DC-coupled vertical deflection circuit

The ILA8356 is a power circuit for use in 90° and 110° colour deflection systems for field frequencies of 50 to 120 Hz. The circuit provides a DC driven vertical deflection output circuit, operating as a highly efficient class G system.

FEATURES

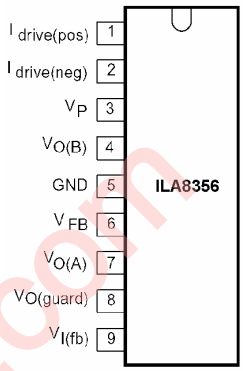
- Few external components
- Highly efficient fully DC-coupled vertical output bridge circuit
- Vertical flyback switch
- Guard circuit
- Protection against:

– short-circuit of the output pins (7 and 4)

– short-circuit of the output pins to V_P

- Temperature (thermal) protection
- High EMC immunity because of common mode inputs

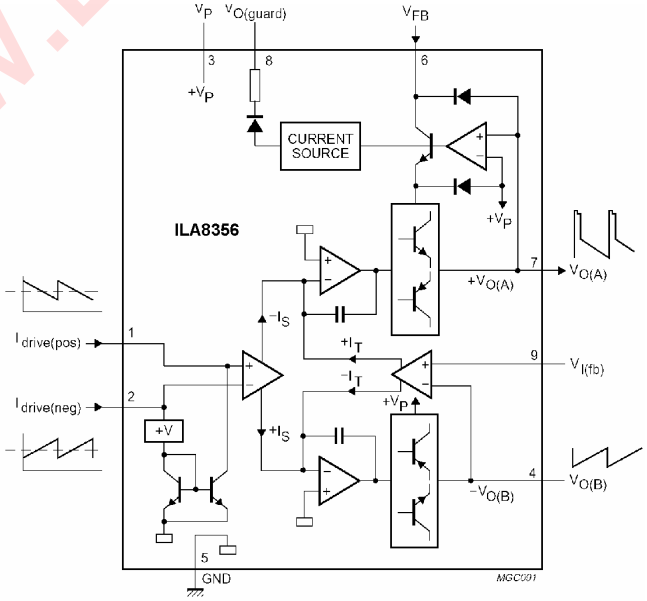
A guard signal in zoom mode



PINNING

SYMBOL	PIN	DESCRIPTION
$I_{drive(pos)}$	1	input power-stage (positive); includes $I_{I(sb)}$ signal bias
$I_{drive(neg)}$	2	input power-stage (negative);includes $I_{I(sb)}$ signal bias
V_P	3	operating supply voltage
$V_{O(B)}$	4	output voltage B
GND	5	ground
V_{FB}	6	input flyback supply voltage
$V_{O(A)}$	7	output voltage A
$V_{O(guard)}$	8	guard output voltage
$V_{I(fb)}$	9	input feedback voltage

BLOCK DIAGRAM



QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
DC supply					
V_P	supply voltage	9	4.5	25	V
I_q	quiescent supply current	-	30	-	mA
Vertical circuit					
$I_{O(p-p)}$	output current	-	-	2	A
	(peak-to-peak value)				
$I_{diff(p-p)}$	differential input current (peak-to-peak value)	-	600	-	µA
$V_{diff(p-p)}$	differential input voltage (peak-to-peak value)	-	1.5	1.8	V
Flyback switch					
I_M	peak output current	-	-	±1	A
V_{FB}	flyback supply voltage	-	-	50	V
Thermal data					
T_{stg}	storage temperature	-55	-	+150	°C
T_{amb}	operating ambient temperature	-25	-	+75	°C
T_{vj}	virtual junction temperature	-	-	150	°C

