

**SFT2010 SFT2012 SFT2014**  
**200 AMP**  
**HIGH ENERGY NPN TRANSISTOR**  
**V<sub>CEO</sub> 100, 120, 140 VOLTS**



14830 Valley View Avenue  
 La Mirada, California 90638  
 (213) 921-9660  
 TWX 910-583-4807  
 FAX 213-921-2396

**CASE STYLE R**  
**TO-3 WITH .060 PINS**



**FEATURES**

- BVCBO 250 VOLTS MIN
- 600 WATTS POWER DISSIPATION
- EXCELLENT SOA CURVE
- Es/b OF 800mJ
- GAIN OF OVER 5 AT 200 AMPS
- HIGH REL CONSTRUCTION INCLUDING GOLD EUTECTIC DIE MOUNTING, ALUMINUM WIRING
- PLANAR CHIP CONSTRUCTION WITH LOW LEAKAGE AND VERY FAST SWITCHING

**MAXIMUM RATINGS**

Rating	Symbol	Value	Unit
Collector - Emitter Voltage	V <sub>CEO</sub>	100 120 140	Volts
Collector - Base Voltage	V <sub>CBO</sub>	250	Volts
Emitter - Base Voltage	V <sub>EBO</sub>	8	Volts
Collector Current	I <sub>C</sub>	200	Amps
Base Current	I <sub>B</sub>	75	Amps
Total Device Dissipation @ TC = 50 °C	P <sub>D</sub>	600	Watts
Derate above 50 °C		4	W/°C
Operating and Storage Temperature	T <sub>J</sub> , T <sub>stg</sub>	-65 to 200	°C

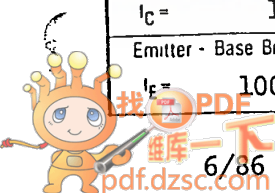
**THERMAL CHARACTERISTICS**

Characteristics	Symbol	Value	Unit
Thermal Resistance, Junction to Case	R <sub>θJC</sub>	0.25	°C/W

**ELECTRICAL CHARACTERISTICS**

Characteristics	Symbol	Min.	Max.	Unit
Collector - Emitter Breakdown Voltage* I <sub>C</sub> = 200 mA <sub>dc</sub>	BV <sub>CEO</sub> *	100 120 140		V <sub>dc</sub>
Collector - Base Breakdown Voltage I <sub>C</sub> = 100 μA <sub>dc</sub>	BV <sub>CBO</sub>	250		V <sub>dc</sub>
Emitter - Base Breakdown Voltage I <sub>E</sub> = 100 μA <sub>dc</sub>	BV <sub>EBO</sub>	8		V <sub>dc</sub>

NOTE: All specifications subject to change without notice.



