

## 2 T838/839 Circuit Operation

This section provides a basic description of the circuit operation of the T838/839 PA.

Refer to Section 5 where the parts lists, grid reference index and diagrams will provide detailed information on identifying and locating components. Refer also to Figure 3.2 which shows the location of the main adjustment controls.

The following topics are covered in this section.

Section	Title	Page
2.1	<b>Introduction</b>	2.3
2.2	<b>RF Circuitry</b>	2.4
2.3	<b>Control Circuitry</b>	2.5
2.3.1	Power Control	2.6
2.3.2	Driver Power Level	2.6
2.3.3	Thermal Protection	2.6
2.3.4	Forward And Reverse Power Alarms	2.7
2.3.5	Forward And Reverse Power Metering	2.7
2.3.6	Fan Control Circuitry	2.7
2.4	<b>Power Supply &amp; Regulator Circuits</b>	2.8

Figure	Title	Page
2.1	T838 High Level Block Diagram	2.3
2.2	T839 High Level Block Diagram	2.3
2.3	T838/839 Control Circuitry Block Diagram	2.5
2.4	T839 Fan Control Logic Diagram	2.7
2.5	T838/839 Power Supply & Regulator Circuitry Block Diagram	2.8



## 2.1 Introduction

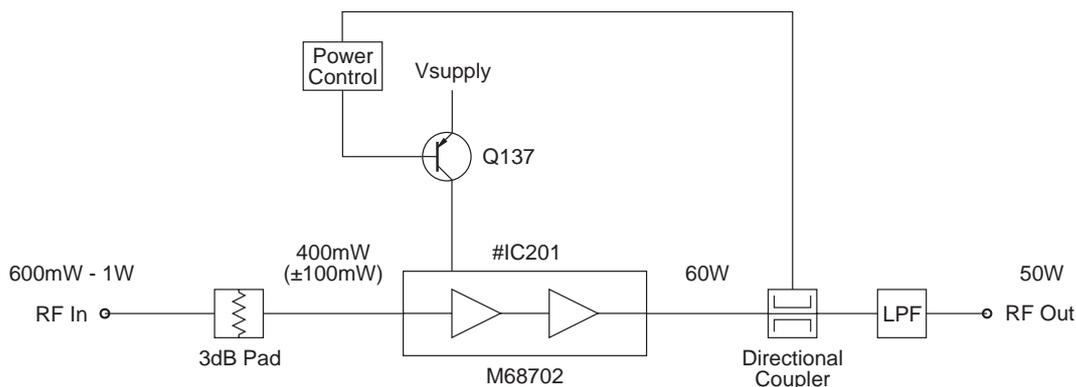


Figure 2.1 T838 High Level Block Diagram

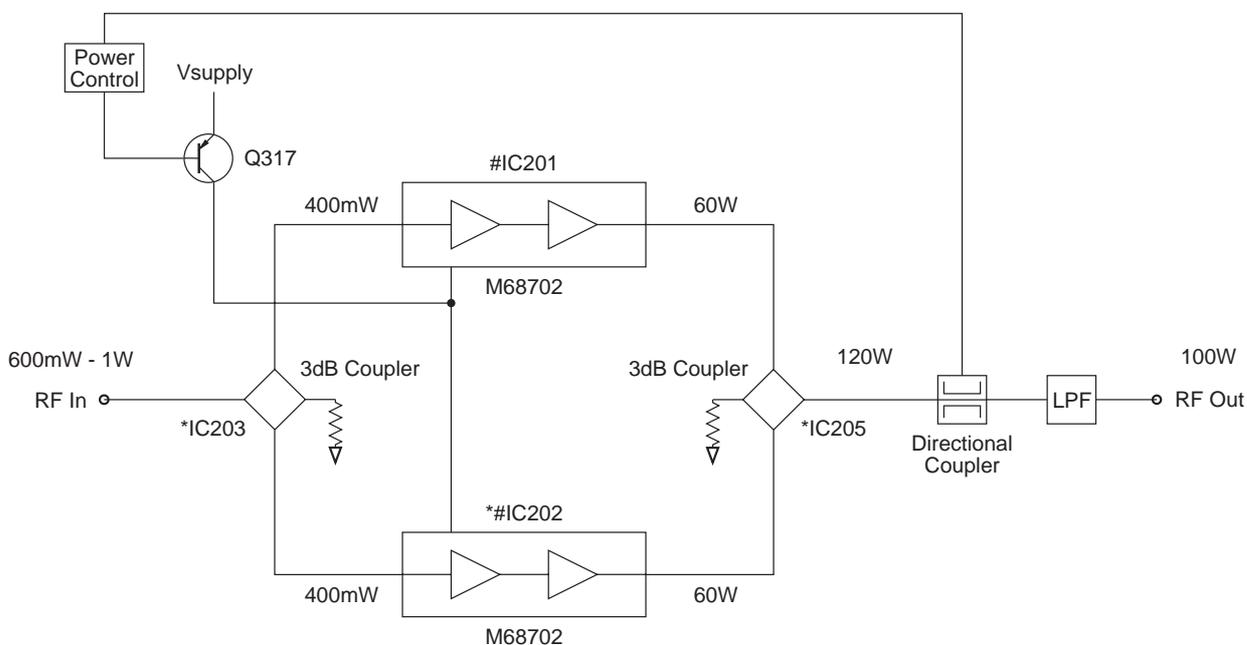


Figure 2.2 T839 High Level Block Diagram

The T838/839 comprise a single stage RF power amplifier with extensive control circuitry:

- in the T838 this stage consists of a single, two-stage RF power module which increases the drive level to approx. 60W;
