gMTX0014C
SMD E-band HP-TX
81-86 (75-87) GHz

FEATURES

- SMD package (WR-12 interface)
- 81-86 GHz
- 25.5/26.5 dBm P1dB/PSAT
- 33 dBm OIP3
- Integrated detectors
- Size: 16 x 23 x 4 mm
- Evaluation board available

DESCRIPTION

gMTX0014 is a surface-mount GaAs transmitter for the 81-86 GHz frequency band. The transmitter offers a wide IF bandwidth from DC to 10 GHz suitable for direct conversion or IF modulation/demodulation. The package output has a WR-12 aperture for low-loss connection to a rectangular waveguide.

APPLICATIONS

- Direct or IF up-conversion
- Point-to-point communication
- Radar and imaging
- Instrumentation
- Fiber over radio

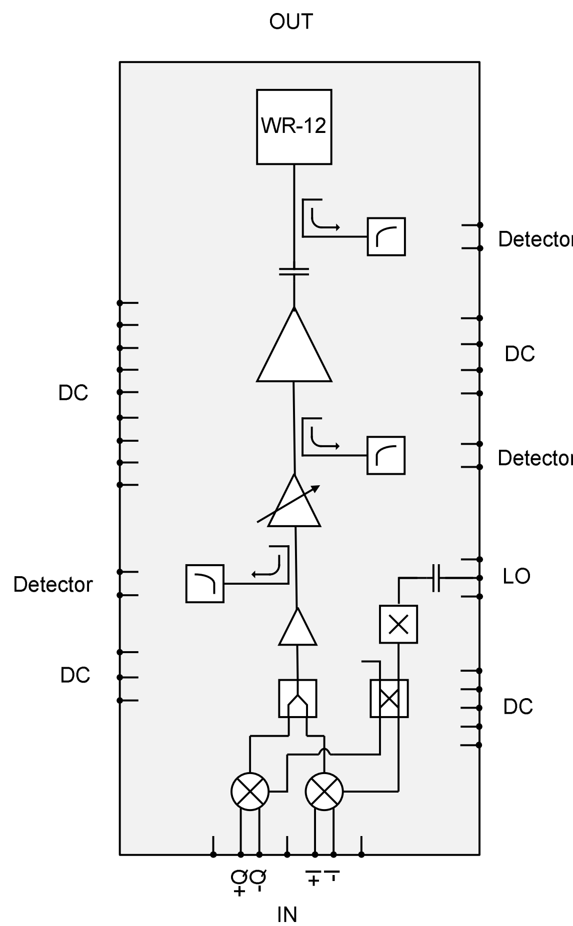


Figure 1. Block diagram

ELECTRICAL PERFORMANCE

Table 1. Electrical specifications, backside temperature +25 °C, nominal bias

Parameter	Min	Typ	Max	Unit
RF Frequency Range (performance)	81		86	GHz
RF Frequency Range (extended)	75		87	GHz
IF Frequency Range	DC		10	GHz
LO Frequency Range	11.3		14.7	GHz
LO Multiplication Factor		6		
LO Input Power		5		dBm
Max Conversion Gain		32		dB
Gain Temperature Slope		-0.08		dB/°C
Gain Control Range		40		dB
OP1dB		25.5		dBm
PSAT (3 dB compression)		26.5		dBm
OIP3		33		dBm
RF Return Loss		10		dB
IF Return Loss		10		dB
LO Return Loss		10		dB
PDC (quiescent)		8200		mW

Table 2. Absolute maximum ratings

Gate voltage (VG..)	-2.0 V
Drain voltage (VD..) VD_X3	+4.5 V +6.0 V
Drain currents: VD_PA VD1_VGA VD2_VGA VD_BUFFER VD_AMP_X2 VD_X3	 2000 mA 450 mA 550 mA 70 mA (AMP 150 mA, X2 40 mA) 30 mA
VDET and VREF	50 uA
RF input power	+15 dBm
Junction temperature (1 million hours MTTF) *Thermal resistance (+85 °C backside temp)*	+150 °C *6.5 °C/W*
Operating temperature	-40 to +85 °C
Storage temperature	-65 to +150 °C

Pin Configuration and Bias

Always apply the gate supplies first followed by the drain supplies. It is recommended to initially set all gates to -1.6 V and adjust the gate supplies to obtain the specified drain currents. The typical gate voltage can vary by up to 0.2 V from what is noted. The drain currents are listed with all RF input signals off.

