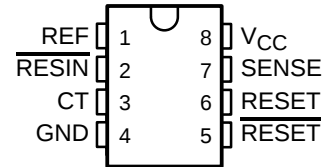


TL7702A, TL7705A, TL7709A, TL7712A, TL7715A SUPPLY-VOLTAGE SUPERVISORS

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- 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	
–40°C to 85°C	PDIP (P)	Tube of 50	TL7715ACP	TL7715ACP
	SOIC (D)	Tube of 75	TL7715ACD	7715AC
		Reel of 2500	TL7715ACDR	
	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.



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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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TL7702A, TL7705A, TL7709A, TL7712A, TL7715A SUPPLY-VOLTAGE SUPERVISORS

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description/ordering information (continued)

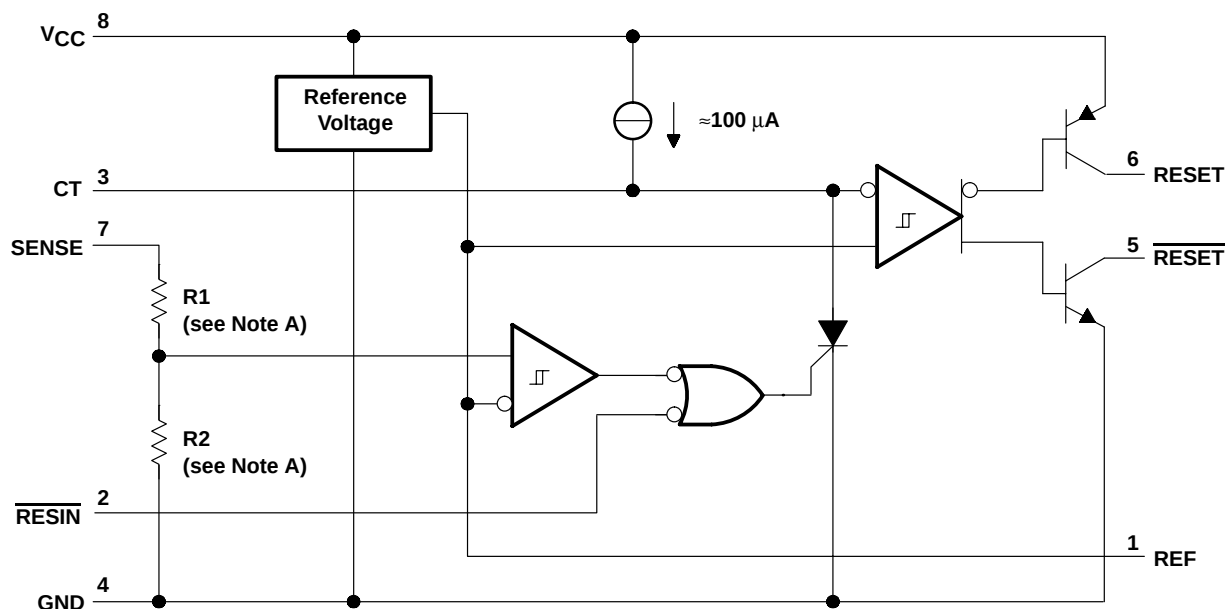
The TL77xxA family of integrated-circuit supply-voltage supervisors is designed specifically for use as reset controllers in microcomputer and microprocessor systems. The supply-voltage supervisor monitors the supply for undervoltage conditions at the SENSE input. During power up, the $\overline{\text{RESET}}$ 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.

