

# 2N3906RL1G Datasheet

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DiGi Electronics Part Number	2N3906RL1G-DG
Manufacturer	<a href="#">onsemi</a>
Manufacturer Product Number	2N3906RL1G
Description	TRANS PNP 40V 0.2A TO92
Detailed Description	Bipolar (BJT) Transistor PNP 40 V 200 mA 250MHz 6 25 mW Through Hole TO-92 (TO-226)



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DiGi is a global authorized distributor of electronic components.

## Purchase and inquiry

Manufacturer Product Number:

2N3906RL1G

Series:

-

Transistor Type:

PNP

Voltage - Collector Emitter Breakdown (Max):

40 V

Current - Collector Cutoff (Max):

-

Power - Max:

625 mW

Operating Temperature:

-55°C ~ 150°C (TJ)

Package / Case:

TO-226-3, TO-92-3 Long Body (Formed Leads)

Base Product Number:

2N3906

Manufacturer:

onsemi

Product Status:

Obsolete

Current - Collector (Ic) (Max):

200 mA

Vce Saturation (Max) @ Ib, Ic:

400mV @ 5mA, 50mA

DC Current Gain (hFE) (Min) @ Ic, Vce:

100 @ 10mA, 1V

Frequency - Transition:

250MHz

Mounting Type:

Through Hole

Supplier Device Package:

TO-92 (TO-226)

## Environmental & Export classification

Moisture Sensitivity Level (MSL):

1 (Unlimited)

ECCN:

EAR99

REACH Status:

REACH Unaffected

HTSUS:

8541.21.0075



# 2N3906

## General Purpose Transistors

### PNP Silicon

#### Features

- Pb-Free Packages are Available\*

#### 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	mA <sub>dc</sub>
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	625 5.0	mW mW/ $^\circ\text{C}$
Total Power Dissipation @ $T_A = 60^\circ\text{C}$	$P_D$	250	mW
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	1.5 12	W mW/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$

#### THERMAL CHARACTERISTICS (Note 1)

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

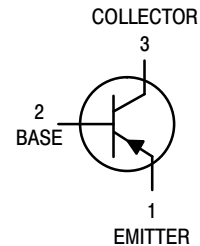
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Indicates Data in addition to JEDEC Requirements.

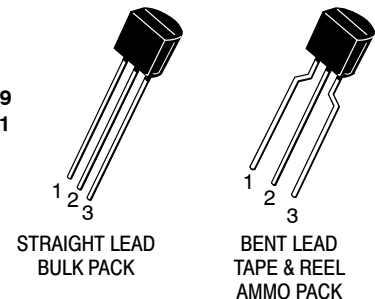


ON Semiconductor®

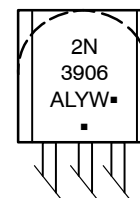
<http://onsemi.com>



TO-92  
CASE 29  
STYLE 1



#### 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.

**2N3906****ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector – Emitter Breakdown Voltage (Note 2) ( $I_C = 1.0 \text{ mAdc}, I_B = 0$ )	$V_{(BR)CEO}$	40	–	Vdc
Collector – Base Breakdown Voltage ( $I_C = 10 \text{ }\mu\text{Adc}, I_E = 0$ )	$V_{(BR)CBO}$	40	–	Vdc
Emitter – Base Breakdown Voltage ( $I_E = 10 \text{ }\mu\text{Adc}, I_C = 0$ )	$V_{(BR)EBO}$	5.0	–	Vdc
Base Cutoff Current ( $V_{CE} = 30 \text{ Vdc}, V_{EB} = 3.0 \text{ Vdc}$ )	$I_{BL}$	–	50	nAdc
Collector Cutoff Current ( $V_{CE} = 30 \text{ Vdc}, V_{EB} = 3.0 \text{ Vdc}$ )	$I_{CEX}$	–	50	nAdc

