

High voltage controller for CRT displays

BA9755S

The BA9755S is an LSI chip with a chopper voltage controller designed to control the anode voltage of multiscan monitors and other CRTs. There are two internal high-precision power supplies, each with an output voltage precision of $\pm 1\%$. Using a high-precision voltage detection resistor makes it possible to set anode voltage without adjustment. Other internal components include an output voltage error detector and an overcurrent detector, which detects overcurrent when the power is turned on.

●Applications

CRT displays and HDTV products

●Features

- 1) Internal chopper voltage controller.
- 2) Two internal high-precision power supplies, each with an output voltage precision of $\pm 1\%$.
- 3) Internal output voltage error detector.
- 4) Internal buffer circuit that directly drives power MOS-FET for output drive.

●Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Applied voltage 1	V _{cc1}	18 ^{*1}	V
Applied voltage 2	V _{cc2}	20 ^{*2}	V
Power dissipation	P _d	600 ^{*1}	mW
Operating temperature	T _{opr}	– 25 ~ + 75	°C
Storage temperature	T _{stg}	– 55 ~ + 125	°C

* 1 18pin * 2 3pin

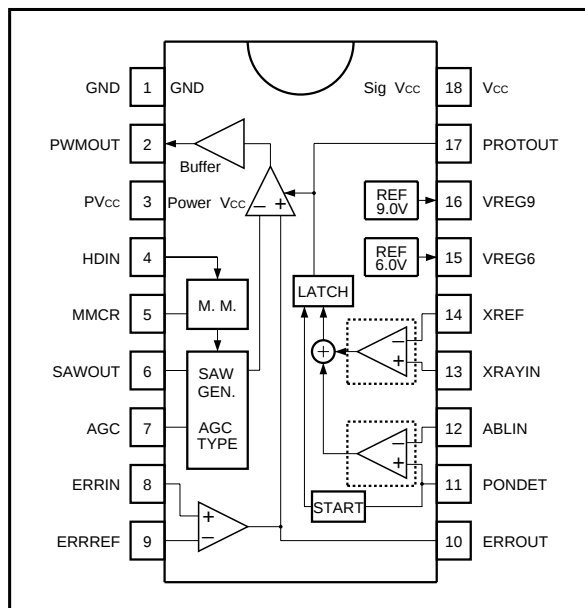
* 3 Reduced by 6.0mW for each increase in Ta of 1°C over 25°C.

●Recommended operating voltage (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Applied voltage 1	V _{cc1}	11 ~ 13	V
Applied voltage 2	V _{cc2}	11 ~ 16	V

