FP101

High Dynamic Range FET

The Communications Edge ™

Product Information

Product Features

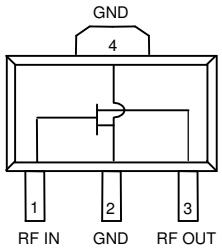
- 50 – 3000 MHz
- 13.5 dB Gain
- +26 dBm P1dB
- +37 dBm OIP3
- 2.0 dB Noise Figure
- MTTF > 100 years
- Lead-free/Green/RoHS-compliant SOT-89 Package

Product Description

The FP101 is a high dynamic range GaAs FET packaged in a low-cost surface-mount package. The combination of low noise figure and high output IP3 at the same bias point makes it ideal for receiver and transmitter applications. The FP101 achieves +37 dBm OIP3 with consistent quality to maintain MTTF values exceeding 100 years at mounting temperatures of +85°C and is available in the environmentally-friendly lead-free/green/RoHS-compliant SOT-89 package.

All devices are 100% RF and DC tested. The product is targeted for applications where high linearity is required.

Functional Diagram



Function	Pin No.
Input / Gate	1
Output / Drain	3
Ground	2, 4

Specification

DC Parameter	Units	Min	Typ	Max	Comments
Saturated Drain Current, I_{dss}	mA		270		V_{gs} = 0 V, V_{ds} = 3 V
Transconductance, G_m	mS		120		
Pinch Off Voltage, V_p	V		-2.3		I_{ds} = 1.2 mA

RF Parameter	Units	Min	Typ	Max	Comments
Frequency Range	MHz	50	800	3000	
Small Signal Gain, Gss	dB		13.5		
Maximum Stable Gain, Gmsg	dB		20.5		
Output P1dB	dBm	+23	+26		
Output IP3	dBm	+34	+37		+8 dBm / tone, 10 MHz spacing, 1850 MHz
Noise Figure	dB		1.9		V_{ds} = +5 V

Test conditions unless otherwise noted: T = 25ºC, V_{ds} = +8 V, I_{dq} = 100 mA, frequency = 800 MHz in a 50 ohm system.

Thermal Information

Parameters	Rating
Operating Case Temperature	-40 to +85° C
Storage Temperature	-55 to +125° C
Thermal Resistance (junction to ground tab)	68° C / W
Junction Temperature* (8V / 100 mA)	139° C
Junction Temperature* (5V / 100 mA)	119° C

Absolute Maximum Rating

Parameter	Rating
Operating Case Temperature	-40 to +85 °C
Storage Temperature	-55 to +150 °C
Gate to Source Voltage	-6 V
RF Input Power (continuous)	+17 dBm
DC Power	2.0 W
Junction Temperature	+220° C

Operation of this device above any of these parameters may cause permanent damage.

Ordering Information

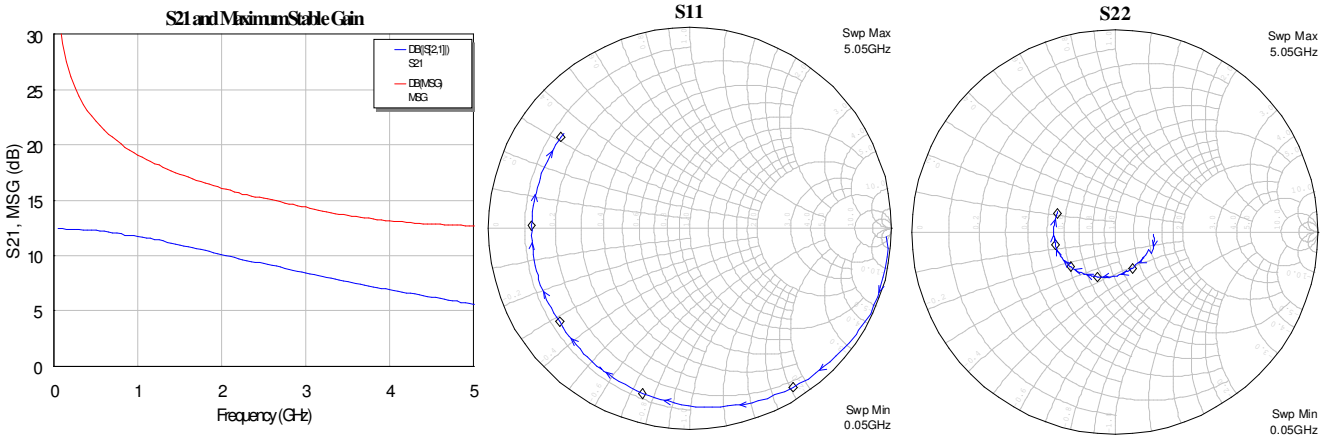
Part No.	Description
FH101*	High Dynamic Range FET (lead-tin SOT-89 package)
FH101-G	High Dynamic Range FET (lead-free/green/RoHS-compliant SOT-89 package)

