DATA SHEET

TDA8601
RGB/YUV and fast blanking switch

Product specification
Supersedes data of July 1994
File under Integrated Circuits, IC02

1996 Jun 27

Philips
Semiconductors

PHILIPS

RGB/YUV and fast blanking switch TDA8601

FEATURES

- YUV/RGB and fast blanking switch
- 3-state output
- Selectable clamp:
  - passive (with diodes) or
  - active clamp
- Bandwidth greater than 22 MHz
- Fully ESD protected
- Latch-up free.

APPLICATIONS

- Standard and high definition television sets
- Peri-television sets.

GENERAL DESCRIPTION

The device is intended for switching between two RGB or YUV video sources. The outputs can be set to a high-impedance state to enable parallel connection of several devices.

A HIGH level on SEL (pin 5) selects the video inputs of Channel 2. The IOCNTR control pin (pin 16) defines the 3-state outputs and clamp inputs:

- HIGH = 3-state outputs (also for test; active clamp)
- LOW = passive clamp at the video inputs (diode)
- Sandcastle: the video signal is clamped with an active clamp during the sync pulse.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_P	supply voltage		7.2	8.0	8.8	V
G_v	voltage gain		–0.5	0	+0.5	dB
B	bandwidth	at 3 dB	22	–	–	MHz
α_{ct}	crosstalk attenuation between two video channels	f_i = 5 MHz	–60	–	–	dB
T_{amb}	operating ambient temperature		0	–	70	°C

ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
TDA8601	DIP16	plastic dual in-line package; 16 leads (300 mil); long body	SOT38-1
TDA8601T	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1

BLOCK DIAGRAM

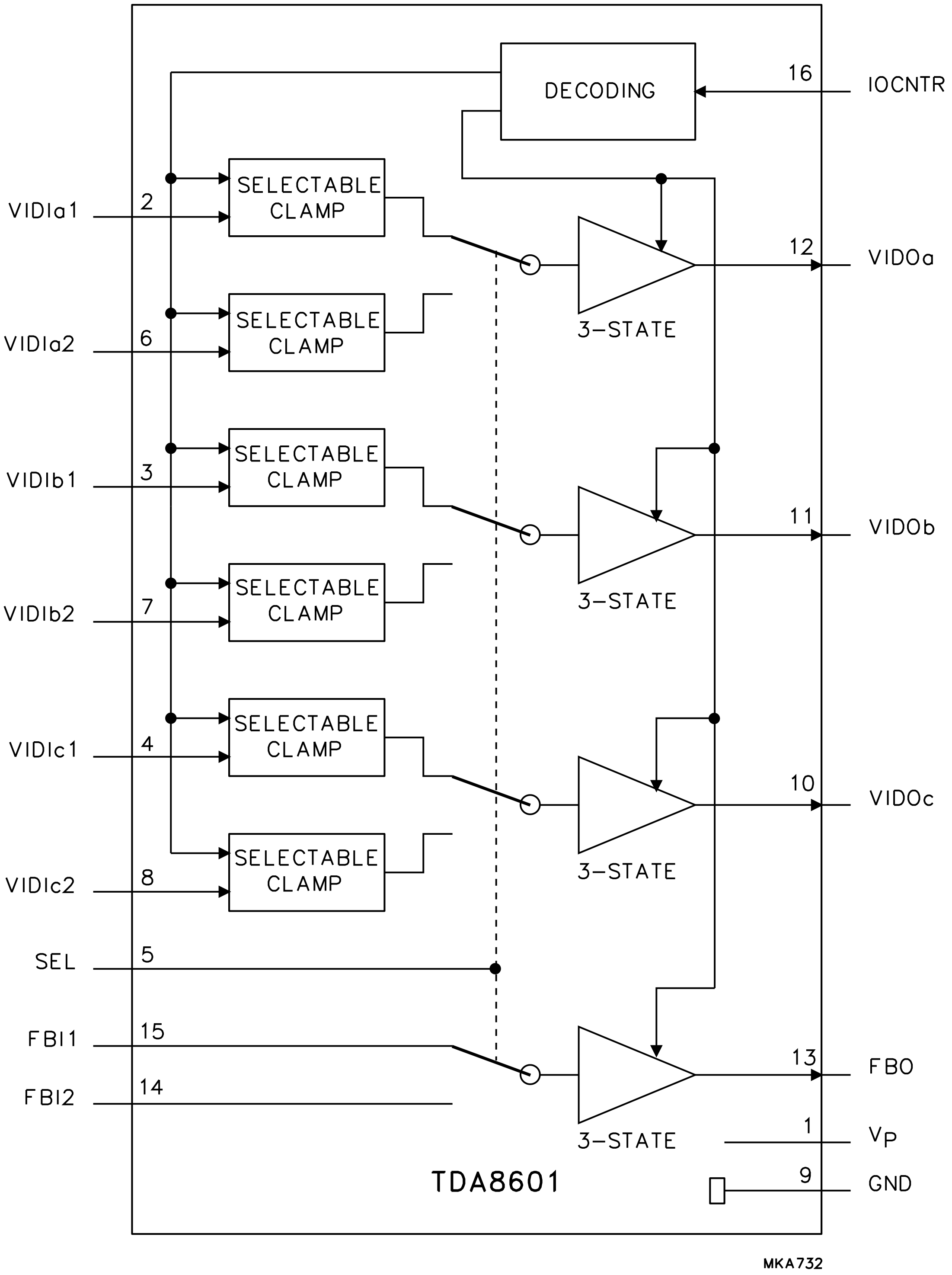


Fig.1 Block diagram.

