

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

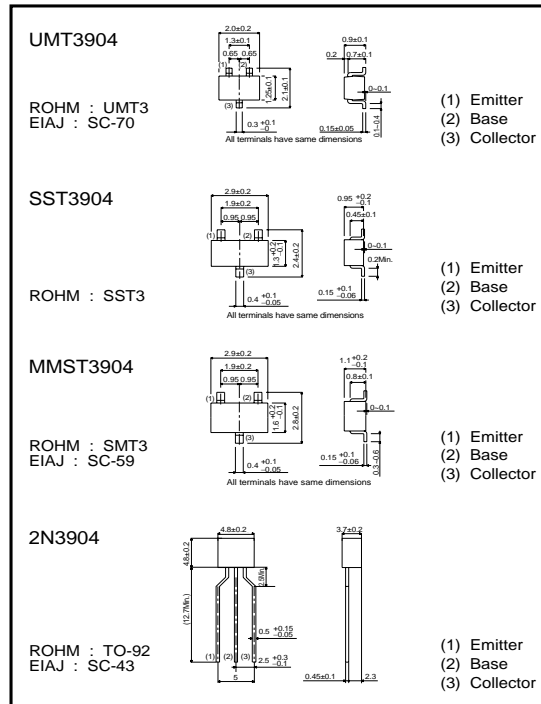
Part No.	UMT3904	SST3904	MMST3904	2N3904
Packaging type	UMT3	SST3	SMT3	TO-92
Marking	R1A	R1A	R1A	-
Code	T106	T116	T146	T93
Basic ordering unit (pieces)	3000	3000	3000	3000

●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	$V_{CC} = 3V, I_c = 10mA, I_{B1} = -I_{B2} = 1mA$

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● Electrical characteristic curves

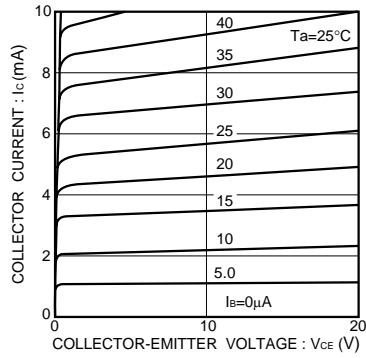


Fig.1 Grounded emitter output characteristics

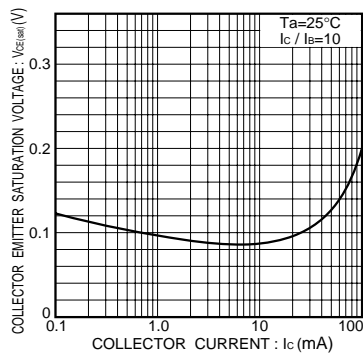


Fig.2 Collector-emitter saturation voltage vs. collector current

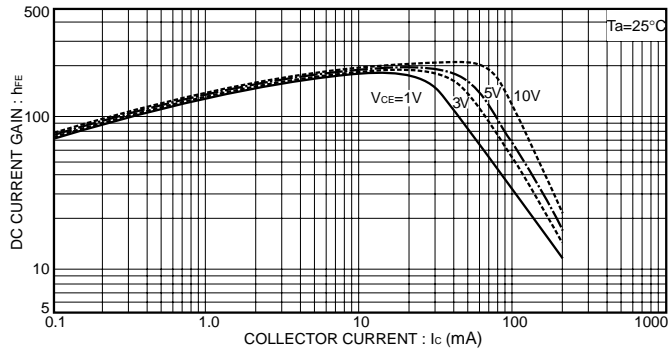


Fig.3 DC current gain vs. collector current ( I )

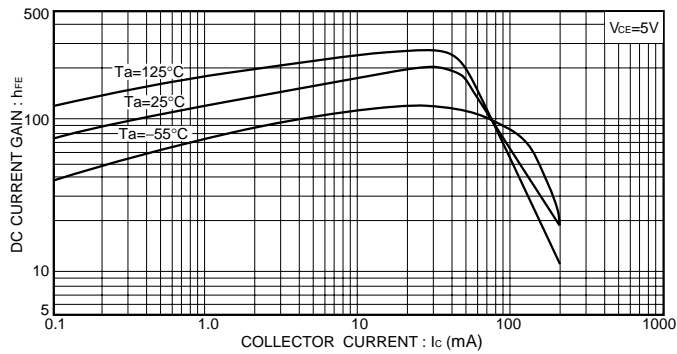


Fig.4 DC current gain vs. collector current ( II )

