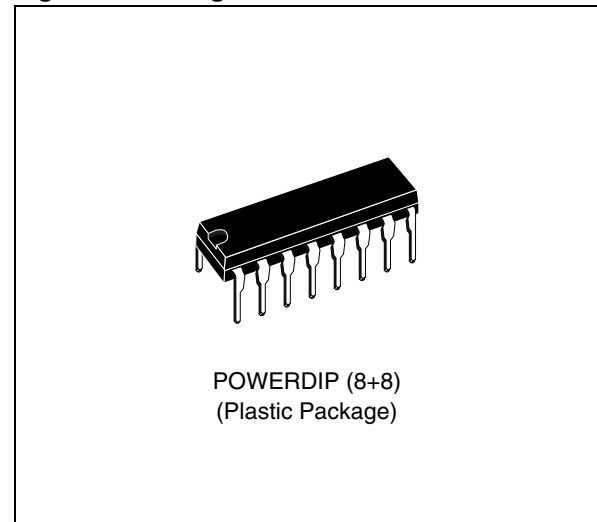


## HORIZONTAL AND VERTICAL DEFLECTION MONITOR

### FEATURES SUMMARY

- DIRECT LINE DARLINGTON DRIVE
- DIRECT FRAME-YOKE DRIVE ( $\pm 1A$ )
- COMPOSITE VIDEO SIGNAL INPUT CAPABILITY
- FRAME OUTPUT PROTECTION AGAINST SHORT CIRCUITS
- PLL
- HORIZONTAL OSCILLATOR FREQUENCY RANGE FROM 15kHz TO 100kHz
- VERTICAL OSCILLATOR FREQUENCY RANGE FROM 30Hz TO 120Hz
- VERY FEW EXTERNAL COMPONENTS
- VERY LOW COST POWER PACKAGE

Figure 1. Package



### DESCRIPTION

The TEA2037A is an horizontal and vertical deflection circuit. It uses the same concept as TEA2117 but optimised for small screens, for a very low cost solution.

