



# PNP POWER SILICON TRANSISTOR

Qualified per MIL-PRF-19500/535

*Qualified Levels:  
JAN, JANTX, and  
JANTXV*

## DESCRIPTION

This high speed transistor is rated at 5 amps and is military qualified up to a JANTXV level. This TO-59 isolated package is available with a 180 degree lead orientation. Microsemi also offers numerous other products to meet higher and lower power voltage regulation applications.

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## FEATURES

- JEDEC registered 2N5003 and 2N5005.
- Internal metallurgical bond option available.
- JAN, JANTX, and JANTXV, qualification per MIL-PRF-19500/535 available.
- RoHS compliant versions available (commercial grade only).



Marking may vary.

## TO-59 (TO-210AA) Isolated Package

## APPLICATIONS / BENEFITS

- Fast switching capable - 0.5  $\mu$ s rise time.
- High frequency response.
- TO-59 case with Isolated terminals.
- Class 3B to ESD per MIL-STD-750 Method 1020.

## MAXIMUM RATINGS

Parameters/Test Conditions	Symbol	Value	Unit
Junction and Storage Temperature	$T_J$ and $T_{STG}$	-65 to +200	$^{\circ}C$
Thermal Resistance Junction-to-Ambient	$R_{\theta JA}$	88	$^{\circ}C/W$
Thermal Resistance Junction-to-Case	$R_{\theta JC}$	3.0	$^{\circ}C/W$
Collector Current	$I_C$	5.0	A
	$I_C^{(3)}$	10	
Collector-Emitter Voltage	$V_{CEO}$	80	V
Collector-Base Voltage	$V_{CBO}$	100	V
Emitter-Base Voltage	$V_{EBO}$	5.5	V
Steady-State Power Dissipation	@ $T_A = +25^{\circ}C$ <sup>(1)</sup>	2.0	W
	@ $T_C = +25^{\circ}C$ <sup>(2)</sup>	58	

- Notes:**
1. Derate linearly 11.4 mW/ $^{\circ}C$  for  $T_A > +25^{\circ}C$ .
  2. Derate linearly 331 mW/ $^{\circ}C$  for  $T_C > +25^{\circ}C$ .
  3. This value applies for  $PW \leq 8.3$  ms, duty cycle  $\leq 1\%$ .

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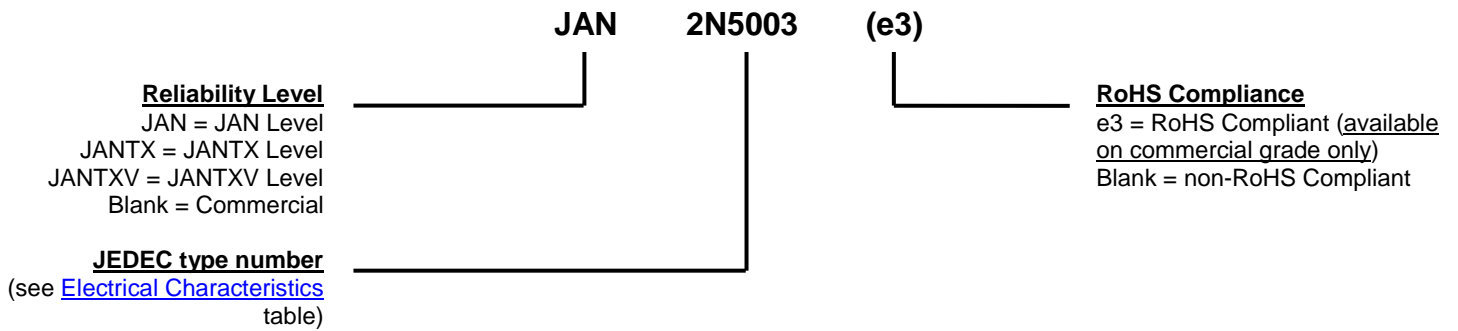
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**MECHANICAL and PACKAGING**

- CASE: Nickel Plated.
- TERMINALS: Solder Dip over Nickel Plating. RoHS compliant Matte/Tin available on commercial grade only.
- MARKING: Manufacturer's ID, Date Code, Part Number, BeO.
- POLARITY: See Package Outline Drawing on last page.
- See [Package Dimensions](#) on last page.

