

# TISP6NTP2B

## QUAD FORWARD-CONDUCTING BUFFERED P-GATE THYRISTORS PROGRAMMABLE OVERVOLTAGE PROTECTORS

JUNE 1998 - REVISED MAY 1999

### PROGRAMMABLE OVERVOLTAGE PROTECTION FOR ISDN DC FEEDS

- **Overvoltage Protection for ISDN DC Feeds:**
  - Supply Voltages Down to -120 V
  - Low 5 mA max. Gate Triggering Current
  - High 150 mA min. (25 °C) Holding Current

- **Rated for Common Impulse Waveforms**

VOLTAGE IMPULSE FORM	CURRENT IMPULSE SHAPE	I <sub>TSP</sub> A
10/1000 $\mu$ s	10/1000 $\mu$ s	20
10/700 $\mu$ s	5/310 $\mu$ s	25
1.2/50 $\mu$ s	8/20 $\mu$ s	60
2/10 $\mu$ s	2/10 $\mu$ s	70

- **Small Outline Surface Mount Package**
  - Available Ordering Options

CARRIER	ORDER #
Tube	TISP6NTP2BD
Taped and reeled	TISP6NTP2BDR

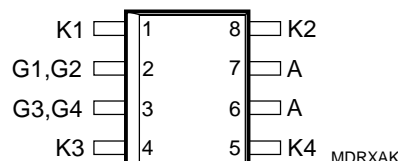
### description

The TISP6NTP2B has an array of four buffered P-gate forward conducting thyristors with twin commoned gates and a common anode connection. Each thyristor cathode has a separate terminal connection. An antiparallel anode-cathode diode is connected across each thyristor. The buffer transistors reduce the gate supply current.

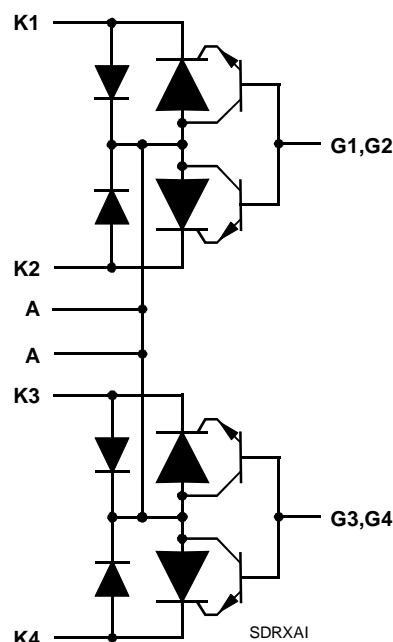
In use, the cathodes of an TISP6NTP2B thyristors are connected to the four conductors to be protected (see Figure 2 and Figure 3). Each gate is connected to the appropriate negative voltage feed. The anode of the TISP6NTP2B is connected to the system common. The TISP6NTP2B is in an 8-pin small-outline surface mount package.

Positive overvoltages are clipped to common by forward conduction of the TISP6NTP2B antiparallel diode. In Figure 2, a negative overvoltage draws a current through the 6.8  $\Omega$  resistor and the voltage developed triggers the thyristor on. In Figure 3, negative overvoltages are initially clipped close to the negative supply by emitter follower action of the TISP6NTP2B buffer transistor. If sufficient clipping current flows, the TISP6NTP2B thyristor will regenerate and switch into a low voltage on-state condition. As the negative overvoltage subsides, the high holding current of the TISP6NTP2B prevents d.c. latchup.

