Port 1
9	GND	RF Ground
10	GND	RF Ground
11	GND	RF Ground
12	GND	RF Ground
13	RFC	Common RF Port
14	GND	RF Ground
15	GND	RF Ground
16	GND	RF Ground
17	GND	RF Ground
18	RF2	RF Port 2
19	GND	RF Ground
20	GND	RF Ground
21	GND	RF Ground PAD, connected to RF Ground

Use with External Matching

For further improvement in the high frequency performance region up to 8 GHz, the FW2003 may be used with external matching elements. Use of distributed matching elements does increase the usable frequency range to 8 GHz and lower the insertion loss in the upper frequency region. The method is described in the Application Note *APP00003, Matching FW2003 for Operation up to 8 GHz.*

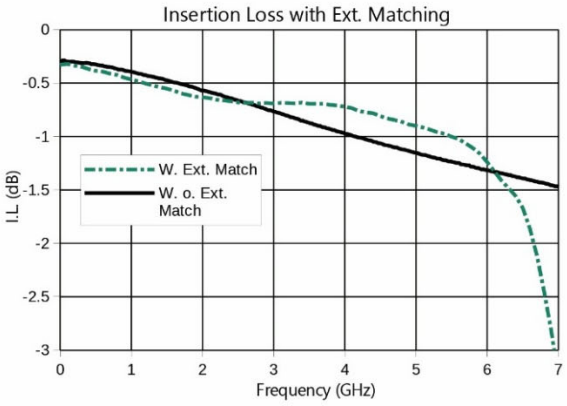
If a distributed match is not practical, a discrete version match is available that can improve the Insertion Loss and Return Loss Performance in the 3 GHz – 6 GHz frequency range. This is accomplished by adding an external 1.1 nH series inductor and a 0.4 pF shunt capacitor to each of the ports of the FW2003.

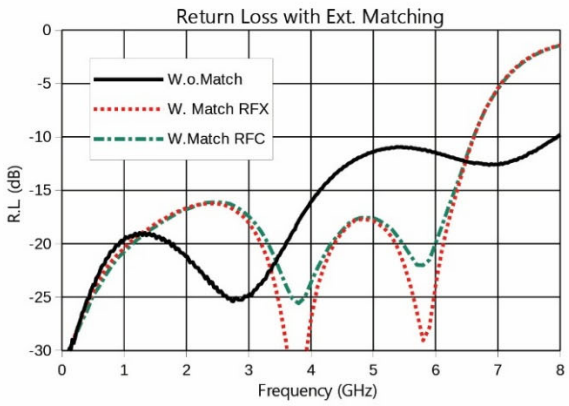


Recommended Series Inductor: 1.1 nH High-Q RF Inductor such as LQW1005-Series or 0402-HP Series. Selected inductor must be able to handle 1400 mA RF current if operating at max rated power.

