

## SCSI Active Terminator

### FEATURES

- Complies with SCSI, SCSI-2 Standards
- 10pF Channel Capacitance During Disconnect
- Active Termination for 18 Lines
- Logic Command Disconnects all Termination Lines
- Low Supply Current in Disconnect Mode
- Trimmed Regulator for Accurate Termination Current
- Current Limit and Thermal Shutdown Protection
- 110 Ohm Termination
- Meets SCSI Hot Plugging

### DESCRIPTION

The UC5601 provides precision resistive pull-up to a 2.9V reference for all 18 lines in a Small Computer Systems Interface (SCSI) bus cable. The SCSI-2 standard recommends active termination at both ends of every cable segment utilizing single ended drivers and receivers.

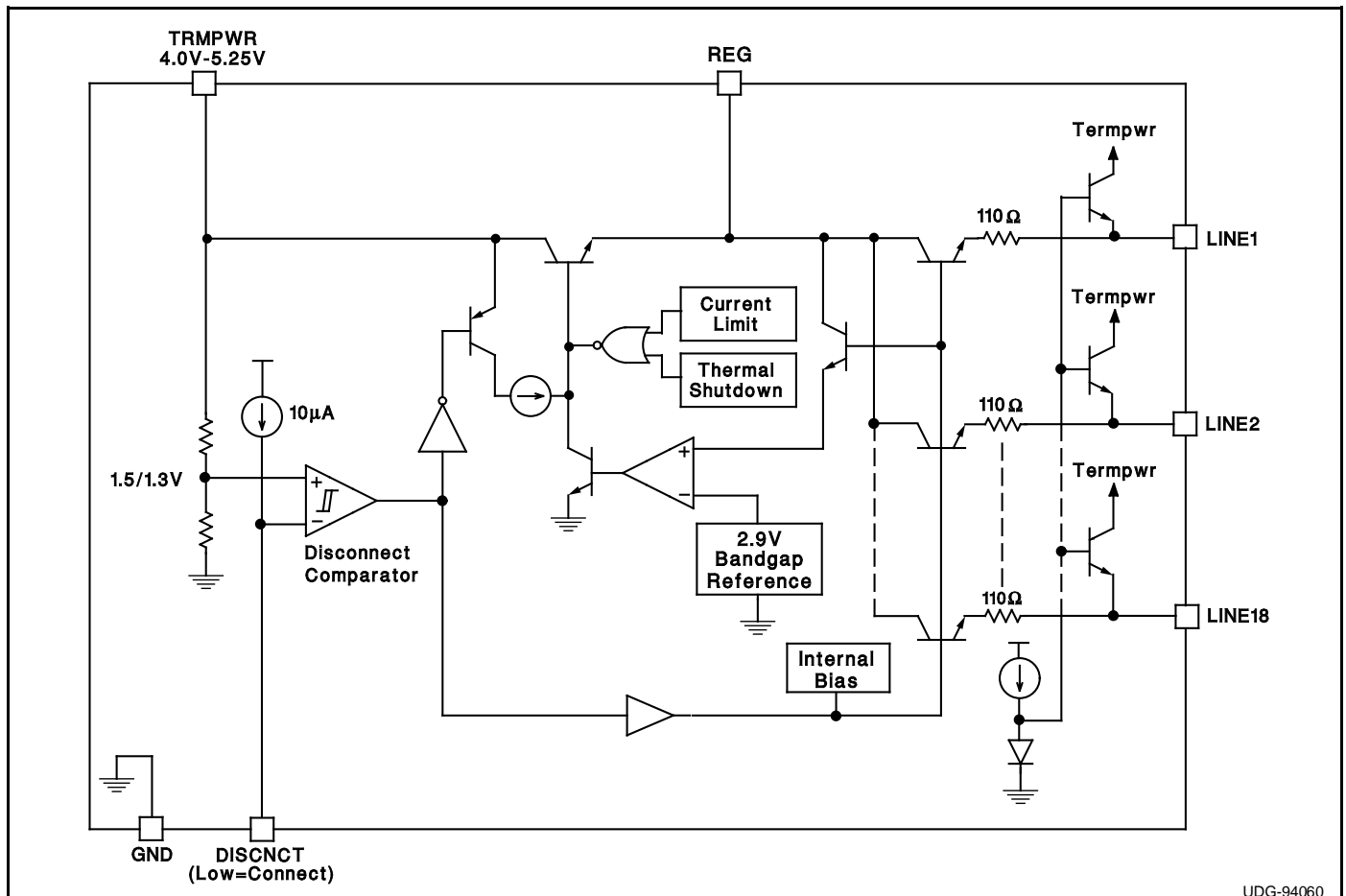
Internal circuit trimming is utilized, first to reduce resistor tolerances to  $\pm 3\%$  and then to adjust the regulator's output voltage to insure termination current accuracy of  $\pm 3\%$ .

