Description and User Manual

700/800 MHz
MOBILE AMPLIFIER

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Crescend Technologies
100 High Grove Blvd
Glendale Heights, IL 60139

Tel: 847 908 5400
Fax: 847 908 5408
Email: sales@Crescendrf.com
Web Site: www.Crescendrf.com

Mobile Power Amplifier DSDTJK50-01T

1. General description.

The power amplifier (PA) is nonlinear AB to C class unit that is intended for frequency (phase) modulated (manipulated) signals amplification.

PA has the by-pass chain. If RF power, applied to the connector "XCVR" (Pin), is less than 50 mW, PA stays in bypass (RX) mode. When Pin exceeds 0.1 – 0.2 W, PA switches to TX (amplification) mode. Unit returns to RX mode in the case of overheat(when the heatsink temperature becomes +85ºC or greater).

PA has the automatic power control loop, which keeps the output power at the rated level. It reduces this level, when the load VSWR is above 2.

The general parameters of unit are listed below. The term *nominal* means the nominal power supply voltage and the heatsink temperature close to room temperature.

Frequency range of operation (F), MHz . . . . . 769 - 869;
Input power (Pin), W . . . . . 1 - 4;
Output power at the normal operation (Pout-n), W…….. . . . . 50;
Relative harmonic level, dBc, less than . . . . . -68;
DC power supply voltage (Vsup), V:
- nominal 13.8;
- continuous, allowed . . . . . 10.8 – 17.8;
- pulse, not longer than 30 ms and on/off ratio less than 0.1 . . . . . 40;

Reversed polarity DC voltage acting, ms, not longer than 250;
DC current with the nominal supply voltage, A, not greater than:
- in RX mode 0.001;
- in TX mode 11.5;

Load VSWR, not greater than 2.5;
Input return loss, dB, less than . . . . . -10;
Switching time between RX and TX mode, ms, not greater than 0.5;
Insertion loss in RX mode, dB, less than 1.3;
Continuous transmit time, min, not greater than 3;
Duty cycle, % of Power, not greater than 40;
Operating temperature range, ºC . . . . . -30 to +60;
RF connectors . . . . . 50 Ohm TNC (F);
DC connectors . . . . . # 6-32 AWG screws.

The block-diagram of PA is represented in Fig.1.