Note: Not connected (NC) pins are floating and must not be grounded.

Table 3. Pin functions and electrical settings

Pad No.	Reference	Supply (V)	Current (mA)	Function
1	NC			
2	NC			
3	VD_PA**	4	650**	Bias
4				
5				
6	NC			
7	VG_PA	-0.5 (typ)		Bias
8	NC			
9	VTEMP	See temperature sensor		Temperature output
10	NC			
11	NC			
12	VD2_VGA	3.3	400	Bias
13	VG2_VGA	-0.5 (typ)		Bias
14	VG1_VGA	-0.5 (typ)		Bias
15	VD1_VGA	3.3	350	Bias
16	NC			
17	VDET_1	See detector operation		Detector output
18	VREF_1			Detector reference
19	NC			
20	VD_BUF	3.3	50	Bias
21	VG_BUF	-0.5 (typ)		Bias
22	VG_MIX	-0.8 (typ)		Bias
23	Q+	Z0 = 100Ω differential impedance, DC-coupled		Input
24	Q-			Input
25	I+	Z0 = 100Ω differential impedance, DC-coupled		Input
26	I-			Input
27	NC			
28	VG_AMP_X2	-0.45 (typ)	(105)	Bias
29	VD_AMP_X2	3.3	105+3=108	Bias
30	VG_X2	-0.8 (typ)	(3)	Bias
31	VD_X3*	5.0	8*	Bias
32	VG_X3	-0.75 (typ)		Bias

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

33	LO	Z0 = 50Ω, AC-coupled	LO
34	VREF_2	See detector operation	Detector reference
35	VDET_2		Detector output
36	NC		
37	NC		
38	NC		
39	NC		
40	VD_PA**	650**	Bias
41			
42			
43	VREF_3	See detector operation	Detector reference
44	VDET_3		Detector output
45-58	NC		
59	RF OUT	WR-12	Output
60-72	GND		GND

* VD_X3, when pinched off consumes 5 mA, adjust VG_X3 +3mA for a total of 8 mA.
** VD_PA, bias supply to pin 3-5 and 40-42, total current is 650+650=1300 mA.

