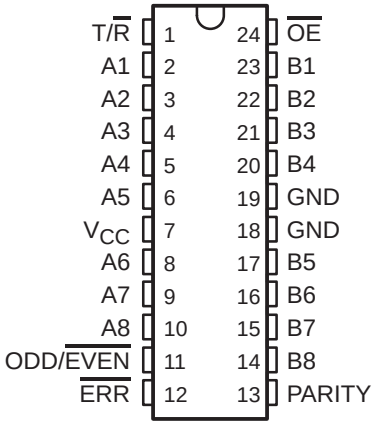
- **Combines ′F245 and ′F280B Functions in One Package**
- **High-Impedance N-P-N Inputs for Reduced Loading (70 μA in Low and High States)**
- **High Output Drive and Light Bus Loading**
- **3-State B Outputs Sink 64 mA and Source 15 mA**
- **Input Diodes for Termination Effects**
- **Package Options Include Plastic Small-Outline Packages and Standard Plastic 300-mil DIPs**

DW OR NT PACKAGE
(TOP VIEW)



description

The SN74F657 contains eight noninverting buffers with 3-state outputs and an 8-bit parity generator/checker. It is intended for bus-oriented applications. The buffers have a specified current sinking capability of 24 mA at the A port and 64 mA at the B port.

The transmit/receive (T/$\overline{R}$) input determines the direction of the data flow through the bidirectional transceivers. When T/$\overline{R}$ is high, data is transmitted from the A port to the B port. When T/$\overline{R}$ is low, data is received at the A port from the B port.

When the output enable ($\overline{OE}$) input is high, both the A and B ports are placed in a high-impedance state (disabled). The ODD/$\overline{EVEN}$ input allows the user to select between odd or even parity systems. When transmitting from A port to B port (T/$\overline{R}$ high), PARITY is an output from the generator/checker. When receiving from B port to A port (T/$\overline{R}$ low), PARITY is an input.

When transmitting (T/$\overline{R}$ high), the parity select (ODD/$\overline{EVEN}$) input is made high or low as appropriate. The A port is then polled to determine the number of high bits.The PARITY output goes to the logic state determined by ODD/$\overline{EVEN}$ and the number of high bits on A port. When ODD/$\overline{EVEN}$ is low (for even parity) and the number of high bits on A port is odd, the PARITY will be high, transmitting even parity. If the number of high bits on A port is even, the PARITY will be low, keeping even parity.

When in the receive mode (T/$\overline{R}$ low), the B port is polled to determine the number of high bits. If ODD/$\overline{EVEN}$ is low (for even parity) and the number of highs on B port is:

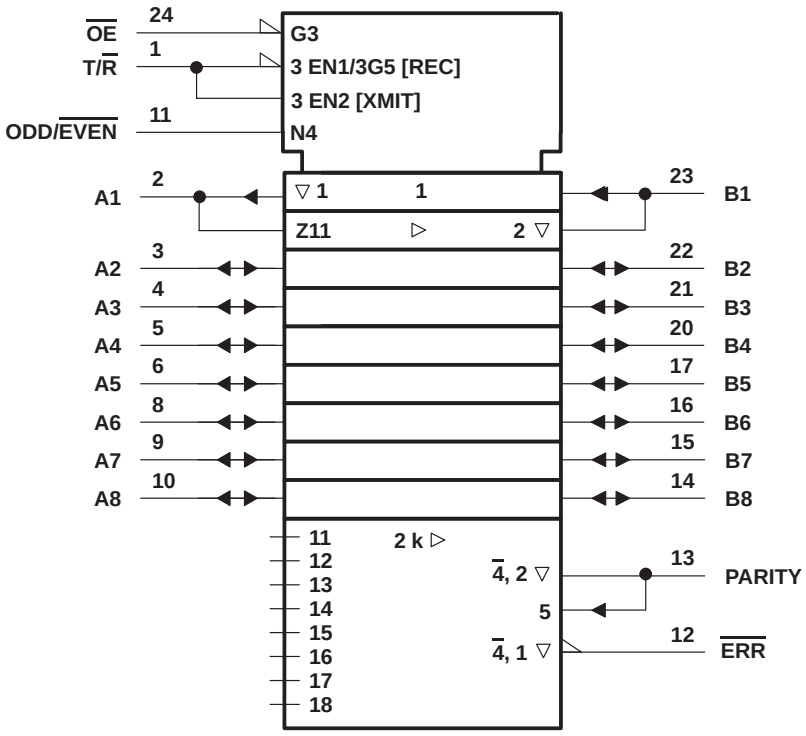
1. Odd and the PARITY input is high, then $\overline{ERR}$ will be high signifying no error.
2. Even and the PARITY input is high, then $\overline{ERR}$ will be low indicating an error.

