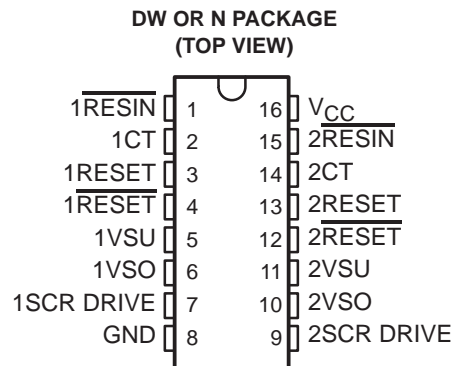


- Power-On Reset Generator
- Automatic Reset Generation After Voltage Drop
- $\overline{\text{RESET}}$  Defined When  $V_{CC}$  Exceeds 1 V
- Wide Supply-Voltage Range . . . 3.5 V to 18 V
- Precision Overvoltage and Undervoltage Sensing
- 250-mA Peak Output Current for Driving SCR Gates
- 2-mA Active-Low 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  $\overline{\text{RESET}}$  output becomes active (low). As  $V_{CC}$  approaches 3.5 V, the time-delay function activates, latching RESET and  $\overline{\text{RESET}}$  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  $\overline{\text{RESIN}}$  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.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

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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# TL7770-5, TL7770-12

## DUAL POWER-SUPPLY SUPERVISORS

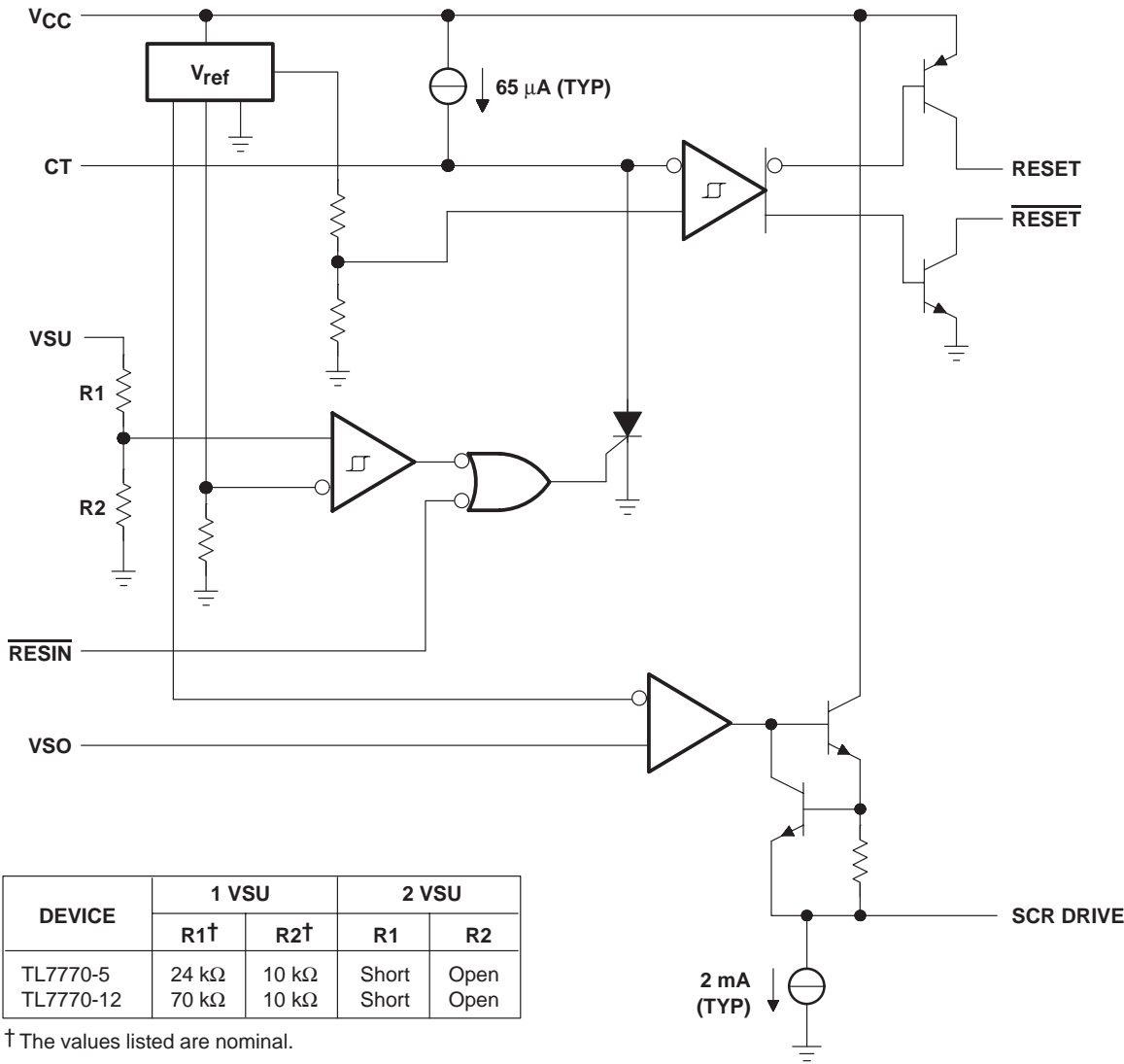
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AVAILABLE OPTIONS

