

Die no. C-37

NPN small signal transistor

These epitaxial planar NPN silicon transistors are gold doped.

Features

- available in the following packages:
 - SST3 (SST, SOT-23)
 - SMT3 (SMT, SC-59)
 - UMT3 (UMT, SOT-323), see page 300

Features

- collector-to-emitter breakdown voltage, $BV_{CEO} = 40 \text{ V (min)}$ at $I_C = 1.0 \text{ mA}$
- low capacitance, $C_{ob} = 4 \text{ pF}$
- complete amplifier and switching specifications
- current gain specified from $10 \mu\text{A}$ to 100 mA
- high transition frequency, typically $f_T = 300 \text{ MHz min}$ at $I_C = 10 \text{ mA}$

Device types

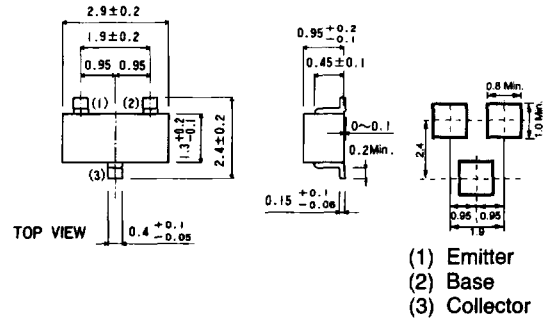
Package style	Part number	Part marking
SST3 (SOT-23)	SST3904	R1A
SMT3 (SC-59)	MMST3904	R1A
UMT3 (SOT-323)	UMT3904	R1A

Applications

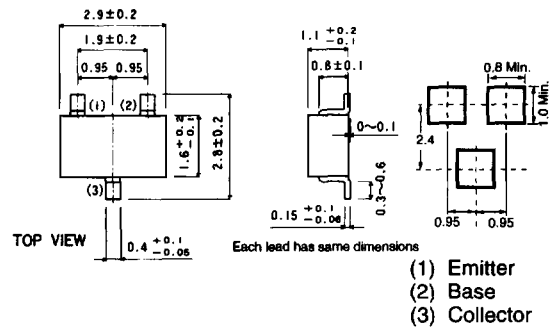
- general purpose, switching and amplifier transistor

Dimensions (Units : mm)

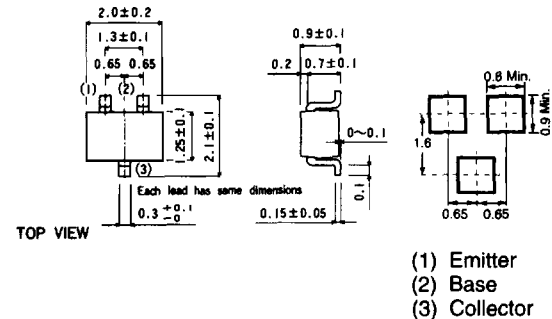
SST3



SMT3



UMT3



C-37 Transistors (US/European) NPN

Absolute maximum ratings ($T_a = 25^\circ\text{C}$)

Parameter	Symbol	Limits	Unit	Conditions
Collector-to-base voltage	V_{CB0}	60	V	
Collector-to-emitter voltage	V_{CEO}	40	V	
Emitter-to-base voltage	V_{EBO}	5	V	
Collector current	I_C	200	mA	DC
Power dissipation	SST3 (SOT-23)	200	mW	For derating, see derating curve following
	SMT3 (SC-59)	200		
	UMT3 (SOT-323)	200		
Junction temperature	T_j	-55 ~ +150	$^\circ\text{C}$	

Electrical characteristics (unless otherwise noted, $T_a = 25^\circ\text{C}$) (Sheet 1 of 2)

