

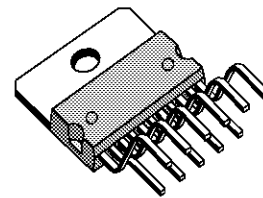
RGB VIDEO OUTPUT AMPLIFIER

- THREE INDEPENDENT VIDEO AMPLIFIERS WITH TYPICAL SR > 1000V/μs
- CRT-CATHODE SENSING OUTPUT FOR SEQUENTIAL SAMPLING
- INTERNAL G1 VOLTAGE GENERATOR
- CATHODE SHORT CIRCUIT PROTECTION
- FLASHOVER PROTECTION OF THE OUTPUT STAGES
- COMPENSATES POSITIVE AND NEGATIVE TUBE LEAKAGES

DESCRIPTION

Realized with a high voltage bipolar technology, the TDA8153 is a monolithic RGB video output stage for TV color applications. It drives the CRT cathodes directly and offers a video bandwidth compatible with CCIR standards. In addition to three independent video amplifiers, the device features an internal generator for the first grid voltage, flashover protection, cathode short circuit protection and a common cut-off sensing output for use in sequential sampling applications.

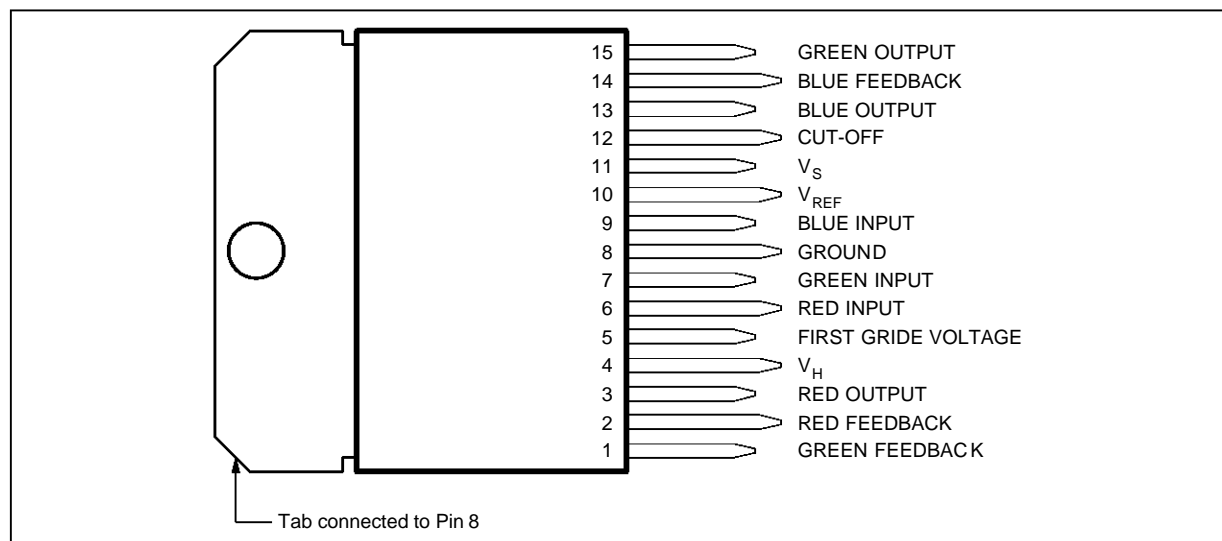
The TDA8153 is supplied in a 15 lead Multiwatt plastic power package.



MULTIWATT15
(Plastic Package)