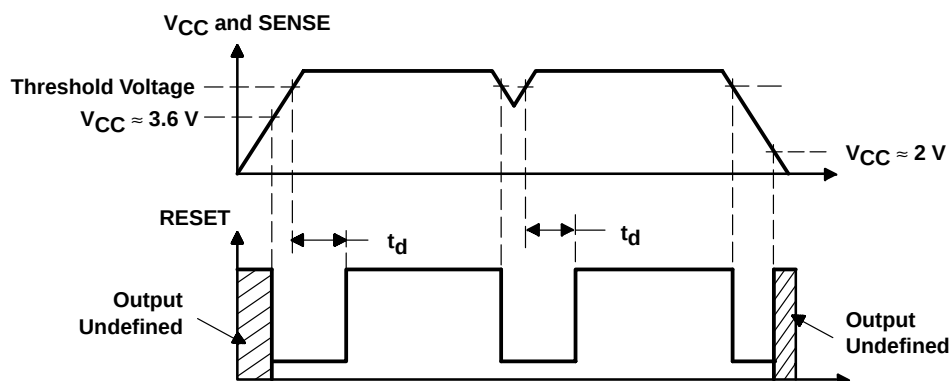
functional block diagram

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: $R1 = 0 \Omega$, $R2 = \text{open}$
 TL7705A: $R1 = 7.8 \text{ k}\Omega$, $R2 = 10 \text{ k}\Omega$
 TL7709A: $R1 = 19.7 \text{ k}\Omega$, $R2 = 10 \text{ k}\Omega$
 TL7712A: $R1 = 32.7 \text{ k}\Omega$, $R2 = 10 \text{ k}\Omega$
 TL7715A: $R1 = 43.4 \text{ k}\Omega$, $R2 = 10 \text{ k}\Omega$
 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 $T_J(\text{max})$, θ_{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 affect reliability.
 4. The package thermal impedance is calculated in accordance with JESD 51-7.

TL7702A, TL7705A, TL7709A, TL7712A, TL7715A SUPPLY-VOLTAGE SUPERVISORS

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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, $\overline{\text{RESET}}$		–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, 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	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, 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.



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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 <u>RESIN</u>			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, <u>RESIN</u> to <u>RESET</u>	V _{CC} = 5 V			1	μs	
t _r	Rise time	<u>RESET</u>	V _{CC} = 5 V, See Note 5			0.2	μs
		<u>RESET</u>				3.5	
t _f	Fall time	<u>RESET</u>	V _{CC} = 5 V, See Note 5			3.5	μs
		<u>RESET</u>				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-k Ω load resistor at RESET and $\overline{\text{RESET}}$.