PINNING

SYMBOL	PIN	DESCRIPTION
V_P	1	supply voltage (8 V)
VIDIa1	2	video input a (channel 1)
VIDIb1	3	video input b (channel 1)
VIDIc1	4	video input c (channel 1)
SEL	5	channel selection
VIDIa2	6	video input a (channel 2)
VIDIb2	7	video input b (channel 2)
VIDIc2	8	video input c (channel 2)
GND	9	ground
VIDOc	10	video output c
VIDOb	11	video output b
VIDOa	12	video output a
FBO	13	fast blanking output signal
FBI2	14	fast blanking input signal (channel 2)
FBI1	15	fast blanking input signal (channel 1)
IOCNTR	16	control of video input or video output

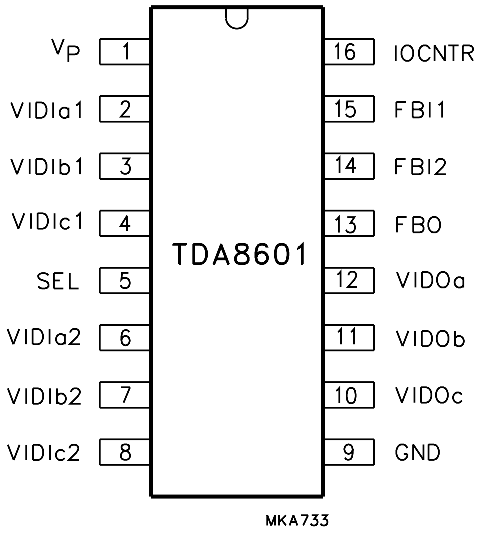


Fig.2 Pin configuration.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_P	supply voltage	–0.3	+12	V
V_i	input voltage (pins 2 to 4 and 6 to 8) referenced to ground	0	8.8	V
T_j	junction temperature	–	150	°C
T_{stg}	IC storage temperature	–55	+150	°C

HANDLING

Inputs and outputs are protected against electrostatic discharge in normal handling. However, to be totally safe, it is desirable to take normal precautions appropriate to handling MOS devices.

ESD in accordance with *“MIL STD 883C”* - *“Method 3015”*:

1. Human body model: 1500 Ω, 100 pF, 3 pulses positive and 3 pulses negative on each pin with respect to ground. Class 2: 2000 to 3999 V.
2. Machine model: 0 Ω, 200 pF, 3 pulses positive and 3 pulses negative on each pin with respect to ground. The IC withstands 200 V.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient in free air		
	DIP16	70	K/W
	SO16	115	K/W

OPERATING CHARACTERISTICS

The operating characteristics are the conditions within the IC when it is functional; these conditions can have any value. For example, condition V_{IL} (pin 5) is fixed at 0.5 V. The IC will then operate over the full temperature range and supply voltage range.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply						
V_P	supply voltage		7.2	8.0	8.8	V
Video inputs (pins 1 to 3 and 6 to 8)						
$V_{i(p-p)}$	input video signal amplitude (peak-to-peak value)	R, G, B signals	–	0.7	1	V
		Y signal; active clamp	–	1	1.4	V
		–(B – Y) signal; active clamp	–	1.05	1.5	V
		–(R – Y) signal; active clamp	–	1.33	1.9	V
C_i	input clamp capacitor		–	47	–	nF
Control inputs (pins 5 and 16)						
V_{IH}	HIGH level input voltage (pin 5)	I_{IH} = 10 μA	0.9	–	V_P	V
V_{IL}	LOW level input voltage (pin 5)	I_{IL} = –10 μA	–	–	0.5	V
V_{IH}	HIGH level input voltage (pin 16)	I_{IH} = 10 μA	2.0	–	V_P	V
V_{IL}	LOW level input voltage (pin 16)	I_{IL} = –10 μA	–	–	0.8	V
V_{sc}	sandcastle input voltage level (pin 16)	zero level	–	–	1.1	V
		blanking level	2.0	–	3.1	V
		clamp level	3.9	–	5.5	V
t_W	clamp pulse width	SECAM mode	–	3.6	–	μs
		PAL mode	–	2.5	–	μs
Fast blanking inputs (pins 14 and 15)						
V_{IH}	HIGH level input voltage		0.95	–	V_P	V
V_{IL}	LOW level input voltage		–	–	0.5	V
Video outputs (pins 10 to 12)						
C_L	output load capacitor		–	40	100	pF
R_L	output load resistor	note 1	1	–	–	kΩ

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Fast blanking output (pin 13)						
C_L	output load capacitor		–	40	100	pF
R_L	output load resistor	note 1	1	–	–	kΩ

