2SA1190, 2SA1191

Silicon PNP Epitaxial

HITACHI

Application

- Low frequency low noise amplifier
- Complementary pair with 2SC2855 and 2SC2856

Outline

TO-92 (1)

1. Emitter
2. Collector
3. Base

Hitachi semiconductor

Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	2SA1190	2SA1191	Unit
Collector to base voltage	V_{CBO}	–90	–120	V
Collector to emitter voltage	V_{CEO}	–90	–120	V
Emitter to base voltage	V_{EBO}	–5	–5	V
Collector current	I_C	–100	–100	mA
Emitter current	I_E	100	100	mA
Collector power dissipation	P_C	400	400	mW
Junction temperature	Tj	150	150	°C
Storage temperature	Tstg	–55 to +150	–55 to +150	°C

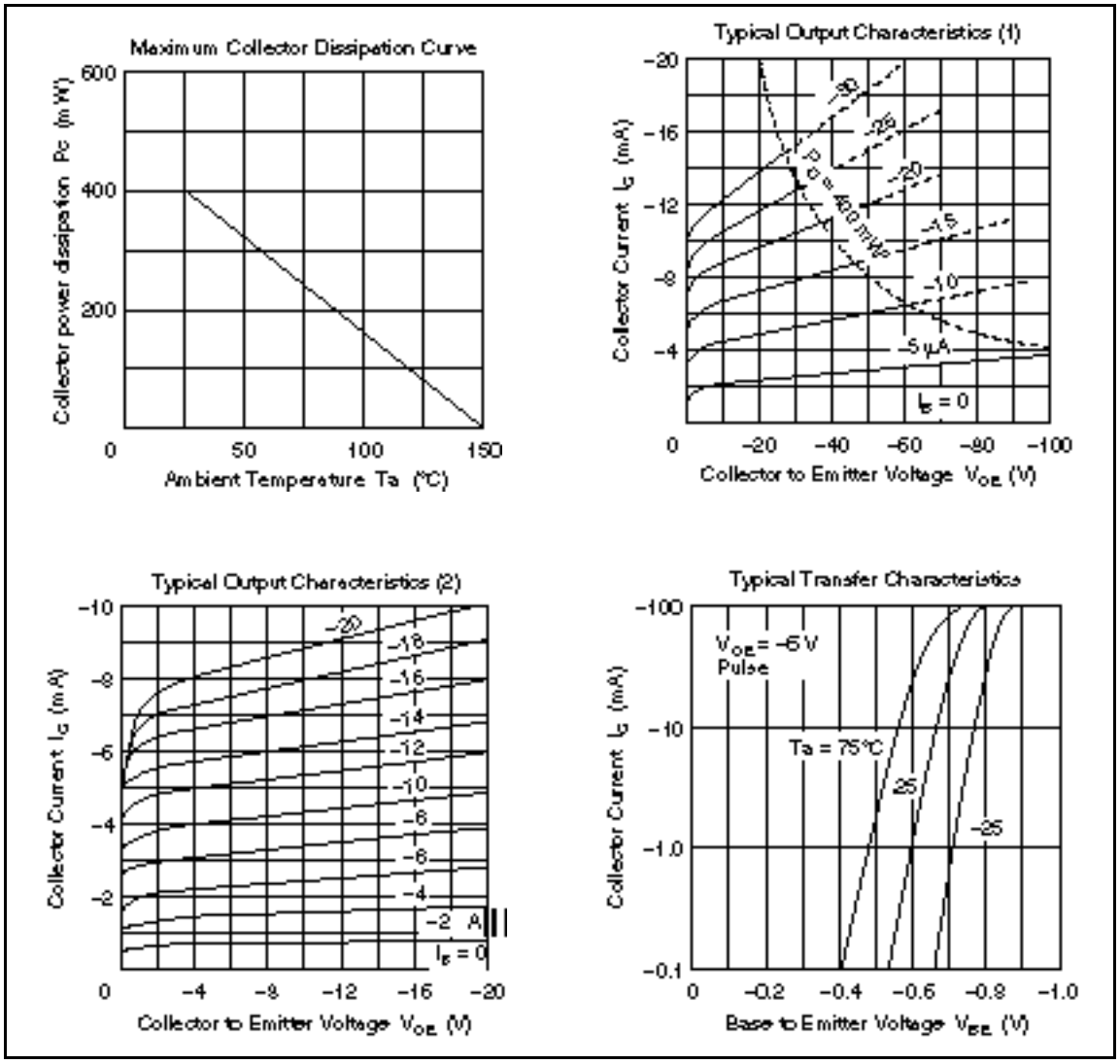
Electrical Characteristics (Ta = 25°C)

