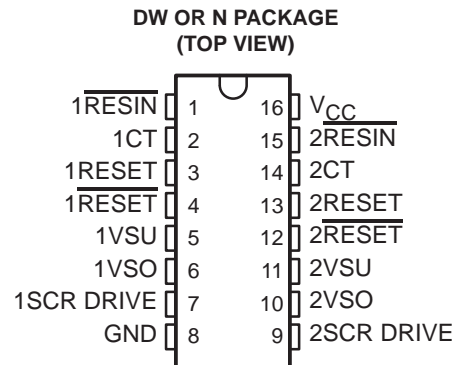


# TL7770-5, TL7770-12 DUAL POWER-SUPPLY SUPERVISORS

SLVS019F – OCTOBER 1987 – REVISED JULY 1999

- Power-On Reset Generator
- Automatic Reset Generation After Voltage Drop
- RESET Defined When  $V_{CC}$  Exceeds 1 V
- Wide Supply-Voltage Range . . . 3.5 V to 18 V
- Precision Overvoltage and Undervoltage Sensing
- 250-mA Peak Output Current for Driving SCR Gates
- 2-mA Active-Low SCR Gate Drive for False-Trigger Protection
- Temperature-Compensated Voltage Reference
- True and Complementary Reset Outputs
- Externally Adjustable Output Pulse Duration



## description

The TL7770 is an integrated-circuit system supervisor designed for use as a reset controller in microcomputer and microprocessor power-supply systems. This device contains two independent supply-voltage supervisors that monitor the supplies for overvoltage and undervoltage conditions at the VSO and VSU terminals, respectively. When  $V_{CC}$  attains the minimum voltage of 1 V during power up, the RESET output becomes active (low). As  $V_{CC}$  approaches 3.5 V, the time-delay function activates, latching RESET and RESET active (high and low, respectively) for a time delay ( $t_d$ ) after system voltages have achieved normal levels. Above  $V_{CC} = 3.5$  V, taking RESIN low activates the time-delay function during normal system-voltage levels. To ensure that the microcomputer system has reset, the outputs remain active until the voltage at VSU exceeds the threshold value,  $V_{IT+}$ , for a time delay, which is determined by an external timing capacitor such that:

$$t_d \approx 20 \times 10^3 \times \text{capacitance}$$

where  $t_d$  is in seconds and capacitance is in farads.

The overvoltage-detection circuit is programmable for a wide range of designs. During an overvoltage condition, an internal silicon-controlled rectifier (SCR) is triggered, providing 250-mA peak instantaneous current and 25-mA continuous current to the SCR gate drive terminal, which can drive an external high-current SCR gate or an overvoltage-warning circuit.

The TL7770C series is characterized for operation from 0°C to 70°C. The TL7770I series is characterized for operation from -40°C to 85°C.



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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**

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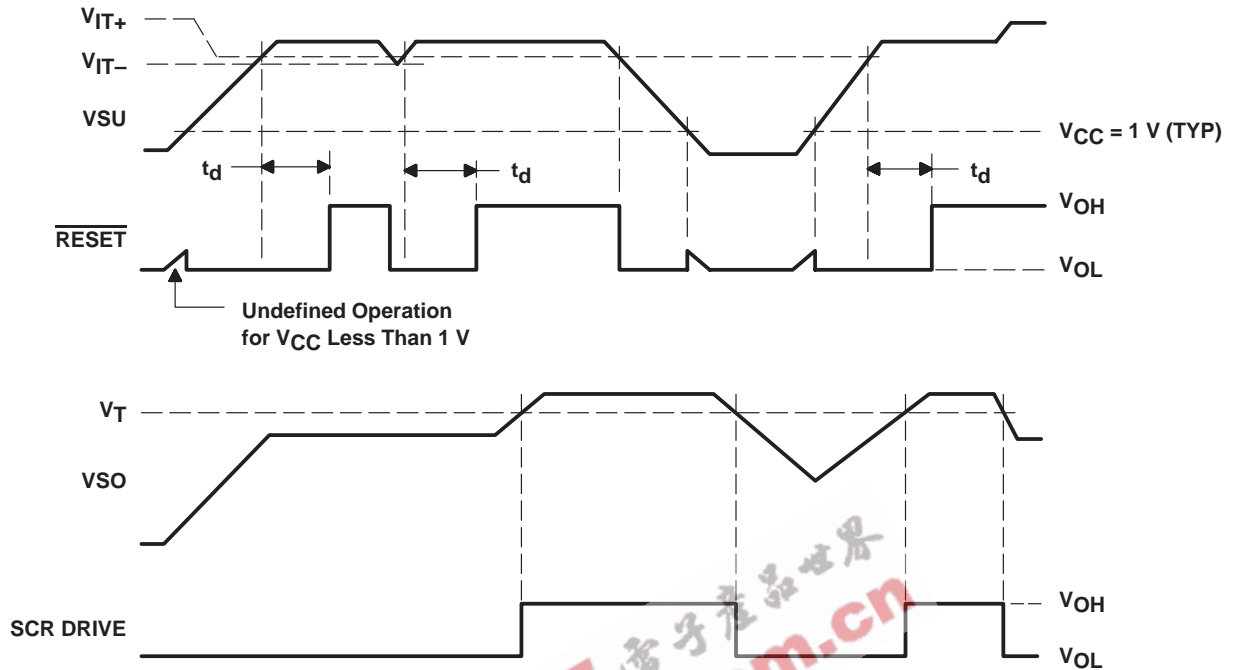
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# TL7770-5, TL7770-12 DUAL POWER-SUPPLY SUPERVISORS