ORDER CODE : TDA8153

PIN CONNECTIONS



8153-01.EPS

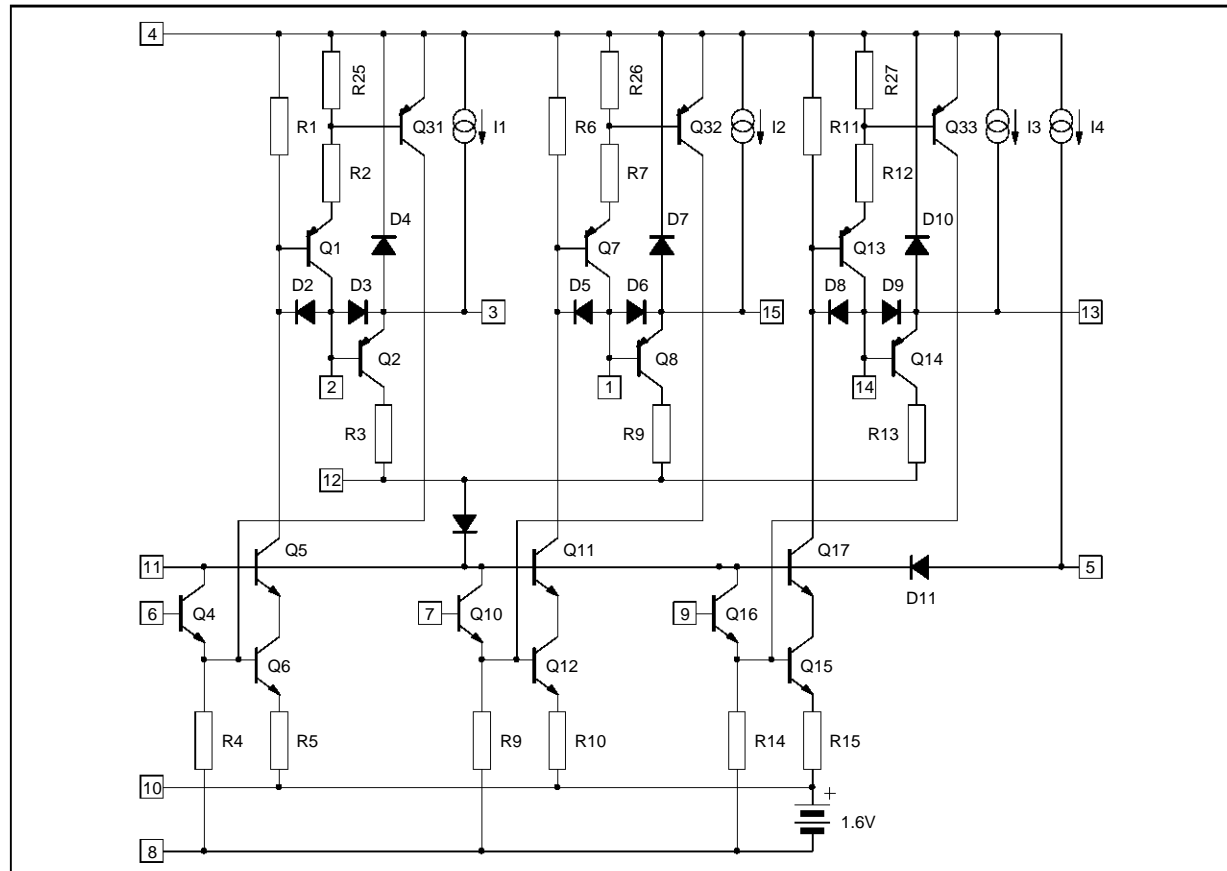
TDA8153

PIN FUNCTIONS

| N° | Name | Function |
|----|--------------------|---|
| 1 | GREEN FEEDBACK | Feedback Output for 'Green' Amplifier. The optimal value for the resistor connected here to set gain is 68kΩ as shown in fig. 1.2. Other feedback connections are pin 2 (red) and pin 14 (blue). |
| 2 | RED FEEDBACK | Feedback Output for 'Red' Amplifier. See pin 1. |
| 3 | RED OUTPUT | Output of 'Red' Video Amplifier. See pin 15. |
| 4 | V _H | High Voltage Supply for Amplifier Stages, Typically 200V (see fig. 1.2). |
| 5 | FIRST GRID VOLTAGE | Output providing DC voltage for first grid of CRT, typically V _s + V _{BE} . |
| 6 | RED INPUT | Input of 'Red' Video Amplifier. See pin 7. |
| 7 | GREEN INPUT | Input of 'Green' Video Amplifier. The bias voltage at the inputs is equal to V _{ref} + 2V _{BE} . Other inputs are pin 6 (red) and pin 9 (blue). |
| 8 | GROUND | Ground Connection (pin 8 is also connected to the tab). |
| 9 | BLUE INPUT | Input of 'Blue' Video Amplifier. See pin 7. |
| 10 | V _{ref} | The reference voltage for the three amplifiers is available on this pin. Typical value is 1.6V. The capacitor connected between pin 10 and ground eliminates AC crosstalk between the amplifiers. |
| 11 | V _s | Supply Voltage Input for Low Voltage Circuitry, typically 12V. |
| 12 | SAMPLING | Cathode Current Sampling Output. Provides sum of cathode currents for automatic cut-off adjustment with video processors using the sequential system. The three current generators I ₁ , I ₂ and I ₃ bias the inputs of this circuit which performs the cut-off adjustment, allowing also adjustment with in flowing CRT leakages. |
| 13 | BLUE OUTPUT | Output of 'Blue' Video Amplifier. See pin 15. |
| 14 | BLUE FEEDBACK | Feedback Output for 'Blue' Amplifier. See pin 1. |
| 15 | GREEN OUTPUT | Output of the 'Green' Video Amplifier. The output is protected against CRT flashovers. Other outputs are pin 3 (red) and pin 13 (blue). |