**PART NOMENCLATURE**

**SYMBOLS & DEFINITIONS**

Symbol	Definition
$C_{obo}$	Common-base open-circuit output capacitance.
$I_{CEO}$	Collector cutoff current, base open.
$I_{CES}$	Collector emitter cutoff current, circuit between base and emitter.
$I_{EBO}$	Emitter cutoff current, collector open.
$h_{FE}$	Common-emitter static forward current transfer ratio.
$V_{CEO}$	Collector-emitter voltage, base open.
$V_{CBO}$	Collector-emitter voltage, emitter open.
$V_{EBO}$	Emitter-base voltage, collector open.

**ELECTRICAL CHARACTERISTICS @  $T_C = 25^\circ\text{C}$  unless otherwise noted.**

Characteristic	Symbol	Min.	Max.	Unit
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**OFF CHARACTERISTICS**

Collector-Emitter Breakdown Voltage $I_C = 100\text{ mA}$	$V_{(BR)CEO}$	80		V
Collector-Emitter Cutoff Current $V_{CE} = 40\text{ V}, I_B = 0$	$I_{CEO}$		50	$\mu\text{A}$
Collector-Emitter Cutoff Current $V_{CE} = 60\text{ V}, V_{BE} = 0$ $V_{CE} = 100\text{ V}, V_{BE} = 0$	$I_{CES}$		1.0 1.0	$\mu\text{A}$ mA
Emitter-Base Cutoff Current $V_{BE} = 4.0\text{ V}, I_C = 0$ $V_{BE} = 5.5\text{ V}, I_C = 0$	$I_{EBO}$		1.0 1.0	$\mu\text{A}$ mA

**ON CHARACTERISTICS**

Forward-Current Transfer Ratio $I_C = 50\text{ mA}, V_{CE} = 5.0\text{ V}$ $I_C = 2.5\text{ A}, V_{CE} = 5.0\text{ V}$ $I_C = 5.0\text{ A}, V_{CE} = 5.0\text{ V}$  $I_C = 50\text{ mA}, V_{CE} = 5.0\text{ V}$ $I_C = 2.5\text{ A}, V_{CE} = 5.0\text{ V}$ $I_C = 5.0\text{ A}, V_{CE} = 5.0\text{ V}$	2N5003    2N5005	$h_{FE}$	20 30 20  50 70 40	90 200	
Base-Emitter Voltage Non-saturated $V_{CE} = 5.0\text{ V}, I_C = 2.5\text{ A}$		$V_{BE}$		1.45	V
Collector-Emitter Saturation Voltage $I_C = 2.5\text{ A}, I_B = 250\text{ mA}$ $I_C = 5.0\text{ A}, I_B = 500\text{ mA}$		$V_{CE(sat)}$		0.75 1.5	V
Base-Emitter Saturation Voltage $I_C = 2.5\text{ A}, I_B = 250\text{ mA}$ $I_C = 5.0\text{ A}, I_B = 500\text{ mA}$		$V_{BE(sat)}$		1.45 2.2	V

**DYNAMIC CHARACTERISTICS**

Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio $I_C = 100\text{ mA}, V_{CE} = 5.0\text{ V}, f = 1\text{ kHz}$	2N5003 2N5005	$h_{fe}$	20 50		
Magnitude of Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio $I_C = 500\text{ mA}, V_{CE} = 5.0\text{ V}, f = 10\text{ MHz}$	2N5003 2N5005	$ h_{fe} $	6.0 7.0		
Output Capacitance $V_{CB} = 10\text{ V}, I_E = 0, f = 1\text{ MHz}$		$C_{obo}$		250	pF