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## timing requirements



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

Supply voltage, $V_{CC}$ (see Note 1)	20 V
Input voltage range, $V_I$ : 1VSU, 2VSU, 1VSO, and 2VSO (see Note 1)	-0.3 V to 18 V
Low-level output current (1RESET and 2RESET), $I_{OL}$	20 mA
High-level output current (1RESET and 2RESET), $I_{OH}$	-20 mA
Package thermal impedance, $\theta_{JA}$ (see Notes 2 and 3): DW package	57°C/W
N package	88°C/W
Lead temperature 1,6 mm (1/16 in) from case for 10 seconds: DW or N package	260°C
Storage temperature range, $T_{stg}$	-65°C to 150°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.

- NOTES:
- All voltage values are with respect to the network ground terminal.
  - Maximum power dissipation is a function of  $T_J(\max)$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(\max) - T_A)/\theta_{JA}$ . Operating at the absolute maximum  $T_J$  of 150°C can impact reliability.
  - The package thermal impedance is calculated in accordance with JESD 51, except for through-hole packages, which use a trace length of zero.

# TL7770-5, TL7770-12

## DUAL POWER-SUPPLY SUPERVISORS

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### recommended operating conditions

		MIN	MAX	UNIT
Supply voltage, $V_{CC}$		3.5	18	V
Input voltage range, $V_I$ (see Note 4)	1VSU, 2VSU, 2VSO, 1VSO	0	18	V
Output voltage, $V_O$ (1CT, 2CT)			5	V
High-level input voltage range, $V_{IH}$ (1RESIN, 2RESIN)		2	18	V
Low-level input voltage range, $V_{IL}$ (1RESIN, 2RESIN)		0	0.8	V
Output sink current, $I_O$ (1CT, 2CT)			50	$\mu$ A
High-level output current, $I_{OH}$ (1RESET, 2RESET)			-16	mA
Low-level output current, $I_{OL}$ (1RESET, 2RESET)			16	mA
Continuous output current, $I_O$ (1SCR DRIVE, 2SCR DRIVE)			25	mA
Timing capacitor, $C_T$			10	$\mu$ F
Operating free-air temperature, $T_A$	TL7770C series	0	70	$^{\circ}$ C
	TL7770I series	-40	85	$^{\circ}$ C

NOTE 4: The algebraic convention, in which the least positive (most negative) value is designated minimum, is used in this data sheet for logic voltage levels only.

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# TL7770-5, TL7770-12 DUAL POWER-SUPPLY SUPERVISORS

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## electrical characteristics over recommended operating conditions (unless otherwise noted)

