



# NPN MEDIUM POWER MICROWAVE TRANSISTOR

**NE64300**  
**NE64310**  
**NE64320**

## FEATURES

- **HIGH OUTPUT POWER:** 900 mW at 2 GHz
- **HIGH GAIN:** 11 dB at 1 GHz
- **RELIABILITY:** Platinum - Gold Metallization

## DESCRIPTION AND APPLICATIONS

The NE643 series of NPN silicon medium power transistors is designed to operate in amplifiers and oscillators up to 2 GHz with supply voltages up to 18 volts. The series is available in chip form (NE64300), in a low inductance TO-46 can (NE64310), and an economical stud-stripline package (NE64320). NEC's stringent quality control, with its titanium, platinum, and gold metallization system, provides the utmost in reliability and uniformity. This unique metallization system eliminates many of the problems associated with aluminum and moly-gold and allows high temperature operation (100°C) at rated dissipation. The NE64320 (2SC1041) is processed and screened to NEC's Grade C level of reliability which is patterned after MIL-S-19500.

## ABSOLUTE MAXIMUM RATINGS (TA = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V <sub>CB0</sub>	Collector to Base Voltage	V	40
V <sub>CE0</sub>	Collector to Emitter Voltage	V	20*
V <sub>EB0</sub>	Emitter to Base Voltage	V	3
I <sub>C(DC)</sub>	Collector Current (DC)	mA	150
I <sub>C(Peak)</sub>	Collector Current (Peak)	mA	450
T <sub>J</sub>	Junction Temperature	°C	200
T <sub>STG</sub>	Storage Temperature	°C	-65 to +200

\*Typical V<sub>CE0</sub> = 30 V for R ≤ 300 Ω

## ELECTRICAL CHARACTERISTICS (TA = 25°C)

PART NUMBER EIAJ <sup>1</sup> REGISTERED NUMBER			NE64310 V020			NE64320 2SC1041 - Grd C 2SC1593 - Grd D 20		
PACKAGE OUTLINE			10 (TO-46)					
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX
I <sub>CB0</sub>	Collector Cutoff Current at V <sub>CB</sub> = 20 V, I <sub>E</sub> = 0	μA			50			50
I <sub>EB0</sub>	Emitter Cutoff Current at V <sub>EB</sub> = 2 V, I <sub>C</sub> = 0	μA			100			100
h <sub>FE</sub>	Forward Current Gain <sup>2,3</sup> at V <sub>CE</sub> = 10 V, I <sub>C</sub> = 70 mA		15	80	200	15	80	200
C <sub>CB</sub>	Collector to Base Capacitance <sup>4</sup> at V <sub>CB</sub> = 10 V, I <sub>C</sub> = 0 mA, f = 1 MHz	pF		2	3		2.5	3.5
R <sub>TH</sub>	Thermal Resistance (Junction-to-Case)	°C/W			70*			40
P <sub>T</sub>	Total Device Dissipation (T <sub>C</sub> = 25°C)	W			2			3.75

### Notes:

1. Electronic Industrial Association of Japan.
2. Pulse width ≤ 350 μs, duty cycle ≤ 2%/pulse.
3. h<sub>FE</sub> temperature coefficient = 0.6% per °C.
4. Standard steel header, R<sub>θJC</sub> for Kovar header is 85° C/W
5. C<sub>CB</sub> measurement employs a three terminal bridge incorporating a guard circuit. The emitter terminal shall be connected to the guard terminal.

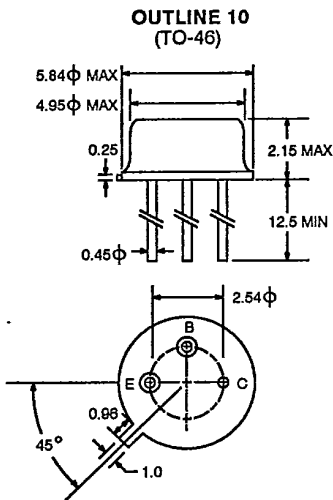
**PERFORMANCE SPECIFICATIONS** (TA = 25°C)

