NEC®

NPN SILICON GENERAL PURPOSE TRANSISTOR

NE734 SERIES

FEATURES

- **LOW NOISE FIGURE:** < 3 dB at 500 MHz
- **HIGH GAIN:** 15 dB at 500 MHz
- **HIGH GAIN BANDWIDTH PRODUCT:** 2 GHz (3 GHz for the NE73435)
- **SMALL COLLECTOR CAPACITANCE:** 1 pF
- **DUAL CHIP CONFIGURATIONS**
- **HIGH RELIABILITY METALLIZATION**

DESCRIPTION AND APPLICATIONS

The NE734 series of NPN silicon general purpose UHF transistors provide the designer with a wide selection of reliable transistors for high speed logic and wide-band low noise amplifier applications. The series uses NEC's highly reliable platinum-silicide, titanium, platinum, and gold metallization system to assure uniform performance and reliability. Besides the chip form (NE73400), several package styles are available in both single and dual chip configurations. While the series is designed for industrial applications, the NE734 is also available in Grade C (JANTXV equivalent) and Grade CX (JANTX equivalent). The NE73432 is packaged in the popular TO-92 plastic package and is available in two lead configurations. The NE73433 is in the plastic Mini-Mold package designed for high-speed automated assembly operations for large volume hybrid IC's. The NE73436 and NE73437 are packaged in the plastic Disk-Mold stripline package. For hybrid MIC applications requiring more performance, the NE73435 is recommended. This device is packaged in the economical metal-ceramic, hermetic Micro-X package.

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{CBO}	Collector to Base Voltage	V	30
V_{CEO}	Collector to Emitter Voltage	V	14
V_{EBO}	Emitter to Base Voltage	V	3
I_C	Collector Current	mA	50
T_J	Junction Temperature	°C	200
T_{STG}	Storage Temperature	°C	-65 to +200*

*Maximum Case Temperature for the
NE73432: T_{STG} = -55° to 150°C
NE73433: T_{STG} = -55° to 150°C
NE73435 Grade D: T_{STG} = -65° to 150°C
NE73435 Grade C: T_{STG} = -65° to 200°C
NE73437: T_{STG} = -65° to 150°C

NE73435 TYPICAL NOISE PARAMETERS

FREQUENCY (MHz)	NF min (dB)	G_a (dB)	OPT SOURCE	$R_N/50\ \Omega$
V_{CE} = 10 V, I_C = 3 mA				
500	2.0	16.1	.30 ∠ 80°	.63
1000	3.1	11.2	.43 ∠ 126°	.33
1500	4.2	9.2	.54 ∠ 168°	.19
2000	5.1	7.1	.56 ∠ 178°	.20
V_{CE} = 10 V, I_C = 15 mA				
500	3.3	17.5	.34 ∠ 120°	.36
1000	4.7	13.5	.47 ∠ 168°	.27
1500	6.5	10.8	.67 ∠-174°	.13
2000	7.4	9.2	.64 ∠-163°	.46

*Input tuned for minimum Noise Figure, output tuned for Maximum Gain.

PERFORMANCE SPECIFICATIONS (T_A = 25°C)

PART NUMBER / EIAJ[1] REGISTERED NUMBER / PACKAGE OUTLINE			NE73412 2SC1275(Grd CX) 2SC1424(Grd D) 12			NE73416 2SC1733(Grd C) 16			NE73432E 2SC2026 32E			NE73432B 2SC2037 32B			NE73433 2SC2759 33			NE73435 2SC2148 35			NE73437 2SC2368 37			NE73440A, B 2SC1926 2SC1927 40		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
fT	Gain Bandwidth Product at VCE = 10 V, IC = 10 mA	GHz	1.5	2		1.5	2		1.5	2		1.5	2		1.5	2		1.5	3			2.8		1.5	2	
$\|S21E\|^2$	Insertion Power Gain at VCE = 10 V, IC = 10 mA, f = 0.5 GHz f = 1 GHz	dB dB	5	12 6						13 8			12 7					8	16 9.3		13	14.5				
NFMIN	Minimum Noise Figure[2] at VCE = 10 V, IC = 3 mA, f = 0.5 GHz	dB		3	4					3	4		3	4		3	4		2.1	3.5		2.3	3.5			
MAG	Maximum Available Gain[3] at VCE = 10 V, IC = 10 mA, f = 0.5 GHz f = 1 GHz	dB dB	13	15 8					13	15 9		11	13			17			18 13			17 11				

