

Transistors

# NPN General Purpose Transistor

## UMT3904 / SST3904 / MMST3904 / 2N3904

●Features

- 1)  $BV_{CEO} > 40V$  ( $I_c = 1mA$ )
- 2) Complements the UMT3906 / SST3906 / MMST3906 / 2N3906.

●Package, marking and packaging specifications

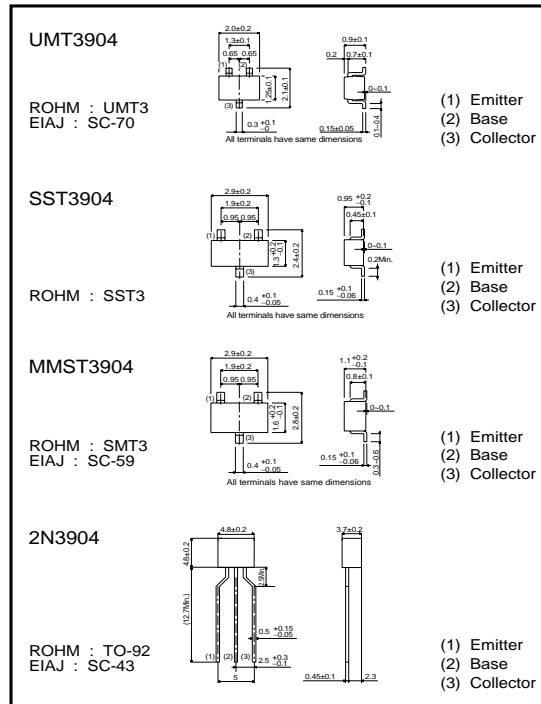
Part No.	UMT3904	SST3904	MMST3904	2N3904
Packaging type	UMT3	SST3	SMT3	TO-92
Marking	R1A	R1A	R1A	-
Code	T106	T116	T146	T93
Basic ordering unit (pieces)	3000	3000	3000	3000

●Absolute maximum ratings ( $T_a = 25^\circ C$ )

Parameter	Symbol	Limits	Unit
Collector-base voltage	$V_{CBO}$	60	V
Collector-emitter voltage	$V_{CEO}$	40	V
Emitter-base voltage	$V_{EBO}$	6	V
Collector current	$I_c$	0.2	A
Collector power dissipation	UMT3904, SST3904, MMST3904	0.2	W
	SST3904, MMST3904	0.35	W *
	2N3904	0.625	W
Junction temperature	$T_j$	150	$^\circ C$
Storage temperature	$T_{stg}$	-55+150	$^\circ C$

\* When mounted on a 7 x 5 x 0.6 mm ceramic board.

●External dimensions (Units : mm)



●Electrical characteristics ( $T_a = 25^\circ C$ )

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Collector-base breakdown voltage	$BV_{CBO}$	60	-	-	V	$I_c = 10\mu A$
Collector-emitter breakdown voltage	$BV_{CEO}$	40	-	-	V	$I_c = 1mA$
Emitter-base breakdown voltage	$BV_{EBO}$	6	-	-	V	$I_e = 10\mu A$
Collector cutoff current	$I_{CES}$	-	-	50	nA	$V_{CB} = 30V$
Emitter cutoff current	$I_{EBO}$	-	-	50	nA	$V_{EB} = 3V$
Collector-emitter saturation voltage	$V_{CE(sat)}$	-	-	0.2	V	$I_c/I_b = 10mA/1mA$
		-	-	0.3	V	$I_c/I_b = 50mA/5mA$
Base-emitter saturation voltage	$V_{BE(sat)}$	0.65	-	0.85	V	$I_c/I_b = 10mA/1mA$
		-	-	0.95	V	$I_c/I_b = 50mA/5mA$
DC current transfer ratio	$h_{FE}$	40	-	-	-	$V_{CE} = 1V, I_c = 0.1mA$
		70	-	-	-	$V_{CE} = 1V, I_c = 1mA$
		100	-	300	-	$V_{CE} = 1V, I_c = 10mA$
		60	-	-	-	$V_{CE} = 1V, I_c = 50mA$
		30	-	-	-	$V_{CE} = 1V, I_c = 100mA$
Transition frequency	$f_T$	300	-	-	MHz	$V_{CE} = 20V, I_e = -10mA, f = 100MHz$
Collector output capacitance	$C_{ob}$	-	-	4	pF	$V_{CB} = 10V, f = 100kHz$
Emitter input capacitance	$C_{ib}$	-	-	8	pF	$V_{EB} = 0.5V, f = 100kHz$
Delay time	$t_d$	-	-	35	ns	$V_{CC} = 3V, V_{BE(OFF)} = 0.5V, I_c = 10mA, I_{B1} = 1mA$
Rise time	$t_r$	-	-	35	ns	$V_{CC} = 3V, V_{BE(OFF)} = 0.5V, I_c = 10mA, I_{B1} = 1mA$
Storage time	$t_{stg}$	-	-	200	ns	$V_{CC} = 3V, I_c = 10mA, I_{B1} = -I_{B2} = 1mA$
Fall time	$t_f$	-	-	50	ns	$V_{CC} = 3V, I_c = 10mA, I_{B1} = -I_{B2} = 1mA$

