P2N2222A

Amplifier Transistors

NPN Silicon

ON Semiconductor®

http://onsemi.com

Features

- These are Pb−Free Devices*

MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

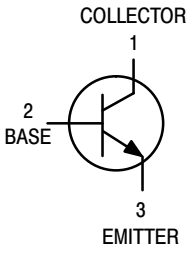
Characteristic	Symbol	Value	Unit
Collector − Emitter Voltage	V_{CEO}	40	Vdc
Collector − Base Voltage	V_{CBO}	75	Vdc
Emitter − Base Voltage	V_{EBO}	6.0	Vdc
Collector Current − Continuous	I_C	600	mAdc
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	625 5.0	mW mW/°C
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	1.5 12	W mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−55 to +150	°C

THERMAL CHARACTERISTICS

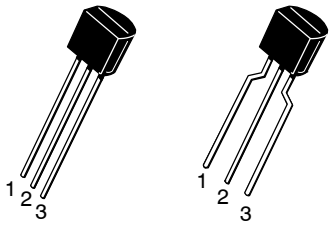
Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	200	°C/W
Thermal Resistance, Junction to Case	$R_{\theta JC}$	83.3	°C/W

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



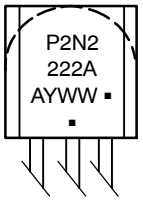
TO−92
CASE 29
STYLE 17



STRAIGHT LEAD
BULK PACK

BENT LEAD
TAPE & REEL
AMMO PACK

MARKING DIAGRAM



A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb−Free Package
(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping†
P2N2222AG	TO−92 (Pb−Free)	5000 Units/Bulk
P2N2222ARL1G	TO−92 (Pb−Free)	2000/Tape & Ammo

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector – Emitter Breakdown Voltage (I_C = 10 mAdc, I_B = 0)	$V_{(BR)CEO}$	40	–	Vdc
Collector – Base Breakdown Voltage (I_C = 10 μAdc, I_E = 0)	$V_{(BR)CBO}$	75	–	Vdc
Emitter – Base Breakdown Voltage (I_E = 10 μAdc, I_C = 0)	$V_{(BR)EBO}$	6.0	–	Vdc
Collector Cutoff Current (V_{CE} = 60 Vdc, $V_{EB(off)}$ = 3.0 Vdc)	I_{CEX}	–	10	nAdc
Collector Cutoff Current (V_{CB} = 60 Vdc, I_E = 0) (V_{CB} = 60 Vdc, I_E = 0, T_A = 150°C)	I_{CBO}	– –	0.01 10	μAdc
Emitter Cutoff Current (V_{EB} = 3.0 Vdc, I_C = 0)	I_{EBO}	–	10	nAdc
Collector Cutoff Current (V_{CE} = 10 V)	I_{CEO}	–	10	nAdc
Base Cutoff Current (V_{CE} = 60 Vdc, $V_{EB(off)}$ = 3.0 Vdc)	I_{BEX}	–	20	nAdc
ON CHARACTERISTICS				
DC Current Gain (I_C = 0.1 mAdc, V_{CE} = 10 Vdc) (I_C = 1.0 mAdc, V_{CE} = 10 Vdc) (I_C = 10 mAdc, V_{CE} = 10 Vdc) (I_C = 10 mAdc, V_{CE} = 10 Vdc, T_A = −55°C) (I_C = 150 mAdc, V_{CE} = 10 Vdc) (Note 1) (I_C = 150 mAdc, V_{CE} = 1.0 Vdc) (Note 1) (I_C = 500 mAdc, V_{CE} = 10 Vdc) (Note 1)	h_{FE}	 35 50 75 35 100 50 40	 – – – – 300 – –	–
Collector – Emitter Saturation Voltage (Note 1) (I_C = 150 mAdc, I_B = 15 mAdc) (I_C = 500 mAdc, I_B = 50 mAdc)	$V_{CE(sat)}$	 – –	 0.3 1.0	Vdc
Base – Emitter Saturation Voltage (Note 1) (I_C = 150 mAdc, I_B = 15 mAdc) (I_C = 500 mAdc, I_B = 50 mAdc)	$V_{BE(sat)}$	 0.6 –	 1.2 2.0	Vdc
SMALL−SIGNAL CHARACTERISTICS				
Current – Gain – Bandwidth Product (Note 2) (I_C = 20 mAdc, V_{CE} = 20 Vdc, f = 100 MHz)C	f_T	300	–	MHz
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1.0 MHz)	C_{obo}	–	8.0	pF
Input Capacitance (V_{EB} = 0.5 Vdc, I_C = 0, f = 1.0 MHz)	C_{ibo}	–	25	pF
Input Impedance (I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz) (I_C = 10 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)	h_{ie}	 2.0 0.25	 8.0 1.25	kΩ
Voltage Feedback Ratio (I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz) (I_C = 10 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)	h_{re}	 – –	 8.0 4.0	X 10^{-4}
Small−Signal Current Gain (I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz) (I_C = 10 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)	h_{fe}	 50 75	 300 375	–
Output Admittance (I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz) (I_C = 10 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)	h_{oe}	 5.0 25	 35 200	μMhos
Collector Base Time Constant (I_E = 20 mAdc, V_{CB} = 20 Vdc, f = 31.8 MHz)	$rb'C_c$	–	150	ps
Noise Figure (I_C = 100 μAdc, V_{CE} = 10 Vdc, R_S = 1.0 kΩ, f = 1.0 kHz)	N_F	–	4.0	dB

1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.
2. f_T is defined as the frequency at which $|h_{fe}|$ extrapolates to unity.

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) (Continued)

Characteristic		Symbol	Min	Max	Unit
SWITCHING CHARACTERISTICS					
Delay Time	(V_{CC} = 30 Vdc, $V_{BE(off)}$ = −2.0 Vdc, I_C = 150 mAdc, I_{B1} = 15 mAdc) (Figure 1)	t_d	–	10	ns
Rise Time		t_r	–	25	ns
Storage Time	(V_{CC} = 30 Vdc, I_C = 150 mAdc, I_{B1} = I_{B2} = 15 mAdc) (Figure 2)	t_s	–	225	ns
Fall Time		t_f	–	60	ns

SWITCHING TIME EQUIVALENT TEST CIRCUITS

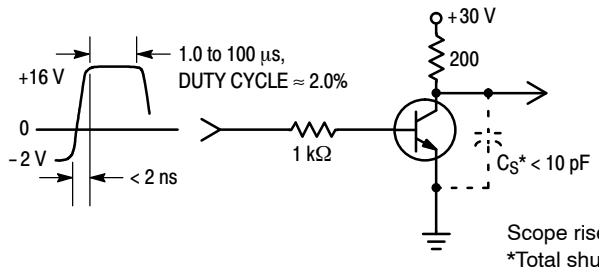
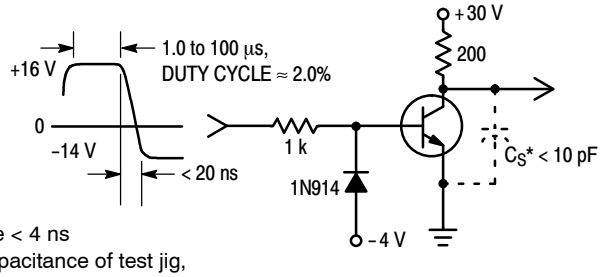


Figure 1. Turn−On Time



Scope rise time < 4 ns
*Total shunt capacitance of test jig, connectors, and oscilloscope.

Figure 2. Turn−Off Time

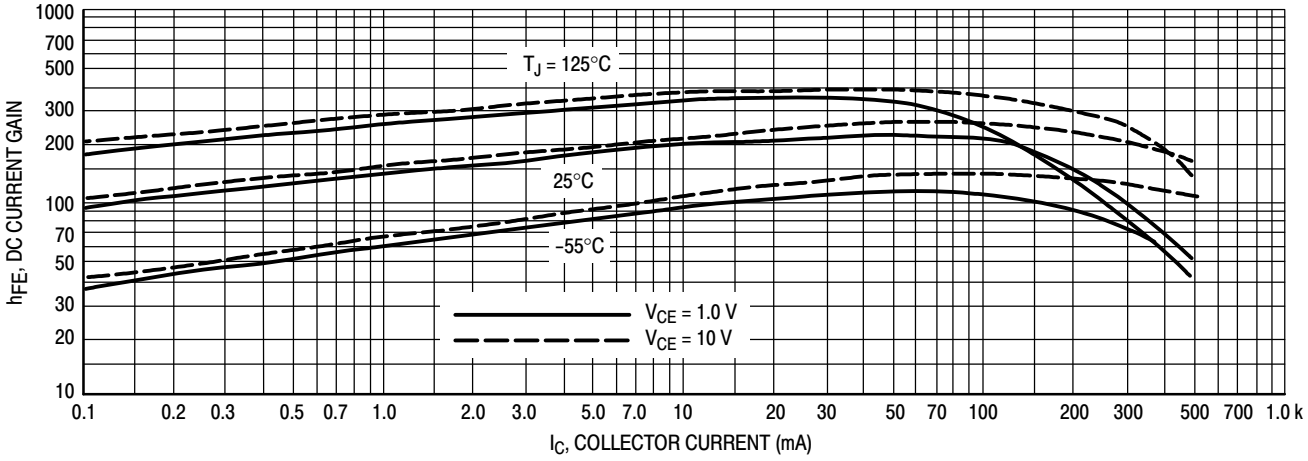


Figure 3. DC Current Gain

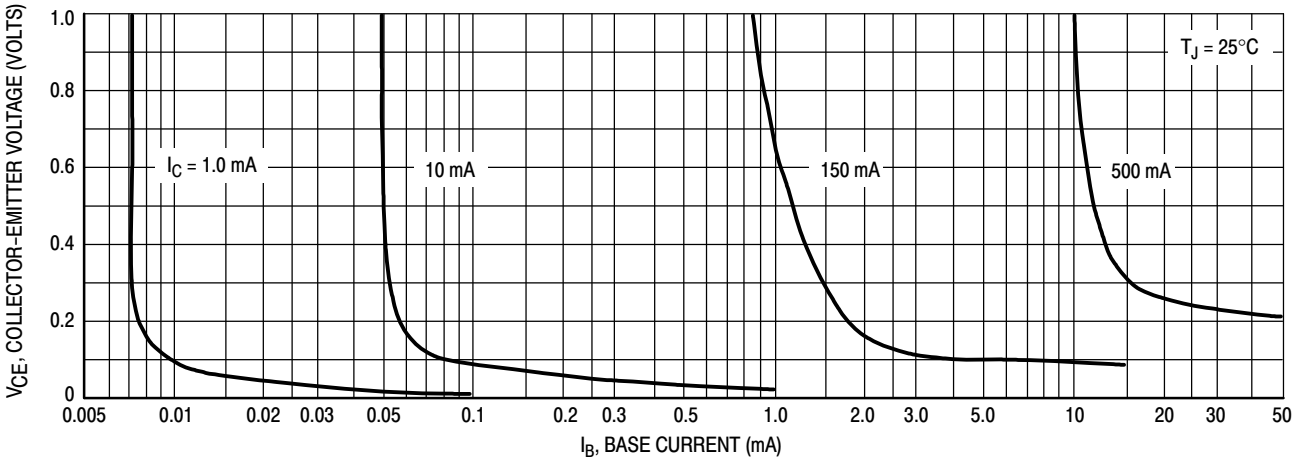


Figure 4. Collector Saturation Region

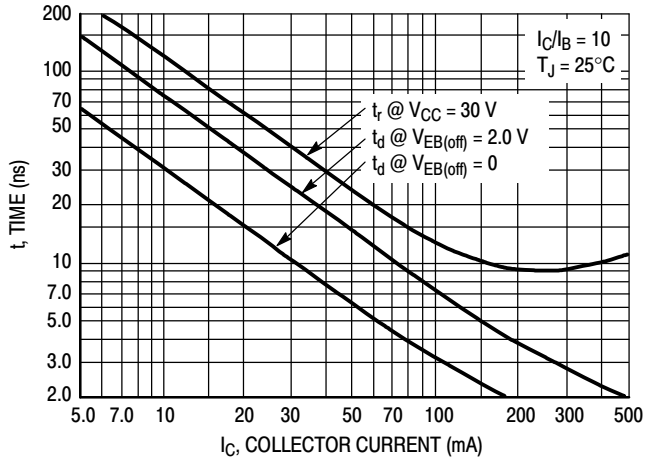


Figure 5. Turn – On Time

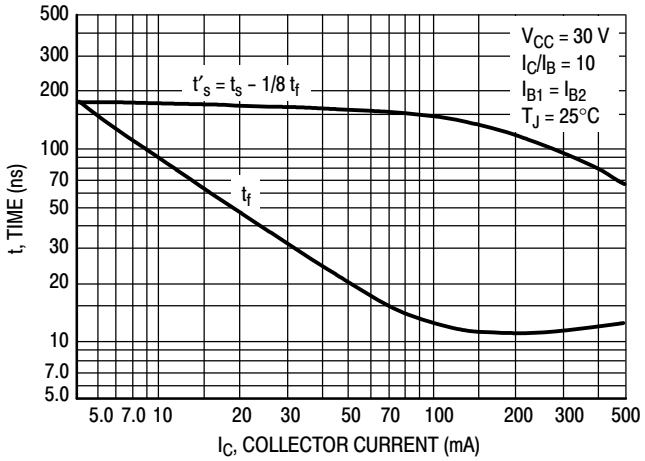


Figure 6. Turn – Off Time

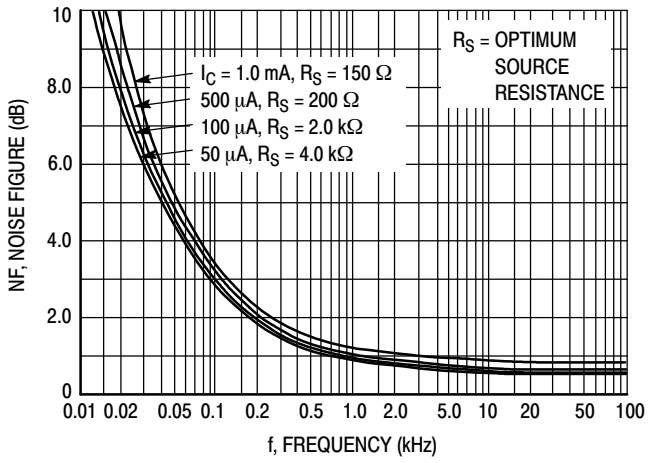


Figure 7. Frequency Effects

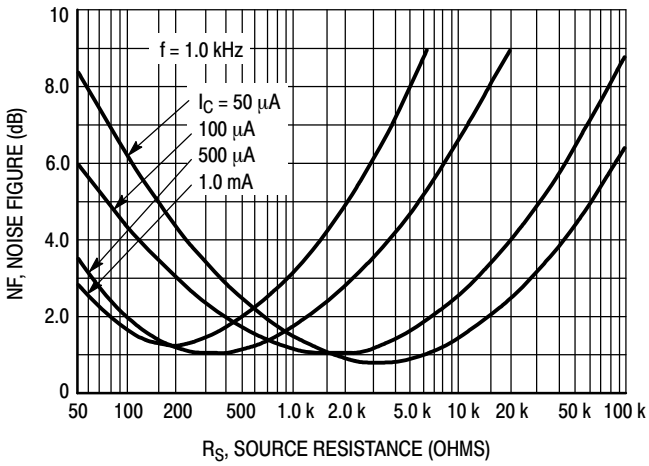


Figure 8. Source Resistance Effects

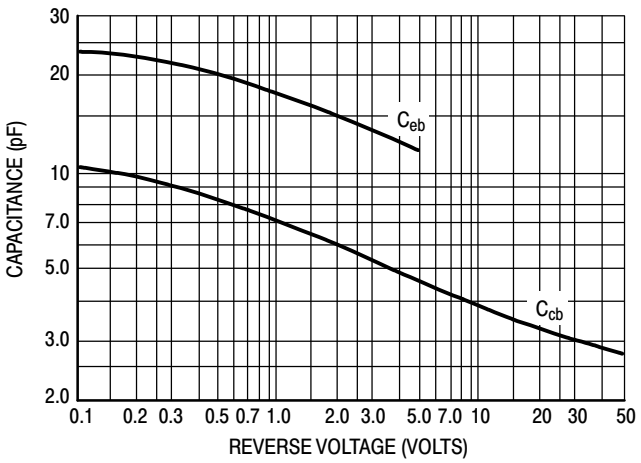


Figure 9. Capacitances

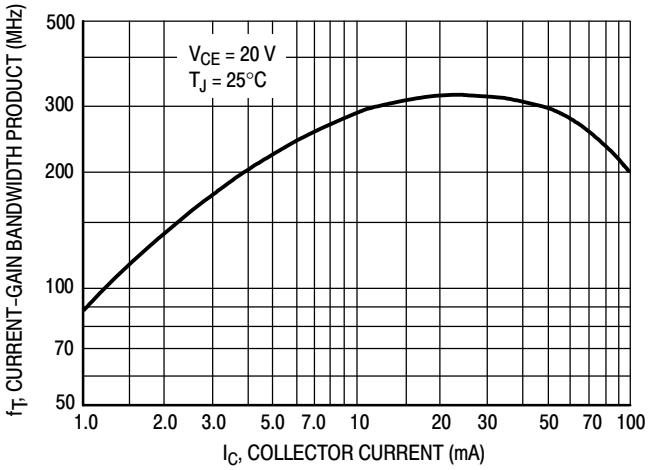


Figure 10. Current−Gain Bandwidth Product

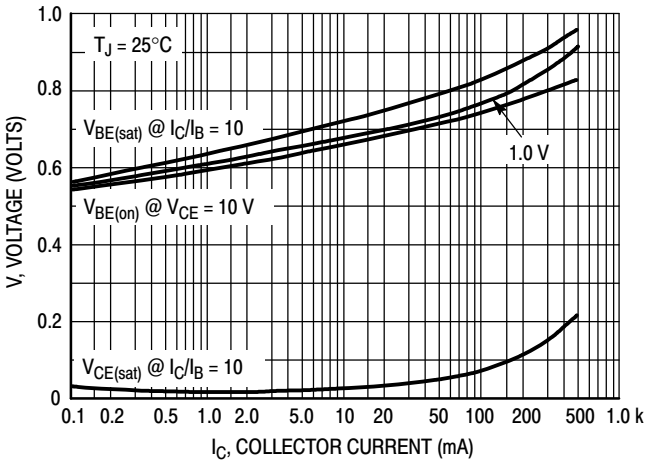


Figure 11. “On” Voltages

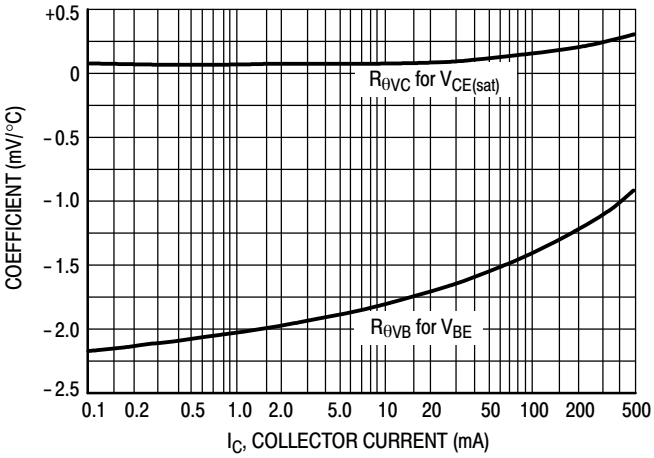
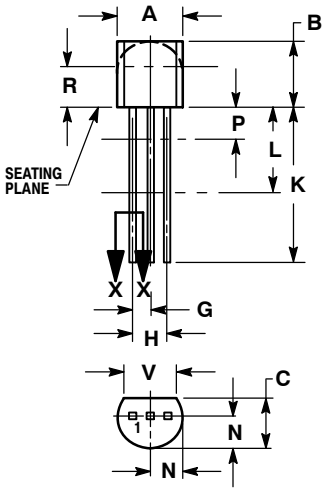


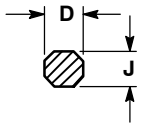
Figure 12. Temperature Coefficients

PACKAGE DIMENSIONS

TO−92 (TO−226)
CASE 29−11
ISSUE AM



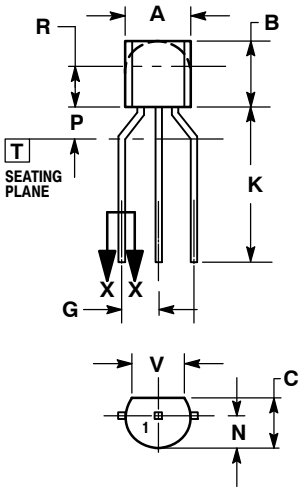
STRAIGHT LEAD
BULK PACK



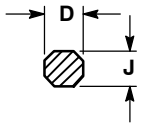
SECTION X−X

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.175	0.205	4.45	5.20
B	0.170	0.210	4.32	5.33
C	0.125	0.165	3.18	4.19
D	0.016	0.021	0.407	0.533
G	0.045	0.055	1.15	1.39
H	0.095	0.105	2.42	2.66
J	0.015	0.020	0.39	0.50
K	0.500	---	12.70	---
L	0.250	---	6.35	---
N	0.080	0.105	2.04	2.66
P	---	0.100	---	2.54
R	0.115	---	2.93	---
V	0.135	---	3.43	---



BENT LEAD
TAPE & REEL
AMMO PACK



SECTION X−X

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

	MILLIMETERS	
DIM	MIN	MAX
A	4.45	5.20
B	4.32	5.33
C	3.18	4.19
D	0.40	0.54
G	2.40	2.80
J	0.39	0.50
K	12.70	---
N	2.04	2.66
P	1.50	4.00
R	2.93	---
V	3.43	---

STYLE 17:
PIN 1. COLLECTOR
2. BASE
3. EMITTER

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81−3−5817−1050

ON Semiconductor Website: **www.onsemi.com**

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative

P2N2222A/D

2N3903, 2N3904

General Purpose Transistors

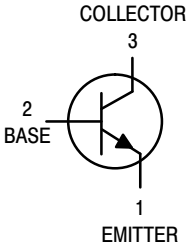
NPN Silicon

Features

- Pb−Free Packages are Available*

ON Semiconductor®

http://onsemi.com



MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector − Emitter Voltage	V_{CEO}	40	Vdc
Collector − Base Voltage	V_{CBO}	60	Vdc
Emitter − Base Voltage	V_{EBO}	6.0	Vdc
Collector Current − Continuous	I_C	200	mAdc
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	 625 5.0	 mW mW/°C
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	 1.5 12	 W mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−55 to +150	°C

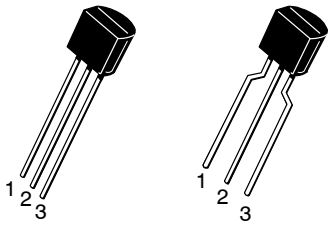
THERMAL CHARACTERISTICS (Note 1)

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction−to−Ambient	$R_{\theta JA}$	200	°C/W
Thermal Resistance, Junction−to−Case	$R_{\theta JC}$	83.3	°C/W

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Indicates Data in addition to JEDEC Requirements.

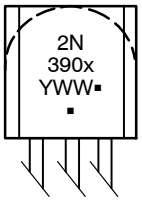
TO−92
CASE 29
STYLE 1



STRAIGHT LEAD
BULK PACK

BENT LEAD
TAPE & REEL
AMMO PACK

MARKING DIAGRAMS



x = 3 or 4
Y = Year
WW = Work Week
▪ = Pb−Free Package
(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 3 of this data sheet.

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector – Emitter Breakdown Voltage (Note 2) (I_C = 1.0 mAdc, I_B = 0)		$V_{(BR)CEO}$	40	–	Vdc
Collector – Base Breakdown Voltage (I_C = 10 μAdc, I_E = 0)		$V_{(BR)CBO}$	60	–	Vdc
Emitter – Base Breakdown Voltage (I_E = 10 μAdc, I_C = 0)		$V_{(BR)EBO}$	6.0	–	Vdc
Base Cutoff Current (V_{CE} = 30 Vdc, V_{EB} = 3.0 Vdc)		I_{BL}	–	50	nAdc
Collector Cutoff Current (V_{CE} = 30 Vdc, V_{EB} = 3.0 Vdc)		I_{CEX}	–	50	nAdc
ON CHARACTERISTICS					
DC Current Gain (Note 2)		h_{FE}			–
(I_C = 0.1 mAdc, V_{CE} = 1.0 Vdc)	2N3903		20	–	
	2N3904		40	–	
(I_C = 1.0 mAdc, V_{CE} = 1.0 Vdc)	2N3903		35	–	
	2N3904		70	–	
(I_C = 10 mAdc, V_{CE} = 1.0 Vdc)	2N3903		50	150	
	2N3904		100	300	
(I_C = 50 mAdc, V_{CE} = 1.0 Vdc)	2N3903		30	–	
	2N3904		60	–	
(I_C = 100 mAdc, V_{CE} = 1.0 Vdc)	2N3903		15	–	
	2N3904		30	–	
Collector – Emitter Saturation Voltage (Note 2)		$V_{CE(sat)}$			Vdc
(I_C = 10 mAdc, I_B = 1.0 mAdc)			–	0.2	
(I_C = 50 mAdc, I_B = 5.0 mAdc			–	0.3	
Base – Emitter Saturation Voltage (Note 2)		$V_{BE(sat)}$			Vdc
(I_C = 10 mAdc, I_B = 1.0 mAdc)			0.65	0.85	
(I_C = 50 mAdc, I_B = 5.0 mAdc)			–	0.95	
SMALL–SIGNAL CHARACTERISTICS					
Current – Gain – Bandwidth Product		f_T			MHz
(I_C = 10 mAdc, V_{CE} = 20 Vdc, f = 100 MHz)	2N3903		250	–	
	2N3904		300	–	
Output Capacitance (V_{CB} = 5.0 Vdc, I_E = 0, f = 1.0 MHz)		C_{obo}	–	4.0	pF
Input Capacitance (V_{EB} = 0.5 Vdc, I_C = 0, f = 1.0 MHz)		C_{ibo}	–	8.0	pF
Input Impedance		h_{ie}			k Ω
(I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)	2N3903		1.0	8.0	
	2N3904		1.0	10	
Voltage Feedback Ratio		h_{re}			X 10^{-4}
(I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)	2N3903		0.1	5.0	
	2N3904		0.5	8.0	
Small–Signal Current Gain		h_{fe}			–
(I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)	2N3903		50	200	
	2N3904		100	400	
Output Admittance (I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)		h_{oe}	1.0	40	μmhos
Noise Figure		NF			dB
(I_C = 100 μAdc, V_{CE} = 5.0 Vdc, R_S = 1.0 k Ω, f = 1.0 kHz)	2N3903		–	6.0	
	2N3904		–	5.0	

SWITCHING CHARACTERISTICS

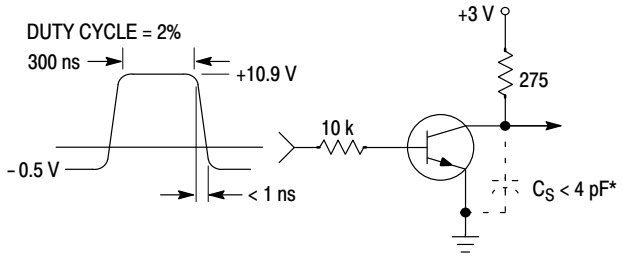
Delay Time	(V_{CC} = 3.0 Vdc, V_{BE} = 0.5 Vdc, I_C = 10 mAdc, I_{B1} = 1.0 mAdc)	t_d	–	35	ns
Rise Time		t_r	–	35	ns
Storage Time	(V_{CC} = 3.0 Vdc, I_C = 10 mAdc, I_{B1} = I_{B2} = 1.0 mAdc) 2N3903	t_s	–	175	ns
	2N3904		–	200	
Fall Time		t_f	–	50	ns

2. Pulse Test: Pulse Width ≤ 300 μs; Duty Cycle ≤ 2%.

ORDERING INFORMATION

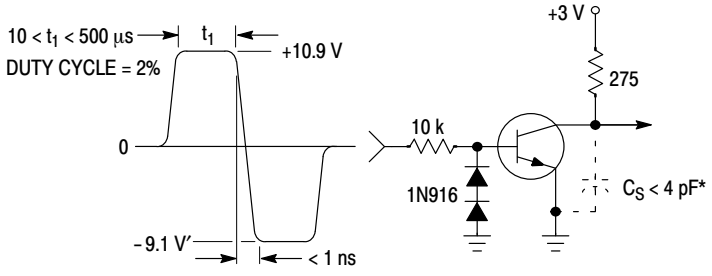
Device	Package	Shipping†
2N3903RLRM	TO−92	2000 / Ammo Pack
2N3904	TO−92	5000 Units / Bulk
2N3904G	TO−92 (Pb−Free)	5000 Units / Bulk
2N3904RLRA	TO−92	2000 / Tape & Reel
2N3904RLRAG	TO−92 (Pb−Free)	2000 / Tape & Reel
2N3904RLRM	TO−92	2000 / Ammo Pack
2N3904RLRMG	TO−92 (Pb−Free)	2000 / Ammo Pack
2N3904RLRP	TO−92	2000 / Ammo Pack
2N3904RLRPG	TO−92 (Pb−Free)	2000 / Ammo Pack
2N3904RL1G	TO−92 (Pb−Free)	2000 / Tape & Reel
2N3904ZL1	TO−92	2000 / Ammo Pack
2N3904ZL1G	TO−92 (Pb−Free)	2000 / Ammo Pack

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.