The SN74F657 is characterized for operation from 0°C to 70°C.

FUNCTION TABLE

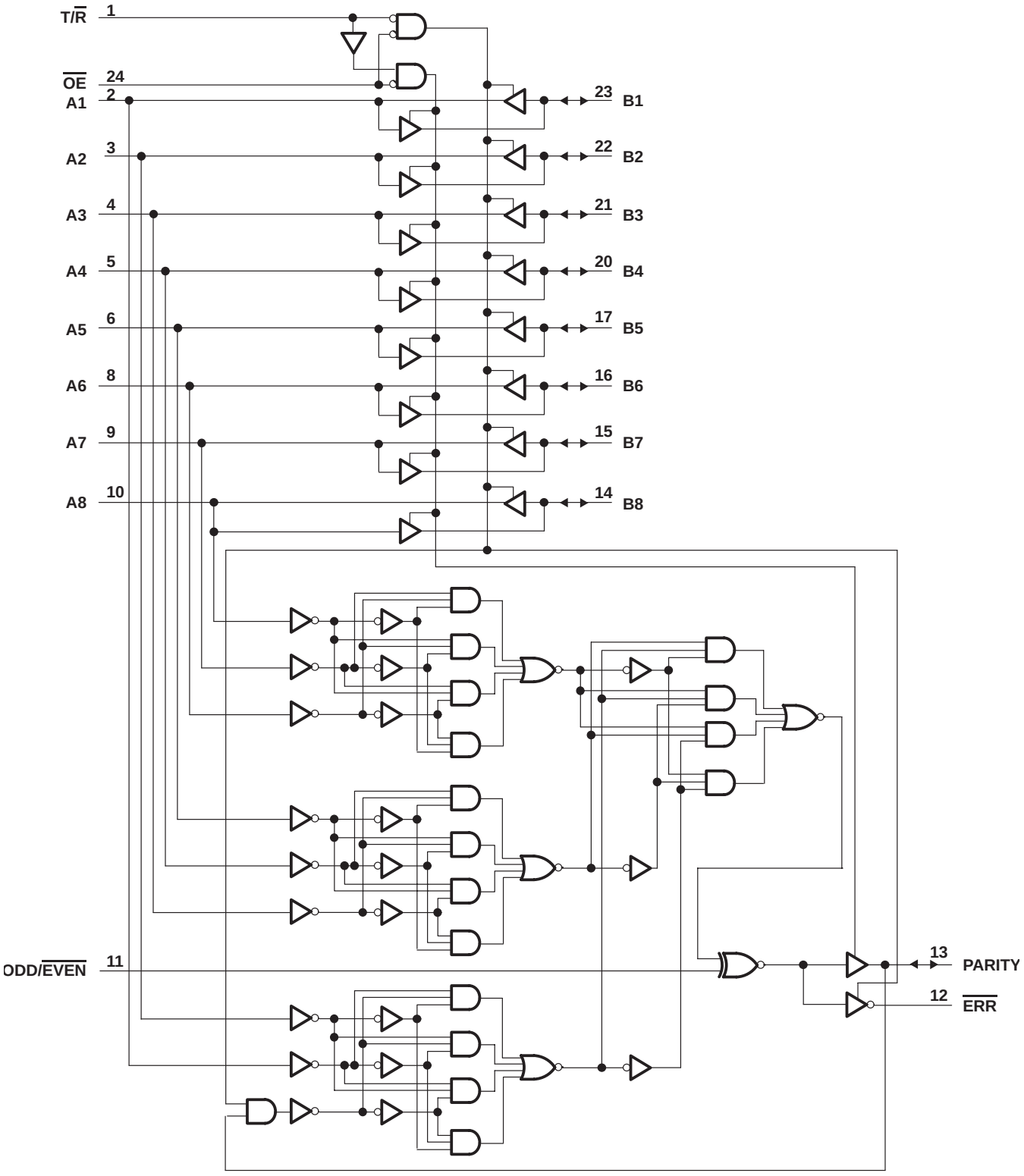
NUMBER OF A OR B INPUTS THAT ARE HIGH	INPUTS			INPUT/OUTPUT PARITY	OUTPUTS	
	$\overline{OE}$	T/$\overline{R}$	ODD/$\overline{EVEN}$		$\overline{ERR}$	OUTPUT MODE
0, 2, 4, 6, 8	L	H	H	H	Z	Transmit
	L	H	L	L	Z	Transmit
	L	L	H	H	H	Receive
	L	L	H	L	L	Receive
	L	L	L	H	L	Receive
	L	L	L	L	H	Receive
1, 3, 5, 7	L	H	H	L	Z	Transmit
	L	H	L	H	Z	Transmit
	L	L	H	H	L	Receive
	L	L	H	L	H	Receive
	L	L	L	H	H	Receive
	L	L	L	L	L	Receive
Don't care	H	X	X	Z	Z	Z