Transistors

● Electrical characteristic curves

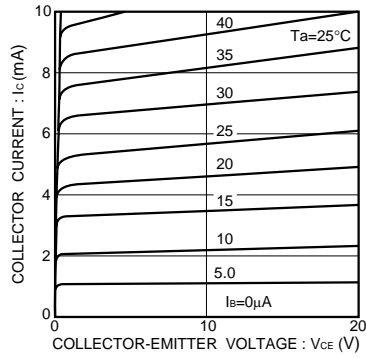


Fig.1 Grounded emitter output characteristics

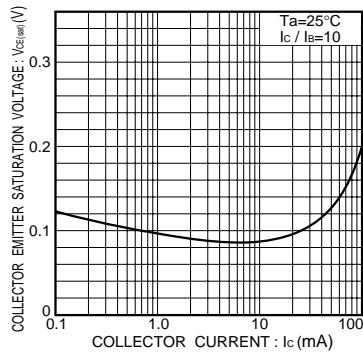


Fig.2 Collector-emitter saturation voltage vs. collector current

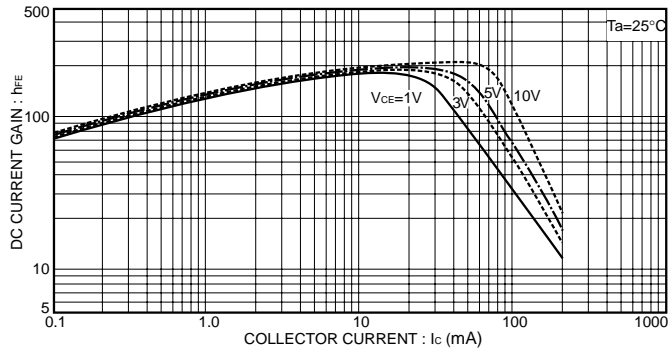


Fig.3 DC current gain vs. collector current (I)

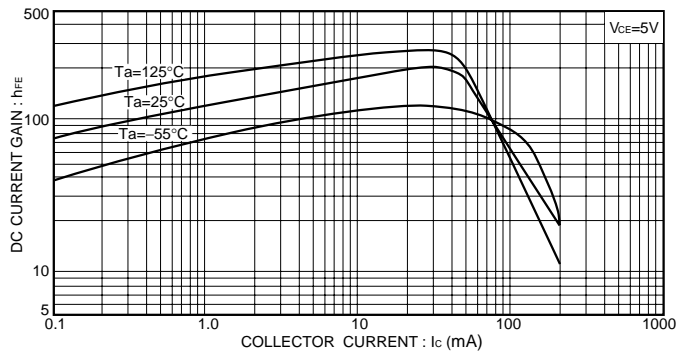


Fig.4 DC current gain vs. collector current (II)