**ON CHARACTERISTICS** (Note 2)

DC Current Gain ( $I_C = 0.1 \text{ mAdc}, V_{CE} = 1.0 \text{ Vdc}$ ) ( $I_C = 1.0 \text{ mAdc}, V_{CE} = 1.0 \text{ Vdc}$ ) ( $I_C = 10 \text{ mAdc}, V_{CE} = 1.0 \text{ Vdc}$ ) ( $I_C = 50 \text{ mAdc}, V_{CE} = 1.0 \text{ Vdc}$ ) ( $I_C = 100 \text{ mAdc}, V_{CE} = 1.0 \text{ Vdc}$ )	$h_{FE}$	60 80 100 60 30	– – 300 – –	–
Collector – Emitter Saturation Voltage ( $I_C = 10 \text{ mAdc}, I_B = 1.0 \text{ mAdc}$ ) ( $I_C = 50 \text{ mAdc}, I_B = 5.0 \text{ mAdc}$ )	$V_{CE(sat)}$	– –	0.25 0.4	Vdc
Base – Emitter Saturation Voltage ( $I_C = 10 \text{ mAdc}, I_B = 1.0 \text{ mAdc}$ ) ( $I_C = 50 \text{ mAdc}, I_B = 5.0 \text{ mAdc}$ )	$V_{BE(sat)}$	0.65 –	0.85 0.95	Vdc

**SMALL-SIGNAL CHARACTERISTICS**

Current – Gain – Bandwidth Product ( $I_C = 10 \text{ mAdc}, V_{CE} = 20 \text{ Vdc}, f = 100 \text{ MHz}$ )	$f_T$	250	–	MHz
Output Capacitance ( $V_{CB} = 5.0 \text{ Vdc}, I_E = 0, f = 1.0 \text{ MHz}$ )	$C_{obo}$	–	4.5	pF
Input Capacitance ( $V_{EB} = 0.5 \text{ Vdc}, I_C = 0, f = 1.0 \text{ MHz}$ )	$C_{ibo}$	–	10	pF
Input Impedance ( $I_C = 1.0 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}, f = 1.0 \text{ kHz}$ )	$h_{ie}$	2.0	12	k $\Omega$
Voltage Feedback Ratio ( $I_C = 1.0 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}, f = 1.0 \text{ kHz}$ )	$h_{re}$	0.1	10	$\times 10^{-4}$
Small-Signal Current Gain ( $I_C = 1.0 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}, f = 1.0 \text{ kHz}$ )	$h_{fe}$	100	400	–
Output Admittance ( $I_C = 1.0 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}, f = 1.0 \text{ kHz}$ )	$h_{oe}$	3.0	60	$\mu\text{mhos}$
Noise Figure ( $I_C = 100 \text{ }\mu\text{Adc}, V_{CE} = 5.0 \text{ Vdc}, R_S = 1.0 \text{ k}\Omega, f = 1.0 \text{ kHz}$ )	NF	–	4.0	dB

**SWITCHING CHARACTERISTICS**

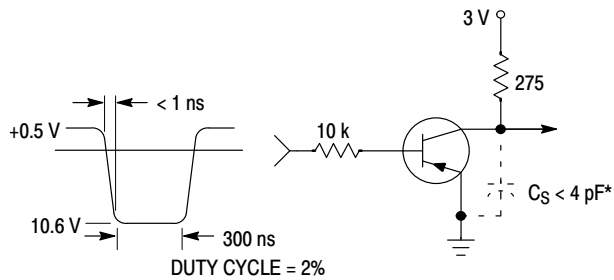
Delay Time	$(V_{CC} = 3.0 \text{ Vdc}, V_{BE} = 0.5 \text{ Vdc}, I_C = 10 \text{ mAdc}, I_{B1} = 1.0 \text{ mAdc})$	$t_d$	–	35	ns
Rise Time		$t_r$	–	35	ns
Storage Time	$(V_{CC} = 3.0 \text{ Vdc}, I_C = 10 \text{ mAdc}, I_{B1} = I_{B2} = 1.0 \text{ mAdc})$	$t_s$	–	225	ns
Fall Time	$(V_{CC} = 3.0 \text{ Vdc}, I_C = 10 \text{ mAdc}, I_{B1} = I_{B2} = 1.0 \text{ mAdc})$	$t_f$	–	75	ns

