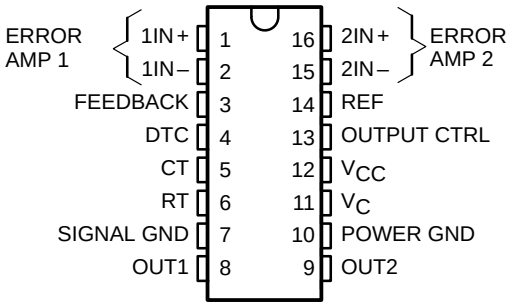
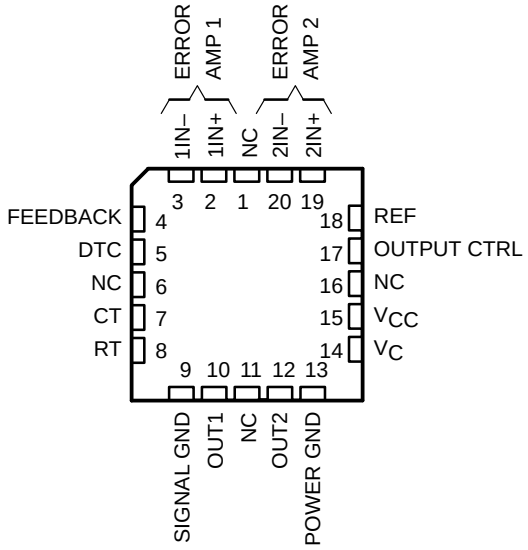
SLVS053B – FEBRUARY 1988 – REVISED OCTOBER 1995

- **Complete PWM Power Control Function**
- **Totem-Pole Outputs for 200-mA Sink or Source Current**
- **Output Control Selects Parallel or Push-Pull Operation**
- **Internal Circuitry Prohibits Double Pulse at Either Output**
- **Variable Dead-Time Provides Control Over Total Range**
- **Internal Regulator Provides a Stable 5-V Reference Supply, Trimmed to 1% Tolerance**
- **On-Board Output Current-Limiting Protection**
- **Undervoltage Lockout for Low V_{CC} Conditions**
- **Separate Power and Signal Grounds**
- **TL598Q Has Extended Temperature Range . . . –40°C to 125°C**

D, J, OR N PACKAGE
(TOP VIEW)



FK PACKAGE
(TOP VIEW)



NC–No internal connection

description

The TL598 incorporates all the functions required in the construction of pulse-width-modulated (PWM) controlled systems on a single monolithic chip. Designed primarily for power supply control, the TL598 provides the systems engineer with the flexibility to tailor the power supply control circuits to a specific application.

The TL598 contains two error amplifiers, an internal oscillator (externally adjustable), a dead-time control (DTC) comparator, a pulse-steering flip-flop, a 5-V precision reference, undervoltage lockout control, and output control circuits. Two totem-pole outputs provide exceptional rise and fall time performance for power FET control. The outputs share a common source supply and common power ground terminals, which allow system designers to eliminate errors caused by high current-induced voltage drops and common-mode noise.

FUNCTION TABLE

INPUT OUTPUT CTRL	OUTPUT FUNCTION
V_I = GND	Single-ended or parallel output
V_I = REF	Normal push-pull operation

AVAILABLE OPTIONS

T_A	PACKAGED DEVICES				CHIP FORM (Y)
	SMALL OUTLINE (D)	CHIP CARRIER (FK)	CERAMIC DIP (J)	PLASTIC DIP (N)	
0°C to 70°C	TL598CD	—	—	TL598CN	TL598Y
–40°C to 125°C	TL598QD	—	—	TL598QN	
–55°C to 125°C	—	TL598MFK	TL598MJ	—	

Chip forms are tested at 25°C.

