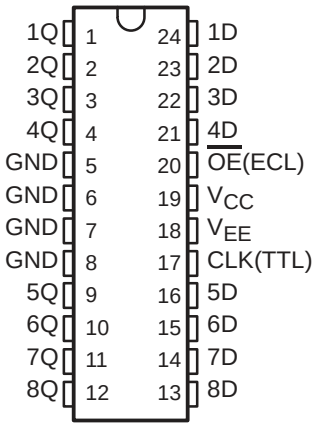
- **10KH Compatible**
- **TTL Clock and ECL Control Inputs**
- **Noninverting Outputs**
- **Flow-Through Architecture Optimizes PCB Layout**
- **Center Pin V_{CC}, V_{EE}, and GND Configurations Minimize High-Speed Switching Noise**
- **ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015**
- **Package Options Include Plastic Small-Outline (DW) Package and Standard Plastic (NT) DIPs**

DW OR NT PACKAGE
(TOP VIEW)



description

This octal TTL-to-ECL translator is designed to provide efficient translation between a TTL signal environment and a 10KH ECL signal environment. This device is designed specifically to improve the performance and density of TTL-to-ECL CPU/bus-oriented functions such as memory address drivers, clock drivers, and bus-oriented receivers and transmitters.

The eight flip-flops of the ’5578 are edge-triggered D-type flip-flops. On the positive transition of the clock, the Q outputs are set to the logic levels that were set up at the D inputs.

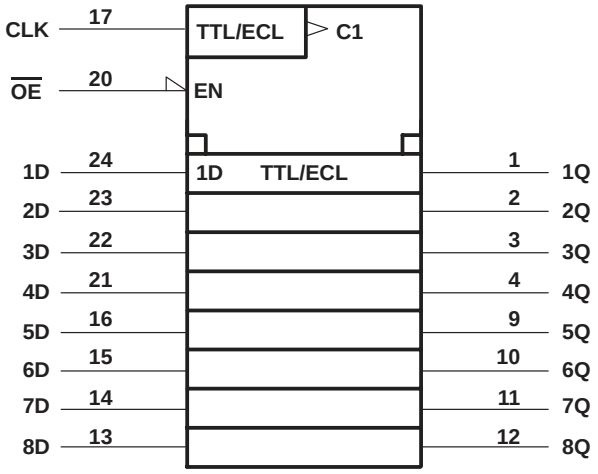
The output-control input $\overline{OE}$ does not affect the internal operations of the flip-flops. Old data can be retained or new data can be entered while the outputs are off.

The SN10KHT5578 is characterized for operation from 0°C to 75°C.