Notes:

1. Electronic Industrial Association of Japan.
2. Input and output are tuned for optimum noise figures.
3. Maximum Available Gain (MAG) is calculated for the device S-Parameters using the equation, $MAG = |S21E|^2 \cdot \frac{1}{1-|S11E|^2} \cdot \frac{1}{1-|S22E|^2}$

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

PART NUMBER / EIAJ[1] REGISTERED NUMBER / PACKAGE OUTLINE			NE73412 2SC1275(Grd CX) 2SC1424(Grd D) 12			NE73416 2SC1733(Grd C) 16			NE73432E 2SC2026 32E			NE73432B 2SC2037 32B			NE73433 2SC2759 33			NE73435 2SC2148 35			NE73437 2SC2368 37			NE73440A, B 2SC1926 2SC1927 40		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
ICBO	Collector Cutoff Current at VCB = 15 V, IE = 0	µA			.05			.05			.01			.01			.01			0.1			0.1			0.5
ICES	Collector Cutoff Current at VCE = 15 V, RBE = 0	µA			.05			.05									.01									
IEBO	Emitter Cutoff Current at VEB = 2 V, IC = 0	µA									0.1			0.1						0.1			.01			.05
hFE	Forward Current Gain Ratio at VCE = 10 V, IC = 10 mA		25	100	200	25	100	200	25	100	200	25	100	200	25	100	200	25	100	200	25	100	200	25	100	200
$\frac{\Delta hFE1}{\Delta hFE2}$	Forward Current Gain Ratio at VCE = 10 V, IC = 10 mA					0.8		1																0.8		1
ΔVBE	Base to Emitter Voltage at VCE = 10 V, IC = 10 mA	mV						30																		30
CCB	Collector to Base Capacitance[2] at VCB = 10 V, IC = 0 mA, f = 1 MHz	pF		1.1	1.5		1.1	1.5		0.75	1.1		0.9	1.3		1	1.5		.55	1.5		0.7	1		1.1	1.5
RTH	Thermal Resistance (J-C)[3]	°C/W		190	300		95	150			130			130						130						55
PC	Collector Dissipation	mW/Chip						200																		200
PT	Total Power Dissipation	mW			250			300			250			250			200			250			250			300

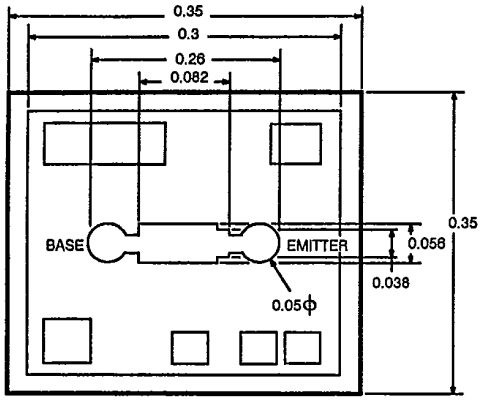
Notes:

1. Electronic Industrial Association of Japan.
2. CCB measurement employs a three-terminal capacitance bridge incorporating a guard circuit. The emitter terminal shall be connected to the guard terminal.
3. RTH for dual chip devices (°C/W): Per Chip / Total

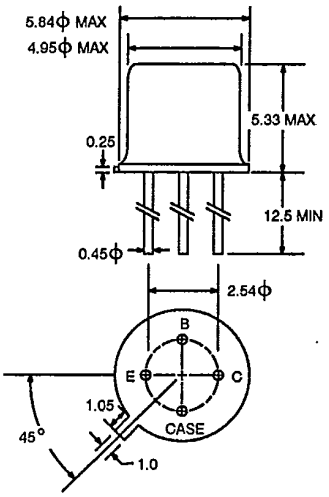
	Per Chip	Total
NE73416:		
RTH (J-A)	875	583
RTH (J-C)	300	150
NE73440:		
RTH (J-A)	500	445
RTH (J-C)	110	55