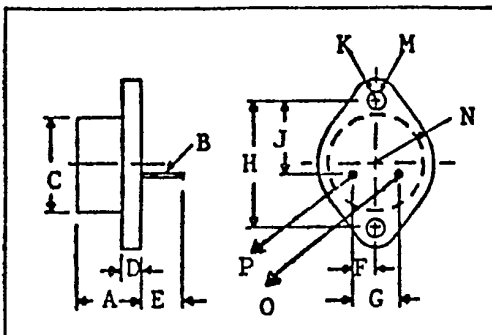
**ELECTRICAL CHARACTERISTICS**

Characteristics	Symbol	Min.	Max.	Unit
Collector Cutoff Current ( $V_{CB} = 250$ Vdc)	$I_{CBO}$		10	$\mu$ A
Emitter Cutoff Current ( $V_{EB} = 7$ Vdc)	$I_{EBO}$		10	$\mu$ A
DC Current Gain* ( $I_C = 10$ Adc, $V_{CE} = 2$ Vdc) ( $I_C = 100$ Adc, $V_{CE} = 5$ Vdc) ( $I_C = 200$ Adc, $V_{CE} = 5$ Vdc)	$h_{FE}$	40 30 5		
Collector - Emitter Saturation Voltage* ( $I_C = 120$ Adc, $I_B = 12$ Adc) ( $I_C = 200$ Adc, $I_B = 30$ Adc)	$V_{CE(SAT)}$		2.0 3.0	Vdc
Base - Emitter Saturation Voltage* ( $I_C = 120$ Adc, $I_B = 12$ Adc)	$V_{BE(SAT)}$		2.2	Vdc
Current - Gain - Bandwidth Product ( $I_C = 1.0$ Adc, $V_{CE} = 10$ Vdc, $f = 10$ MHz)	$f_T$	30		MHz
Output Capacitance ( $V_{CB} = 10$ Vdc, $f = 0.1 = 1$ MHz)	$C_{ob}$		1200	pf
RB SOA ( $I_B = 1$ Adc, $R_{B1} = R_{B2} = 20$ ohms) ( $V_{BE(off)} = 2.0$ Vdc, $L = 1.0$ mH)	$E_{S/b}$	800		mJ
FB SOA ( $V_{CE} = 20$ Vdc, $I_C = 30$ Adc) ( $V_{CE} = 100$ Vdc, $I_C = 0.75$ Adc)	$I_{S/b}$	1 1		sec
ON TIME	$t_{on}$		800	ns
Storage Time	$t_s$	( $V_{CC} = 60$ Vdc, $I_C = 10$ Adc)	1500	ns
Fall Time	$t_f$	( $I_{B1} = I_{B2} = 1.0$ Adc)	400	ns

\*Pulse Test: Pulse width = 300 us, DutyCycle = 2%

**PHYSICAL DIMENSIONS**

**KEY TO DIMENSIONS:**



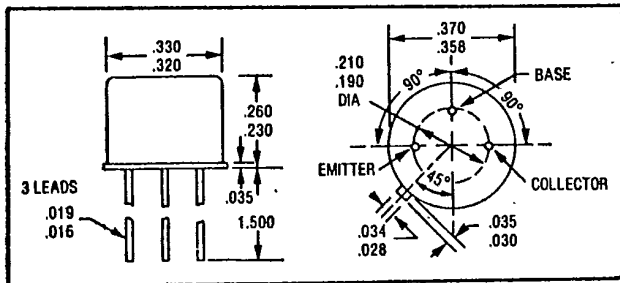
- (Inches)
- A = .250 - .450
  - B = .057 - .062
  - C = .875 MAX.
  - D = .135 MAX.
  - E = .312 MIN.
  - F = .205 - .225
  - G = .420 - .440
  - H = 1.177 - 1.197
  - J = .655 - .675
  - K = .188 MAX.
  - M = .151 - .161
  - N = .525 MAX.
  - U = BASE
  - P = EMITTER



<h1 style="margin: 0;">2N5094 AND 2N5096</h1> <h2 style="margin: 0;">1 AMP</h2> <h3 style="margin: 0;">HIGH VOLTAGE PNP TRANSISTOR</h3> <h3 style="margin: 0;">450-500 VOLTS</h3>	
14830 Valley View Avenue La Mirada, California 90638 (213) 921-9660 TWX 910-583-4807 FAX 213-921-2396	

**CASE STYLE W**  
**JEDEC TO-5**

**FEATURES**



- BVCBO TO 500 VOLTS
- LOW SATURATION VOLTAGE
- LOW LEAKAGE AT HIGH TEMPERATURE
- 200°C OPERATING, GOLD EUTECTIC DIE ATTACH
- DESIGNED FOR COMPLEMENTARY USE WITH 2N5095 THRU 2N5097
- 2N5091 AND 2N5093 ALSO AVAILABLE