PARAMETER MEASUREMENT INFORMATION

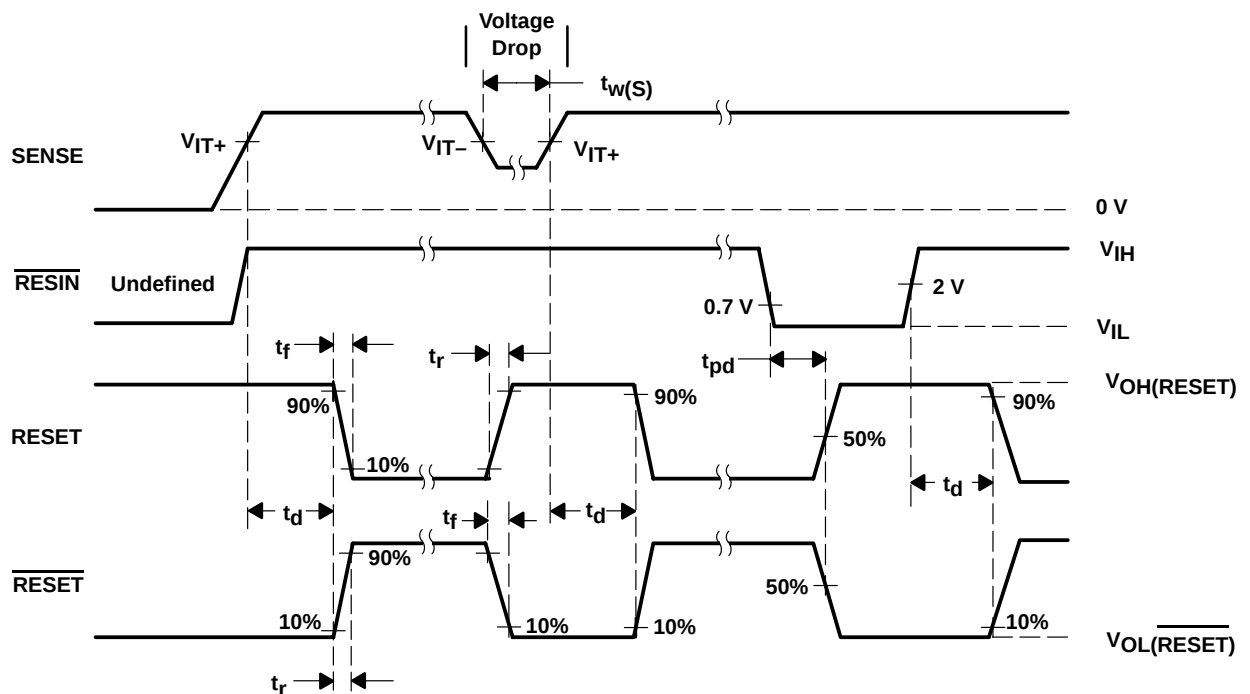


Figure 1. Voltage Waveforms

TL7702A, TL7705A, TL7709A, TL7712A, TL7715A SUPPLY-VOLTAGE SUPERVISORS

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TYPICAL CHARACTERISTICS†