OUTLINE DIMENSIONS (Units in mm)

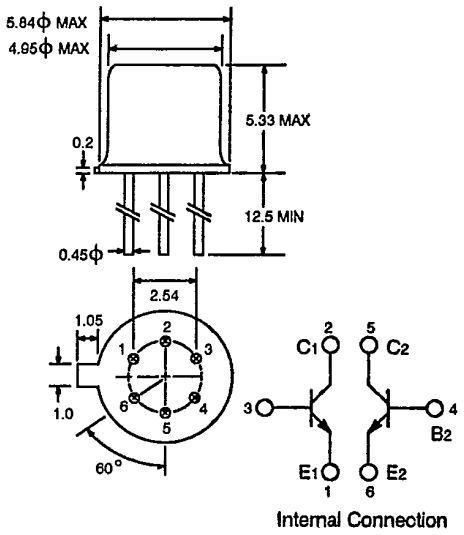
NE73400 (CHIP)
Chip Thickness: 160 µm TYP



OUTLINE 12
(TO-72)

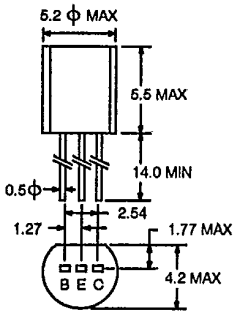


OUTLINE 16



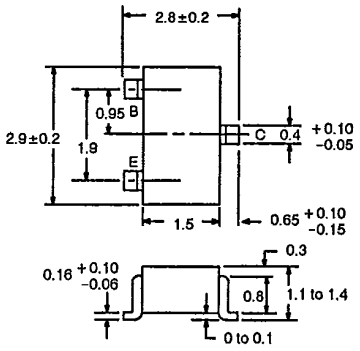
Internal Connection

OUTLINE 32
(TO-92)

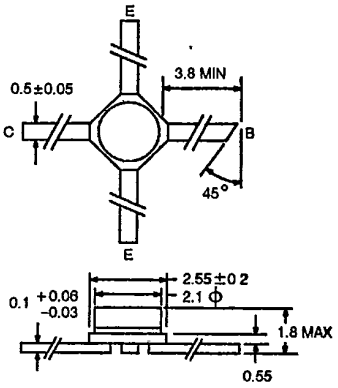


*32B has emitter base reversed.

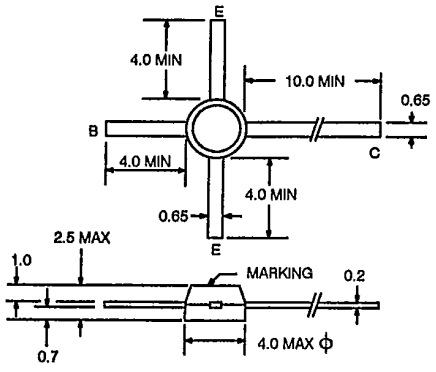
OUTLINE 33
(SOT-23)



OUTLINE 35
(MICRO-X)

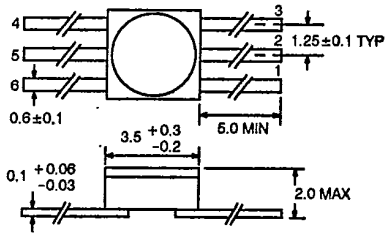


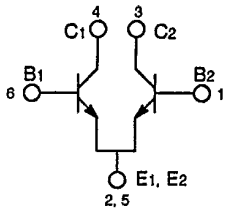
OUTLINE 37



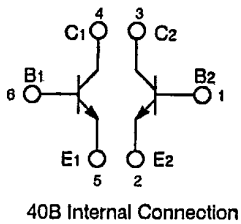
*36 package is available with only the bottom emitter lead.