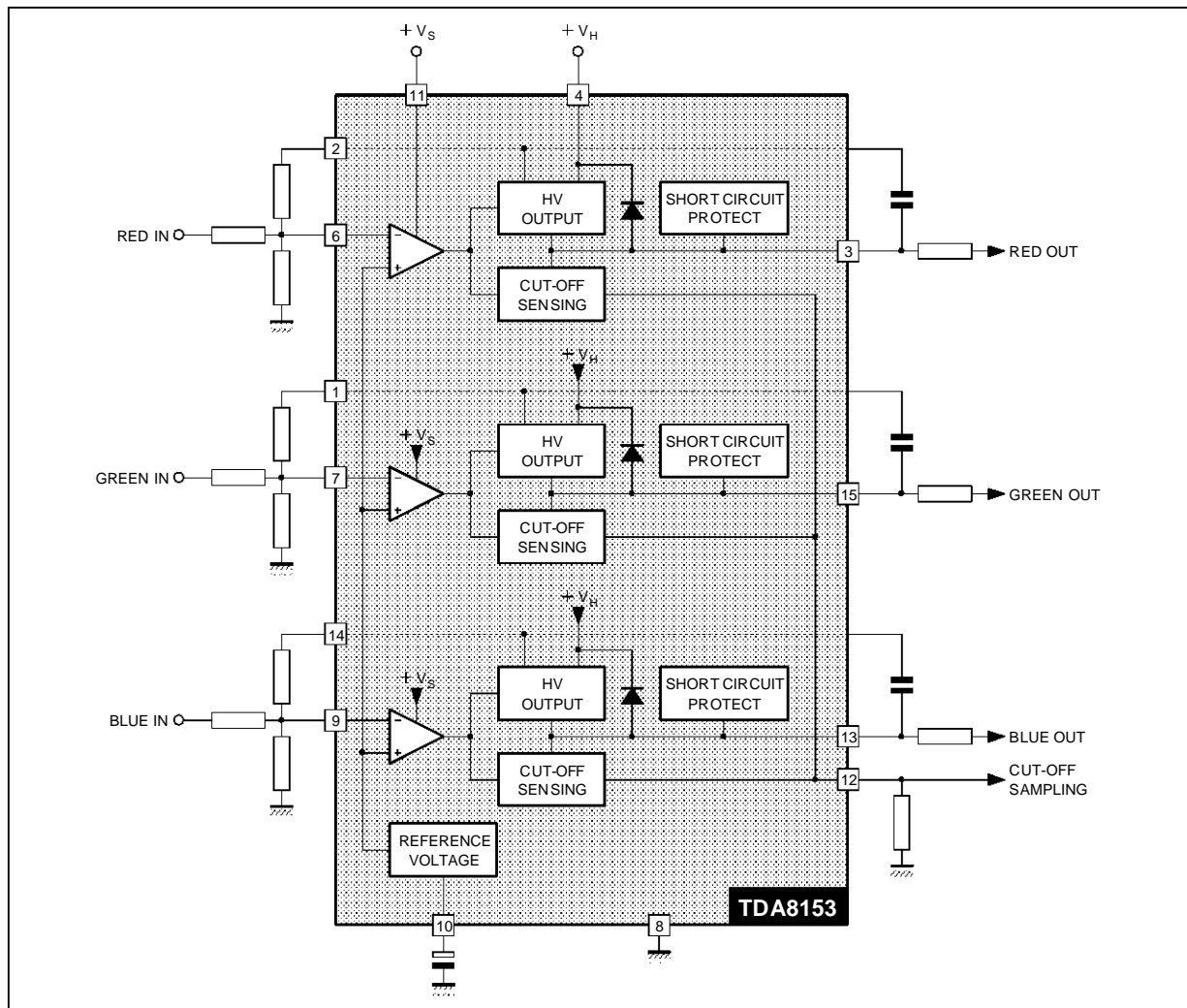
8153-01.TBL

SCHEMATIC DIAGRAM



8153-02.EPS

BLOCK DIAGRAM



8153-03.EPS

ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|----------------|---|-------------|-------------|
| V_H | High Voltage Supply | 250 | V |
| V_S | Low Voltage Supply | 35 | V |
| P_{tot} | Power Dissipation at $T_{case} = 90^{\circ}C$ | 20 | W |
| V_I | Input Voltage | V_S | |
| T_{stg}, T_j | Storage and Junction Temperature | - 25, + 150 | $^{\circ}C$ |
| T_{oper} | Operating Ambient Temperature | 0, + 70 | $^{\circ}C$ |

8153-02.TBL

THERMAL DATA

| Symbol | Parameter | Value | Unit |
|---------------|----------------------------------|-------|---------------|
| $R_{th(j-c)}$ | Thermal Resistance Junction-case | Max 3 | $^{\circ}C/W$ |

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TDA8153

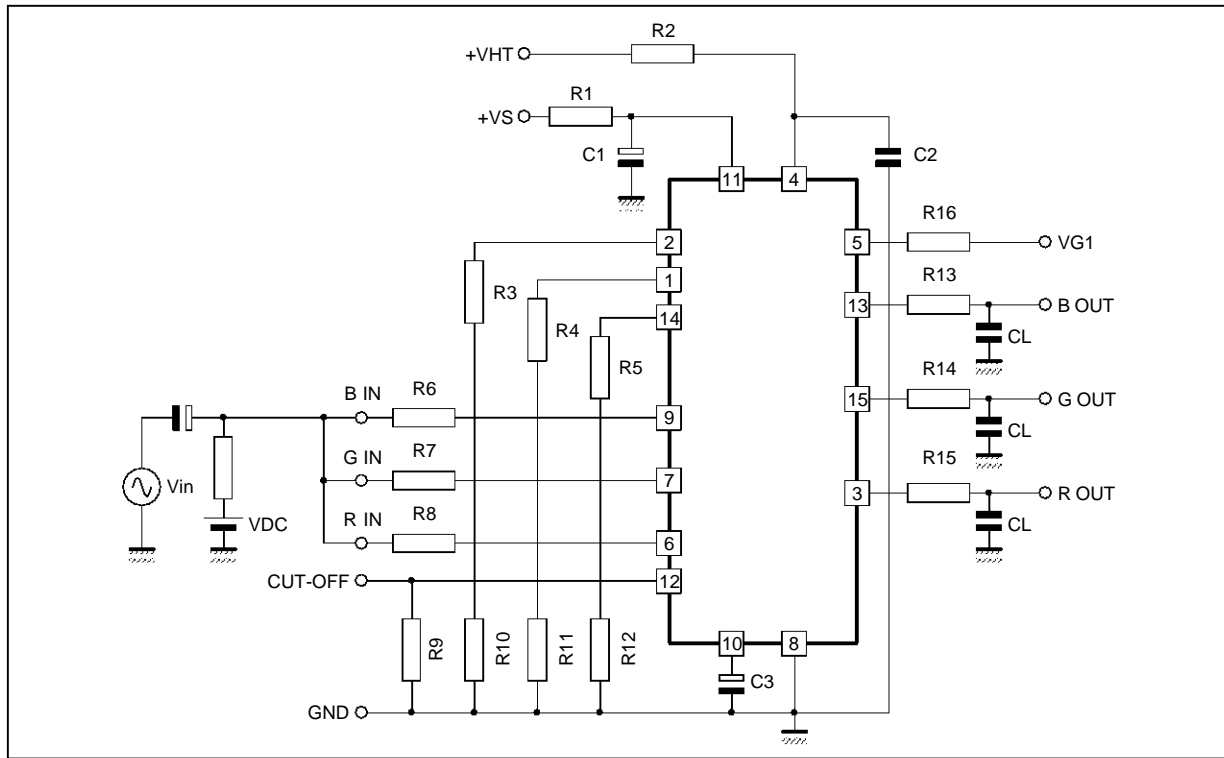
ELECTRICAL CHARACTERISTICS (ref. to test and application circuits, $V_{HT} = 200V$, $V_S = 12V$, $C_L = 10pF$ *, heatsink $R_{th} = 9^{\circ}C/W$, $T_{amb} = 25^{\circ}C$ unless otherwise specified)