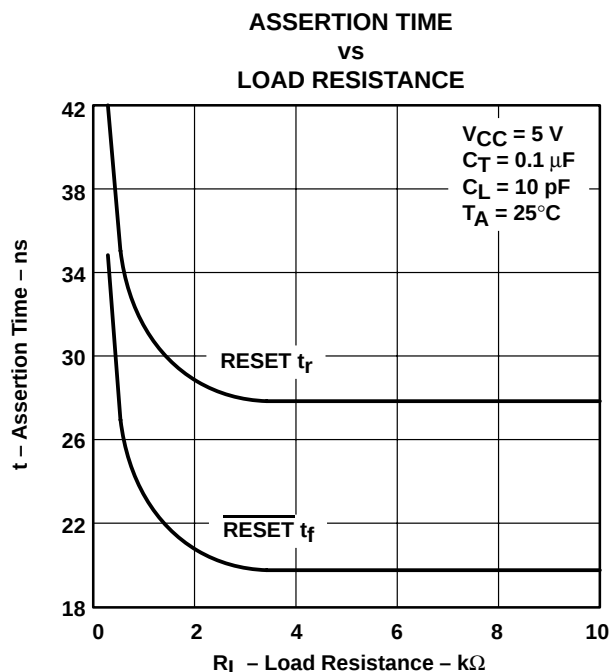


Figure 2

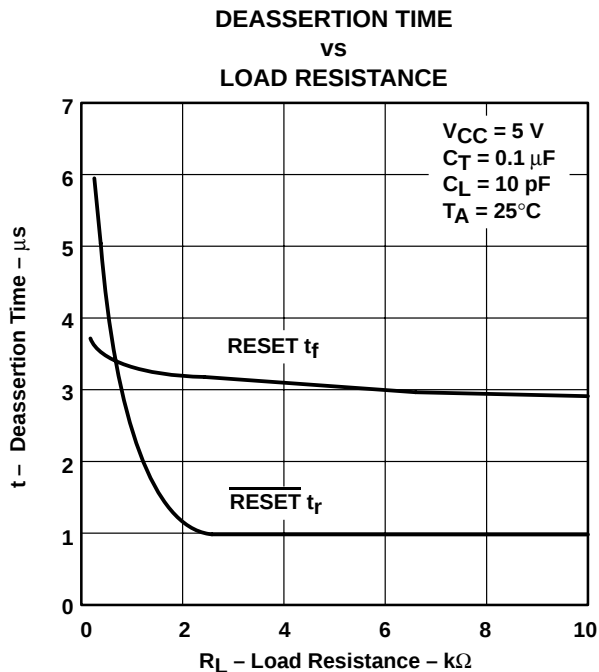


Figure 3

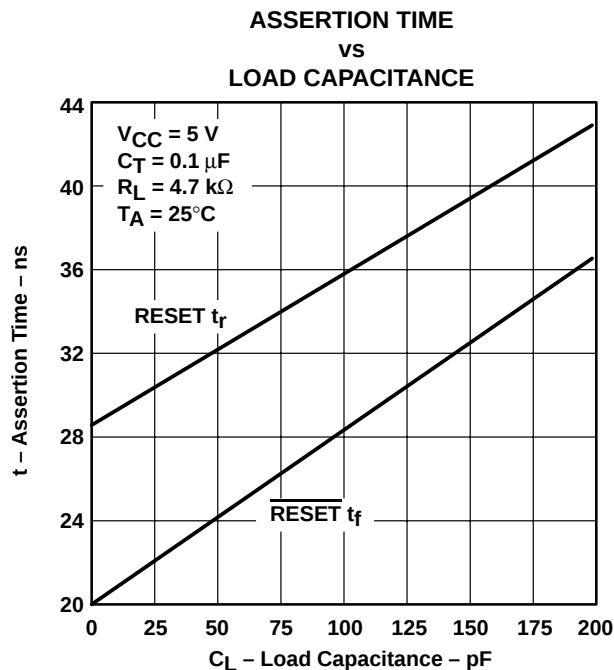


Figure 4

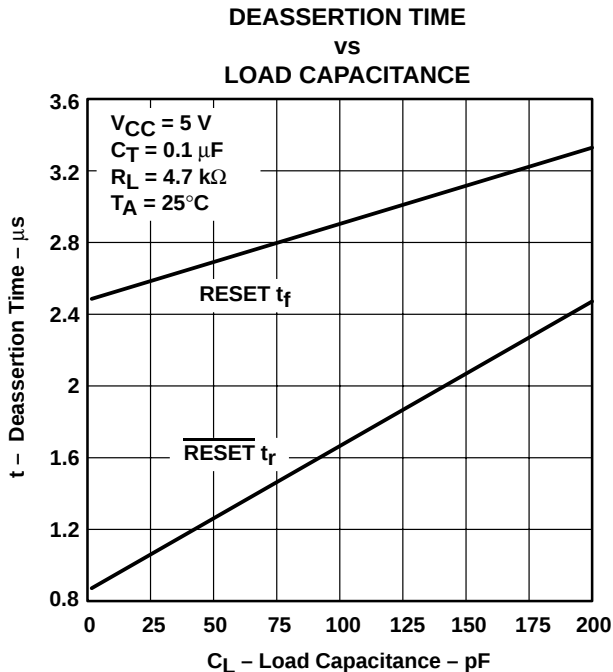


Figure 5

† 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.

[illegible]