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 free-air temperature range (unless otherwise noted)†

Supply voltage range, V_{CC} . . . . . –0.5 V to 7 V
Input voltage range, V_I (excluding I/O ports) (see Note 1) . . . . . –1.2 V to 7 V
Input current range . . . . . –30 mA to 5 mA
Voltage range applied to any output in the disabled or power-off state . . . . . –0.5 V to 5.5 V
Voltage range applied to any output in the high state . . . . . –0.5 V to V_{CC}
Current into any output in the low state: A1–A8 . . . . . 48 mA
B1–B8 . . . . . 128 mA
Operating free-air temperature range . . . . . 0°C to 70°C
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.

NOTE 1: The input-voltage ratings may be exceeded provided the input-current ratings are observed.

recommended operating conditions

			MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage		4.5	5	5.5	V
V_{IH}	High-level input voltage		2			V
V_{IL}	Low-level input voltage				0.8	V
I_{OH}	High-level output current	A1–A8			–3	mA
		B1–B8, PARITY, $\overline{ERR}$			–12	
I_{OL}	Low-level output current	A1–A8			24	mA
		B1–B8, PARITY, $\overline{ERR}$			64	
T_A	Operating free-air temperature		0		70	°C

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

PARAMETER		TEST CONDITIONS			MIN	TYP†	MAX	UNIT
V_{IK}		V_{CC} = 4.5 V,	I_I = – 18 mA				– 1.2	V
V_{OH}	Any output	V_{CC} = 4.5 V,	I_{OH} = – 3 mA		2.4	3.3		V
	B1–B8, PARITY, $\overline{ERR}$	V_{CC} = 4.5 V,	I_{OH} = – 15 mA		2	3.1		
	Any output	V_{CC} = 4.75 V,	I_{OH} = – 1 mA to – 3 mA		2.7			
V_{OL}	A1–A8	V_{CC} = 4.5 V	I_{OL} = 24 mA			0.35	0.5	V
	B1–B8, PARITY, $\overline{ERR}$		I_{OL} = 64 mA			0.42	0.55	
I_I	T/$\overline{R}$	V_{CC} = 0,	V_I = 7 V,	$\overline{OE}$ = 4.5 V			0.1	mA
	$\overline{OE}$	V_{CC} = 0,	V_I = 7 V,	T/$\overline{R}$ = 4.5 V			0.1	
	ODD/$\overline{EVEN}$	V_{CC} = 0,	V_I = 7 V				0.1	
	A1–A8	V_{CC} = 5.5 V,	V_I = 7 V				2	
	B1–B8						1	
I_{IH}‡	A, B, PARITY	V_{CC} = 5.5 V,	V_I = 2.7 V				70	µA
	T/$\overline{R}$, $\overline{OE}$						40	
	ODD/$\overline{EVEN}$						20	
I_{IL}‡	A, B, PARITY	V_{CC} = 5.5 V,	V_I = 0.5 V				– 70	µA
