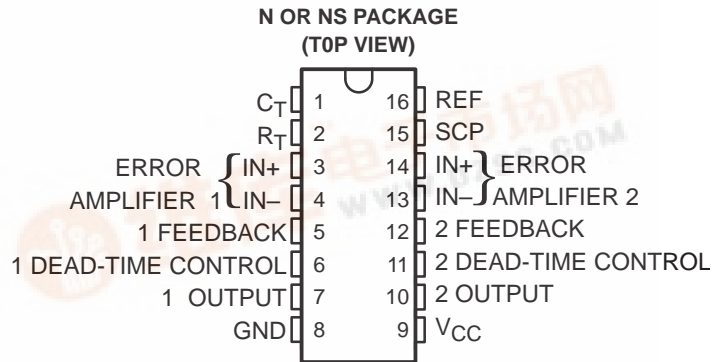


DUAL PULSE-WIDTH-MODULATION CONTROL CIRCUIT

SLVS039A – FEBRUARY 1990 – REVISED DECEMBER 1990

- Complete PWM Power Control Circuitry
- Completely Synchronized Operation
- Internal Undervoltage Lockout Protection
- Wide Supply Voltage Range
- Oscillator Frequency . . . 500 kHz Max
- Variable Dead Time Provides Control Over Total Range
- Internal Regulator Provides a Stable 2.5-V Reference Supply



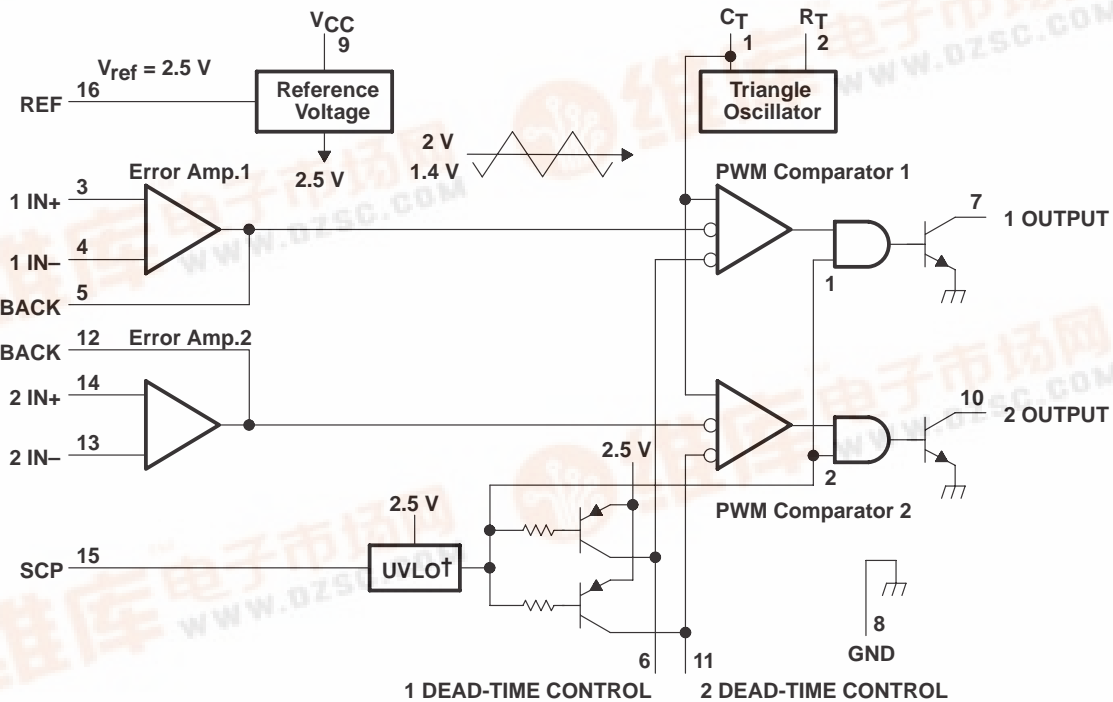
description

The TL1453C incorporates the functions required in the construction of two pulse-width-modulation control circuits on a single monolithic chip. Designed primarily for power supply control, the TL1453C contains an on-chip 2.5-V regulator, two error amplifiers, an adjustable oscillator, two dead-time comparators, undervoltage lockout circuitry, and dual common-emitter output transistor circuits.