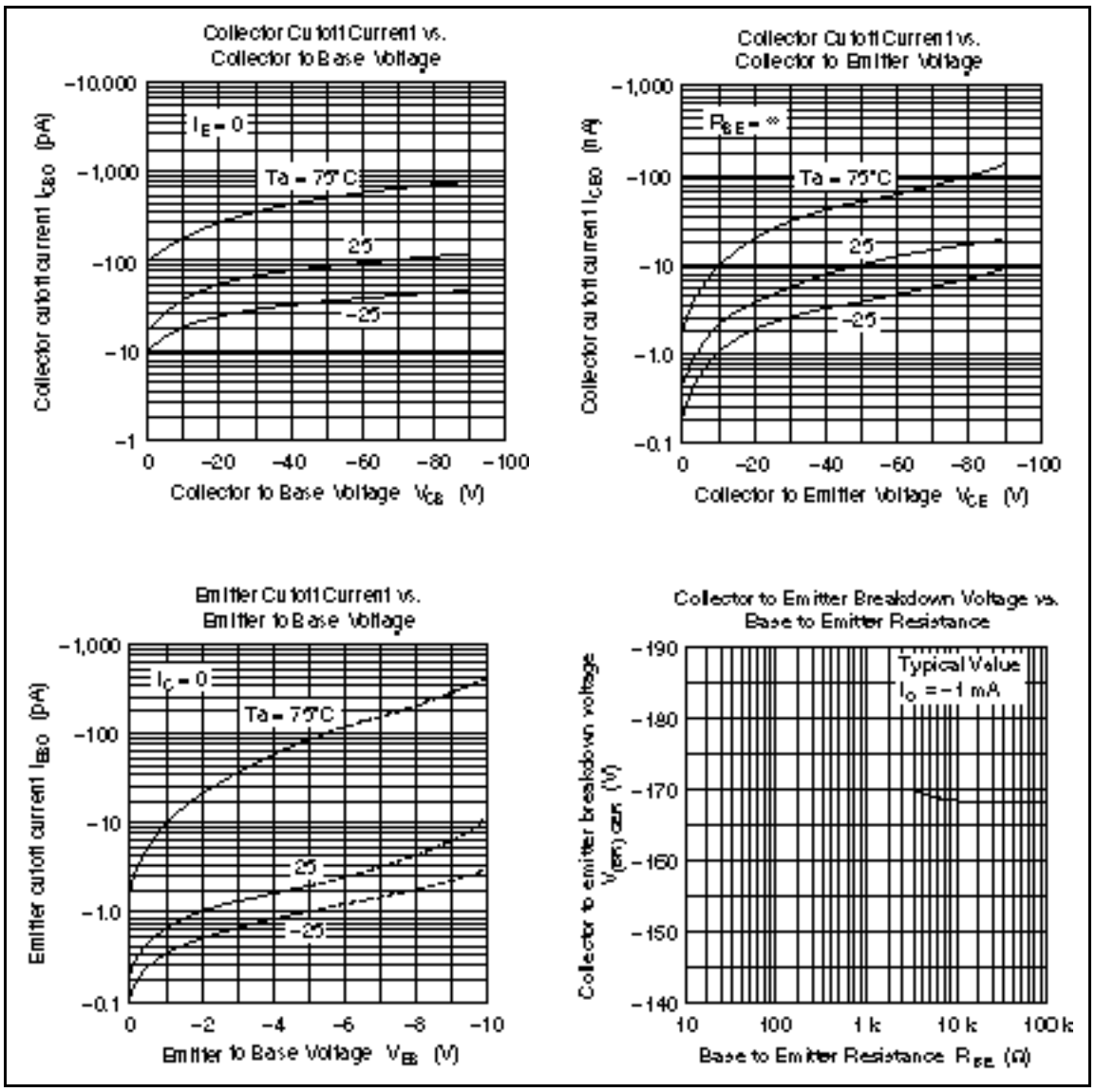
Item	Symbol	2SA1190 Min	2SA1190 Typ	2SA1190 Max	2SA1191 Min	2SA1191 Typ	2SA1191 Max	Unit	Test conditions
Collector to base breakdown voltage	$V_{(BR)CBO}$	–90	—	—	–120	—	—	V	I_C = –10 µA, I_E = 0
Collector to emitter breakdown voltage	$V_{(BR)CEO}$	–90	—	—	–120	—	—	V	I_C = –1 mA, R_{BE} = ∞
Emitter to base breakdown voltage	$V_{(BR)EBO}$	–5	—	—	–5	—	—	V	I_E = –10 µA, I_C = 0
Collector cutoff current	I_{CBO}	—	—	–0.1	—	—	–0.1	µA	V_{CB} = –70 V, I_E = 0
Emitter cutoff current	I_{EBO}	—	—	–0.1	—	—	–0.1	µA	V_{EB} = –2 V, I_C = 0
DC current trnsfer ratio	h_{FE}*[1]	250	—	800	250	—	800		V_{CE} = –12 V, I_C = –2 mA*[2]
Collector to emitter saturation voltage	$V_{CE(sat)}$	—	–0.05	–0.15	—	–0.05	–0.15	V	I_C = –10 mA, I_B = –1 mA*[2]
Base to emitter saturation voltage	$V_{BE(sat)}$	—	–0.7	–1.0	—	–0.7	–1.0	V	
Gain bandwidth product	f_T	—	130	—	—	130	—	MHz	V_{CE} = –6 V, I_C = –10 mA
Collector output capacitance	Cob	—	3.2	—	—	3.2	—	pF	V_{CB} = –10 V, I_E = 0, f = 1 MHz
Noise figure	NF	—	0.15	1.5	—	0.15	1.5	dB	V_{CE} = –6 V, I_C = –0.1 mA, R_g = 10 kΩ, f = 1 kHz
		—	0.2	2.0	—	0.2	2.0	dB	V_{CE} = –6 V, I_C = –0.1 mA, R_g = 10 kΩ, f = 10 Hz
Noise voltage reffered to input	e_n	—	0.7	—	—	0.7	—	nV/√Hz	V_{CB} = –6 V, I_C = –10 mA, Rg = 0, f = 1 kHz

