

# 2N5338 AND 2N5339

## 5 AMP

### HIGH SPEED NPN TRANSISTOR

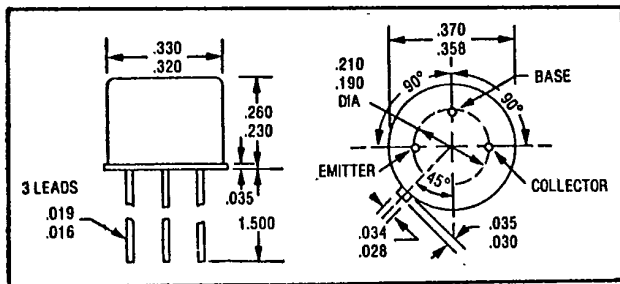
## 100 VOLTS



14830 Valley View Avenue  
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FAX 213-921-2396

#### CASE STYLE W

#### JEDEC TO-5



#### FEATURES

- RADIATION TOLERANT
- FAST SWITCHING, 100 NSEC MAX  $t_d$
- HIGH FREQUENCY, TYPICAL  $f_T$  100 MHZ
- $V_{CE0}$  100 VOLTS MIN
- HIGH LINEAR GAIN, LOW SATURATION VOLTAGE
- 200°C OPERATING, GOLD EUTECTIC DIE ATTACH
- DESIGNED FOR COMPLEMENTARY USE WITH 2N6192 AND 2N6193
- 2N5334 THRU 2N5337 ALSO AVAILABLE

#### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector - Emitter Voltage	$V_{CE0}$	100	Volts
Collector - Base Voltage	$V_{CBO}$	100	Volts
Emitter - Base Voltage	$V_{EBO}$	6	Volts
Collector Current	$I_C$	5	Amps
Base Current	$I_B$	1	Amps
Total Device Dissipation @ $T_C = 25^\circ C$	$P_D$	6	Watts
Derate above $25^\circ C$		34.3	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	$R_{\theta JC}$	29.2	°C/W

#### ELECTRICAL CHARACTERISTICS

Characteristics	Symbol	Min.	Max.	Unit
Collector - Emitter Breakdown Voltage* ( $I_C = 50$ mA dc)	$BV_{CE0}$ *	100		Vdc
Collector - Base Breakdown Voltage ( $I_C = 200$ $\mu$ A dc)	$BV_{CBO}$	100		Vdc
Emitter - Base Breakdown Voltage ( $I_E = 200$ $\mu$ A dc)	$BV_{EBO}$	6		Vdc

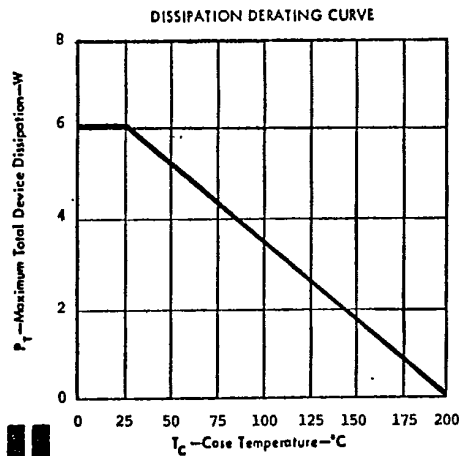
NOTE: All specifications subject to change without notice.

