

## TL77xxA Supply-Voltage Supervisors

### 1 Features

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

### 2 Applications

- Computers
- Tablets
- Smart Phones
- Servers
- Music Players

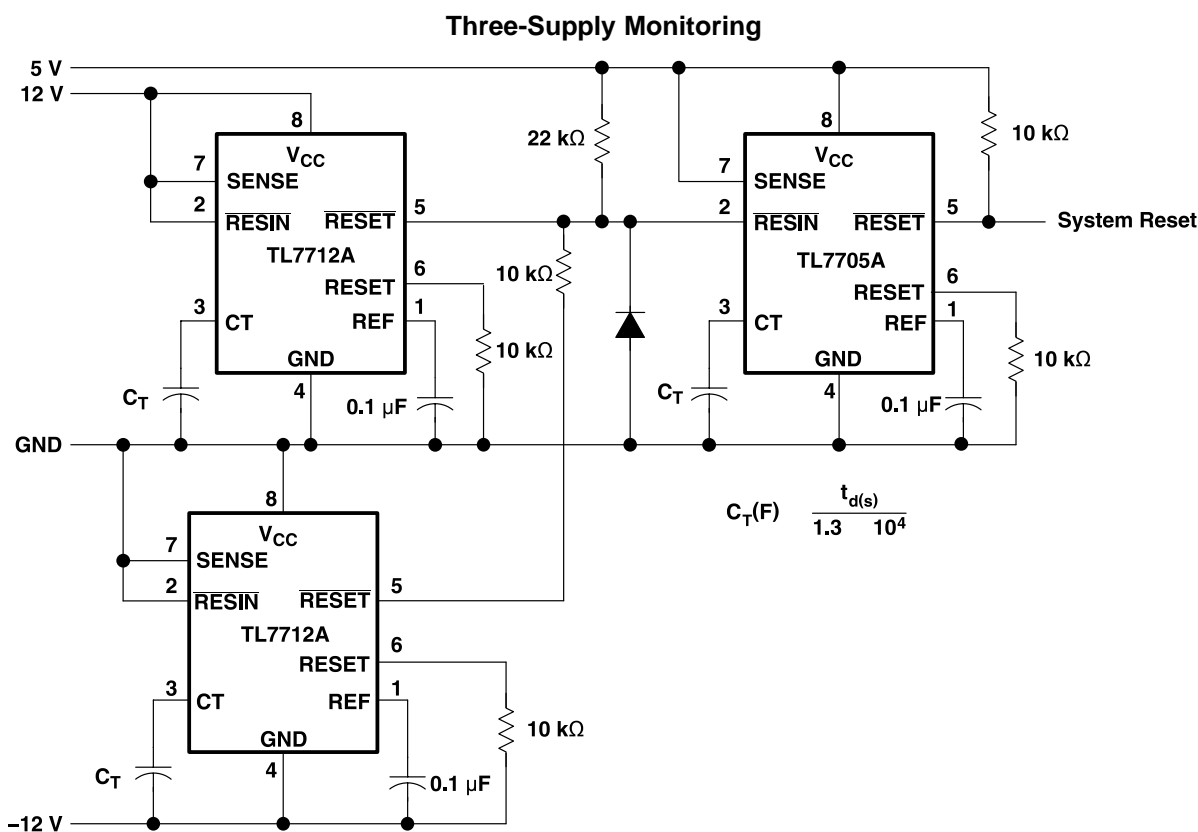
### 3 Description

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 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.

#### Device Information<sup>(1)</sup>

PART NUMBER	PACKAGE	BODY SIZE (NOM)
TL77xxA	SOIC (8)	4.90 mm x 3.91 mm
	PDIP (8)	9.81 mm x 6.35 mm
TL7705A	SO (8)	6.20 mm x 5.30 mm

(1) For all available packages, see the orderable addendum at the end of the datasheet.



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## 4 Revision History

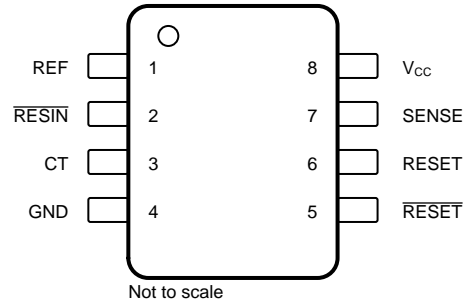
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

<b>Changes from Revision J (January 2015) to Revision K</b>	<b>Page</b>
• Added SO (8) to <i>Device Information</i> table.....	1
• Changed RESET to $\overline{\text{RESET}}$ in <i>Timing Diagram</i> .....	6
• Added <i>Receiving Notification of Documentation Updates</i> section .....	15

<b>Changes from Revision I (July 2009) to Revision J</b>	<b>Page</b>
• Added <i>Applications</i> , <i>Device Information</i> table, <i>Pin Functions</i> table, <i>ESD Ratings</i> table, <i>Thermal Information</i> table, <i>Typical Characteristics</i> , <i>Feature Description</i> section, <i>Device Functional Modes</i> , <i>Application and Implementation</i> section, <i>Power Supply Recommendations</i> section, <i>Layout</i> section, <i>Device and Documentation Support</i> section, and <i>Mechanical, Packaging, and Orderable Information</i> section. ....	1
• Deleted <i>Ordering Information</i> table. ....	1

## 5 Pin Configuration and Functions

TL7702A, TL7709A, TL77012A, TL7715A D or P Package  
 TL7705A D, P, or PS Package  
 8-Pin SOIC, PDIP, or SO  
 Top View



### Pin Functions

PIN		TYPE	DESCRIPTION
NAME	NO.		
CT	3	I/O	External timing-capacitor pin
GND	4	—	Device ground
REF	1	O	Voltage reference output
RESET	6	O	Supervisor reset signal output
$\overline{\text{RESET}}$	5	O	Supervisor reset signal output (inverted)
$\overline{\text{RESIN}}$	2	I	Reset input
SENSE	7	I	Sense input
V <sub>CC</sub>	8	—	Power Supply

## 6 Specifications

### 6.1 Absolute Maximum Ratings

 over operating free-air temperature range (unless otherwise noted) <sup>(1)</sup>

		MIN	MAX	UNIT	
V <sub>CC</sub>	Supply voltage <sup>(2)</sup>		20	V	
V <sub>I</sub>	Input voltage, $\overline{\text{RESIN}}$	-0.3	20	V	
V <sub>I</sub>	Input voltage range SENSE	TL7702A <sup>(3)</sup>	-0.3	6	V
		TL7705A	-0.3	20	V
		TL7709A	-0.3	20	V
		TL7712A, TL7715A	-0.3	20	V
I <sub>OH</sub>	High-level output current, I <sub>OH</sub> , $\overline{\text{RESET}}$		-30	mA	
I <sub>OL</sub>	Low-level output current, I <sub>OL</sub> , $\overline{\text{RESET}}$		30	mA	
T <sub>J</sub>	Operating virtual junction temperature		150	°C	
T <sub>stg</sub>	Storage temperature	-65	150	°C	

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) For proper operation of the TL7702A, the voltage applied to the SENSE terminal should not exceed V<sub>CC</sub> - 1 V or 6 V, whichever is less.
- (3) All voltage values are with respect to GND.