Note

1. For the DIP16 package, the thermal resistance is lower. The minimum value for the output load resistor is 270 Ω.

CHARACTERISTICS

The typical values are given for V_P = 8 V; T_{amb} = 25 °C. C_L = 40 pF; no load resistor; measured in application circuit of Fig.8 over full supply voltage and temperature range; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply						
I_P	supply current	no resistive load on the outputs	–	33	40	mA
SVRR	supply voltage rejection ratio	f_i = 40 Hz to 50 kHz; note 1	–	–	–36	dB
		f_i = 40 Hz; note 1	–	–51	–36	dB
Video inputs (pins 1 to 3 and 4 to 6)						
R_i	input resistance	for each type of clamp	10	–	–	kΩ
$C_{i(max)}$	maximum input capacitance		–	3	–	pF
V_{clamp}	input clamping voltage level	I_i = –50 mA; passive clamp	1.05	1.21	1.35	V
		I_i = 50 mA; active clamp; V_{IOCNTR} = 3.9 V	2.05	2.42	2.70	V
		I_i = –50 mA; active clamp; V_{IOCNTR} = 3.9 V	2.05	2.37	2.70	V
I_{sink}	input sink current	V_i = 2 V; passive clamp	0.5	1.6	3	µA
$\lvert I_{clamp} \rvert$	maximum absolute input clamping current	$V_i = V_{clamp}$ + 0.5 V; active clamp	200	–	–	µA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Video outputs (pins 10 to 12)						
R_o	output resistance		–	–	50	Ω
R_{oZ}	output resistance	3-state output	0.1	–	–	MΩ
$C_{oZ(max)}$	maximum output capacitance	3-state output	–	3	–	pF
G_v	voltage gain	f_i = 1 MHz	–0.5	0	+0.5	dB
B	bandwidth	at ±0.5 dB	5	–	–	MHz
		at ±1 dB	10	–	–	MHz
		at ±3 dB	22	40	–	MHz
α_{ct}	crosstalk attenuation between two video channels	f_i = 5 MHz; note 2	–60	–	–	dB
		f_i = 10 MHz; note 2	–50	–	–	dB
		f_i = 22 MHz; note 2	–40	–	–	dB
α_{off}	isolation of the 3-state configuration	f_i = 5 MHz; note 2	–60	–	–	dB
		f_i = 10 MHz; note 2	–50	–	–	dB
		f_i = 22 MHz; note 2	–40	–	–	dB
SR	slew rate		100	120	–	V/µs
$\lvert \Delta G_m \rvert$	gain matching between two different signals of the same channel	f_i = 5 MHz	–	–	0.5	dB
$V_{o(bl)}$	output blanking level voltage		2.1	2.23	2.7	V
$V_{os(bl)}$	output blanking offset voltage	$V_{i(ch1)}$ = 0.7 V (p-p) (white); $V_{i(ch2)}$ = 0 V (p-p) (black); active clamp; note 3	–	–	5	mV
		$V_{i(ch1)}$ = 0.7 V (p-p) (white); $V_{i(ch2)}$ = 0 V (p-p) (black); passive clamp; note 3	–	–	15	mV
$\Delta V_{os(bl)}$	matching of output blanking offset voltage	$V_{i(ch1)}$ = 0.7 V (p-p) (white); $V_{i(ch2)}$ = 0 V (p-p) (black); active clamp; note 3	–	–	5	mV
		$V_{i(ch1)}$ = 0.7 V (p-p) (white); $V_{i(ch2)}$ = 0 V (p-p) (black); passive clamp; note 3	–	–	5	mV
Fast blanking inputs (pins 14 and 15)						
Z_i	input impedance		10	–	–	kΩ
Fast blanking output (pin 13)						
V_{OH}	HIGH level output voltage		2	2.35	3	V
V_{OL}	LOW level output voltage		0	0.15	0.3	V
Z_o	output impedance		–	–	50	Ω
SEL input (pin 5)						
Z_i	input impedance		10	–	–	kΩ

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Timing						
$t_{dSEL;VID}$	delay time between SEL input and video output	note 4	–	12	20	ns
$t_{dSEL;FBO}$	delay time between SEL input and fast blanking output	note 5	–	15	40	ns
t_{SWVID}	switching time of video output	note 4	–	8.5	15	ns
t_{SWFBO}	switching time of fast blanking output	note 5	–	8.5	15	ns
t_{dFB}	fast blanking level delay between input and output	note 6	–	13	20	ns
t_{dVID}	video delay between input and output	note 7	–	4	20	ns
Δt_{dVID}	delay difference between two video signals at the output	note 7	–	0.5	10	ns
$\Delta t_{dFB;VID}$	delay difference between fast blanking level and video at the output	note 7	–	5	10	ns

Notes

1. The supply voltage rejection ratio is measured at the video outputs (pins 10 to 12) when a sine wave is applied on the power supply pin (pin 1); where: V_{DC} = 8 V; V_i = 100 mV (p-p). This additional sine wave on the power supply pin is guaranteed not to cause extraneous oscillations on the video control and fast blanking signals.
2. The 6 video inputs will contain the same signal. The source impedance is 50 Ω.
3. The blanking offset is the level difference between the two channels when they are selected separately and, also, on one video output. This value is measured on each video signal.
4. The delay between the SEL input and the video output together with the switching time of the video output is illustrated in Fig.3. The amplitude of the video signal is 1.9 V (p-p) when the clamp is active and 1.0 V (p-p) when the clamp is passive.
5. The delay between the SEL input and fast blanking output together with the switching time of fast blanking output is illustrated in Fig.4.
6. The fast blanking delay between input and output is illustrated in Fig.5.
7. The video delay between input and output and delay differences are illustrated in Fig.6. Inputs 1 and 2 are either fast blanking input plus a video signal or two video signals. The amplitude of the video signal is 0.5 V (p-p). The video signal levels (i1, i2, o1 and o2) are 50% of the video amplitude. The fast blanking signal levels (i1 and o1) are 0.95 V when the signal rises and 0.5 V when the signal falls.