**ELECTRICAL CHARACTERISTICS**

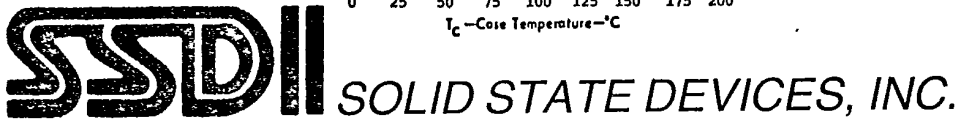
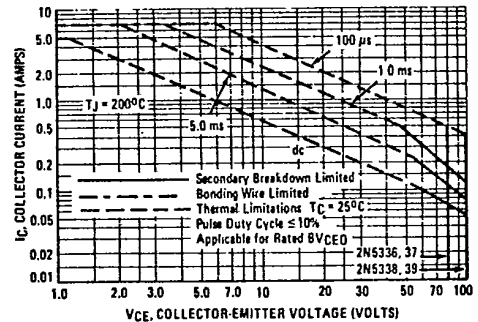
Characteristics	Symbol	Min.	Max.	Unit
Collector Cutoff Current ( $V_{CE} = 90 \text{ Vdc}$ ) ( $V_{CE} = 90 \text{ Vdc}, V_{EB} = 1.5 \text{ Vdc}$ ) ( $V_{CE} = 90 \text{ Vdc}, V_{EB} = 1.5 \text{ Vdc}, T_C = 150^\circ\text{C}$ )			100 10 1.0	$\mu\text{Adc}$ $\mu\text{Adc}$ $\text{mAdc}$
Collector Cutoff Current ( $V_{CB} = 100 \text{ Vdc}$ )	$I_{CBO}$		10	$\mu\text{Adc}$
Emitter Cutoff Current ( $V_{EB} = 6 \text{ Vdc}$ )	$I_{EBO}$		100	$\mu\text{Adc}$
DC Current Gain* ( $I_C = 500 \text{ mAdc}, V_{CE} = 2 \text{ Vdc}$ ) ( $I_C = 2 \text{ Adc}, V_{CE} = 2 \text{ Vdc}$ ) ( $I_C = 5 \text{ Adc}, V_{CE} = 2 \text{ Vdc}$ )	$h_{FE}$	30 60 30 60 20 40	120 240	
Collector - Emitter Saturation Voltage* ( $I_C = 2 \text{ Adc}, I_B = 200 \text{ mAdc}$ ) ( $I_C = 5 \text{ Adc}, I_B = 500 \text{ mAdc}$ )	$V_{CE(SAT)}$		0.7 1.2	Vdc
Base - Emitter Saturation Voltage* ( $I_C = 2 \text{ Adc}, I_B = 200 \text{ mAdc}$ ) ( $I_C = 5 \text{ Adc}, I_B = 500 \text{ mAdc}$ )	$V_{BE(SAT)}$		1.2 1.8	Vdc
Current - Gain - Bandwidth Product ( $I_C = 500 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}, f = 10 \text{ MHz}$ )	$f_T$	30		M Hz
Output Capacitance ( $V_{CB} = 10 \text{ Vdc}, I_E = 0, f = 100 \text{ KHz}$ )	$C_{ob}$		250	pf
Input Capacitance ( $V_{BE} = 2 \text{ Vdc}, I_C = 0, f = 100 \text{ KHz}$ )	$C_{ib}$		1000	pf
Delay Time ( $V_{CC} = 40 \text{ Vdc}$ )	$t_d$		100	ns
Rise Time ( $I_C = 2.0 \text{ Adc}$ )	$t_r$		100	ns
Storage Time ( $V_{EB(Off)} = 3.0 \text{ Vdc}$ )	$t_s$		2.0	$\mu\text{s}$
Fall Time ( $I_{B1} = I_{B2} = 200 \text{ mAdc}$ )	$t_f$		200	ns

\*Pulse Test: Pulse width = 300  $\mu\text{s}$ , DutyCycle = 2%

**TYPICAL OPERATING CURVES**



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



# 2N3996 AND 2N3997

## 5 AMP

### HIGH SPEED NPN TRANSISTOR

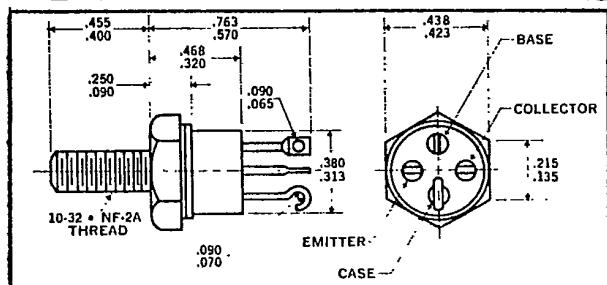
## 100 VOLTS



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**CASE STYLE Z****JEDEC TO-111****ALL TERMINALS ISOLATED FROM CASE****FEATURES**