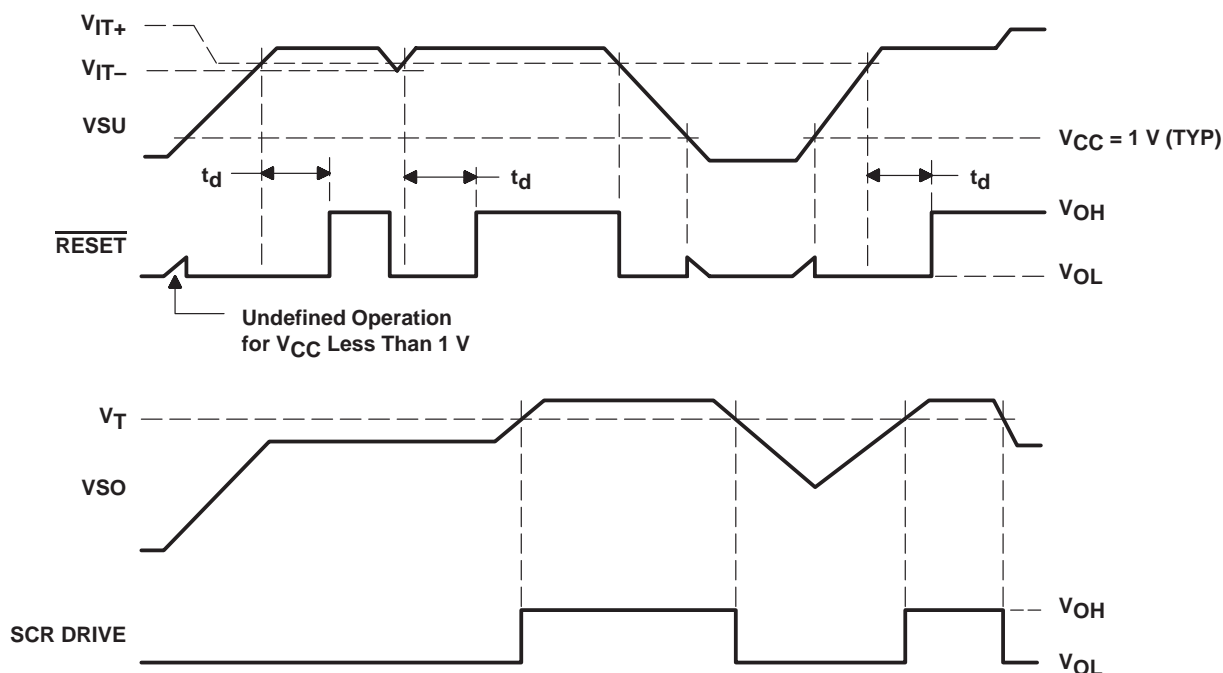
T <sub>A</sub>	PACKAGED DEVICES		CHIP FORM (Y)
	SMALL OUTLINE (DW)	PLASTIC DIP (N)	
0°C to 70°C	TL7770-5CDW TL7770-12CDW	TL7770-5CN TL7770-12CN	TL7770-5Y TL7770-12Y
–40°C to 85°C	TL7770-5IDW	TL7770-5IN	—