Transistors

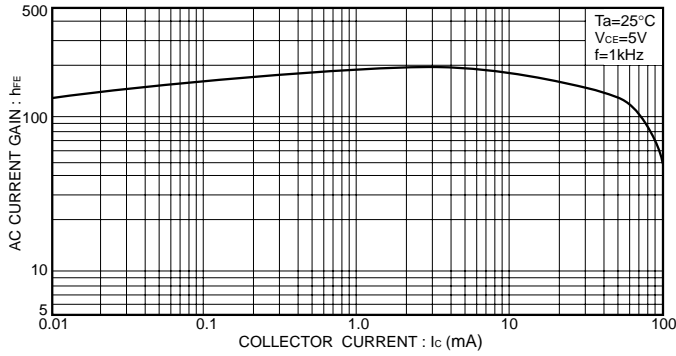


Fig.5 AC current gain vs. collector current

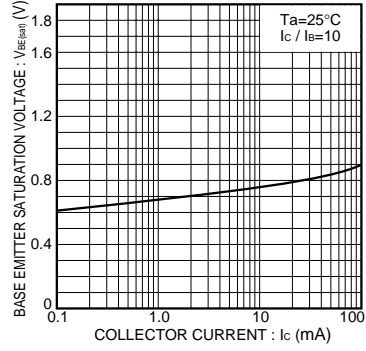


Fig.6 Base-emitter saturation voltage vs. collector current

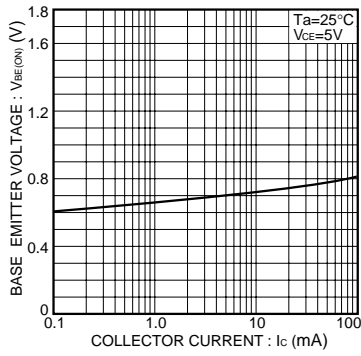


Fig.7 Grounded emitter propagation characteristics

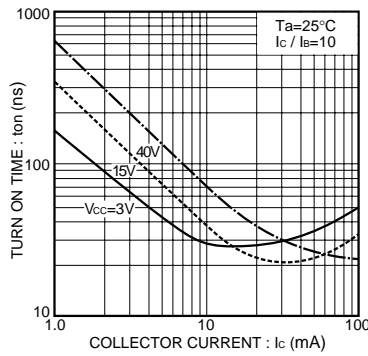


Fig.8 Turn-on time vs. collector current

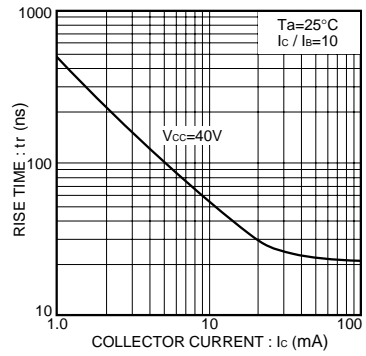


Fig.9 Rise time vs. collector current

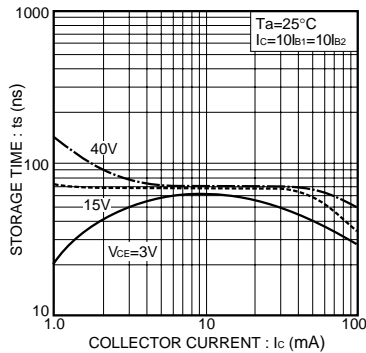


Fig.10 Storage time vs. collector current

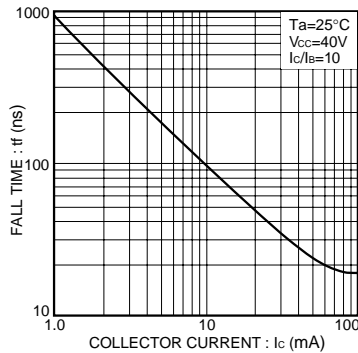


Fig.11 Fall time vs. collector current

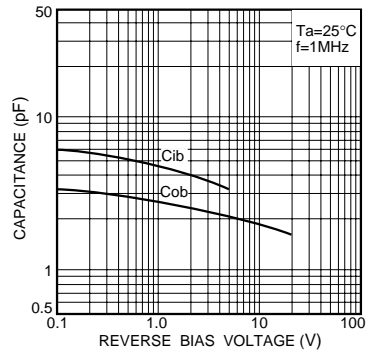


Fig.12 Input/output capacitance vs. voltage