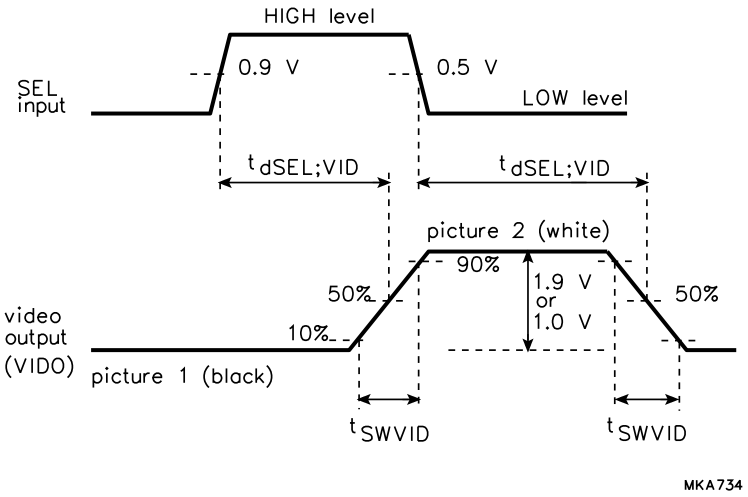


Fig.3 Timing definition: SEL and VIDO.

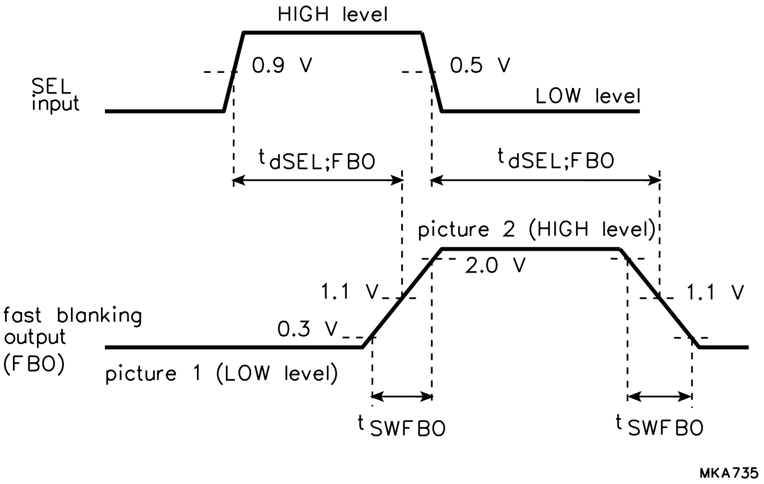


Fig.4 Timing definition: SEL and FBO.

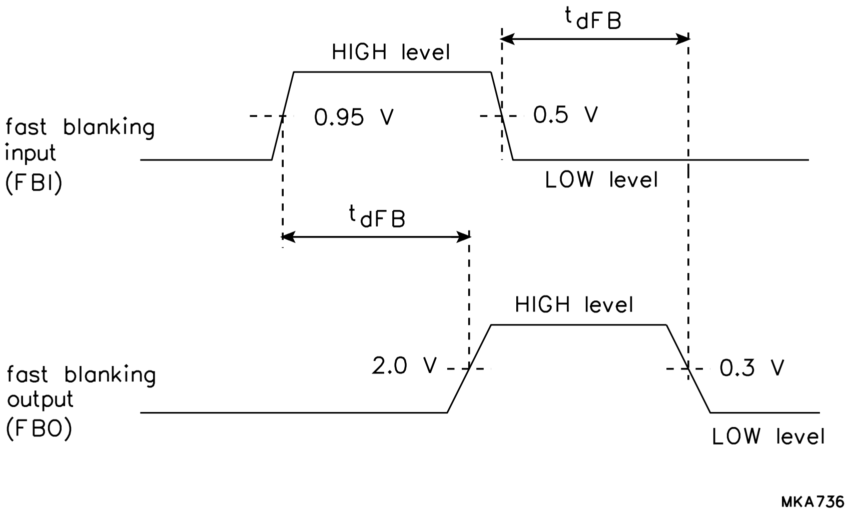


Fig.5 Timing definition: fast blanking delay.