FUNCTION TABLE

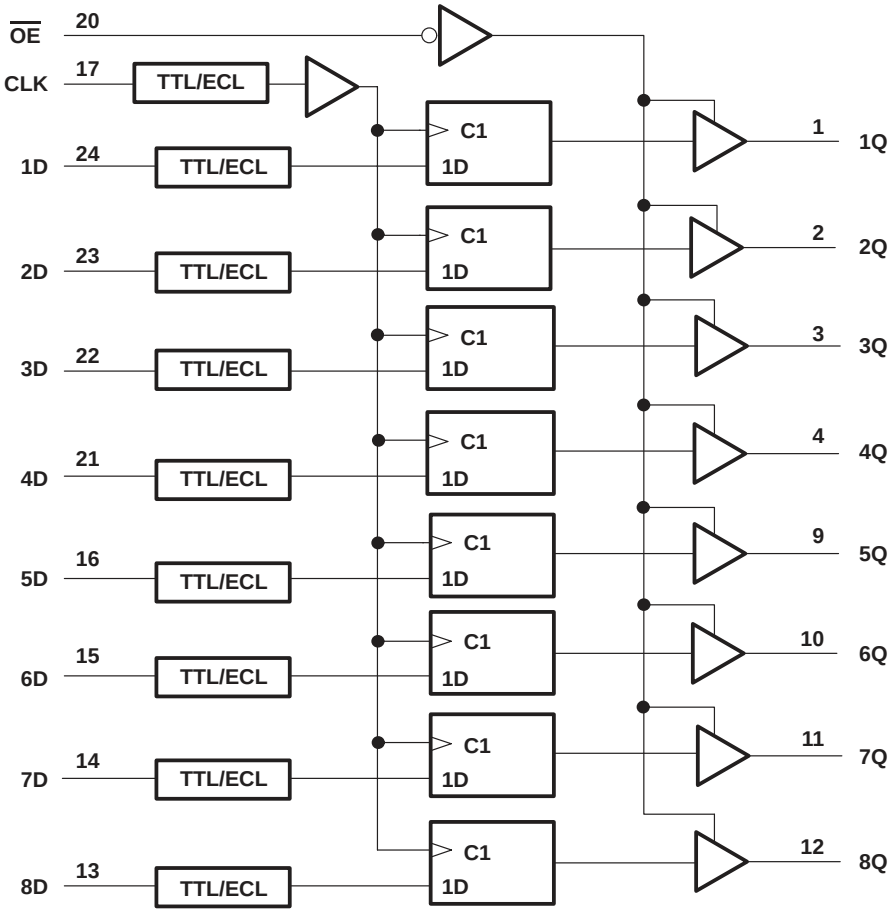
INPUTS			OUTPUT (ECL)
$\overline{OE}$	CLK	D	Q
L	↑	L	L
L	↑	H	H
L	L	X	Q_0
H	X	X	L

logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)



absolute maximum ratings over operating ambient temperature range (unless otherwise noted)†

Supply voltage range, V_{CC} . . . . . –0.5 V to 7 V
Supply voltage range, V_{EE} . . . . . –8 V to 0 V
Input voltage range (TTL) (see Note 1) . . . . . –1.2 V to 7 V
Input voltage range (ECL) . . . . . V_{EE} to 0 V
Input current range (TTL) . . . . . –30 mA to 5 mA
Current out of any output . . . . . 50 mA
Package thermal impedance, θ_{JA} (see Note 2): DW package . . . . . 81°C/W
NT package . . . . . 67°C/W
Storage temperature range . . . . . –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. The TTL input voltage ratings may be exceeded provided the input current ratings are observed.
2. The package thermal impedance is calculated in accordance with JESD 51, except for through-hole packages, which use a trace length of zero.

recommended operating conditions

			MIN	NOM	MAX	UNIT
V_{CC}	TTL supply voltage		4.5	5	5.5	V
V_{EE}	ECL supply voltage		–4.94	–5.2	–5.46	V
V_{IH}	TTL high-level input voltage		2			V
V_{IH}	ECL high-level input voltage‡	0°C	–1170		–840	mV
		25°C	–1130		–810	mV
		75°C	–1070		–735	mV
V_{IL}	TTL low-level input voltage				0.8	V
V_{IL}	ECL low-level input voltage‡	0°C	–1950		–1480	mV
		25°C	–1950		–1480	mV
		75°C	–1950		–1450	mV
I_{IK}	TTL input clamp current				–18	mA
T_A	Operating ambient temperature (see Note 3)		0		75	°C

‡ The algebraic convention, in which the least positive (most negative) value is designated minimum, is used in this data sheet for logic levels only.

NOTE 3: Each 10KH-series circuit has been designed to meet the dc specifications shown in the electrical characteristics table after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board, and transverse airflow greater than 500 linear ft/min is maintained.

