TDA3651A/3653
Vertical Deflection

Product Specification

Linear Products

DESCRIPTION

The TDA3651A is a vertical deflection output circuit for drive of various deflection systems with deflector currents up to 2A peak-to-peak.

FEATURES

- **Driver**
- **Output stage**
- **Thermal protection and output stage protection**
- **Flyback generator**
- **Voltage stabilizer**

APPLICATIONS

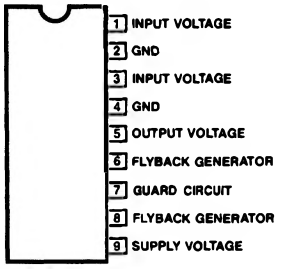
- **Video terminals**
- **Television**

ORDERING INFORMATION

DESCRIPTION	TEMPERATURE RANGE	ORDER CODE
9-Pin Plastic SIP (SOT-131B)	0 to +70°C	TDA3651A
9-Pin Plastic SIP (SOT-157B)	0 to +70°C	TDA3651AQ
9-Pin Plastic SIP (SOT-110B)	0 to +70°C	TDA3653A

PIN CONFIGURATIONS

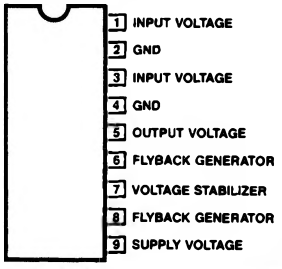
TDA3653
A Package



TOP VIEW

CD10341S

TDA3651
A Package

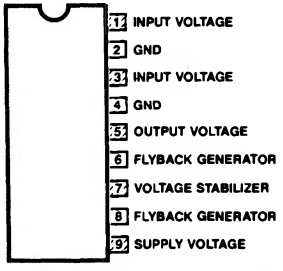


TOP VIEW

CD10350S

TDA3651
AQ Package

(SIL BENT)

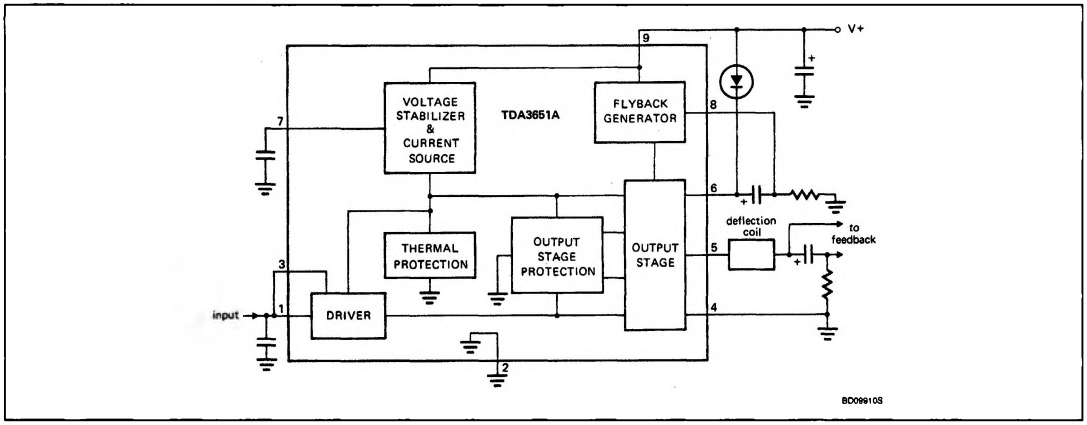


TOP VIEW

▨ = BENT LEADS

CD10290S

BLOCK DIAGRAM TDA3651A/AQ



FUNCTIONAL DESCRIPTION

Output Stage and Protection Circuit

Pin 5 is the output pin. The supply for the output stage is fed to Pin 6 and the output stage ground is connected to Pin 4. The output transistors of the Class-B output stage can each deliver 1A maximum. The 'upper' power transistor is protected against short-circuit currents to ground, whereas during flyback, the 'lower' power transistor is protected against too high voltages which may occur during adjustments.

Moreover, the output transistors have been given extra solidity by means of special measures in the internal circuit layout.

A thermal protection circuit is incorporated to protect the IC against too high dissipation. This circuit is 'active' at 175°C and then reduces the deflection current to such a value that the dissipation cannot increase.

Driver and Switching Circuit

Pin 1 is the input for the driver of the output stage. The signal at Pin 1 is also applied to Pin 3 which is the input of a switching circuit. When the flyback starts, this switching circuit rapidly turns off the lower output stage and so limits the turn-off dissipation. It also allows a quick start of the flyback generator. Pin 3 is connected externally to Pin 1, in order to allow for different applications in which Pin 3 is driven separate from Pin 1.