	T/$\overline{R}$, $\overline{OE}$						– 40	
	ODD/$\overline{EVEN}$						– 20	
I_{OS}§	A1–A8	V_{CC} = 5.5 V,	V_O = 0		– 60		– 150	mA
	B1–B8				– 100		– 225	
I_{OZH}	$\overline{ERR}$	V_{CC} = 5.5 V,	V_I = 2.7 V				50	µA
I_{OZL}	$\overline{ERR}$	V_{CC} = 5.5 V,	V_I = 0.5 V				–50	µA
I_{CCH}		V_{CC} = 5.5 V				90	125	mA
I_{CCL}		V_{CC} = 5.5 V				106	150	mA
I_{CCZ}		V_{CC} = 5.5 V				98	145	mA

† All typical values are at V_{CC} = 5 V, T_A = 25°C.
‡ For I/O ports, the parameters I_{IH} and I_{IL} include the off-state output current.
§ Not more than one output should be shorted at a time, and the duration of the short circuit should not exceed one second.

switching characteristics (see Note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC} = 5 V, C_L = 50 pF, R1 = 500 Ω, R2 = 500 Ω, T_A = 25°C			V_{CC} = 4.5 V to 5.5 V, C_L = 50 pF, R1 = 500 Ω, R2 = 500 Ω, T_A = MIN to MAX†		UNIT
			MIN	TYP	MAX	MIN	MAX	
t_{PLH}	A or B	B or A	2.5	4.2	7.5	2.5	8	ns
t_{PHL}			3	4	7.5	3	8	
t_{PLH}	A	PARITY	6	8.4	14	6	16	ns
t_{PHL}			6.8	8.5	15	6.8	16	
t_{PLH}	ODD/$\overline{\text{EVEN}}$	PARITY, $\overline{\text{ERR}}$	4	6.4	11	4	12	ns
t_{PHL}			4.5	6.9	11.5	4.5	12.5	
t_{PLH}	B	$\overline{\text{ERR}}$	8	12.7	20.5	7.5	22.5	ns
t_{PHL}			8	13.4	20.5	7.5	22.5	
t_{PLH}	PARITY	$\overline{\text{ERR}}$	6	8.1	15.5	6	16.5	ns
t_{PHL}			7.5	8.8	15.5	7.5	17	
t_{PZH}	$\overline{\text{OE}}$	A, B, PARITY, or $\overline{\text{ERR}}$‡	3	5.3	8	3	9	ns
t_{PZL}			4	5.4	9.5	4	11	
t_{PHZ}	$\overline{\text{OE}}$	A, B, PARITY, or $\overline{\text{ERR}}$‡	2	4.2	7.5	2	8	ns
t_{PLZ}			2	3.7	6	2	6.5	

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ These delay times reflect the 3-state recovery time only and not the signal through the buffers or parity check circuitry. To assure valid information at the $\overline{\text{ERR}}$ output pin, time must be allowed for the signal to propagate through the drivers (B to A), and to the $\overline{\text{ERR}}$ output. Valid data at the $\overline{\text{ERR}}$ output is greater than or equal to (B to A) + (A to PARITY).