D PACKAGE  
(TOP VIEW)



### device symbol



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**absolute maximum ratings at  $T_{amb} = 25^{\circ}\text{C}$  (unless otherwise noted)**

RATING	SYMBOL	VALUE	UNIT
Repetitive peak off-state voltage, $I_G = 0$	$V_{DRM}$	-130	V
Repetitive peak gate-cathode voltage, $V_{KA} = 0$	$V_{GKRM}$	-120	V
Non-repetitive peak on-state pulse current, (see Notes 1 and 2) 10/1000 $\mu\text{s}$ (Bellcore GR-1089-CORE, Issue 1, November 1994, Section 4) 0.2/310 $\mu\text{s}$ (I3124, open-circuit voltage wave shape 0.5/700 $\mu\text{s}$ ) 5/310 $\mu\text{s}$ (ITU-T K20 & K21, open-circuit voltage wave shape 10/700 $\mu\text{s}$ ) 8/20 $\mu\text{s}$ (IEC 61000-4-5:1995, open-circuit voltage wave shape 1.2/50 $\mu\text{s}$ ) 2/10 $\mu\text{s}$ (Bellcore GR-1089-CORE, Issue 1, November 1994, Section 4)	$I_{TSP}$	20 25 25 60 70	A
Non-repetitive peak on-state current, 50/60 Hz, (see Notes 1 and 2) 100 ms 1 s 5 s 300 s 900 s	$I_{TSM}$	7 2.7 1.5 0.45 0.43	A
Non-repetitive peak gate current, 1/2 $\mu\text{s}$ pulse, cathodes commoned (see Note 1)	$I_{GSM}$	25	A
Operating free-air temperature range	$T_A$	-40 to +85	$^{\circ}\text{C}$
Junction temperature	$T_J$	-40 to +150	$^{\circ}\text{C}$
Storage temperature range	$T_{stg}$	-65 to +150	$^{\circ}\text{C}$

NOTES: 1. Initially the protector must be in thermal equilibrium. The surge may be repeated after the device returns to its initial conditions.  
2. These non-repetitive rated currents are peak values for either polarity. The rated current values may be applied to any cathode-anode terminal pair. Additionally, all cathode-anode terminal pairs may have their rated current values applied simultaneously (in this case the anode terminal current will be four times the rated current value of an individual terminal pair).

### recommended operating conditions

	MIN	TYP	MAX	UNIT
R1, R2 Series resistor for ITU-T recommendation K20	12			$\Omega$
Seeries resistor for ITU-T recommendation K21	20			

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**electrical characteristics for any section,  $T_{amb} = 25\text{ }^{\circ}\text{C}$  (unless otherwise noted)**

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$I_D$	Off-state current	$V_D = V_{DRM}$ , $I_G = 0$	$T_J = 25\text{ }^{\circ}\text{C}$		-5	$\mu\text{A}$
			$T_J = 85\text{ }^{\circ}\text{C}$		-50	$\mu\text{A}$
$V_F$	Forward voltage	$I_F = 0.6\text{ A}$ , $t_w = 500\text{ }\mu\text{s}$ , $V_{GG} = -50\text{ V}$ $I_F = 18\text{ A}$ , $t_w = 500\text{ }\mu\text{s}$ , $V_{GG} = -50\text{ V}$			3 5	V
$I_H$	Holding current	$I_T = -1\text{ A}$ , $di/dt = 1\text{ A/ms}$ , $V_{GG} = -50\text{ V}$ , $T_J = 85\text{ }^{\circ}\text{C}$	-150			mA
$I_{GKS}$	Gate reverse current	$V_{GG} = V_{GKRM}$ , $V_{AK} = 0$	$T_J = 25\text{ }^{\circ}\text{C}$		-5	$\mu\text{A}$
			$T_J = 85\text{ }^{\circ}\text{C}$		-50	$\mu\text{A}$
$I_{GAT}$	Gate reverse current, on state	$I_T = -0.6\text{ A}$ , $t_w = 500\text{ }\mu\text{s}$ , $V_{GG} = -50\text{ V}$			-1	mA
$I_{GAF}$	Gate reverse current, forward conducting state	$I_F = 0.6\text{ A}$ , $t_w = 500\text{ }\mu\text{s}$ , $V_{GG} = -50\text{ V}$			-40	mA
$I_{GT}$	Gate trigger current	$I_T = -5\text{ A}$ , $t_{p(g)} \geq 20\text{ }\mu\text{s}$ , $V_{GG} = -50\text{ V}$			5	mA
$V_{GT}$	Gate trigger voltage	$I_T = -5\text{ A}$ , $t_{p(g)} \geq 20\text{ }\mu\text{s}$ , $V_{GG} = -50\text{ V}$			2.5	V
$C_{AK}$	Anode-cathode off-state capacitance	$f = 1\text{ MHz}$ , $V_d = 1\text{ V}$ , $I_G = 0$ , (see Note 3)	$V_D = -3\text{ V}$		100	pF
			$V_D = -50\text{ V}$		60	pF

NOTE 3: These capacitance measurements employ a three terminal capacitance bridge incorporating a guard circuit. The unmeasured device terminals are a.c. connected to the guard terminal of the bridge.