* Used with condition V_{cc2} $\geq$ V_{cc1}

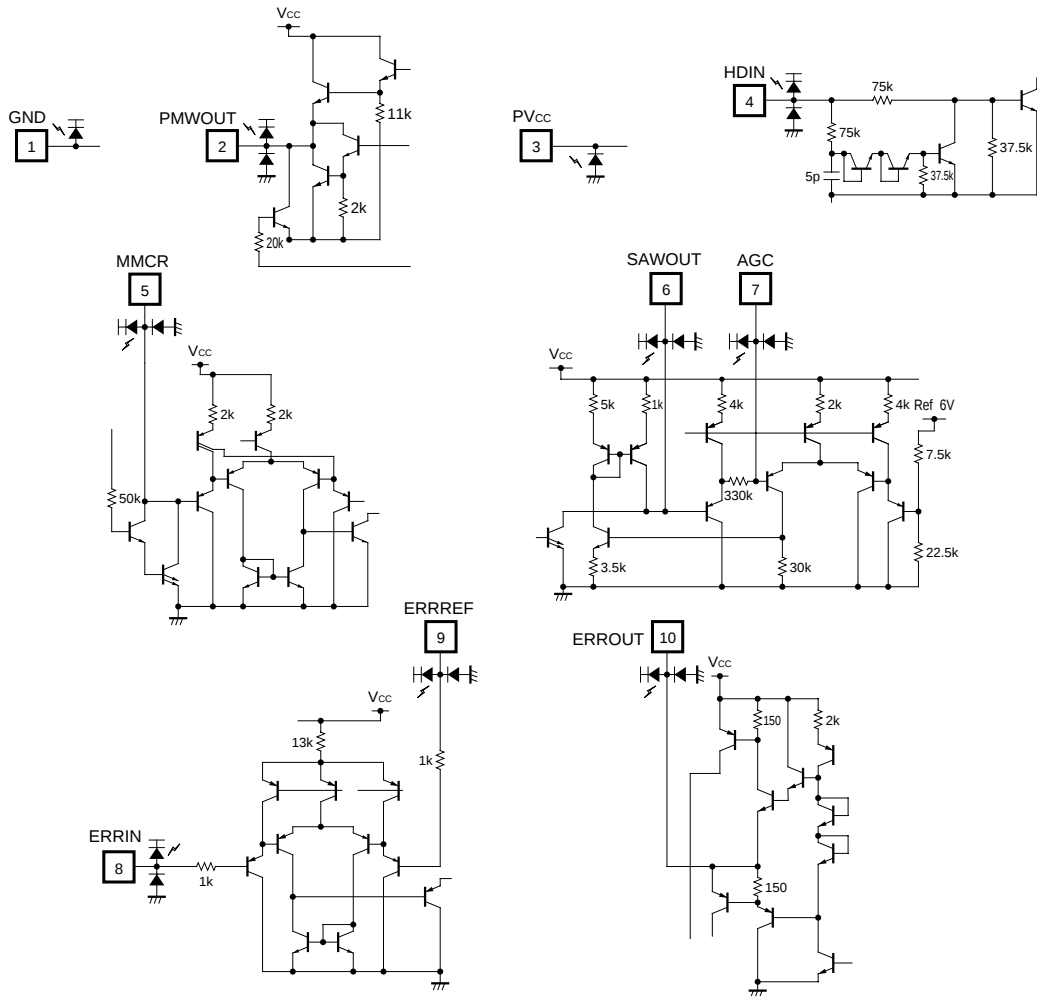
● Block diagram

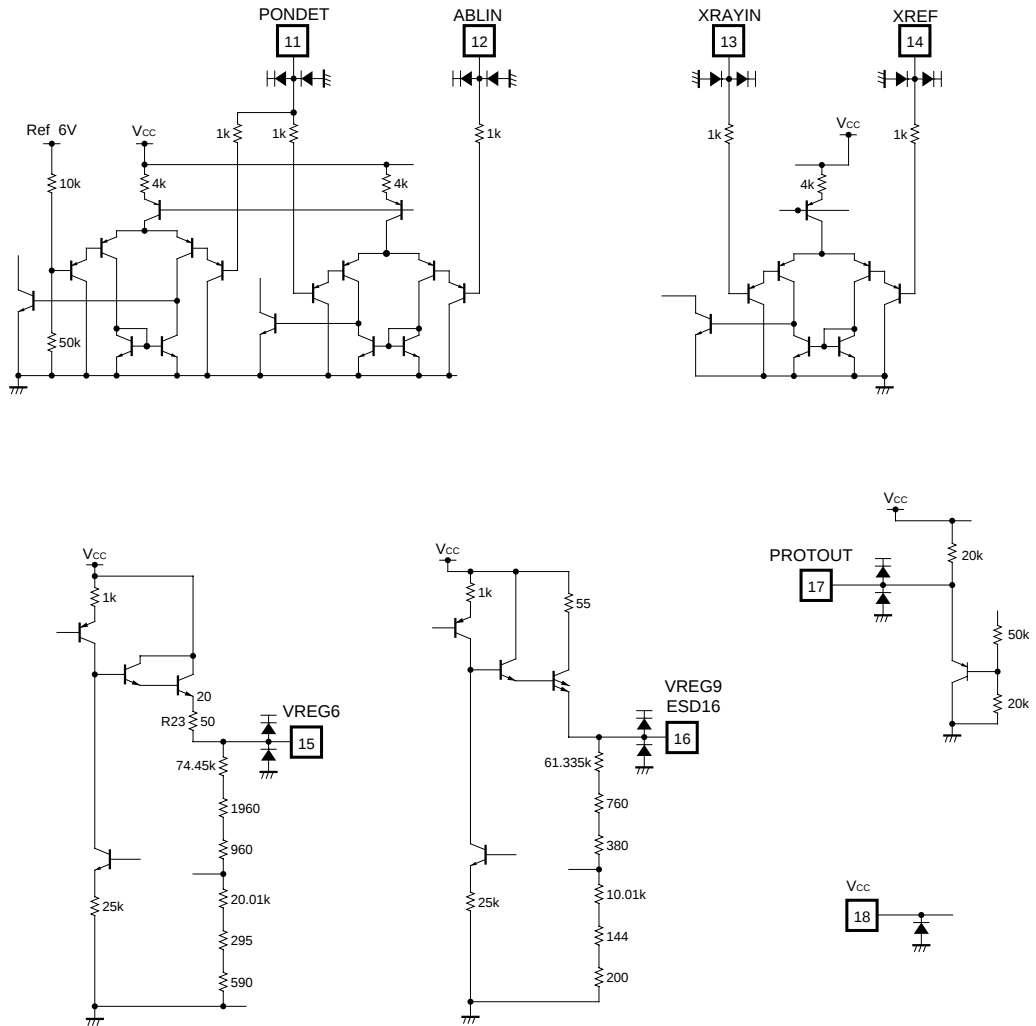


● Pin descriptions

Pin No.	Pin name	Function
1	GND	Ground This is the common ground for the small signal system and the power system, and so requires a stable ground suitable for common impedance.
2	PWMOUT	PWM wave output Output is fixed at the low level when the protector circuit or thermal shutdown circuit is activated.
3	PV _{CC}	Power supply for the power system. Place a decoupling capacitor in proximity to this pin.
4	HDIN	HD pulse input. The input signal should be shorter than the rise time (μ s).
5	MMCR	Internal mono-multi time constant setting. Shifts the phase of the serrated wave. Use a charge resistance higher than 4.7k Ω .
6	SAWOUT	Serrated wave output. Adjust maximum capacity by changing maximum oscillation frequency. $f_{\text{Max. 120kHz}} \rightarrow C = 1000\text{p}$, $f_{\text{Max. 100kHz}} \rightarrow C = 1200\text{p}$ $f_{\text{Max. 80kHz}} \rightarrow C = 1500\text{p}$, $f_{\text{Max. 60kHz}} \rightarrow C = 2000\text{p}$
7	AGC	AGC time constant setting. Set capacity according to the linearity of the minimum oscillation frequency and the response time during frequency change.
8	ERRIN	Input of the error amplifiers feedback voltage.
9	ERRREF	Input of the error amplifiers feedback voltage. When this voltage is given a time constant, the IC soft-starts when the power is turned on.
10	ERROUT	Output of the error detection voltage.
11	PON DET	Setting the time constant for the protector output suppression time and input of the beam protectors reference voltage. This stops the protectors until the system stabilizes. The latch can be unlocked by raising the voltage of this pin above 4.5V.
12	ABLIN	Beam protector input. When the protector is activated, the latch locks and PWM output is fixed at the low level.
13	XRAYIN	X-ray protector input. When the protector is activated, the latch locks and PWM output is fixed at the low level.
14	XREF	Input of the X-ray protector's reference voltage.
15	VREG6	Reference voltage output (6V). Output variation is guaranteed to be 1% or less (with trimming). This circuit is completely separate from the 9V system. Output is stopped when the thermal shutdown circuit is activated. Use a 47 μ F bypass capacitor.
16	VREG9	Reference voltage output (9V). Output variation is guaranteed to be 1% or less (with trimming). This circuit is completely separate from the 6V system. Output is stopped when the thermal shutdown circuit is activated. Use a 10 μ F bypass capacitor.
17	PROTOUT	Protector output. Output changes to the high level when the protector circuit or thermal shutdown circuit is activated.
18	V _{CC}	Power supply for the signal system. Place a decoupling capacitor in proximity to this pin.