* Total shunt capacitance of test jig and connectors

Figure 1. Delay and Rise Time Equivalent Test Circuit



* Total shunt capacitance of test jig and connectors

Figure 2. Storage and Fall Time Equivalent Test Circuit

TYPICAL TRANSIENT CHARACTERISTICS

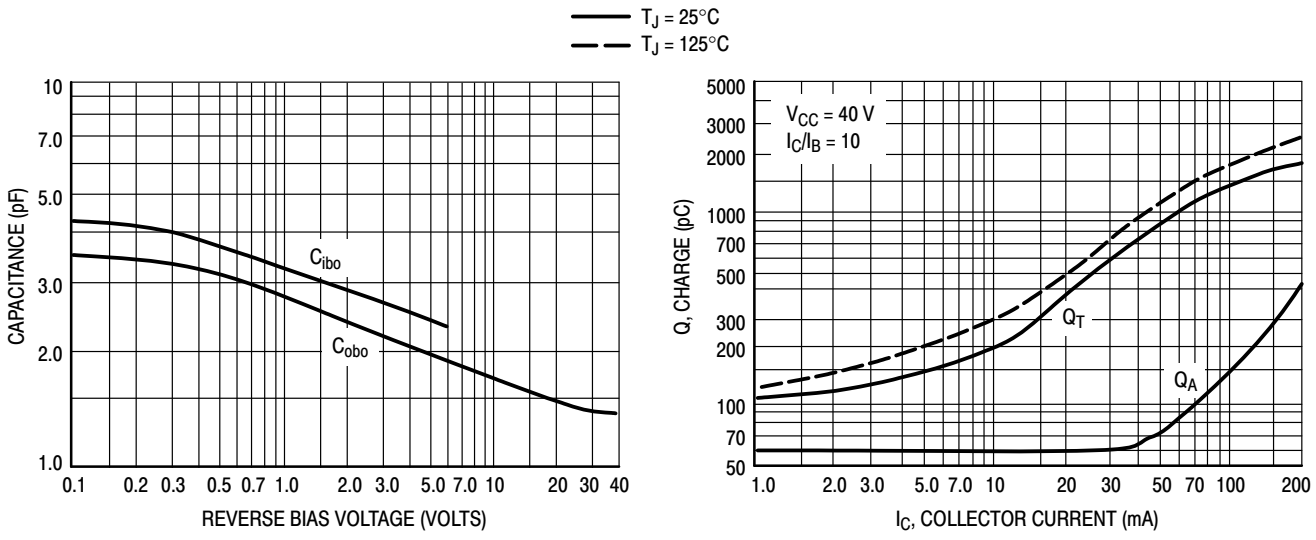


Figure 3. Capacitance

Figure 4. Charge Data

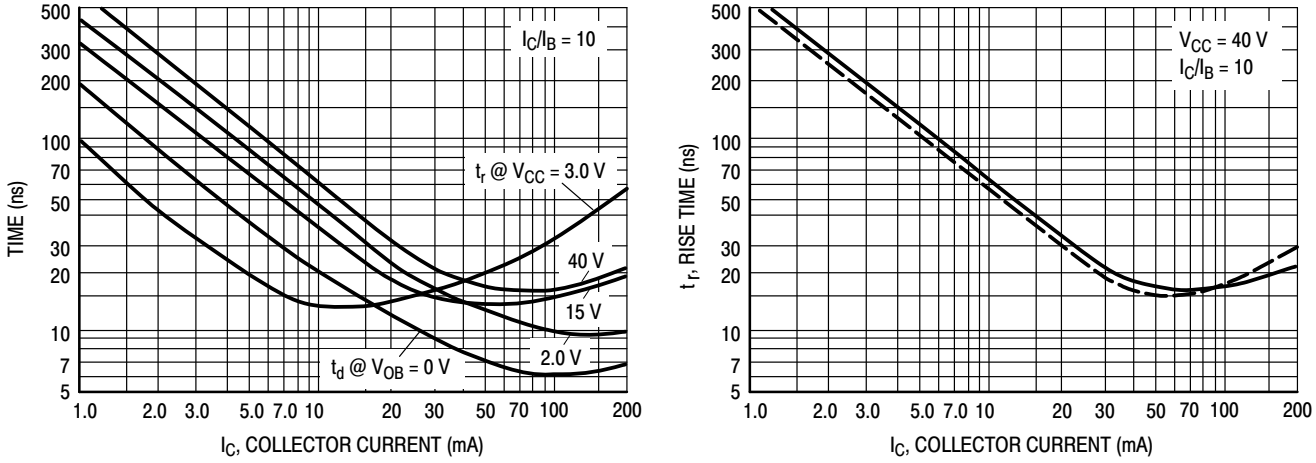


Figure 5. Turn – On Time

Figure 6. Rise Time

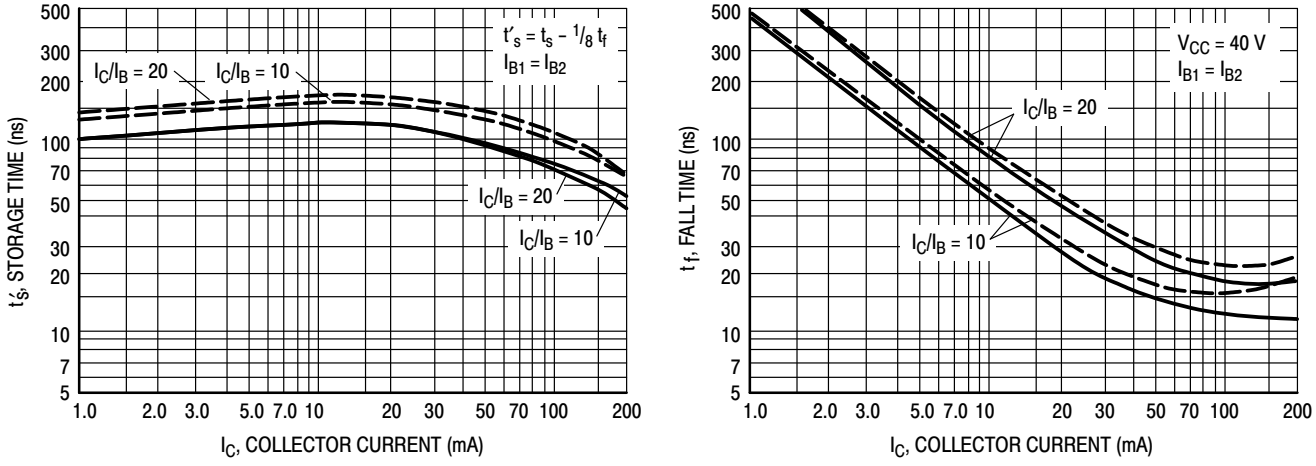


Figure 7. Storage Time

Figure 8. Fall Time

TYPICAL AUDIO SMALL−SIGNAL CHARACTERISTICS
NOISE FIGURE VARIATIONS

(V_{CE} = 5.0 Vdc, T_A = 25°C, Bandwidth = 1.0 Hz)

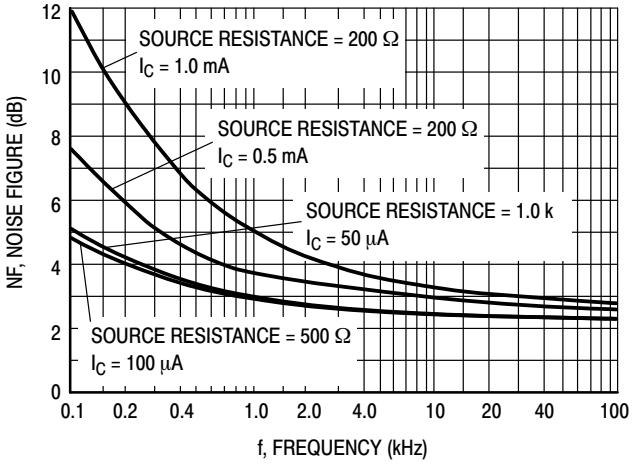


Figure 9.

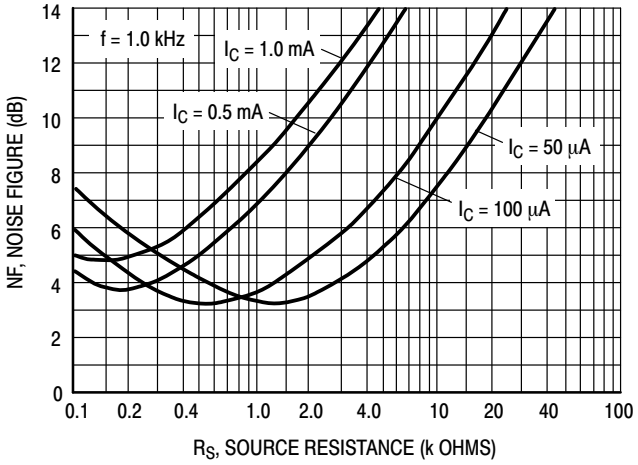


Figure 10.

h PARAMETERS

(V_{CE} = 10 Vdc, f = 1.0 kHz, T_A = 25°C)

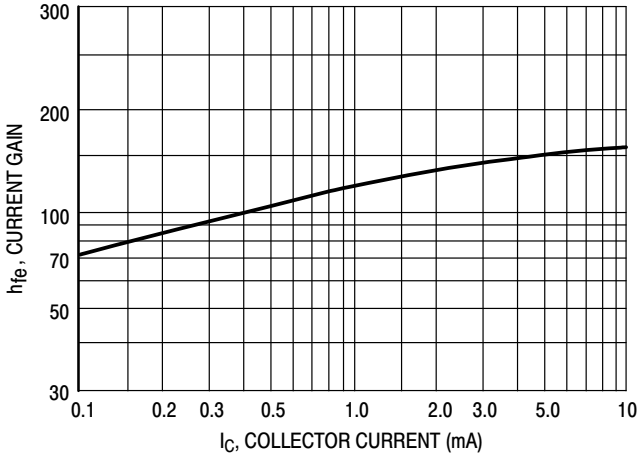


Figure 11. Current Gain

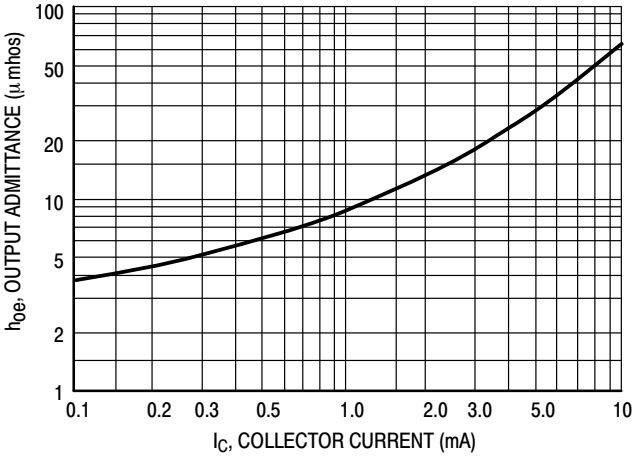


Figure 12. Output Admittance

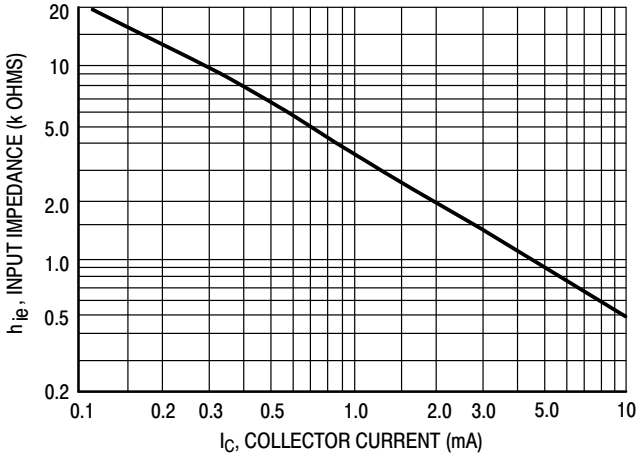


Figure 13. Input Impedance

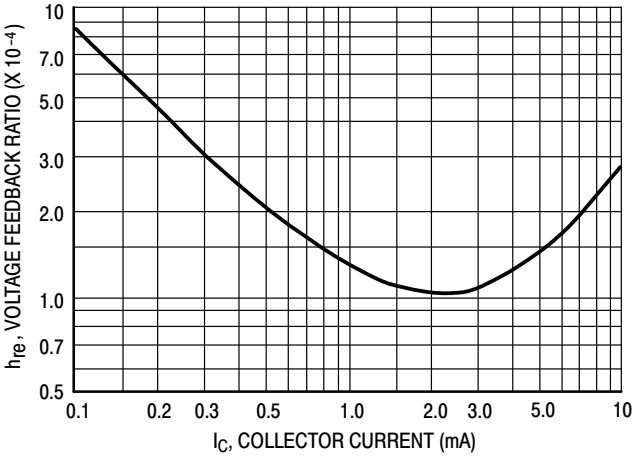


Figure 14. Voltage Feedback Ratio

TYPICAL STATIC CHARACTERISTICS

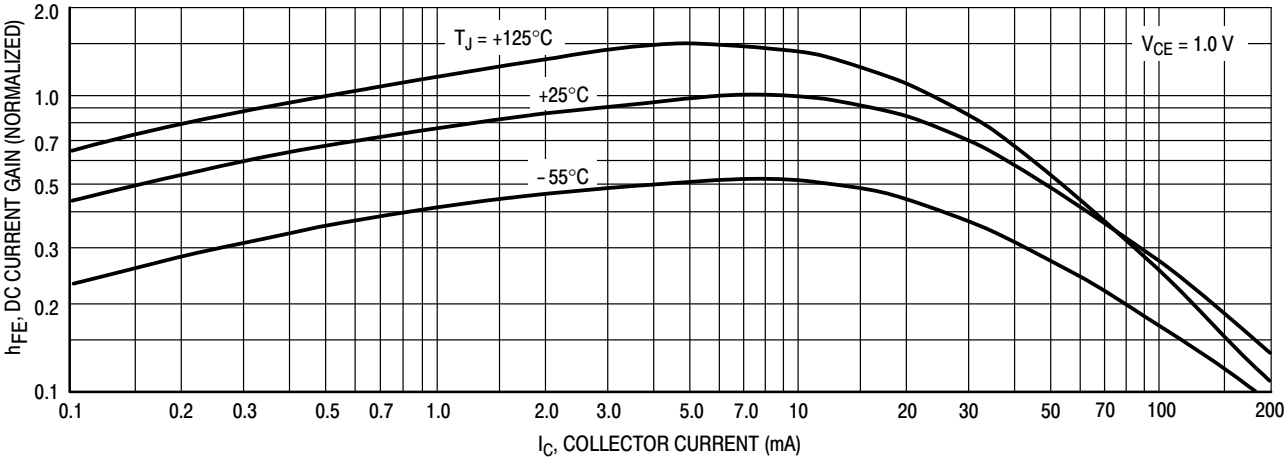


Figure 15. DC Current Gain

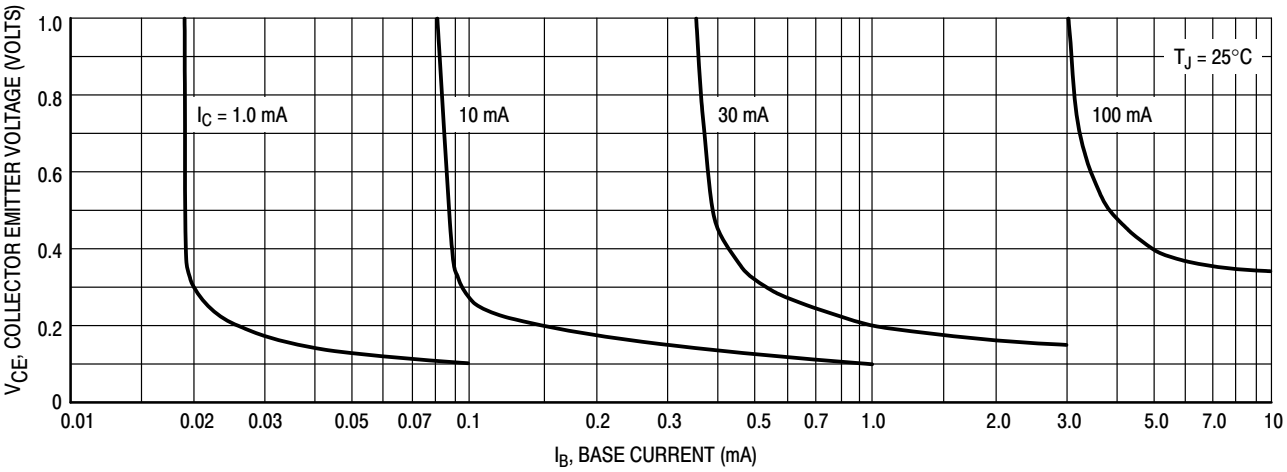


Figure 16. Collector Saturation Region

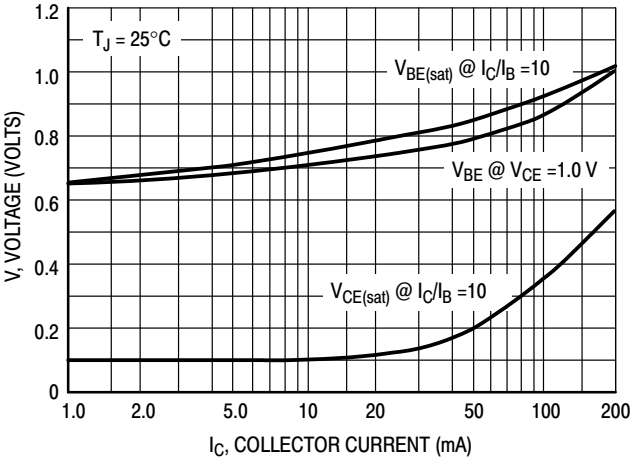


Figure 17. “ON” Voltages

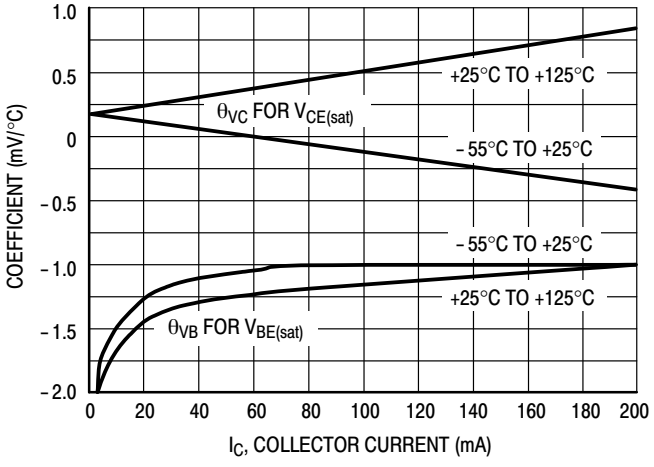
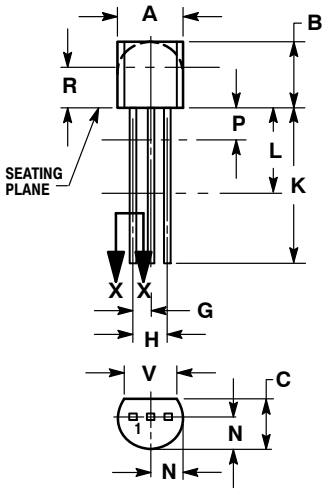


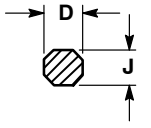
Figure 18. Temperature Coefficients

PACKAGE DIMENSIONS

TO−92 (TO−226)
CASE 29−11
ISSUE AM



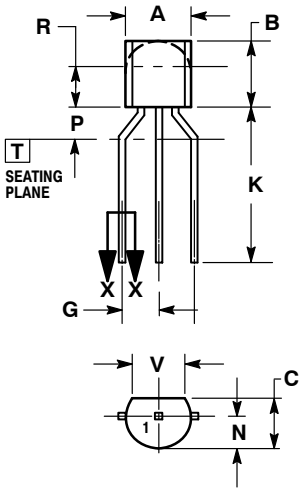
STRAIGHT LEAD
BULK PACK



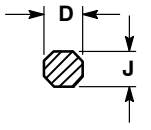
SECTION X−X

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.175	0.205	4.45	5.20
B	0.170	0.210	4.32	5.33
C	0.125	0.165	3.18	4.19
D	0.016	0.021	0.407	0.533
G	0.045	0.055	1.15	1.39
H	0.095	0.105	2.42	2.66
J	0.015	0.020	0.39	0.50
K	0.500	---	12.70	---
L	0.250	---	6.35	---
N	0.080	0.105	2.04	2.66
P	---	0.100	---	2.54
R	0.115	---	2.93	---
V	0.135	---	3.43	---



BENT LEAD
TAPE & REEL
AMMO PACK



SECTION X−X

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

	MILLIMETERS	
DIM	MIN	MAX
A	4.45	5.20
B	4.32	5.33
C	3.18	4.19
D	0.40	0.54
G	2.40	2.80
J	0.39	0.50
K	12.70	---
N	2.04	2.66
P	1.50	4.00
R	2.93	---
V	3.43	---

STYLE 1:
PIN 1. EMITTER
2. BASE
3. COLLECTOR

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81−3−5817−1050

ON Semiconductor Website: **www.onsemi.com**

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative

2N3906

General Purpose Transistors

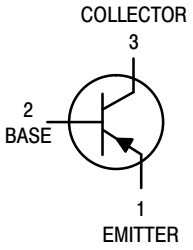
PNP Silicon

ON Semiconductor®

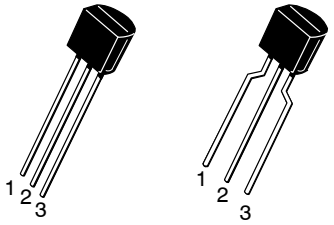
http://onsemi.com

Features

- Pb−Free Packages are Available*



TO−92
CASE 29
STYLE 1



STRAIGHT LEAD
BULK PACK

BENT LEAD
TAPE & REEL
AMMO PACK

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector − Emitter Voltage	V_{CEO}	40	Vdc
Collector − Base Voltage	V_{CBO}	40	Vdc
Emitter − Base Voltage	V_{EBO}	5.0	Vdc
Collector Current − Continuous	I_C	200	mAdc
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	625 5.0	mW mW/°C
Total Power Dissipation @ T_A = 60°C	P_D	250	mW
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	1.5 12	W mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−55 to +150	°C

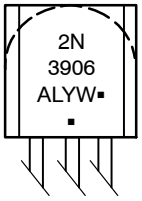
THERMAL CHARACTERISTICS (Note 1)

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction−to−Ambient	$R_{\theta JA}$	200	°C/W
Thermal Resistance, Junction−to−Case	$R_{\theta JC}$	83.3	°C/W

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Indicates Data in addition to JEDEC Requirements.

MARKING DIAGRAM



A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
▪ = Pb−Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 3 of this data sheet.

