

8. CIRCUIT DESCRIPTION

8-1. INTRODUCTION

THE FREQUENCIES FOR TRANSMITTER AND RECEIVER LOCAL FREQUENCIES ARE ALL DRIVEN FROM A SINGLE 25.6MHz CRYSTAL BY MEANS OF A PHASE LOCKED LOOP.

THE LOCAL OSCILLATOR FREQUENCIES ARE 891.800 MHz (CH.1) TO 916.800 MHz(CH.26) FOR RECEIVER. DURING TRANSMIT, THE VCO OF THE PLL OPERATES 902.500 MHz TO 927.500 MHz.

THE VCO OPERATING FREQUENCY FOR THE RECEIVER IS 891.800 MHz (CH.1) TO 916.800 MHz (CH.26) AS THE LOCAL OSCILLATOR, INJECTED THROUGH THE TRF6900 INNER CIRCUIT.

RF TRANSCEIVER_TRF6900A SINGLE-CHIP IS AN INTEGRATED CIRCUIT INTENDED FOR USE AS A FSK TRANSCEIVER TO ESTABLISH A FREQUENCY-AGILE, HALF-DUPLEXER, BIDIRECTIONAL RF LINK.

THE DEVICE DESIGNED TO PROVIDE A FULLY-FUNCTIONAL FM TRANSCEIVER.

THE CHIP INTENDED FOR LINEAR (FM) OR DIGITAL (FSK) MODULATED IN NORTH AMERICAN 915MHz ISM BAND.

THE SINGLE CHIP TRANSCEIVER OPERATES DOWN TO 2.2V AND IS EXPRESSLY DESIGNED FOR LOW POWER AS WELL AS WIDE-BAND APPLICATION.

DUE TO THE NARROW CHANNEL SPACING OF THE DIRECT DIGITAL SYNTHESIZER (DDS), THE DDS CAN BE USED TO ADJUST THE TX / RX FREQUENCY AND ALLOWS THE USE OF INEXPENSIVE REFERENCE CRYSTAL (26.5MHz).

TWO FULLY-PROGRAMMABLE OPERATION MODES, MODE 0 AND MODE 1, ALLOW EXTREMELY FAST SWITCHING BETWEEN TWO PRE-PROGRAMMING SETTINGS

(e.g., RECEIVE (RX) / TRANSMIT (TX) ;
TX_FREQUENCY_0 / TX_FREQUENCY_1;
RX_FREQUENCY_0 / RX_FREQUENCY_1;)

WITHOUT RE-PROGRAMMING THE DEVICE.

EACH FUNCTION BLOCK OF THE TRANSCEIVER CAN BE SPECIFICALLY ENABLES OR DISABLED VIA THE SERIAL INTERFACE.

8-2. TRANSMITTER

THE TRANSMITTER CONSISTS OF AN INTEGRATED VCO, A COMPLETE FULLY-PROGRAMMABLE DIRECT DIGITAL SYNTHESIZER, AND A POWER AMPLIFIER.

THE INTERNAL VCO CAN BE USED WITH AN EXTERNAL TANK CIRCUIT.

THE DIVIDER, PRE-SCALAR, AND REFERENCE OSCILLATOR REQUIRE ONLY THE ADDITION OF AN EXTERNAL CRYSTAL AND A LOOP FILTER TO PROVIDE A COMPLETE DDS WITH A TYPICAL FREQUENCY RESOLUTION OF 230Hz.

THE 8-BIT FSK FREQUENCY DEVIATION RESISTER DETERMINE THE FREQUENCY DEVIATION IN FSK MODE.

THE MODULATION ITSELF IS DONE IN THE DIRECT DIGITAL SYNTHESIZER, HENCE NO ADDITIONAL EXTERNAL COMPONENTS ARE NECESSARY.

SINCE THE TYPICAL RF OUTPUT POWER IS APPROXIMATELY 24dBm.

8-3. RECEIVER

THE INTEGRATED RECEIVER IS INTENDED TO BE USED AS A SINGLE-CONVERSION FSK RECEIVER.

IT CONSISTS OF LOW-NOISE AMPLIFIER, MIXER, IF AMPLIFIER, LIMITER, FM / FSK DE-MODULATOR WITH AN EXTERNAL LC TANK CIRCUIT, AND A DATA SLICER.

THE RECEIVE STRENGTH INDICATOR (RSSI) CAN BE USED FOR FAST CARRIER SENSE DETECTION OR AS ON/OFF KEYING, OR AMPLITUDE SHIFT KEYING (OOK/ASK) DE-MODULATOR.

IN THE LEARNING MODE, DURING A LEARNING SEQUENCE (0,1,0,10, ...)THE INITIAL TOLERANCES OF THE LC DE-MODULATOR TANK CIRCUIT ARE COMPENSATED AND A EXTERNAL CAPACITOR IS CHARGED TO A DC VOLTAGE THAT IS PROPORTIONAL TO THE AVERAGE DE-MODULATION DC LEVEL.

THIS LEVEL IS THE ZERO REFERENCE FOR THE DATA SLICER TO GENERATED THE LOGICAL LEVELS OF THE DATA SEQUENCE THAT FOLLOW THE LEARN SEQUENCE.