The UC5601 provides a disconnect feature which, upon a logic command, disconnects all terminating resistors, and turns off the regulator; greatly reducing standby power.

Other features include negative clamping on all signal lines, 20mA of active negation sink current capability, regulator current limiting, and thermal shut-down protection.

This device is offered in low thermal resistance versions of the industry standard 28 pin wide body SOIC and PLCC, as well as a 24 pin DIL plastic package.

### BLOCK DIAGRAM



UDG-94060

Circuit Design Patented

**ABSOLUTE MAXIMUM RATINGS**

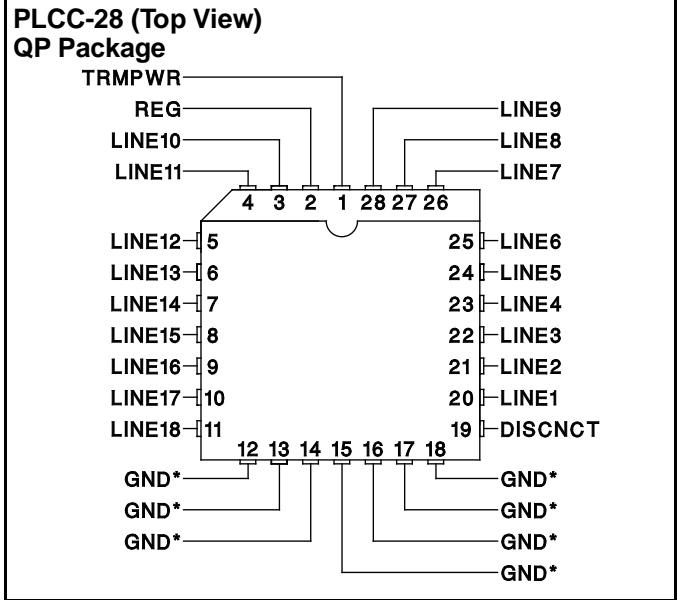
- Tempwr Voltage ..... +7V
- Signal Line Voltage..... 0V to +7V
- Regulator Output Current ..... 1A
- Storage Temperature ..... -65°C to +150°C
- Operating Temperature ..... -55°C to +150°C
- Lead Temperature (Soldering, 10 Sec.)..... +300°C

Unless otherwise specified all voltages are with respect to Ground. Currents are positive into, negative out of the specified terminal.  
Consult Packaging Section of Unitrode Integrated Circuits databook for thermal limitations and considerations of packages.

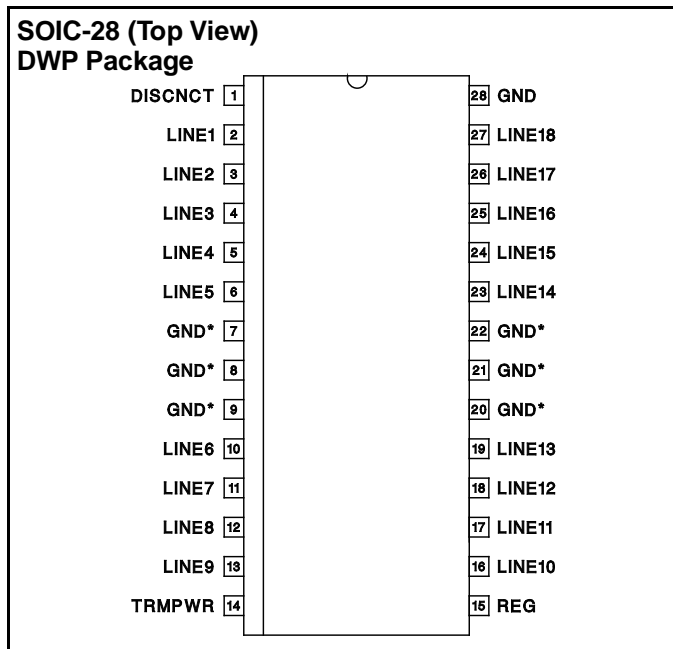
**RECOMMENDED OPERATING CONDITIONS**

- Tempwr Voltage ..... 4.0V to 5.25V
- Signal Line Voltage..... 0V to +3V
- Disconnect Input Voltage ..... 0V to Tempwr

