2 T858/859 Circuit Operation

This section provides a basic description of the circuit operation of the T858 and T859 power amplifiers.

Refer to Section 5 where the parts lists, grid reference index and diagrams will provide detailed information on identifying and locating components.

The following topics are covered in this section.

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2.1 Introduction

T858	0.7-1W	2-3dB	2W	8-10W	20-30W	35-40W	60-70W
T859	0.7-1W	2dB	5W	15-20W	40-50W	60-70W	105-120W
T878	0.7-1.8W	4dB	5W		20-35W	35-40W	60-80W

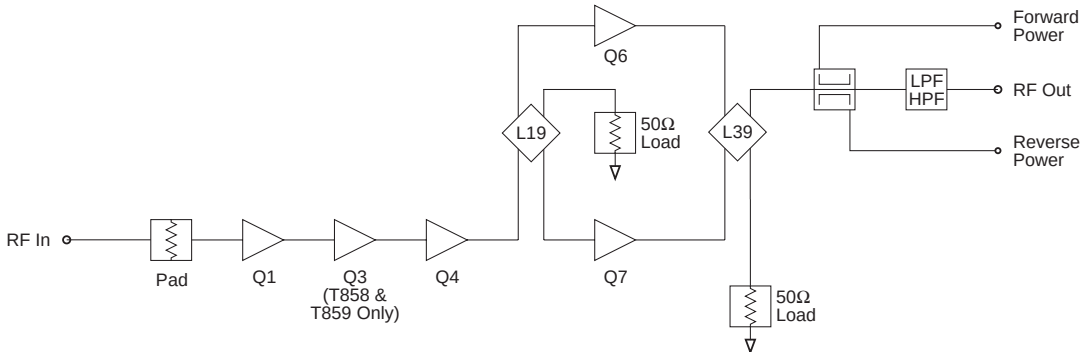

Figure 2.1 T858/859 High Level Block Diagram

The T858 and T859 comprise a five-stage RF power amplifier, the final two stages of which are combined, and extensive control circuitry.

The configuration of each of the main circuit blocks may be seen on a functional level in Figure 2.1.

2.2 RF Circuitry

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

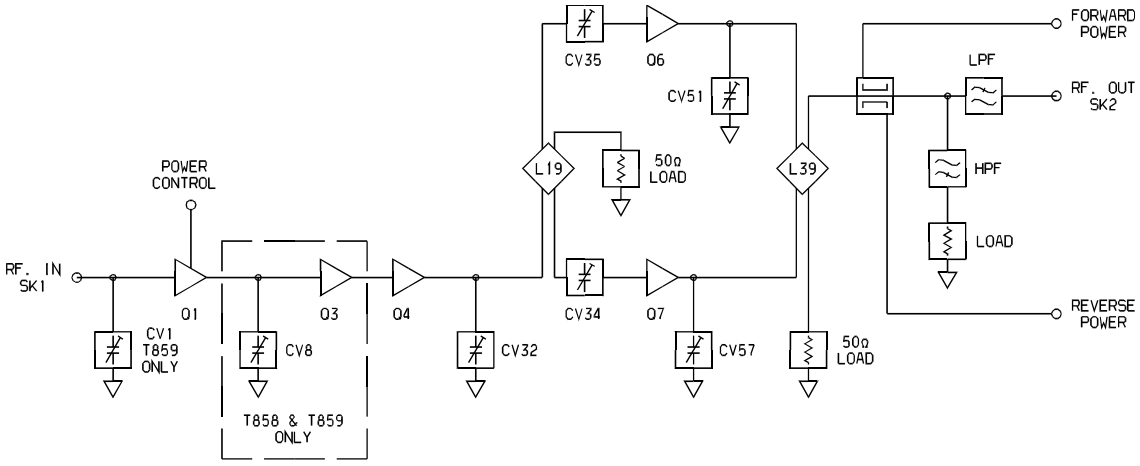

Figure 2.2 T858/859 RF Circuitry Block Diagram

The driver stage of the T858/859 consists of a three-stage transistor amplifier (Q1, Q3 & Q4) which delivers 30W in the T858 and 50W in the T859. This signal is split via a 3dB coupler (L19) and used to drive the two final amplifiers (Q6 & Q7). The outputs from the finals are passed to the antenna socket via the harmonic filter.

The diplexer presents the final amplifiers with a good load at harmonic frequencies, which helps to achieve the expected harmonic attenuation in the output filter.