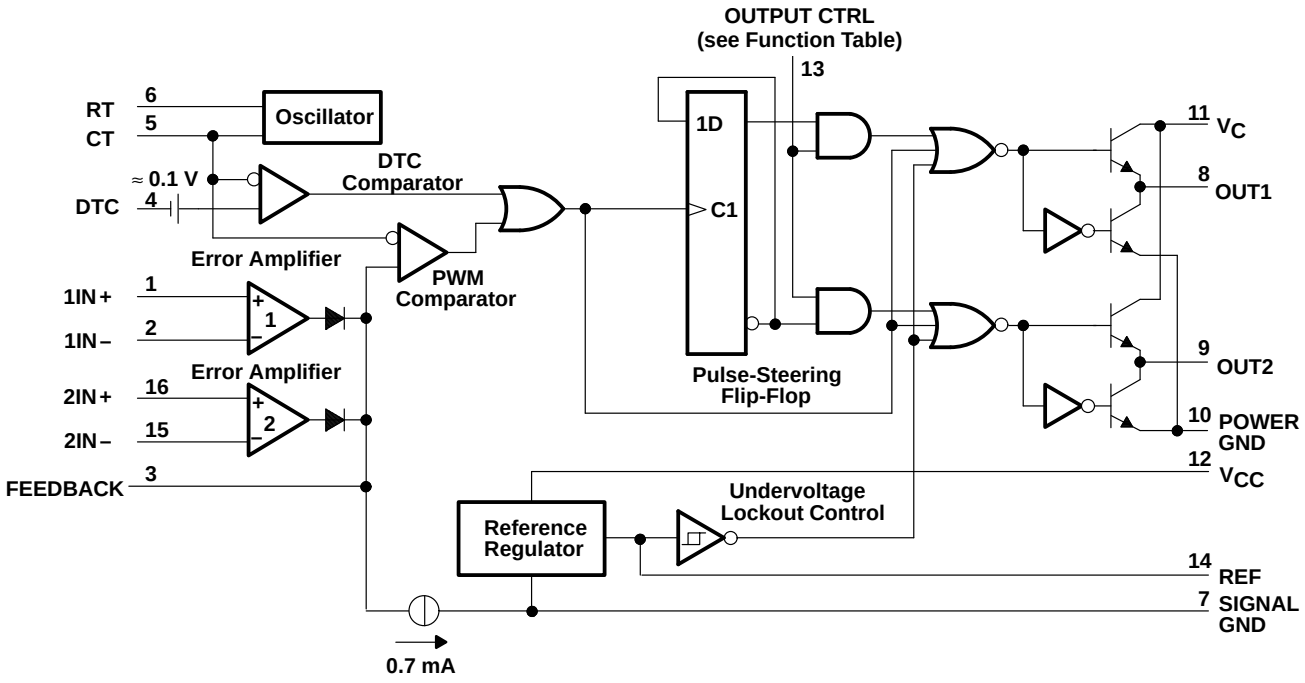
The error amplifier has a common-mode voltage range from 0 V to V_{CC} −2 V. The DTC comparator has a fixed offset that prevents overlap of the outputs during push-pull operation. A synchronous multiple supply operation may be achieved by connecting RT to the reference output and providing a sawtooth input to CT.

The TL598 device provides an output control function to select either push-pull or parallel operation. Circuit architecture prevents either output from being pulsed twice during push-pull operation. The output frequency for push-pull applications is one-half the oscillator frequency $\left(f_o = \frac{1}{2\ RT\ CT}\right)$. For single-ended applications:

$f_o = \frac{1}{RT\ CT}$

The TL598C is characterized for operation from 0°C to 70°C. The TL598Q is characterized for operation from −40°C to 125°C. The TL598M is characterized for operation from −55°C to 125°C.