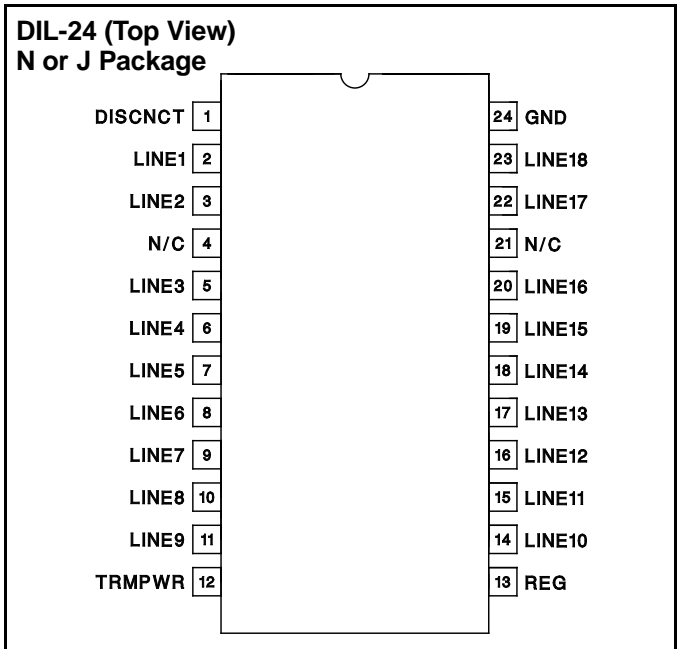
**CONNECTION DIAGRAMS**



\* QP package pins 12 - 18 serve as both heatsink and signal ground.



\* DWP package pin 28 serves as signal ground; pins 7, 8, 9, 20, 21, 22 serve as heatsink/ground.



Note: Drawings are not to scale.

**ELECTRICAL CHARACTERISTICS** Unless otherwise stated, these specifications apply for  $T_A = 0^\circ\text{C}$  to  $70^\circ\text{C}$ .  
 TRMPWR = 4.75V, DISCNCT = 0V.  $T_A = T_J$ .

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS	
<b>Supply Current Section</b>						
Termpwr Supply Current	All termination lines = Open		17	25	mA	
	All termination lines = 0.5V		400	430	mA	
Power Down Mode	DISCNCT = Open		100	150	$\mu\text{A}$	
<b>Output Section (Termination Lines)</b>						
Termination Impedance	$\Delta\text{LINE} = -5\text{mA}$ to $-15\text{mA}$	107	110	113	$\Omega$	
Output High Voltage	$V_{\text{TRMPWR}} = 4\text{V}$ (Note 1)	2.65	2.9		V	
Max Output Current	$V_{\text{LINE}} = 0.5\text{V}$	-21.1	-21.7	-22.4	mA	
	$V_{\text{LINE}} = 0.5\text{V}$ , TRMPWR = 4V (Note 1)	-19.8	-21.7	-22.4	mA	
Output Clamp Level	$I_{\text{LINE}} = -30\text{mA}$	-0.2	-0.05	0.1	V	
Output Leakage	DISCNCT = 4V	TRMPWR = 0V to 5.25V REG = 0V	$V_{\text{LINE}} = 0$ to 4V	10	400	nA
			$V_{\text{LINE}} = 5.25\text{V}$		100	$\mu\text{A}$
		TRMPWR = 0V to 5.25V, REG = Open $V_{\text{LINE}} = 0\text{V}$ to 5.25V		10	400	nA
Output Capacitance	DISCNCT = Open (Note 2)		10	12	pF	
<b>Regulator Section</b>						
Regulator Output Voltage		2.8	2.9	3.0	V	
Line Regulation	TRMPWR = 4V to 6V		10	20	mV	
Load Regulation	$I_{\text{REG}} = 0$ to $-400\text{mA}$		20	50	mV	
Drop Out Voltage	All Termination Lines = 0.5V		1.0	1.2	V	
Short Circuit Current	$V_{\text{REG}} = 0\text{V}$	-450	-650	-850	mA	
Current Sink Capability	$V_{\text{REG}} = 3.5\text{V}$	8	20	25	mA	
Thermal Shutdown			170		$^\circ\text{C}$	
<b>Disconnect Section</b>						
Disconnect Threshold		1.3	1.5	1.7	V	
Threshold Hysteresis		100	160	250	mV	
Input Current	DISCNCT = 0V		10	15	$\mu\text{A}$	

