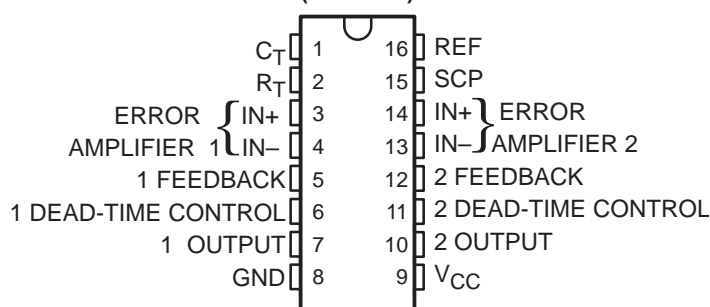


TL1453C DUAL PULSE-WIDTH-MODULATION CONTROL CIRCUIT

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

N OR NS PACKAGE
(TOP VIEW)



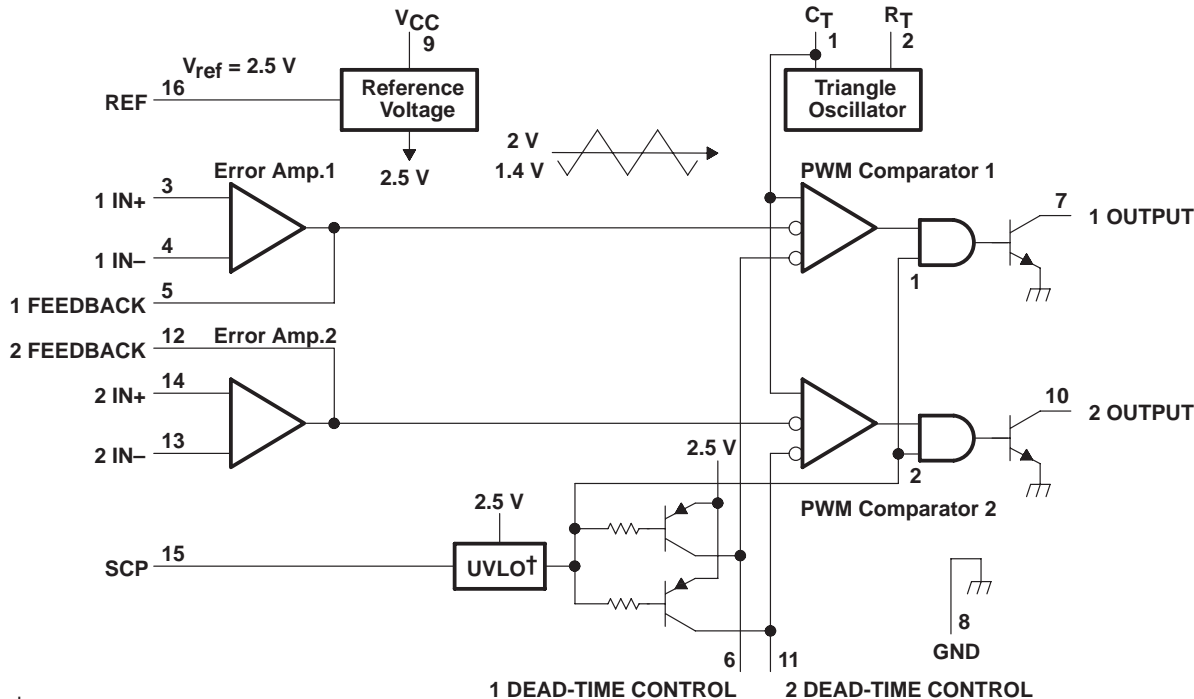
description

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

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 1990, Texas Instruments Incorporated

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		kΩ
Timing capacitor, C_T	150	15000	pF
Timing resistor, R_T	5.1	100	kΩ
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%		±1%	
	$T_A = 25^\circ\text{C}$ to 85°C	–0.2%		±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 $T_A = 25^\circ\text{C}$.