| Symbol | Parameter | Test Conditions | Pin | Min. | Typ. | Max. | Unit | Fig. |
|-----------------------------------|--|--|---------------|------------------|------------------|-------|----------------|------|
| V_{HT} | High Voltage Supply | | 4 | | 200 | 220 | V | 1-2 |
| V_S | Low Voltage Supply | | 11 | 10.8 | 12 | 13.2 | V | 1-2 |
| I_{HT} | Quiescent Drain Current | $V_{in} = 0$, $V_{odc} = V_{sat H}$ | 4 | | 10 | 15 | mA | 1 |
| I_S | Quiescent Drain Current | $V_{in} = 0$, $V_{odc} = V_{sat H}$ | 11 | | 10 | 17 | mA | 1 |
| V_{ref} | Reference Voltage | | 10 | 1.4 | 1.6 | 1.9 | V | 1 |
| V_{g1} | CRT G1 Voltage Supply | | 5 | | $V_S + V_{be}$ | | V | 1 |
| V_{sat} | H Output Saturation | $V_{in} = 0$, $V_{dc} = -3V$ | 3 13 15 | | V_{HT} -3V | | V | 1 |
| V_{sat} | L Output Saturation | $V_{in} = 0$, $V_{dc} = 9V$ | 3 13 15 | | V_S | | V | 1 |
| I_1, I_2, I_3 | | See schematic diag. $V_{in} = 0$; $V_{odc} = 150V$ | 12 | 7 | 15 | 20 | μA | 1 |
| V_{odc} | Quiescent Output Voltage | Inputs Floating | 3 13 15 | | 123 | | V | 1 |
| V_o | Peak-to-peak Output Swing | $f = 10kHz$ | 3 13 15 | 170 | | | Vpp | 1 |
| $\frac{\Delta V_{odc}}{\Delta T}$ | DC Output Voltage versus Temperature | $V_{odc} = 150V$ $T_{amb} = 0 \div 70^{\circ}C$ | 3 13 15 | | 0.03 | | V/ $^{\circ}C$ | 1 |
| $\frac{\Delta V_{odc}}{\Delta T}$ | DC Differential Voltage versus Temperature | $V_{odc} = 150V$ $T_{amb} = 0 \div 70^{\circ}C$ | 3 13 15 | | | 0.015 | V/ $^{\circ}C$ | 1 |
| G_{Vo} | Open-loop Gain | $V_{in} = 50mV_{pp}$, $f = 10kHz$ | | 50 | 56 | | dB | 1 |
| G_{Vc} | Closed-loop Gain | $V_{in} = 1.5V_{pp}$, $f = 10kHz$ | | 20 | 25 | | dB | 1 |
| B_w | Video Bandwidth (-3 dB) | $V_{obl} = 125V$, 0dB at $f = 100kHz$ $V_o =$ 80Vpp 50Vpp 10Vpp | | 4.5 6.5 12 | 6.0 8.0 15 | | MHz | 2 |
| t_r | Rise Time | $V_o = 100V_{pp}$; $V_{obl} = 150V$ $f = 100kHz$, Duty Cycle = 0.5 | | | 80 | 120 | ns | 2 |
| t_f | Fall Time | $V_o = 100V_{pp}$; $V_{obl} = 150V$ $f = 100kHz$, Duty Cycle = 0.5 | | | 80 | 120 | ns | 2 |
| ΔT | Differential Rise and Fall Time | | | | | 20 | ns | 2 |
| | Overshoot | $V_o = 100V_{pp}$, $V_{obl} = 150V$ $f = 100kHz$, Duty Cycle = 0.5 | | | | 5 | % | 2 |
| | Undershoot | $V_o = 100V_{pp}$; $V_{obl} = 150V$ $f = 100kHz$, Duty Cycle = 0.5 | | | | 5 | % | 2 |

8153-04.TBL

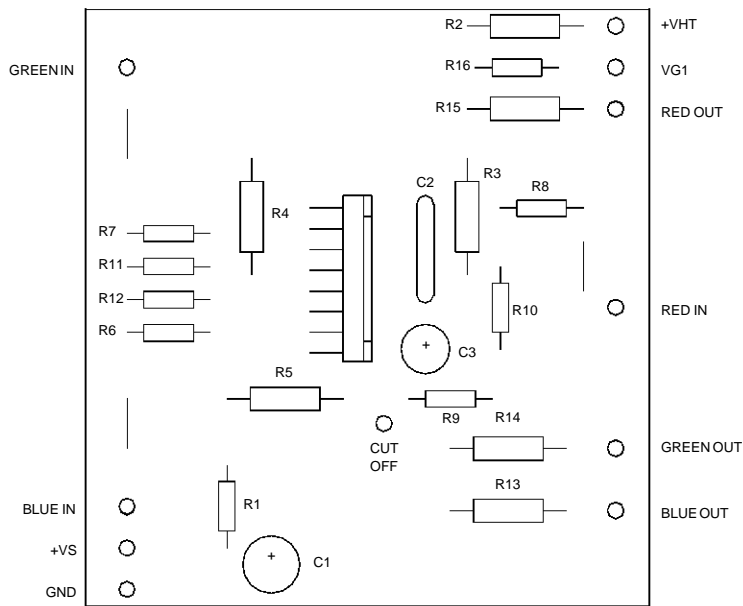
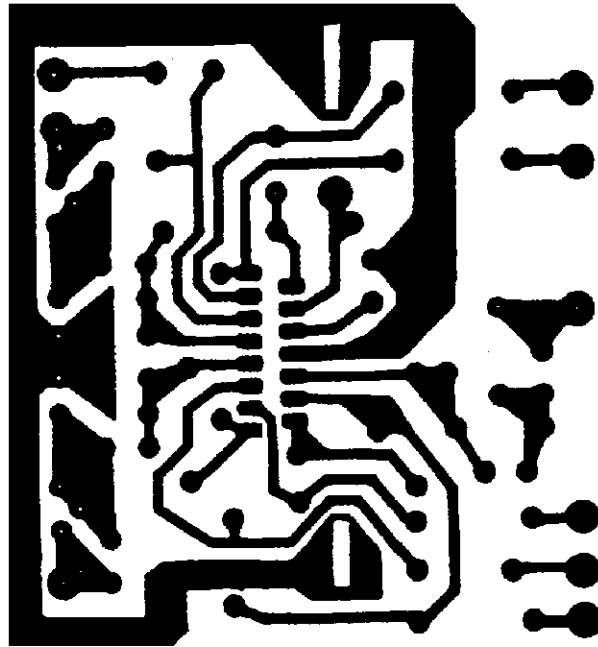
* $C_L = 10pF$ is the sum of the P.C. board capacitance (with socket) and the cathode capacitance of the CRT.