DW package is available taped and reeled. Add the suffix R to the device type (e.g., TL7770-5CDWR). Chip forms are tested at 25°C.

functional block diagram (each channel)



## timing requirements



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

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

<sup>†</sup> 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:
1. All voltage values are with respect to the network ground terminal.
  2. Maximum power dissipation is a function of  $T_J(\text{max})$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(\text{max}) - T_A)/\theta_{JA}$ . Operating at the absolute maximum  $T_J$  of 150°C can impact reliability.
  3. The package thermal impedance is calculated in accordance with JEDEC 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, $V_{IH}$ ( $\overline{1RESIN}$ , $\overline{2RESIN}$ )		2	18	V
Low-level input voltage range, $V_{IL}$ ( $\overline{1RESIN}$ , $\overline{2RESIN}$ )		0	0.8	V
Output sink current, $I_O$ (1CT, 2CT)			50	$\mu A$
High-level output current, $I_{OH}$ ( $\overline{1RESET}$ , $\overline{2RESET}$ )			–16	mA
Low-level output current, $I_{OL}$ ( $\overline{1RESET}$ , $\overline{2RESET}$ )			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.



# 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 CONDITION†	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 <sub>CC</sub> −1.5		V	
		SCR DRIVE	I <sub>OH</sub> = −20 mA	V <sub>CC</sub> −1.5			
V <sub>OL</sub>	Low-level output voltage	RESET	I <sub>OL</sub> = 15 mA	0.4		V	
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	RESIN	V <sub>I</sub> = 5.5 V or 0.4 V	−10		μA	
		VSO	V <sub>I</sub> = 2.4 V	0.5 2			
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 CONDITION†		TL7770-5C TL7770-12C TL7770-5I			UNIT
				MIN	TYP‡	MAX	
Vres§	Power-up reset voltage	VCC = VSU		0.8	1		V
ICC	Supply current	1VSU = 18 V, 2VSU = 2 V, 1RESIN and 2RESIN at VCC, 1VSO and 2VSO at 0 V	TA = 25°C	5			mA
			TA = 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	
$V_{IT-}$ Undervoltage input threshold at VSU (negative-going)	TL7770-5 (5-V sense, 1VSU)	$T_A = \text{MIN to MAX}$	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	
$V_{hys}$ Hysteresis at VSU ( $V_{IT+} - V_{IT-}$ )	TL7770-5 (5-V sense, 1VSU)	$T_A = \text{MIN to MAX}$		15		mV
	TL7770-12 (12-V sense, 1VSU)			36		
	TL7770-5, TL7770-12 (programmable sense, 2VSU)			5		
$V_T$ Overvoltage threshold at VSO	TL7770-5, TL7770-12 (VSO)	$T_A = \text{MIN to MAX}$	2.48		2.68	V
$I_I$ Input current	VSO	$V_I = 2.4 \text{ V}$		0.5		$\mu\text{A}$

† Typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

#### total device

PARAMETER		TEST CONDITIONS	TL7770-5Y TL7770-12Y			UNIT
			MIN	TYP†	MAX	
$V_{res}^\ddagger$ Power-up reset voltage		$V_{CC} = \text{VSU}$ , $V_{OL} = 0.4 \text{ V}$ , $I_{OL} = 1 \text{ mA}$		0.8		V
$I_{CC}$ Supply current		$1\text{VSU} = 18 \text{ V}$ , $2\text{VSU} = 2 \text{ V}$ , $1\text{RESIN}$ and $2\text{RESIN}$ at $V_{CC}$ , $1\text{VSO}$ and $2\text{VSO}$ at $0 \text{ V}$			5	mA

† Typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

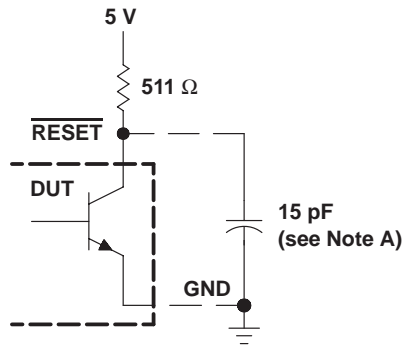
‡ This is the lowest voltage at which RESET becomes active.