electrical characteristics over recommended operating ambient temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS				MIN	TYP†	MAX	UNIT
V_{IK}	CLK and D inputs	V_{CC} = 4.5 V,	V_{EE} = –4.94 V,	I_I = –18 mA				–1.2	V
I_I	CLK and D inputs	V_{CC} = 5.5 V,	V_{EE} = –5.46 V,	V_I = 7 V				0.1	mA
I_{IH}	CLK and D inputs	V_{CC} = 5.5 V,	V_{EE} = –5.46 V,	V_I = 2.7 V				20	µA
	$\overline{OE}$ input	V_{CC} = 5.5 V,	V_{EE} = –5.46 V,	V_I = –840 mV	0°C			350	
		V_{CC} = 5.5 V,	V_{EE} = –5.46 V,	V_I = –810 mV	25°C			350	
		V_{CC} = 5.5 V,	V_{EE} = –5.46 V,	V_I = –735 mV	75°C			350	
I_{IL}	CLK and D inputs	V_{CC} = 5.5 V,	V_{EE} = –5.46 V,	V_I = 0.5 V				–0.5	mA
	$\overline{OE}$ input	V_{CC} = 5.5 V,	V_{EE} = –5.46 V,	V_I = –1950 mV	0°C	0.5			µA
					25°C	0.5			
					75°C	0.5			
V_{OH}‡		V_{CC} = 4.5 V,	V_{EE} = –5.2 V ± 5%,	See Note 4	0°C	–1020		–840	mV
					25°C	–980		–810	
					75°C	–920		–735	
V_{OL}‡		V_{CC} = 4.5 V,	V_{EE} = –5.2 V ± 5%,	See Note 4	0°C	–1950		–1630	mV
					25°C	–1950		–1630	
					75°C	–1950		–1600	
I_{CCH}		V_{CC} = 5.5 V,	V_{EE} = –5.46 V				17.5	25	mA
I_{CCL}		V_{CC} = 5.5 V,	V_{EE} = –5.46 V				15	22	mA
I_{EE}		V_{CC} = 5.5 V,	V_{EE} = –5.46 V				–104	–149	mA
C_i		V_{CC} = 5 V,	V_{EE} = –5.2 V,	f = 10 MHz			4		pF

† All typical values are at V_{CC} = 5 V, V_{EE} = –5.2 V, T_A = 25°C.
‡ The algebraic convention, in which the least positive (most negative) value is designated minimum, is used in this data sheet for logic levels only.
NOTE 4: Outputs are terminated through a 50-Ω resistor to –2 V.