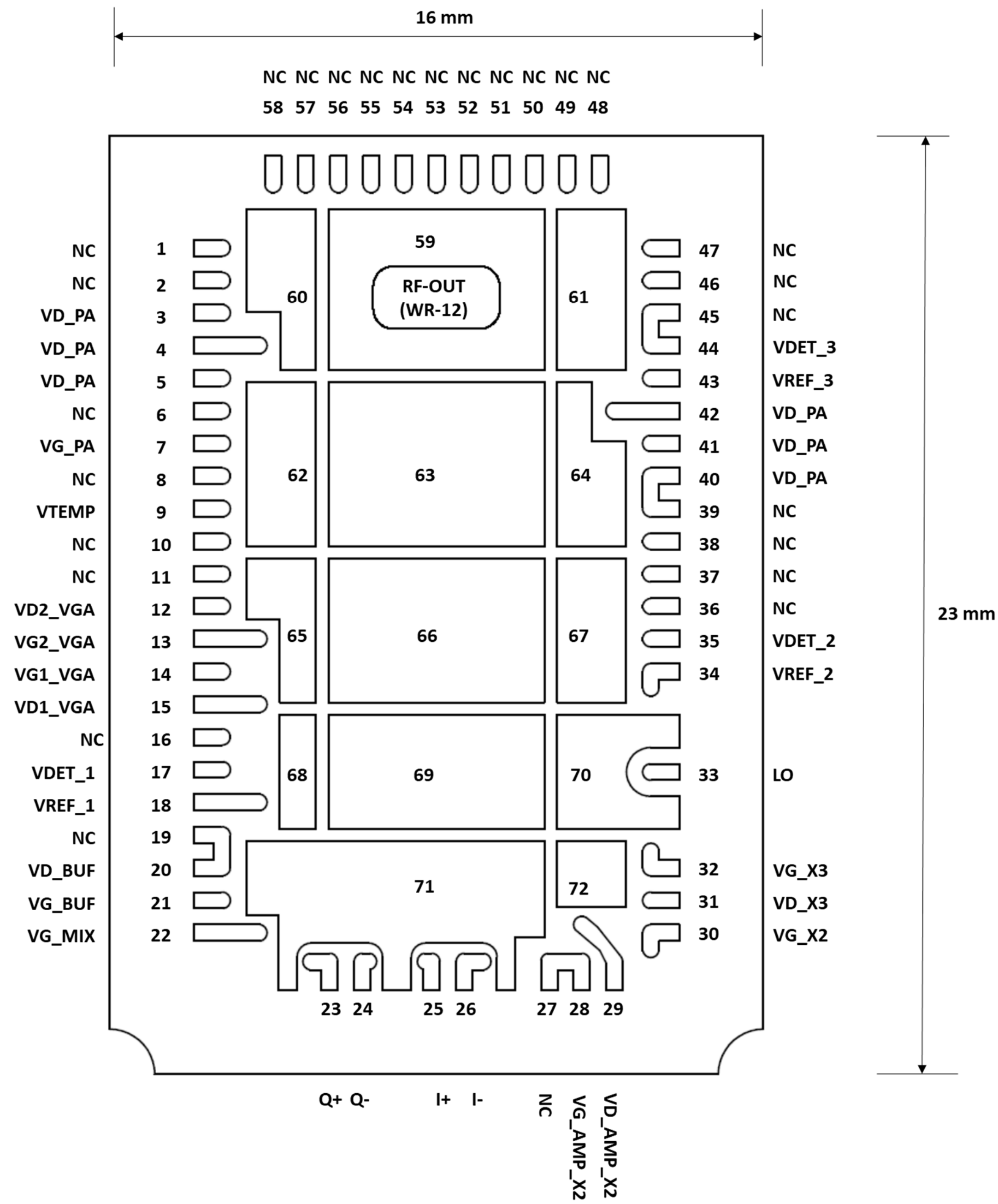


Figure 2. Pin configuration.

MEASURED PERFORMANCE

Unless otherwise noted, all data presented has been obtained with a test-fixture, at room temperature and at nominal bias. The two-tone RF input signal has a separation frequency of 50 MHz.

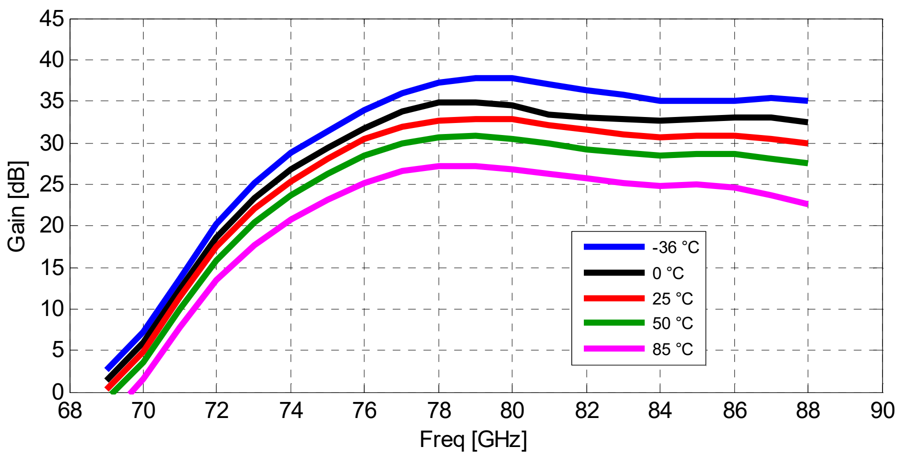


Figure 3. Gain vs RF (LSB) frequency, IF 1 GHz.