2. Pulse Test: Pulse Width  $\leq 300 \text{ }\mu\text{s}$ ; Duty Cycle  $\leq 2\%$ .

**2N3906****ORDERING INFORMATION**

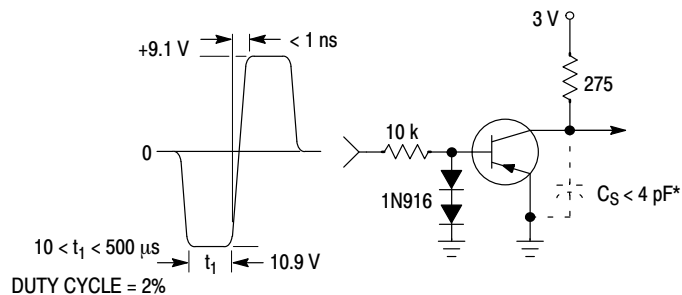
Device	Package	Shipping†
2N3906	TO-92	5000 Units / Bulk
2N3906G	TO-92 (Pb-Free)	5000 Units / Bulk
2N3906RL1	TO-92	2000 / Tape & Reel
2N3906RL1G	TO-92 (Pb-Free)	2000 / Tape & Reel
2N3906RLRA	TO-92	2000 / Tape & Reel
2N3906RLRAG	TO-92 (Pb-Free)	2000 / Tape & Reel
2N3906RLRM	TO-92	2000 / Tape & Ammo Box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



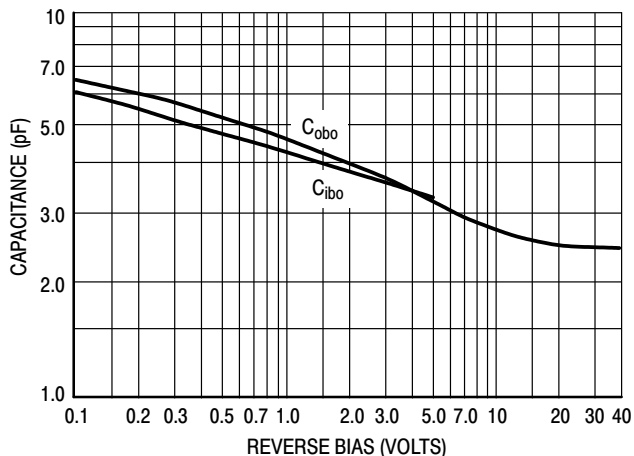
\* Total shunt capacitance of test jig and connectors

