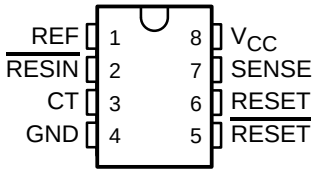
SLVS028G – APRIL 1983 – REVISED MAY 2001

- **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**
- **Package Options Include Plastic Small-Outline (D) Package and Standard Plastic (P) DIP**

D OR P PACKAGE
(TOP VIEW)



description

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.

The TL77xxAC series is characterized for operation from 0°C to 70°C. The TL77xxAI series is characterized for operation from –40°C to 85°C.

AVAILABLE OPTIONS

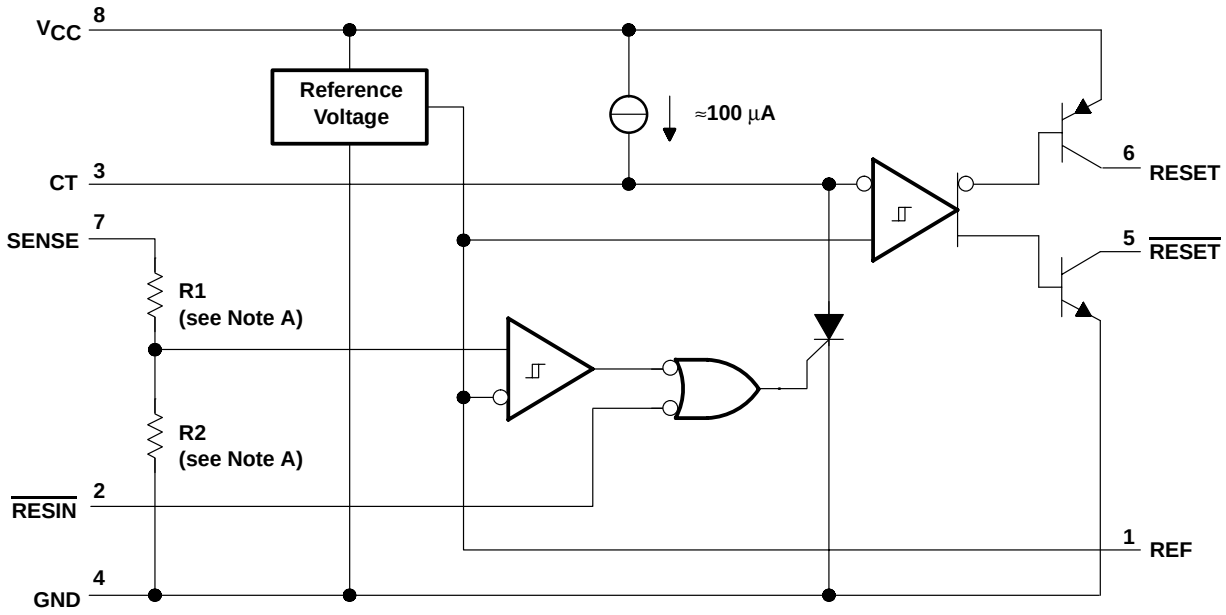
T_A	PACKAGED DEVICES	
	SMALL OUTLINE (D)	PLASTIC DIP (P)
0°C to 70°C	TL7702ACD TL7705ACD TL7709ACD TL7712ACD TL7715ACD	TL7702ACP TL7705ACP TL7709ACP TL7712ACP TL7715ACP
–40°C to 85°C	TL7702AID TL7705AID	TL7702AIP TL7705AIP

The D package is available taped and reeled. Add the suffix R to the device type (e.g., TL7702ACDR).

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.

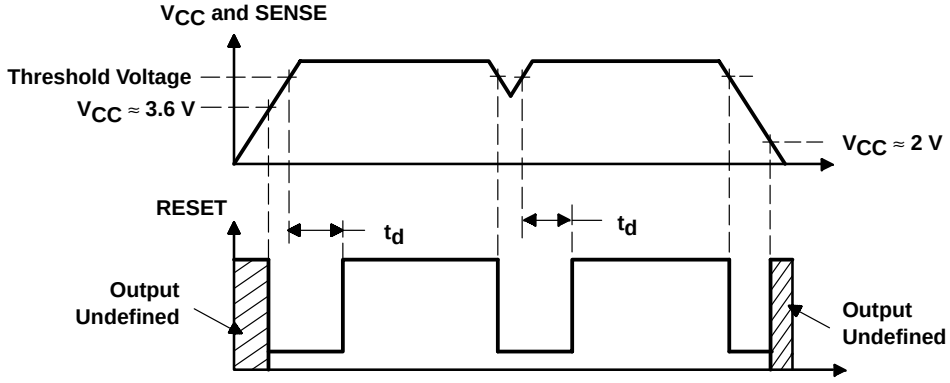
functional block diagram

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 (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
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D or P 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: 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
C_T	Timing capacitor			10	µF
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