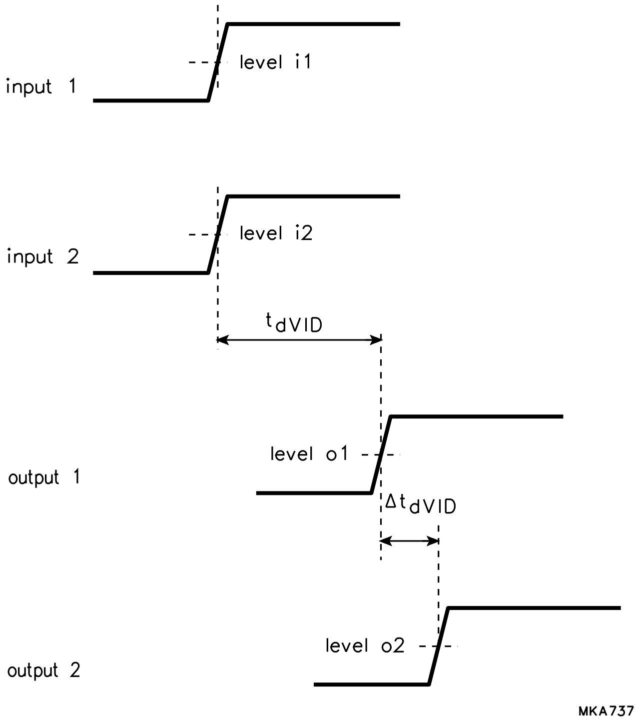


Fig.6 Timing definition: video delay.

INTERNAL PIN CONFIGURATION

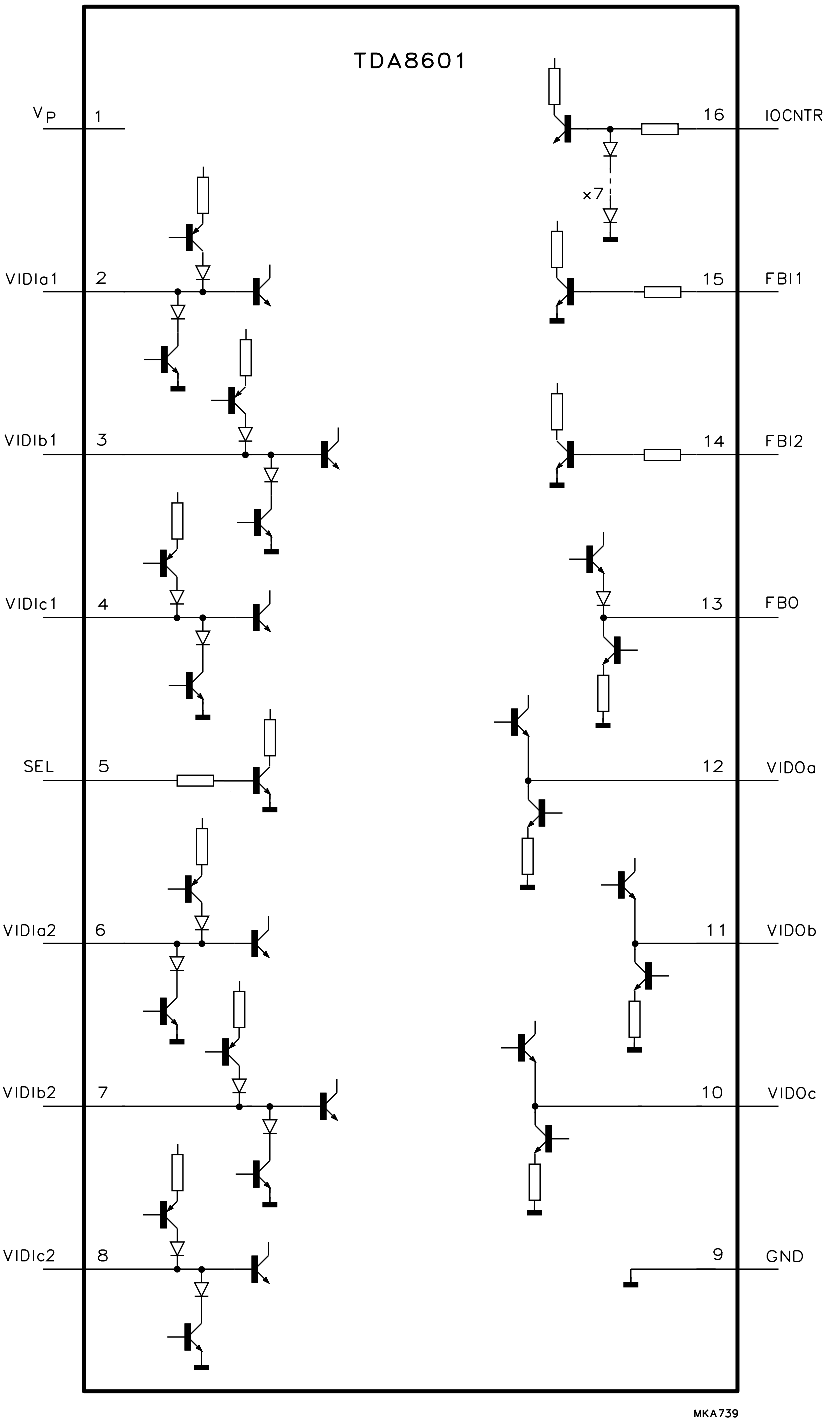


Fig.7 Internal pin configuration.