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

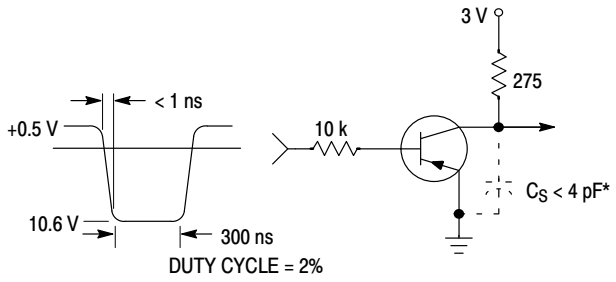
Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector – Emitter Breakdown Voltage (Note 2)	(I_C = 1.0 mAdc, I_B = 0)	$V_{(BR)CEO}$	40	–	Vdc
Collector – Base Breakdown Voltage	(I_C = 10 μAdc, I_E = 0)	$V_{(BR)CBO}$	40	–	Vdc
Emitter – Base Breakdown Voltage	(I_E = 10 μAdc, I_C = 0)	$V_{(BR)EBO}$	5.0	–	Vdc
Base Cutoff Current	(V_{CE} = 30 Vdc, V_{EB} = 3.0 Vdc)	I_{BL}	–	50	nAdc
Collector Cutoff Current	(V_{CE} = 30 Vdc, V_{EB} = 3.0 Vdc)	I_{CEX}	–	50	nAdc
ON CHARACTERISTICS (Note 2)					
DC Current Gain	(I_C = 0.1 mAdc, V_{CE} = 1.0 Vdc) (I_C = 1.0 mAdc, V_{CE} = 1.0 Vdc) (I_C = 10 mAdc, V_{CE} = 1.0 Vdc) (I_C = 50 mAdc, V_{CE} = 1.0 Vdc) (I_C = 100 mAdc, V_{CE} = 1.0 Vdc)	h_{FE}	60 80 100 60 30	– – 300 – –	–
Collector – Emitter Saturation Voltage	(I_C = 10 mAdc, I_B = 1.0 mAdc) (I_C = 50 mAdc, I_B = 5.0 mAdc	$V_{CE(sat)}$	– –	0.25 0.4	Vdc
Base – Emitter Saturation Voltage	(I_C = 10 mAdc, I_B = 1.0 mAdc) (I_C = 50 mAdc, I_B = 5.0 mAdc)	$V_{BE(sat)}$	0.65 –	0.85 0.95	Vdc
SMALL–SIGNAL CHARACTERISTICS					
Current – Gain – Bandwidth Product	(I_C = 10 mAdc, V_{CE} = 20 Vdc, f = 100 MHz)	f_T	250	–	MHz
Output Capacitance	(V_{CB} = 5.0 Vdc, I_E = 0, f = 1.0 MHz)	C_{obo}	–	4.5	pF
Input Capacitance	(V_{EB} = 0.5 Vdc, I_C = 0, f = 1.0 MHz)	C_{ibo}	–	10	pF
Input Impedance	(I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)	h_{ie}	2.0	12	kΩ
Voltage Feedback Ratio	(I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)	h_{re}	0.1	10	X 10^{-4}
Small–Signal Current Gain	(I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)	h_{fe}	100	400	–
Output Admittance	(I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)	h_{oe}	3.0	60	μmhos
Noise Figure	(I_C = 100 μAdc, V_{CE} = 5.0 Vdc, R_S = 1.0 kΩ, f = 1.0 kHz)	NF	–	4.0	dB
SWITCHING CHARACTERISTICS					
Delay Time	(V_{CC} = 3.0 Vdc, V_{BE} = 0.5 Vdc, I_C = 10 mAdc, I_{B1} = 1.0 mAdc)	t_d	–	35	ns
Rise Time		t_r	–	35	ns
Storage Time	(V_{CC} = 3.0 Vdc, I_C = 10 mAdc, I_{B1} = I_{B2} = 1.0 mAdc)	t_s	–	225	ns
Fall Time	(V_{CC} = 3.0 Vdc, I_C = 10 mAdc, I_{B1} = I_{B2} = 1.0 mAdc)	t_f	–	75	ns

2. Pulse Test: Pulse Width ≤ 300 μs; Duty Cycle ≤ 2%.

ORDERING INFORMATION

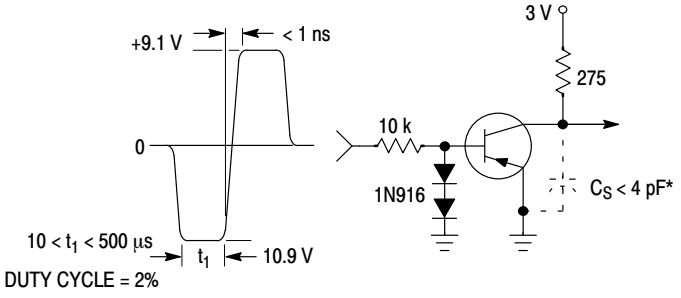
Device	Package	Shipping†
2N3906	TO−92	5000 Units / Bulk
2N3906G	TO−92 (Pb−Free)	5000 Units / Bulk
2N3906RL1	TO−92	2000 / Tape & Reel
2N3906RL1G	TO−92 (Pb−Free)	2000 / Tape & Reel
2N3906RLRA	TO−92	2000 / Tape & Reel
2N3906RLRAG	TO−92 (Pb−Free)	2000 / Tape & Reel
2N3906RLRM	TO−92	2000 / Tape & Ammo Box
2N3906RLRMG	TO−92 (Pb−Free)	2000 / Tape & Ammo Box
2N3906RLRP	TO−92	2000 / Tape & Ammo Box
2N3906RLRPG	TO−92 (Pb−Free)	2000 / Tape & Ammo Box

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.



* Total shunt capacitance of test jig and connectors

Figure 1. Delay and Rise Time Equivalent Test Circuit



* Total shunt capacitance of test jig and connectors

Figure 2. Storage and Fall Time Equivalent Test Circuit

TYPICAL TRANSIENT CHARACTERISTICS

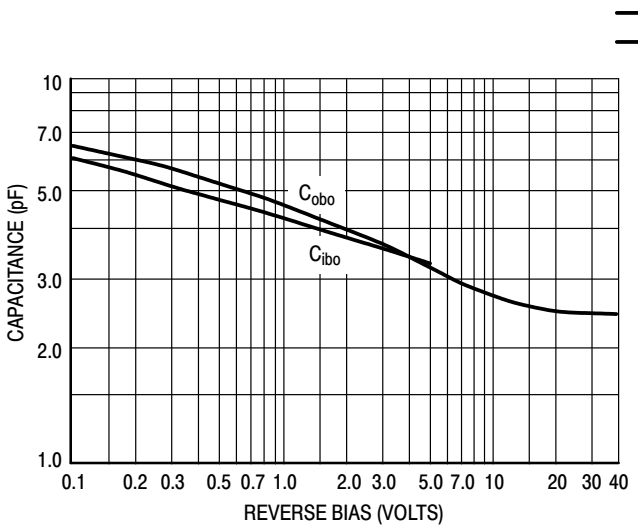


Figure 3. Capacitance

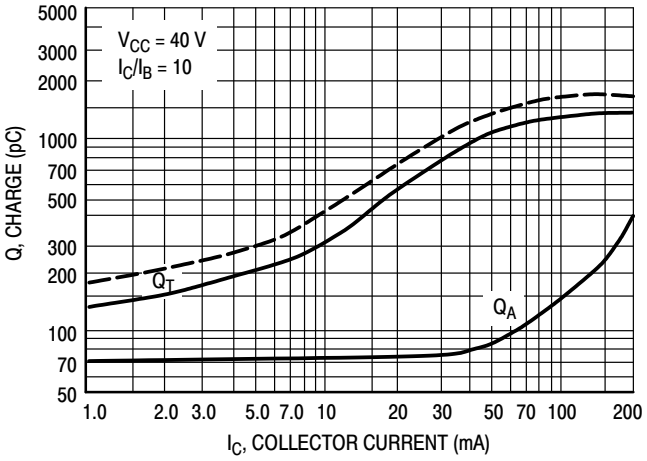


Figure 4. Charge Data

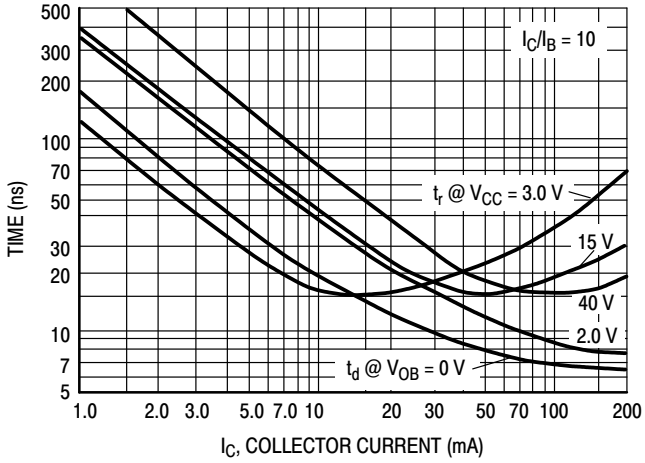


Figure 5. Turn – On Time

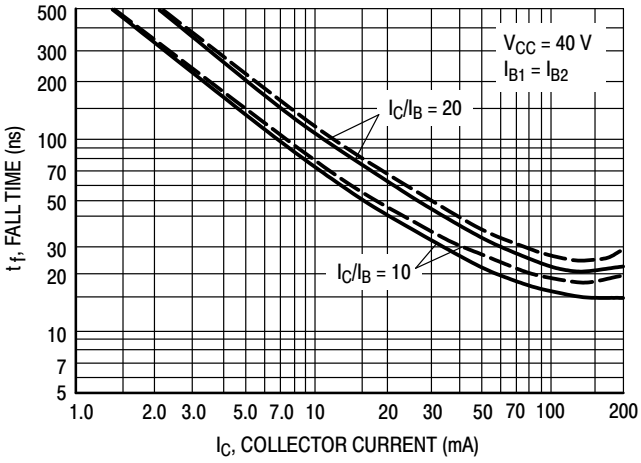


Figure 6. Fall Time

TYPICAL AUDIO SMALL−SIGNAL CHARACTERISTICS
NOISE FIGURE VARIATIONS

(V_{CE} = −5.0 Vdc, T_A = 25°C, Bandwidth = 1.0 Hz)

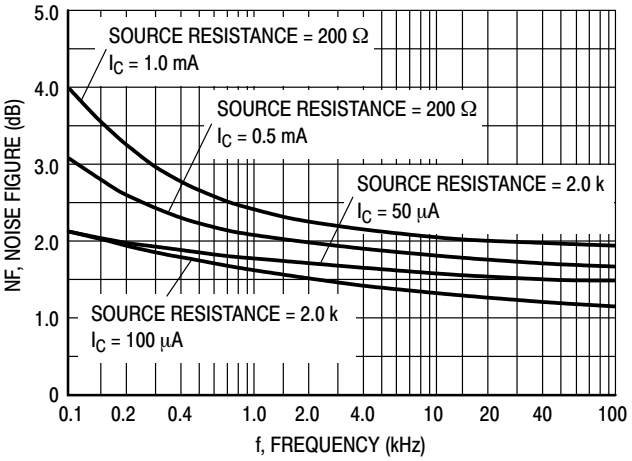


Figure 7.

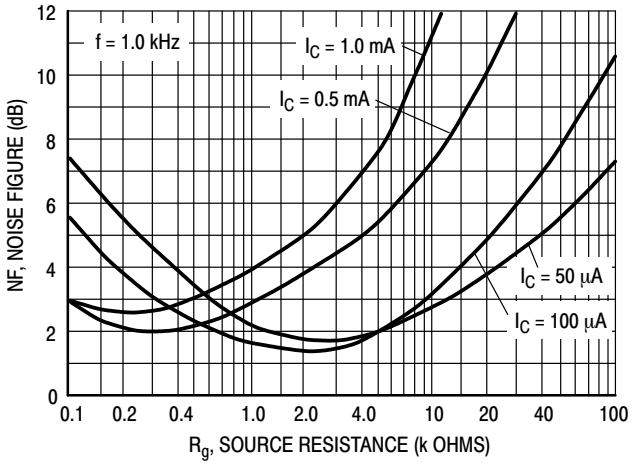


Figure 8.

h PARAMETERS

(V_{CE} = −10 Vdc, f = 1.0 kHz, T_A = 25°C)

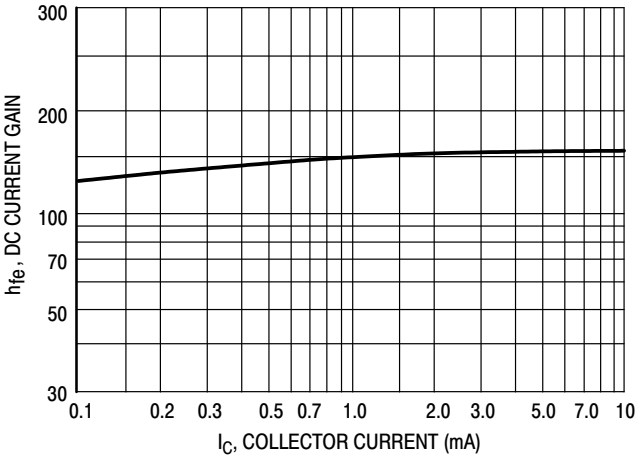


Figure 9. Current Gain

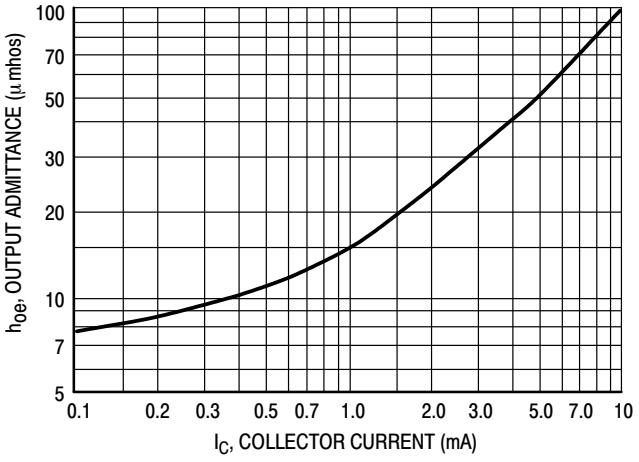


Figure 10. Output Admittance

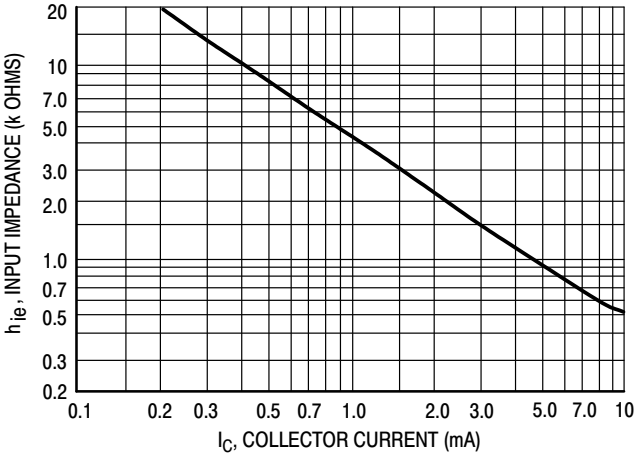


Figure 11. Input Impedance

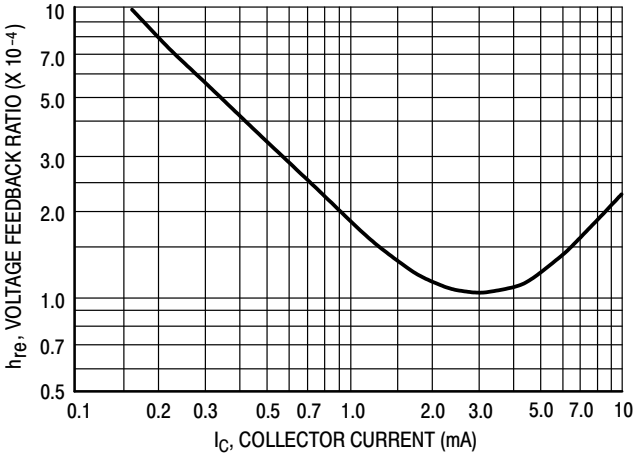


Figure 12. Voltage Feedback Ratio

TYPICAL STATIC CHARACTERISTICS

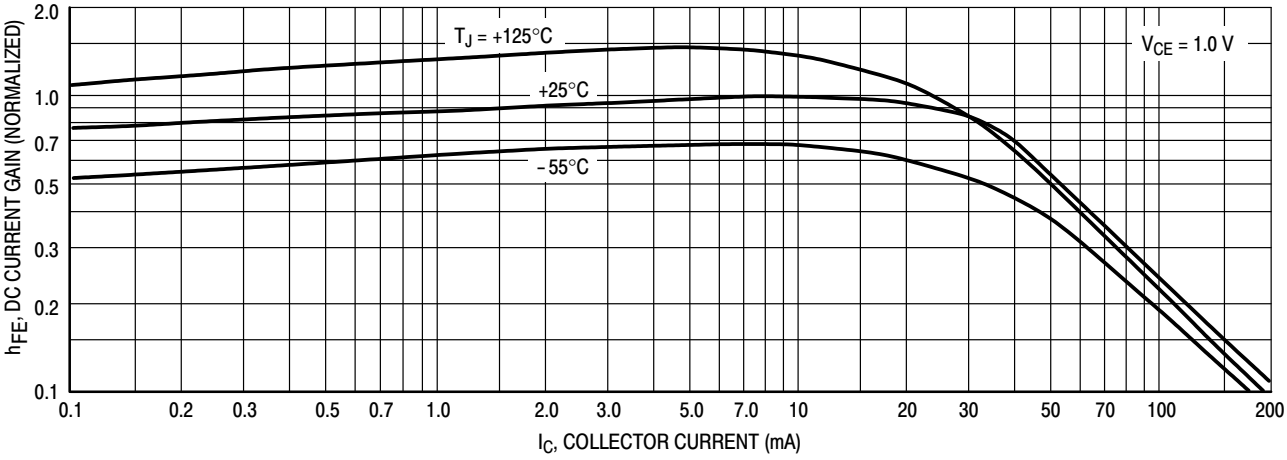


Figure 13. DC Current Gain

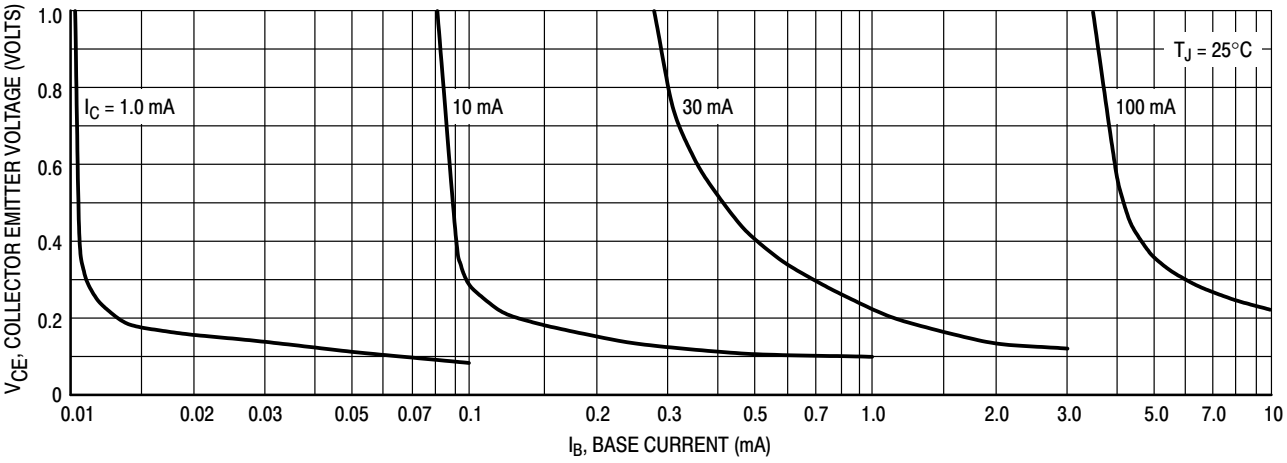


Figure 14. Collector Saturation Region

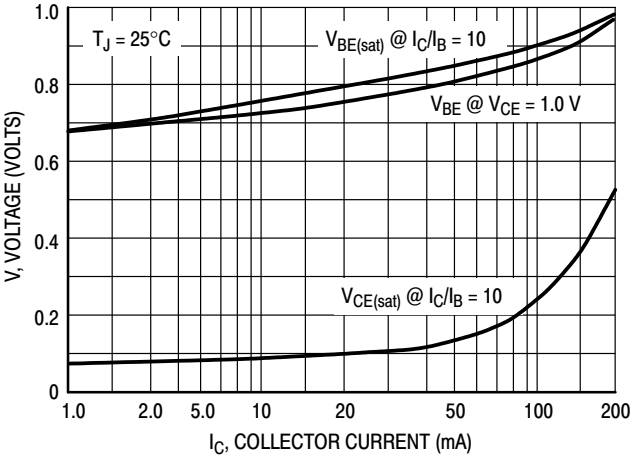


Figure 15. “ON” Voltages

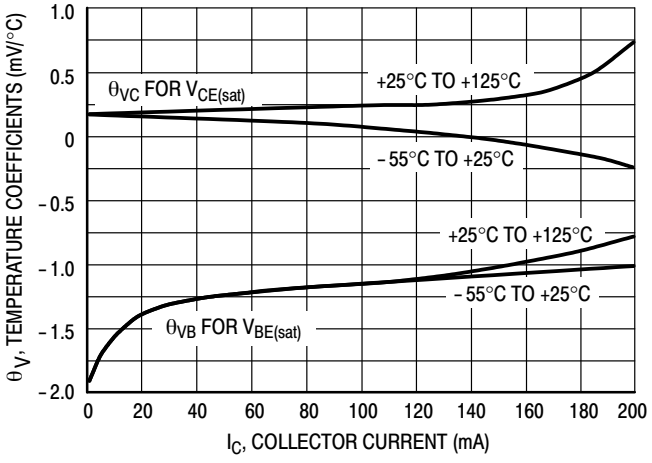
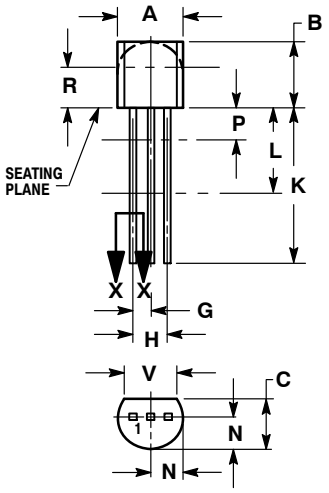


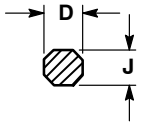
Figure 16. Temperature Coefficients

PACKAGE DIMENSIONS

TO−92 (TO−226)
CASE 29−11
ISSUE AM



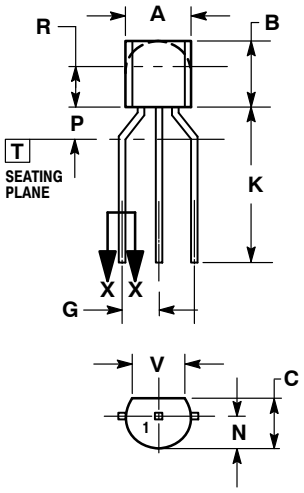
STRAIGHT LEAD
BULK PACK



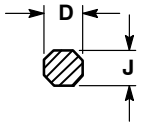
SECTION X−X

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.175	0.205	4.45	5.20
B	0.170	0.210	4.32	5.33
C	0.125	0.165	3.18	4.19
D	0.016	0.021	0.407	0.533
G	0.045	0.055	1.15	1.39
H	0.095	0.105	2.42	2.66
J	0.015	0.020	0.39	0.50
K	0.500	---	12.70	---
L	0.250	---	6.35	---
N	0.080	0.105	2.04	2.66
P	---	0.100	---	2.54
R	0.115	---	2.93	---
V	0.135	---	3.43	---



BENT LEAD
TAPE & REEL
AMMO PACK



SECTION X−X

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

	MILLIMETERS	
DIM	MIN	MAX
A	4.45	5.20
B	4.32	5.33
C	3.18	4.19
D	0.40	0.54
G	2.40	2.80
J	0.39	0.50
K	12.70	---
N	2.04	2.66
P	1.50	4.00
R	2.93	---
V	3.43	---

STYLE 1:
PIN 1. EMITTER
2. BASE
3. COLLECTOR

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81−3−5773−3850

ON Semiconductor Website: **www.onsemi.com**

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative

2N5401

Amplifier Transistors

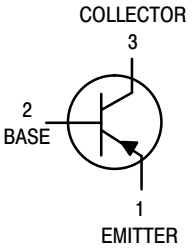
PNP Silicon

Features

- These are Pb−Free Devices*

ON Semiconductor®

http://onsemi.com



MAXIMUM RATINGS

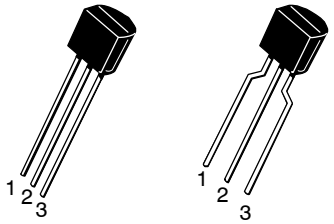
Rating	Symbol	Value	Unit
Collector − Emitter Voltage	V_{CEO}	150	Vdc
Collector − Base Voltage	V_{CBO}	160	Vdc
Emitter − Base Voltage	V_{EBO}	5.0	Vdc
Collector Current − Continuous	I_C	600	mAdc
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	625 5.0	mW mW/°C
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	1.5 12	W mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−55 to +150	°C

THERMAL CHARACTERISTICS

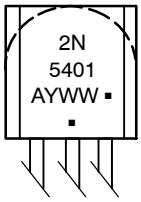
Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction−to−Ambient	$R_{\theta JA}$	200	°C/W
Thermal Resistance, Junction−to−Case	$R_{\theta JC}$	83.3	°C/W

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

TO−92
CASE 29
STYLE 1



MARKING DIAGRAM



A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb−Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector−Emitter Breakdown Voltage (Note 1) (I_C = 1.0 mAdc, I_B = 0)	$V_{(BR)CEO}$	150	–	Vdc
Collector−Base Breakdown Voltage (I_C = 100 μAdc, I_E = 0)	$V_{(BR)CBO}$	160	–	Vdc
Emitter−Base Breakdown Voltage (I_E = 10 μAdc, I_C = 0)	$V_{(BR)EBO}$	5.0	–	Vdc
Collector Cutoff Current (V_{CB} = 120 Vdc, I_E = 0) (V_{CB} = 120 Vdc, I_E = 0, T_A = 100°C)	I_{CBO}	– –	50 50	nAdc μAdc
Emitter Cutoff Current (V_{EB} = 3.0 Vdc, I_C = 0)	I_{EBO}	–	50	nAdc
ON CHARACTERISTICS (Note 1)				
DC Current Gain (I_C = 1.0 mAdc, V_{CE} = 5.0 Vdc) (I_C = 10 mAdc, V_{CE} = 5.0 Vdc) (I_C = 50 mAdc, V_{CE} = 5.0 Vdc)	h_{FE}	50 60 50	– 240 –	–
Collector−Emitter Saturation Voltage (I_C = 10 mAdc, I_B = 1.0 mAdc) (I_C = 50 mAdc, I_B = 5.0 mAdc)	$V_{CE(sat)}$	– –	0.2 0.5	Vdc
Base−Emitter Saturation Voltage (I_C = 10 mAdc, I_B = 1.0 mAdc) (I_C = 50 mAdc, I_B = 5.0 mAdc)	$V_{BE(sat)}$	– –	1.0 1.0	Vdc
SMALL−SIGNAL CHARACTERISTICS				
Current−Gain — Bandwidth Product (I_C = 10 mAdc, V_{CE} = 10 Vdc, f = 100 MHz)	f_T	100	300	MHz
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1.0 MHz)	C_{obo}	–	6.0	pF
Small−Signal Current Gain (I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)	h_{fe}	40	200	–
Noise Figure (I_C = 250 μAdc, V_{CE} = 5.0 Vdc, R_S = 1.0 kΩ, f = 1.0 kHz)	NF	–	8.0	dB

1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

ORDERING INFORMATION

Device	Package	Shipping†
2N5401G	TO−92 (Pb−Free)	5000 Unit / Bulk
2N5401RLRAG	TO−92 (Pb−Free)	2000 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