Figure 2. Pin Connections

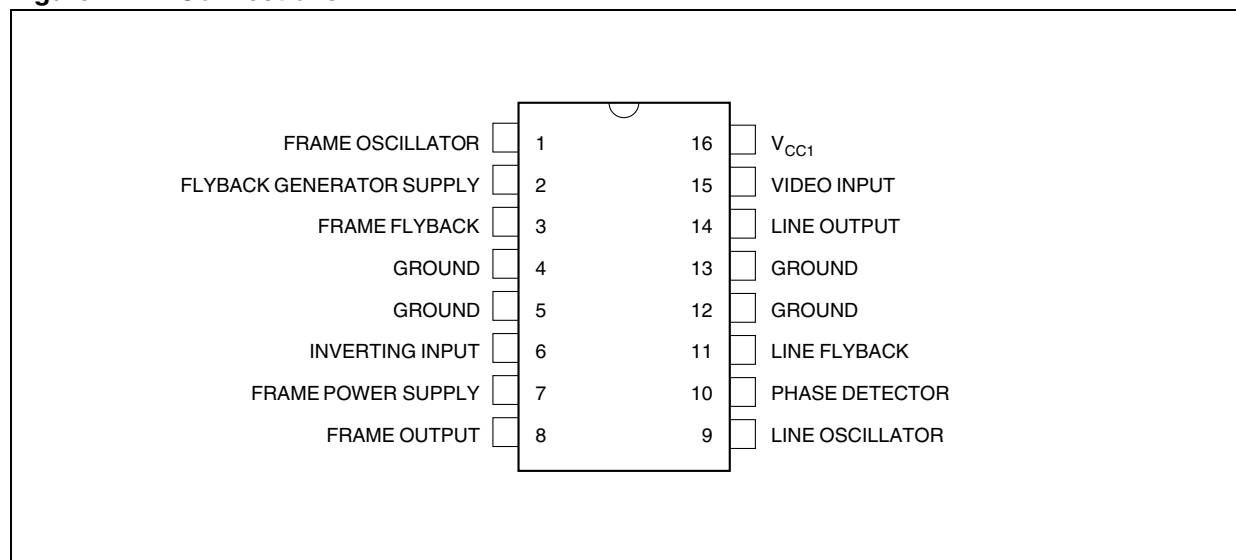


Figure 3. Block Diagram

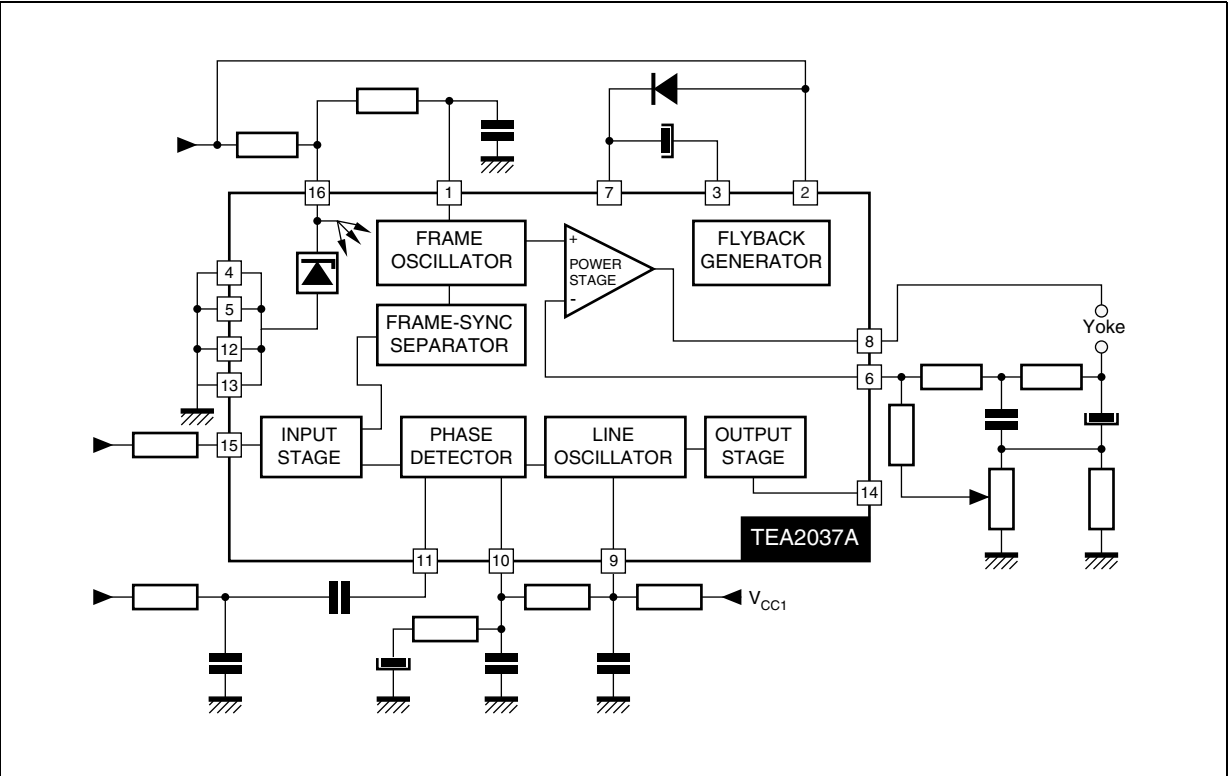


Table 1. Absolute Maximum Ratings

| Symbol           | Parameter                             | Value      | Unit |
|------------------|---------------------------------------|------------|------|
| V <sub>CC1</sub> | Supply Voltage                        | 30         | V    |
| V <sub>2</sub>   | Flyback Generator Supply Voltage      | 35         | V    |
| V <sub>7</sub>   | Frame Power Supply Voltage            | 60         | V    |
| I <sub>8nr</sub> | Frame Output Current (non repetitive) | ± 1.5      | A    |
| I <sub>8</sub>   | Frame Output Current (continuous)     | ± 1        | A    |
| V <sub>14</sub>  | Line Output Voltage (external)        | 60         | V    |
| I <sub>p14</sub> | Line Output Peak Current              | 0.8        | A    |
| I <sub>C14</sub> | Line Output Continuous Current        | 0.4        | A    |
| T <sub>stg</sub> | Storage Temperature                   | –40 to 150 | °C   |
| T <sub>J</sub>   | Max Operating Junction Temperature    | + 150      | °C   |

Table 2. Thermal Data

| Symbol                | Parameter                                                                                                | Value   | Unit |
|-----------------------|----------------------------------------------------------------------------------------------------------|---------|------|
| R <sub>th (j-c)</sub> | Junction-case Thermal Resistance                                                                         | Max 15  | °C/W |
| R <sub>th (j-a)</sub> | Junction-ambient Thermal Resistance<br>(Soldered on a 35µm thick 45cm <sup>2</sup> PC Board copper area) | Typ. 45 | °C/W |
| T <sub>j</sub>        | Recommended Junction Temperature                                                                         | Max 120 | °C   |

**ELECTRICAL CHARACTERISTICS** ( $T_{amb} = 25^{\circ}\text{C}$ )**Table 3. Supply (shunt regulator) (Pin 16)**

| Symbol           | Parameter                                     | Min. | Typ. | Max. | Unit |
|------------------|-----------------------------------------------|------|------|------|------|
| $I_{CC1}$        | Supply Current                                | 10   |      | 20   | mA   |
| $V_{CC1}$        | Supply Voltage ( $I_{CC1} = 15\text{mA}$ )    | 9    | 9.8  | 10.5 | V    |
| $\Delta V_{CC1}$ | Voltage Variation ( $I_{CC1}$ : 10mA to 20mA) | -280 | 50   | +280 | mV   |
| LPS              | Starting Threshold for Line Output Pulses     |      |      | 5    | V    |