timing requirements over recommended operating conditions

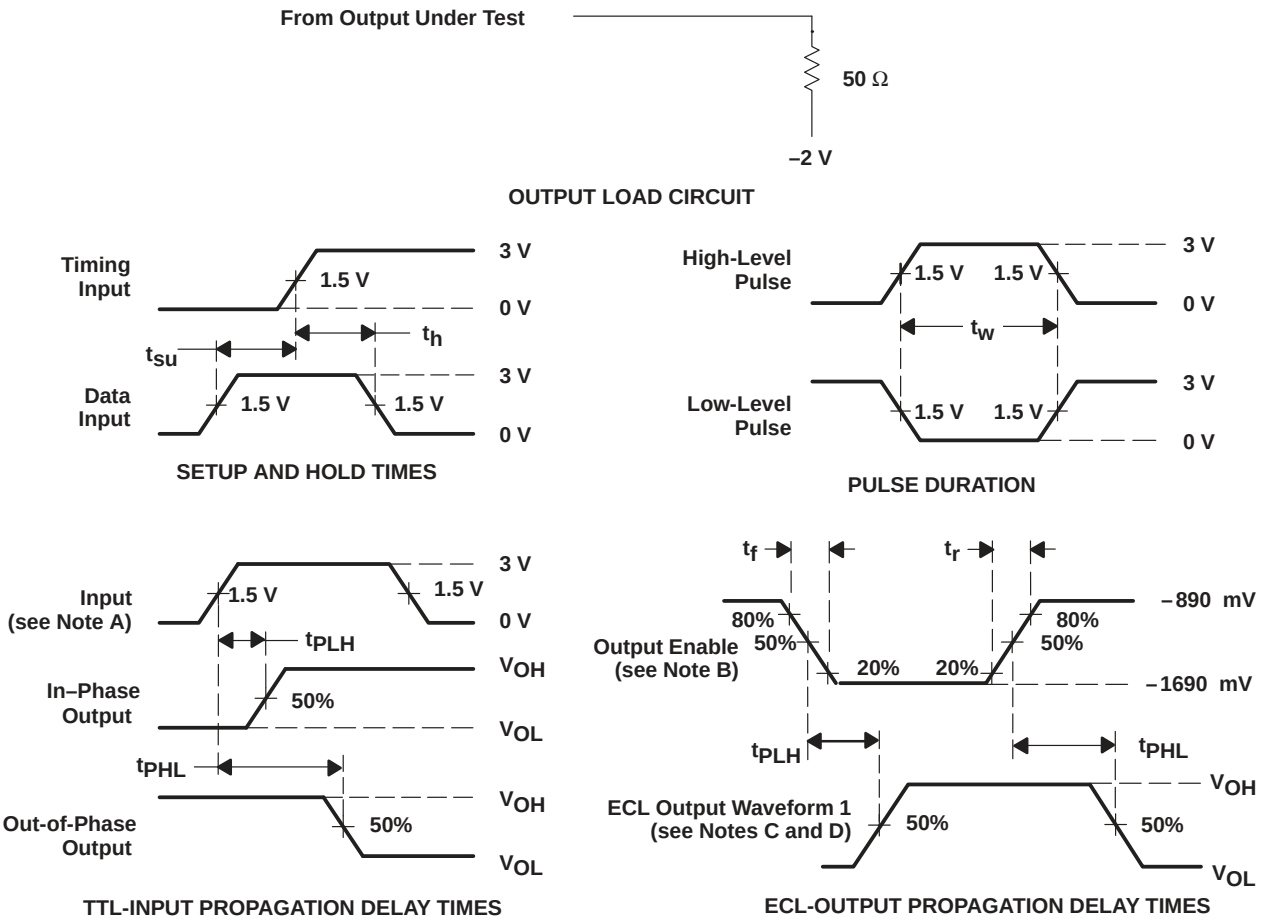
			MIN	MAX	UNIT
f_{clock}	Clock frequency			180	MHz
t_w	Pulse duration, CLK	High	4		ns
		Low	4		
t_{su}	Setup time, data before CLK↑	High	1.5		ns
		Low	2.5		
t_h	Hold time, data after CLK↑	High	1		ns
		Low	1		

switching characteristics over recommended ranges of supply voltage and operating ambient temperature (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	MIN	TYP†	MAX	UNIT
f_{max}			180			MHz
t_{PLH}	CLK	Q	0.8	2.2	4	ns
t_{PHL}			0.8	2.1	3.8	
t_{PLH}	OE	Q	0.5	1.4	3.2	ns
t_{PHL}			0.5	1.7	3.3	
t_r		Y		1.5		ns
t_f		Y		1.5		ns

† All typical values are at V_{CC} = 5 V, V_{EE} = –5.2 V, T_A = 25°C.

PARAMETER MEASUREMENT INFORMATION



NOTES: A. For TTL inputs, input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω, t_r = 2.5 ns, t_f = 2.5 ns.
B. For ECL inputs, input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω, t_r = 1.5 ns, t_f = 1.5 ns.
C. Waveform 1 is for an output with internal conditions such that the output is high except when disabled by $\overline{OE}$.
D. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and 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)
SN10KHT5578DW	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN10KHT5578DWR	ACTIVE	SOIC	DW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN10KHT5578NT	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN10KHT5578NTE4	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type

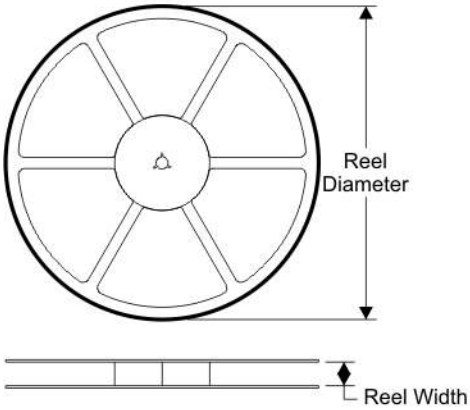
(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, 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), 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)