PART NUMBER EIAJ <sup>1</sup> REGISTERED NUMBER			NE64310 V020			NE64320 2SC1041 - Grd C 2SC1593 - Grd D 20		
PACKAGE OUTLINE			10 (TO-46)			20		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX
fr	Gain Bandwidth Product at VCE = 10 V, IC = 70 mA	GHz	1.8	2		1.8	2	
S21E  <sup>2</sup>	Insertion Power Gain at VCE = 10 V, IC = 60 mA, f = 0.5 GHz f = 1 GHz	dB dB		10.5 5			12.5 6.5	
MAG	Maximum Available Gain at VCE = 10 V, IC = 60 mA PIN = 24 dBm, f = 1 GHz f = 2 GHz	dB dB		8 3		5	11 5.6	
Posc	Oscillator Output Power at VCC = 18 V, IC = 100 mA, f = 2 GHz	mW		300			500	
Pout	Power Output at VCC = 18 V, IC = 60 mA, PIN = 250 mW, f = 2 GHz	mW				800	900	

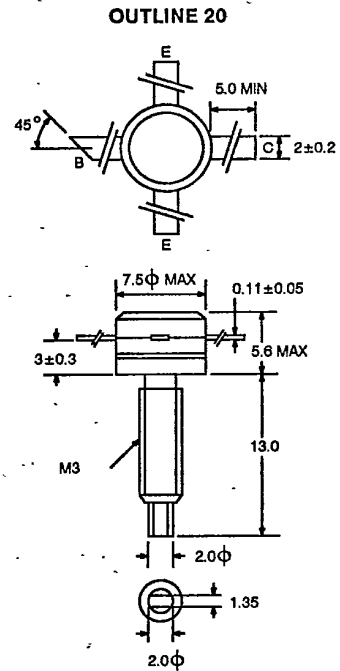
**Notes:**

1. Electronic Industrial Association of Japan.
2. Pulse width ≤ 350 μs, duty cycle ≤ 2%/pulse.

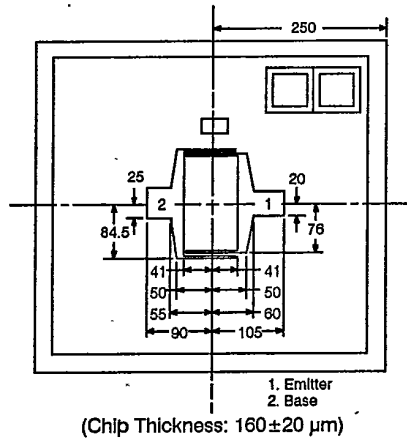
**OUTLINE DIMENSIONS** (Units in mm)



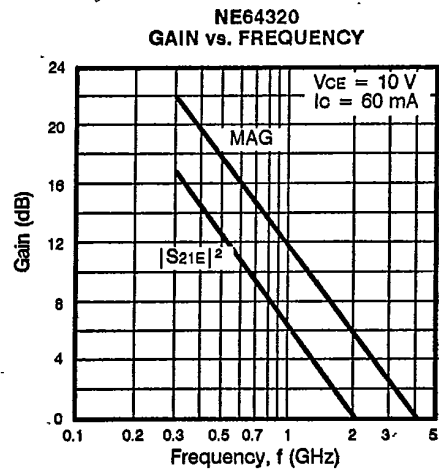
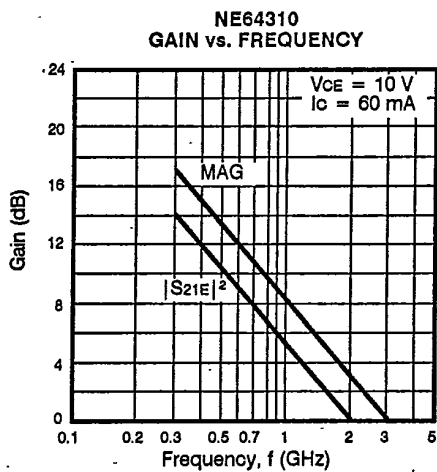
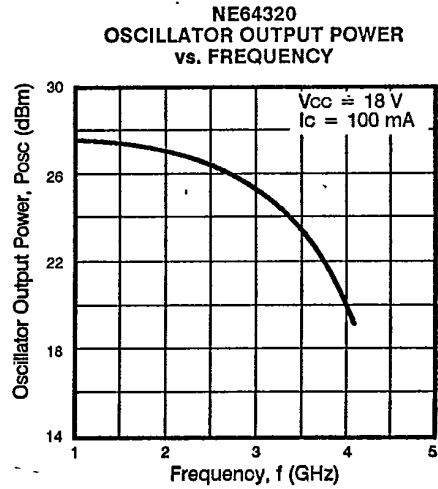
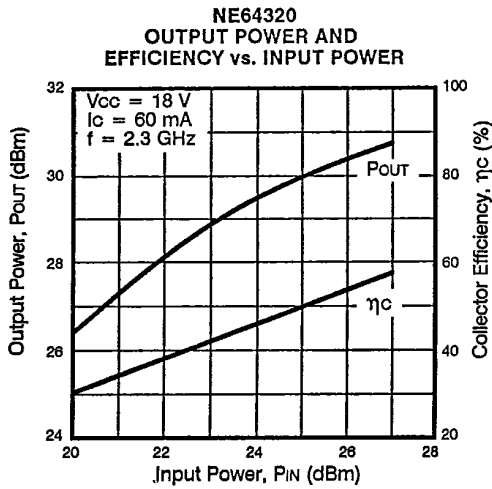
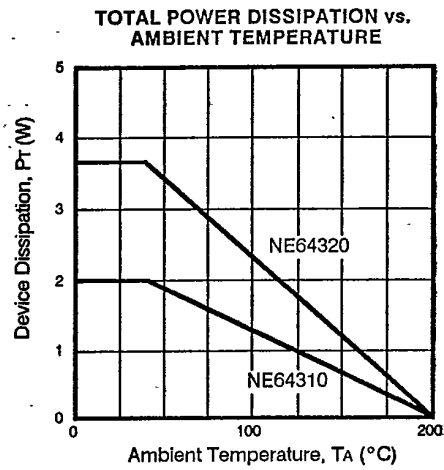
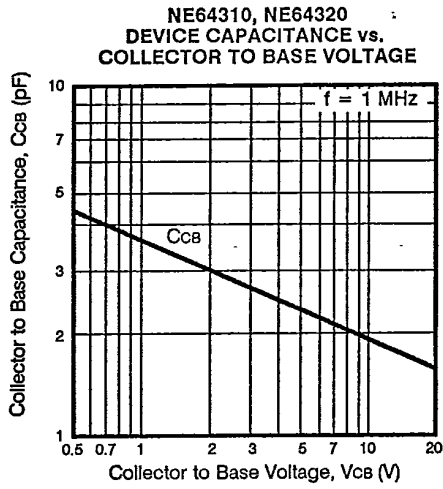
Collector is connected to case.