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

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 V		1%		
Frequency change with temperature	$T_A = -20^\circ\text{C}$ to 25°C		-0.4%	$\pm 2\%$	
	$T_A = 25^\circ\text{C}$ to 85°C		-0.2%	$\pm 2\%$	

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 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

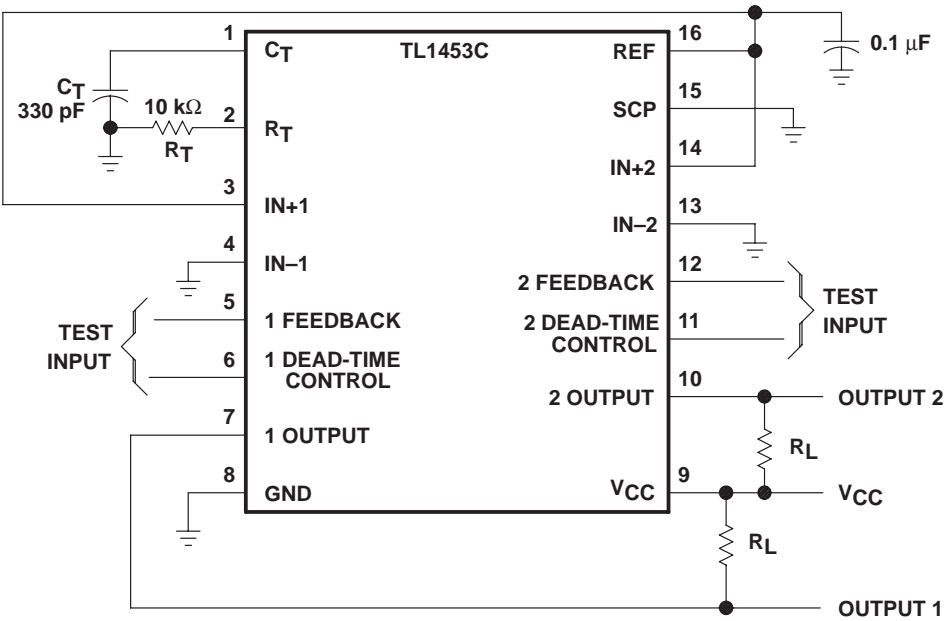
PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
Input threshold voltage at $f = 10\text{ kHz}$ (pins 5 and 12)	Zero duty cycle		2.05	2.25	V
	Maximum duty cycle	1.2	1.45		
Input (sink) current (pins 5 and 12)	$V_I = 1.25\text{ V}$	0.5	1.6		mA
Input (source) current (pins 5 and 12)	$V_I = 1.25\text{ V}$	-45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