$$C_T(F) = \frac{t_{d(s)}}{1.3 \times 10^4}$$



TL7702A, TL7705A, TL7709A, TL7712A, TL7715A SUPPLY-VOLTAGE SUPERVISORS

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APPLICATION INFORMATION

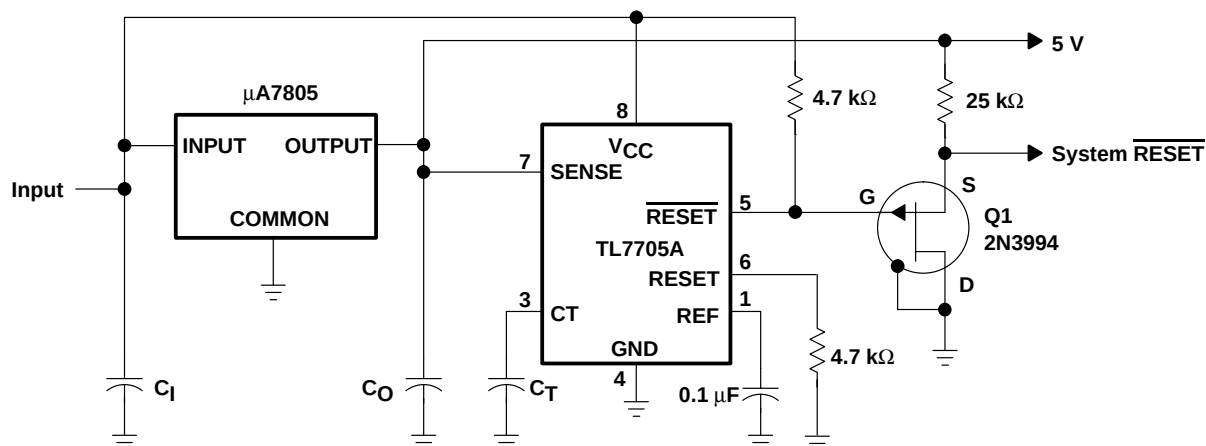


Figure 8. Eliminating Undefined States Using a P-Channel JFET

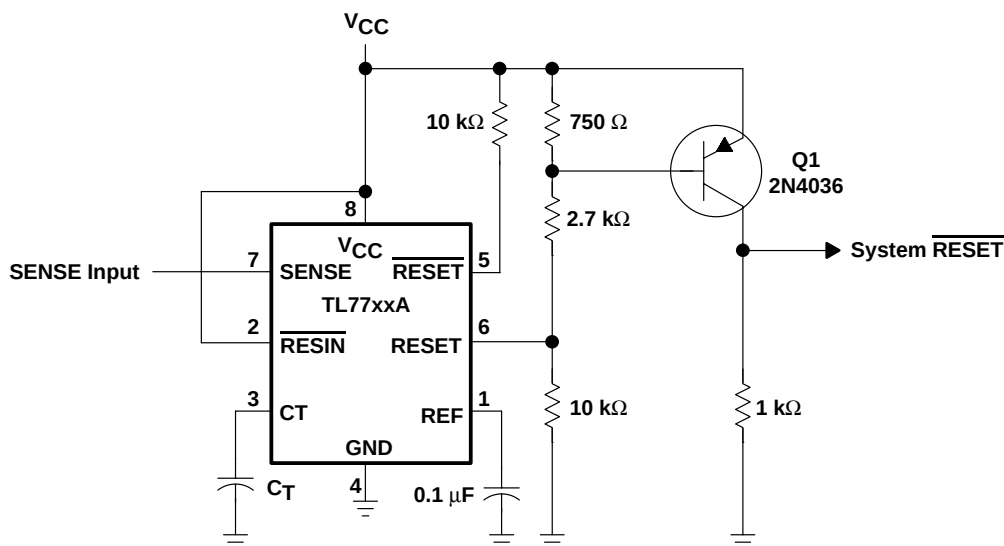


Figure 9. Eliminating Undefined States Using a pnp Transistor

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		None	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		None	Call TI	Call TI
TL7702AMJG	OBSOLETE	CDIP	JG	8		None	Call TI	Call TI
TL7702AMJGB	OBSOLETE	CDIP	JG	8		None	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		None	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		None	Call TI	Call TI
TL7705AMJG	OBSOLETE	CDIP	JG	8		None	Call TI	Call TI