### supply supervisor section

PARAMETER		TEST CONDITIONS†	TL7770-5C TL7770-12C TL7770-5I			UNIT	
			MIN	TYP‡	MAX		
V <sub>OH</sub>	High-level output voltage	RESET	I <sub>OH</sub> = -15 mA			V	
		SCR DRIVE	I <sub>OH</sub> = -20 mA				
V <sub>OL</sub>	Low-level output voltage	RESET	I <sub>OL</sub> = 15 mA			V	
V <sub>IT-</sub>	Undervoltage input threshold at VSU (negative-going)	TL7770-5 (5-V sense, 1VSU)	4.46		4.64	V	
		TL7770-12 (12-V sense, 1VSU)	10.68		11.12		
		TL7770-5, TL7770-12 (programmable sense, 2VSU)	1.47		1.53		
V <sub>hys</sub>	Hysteresis at VSU (V <sub>IT+</sub> - V <sub>IT-</sub> )	TL7770-5 (5-V sense, 1VSU)	15			mV	
		TL7770-12 (12-V sense, 1VSU)	36				
		TL7770-5, TL7770-12 (programmable sense, 2VSU)	5				
V <sub>T</sub>	Overvoltage threshold at VSO	TL7770-5, TL7770-12 (VSO)	T <sub>A</sub> = MIN to MAX		2.48	2.68	V
I <sub>I</sub>	Input current	RESIN	V <sub>I</sub> = 5.5 V or 0.4 V			-10	μA
		VSO	V <sub>I</sub> = 2.4 V			0.5	
I <sub>OH</sub>	High-level output current	RESET	V <sub>O</sub> = 18 V			50	μA
I <sub>OL</sub>	Low-level output current	RESET	V <sub>O</sub> = 0			-50	μA
I <sub>OH</sub>	Peak output current	SCR DRIVE	Duration = 1 ms			250	mA

† For conditions shown as MIN or MAX, use the appropriate value specified in the recommended operating conditions.

‡ Typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

### total device

PARAMETER		TEST CONDITIONS†	TL7770-5C TL7770-12C TL7770-5I			UNIT	
			MIN	TYP‡	MAX		
V <sub>res</sub> §	Power-up reset voltage	V <sub>CC</sub> = VSU	0.8		1	V	
I <sub>CC</sub>	Supply current	1VSU = 18 V, 2VSU = 2 V, 1RESIN and 2RESIN at V <sub>CC</sub> , 1VSO and 2VSO at 0 V	T <sub>A</sub> = 25°C			5	mA
			T <sub>A</sub> = MIN to MAX			6.5	

† For conditions shown as MIN or MAX, use the appropriate value specified in the recommended operating conditions.

‡ Typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

§ This is the lowest voltage at which RESET becomes active.

# TL7770-5, TL7770-12 DUAL POWER-SUPPLY SUPERVISORS

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## electrical characteristics over recommended operating conditions (unless otherwise noted)

### supply supervisor section

PARAMETER		TEST CONDITIONS	TL7770-5Y TL7770-12Y			UNIT
			MIN	TYP†	MAX	
V <sub>IT-</sub>	Undervoltage input threshold at VSU (negative-going)	TL7770-5 (5-V sense, 1VSU)	T <sub>A</sub> = MIN to MAX	4.46	4.64	V
		TL7770-12 (12-V sense, 1VSU)		10.68	11.12	
		TL7770-5, TL7770-12 (programmable sense, 2VSU)		1.47	1.53	
V <sub>hys</sub>	Hysteresis at VSU (V <sub>IT+</sub> - V <sub>IT-</sub> )	TL7770-5 (5-V sense, 1VSU)	T <sub>A</sub> = MIN to MAX	15		mV
		TL7770-12 (12-V sense, 1VSU)		36		
		TL7770-5, TL7770-12 (programmable sense, 2VSU)		5		
V <sub>T</sub>	Overvoltage threshold at VSO	TL7770-5, TL7770-12 (VSO)	T <sub>A</sub> = MIN to MAX	2.48	2.68	V
I <sub>I</sub>	Input current	VSO	V <sub>I</sub> = 2.4 V	0.5		μA

† Typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

### total device

PARAMETER	TEST CONDITIONS	TL7770-5Y TL7770-12Y			UNIT
		MIN	TYP†	MAX	
V <sub>res</sub> ‡	Power-up reset voltage	V <sub>CC</sub> = VSU, V <sub>OL</sub> = 0.4 V, I <sub>OL</sub> = 1 mA		0.8	V
I <sub>CC</sub>	Supply current	1VSU = 18 V, 2VSU = 2 V, 1RESIN and 2RESIN at V <sub>CC</sub> , 1VSO and 2VSO at 0 V		5	mA

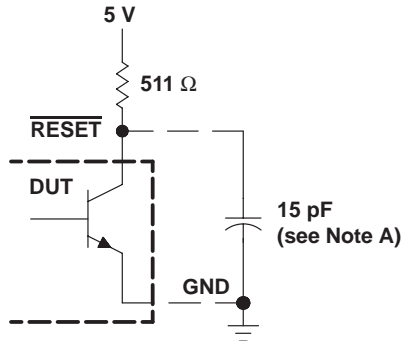
† Typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

‡ This is the lowest voltage at which RESET becomes active.