NOTE 2: Load circuits and waveforms are shown in Section 1.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
SN74F657DW	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74F657DWE4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74F657DWG4	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74F657DWR	ACTIVE	SOIC	DW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74F657DWRE4	ACTIVE	SOIC	DW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74F657DWRG4	ACTIVE	SOIC	DW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74F657NT	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74F657NTE4	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type

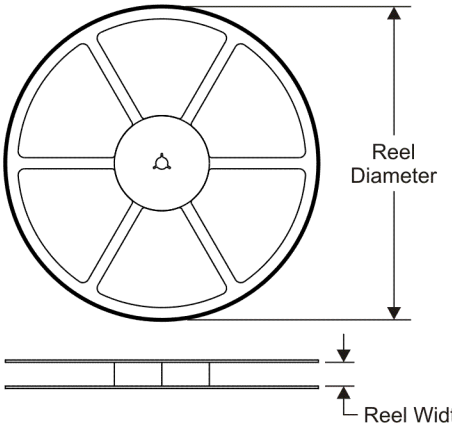
(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers,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

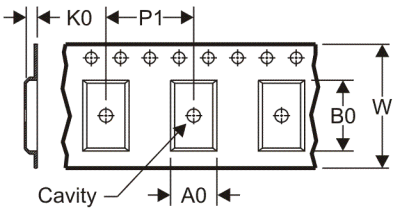
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

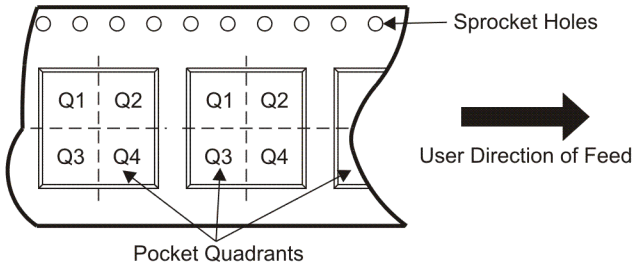


TAPE DIMENSIONS



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

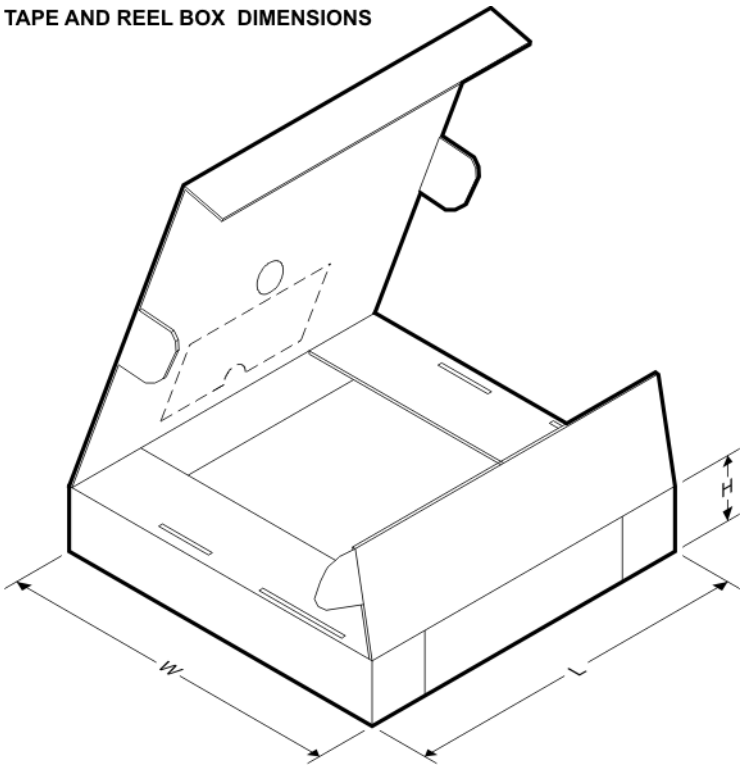
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
SN74F657DWR	SOIC	DW	24	2000	330.0	24.4	10.75	15.7	2.7	12.0	24.0	Q1