Parameter	Symbol	Min	Typical	Max	Unit	Conditions
Collector-to-base breakdown voltage	BV_{CB0}	60	100		V	$I_C = 10 \mu\text{A}$
Collector-to-emitter breakdown voltage	BV_{CEO}	40	60		V	$I_C = 1.0 \text{ mA}$
Emitter-to-base breakdown voltage	BV_{EBO}	5		8	V	$I_E = 10 \mu\text{A}$
Collector cutoff current	I_{CB0}			50	nA	$V_{CB} = 25 \text{ V}$
Emitter cutoff current	I_{EBO}			50	nA	$V_{EB} = 4 \text{ V}$
DC current gain	h_{FE}	50				$I_C = 0.1 \text{ mA}, V_{CE} = 1.0 \text{ V}$
		70				$I_C = 1.0 \text{ mA}, V_{CE} = 1.0 \text{ V}$
		100	175	300		$I_C = 10 \text{ mA}, V_{CE} = 1.0 \text{ V}$
		60				$I_C = 50 \text{ mA}, V_{CE} = 1.0 \text{ V}$
		30				$I_C = 100 \text{ mA}, V_{CE} = 1.0 \text{ V}$
		80				$I_C = 50 \text{ mA}, V_{CE} = 5.0 \text{ V}$
		60				$I_C = 100 \text{ mA}, V_{CE} = 5.0 \text{ V}$
Collector-to-emitter saturation voltage	$V_{CE(sat)}$		0.08	0.20	V	$I_C/I_B = 10 \text{ mA}/1.0 \text{ mA}$
			0.13	0.30		$I_C/I_B = 50 \text{ mA}/5 \text{ mA}$
Base-to-emitter saturation voltage	$V_{BE(sat)}$		0.70	0.85	V	$I_C/I_B = 10 \text{ mA}/1.0 \text{ mA}$
			0.75	0.95		$I_C/I_B = 50 \text{ mA}/5 \text{ mA}$
AC current gain	h_{fe}	100	400			$I_C = 1.0 \text{ mA}, V_{CE} = 10 \text{ V}, f = 1 \text{ kHz}$
Collector output capacitance	C_{ob}		2	4	pF	$V_{CB} = 5.0 \text{ V}, I_E = 0, f = 1 \text{ MHz}$

Electrical characteristics (unless otherwise noted, $T_a = 25^\circ\text{C}$) (Sheet 2 of 2)

Parameter	Symbol	Min	Typical	Max	Unit	Conditions
Collector input capacitance	C_{ib}		4	6	pF	$V_{EB} = 5.0\text{ V}$, $I_C = 0$, $f = 1\text{ MHz}$
Transition frequency	f_T	300	400		MHz	$I_C = 10\text{ mA}$, $V_{CE} = 20\text{ V}$, $f = 100\text{ MHz}$
Noise figure	NF		2	5	dB	$I_C = 100\ \mu\text{A}$, $V_{CE} = 5.0\text{ V}$, $R_S = 1\text{ k}\Omega$, $f = 10\text{ Hz to } 15.7\text{ kHz}$
Rise time	t_r			35	ns	$I_C = 10\text{ mA}$, $I_{B1} = 1.0\text{ mA}$, $V_{CC} = 3\text{ V}$
Delay time	t_d			35	ns	$I_C = 10\text{ mA}$, $I_{B1} = 1.0\text{ mA}$, $V_{CC} = 3\text{ V}$
Turn on time	t_{on}		40	70	ns	$I_C = 10\text{ mA}$, $I_{B1} = 1.0\text{ mA}$, $V_{CC} = 3\text{ V}$
Storage time	t_s			200	ns	$I_C = 10\text{ mA}$, $I_{B1} = I_{B2} = 1.0\text{ mA}$
Fall time	t_f			50	ns	$I_C = 10\text{ mA}$, $I_{B1} = I_{B2} = 1.0\text{ mA}$
Turn off time	t_{off}		120	250	ns	$I_C = 10\text{ mA}$, $I_{B1} = I_{B2} = 1.0\text{ mA}$