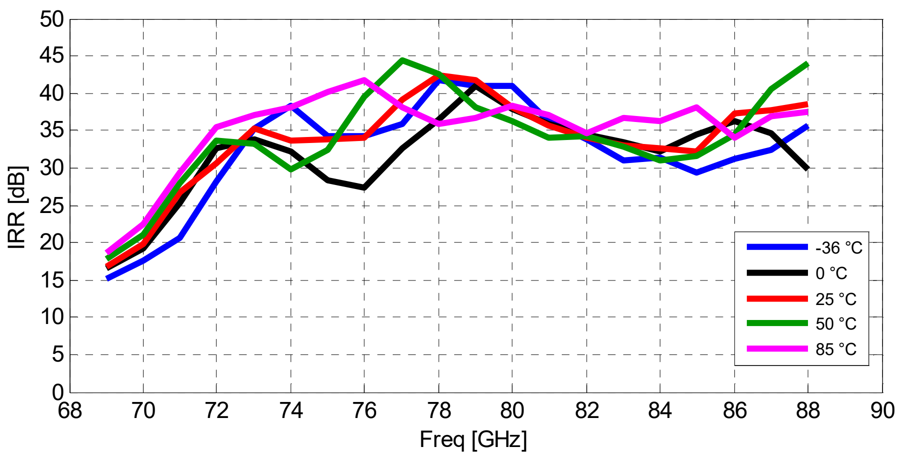


Figure 4. IRR vs RF (LSB) frequency, IF 1 GHz.

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

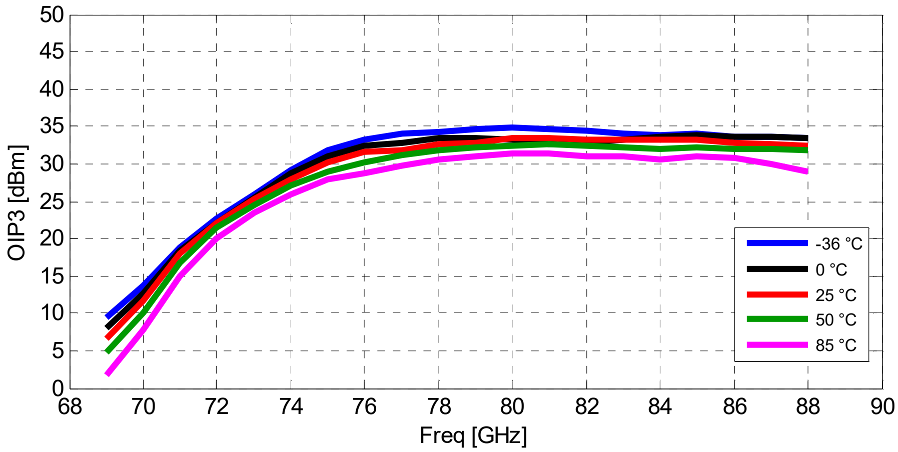


Figure 5. OIP3 vs RF (LSB) frequency, IF 1 GHz.

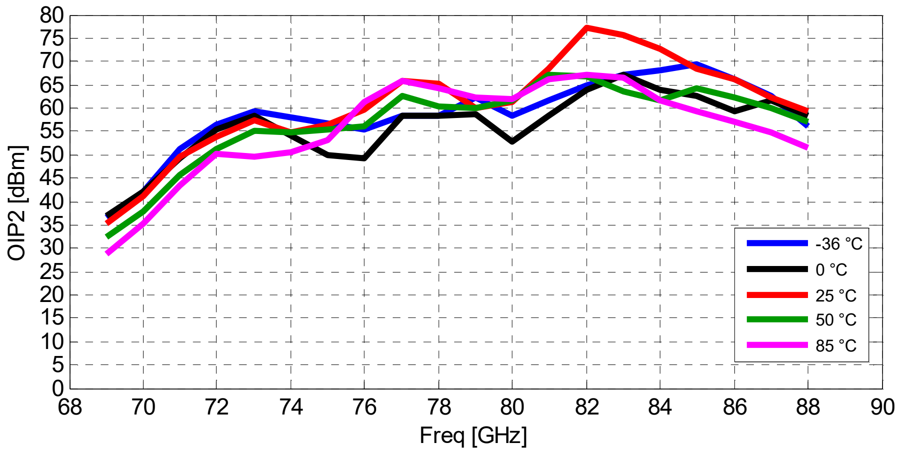


Figure 6. OIP2 vs RF (LSB) frequency, IF 1 GHz.