TAPE AND REEL BOX DIMENSIONS

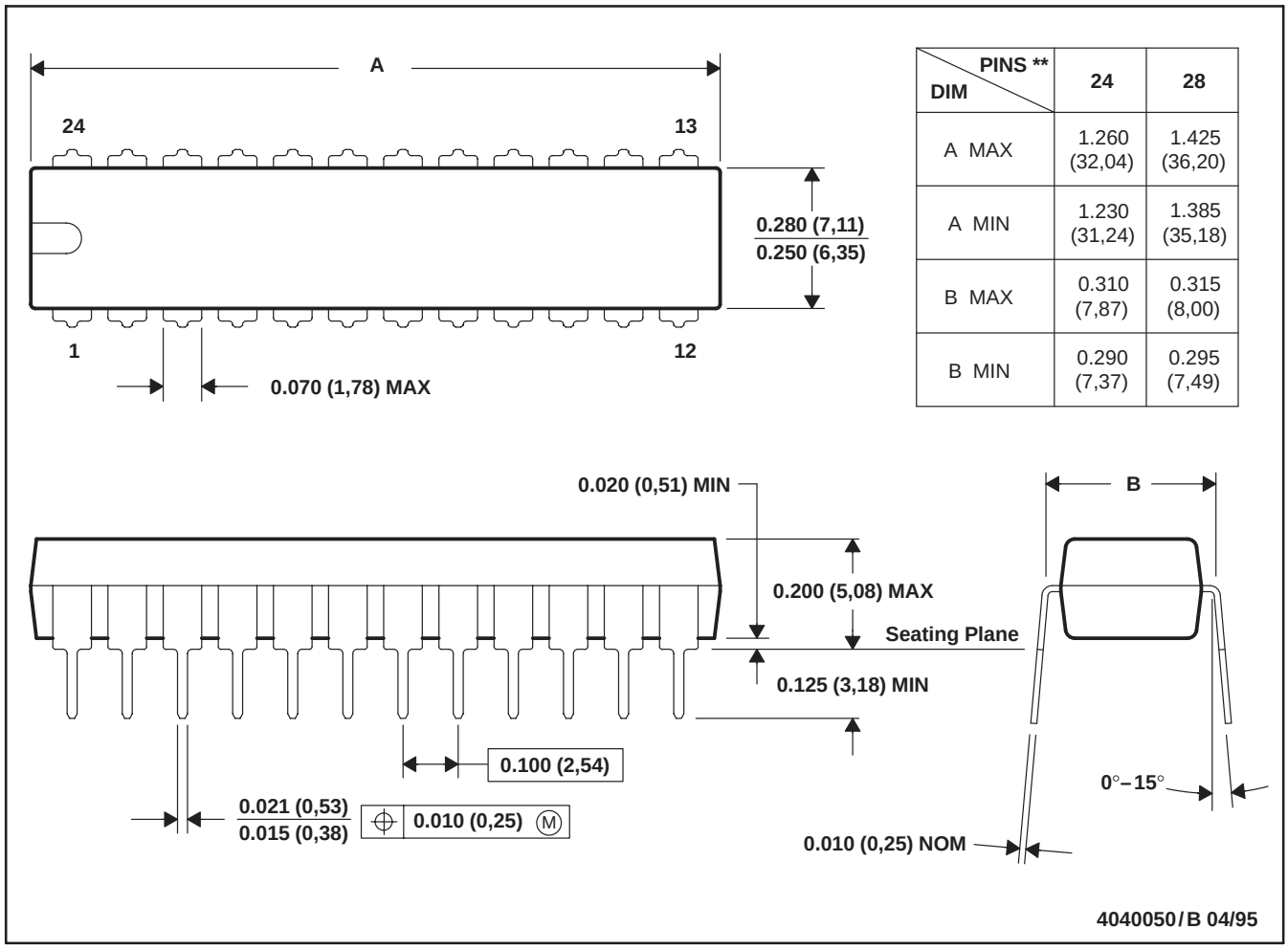


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74F657DWR	SOIC	DW	24	2000	346.0	346.0	41.0