**Table 4. Video Input (Pin 15)**

| Symbol   | Parameter                                                         | Min. | Typ. | Max. | Unit          |
|----------|-------------------------------------------------------------------|------|------|------|---------------|
| $V_{15}$ | Reference Voltage ( $I_{15} = -1\mu\text{A}$ )                    | 1.4  | 1.75 | 2    | V             |
| MWF      | Minimum Width of Frame Pulse (When synchronized with TTL signal)  | 50   |      |      | $\mu\text{s}$ |
| $V_{IN}$ | Sync Bottom to Black Level ( $R_{SYNC\ 15} = 560\text{k}\Omega$ ) | 0.2  | 0.3  |      | $V_{PP}$      |

**Table 5. Line Oscillator (Pin 9)**

| Symbol                           | Parameter                                                                                                     | Min. | Typ. | Max. | Unit                         |
|----------------------------------|---------------------------------------------------------------------------------------------------------------|------|------|------|------------------------------|
| LT9                              | Low Threshold Voltage                                                                                         | 2.8  | 3.2  | 3.6  | V                            |
| HT9                              | High Threshold Voltage                                                                                        | 5.4  | 6.6  | 7.8  | V                            |
| BI9                              | Bias Current                                                                                                  |      | 100  |      | nA                           |
| DR9                              | Discharge Impedance                                                                                           | 1.0  | 1.4  | 1.8  | $\text{k}\Omega$             |
| FLP1                             | Free Running Line Period<br>( $R = 34.9\text{k}\Omega$ Tied to $V_{CC1}$ , $C = 2.2\text{nF}$ Tied to Ground) | 62   | 64   | 66   | $\mu\text{s}$                |
| FLP2                             | Free Running Line Period ( $R = 13.7\text{k}\Omega$ , $C = 2.2\text{nF}$ )                                    |      | 27   |      | $\mu\text{s}$                |
| OT9                              | Oscillator Threshold for Line Output Pulse Triggering                                                         |      | 4.6  |      | V                            |
| $\frac{\Delta F}{\Delta \theta}$ | Horizontal Frequency Drift with Temperature<br>(see application Figure 11)                                    |      | 2    |      | $\text{Hz}/^{\circ}\text{C}$ |

