gTSC0020 B
V-band TX MMIC
57 - 66 (52 – 72) GHz

Features

- Full V-band coverage
- 22 dB conversion gain
- 25 dB dynamic range
- 20/26 dBm P1dB/OIP3
- Direct conversion or IF up conversion

Typical applications

- V-band point-to-point radio
- Active imaging
- Instrumentation
- General purpose

Description

gTSC0020 is a complete highly integrated transmitter for V-band radio applications. The differential IQ mixer is highly linear with low conversion loss. The frequency multiplier has low spuriouses and flat output power throughout the entire V-band. The medium power amplifier at the output delivers more than 20 dBm (P1dB) output power and has an integrated power detector. The chip is suitable for 64+ QAM modulation.

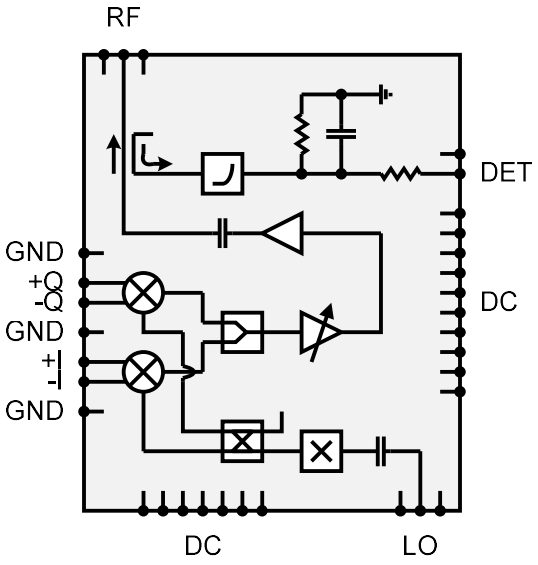

Figure 1. Block diagram of the transmitter.

Gotmic AB, Arvid Hedvalls Backe 4, S-411 33 Göteborg, Sweden. Tel: +46 (0) 31 184 030
http://www.gotmic.se/

Electrical performance

Table 1. Electrical performance T_A=25°C

Parameter	Min	Typ	Max	Unit
RF frequency	57 (52)		66 (72)	GHz
IF frequency	DC		12	GHz
LO frequency	9.1		11	GHz
LO input power		10		dBm
LO multiplication factor		6		
Max conversion gain[1]		22		dB
LO to RF suppression[2,3]	35			dBc
Dynamic range	25			dB
Image rejection ratio (IRR)		24		dB
P1dB[3]		20		dBm
PSAT[3]		tbd		dBm
OIP3[3]		26		dBm
IIP3[4]		4		dBm
OIP2[2,3]	tbd			dBm
IIP2[4]	tbd			dBm
Out of band spuriouses			tbd	dBm
NF			tbd	dB
RF return loss	12			dB
IF return loss	tbd			dB
LO return loss	10			dB
Power consumption		1600	2000	mW

[1] Gain temperature coefficient is (tbd) dB/C.

[2] Apply I+, I-, Q+ and Q- input DC offset voltage for LO cancellation.

[3] At maximum gain. VGA drain current = 160 mA, IF power = -13 dBm/tone.

[4] At typical gain. VGA drain current = 120 mA, IF power = -13 dBm/tone.

Gotmic AB, Arvid Hedvalls Backe 4, S-411 33 Göteborg, Sweden. Tel: +46 (0) 31 184 030
http://www.gotmic.se/

Measured performance

Measurements have been performed on-wafer with IF input power = -13 dBm/tone, tone separation = 10 MHz, IF frequency = 1 GHz, T_A = 25°C and typical bias settings if not specified differently.