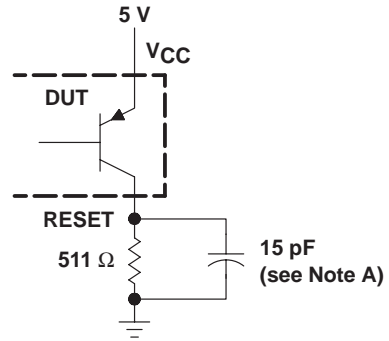
### switching characteristics, V<sub>CC</sub> = 5 V, C<sub>T</sub> open, T<sub>A</sub> = 25°C

PARAMETER		FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>PLH</sub>	Propagation delay time, low-to-high-level output	$\overline{\text{RESIN}}$	RESET	See Figures 1 and 3	270	500		ns
t <sub>PHL</sub>	Propagation delay time, high-to-low-level output	$\overline{\text{RESIN}}$	$\overline{\text{RESET}}$		270	500		ns
t <sub>r</sub>	Rise time		RESET				75	ns
t <sub>f</sub>	Fall time		RESET			150		
t <sub>r</sub>	Rise time		$\overline{\text{RESET}}$				75	ns
t <sub>f</sub>	Fall time		$\overline{\text{RESET}}$				50	
t <sub>w(min)</sub>	Minimum effective pulse duration	$\overline{\text{RESIN}}$		See Figure 2a	150		ns	
		VSU		See Figure 2b	100			

PARAMETER MEASUREMENT INFORMATION



RESET OUTPUT CONFIGURATION



RESET OUTPUT CONFIGURATION

NOTE A: This includes jig and probe capacitance.