Note 1: Measuring each termination line while other 17 are low (0.5V).

Note 2: Guaranteed by design. Not 100% tested in production.

## THERMAL DATA

QP package: (see packaging section of UICC data book for more details on thermal performance)

Thermal Resistance Junction to Leads,  $\theta_{jL}$  ..... 15 $^\circ\text{C}/\text{W}$

Thermal Resistance Junction to Ambient,  $\theta_{ja}$  ..... 30 $^\circ$ -40 $^\circ\text{C}/\text{W}$

DWP package:

Thermal Resistance Junction to Leads,  $\theta_{jL}$  ..... 18 $^\circ\text{C}/\text{W}$

Thermal Resistance Junction to Ambient,  $\theta_{ja}$  ..... 33 $^\circ$ -43 $^\circ\text{C}/\text{W}$

J package:

Thermal Resistance Junction to Leads,  $\theta_{jL}$  ..... 40 $^\circ\text{C}/\text{W}$

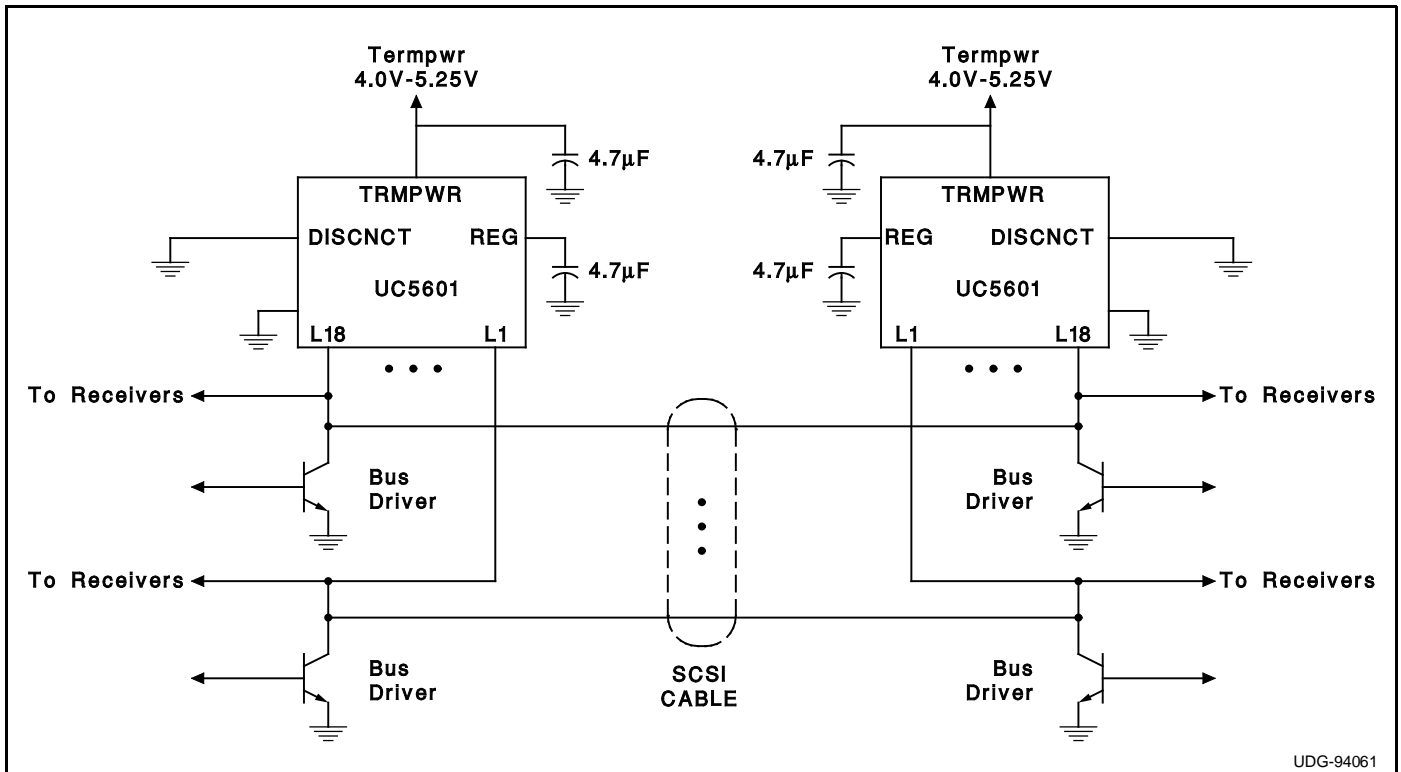
Thermal Resistance Junction to Ambient,  $\theta_{ja}$  ..... 75 $^\circ$ -85 $^\circ\text{C}/\text{W}$