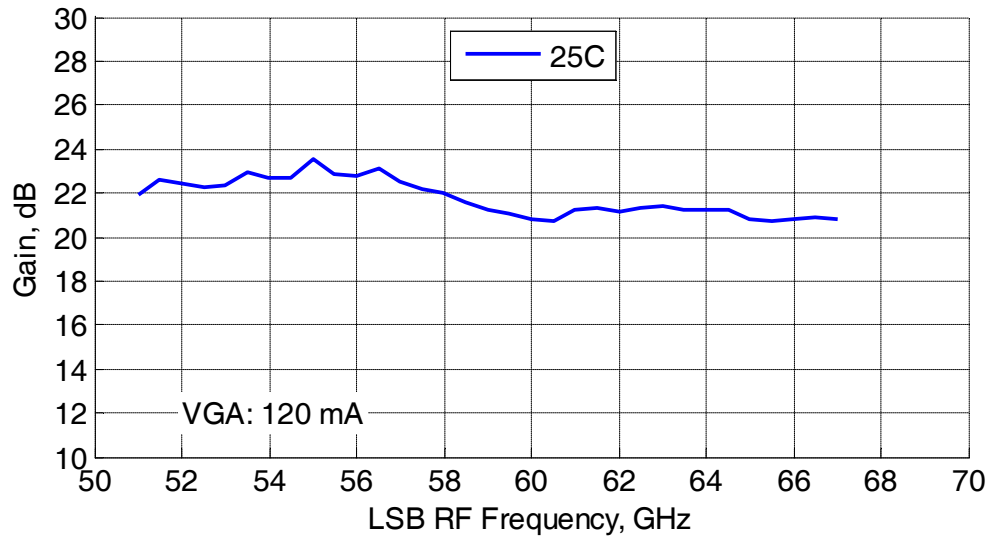

Figure 2: Conversion gain at typical gain setting.

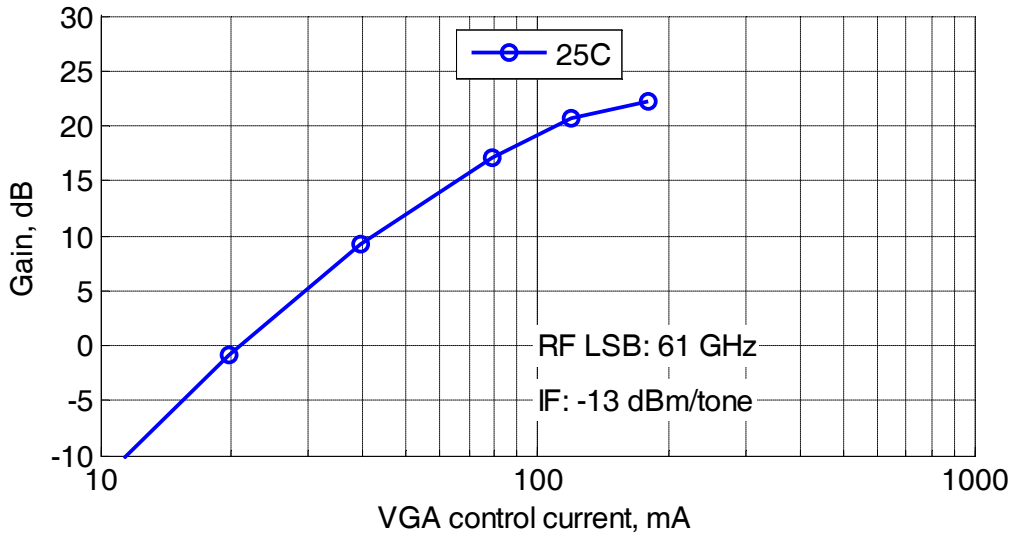

Figure 3: Conversion gain VS VGA control current @ 61 GHz.

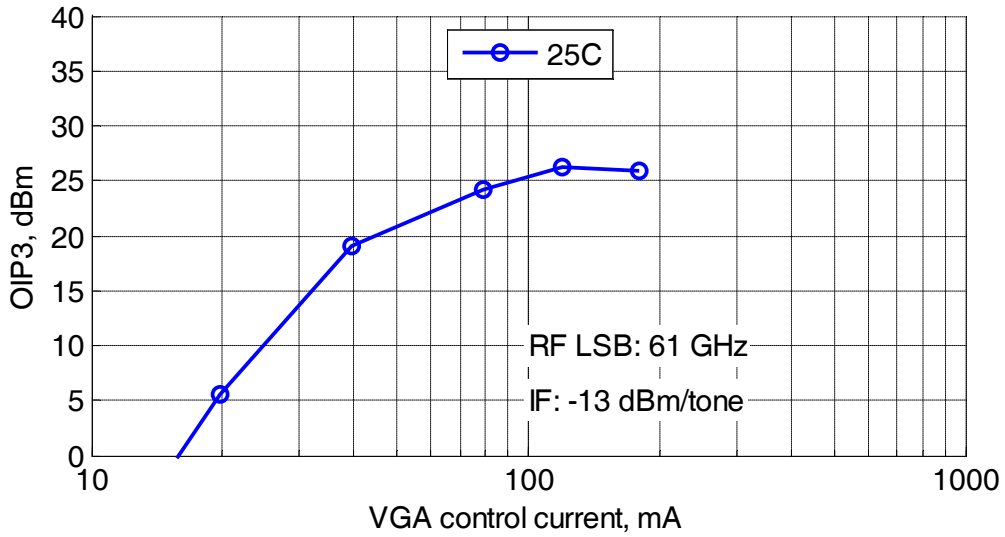

Figure 4: OIP3 VS VGA control current @ 61 GHz. Disregard OIP3 performance below 40 mA, due to measurement system dynamic range limit.