**Table 6. Line Output (Pin 14)**

| Symbol | Parameter                                           | Min. | Typ. | Max. | Unit          |
|--------|-----------------------------------------------------|------|------|------|---------------|
| LV14   | Saturation Voltage ( $I_{14} = 200\text{mA}$ )      |      | 1.1  | 1.6  | V             |
| OPW    | Output Pulse Width (line period = $64\mu\text{s}$ ) | 20   | 22   | 24   | $\mu\text{s}$ |

**Table 7. Line Flyback Input (Pin 11)**

| Symbol | Parameter       | Min. | Typ. | Max. | Unit             |
|--------|-----------------|------|------|------|------------------|
| V11    | Bias Voltage    | 1.8  | 2.4  | 3.2  | V                |
| Z11    | Input Impedance | 4.5  | 5.8  | 8    | $\text{k}\Omega$ |

**Table 8. Phase Detector**

| Symbol          | Parameter                           | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------------------|------|------|------|------|
| I <sub>10</sub> | Output Current During Synchro Pulse | 250  | 450  | 800  | μA   |
| RI10            | Current Ratio (positive/negative)   | 0.95 | 1    | 1.05 |      |
| LI10            | Leakage Current                     | -2   |      | +2   | μA   |
| CV10            | Control Range Voltage               | 2.60 |      | 7.10 | V    |

**Table 9. Frame Oscillator (Pin 1)**

| Symbol                           | Parameter                                                                                   | Min. | Typ.               | Max. | Unit  |
|----------------------------------|---------------------------------------------------------------------------------------------|------|--------------------|------|-------|
| LT1                              | Low Threshold Voltage                                                                       | 1.6  | 2.0                | 2.3  | V     |
| HT1                              | High Threshold Voltage                                                                      | 2.6  | 3.1                | 3.6  | V     |
| BI1                              | Bias Current                                                                                |      | 30                 |      | nA    |
| DR1                              | Discharge Impedance                                                                         | 300  | 470                | 700  | kΩ    |
| FFP1                             | Free Running Line Period<br>(R = 845kΩ Tied to V <sub>CC1</sub> , C = 180nF Tied to Ground) | 20.5 | 23                 | 25   | ms    |
| MFP                              | Minimum Frame Period (I <sub>15</sub> = -100μA) (with the Same RC)                          |      | 12.8               |      | ms    |
| FFP2                             | Free Running Line Period (R = 408kΩ, C = 220nF)                                             |      | 14.3               |      | ms    |
| FPR                              | Frame Period Ratio =                                                                        | 1.7  | 1.8                | 1.9  |       |
| FG                               | Frame Saw-tooth Gain Between Pin 1 and non Inverting Input of the Frame Amplifier           |      | -0.4               |      |       |
| $\frac{\Delta F}{\Delta \theta}$ | Vertical Frequency Drift with Temperature (see application Figure 11)                       |      | 4.10 <sup>-3</sup> |      | Hz/°C |

**Table 10. Frame Power Supply (Pin 7)**

| Symbol         | Parameter                                  | Min. | Typ. | Max. | Unit |
|----------------|--------------------------------------------|------|------|------|------|
| V <sub>7</sub> | Operating Voltage (with flyback generator) | 10   |      | 58   | V    |
| I <sub>7</sub> | Supply Current (V <sub>7</sub> = 30V)      |      |      | 22   | mA   |

**Table 11. Flyback Generator Supply (Pin 2)**

| Symbol         | Parameter         | Min. | Typ. | Max. | Unit |
|----------------|-------------------|------|------|------|------|
| V <sub>2</sub> | Operating Voltage | 10   |      | 30   | V    |

**Table 12. Frame Output (Pin 8)**

| Symbol       | Parameter                                                                                | Min. | Typ.         | Max.       | Unit   |
|--------------|------------------------------------------------------------------------------------------|------|--------------|------------|--------|
| LV8A<br>LV8B | Saturation Voltage to Ground ( $V_7 = 30V$ )<br>$I_8 = 0.1$<br>$I_8 = 1A$                |      | 0.06<br>0.37 | 0.6<br>1   | V<br>V |
| HV8A<br>HV8B | Saturation Voltage to $V_7$ ( $V_7 = 30V$ )<br>$I_8 = -0.1$<br>$I_8 = -1A$               |      | 1.3<br>1.7   | 1.6<br>2.4 | V<br>V |
| FV8A<br>FV8B | Saturation Voltage to $V_7$ in Flyback Mode ( $V_8 > V_7$ )<br>$I_8 = 0.1$<br>$I_8 = 1A$ |      | 1.6<br>2.5   | 2.1<br>4.5 | V<br>V |

**Table 13. Flyback Generator (Pin 2 and 3)**

| Symbol                       | Parameter                                                                                                                                                                                                            | Min. | Typ.                     | Max.                     | Unit             |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------------------------|--------------------------|------------------|
| F2DA<br>F2DB<br>FSVA<br>FSVB | Flyback Transistor on (output = high state) ( $V_2 = 30V$ )<br>$V_{3/2}$ with $I_{3 \rightarrow 2} = 0.1A$<br>$I_{3 \rightarrow 2} = 1A$<br>$V_{2/3}$ with $I_{3 \rightarrow 2} = 0.1$<br>$I_{3 \rightarrow 2} = 1A$ |      | 1.5<br>3.0<br>0.8<br>2.2 | 2.1<br>4.5<br>1.1<br>4.5 | V<br>V<br>V<br>V |
|                              | Flyback Transistor off (output = $V_7 - 8V$ ) ( $V_7 = V_2 = 30V$ )                                                                                                                                                  |      |                          |                          |                  |
| FCI                          | Leakage Current Pin 2                                                                                                                                                                                                |      |                          | 170                      | $\mu A$          |

The TEA2037A performs all the video and power functions required to provide signals for the direct drive of the line darlington and frame yoke.