### 6.2 ESD Ratings

		VALUE	UNIT
V <sub>(ESD)</sub>	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>	1000
		Charged device model (CDM), per JEDEC specification JESD22-C101 <sup>(2)</sup>	1000

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
- (2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

### 6.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

		MIN	MAX	UNIT	
V <sub>CC</sub>	Supply Voltage	3.5	18	V	
V <sub>IH</sub>	High-level input voltage at $\overline{\text{RESIN}}$	2		V	
V <sub>IL</sub>	Low-level input voltage at $\overline{\text{RESIN}}$		0.6	V	
V <sub>I</sub>	Input voltage, SENSE	TL7702A	0	See <sup>(1)</sup>	V
		TL7705A	0	10	
		TL7709A	0	15	
		TL7712A	0	20	
		TL7715A	0	20	
I <sub>OH</sub>	High-level output current, $\overline{\text{RESET}}$		-16	mA	
I <sub>OL</sub>	Low-level output current, $\overline{\text{RESET}}$		16	mA	
T <sub>A</sub>	Operating free-air temperature	TL77xxAC	0	70	°C
		TL77xxAI	-40	85	

- (1) For proper operation of the TL7702A, the voltage applied to the SENSE terminal should not exceed V<sub>CC</sub> - 1 V or 6 V, whichever is less.

## 6.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>	TL77xxA			UNIT
	D	P	PS	
	8 PINS	8 PINS	8 PINS	
R <sub>θJA</sub> Junction-to-ambient thermal resistance	97	85	95	°C/W

(1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application report.

## 6.5 Electrical Characteristics

over operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS <sup>(1)</sup>	TL77xxAC TL77xxAI			UNIT	
		MIN	TYP	MAX		
V <sub>OH</sub> High-level output voltage, RESET	I <sub>OH</sub> = -16 mA	V <sub>CC</sub> - 1.5			V	
V <sub>OL</sub> Low-level output voltage, RESET	I <sub>OL</sub> = 16 mA	0.4			V	
V <sub>ref</sub> Reference Voltage	T <sub>A</sub> = 25°C	2.48	2.53	2.58	V	
V <sub>IT-</sub> Negative-going input threshold voltage, SENSE	T <sub>A</sub> = 25°C	TL7702A	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 <sub>hys</sub> Hysteresis, SENS (V <sub>IT+</sub> - V <sub>IT-</sub> )	T <sub>A</sub> = 25°C	TL7702A	10			mV
		TL7705A	15			
		TL7709A	20			
		TL7712A	35			
		TL7715A	45			
I <sub>i</sub> Input current	RESIN	V <sub>I</sub> = 2.4 V to V <sub>CC</sub>		20	μA	
		V <sub>I</sub> = 0.4 V		-100		
	SENSE	TL7702A	V <sub>ref</sub> < V <sub>I</sub> < V <sub>CC</sub> - 1.5 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>CC</sub> Supply current	All inputs and outputs open	1.8			3	mA

(1) All electrical characteristics are measured with 0.1-μF capacitors connected at REF, CT, and V<sub>CC</sub> to GND.

## 6.6 Switching Characteristics

over operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS <sup>(1)</sup>	TL77xxAC TL77xxAI			UNIT	
		MIN	TYP	MAX		
Output pulse duration	CT = 0.1 μF	0.65	1.2	2.6	msec	
Input pulse duration at RESIN		0.4			μs	
t <sub>w(S)</sub> Pulse duration at sense input to switch outputs	V <sub>IH</sub> = V <sub>IT-</sub> + 200 mV, V <sub>IL</sub> = V <sub>IT-</sub> - 200 mV	2			μs	
t <sub>pd</sub> propagation delay time, RESIN to RESET	V <sub>CC</sub> = 5V	1			μs	
t <sub>r</sub> Rise time	RESET	V <sub>CC</sub> = 5 V <sup>(2)</sup>			0.2	μs
	RESET				3.5	
t <sub>f</sub> Fall time	RESET	V <sub>CC</sub> = 5 V <sup>(2)</sup>			3.5	μs
	RESET				0.2	

(1) All switching characteristics are measured with 0.1-μF capacitors connected at REF and V<sub>CC</sub> to GND.

(2) The rise and fall times are measured with a 4.7-kΩ load resistor at RESET and RESET.