TEST CIRCUIT



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TEST CIRCUIT



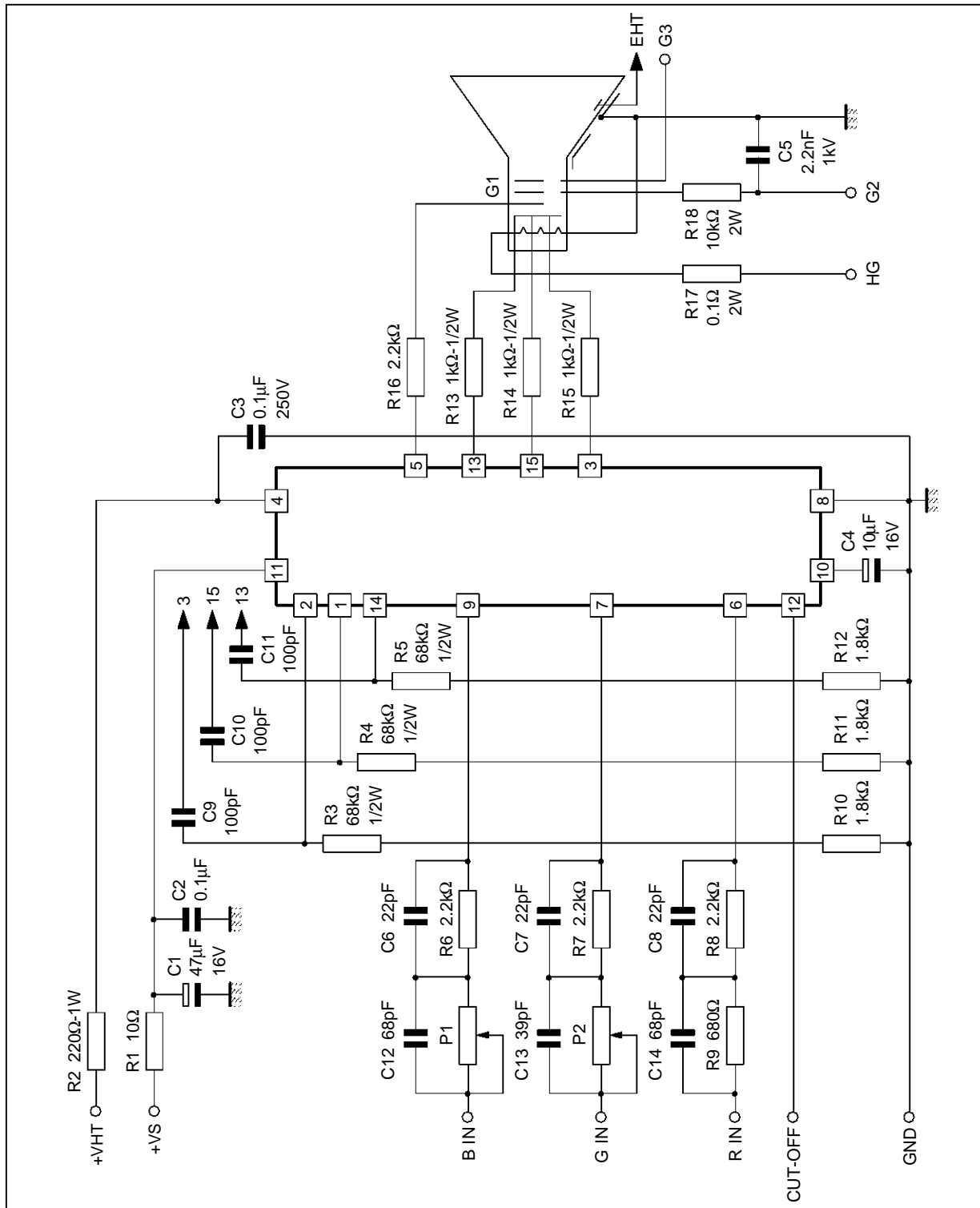
R1 = 10 Ω
 R2 = 220 Ω 1/2W
 R3 = 68k Ω 1/2W
 R4 = 68k Ω 1/2W
 R5 = 68k Ω 1/2W
 R6 = 3k Ω
 R7 = 3k Ω
 R8 = 3k Ω

R9 = 47k Ω
 R10 = 1.8k Ω 1/2W
 R11 = 1.8k Ω 1/2W
 R12 = 1.8k Ω 1/2W
 R13 = 1k Ω 1/2W
 R14 = 1k Ω 1/2W
 R15 = 1k Ω 1/2W
 R16 = 2.2k Ω