N package:

Thermal Resistance Junction to Leads,  $\theta_{jL}$  ..... 50 $^\circ\text{C}/\text{W}$

Thermal Resistance Junction to Ambient,  $\theta_{ja}$  ..... 95 $^\circ$ -105 $^\circ\text{C}/\text{W}$

Note: The above numbers for  $\theta_{jL}$  are maximums for the limiting thermal resistance of the package in a standard mounting configuration. The  $\theta_{ja}$  numbers are meant to be guidelines for the thermal performance of the device/pc-board system. All of the above numbers assume no ambient airflow.



Typical SCSI Bus Configuration Using the UC5601

**A Look at the Response of a SCSI-2 Cable**

Figure 1 shows a single line of a SCSI cable. The driver is an open collector type which when asserted pulls low, and when negated the termination resistance serves as the pull-up.

Figure 2 shows a worst case scenario of mid cable de-assertion with a close proximity receiver. The voltage  $V_{STEP}$  is defined as:

$$V_{STEP} = V_{OL} + I_o Z_0$$

- $V_{OL}$  = Driver Output Low Voltage
- $I_o$  = Current from Receiving Terminator
- $Z_0$  = Cable Characteristic Impedance

$$I_o = \frac{V_{REG} - V_{OL}}{110}$$

In the pursuit of higher data rates, sampling could occur during this step portion, therefore it is important to ensure that the step is as high as possible to get the most noise margin. For this reason the UC5601 is trimmed so that the output current ( $I_o$ ) is as close as possible to the SCSI max current spec of 22.4mA. The Termination impedance is initially trimmed on the IC to 110 ohms typical, then the regulator voltage is trimmed for the highest output current to within 22.4mA.

