2N554 (GERMANIUM)
2N555

For Specifications, See 2N178 Data.

JAN 2N559-1 (GERMANIUM)
JAN 2N559-2
JAN 2N559-3*

CASE 22
(TO-18)

Collector connected to case

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

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 @ $T_A = 25^oC$ Derate above 25^oC	P_D	150 2.0	mW $mW/^oC$
Total Device Dissipation @ $T_C = 25^oC$ Derate above 25^oC	P_D	300 4.0	mW $mW/^oC$
Operating Junction Temperature Range	T_J	-65 to +100	^oC
Storage Temperature Range	T_{stg}	-65 to +150	^oC

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

RELIABILITY RATINGS†

Reliability Level Indicator	QUALITY LEVELS (LTPD)				RELIABILITY LEVELS Maximum failure rate (λ) during first 1000 hours with 90% confidence.						Est. Max Failure Rate in Conservatively Designed Equipment %/1000 Hrs
					Operation Life		Storage Life				
	Group A Subgroups		Group B Subgroups		$P_D = 150$ mW $I_E = 50$ mA $T_A = 25°C$		$T_A = 100°C$		$T_A = 150°C$		
	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	
SUBGROUP 1													
Visual and Mechanical Examination	2071	10	7	5	7	5	3	—	—	—	—	—	—
SUBGROUP 2		5	3	2	3	1.5	1.0						
Emitter-Base Cutoff Current (V_{EB} = -1 Vdc)	3061 Condition D							I_{EBO}	—	5.0	>5 to 10	>10	μAdc
Collector-Base Cutoff Current (V_{CB} = -5 Vdc)	3036 Condition D							I_{CBO}	—	3.0	>3 to 5	>5	μAdc
Emitter-Base Breakdown Voltage (I_E = -200 μAdc)	3026 Condition D							BV_{EBO}	5.0	—	3.5 to <5	<3.5	Vdc
Collector-Emitter Breakdown Voltage (I_C = -100 μAdc)	3011 Condition C							BV_{CES}	15	—	12 to <15	<12	Vdc
SUBGROUP 3		5	3	2	3	1.5	1.0						
Collector-Emitter Saturation Voltage (I_C = -50 mAdc, I_B = -1.5 mAdc)	3071							$V_{CE(sat)}$	—	1.0	>1.0 to 1.2	>1.2	Vdc
(I_C = -10 mAdc, I_B = -0.4 mAdc)									—	0.3	>0.3 to 0.35	>0.35	
Base-Emitter Saturation Voltage (I_C = -10 mAdc, I_B = -0.4 mAdc)	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 mAdc, V_{CE} = -0.5 Vdc)	3076							h_{FE}	25	150	20 to <25 and >150 to 200	<20 and >200	—
SUBGROUP 4		5	3	2	3	1.5	1.0						
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, $C_{CB} = 2^{+0.5}_{-0}$ pF)	3251 Condition A							t_r	—	95	>95 to 115	>115	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	—	95	>95 to 115	>115	ns
Fall Time (V_{CC} = -3.5 Vdc, I_{B1} = -1 mAdc, I_{B2} = 0.25 mAdc, R_C = 300 ohms, $C_{CB} = 2^{+0.5}_{-0}$ 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.

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	
SUBGROUP 1													
Physical Dimensions	2066	20	15	7	—	—	—	—	—	—	—	—	—
SUBGROUP 2		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	μAdc
Collector-Base Cutoff Current (V_{CB} = -5 Vdc)	3036 Condition D							I_{CBO}	—	**5.0**	> 5 to 10	>10	μAdc
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	—
SUBGROUP 3		20	15	7	10	5	3						
Tension	2036 Condition A							—	—	—	—	—	—
Solderability	2026							—	—	—	—	—	—
Temperature Cycling (5 cycles) $T_{(high)} = 100^{+5}_{-0}$ °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													
SUBGROUP 4		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													
SUBGROUP 5		20	15	7	10	5	3						
Terminal Strength - Lead Fatigue (2)	2036 Condition E							—	—	—	—	—	—
SUBGROUP 6		20	—	—	10	—	—						
High-Temperature Life (Non-operating) ($T_{stg} = 100^{+0}_{-5}$ °C 2N559 (1) ONLY	1031							—	—	—	—	—	—
End-Point Tests: Same as Subgroup 2													
SUBGROUP 7		—	20	3	—	7	1						
High-Temperature Life (Non-operating) ($T_{stg} = 150^{+0}_{-5}$ °C) 2N559 (2), 2N559 (3)	1031							—	—	—	—	—	—
End-Point Tests: Same as Subgroup 2													
SUBGROUP 8		20	15	5	10	5	2						
Steady-State Operation Life ($I_F = 50^{+0}_{-5}$ mAdc, $P_D = 150^{+0}_{-15}$ 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.

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	
SUBGROUP 1		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_C = -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, $C_{CB} = 2^{+0.5}_{-0}$ pF, C_{BE} = 2 ±0.5 pF	3251 Condition A							$t_d + t_r$	—	50	>50 to 75	>75	ns
SUBGROUP 2		10	7	5	5	3	2						
Collector-Emitter Cutoff Current (V_{CE} = 5 Vdc, T_A = +55°C)	3041 Condition C							I_{CES}	—	40	>40 to 50	>50	μAdc
DC Current Gain (I_C = -10 mAdc, V_{CE} = -0.5 Vdc, T_A = -55°C)	3076							h_{FE}	10	—	8 to <10	<8	—
SUBGROUP 3		20	15	7	10	5	3						
Salt Atmosphere (Corrosion)	1041							—	—	—	—	—	—
End-Point Tests: Same as Group B, Subgroup 2													
SUBGROUP 4		—	20	10	—	10	5						
High-Temperature Life (Non-operating) (T_{stg} = 100^{+0}_{-5} °C)	1031							—	—	—	—	—	—
End-Point Tests:													
Emitter-Base Breakdown Voltage (I_E = -300 μAdc)	3026 Condition D							BV_{EBO}	5.0	—	3.5 to <5	<3.5	Vdc
Collector-Emitter Breakdown Voltage (I_C = -100 μAdc)	3011 Condition C							BV_{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, $C_{CB} = 2^{+0.5}_{-0}$ pF, C_{BE} = 2 ±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, $C_{CB} = 2^{+0.5}_{-0}$ 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.