C1 = 4 μ F 16V
 C2 = 100nF 250V
 C3 = 10 μ F 16V

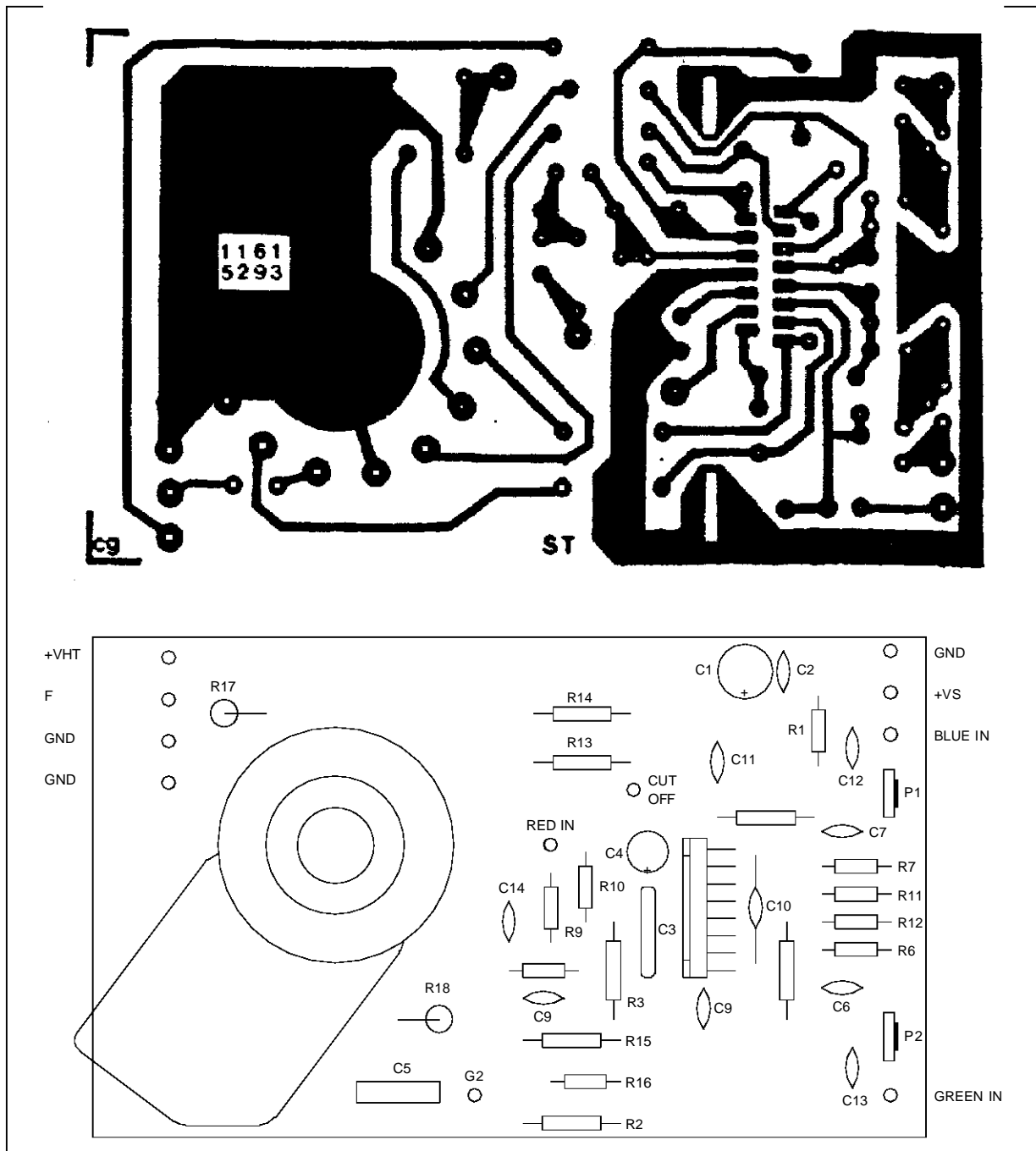
8153-05.TIF / 8153-06.EPS

APPLICATION CIRCUIT



8153-07.EPS

APPLICATION CIRCUIT



8153-08.TIF / 8153-09.EPS

Figure 1 : Video Bandwith

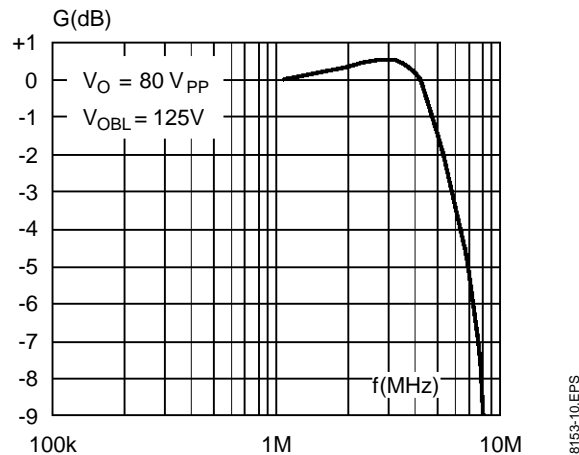


Figure 2 : Fall Time

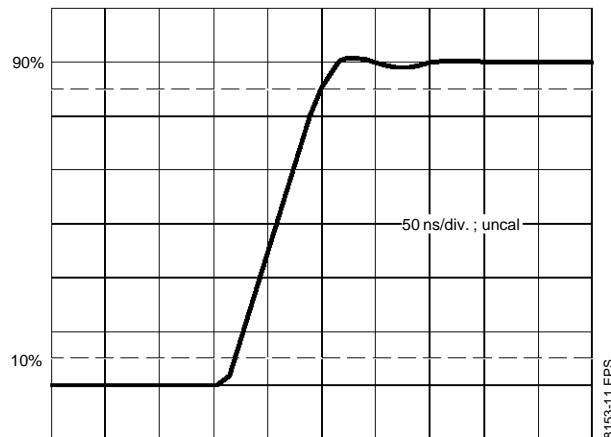
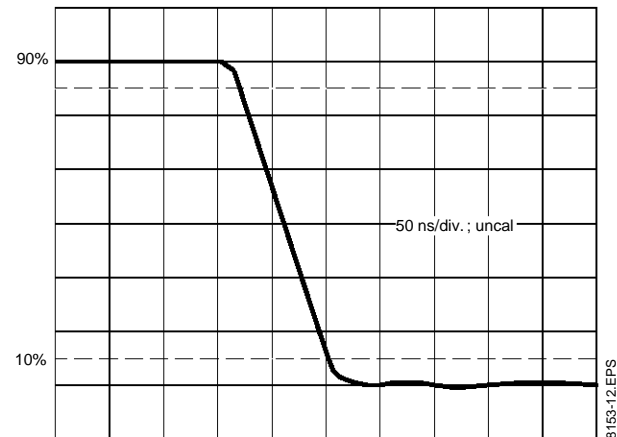