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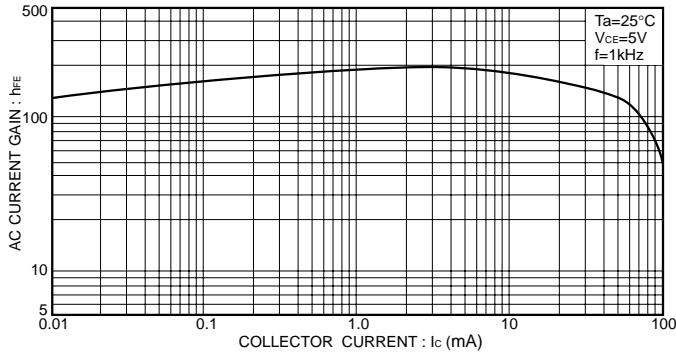


Fig.5 AC current gain vs. collector current

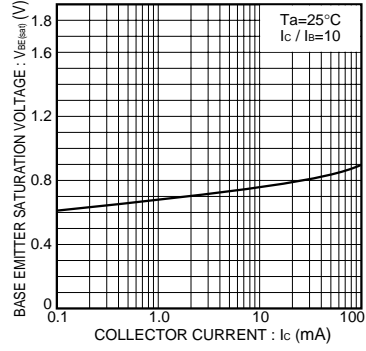


Fig.6 Base-emitter saturation voltage vs. collector current

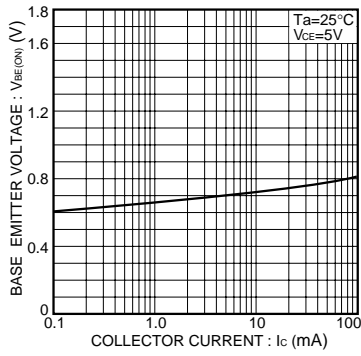


Fig.7 Grounded emitter propagation characteristics

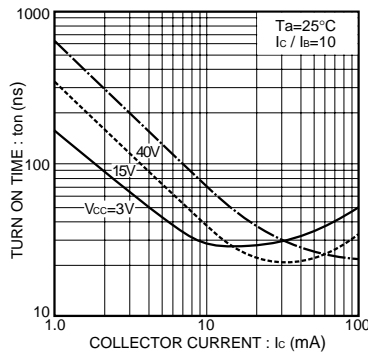


Fig.8 Turn-on time vs. collector current

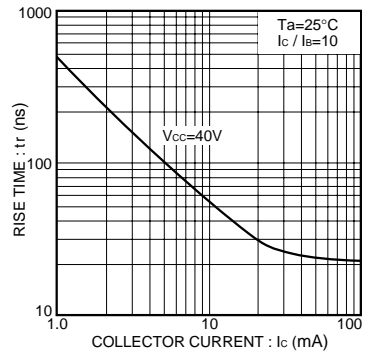


Fig.9 Rise time vs. collector current

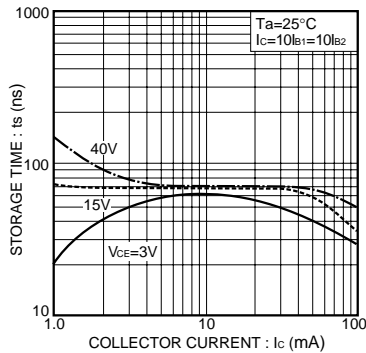


Fig.10 Storage time vs. collector current

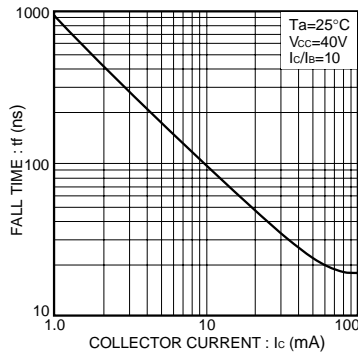


Fig.11 Fall time vs. collector current

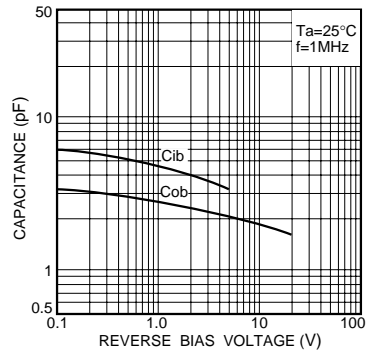


Fig.12 Input/output capacitance vs. voltage

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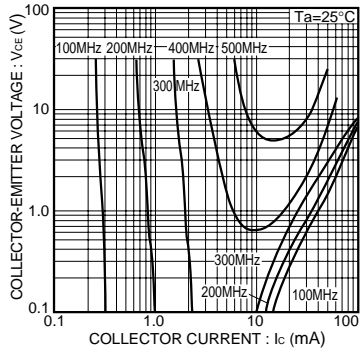