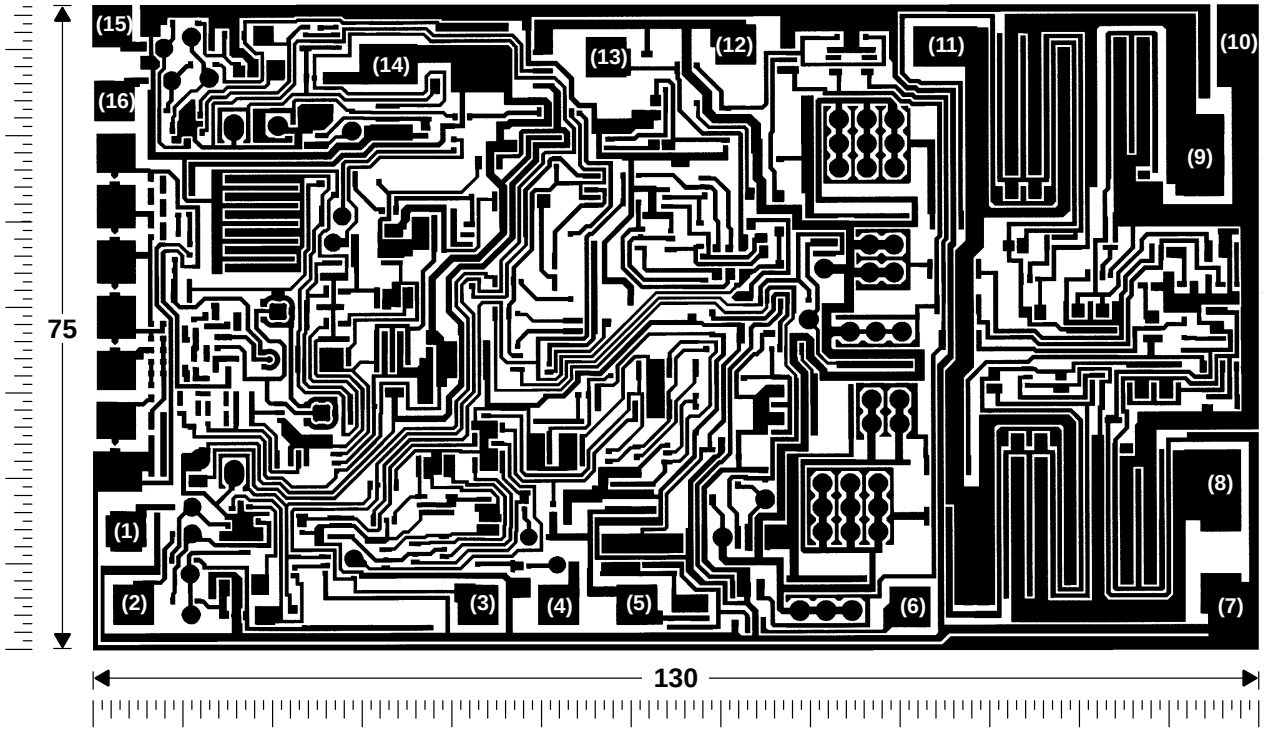
functional block diagram

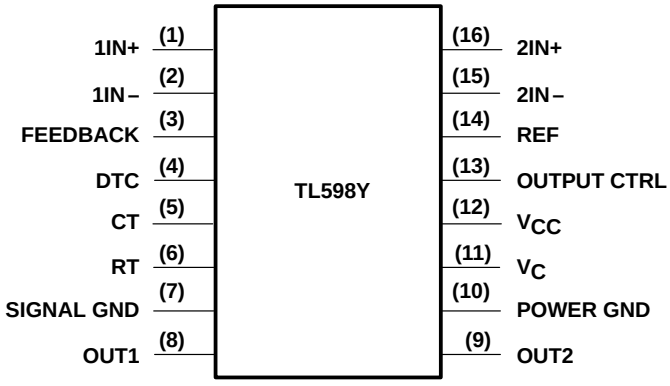


TL598Y chip information

This chip, when properly assembled, displays characteristics similar to the TL598C. Thermal compression or ultrasonic bonding can be used on the doped aluminum bonding pads. The chip can be mounted with conductive epoxy or a gold-silicon preform.

BONDING PAD ASSIGNMENTS





CHIP THICKNESS:
15 MILS TYPICAL

BONDING PADS:
4 × 4 MILS MINIMUM

$T_J$max = 150°C

TOLERANCES ARE ±10%.

ALL DIMENSIONS ARE IN MILS.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage, V_{CC} (see Note 1) . . . . . 41 V
Amplifier input voltage, V_I . . . . . V_{CC} + 0.3 V
Collector voltage . . . . . 41 V
Output current (each output), sink or source, I_O . . . . . 250 mA
Continuous total power dissipation . . . . . See Dissipation Rating Table
Operating virtual junction temperature range, T_J: TL598C . . . . . 0°C to 150°C
TL598Q . . . . . –40°C to 150°C
TL598M . . . . . –55°C to 150°C
Storage temperature range, T_{stg} . . . . . –65°C to 150°C
Case temperature for 60 seconds, T_C: FK package . . . . . 260°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D or N packages . . . . . 260°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: J package . . . . . 300°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: All voltage values, except differential voltages, are with respect to the signal ground terminal.

DISSIPATION RATING TABLE

PACKAGE	$T_A \le 25°C$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25°C$	$T_A = 70°C$ POWER RATING	$T_A = 125°C$ POWER RATING
D	950 mW	7.6 mW/°C	608 mW	190 mW
FK	1375 mW	11 mW/°C	880 mW	275 mW
J	1375 mW	11 mW/°C	800 mW	275 mW
N	1150 mW	9.2 mW/°C	736 mW	230 mW

recommended operating conditions

		MIN	MAX	UNIT
Supply voltage, V_{CC}		7	40	V
Amplifier input voltage, V_I		0	V_{CC}–2	V
Collector voltage			40	V
Output current (each output), sink or source, I_O			200	mA
Current into feedback terminal, I_{IL}			0.3	mA
Timing capacitor, C_T		0.00047	10	μF
Timing resistor, R_T		1.8	500	kΩ
Oscillator frequency, f_{osc}		1	300	kHz
Operating free-air temperature, T_A	TL598C	0	70	°C
	TL598Q	–40	125	
	TL598M	–55	125	

electrical characteristics over recommended operating free-air temperature range, V_{CC} = 15 V (unless otherwise noted)

reference section (see Note 2)

PARAMETER	TEST CONDITIONS†		TL598C			TL598Q			UNIT
			MIN	TYP‡	MAX	MIN	TYP‡	MAX	
Output voltage (REF)	I_O = 1 mA	T_A = 25°C	4.95	5	5.05	4.95	5	5.05	V
		T_A = MIN to MAX	4.9		5.1	4.9		5.1	
Input regulation	V_{CC} = 7 V to 40 V	T_A = 25°C		2	25		2	22	mV
Output regulation	I_O = 1 mA to 10 mA	T_A = 25°C		1	15		1	15	mV
		T_A = MIN to MAX			50			80	
Output voltage change with temperature	ΔT_A = MIN to MAX			2	10		2	10	mV/V
Short-circuit output current§	REF = 0 V		−10	−48		−10	−48		mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ All typical values except for parameter changes with temperature are at T_A = 25°C.
§ Duration of the short circuit should not exceed one second.
NOTE 2: Pulse-testing techniques that maintain the junction temperature as close to the ambient temperature as possible must be used.