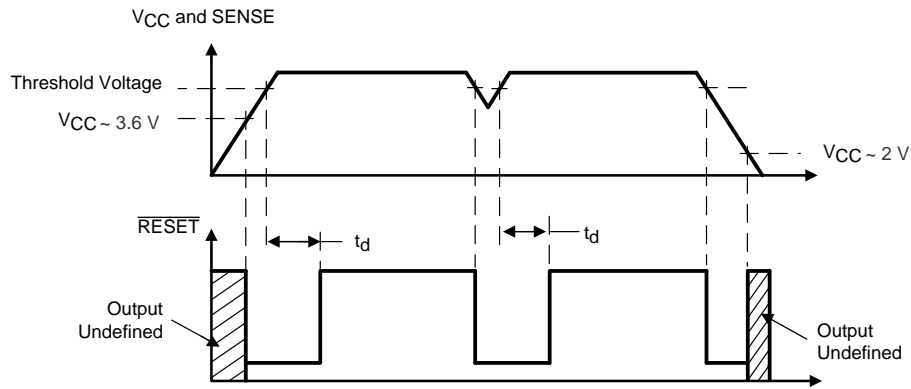


Figure 1. Timing Diagram

### 6.7 Typical Characteristics

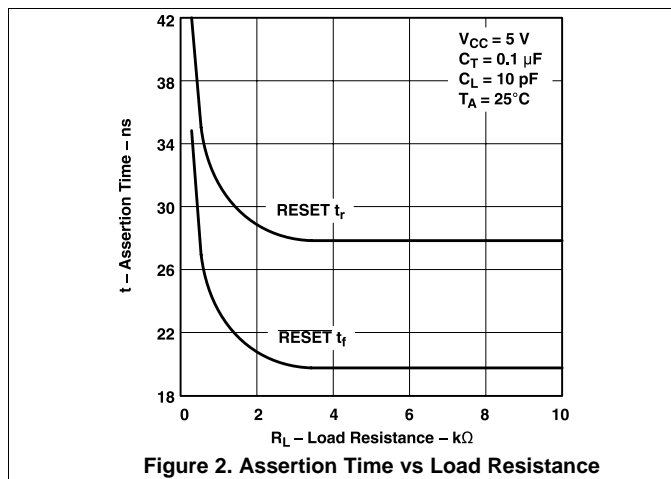


Figure 2. Assertion Time vs Load Resistance

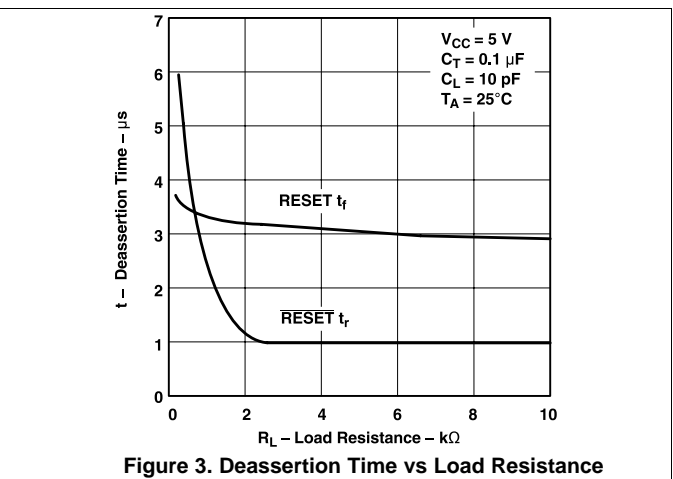


Figure 3. Deassertion Time vs Load Resistance

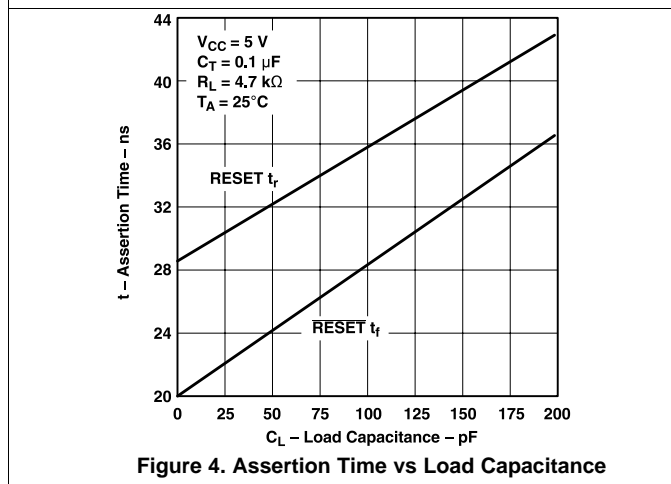


Figure 4. Assertion Time vs Load Capacitance

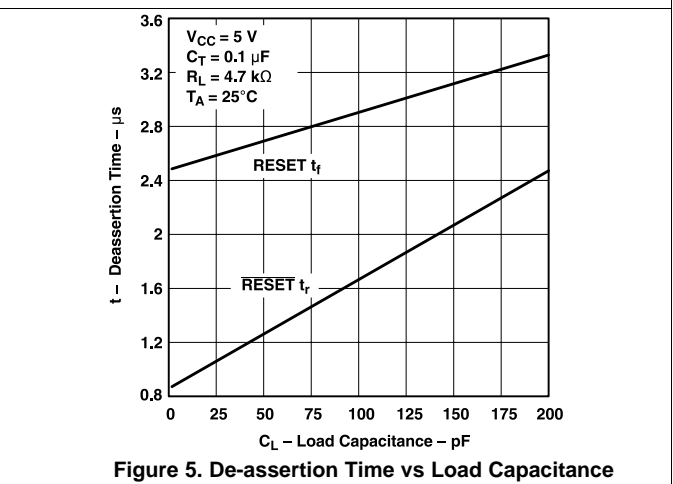


Figure 5. De-assertion Time vs Load Capacitance

## 7 Parameter Measurement Information

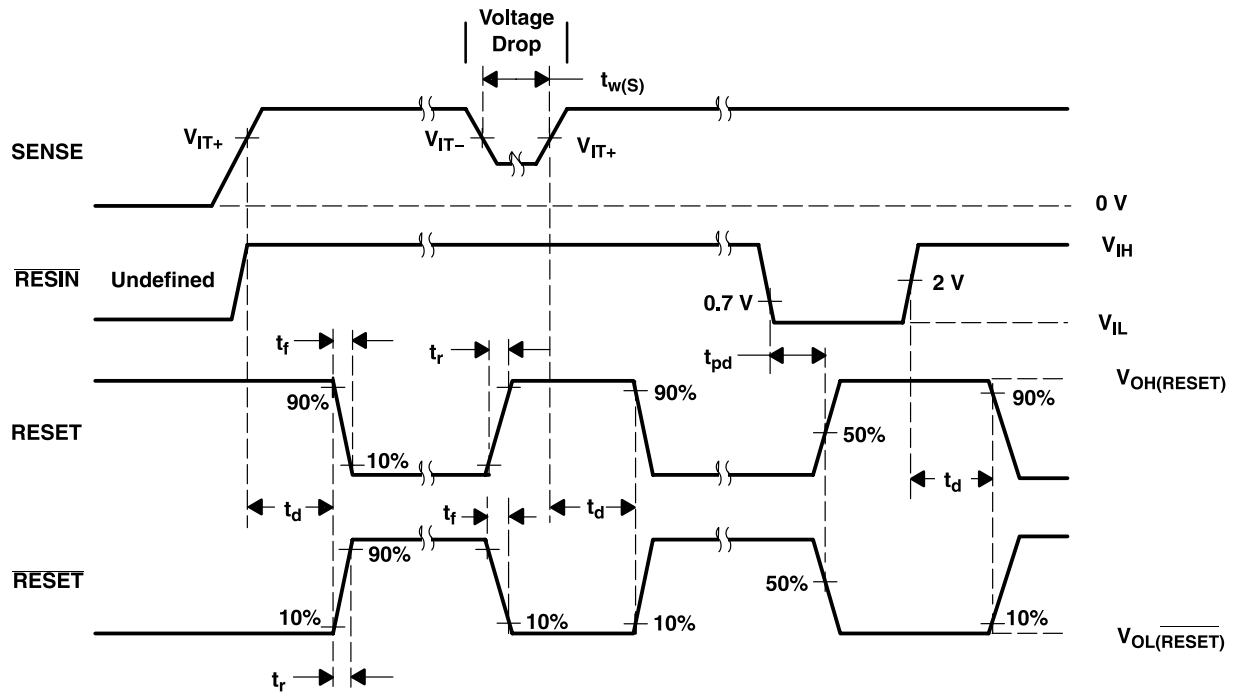


Figure 6. Voltage Waveform

## 8 Detailed Description

### 8.1 Overview

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 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.

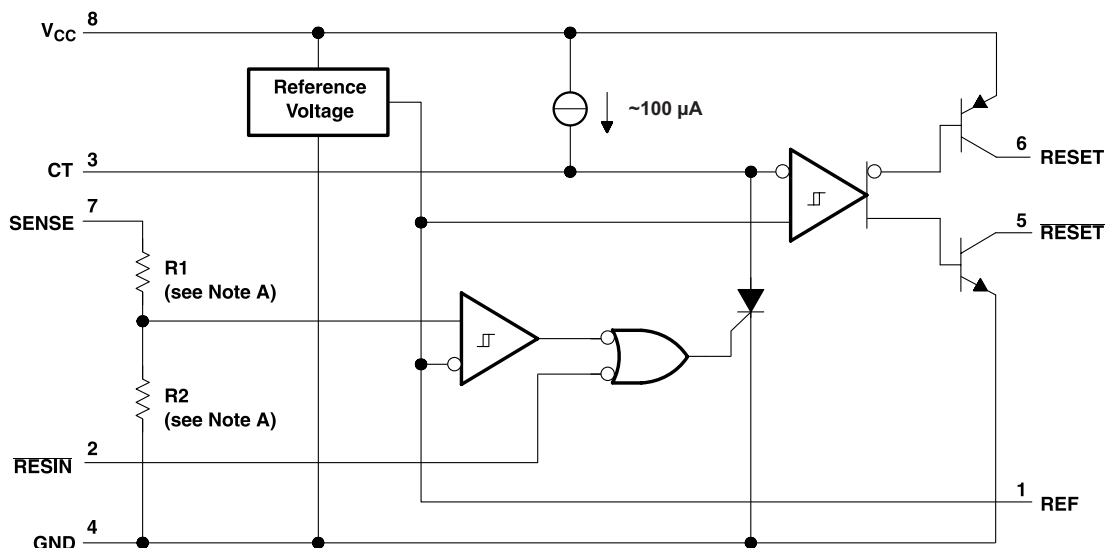
During power down and when SENSE is below  $V_{IT-}$ , the outputs remain active until  $V_{CC}$  falls below 2 V. After this, the outputs are undefined. An external capacitor (typically 0.1  $\mu\text{F}$ ) must be connected to REF to reduce the influence of fast transients in the supply voltage.