**Figure 2. Storage and Fall Time Equivalent Test Circuit**

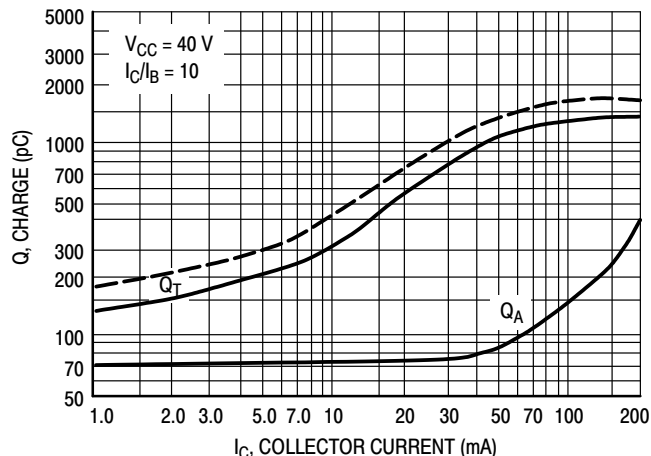
# 2N3906

## TYPICAL TRANSIENT CHARACTERISTICS

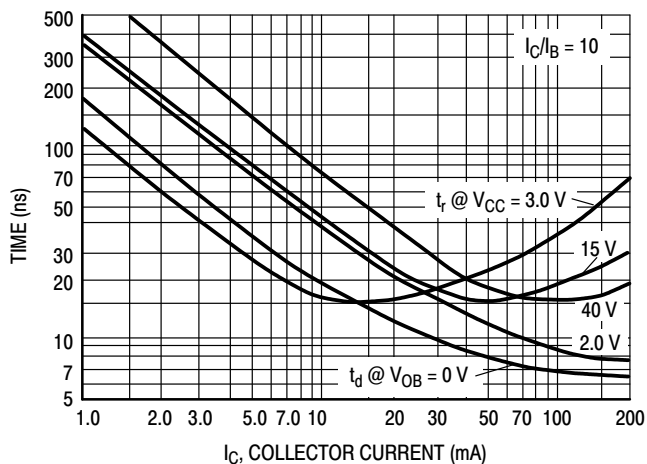
—  $T_J = 25^\circ\text{C}$   
 - - -  $T_J = 125^\circ\text{C}$



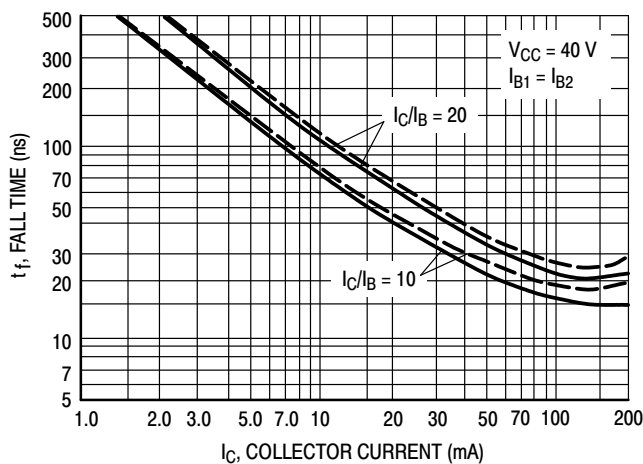
**Figure 3. Capacitance**



**Figure 4. Charge Data**



**Figure 5. Turn-On Time**



**Figure 6. Fall Time**

**2N3906**

**TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS  
NOISE FIGURE VARIATIONS**

( $V_{CE} = -5.0$  Vdc,  $T_A = 25^\circ\text{C}$ , Bandwidth = 1.0 Hz)

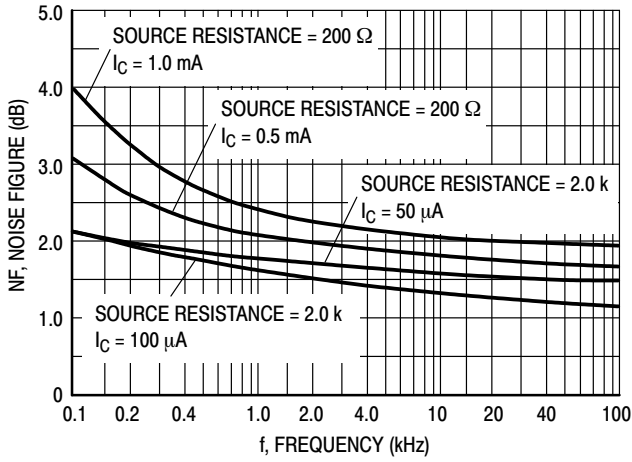


Figure 7.

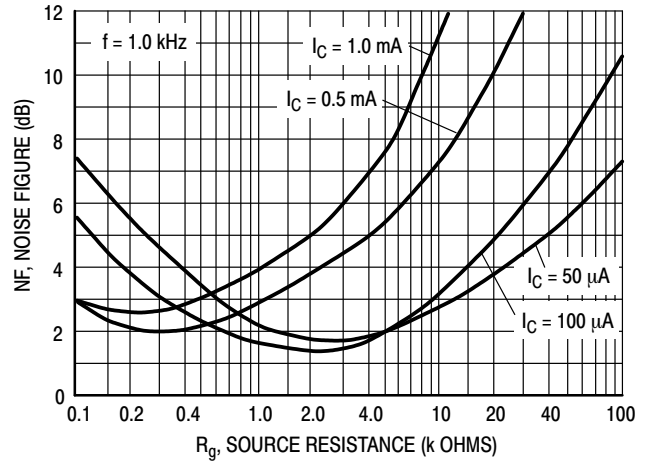


Figure 8.