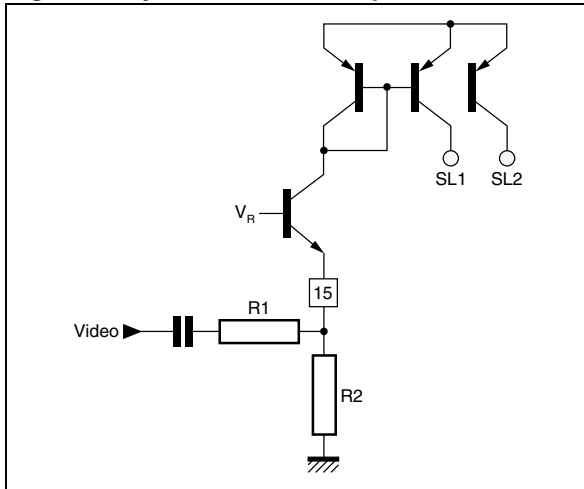
It contains:

- A shunt regulator
- A synchronization separator
- An integrated frame separator without external components
- A saw-tooth generator for the frame
- A power amplifier for direct drive of frame yoke (short circuit protected)

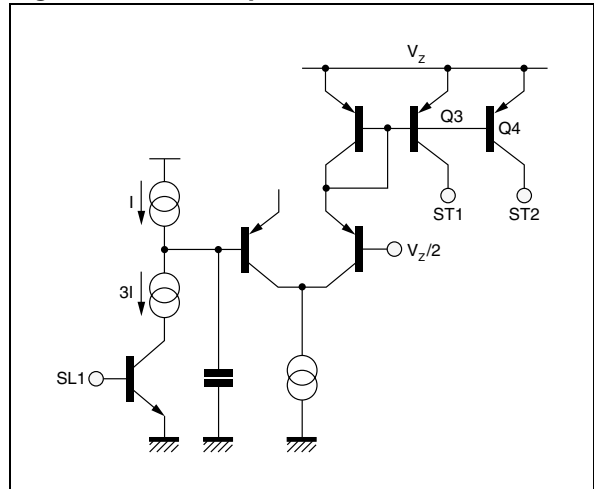
- An open collector output for the line darlington drive
- A line phase detector and a voltage control oscillator.

The slice level of sync-separation is fixed by value of the external resistors  $R_1$  and  $R_2$ .  $V_R$  is an internally fixed voltage.

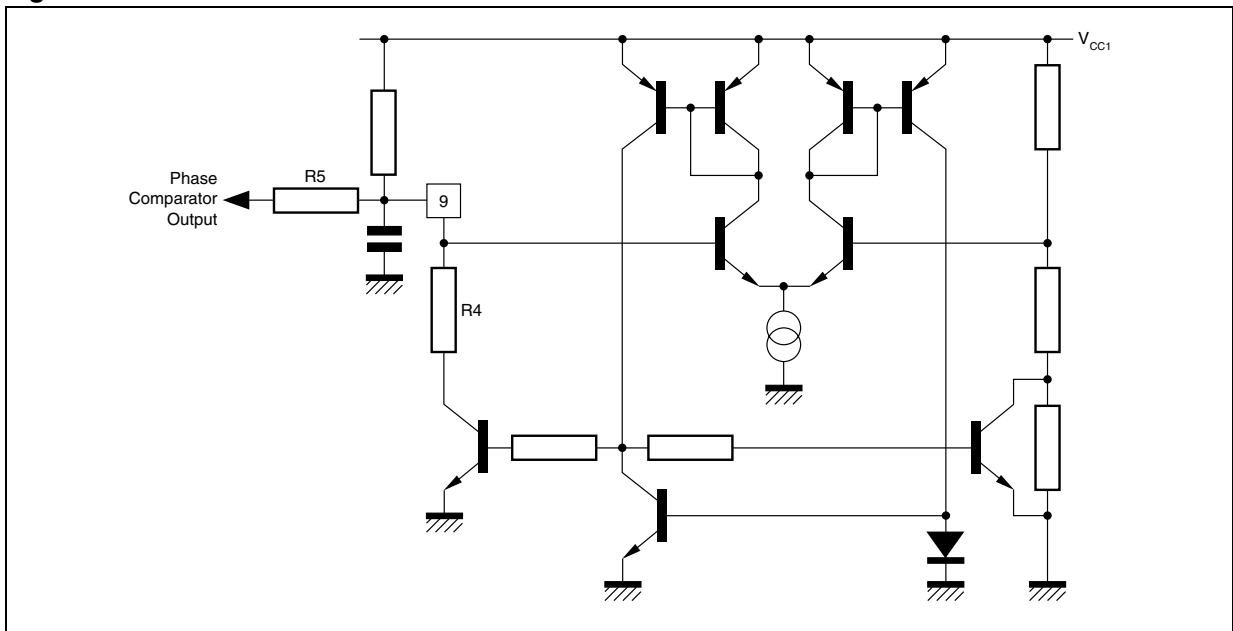
The sync-pulse allows the discharge of the capacitor by a  $2 \times 1$  current. A line sync-pulse is not able to discharge the capacitor under  $V_Z/2$ . A frame sync pulse permits the complete discharge of the capacitor, so during the frame sync-pulse Q3 and Q4 provide current for the other parts of the circuit.