Five versions of this circuit are available:

- TL7705A ( $V_t = 4.55 \text{ V}$ ): Application in TTL-systems and microcomputer systems which require a 5 volt supply (for example, TMS7000)
- TL7709A ( $V_t = 7.6 \text{ V}$ ): Application in microcomputer systems using the TMS1XXXNLL
- TL7712A ( $V_t = 10.8 \text{ V}$ ): Application in CMOS, microprocessor, and memory circuits with a 12 volt supply.
- TL7715A ( $V_t = 13.5 \text{ V}$ ): Application in circuits which operate with a supply voltage of 15 V, as is found often in analog circuits.
- TL7702A ( $V_t = 2.5 \text{ V}$ ): Application in systems where other supply voltages are used. The required trigger level may be adjusted with an external resistor divider at the SENSE input.

### 8.2 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.



- 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.

## 8.3 Feature Description

### 8.3.1 Wide Supply-Voltage Range

The TL77xxA family operates over a wide supply voltage range of 3.5 V to 18 V.

### 8.3.2 Externally Adjustable Pulse Duration

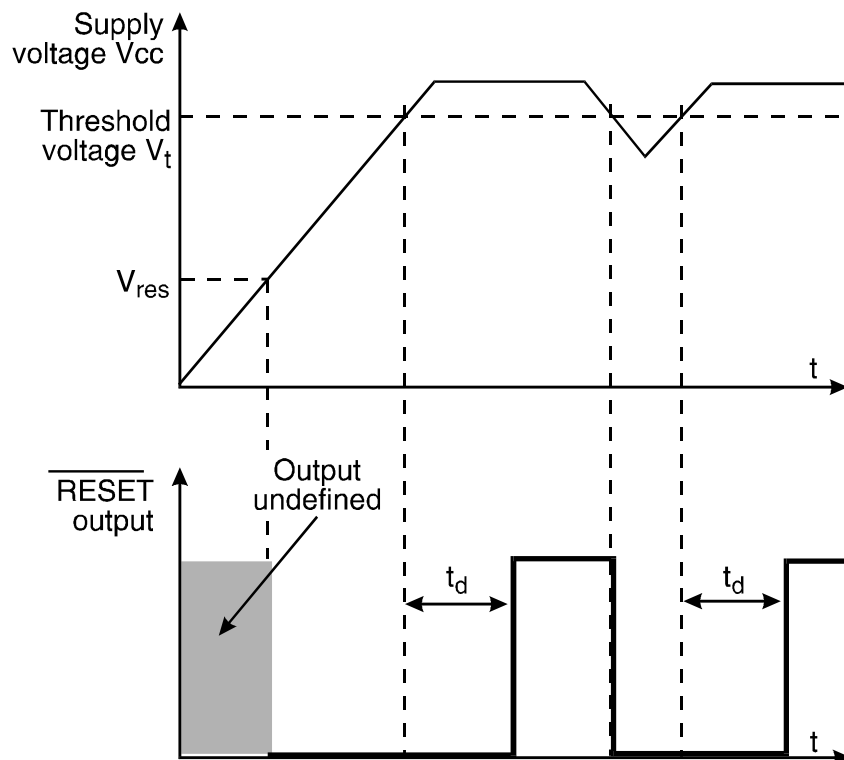
The time delay is determined by the value of the external capacitor  $C_T$ :  $t_d = 1.3 \times 10^4 \times C_T$ , where  $C_T$  is in farads (F) and  $t_d$  is in seconds (s).

### 8.3.3 Temperature-Compensated Voltage Reference

The series TL77xxA incorporates an extremely stable reference voltage source. This voltage source can also be used in applications where a constant voltage source is required. The reference voltage varies less than 10 mV over the supply voltage range of 3.5 V to 18 V. The same stability of the reference voltage is maintained, when the ambient temperature is changed. The reference's voltage varies only 16 mV when the ambient temperature is changed from  $-40^\circ\text{C}$  to  $+85^\circ\text{C}$ .

## 8.4 Device Functional Modes

Figure 7 shows the timing of the various signals. In this example the SENSE input is connected to the supply voltage  $V_{CC}$  as in typical applications of this device. The minimum supply voltage for which the function of this device is guaranteed is 3.6 V. After power-on, the outputs are undefined until the minimum supply voltage  $V_{res}$  is reached. For the TL77xxA the minimum supply voltage is  $V_{res} = 3\text{ V}$  (typical 2.5 V). Beyond the voltage  $V_{res}$  the capacitor  $C_T$  is first kept discharged, and the outputs stay in the active state (RESET = High, RESET = Low). When the input voltage becomes higher than the threshold voltage  $V_t$ , the thyristor is turned off and the capacitor is charged. After a delay,  $t_d$ , the voltage at the capacitor passes the trigger level of the output comparator and the outputs become inactive. The circuit to be initialized is now set to a defined state and starts the correct operation.



A. Note: SENSE Input connected to  $V_{CC}$

Figure 7. Timing Diagram

## 9 Application and Implementation

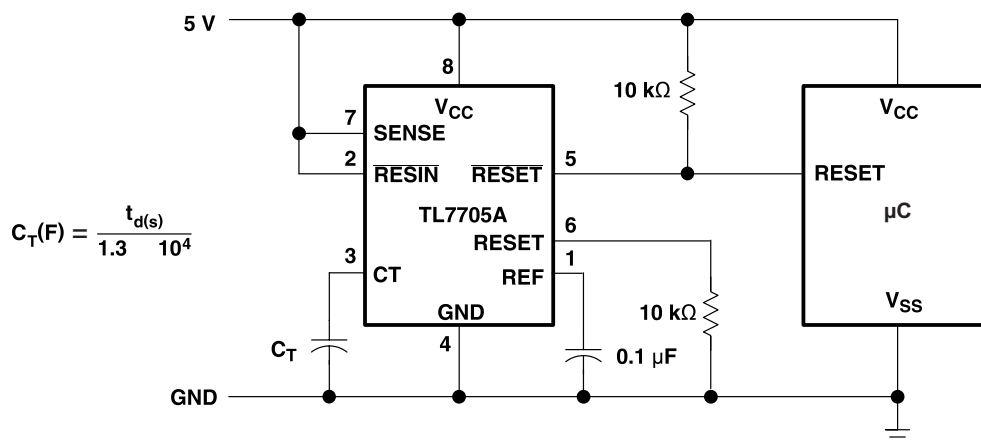
### NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

### 9.1 Application Information

This application shows the initialization circuit diagrams for a microprocessor system with supply voltage  $V_{CC} = 5$  V. The external components required are the decoupling capacitor  $C_{ref}$  for the reference voltage and the timing capacitor  $C_T$ . The outputs of the TL77xxA are open collector outputs. In Figure 8 therefore a pull-up resistor is shown at the RESET output to ensure the correct HIGH level.

### 9.2 Typical Application



**Figure 8. Reset Controller Schematic for a Microprocessor**

#### 9.2.1 Design Requirements

- 5-V microprocessor supply voltage
- $t_d = 1.3$  ms

#### 9.2.2 Detailed Design Procedure

- Select reasonable values for pull-up/pull-down resistors for RESET and  $\overline{\text{RESET}}$ . This design uses 10 kΩ.
- Choose  $C_T = 0.1$  µF to achieve  $t_d = 1.3$  ms
- This design uses only the active-low reset output ( $\overline{\text{RESET}}$ ) because the example microcontroller resets when the input is Low.