The uncommitted output transistors provide common-emitter output capability for each controller. The internal amplifiers exhibit a common-mode voltage range from 1.05 V to 1.45 V. The dead-time control comparator has no offset unless externally altered and may be used to provide 0% to 100% dead time. The on-chip oscillator may be operated by terminating R_T (pin 2) and C_T (pin 1). During low- V_{CC} conditions, the undervoltage lockout control circuit feature inhibits the output until the internal circuitry is operational.

The TL1453C is characterized for operation from -20°C to 85°C .

functional block diagram



† UVLO = Undervoltage Lockout Protection



TL1453C

DUAL PULSE-WIDTH-MODULATION CONTROL CIRCUIT

SLVS039A – FEBRUARY 1990 – REVISED DECEMBER 1990

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

Supply voltage, V_{CC} (see Note 1)	41 V
Amplifier input voltage	20 V
Collector output voltage	51 V
Collector output current	21 mA
Continuous total power dissipation	See Dissipation Rating Table
Operating free-air temperature range, T_A	-20°C to 85°C
Storage temperature range	-65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C

NOTE 1: All voltage values are with respect to network ground terminal.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$	$T_A = 85^\circ\text{C}$ POWER RATING
N	1000 mW	8 mW/°C	520 mW
NS	725 mW	5.8 mW/°C	397 mW

recommended operating conditions

	MIN	MAX	UNIT
Supply voltage, V_{CC}	3.6	40	V
Amplifier input voltage, V_I	1.05	1.45	V
Collector output voltage, V_O		50	V
Collector output current		20	mA
Current into feedback terminal		45	μA
Feedback resistor, R_F	100		k Ω
Timing capacitor, C_T	150	15000	pF
Timing resistor, R_T	5.1	100	k Ω
Oscillator frequency	1	500	kHz
Operating free-air temperature, T_A	-20	85	°C

electrical characteristics over recommended operating free-air temperature range, $V_{CC} = 6\text{ V}$, $f = 200\text{ kHz}$ (unless otherwise noted)

reference section

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
Output voltage (pin 16)	$I_O = 1\text{ mA}$	2.4	2.5	2.6	V
Output voltage change with temperature	$T_A = -20^\circ\text{C}$ to 25°C		-0.1%	$\pm 1\%$	
	$T_A = 25^\circ\text{C}$ to 85°C		-0.2%	$\pm 1\%$	
Input regulation	$V_{CC} = 3.6\text{ V}$ to 40 V		2	12.5	mV
Output regulation	$I_O = 0.1\text{ mA}$ to 1 mA		1	7.5	mV
Short-circuit output current	$V_O = 0$	3	10	30	mA

† All typical values are at $T_A = 25^\circ\text{C}$.

TL1453C

DUAL PULSE-WIDTH-MODULATION CONTROL CIRCUIT

SLVS039A – FEBRUARY 1990 – REVISED DECEMBER 1990

electrical characteristics over recommended operating free-air temperature range, $V_{CC} = 6\text{ V}$, $f = 200\text{ kHz}$ (unless otherwise noted) (continued)

undervoltage lockout section

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
Upper threshold voltage (pin 9)	$I_{Oref} = 0.1\text{ mA}$, $T_A = 25^\circ\text{C}$		2.72		V
Lower threshold voltage (pin 9)	$I_{Oref} = 0.1\text{ mA}$, $T_A = 25^\circ\text{C}$		2.6		V
Hysteresis (pin 9)	$I_{Oref} = 0.1\text{ mA}$, $T_A = 25^\circ\text{C}$	80	120		mV

oscillator section

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
Frequency	$C_T = 330\text{ pF}$, $R_T = 10\text{ k}\Omega$		200		kHz
Standard deviation of frequency	V_{CC} , T_A , R_T , C_T values are constant		10%		
Frequency change with voltage	$V_{CC} = 3.6\text{ V to }40\text{ V}$		1%		
Frequency change with temperature	$T_A = -20^\circ\text{C to }25^\circ\text{C}$		-0.4%	±2%	
	$T_A = 25^\circ\text{C to }85^\circ\text{C}$		-0.2%	±2%	

dead-time control section

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
Input bias current (pins 6 and 11)				1	μA
Input threshold voltage at $f = 10\text{ kHz}$ (pins 6 and 11)	Zero duty cycle		2.05	2.25	V
	Maximum duty cycle	1.2	1.45		