- in the T839 this stage consists of two, two-stage RF power modules, each of which increases the drive level to approx. 60W; the outputs from these modules are then combined to provide the rated output power.

Figure 2.1 and Figure 2.2 show the configuration of each of the main circuit blocks on a functional level, while the fold-out Figure 1.1 shows their location on the PCB.

## 2.2 RF Circuitry

(Refer to the RF & thermistor control sections circuit diagram in Section 5.)

The T838 consists of a single RF power module (#IC201) which delivers 60-70W. The input signal is fed directly into the module, and the output from the module is passed to the antenna socket via the directional coupler and low pass filter.

The T839 consists of two RF power modules (#IC201 & \*#IC202), each of which delivers 60-70W. The input signal to these modules is split via a 3dB quadrature hybrid (\*IC203). The outputs from the modules are recombined by a second 3dB quadrature hybrid (\*IC205) before being passed to the antenna socket via the directional coupler and low pass filter.

The directional coupler senses forward and reflected power, which is rectified (D201 & D203) and passed to the control circuitry for metering, alarm and power control purposes.

Power control is via a series pass transistor (Q137), which controls the supply voltage on pin 2 of #IC201 in the T838, and pin 2 of both #IC201 and \*#IC202 in the T839.

## 2.3 Control Circuitry

(Refer to the control section circuit diagram in Section 5.)