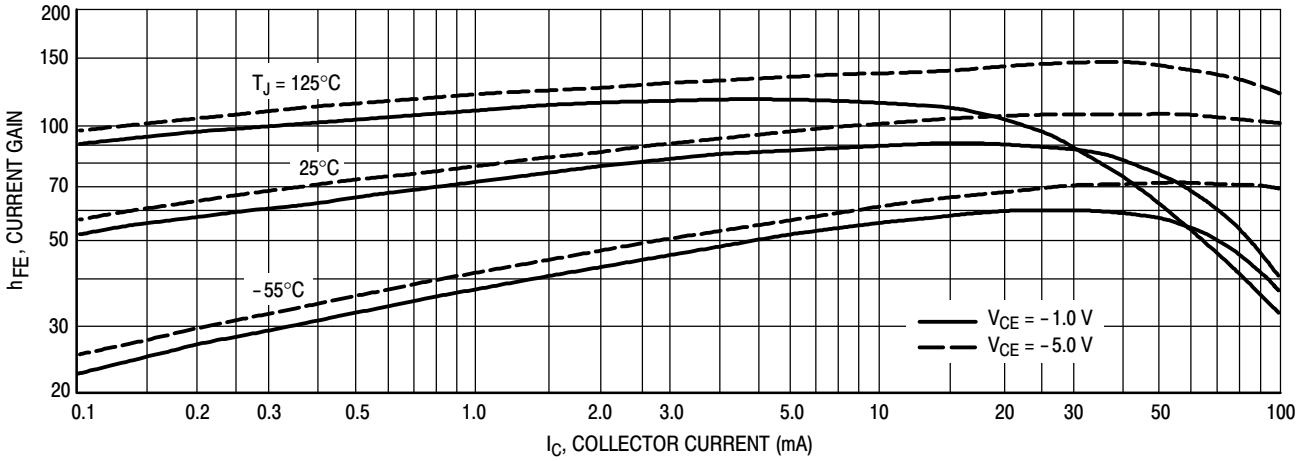


Figure 1. DC Current Gain

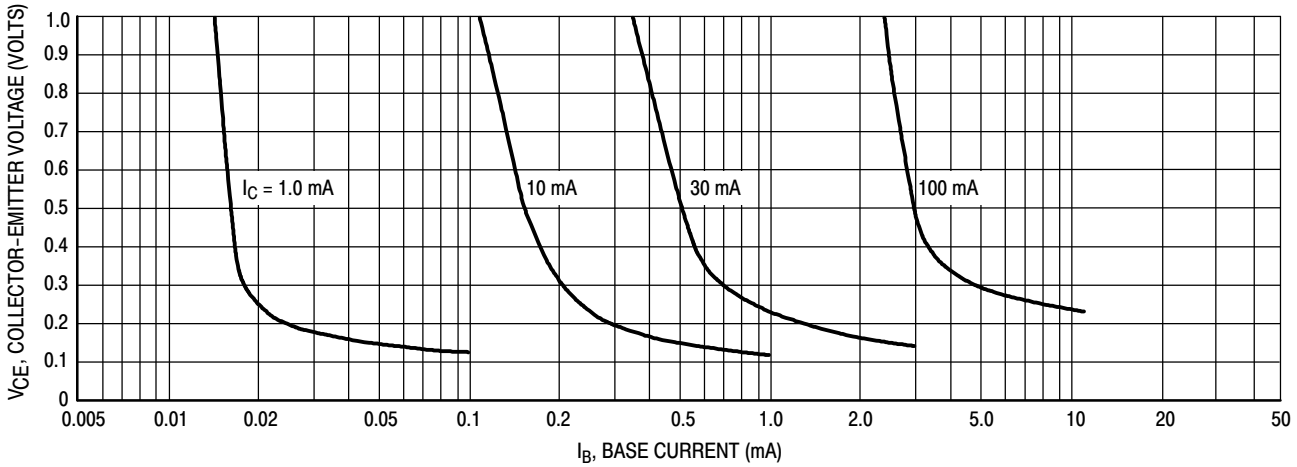


Figure 2. Collector Saturation Region

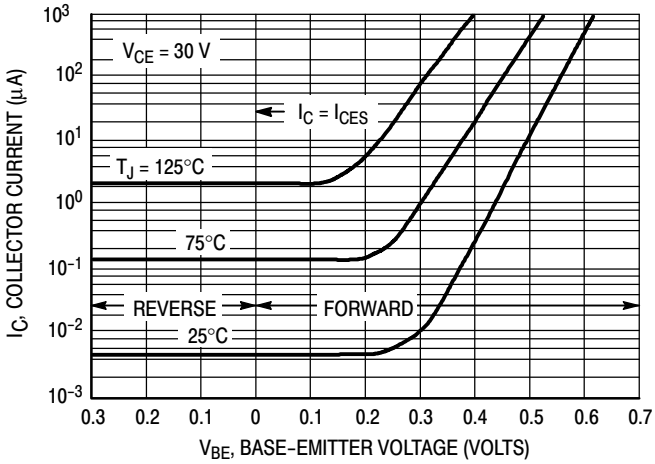


Figure 3. Collector Cut−Off Region

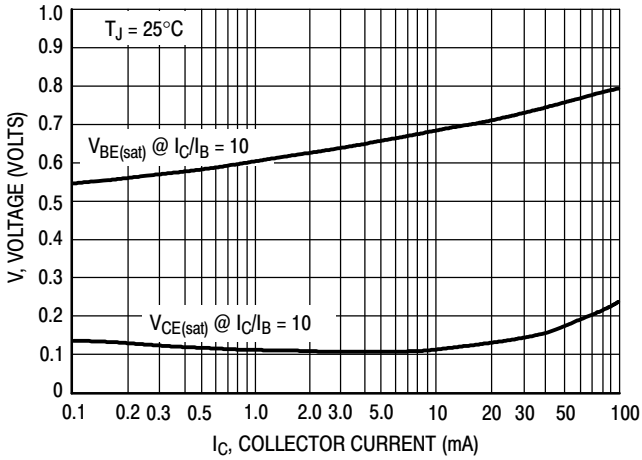


Figure 4. “On” Voltages

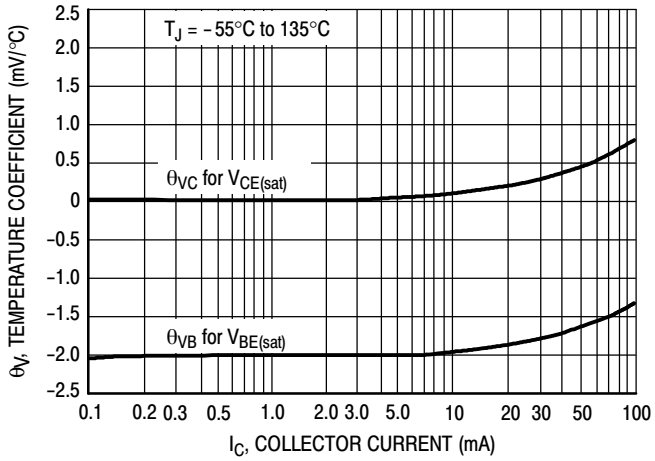
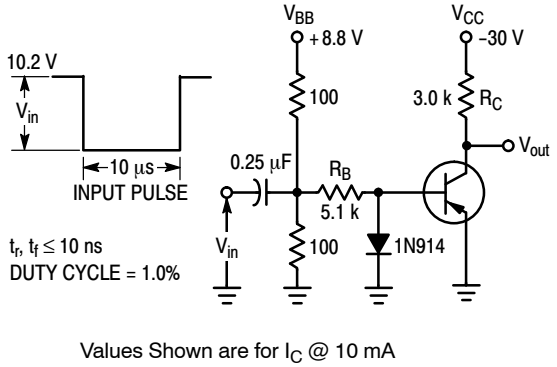


Figure 5. Temperature Coefficients



Values Shown are for I_C @ 10 mA

Figure 6. Switching Time Test Circuit

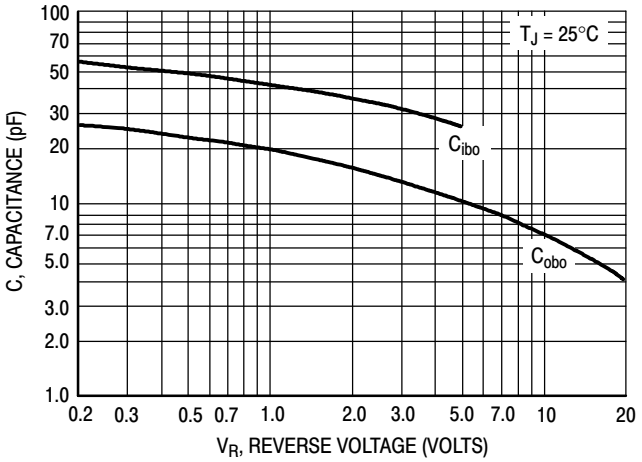


Figure 7. Capacitances

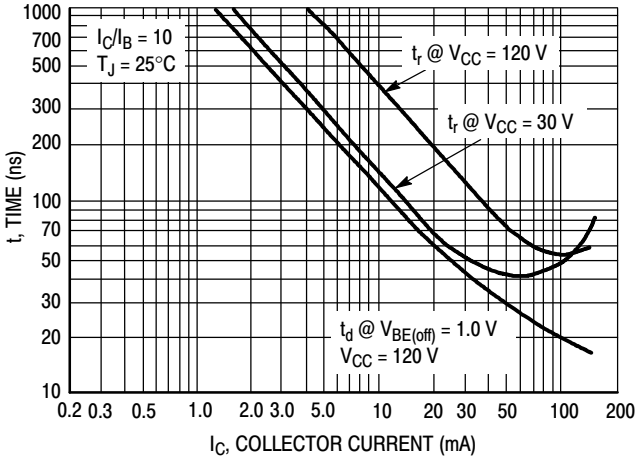


Figure 8. Turn−On Time

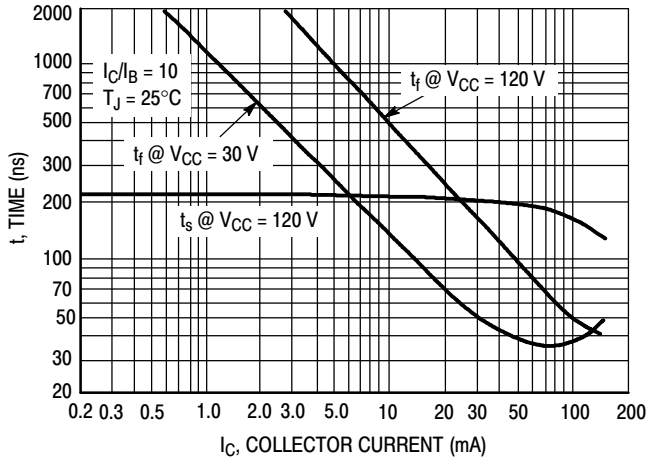


Figure 9. Turn−Off Time

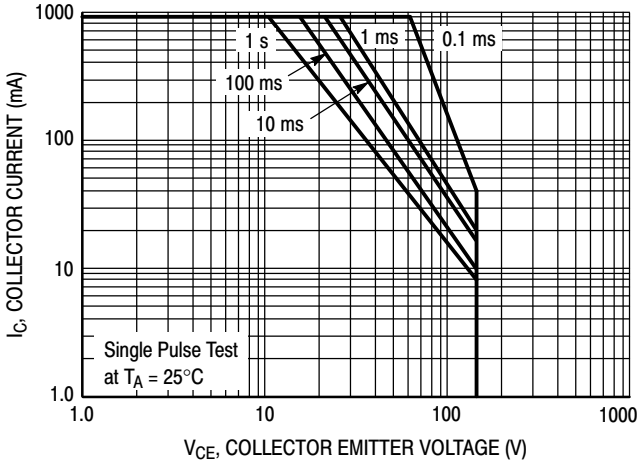
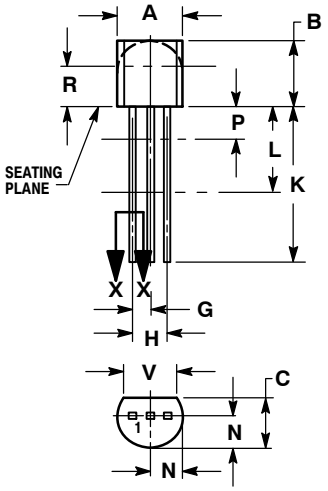


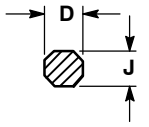
Figure 10. Safe Operating Area

PACKAGE DIMENSIONS

TO−92 (TO−226)
CASE 29−11
ISSUE AM



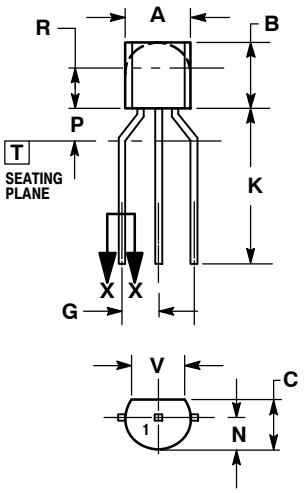
STRAIGHT LEAD
BULK PACK



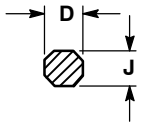
SECTION X−X

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.175	0.205	4.45	5.20
B	0.170	0.210	4.32	5.33
C	0.125	0.165	3.18	4.19
D	0.016	0.021	0.407	0.533
G	0.045	0.055	1.15	1.39
H	0.095	0.105	2.42	2.66
J	0.015	0.020	0.39	0.50
K	0.500	---	12.70	---
L	0.250	---	6.35	---
N	0.080	0.105	2.04	2.66
P	---	0.100	---	2.54
R	0.115	---	2.93	---
V	0.135	---	3.43	---



BENT LEAD
TAPE & REEL
AMMO PACK



SECTION X−X

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

	MILLIMETERS	
DIM	MIN	MAX
A	4.45	5.20
B	4.32	5.33
C	3.18	4.19
D	0.40	0.54
G	2.40	2.80
J	0.39	0.50
K	12.70	---
N	2.04	2.66
P	1.50	4.00
R	2.93	---
V	3.43	---

STYLE 1:
PIN 1. EMITTER
2. BASE
3. COLLECTOR

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Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81−3−5817−1050

ON Semiconductor Website: **www.onsemi.com**

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For additional information, please contact your loca
Sales Representative

2N5550, 2N5551

Preferred Device

Amplifier Transistors

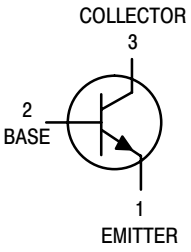
NPN Silicon

ON Semiconductor®

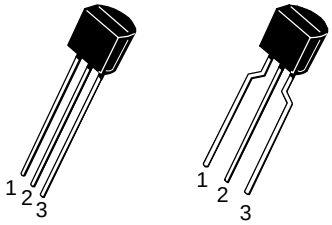
http://onsemi.com

Features

- These are Pb−Free Devices*



TO−92
CASE 29
STYLE 1



STRAIGHT LEAD
BULK PACK

BENT LEAD
TAPE & REEL
AMMO PACK

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector − Emitter Voltage 2N5550 2N5551	V_{CEO}	 140 160	Vdc
Collector − Base Voltage 2N5550 2N5551	V_{CBO}	 160 180	Vdc
Emitter − Base Voltage	V_{EBO}	6.0	Vdc
Collector Current − Continuous	I_C	600	mAdc
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	625 5.0	mW mW/°C
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	1.5 12	W mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−55 to +150	°C

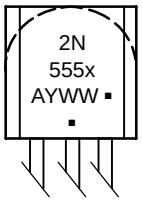
THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction−to−Ambient	$R_{\theta JA}$	200	°C/W
Thermal Resistance, Junction−to−Case	$R_{\theta JC}$	83.3	°C/W

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

MARKING DIAGRAM



x = 0 or 1
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb−Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

Preferred devices are recommended choices for future use and best overall value.

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector−Emitter Breakdown Voltage (Note 1)		$V_{(BR)CEO}$			
(I_C = 1.0 mAdc, I_B = 0)	2N5550		140	−	Vdc
	2N5551		160	−	
Collector−Base Breakdown Voltage		$V_{(BR)CBO}$			
(I_C = 100 μAdc, I_E = 0)	2N5550		160	−	Vdc
	2N5551		180	−	
Emitter−Base Breakdown Voltage		$V_{(BR)EBO}$			
(I_E = 10 μAdc, I_C = 0)			6.0	−	Vdc
Collector Cutoff Current		I_{CBO}			
(V_{CB} = 100 Vdc, I_E = 0)	2N5550		−	100	nAdc
(V_{CB} = 120 Vdc, I_E = 0)	2N5551		−	50	
(V_{CB} = 100 Vdc, I_E = 0, T_A = 100°C)	2N5550		−	100	μAdc
(V_{CB} = 120 Vdc, I_E = 0, T_A = 100°C)	2N5551		−	50	
Emitter Cutoff Current		I_{EBO}	−	50	nAdc
(V_{EB} = 4.0 Vdc, I_C = 0)					
ON CHARACTERISTICS (Note 1)					
DC Current Gain		h_{FE}			
(I_C = 1.0 mAdc, V_{CE} = 5.0 Vdc)	2N5550		60	−	−
	2N5551		80	−	
(I_C = 10 mAdc, V_{CE} = 5.0 Vdc)	2N5550		60	250	
	2N5551		80	250	
(I_C = 50 mAdc, V_{CE} = 5.0 Vdc)	2N5550		20	−	
	2N5551		30	−	
Collector−Emitter Saturation Voltage		$V_{CE(sat)}$			
(I_C = 10 mAdc, I_B = 1.0 mAdc)	Both Types		−	0.15	Vdc
(I_C = 50 mAdc, I_B = 5.0 mAdc)	2N5550		−	0.25	
	2N5551		−	0.20	
Base−Emitter Saturation Voltage		$V_{BE(sat)}$			
(I_C = 10 mAdc, I_B = 1.0 mAdc)	Both Types		−	1.0	Vdc
(I_C = 50 mAdc, I_B = 5.0 mAdc)	2N5550		−	1.2	
	2N5551		−	1.0	
SMALL−SIGNAL CHARACTERISTICS					
Current−Gain — Bandwidth Product		f_T	100	300	MHz
(I_C = 10 mAdc, V_{CE} = 10 Vdc, f = 100 MHz)					
Output Capacitance		C_{obo}	−	6.0	pF
(V_{CB} = 10 Vdc, I_E = 0, f = 1.0 MHz)					
Input Capacitance		C_{ibo}			pF
(V_{EB} = 0.5 Vdc, I_C = 0, f = 1.0 MHz)	2N5550		−	30	
	2N5551		−	20	
Small−Signal Current Gain		h_{fe}	50	200	−
(I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)					
Noise Figure		NF			dB
(I_C = 250 μAdc, V_{CE} = 5.0 Vdc, R_S = 1.0 kΩ, f = 1.0 kHz)	2N5550		−	10	
	2N5551		−	8.0	

1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

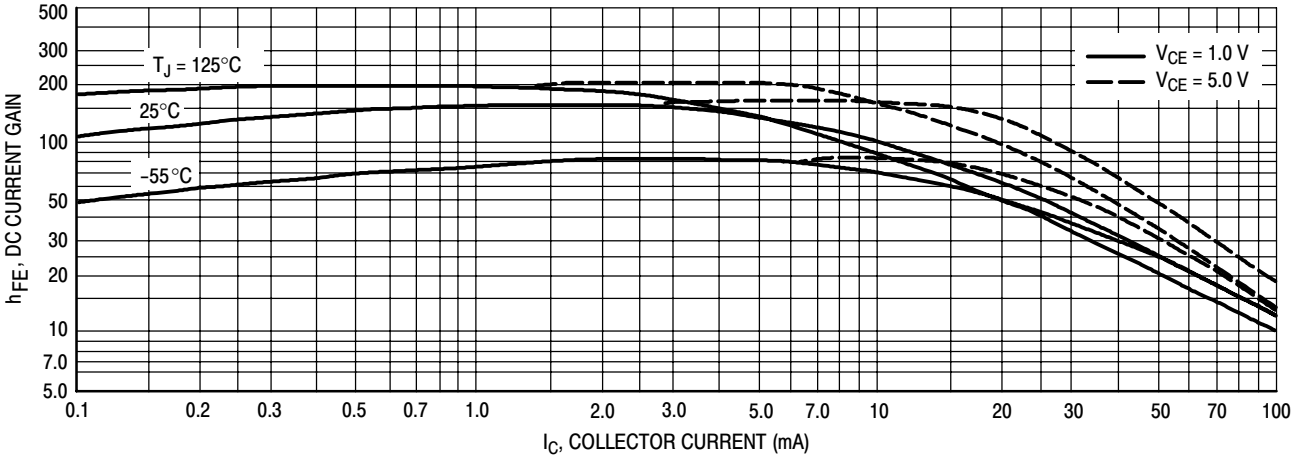


Figure 1. DC Current Gain

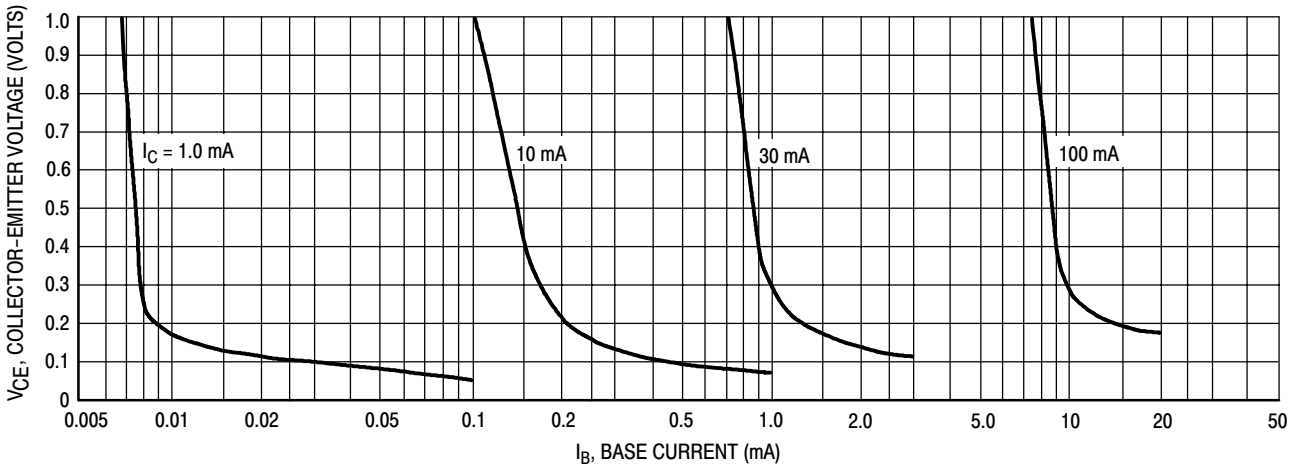


Figure 2. Collector Saturation Region

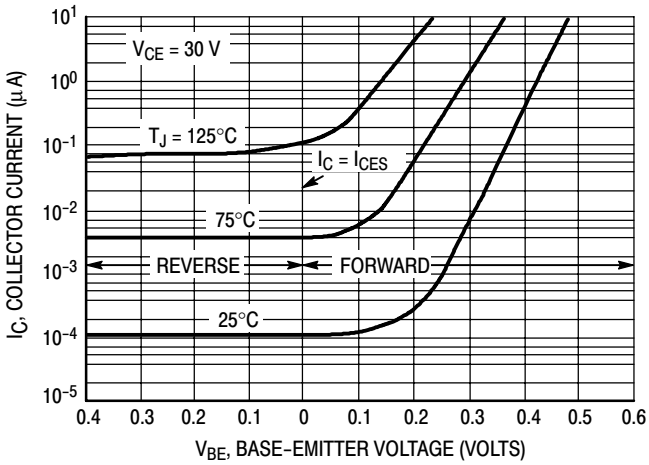


Figure 3. Collector Cut−Off Region

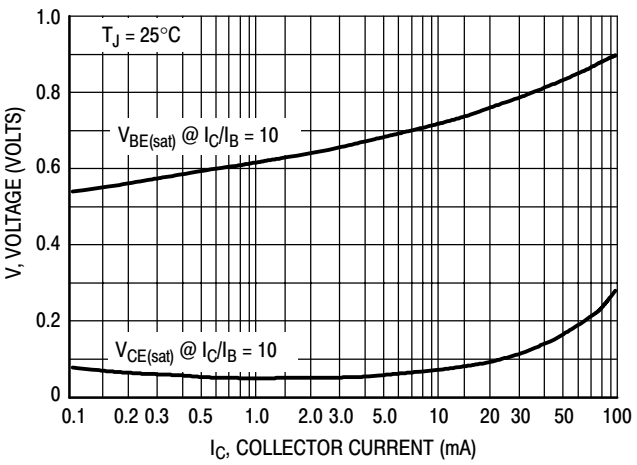


Figure 4. “On” Voltages

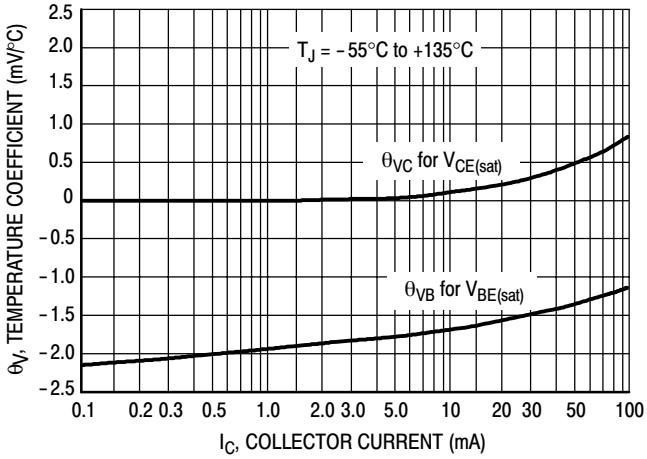
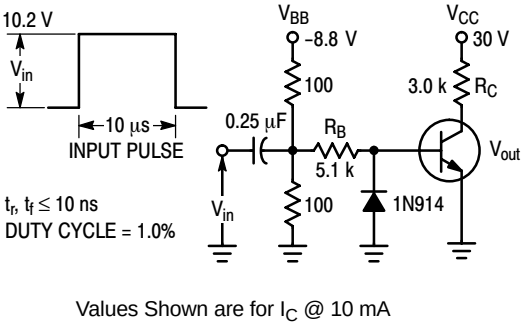