**MAXIMUM RATINGS**

Rating	Symbol	2N5094	2N5096	Unit
Collector - Emitter Voltage	$V_{CE0}$	400	450	Volts
$R_{BE} = 1 \text{ K Ohms}$	$V_{CER}$	450	500	Volts
Collector - Base Voltage	$V_{CBO}$	450	500	Volts
Emitter - Base Voltage	$V_{EBO}$	6.0		Volts
Collector Current	$I_C$	1.0		Amps
Base Current	$I_B$	0.5		Amps
Total Device Dissipation @ $T_C = 100^\circ\text{C}$	$P_D$	2		Watts
Derate above 100 °C		20		mW/°C
Operating and Storage Temperature	$T_j, T_{stg}$	-65 to +200		°C

**THERMAL CHARACTERISTICS**

Characteristics	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	50	°C/W

**ELECTRICAL CHARACTERISTICS**

Characteristics	Symbol	Min.	Max.	Unit
Collector - Emitter Breakdown Voltage* ( $I_C = 50 \text{ mA dc}$ )	$BV_{CE0}^*$	400		Vdc
( $I_C = 100 \text{ uA dc}, R_{BE} = 1 \text{ K Ohms}$ )	$BV_{CER}^*$	450		Vdc
Collector - Base Breakdown Voltage ( $I_C = 100 \text{ uA dc}$ )	$BV_{CBO}$	450		Vdc
Emitter - Base Breakdown Voltage ( $I_E = 20 \text{ uA dc}$ )	$BV_{EBO}$	6		Vdc

**ELECTRICAL CHARACTERISTICS**

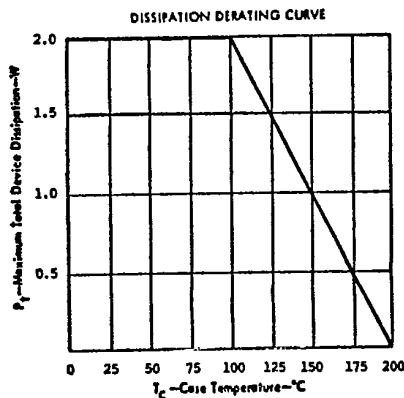
Characteristics	Symbol	Min.	Max.	Unit
Collector Cutoff Current 2N5094 VCB= 450 Vdc 2N5096 VCB= 500 Vdc	$I_{CBO}$		500	nAdc
Emitter Cutoff Current ( $V_{EB} = 4 \text{ Vdc}$ )	$I_{EBO}$		250	nAdc
DC Current Gain* ( $I_C = 1 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}$ ) ( $I_C = 25 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}$ ) ( $I_C = 100 \text{ mAdc}, V_{CE} = 15 \text{ Vdc}$ )	$h_{FE}$	20 40 20	200 250 200	
Collector - Emitter Saturation Voltage* ( $I_C = 25 \text{ mAdc}, I_B = 2.5 \text{ mAdc}$ )	$V_{CE(SAT)}$		3.0	Vdc
Base - Emitter Saturation Voltage* ( $I_C = 25 \text{ mAdc}, I_B = 2.5 \text{ mAdc}$ )	$V_{BE(SAT)}$		1.0	Vdc
Current - Gain - Bandwith Product ( $I_C = 10 \text{ mAdc}, V_{CE} = 20 \text{ Vdc}, f = 5 \text{ MHz}$ )	$f_T$	20		MHz
Output Capacitance ( $V_{CB} = 15 \text{ Vdc}, I_E = 0, f = 2 \text{ MHz}$ )	$C_{ob}$		20	pf

**SWITCHING TIMES**

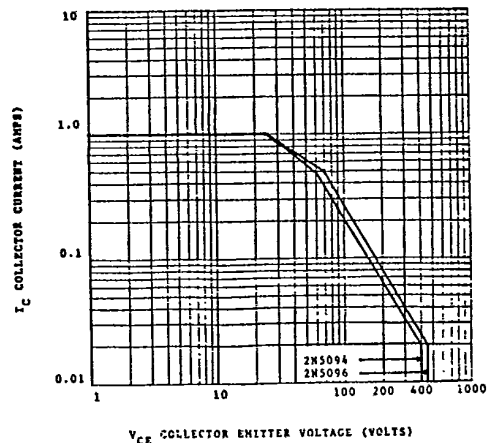
Delay Time	$(V_{CC} = 150 \text{ Vdc}, I_C = 100 \text{ mAdc}, I_{B1} = I_{B2} = 10 \text{ mAdc})$	$t_d$	700	ns
Rise Time		$t_r$	1500	ns
Storage Time		$t_s$	3	us
Fall Time		$t_f$	200	ns