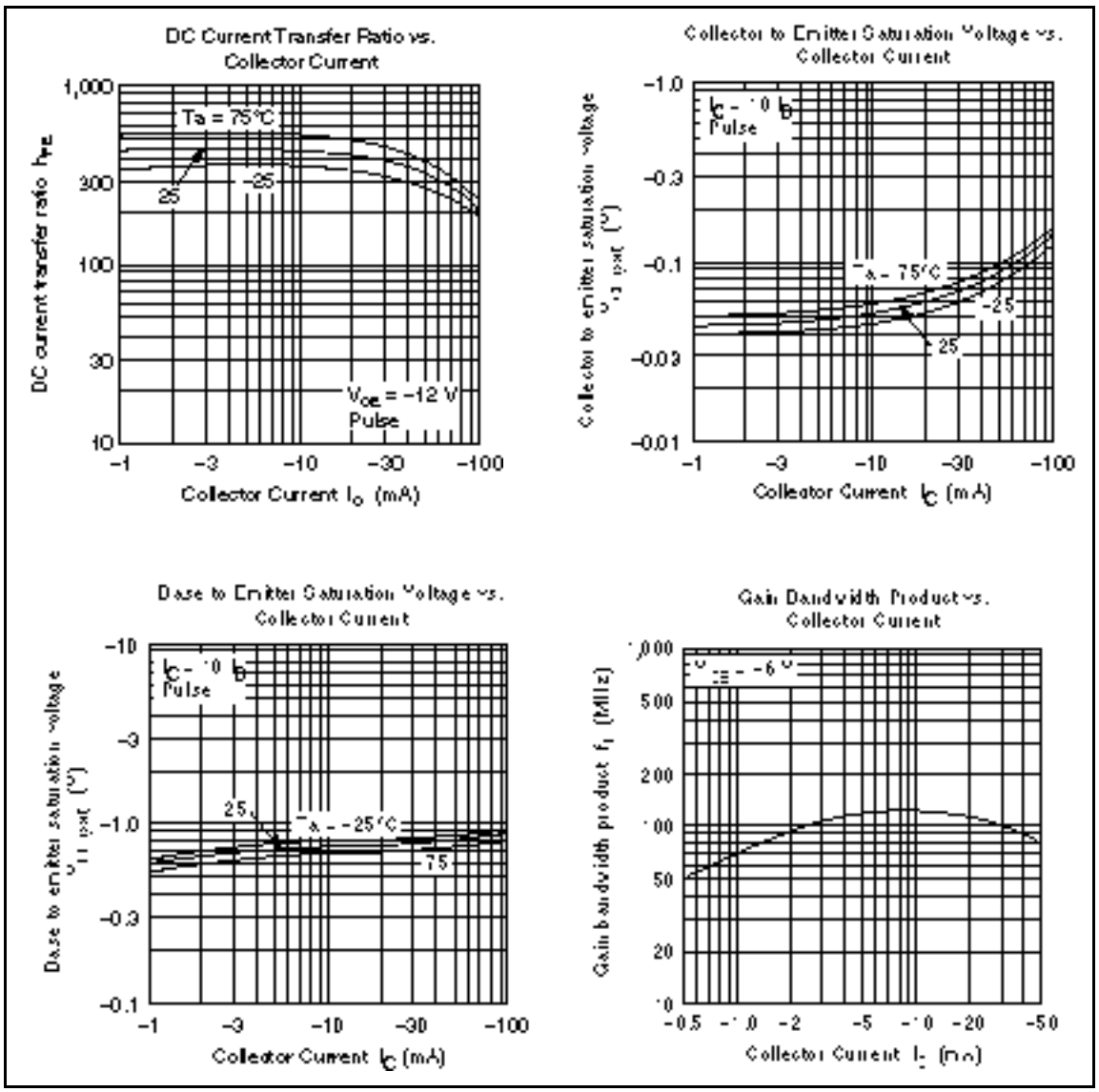
Notes: 1. The 2SA1190 and 2SA1191 are grouped by h_{FE} as follows.