Typical Application (continued)

9.2.3 Application Curves

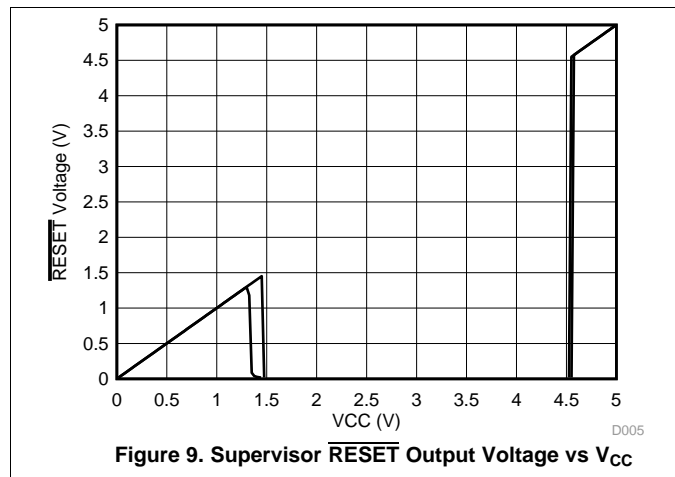


Figure 9. Supervisor  $\overline{\text{RESET}}$  Output Voltage vs  $V_{CC}$

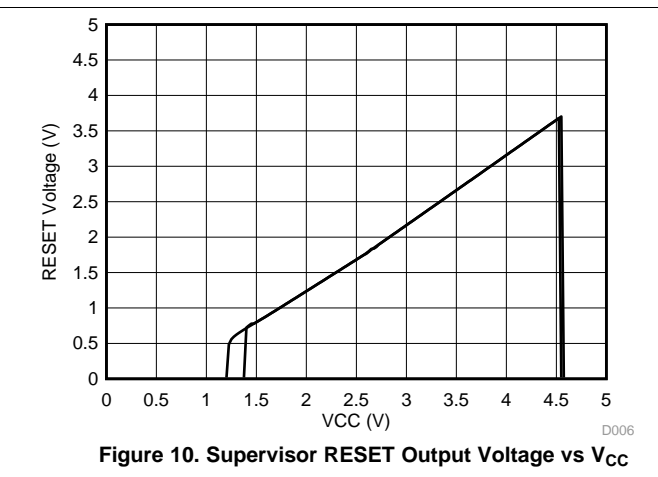


Figure 10. Supervisor  $\overline{\text{RESET}}$  Output Voltage vs  $V_{CC}$

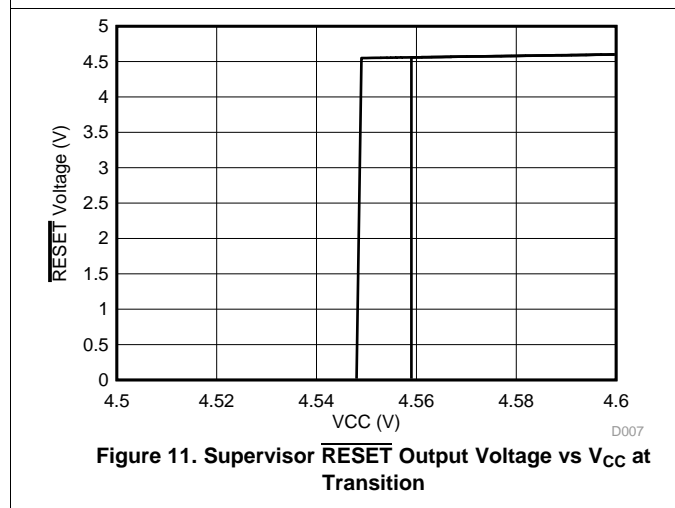


Figure 11. Supervisor  $\overline{\text{RESET}}$  Output Voltage vs  $V_{CC}$  at Transition

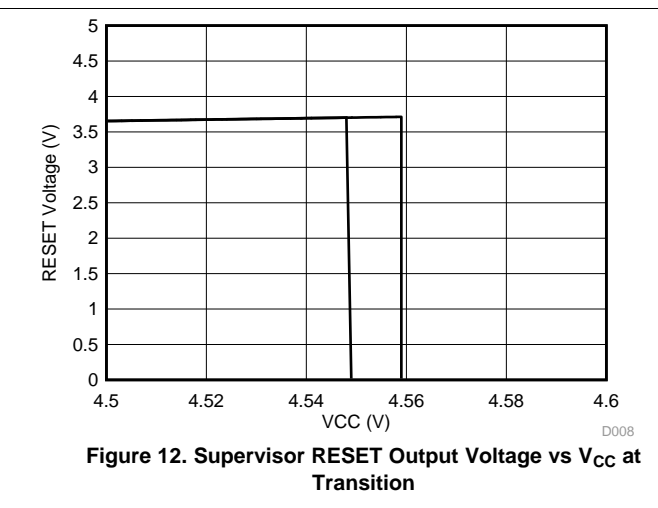
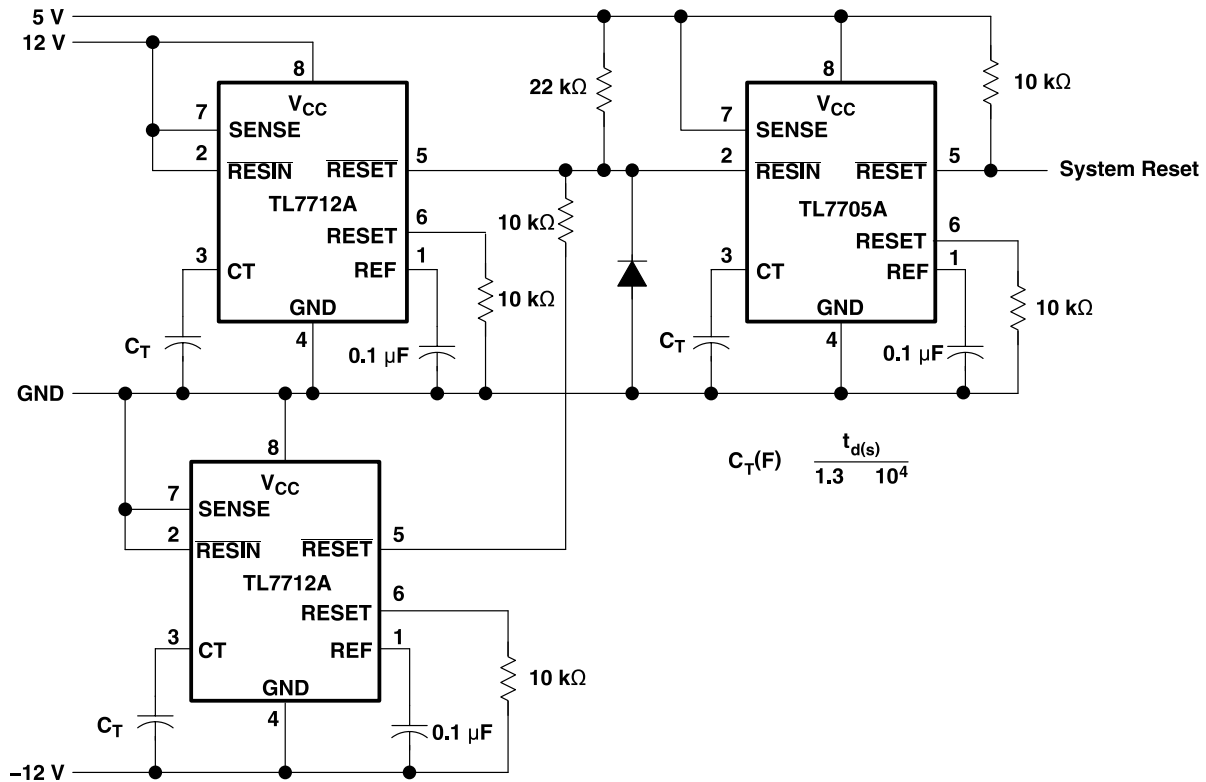
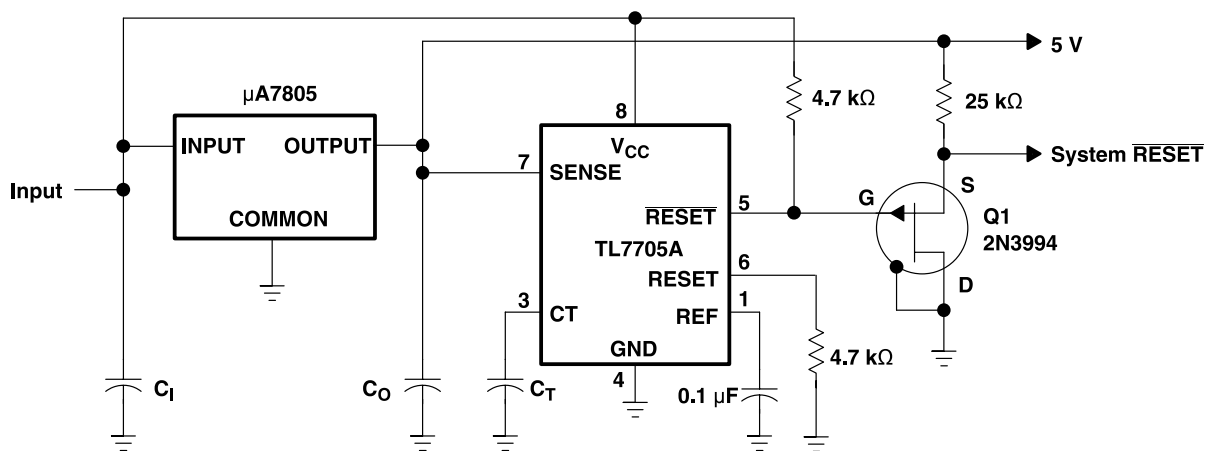