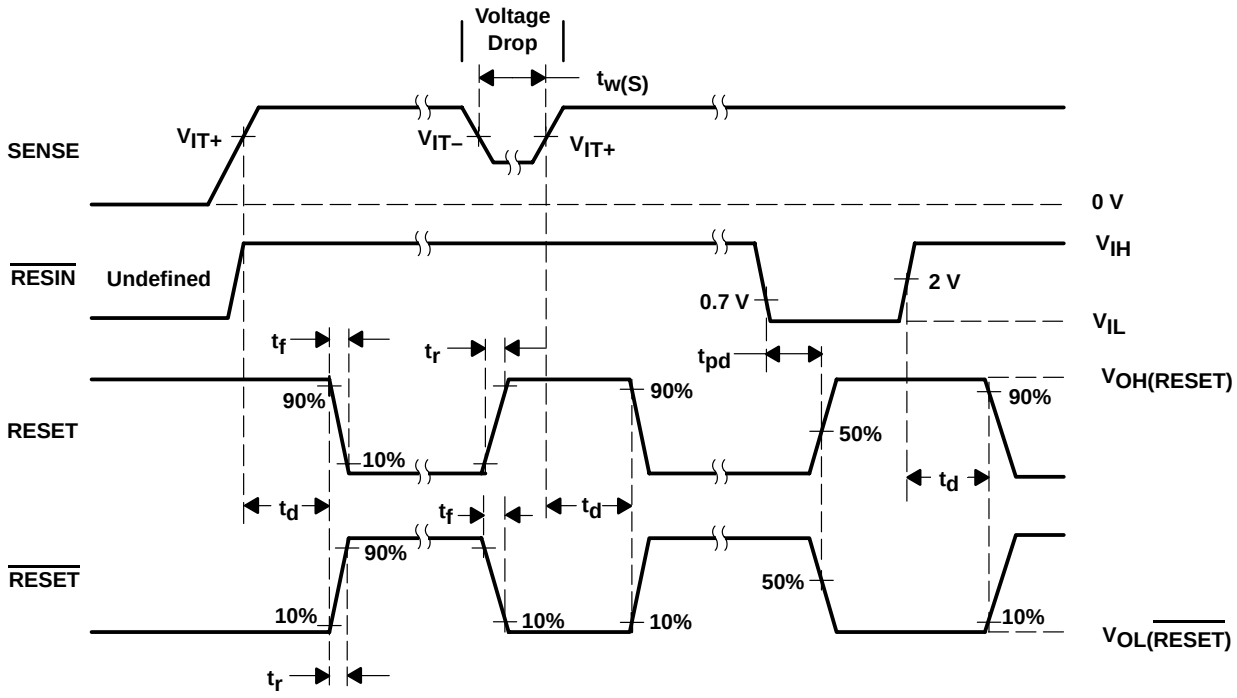


Figure 1. Voltage Waveforms

TYPICAL CHARACTERISTICS†

ASSERTION TIME vs LOAD RESISTANCE

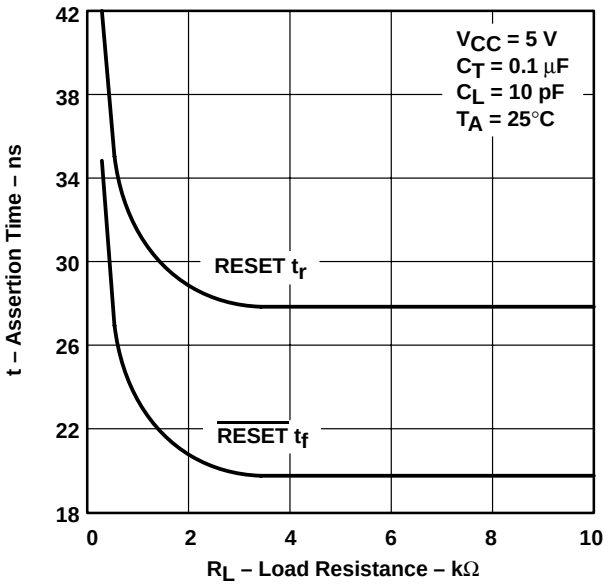


Figure 2

DEASSERTION TIME vs LOAD RESISTANCE

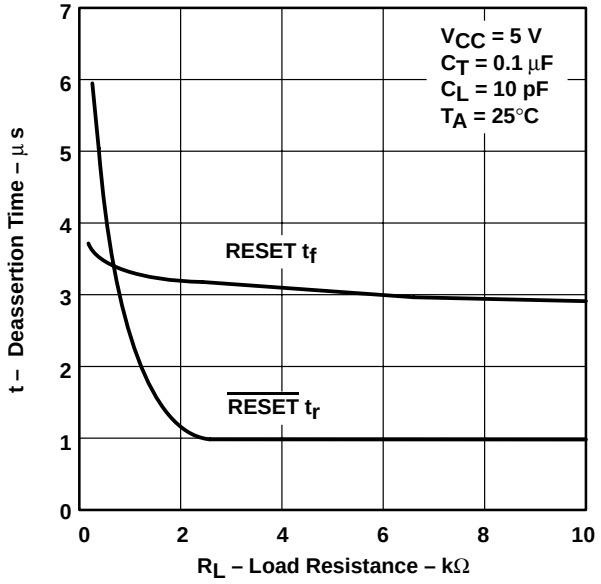


Figure 3

ASSERTION TIME vs LOAD CAPACITANCE