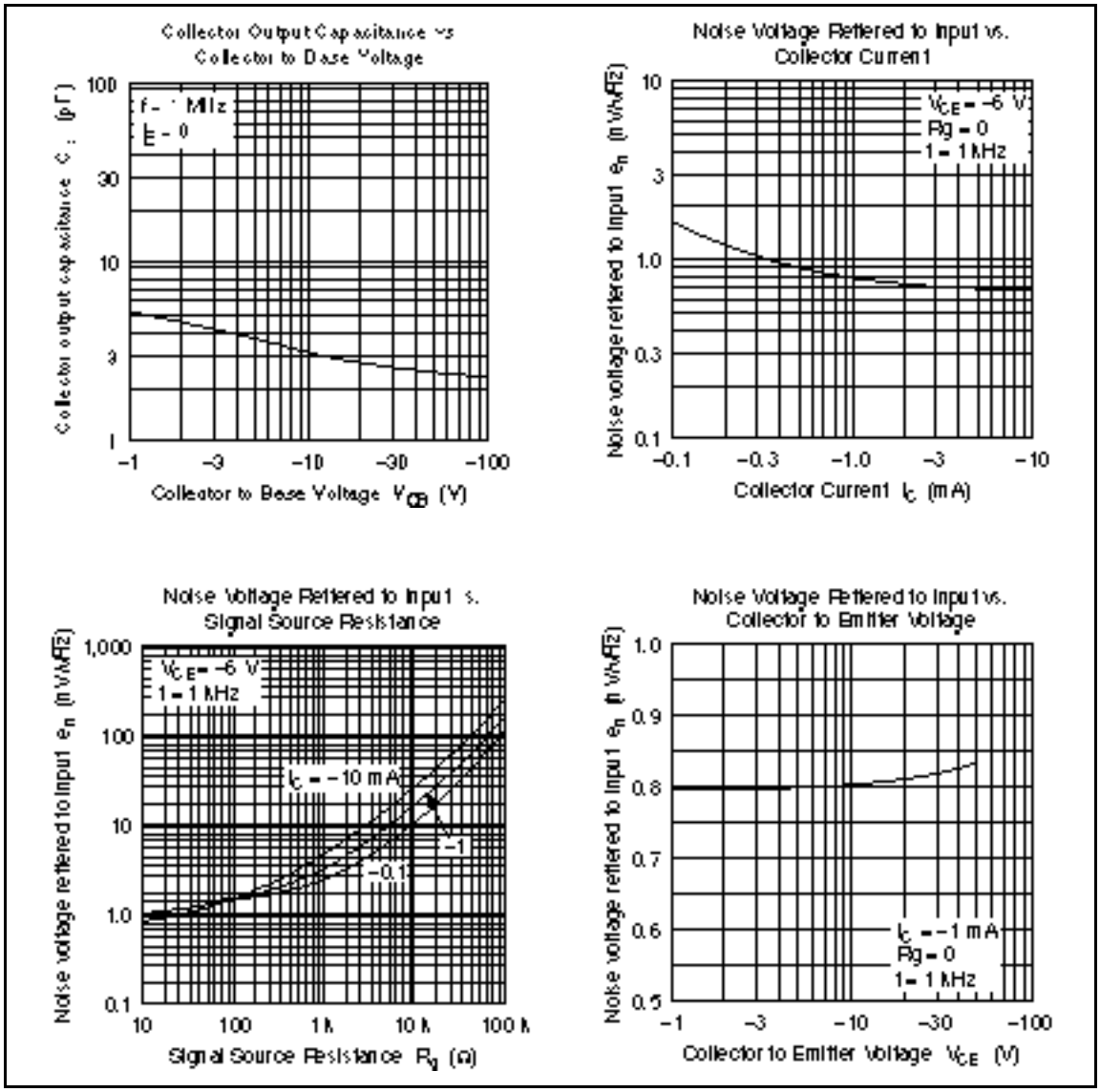
2. Pulse test

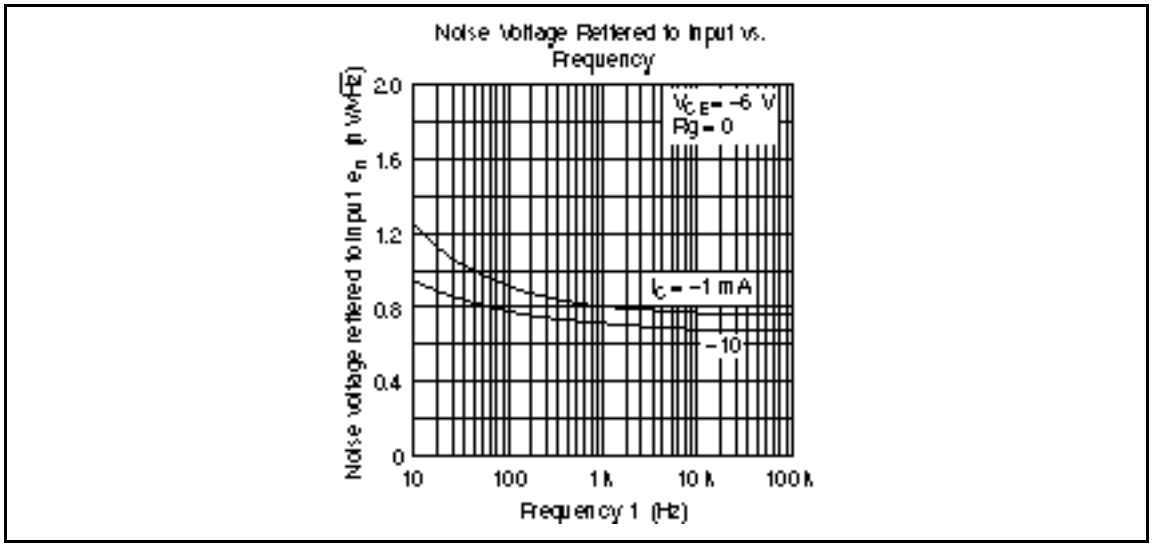
D	E
250 to 500	400 to 800


Maximum Collector Dissipation Curve
Collector power dissipation Pc (mW)
600
400
200
0
50
100
150
Ambient Temperature Ta (°C)
Typical Output Characteristics (1)
Collector Current I_C (mA)
−20
−16
−12
−8
−4
Pc = 400 mW
−30
−25
−20
−15
−10
−5 µA
I_B = 0
0
−20
−40
−60
−80
−100
Collector to Emitter Voltage V_{CE} (V)
Typical Output Characteristics (2)
Collector Current I_C (mA)
−10
−8
−6
−4
−2
−20
−18
−16
−14
−12
−10
−8
−6
−4
−2 A
I_B = 0
0
−4
−8
−12
−16
−20
Collector to Emitter Voltage V_{CE} (V)
Typical Transfer Characteristics
Collector Current I_C (mA)
−100
−10
−1.0
−0.1
V_{CE} = −6 V
Pulse
Ta = 75°C
25
−25
0
−0.2
−0.4
−0.6
−0.8
−1.0
Base to Emitter Voltage V_{BE} (V)