Note: Minus sign for PNP transistor is omitted

Electrical characteristic curves

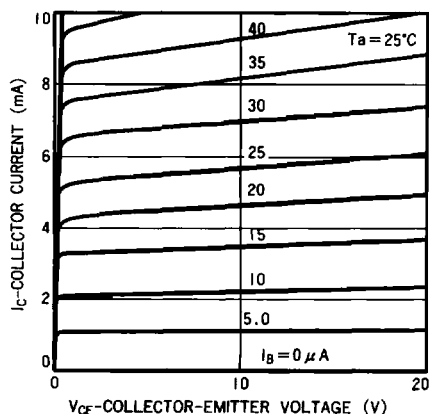


Figure 1

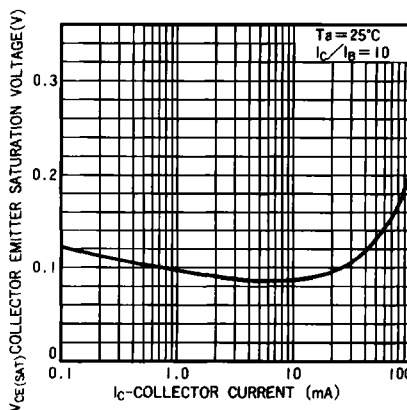


Figure 2

C-37 Transistors (US/European) NPN

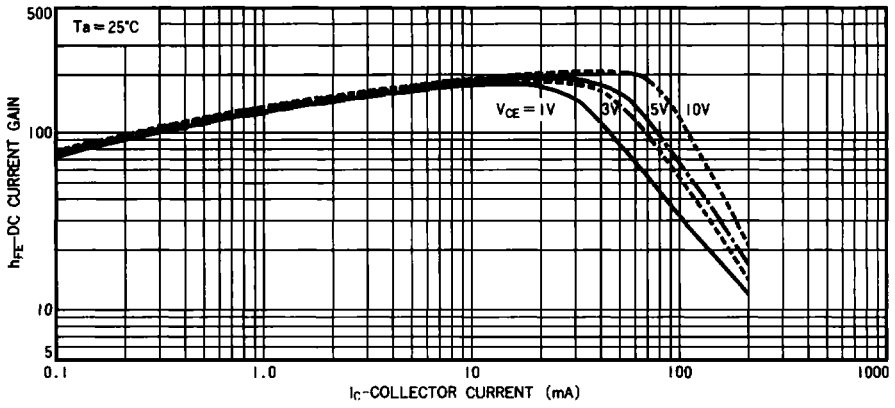


Figure 3

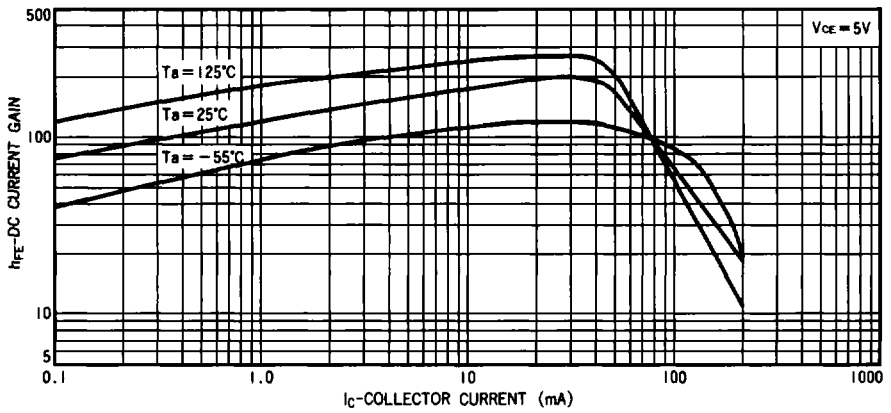


Figure 4

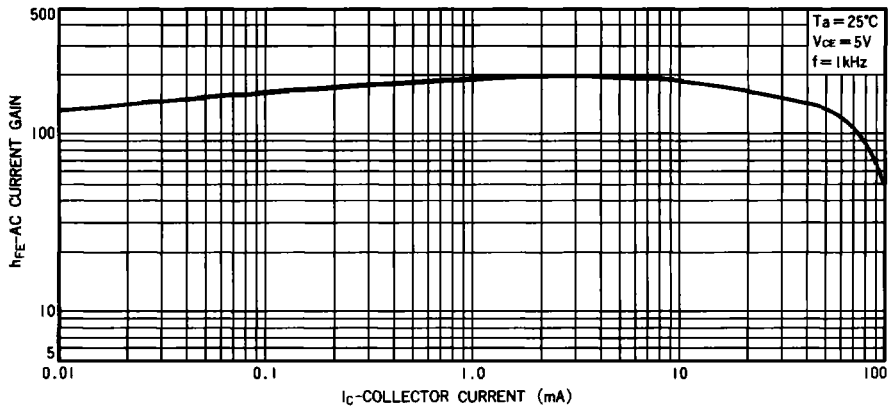


Figure 5

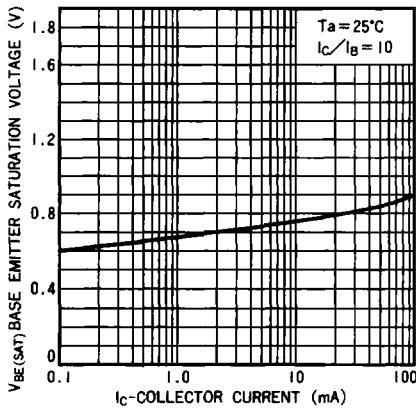