FUNCTIONAL DESCRIPTION

The vertical driver circuit is a bridge configuration. The deflection coil is connected between the output amplifiers, which are driven in phase opposition. An external resistor (R_M) connected in series with the deflection coil provides internal feedback information. The differential input circuit is voltage driven. An external resistor (R_{CON}) connected between the differential input determines the output current through the deflection coil. The relationship between the differential input current and

the output current is defined by: $I_{diff} \times R_{CON} = I_{coil} \times R_M$. The output current is adjustable from 0.5 A (p-p) to 2 A (p-p) by varying R_M. The maximum input differential voltage is 1.8 V. In the application it is recommended that V_{diff} = 1.5 V (typ). This is recommended because of the spread of input current and the spread in the value of R_{CON}. The flyback voltage is determined by an additional supply voltage V_{FB}. The principle of operating with two supply voltages (class G) makes it possible to fix the supply voltage V_P optimum for the scan voltage and the second supply voltage V_{FB} optimum for the flyback voltage. Using this method, very high efficiency is achieved.

The supply voltage V_{FB} is almost totally available as flyback voltage across the coil, this being possible due to the absence of a decoupling capacitor (not necessary, due to the bridge configuration).

The output circuit is fully protected against the following:

- thermal protection
- short-circuit protection of the output pins (pins 4 and 7)
- short-circuit of the output pins to V_P.

A guard circuit V_O(guard) is provided. The guard circuit is activated at the following conditions:

- during flyback
- during short-circuit of the coil and during short-circuit of the output pins (pins 4 and 7) to V_P or ground
- during open loop
- when the thermal protection is activated.

This signal can be used for blanking the picture tube screen.

LIMITING VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
DC supply					
V_P	supply voltage	non-operating	~	40	V
			~	25	V
V_{FB}	flyback supply voltage		~	50	V
Vertical circuit					
$I_{O(p-p)}$	output current (peak-to-peak value)	note 1	~	2	A
$V_{O(A)}$	output voltage (pin 7)		~	52	V
Flyback switch					
I_M	peak output current		~	±1.5	A
Thermal data					
T_{stg}	storage temperature		~55	+150	°C
T_{amb}	operating ambient temperature		~25	+75	°C
T_{vj}	virtual junction temperature			150	°C
$R^{th\ vj-c}$	resistance v_j-case			4	K/W
$R_{th\ vj-a}$	resistance v_j-ambient in free air			40	K/W
t_{sc}	short-circuiting time	note 2		1	hr