\*Pulse Test: Pulse width = 300 us, DutyCycle = 2%

**TYPICAL OPERATING CURVES**



FORWARD BIAS DC SAFE OPERATION AREA (S.O.A. CURVE)  
CURVES APPLY BELOW RATED  $V_{CEO}$   $T_C = 25^\circ\text{C}$




# 2N4999 AND 2N5001

## 2 AMP

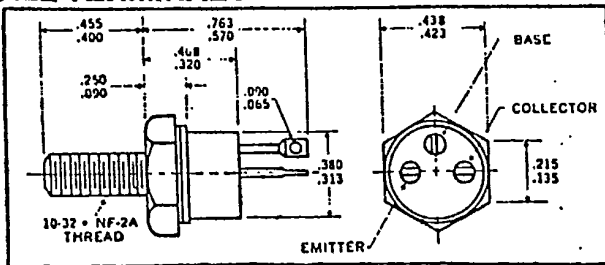
# HIGH SPEED PNP TRANSISTOR

## 100 VOLTS



14830 Valley View Avenue  
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**CASE STYLE X**  
**JEDEC TO-59**  
**ALL TERMINALS ISOLATED FROM CASE**



**FEATURES**

- RADIATION TOLERANT
- FAST SWITCHING, 200 NSEC MAX  $t_{on}$
- HIGH FREQUENCY, TYPICAL  $f_T$  100 MHZ
- $V_{CE0}$  80 VOLTS MIN
- HIGH LINEAR GAIN, LOW SATURATION VOLTAGE
- 200 °C OPERATING, GOLD EUTECTIC DIE ATTACH
- DESIGNED FOR COMPLEMENTARY USE WITH 2N3996 AND 2N3997

**MAXIMUM RATINGS**

Rating	Symbol	Value	Unit
Collector - Emitter Voltage	$V_{CE0}$	80	Volts
Collector - Base Voltage	$V_{CB0}$	100	Volts
Emitter - Base Voltage	$V_{EB0}$	5.5	Volts
Collector Current	$I_C$	2	Amps
Base Current	$I_B$	1	Amps
Total Device Dissipation @ $T_C = 50$ °C	$P_D$	30	Watts
Derate above 50 °C		200	mW/°C
Operating and Storage Temperature	$T_j, T_{stg}$	-65 to +200	°C

**THERMAL CHARACTERISTICS**

Characteristics	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	5.0	°C/W

**ELECTRICAL CHARACTERISTICS**

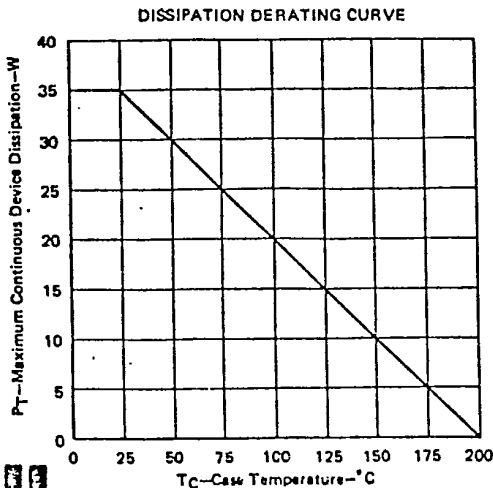
Characteristics	Symbol	Min.	Max.	Unit
Collector - Emitter Breakdown Voltage* ( $I_C = 100$ mA dc)	$BV_{CE0}$	80		Vdc
Collector - Base Breakdown Voltage ( $I_C = 200$ uA dc)	$BV_{CB0}$	100		Vdc
Emitter - Base Breakdown Voltage ( $I_E = 200$ uA dc)	$BV_{EB0}$	5.5		Vdc