Figure 1. RESET and RESET Output Configurations

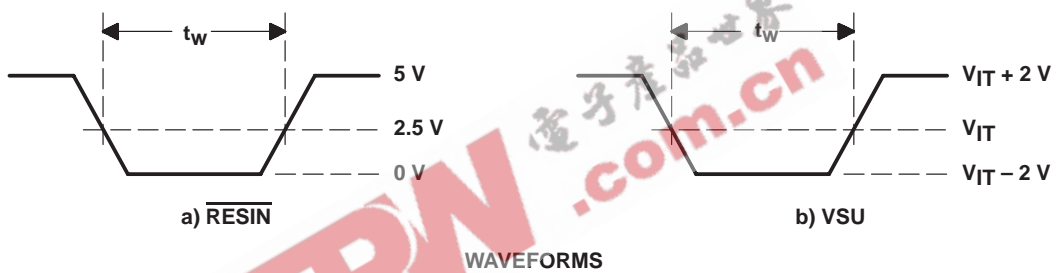


Figure 2. Input Pulse Definition

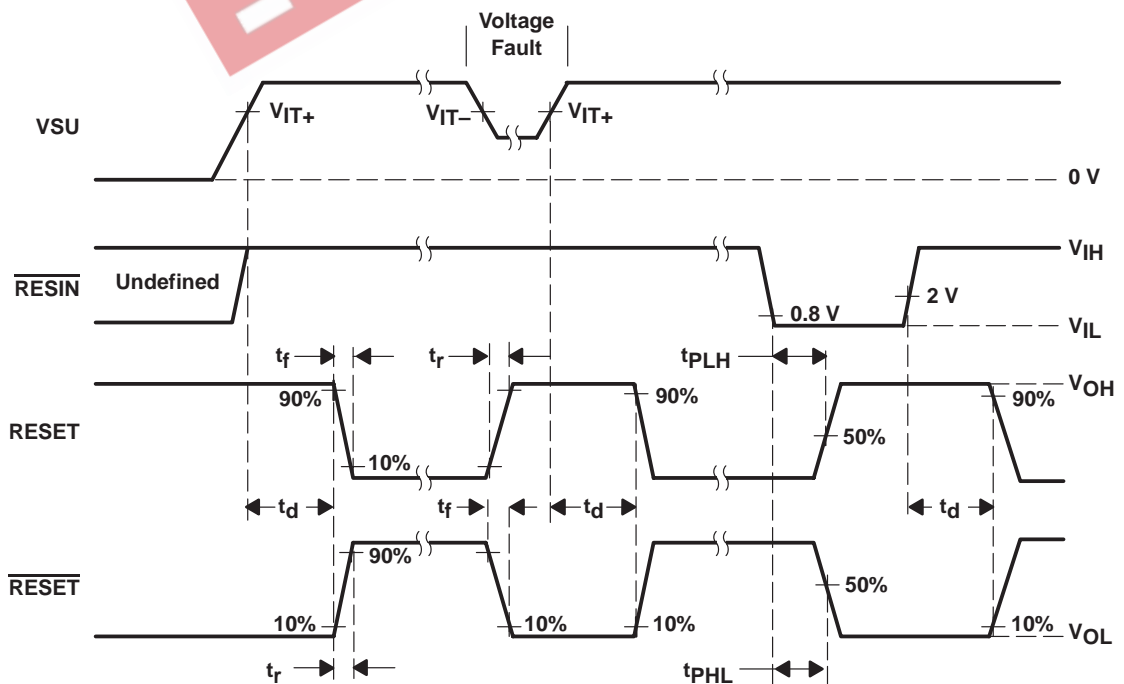
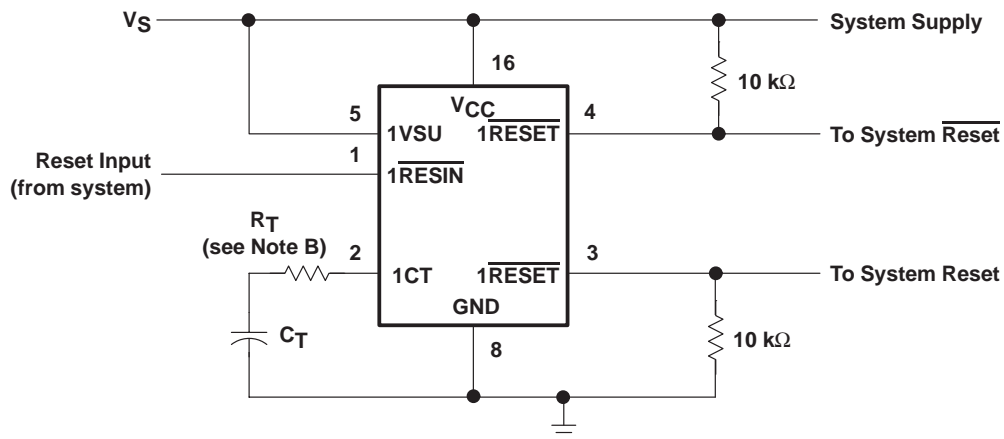


Figure 3. Voltage Waveforms

# TL7770-5, TL7770-12 DUAL POWER-SUPPLY SUPERVISORS

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## APPLICATION INFORMATION



NOTE B: When  $V_{CC}$  and  $1VSU$  are connected to the same point, it is recommended that series resistance ( $R_T$ ) be added between the time-delay programming capacitor ( $C_T$ ) and the voltage-supervisor device terminal ( $1CT$ ). The suggested  $R_T$  value is given by:

$$R_T > \frac{V_I - V_{IT-}}{1 \times 10^{-3}}, \text{ where } V_I = (\text{the lesser of } 7.1 \text{ V or } V_S)$$

When this series resistor is used, the  $t_d$  calculation is as follows:

$$t_d = \frac{1.3 - [(6.5E - 5) \times 10^{-5}] \times R_T}{6.5 \times 10^{-5}} \times C_T$$

Figure 4. System Reset Controller With Undervoltage Sensing



**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
5962-9093201MEA	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI
5962-9093202M2A	OBSOLETE	LCCC	FK	20		TBD	Call TI	Call TI
5962-9093202MEA	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI
TL7770-12CDW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL7770-12CDWE4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL7770-12CDWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL7770-12CDWRE4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL7770-12CN	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
TL7770-12MJB	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI
TL7770-5CDW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL7770-5CDWE4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL7770-5CDWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL7770-5CDWRE4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL7770-5CN	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TL7770-5CNE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TL7770-5IDW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL7770-5IDWE4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL7770-5IDWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL7770-5IDWRE4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL7770-5MFKB	OBSOLETE	LCCC	FK	20		TBD	Call TI	Call TI
TL7770-5MJB	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI
TL7770-5QDW	OBSOLETE	SOIC	DW	16		TBD	Call TI	Call TI
TL7770-5QDWR	OBSOLETE	SOIC	DW	16		TBD	Call TI	Call TI
TL7770-5QN	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI

<sup>(1)</sup> 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.

