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Application Note

Tango3 and Romeo2 Layout Recommendations

Introduction

Tango3 (MC33493) is a UHF transmitter IC and Romeo2 (MC33591/2/3) is a UHF receiver IC. They are designed for remote keyless and remote control applications along with any other ISM applications. Special care concerning the PCB layout must be considered to prevent application issues. A poor layout may result in degraded performances (high transmission spurious with Tango3 or low sensitivity with Romeo2) or even worse, in non-functionalities.

This application note provides some recommendations for the proper use of Romeo2 and Tango3.

Tango3 Layout Recommendations

Crystal placement

The crystal unit must be placed as close as possible to the X_{TAL1} and X_{TAL0} pins; the X_{TAL1} track also needs to be minimized. It should, ideally, be shielded by a ground plan around the crystal unit and a ground plane below the crystal unit (on the opposite side of the board).

The purpose of this shielding is to minimize parasitic-coupled harmonics of the crystal frequency in the transmitted power and also to prevent the crystal oscillator from being disturbed by external EMC noise or parasitic couplings. The shielding plan will have a capacitor effect which must be taken into account in order to calculate the right load capacitor for the expected carrier frequency and deviation in FSK modulation.

When the crystal cannot be shielded, the designer must take care if a digital track is running in the crystal oscillator neighborhood or beneath the crystal unit, that no voltage is toggled while the Tango3 oscillator is enabled (Enable pin = High). Otherwise, it may introduce phase transient shifts in FSK modulation or even a transient oscillator stop.

CFSK

The CFSK track length must be minimized in a FSK application. The longer the track length, the more parasitic capacitance produced and the more it will affect the frequency deviation. Therefore, it must be minimized so that the frequency deviation is compliant with the expected deviation.

Decoupling capacitances

The decoupling capacitances must be very close to the V_{CC} and GNDRF pins. If the track lengths between the capacitances and the product pins are too long, the V_{CC} pins cannot be considered as a ground for RF frequencies. It could impact the matching of the Tango3 RF output with the antenna and subsequently the radiated output power.

The recommended decoupling capacitances are 100 pF and 10 nF.

Dataclock

The dataclock driver requires a very small capacitive load. If the length of the dataclock track is too long or if additional capacitances (like a standard oscilloscope probe) are added onto this track, the dataclock signal may become a trapezoidal or triangular shaped signal. For this reason, the track must be shortened as much as possible.

Romeo2 Layout Recommendations

Crystal placement

The crystal must be placed as close as possible to the X_{TAL1} and X_{TAL2} pins; also, the X_{TAL1} track length must be minimized. Ideally, it should be shielded by a ground plan around the crystal unit and a ground plane below the crystal unit (on the opposite side of the board).

The purpose of this shielding is to prevent the crystal oscillator from being disturbed by external EMC noise or parasitic couplings. The shielding plan will have a capacitive effect which must be taken into account in order to design the right load capacitor for the expected local oscillator frequency.

When the crystal cannot be shielded, the designer must take care, if a digital track is running in the crystal neighborhood or beneath the crystal, that no output port is toggled while the Romeo2 oscillator is enabled. Otherwise, it may introduce transient phase shifts of local oscillator which may result in data loss in FSK).

PFD

The PFD pin can, theoretically, be non-connected. But, since the PDF voltage controls the V_{CO}, it is a “sensitive input” and any coupled noise or signal will result in phase noise of the local oscillator or will shift its frequency. Thus, it is ideal to implement the external filter that is proposed in the MC33591 data sheet.

Decupling capacitances

The decoupling capacitances must be very close to the V_{CC} and V_{CC}LNA (pins 1, 2, and 3) and to the GNDLNA and GNDSUB pins. In addition, special care must be considered for the ground plane connecting the $GNDV_{CO}$, GNDSUB, and GNDLNA pins.

RFin

RF_{in} is a biased input. Therefore, to avoid any DC conflict between Romeo2 and an external device, it is recommended that a DC decoupling capacitance be inserted. The DC decoupling capacitance acts as a short circuit at the RF frequencies (for example, a 100 pF to 1 nF capacitance.)

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