**ELECTRICAL CHARACTERISTICS**

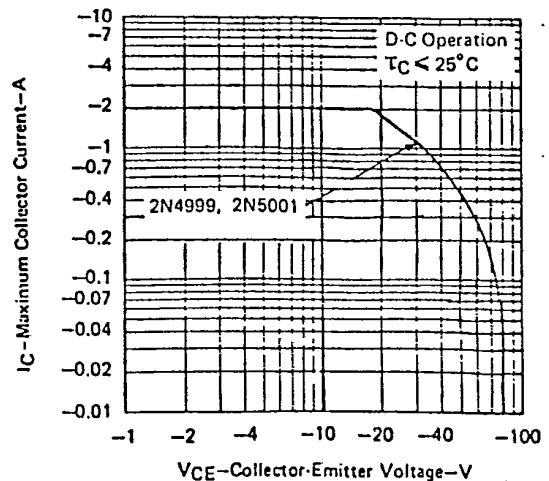
Characteristics	Symbol	Min.	Max.	Unit
Collector Cutoff Current ( $V_{CE} = 40 \text{ Vdc}$ )	$I_{CEO}$		50	$\mu\text{Adc}$
Emitter Cutoff Current ( $V_{EB} = 4 \text{ Vdc}$ ) ( $V_{EB} = 5.5 \text{ Vdc}$ )	$I_{EBO}$		1.0 1.0	$\mu\text{Adc}$ $\text{mAdc}$
DC Current Gain* ( $I_C = 50 \text{ mAdc}, V_{CE} = 5 \text{ Vdc}$ ) ( $I_C = 1 \text{ Adc}, V_{CE} = 5 \text{ Vdc}$ ) ( $I_C = 3 \text{ Adc}, V_{CE} = 5 \text{ Vdc}$ )	$h_{FE}$	20 50 30 70 5 15	90 200	
Collector - Emitter Saturation Voltage* ( $I_C = 1 \text{ Adc}, I_B = 100 \text{ mAdc}$ ) ( $I_C = 2 \text{ Adc}, I_B = 200 \text{ mAdc}$ )	$V_{CE(SAT)}$		0.46 0.85	Vdc
Base - Emitter Saturation Voltage* ( $I_C = 1 \text{ Adc}, I_B = 100 \text{ mAdc}$ ) ( $I_C = 2 \text{ Adc}, I_B = 200 \text{ mAdc}$ )	$V_{BE(SAT)}$		1.2 1.5	Vdc
Current - Gain - Bandwidth Product ( $I_C = 200 \text{ Adc}, V_{CE} = 5 \text{ Vdc}, f = 20 \text{ MHz}$ )	$f_T$	50 60		MHz
Output Capacitance ( $V_{CB} = 10 \text{ Vdc}, I_E = 0, f = 1 \text{ MHz}$ )	$C_{ob}$		120	pf
Base - Emitter Voltage* $V_{CE} = 5 \text{ Vdc}, I_C = 2 \text{ Adc}$	$V_{BE(on)}$		1.5	Vdc
Delay Time ( $V_{CC} = 30 \text{ Vdc}$ )	$t_d$		200	ns
Rise Time	$t_r$			
Storage Time	$t_s$		400	ns
Fall Time	$t_f$			

\*Pulse Test: Pulse width = 300 us, DutyCycle = 2%

**TYPICAL OPERATING CURVES**



FORWARD BIAS DC SAFE OPERATION AREA (S.O.A. CURVES)  
CURVES APPLY BELOW RATED  $V_{CEO}$   $T_C = 25^\circ\text{C}$



SOLID STATE DEVICES, INC.