error-amplifier section

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
Input offset voltage	V_O (pins 5 and 12) = 1.25 V			±6	mV
Input offset current	V_O (pins 5 and 12) = 1.25 V			±100	nA
Input bias current	V_O (pins 5 and 12) = 1.25 V		160	500	nA
Common-mode input voltage range	$V_{CC} = 3.6\text{ V to }40\text{ V}$	1.05 to 1.45			V
Open-loop voltage amplification	$R_F = 200\text{ k}\Omega$	70	80		dB
Unity-gain bandwidth			1.5		MHz
Common-mode rejection ratio		60	80		dB
Positive output voltage swing		$V_{ref} - 0.1$			V
Negative output voltage swing				1	V
Output (sink) current (pins 5 and 12)	$V_{ID} = -0.1\text{ V}$, $V_O = 1.25\text{ V}$	0.5	1.6		mA
Output (source) current (pins 5 and 12)	$V_{ID} = 0.1\text{ V}$, $V_O = 1.25\text{ V}$	-45	-70		μA

output section

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
Collector off-state current	$V_{CC} = 0$, $V_O = 50\text{ V}$			10	μA
	$V_O = 50\text{ V}$			10	
Output saturation voltage	$I_O = 10\text{ mA}$		1.2	2	V
Short-circuit output current	$V_O = 6\text{ V}$		90		mA

† All typical values are at $T_A = 25^\circ\text{C}$.

TL1453C

DUAL PULSE-WIDTH-MODULATION CONTROL CIRCUIT

SLVS039A – FEBRUARY 1990 – REVISED DECEMBER 1990

electrical characteristics over recommended operating free-air temperature range, $V_{CC} = 6\text{ V}$, $f = 200\text{ kHz}$ (unless otherwise noted) (continued)

pwm comparator section

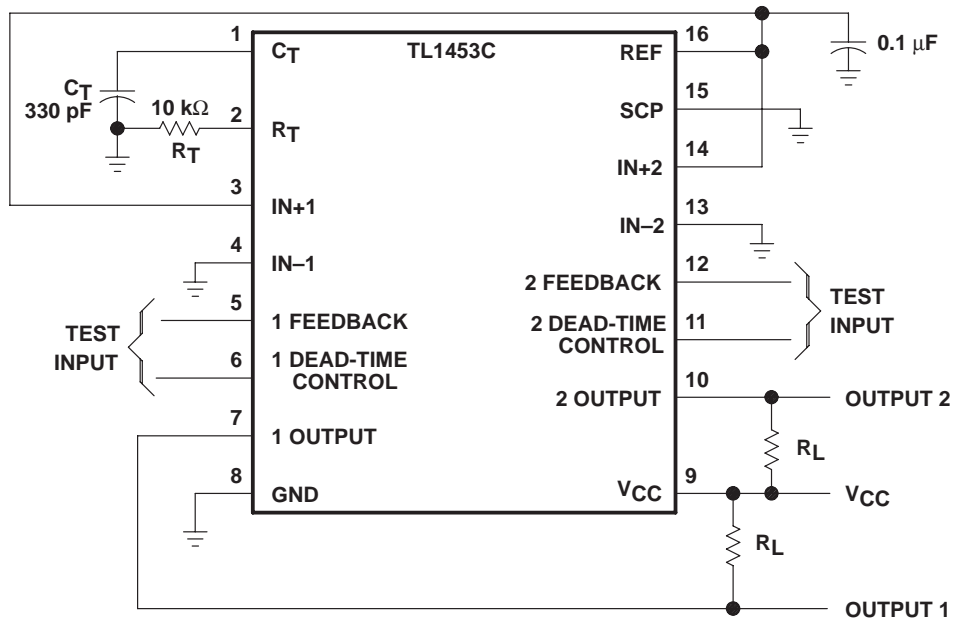
PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
Input threshold voltage at $f = 10\text{ kHz}$ (pins 5 and 12)	Zero duty cycle		2.05	2.25	V
	Maximum duty cycle	1.2	1.45		
Input (sink) current (pins 5 and 12)	$V_I = 1.25\text{ V}$	0.5	1.6		mA
Input (source) current (pins 5 and 12)	$V_I = 1.25\text{ V}$	-45	-70		μA

total device

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
Standby supply current	Off-state		1.3	1.8	mA
Average supply current	$R_T = 10\text{ k}\Omega$		1.7	2.4	mA