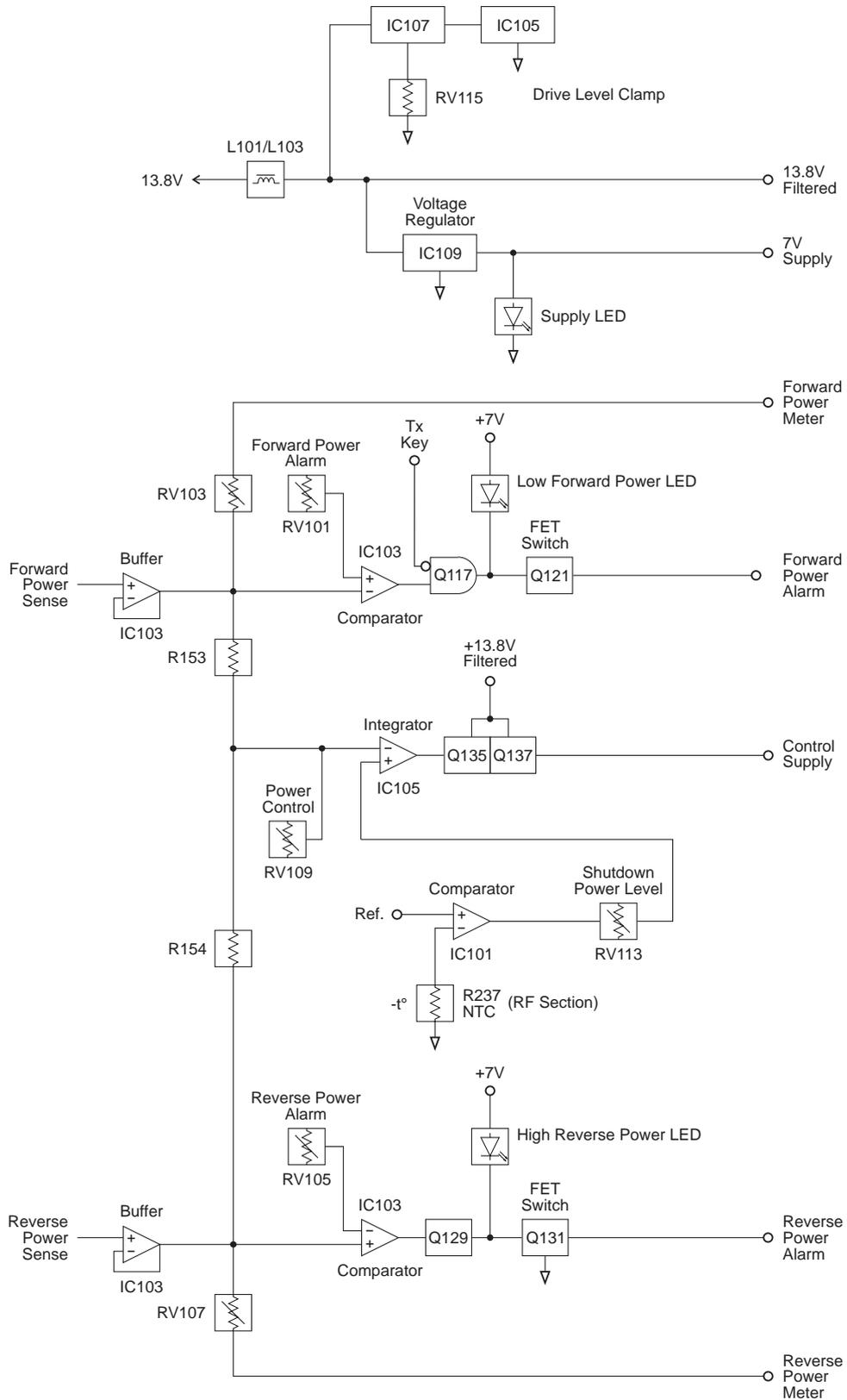


Figure 2.3 T838/839 Control Circuitry Block Diagram

### 2.3.1 Power Control

The DC voltages from the directional coupler representing forward and reflected power are buffered by the two voltage followers, IC103 pins 1, 2 & 3 and pins 8, 9 & 10. Their outputs are summed at an integrator (IC105 pins 1, 2 & 3), which drives the series pass control elements (Q135 & Q137).

Forward and reflected power are summed so that, under high output VSWR, the power control turns the PA down. This is because the control loop adjusts for the same DC voltage from the directional coupler that would have been present if there were no reflected power.

### 2.3.2 Driver Power Level

The maximum output power of the T838/839 can be limited by placing a ceiling on the driver output power level using RV115 (accessible through the side cover). For example, if RV115 is set for a maximum output power of 50W, the range of adjustment using RV109 (front panel power adjust) will be 20 to 50W.