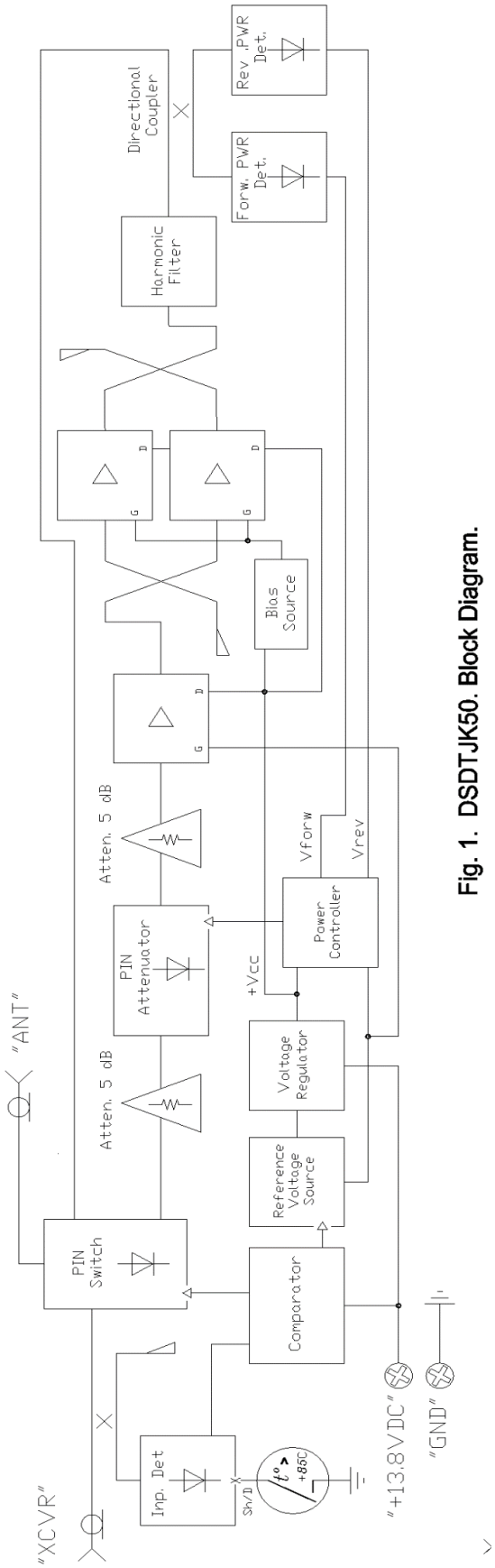


Fig. 1. DSDTJK50. Block Diagram.

There are the following general blocks:

- RF chain devices:
    - Directional coupler with input power detector;
    - PIN diode TX/RX mode switch;
    - Two constant value attenuators;
    - PIN-diode attenuator;
    - Drive stage of amplifier;
    - Final stage of amplifier;
    - Harmonic filter;
    - Directional coupler with forward and reversed power detectors.
    -
- DC chain devices:
    - TX/RX switching control circuit;
    - Reference voltage source;
    - Voltage regulator;
    - Final stage bias source;
    - Power control circuit.

2. Schematic Description.

RF Circuit Description.

RF signal, applied to the connector “XCVR”, proceeds to the pad J1 of PCB. Directional coupler Y3 with RF input detector D1 forms the activation signal for switching control circuit. Until this signal is low (Pin < 50 mW), the unit remains in RX mode. Then all PIN diodes DS1…DS4 are closed. RF signal via the band-pass chain, passing microstrip lines and C3, C13, C19, goes to the pad J2 and, after it, to the connector “ANT”.

When Pin > 0.12 W, PIN diodes DS1…DS4 open and RF signal via DS1, ATT3, PIN diode attenuator (D5, D6)
and ATT4 goes to the input of driver stage (Q100).

The final stage contains two quadrature combined identical amplifiers (Q101, Q102). SMT hybrids Y1 and Y2 serve as the power splitter and combiner respectively.

Passing the harmonic filter (CF1, CF2 and microstrip lines), directional coupler (two parallel strip lines under 60 mills thick dielectric cover) and DS4, RF output signal from the pad J2 by the coax cable goes to connector “ANT”. Diodes DD and DR are parts of forwarded and reversed components of the output signal.

DC Circuit Description.

DC power supply voltage is applied to clamps “+13.8VDC” and “GND”, connected to pads J3 and J4 of p/c board. Power diode D9 protect the unit against the reverse of DC voltage polarity and against DC voltage short spikes. This voltage supplies the voltage limiter (Q3, Q100), the input detector voltage comparator (U1) and key elements Q1 and Q2.

When the voltage at the output of detector exceeds 0.9V (the reference level, established by RE1, RE2 and R20), the left half of the differential pair Q6 opens, also opening keys Q1 and Q2. As a result, the switching to TX mode current comes to PIN diode switch via Q1, as well as opened Q2 keys 5V reference voltage (D7). Opened right half of Q3 unblocks the gate bias voltage of Q100. At the same moment, the right half of Q6 closes, closing Q7. Then the reference at the pin Q6/1 voltage becomes two times lower - this create the hysteresis of switching.

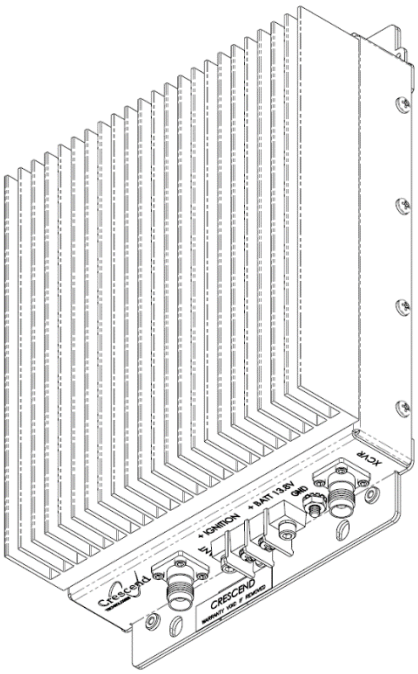
Appearance of 5V reference voltage follows by keying on the voltage limiter, gate bias circuits and power control circuitry.