oscillator section, C_T = 0.001 μF, R_T = 12 kΩ (see Figure 1) (see Note 2)

PARAMETER	TEST CONDITIONS†	TL598C, TL598Q			UNIT
		MIN	TYP‡	MAX	
Frequency			100		kHz
Standard deviation of frequency¶	All values of V_{CC}, C_T, R_T, T_A constant		100		Hz/kHz
Frequency change with voltage	V_{CC} = 7 V to 40 V, T_A = 25°C		1	10	Hz/kHz
Frequency change with temperature#	ΔT_A = MIN to MAX		70	120	Hz/kHz
	ΔT_A = MIN to MAX, C_T = 0.01 μF		50	80	

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ All typical values except for parameter changes with temperature are at T_A = 25°C.
¶ Standard deviation is a measure of the statistical distribution about the mean as derived from the formula: $\sigma = \sqrt{\dfrac{\sum_{n=1}^{N} (x_n - \overline{X})^2}{N - 1}}$
# Effects of temperature on external R_T and C_T are not taken into account.
NOTE 2: Pulse-testing techniques that maintain the junction temperature as close to the ambient temperature as possible must be used.

error amplifier section (see Note 2)

PARAMETER	TEST CONDITIONS	TL598C, TL598Q			UNIT
		MIN	TYP‡	MAX	
Input offset voltage	FEEDBACK = 2.5 V		2	10	mV
Input offset current	FEEDBACK = 2.5 V		25	250	nA
Input bias current	FEEDBACK = 2.5 V		0.2	1	μA
Common-mode input voltage range	V_{CC} = 7 V to 40 V	0 to V_{CC}−2			V
Open-loop voltage amplification	ΔV_O (FEEDBACK) = 3 V, V_O (FEEDBACK) = 0.5 V to 3.5 V	70	95		dB
Unity-gain bandwidth			800		kHz
Common-mode rejection ratio	V_{CC} = 40 V, ΔV_{IC} = 6.5 V, T_A = 25°C	65	80		dB
Output sink current (FEEDBACK)	FEEDBACK = 0.5 V	0.3	0.7		mA
Output source current (FEEDBACK)	FEEDBACK = 3.5 V	−2			mA
Phase margin at unity gain	FEEDBACK = 0.5 V to 3.5 V, R_L = 2 kΩ		65°		
Supply voltage rejection ratio	FEEDBACK = 2.5 V, ΔV_{CC} = 33 V, R_L = 2 kΩ		100		dB

‡ All typical values except for parameter changes with temperature are at T_A = 25°C.
NOTE 2: Pulse-testing techniques that maintain the junction temperature as close to the ambient temperature as possible must be used.

electrical characteristics over recommended operating free-air temperature range, V_{CC} = 15 V (unless otherwise noted)

undervoltage lockout section (see Note 2)

PARAMETER	TEST CONDITIONS†	TL598C		TL598Q		UNIT
		MIN	MAX	MIN	MAX	
Threshold voltage	T_A = 25°C	4	6	4	6	V
	ΔT_A = MIN to MAX	3.5	6.9	3	6.9	
Hysteresis‡	T_A = 25°C	100		100		mV
	T_A = MIN to MAX	50		30		

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ Hysteresis is the difference between the positive-going input threshold voltage and the negative-going input threshold voltage.
NOTE 2: Pulse-testing techniques must be used that maintain the junction temperature as close to the ambient temperature as possible.

output section (see Note 2)

PARAMETER	TEST CONDITIONS		TL598C, TL598Q		UNIT
			MIN	MAX	
High-level output voltage	V_{CC} = 15 V, V_C = 15 V	I_O = –200 mA	12		V
		I_O = –20 mA	13		
Low-level output voltage	V_{CC} = 15 V, V_C = 15 V	I_O = 200 mA		2	V
		I_O = 20 mA		0.4	
Output control input current	$V_I = V_{ref}$			3.5	mA
	V_I = 0.4 V			100	µA

NOTE 2: Pulse-testing techniques must be used that maintain the junction temperature as close to the ambient temperature as possible.

dead-time control section (see Figure 1) (see Note 2)

PARAMETER	TEST CONDITIONS	TL598C			TL598Q			UNIT
		MIN	TYP§	MAX	MIN	TYP§	MAX	
Input bias current (DTC)	V_I = 0 to 5.25 V		–2	–10		–2	–25	µA
Maximum duty cycle, each output	DTC = 0 V	0.45			0.45			
Input threshold voltage (DTC)	Zero duty cycle		3	3.3		3	3.2	V
	Maximum duty cycle	0			0			