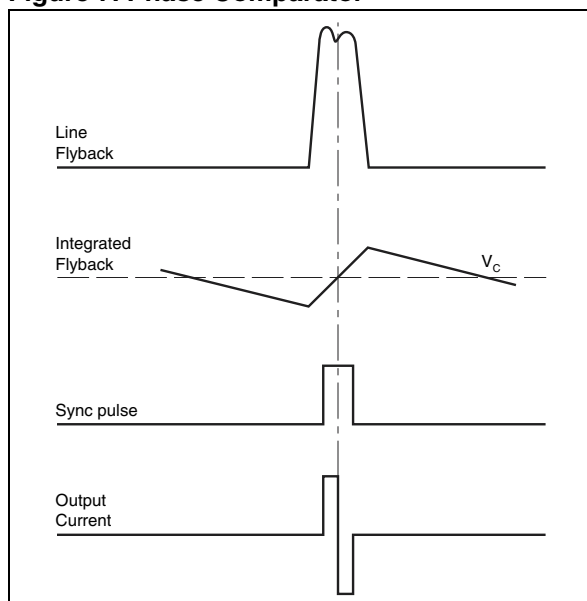
**Figure 4. Synchronization Separator Circuit**

The oscillator thresholds are internally fixed by resistors. The discharge of the capacitor depends on

**Figure 5. Frame Separator**

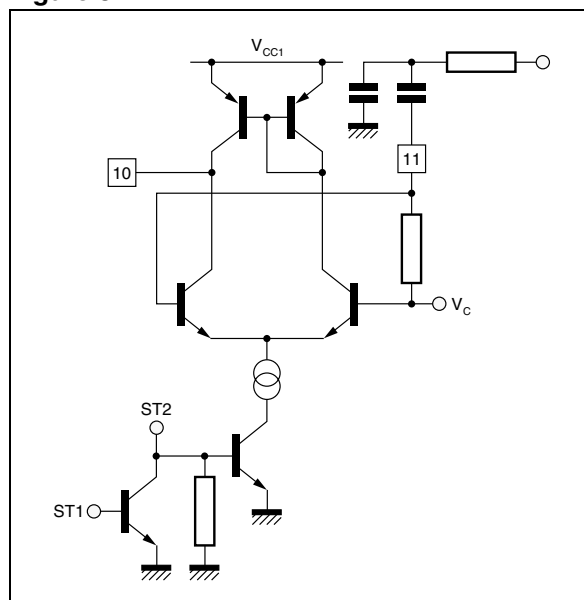
the internal resistor R4. The control voltage is applied on resistor R5.

**Figure 6. Line Oscillator**

**Figure 7. Phase Comparator**

The sync-pulse drives the current in the comparator. The line flyback integrated by the external network gives on pin 11 a saw tooth, the DC offset of this saw tooth is fixed by  $V_c$ . The comparator output provides a positive current for the part of the signal on pin 11 greater than to  $V_c$  and a negative current for the other part. When the line flyback and

the video signal are synchronized, the output of the comparator is an alternatively negative and positive current. The frame sync-pulse inhibits the comparator to prevent frequency drift of the line oscillator on the frame beginning.

**Figure 8.**

**Line Output (pin 14)**

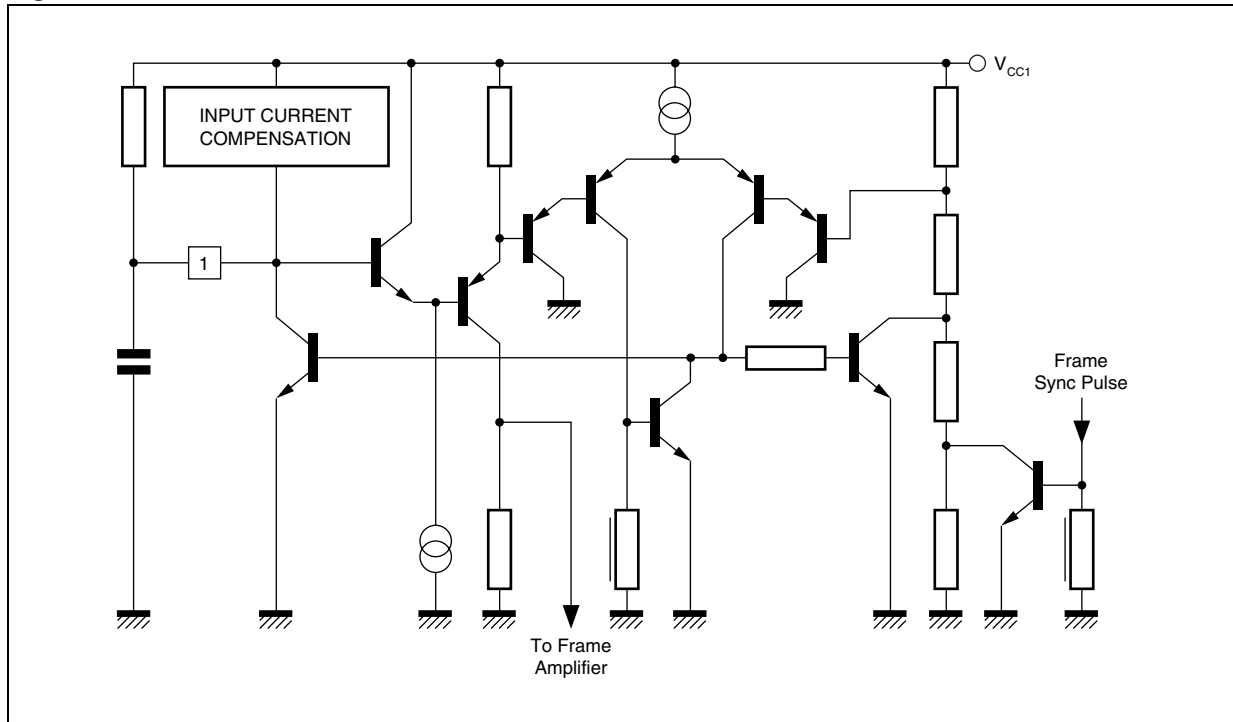
It is an open collector output which is able to drive pulse current of 800mA for a rapid discharging of the darlington base. The output pulse time is 22 $\mu$ s for a 64 $\mu$ s period.