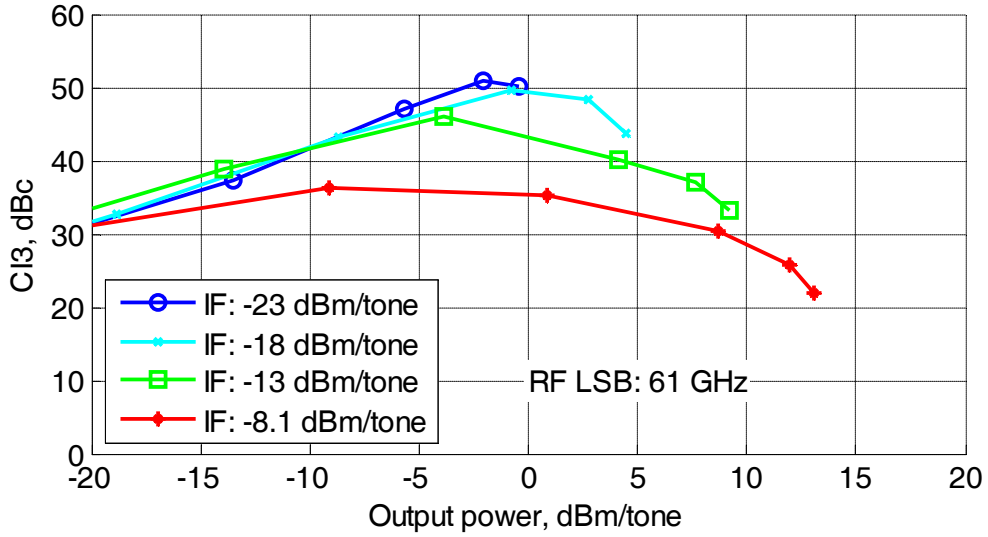

Figure 5: Third-order intermodulation VS output power (dBm/tone) @ 61 GHz and typical input power levels (dBm/tone). Disregard C/I3 performance drop below knee to the left, due to measurement system dynamic range limit.

Gotmic AB, Arvid Hedvalls Backe 4, S-411 33 Göteborg, Sweden. Tel: +46 (0) 31 184 030
http://www.gotmic.se/

Settings

The bias sequence is to first apply all gates (VG…) followed by all drains (VD…). The typical drain current should be obtained by adjusting the corresponding gate. The stated drain currents are when all input signals are off.

Table 2. Electrical settings on connector P1

Connector P1	Pad No.	Bias settings (V / mA)			Function
		Min	Typ[5]	Max	
NC	1				NC
Vout_PD	2	0.0	0.2		Output
Vref_PD	3	0.0	0.1		Output
Vg_PD	4		0.9		Input
Vd2_PA	5	3.2	3.3 / 150	3.4 / 280[6]	Input
Vg2_PA	6	-0.6	-0.4[7]	-0.2	Input
Vd1_PA	7	2.4	2.5 / 112	2.6 / 240[6]	Input
Vg1_PA	8	-0.6	-0.4[7]	-0.2	Input
GND	9				Ground
Vd2_VGA[8]	10	2.9	3.0 / 60[5]	3.1 / 1206	Input
Vg2_VGA8	11	-1.0	-0.6	-0.2	Input
Vd1_VGA8	12	2.9	3.0 / 60[5]	3.1 / 120[6]	Input
Vg1_VGA8	13	-1.0	-0.6	-0.2	Input
NC	14				NC
Vg_MIX	15	-0.9	-0.7	-0.5	Input
NC	16				NC
NC	17				NC

Table 3. Electrical settings on connector P2

[5] The gain is typically 22 dB when biasing the VGA (VGA_1 + VGA_2) at 120 mA.

[6] Maximum current level before damage. Not for improved performance.

[7] Adjust the gate voltage according to the specified typical current on the drain. VG1_PA controls the current on VD1_PA and VG2_PA controls VD2_PA.

[8] Connect VG1_VGA together with VG2_VGA and VD1_VGA together with VD2_VGA. Joint point for VG1_VGA and VG2_VGA is after series 500 Ohm, see assembly drawing. Adjust the gate voltage of VG1,2_VGA to change the drain current VD1,2_VGA.

