5 Measurement results

5.1 Radiation Pattern

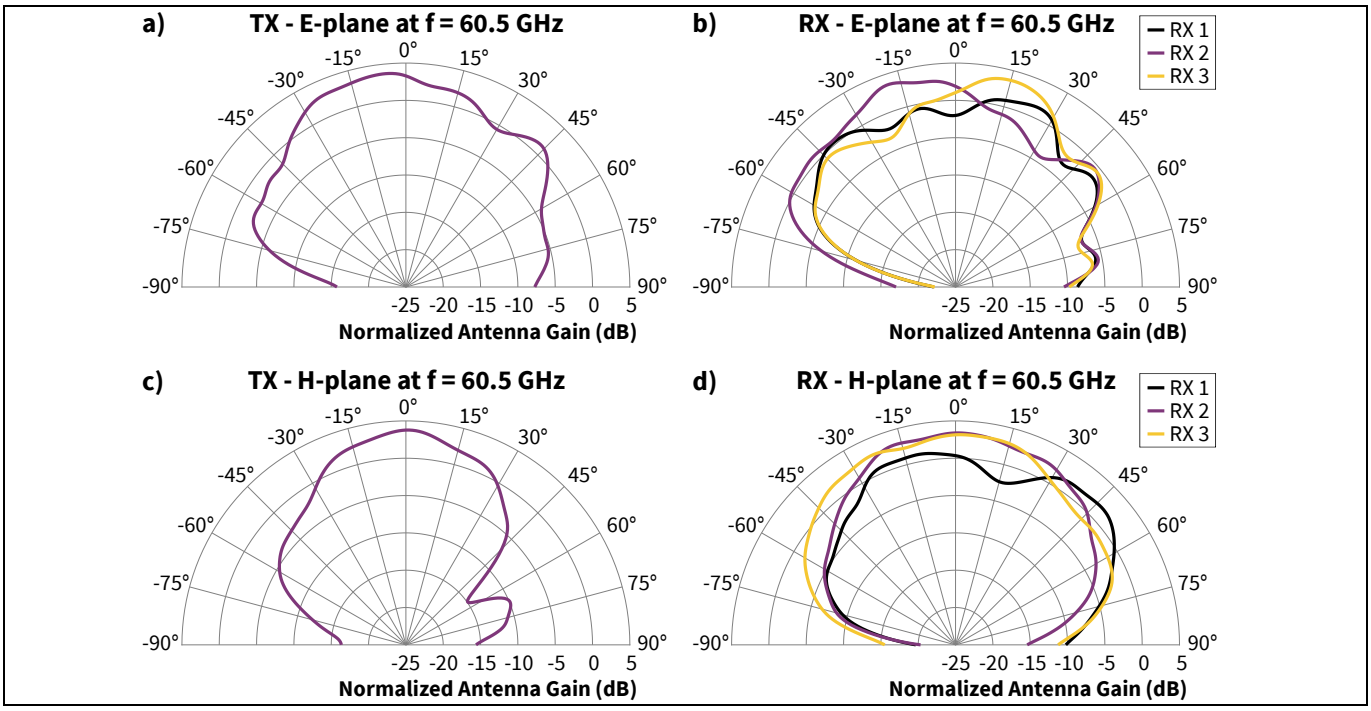

Figure 12 Radiation Pattern of a typical BGT60TR13C

The datasheet of the BGT60TR13C only shows the 3dB values for transmit and receive antenna characteristics. This subsection shows the radiation pattern of a typical BGT60TR13C radar sensor. Figure 12a and c show the EIRP of the transmit antenna in E-plane and H-plane at a frequency of 60.5 GHz. Figure 12b and d illustrate the antenna characteristics of the three receive antennas in E-plane and H-plane at a frequency of 60.5 GHz.

5.2 Radar radiation pattern

To analyze the radar radiation pattern, the BGT60TR13C shield is characterized along the E-plane and H-plane of the sensor. A corner reflector is placed opposite the radar board. The radiation emitted by the radar sensor is reflected by the corner reflector and measured with the receiver antennas of the radar board. In order to avoid clutter, the measurement is typically performed in an anechoic RF chamber. The measurement characterizes the chip in radar operation. Thus, both transmit and receive antennas are part of the measurement. For the measurement, the standard FMCW radar scheme is followed and the signal at all three receive antennas is recorded. Then the sensor is rotated into different angles and the measurement is repeated for each angle, resulting in an angle dependence of the received signal for all three receiver antennas.

