

# 2N554 (GERMANIUM)

# 2N555

For Specifications, See 2N178 Data.

## JAN 2N559-1 (GERMANIUM)

## JAN 2N559-2

## JAN 2N559-3\*



**CASE 22**  
(TO-18)

PNP germanium mesa transistors designed for military and industrial high-reliability, high-speed switching applications.

Collector connected to case

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CES}$	15	Vdc
Collector-Base Voltage	$V_{CB}$	15	Vdc
Emitter-Base Voltage	$V_{EB}$	5.0	Vdc
Collector Current	$I_C$	50	mAdc
Base Current	$I_B$	50	mAdc
Emitter Current	$I_E$	50	mAdc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	150 2.0	mW mW/ $^\circ\text{C}$
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	300 4.0	mW mW/ $^\circ\text{C}$
Operating Junction Temperature Range	$T_J$	-65 to +100	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-65 to +150	$^\circ\text{C}$

\* Level 3 reliability data shown for information only. Qualification tests will be initiated upon established customer requirements.

**JAN 2N559-1, -2, -3 (Continued)**

**RELIABILITY RATINGS†**

Reliability Level Indicator	QUALITY LEVELS (LTPD)				RELIABILITY LEVELS						Est. Max Failure Rate in Conservatively Designed Equipment %/1000 Hrs
					Maximum failure rate ( $\lambda$ ) during first 1000 hours with 90% confidence.						
	Group A Subgroups		Group B Subgroups		Operation Life		Storage Life				
					$P_D = 150 \text{ mW}$ $I_E = 50 \text{ mA}$ $T_A = 25^\circ\text{C}$		$T_A = 100^\circ\text{C}$		$T_A = 150^\circ\text{C}$		
Major Defect	Minor Defect	Major Defect	Minor Defect	Major Defect	Minor Defect	Major Defect	Minor Defect	Major Defect	Minor Defect	Major Defect	Minor Defect
(1)	3.0	5.0	10	20	10	20	10	20	20	—	0.1
(2)	1.5	3.0	5.0	15	5.0	15	1.5	3.0	7.0	20	0.01
(3)*	1.0	2.0	3.0	7.0	2.0	5.0	0.2	0.5	1.0	3.0	0.001

† This table relates the statistical sampling requirements in the specification to the reliability levels for the transistor.

\* Level 3 reliability data shown for information only. Qualification tests will be initiated upon established customer requirements.

**TABLE I - GROUP A INSPECTION**

Examination or Test	MIL-STD-750 Method	LTPD for Respective Reliability Level						Symbol	Limit				Unit
		Total ①			Major				Requirement Limit		Defect Classification		
		(1)	(2)	(3)	(1)	(2)	(3)		Min	Max	Minor	Major	
<b>SUBGROUP 1</b> Visual and Mechanical Examination	2071	10	7	5	7	5	3	—	—	—	—	—	—
<b>SUBGROUP 2</b> Emitter-Base Cutoff Current ( $V_{EB} = -1 \text{ Vdc}$ )	3061 Condition D	5	3	2	3	1.5	1.0	$I_{EBO}$	—	5.0	>5 to 10	>10	$\mu\text{Ade}$
Collector-Base Cutoff Current ( $V_{CB} = -5 \text{ Vdc}$ )	3036 Condition D							$I_{CBO}$	—	3.0	>3 to 5	>5	$\mu\text{Ade}$
Emitter-Base Breakdown Voltage ( $I_E = -200 \mu\text{Ade}$ )	3026 Condition D							$V_{EBO}$	5.0	—	3.5 to <5	<3.5	Vdc
Collector-Emitter Breakdown Voltage ( $I_C = -100 \mu\text{Ade}$ )	3011 Condition C							$V_{CES}$	15	—	12 to <15	<12	Vdc
<b>SUBGROUP 3</b> Collector-Emitter Saturation Voltage ( $I_C = -50 \text{ mAde}$ , $I_B = -1.5 \text{ mAde}$ ) ( $I_C = -10 \text{ mAde}$ , $I_B = -0.4 \text{ mAde}$ )	3071	5	3	2	3	1.5	1.0	$V_{CE(sat)}$	—	1.0	>1.0 to 1.2	>1.2	Vdc
Base-Emitter Saturation Voltage ( $I_C = -10 \text{ mAde}$ , $I_B = -0.4 \text{ mAde}$ )	3066 Condition A							$V_{BE(sat)}$	0.32	0.44	0.30 to <0.32 and 0.44 to 0.50	<0.30 and >0.50	Vdc
DC Current Gain ( $I_C = -10 \text{ mAde}$ , $V_{CE} = -0.5 \text{ Vdc}$ )	3076							$h_{FE}$	25	150	20 to <25 and >150 to 200	<20 and >200	—
<b>SUBGROUP 4</b> Rise Time ( $V_{CC} = -3.5 \text{ Vdc}$ , $V_{BE(off)} = 0.5 \text{ Vdc}$ , $I_{B1} = -0.55 \text{ mAde}$ , $R_C = 300 \text{ ohms}$ , $C_{CE} = 150 \text{ pF}$ , $C_{CB} = 2 \times 10^{-5} \text{ pF}$ )	3251 Condition A	5	3	2	3	1.5	1.0	$t_r$	—	95	>95 to 115	>115	ns
Storage Time ( $V_{CC} = -3.5 \text{ Vdc}$ , $I_{B1} = -1 \text{ mAde}$ , $I_{B2} = 0.25 \text{ mAde}$ , $R_C = 300 \text{ ohms}$ )	3251 Condition A							$t_s$	—	95	>95 to 115	>115	ns
Fall Time ( $V_{CC} = -3.5 \text{ Vdc}$ , $I_{B1} = -1 \text{ mAde}$ , $I_{B2} = 0.25 \text{ mAde}$ , $R_C = 300 \text{ ohms}$ , $C_{CB} = 2 \times 10^{-5} \text{ pF}$ )	3251 Condition A							$t_f$	—	100	>100 to 120	>120	ns