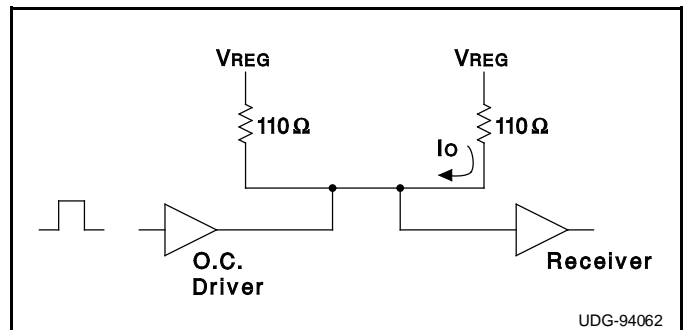


Figure 1. A Single Line of a SCSI Cable

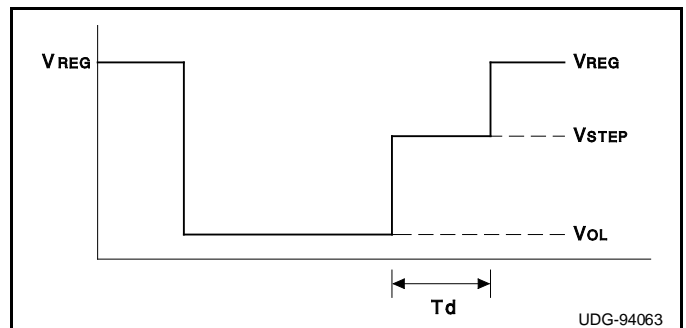


Figure 2. A Typical Response of a SCSI Cable

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
UC5601DWP	ACTIVE	SOIC	DW	28	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
UC5601DWPG4	ACTIVE	SOIC	DW	28	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
UC5601DWPTR	ACTIVE	SOIC	DW	28	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
UC5601DWPTRG4	ACTIVE	SOIC	DW	28	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
UC5601N	ACTIVE	PDIP	N	24		TBD	Call TI	Call TI
UC5601NG4	ACTIVE	PDIP	N	24		TBD	Call TI	Call TI
UC5601QP	ACTIVE	PLCC	FN	28	37	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR
UC5601QPTR	ACTIVE	PLCC	FN	28	750	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR

<sup>(1)</sup> 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.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), 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.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

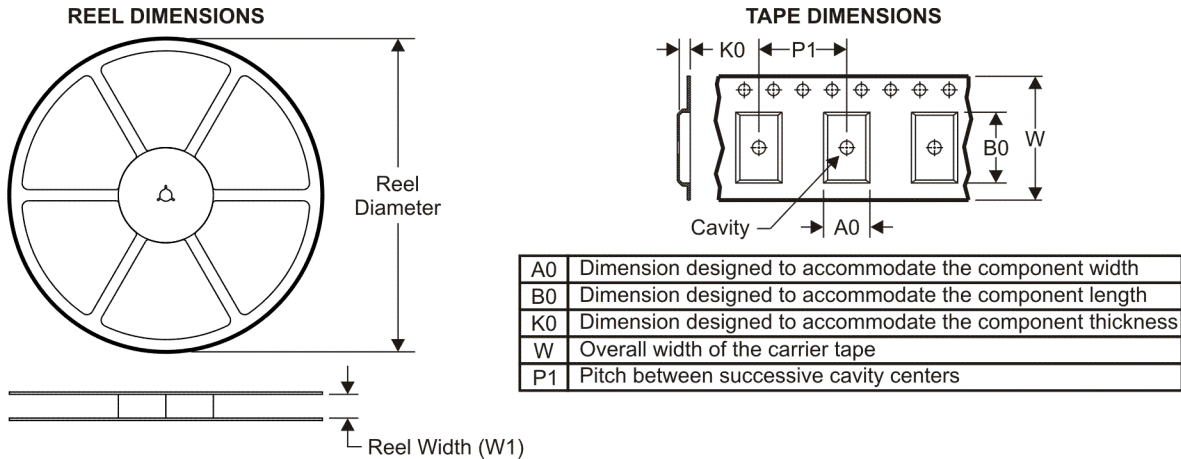
**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

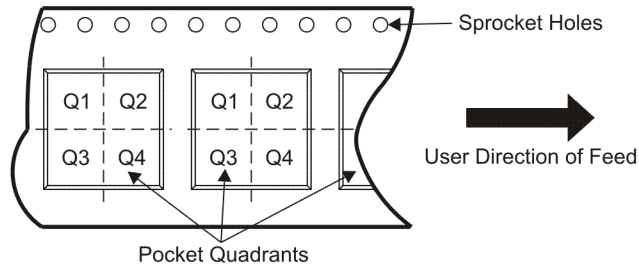
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## TAPE AND REEL INFORMATION



### 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
UC5601DWPTR	SOIC	DW	28	1000	330.0	32.4	11.35	18.67	3.1	16.0	32.0	Q1