- RADIATION TOLERANT
- FAST SWITCHING, 300 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 2N4999 AND 2N5001

**MAXIMUM RATINGS**

Rating	Symbol	Value	Unit
Collector - Emitter Voltage	$V_{CE0}$	80	Volts
Collector - Base Voltage	$V_{CB0}$	100	Volts
Emitter - Base Voltage	$V_{EB0}$	8	Volts
Collector Current	$I_C$	5	Amps
Base Current	$I_B$	1	Amps
Total Device Dissipation @ $T_C = 100^\circ\text{C}$	$P_D$	30	Watts
Derate above 100 °C		300	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	$R_{\theta JC}$	3.33	°C/W

**ELECTRICAL CHARACTERISTICS**

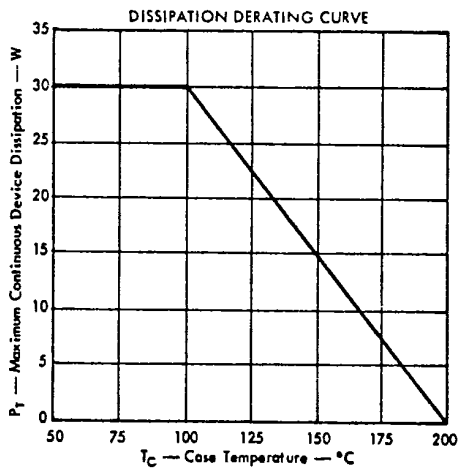
Characteristics	Symbol	Min.	Max.	Unit
Collector - Emitter Breakdown Voltage* ( $I_C = 50$ mA dc)	$BV_{CE0}^*$	80		Vdc
Collector - Base Breakdown Voltage ( $I_C = 200$ uA dc)	$BV_{CB0}$	100		Vdc
Emitter - Base Breakdown Voltage ( $I_E = 200$ uA dc)	$BV_{EB0}$	8		Vdc

**ELECTRICAL CHARACTERISTICS**

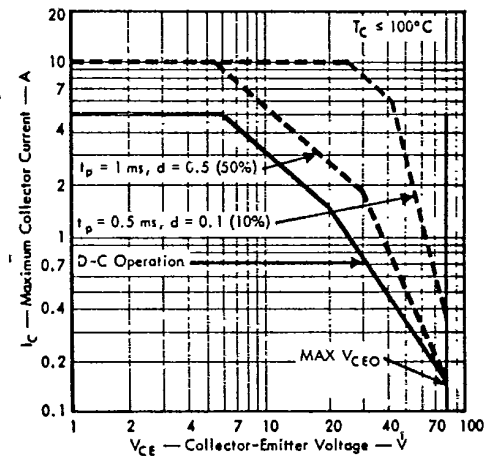
Characteristics	Symbol	Min.	Max.	Unit
Collector Cutoff Current ( $V_{CE} = 60 \text{ Vdc}$ )	$I_{CEO}$		10	$\mu\text{Adc}$
Collector Cutoff Current ( $V_{CE} = 90 \text{ Vdc}$ ) ( $V_{CE} = 90 \text{ Vdc}, T_C = 150^\circ\text{C}$ )	$I_{CES}$		5 50	$\mu\text{Adc}$ $\mu\text{Adc}$
Emitter Cutoff Current ( $V_{EB} = 5 \text{ Vdc}$ ) ( $V_{EB} = 8 \text{ Vdc}$ )	$I_{EBO}$		500 10	$\text{nAdc}$ $\mu\text{Adc}$
DC Current Gain* ( $I_C = 50 \text{ mAdc}, V_{CE} = 2 \text{ Vdc}$ ) ( $I_C = 1 \text{ Adc}, V_{CE} = 2 \text{ Vdc}$ ) ( $I_C = 5 \text{ Adc}, V_{CE} = 2 \text{ Vdc}$ )	$h_{FE}$	30 60 40 80 15 20	120 240	
Collector - Emitter Saturation Voltage* ( $I_C = 1 \text{ Adc}, I_B = 100 \text{ mAdc}$ ) ( $I_C = 5 \text{ Adc}, I_B = 500 \text{ mAdc}$ )	$V_{CE(SAT)}$		0.25 2.0	Vdc
Base - Emitter Saturation Voltage* ( $I_C = 1 \text{ Adc}, I_B = 100 \text{ mAdc}$ ) ( $I_C = 5 \text{ Adc}, I_B = 500 \text{ mAdc}$ )	$V_{BE(SAT)}$	0.6	1.2 1.6	Vdc
Current - Gain - Bandwidth Product ( $I_C = 1 \text{ Adc}, V_{CE} = 5 \text{ Vdc}, f = 10 \text{ MHz}$ )	$f_T$	40		MHz
Output Capacitance ( $V_{CB} = 10 \text{ Vdc}, I_E = 0.1 = 1 \text{ MHz}$ )	$C_{ob}$		150	pf
Delay Time Rise Time Storage Time Fall Time	$t_d$ $t_r$ $t_s$ $t_f$		300	$\text{n s}$ $\text{u s}$