The oscillator thresholds are internally fixed by resistors. The oscillator is synchronized during the

last half free run period. The input current during the charge of the capacitor is less than 100nA.

**Frame Output Amplifier**

This amplifier is able to drive directly the frame yoke. Its output is short circuit and overload protected; it contains also a thermal protection.

**Figure 9. Frame Oscillator**



## TYPICAL APPLICATION FOR DISPLAY UNITS

Figure 10. Application without flyback generator and with sync-pulse drive; yoke: 72mH, 40Ω

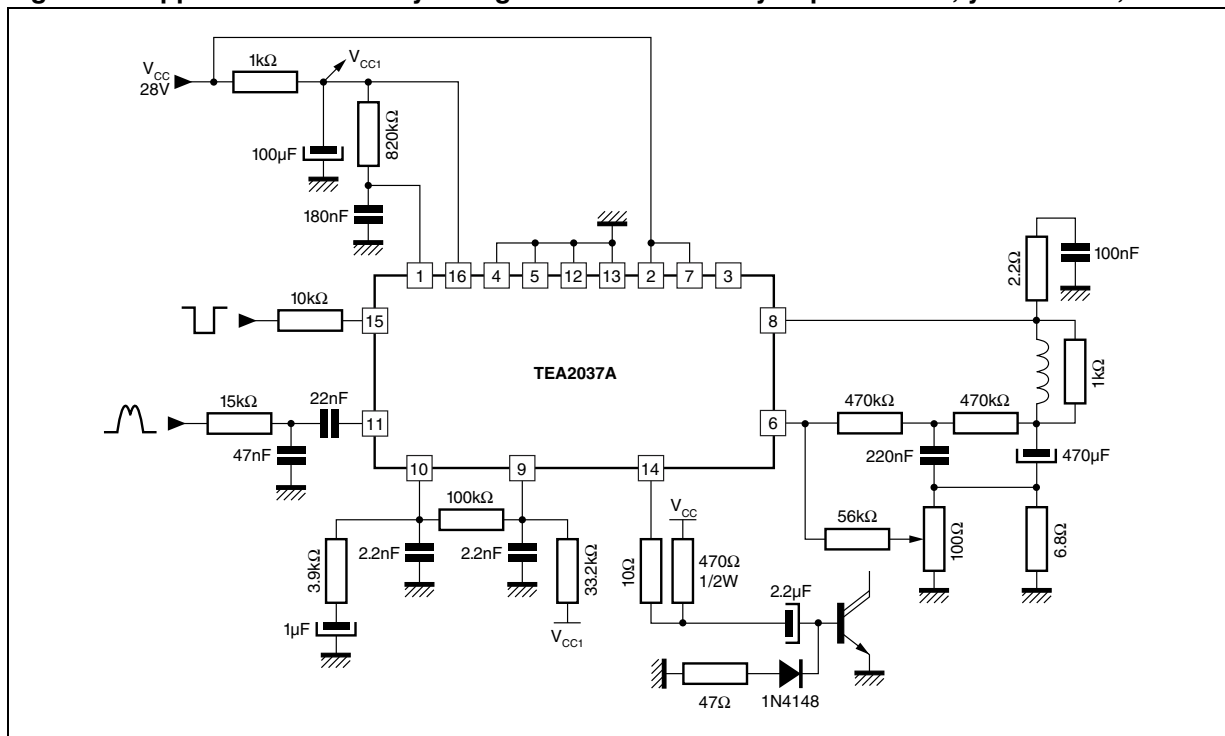
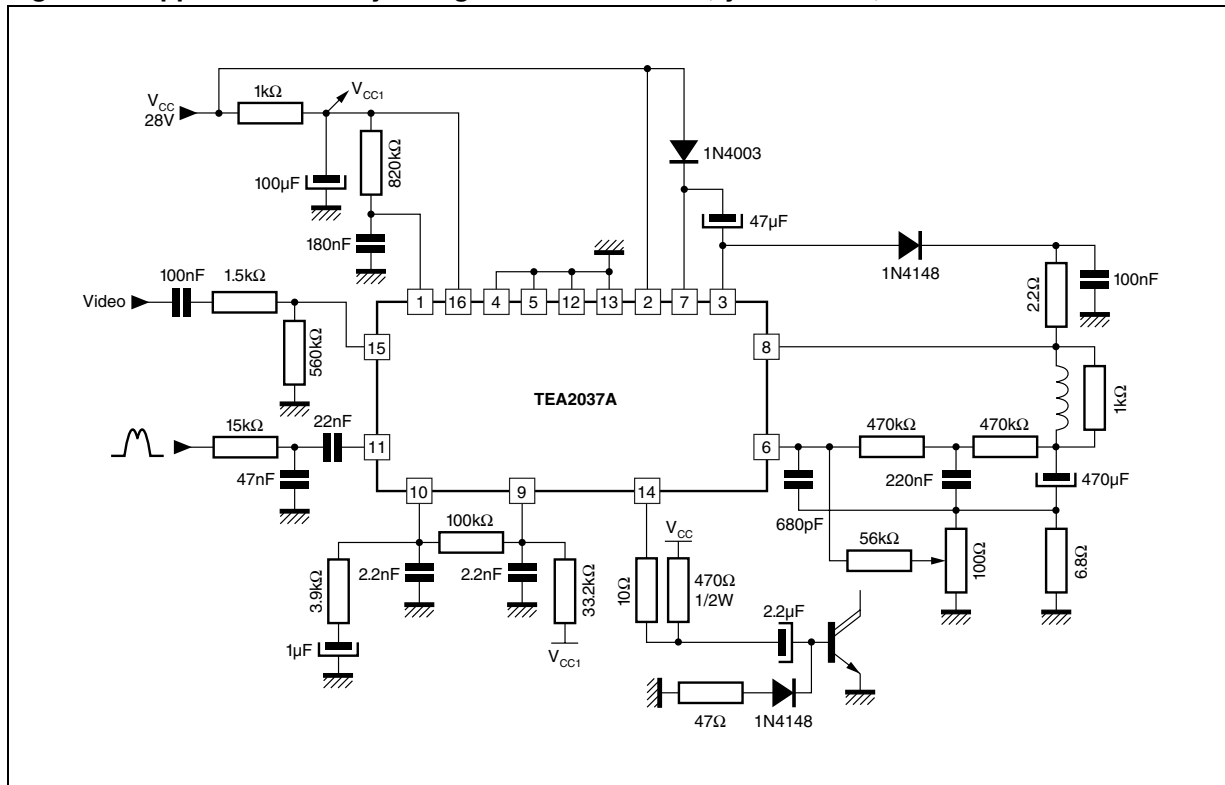