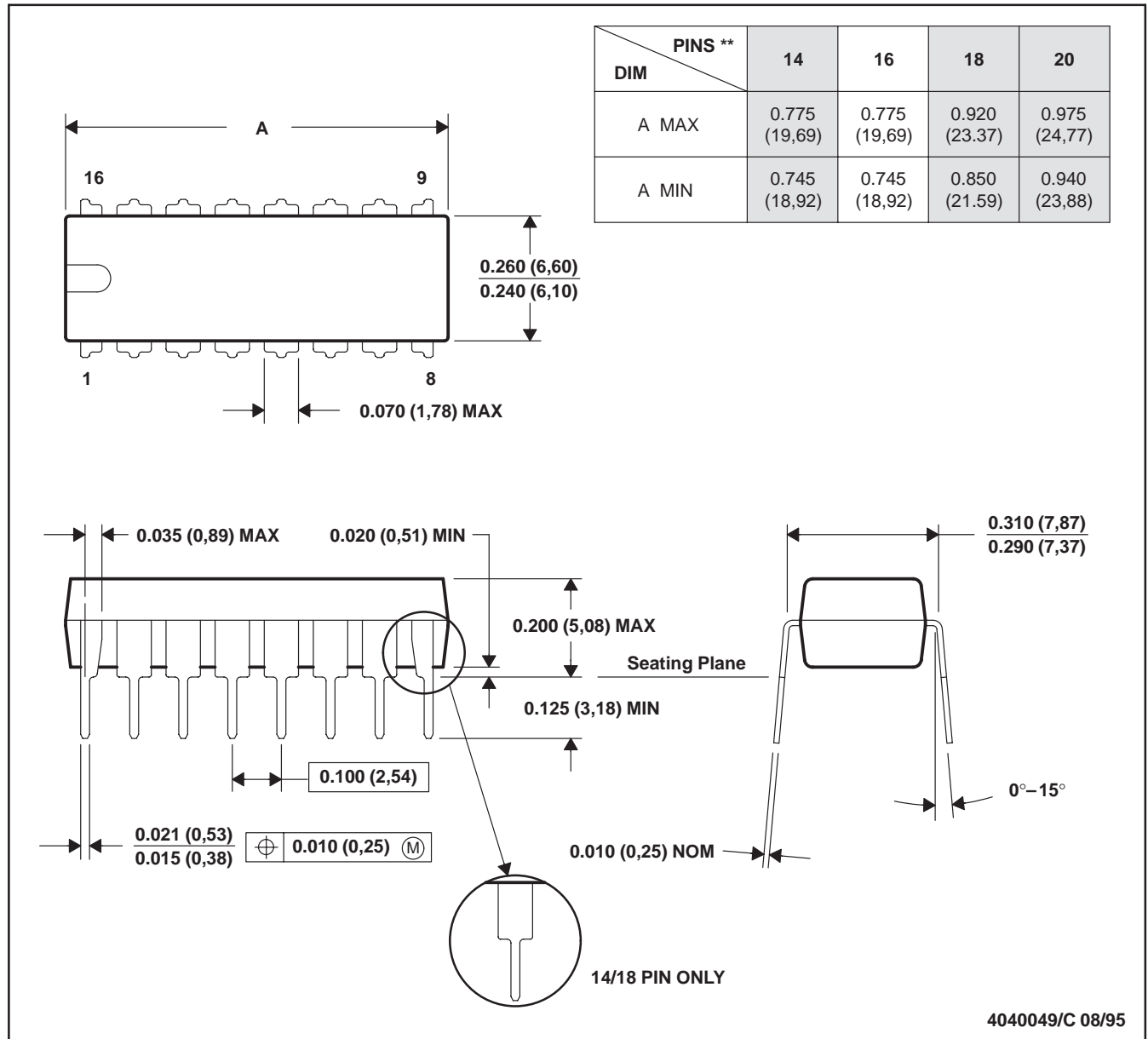
TL1453C DUAL PULSE-WIDTH-MODULATION CONTROL CIRCUIT