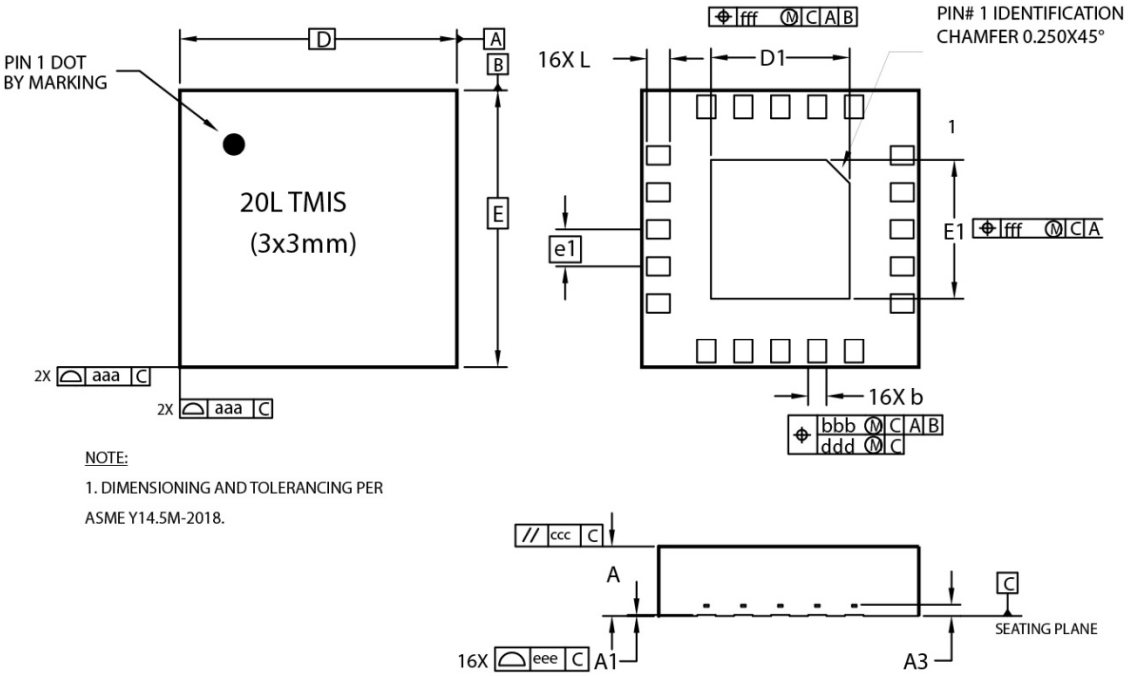
Recommended Shunt Capacitor: 0.4 pF 200 V COG or NPO case size 0201 or 0402 such as GQM0335C2DR40WB01J or GQM1555C2DR40WB01DCT.

Typical performance improvements with matching circuits:





Outline Dimensions



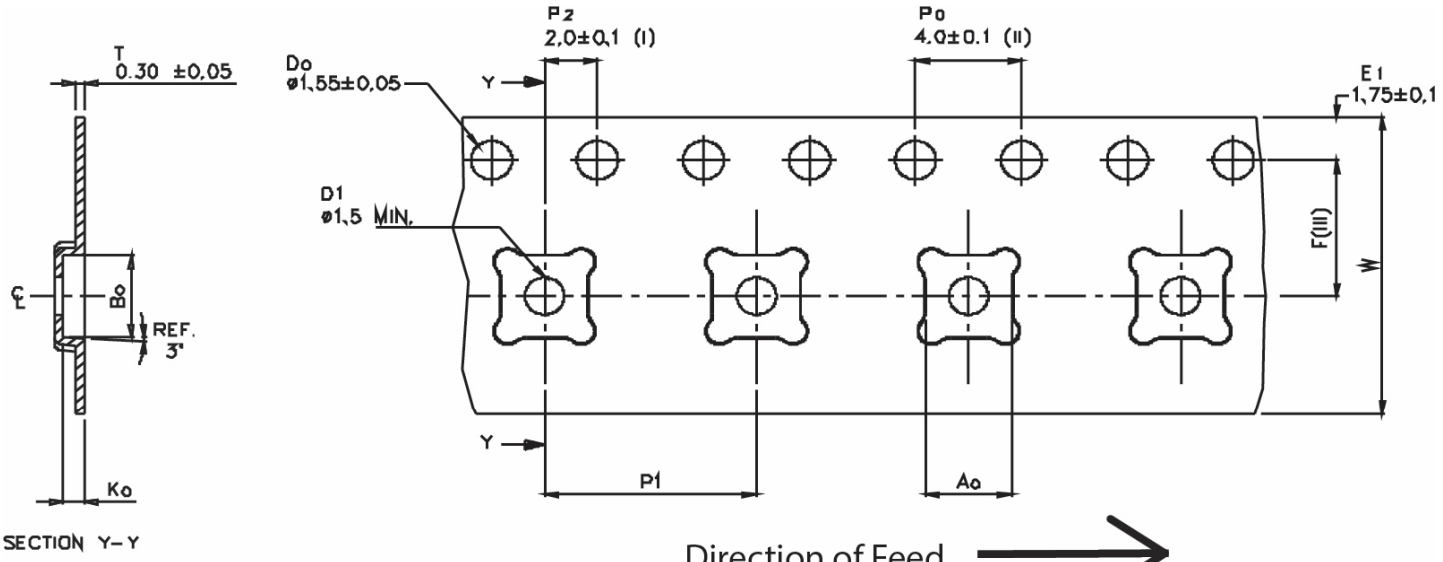
NOTE:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2018.