§ All typical values except for parameter changes with temperature are at T_A = 25°C.
NOTE 2: Pulse-testing techniques must be used that maintain the junction temperature as close to the ambient temperature as possible.

pwm comparator section (see Note 2)

PARAMETER	TEST CONDITIONS	TL598C, TL598Q			UNIT
		MIN	TYP§	MAX	
Input threshold voltage (FEEDBACK)	DTC = 0 V		3.75	4.5	V
Input sink current (FEEDBACK)	$V_{(FEEDBACK)}$ = 0.5 V	0.3	0.7		mA

§ All typical values except for parameter changes with temperature are at T_A = 25°C.
NOTE 2: Pulse-testing techniques must be used that maintain the junction temperature as close to the ambient temperature as possible.

total device (see Figure 1) (see Note 2)

PARAMETER	TEST CONDITIONS		TL598C, TL598Q			UNIT
			MIN	TYP§	MAX	
Standby supply current	RT = V_{ref}, All other inputs and outputs open	V_{CC} = 15 V		15	21	mA
		V_{CC} = 40 V		20	26	
Average supply current	DTC = 2 V			15		mA

§ All typical values except for parameter changes with temperature are at T_A = 25°C.
NOTE 2: Pulse-testing techniques must be used that maintain the junction temperature as close to the ambient temperature as possible.

electrical characteristics over recommended operating free-air temperature range, V_{CC} = 15 V (unless otherwise noted)

switching characteristics, T_A = 25°C (see Note 2)

PARAMETER	TEST CONDITIONS			TL598C, TL598Q			UNIT
				MIN	TYP	MAX	
Output voltage rise time	CL = 1500 pF, See Figure 2	VC = 15 V,	VCC = 15 V,		60	150	ns
Output voltage fall time					35	75	

NOTE 2: Pulse-testing techniques must be used that maintain the junction temperature as close to the ambient temperature as possible.

reference section (see Note 2)

PARAMETER	TEST CONDITIONS†		TL598M			UNIT
			MIN	TYP‡	MAX	
Output voltage (REF)	I_O = 1 mA	T_A = 25°C	4.95	5	5.05	V
		T_A = MIN to MAX	4.9		5.1	
Input regulation	V_{CC} = 7 V to 40 V	T_A = 25°C		2	22	mV
Output regulation	I_O = 1 mA to 10 mA	T_A = 25°C		1	15	mV
		T_A = MIN to MAX			80	
Output voltage change with temperature	ΔT_A = MIN to MAX			0.5%		
Short-circuit output current§	REF = 0		−10	−48		mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ All typical values except for parameter changes with temperature are at T_A = 25°C.
§ Duration of the short circuit should not exceed one second.
NOTE 2: Pulse-testing techniques must be used that maintain the junction temperature as close to the ambient temperature as possible.

oscillator section, C_T = 0.001 μF, R_T = 12 kΩ (see Figure 1) (see Note 2)

PARAMETER	TEST CONDITIONS†	TL598M			UNIT
		MIN	TYP‡	MAX	
Frequency			100		kHz
Standard deviation of frequency¶	All values of V_{CC}, C_T, R_T, T_A constant		10%		
Frequency change with voltage	V_{CC} = 7 V to 40 V, T_A = 25°C		0.1%	1%	
Frequency change with temperature#	ΔT_A = MIN to MAX		7%	15%*	

* On products compliant to MIL-STD-883, Class B, this parameter is not production tested.
† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ All typical values except for parameter changes with temperature are at T_A = 25°C.
¶ Standard deviation is a measure of the statistical distribution about the mean as derived from the formula:

$$\sigma = \sqrt{\frac{\sum_{n=1}^{N} (x_n - X)^2}{N - 1}}$$

Effects of temperature on external R_T and C_T are not taken into account.

NOTE 2: Pulse-testing techniques that maintain the junction temperature as close to the ambient temperature as possible must be used.

electrical characteristics over recommended operating free-air temperature range, V_{CC} = 15 V (unless otherwise noted)

error amplifier section (see Note 2)

PARAMETER	TEST CONDITIONS	TL598M			UNIT
		MIN	TYP†	MAX	
Input offset voltage	FEEDBACK at 2.5 V		2	10	mV
Input offset current	FEEDBACK at 2.5 V		25	250	nA
Input bias current	FEEDBACK at 2.5 V		0.2	1	µA
Common-mode input voltage range	V_{CC} = 7 V to 40 V	0 to $V_{CC}-2$			V
Open-loop voltage amplification	ΔV_O (FEEDBACK) = 3 V, V_O (FEEDBACK) = 0.5 V to 3.5 V	70	95		dB
Unity-gain bandwidth			800		kHz
Common-mode rejection ratio	V_{CC} = 40 V, ΔV_{IC} = 6.5 V, T_A = 25°C	65	80		dB
Output sink current (FEEDBACK)	FEEDBACK at 0.5 V	0.3	0.7		mA
Output source current (FEEDBACK)	FEEDBACK at 3.5 V	–2			mA
Phase margin at unity gain	FEEDBACK at 0.5 V to 3.5 V, R_L = 2 kΩ		65°		
Supply voltage rejection ratio	FEEDBACK at 2.5 V, ΔV_{CC} = 33 V, R_L = 2 kΩ		100		dB