NOTES:

① Total is defined as the sum of the major and minor defectives.

**JAN 2N559-1, -2, -3 (Continued)**

**TABLE II - GROUP B INSPECTION**

Examination or Test	MIL-STD-750 Method	LTPD for Respective Reliability Level						Symbol	Limit				Unit
		Total (1)			Major				Requirement Limit		Defect Classification		
		(1)	(2)	(3)	(1)	(2)	(3)		Min	Max	Minor	Major	
<b>SUBGROUP 1</b>													
Physical Dimensions	2066	20	15	7	—	—	—	—	—	—	—	—	—
<b>SUBGROUP 2</b>		5	3	2	3	1.5	1						
Moisture Resistance (No initial conditioning; one cycle; only steps 1 to 6)	1021												
End-Point Tests:													
Emitter-Base Cutoff Current ( $V_{EB} = -1$ Vdc)	3061 Condition D							$I_{EBO}$	—	10	>10 to 20	>20	$\mu$ Adc
Collector-Base Cutoff Current ( $V_{CB} = -5$ Vdc)	3036 Condition D							$I_{CBO}$	—	5.0	> 5 to 10	>10	$\mu$ Adc
DC Current Gain ( $I_C = -10$ mAdc, $V_{CE} = -0.5$ Vdc)	3076							$h_{FE}$	20	200	15 to <20 and >200 to 250	<15 and >250	—
<b>SUBGROUP 3</b>		20	15	7	10	5	3						
Tension	2036 Condition A							—	—	—	—	—	—
Solderability	2026							—	—	—	—	—	—
Temperature Cycling (5 cycles) $T_{(high)} = 100 \pm 5$ °C 2N559 (1) $T_{(high)} = 150 \pm 5$ °C 2N559 (2), 2N559 (3)	1051 Condition B							—	—	—	—	—	—
Thermal Shock (Glass Strain)	1056 Condition A							—	—	—	—	—	—
Moisture Resistance	1021							—	—	—	—	—	—
End-Point Tests: Same as Subgroup 2													
<b>SUBGROUP 4</b>		20	15	7	10	5	3						
Shock (Non-operating; 5 blows: 1500 G in Orientations $X_1$ , $Y_1$ , $Y_2$ , and $Z_1$ (total = 20 blows))	2016							—	—	—	—	—	—
Constant Acceleration (20,000 G, Orientations $X_1$ , $Y_1$ , $Y_2$ , and $Z_1$ )	2006							—	—	—	—	—	—
Vibration Fatigue (No bias applied)	2046							—	—	—	—	—	—
Vibration, Variable Frequency (1 cycle each in Orientations $X_1$ , $Y_1$ , and $Z_1$ )	2056							—	—	—	—	—	—
End-Point Tests: Same as Subgroup 2													
<b>SUBGROUP 5</b>		20	15	7	10	5	3						
Terminal Strength - Lead Fatigue (2)	2036 Condition E							—	—	—	—	—	—
<b>SUBGROUP 6</b>		20	—	—	10	—	—						
High-Temperature Life (Non-operating) ( $T_{stg} = 100 \pm 5$ °C) 2N559 (1) ONLY	1031							—	—	—	—	—	—
End-Point Tests: Same as Subgroup 2													
<b>SUBGROUP 7</b>		—	20	3	—	7	1						
High-Temperature Life (Non-operating) ( $T_{stg} = 150 \pm 5$ °C) 2N559 (2), 2N559 (3)	1031							—	—	—	—	—	—
End-Point Tests: Same as Subgroup 2													
<b>SUBGROUP 8</b>		20	15	5	10	5	2						
Steady-State Operation Life ( $I_E = 50 \pm 5$ mAdc, $P_D = 150 \pm 15$ mW, $T_A = 25 \pm 3$ °C)	1026							—	—	—	—	—	—
End-Point Tests: Same as Subgroup 2													

NOTES (1) Total is defined as the sum of the major and minor defectives.  
(2) Rejects from prior electrical-test samples from the same lot may be used for this test.