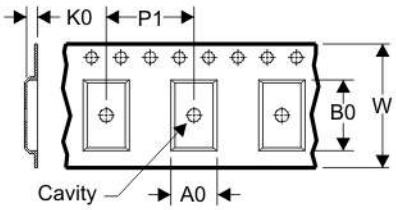
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

TAPE AND REEL BOX INFORMATION

REEL DIMENSIONS

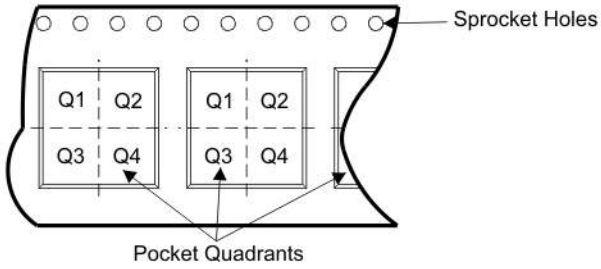


TAPE DIMENSIONS



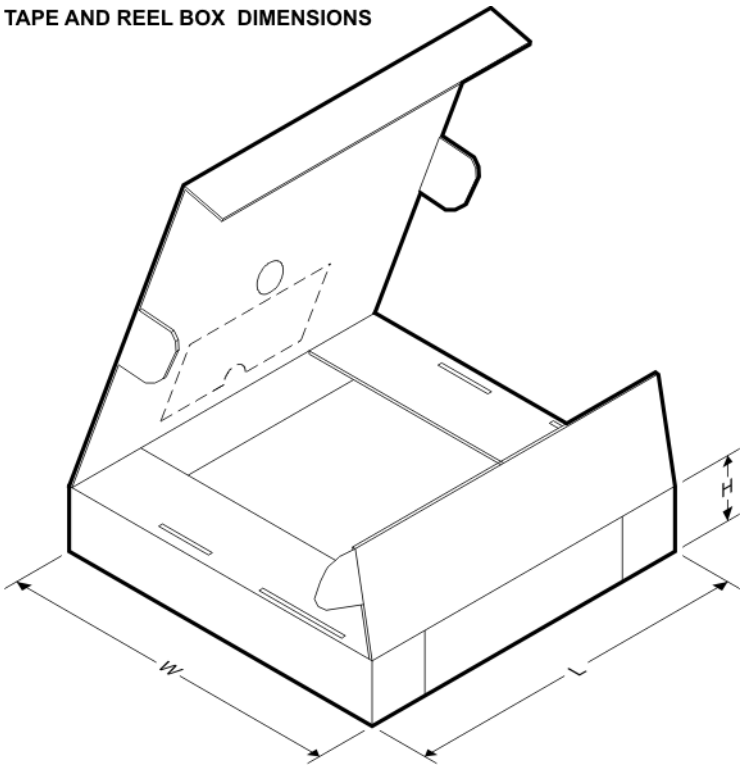
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



Device	Package	Pins	Site	Reel Diameter (mm)	Reel Width (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN10KHT5578DWR	DW	24	SITE 60	330	24	10.75	15.7	2.7	12	24	Q1