Notes

1. I_O maximum determined by current protection.
2. Up to V_P = 18 V.

CHARACTERISTICS

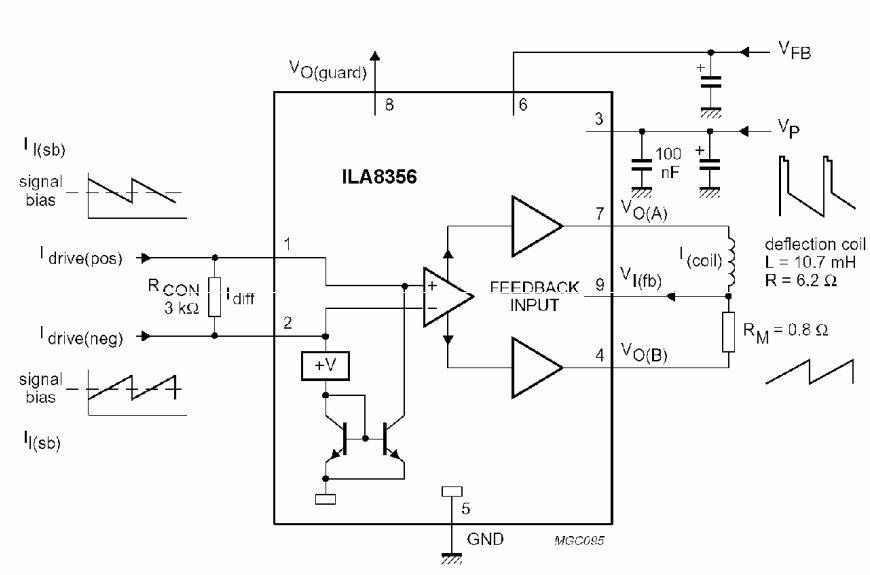
V_P = 14.5 V; T_{amb} = 25 C; V_{FB} = 45 V; fi = 50 Hz; $I_{I(sb)}$ = 400 A; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC supply						
V_P	operating supply voltage		9.0	4.5	25	V
V_{FB}	flyback supply voltage		V_P	~	50	V
I_P	supply current	no signal; no load	~	30	55	mA
Vertical circuit						
V_O	output voltage swing (scan)	I_{diff} = 0.6 mA (p-p); V_{diff} = 1.8 V (p-p); I_O = 2 A (p-p)	13.2	~	~	V
LE	linearity error	I_O = 2 A (p-p);	~	1	4	%
		I_O = 50 mA (p-p);	~	1	4	%
V_O	output voltage swing (flyback) $^{V}O(A)$ - $^{V}O(B)$	I_{diff} = 0.3 mA; I_O = 1 A (M)	~	40	~	V
V_{DF}	forward voltage of the internal efficiency diode ($V_{O(A)}$ - V_{FB})	I_O = 1 A (M); I_{diff} = 0.3 mA	~	~	1.5	V
$\|I_{os}\|$	output offset current	I_{diff} = 0; $I_{I(sb)}$ = 50 to 500 μA	~	~	40	mA
$\|V_{os}\|$	offset voltage at the input of the feedback amplifier ($V_{I(fb)}$ - $V_{O(B)}$)	I_{diff} = 0; $I_{I(sb)}$ = 50 to 500 μA	~	~	24	mV
$\Delta V_{os}T$	output offset voltage as a function of temperature	I_{diff} = 0	~	~	72	μV/K
$V_{O(A)}$	DC output voltage	I_{diff} = 0;	~	6.5	~	V
G_{vo}	open-loop voltage gain (V_{7-4}/V_{1-2})		~	80	~	dB

	open loop voltage gain (V_{7-4}/V_{9-4}; V_{1-2} = 0)		~	80	~	dB
V_R	voltage ratio V_{1-2}/V_{9-4}		~	0	~	dB
f_{res}	frequency response (3 dB)	open loop;	~	40	~	Hz
G_I	current gain (I_O/I_{diff})		~	5000	~	
$\Delta G_c T$	current gain drift as a function of temperature				10^{-4}	K
$I_{I(sb)}$	signal bias current		50	400	500	μA
I_{FB}	flyback supply current	during scan	~	~	100	μA
PSRR	power supply ripple rejection		~	80	~	dB
$V_{I(DC)}$	DC input voltage		~	2.7	~	V
$V_{I(CM)}$	common mode input voltage	$I_{I(sb)}$ = 0	0	~	1.6	V
I_{bias}	input bias current	$I_{I(sb)}$ = 0	~	0.1	0.5	μA
$I_{O(CM)}$	common mode output current	$\Delta I_{I(sb)}$ = 300 μA (p-p);	~	0.2	~	mA
		f_i = 50 Hz; I_{diff} = 0				
Guard circuit						
I_O	output current	not active; $V_{O(guard)}$ = 0 V	~	~	50	μA
		active; $V_{O(guard)}$ = 4.5 V	1	~	2.5	mA
$V_{O(guard)}$	output voltage on pin 8	I_O = 100 μA	~	~	5.5	V
	allowable voltage on pin 8	maximum leakage current = 10 μA;	~	~	40	V

V_P = 13.5 V; $I_{O(p-p)}$ = 1.87 A; $I_{I(sb)}$ = 400 μA; $I_{diff(p-p)}$ = 500 μA; V_{FB} = 42 V; t_{FB} = 0.6 ms.

APPLICATION DIAGRAM.



- **9-Pin Plastic Power Single-in-Line (SIL-9MPF, SOT 131-2)**