\*Pulse Test: Pulse width = 300  $\mu\text{s}$ , DutyCycle = 2%

**TYPICAL OPERATING CURVES**



FORWARD BIAS DC SAFE OPERATION AREA (S.O.A.) CURVE  
CURVES APPLY BELOW RATED  $V_{CE0}$   $T_C = 25^\circ\text{C}$



# 2N5002 AND 2N5004

## 5 AMP

### HIGH SPEED NPN TRANSISTOR

## 100 VOLTS

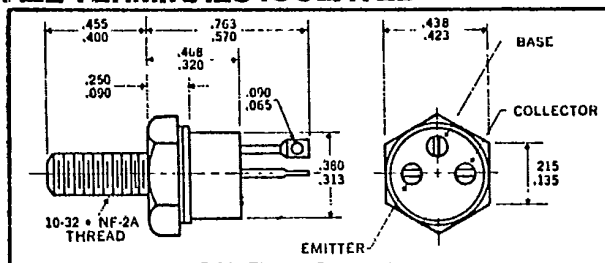


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#### CASE STYLE X

#### JEDEC TO-59

#### ALL TERMINALS ISOLATED FROM CASE



#### FEATURES

- RADIATION TOLERANT
- FAST SWITCHING, TYPICAL 200 NSEC  $t_{on}$
- 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 2N5003 AND 2N5005

#### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector - Emitter Voltage	$V_{CE0}$	80	Volts
Collector - Base Voltage	$V_{CBO}$	100	Volts
Emitter - Base Voltage	$V_{EBO}$	6	Volts
Collector Current	$I_C$	5	Amps
Base Current	$I_B$	2	Amps
Total Device Dissipation @ $T_C = 50^\circ C$	$P_D$	50	Watts
Derate above 50 °C		333	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	$R_{\theta JC}$	3.0	°C/W

#### ELECTRICAL CHARACTERISTICS

Characteristics	Symbol	Min.	Max.	Unit
Collector - Emitter Breakdown Voltage* ( $I_C = 100$ mA)	$BV_{CE0}$	80		Vdc
Collector - Base Breakdown Voltage ( $I_C = 200$ $\mu$ A)	$BV_{CBO}$	100		Vdc
Emitter - Base Breakdown Voltage ( $I_E = 200$ $\mu$ A)	$BV_{EBO}$	6		Vdc