Flyback Generator

The capacitor at Pin 6 is charged to a maximum voltage, which is equal to the supply voltage V_{CC} (Pin 9), during scan.

When the flyback starts and the voltage at the output pin (Pin 5) exceeds the supply voltage (Pin 9), the flyback generator is activated. The V_{CC} is connected in series (via Pin 8) with the voltage across the capacitor.

The voltage at the supply pin (Pin 6) of the output stage will then be maximum twice V_{CC}. Lower voltages can be chosen by changing the value of the external resistor at Pin 8.

Voltage Stabilizer

The internal voltage stabilizer provides a stabilized supply of 6V for drive of the output stage, so the drive current of the output stage is not affected by supply voltage variations. The stabilized voltage is available at Pin 7.

A decoupling capacitor of 2.2μF can be connected to this pin.

ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	RATING		UNIT
		3651	3653	
Voltage (Pins 4 and 2 externally connected to ground)				
V_{5-4}	Output voltage (Pin 5)	55	60	V
$V_{9-4} = V_{CC}$	Supply voltage (Pin 9)	50	40	V
V_{6-4}	Supply voltage output stage (Pin 6)	55	60	V
V_{1-2}; V_{3-2}	Input voltage (Pins 1 and 3)	V_{CC}	V_{CC}	
V_{7-2}	External voltage (Pin 7)		5.6	V
Currents				
$\pm I_{5RM}$	Repetitive peak output current (Pin 5)	0.75	0.75	A
$\pm I_{5SM}$	Non-repetitive peak output current (Pin 5)	1.5	1.5	A[1]
I_{8SM}	Repetitive peak flyback generator output current (Pin 8)	−0.75 +0.85	−0.75 ±0.85	A A
I_{8SM}	Non-repetitive peak flyback generator output current (Pin 8)	−1.5 +1.6	−1.5 +1.6	A A[1]
Temperatures				
T_{STG}	Storage temperature range	−65 to +150	−65 to +150	°C
T_A	Operating ambient temperature range	−25 to +65	−25 to +65	°C
T_J	Operating junction temperature range	−25 to +150	−25 to +150	°C

NOTE:
1. Non-repetitive duty factor maximum 3.3%.

DC ELECTRICAL CHARACTERISTICS

$T_A = 25°C$; $V_{CC} = 26V$; Pins 4 and 2 externally connected to ground, unless otherwise specified.

SYMBOL	PARAMETER	3651			3653			UNIT
		Min	Typ	Max	Min	Typ	Max	
$I_{5(P-P)}$	Output current (peak-to-peak value)		1.2	1.5		1.2	1.5	A
$-I_8$	Flyback generator output current		0.7	0.85		0.7	0.85	A
I_8	Flyback generator output current		0.6	0.75		0.6	0.75	A
Output voltages								
V_{5-4M}	Peak voltage during flyback			55			60	V
$-V_{5-6sat}$	Saturation voltage to supply at $-I_5$ = 1A (3651); 0.6A (3653)		2.5	3.0		2.3	2.8	V
V_{5-4sat}	Saturation voltage to ground at $-I_5$ = 1A (3651); 0.6A (3653)		2.5	3.0		1.7	2.2	V
$-V_{5-6sat}$	Saturation voltage to supply at $-I_5$ = 0.75A		2.2	2.7		2.5	3.0	V
V_{5-4sat}	Saturation voltage to ground at I_5 = 0.75A		2.2	2.7		2.0	2.5	V
Supply								
V_{9-2}	Supply voltage	10		50	10		40	V
V_{6-4}	Supply voltage output stage			55			60	V
I_9	Supply current (no load and no quiescent current)		9			10		mA
				12			20	
I_4	Quiescent Current (see Figure 1)		38			25		mA
		25		52	6		40	
	Variation of quiescent current with temperature		−0.04			−0.04		mA

DC ELECTRICAL CHARACTERISTICS (Continued) $T_A = 25°C$; $V_{CC} = 26V$; Pins 4 and 2 externally connected to ground, unless otherwise specified.