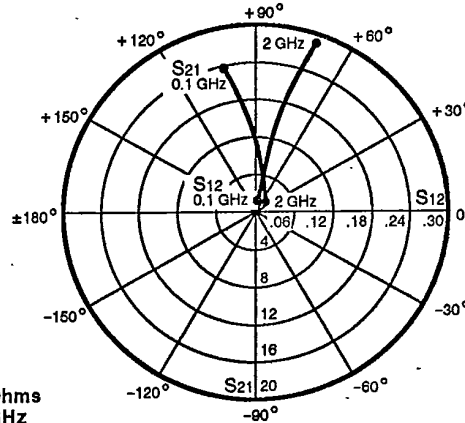
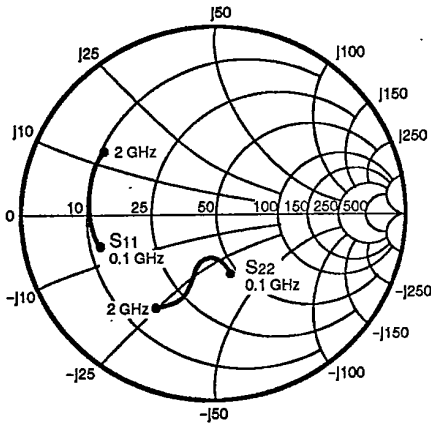
**NE64300 (CHIP)**  
(Units in μm)



TYPICAL PERFORMANCE CHARACTERISTICS (TA = 25°C)



TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE64310  
Coordinates in Ohms  
Frequency in GHz  
(VCE = 10 V, IC = 60 mA)

S-MAGN AND ANGLES:

VCE = 10 V, IC = 20 mA

FREQUENCY (MHz)	S11		S21		S12		S22	
100	.59	-146	14.33	107	.03	50	.43	-64
200	.64	-163	7.66	94	.03	52	.31	-75
400	.64	-175	3.97	80	.07	66	.27	-84
600	.65	178	2.70	72	.10	68	.30	-93
800	.66	172	2.04	64	.12	72	.35	-100
1000	.66	168	1.68	57	.15	72	.39	-105
1200	.65	164	1.43	51	.18	75	.44	-108
1400	.65	160	1.23	47	.21	73	.50	-113
1600	.65	157	1.09	42	.24	74	.54	-116
1800	.66	153	1.01	39	.25	73	.57	-120
2000	.65	149	.93	37	.28	72	.60	-123