Figure 6

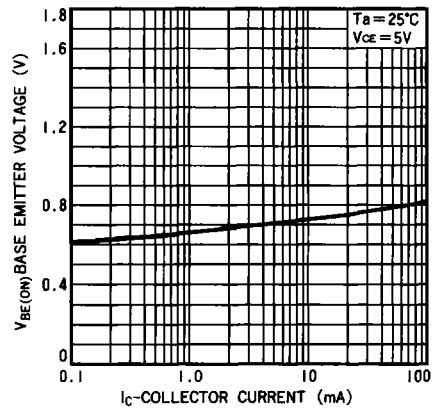


Figure 7

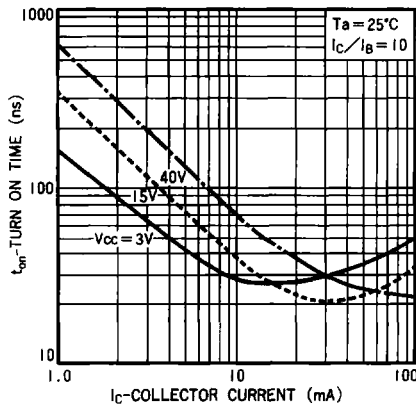


Figure 8

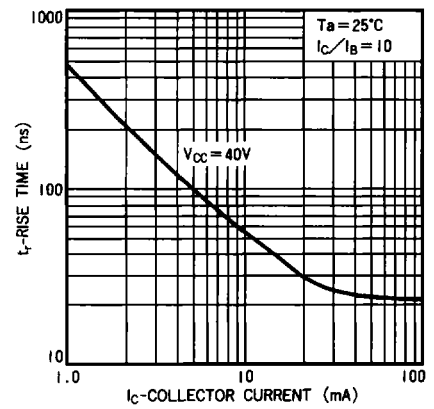


Figure 9

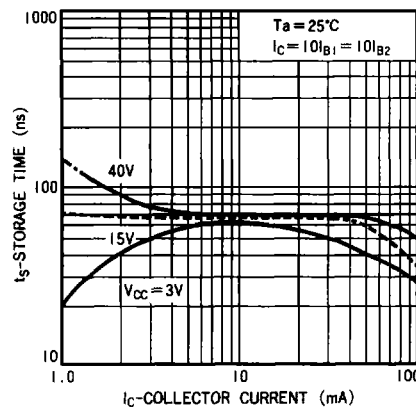


Figure 10

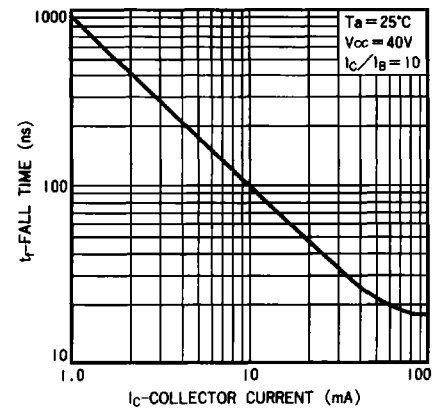


Figure 11

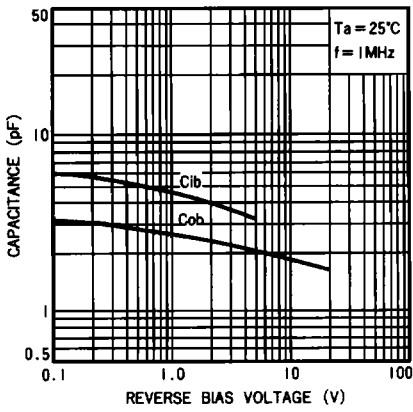


Figure 12

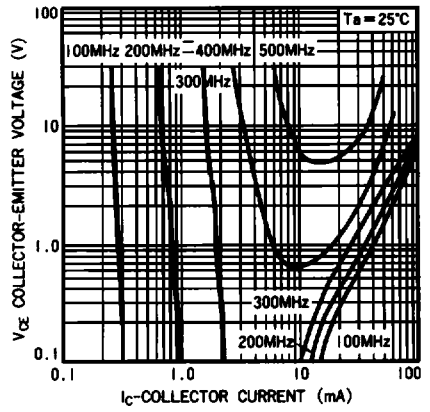


Figure 13

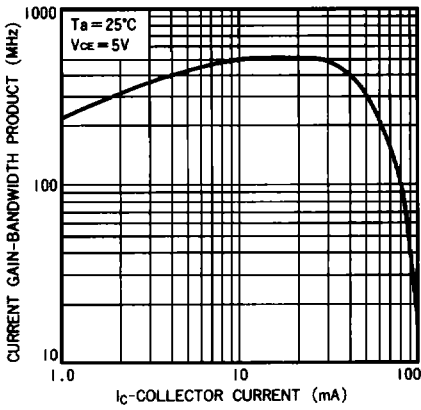