Figure 3 : Rise Time



APPLICATION NOTES

P. C. Board

The best performance of the RGB video amplifier can be obtained only with a carefully designed P.C. board. The layout of the printed circuit must be realized to achieve the best possible symmetry of the three channels.

Output to input capacitances are of particular importance. The input-output capacitances, in parallel with the relative high feedback resistances, create poles in the closed loop transfer function.

To optimize the band response and to minimize the channels crosstalk a low parasitic capacitance feedback resistors of not inductive type is necessary.

Capacitive coupling from the output of an amplifier and the input of another one may induce excessive crosstalk. It is advisable to keep the amplifier outputs away from amplifier inputs.

The small size of the P.C. board allows you to

mount the TDA8153 directly beside the picture tube socket, to minimize the capacitances of the connections between the video amplifiers and the picture tube cathodes.

The capacitors connected in parallel with the input resistors compensate the effects of the distributed constants of the printed circuit on the step response times. Their values must be selected on the basis of the layout and can be considered as function of the printed circuit.

The three capacitors (C9, C10, C11) between the amplifier outputs and the feedback resistors reduce the noise effect on the cut-off control, their value, of course, depends on the noise amplitude and spectrum coming from the I.F. video stage.

To prevent possible oscillation problems, it is necessary to place the high voltage filter capacitor (C3) as near as possible to the IC ground and the latter must be of a substantial width.

Power Dissipation

Taking as reference the IC internal schematic diagram we can calculate the power dissipated by the video amplifiers.

The power dissipation of the IC is defined by a static and a dynamic part.

The statically dissipated power is given by :

$$P_S = 3 V_{ht} \left(\frac{V_{ht} - V_{obl}}{R_1} + \frac{V_{obl}}{R_f} \right) - 3 \frac{V_{obl}^2}{R_f} - 3 \frac{(V_{ref} + 2V_{be})^2}{R_b}$$

Where R_f is the feedback resistance and R_b the input to ground resistance with a black level $V_{obl} = 150V$, $V_{ht} = 200V$, $R_f = 68k\Omega$ and $R_b = 1.8k\Omega$ we have : $P_S = 1.75W$

The dynamic power dissipation has been calculated with a 5MHz, 80Vpp sinusoidal output signal and a load capacitor $C_L = 10pF$ with the following expression :

$$P_d = \left[0.8 V_{ht} (2f C_L V_{op}) - 0.8 \frac{V_{op}^2}{2R_f} \right] = 1.90W$$

The value is reduced by 20% (0.8 factor) because during the flyback time there is not signal.

The total power dissipated by the IC is therefore : $P_T = P_S + P_d = 1.75 + 1.90 = 3.65W$

One of the worst working condition of the TV set as regards the power dissipation, is when you get white noise on the screen, for example, when you disconnect the TV aerial or the channels are not properly tuned.

In these cases if we set the TV receiver for 80V_{PP}

white noise output signal with a black level $V_{obl} = 125V$, the total power dissipated by the IC can be measured.

It results about $P_T = 4.8W$.

With a maximum ambient temperature of 70°C and a junction temperature of 150°C a 15°C/W heatsink is required.