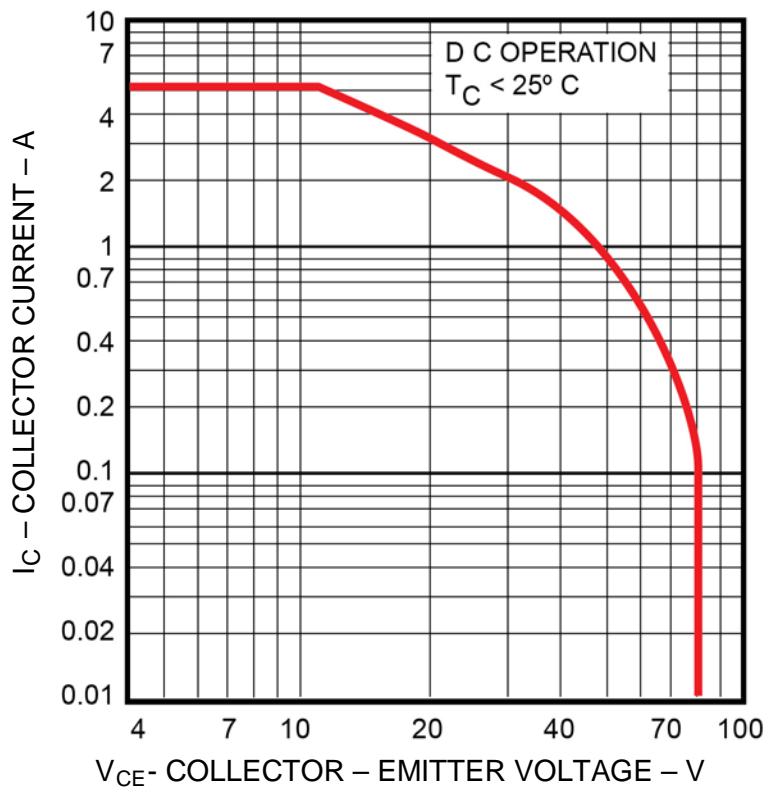
**SWITCHING CHARACTERISTICS**

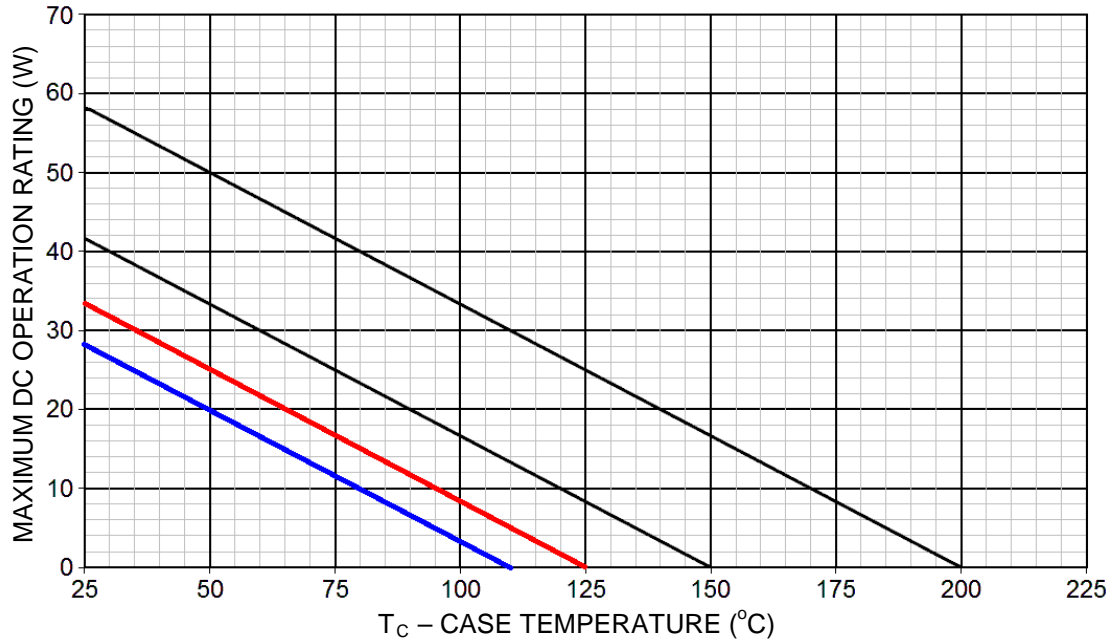
Turn-On Time $I_C = 5\text{ A}; I_{B1} = 500\text{ mA}$		$t_{on}$		0.5	$\mu\text{s}$
Storage Time $I_{B2} = -500\text{ mA}$		$t_s$		1.4	$\mu\text{s}$
Fall Time $V_{BE(OFF)} = 3.7\text{ V}$		$t_f$		0.5	$\mu\text{s}$
Turn-Off Time $R_L = 6\text{ Ohms}$		$t_{off}$		1.5	$\mu\text{s}$