APPLICATION INFORMATION

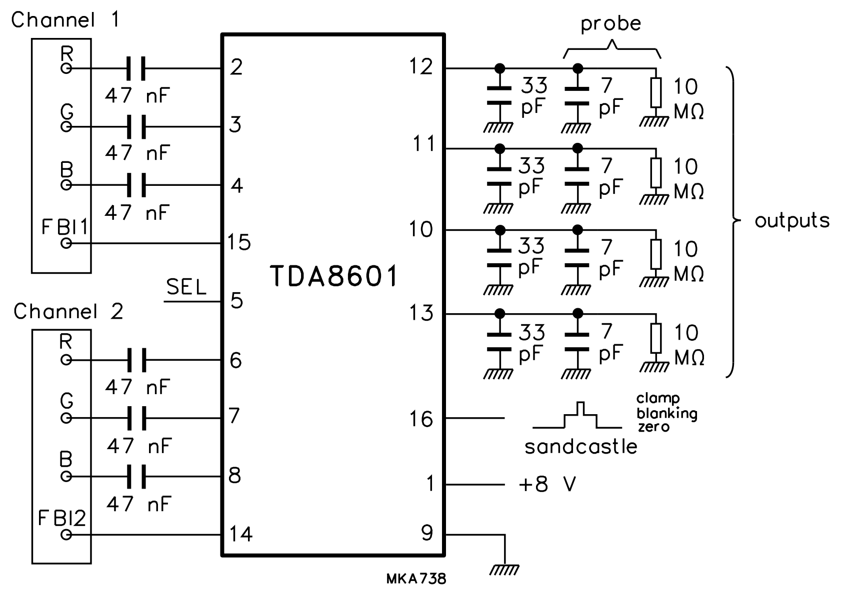


Fig.8 Application diagram.