**h PARAMETERS**

( $V_{CE} = -10$  Vdc,  $f = 1.0$  kHz,  $T_A = 25^\circ\text{C}$ )

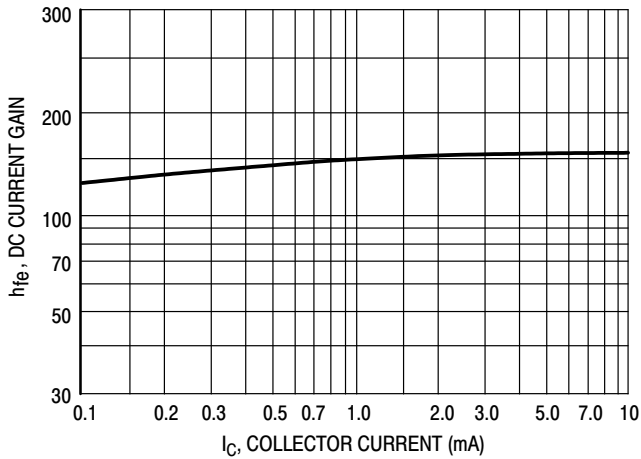


Figure 9. Current Gain

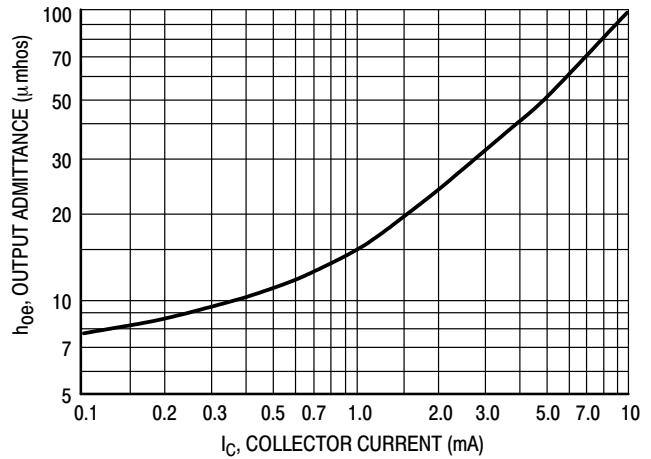