SYMBOL	PARAMETER	3651			3653			UNIT
		Min	Typ	Max	Min	Typ	Max	
Flyback generator								
V_{9-8sat}	Saturation voltage at $-I_8 = 1.1A$ (3651); 0.85A (3653)		1.6	2.1		1.6	2.1	V
V_{8-9sat}	Saturation voltage at $I_8 = 1A$ (3651); 0.75A (3653)		2.5	3.0		2.3	2.8	V
V_{9-8sat}	Saturation voltage at $I_8 = 0.85A$ (3651); 0.7A (3653)		1.4	1.9		1.4	1.9	V
V_{8-9sat}	Saturation voltage at $I_8 = 0.75A$ (3651); 0.6A (3653)		2.3	2.8		2.2	2.7	V
V_{5-9}	Flyback generator active if	4			4			V
$-I_8$	Leakage current		250	100		5	100	μA
I_1	Input current for $\pm I_5 = 1A$ (3651); 1.5A (3653)	175	2.30	380			1300	μA
V_{1-2}	Input voltage during scan	0.9	1.9	2.7			3.2	V
I_3	Input current during scan	0.01		2.5	.01		.52	mA
V_{3-2}	Input voltage during scan	0.9		V_{CC}	0.9		V_{CC}	V
V_{3-2}	Input voltage during flyback	0		200			250	mV
V_{7-2}	Voltage at Pin 7	5.5	6.1	6.6	4.4	5.0	5.6	V
I_7	Load current of Pin 7			15				V
V_{7-2}	Unloaded voltage at Pin 7 during flyback		15					V
T_J	Junction temperature of switching on the thermal protection	158	175	192				°C
θ_{JMB}	Thermal resistance from junction to mounting base		3	4		10	12	°C/W
P_D	Power dissipation		see Figure 3					
G_O	Open-loop gain at 1kHz; $R_L = 1k\Omega$		36			42		dB
f_R	Frequency response (−3dB); $R = 1k\Omega$		60			40		kHz

NOTE:
1. The maximum supply voltage should be chosen such that during flyback the voltage at Pin 5 does not exceed 55V.

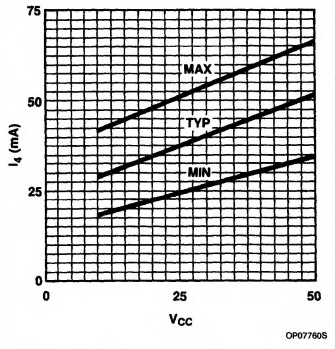


Figure 1. Quiescent Current I_4 as a Function of Supply Voltage V_{CC}

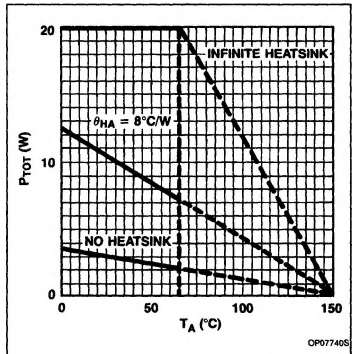
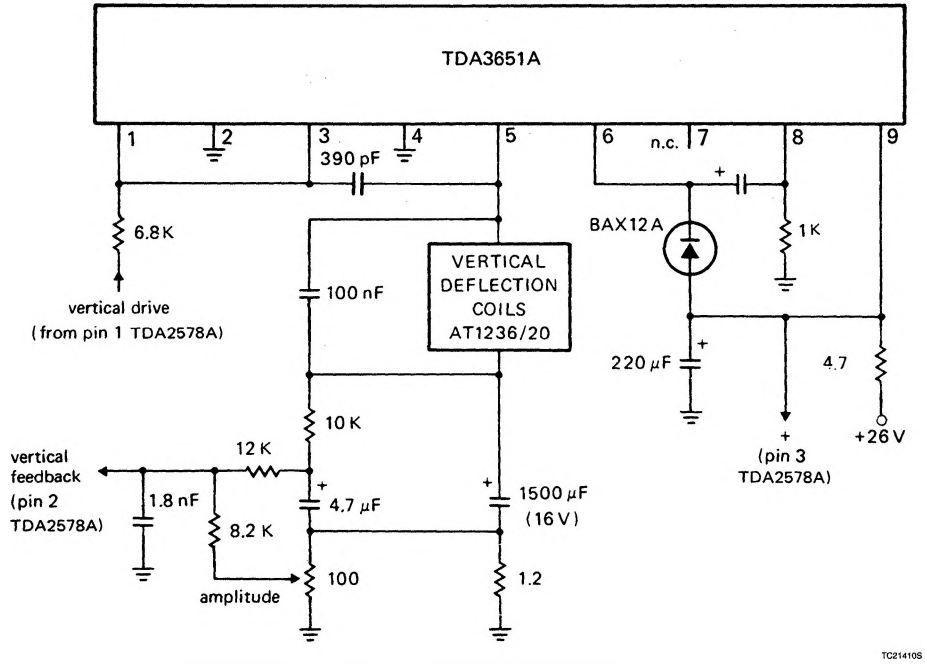


Figure 2. Power Derating Curves

APPLICATION INFORMATION The following application data are measured in a typical application as shown in Figures 3 and 4.