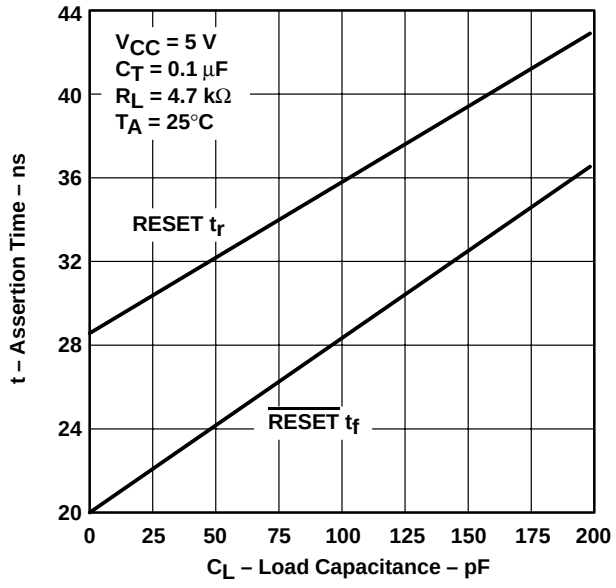


Figure 4

DEASSERTION TIME vs LOAD CAPACITANCE

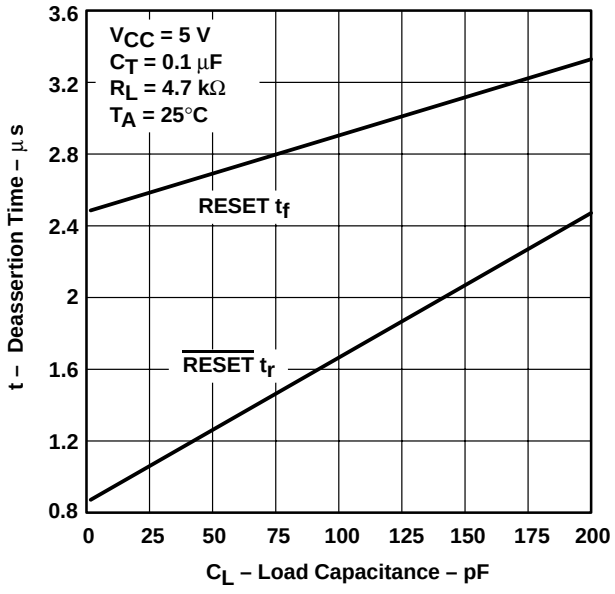


Figure 5

† For proper operation, both RESET and $\overline{\text{RESET}}$ should be terminated with resistors of similar value. Failure to do so may cause unwanted plateauing in either output waveform during switching.