Fig.13 Gain bandwidth product

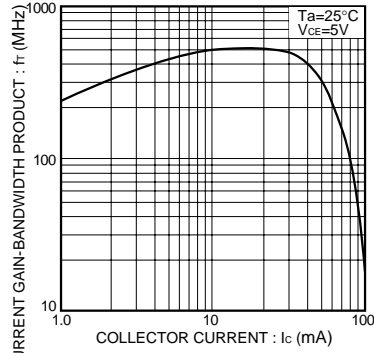


Fig.14 Gain bandwidth product vs. collector current

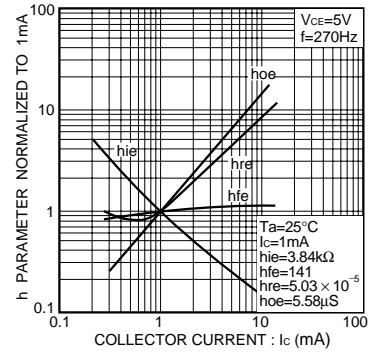


Fig.15 h parameter vs. collector current

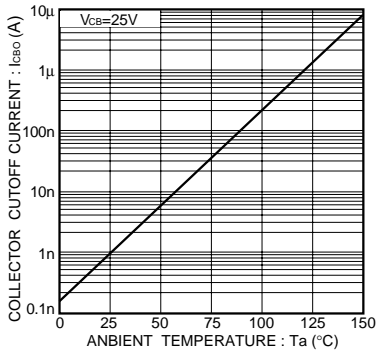


Fig.16 Noise characteristics (I)

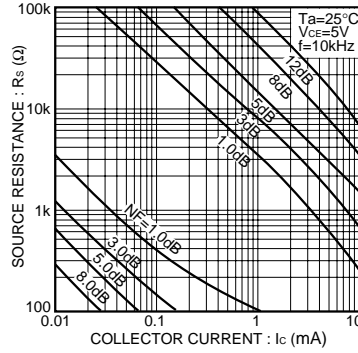


Fig.17 Noise characteristics (II)

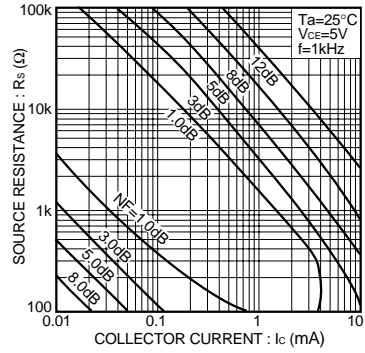


Fig.18 Noise characteristics (III)

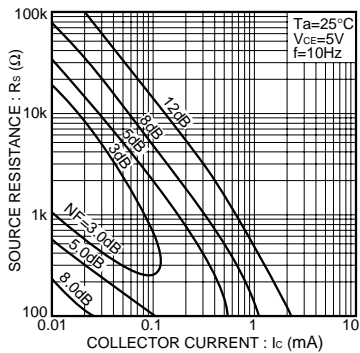


Fig.19 Noise characteristics (IV)

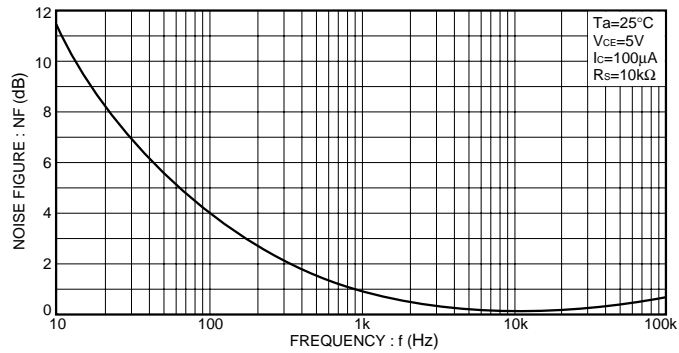


Fig.20 Noise vs. collector current