**thermal characteristics**

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$R_{\theta JA}$	Junction to free air thermal resistance	$P_{tot} = 0.52\text{ W}$ , $T_A = 85\text{ }^{\circ}\text{C}$ , $5\text{ cm}^2$ , FR4 PCB			160	$^{\circ}\text{C/W}$

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#### PARAMETER MEASUREMENT INFORMATION

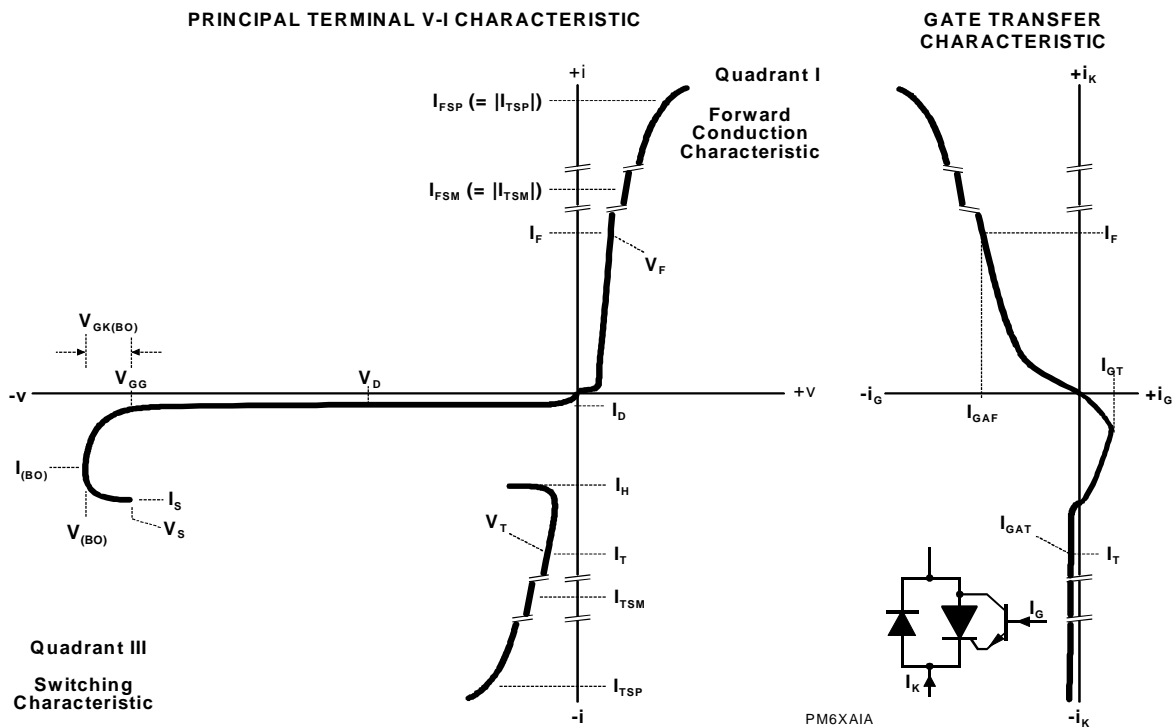
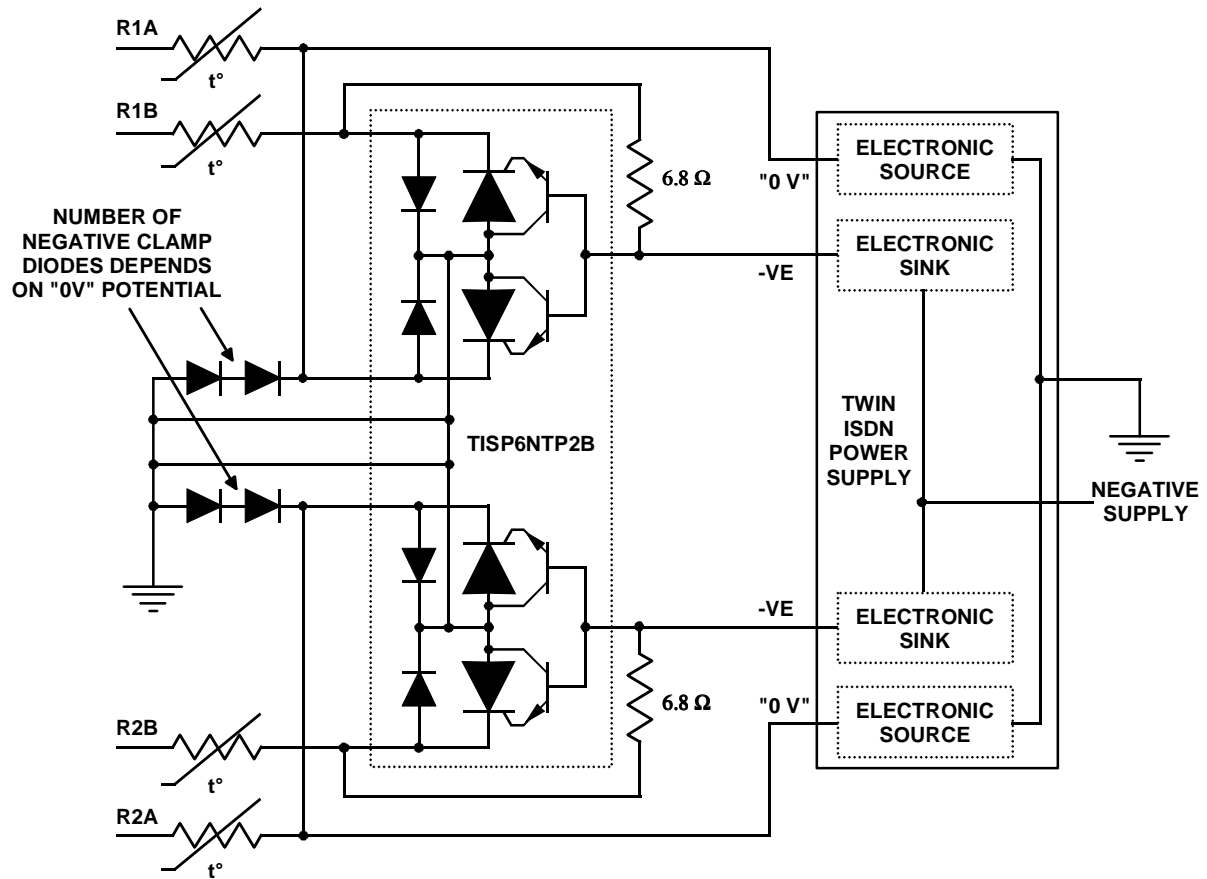