<sup>(2)</sup> 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.

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**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)

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

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J (R-GDIP-T\*\*)  
14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



DIM \ PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



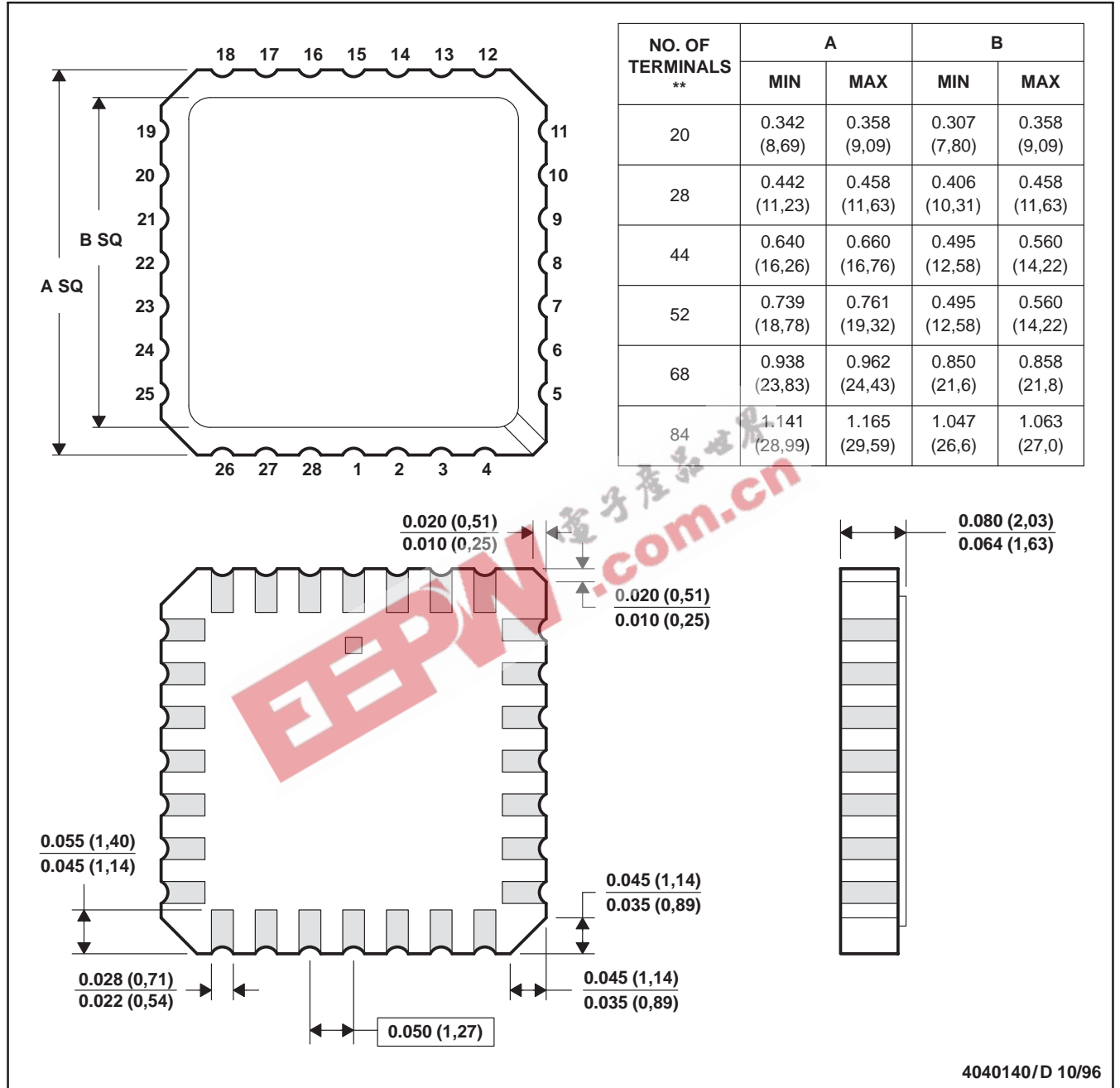
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- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package is hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