USING THE INTERNAL DATA SWITCH, THE DE-MODULATED OOK AND FSK SIGNAL ARE AVAILABLE AT THE SAME DATA_OUT TERMINAL.

8-3. REFERENCE FREQUENCY

THE CRYSTAL, X301_25.600 [] AND OTHER COMPONENTS AS IC301_TRF6900 CAN MAKE A REFERENCE FREQUENCY OSCILLATOR WITH INTERNAL AMPLIFIER. THIS SET IS USED EXTERNAL CLOCK SOURCE BY THE CRYSTAL.

THE REFERENCE FREQUENCY(25.600MHz) IS ADJUSTED BY C314 EXACTLY.

8-4. VCO

THE PIN13,14 OF IC301 AND SURROUNDING PARTS ARE CONSISTING A OSCILLATOR WORKS AS A VCO OF IC301 WITH APPROPRIATE CONTROL VOLTAGE ON VC301.

THE VCO CAN BE OSCILLATE OVER THE REQUIRES RANGE OF 891.800 [] TO 927.500 []

8-5. PROGRAMMABLE DIVIDER AND ITS CONTROL

THE PROGRAMMABLE INPUTS FOR EACH CHANNELS ARE SETTED IC INSIDE. EACH INPUT SIGNAL TO CONTROL THE PLL IC(IC301) IS DONE WITH THE PROVIDED(DSP IC401). AN INTERNAL CODE CONVERT EPROM PROVIDES THE APPROPRIATE BINARY CONTROL TO THE PLL_IC(IC301) FOR THAT CHANNEL. SINCE THE BINARY NUMBER NECESSARY TO CHANCE DURING TRANSMIT AND RECEIVE, AND ADDITIONAL BIT IS REQUIRES AT PIN. TO ALLOW THE ROM TO RECOGNIZING THE STATUS IS TX OR RX. THE PROGRAMMABLE DIVIDER TO PLL_IC (IC301). THE IC301 OUTPUT IS FED TO THE PHASE DETECTOR FOR COMPARING WITH THE 500 kHz REFERENCE FREQUENCY INSIDE.

8-6. PHASE DETECTOR AND VCO CONTROL

THE PHASE DETECTOR IS A DIGITAL PHASE COMPARATOR WHICH COMPARES THE PHASE OF THE REFERENCE SIGNAL WITH PROGRAMMABLE DIVIDER OUTPUT SQUARE WAVES AND DEVELOPS A SERIES OF PULSE WHOSE DC LEVEL DEPENDS ON THE PHASE ERROR OF EACH SIGNAL. THE PHASE DETECTOR PULSE OUTPUT IS FED TO AN ACTIVE LOW PASS FILTER, AND FED TO VAR1_CAP VC301 CONTROL THE VCO FREQUENCY.

8-7. TRANSMITTER POWER AMP

OUTPUT SIGNAL OF IC301 IS FED INTO THE POWER AMP IC202 TO INCREASE THE STRENGTH OF TX CARRIER FREQUENCY.

8-9. SWITCHING OF TUNING CAPACITOR IN VCO

THE VCO CIRCUIT MUST USE WITH A WIDE RANGE OF FREQUENCIES 902.500 ~ [] ~ [] OR RECEIVER. TO COMPLY ABOVE RANGE OF VCO, THE TUNING CAPACITANCE SHOULD SWITCHED FOR TRANSMISSION OR RECEPTION.

8-10. FREQUENCY STABILITY

LET :

F_0 =CRYSTAL OSCILLATOR FREQUENCY

F_r =PHASE DETECTOR REFERENCE FREQUENCY

F_{vco} =VCO FREQUENCY

F_t =TRANSMIT FREQUENCY

THEN : $F_r = F_0/512$

AND UNDER LOCKED CONDITIONS : $F_r = F_{vco}/N$

WHERE, "N" IS THE DIVIDE RATIO OF PROGRAMMABLE DIVIDER.

THEN : $F_{vco} = N \cdot F_r$

FROM WHICH IT CAN BE SEEN, THE PERCENTAGE ERROR IN THE SAME AS THE PERCENTAGE ERROR IN F_0 . THE STABILITY OF THE CRYSTAL OSCILLATOR IS DETERMINED IN F_t IS THE SAME AS THE PERCENTAGE ERROR IN F_0 . THE HAVING PASSIVE COMPONENTS OF THE OSCILLATOR. THE CHOICE OF CRYSTAL AND COMPONENTS IS SUCH THAT THE REQUIRES FREQUENCY STABILITY IS MAINTAINED OVER THE REQUIRED VOLTAGE AND TEMPERATURE RANGE.

8-11. CIRCUIT FOR SUPPRESSION OF SPURIOUS RADIATION

THE TUNING CIRCUIT BETWEEN THE OUTPUT OF FINAL RX/TX SWITCH IC201 AND ANTENNA, 3 STAGE "LPF TYPE" NETWORK L200, L201, C201, C202, C203 SERVES AS A SPURIOUS RADIATION SUPPRESSOR. THIS NETWORK ALSO SPURIOUS RADIATION SUPPRESSOR. THIS NETWORK ALSO SERVES TO MATCH THE IMPEDANCE BETWEEN TX POWER IC202 AND ANTENNA.