The voltage limiter (Q5, Q99) limit the output voltage at the level Vcc-max $\underset{\sim}{}$ 13.5 V. Potentiometers RP1, RP2 and RP3 allow to set up gate bias voltages (quiescent currents) of Q100, Q101 and Q102 respectively. Resistors R26, R44 with R44A and R44B with R44C allow to monitor DC currents of mentioned above transistors.

Levered by divider RD3-RD4 voltage from forwarded and reversed power detectors comes to bases of differential pair Q4. Then the biggest signal, selected by Q4, proceeds to input of comparator U3, that forms the signal, controlled PIN diode attenuator. The reference voltage comes from the output of repeater U2. The output RF power level of unit sets by potentiometer RP4L.

Construction.

The unit is assembled in the chassis with heatsink, intended for conventional cooling.



Unit dimensions are 2.7” x 6.75” x 9.8”.

All connectors are placed at one side of chassis.

Fig. 2

3. Installation Guide.

Install the unit in one of two positions, showed in Fig. 2: horizontal (fins up) or vertical. The proper air access to the unit shall be provided: no obstacle for air is allowed closer than 3” from heatsink. The place of installation shall provide the ambient temperature between -30ºC and +60ºC.

Do not destroy the sealing labels.

Screws from # 10 to # 1/4-20 are recommended for unit fastening. See the fastening hole’s positions in Fig. 3.

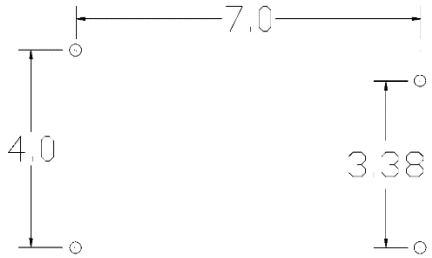


Fig. 3

It is recommended to connect the nut clamp “GND” to the nearest ground point at the place of installation.
Use copper wire # 10 or #12 AWG shall for connection to the car battery. Wires shall be crimped for making ring terminals.
Connect the clamp “- 13.8V” to the pole “-” of car battery.
Connect the clamp “+ 13.8V” to the pole “+” of car battery. Use 30 A fuse for protection.
Use 50 Ohm coax cables with TNC (M) connectors for connecting to “XCVR” and “ANT” .
Connect the port “XCVR” to RF output of radio.
Connect the port “ANT” to antenna.

4. Operation Guide

- The DC power supply voltage should provide 13.8 V nominal. The allowed DC voltage value is between 10.8 V and 17.8 V. Note: with DC voltage less than 13.8 V, the output power may be less than the rated 50W;
- Do not apply RF signal out of rated frequency range 769-869 MHz;
- For transmitting the input RF power should be in the range 1…4 W;
- The continuous transmit time should not exceed 3 min, and the duty cycle should not be greater than 40% for avoiding the overheat;
- In the case of overheat (if the heatsink temperature reaches +85°C) the unit switches to RX mode;
- If the load VSWR exceeds 2-3, the output power reduces

FCC RF Exposure:
This transmitter must be restricted to work related operations in a controlled RF exposure environment. All qualified end-users of this device must have the knowledge to control their exposure conditions and/or duration, and the exposure conditions and/or duration of their passengers, to comply with the General Population/Uncontrolled MPE limit and requirements. All users should maintain a safe distance of 115cm.

Part 90 Amplifier - FCC 90.219 CLASS A DEVICE

WARNING: This is NOT a CONSUMER device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST have an FCC LICENSE or express consent of an FCC Licensee to operate this device. Unauthorized use may result in significant forfeiture penalties, including in excess of $100,000 for each continuing violation.

FCC ID#: CWWDSDTJK50