TAPE AND REEL BOX DIMENSIONS

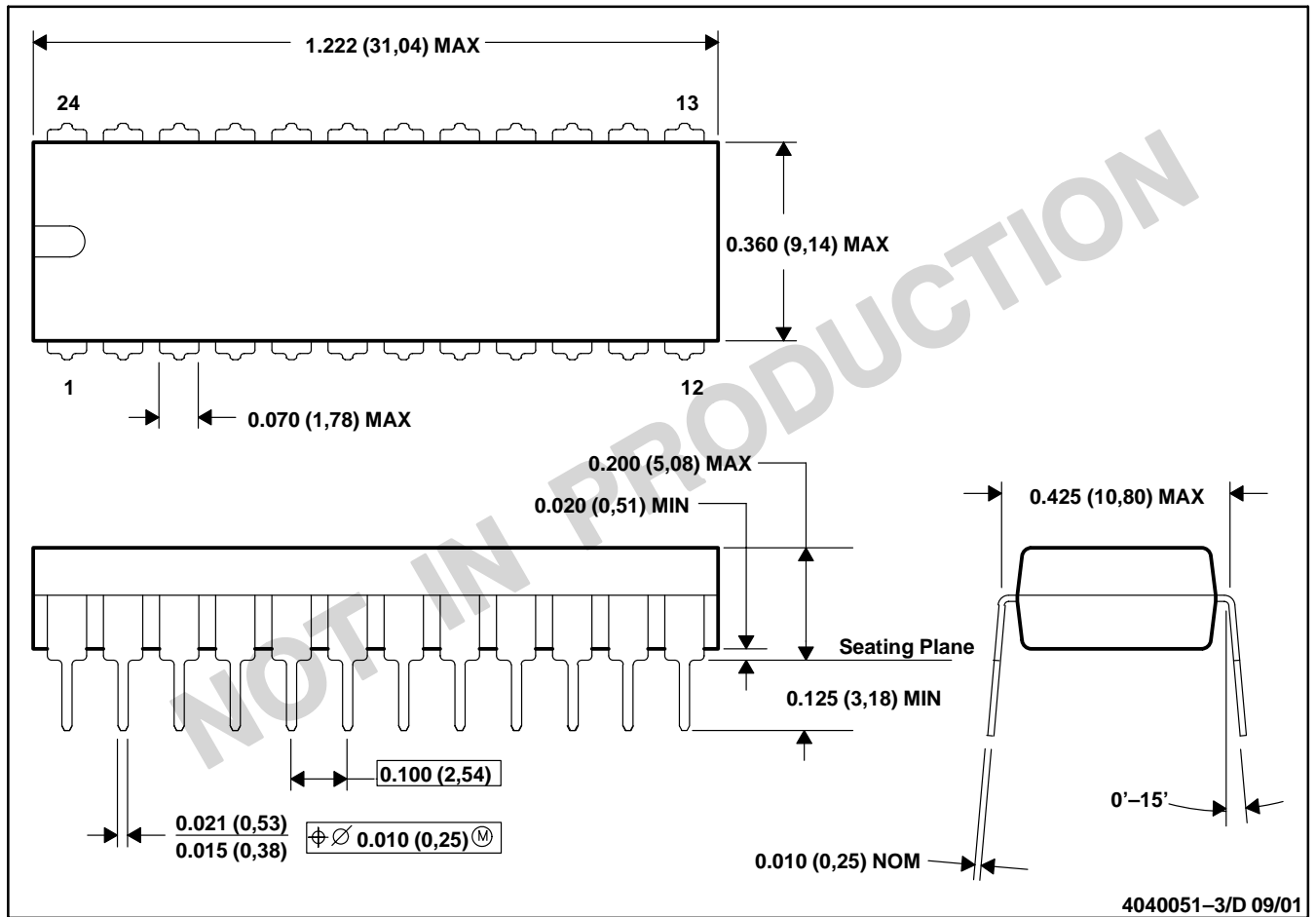


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
UC5601DWPTR	SOIC	DW	28	1000	346.0	346.0	49.0

N (R-PDIP-T24)