Figure 12. Supervisor  $\overline{\text{RESET}}$  Output Voltage vs  $V_{CC}$  at Transition

### 9.3 System Examples



**Figure 13. Multi Power-Supply System Reset Generation Schematic**



**Figure 14. Eliminating Undefined States Using a P-Channel JFET Schematic**

System Examples (continued)

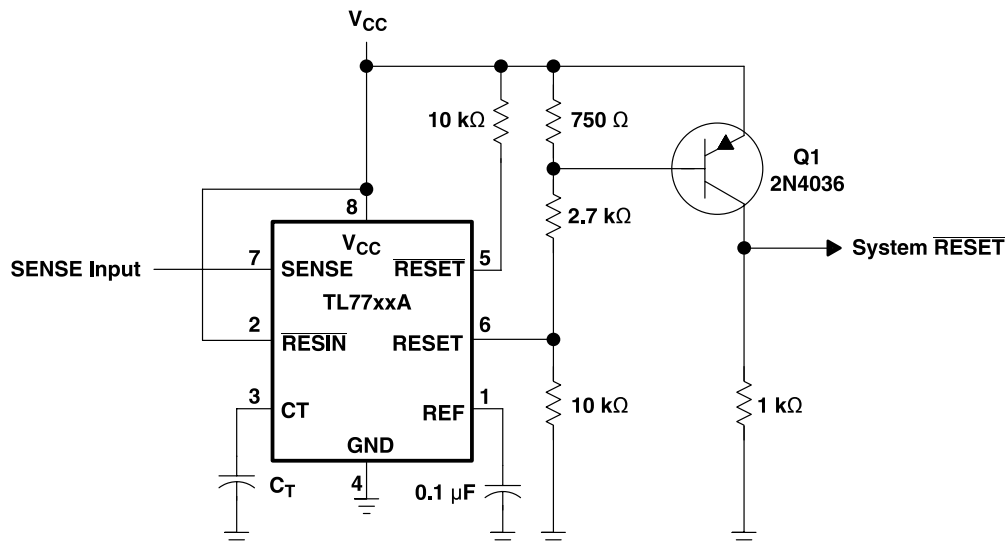


Figure 15. Eliminating Undefined States Using PNP Transistor Schematic

## 10 Power Supply Recommendations

The TL77xxA devices operate within the specifications from the [Recommended Operating Conditions](#) between 3.5 V and 18 V.

### CAUTION

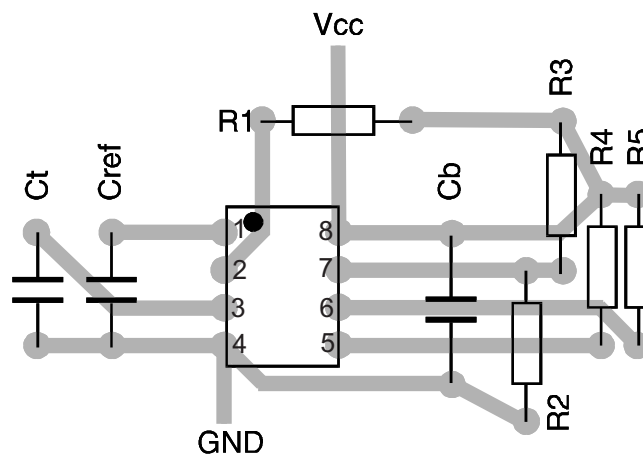
These devices risk being damaged when powered by more than 20 V.

## 11 Layout

### 11.1 Layout Guidelines

The voltage monitor should be placed on the printed circuit board, where there are no neighboring circuits in the which switch high currents (like bus interface circuits and power switches). When laying out the layout of the printed circuit board, take special care with the interconnects which carry analog signals. Beside the SENSE input these are the  $C_T$  and  $V_{ref}$  terminals. Noise coupled into the  $C_T$  input will lead to a reduction of the output pulse width. Noise coupled into the  $V_{ref}$  input or into the filter capacitor at this input may lead to undesired triggering of the circuit and by this to an undesired RESET pulse. Practice shows, that this malfunction when high currents flow over the interconnects of these capacitors to the GND terminal of the voltage monitor. To avoid these effects, the GND terminals of these capacitors must be connected by the shortest way to the GND terminal of the voltage monitor in so that no currents caused by other circuits flow over these wires. [Figure 16](#) show a layout proposal for the printed circuit board. Furthermore the resistors of the voltage divider at the SENSE input of the TL7702 (R2 and R3 in [Figure 16](#)) have to be placed in so, that no noise may be coupled into this circuit.

### 11.2 Layout Example



**Figure 16. Printed Circuit Layout for the Supply Voltage Supervisor**

## 12 Device and Documentation Support

### 12.1 Related Links

The table below lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to sample or buy.

**Table 1. Related Links**

PARTS	PRODUCT FOLDER	SAMPLE & BUY	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY
TL7702A	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>
TL7705A	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>
TL7709A	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>
TL7712A	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>
TL7715A	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>

### 12.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on *Alert me* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

### 12.3 Community Resources

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

**TI E2E™ Online Community** *TI's Engineer-to-Engineer (E2E) Community*. Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

**Design Support** *TI's Design Support* Quickly find helpful E2E forums along with design support tools and contact information for technical support.