Figure 5. Temperature Coefficients



Values Shown are for I_C @ 10 mA

Figure 6. Switching Time Test Circuit

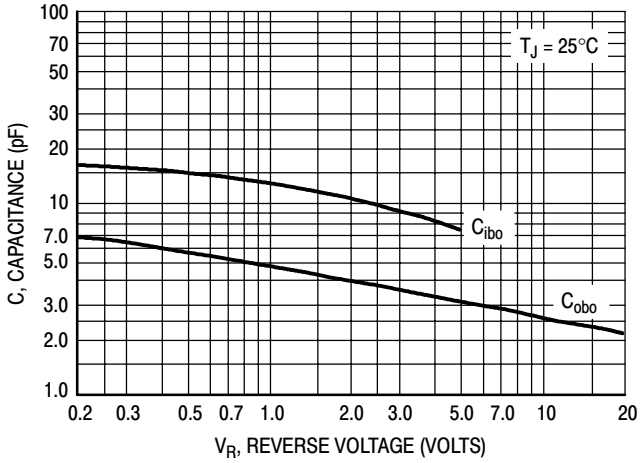


Figure 7. Capacitances

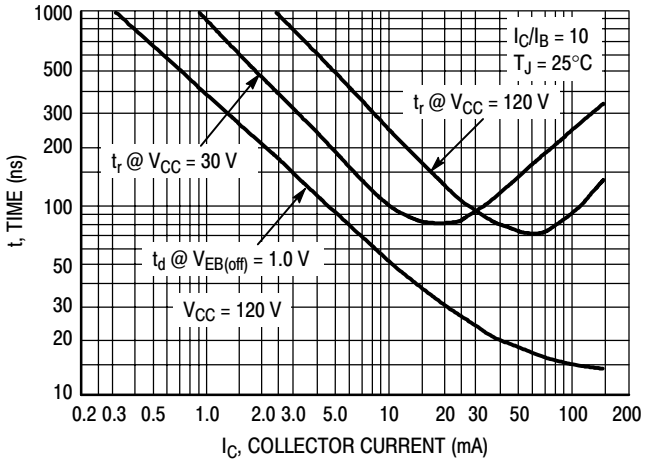


Figure 8. Turn−On Time

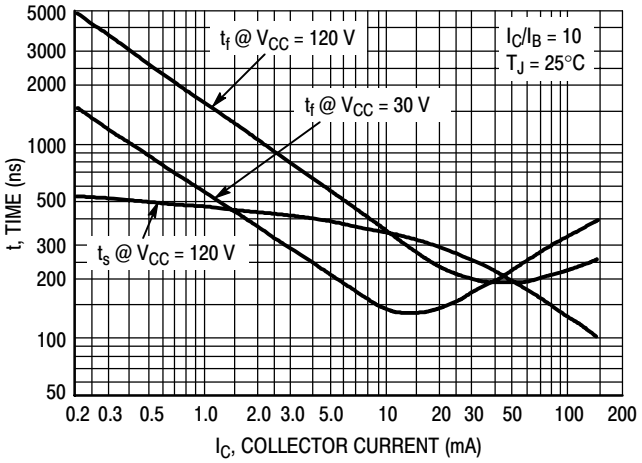


Figure 9. Turn−Off Time

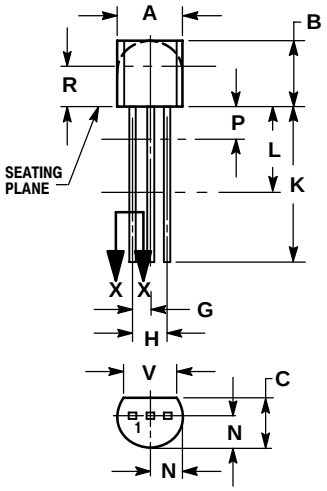
ORDERING INFORMATION

Device	Package	Shipping†
2N5550G	TO−92 (Pb−Free)	5000 Units / Bulk
2N5550RLRPG	TO−92 (Pb−Free)	2000 / Tape & Ammo Box
2N5551G	TO−92 (Pb−Free)	5000 Units / Bulk
2N5551RL1G	TO−92 (Pb−Free)	2000 / Tape & Reel
2N5551RLRAG	TO−92 (Pb−Free)	
2N5551RLRPG	TO−92 (Pb−Free)	2000 / Tape & Ammo Box
2N55551ZL1G	TO−92 (Pb−Free)	

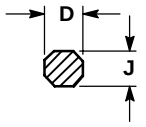
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

PACKAGE DIMENSIONS

TO−92 (TO−226)
CASE 29−11
ISSUE AM



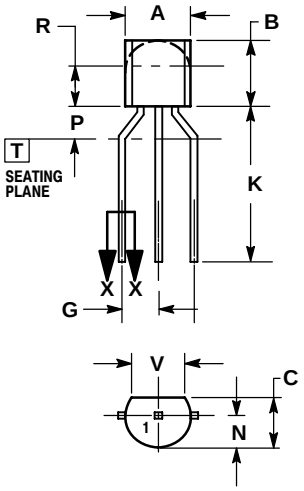
STRAIGHT LEAD
BULK PACK



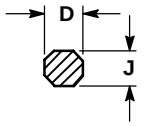
SECTION X−X

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.175	0.205	4.45	5.20
B	0.170	0.210	4.32	5.33
C	0.125	0.165	3.18	4.19
D	0.016	0.021	0.407	0.533
G	0.045	0.055	1.15	1.39
H	0.095	0.105	2.42	2.66
J	0.015	0.020	0.39	0.50
K	0.500	---	12.70	---
L	0.250	---	6.35	---
N	0.080	0.105	2.04	2.66
P	---	0.100	---	2.54
R	0.115	---	2.93	---
V	0.135	---	3.43	---



BENT LEAD
TAPE & REEL
AMMO PACK



SECTION X−X

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

	MILLIMETERS	
DIM	MIN	MAX
A	4.45	5.20
B	4.32	5.33
C	3.18	4.19
D	0.40	0.54
G	2.40	2.80
J	0.39	0.50
K	12.70	---
N	2.04	2.66
P	1.50	4.00
R	2.93	---
V	3.43	---

STYLE 1:
PIN 1. EMITTER
2. BASE
3. COLLECTOR

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
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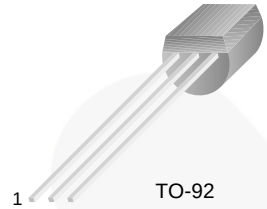
May 2016

KSC1815
NPN Epitaxial Silicon Transistor

Features

- Audio Frequency Amplifier and High-Frequency OSC
- Complement to KSA1015
- Collector-Base Voltage: V_{CBO} = 50 V



TO-92

1. Emitter 2. Collector 3. Base

Ordering Information

Part Number	Top Mark	Package	Packing Method
KSC1815YTA	YC&3	TO-92 3L	Ammo

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter	Value	Unit
V_{CBO}	Collector-Base Voltage	60	V
V_{CEO}	Collector-Emitter Voltage	50	V
V_{EBO}	Emitter-Base Voltage	5	V
I_C	Collector Current	150	mA
I_B	Base Current	50	mA
T_J	Junction Temperature	150	°C
T_{STG}	Storage Temperature Range	-55 to 150	°C

Thermal Characteristics[1]

Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter	Max.	Unit
P_D	Total Device Dissipation	400	mW
	Derate Above 25°C	3.2	mW/°C
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	312	°C/W

Note:

1. PCB size: FR-4, 76 mm x 114 mm x 1.57 mm (3.0 inch x 4.5 inch x 0.062 inch) with minimum land pattern size.

Electrical Characteristics

Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{CBO}	Collector-Base Voltage	I_C = 1 mA, I_E = 0	60			V
BV_{CEO}	Collector-Emitter Voltage	I_C = 10 mA, I_B = 0	50			V
BV_{EBO}	Emitter-Base Voltage	I_E = 10 μA, I_C = 0	5			V
I_{CBO}	Collector Cut-Off Current	V_{CB} = 60 V, I_E = 0			0.1	μA
I_{EBO}	Emitter Cut-Off Current	V_{EB} = 5 V, I_C = 0			0.1	μA
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 100 mA, I_B = 10 mA		0.10	0.25	V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 100 mA, I_B = 10 mA			1.0	V
h_{FE1}	DC Current Gain	V_{CE} = 6 V, I_C = 2 mA	70		700	
h_{FE2}	DC Current Gain	V_{CE} = 6 V, I_C = 150 mA	25			
f_T	Current Gain Bandwidth Product	V_{CE} = 10 V, I_C = 1 mA	80			MHz
C_{ob}	Output Capacitance	V_{CB} = 10 V, I_E = 0, f = 1 MHz		2.0	3.0	pF
N_F	Noise Figure	V_{CE} = 6 V, I_C = 0.1 mA, R_S = 10 kΩ, f = 1 Hz		1.0	10.0	dB

h_{FE} Classification

Classification	O	Y	GR	L
h_{FE1}	70 ~ 140	120 ~ 240	200 ~ 400	350 ~ 700

Typical Performance Characteristics

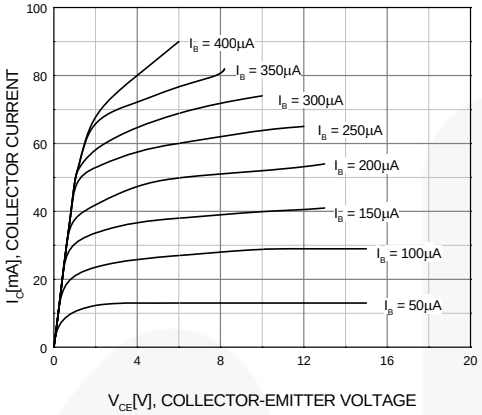


Figure 1. Static Characteristic

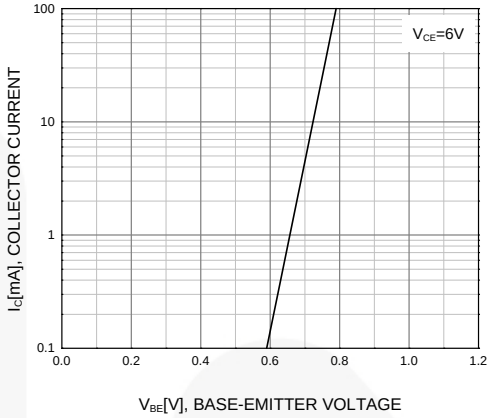


Figure 2. Transfer Characteristic

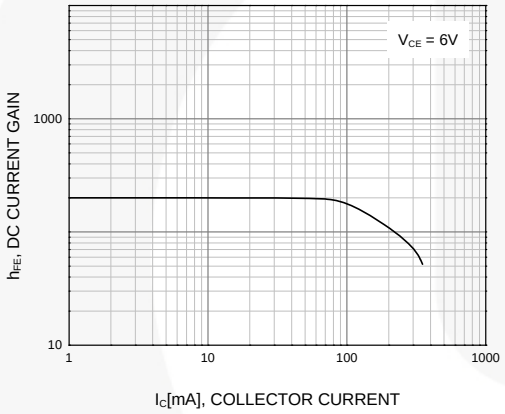


Figure 3. DC Current Gain

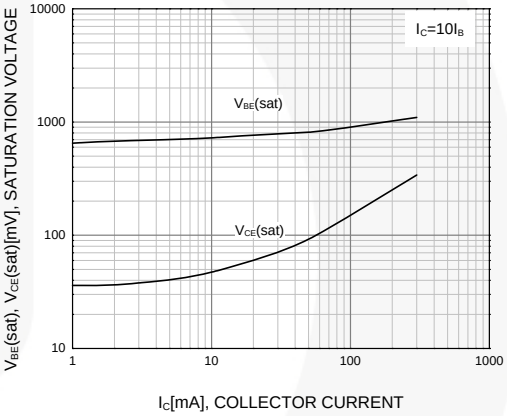


Figure 4. Base-Emitter Saturation Voltage and Collector-Emitter Saturation Voltage

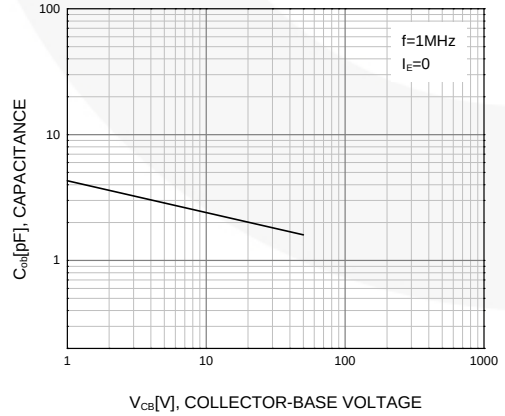


Figure 5. Output Capacitance

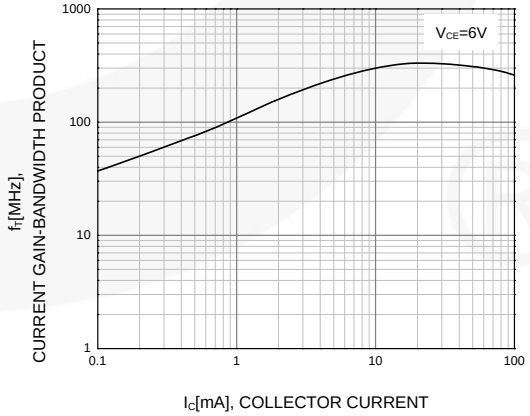
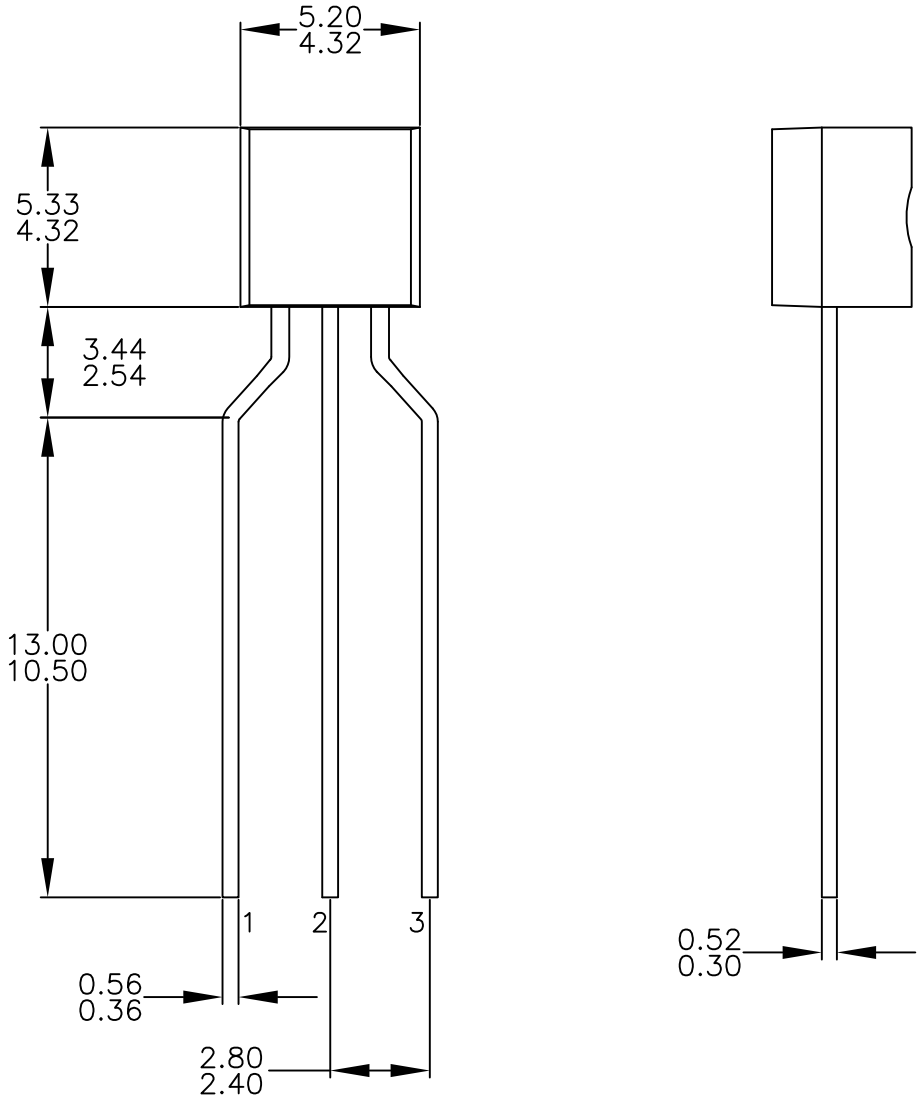
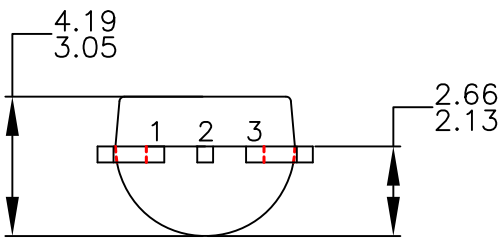


Figure 6. Current Gain Bandwidth Product





NOTES: UNLESS OTHERWISE SPECIFIED

A. DRAWING CONFORMS TO JEDEC MS-013, VARIATION AC.
B. ALL DIMENSIONS ARE IN MILLIMETERS.
C. DRAWING CONFORMS TO ASME Y14.5M-2009.
D. DRAWING FILENAME: MKT-ZA03FREV3.
E. FAIRCHILD SEMICONDUCTOR.

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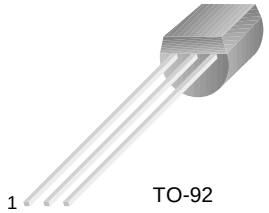
SEMICONDUCTOR®

KSA1015

LOW FREQUENCY AMPLIFIER

- Collector-Base Voltage : V_{CBO}= -50V
- Complement to KSC1815



1 TO-92

1. Emitter 2. Collector 3. Base

PNP Epitaxial Silicon Transistor

Absolute Maximum Ratings T_a=25°C unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{CBO}	Collector-Base Voltage	-50	V
V_{CEO}	Collector-Emitter Voltage	-50	V
V_{EBO}	Emitter-Base Voltage	-5	V
I_C	Collector Current	-150	mA
I_B	Base Current	-50	mA
P_C	Collector Power Dissipation	400	mW
T_J	Junction Temperature	125	°C
T_{ST9}	Storage Temperature	-65 ~ 150	°C

Electrical Characteristics T_a=25°C unless otherwise noted

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
BV_{CBO}	Collector-Base Breakdown Voltage	I_C= -100μA, I_E=0	-50			V
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C= -10mA, I_B=0	-50			V
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E= -10μA, I_C=0	-5			V
I_{CBO}	Collector Cut-off Current	V_{CB}= -50V, I_E=0			-0.1	μA
I_{EBO}	Emitter Cut-off Current	V_{EB}= -5V, I_C=0			-0.1	μA
h_{FE1} h_{FE2}	DC Current Gain	V_{CE}= -6V, I_C= -2mA V_{CE}= -6V, I_C= -150mA	70 25		400	
V_{CE} (sat)	Collector-Emitter Saturation Voltage	I_C= -100mA, I_B= -10mA		-0.1	-0.3	V
V_{BE} (sat)	Base-Emitter Saturation Voltage	I_C= -100mA, I_B= -10mA			-1.1	V
f_T	Current Gain Bandwidth Product	V_{CE}= -10V, I_C=-1mA	80			MHz
C_{ob}	Output Capacitance	V_{CB}= -10V, I_E=0, f=1MHz		4	7	pF
NF	Noise Figure	V_{CE}= -6V, I_C= -0.1mA f=100Hz, R_G=10kΩ		0.5	6	dB

h_{FE} Classification

Classification	O	Y	G
h_{FE1}	70 ~ 140	120 ~ 240	200 ~ 400

Typical Characteristics

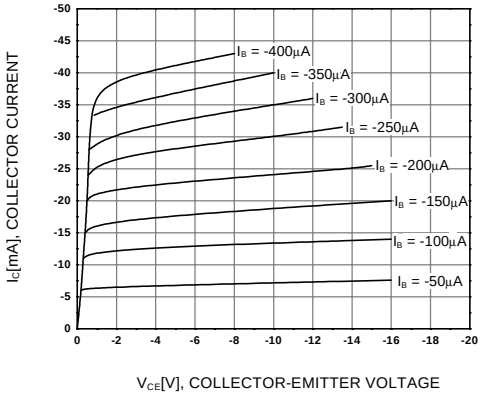


Figure 1. Static Characteristic

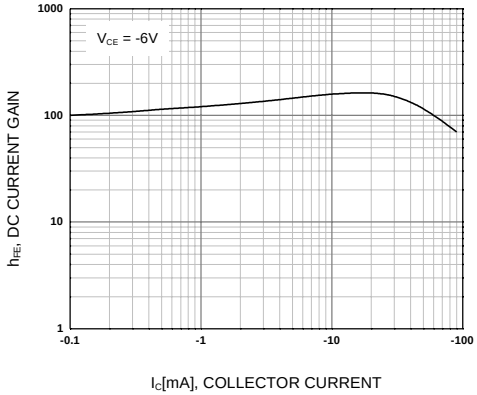


Figure 2. DC current Gain

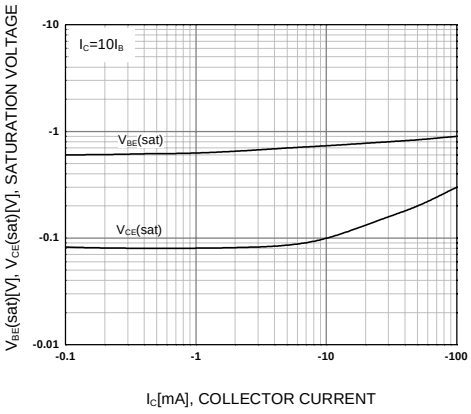


Figure 3. Base-Emitter Saturation Voltage Collector-Emitter Saturation Voltage

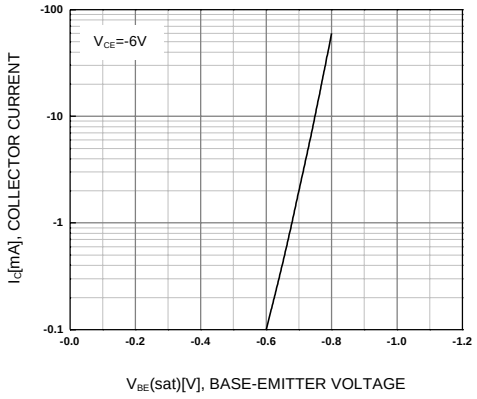


Figure 4. Base-Emitter On Voltage

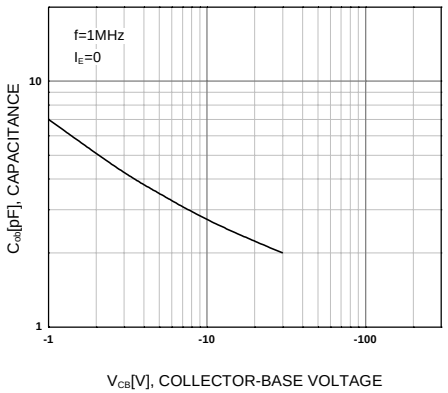


Figure 5. Collector Output Capacitance

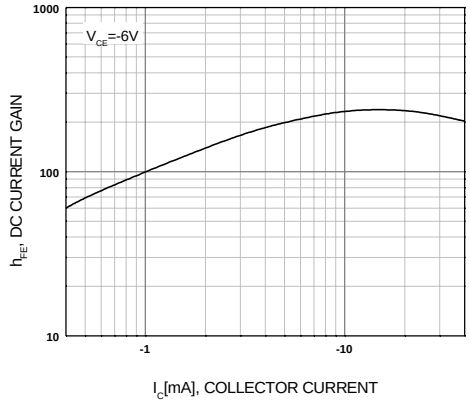
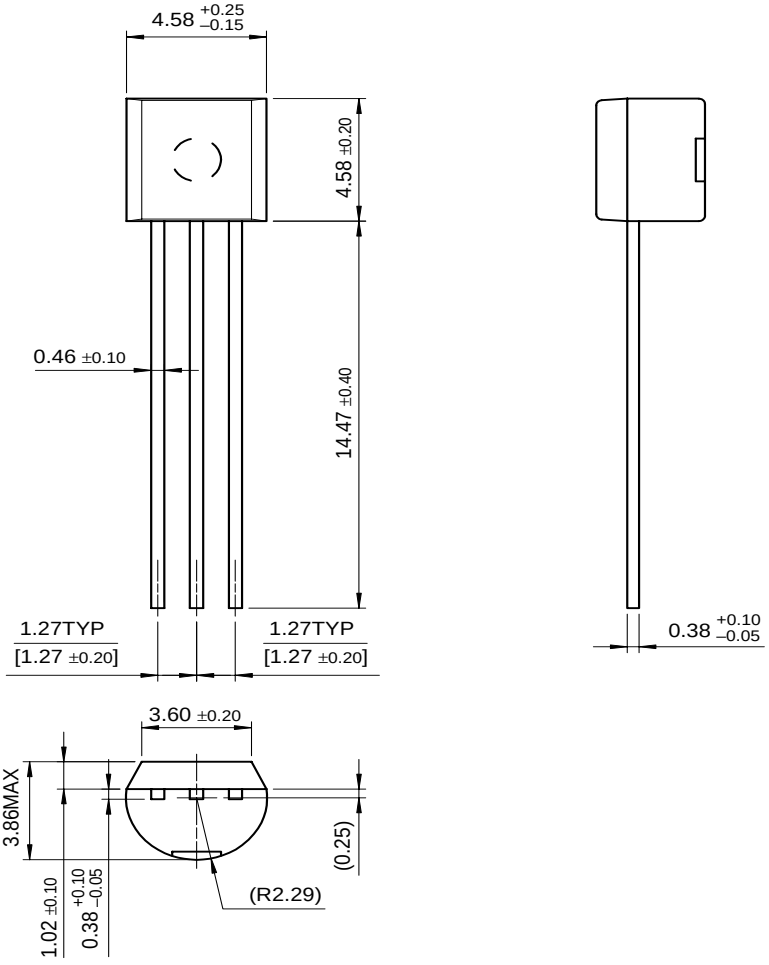


Figure 6. Current Gain Bandwidth Product

Package Dimensions

TO-92



Dimensions in Millimeters

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Datasheet Identification	Product Status	Definition
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No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.