* This package is being phased out in favor of the green package type which is backwards compatible for existing designs.

Specifications and information are subject to change without notice.

Typical Device Data

S-Parameters (V_{ds} = 8 V, I_{ds} = 100 mA, 25°C, Unmatched 50 ohm system)

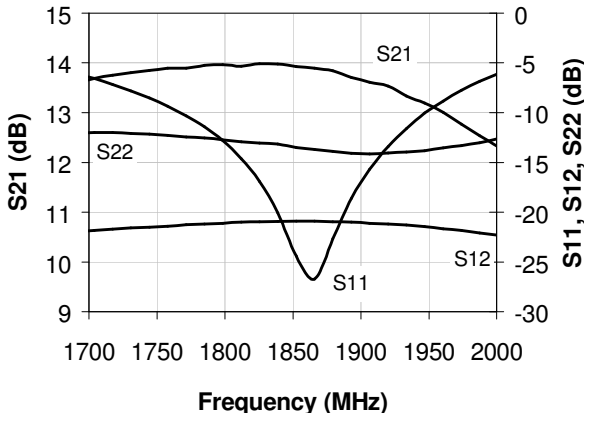


Reference Design (1800 – 1900 MHz)

Typical Performance

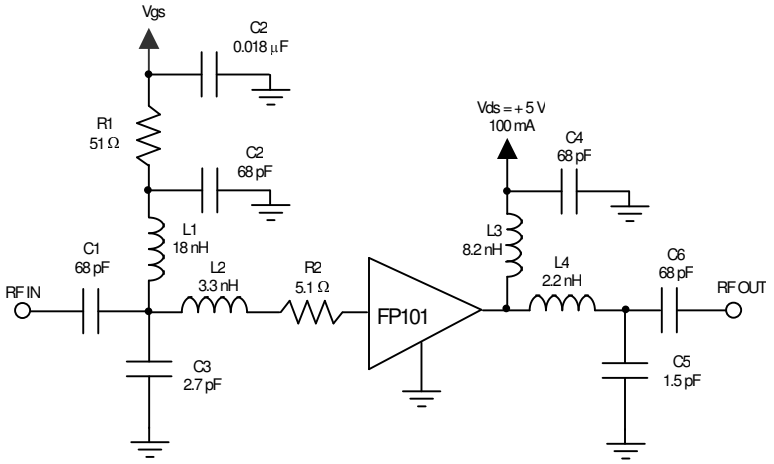
Parameter	Value	Comments
Frequency	1850 MHz	
S21 - Gain	13.9 dB	
S11 - Input Return Loss	-23.6 dB	
S22 - Output Return Loss	-13.5 dB	
S12 - Isolation	-20.9 dB	
Output IP3	36.2 dBm	See Note 1, 3
Output P1dB	23.3 dBm	See Note 3
Noise Figure	3.6 dB	
Drain Bias	5 V @ 100 mA	