Figure 14

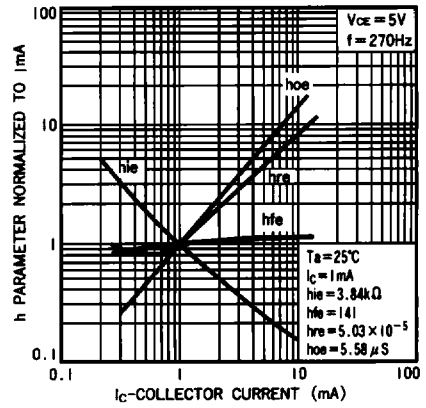


Figure 15

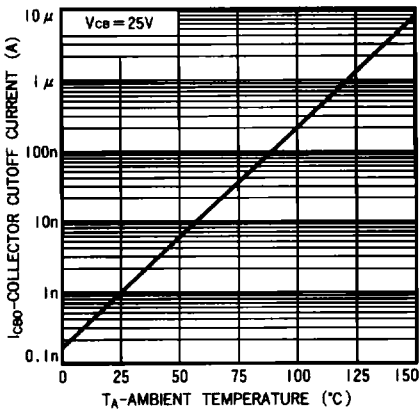


Figure 16

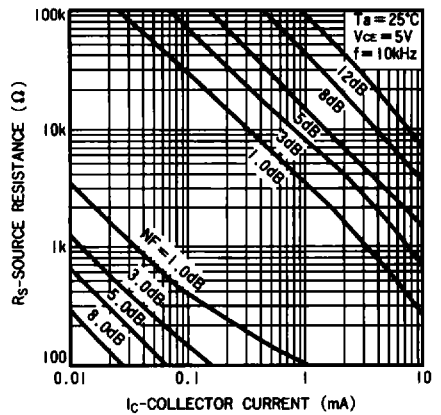


Figure 17

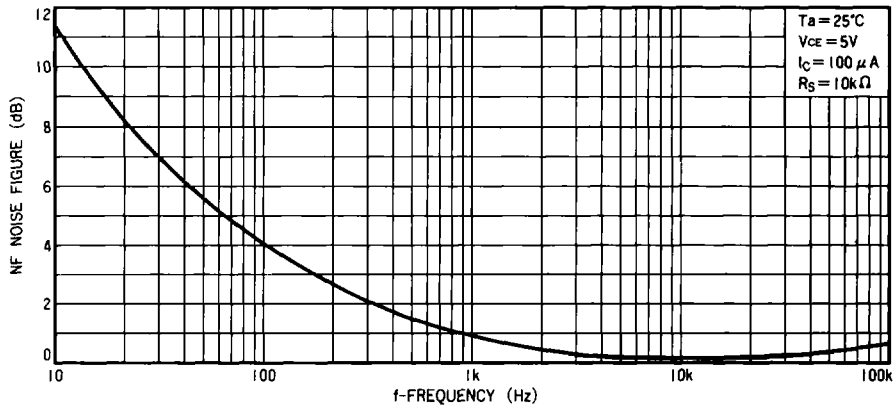


Figure 18

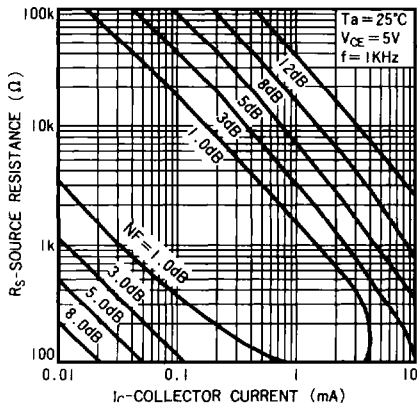


Figure 19

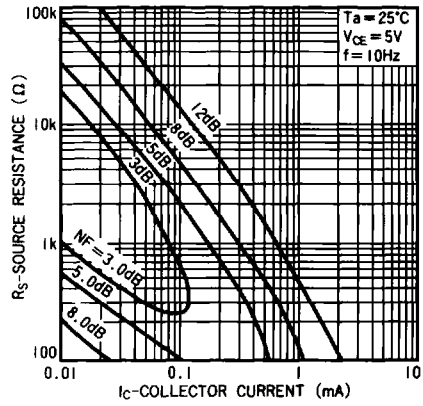


Figure 20

C-37 Transistors (US/European) NPN

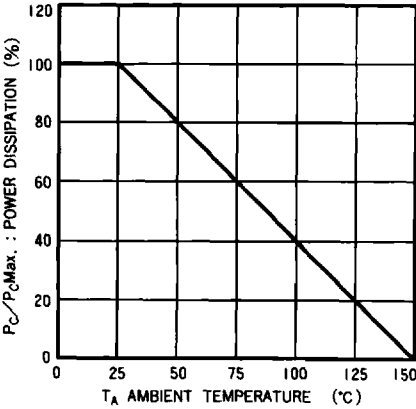


Figure 21