**ELECTRICAL CHARACTERISTICS @  $T_C = 25^\circ\text{C}$  unless otherwise noted. (continued)**
**SAFE OPERATING AREA (See Figure below and [MIL-STD-750, Test Method 3053](#))**
**DC Tests**
 $T_C = +25^\circ\text{C}$ ,  $V_{CE} = 0$ ,  $t_p = 1$  second 1 Cycle

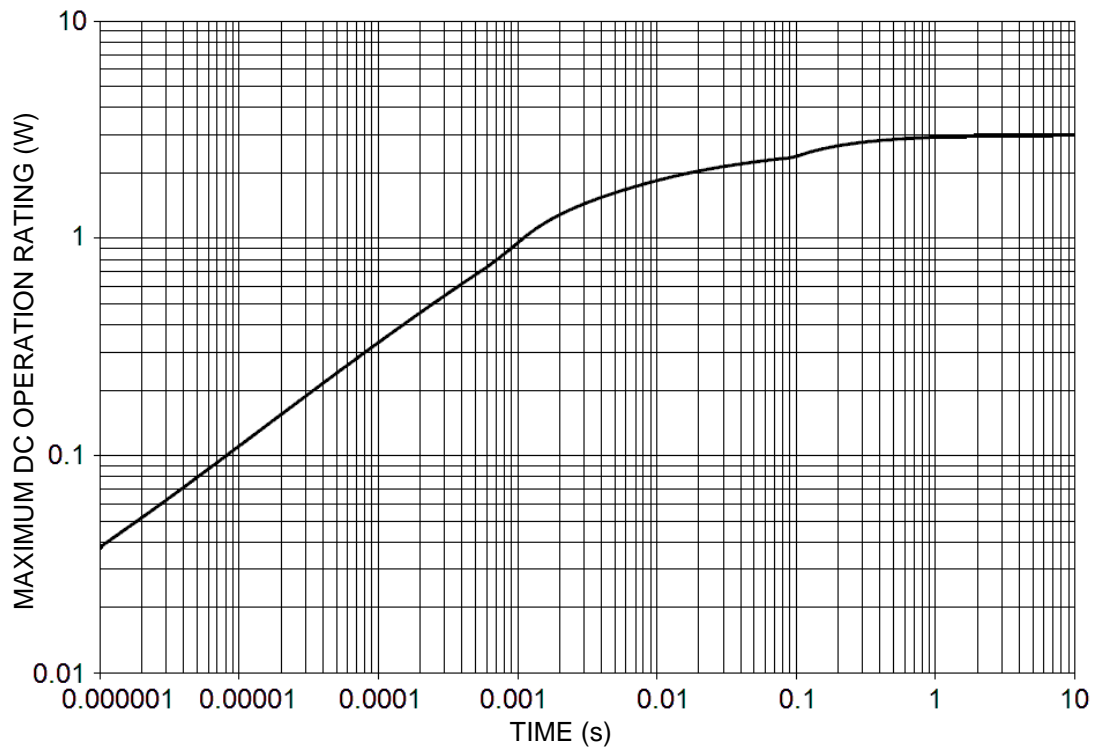
**Test 1**
 $V_{CE} = 12$  V,  $I_C = 5$  A

