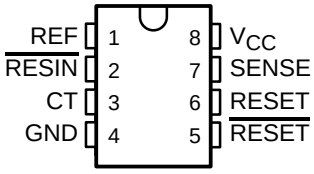
SLVS028H – APRIL 1983 – REVISED MAY 2003

- **Power-On Reset Generator**
- **Automatic Reset Generation After Voltage Drop**
- **Wide Supply-Voltage Range**
- **Precision Voltage Sensor**
- **Temperature-Compensated Voltage Reference**
- **True and Complement Reset Outputs**
- **Externally Adjustable Pulse Duration**

TL7702A, TL7709A, TL7712A, TL7715A . . . D OR P PACKAGE
TL7705A . . . D, P, OR PS PACKAGE,
(TOP VIEW)



description/ordering information

ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	PDIP (P)	Tube of 50	TL7702ACP	TL7702ACP
	SOIC (D)	Tube of 75	TL7702ACD	7702AC
		Reel of 2500	TL7702ACDR	
	PDIP (P)	Tube of 50	TL7705ACP	TL7705ACP
	SOIC (D)	Tube of 75	TL7705ACD	7705AC
		Reel of 2500	TL7705ACDR	
	SOP (PS)	Reel of 2000	TL7705ACPSR	T7705A
	PDIP (P)	Tube of 50	TL7709ACP	TL7709ACP
	SOIC (D)	Tube of 75	TL7709ACD	7709AC
		Reel of 2500	TL7709ACDR	
	PDIP (P)	Tube of 50	TL7712ACP	TL7709ACP
	SOIC (D)	Tube of 75	TL7712ACD	7712AC
		Reel of 2500	TL7712ACDR	
	PDIP (P)	Tube of 50	TL7715ACP	TL7715ACP
	SOIC (D)	Tube of 75	TL7715ACD	7715AC
–40°C to 85°C	PDIP (P)	Tube of 50	TL7702AIP	TL7702AIP
	SOIC (D)	Tube of 75	TL7702AID	7702AI
		Reel of 2500	TL7702AIDR	
	PDIP (P)	Tube of 50	TL7705AIP	TL7705AIP
	SOIC (D)	Tube of 75	TL7705AID	7705AI
		Reel of 2500	TL7705AIDR	

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

description/ordering information (continued)

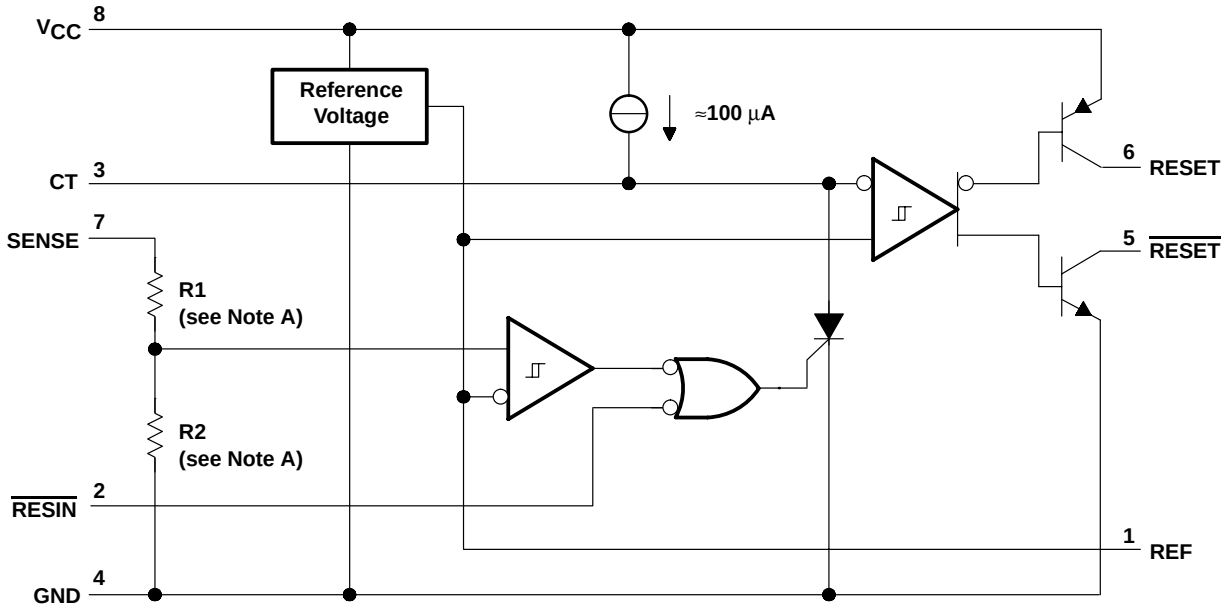
The TL77xxA family of integrated-circuit supply-voltage supervisors is designed specifically for use as reset controllers in microcomputer and microprocessor systems. The supply-voltage supervisor monitors the supply for undervoltage conditions at the SENSE input. During power up, the $\overline{\text{RESET}}$ output becomes active (low) when V_{CC} attains a value approaching 3.6 V. At this point (assuming that SENSE is above V_{IT+}), the delay timer function activates a time delay, after which outputs $\overline{\text{RESET}}$ and RESET go inactive (high and low, respectively). When an undervoltage condition occurs during normal operation, $\overline{\text{RESET}}$ and RESET go active. To ensure that a complete reset occurs, the reset outputs remain active for a time delay after the voltage at the SENSE input exceeds the positive-going threshold value. The time delay is determined by the value of the external capacitor C_T: $t_d = 1.3 \times 10^4 \times C_T$, where C_T is in farads (F) and t_d is in seconds (s).