Gotmic AB, Arvid Hedvalls Backe 4, S-411 33 Göteborg, Sweden. Tel: +46 (0) 31 184 030
http://www.gotmic.se/

Connector P2	Pad No.	Settings	Function
GND	1		Ground
RF	2	Z_0 = 50 Ohm, AC coupled	Output
GND	3		Ground

Table 4. Electrical settings on connector P3

Connector P3	Pad No.	Settings	Function
GND	1		Ground
LO	2	Z_0 = 50 Ohm, AC coupled	Input
GND	3		Ground

Table 5. Electrical settings on connector P4

Connector P4	Pad No.	Bias settings (V / mA)			Function
		Min	Typ	Max	
NC	1				NC
VD_AMP	2	3.2	3.3 / 80	3.4 / 1806	Input
VG_AMP	3	-0.7	-0.5	-0.3	Input
GND	4				Ground
VD_X2	5	3.2	3.3 / 5	3.4 / 60[6]	Input
VG_X2	6	-1.1	-0.9	-0.7	Input
VD_X3	7	3.2	3.3 / 50	3.4 / 80[6]	Input
VG_X3	8	-0.7	-0.5	-0.3	Input
NC	9				NC
NC	10				NC

Table 6. Electrical settings on connector P5

Connector P5	Pad No.	Settings	Function
GND	1		Ground
I-	2	Z_0 = 100 Ohm differential impedance, DC coupled	Input
I+	3		Input
GND	4		Ground
Q-	5	Z_0 = 100 Ohm differential impedance, DC coupled	Input
Q+	6		Input
GND	7		Ground

Table 7. Absolute Maximum Ratings

Gate-source voltage	-2 to +0.7 V
Drain-source voltage	4.5 V
Gate-drain breakdown voltage	8 V
IF in (I+, I-, Q+, Q-)	+7 dBm/ch.
IF in (I+, I-, Q+, Q-)	3 Vpp/ch.
LO input power	+15 dBm
Operating temperature	-40 to + 85°C
Storage temperature	-65 to +150°C

Outline drawing

Mechanical drawing with pad locations is also available in dxf-file format on the web. Substrate thickness is 50 µm (GaAs).

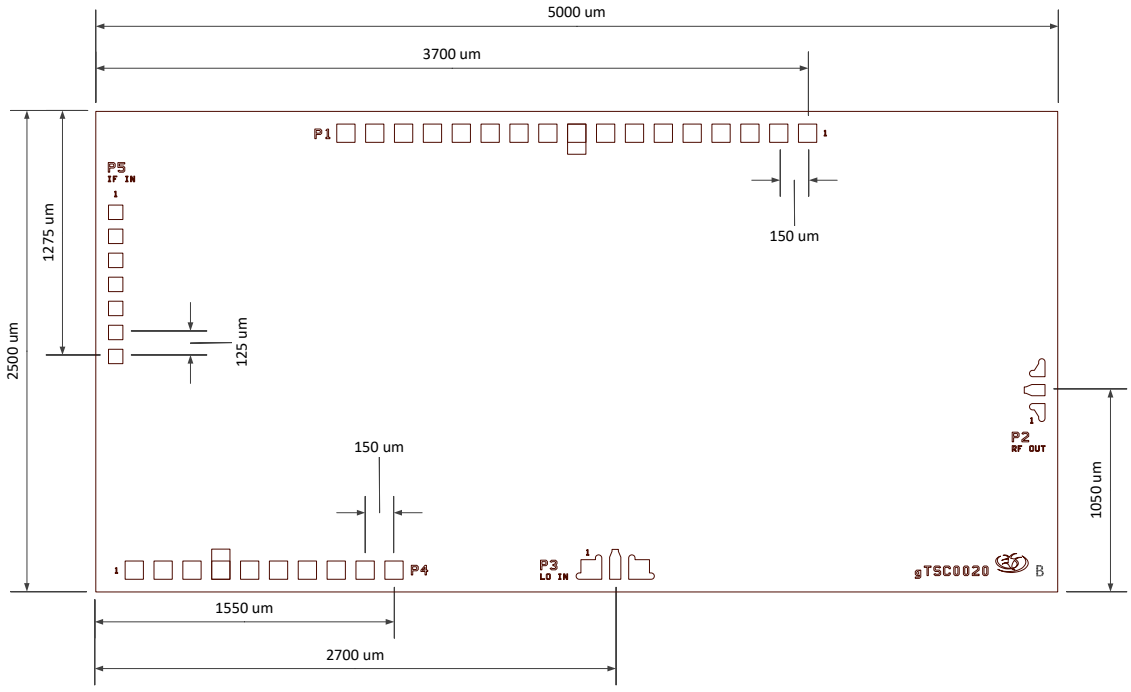

Figure 6. Outline drawing of the gTSC0020 MMIC. Dimensions are in um.