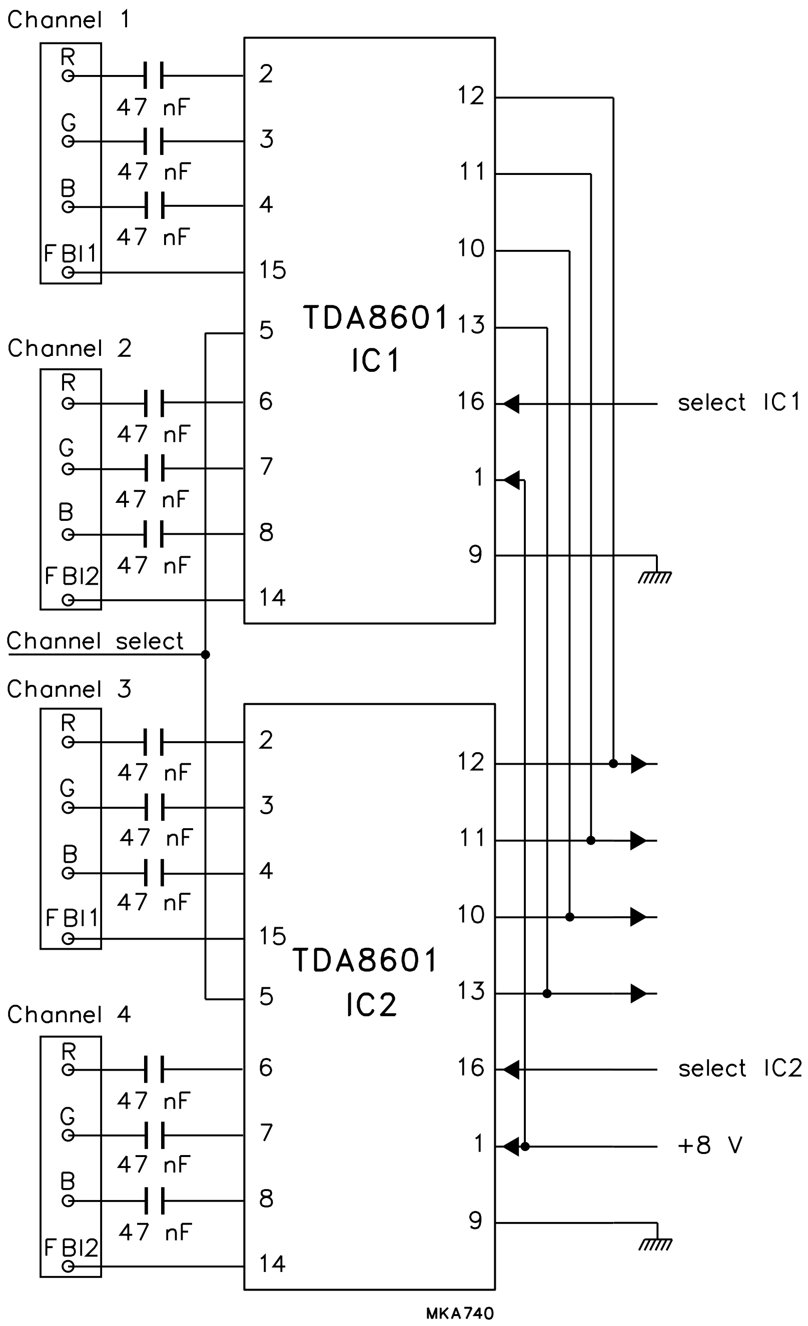
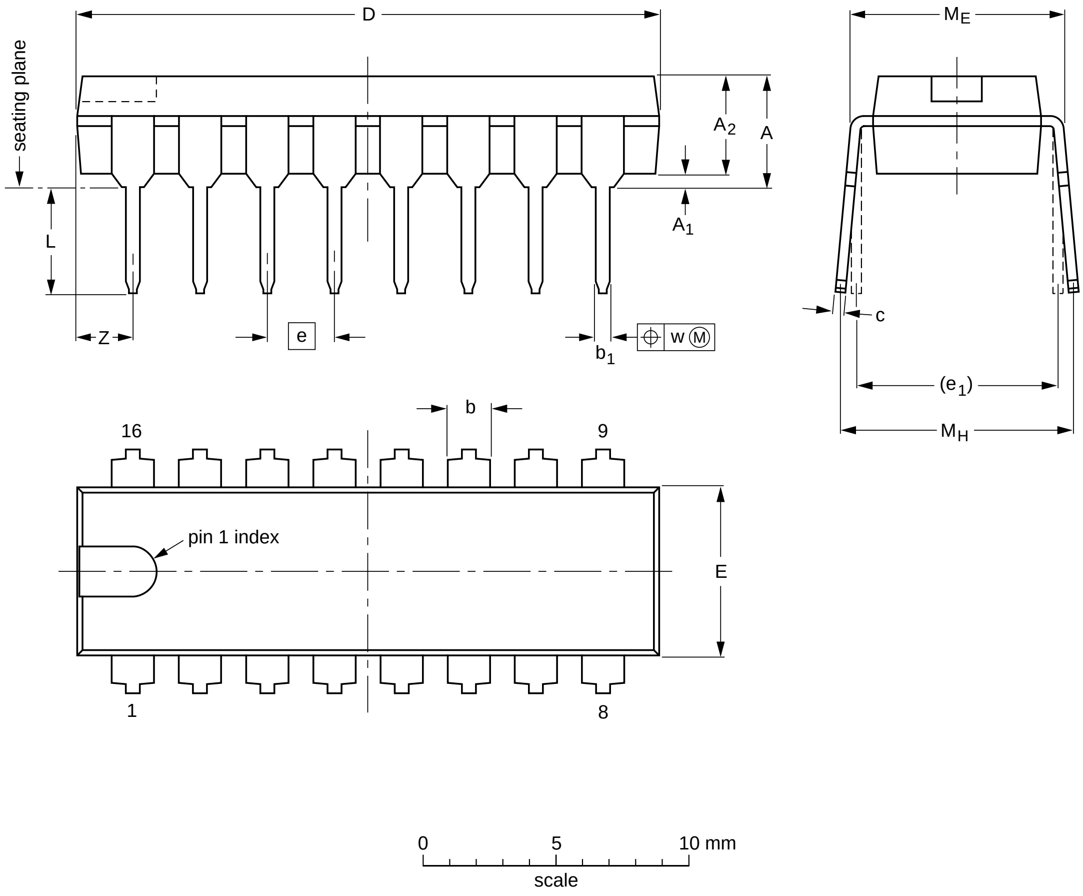