TL7705AMJGB	OBSOLETE	CDIP	JG	8		None	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		None	Call TI	Call TI
TL7709AIP	OBSOLETE	PDIP	P	8		None	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		None	Call TI	Call TI
TL7712AIP	OBSOLETE	PDIP	P	8		None	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		None	Call TI	Call TI
TL7715AIP	OBSOLETE	PDIP	P	8		None	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 - May not be currently available - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

None: Not yet available Lead (Pb-Free).

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" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

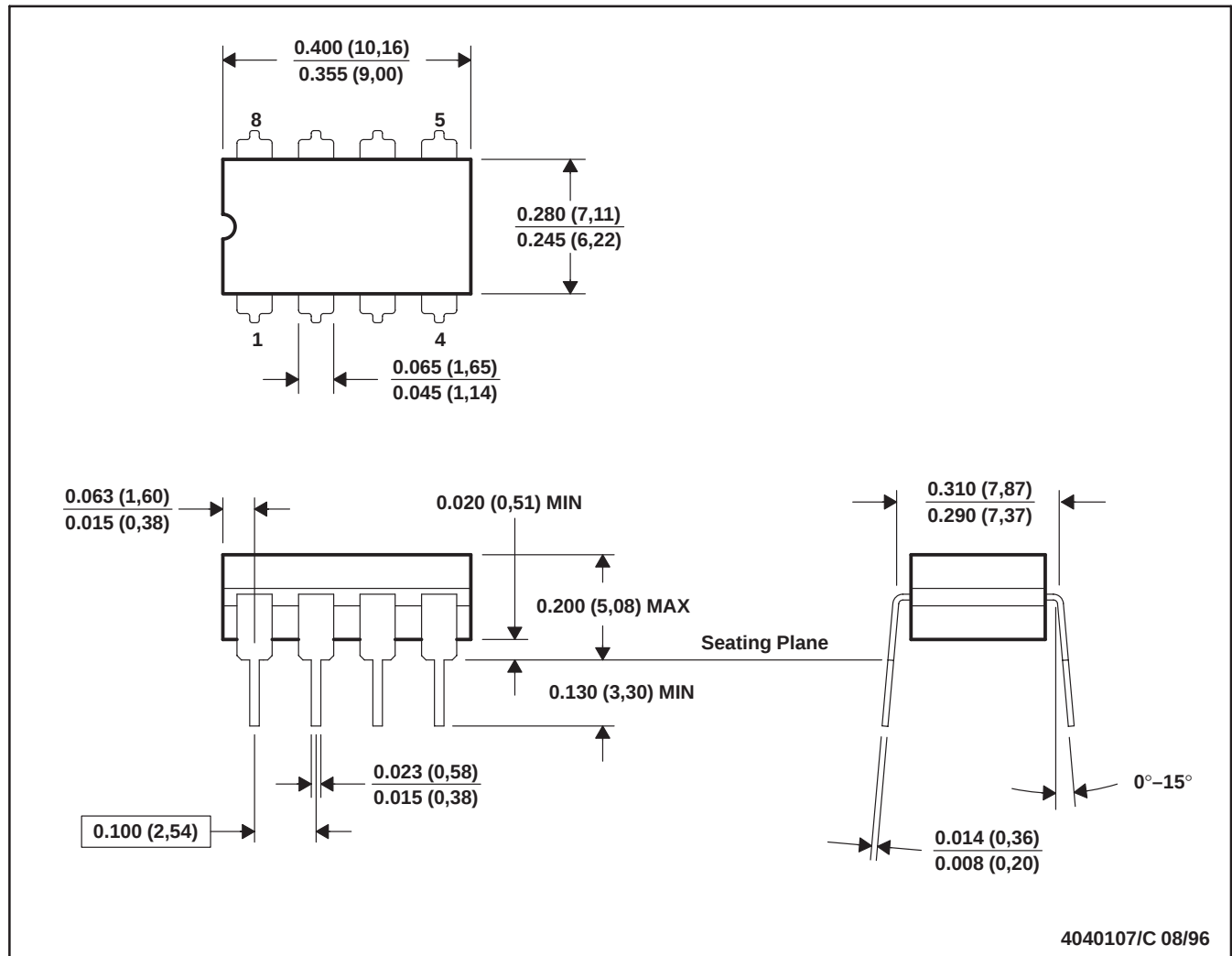
⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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JG (R-GDIP-T8)