**Caution:** The driver power level clamp (RV115) is factory set to give a maximum power output of 60W for the T838 and 120W for the T839. The unit may be damaged if this level is increased.

### 2.3.3 Thermal Protection

At excessively high temperatures, the output power will automatically reduce to a preset level (set by RV113), thus preventing the PA from overheating.

Ambient temperature within the PA is measured by a thermistor controlled voltage divider (R168, R237) which applies a voltage to a comparator with hysteresis (IC101 pins 8, 9 & 10). This thermistor is located on the PCB in the low pass filter cavity.

Thermal protection is also provided for each RF power module to prevent the module itself from overheating. This protection consists of a thermistor controlled voltage divider (R207, \*R215 and R220, R219) which sets a voltage on a comparator with hysteresis (IC204 pins 1, 2 & 3 and 5, 6 & 7). These thermistors are located on the module flanges.

The output current from all comparators is summed into the power control network via RV113 so that the power level to which the PA must turn down may be set.

### 2.3.4 Forward And Reverse Power Alarms

If forward power drops below, or reverse power rises above, presettable limits, alarms may be triggered.

The alarm outputs are open drain configuration and are low under normal conditions (i.e. forward and reverse power levels are normal).

IC103 pins 12, 13 & 14 and pins 5, 6 & 7 form comparators with thresholds adjusted via RV101 and RV105 respectively. The inputs are from the forward and reverse power signals from the directional coupler, buffered by IC103 pins 1, 2 & 3 and pins 8, 9 & 10. Thus, the power levels at which the forward and reverse power alarms are triggered are defined by RV101 and RV105 respectively.

### 2.3.5 Forward And Reverse Power Metering

Forward and reverse power signals from the two IC1 buffers are available for metering purposes. The output currents are adjustable via RV103 (forward power) and RV107 (reverse power).