Figure 10. Output Admittance

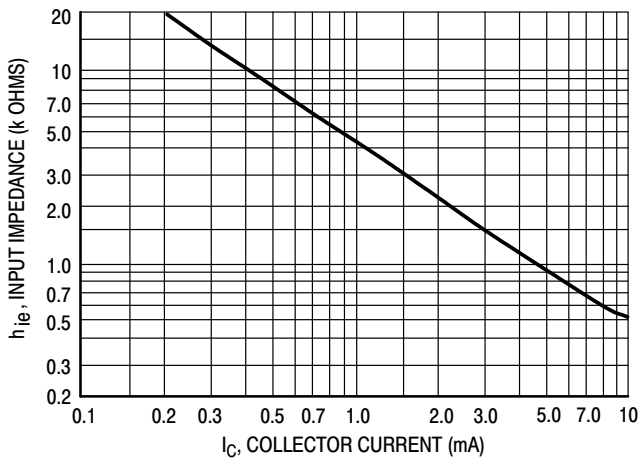


Figure 11. Input Impedance

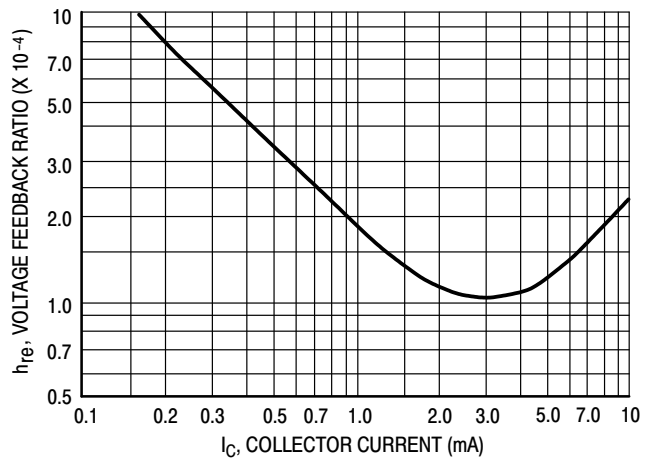
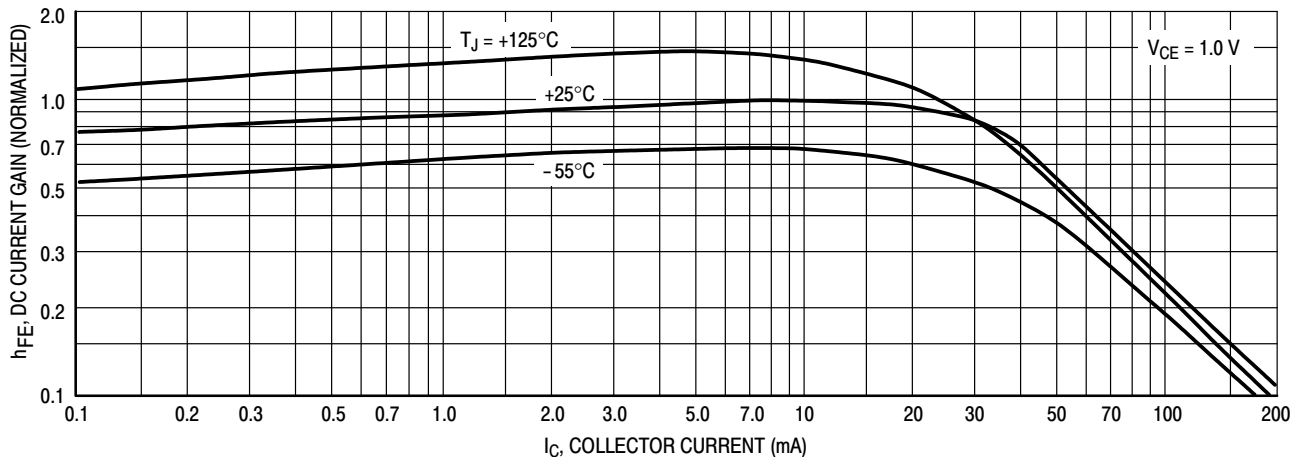