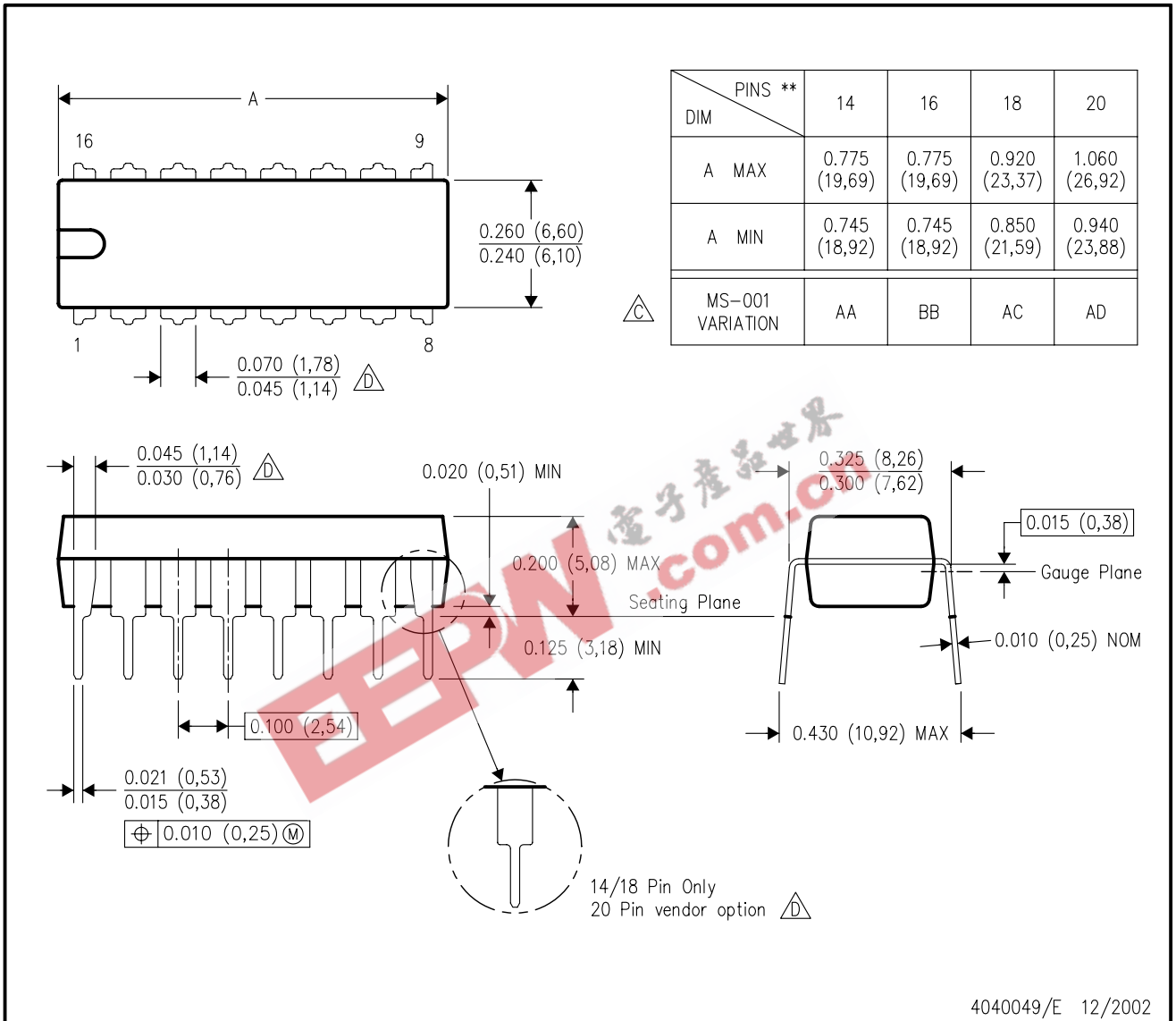
- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package can be hermetically sealed with a metal lid.
  - D. The terminals are gold plated.
  - E. Falls within JEDEC MS-004