S-Parameters



Notes

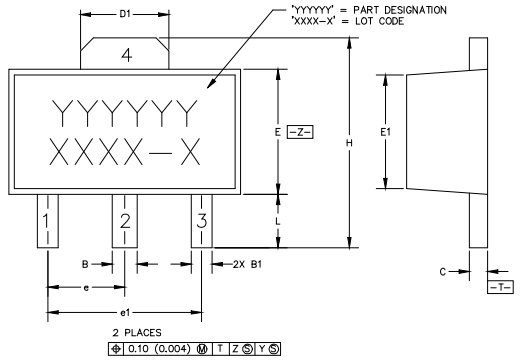
1. OIP3 is measured with 2 tones at an output power of +10 dBm/tone with 10 MHz spacing at 1850 MHz. The suppression on the largest IM3 product is used to calculate OIP3 using a 2:1 slope rule. Test parameters were taken at 25 °C.
2. All components are 0603 size. Toko LL1608-FH chip inductors and AVX ±0.1 pF tolerance capacitors (C3 and C5) were used in the design. Other capacitor components are standard types. The overall circuit size should be minimized as much as possible.
3. The drain voltage can be increased to +8 V for increased output power performance (higher P1dB, higher OIP3). The gate voltage can be adjusted so that the drain bias can be anywhere between 50 - 150 mA.



FP101 (SOT-89 Package) Mechanical Information

This package may contain lead-bearing materials. The plating material on the leads is SnPb.

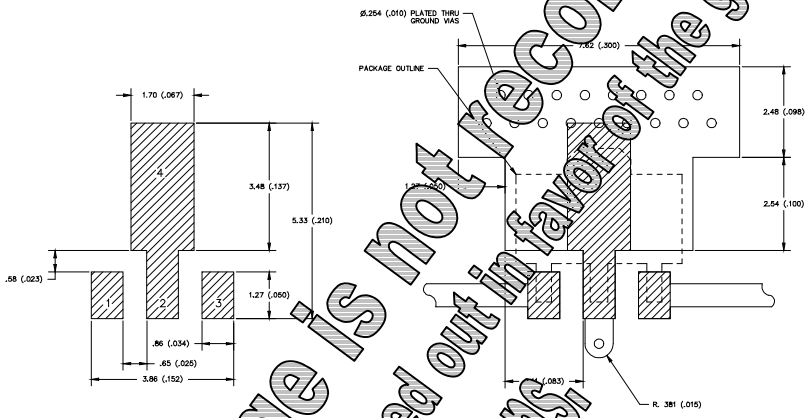
Outline Drawing



SYMBOL	MIN	MAX
A	1.40 (.055)	1.60 (.063)
B	.44 (.017)	.56 (.022)
B1	.36 (.014)	.48 (.019)
C	.35 (.014)	.44 (.017)
D	4.40 (.173)	4.60 (.181)
D1	1.62 (.064)	1.83 (.072)
E	2.29 (.090)	2.60 (.102)
E1	2.01 (.079)	2.29 (.090)
e	1.50 BSC (.059)	
e1	3.00 BSC (.118)	
H	3.94 (.155)	4.25 (.167)
L	.89 (.035)	1.20 (.047)
M	4.04 (.159)	4.19 (.165)

NOTES:
1. DIMENSIONS CONFORM WITH JEDEC TO-243C EXCEPT WHERE INDICATED.
2. DIMENSIONS ARE EXPRESSED IN MILLIMETERS(INCHES).
3. DIMENSIONING AND TOLERANCING IAW ANSI Y14.5M

Land Pattern



Product Marking

The FP101 will be marked with an 'FP101' designator while the lead-free version, FP101-G will be marked with an 'F101G' designator shown in the Outline Drawing as 'YYYYYY'). An alphanumeric lot code ('XXXX–X') is also marked below the part designator on the top surface of the package.

Tape and reel specifications for this part are located on the website in the "Application Notes" section.

ESD / MSL Information

Caution! ESD sensitive device.

ESD Rating: Class 1C
Value: Passes ≥ 1000 V to <2000 V
Test: Human Body Model (HBM)
Standard: JEDEC Standard JESD22-A114

ESD Rating: Class IV
Value: Passes ≥ 1000 V
Test: Charged Device Model (CDM)
Standard: JEDEC Standard JESD22-C101

MSL Rating
FP101: Level 3 at +235 °C convection reflow
FP101-G: Level 3 at +260 °C convection reflow
Standard: JEDEC Standard J-STD-020