#### switching characteristics, $V_{CC} = 5 \text{ V}$ , $C_T$ open, $T_A = 25^\circ\text{C}$

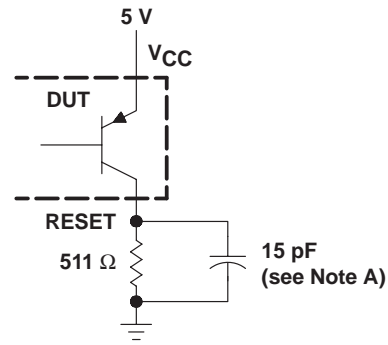
PARAMETER		FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$	Propagation delay time, low-to-high-level output	$\overline{\text{RESIN}}$	RESET	See Figures 1 and 3		270	500	ns
$t_{PHL}$	Propagation delay time, high-to-low-level output	$\overline{\text{RESIN}}$	$\overline{\text{RESET}}$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



## PARAMETER MEASUREMENT INFORMATION



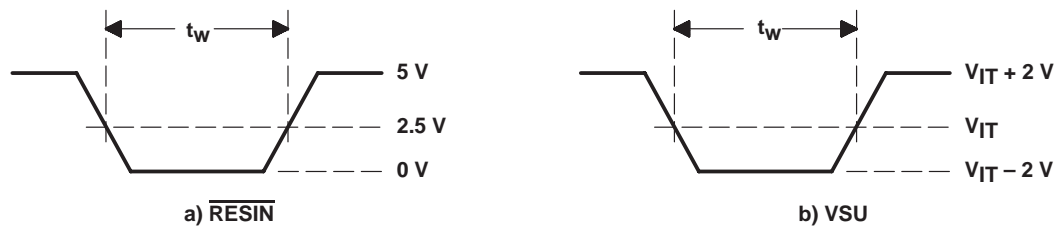
RESET OUTPUT CONFIGURATION



RESET OUTPUT CONFIGURATION

NOTE A: This includes jig and probe capacitance.