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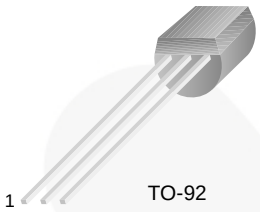
November 2014

KSC945
NPN Epitaxial Silicon Transistor

Features

- Audio Frequency Amplifier and High-Frequency OSC.
- Complimentary to KSA733
- Collector-Base Voltage: V_{CBO} = 60 V
- High Current Gain Bandwidth Product: f_T = 300 MHz (Tyical)
- Suffix “-C” means Center Collector (1. Emitter 2. Collector 3. Base)



TO-92

1. Emitter 2. Base 3. Collector

Ordering Information

Part Number	Top Mark	Package	Packing Method
KSC945YBU	C945	TO-92 3L	Bulk
KSC945YTA	C945	TO-92 3L	Ammo
KSC945GTA	C945	TO-92 3L	Ammo
KSC945CYTA	C945	TO-92 3L	Ammo
KSC945CGBU	C945	TO-92 3L	Bulk
KSC945CGTA	C945	TO-92 3L	Ammo

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter	Value	Unit
V_{CBO}	Collector-Base Voltage	60	V
V_{CEO}	Collector-Emitter Voltage	50	V
V_{EBO}	Emitter-Base Voltage	5	V
I_C	Collector Current	150	mA
T_J	Junction Temperature	150	°C
T_{STG}	Storage Temperature	-55 to 150	°C

Thermal Characteristics[1]

Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter	Value	Unit
P_D	Power Dissipation	250	mW
	Derate Above 25°C	2.0	mW/°C
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	500	°C/W

Note:

1. PCB size: FR-4, 76 mm x 114 mm x 1.57 mm (3.0 inch x 4.5 inch x 0.062 inch) with minimum land pattern size.

Electrical Characteristics

Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 100 μA, I_E = 0	60			V
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 10 mA, I_B = 0	50			V
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 10 μA, I_C = 0	5			V
I_{CBO}	Collector Cut-Off Current	V_{CB} = 40 V, I_E = 0			0.1	μA
I_{EBO}	Emitter Cut-Off Current	V_{EB} = 3 V, I_C = 0			0.1	μA
h_{FE}	DC Current Gain	V_{CE} = 6 V, I_C = 1.0 mA	40		700	
V_{CE}(sat)	Collector-Emitter Saturation Voltage	I_C = 100 mA, I_B = 10 mA		0.15	0.30	V
f_T	Current Gain Bandwidth Product	V_{CE} = 6 V, I_C = 10 mA		300		MHz
C_{ob}	Output Capacitance	V_{CB} = 6 V, I_E = 0, f = 1 MHz		2.5		pF
NF	Noise Figure	V_{CE} = 6 V, I_C = 0.5 mA, f = 1 kHz, R_S = 500 Ω		4.0		dB

h_{FE} Classification

Classification	R	O	Y	G	L
h_{FE}	40 ~ 80	70 ~ 140	120 ~ 240	200 ~ 400	350 ~ 700

Typical Performance Characteristics

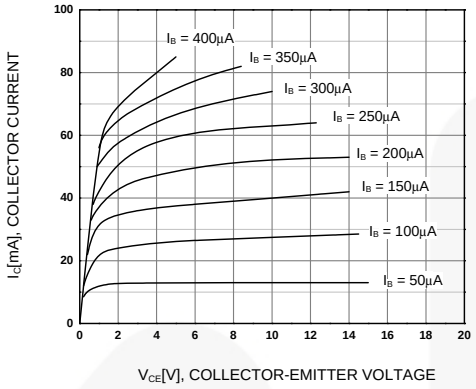


Figure 1. Static Characteristic

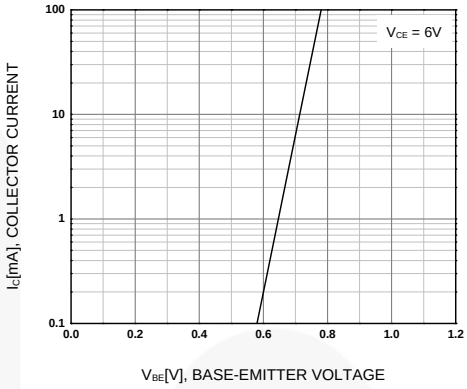


Figure 2. Transfer Characteristic

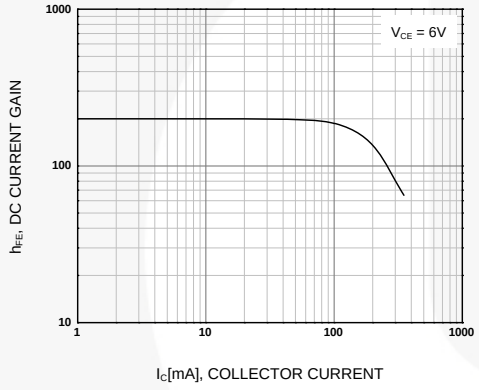


Figure 3. DC Current Gain

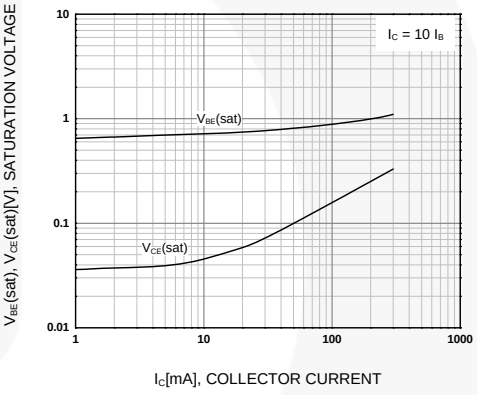


Figure 4. Base-Emitter Saturation Voltage and Collector-Emitter Saturation Voltage

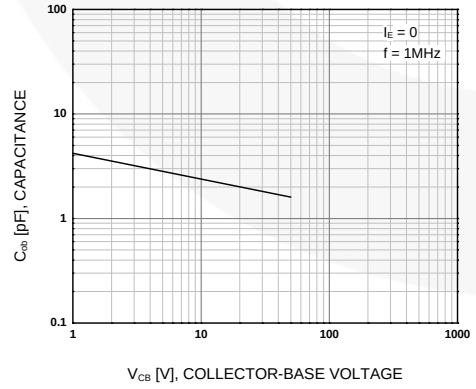


Figure 5. Output Capacitance

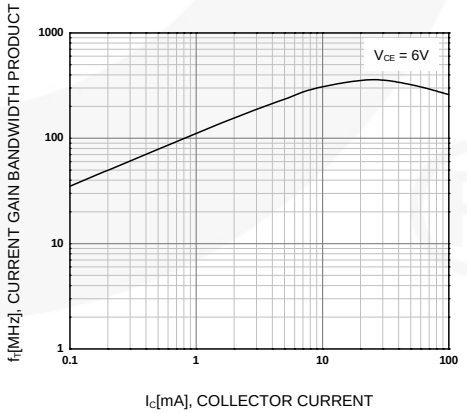
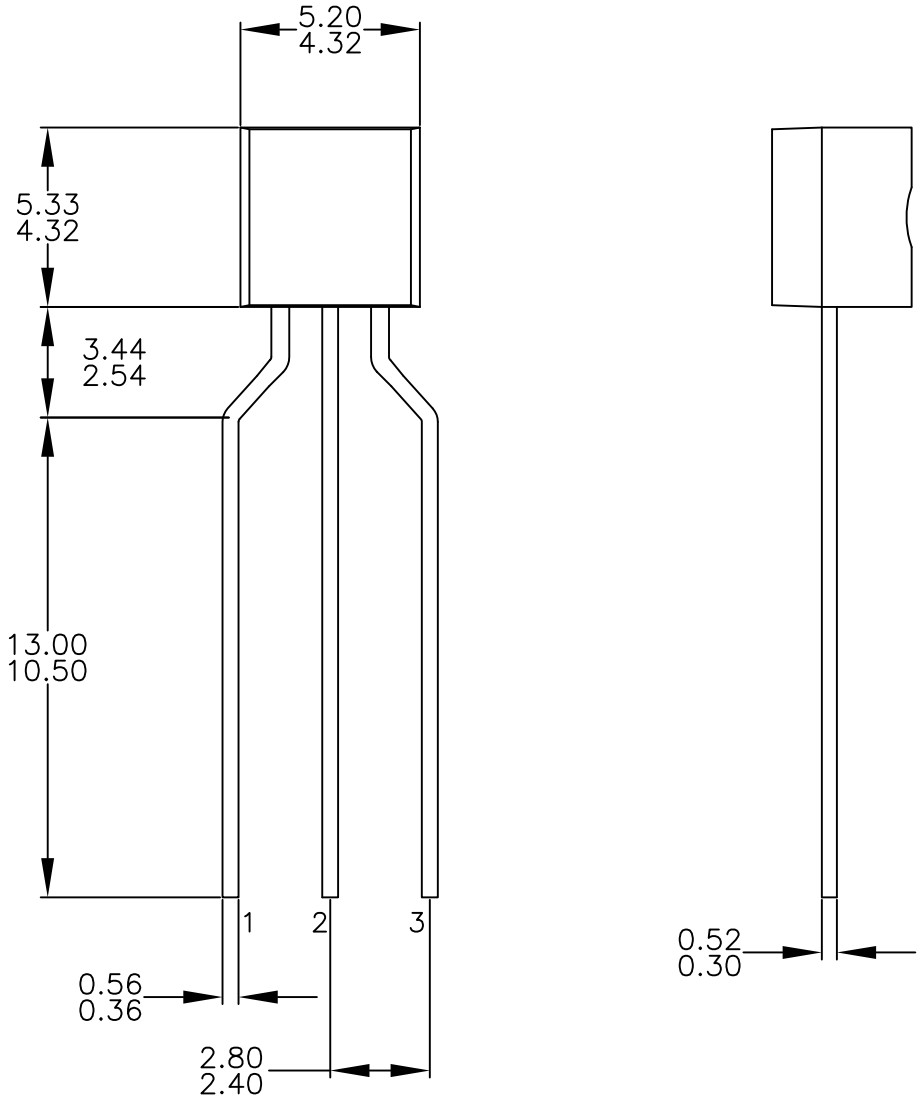
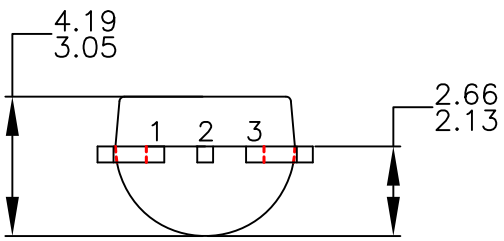


Figure 6. Current Gain Bandwidth Product





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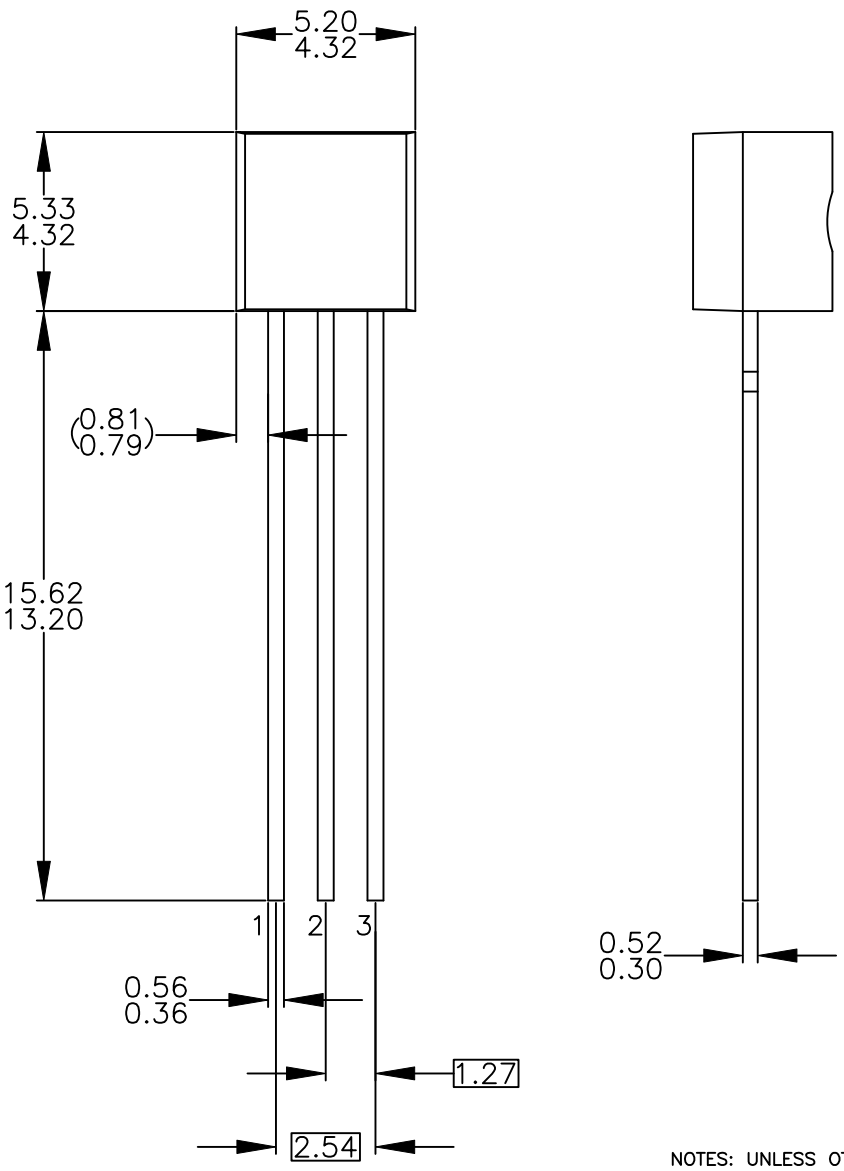

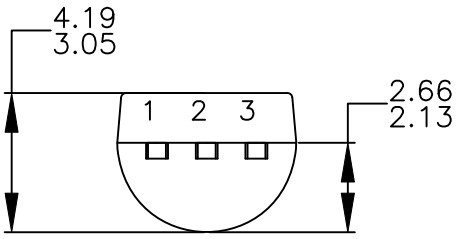

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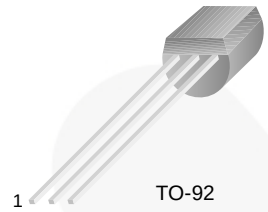
November 2014

SS8050
NPN Epitaxial Silicon Transistor

Features

- 2 W Output Amplifier of Portable Radios in Class B Push-pull Operation.
- Complimentary to SS8550
- Collector Current: I_C = 1.5 A



TO-92

1. Emitter 2. Base 3. Collector

Ordering Information

Part Number	Top Mark	Package	Packing Method
SS8050BBU	S8050	TO-92 3L	Bulk
SS8050CBU	S8050	TO-92 3L	Bulk
SS8050CTA	S8050	TO-92 3L	Ammo
SS8050DBU	S8050	TO-92 3L	Bulk
SS8050DTA	S8050	TO-92 3L	Ammo

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter	Value	Unit
V_{CBO}	Collector-Base Voltage	40	V
V_{CEO}	Collector-Emitter Voltage	25	V
V_{EBO}	Emitter-Base Voltage	6	V
I_C	Collector Current	1.5	A
T_J	Junction Temperature	150	°C
T_{STG}	Storage Temperature	-65 to 150	°C

Thermal Characteristics[1]

Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter	Value	Unit
P_D	Power Dissipation	1	W
	Derate Above 25°C	8	mW/°C
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	125	°C/W

Note:

1. PCB size: FR-4, 76 mm x 114 mm x 1.57 mm (3.0 inch x 4.5 inch x 0.062 inch) with minimum land pattern size.

Electrical Characteristics

Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 100 μA, I_E = 0	40			V
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 2 mA, I_B = 0	25			V
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 100 μA, I_C = 0	6			V
I_{CBO}	Collector Cut-Off Current	V_{CB} = 35 V, I_E = 0			100	nA
I_{EBO}	Emitter Cut-Off Current	V_{EB} = 6 V, I_C = 0			100	nA
h_{FE1}	DC Current Gain	V_{CE} = 1 V, I_C = 5 mA	45			
h_{FE2}		V_{CE} = 1 V, I_C = 100 mA	85		300	
h_{FE3}		V_{CE} = 1 V, I_C = 800 mA	40			
V_{CE}(sat)	Collector-Emitter Saturation Voltage	I_C = 800 mA, I_B = 80 mA			0.5	V
V_{BE}(sat)	Base-Emitter Saturation Voltage	I_C = 800 mA, I_B = 80 mA			1.2	V
V_{BE}(on)	Base-Emitter On Voltage	V_{CE} = 1 V, I_C = 10 mA			1	V
C_{ob}	Output Capacitance	V_{CB} = 10 V, I_E = 0, f = 1 MHz		9.0		pF
f_T	Current Gain Bandwidth Product	V_{CE} = 10 V, I_C = 50 mA	100			MHz

h_{FE} Classification

Classification	B	C	D
h_{FE2}	85 ~ 160	120 ~ 200	160 ~ 300

Typical Performance Characteristics

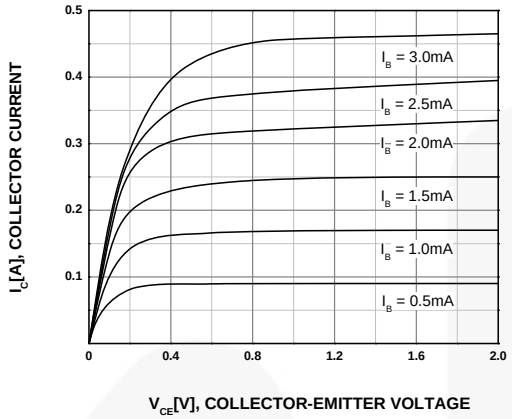


Figure 1. Static Characteristic

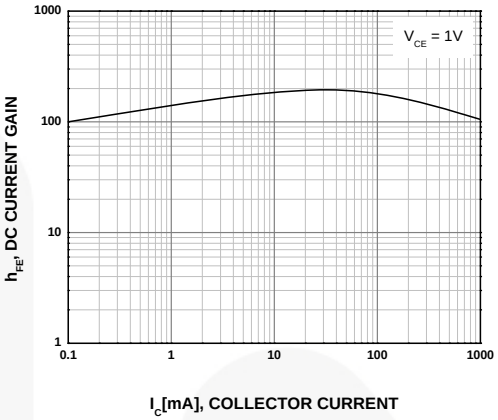


Figure 2. DC Current Gain

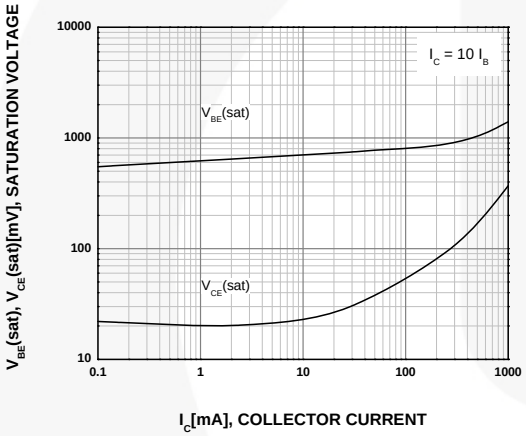


Figure 3. Base-Emitter Saturation Voltage and Collector-Emitter Saturation Voltage

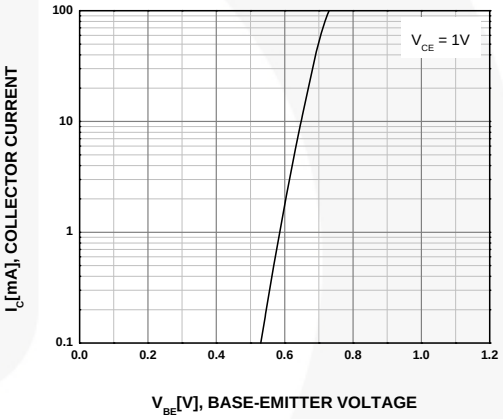


Figure 4. Base-Emitter On Voltage

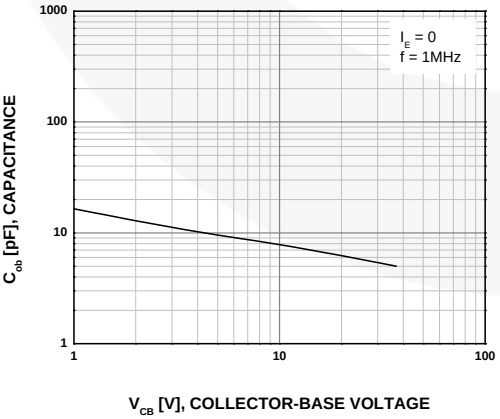


Figure 5. Collector Output Capacitance

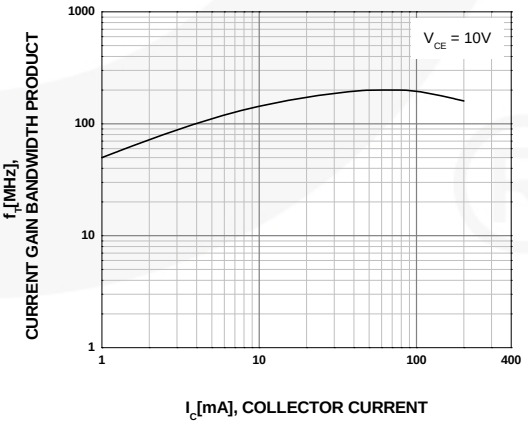
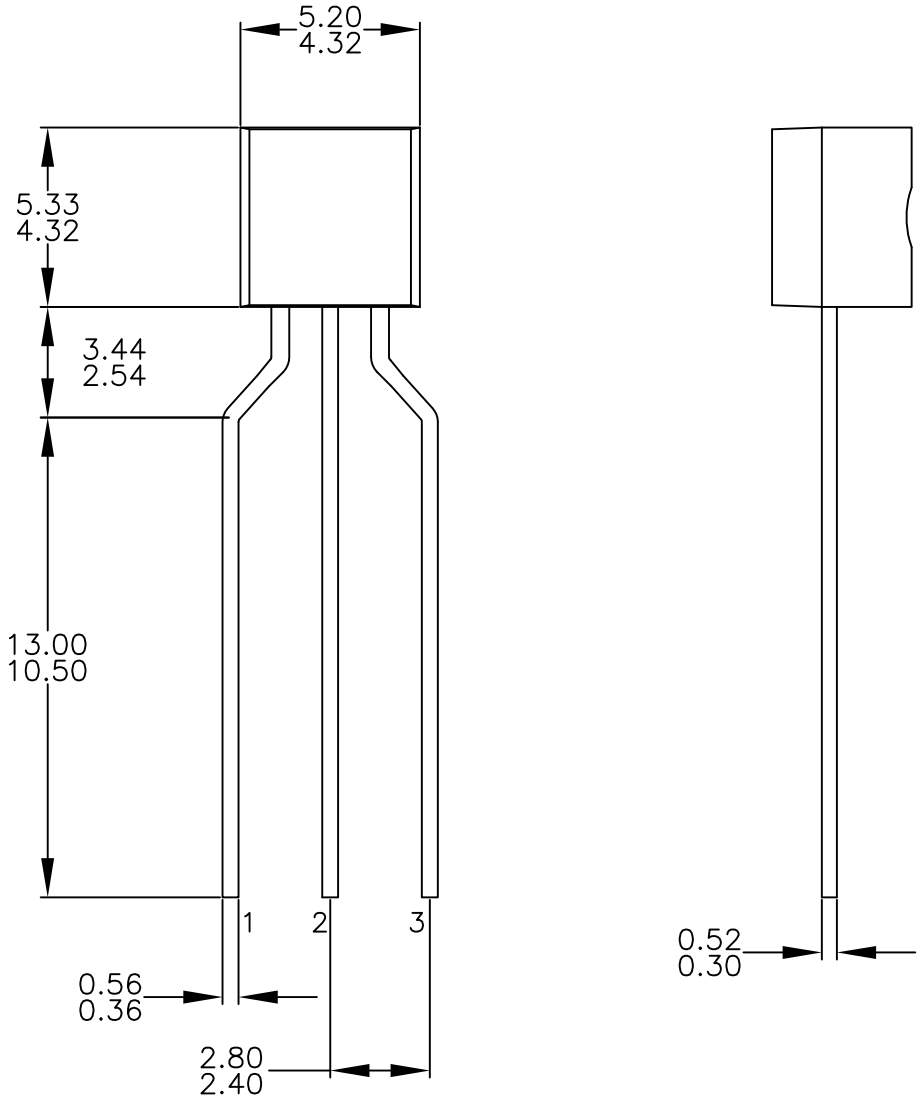
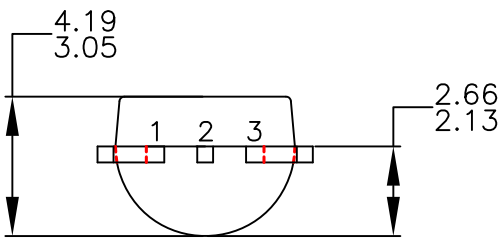


Figure 6. Current Gain Bandwidth Product





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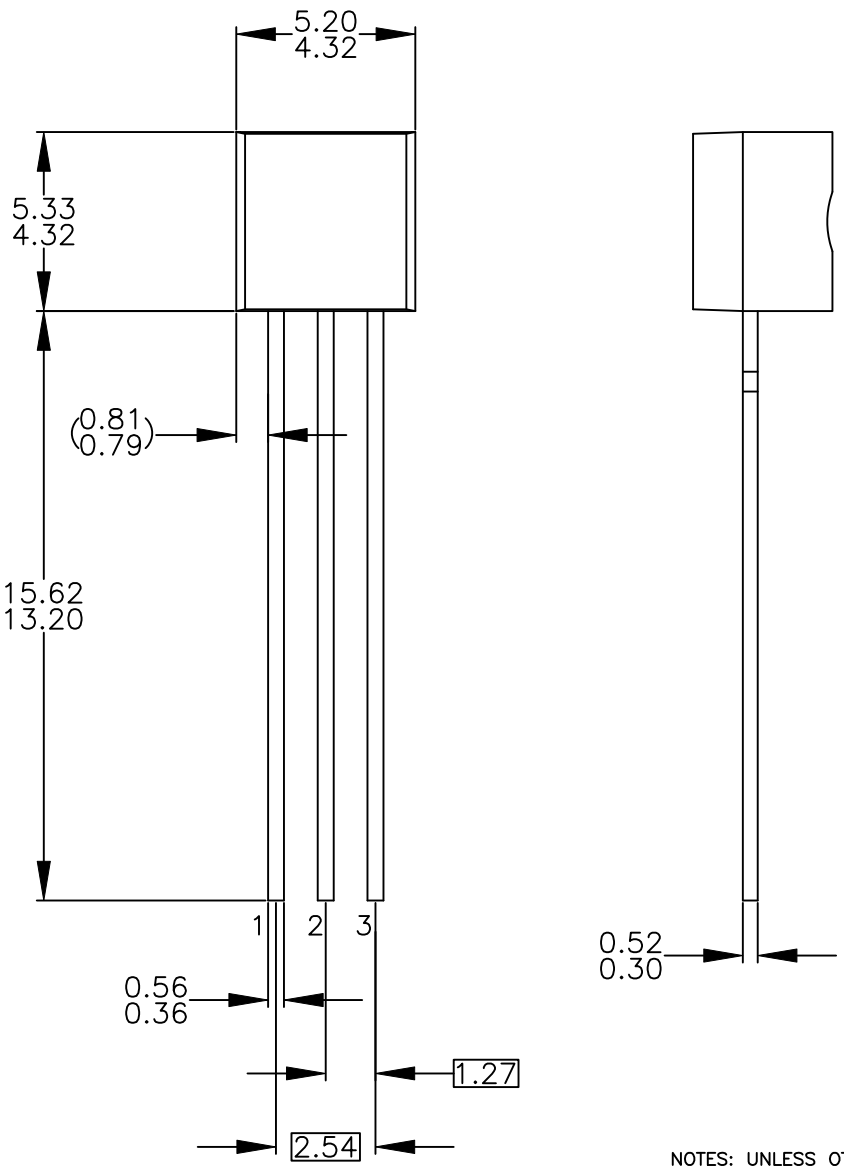

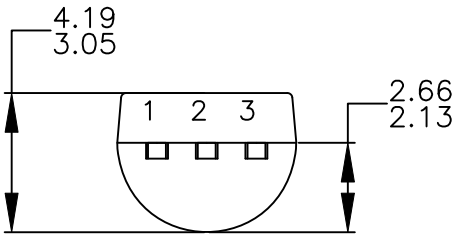

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2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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Rev. I73

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Fairchild Semiconductor:

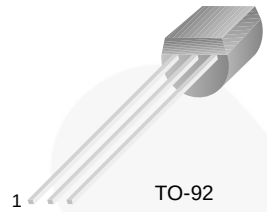
SS8050CBU SS8050DBU SS8050BBU SS8050DTA SS8050CTA

November 2014

SS8550
PNP Epitaxial Silicon Transistor

Features

- 2 W Output Amplifier of Portable Radios in Class B Push-pull Operation.
- Complimentary to SS8050
- Collector Current: I_C = 1.5 A