During power down and when SENSE is below V_{IT-}, the outputs remain active until V_{CC} falls below 2 V. After this, the outputs are undefined.

An external capacitor (typically 0.1 μF) must be connected to REF to reduce the influence of fast transients in the supply voltage.

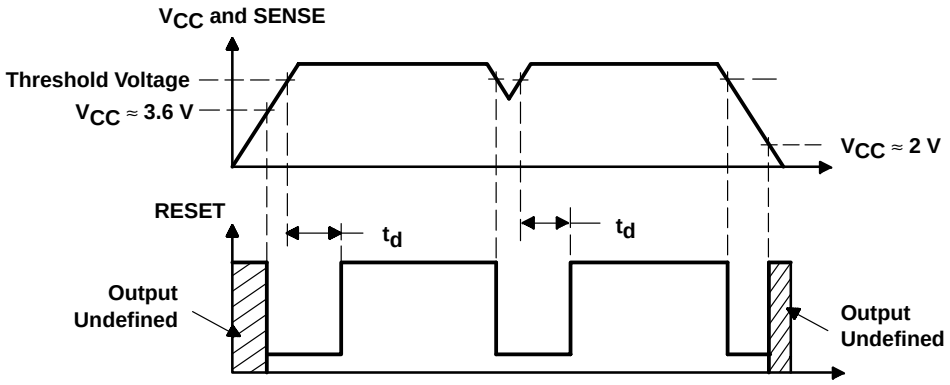
functional block diagram

The functional block diagram is shown for illustrative purposes only; the actual circuit includes a trimming network to adjust the reference voltage and sense-comparator trip point.



NOTES: A. TL7702A: R1 = 0 Ω, R2 = open
TL7705A: R1 = 7.8 kΩ, R2 = 10 kΩ
TL7709A: R1 = 19.7 kΩ, R2 = 10 kΩ
TL7712A: R1 = 32.7 kΩ, R2 = 10 kΩ
TL7715A: R1 = 43.4 kΩ, R2 = 10 kΩ
B. Resistor values shown are nominal.

timing diagram



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, $\overline{\text{RESIN}}$ . . . . . –0.3 V to 20 V
Input voltage range, V_I, SENSE: TL7702A (see Note 2) . . . . . –0.3 V to 6 V
TL7705A . . . . . –0.3 V to 20 V
TL7709A . . . . . –0.3 V to 20 V
TL7712A, TL7715A . . . . . –0.3 V to 20 V
High-level output current, I_{OH}, $\overline{\text{RESET}}$ . . . . . –30 mA
Low-level output current, I_{OL}, $\overline{\text{RESET}}$ . . . . . 30 mA
Package thermal impedance, θ_{JA} (see Notes 3 and 4): D package . . . . . 97°C/W
P package . . . . . 85°C/W
PS package . . . . . 95°C/W
Operating virtual junction temperature, T_J . . . . . 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds . . . . . 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: 1. All voltage values are with respect to GND.
2. For proper operation of the TL7702A, the voltage applied to the SENSE terminal should not exceed V_{CC} – 1 V or 6 V, whichever is less.
3. Maximum power dissipation is a function of $T_J(max)$, θ_{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 affect reliability.
4. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions

			MIN	MAX	UNIT
V_{CC}	Supply voltage		3.5	18	V
V_{IH}	High-level input voltage at $\overline{\text{RESIN}}$		2		V
V_{IL}	Low-level input voltage at $\overline{\text{RESIN}}$			0.6	V
V_I	Input voltage, SENSE	TL7702A	0	See Note 2	V
		TL7705A	0	10	
		TL7709A	0	15	
		TL7712A	0	20	
		TL7715A	0	20	
I_{OH}	High-level output current, RESET			–16	mA
I_{OL}	Low-level output current, $\overline{\text{RESET}}$			16	mA
T_A	Operating free-air temperature range	TL77xxAC	0	70	°C
		TL77xxAI	–40	85	

NOTE 2: For proper operation of the TL7702A, the voltage applied to the SENSE terminal should not exceed V_{CC} – 1 V or 6 V, whichever is less.

electrical characteristics over recommended operating conditions (unless otherwise noted)

PARAMETER			TEST CONDITIONS†	TL77xxAC TL77xxAI			UNIT
				MIN	TYP	MAX	
V_{OH}	High-level output voltage, RESET		I_{OH} = –16 mA	V_{CC}–1.5			V
V_{OL}	Low-level output voltage, $\overline{\text{RESET}}$		I_{OL} = 16 mA			0.4	V
V_{ref}	Reference voltage		T_A = 25°C	2.48	2.53	2.58	V
$V_{IT–}$	Negative-going input threshold voltage, SENSE	TL7702A	T_A = 25°C	2.48	2.53	2.58	V
		TL7705A		4.5	4.55	4.6	
		TL7709A		7.5	7.6	7.7	
		TL7712A		10.6	10.8	11	
		TL7715A		13.2	13.5	13.8	
V_{hys}	Hysteresis, SENSE ($V_{IT+} – V_{IT–}$)	TL7702A	T_A = 25°C		10		mV
		TL7705A			15		
		TL7709A			20		
		TL7712A			35		
		TL7715A			45		
I_I	Input current	$\overline{\text{RESIN}}$	V_I = 2.4 V to V_{CC}			20	µA
			V_I = 0.4 V			–100	
		SENSE TL7702A	$V_{ref} < V_I < V_{CC} – 1.5$ V		0.5	2	
I_{OH}	High-level output current, $\overline{\text{RESET}}$		V_O = 18 V			50	µA
I_{OL}	Low-level output current, RESET		V_O = 0			–50	µA
I_{CC}	Supply current		All inputs and outputs open		1.8	3	mA

† All electrical characteristics are measured with 0.1-µF capacitors connected at REF, CT, and V_{CC} to GND.

switching characteristics over recommended operating conditions (unless otherwise noted)

PARAMETER			TEST CONDITIONS†		TL77xxAC TL77xxAI			UNIT
					MIN	TYP	MAX	
	Output pulse duration		C_T = 0.1 µF		0.65	1.2	2.6	msec
	Input pulse duration at $\overline{\text{RESIN}}$				0.4			µs
$t_{w(S)}$	Pulse duration at SENSE input to switch outputs		$V_{IH} = V_{IT-} + 200$ mV,	$V_{IL} = V_{IT-} - 200$ mV	2			µs
t_{pd}	Propagation delay time, $\overline{\text{RESIN}}$ to $\overline{\text{RESET}}$		V_{CC} = 5 V				1	µs
t_r	Rise time	RESET	V_{CC} = 5 V,	See Note 5			0.2	µs
		$\overline{\text{RESET}}$					3.5	
t_f	Fall time	RESET	V_{CC} = 5 V,	See Note 5			3.5	µs
		$\overline{\text{RESET}}$					0.2	

† All switching characteristics are measured with 0.1-µF capacitors connected at REF and V_{CC} to GND.
NOTE 5: The rise and fall times are measured with a 4.7-kΩ load resistor at RESET and $\overline{\text{RESET}}$.