OUTLINE 40





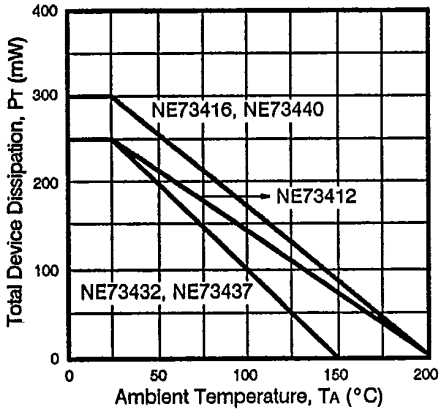
40A Internal Connection



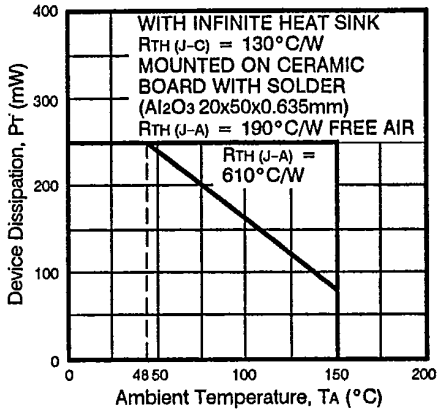
40B Internal Connection

TYPICAL DEVICE CHARACTERISTICS (T_A = 25°C)

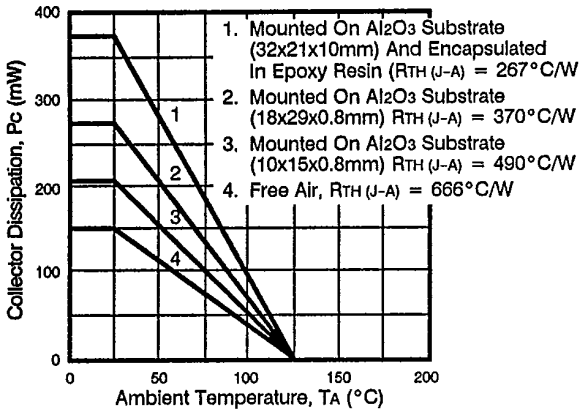
DC POWER DERATING CURVES



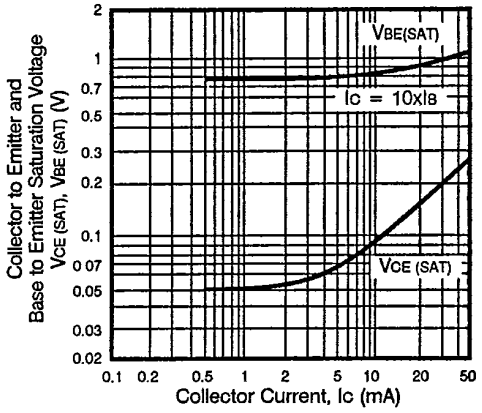
NE73435
DC POWER DERATING CURVES



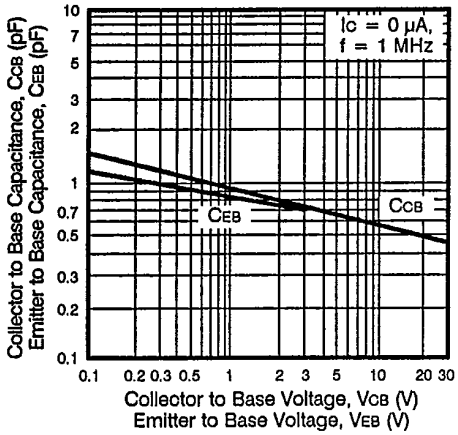
NE73433
DC POWER DERATING CURVES



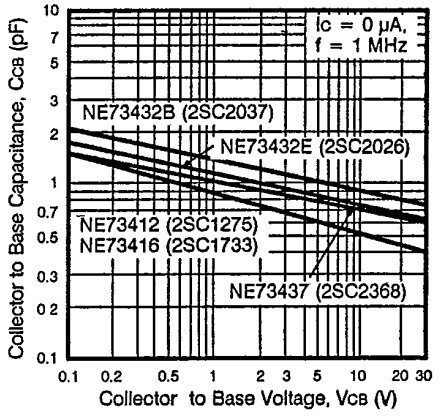
SATURATION VOLTAGE vs.
COLLECTOR CURRENT