† All typical values except for parameter changes with temperature are at T_A = 25°C.
NOTE 2: Pulse-testing techniques must be used that maintain the junction temperature as close to the ambient temperature as possible.

undervoltage lockout section (see Note 2)

PARAMETER	TEST CONDITIONS‡	TL598M		UNIT
		MIN	MAX	
Threshold voltage	T_A = 25°C	4	6	V
	ΔT_A = MIN to MAX	3	6.9	
Hysteresis§	T_A = 25°C	100		mV
	T_A = MIN to MAX	30		

‡ For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
§ Hysteresis is the difference between the positive-going input threshold voltage and the negative-going input threshold voltage.
NOTE 2: Pulse-testing techniques must be used that maintain the junction temperature as close to the ambient temperature as possible.

output section (see Note 2)

PARAMETER	TEST CONDITIONS		TL598M			UNIT
			MIN	TYP	MAX	
Collector off-state current	V_{CE} = 40 V, V_{CC} = 40 V, DTC connected to 0 V			2	100	µA
High-level output voltage	V_{CC} = 15 V,	I_O = –200 mA	12			V
	V_C = 15 V	I_O = –20 mA	13			
Low-level output voltage	V_{CC} = 15 V,	I_O = 200 mA			2	V
	V_C = 15 V	I_O = 20 mA			0.4	
Output control input current	V_I = REF				3.5	mA
	V_I = 0.4 V				100	µA

NOTE 2: Pulse-testing techniques must be used that maintain the junction temperature as close to the ambient temperature as possible.

electrical characteristics over recommended operating free-air temperature range, V_{CC} = 15 V (unless otherwise noted)

dead-time control section (see Figure 1) (see Note 2)

PARAMETER	TEST CONDITIONS	TL598M			UNIT
		MIN	TYP†	MAX	
Input bias current (DTC)	V_I = 0 to 5.25 V		–2	–25	μA
Maximum duty cycle, each output	DTC at 0 V	45%*			
Input threshold voltage (DTC)	Zero duty cycle		3	3.2	V
	Maximum duty cycle	0*			

* On products compliant to MIL-STD-883, Class B, this parameter is not production tested.
† All typical values except for parameter changes with temperature are at T_A = 25°C.
NOTE 2: Pulse-testing techniques must be used that maintain the junction temperature as close to the ambient temperature as possible.

pwm comparator section (see Note 2)

PARAMETER	TEST CONDITIONS	TL598M			UNIT
		MIN	TYP†	MAX	
Input threshold voltage (FEEDBACK)	DTC = 0 V		3.75	4.5	V
Input sink current (FEEDBACK)	$V_{(FEEDBACK)}$ = 0.5 V	0.3	0.7		mA

† All typical values except for parameter changes with temperature are at T_A = 25°C.
NOTE 2: Pulse-testing techniques must be used that maintain the junction temperature as close to the ambient temperature as possible.

total device (see Figure 1) (see Note 2)

PARAMETER	TEST CONDITIONS		TL598M			UNIT
			MIN	TYP†	MAX	
Standby supply current	RT at REF, All other inputs and outputs open	V_{CC} = 15 V		15	21	mA
		V_{CC} = 40 V		20	26	
Average supply current	DTC at 2 V			15		mA

NOTE 2: Pulse-testing techniques must be used that maintain the junction temperature as close to the ambient temperature as possible.

switching characteristics, T_A = 25°C (see Note 2)

PARAMETER	TEST CONDITIONS			TL598M			UNIT
				MIN	TYP	MAX	
Output voltage rise time	CL = 1500 pF, See Figure 2	VC = 15 V,	VCC = 15 V,			150*	ns
Output voltage fall time						75*	

* On products compliant to MIL-STD-883, Class B, this parameter is not production tested.
NOTE 2: Pulse-testing techniques must be used that maintain the junction temperature as close to the ambient temperature as possible.

electrical characteristics, V_{CC} = 15 V, T_A = 25°C

reference section (see Note 2)

PARAMETER	TEST CONDITIONS	TL598Y			UNIT
		MIN	TYP†	MAX	
Output voltage (REF)	I_O = 1 mA		5		V
Input regulation	V_{CC} = 7 V to 40 V		2		mV
Output regulation	I_O = 1 mA to 10 mA		1		mV
Output voltage change with temperature	ΔT_A = MIN to MAX		2		mV/V
Short-circuit output current‡	REF = 0 V		–48		mA

† All typical values except for parameter changes with temperature are at T_A = 25°C.
‡ Duration of the short circuit should not exceed one second.
NOTE 2 Pulse-testing techniques that maintain the junction temperature as close to the ambient temperature as possible must be used.