● Input / output circuits





●Electrical characteristics (unless otherwise noted, Ta = 25°C, V_{CC} = 12V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Supply current	I _{CC}	—	13	21	mA	S6 = 2
< Error amplifier >						
Input bias current	I _B	—	− 45	− 250	nA	S8, 9a, 9b, 9c = 2 ; Vs8, 9 = 0V ; I _{BS} (I _{BS}) = V8 (V9) × 10 ^{−5}
Input offset voltage	V _{IO}	—	± 1	± 5	mV	S9b, 9c = 3 ; V _{IO} = V10 × 10 ^{−2}
Output voltage, Low	V _{OL}	0	0.2	0.5	V	S9a, 9c = 2 ; Vs9 = 6V
Output voltage, High	V _{OH}	10	10.5	—	V	S9a, 9c = 2 ; Vs9 = 4V
Open loop gain	A _V	50	60	—	dB	f = 1kHz, guaranteed performance
Maximum output current	I _{OM}	± 3	± 5	± 7	mA	S10 = 2 ; Vs10 = 12V, 0V
< Protector >						
Input bias current	I _B	—	0	− 50	nA	Vs11, 12, 13, 14 = 0V
Input offset voltage	V _{IO}	—	± 1	± 5	mV	Verify: pin 17 = LO→HI when Vs12 = 6.005V→5.995V Verify: pin 17 = LO→HI when Vs13 = 5.995V→6.005V
Common mode input voltage	V _{ICR}	0	—	10	V	Verify: pin 17 = LO when Vs11 (Vs12 = Vs11 + 0.5V) = 0, 10V Verify: pin 17 = LO when Vs13 (Vs14 = Vs13 + 0.5V) = 0, 10V
Output voltage, High	V _{OH}	10.0	11.0	—	V	S17 = 2 ; Vs12 = 5V ; Is17 = − 50μA
Output voltage, Low	V _{OL}	—	1.0	2.0	V	S17 = 2 ; Is17 = 3mA
< PWM amplifier >						
Output voltage, High level	V _{OH}	9.5	10.5	—	V	S2 = 2 ; Is2 = − 100mA
Output voltage, Low level	V _{OL}	—	1	2	V	S2 = 2 ; Vs8 = 3V ; Is2 = 100mA
Rise time	T _r	—	—	60	ns	Guaranteed performance
Fall time	T _d	—	—	40	ns	Guaranteed performance
Minimum pulse width	T _{Min.}	0.5	—	1.3	μs	S4 = 2 ; Vs8 = 0V ; SG4 = p1 (f = 90kHz) ; threshold = 5V
< Hd input pin >						
Input voltage, High level	V _{IH}	4.0	—	V _{CC}	V	Verify oscillation of SAW GEN. S4 = 2 ; Vs8 = 0V ; SG4 = p1
Input voltage, Low level	V _{IL}	—	—	1.5	V	Verify oscillation of SAW GEN. S4 = 2 ; Vs8 = 0V ; SG4 = p1
Input current, High level	I _{OH}	—	285	420	μA	Vs4 = 12V
Input current, Low level	I _{OL}	—	0	− 1	μA	—
< Monomulti >						
Delay time	T _{dl}	0.3	0.5	0.8	μs	S4 = 2 ; Vs8 = 0V ; SG4 = p1 ; (R = 4.7kΩ, C = 0pF)*1
< SAW GEN >						
Output level, High	H _{OS}	8.0	9.0	10.0	V	HI level of S4 = 2 ; SG4 = p1 ; 6pin output wave form
Output level, Low	L _{OS}	0	0.15	0.35	V	LO level of S4 = 2 ; SG4 = p1 ; 6pin output wave form
Output frequency characteritic	F _{SAW}	150	200	—	kHz	S4 = 2, SG4 = input frequency 1 dB lower than HI level of pin 6 output waveform when SG4 = p2
< Reference voltage source 1 >						
Output voltage	V _{REF9}	8.91	9.0	9.09	V	—
Maximum output current	I _{RMax.}	10	—	—	mA	S15 = 2 ; Is = 10mA ;
Output voltage temperature characteristics	T _{VREF}	− 0.7	—	0.7	%	Ta = − 25°C ~ + 75°C
< Reference voltage source 2 >						
Output voltage	V _{REF6}	5.94	6.0	6.06	V	—
Max. output current	I _{RMax.}	10	—	—	mA	S15 = 2 ; Is = 10mA ;
Output voltage temp. characteristics	T _{VREF}	− 0.7	—	0.7	%	Ta = − 25°C ~ + 75°C
Thermal shutdown	T _{dow}	100	—	—	deg	—