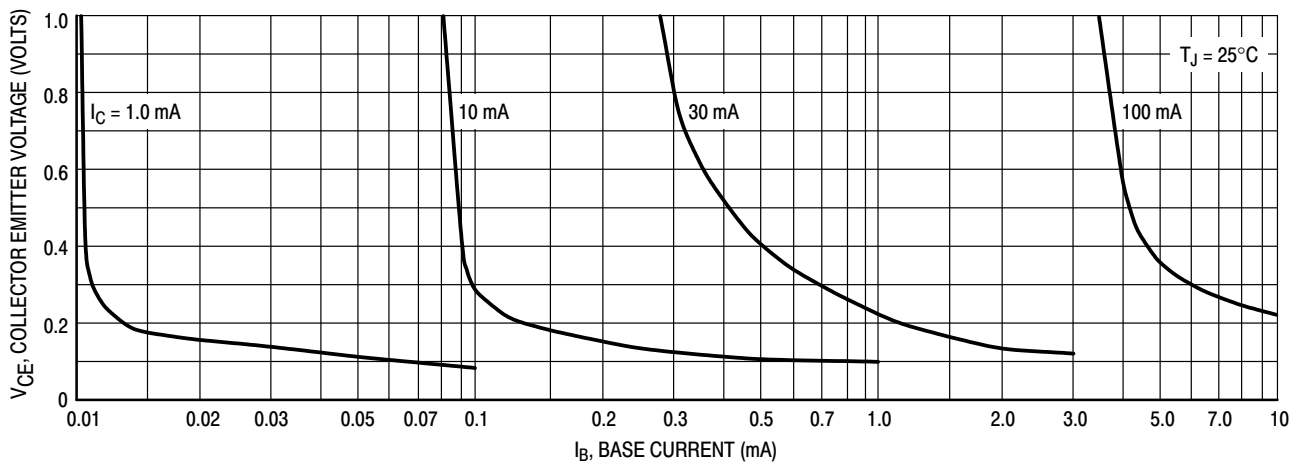
Figure 12. Voltage Feedback Ratio

**2N3906**

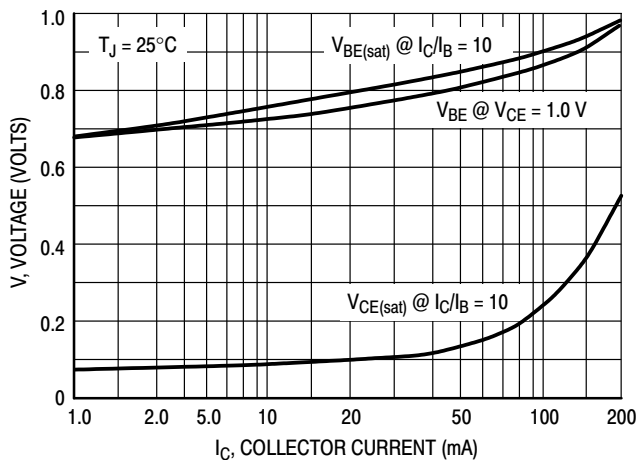
**TYPICAL STATIC CHARACTERISTICS**



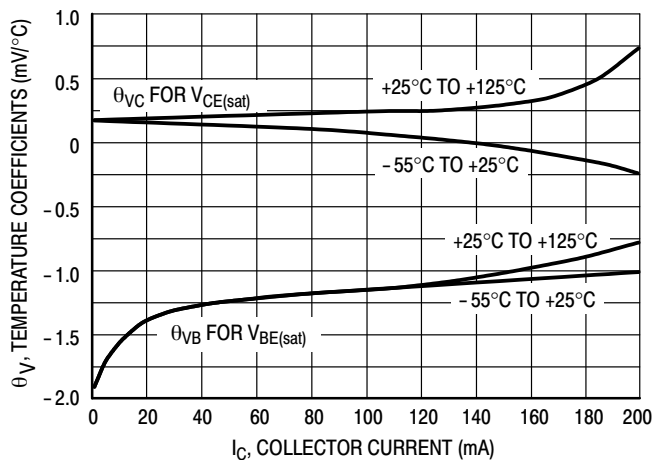
**Figure 13. DC Current Gain**



**Figure 14. Collector Saturation Region**



**Figure 15. "ON" Voltages**

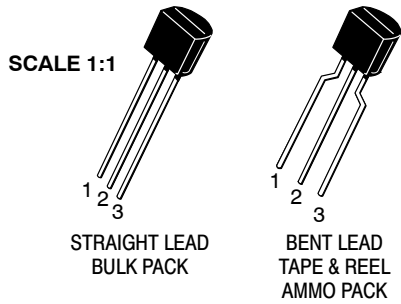


**Figure 16. Temperature Coefficients**



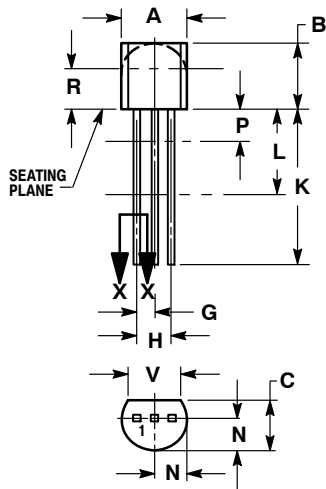


**MECHANICAL CASE OUTLINE  
PACKAGE DIMENSIONS**

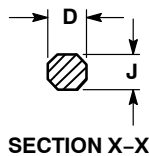


**TO-92 (TO-226)**  
CASE 29-11  
ISSUE AM

DATE 09 MAR 2007



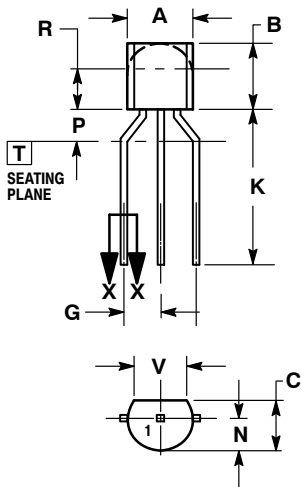
STRAIGHT LEAD  
BULK PACK



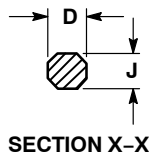
NOTES:

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.