VCE = 10 V, IC = 60 mA

100	.60	-163	15.91	102	.02	65	.32	-75
200	.63	-172	8.33	91	.03	66	.24	-88
400	.63	180	4.30	79	.07	74	.22	-95
600	.65	174	2.92	72	.10	74	.26	-102
800	.65	169	2.21	64	.13	73	.30	-107
1000	.65	166	1.81	57	.16	74	.34	-109
1200	.64	163	1.55	52	.19	74	.39	-110
1400	.65	159	1.35	47	.22	73	.44	-114
1600	.64	156	1.19	41	.25	72	.48	-116
1800	.63	153	1.11	37	.26	71	.52	-120
2000	.64	149	1.02	35	.29	70	.56	-122

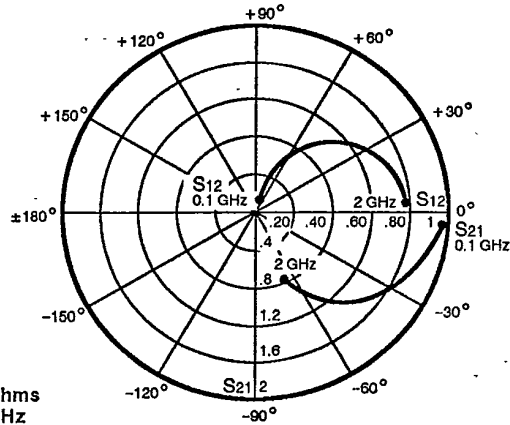
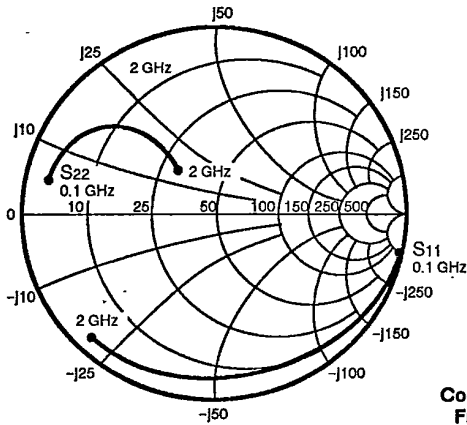
VCE = 10 V, IC = 100 mA

100	.65	-169	12.93	100	.02	72	.31	-54
200	.67	-176	6.81	90	.03	70	.26	-63
400	.67	177	3.59	78	.06	77	.27	-76
600	.69	173	2.45	71	.10	76	.31	-87
800	.69	169	1.87	62	.13	77	.35	-95
1000	.68	166	1.53	54	.16	76	.40	-101
1200	.69	162	1.30	48	.18	78	.45	-105
1400	.69	158	1.12	43	.22	76	.50	-110
1600	.69	155	.99	38	.24	75	.55	-114
1800	.68	151	.89	36	.26	75	.58	-119
2000	.69	147	.83	34	.29	73	.61	-122



NE64300, NE64310, N64320

TYPICAL COMMON COLLECTOR SCATTERING PARAMETERS



NE64310  
Coordinates in Ohms  
Frequency in GHz  
(VCE = 10 V, IC = 50 mA)

S-MAGN AND ANGLES:

VCE = 10 V, IC = 25 mA

FREQUENCY (MHz)	S11		S21		S12		S22	
100	.97	-11	1.87	-5	.07	61	.91	174
200	.95	-22	1.81	-12	.17	66	.91	168
400	.94	-42	1.69	-23	.31	61	.85	158
600	.91	-60	1.57	-32	.44	52	.78	148
800	.87	-75	1.42	-40	.53	43	.71	140
1000	.86	-90	1.27	-45	.60	34	.62	136
1200	.89	-99	1.15	-49	.67	26	.51	130
1400	.90	-110	1.05	-55	.69	20	.43	129
1600	.88	-118	.98	-59	.71	12	.33	127
1800	.86	-125	.86	-63	.74	3	.26	129
2000	.88	-133	.78	-66	.76	0	.24	137