Transistors

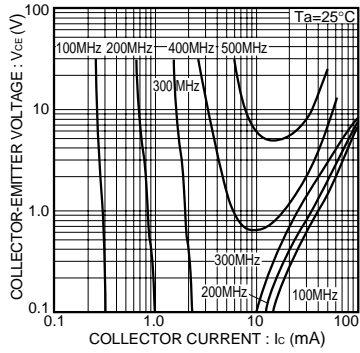


Fig.13 Gain bandwidth product

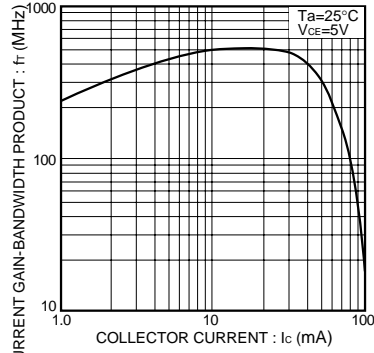


Fig.14 Gain bandwidth product vs. collector current

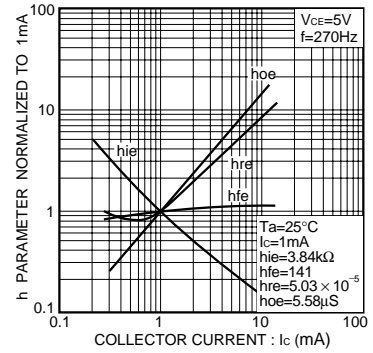


Fig.15 h parameter vs. collector current

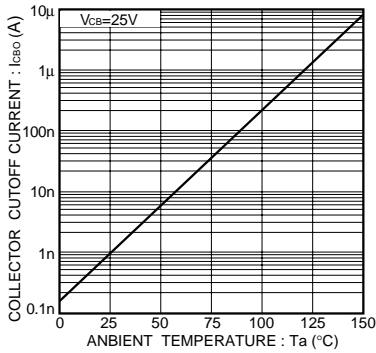


Fig.16 Noise characteristics ( I )

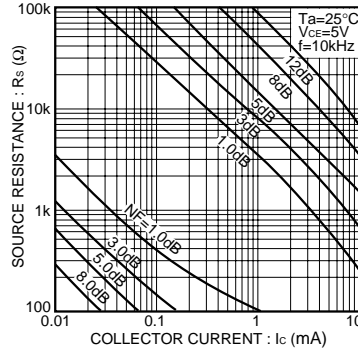


Fig.17 Noise characteristics ( II )

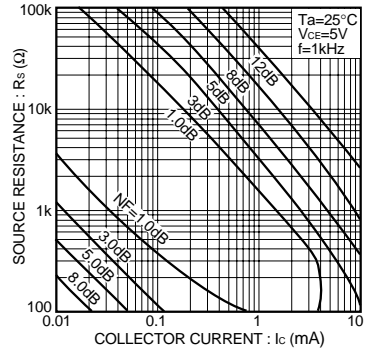


Fig.18 Noise characteristics ( III )

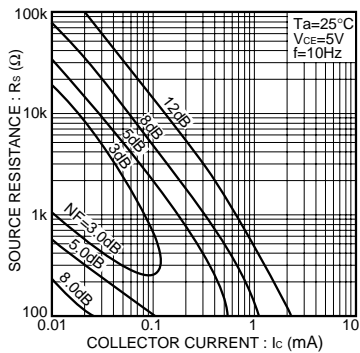


Fig.19 Noise characteristics ( IV )

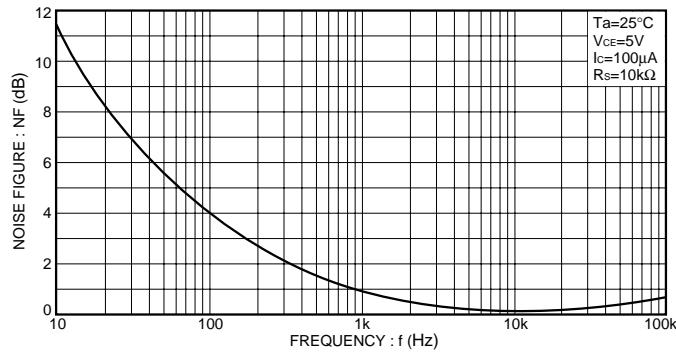


Fig.20 Noise vs. collector current

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