Deflection current (including 6% overscan) peak-to-peak value	$I_{5(P-P)}$ typ. 0.87A
Supply voltage	V_{9-4} typ. 26V
Total supply current	I_{TOT} typ. 148mA
Peak output voltage during flyback	$V_{5-4M} < 50V$
Saturation voltage to supply	typ. 2.0V $V_{5-6sat} < 2.5V$
Saturation voltage to ground	typ. 2.0V $V_{5-4sat} < 2.5V$
Flyback time	typ. 0.95ms $t_{fl} < 1.2ms$
Total power dissipation in IC	P_{TOT} typ. 2.5W
Operating ambient temperature	$T_A < 65°C$



NOTE:
Deflection coils AT1236/20: L = 29mH, R = 13.6Ω; deflection current without overscan is 0.82 A_{p-p} and EHT voltage is 25kV.

Figure 3. Typical Application Circuit Diagram of the TDA3651A (Vertical Output), When Used In Combination With the TDA2578A (See Figure 5)

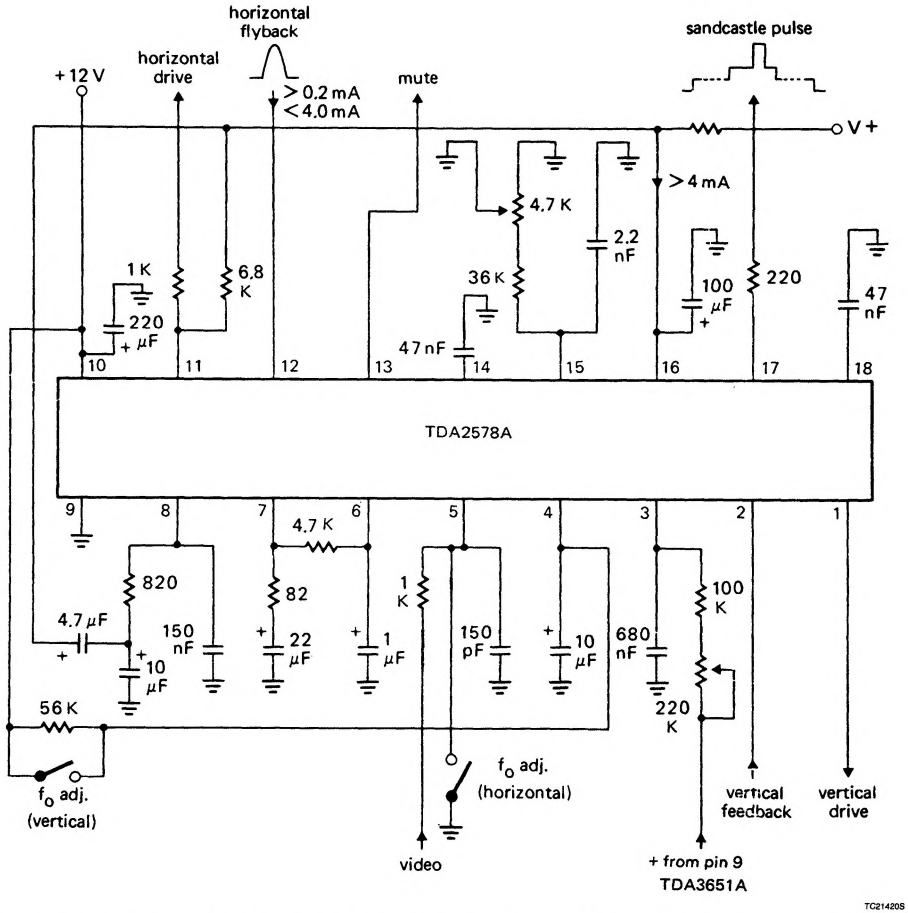


Figure 4. Typical Application Circuit Diagram; for Combination of the TDA2578A With the TDA3651A (See Figure 3)

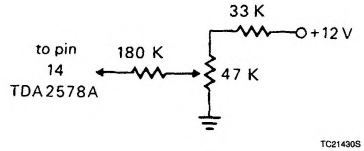
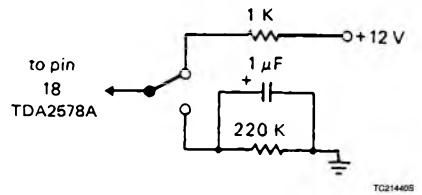


Figure 5. Circuit Configuration at Pin 14 for Phase Adjustment



NOTES:
1kΩ resistor between Pin 18 and +12V: without mute function.
220kΩ between Pin 18 and ground: with mute function.

Figure 6. Circuit Configuration at Pin 18 for VCR Mode