Figure 1. PRINCIPAL TERMINAL AND GATE TRANSFER CHARACTERISTICS

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**APPLICATIONS INFORMATION**



**Figure 2. PROTECTION OF TWO ISDN POWER FEEDS**

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## APPLICATIONS INFORMATION

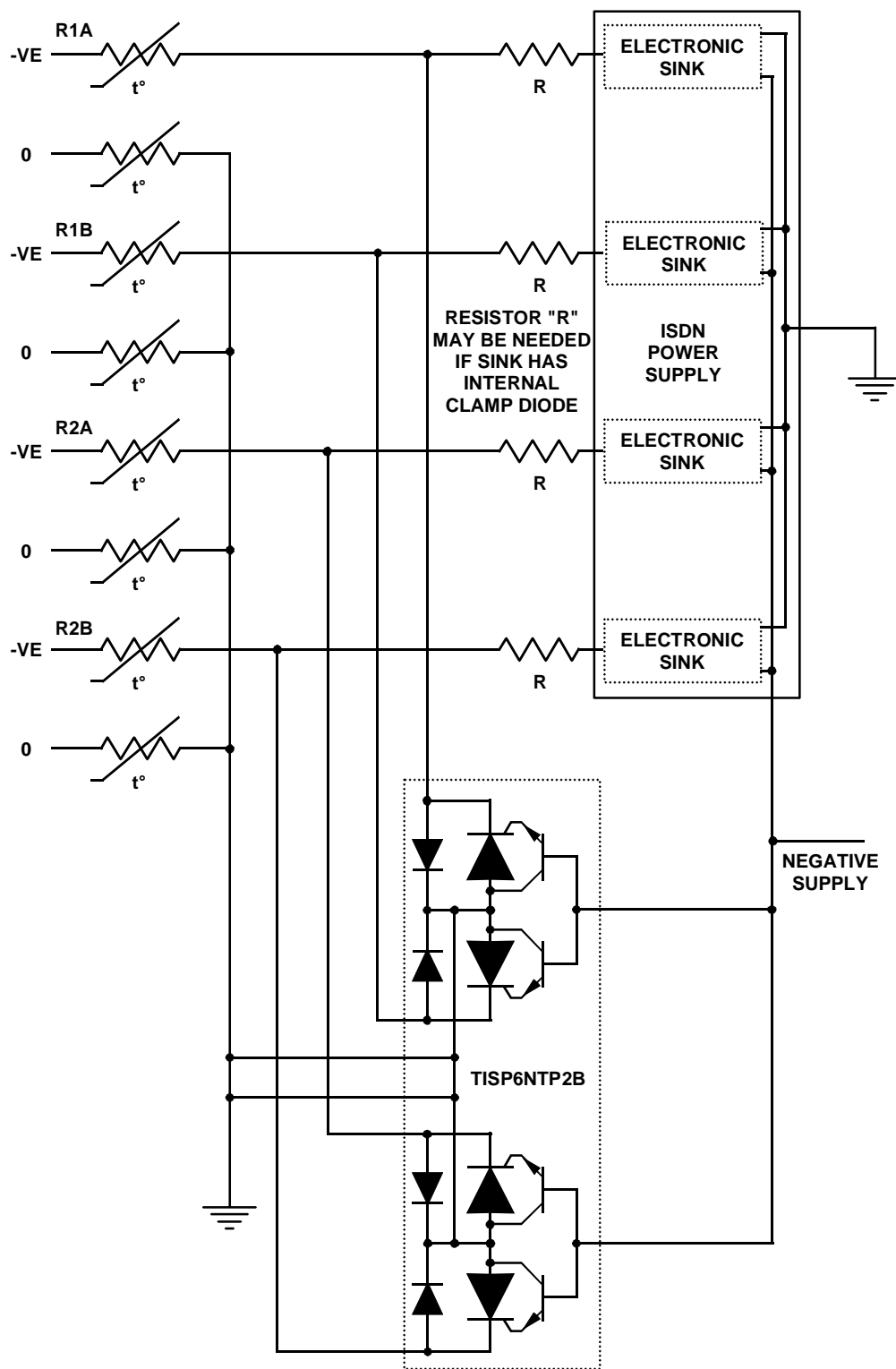


Figure 3. PROTECTION OF FOUR ISDN POWER FEEDS

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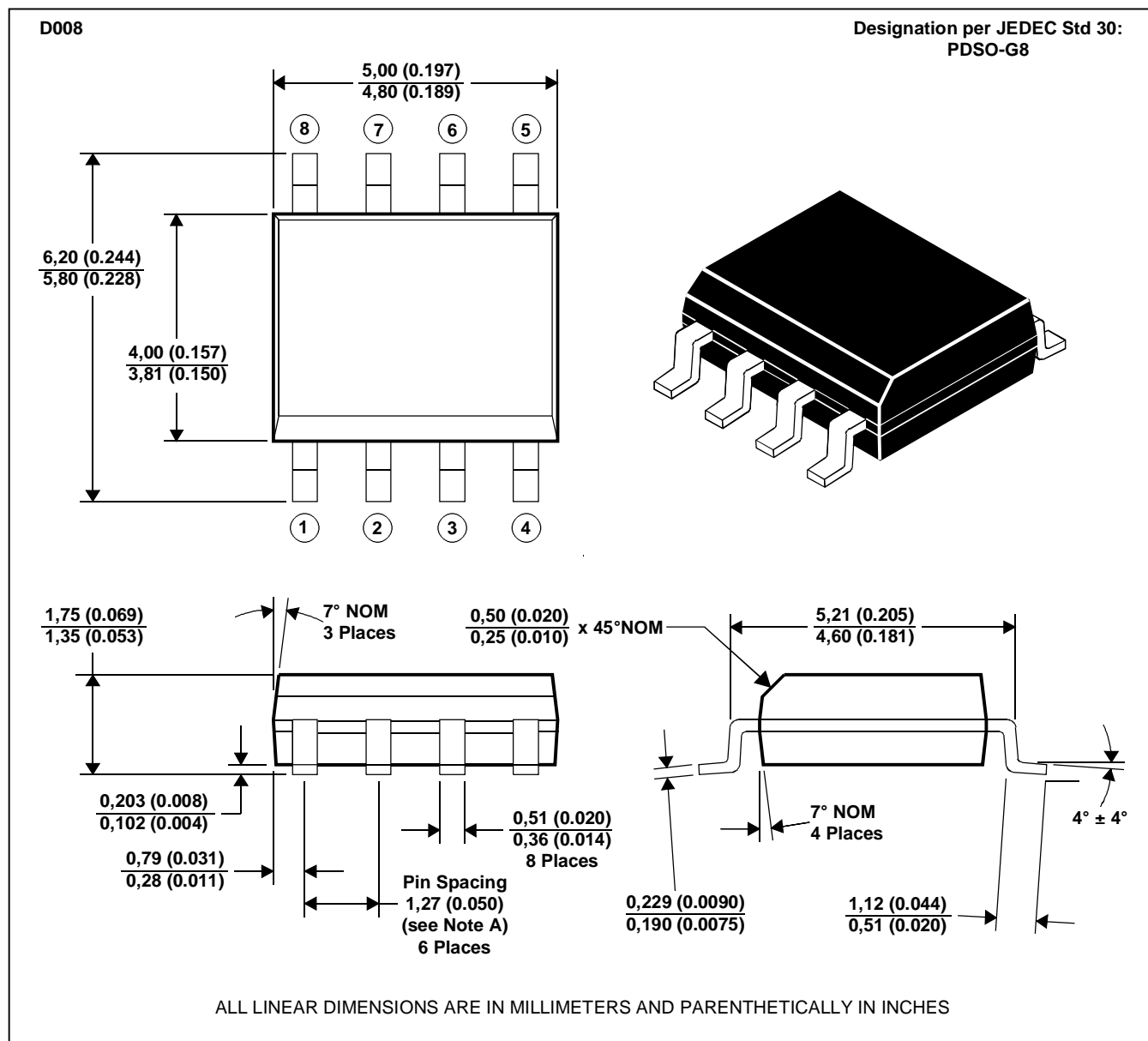
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### MECHANICAL DATA

#### D008

#### plastic small-outline package

This small-outline package consists of a circuit mounted on a lead frame and encapsulated within a plastic compound. The compound will withstand soldering temperature with no deformation, and circuit performance characteristics will remain stable when operated in high humidity conditions. Leads require no additional cleaning or processing when used in soldered assembly.



- NOTES: A. Leads are within 0,25 (0.010) radius of true position at maximum material condition.  
 B. Body dimensions do not include mold flash or protrusion.  
 C. Mold flash or protrusion shall not exceed 0,15 (0.006).  
 D. Lead tips to be planar within ±0,051 (0.002).