† All typical values are at $T_A = 25^\circ\text{C}$.

test circuit



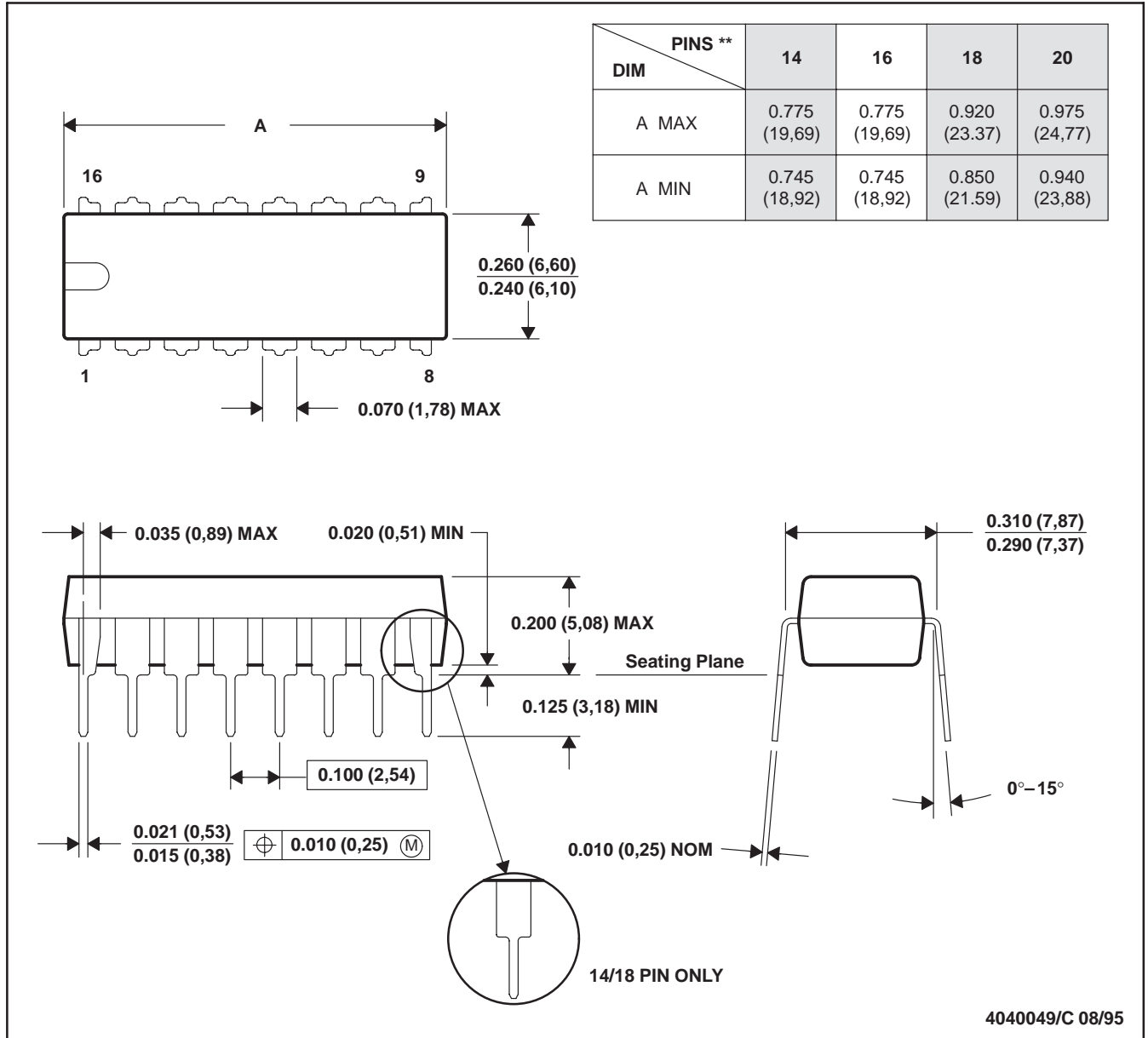
TL1453C DUAL PULSE-WIDTH-MODULATION CONTROL CIRCUIT

SLVS039A – FEBRUARY 1990 – REVISED DECEMBER 1990

N (R-PDIP-T)**

PLASTIC DUAL-IN-LINE PACKAGE

16 PIN SHOWN



- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. Falls within JEDEC MS-001 (20 pin package is shorter than MS-001.)