### 12.4 Trademarks

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### 12.5 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

### 12.6 Glossary

[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

## 13 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

**PACKAGING INFORMATION**

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">TL7702ACD</a>	Active	Production	SOIC (D)   8	75   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	7702AC
TL7702ACD.A	Active	Production	SOIC (D)   8	75   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	7702AC
<a href="#">TL7702ACDR</a>	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	7702AC
TL7702ACDR.A	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	7702AC
<a href="#">TL7702ACP</a>	Active	Production	PDIP (P)   8	50   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	TL7702ACP
TL7702ACP.A	Active	Production	PDIP (P)   8	50   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	TL7702ACP
<a href="#">TL7702AID</a>	Active	Production	SOIC (D)   8	75   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	7702AI
TL7702AID.A	Active	Production	SOIC (D)   8	75   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	7702AI
<a href="#">TL7702AIDR</a>	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	7702AI
TL7702AIDR.A	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	7702AI
<a href="#">TL7702AIP</a>	Active	Production	PDIP (P)   8	50   TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 85	TL7702AIP
TL7702AIP.A	Active	Production	PDIP (P)   8	50   TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 85	TL7702AIP
<a href="#">TL7705ACD</a>	Active	Production	SOIC (D)   8	75   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	7705AC
TL7705ACD.A	Active	Production	SOIC (D)   8	75   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	7705AC
<a href="#">TL7705ACDR</a>	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	7705AC
TL7705ACDR.A	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	7705AC
<a href="#">TL7705ACP</a>	NRND	Production	PDIP (P)   8	50   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	TL7705ACP
TL7705ACP.A	NRND	Production	PDIP (P)   8	50   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	TL7705ACP
<a href="#">TL7705ACPSR</a>	Active	Production	SO (PS)   8	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	T7705A
TL7705ACPSR.A	Active	Production	SO (PS)   8	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	T7705A
<a href="#">TL7705AID</a>	Active	Production	SOIC (D)   8	75   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	7705AI
TL7705AID.A	Active	Production	SOIC (D)   8	75   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	7705AI
<a href="#">TL7705AIDR</a>	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	7705AI
TL7705AIDR.A	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	7705AI
<a href="#">TL7705AIP</a>	NRND	Production	PDIP (P)   8	50   TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 85	TL7705AIP
TL7705AIP.A	NRND	Production	PDIP (P)   8	50   TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 85	TL7705AIP
<a href="#">TL7709ACD</a>	Active	Production	SOIC (D)   8	75   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	7709AC
TL7709ACD.A	Active	Production	SOIC (D)   8	75   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	7709AC
<a href="#">TL7709ACDR</a>	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	7709AC

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TL7709ACDR.A	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	7709AC
<a href="#">TL7709ACP</a>	Active	Production	PDIP (P)   8	50   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	TL7709ACP
TL7709ACP.A	Active	Production	PDIP (P)   8	50   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	TL7709ACP
<a href="#">TL7712ACD</a>	Active	Production	SOIC (D)   8	75   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	7712AC
TL7712ACD.A	Active	Production	SOIC (D)   8	75   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	7712AC
<a href="#">TL7712ACDR</a>	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	7712AC
TL7712ACDR.A	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	7712AC
<a href="#">TL7712ACP</a>	Active	Production	PDIP (P)   8	50   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	TL7712ACP
TL7712ACP.A	Active	Production	PDIP (P)   8	50   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	TL7712ACP
<a href="#">TL7712AIDR</a>	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-	7712AI
TL7712AIDR.A	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	7712AI
<a href="#">TL7715ACD</a>	Active	Production	SOIC (D)   8	75   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	7715AC
TL7715ACD.A	Active	Production	SOIC (D)   8	75   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	7715AC
<a href="#">TL7715ACP</a>	Active	Production	PDIP (P)   8	50   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	TL7715ACP
TL7715ACP.A	Active	Production	PDIP (P)   8	50   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	TL7715ACP

(1) **Status:** For more details on status, see our [product life cycle](#).

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

(4) **Lead finish/Ball material:** Parts 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.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*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
TL7702ACDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TL7702AIDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TL7705ACDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TL7705ACPSR	SO	PS	8	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1
TL7705AIDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TL7709ACDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TL7712ACDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TL7712AIDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TL7702ACDR	SOIC	D	8	2500	353.0	353.0	32.0
TL7702AIDR	SOIC	D	8	2500	353.0	353.0	32.0
TL7705ACDR	SOIC	D	8	2500	353.0	353.0	32.0
TL7705ACPSR	SO	PS	8	2000	353.0	353.0	32.0
TL7705AIDR	SOIC	D	8	2500	353.0	353.0	32.0
TL7709ACDR	SOIC	D	8	2500	353.0	353.0	32.0
TL7712ACDR	SOIC	D	8	2500	353.0	353.0	32.0
TL7712AIDR	SOIC	D	8	2500	353.0	353.0	32.0

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
TL7702ACD	D	SOIC	8	75	507	8	3940	4.32
TL7702ACD	D	SOIC	8	75	506.6	8	3940	4.32
TL7702ACD.A	D	SOIC	8	75	506.6	8	3940	4.32
TL7702ACD.A	D	SOIC	8	75	507	8	3940	4.32
TL7702ACP	P	PDIP	8	50	506	13.97	11230	4.32
TL7702ACP.A	P	PDIP	8	50	506	13.97	11230	4.32
TL7702AID	D	SOIC	8	75	507	8	3940	4.32
TL7702AID.A	D	SOIC	8	75	507	8	3940	4.32
TL7702AIP	P	PDIP	8	50	506	13.97	11230	4.32
TL7702AIP.A	P	PDIP	8	50	506	13.97	11230	4.32
TL7705ACD	D	SOIC	8	75	507	8	3940	4.32
TL7705ACD.A	D	SOIC	8	75	507	8	3940	4.32
TL7705ACP	P	PDIP	8	50	506	13.97	11230	4.32
TL7705ACP.A	P	PDIP	8	50	506	13.97	11230	4.32
TL7705AID	D	SOIC	8	75	507	8	3940	4.32
TL7705AID.A	D	SOIC	8	75	507	8	3940	4.32
TL7705AIP	P	PDIP	8	50	506	13.97	11230	4.32
TL7705AIP.A	P	PDIP	8	50	506	13.97	11230	4.32
TL7709ACD	D	SOIC	8	75	507	8	3940	4.32
TL7709ACD.A	D	SOIC	8	75	507	8	3940	4.32
TL7709ACP	P	PDIP	8	50	506	13.97	11230	4.32
TL7709ACP.A	P	PDIP	8	50	506	13.97	11230	4.32
TL7712ACD	D	SOIC	8	75	507	8	3940	4.32
TL7712ACD.A	D	SOIC	8	75	507	8	3940	4.32
TL7712ACP	P	PDIP	8	50	506	13.97	11230	4.32
TL7712ACP.A	P	PDIP	8	50	506	13.97	11230	4.32
TL7715ACD	D	SOIC	8	75	507	8	3940	4.32
TL7715ACD.A	D	SOIC	8	75	507	8	3940	4.32
TL7715ACP	P	PDIP	8	50	506	13.97	11230	4.32

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Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
TL7715ACP.A	P	PDIP	8	50	506	13.97	11230	4.32



D0008A

# PACKAGE OUTLINE

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



4214825/C 02/2019

## NOTES:

- Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
- This drawing is subject to change without notice.
- This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed  $.006$  [0.15] per side.
- This dimension does not include interlead flash.
- Reference JEDEC registration MS-012, variation AA.