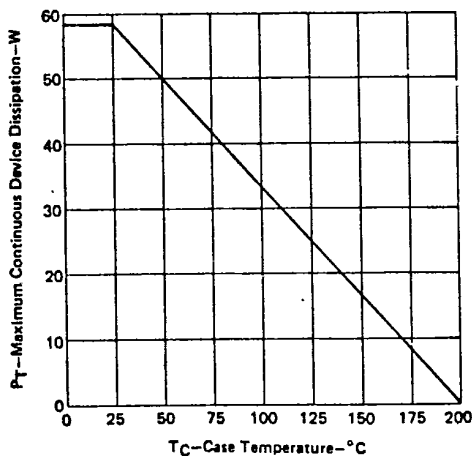
**ELECTRICAL CHARACTERISTICS**

Characteristics	Symbol	Min.	Max.	Unit
Collector Cutoff Current (VCE = 60 Vdc, VBE = 2 Vdc, TC = 150°C) (VCE = 40 Vdc)	$I_{CEV}$ $I_{CEO}$		500 50	$\mu$ Adc uAdc
Collector Cutoff Current (VCE = 60 Vdc) (VCE = 100 Vdc)	$I_{CES}$		1.0 1.0	$\mu$ Adc mAcd
Emitter Cutoff Current (VEB = 5 Vdc) (VEB = 6 Vdc)	$I_{EBO}$		1.0 1.0	$\mu$ Adc mAcd
DC Current Gain* ( $I_C = 50$ mAcd, $V_{CE} = 5$ Vdc) ( $I_C = 2.5$ Acd, $V_{CE} = 5$ Vdc) ( $I_C = 5$ Acd, $V_{CE} = 5$ Vdc)	$h_{FE}$	20 50 30 70 20 40	90 200	
Collector - Emitter Saturation Voltage* ( $I_C = 2.5$ Acd, $I_B = 250$ mAcd) ( $I_C = 5$ Acd, $I_B = 500$ mAcd)	$V_{CE(SAT)}$		0.75 1.5	Vdc
Base - Emitter Saturation Voltage* ( $I_C = 2.5$ Acd, $I_B = 250$ mAcd) ( $I_C = 5$ Acd, $I_B = 500$ mAcd)	$V_{BE(SAT)}$		1.45 2.2	Vdc
Current - Gain - Bandwidth Product ( $I_C = 500$ mAcd, $V_{CE} = 5$ Vdc, $f = 20$ MHz)	$f_T$	60 70		M Hz
Output Capacitance ( $V_{CB} = 10$ Vdc, $I_E = 0.1$ = 1 MHz)	$C_{ob}$		250	pf
Base - Emitter Voltage* ( $V_{CE} = 5$ Vdc, $I_C = 2.5$ Acd)	$V_{BE(ON)}$ *		1.45	Vdc
Delay Time ( $V_{CC} = 30$ Vdc, $I_C = 5$ Acd, $V_{EB(Off)} = 3.7$ Vdc, $I_{B1} = I_{B2} = 500$ mAcd, $R_L = 6$ Ohms)	$t_d$ + $t_r$ + $t_s$ + $t_f$		500	ns
	$t_{off}$		1.3	us

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

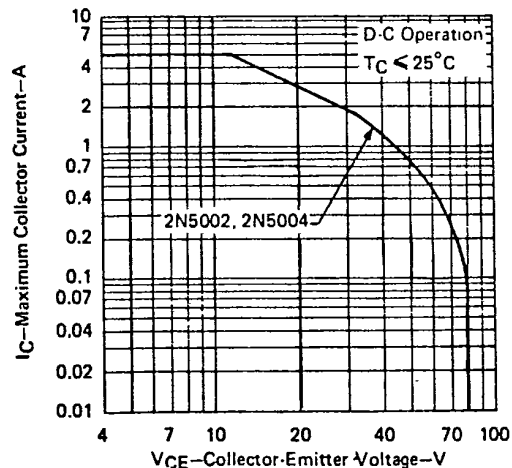
**TYPICAL OPERATING CURVES**

DISSIPATION DERATING CURVE



FORWARD BIAS DC SAFE OPERATION AREA (S.O.A. CURVE)

CURVES APPLY BELOW RATED  $V_{CEO}$   $T_C = 25^\circ C$



SOLID STATE DEVICES, INC.