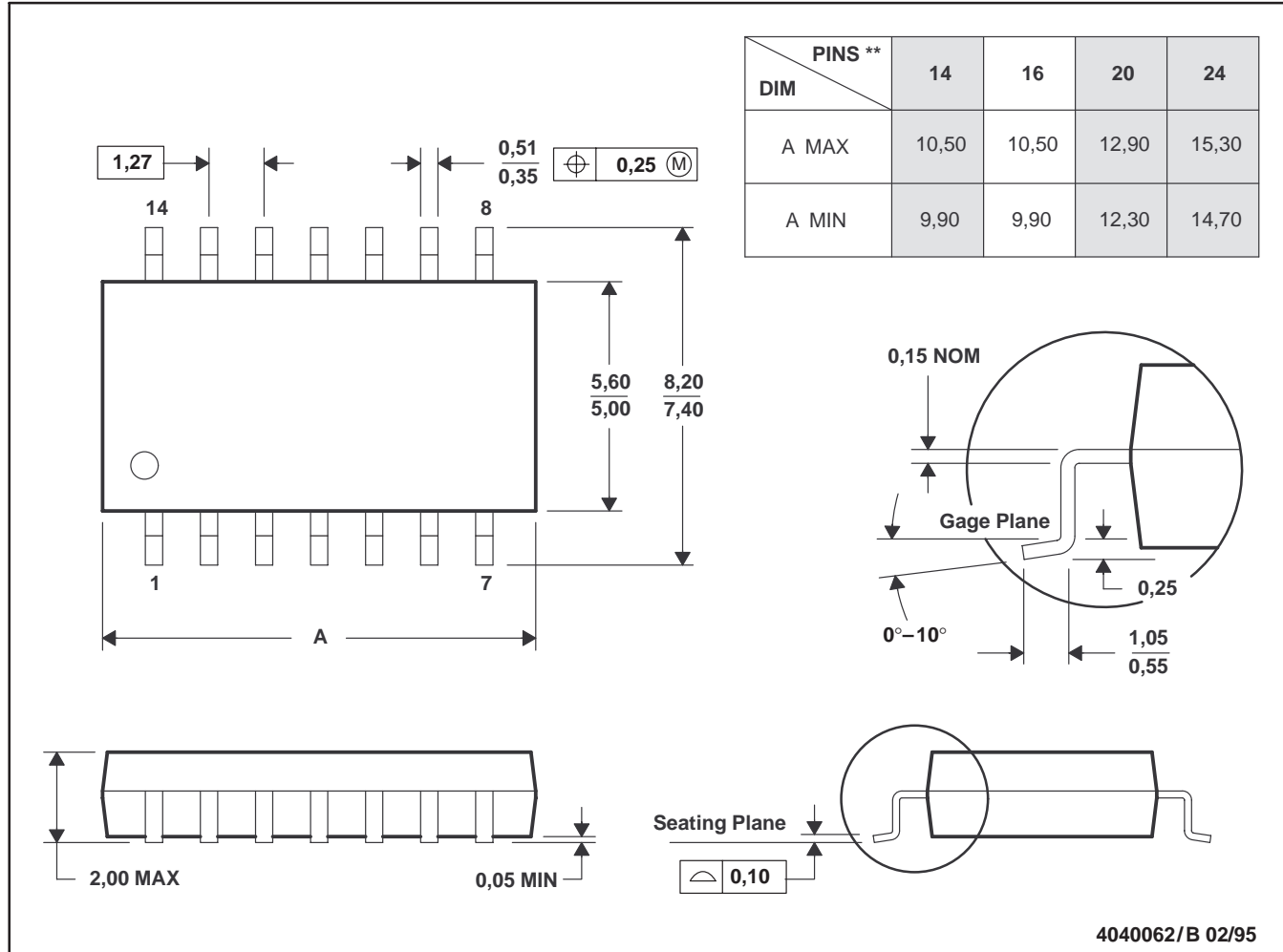
TL1453C DUAL PULSE-WIDTH-MODULATION CONTROL CIRCUIT

SLVS039A – FEBRUARY 1990 – REVISED DECEMBER 1990

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PIN SHOWN



- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

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