# EXAMPLE BOARD LAYOUT

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE  
 EXPOSED METAL SHOWN  
 SCALE:8X



SOLDER MASK DETAILS

4214825/C 02/2019

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

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE  
BASED ON .005 INCH [0.125 MM] THICK STENCIL  
SCALE:8X

4214825/C 02/2019

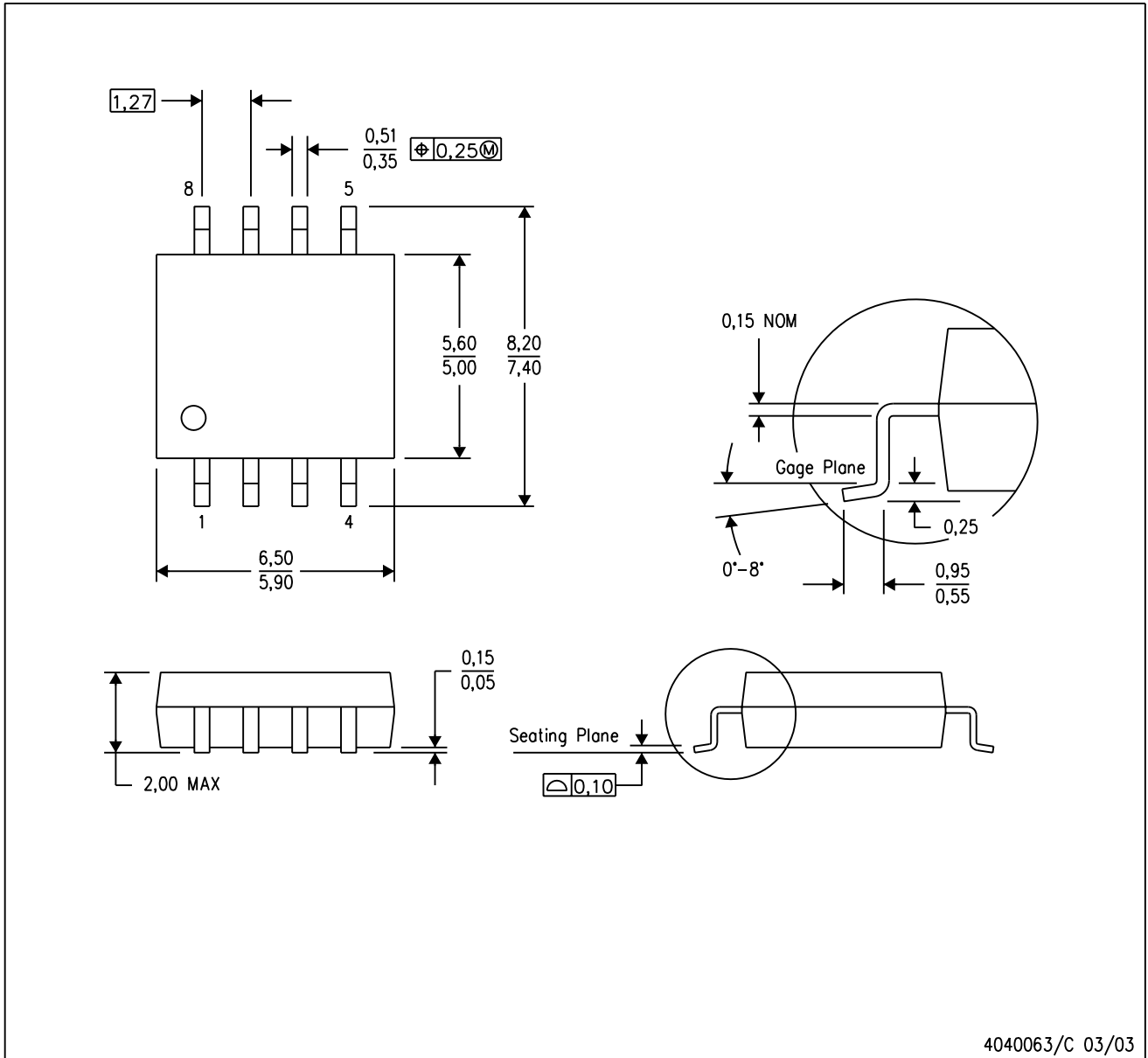
NOTES: (continued)

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.

## MECHANICAL DATA

PS (R-PDSO-G8)

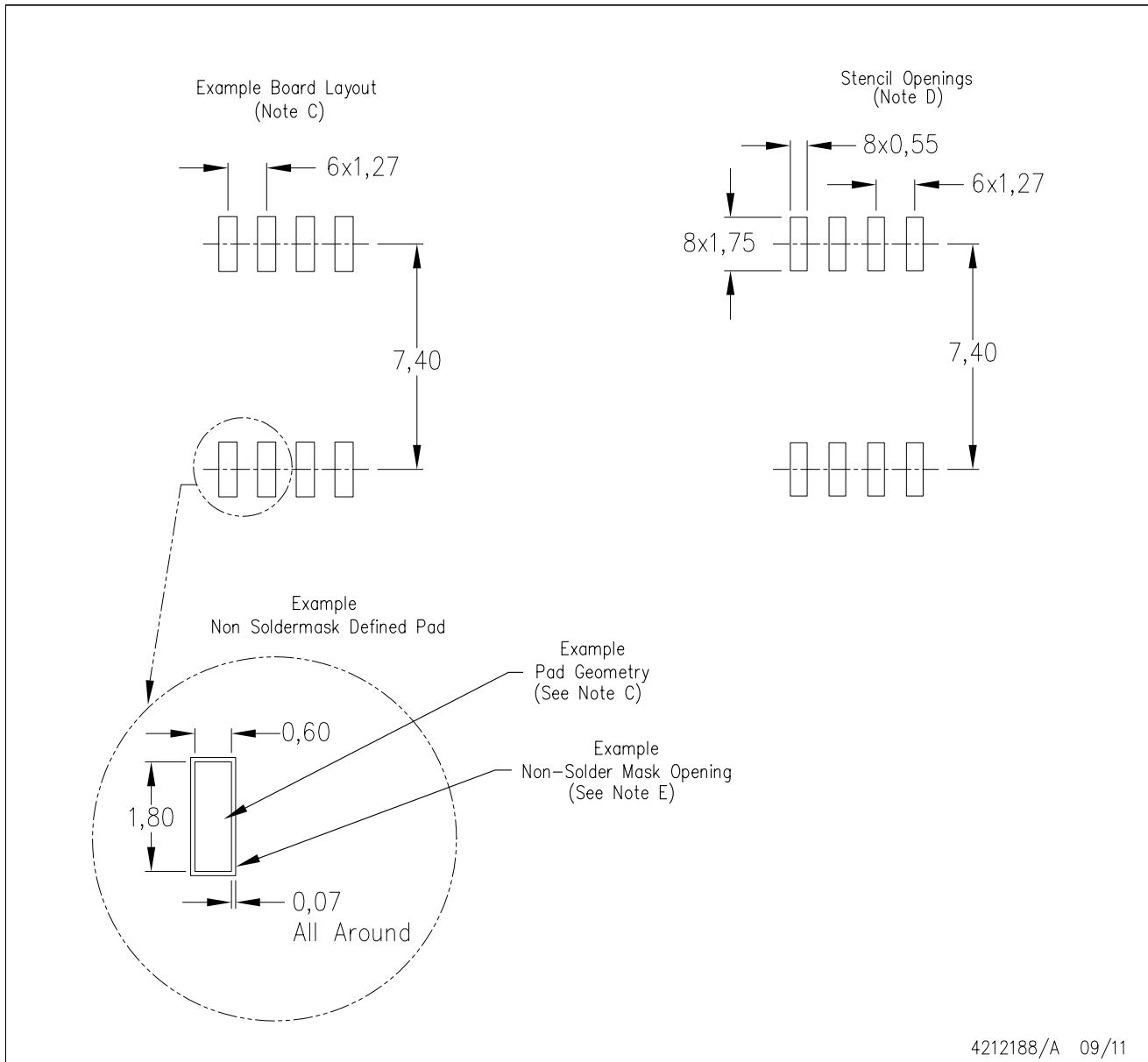
PLASTIC SMALL-OUTLINE PACKAGE



- 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.

PS (R-PDSO-G8)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE PACKAGE



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

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