JAN 2N559-1, -2, -3 (Continued)

TABLE III - GROUP C INSPECTION\*

Examination or Test	MIL-STD-750 Method	LTPD for Respective Reliability Level						Symbol	Limit				Unit	
		Total (1)			Major				Requirement Limit		Defect Classification			
		(1)	(2)	(3)	(1)	(2)	(3)		Min	Max	Minor	Major		
<b>SUBGROUP 1</b>		10	7	5	5	3	2							
Output Capacitance ( $V_{CB} = -5$ Vdc, $I_E = 0$ , $f = 100$ kHz)	3236							$C_{ob}$	—	6.0	>6 to 10	>10	pF	
Current-Gain - Bandwidth Product ( $I_E = 10$ mAdc, $V_{CE} = -1$ Vdc, $f = 100$ MHz)	3261							$f_T$	300	1000	250 to <300 and >1000	<250	MHz	
Delay Plus Rise Time ( $V_{CC} = -3.5$ Vdc, $V_{BE(off)} = 0.5$ Vdc, $I_{B1} = -1$ mAdc, $R_C = 300$ ohms, $C_{CB} = 2 \pm 0.5$ pF, $C_{BE} = 2 \pm 0.5$ pF)	3251 Condition A							$t_d + t_r$	—	50	>50 to 75	>75	ns	
<b>SUBGROUP 2</b>		10	7	5	5	3	2							
Collector-Emitter Cutoff Current ( $V_{CE} = 5$ Vdc, $T_A = +55^\circ\text{C}$ )	3041 Condition C							$I_{CES}$	—	40	>40 to 50	>50	$\mu\text{Adc}$	
DC Current Gain ( $I_C = -10$ mAdc, $V_{CE} = -0.5$ Vdc, $T_A = -55^\circ\text{C}$ )	3076							$h_{FE}$	10	—	8 to <10	<8	—	
<b>SUBGROUP 3</b>		20	15	7	10	5	3							
Salt Atmosphere (Corrosion) End-Point Tests: Same as Group B, Subgroup 2	1041							—	—	—	—	—	—	
<b>SUBGROUP 4</b>		—	20	10	—	10	5							
High-Temperature Life (Non-operating) ( $T_{stg} = 100 \pm 5^\circ\text{C}$ ) End-Point Tests:	1031							—	—	—	—	—	—	
Emitter-Base Breakdown Voltage ( $I_E = -300$ $\mu\text{Adc}$ )	3026 Condition D							$V_{EBO}$	5.0	—	3.5 to <5	<3.5	Vdc	
Collector-Emitter Breakdown Voltage ( $I_C = -100$ $\mu\text{Adc}$ )	3011 Condition C							$V_{CES}$	12	—	8 to <12	<8	Vdc	
Collector-Emitter Saturation Voltage ( $I_C = -10$ mAdc, $I_B = -0.5$ mAdc)	3071							$V_{CE(sat)}$	—	0.3	>0.3 to 0.6	>0.6	Vdc	
Base-Emitter Saturation Voltage ( $I_C = -10$ mAdc, $I_B = -0.4$ mAdc)	3066 Condition A							$V_{BE(sat)}$	0.31	0.47	0.25 to <0.31 and >0.47 to 0.55	<0.25 and >0.55	Vdc	
Delay Time ( $V_{CC} = -3.5$ Vdc, $V_{BE(off)} = 0.5$ Vdc, $I_{B1} = -0.55$ mAdc, $R_C = 300$ ohms, $C_{CE} = 150$ pF, $C_{CB} = 2 \pm 0.5$ pF, $C_{BE} = 2 \pm 0.5$ pF)	3251 Condition A							$t_d$	10	35	<10 and >35 to 45	>45	ns	
Rise Time ( $V_{CC} = -3.5$ Vdc, $V_{BE(off)} = 0.5$ Vdc, $I_{B1} = -0.55$ mAdc, $R_C = 300$ ohms, $C_{CE} = 150$ pF, $C_{CB} = 2 \pm 0.5$ pF)	3251 Condition A							$t_r$	15	105	<15 and >105 to 125	>125	ns	
Storage Time ( $V_{CC} = -3.5$ Vdc, $I_{B1} = -1$ mAdc, $I_{B2} = 0.25$ mAdc, $R_C = 300$ ohms)	3251 Condition A							$t_s$	15	105	<15 and >105 to 125	>125	ns	

\* Group C is to be performed on the first lot and every 6 months thereafter.  
NOTE: (1) Total is defined as the sum of the major and minor defectives.

2N618 (GERMANIUM)

For Specifications, See 2N375 Data.