Dimensional Ref.			
REF.	Min.	Nom	Max.
A	0.700	0.750	0.800
A1	-0.006	—	0.004
A3	0.120REF		
D	3.000 BSC		
E	3.000 BSC		
D1	1.450	1.500	1.550
E1	1.450	1.500	1.550
b	0.150	0.200	0.250
e	0.400 BSC		
L	0.200	0.250	0.300

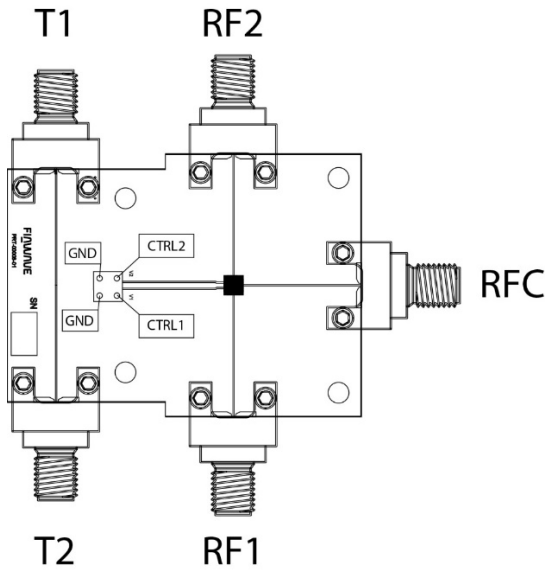
Dimensional Tol.	
aaa	0.050
bbb	0.070
ccc	0.050
ddd	0.050
eee	0.050
fff	0.100

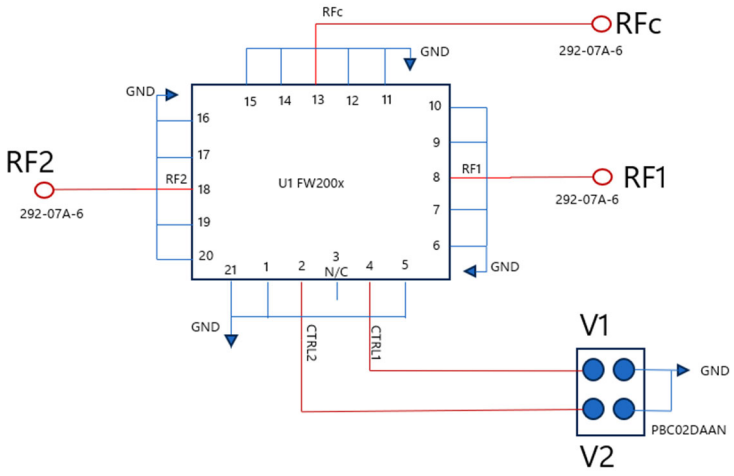
Tape and Reel Information



Ao	3.30 +/− 0.1
Bo	3.30 +/− 0.1
Ko	0.80 +/− 0.1
F	5.50 +/− 0.1
P1	8.00 +/− 0.1
W	12.00 +/− 0.3

Evaluation Board





MSL Level

Moisture Sensitivity Level 1 (MSL1)



Caution! Device may be damaged by ESD events. Please observe handling procedures for ESD sensitive devices.

Ordering Information

Order Code	ECCN	Description
FW2003	EAR99	500 Units on Tape & Reel
FW2003-EVB	EAR99	Evaluation Board
FW2003-ES	EAR99	Engineering Sample

Application Notes

Application Note	Description
APP-00002	Recommended Driver for Finwave GaN-Si Switches
APP-00003	Matching FW2003 for Operation up to 8 GHz
APP-00004	Finwave Switches in High Altitude and Low Earth Orbit Environments

RoHS Compliance

Finwave Switches are compliant with 2011/65/EU RoHS directive, and by directive amendment 2015/863/EU. For additional information, please contact sales@finwavesemi.com

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