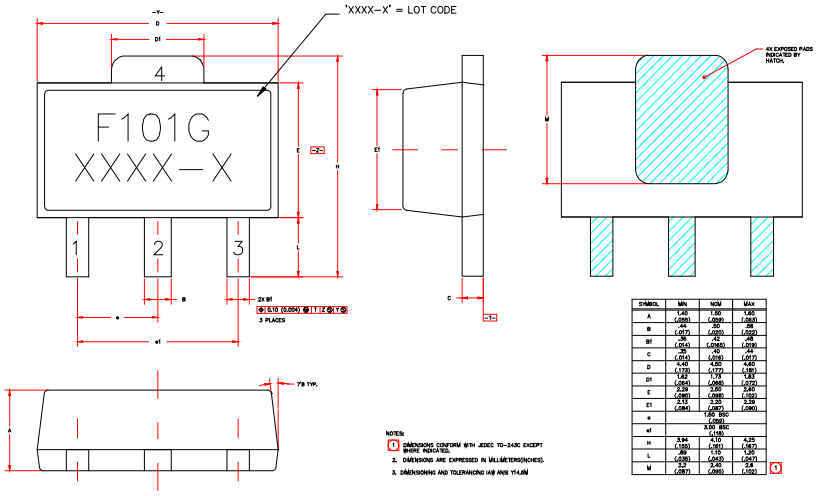
Mounting Config. Notes

1. Ground / thermal vias are critical for the proper performance of this device. Vias should use a .35mm (#80 / .0135") diameter drill and have a final plated thru diameter of .25 mm (.010").
2. Add as much copper as possible to inner and outer layers near the part to ensure optimal thermal performance.
3. Mounting screws can be added near the part to fasten the board to a heatsink. Ensure that the ground / thermal via region contacts the heatsink.
4. Do not put solder mask on the backside of the PC board in the region where the board contacts the heatsink.
5. RF trace width depends upon the PC board material and construction.
6. Use 1 oz. Copper minimum.
7. All dimensions are in millimeters (inches). Angles are in degrees.

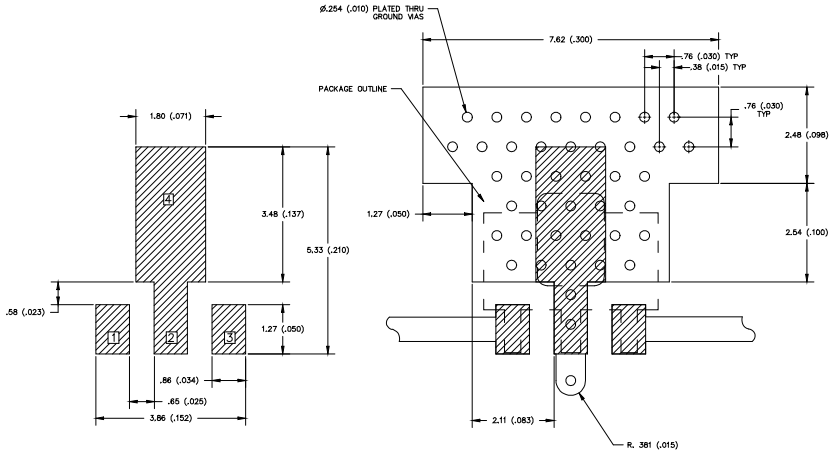
FP101-G (Green / Lead-free SOT-89 Package) Mechanical Information

This package is lead-free/Green/RoHS-compliant. It is compatible with both lead-free (maximum 260°C reflow temperature) and leaded (maximum 245°C reflow temperature) soldering processes. The plating material on the leads is NiPdAu.

Outline Drawing



Land Pattern



Product Marking

The FP101-G will be marked with an "F101G" designator. An alphanumeric lot code ("XXXX-X") is also marked below the part designator on the top surface of the package.

Tape and reel specifications for this part are located on the website in the "Application Notes" section.

MSL / ESD Rating

Caution! ESD sensitive device.