Fig.9 Schematic diagram of two TDA8601s operating four channels.

PACKAGE OUTLINES

DIP16: plastic dual in-line package; 16 leads (300 mil); long body SOT38-1

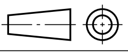


DIMENSIONS (inch dimensions are derived from the original mm dimensions)

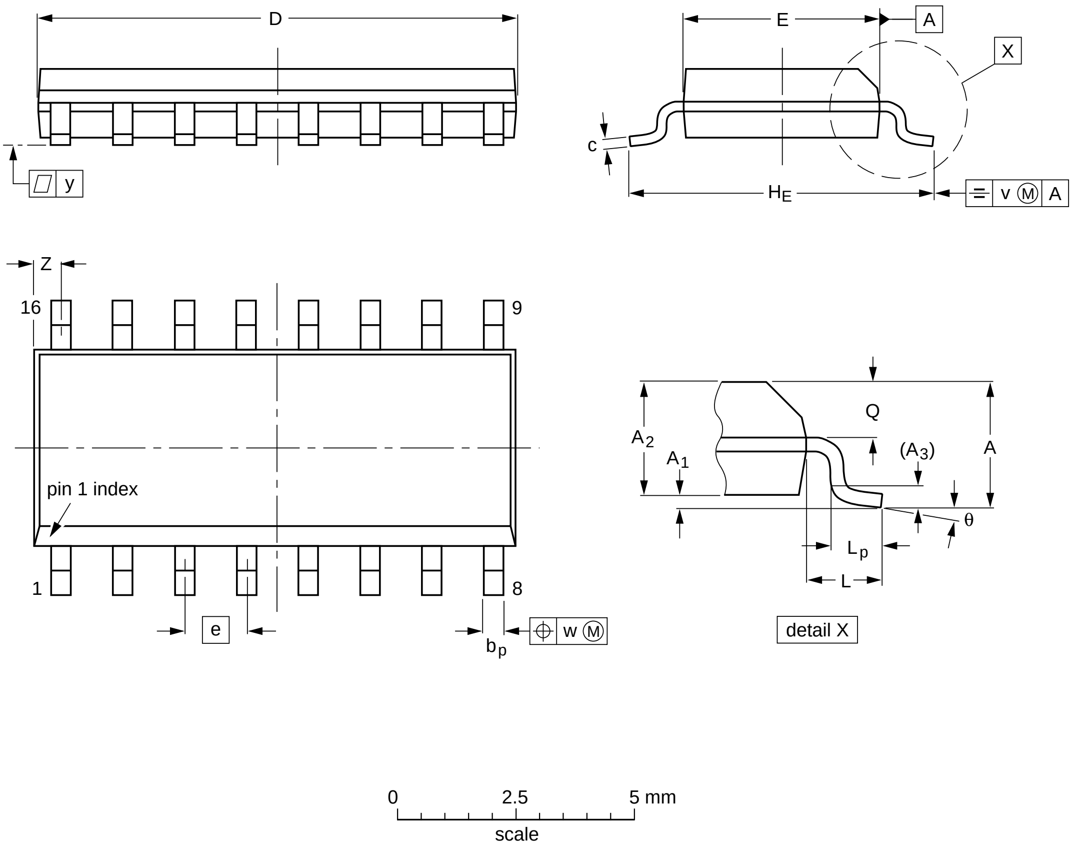
UNIT	A max.	A_1 min.	A_2 max.	b	b_1	c	$D^{(1)}$	$E^{(1)}$	e	e_1	L	M_E	M_H	w	$Z^{(1)}$ max.
mm	4.7	0.51	3.7	1.40 1.14	0.53 0.38	0.32 0.23	21.8 21.4	6.48 6.20	2.54	7.62	3.9 3.4	8.25 7.80	9.5 8.3	0.254	2.2
inches	0.19	0.020	0.15	0.055 0.045	0.021 0.015	0.013 0.009	0.86 0.84	0.26 0.24	0.10	0.30	0.15 0.13	0.32 0.31	0.37 0.33	0.01	0.087

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT38-1	050G09	MO-001AE				~~92-10-02~~ 95-01-19

SO16: plastic small outline package; 16 leads; body width 3.9 mm SOT109-1



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	10.0 9.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8^o 0^o
inches	0.069	0.0098 0.0039	0.057 0.049	0.01	0.019 0.014	0.0098 0.0075	0.39 0.38	0.16 0.15	0.050	0.24 0.23	0.041	0.039 0.016	0.028 0.020	0.01	0.01	0.004	0.028 0.012	

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT109-1	076E07S	MS-012AC				~~91-08-13~~ 95-01-23

SOLDERING

Introduction

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted ICs, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our *"IC Package Databook"* (order code 9398 652 90011).

DIP

SOLDERING BY DIPPING OR BY WAVE

The maximum permissible temperature of the solder is 260 °C; solder at this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.

The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified maximum storage temperature ($T_{stg\ max}$). If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

REPAIRING SOLDERED JOINTS

Apply a low voltage soldering iron (less than 24 V) to the lead(s) of the package, below the seating plane or not more than 2 mm above it. If the temperature of the soldering iron bit is less than 300 °C it may remain in contact for up to 10 seconds. If the bit temperature is between 300 and 400 °C, contact may be up to 5 seconds.

SO

REFLOW SOLDERING

Reflow soldering techniques are suitable for all SO packages.

Reflow soldering requires solder paste (a suspension of fine solder particles, flux and binding agent) to be applied to the printed-circuit board by screen printing, stencilling or pressure-syringe dispensing before package placement.

Several techniques exist for reflowing; for example, thermal conduction by heated belt. Dwell times vary between 50 and 300 seconds depending on heating method. Typical reflow temperatures range from 215 to 250 °C.

Preheating is necessary to dry the paste and evaporate the binding agent. Preheating duration: 45 minutes at 45 °C.

WAVE SOLDERING

Wave soldering techniques can be used for all SO packages if the following conditions are observed:

- A double-wave (a turbulent wave with high upward pressure followed by a smooth laminar wave) soldering technique should be used.
- The longitudinal axis of the package footprint must be parallel to the solder flow.
- The package footprint must incorporate solder thieves at the downstream end.

During placement and before soldering, the package must be fixed with a droplet of adhesive. The adhesive can be applied by screen printing, pin transfer or syringe dispensing. The package can be soldered after the adhesive is cured.

Maximum permissible solder temperature is 260 °C, and maximum duration of package immersion in solder is 10 seconds, if cooled to less than 150 °C within 6 seconds. Typical dwell time is 4 seconds at 250 °C.

A mildly-activated flux will eliminate the need for removal of corrosive residues in most applications.

REPAIRING SOLDERED JOINTS

Fix the component by first soldering two diagonally-opposite end leads. Use only a low voltage soldering iron (less than 24 V) applied to the flat part of the lead. Contact time must be limited to 10 seconds at up to 300 °C. When using a dedicated tool, all other leads can be soldered in one operation within 2 to 5 seconds between 270 and 320 °C.

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.