Figure 11. Application with flyback generator and video; yoke: 72mH, 40Ω

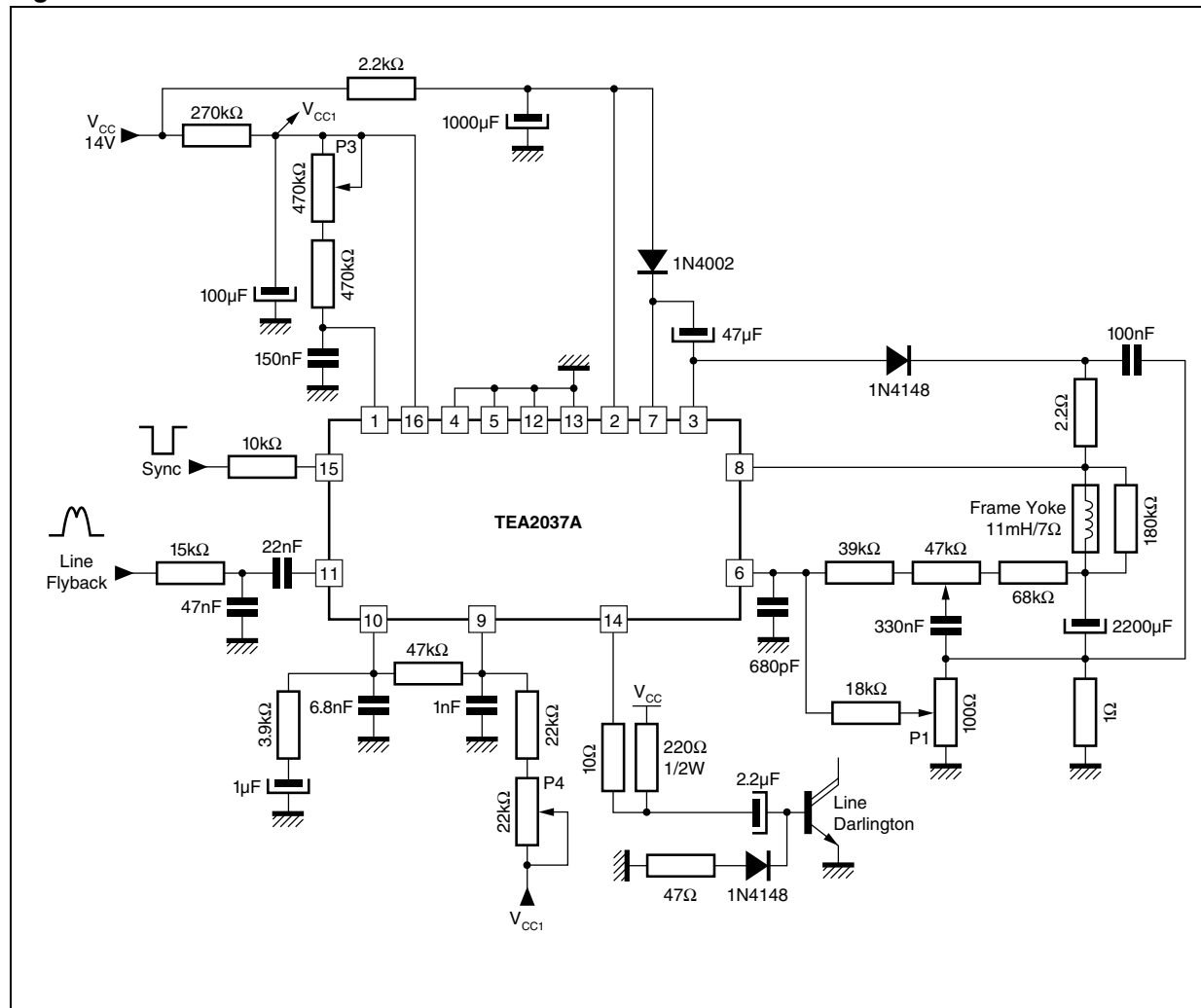


## TYPICAL APPLICATION FOR HIGH FREQUENCY MONITOR

Table 14. Characteristics

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Screen: 14" Color</li> <li>• Frame deflection yoke: 11mH, 7<math>\Omega</math>, 750mA peak-to-peak</li> <li>• <math>V_{CC} = +14V</math> with flyback generator</li> <li>• Frame flyback time: 0.6ms</li> <li>• Vertical frequency: 72Hz</li> <li>• Vertical free-running period: 16ms (adjustable)</li> <li>• Horizontal frequency: 35kHz (adjustable)</li> <li>• Line flyback time: 5.5<math>\mu</math>s</li> </ul> | <ul style="list-style-type: none"> <li>• Capture range: <math>\pm 5\mu</math>s (@ sync pulse = 4.7<math>\mu</math>s)</li> <li>• Input signal: negative TTL sync (line + frame)</li> <li>• Dissipated power: 1.4W (heatsink required)</li> <li>• Adjustments: <ul style="list-style-type: none"> <li>- Vertical amplitude</li> <li>- Vertical Linearity</li> <li>- Vertical frequency</li> <li>- Horizontal frequency</li> </ul> </li> </ul> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Figure 12. Characteristics



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**PART NUMBERING****Table 15. Order Codes**

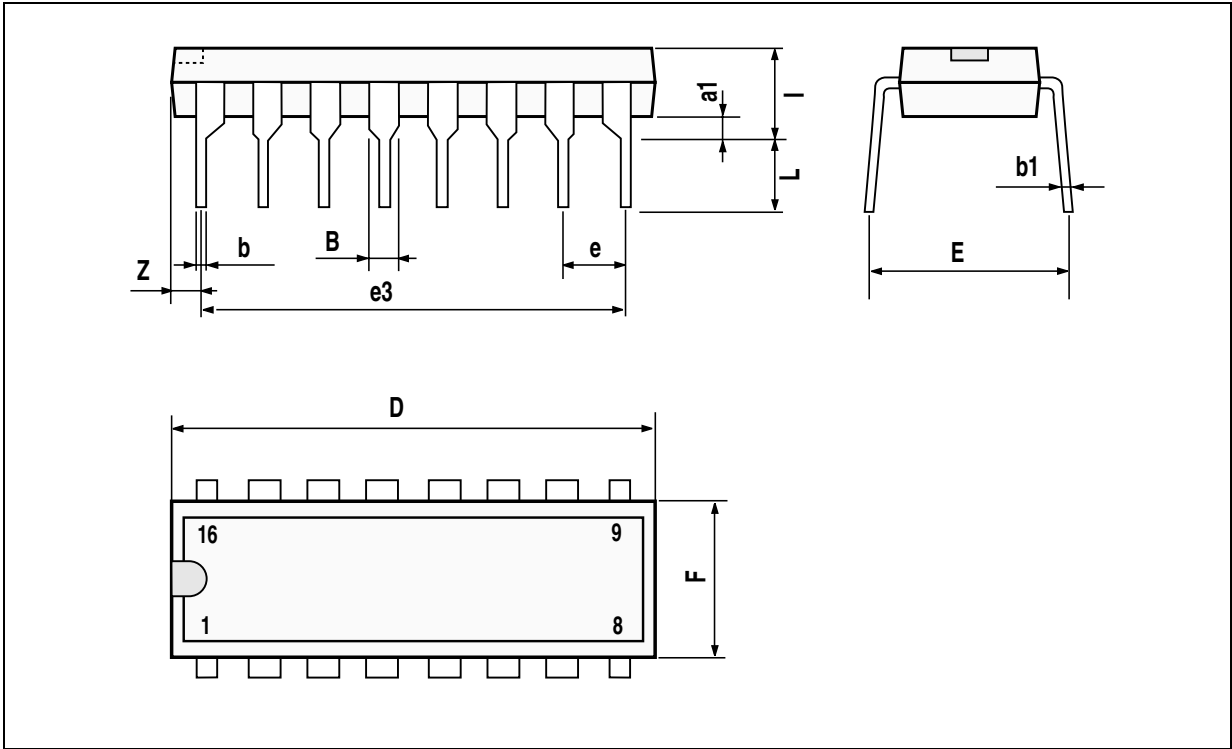
| Part Number | Package        | Temperature Range |
|-------------|----------------|-------------------|
| TEA2037A    | POWERDIP (8+8) | -25 to 85 °C      |

PACKAGE MECHANICAL

Table 16. POWERDIP(8+8) - Mechanical Data

| Symbol | millimeters |       |      | inches |       |       |
|--------|-------------|-------|------|--------|-------|-------|
|        | Min         | Typ   | Max  | Min    | Typ   | Max   |
| a1     | 0.51        |       |      | 0.020  |       |       |
| B      | 0.85        |       | 1.4  | 0.033  |       | 0.055 |
| b      |             | 0.5   |      |        | 0.020 |       |
| b1     | 0.38        |       | 0.5  | 0.015  |       | 0.020 |
| D      |             |       | 20   |        |       | 0.787 |
| E      |             | 8.8   |      |        | 0.346 |       |
| e      |             | 2.54  |      |        | 0.100 |       |
| e3     |             | 17.78 |      |        | 0.700 |       |
| F      |             |       | 7.1  |        |       | 0.280 |
| i      |             |       | 5.1  |        |       | 0.201 |
| L      |             | 3.3   |      |        | 0.130 |       |
| Z      |             |       | 1.27 |        |       | 0.050 |

Figure 13. POWERDIP(8+8) - Package Dimensions



Note: Drawing is not to scale

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**REVISION HISTORY****Table 17. Revision History**

| <b>Date</b>    | <b>Revision</b> | <b>Description of Changes</b>         |
|----------------|-----------------|---------------------------------------|
| September-1996 | 1               | First Issue                           |
| 13-May-2004    | 2               | Stylesheet update. No content change. |

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