*1 Time between rise of pin 4 input waveform and rise of pin 2 output waveform

● Measurement circuit

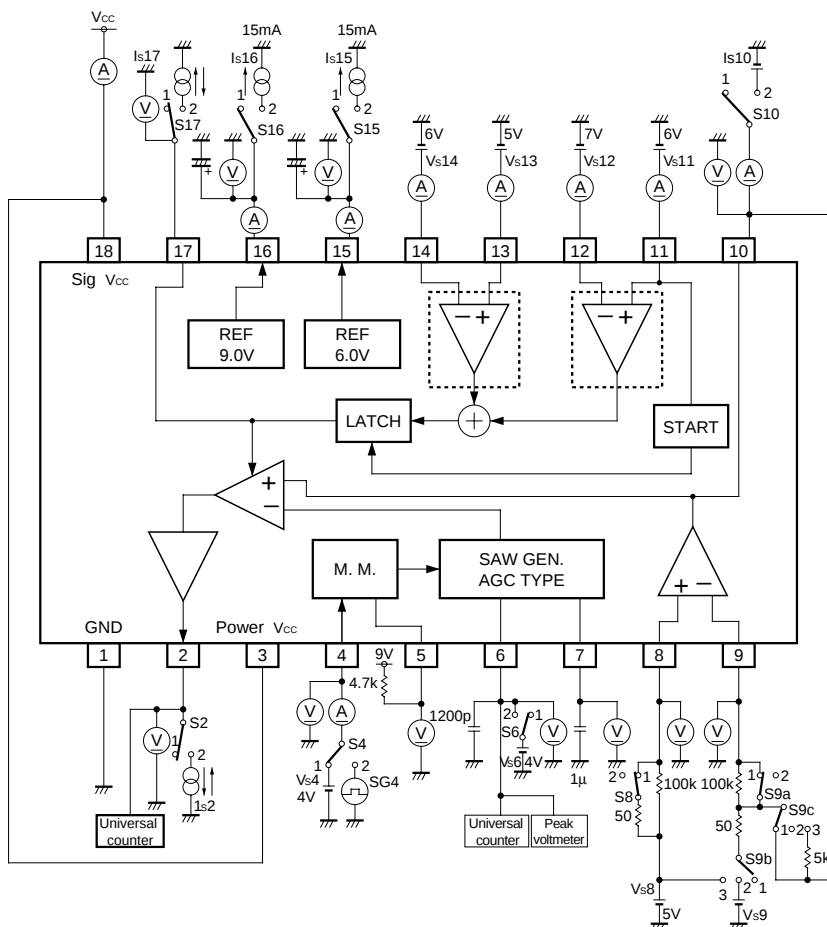
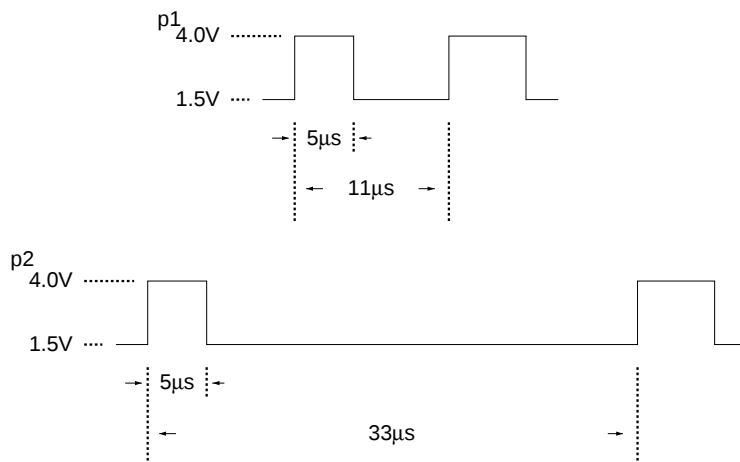