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

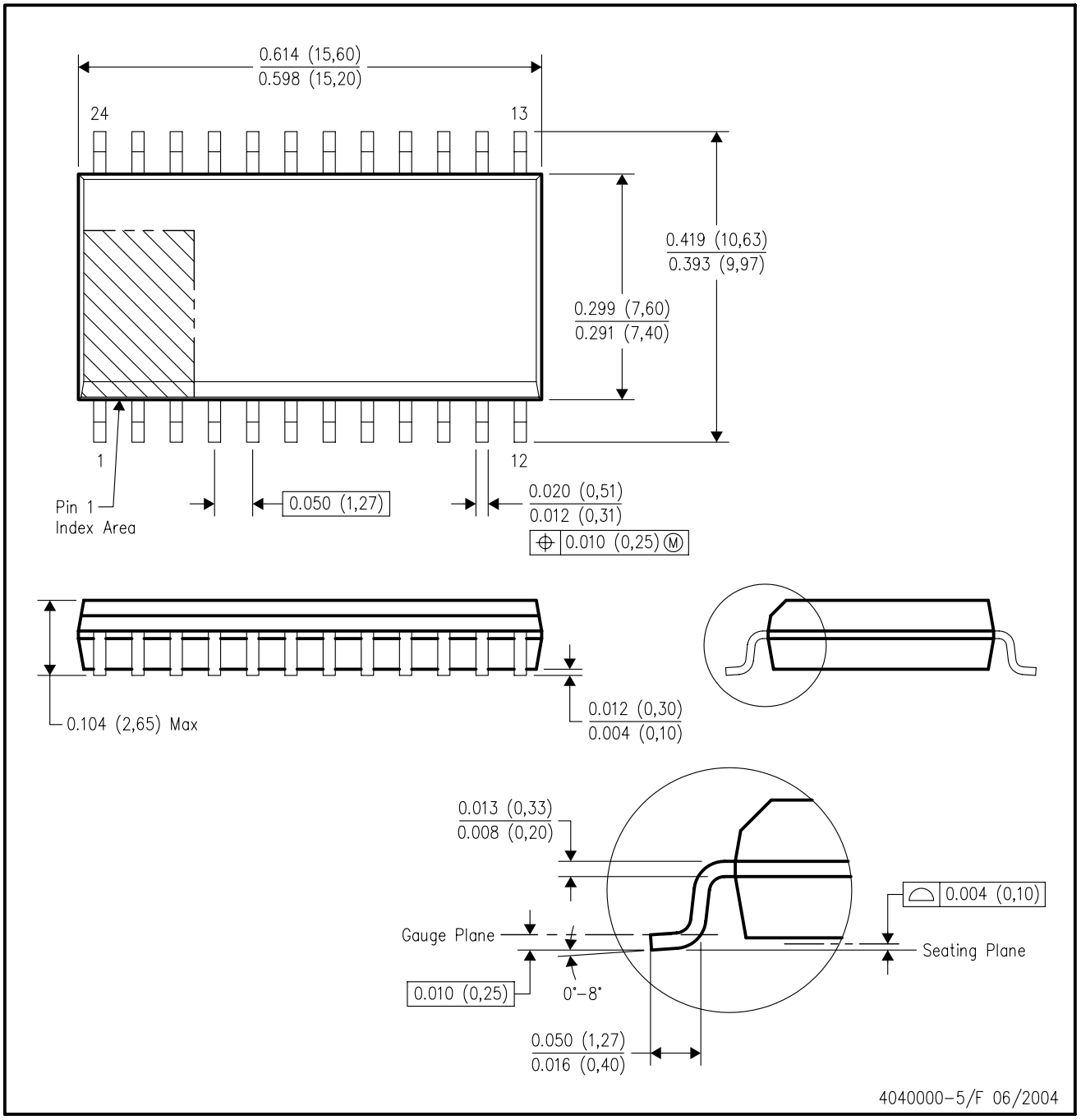
24 PINS SHOWN



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
Clocks and Timers	www.ti.com/clocks	Digital Control	www.ti.com/digitalcontrol
Interface	interface.ti.com	Medical	www.ti.com/medical
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
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

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