

# 2N5228 (SILICON)

## PNP SILICON ANNULAR TRANSISTOR

... designed for general purpose switching applications.

- Current Gain Specified at 10 mA and 50 mA
- Collector-Base Capacitance –  
C<sub>cb</sub> = 5.0 pF (Max)

## PNP SILICON SWITCHING TRANSISTOR



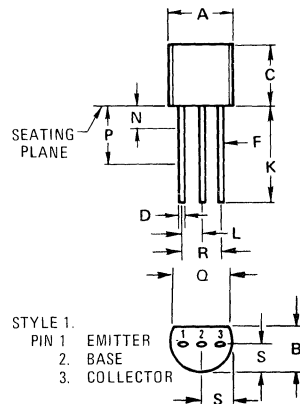
### \*MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V <sub>CEO</sub>	5.0	Vdc
Collector-Base Voltage	V <sub>CB</sub>	5.0	Vdc
Collector-Emitter Voltage	V <sub>CES</sub>	6.0	Vdc
Emitter-Base Voltage	V <sub>EB</sub>	3.0	Vdc
Collector Current – Continuous	I <sub>C</sub>	50	mAdc
Total Power Dissipation @ T <sub>A</sub> = 25°C Derate above 25°C	P <sub>D</sub>	350 2.8	mW mW/°C
Total Power Dissipation @ T <sub>C</sub> = 25°C Derate above 25°C	P <sub>D</sub>	1.0 8.0	Watt mW/°C
Operating and Storage Junction Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C

### \*THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	R <sub>θJA</sub> (1)	357	°C/W
Thermal Resistance, Junction to Case	R <sub>θJC</sub>	125	°C/W

(1) R<sub>θJA</sub> is measured with the device soldered into a typical printed circuit board.  
\*Indicates JEDEC Registered Data.



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.450	5.200	0.175	0.205
B	3.180	4.190	0.125	0.165
C	4.320	5.330	0.170	0.210
D	0.407	0.533	0.016	0.021
F	0.407	0.482	0.016	0.019
K	12.700	–	0.500	–
L	1.150	1.390	0.045	0.055
N	–	1.270	–	0.050
P	6.350	–	0.250	–
O	3.430	–	0.135	–
R	2.410	2.670	0.095	0.105
S	2.030	2.670	0.080	0.105

CASE 29-02  
TO-92

\* ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector-Emitter Breakdown Voltage (1) ( $I_C = 10 \text{ mAdc}$ , $I_B = 0$ )	$BV_{CEO}$	5.0	-	Vdc
Collector-Emitter Breakdown Voltage ( $I_C = 100 \mu\text{Adc}$ , $V_{BE} = 0$ )	$BV_{CES}$	6.0	-	Vdc
Collector-Base Breakdown Voltage ( $I_C = 100 \mu\text{Adc}$ , $I_E = 0$ )	$BV_{CBO}$	5.0	-	Vdc
Emitter-Base Breakdown Voltage ( $I_E = 100 \mu\text{Adc}$ , $I_C = 0$ )	$BV_{EBO}$	3.0	-	Vdc
Collector Cutoff Current ( $V_{CE} = 4.0 \text{ Vdc}$ , $V_{BE} = 0$ )	$I_{CES}$	-	100	nAdc
Emitter Cutoff Current ( $V_{BE} = 2.5 \text{ Vdc}$ , $I_C = 0$ )	$I_{EBO}$	-	100	$\mu\text{Adc}$

<b>ON CHARACTERISTICS</b>				
DC Current Gain ( $I_C = 10 \text{ mAdc}$ , $V_{CE} = 0.3 \text{ Vdc}$ ) ( $I_C = 50 \text{ mAdc}$ , $V_{CE} = 1.0 \text{ Vdc}$ ) (1)	$h_{FE}$	30 15	- -	-
Collector-Emitter Saturation Voltage ( $I_C = 10 \text{ mAdc}$ , $I_B = 3.0 \text{ mAdc}$ )	$V_{CE(sat)}$	-	0.4	Vdc
Base-Emitter Saturation Voltage ( $I_C = 10 \text{ mAdc}$ , $I_B = 3.0 \text{ mAdc}$ )	$V_{BE(sat)}$	0.65	1.25	Vdc

<b>DYNAMIC CHARACTERISTICS</b>				
Current-Gain-Bandwidth Product ( $I_C = 10 \text{ mAdc}$ , $V_{CE} = 5.0 \text{ Vdc}$ , $f = 100 \text{ MHz}$ )	$f_T$	300	-	MHz
Collector-Base Capacitance ( $V_{CB} = 5.0 \text{ Vdc}$ , $I_E = 0$ , $f = 1.0 \text{ MHz}$ )	$C_{cb}$	-	5.0	pF

<b>SWITCHING CHARACTERISTICS</b>					
Delay Time	$(V_{CC} = 3.0 \text{ Vdc}$ , $V_{BE(off)} = 1.5 \text{ Vdc}$ $I_C = 10 \text{ mAdc}$ , $I_{B1} = 3.0 \text{ mAdc}$ )	$t_d$	-	25	ns
Rise Time		$t_r$	-	50	ns
Storage Time	$(V_{CC} = 3.0 \text{ Vdc}$ , $I_C = 10 \text{ mA}$ , $I_{B1} = I_{B2} = 3.0 \text{ mAdc}$ )	$t_s$	-	90	ns
Fall Time		$t_f$	-	50	ns

(1) Pulse Test: Pulse Width = 300  $\mu\text{s}$ , Duty Cycle = 2.0%.

\* Indicates JEDEC Registered Data.

FIGURE 1 — SWITCHING TIME TEST CIRCUIT