Figure 13a shows the measurement set-up that is used. The corner reflector is placed at a distance of 0.4 m from the BGT60TR13C shield in an anechoic chamber. The board is rotated by ±90 degrees along the E-plane (Figure 13b) and H-plane (Figure 13c). The results for the E-plane can be seen in Figure 14a and the ones for the H-plane in Figure 14b. Thereby, a typical board was measured with a frequency chirp from 60.5 to 61.5 GHz and the results of all three receive antennas are plotted. In the E-plane, a side lobe is visible and the main lobe is not perpendicular to the chip surface but rotated by about 25 degrees. This effect is due to the close proximity of the antennas in the package and it is stronger for electric fields than for magnetic fields. In the H-plane, no side lobes are visible and the main lobe is perpendicular to the chip surface. Figure 14c shows the dependence of the received signal strength on the used center frequency of the chirp for the direction 0° in E-plane and 0° in H-plane. The strongest signal can be received at around 59.5 GHz and it decreases towards the edges of the band.

Package

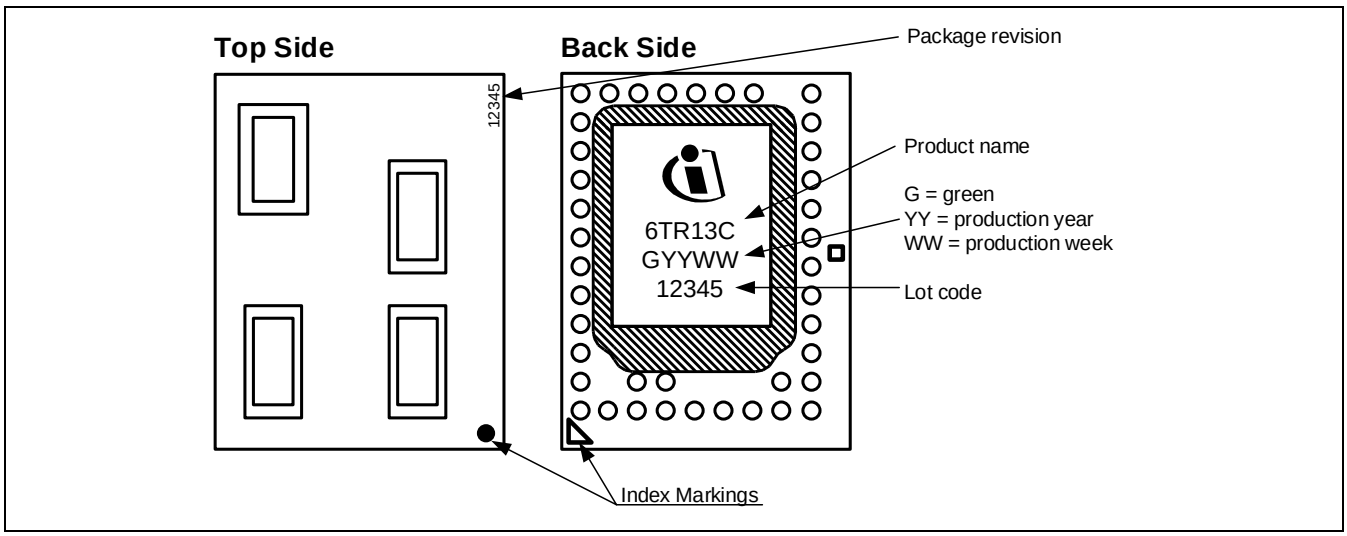

Figure 82 Marking layout of PG-VF2BGA-40-1 (example)

12.1 Built-in Antenna Specifications

Antenna performance reported in Table 71 are guaranteed by design. Typical antenna behavior is measured on Infineon reference board. Typical antenna beam plots are available in a specific application note and upon specific request.

Table 71 Antennas In Package Specifications

Spec	Unit	Value			Condition
Parameter		Min	Typ	Max	
RX_BW, TX_BW	GHz	58.0		63.5	Antenna bandwidth
GTX	dBi	2.0	3.5	5.0	Antenna gain of a single TX antenna
GRX	dBi	2.0	3.5	5.0	Antenna gain of a single RX antenna
HPBW_RX_E	Deg	50	65	80	Half-power beam width of a single RX antenna in the E-plane direction
HPBW_RX_H	Deg	20	35	50	Half-power beam width of a single RX antenna in the H-plane direction.
HPBW_TX_E	Deg	50	65	80	Half-power beam width of a single TX antenna in the E-plane direction
HPBW_TX_H	Deg	25	40	55	Half-power beam width of a single TX antenna in the H-plane direction
D_RX_RX	mm		2.5		Center-to-center distance between RX antennas in X and Y direction