The directional coupler senses forward and reflected power, which is rectified (D1 & D2) and passed to the control circuitry for metering, alarm and power control purposes.

Power control is via a series pass transistor (Q16), which controls the supply voltage on the collector of the driver transistor (Q1).

2.3 Control Circuitry

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

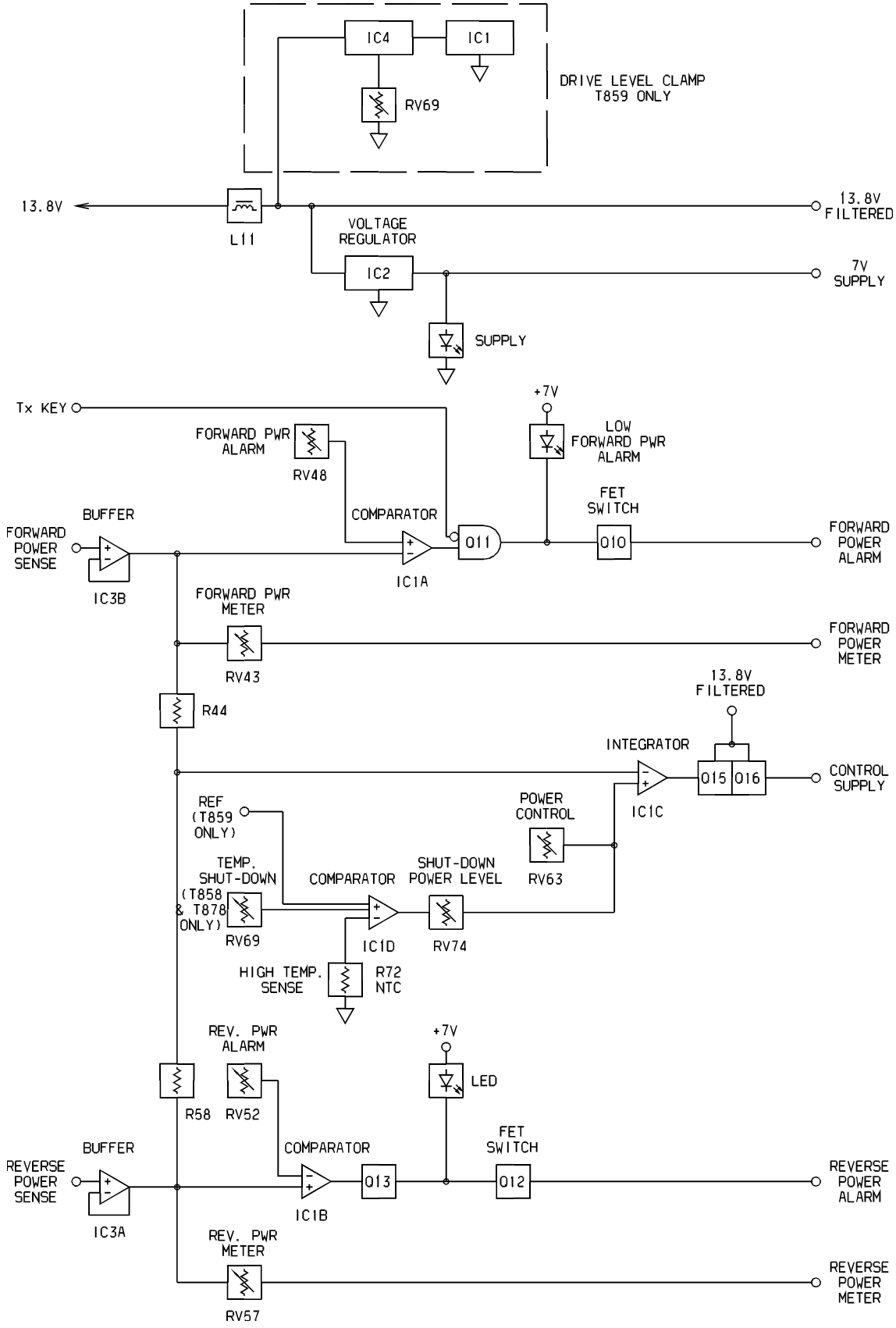

Figure 2.3 T858/859 Control Circuitry Block Diagram

2.3.1 Power Control

The DC voltages from the directional coupler representing forward and reflected power are buffered by the two voltage followers IC3 pins 1, 2 & 3 and pins 5, 6 & 7. Their outputs are summed at an integrator (IC1 pins 8, 9 & 10), which drives the series pass control element (Q16).