Figure 1.  $\overline{\text{RESET}}$  and RESET Output Configurations



WAVEFORMS

Figure 2. Input Pulse Definition

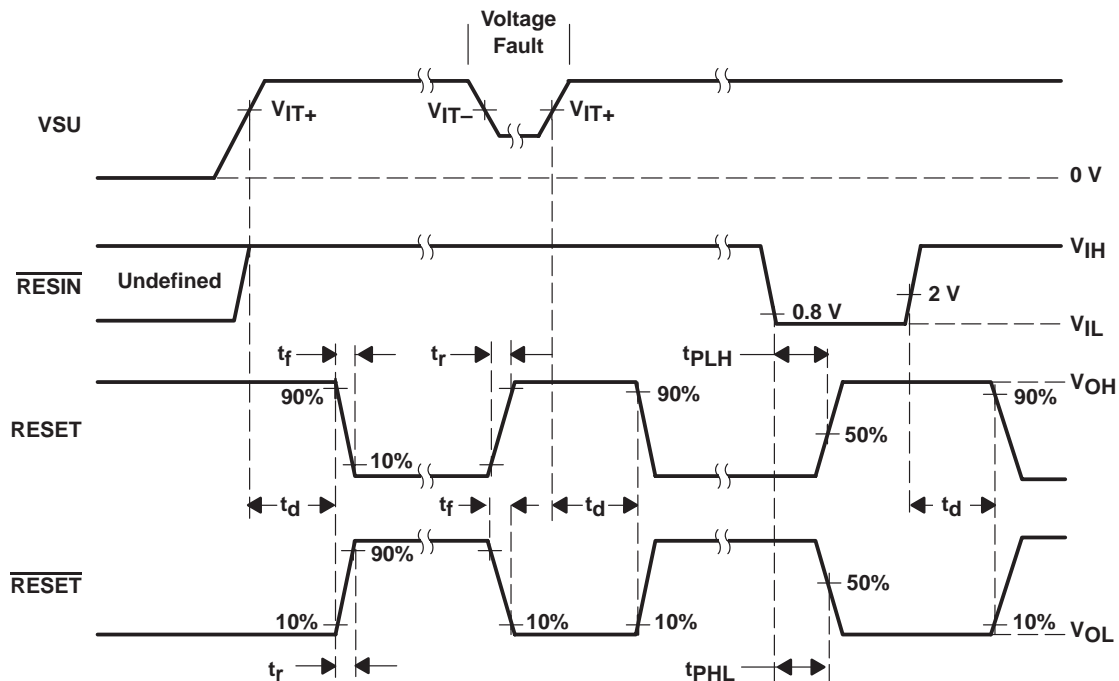


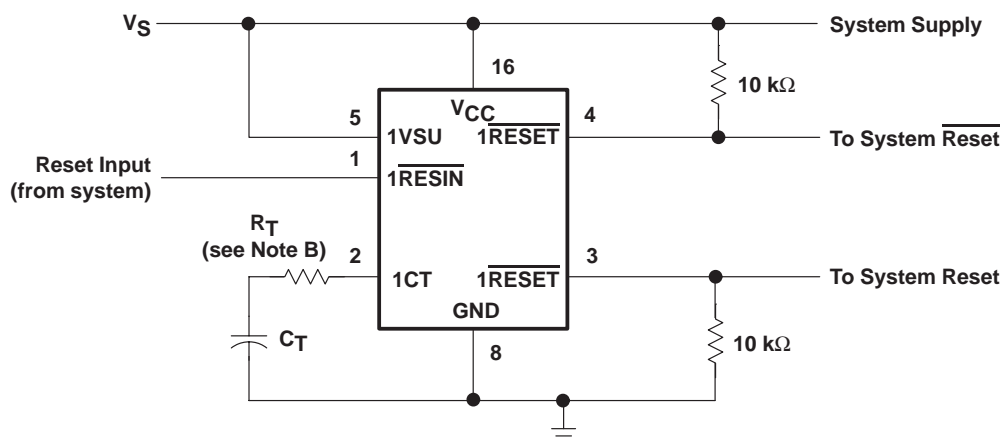
Figure 3. Voltage Waveforms

# 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 (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TL7770-12CDWR	ACTIVE	SOIC	DW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	7770-12C	<a href="#">Samples</a>
TL7770-5CDW	ACTIVE	SOIC	DW	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	TL7770-5C	<a href="#">Samples</a>
TL7770-5CDWR	ACTIVE	SOIC	DW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	TL7770-5C	<a href="#">Samples</a>
TL7770-5CN	ACTIVE	PDIP	N	16	25	RoHS & Green	NIPDAU	N / A for Pkg Type	0 to 70	TL7770-5CN	<a href="#">Samples</a>
TL7770-5IDW	ACTIVE	SOIC	DW	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TL7770-5I	<a href="#">Samples</a>
TL7770-5IDWG4	ACTIVE	SOIC	DW	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TL7770-5I	<a href="#">Samples</a>
TL7770-5IDWR	ACTIVE	SOIC	DW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TL7770-5I	<a href="#">Samples</a>
TL7770-5IDWRE4	ACTIVE	SOIC	DW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TL7770-5I	<a href="#">Samples</a>

(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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

<sup>(6)</sup> Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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**TAPE AND REEL INFORMATION**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TL7770-12CDWR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
TL7770-5CDWR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
TL7770-5IDWR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TL7770-12CDWR	SOIC	DW	16	2000	350.0	350.0	43.0
TL7770-5CDWR	SOIC	DW	16	2000	350.0	350.0	43.0
TL7770-5IDWR	SOIC	DW	16	2000	350.0	350.0	43.0

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

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



PINS ** DIM	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS-001 VARIATION	AA	BB	AC	AD



4040049/E 12/2002

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.

## GENERIC PACKAGE VIEW

**DW 16**

**SOIC - 2.65 mm max height**

7.5 x 10.3, 1.27 mm pitch

SMALL OUTLINE INTEGRATED CIRCUIT

This image is a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.



4224780/A



DW0016A

# PACKAGE OUTLINE

## SOIC - 2.65 mm max height

SOIC



4220721/A 07/2016

### NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm, per side.
5. Reference JEDEC registration MS-013.

# EXAMPLE BOARD LAYOUT

DW0016A

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE  
SCALE:7X



SOLDER MASK DETAILS

4220721/A 07/2016

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



# EXAMPLE STENCIL DESIGN

DW0016A

SOIC - 2.65 mm max height

SOIC



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:7X

4220721/A 07/2016

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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