**Test 2**
 $V_{CE} = 32$  V,  $I_C = 1.7$  A

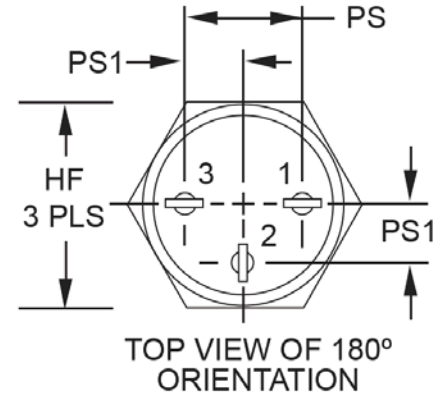
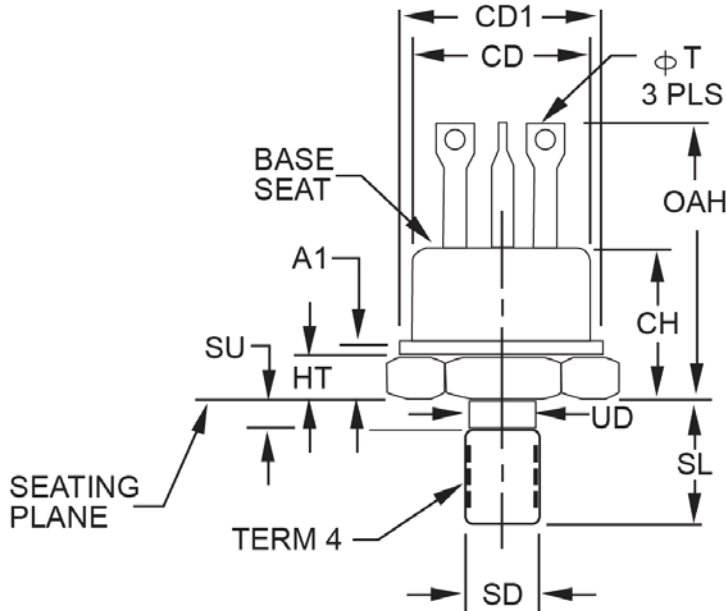
**Test 3**
 $V_{CE} = 80$  V,  $I_C = 100$  mA

**Maximum safe operating area**

**GRAPHS**


**FIGURE 1**  
Temperature-Power Derating



**FIGURE 2**  
Thermal Impedance

**PACKAGE DIMENSIONS**

**NOTES:**

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. See NSB Handbook H28, "Screw-Thread Standards for Federal Services".
4. The orientation of the terminals in relation to the hex flats is not controlled.
5. All three terminals.
6. The case temperature may be measured anywhere on the seating plane within .125 inch (3.18 mm) of the stud.
7. Terminal spacing measured at the base seat only.
8. This dimension applies to the location of the center line of the terminals.
9. Terminal - 1, emitter; terminal - 2, base; terminal - 3, collector. Collector lead is isolated from the case.
10. In accordance with ASME Y14.5M, diameters are equivalent to  $\Phi x$  symbology.

Symbol	Dimension				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
A1		.250		6.35	
CD	.330	.360	8.38	9.14	
CD1	.370	.437	9.40	11.10	
CH	.320	.468	8.13	11.89	
HF	.424	.437	10.77	11.10	
HT	.090	.150	2.29	3.81	
OAH	.575	.763	14.61	19.38	5
PS	.185	.215	4.70	5.46	4, 8
PS1	.090	.110	2.29	2.79	4, 8
SL	.400	.455	10.16	11.56	
SU		.078		1.98	7
T	.040	.065	1.02	1.65	
UD	.155	.189	3.94	4.80	

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