

## 9. Circuit description new circuits

Power supply (diagram A1)

### 9.1 Introduction

#### 9.1.1 General

The switched mode power supply (SMPS) is mains isolated. The control IC7520 (MC44603AP) gives the pulses for driving FET 7518 with duty cycle control at fixed frequency of nominal 70 kHz in normal operation (in stand-by, slow-start and overload situation the SMPS runs at other frequencies than these 70 kHz). IC7520 is featured with a slow-start circuitry and has over- and undervoltage-protection of the secondary supply voltages. Unload and overload (short-circuit) protection is also included. In case the load decreases under a certain threshold level the SMPS will switch into stand-by-mode (in stand-by SMPS is in the so called "reduced frequency mode"; nominal 20 kHz). The +95V (+VBATT) output gives a stabilised +95V for 14", 20" and 21" in normal operation and approx. 102V DC in stand-by mode. IC7541 (TDA8139) having stable regulator o/p +5V and +8V supply and also build in protection circuit for +5V and +8V supply, when pin 4 is low (standby mode) the IC disable the supply output voltage +8V, so the IC7225 (TDA8373/74) line output is shut "down". When pin 6 of IC7541 is low the protection circuit is working +5V & +8V will shut "down". Transistor 7420 & 7421 is a fast discharge circuit (when power switches off).

#### 9.1.2 Output voltage (Diagram A1)

- Power supply - Secondary output voltages
- +10V / 14V for the audio amplifier
- +5V for the control part (is also available in standby)
- +8V for the video processing
- +14V for the horizontal synchronisation drive
- +95V (+VBATT) for the line output stage and the tuning system

#### 9.1.3 Duty cycle and T-on, T-off, T-dead

The duty cycle of the power supply depends on T-on of FET TS7518 that is controlled by pin 3 of IC7520. The IC detects the variations of the +VBATT (the secondary side of T5545) via sensing-winding 1-2 at the primary side of T5545. The switching period of FET 7518 is divided in three main areas; T-on, T-off and T-dead (see Fig. 9.2).

- During **T-on** FET 7518 conducts and so the energy which is extracted from the mains, is stored into the primary winding 4-7 of transformer T5545 with a linear increasing primary current (slope depends on the voltage across C2508). Via T-on regulation by pin 3 IC7520 the duty cycle of the SMPS and so the +VBATT is controlled.
- During **T-off** FET 7518 does not conduct and so all energy "inside" the transformer is supplied to the load via secondary windings of T5545 and the secondary diodes (D6550, D6560 and D6570). The current through the secondary side of the transformer decreases with a linear slope of T5545).
- During **T-dead** FET 7518 does not conduct and so no energy is extracted or supplied (Isec is zero).

### 9.2 Primary side

#### 9.2.1 Mains input and degaussing

**Mains voltage** is filtered by L5500, L5501 and L5502 full wave rectified by a diode bridge and smoothed by C2508 to the DC input voltage for the SMPS at pin 7 of T5545 (e.g. 300V DC for 220V AC mains).

**Degaussing**; R3504 is a dual PTC (2PTC's in one housing). After switching "on" the set, the PTC is cold so low-ohmic and so the degaussing current is very high. After degaussing, the PTC is heated, so high-ohmic, so in normal operation the degaussing current is very low.

#### 9.2.2 Start up and take over

Start-up; Via the start-up circuitry R3530 and R3529 one side of the 220V AC mains is used to start-up IC7520 via the supply pin (Vpin 1). As long as Vpin 1 has not reached 14V5, IC7520 does not start up and only sinks 0.3mA; As soon as Vpin 1 reaches the 14V5, IC7520 starts (FET 7518 into conduction) and pin 1 sinks a typical supply current of 17 mA. This supply current can not be delivered by the start-up circuit, so a take-over circuit has to be available. If no take-over takes place, the voltage on pin 1 will decrease and IC7520 switches off. In that case the restart will start again. Take over of IC7520; During start-up a voltage across winding 1 - 2 is built up. At the moment the voltage across winding 1 - 2 reaches approx. +12V, D6540 start conducting and takes over the supply voltage Vpin 1 of IC7520 (take over current is approx. 17mA).

### 9.3 Control circuitry

#### 9.3.1 IC7520 control mechanisms

IC7520 controls the T-on of FET 7518 in all operation modes by 3 mechanisms:

- "Secondary-output-sensing" controls the secondary output voltages (via the feedback voltage Vpin 1 4).
- "I-prim current sensing" controls both the secondary output voltages and the maximum I-prim (via the current sense voltage Vpin 7).
- "Demagnetisation control" prevents the transformer T5545 from going into saturation via the so called "DEMAG" function at pin 8 (this causes slow-start operation).

#### 9.3.2 Secondary output voltages feedback (pin 14 of IC7520)

Winding 1 - 2 has the same polarity as the secondary windings that are supplying the load. During T-off the secondary windings and so winding 1-2 are positive. D6537 conducts and so charges C2537; the DC level across C2537 is a reference for the secondary output voltages (e.g. the +95V) +VBATT. Via R3538, R3539 and potentiometer R3540 for adjusting the +95V (+VBATT) this DC-voltage is brought to the required level for the error amplifier in IC7520 at pin 14. This voltage Vpin 14 is called feedback voltage and is used to control the secondary output voltages.

#### 9.3.3 I-prim sensing (pin 7 of IC7520)

The current sense voltage Vpin 7 is a measure for the I-prim through FET 7518. The I-prim is converted into a voltage by R3518. The current sense voltage Vpin 7 is used to control both the secondary output voltages and the maximum I-prim (see peak current limiting).

#### 9.3.4 Demagnetisation control (via pin 8 of IC7520)

Winding 1 - 2 has the same polarity as the secondary windings that are supplying the load. As a result the voltage across this winding is negative during T-on, positive during T-off and oscillating during T-dead. The so called demagnetisation "DEMAG" in IC7520 function at pin 8 of IC7520 is used for blocking the output Vpin3 during the time that there is still energy in the transformer (Isec not zero). This is realised by delaying the T-on until the demagnetisation is completely finished. In this way the currents and voltages at the moment of switching "on" the FET are controlled.