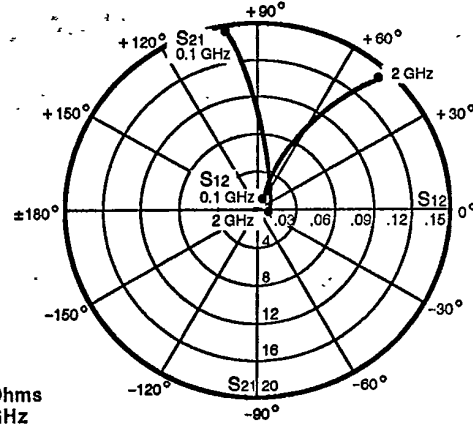
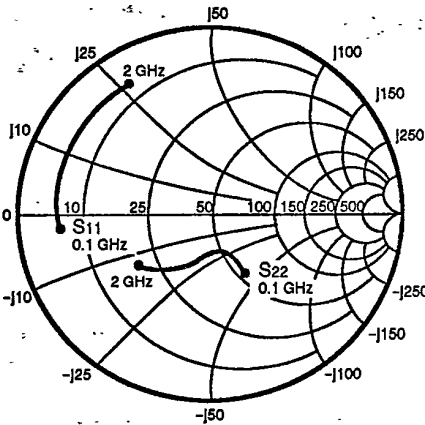
VCE = 10 V, IC = 50 mA

100	.97	-11	1.89	-5	.05	61	.92	174
200	.96	-21	1.83	-12	.15	68	.92	169
400	.96	-41	1.72	-22	.29	63	.88	160
600	.92	-58	1.61	-32	.41	55	.82	150
800	.90	-74	1.47	-40	.50	47	.76	143
1000	.89	-89	1.31	-46	.58	38	.68	137
1200	.91	-99	1.19	-50	.66	30	.58	129
1400	.92	-110	1.08	-57	.68	24	.49	128
1600	.91	-118	1.00	-61	.71	16	.40	124
1800	.89	-125	.87	-65	.75	6	.31	122
2000	.90	-133	.78	-68	.77	3	.28	128

VCE = 10 V, IC = 100 mA

100	.95	-16	1.86	-7	.13	61	.92	172
200	.89	-30	1.76	-16	.26	59	.92	166
400	.85	-53	1.57	-26	.43	50	.83	155
600	.80	-72	1.41	-35	.55	40	.74	144
800	.77	-88	1.25	-42	.64	31	.66	136
1000	.75	-102	1.09	-47	.71	22	.55	131
1200	.76	-111	.98	-50	.76	14	.43	125
1400	.77	-122	.87	-54	.77	8	.33	127
1600	.76	-129	.80	-57	.77	0	.23	129
1800	.75	-135	.71	-59	.79	-8	.16	142
2000	.76	-142	.65	-60	.80	-12	.16	163

TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE64320  
Coordinates In Ohms  
Frequency In GHz  
(VCE = 10 V, IC = 60 mA)

S-MAGN AND ANGLES:

VCE = 10 V, IC = 20 mA

FREQUENCY (MHz)

	S11		S21		S12		S22	
100	.74	-155	16.60	106	.02	35	.48	-50
200	.79	-174	8.96	89	.02	35	.34	-54
400	.80	171	4.54	72	.03	41	.28	-59
600	.80	163	2.30	60	.04	46	.29	-70
800	.79	156	2.26	49	.05	49	.31	-85
1000	.81	151	1.78	38	.06	53	.34	-96
1200	.82	144	1.48	29	.07	53	.38	-108
1400	.81	140	1.29	19	.08	51	.42	-118
1600	.81	134	1.11	10	.10	49	.46	-127
1800	.82	128	.96	3	.12	50	.48	-136
2000	.83	123	.86	-3	.14	46	.53	-142

VCE = 10 V, IC = 60 mA

100	.76	-174	19.71	100	.01	47	.36	-63
200	.79	177	10.38	86	.01	62	.23	-70
400	.79	166	5.19	71	.03	61	.18	-74
600	.79	160	3.44	60	.04	62	.19	-84
800	.79	154	2.57	50	.05	62	.22	-97
1000	.80	149	2.04	39	.07	59	.25	-104
1200	.81	143	1.70	30	.08	56	.29	-115
1400	.80	138	1.47	20	.09	53	.32	-124
1600	.81	133	1.28	11	.11	50	.37	-131
1800	.81	128	1.12	5	.12	49	.40	-138
2000	.82	122	1.01	-3	.14	46	.45	-144

VCE = 10 V, IC = 100 mA

100	.78	-178	19.87	98	.01	63	.33	-64
200	.79	174	10.39	85	.01	67	.21	-69
400	.80	165	5.19	70	.03	63	.17	-74
600	.80	159	3.43	59	.04	64	.18	-83
800	.79	153	2.57	49	.06	62	.21	-96
1000	.81	148	2.04	38	.07	63	.24	-103
1200	.80	142	1.69	29	.08	58	.28	-114
1400	.80	138	1.47	19	.09	55	.31	-123
1600	.81	132	1.27	10	.11	50	.36	-130
1800	.82	127	1.11	4	.12	50	.40	-137
2000	.82	122	.99	-4	.14	47	.44	-143