NE73435
DEVICE CAPACITANCE

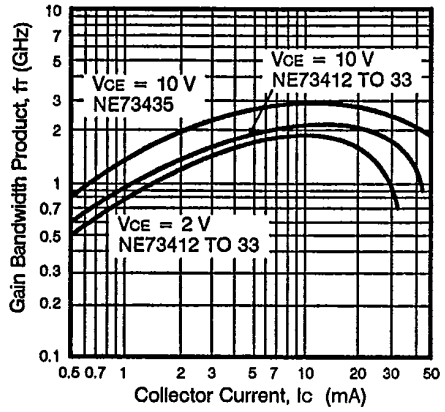


COLLECTOR TO BASE CAPACITANCE

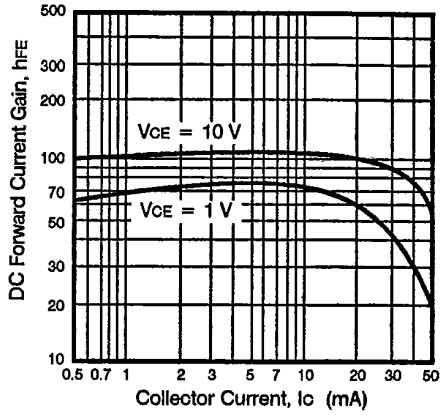


TYPICAL PERFORMANCE CHARACTERISTICS (T_A = 25°C)

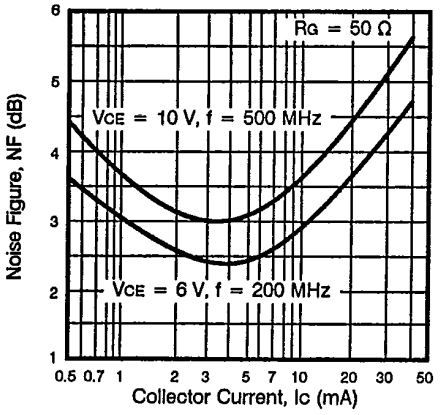
GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT



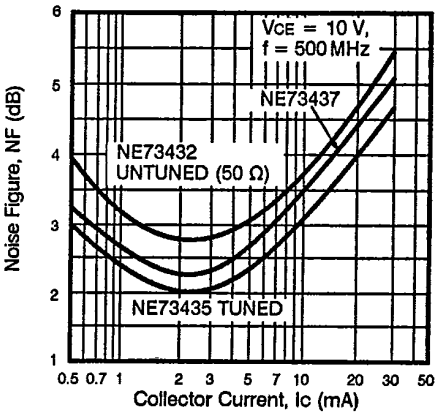
DC CURRENT GAIN
vs. COLLECTOR CURRENT



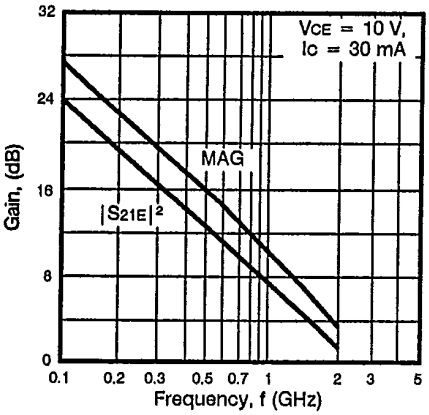
NE73412, NE73433
NOISE FIGURE vs.
COLLECTOR CURRENT



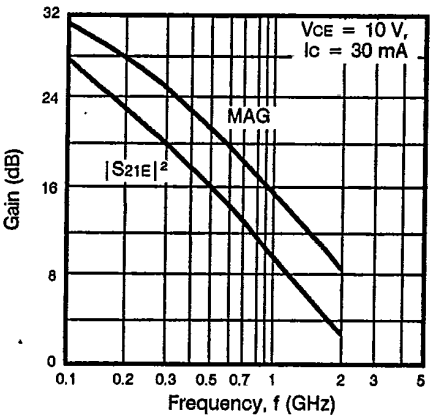
NE73432, NE73435, NE73437
NOISE FIGURE vs.
COLLECTOR CURRENT