APPLICATION INFORMATION

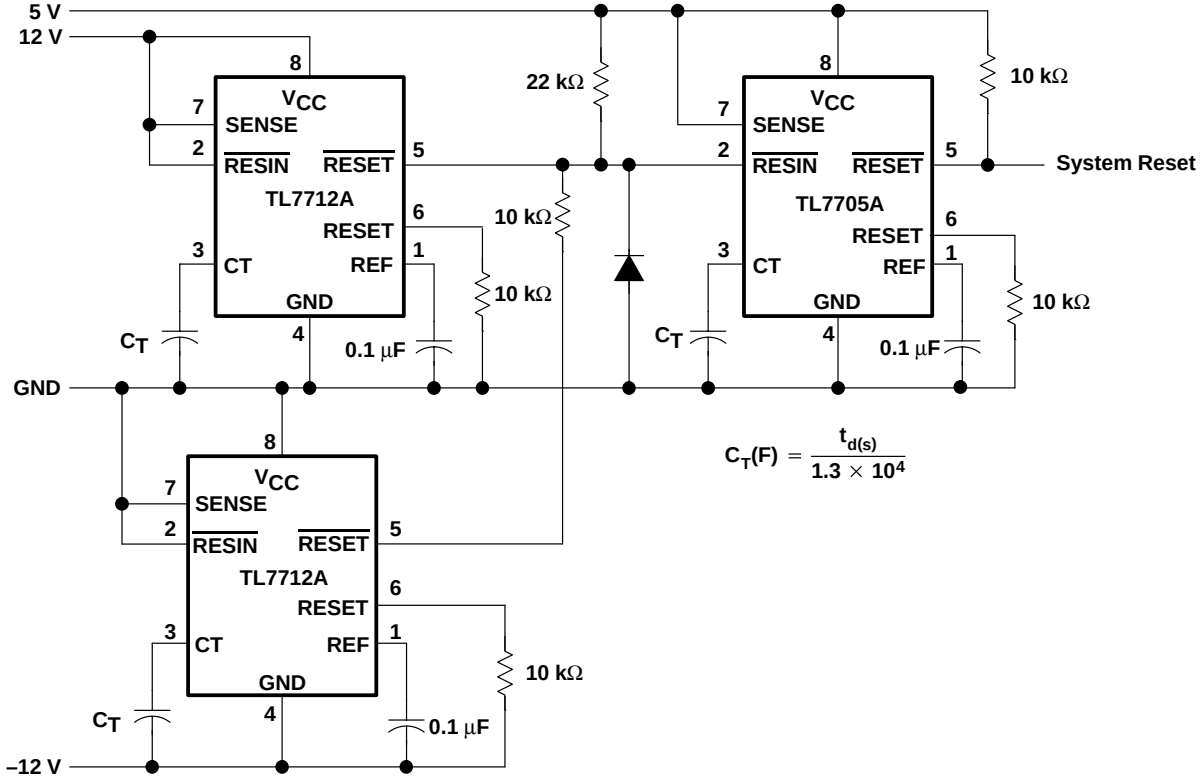


Figure 6. Multiple Power-Supply System Reset Generation

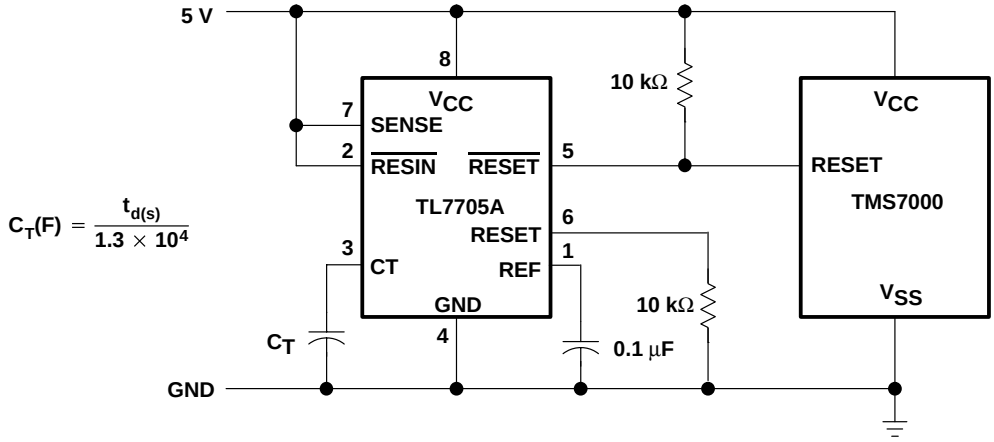


Figure 7. Reset Controller for TMS7000 System

APPLICATION INFORMATION

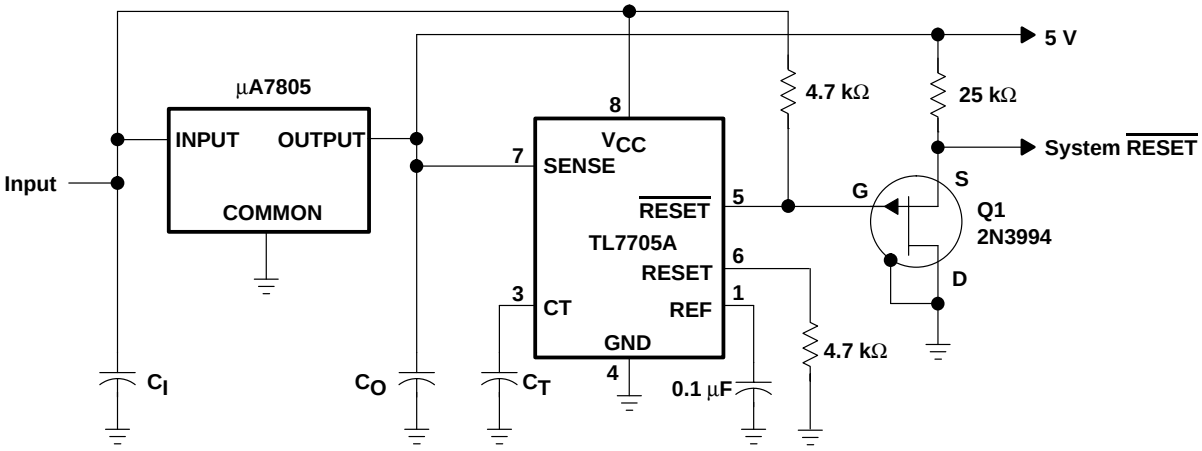


Figure 8. Eliminating Undefined States Using a P-Channel JFET

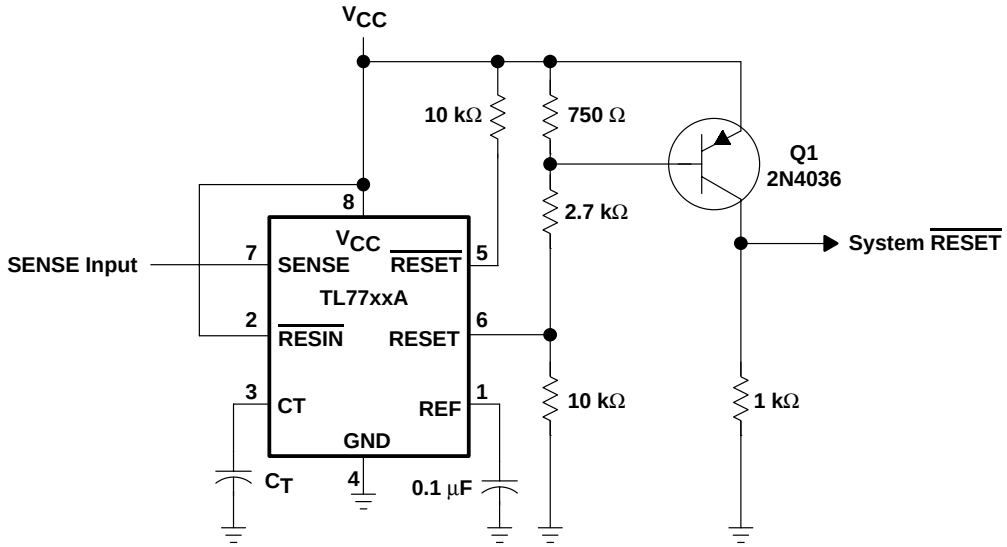


Figure 9. Eliminating Undefined States Using a pnp Transistor

IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgment, including those pertaining to warranty, patent infringement, and limitation of liability.

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

Customers are responsible for their applications using TI components.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, license, warranty or endorsement thereof.

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. Representation or reproduction of this information with alteration voids all warranties provided for an associated TI product or service, is an unfair and deceptive business practice, and TI is not responsible nor liable for any such use.

Resale of TI's 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, is an unfair and deceptive business practice, and TI is not responsible nor liable for any such use.

Also see: Standard Terms and Conditions of Sale for Semiconductor Products. www.ti.com/sc/docs/stdterms.htm

Mailing Address:

Texas Instruments
Post Office Box 655303
Dallas, Texas 75265