DIM	INCHES		MILLIMETERS	
	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



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.

DIM	MILLIMETERS	
	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	---

**STYLES ON PAGE 2**

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**TO-92 (TO-226)**  
**CASE 29-11**  
**ISSUE AM**

DATE 09 MAR 2007

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

STYLE 6:  
 PIN 1. GATE  
 2. SOURCE & SUBSTRATE  
 3. DRAIN

STYLE 11:  
 PIN 1. ANODE  
 2. CATHODE & ANODE  
 3. CATHODE

STYLE 16:  
 PIN 1. ANODE  
 2. GATE  
 3. CATHODE

STYLE 21:  
 PIN 1. COLLECTOR  
 2. EMITTER  
 3. BASE

STYLE 26:  
 PIN 1. V<sub>CC</sub>  
 2. GROUND 2  
 3. OUTPUT

STYLE 31:  
 PIN 1. GATE  
 2. DRAIN  
 3. SOURCE

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

STYLE 7:  
 PIN 1. SOURCE  
 2. DRAIN  
 3. GATE

STYLE 12:  
 PIN 1. MAIN TERMINAL 1  
 2. GATE  
 3. MAIN TERMINAL 2

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

STYLE 22:  
 PIN 1. SOURCE  
 2. GATE  
 3. DRAIN

STYLE 27:  
 PIN 1. MT  
 2. SUBSTRATE  
 3. MT

STYLE 32:  
 PIN 1. BASE  
 2. COLLECTOR  
 3. EMITTER

STYLE 3:  
 PIN 1. ANODE  
 2. ANODE  
 3. CATHODE

STYLE 8:  
 PIN 1. DRAIN  
 2. GATE  
 3. SOURCE & SUBSTRATE

STYLE 13:  
 PIN 1. ANODE 1  
 2. GATE  
 3. CATHODE 2

STYLE 18:  
 PIN 1. ANODE  
 2. CATHODE  
 3. NOT CONNECTED

STYLE 23:  
 PIN 1. GATE  
 2. SOURCE  
 3. DRAIN

STYLE 28:  
 PIN 1. CATHODE  
 2. ANODE  
 3. GATE

STYLE 33:  
 PIN 1. RETURN  
 2. INPUT  
 3. OUTPUT

STYLE 4:  
 PIN 1. CATHODE  
 2. CATHODE  
 3. ANODE

STYLE 9:  
 PIN 1. BASE 1  
 2. EMITTER  
 3. BASE 2

STYLE 14:  
 PIN 1. EMITTER  
 2. COLLECTOR  
 3. BASE

STYLE 19:  
 PIN 1. GATE  
 2. ANODE  
 3. CATHODE

STYLE 24:  
 PIN 1. EMITTER  
 2. COLLECTOR/ANODE  
 3. CATHODE

STYLE 29:  
 PIN 1. NOT CONNECTED  
 2. ANODE  
 3. CATHODE

STYLE 34:  
 PIN 1. INPUT  
 2. GROUND  
 3. LOGIC

STYLE 5:  
 PIN 1. DRAIN  
 2. SOURCE  
 3. GATE

STYLE 10:  
 PIN 1. CATHODE  
 2. GATE  
 3. ANODE

STYLE 15:  
 PIN 1. ANODE 1  
 2. CATHODE  
 3. ANODE 2

STYLE 20:  
 PIN 1. NOT CONNECTED  
 2. CATHODE  
 3. ANODE

STYLE 25:  
 PIN 1. MT 1  
 2. GATE  
 3. MT 2

STYLE 30:  
 PIN 1. DRAIN  
 2. GATE  
 3. SOURCE

STYLE 35:  
 PIN 1. GATE  
 2. COLLECTOR  
 3. EMITTER

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