SLVS039A – FEBRUARY 1990 – REVISED DECEMBER 1990

N (R-PDIP-T)**

PLASTIC DUAL-IN-LINE PACKAGE

16 PIN SHOWN



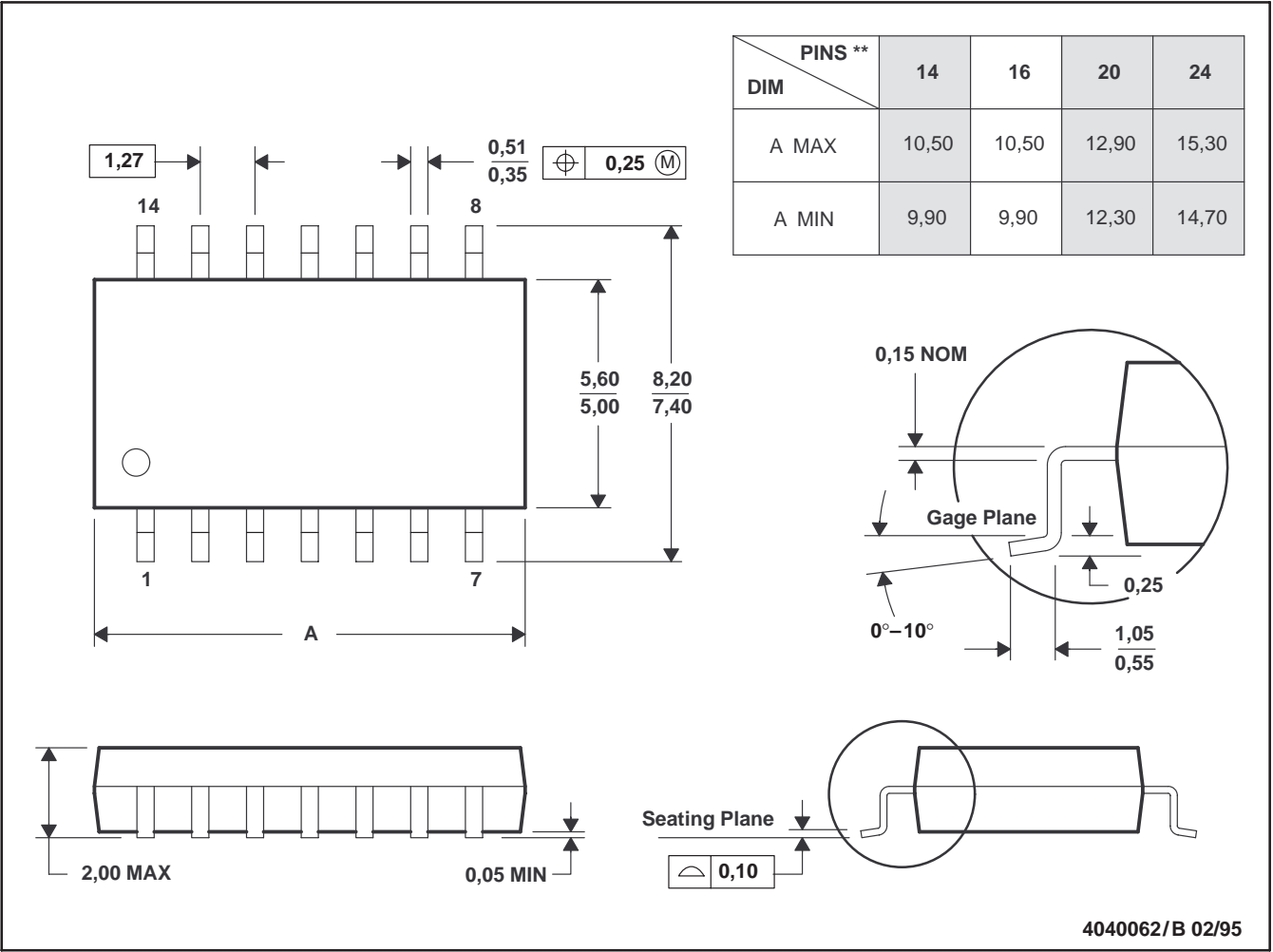
- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. Falls within JEDEC MS-001 (20 pin package is shorter than MS-001.)

TL1453C
DUAL PULSE-WIDTH-MODULATION CONTROL CIRCUIT

SLVS039A – FEBRUARY 1990 – REVISED DECEMBER 1990

NS (R-PDSO-G**)
14 PIN SHOWN

PLASTIC SMALL-OUTLINE PACKAGE



- 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.

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
TL1453CD	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL1453CDG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL1453CN	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TL1453CNE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TL1453CNSLE	OBSOLETE	SO	NS	16		TBD	Call TI	Call TI
TL1453CNSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL1453CNSRG4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL1453CPWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL1453CPWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
Low Power Wireless	www.ti.com/lpw	Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265

Copyright © 2006, Texas Instruments Incorporated