ESD Rating:	Class 1C
Value:	Passes ≥ 1000 V to <2000 V
Test:	Human Body Model (HBM)
Standard:	JEDEC Standard JESD22-A114

ESD Rating:	Class IV
Value:	Passes ≥ 1000V to <2000V
Test:	Charged Device Model (CDM)
Standard:	JEDEC Standard JESD22-C101

MSL Rating:	Level 3 at +260° C convection reflow
Standard:	JEDEC Standard J-STD-020

Mounting Config. Notes

1. Ground / thermal vias are critical for the proper performance of this device. Vias should use a .35mm (#80 / .0135") diameter drill and have a final plated thru diameter of .25 mm (.010").
2. Add as much copper as possible to inner and outer layers near the part to ensure optimal thermal performance.
3. Mounting screws can be added near the part to fasten the board to a heatsink. Ensure that the ground / thermal via region contacts the heatsink.
4. Do not put solder mask on the backside of the PC board in the region where the board contacts the heatsink.
5. RF trace width depends upon the PC board material and construction.
6. Use 1 oz. Copper minimum.
7. All dimensions are in millimeters (inches). Angles are in degrees.

Typical Device Data

S-Parameters (V_D = +5 V, I_D = 100 mA, T = 25°C, calibrated to device leads)

Freq (MHz)	S11 (dB)	S11 (ang)	S21 (dB)	S21 (ang)	S12 (dB)	S12 (ang)	S22 (dB)	S22 (ang)
200	-0.05	-11.65	13.09	170.35	-40.11	83.52	-20.18	-20.22
400	-0.03	-23.12	13.00	161.72	-33.94	77.88	-18.83	-41.57
600	-0.18	-36.31	12.87	151.32	-30.39	68.68	-19.57	-59.31
800	-0.32	-47.17	12.65	142.63	-28.11	61.81	-18.20	-76.47
1000	-0.50	-58.15	12.38	133.74	-26.38	55.76	-17.00	-91.39
1200	-0.67	-69.49	12.09	125.22	-25.12	48.54	-16.25	-103.87
1400	-0.88	-79.35	11.76	117.41	-24.03	42.65	-15.13	-112.58
1600	-0.99	-89.35	11.43	109.46	-23.28	36.62	-14.26	-121.97
1800	-1.21	-98.68	11.04	101.95	-22.60	30.96	-13.77	-129.80
2000	-1.33	-107.48	10.68	94.92	-21.97	25.56	-13.13	-136.00
2200	-1.53	-116.22	10.30	87.87	-21.48	20.05	-12.63	-142.70
2400	-1.67	-124.67	9.94	81.13	-21.06	14.86	-12.13	-148.50
2600	-1.74	-129.96	9.70	76.55	-20.80	11.41	-11.84	-152.37
2800	-1.87	-137.82	9.34	70.28	-20.44	6.62	-11.55	-157.82
3000	-1.97	-146.08	9.01	64.05	-20.22	0.76	-11.24	-162.58

S-Parameters (V_D = +8 V, I_D = 100 mA, T = 25°C, calibrated to device leads)

Freq (MHz)	S11 (dB)	S11 (ang)	S21 (dB)	S21 (ang)	S12 (dB)	S12 (ang)	S22 (dB)	S22 (ang)
200	-0.11	-11.45	12.37	170.42	-39.98	79.95	-14.10	-12.80
400	-0.09	-22.71	12.28	161.78	-33.90	76.01	-13.71	-26.74
600	-0.24	-35.70	12.17	151.43	-30.61	67.68	-14.51	-36.99
800	-0.38	-46.35	11.97	142.64	-28.17	61.30	-14.24	-50.43
1000	-0.53	-57.07	11.72	133.73	-26.47	54.53	-14.01	-63.83
1200	-0.70	-68.34	11.44	125.17	-25.18	47.72	-13.94	-74.67
1400	-0.90	-77.99	11.13	117.20	-24.20	41.43	-13.43	-85.29
1600	-1.02	-88.00	10.81	109.14	-23.36	35.88	-13.06	-95.56
1800	-1.24	-97.21	10.43	101.55	-22.67	30.53	-12.84	-104.03
2000	-1.35	-105.96	10.08	94.34	-22.13	25.25	-12.44	-111.54
2200	-1.54	-114.67	9.70	87.18	-21.60	20.06	-12.16	-119.40
2400	-1.69	-123.07	9.35	80.34	-21.19	14.79	-11.82	-126.07
2600	-1.76	-128.30	9.11	75.57	-20.96	11.26	-11.63	-130.63
2800	-1.89	-136.04	8.76	69.16	-20.59	6.53	-11.40	-136.59
3000	-2.00	-144.31	8.43	62.87	-20.35	1.69	-11.16	-141.99