MDXXAA

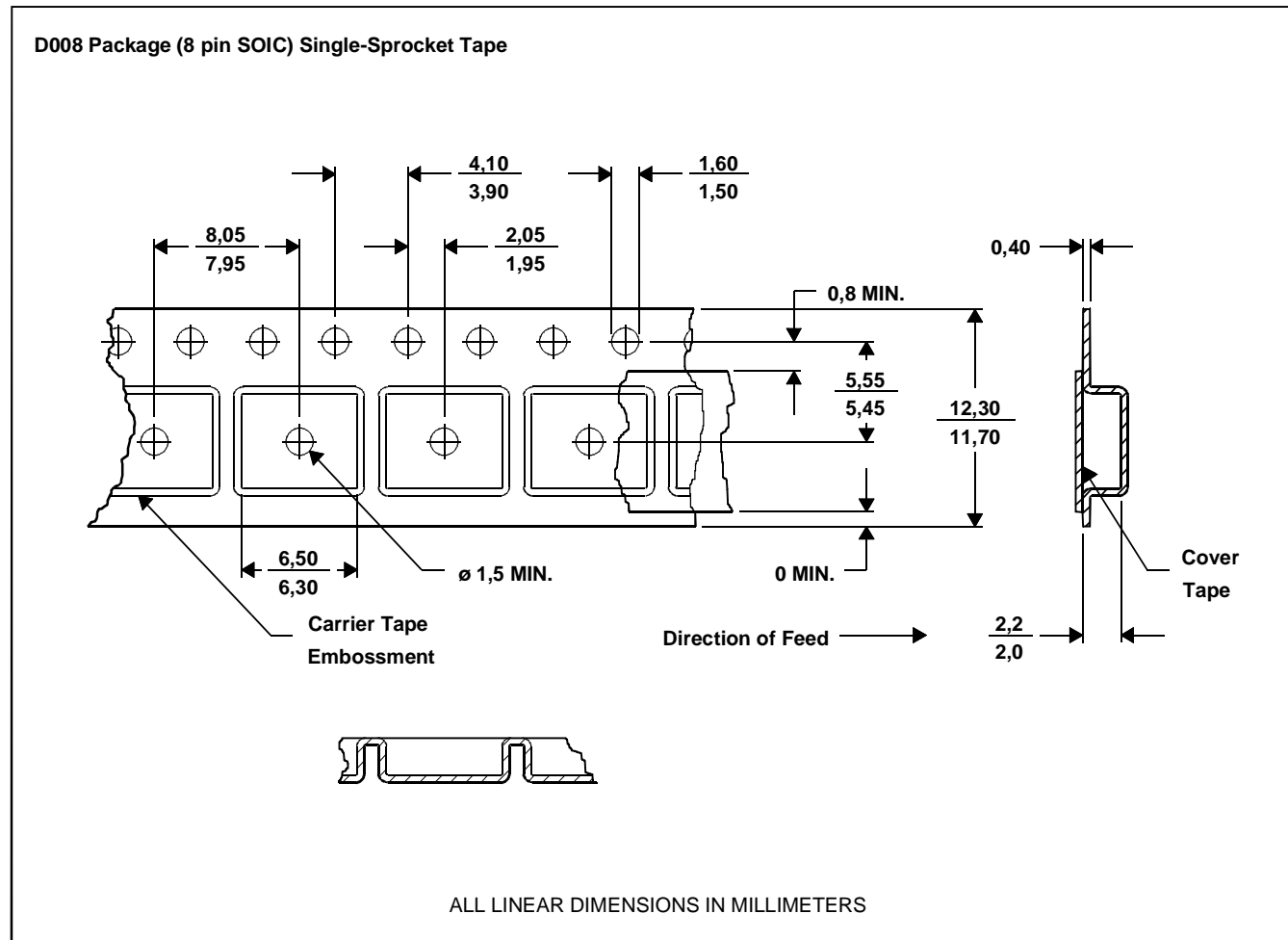
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## MECHANICAL DATA

### D008

#### tape dimensions



NOTES: A. Taped devices are supplied on a reel of the following dimensions:-

MDXXAT

Reel diameter:	330 +0,0/-4,0 mm
Reel hub diameter:	100 ±2,0 mm
Reel axial hole:	13,0 ±0,2 mm

B. 2500 devices are on a reel.



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