TO-92

1. Emitter 2. Base 3. Collector

Ordering Information

Part Number	Top Mark	Package	Packing Method
SS8550BBU	S8550	TO-92 3L	Bulk
SS8550CBU	S8550	TO-92 3L	Bulk
SS8550CTA	S8550	TO-92 3L	Ammo
SS8550DBU	S8550	TO-92 3L	Bulk
SS8550DTA	S8550	TO-92 3L	Ammo

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter	Value	Unit
V_{CBO}	Collector-Base Voltage	-40	V
V_{CEO}	Collector-Emitter Voltage	-25	V
V_{EBO}	Emitter-Base Voltage	-6	V
I_C	Collector Current	-1.5	A
T_J	Junction Temperature	150	°C
T_{STG}	Storage Temperature	-65 to 150	°C

Thermal Characteristics[1]

Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter	Value	Unit
P_D	Power Dissipation	1	W
	Derate Above 25°C	8	mW/°C
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	125	°C/W

Note:

1. PCB size: FR-4, 76 mm x 114 mm x 1.57 mm (3.0 inch x 4.5 inch x 0.062 inch) with minimum land pattern size.

Electrical Characteristics

Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = -100 µA, I_E = 0	-40			V
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = -2 mA, I_B = 0	-25			V
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = -100 µA, I_C = 0	-6			V
I_{CBO}	Collector Cut-Off Current	V_{CB} = -35 V, I_E = 0			-100	nA
I_{EBO}	Emitter Cut-Off Current	V_{EB} = -6 V, I_C = 0			-100	nA
h_{FE1}	DC Current Gain	V_{CE} = -1 V, I_C = -5 mA	45	170		
h_{FE2}		V_{CE} = -1 V, I_C = -100 mA	85	160	300	
h_{FE3}		V_{CE} = -1 V, I_C = -800 mA	40	80		
V_{CE}(sat)	Collector-Emitter Saturation Voltage	I_C = -800 mA, I_B = -80 mA		-0.28	-0.50	V
V_{BE}(sat)	Base-Emitter Saturation Voltage	I_C = -800 mA, I_B = -80 mA		-0.98	-1.20	V
V_{BE}(on)	Base-Emitter On Voltage	V_{CE} = -1 V, I_C = -10 mA		-0.66	-1.00	V
C_{ob}	Output Capacitance	V_{CB} = -10 V, I_E = 0, f = 1 MHz		15		pF
f_T	Current Gain Bandwidth Product	V_{CE} = -10 V, I_C = -50 mA	100	200		MHz

h_{FE} Classification

Classification	B	C	D
h_{FE2}	85 ~ 160	120 ~ 200	160 ~ 300

Typical Performance Characteristics

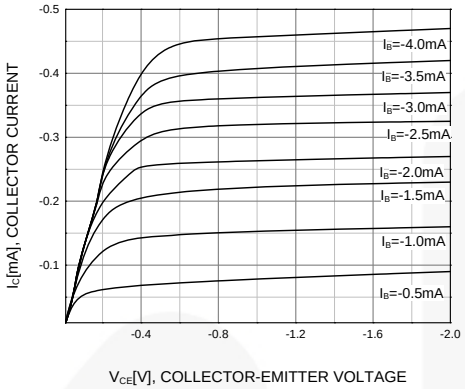


Figure 1. Static Characteristic

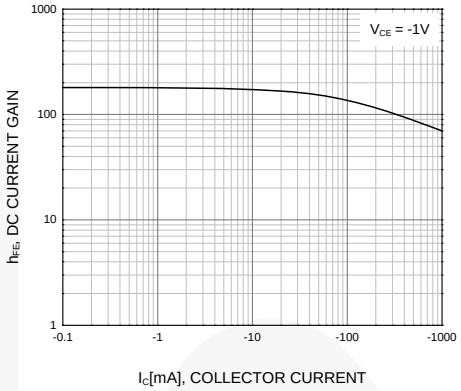


Figure 2. DC Current Gain

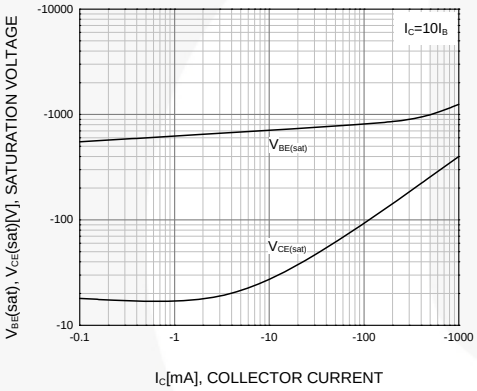


Figure 3. Base-Emitter Saturation Voltage and Collector-Emitter Saturation Voltage

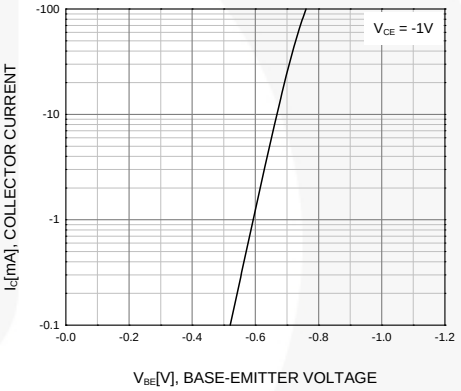


Figure 4. Base-Emitter On Voltage

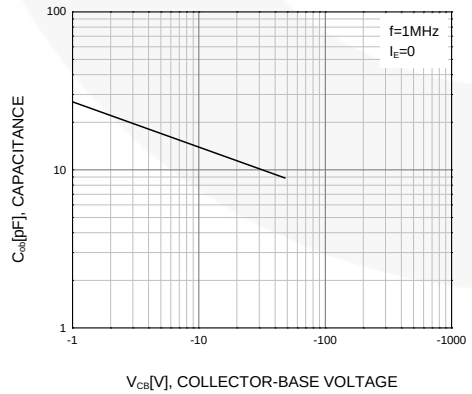


Figure 5. Collector Output Capacitance

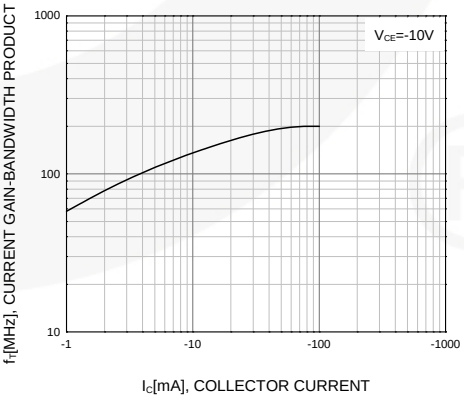
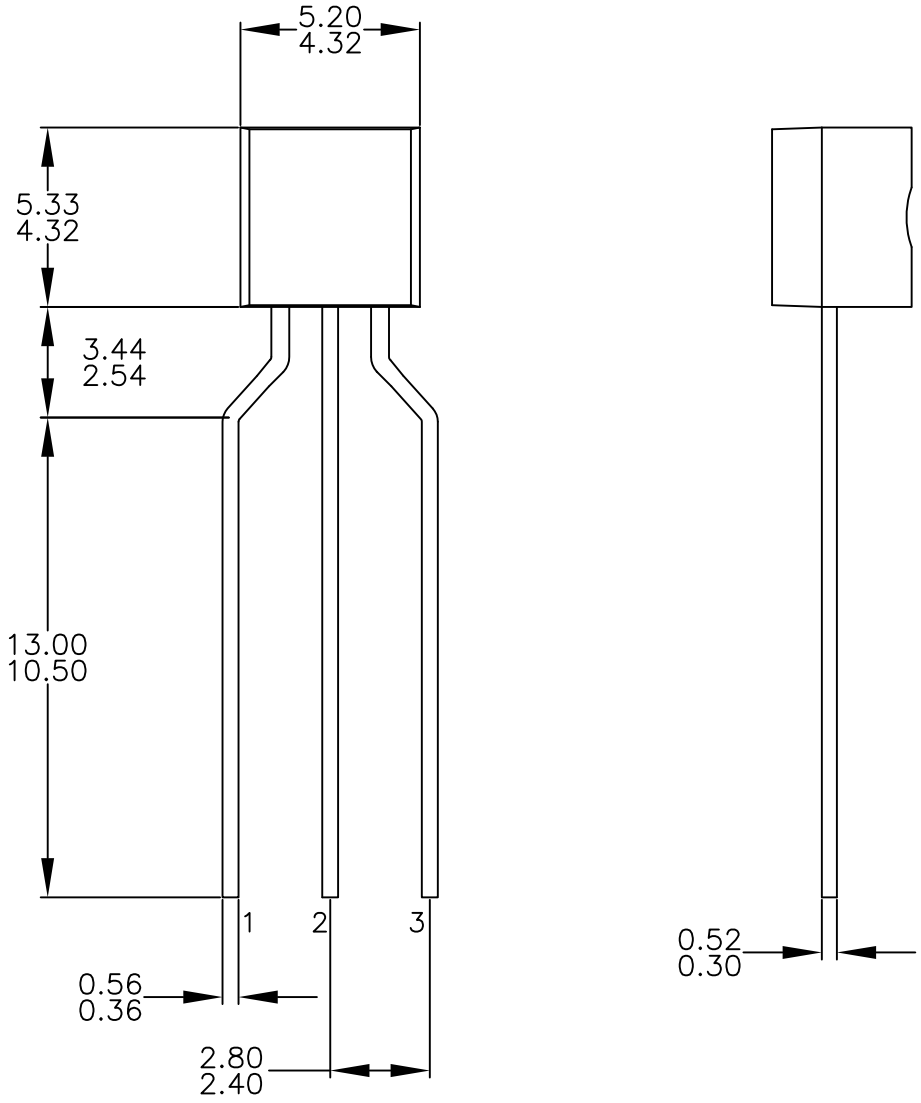
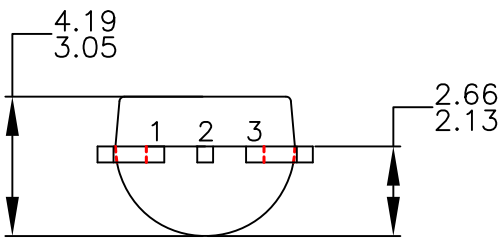


Figure 6. Current Gain Bandwidth Product





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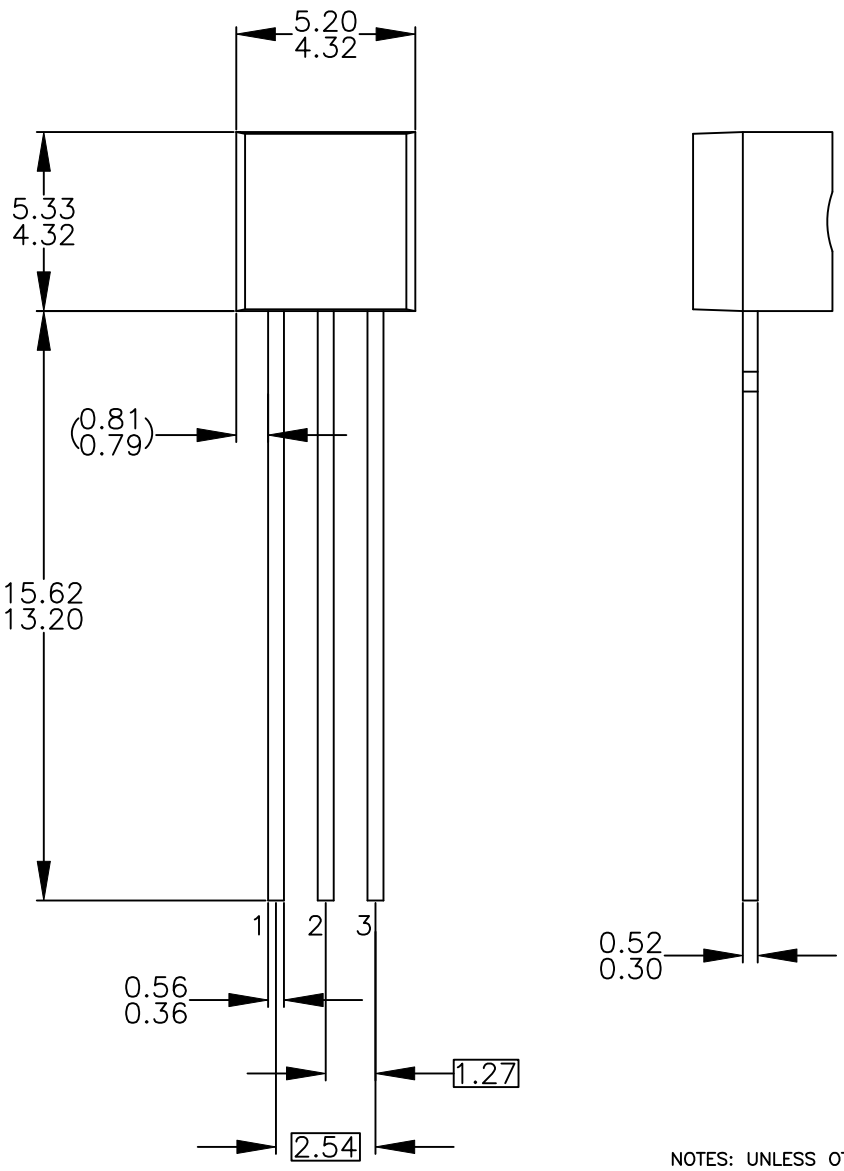

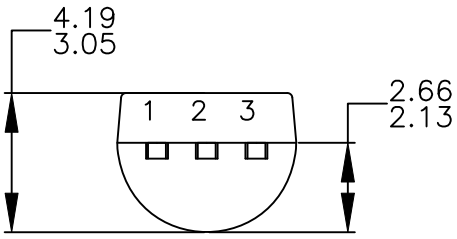

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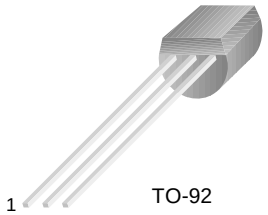
SS9012

1W Output Amplifier of Potable Radios in Class B Push-pull Operation.

- High total power dissipation. (P_T=625mW)
- High Collector Current. (I_C= -500mA)
- Complementary to SS9013
- Excellent h_{FE} linearity.



TO-92

1. Emitter 2. Base 3. Collector

PNP Epitaxial Silicon Transistor

Absolute Maximum Ratings T_a=25°C unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{CBO}	Collector-Base Voltage	-40	V
V_{CEO}	Collector-Emitter Voltage	-20	V
V_{EBO}	Emitter-Base Voltage	-5	V
I_C	Collector Current	-500	mA
P_C	Collector Power Dissipation	625	mW
T_J	Junction Temperature	150	°C
T_{STG}	Storage Temperature	-55 ~ 150	°C

Electrical Characteristics T_a=25°C unless otherwise noted

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = -100μA, I_E =0	-40			V
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = -1mA, I_B =0	-20			V
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = -100μA, I_C =0	-5			V
I_{CBO}	Collector Cut-off Current	V_{CB} = -25V, I_E =0			-100	nA
I_{EBO}	Emitter Cut-off Current	V_{EB} = -3V, I_C =0			-100	nA
h_{FE1} h_{FE2}	DC Current Gain	V_{CE} = -1V, I_C = -50mA V_{CE} = -1V, I_C = -500mA	64 40	120 90	202	
V_{CE} (sat)	Collector-Emitter Saturation Voltage	I_C = -500mA, I_B = -50mA		-0.18	-0.6	V
V_{BE} (sat)	Base-Emitter Saturation Voltage	I_C = -500mA, I_B = -50mA		-0.95	-1.2	V
V_{BE} (on)	Base-Emitter On Voltage	V_{CE} = -1V, I_C = -10mA	-0.6	-0.67	-0.7	V

h_{FE} Classification

Classification	D	E	F	G	H
h_{FE1}	64 ~ 91	78 ~ 112	96 ~ 135	112 ~ 166	144 ~ 202

Typical Characteristics

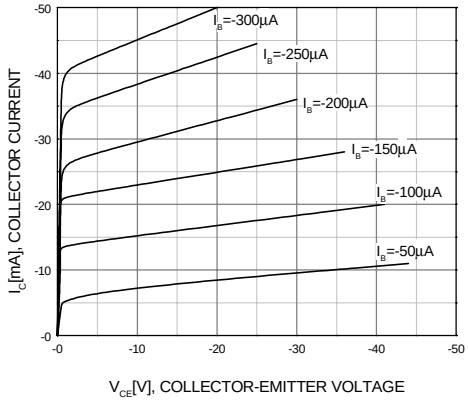


Figure 1. Static Characteristic

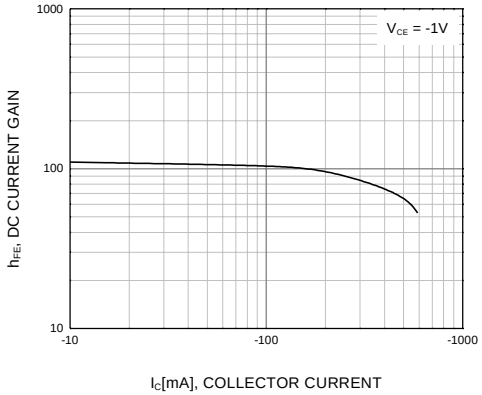


Figure 2. DC current Gain

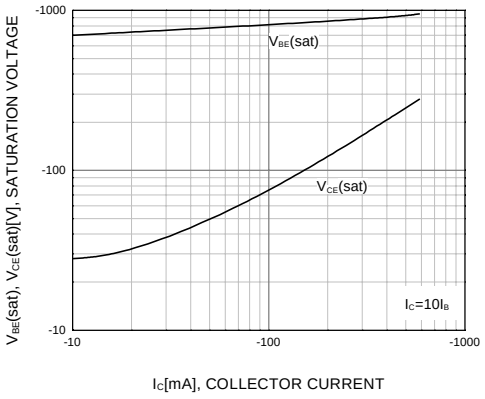


Figure 3. Base-Emitter Saturation Voltage Collector-Emitter Saturation Voltage

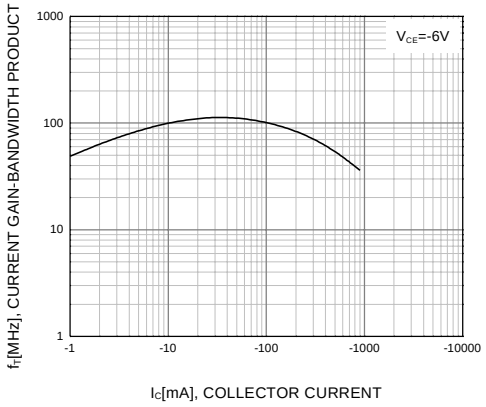
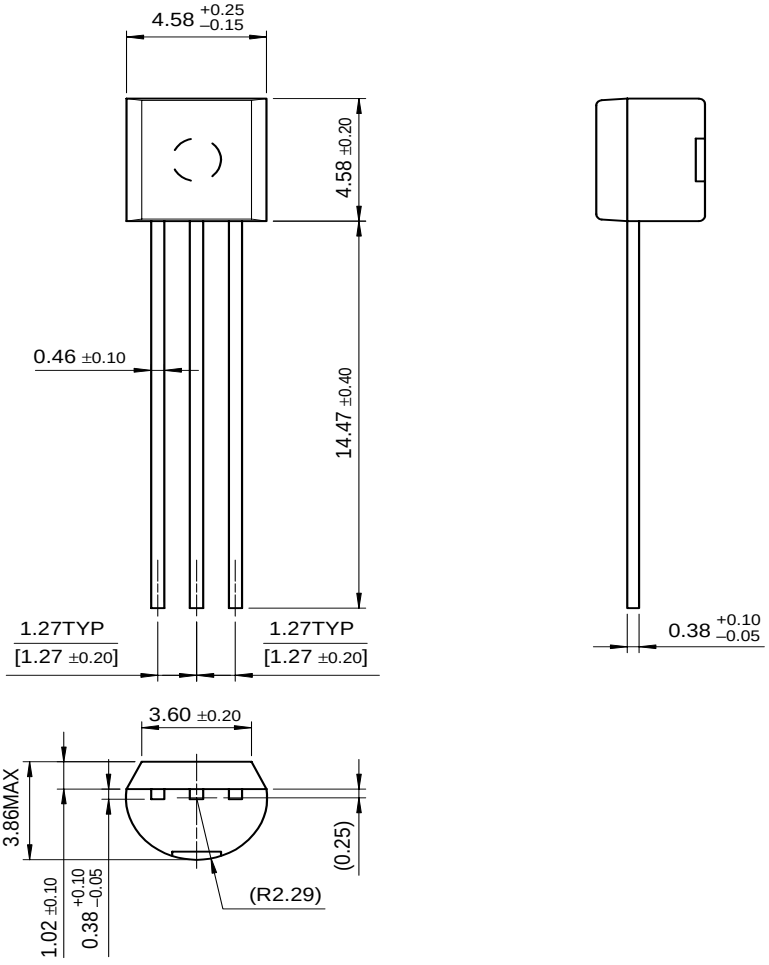


Figure 4. Current Gain Bandwidth Product

Package Dimensions

TO-92



Dimensions in Millimeters

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CoolFET™	FASTr™	MicroFET™	PowerTrench®	SuperSOT™-6
CROSSVOLT™	FRFET™	MicroPak™	QFET™	SuperSOT™-8
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FAIRCHILD
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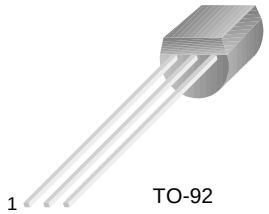
SS9013

1W Output Amplifier of Potable Radios in Class B Push-pull Operation.

- High total power dissipation. (P_T=625mW)
- High Collector Current. (I_C=500mA)
- Complementary to SS9012
- Excellent h_{FE} linearity.



TO-92

1. Emitter 2. Base 3. Collector

NPN Epitaxial Silicon Transistor

Absolute Maximum Ratings T_a=25°C unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{CBO}	Collector-Base Voltage	40	V
V_{CEO}	Collector-Emitter Voltage	20	V
V_{EBO}	Emitter-Base Voltage	5	V
I_C	Collector Current	500	mA
P_C	Collector Power Dissipation	625	mW
T_J	Junction Temperature	150	°C
T_{STG}	Storage Temperature	-55 ~ 150	°C

Electrical Characteristics T_a=25°C unless otherwise noted

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
BV_{CBO}	Collector-Base Breakdown Voltage	I_C =100μA, I_E =0	40			V
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C =1mA, I_B =0	20			V
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E =100μA, I_C =0	5			V
I_{CBO}	Collector Cut-off Current	V_{CB} =25V, I_E =0			100	nA
I_{EBO}	Emitter Cut-off Current	V_{EB} =3V, I_C =0			100	nA
h_{FE1} h_{FE2}	DC Current Gain	V_{CE} =1V, I_C =50mA V_{CE} =1V, I_C =500mA	64 40	120 120	202	
V_{CE} (sat)	Collector-Emitter Saturation Voltage	I_C =500mA, I_B =50mA		0.16	0.6	V
V_{BE} (sat)	Base-Emitter Saturation Voltage	I_C =500mA, I_B =50mA		0.91	1.2	V
V_{BE} (on)	Base-Emitter On Voltage	V_{CE} =1V, I_C =10mA	0.6	0.67	0.7	V

h_{FE} Classification

Classification	D	E	F	G	H
h_{FE1}	64 ~ 91	78 ~ 112	96 ~ 135	112 ~ 166	144 ~ 202

Typical Characteristics

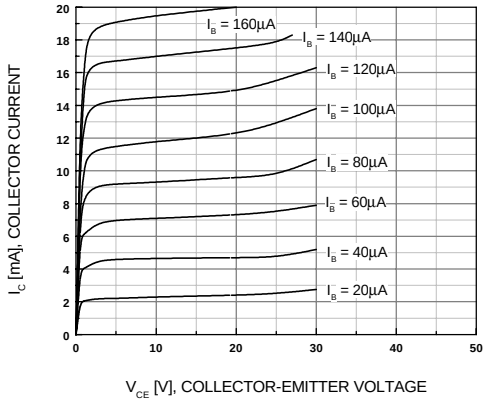


Figure 1. Static Characteristic

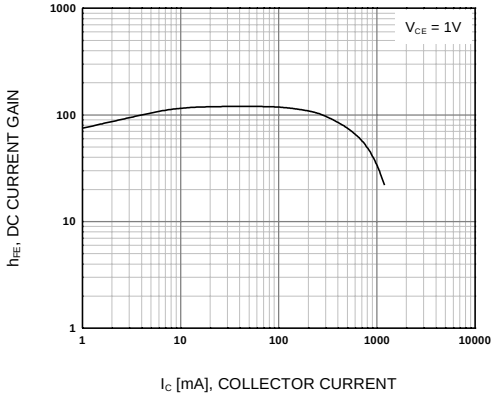


Figure 2. DC current Gain

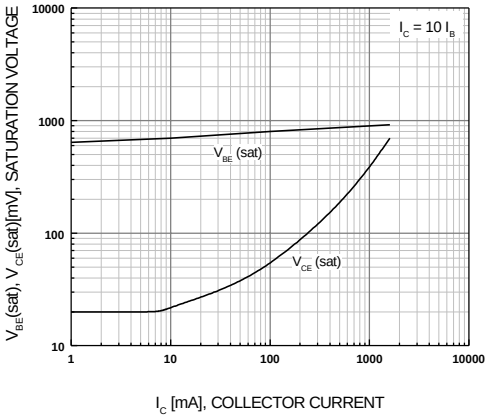


Figure 3. Base-Emitter Saturation Voltage Collector-Emitter Saturation Voltage

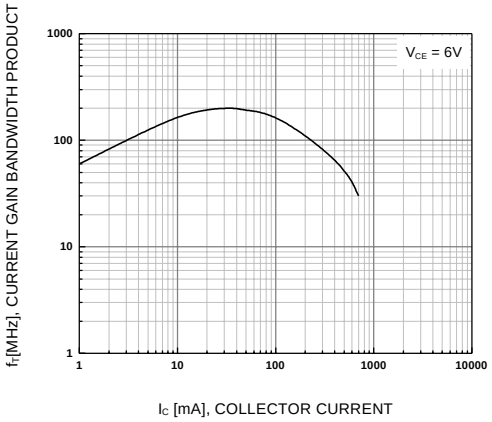
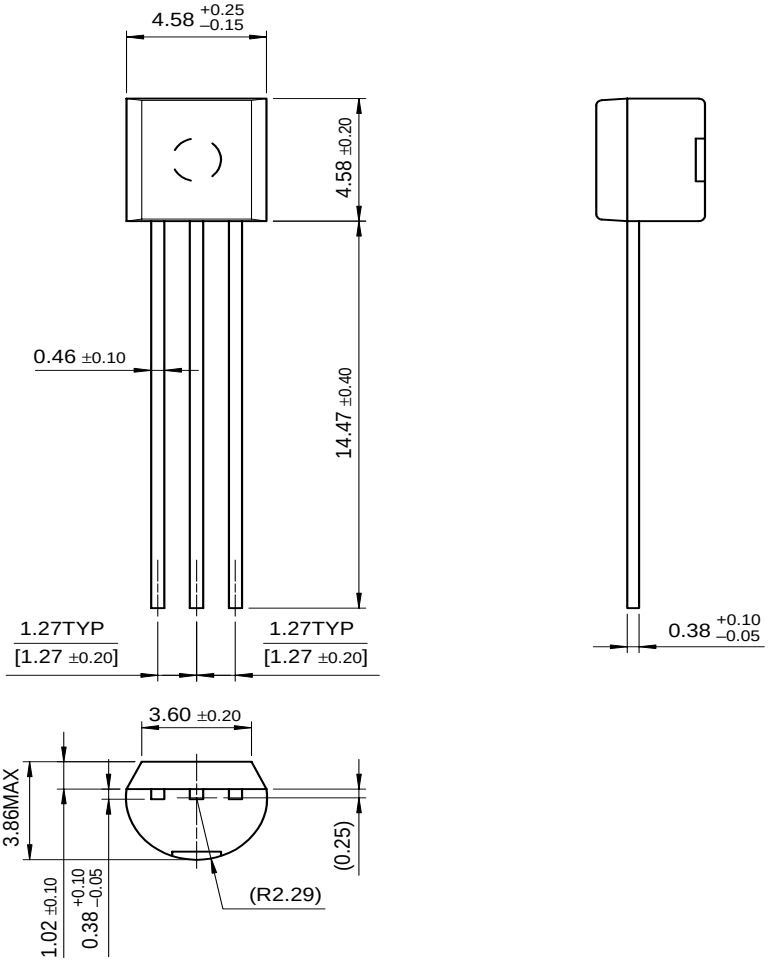