PARAMETER MEASUREMENT INFORMATION

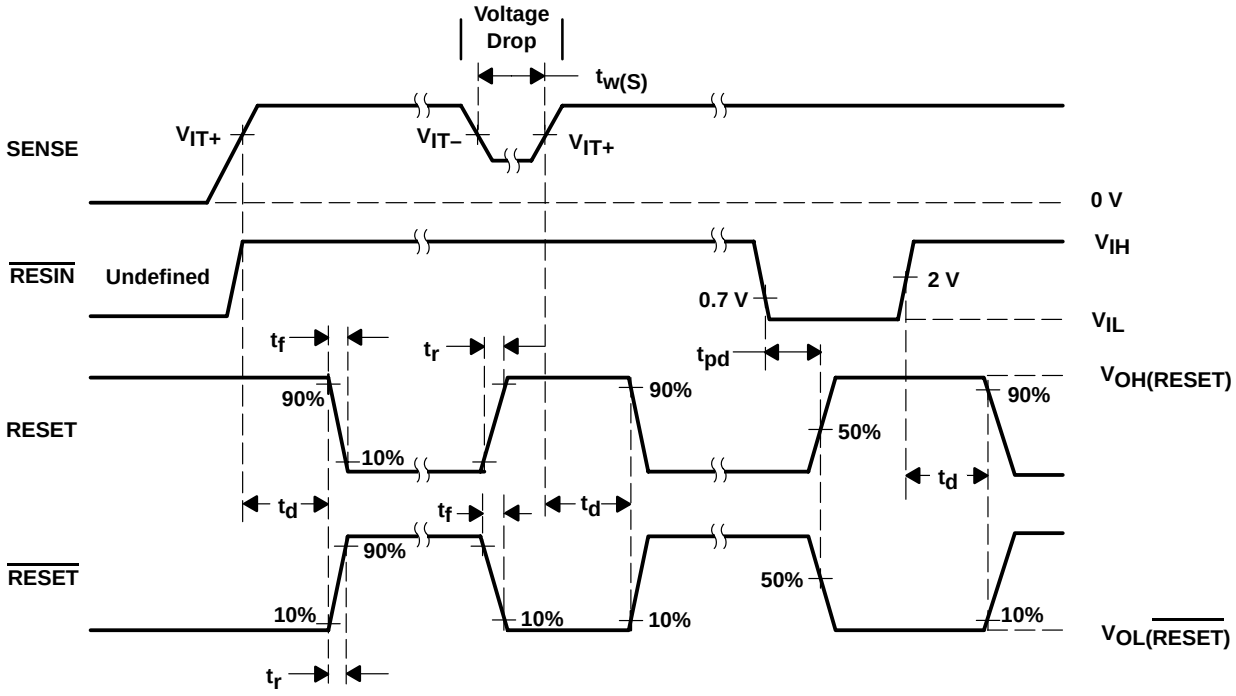


Figure 1. Voltage Waveforms

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
5962-88685012A	OBSOLETE	LCCC	FK	20		TBD	Call TI	Call TI
TL7702ACD	ACTIVE	SOIC	D	8	75	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR
TL7702ACDR	ACTIVE	SOIC	D	8	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR
TL7702ACP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
TL7702AID	ACTIVE	SOIC	D	8	75	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR
TL7702AIDR	ACTIVE	SOIC	D	8	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR
TL7702AIP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
TL7702AMFKB	OBSOLETE	LCCC	FK	20		TBD	Call TI	Call TI
TL7702AMJG	OBSOLETE	CDIP	JG	8		TBD	Call TI	Call TI
TL7702AMJGB	OBSOLETE	CDIP	JG	8		TBD	Call TI	Call TI
TL7705ACD	ACTIVE	SOIC	D	8	75	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR
TL7705ACDR	ACTIVE	SOIC	D	8	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR
TL7705ACP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
TL7705ACPSLE	OBSOLETE	SO	PS	8		TBD	Call TI	Call TI
TL7705ACPSR	ACTIVE	SO	PS	8	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
TL7705AID	ACTIVE	SOIC	D	8	75	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR
TL7705AIDR	ACTIVE	SOIC	D	8	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR
TL7705AIP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
TL7705AMFKB	OBSOLETE	LCCC	FK	20		TBD	Call TI	Call TI
TL7705AMJG	OBSOLETE	CDIP	JG	8		TBD	Call TI	Call TI
TL7705AMJGB	OBSOLETE	CDIP	JG	8		TBD	Call TI	Call TI
TL7709ACD	ACTIVE	SOIC	D	8	75	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR
TL7709ACDR	ACTIVE	SOIC	D	8	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR
TL7709ACP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
TL7709AID	OBSOLETE	SOIC	D	8		TBD	Call TI	Call TI
TL7709AIP	OBSOLETE	PDIP	P	8		TBD	Call TI	Call TI
TL7712ACD	ACTIVE	SOIC	D	8	75	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR
TL7712ACDR	ACTIVE	SOIC	D	8	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR
TL7712ACP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/Ball Finish	MSL Peak Temp [3]
TL7712AID	OBSOLETE	SOIC	D	8		TBD	Call TI	Call TI
TL7712AIP	OBSOLETE	PDIP	P	8		TBD	Call TI	Call TI
TL7715ACD	ACTIVE	SOIC	D	8	75	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR
TL7715ACP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
TL7715AID	OBSOLETE	SOIC	D	8		TBD	Call TI	Call TI
TL7715AIP	OBSOLETE	PDIP	P	8		TBD	Call TI	Call TI

(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) 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.
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.