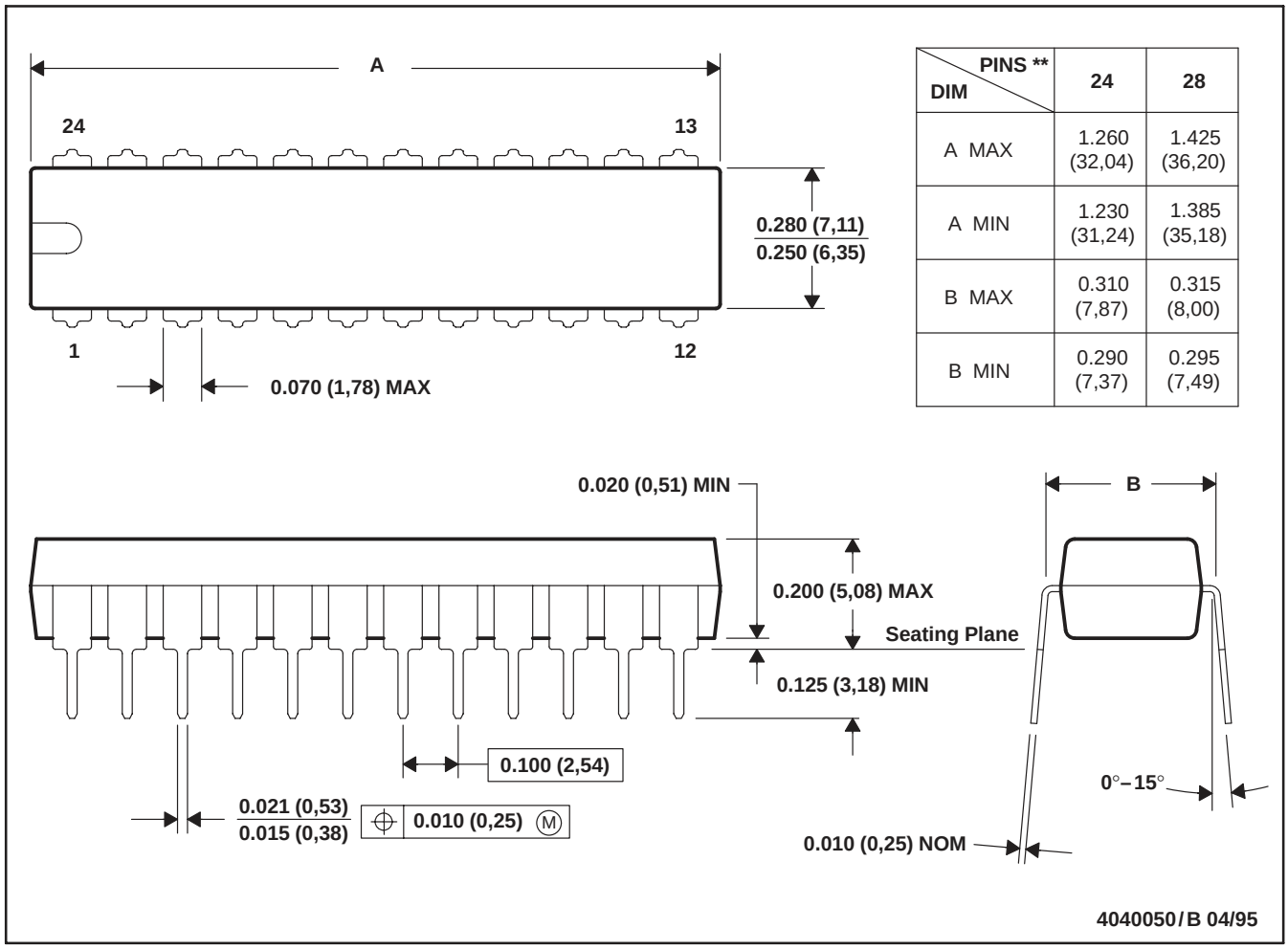
TAPE AND REEL BOX DIMENSIONS



Device	Package	Pins	Site	Length (mm)	Width (mm)	Height (mm)
SN10KHT5578DWR	DW	24	SITE 60	346.0	346.0	0.0