Fig. 1

SG4 input pulse



●Application example

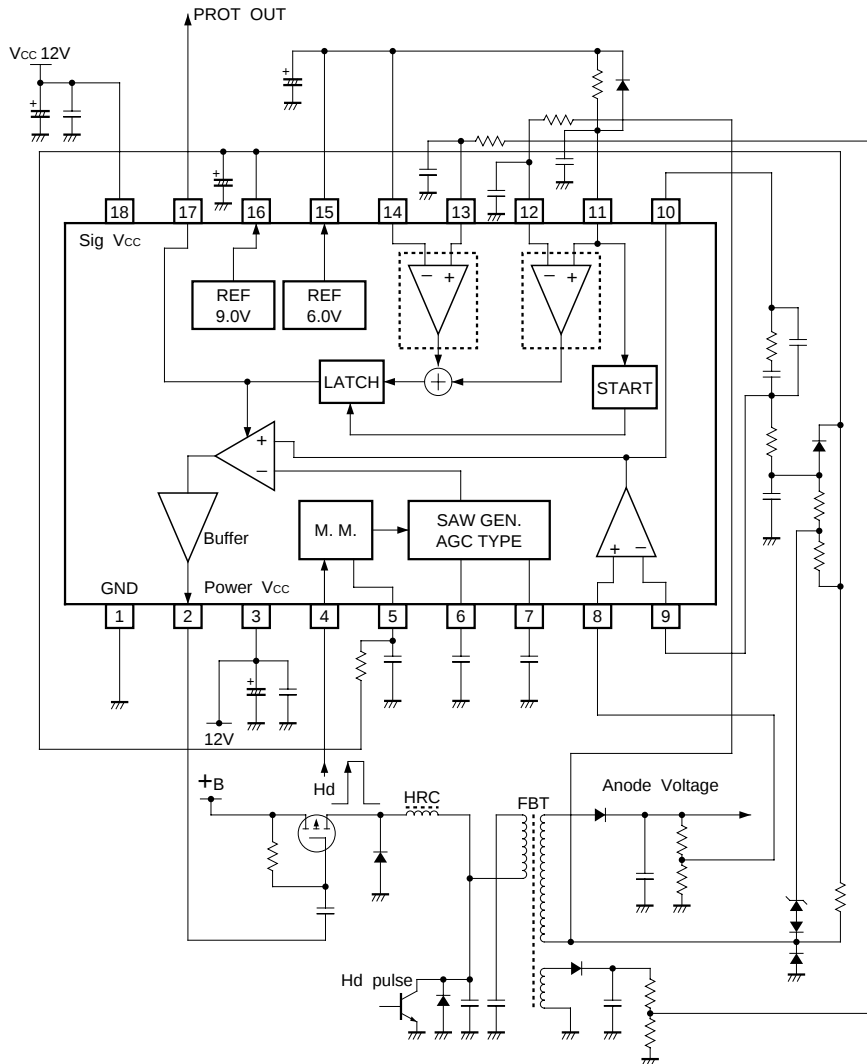


Fig. 2

●Electrical characteristic curves

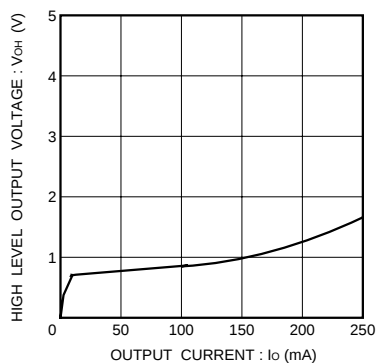


Fig. 3 PWM HIGH output voltage vs. output current

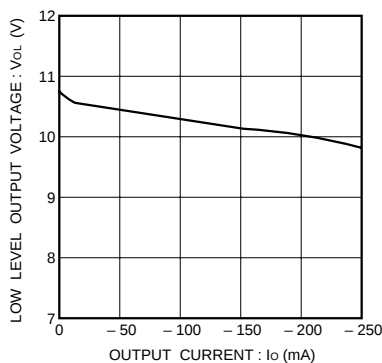


Fig. 4 PWM LOW output voltage vs. output current

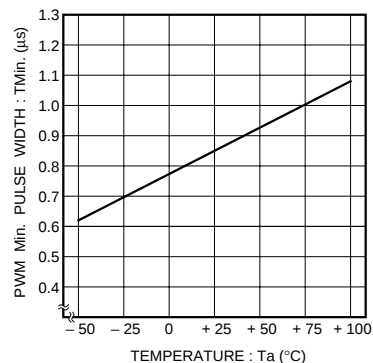


Fig. 5 PWM minimum pulse width vs. temperature

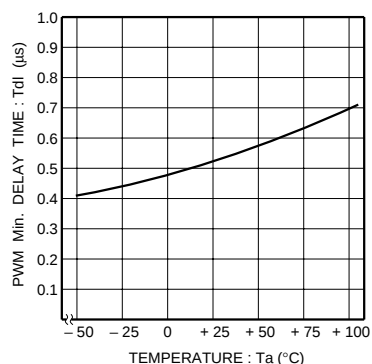