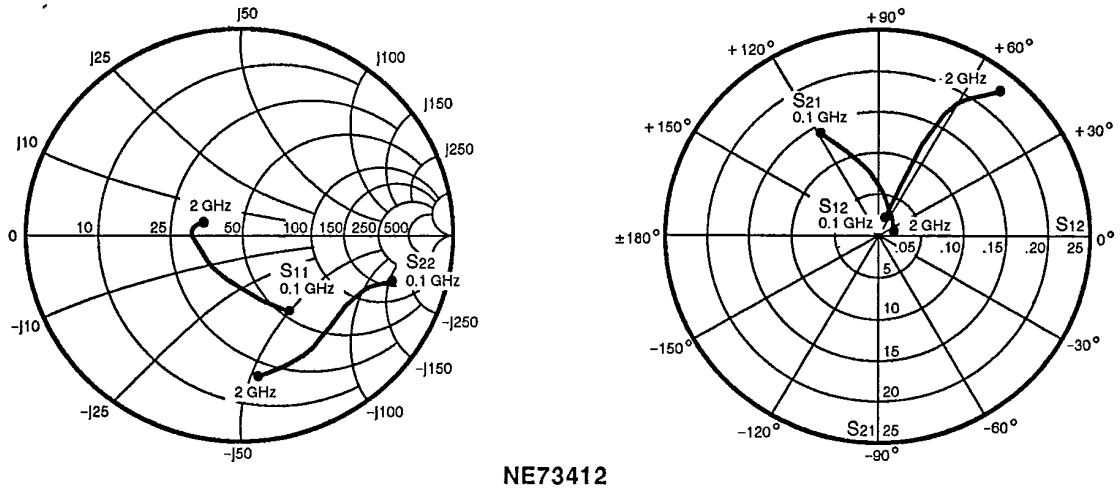
NE73412, NE73432E
GAIN vs. FREQUENCY



NE73435
GAIN vs. FREQUENCY



TYPICAL COMMON EMITTER SCATTERING PARAMETERS



NE73412
Coordinates in Ohms
Frequency in GHz
(V_{CE} = 10 V, I_C = 20 mA)

S-MAGN AND ANGLES:

FREQUENCY (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
VCE = 10 V, IC = 5 mA								
100	.71	-41	10.28	138	.02	66	.87	-15
200	.53	-66	7.51	116	.04	60	.77	-22
500	.30	-105	3.74	85	.08	61	.66	-30
1000	.21	-146	2.08	58	.13	62	.63	-45
1500	.19	-171	1.52	36	.18	57	.67	-64
2000	.15	174	1.16	14	.22	51	.73	-84
VCE = 10 V, IC = 10 mA								
100	.56	-50	13.44	128	.02	67	.81	-17
200	.39	-73	8.71	108	.04	67	.70	-21
500	.23	-112	4.03	80	.08	66	.63	-29
1000	.19	-151	2.21	56	.14	63	.61	-43
1500	.18	-175	1.59	34	.19	58	.65	-63
2000	.14	170	1.22	13	.22	50	.71	-84
VCE = 10 V, IC = 20 mA								
100	.42	-60	14.98	119	.02	71	.75	-17
200	.29	-82	9.07	102	.03	69	.67	-19
500	.19	-121	4.03	77	.08	70	.63	-26
1000	.19	-164	2.18	54	.14	66	.61	-42
1500	.19	170	1.57	33	.19	60	.66	-62
2000	.13	153	1.20	11	.23	50	.71	-84
VCE = 10 V, IC = 30 mA								
100	.36	-68	14.51	115	.02	71	.74	-15
200	.26	-95	8.52	98	.03	69	.67	-17
500	.20	-137	3.71	76	.08	69	.64	-25
1000	.22	-178	2.01	52	.13	67	.63	-43
1500	.22	156	1.45	31	.19	63	.67	-63
2000	.16	130	1.11	9	.23	53	.72	-85