CERAMIC DUAL-IN-LINE



- 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 ceramic lid using glass frit.
 D. Index point is provided on cap for terminal identification.
 E. Falls within MIL STD 1835 GDIP1-T8

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

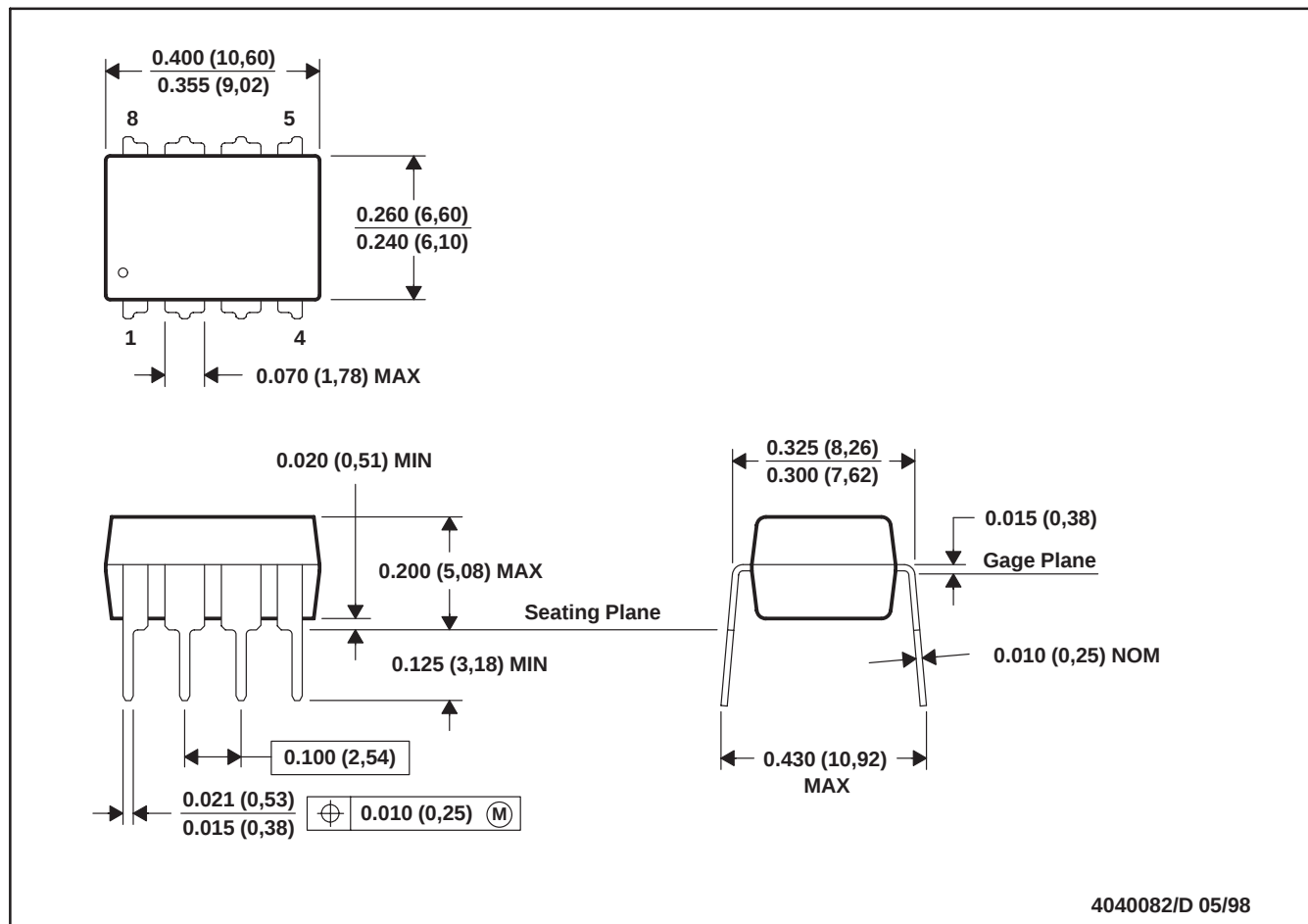
28 TERMINAL SHOWN



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

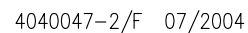
P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE



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

For the latest package information, go to http://www.ti.com/sc/docs/package/pkg_info.htm

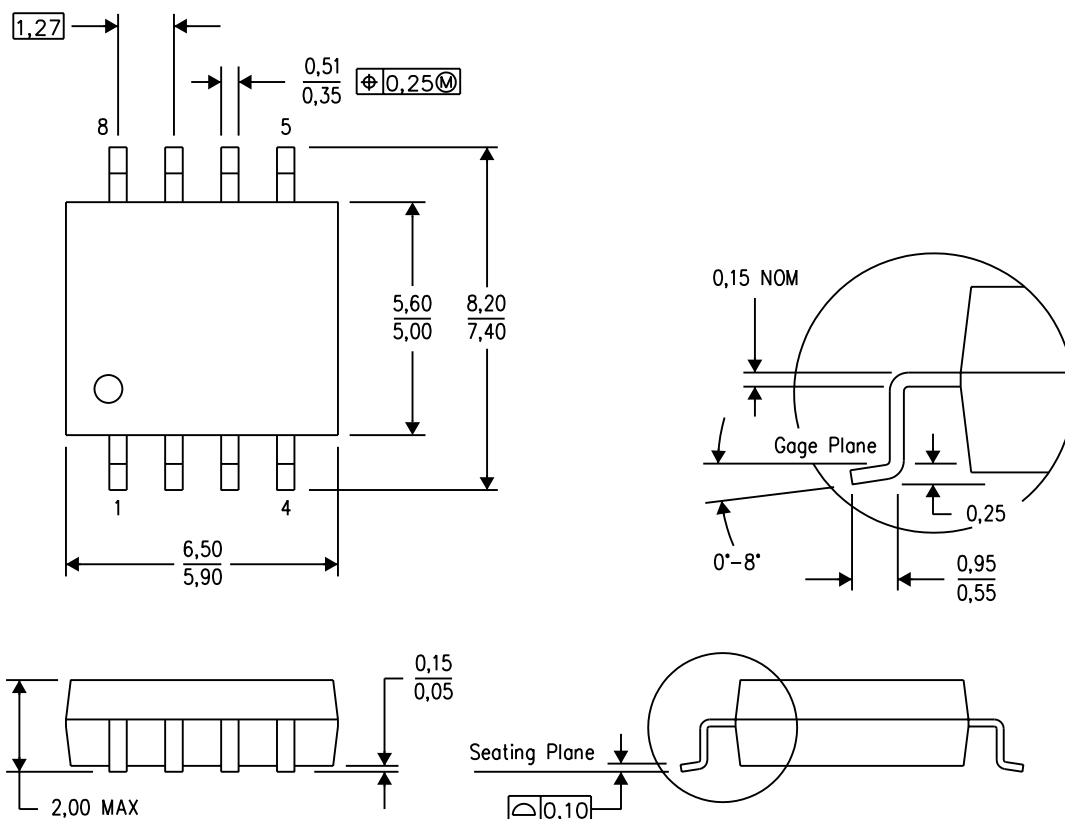


A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MS-012 variation AA.

MECHANICAL DATA

PS (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE



4040063/C 03/03

- 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.

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