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 T859 Driver Power Level

A ceiling is placed on the output power available from driver stages Q1, Q3 and Q4 to ensure final stages Q6 and Q7 are not overdriven. This is achieved by RV69 and IC4 controlling the supply voltage of power control error amplifier IC1c, which in turn limits the maximum supply voltage that can be applied to driver Q4 by power control transistor Q16.

Note: T859 PAs with serial numbers prior to 217262 do not have this feature.

2.3.3 Thermal Protection

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

A thermistor controlled voltage divider (R68, R72) applies a voltage to a comparator with hysteresis (IC1 pins 12, 13 & 14). In all T858 PAs and T859 PAs with serial numbers prior to 217262, the threshold of the comparator is independently set by RV69 which sets the shutdown temperature.

Note: On later model T859 PAs this threshold is fixed.

The output current from the comparator is summed into the power control network via RV74 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).

IC1 pins 1, 2 & 3 and pins 5, 6 & 7 form comparators with thresholds adjusted via RV48 and RV52 respectively. The inputs are from the forward and reverse power signals from

the directional coupler, buffered by IC3 pins 1, 2 & 3 and pins 5, 6 & 7. Thus, the power levels at which the alarms are triggered are defined by RV48 and RV52.

2.3.5 Forward And Reverse Power Metering

Forward and reverse power signals from the two IC3 buffers are available for metering purposes. The output currents are adjustable via RV43 and RV57.

2.3.6 T859 Fan Control Circuitry

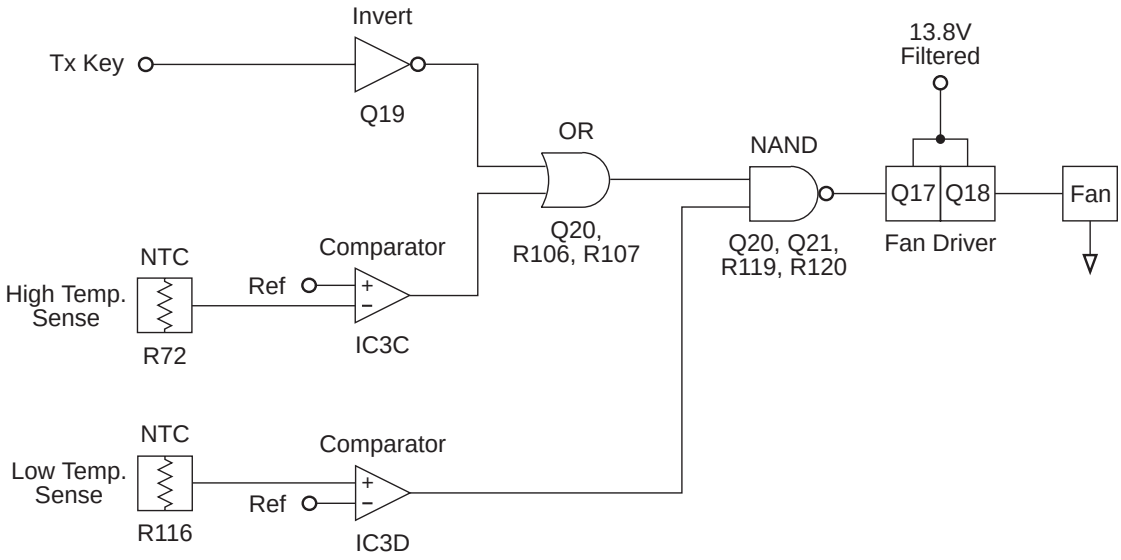

Figure 2.4 T859 Fan Control Logic Diagram

Comparator IC3 pins 8, 9 & 10 are set to trigger at heatsink temperatures greater than +70°C, and pins 12, 13 & 14 at temperatures greater than -10°C.

A logic AND function is applied to the comparator outputs by Q20 and Q21, thereby turning on the fan unconditionally (via Q17 and Q18) if the heatsink temperature exceeds +70°C.

A logic OR function is applied to the comparator IC3 pins 8, 9 & 10 and Tx KEY signals, thereby turning on the fan when the transmitter is keyed and the temperature is between -10°C and +70°C.

If the temperature drops below -10°C, Q21 is turned off, preventing either Q19 or Q20 from activating the fan.

Fan operation may be summarised as follows:

T < -10°C	- fan unconditionally turned off.
-10°C < T < +70°C	- fan turned on only when transmitter keyed.
T > +70°C	- fan unconditionally turned on.