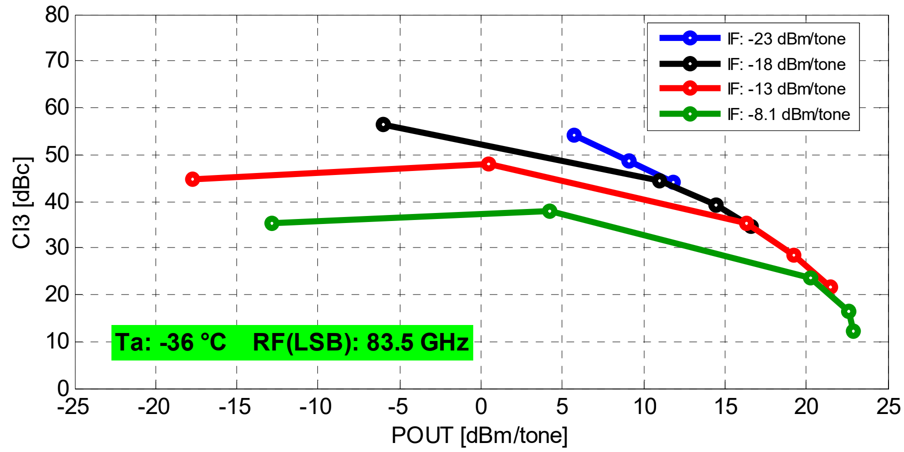


Figure 7. CI3 vs POUT, gain control with VGA, IF 1 GHz.

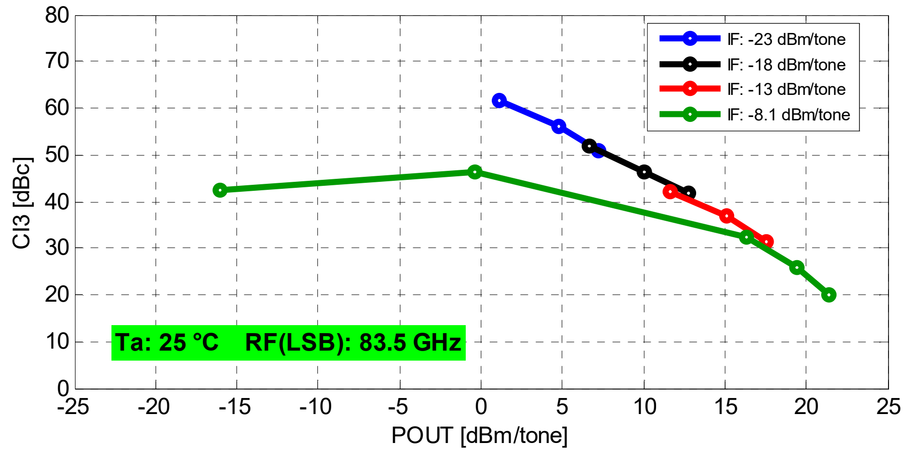


Figure 8. CI3 vs POUT, gain control with VGA, IF 1 GHz.