PLASTIC DUAL-IN-LINE



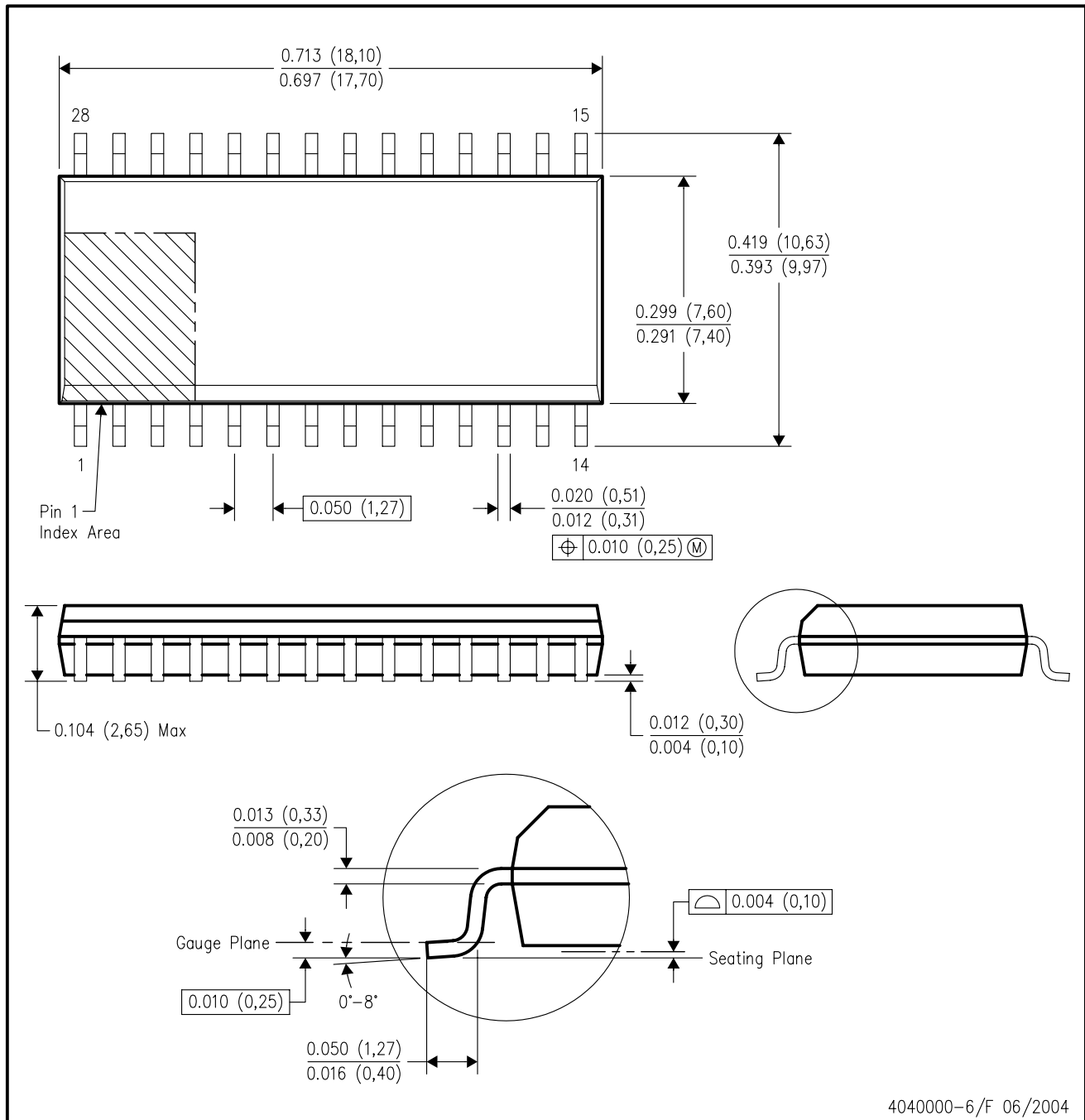
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- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Falls within JEDEC MS-010



DW (R-PDSO-G28)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- 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-013 variation AE.

FN (S-PQCC-J\*\*)

PLASTIC J-LEADED CHIP CARRIER

20 PIN SHOWN



NO. OF PINS **	D/E		D1/E1		D2/E2	
	MIN	MAX	MIN	MAX	MIN	MAX
20	0.385 (9,78)	0.395 (10,03)	0.350 (8,89)	0.356 (9,04)	0.141 (3,58)	0.169 (4,29)
28	0.485 (12,32)	0.495 (12,57)	0.450 (11,43)	0.456 (11,58)	0.191 (4,85)	0.219 (5,56)
44	0.685 (17,40)	0.695 (17,65)	0.650 (16,51)	0.656 (16,66)	0.291 (7,39)	0.319 (8,10)
52	0.785 (19,94)	0.795 (20,19)	0.750 (19,05)	0.756 (19,20)	0.341 (8,66)	0.369 (9,37)
68	0.985 (25,02)	0.995 (25,27)	0.950 (24,13)	0.958 (24,33)	0.441 (11,20)	0.469 (11,91)
84	1.185 (30,10)	1.195 (30,35)	1.150 (29,21)	1.158 (29,41)	0.541 (13,74)	0.569 (14,45)

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