Figure 4 : Maximum Allowable Power Dissipation versus Ambient Temperature

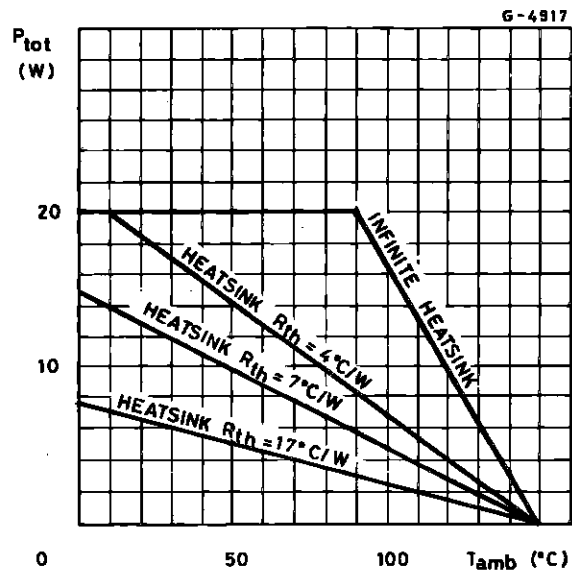
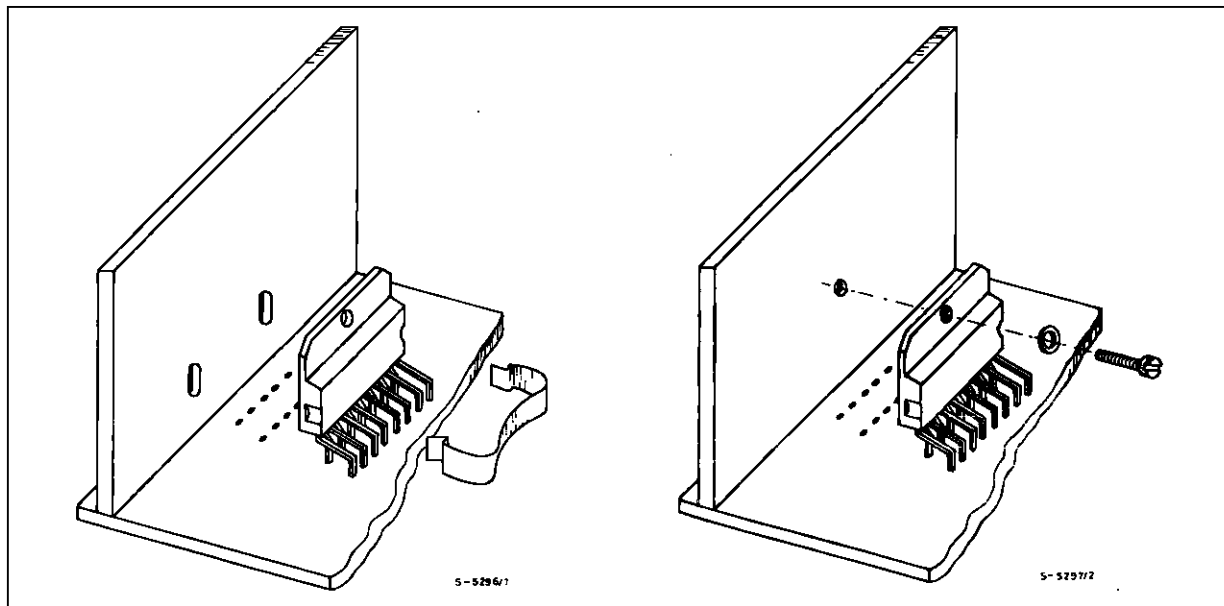
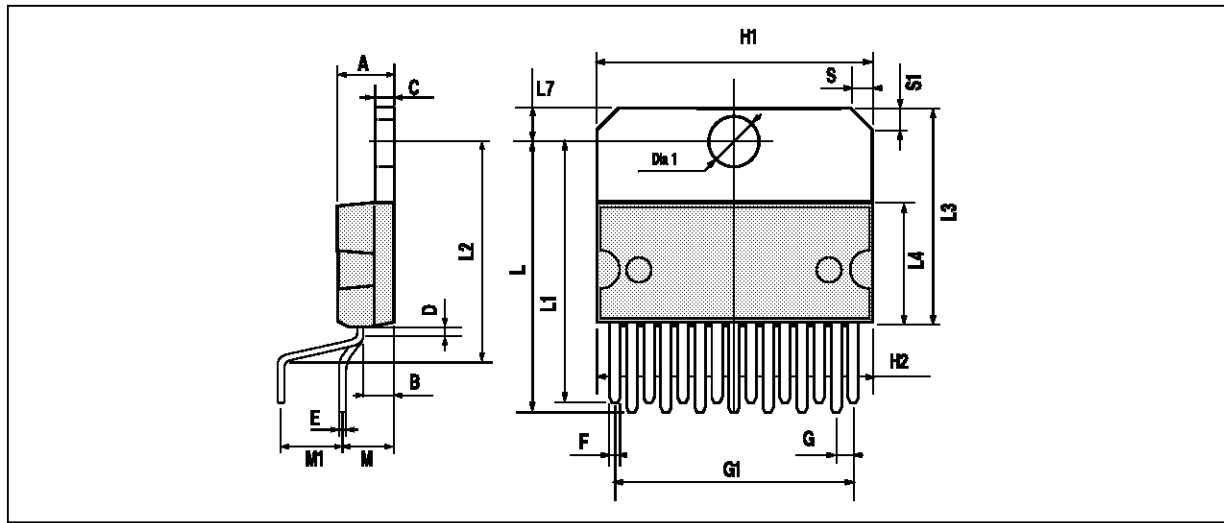


Figure 5 : Mounting Examples



PACKAGE MECHANICAL DATA: 15 PINS - PLASTIC MULTIWATT



PMUL15V/EPS

| Dimensions | Millimeters | | | Inches | | |
|------------|-------------|-------|-------|--------|-------|-------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | | 5 | | | 0.197 |
| B | | | 2.65 | | | 0.104 |
| C | | | 1.6 | | | 0.063 |
| D | | 1 | | | 0.039 | |
| E | 0.49 | | 0.55 | 0.019 | | 0.022 |
| F | 0.66 | | 0.75 | 0.026 | | 0.030 |
| G | 1.14 | 1.27 | 1.4 | 0.045 | 0.050 | 0.055 |
| G1 | 17.57 | 17.78 | 17.91 | 0.692 | 0.700 | 0.705 |
| H1 | 19.6 | | | 0.772 | | |
| H2 | | | 20.2 | | | 0.795 |
| L | 22.1 | | 22.6 | 0.870 | | 0.890 |
| L1 | 22 | | 22.5 | 0.866 | | 0.886 |
| L2 | 17.65 | | 18.1 | 0.695 | | 0.713 |
| L3 | 17.25 | 17.5 | 17.75 | 0.679 | 0.689 | 0.699 |
| L4 | 10.3 | 10.7 | 10.9 | 0.406 | 0.421 | 0.429 |
| L7 | 2.65 | | 2.9 | 0.104 | | 0.114 |
| M | 4.2 | 4.3 | 4.6 | 0.165 | 0.169 | 0.181 |
| M1 | 4.5 | 5.08 | 5.3 | 0.177 | 0.200 | 0.209 |
| S | 1.9 | | 2.6 | 0.075 | | 0.102 |
| S1 | 1.9 | | 2.6 | 0.075 | | 0.102 |
| Dia. 1 | 3.65 | | 3.85 | 0.144 | | 0.152 |

PMUL15V/TBL

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