oscillator section, C_T = 0.001 μF, R_T = 12 kΩ (see Figure 1) (see Note 2)

PARAMETER	TEST CONDITIONS	TL598Y			UNIT
		MIN	TYP	MAX	
Frequency			100		kHz
Standard deviation of frequency§	All values of V_{CC}, C_T, R_T, T_A constant		100		Hz/kHz
Frequency change with voltage	V_{CC} = 7 V to 40 V,		1		Hz/kHz

§ Standard deviation is a measure of the statistical distribution about the mean as derived from the formula:

$$\sigma = \sqrt{\frac{\sum_{n=1}^{N} (x_n - X)^2}{N - 1}}$$

NOTE 2 Pulse-testing techniques that maintain the junction temperature as close to the ambient temperature as possible must be used.

error amplifier section (see Note 2)

PARAMETER	TEST CONDITIONS	TL598Y			UNIT
		MIN	TYP	MAX	
Input offset voltage	Feedback = 2.5 V		2		mV
Input offset current	Feedback = 2.5 V		25		nA
Input bias current	Feedback = 2.5 V		0.2		μA
Open-loop voltage amplification	ΔV_O (FEEDBACK) = 3 V, V_O (FEEDBACK) = 0.5 V to 3.5 V		95		dB
Unity-gain bandwidth			800		kHz
Common-mode rejection ratio	V_{CC} = 40 V, ΔV_{IC} = 6.5 V,		80		dB
Output sink current (FEEDBACK)	FEEDBACK = 0.5 V		0.7		mA
Phase margin at unity gain	FEEDBACK = 0.5 V to 3.5 V, R_L = 2 kΩ		65°		
Supply voltage rejection ratio	FEEDBACK = 2.5 V, ΔV_{CC} = 33 V, R_L = 2 kΩ		100		dB

NOTE 2 Pulse-testing techniques that maintain the junction temperature as close to the ambient temperature as possible must be used.

electrical characteristics, V_{CC} = 15 V, T_A = 25°C

dead-time control section (see Figure 1) (see Note 2)

PARAMETER	TEST CONDITIONS	TL598Y			UNIT
		MIN	TYP	MAX	
Input bias current (DTC)	V_I = 0 to 5.25 V		–2		μA
Input threshold voltage (DTC)	Zero duty cycle		3		V

NOTE 2 Pulse-testing techniques that maintain the junction temperature as close to the ambient temperature as possible must be used.

pwm comparator section (see Note 2)

PARAMETER	TEST CONDITIONS	TL598Y			UNIT
		MIN	TYP	MAX	
Input threshold voltage (FEEDBACK)	DTC = 0 V		3.75		V
Input sink current (FEEDBACK)	FEEDBACK = 0.5 V		0.7		mA

NOTE 2 Pulse-testing techniques that maintain the junction temperature as close to the ambient temperature as possible must be used.

total device (see Figure 1) (see Note 2)

PARAMETER	TEST CONDITIONS		TL598Y			UNIT
			MIN	TYP	MAX	
Standby supply current	RT = V_{ref}, All other inputs and outputs open	V_{CC} = 15 V		15		mA
		V_{CC} = 40 V		20		
Average supply current	DTC = 2 V			15		mA

NOTE 2 Pulse-testing techniques that maintain the junction temperature as close to the ambient temperature as possible must be used.