Collector Cutoff Current vs.
Collector to Base Voltage
Collector cutoff current I_{CBO} (pA)
$I_E = 0$
Ta = 75°C
25
−25
−10,000
−1,000
−100
−10
−1
0
−20
−40
−60
−80
−100
Collector to Base Voltage V_{CB} (V)
Collector Cutoff Current vs.
Collector to Emitter Voltage
Collector cutoff current I_{CEO} (mA)
$R_{BE} = \infty$
Ta = 75°C
25
−25
−1,000
−100
−10
−1.0
−0.1
0
−20
−40
−60
−80
−100
Collector to Emitter Voltage V_{CE} (V)
Emitter Cutoff Current vs.
Emitter to Base Voltage
Emitter cutoff current I_{EBO} (pA)
$I_C = 0$
Ta = 75°C
25
−25
−1,000
−100
−10
−1.0
−0.1
0
−2
−4
−6
−8
−10
Emitter to Base Voltage V_{EB} (V)
Collector to Emitter Breakdown Voltage vs.
Base to Emitter Resistance
Collector to emitter breakdown voltage $V_{(BR)CER}$ (V)
Typical Value
$I_C = -1$ mA
−190
−180
−170
−160
−150
−140
10
100
1 k
10 k
100 k
Base to Emitter Resistance R_{BE} (Ω)


DC Current Transfer Ratio vs.
Collector Current
1,000
300
100
30
10
Ta = 75°C
25
–25
V_{CE} = –12 V
Pulse
–1
–3
–10
–30
–100
Collector Current I_C (mA)
Collector to Emitter Saturation Voltage vs.
Collector Current
–1.0
–0.3
–0.1
–0.03
–0.01
Pulse
Ta = 75°C
25
–25
–1
–3
–10
–30
–100
Collector Current I_C (mA)
Base to Emitter Saturation Voltage vs.
Collector Current
–10
–3
–1.0
–0.3
–0.1
Pulse
25
Ta = –25°C
75
–1
–3
–10
–30
–100
Collector Current I_C (mA)
Gain Bandwidth Product vs.
Collector Current
500
200
100
50
20
10
–0.5
–1.0
–2
–5
–10
–20
–50
Collector Current I_C (mA)


Collector Output Capacitance vs
Collector to Base Voltage
f = 1 MHz
IE = 0
Collector output capacitance Cob (pF)
100
30
10
3
1
−1
−3
−10
−30
−100
Collector to Base Voltage VCB (V)
Noise Voltage Referred to Input vs.
Collector Current
VCE = −6 V
Rg = 0
f = 1 kHz
Noise voltage referred to input en (nV/√Hz)
10
3
1.0
0.3
0.1
−0.1
−0.3
−1.0
−3
−10
Collector Current IC (mA)
Noise Voltage Referred to Input vs.
Signal Source Resistance
VCE = −6 V
f = 1 kHz
IC = −10 mA
−1
−0.1
Noise voltage referred to input en (nV/√Hz)
1,000
100
10
1.0
0.1
10
100
1 k
10 k
100 k
Signal Source Resistance Rg (Ω)
Noise Voltage Referred to Input vs.
Collector to Emitter Voltage
IC = −1 mA
Rg = 0
f = 1 kHz
Noise voltage referred to input en (nV/√Hz)
1.0
0.9
0.8
0.7
0.6
0.5
−1
−3
−10
−30
−100
Collector to Emitter Voltage VCE (V)


Noise Voltage Referred to Input vs.
Frequency
VCE = −6 V
Rg = 0
IC = −1 mA
−10
Noise voltage referred to input en (nV/√Hz)
2.0
1.6
1.2
0.8
0.4
0
10
100
1 k
10 k
100 k
Frequency f (Hz)

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