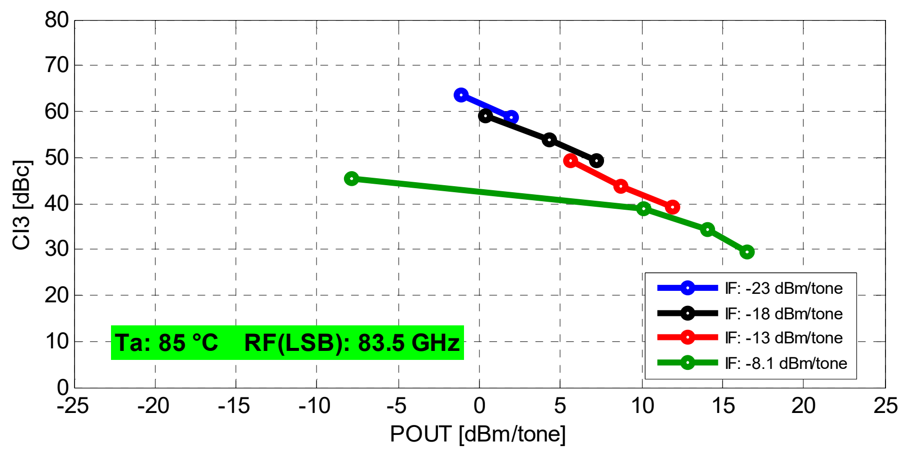
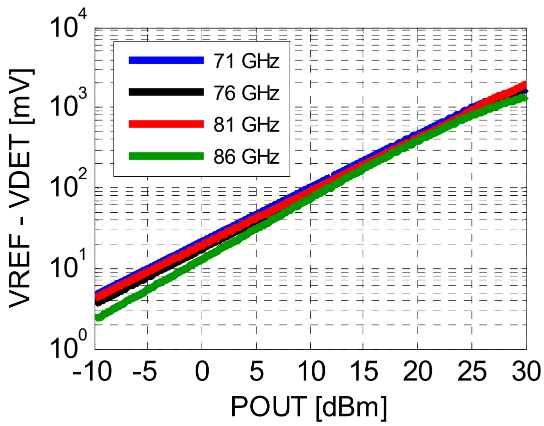


Figure 9. CI3 vs POUT, gain control with VGA, IF 1 GHz.

DETECTOR OPERATION

There are three identical detectors, detector 1, 2 and 3. Each detector can be configured for RMS power or envelope detection. Leave VREF and VDET as no-connect if not used.

To compensate for thermal variation, a reference is included. Therefore, to get a temperature compensated output, take the difference of VREF and VDET using the recommended external detector circuit. Detector bias is applied through VDD and a pair of resistors (R1 and R2), ideally with close to identical values, typically 10k to 100k. We recommend selecting an operational amplifier with excellent input offset voltage performance, eg. LT1012.



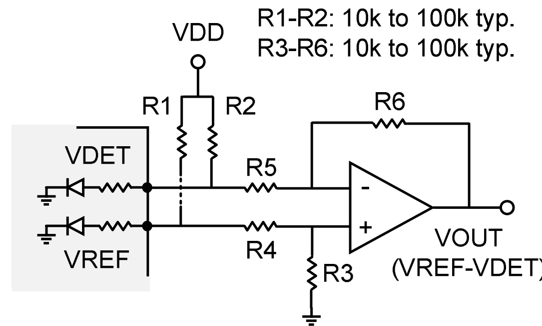


Figure 10. Detector output (left) and the external detector circuit (right)

ENVELOPE DETECTION

When configured for envelope detection it is necessary to keep transmission-line lengths to a minimum and select external components with good RF performance to support wide bandwidth baseband signals. With a bias-T, which can be as simple as a shunt resistor and a series capacitor connected to VDET, the bias current is regulated with the resistor while the envelope signal can pass the capacitor. Input impedance at the pad of VDET is 200 Ohm. The reference output, VREF, is not required for envelope detection.

TEMPERATURE SENSOR

A PN-diode temperature sensor with grounded cathode is available on-chip to monitor package temperature. Typical bias current is 100 uA and can be achieved by connecting eg. a 36.5k resistor between VTEMP and a +5.0 V supply. VTEMP is 1210 mV (typ.) at +25 °C and -1.4 mV/°C.

GAIN CONTROL

A variable gain amplifier is available for gain control with VG1_VGA and VG2_VGA. For additional control the PA and/or buffer can be adjusted with VG_PA and VG_BUF.

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