PARAMETER MEASUREMENT INFORMATION

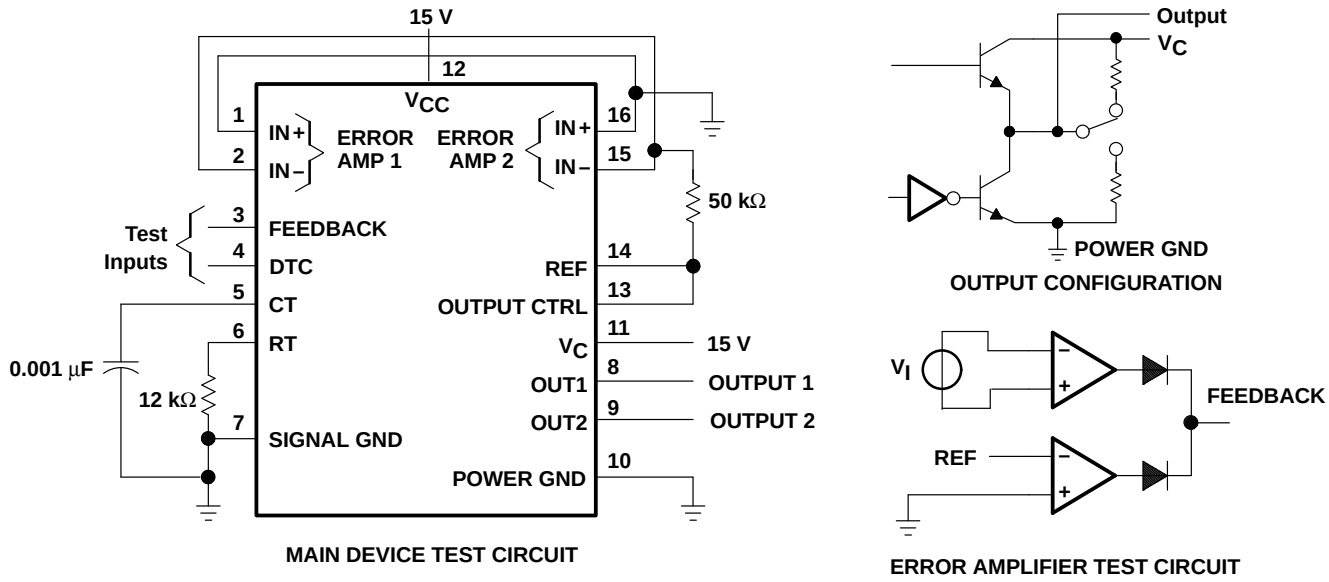


Figure 1. Test Circuits

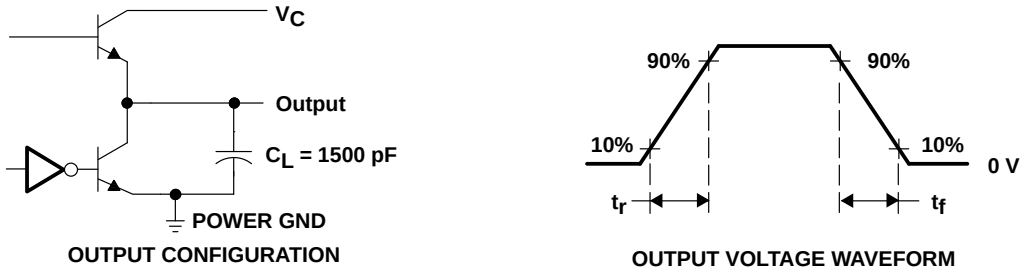
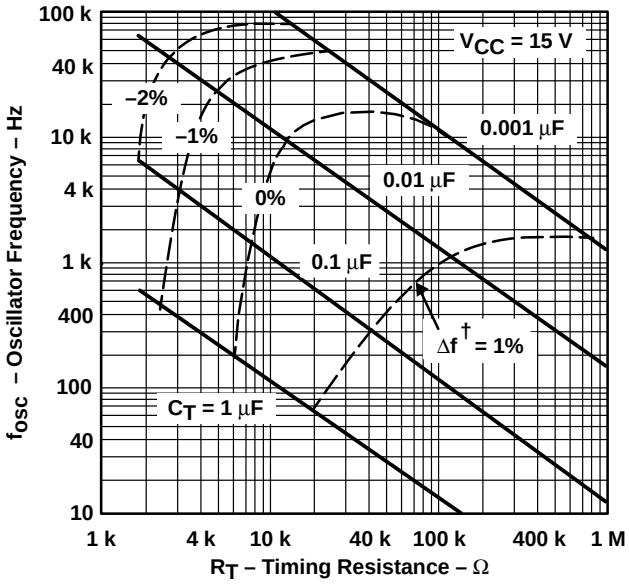


Figure 2. Switching Output Configuration and Voltage Waveform

TYPICAL CHARACTERISTICS

OSCILLATOR FREQUENCY AND FREQUENCY VARIATION † vs TIMING RESISTANCE



† Frequency variation (Δf) is the change in predicted oscillator frequency that occurs over the full temperature range.

Figure 3

AMPLIFIER VOLTAGE AMPLIFICATION vs FREQUENCY

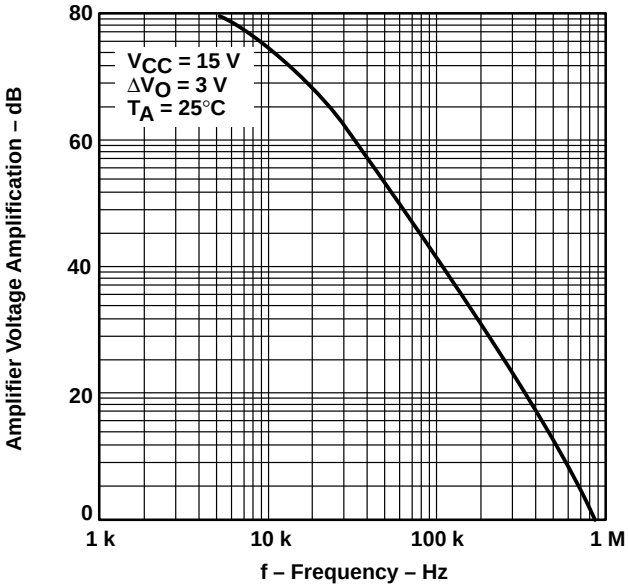


Figure 4

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