### 2.3.6 Fan Control Circuitry

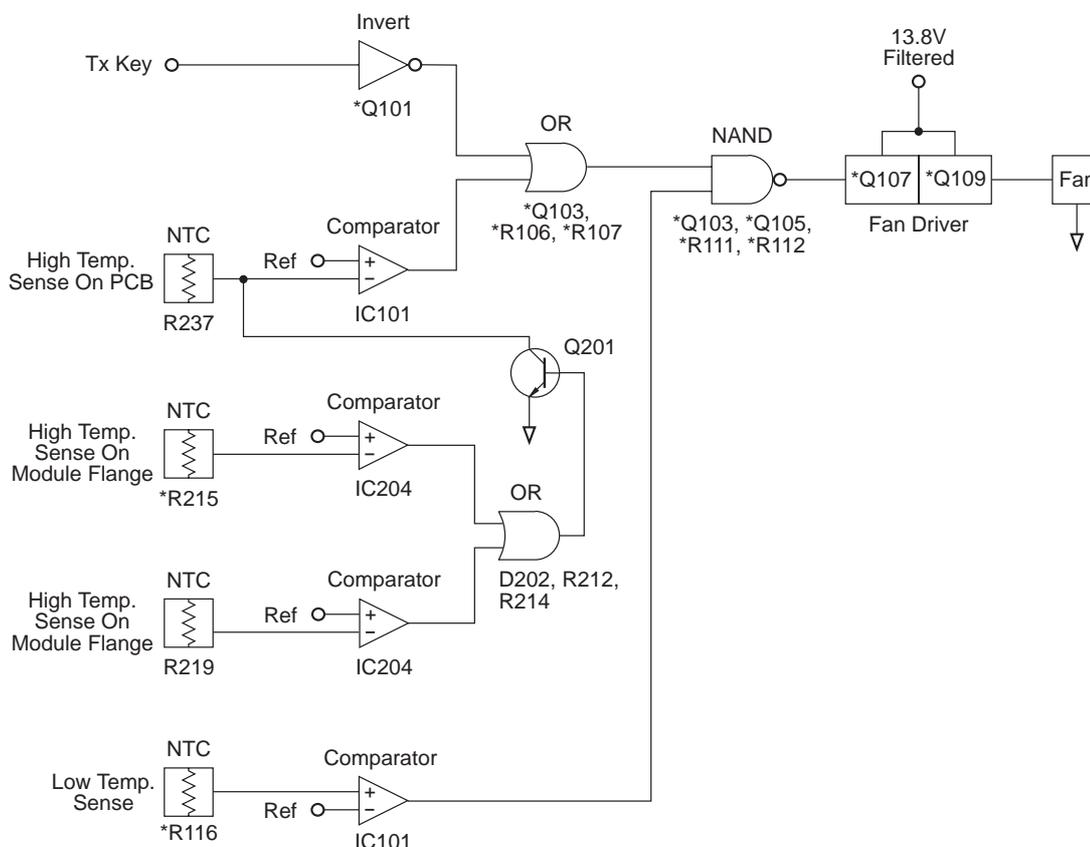


Figure 2.4 T839 Fan Control Logic Diagram

Comparator IC101 pins 12, 13 & 14 are set to switch at heatsink temperatures greater than +90°C or RF power module flange temperatures greater than +110°C, and pins 1, 2 & 3 at temperatures less than -10°C.

A logic AND function is applied to the comparator outputs by \*Q103 and \*Q105, thereby turning on the fan unconditionally (via \*Q107 and \*Q109) if the heatsink temperature exceeds +90°C or the module flange temperatures exceed +110°C.

A logic OR function is applied to comparator IC101 pins 12, 13 & 14 and Tx KEY signals, thereby turning on the fan when the transmitter is keyed and the temperature is between -10°C and +90°C (or +110°C for the module flanges).

If the temperature drops below -10°C, \*Q105 is turned off, preventing \*Q103 from activating the fan.

## 2.4 Power Supply & Regulator Circuits

(Refer to the control section circuit diagram in Section 5.)

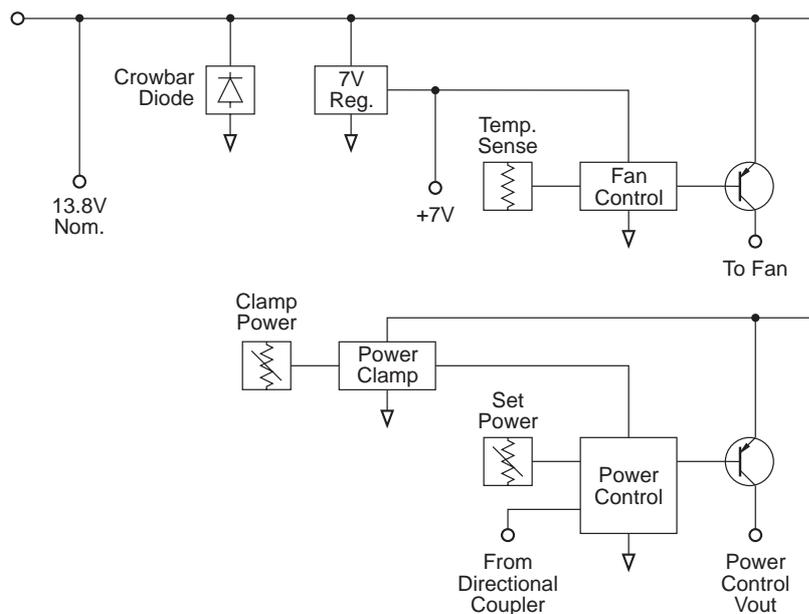


Figure 2.5 T838/839 Power Supply & Regulator Circuitry Block Diagram

The T838/839 are designed to operate off a 10.8-16V DC supply (13.8V nominal). A 7V supply runs directly off the 13.8V rail, driving the fan control, power control and alarm circuitry.

A crowbar diode is fitted for protection against connection to a power supply of incorrect polarity. It also provides transient overvoltage protection.

**Note:** A fuse must be fitted in the power supply line for the diode to provide effective protection.