NT (R-PDIP-T)** **PLASTIC DUAL-IN-LINE PACKAGE**

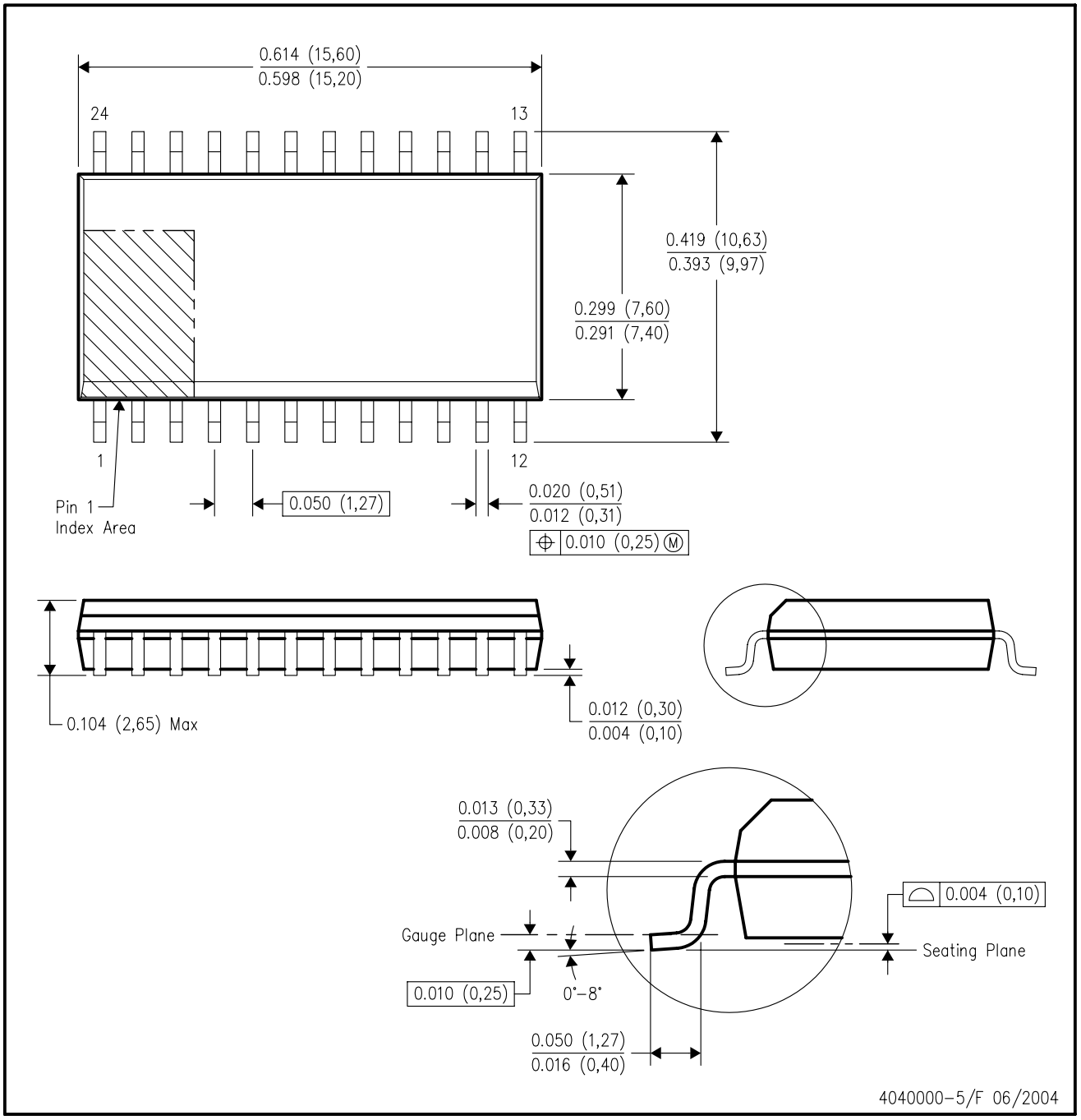
24 PINS SHOWN



DIM \ PINS **	24	28
A MAX	1.260 (32,04)	1.425 (36,20)
A MIN	1.230 (31,24)	1.385 (35,18)
B MAX	0.310 (7,87)	0.315 (8,00)
B MIN	0.290 (7,37)	0.295 (7,49)

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

DW (R–PDSO–G24) 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 AD.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

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

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI 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. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI 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 and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		**Applications**	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
RFID	www.ti-rfid.com	Telephony	www.ti.com/telephony
Low Power Wireless	www.ti.com/lpw	Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265