Figure 4. Current Gain Bandwidth Product

Package Dimensions

TO-92



Dimensions in Millimeters

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CROSSVOLT™	FRFET™	MicroPak™	QFET™	SuperSOT™-8
DOME™	GlobalOptoisolator™	MICROWIRE™	QS™	SyncFET™
EcoSPARK™	GTO™	MSX™	QT Optoelectronics™	TinyLogic™
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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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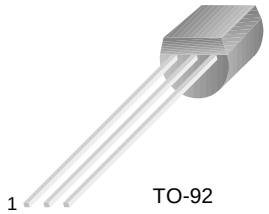
SS9014

Pre-Amplifier, Low Level & Low Noise

- High total power dissipation. (P_T=450mW)
- High h_{FE} and good linearity
- Complementary to SS9015



TO-92

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NPN Epitaxial Silicon Transistor

Absolute Maximum Ratings T_a=25°C unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{CBO}	Collector-Base Voltage	50	V
V_{CEO}	Collector-Emitter Voltage	45	V
V_{EBO}	Emitter-Base Voltage	5	V
I_C	Collector Current	100	mA
P_C	Collector Power Dissipation	450	mW
T_J	Junction Temperature	150	°C
T_{STG}	Storage Temperature	-55 ~ 150	°C

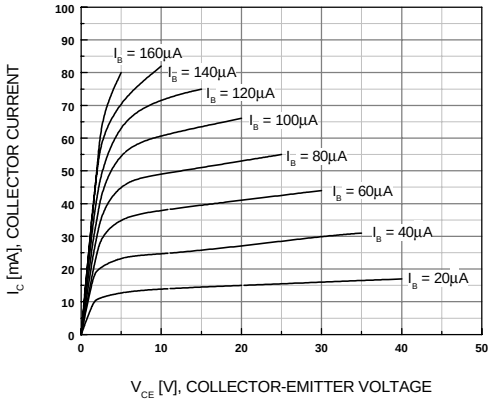
Electrical Characteristics T_a=25°C unless otherwise noted

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
BV_{CBO}	Collector-Base Breakdown Voltage	I_C =100μA, I_E =0	50			V
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C =1mA, I_B =0	45			V
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E =100μA, I_C =0	5			V
I_{CBO}	Collector Cut-off Current	V_{CB} =50V, I_E =0			50	nA
I_{EBO}	Emitter Cut-off Current	V_{EB} =5V, I_C =0			50	nA
h_{FE}	DC Current Gain	V_{CE} =5V, I_C =1mA	60	280	1000	
V_{CE} (sat)	Collector-Base Saturation Voltage	I_C =100mA, I_B =5mA		0.14	0.3	
V_{BE} (sat)	Base-Emitter Saturation Voltage	I_C =100mA, I_B =5mA		0.84	1.0	V
V_{BE} (on)	Base-Emitter On Voltage	V_{CE} =5V, I_C =2mA	0.58	0.63	0.7	V
C_{ob}	Output Capacitance	V_{CB} =10V, I_E =0 f=1MHz		2.2	3.5	pF
f_T	Current Gain Bandwidth Product	V_{CE} =5V, I_C =10mA	150	270		MHz
NF	Noise Figure	V_{CE} =5V, I_C =0.2mA f=1KHz, R_S=2KΩ		0.9	10	dB

h_{FE} Classification

Classification	A	B	C	D
h_{FE}	60 ~ 150	100 ~ 300	200 ~ 600	400 ~ 1000

Typical Characteristics



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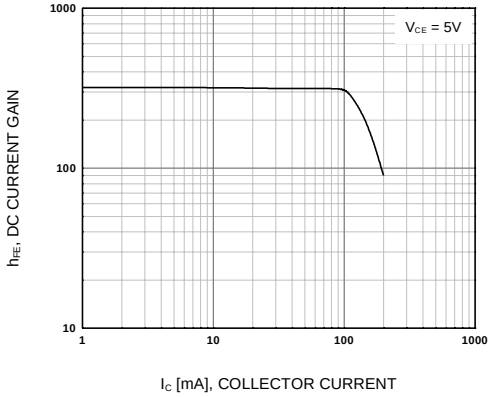

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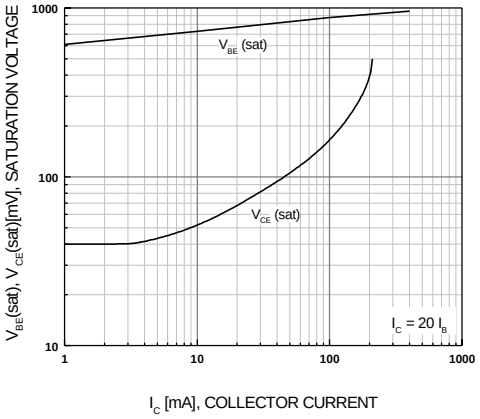

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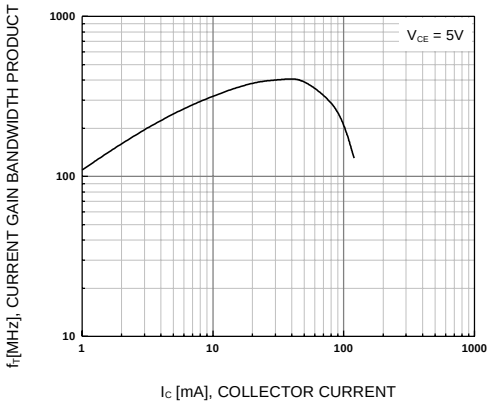
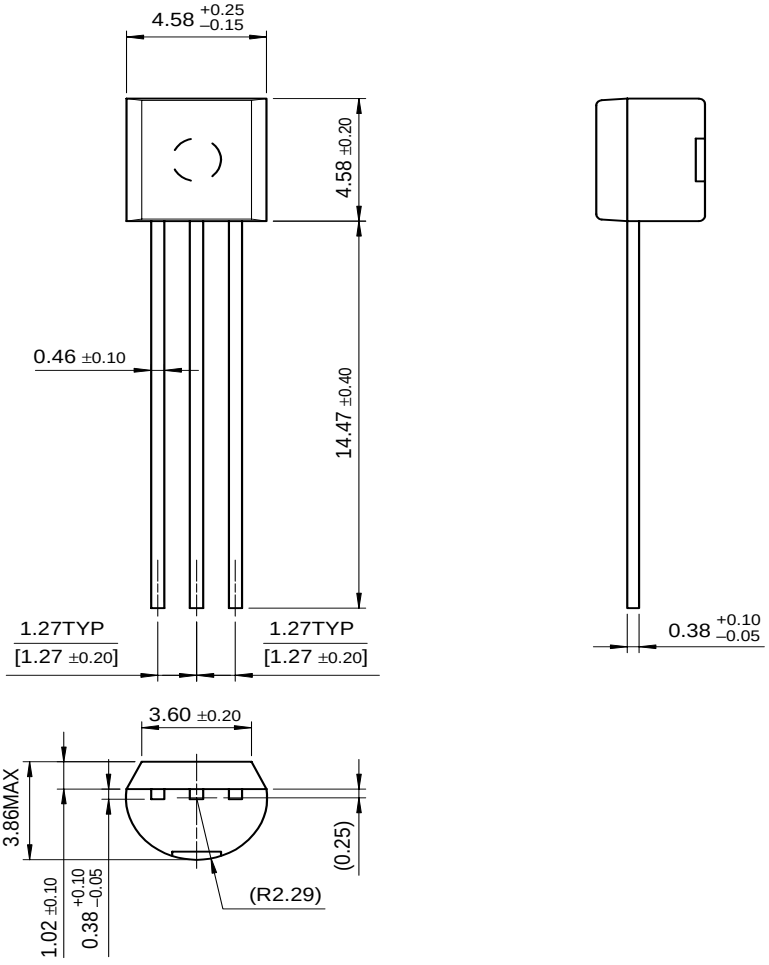


Figure 4. Current Gain Bandwidth Product

Package Dimensions

TO-92



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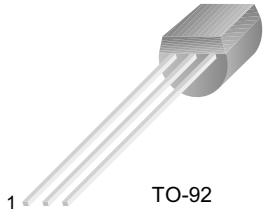
SEMICONDUCTOR®

SS9015

Low Frequency, Low Noise Amplifier

- Complement to SS9014



TO-92

1. Emitter 2. Base 3. Collector

PNP Epitaxial Silicon Transistor

Absolute Maximum Ratings T_a=25°C unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{CBO}	Collector-Base Voltage	-50	V
V_{CEO}	Collector-Emitter Voltage	-45	V
V_{EBO}	Emitter-Base Voltage	-5	V
I_C	Collector Current	-100	mA
P_C	Collector Power Dissipation	450	mW
T_J	Junction Temperature	150	°C
T_{STG}	Storage Temperature	-55 ~ 150	°C

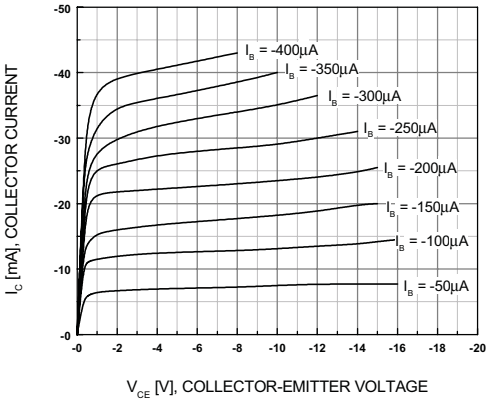
Electrical Characteristics T_a=25°C unless otherwise noted

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = -100μA, I_E =0	-50			V
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = -1mA, I_B =0	-45			V
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = -100μA, I_C =0	-5			V
I_{CBO}	Collector Cut-off Current	V_{CB} = -50V, I_E =0			-50	nA
I_{EBO}	Emitter Cut-off Current	V_{EB} = -5V, I_C =0			-50	nA
h_{FE}	DC Current Gain	V_{CE} = -5V, I_C = -1mA	60		1000	
V_{CE} (sat)	Collector-Base Saturation Voltage	I_C = -100mA, I_B = -5mA			-0.7	
V_{BE} (sat)	Base-Emitter Saturation Voltage	I_C = -100mA, I_B = -5mA			-1.0	V
V_{BE} (on)	Base-Emitter On Voltage	V_{CE} = -5V, I_C = -2mA	-0.6		-0.75	V
C_{ob}	Output Capacitance	V_{CB} = -10V, I_E =0 f=1MHz		4.5	7.0	pF
f_T	Current Gain Bandwidth Product	V_{CE} = -5V, I_C = -10mA	100	190		MHz
NF	Noise Figure	V_{CE} = -5V, I_C = -0.2mA f=1KHz, R_S=1KΩ		0.7	10	dB

h_{FE} Classification

Classification	A	B	C	D
h_{FE}	60 ~ 150	100 ~ 300	200 ~ 600	400 ~ 1000

Typical Characteristics



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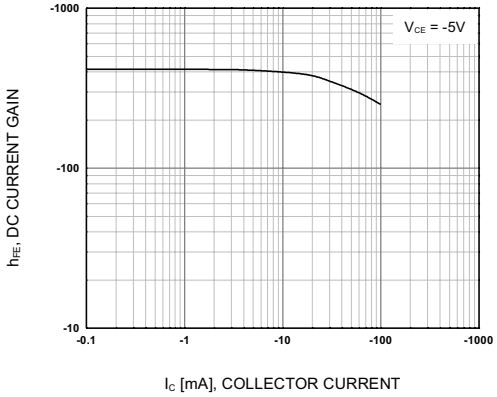

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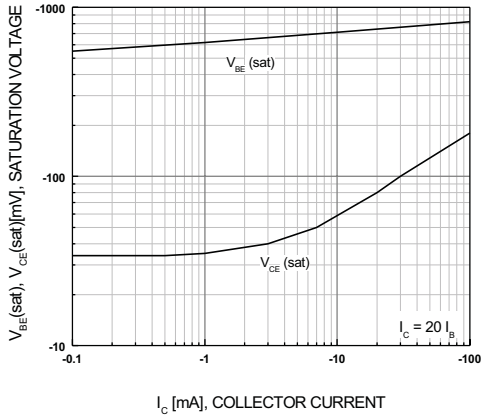

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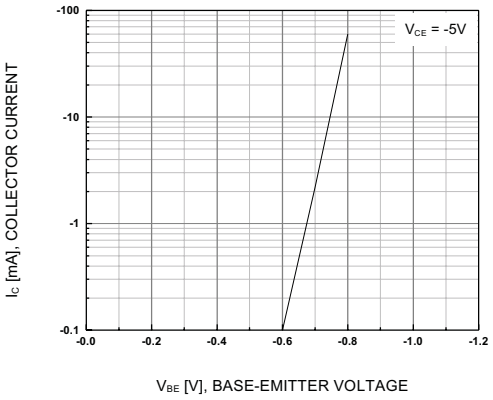


Figure 4. Base-Emitter On Voltage

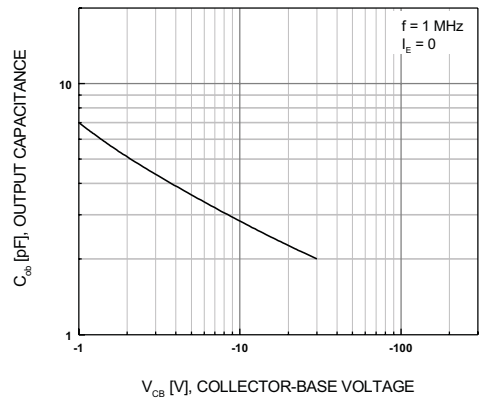
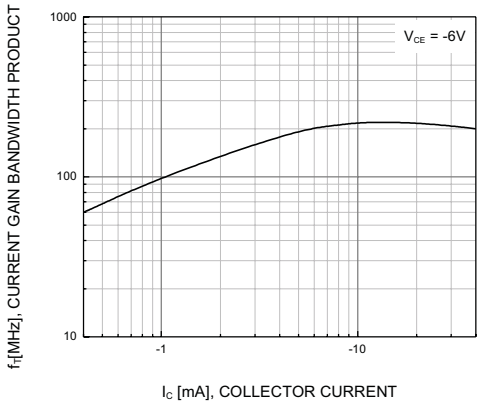


Figure 5. Collector Output Capacitance



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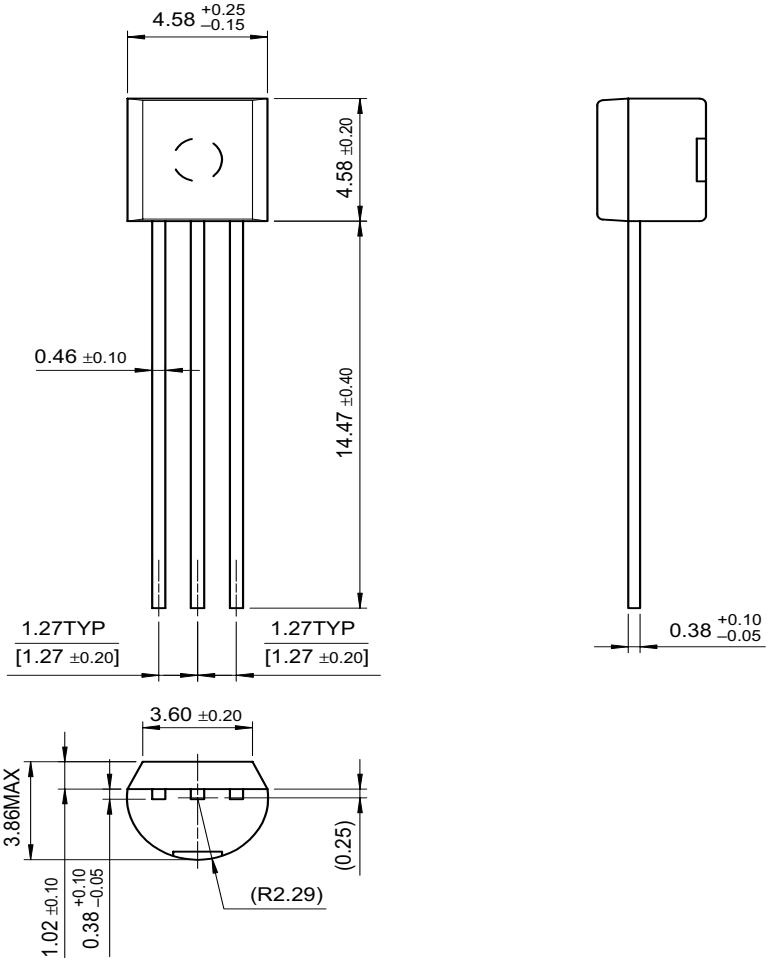
Package Dimensions

TO-92



Dimensions in Millimeters

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As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.

2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
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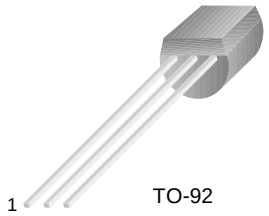
SS9018

AM/FM Amplifier, Local Oscillator of FM/VHF Tuner

- High Current Gain Bandwidth Product f_T=1.1 GHz (Typ)



TO-92

1. Emitter 2. Base 3. Collector

NPN Epitaxial Silicon Transistor

Absolute Maximum Ratings T_a=25°C unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{CBO}	Collector-Base Voltage	30	V
V_{CEO}	Collector-Emitter Voltage	15	V
V_{EBO}	Emitter-Base Voltage	5	V
I_C	Collector Current	50	mA
P_C	Collector Power Dissipation	400	mW
T_J	Junction Temperature	150	°C
T_{STG}	Storage Temperature	-55 ~ 150	°C

Electrical Characteristics T_a=25°C unless otherwise noted

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
BV_{CBO}	Collector-Base Breakdown Voltage	I_C =100μA, I_E =0	30			V
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C =1.0mA, I_B =0	15			V
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E =100μA, I_C =0	5			V
I_{CBO}	Collector Cut-off Current	V_{CB} =12V, I_E =0			50	nA
h_{FE}	Emitter Cut-off Current	V_{CE} =5V, I_C =1.0mA	28	100	198	
V_{CE} (sat)	Collector-Emitter Saturation Voltage	I_C =10mA, I_B =1mA			0.5	V
C_{ob}	Output Capacitance	V_{CB} =10V, I_E =0 f=1MHz		1.3	1.7	pF
f_T	Current Gain Bandwidth Product	V_{CE} =5V, I_C =5mA	700	1100		MHz

h_{FE} Classification

Classification	D	E	F	G	H	I
h_{FE}	28 ~ 45	39 ~ 60	54 ~ 80	72 ~ 108	97 ~ 146	132 ~ 198

Typical Characteristics

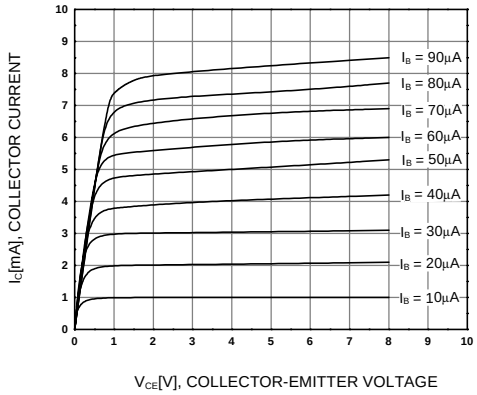


Figure 1. Static Characteristic

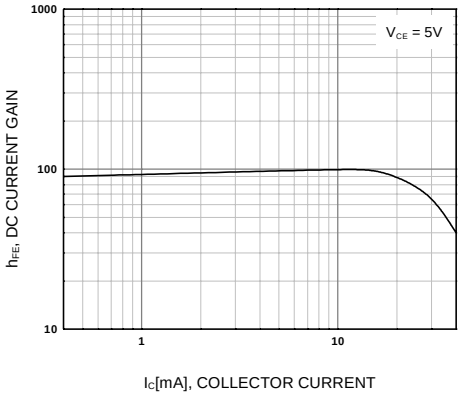


Figure 2. DC current Gain

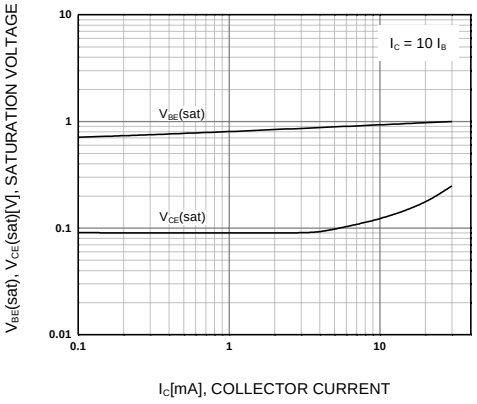


Figure 3. Base-Emitter Saturation Voltage Collector-Emitter Saturation Voltage

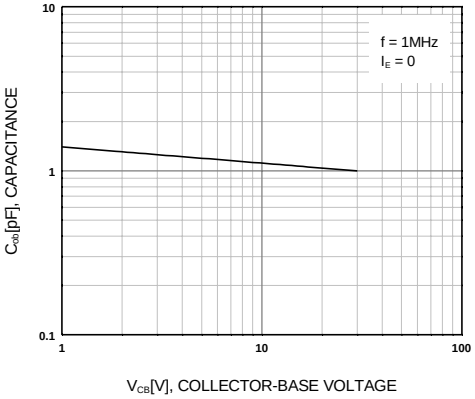


Figure 4. Output Capacitance

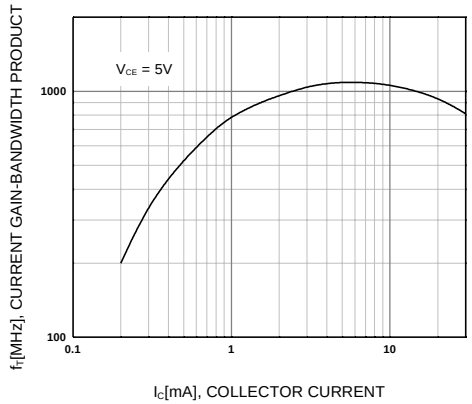
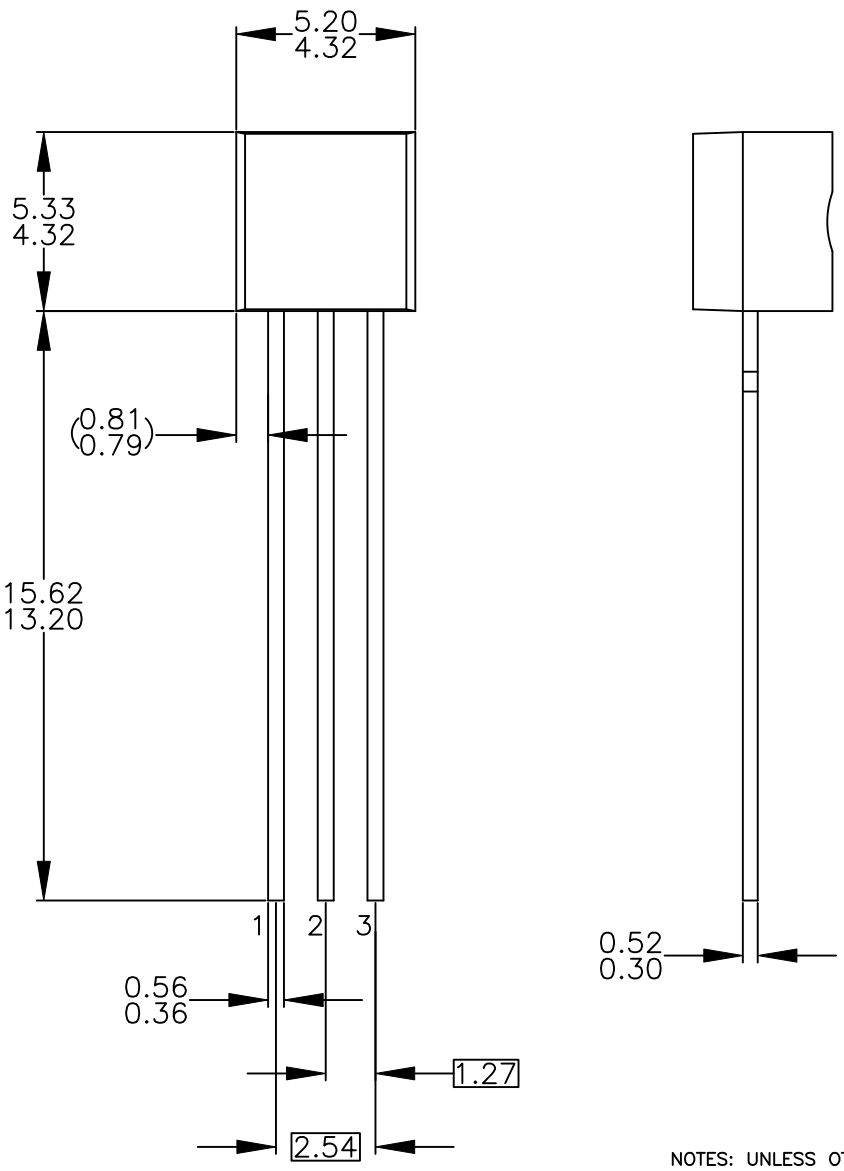
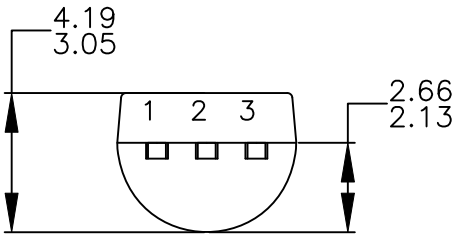


Figure 5. Current Gain Bandwidth Product





NOTES: UNLESS OTHERWISE SPECIFIED

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B) ALL DIMENSIONS ARE IN MILLIMETERS.
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