# MECHANICAL DATA

## N (R-PDIP-T\*\*)

## PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN

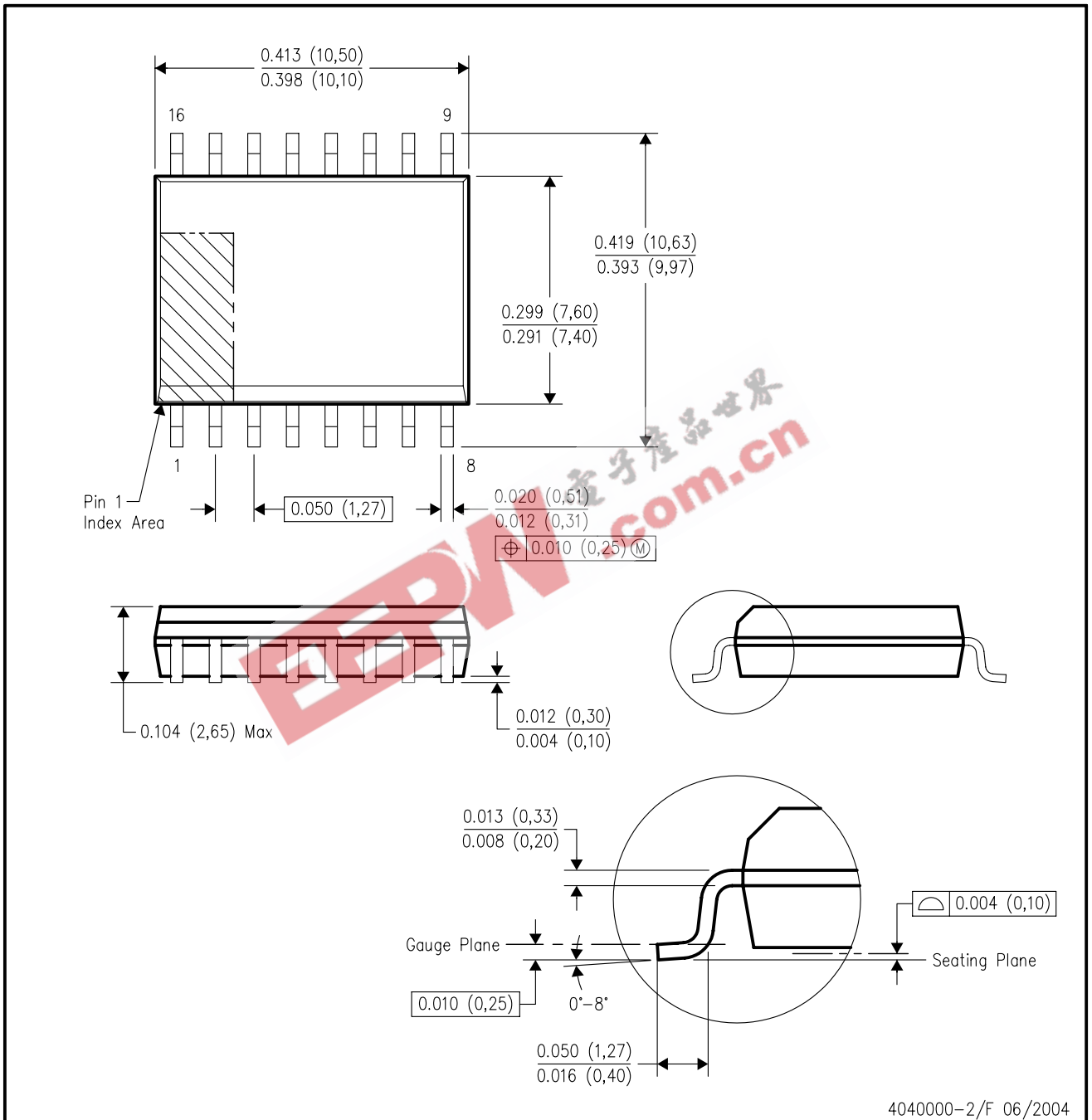


- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - The 20 pin end lead shoulder width is a vendor option, either half or full width.

# MECHANICAL DATA

DW (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - Falls within JEDEC MS-013 variation AA.

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Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>	Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Low Power Wireless	<a href="http://www.ti.com/lpw">www.ti.com/lpw</a>	Telephony	<a href="http://www.ti.com/telephony">www.ti.com/telephony</a>
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