Fig. 6 PWM minimum delay time vs. temperature

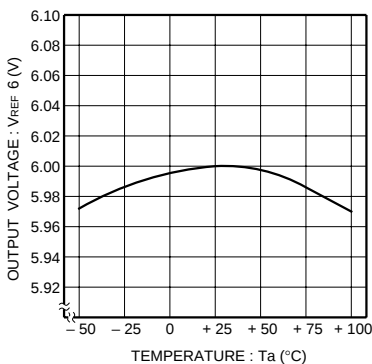


Fig. 7 Output voltage (6V reference voltage) vs. temperature

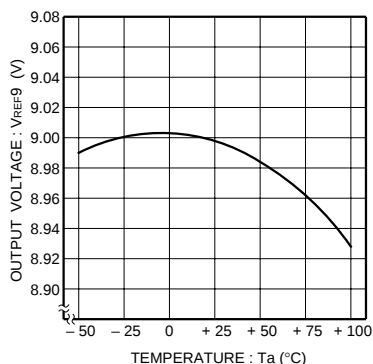


Fig. 8 Output voltage (9V reference voltage) vs. temperature

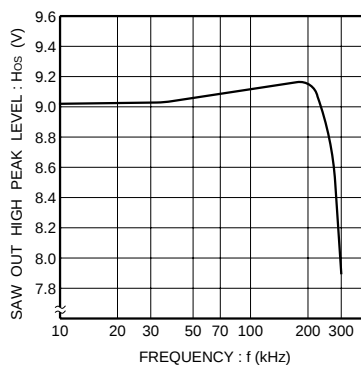
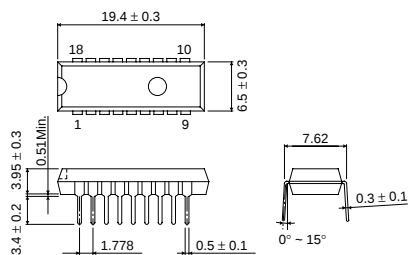


Fig. 9 SAW H peak vs. frequency

● External dimensions (Units: mm)



SDIP18