2N6034G, 2N6035G, 2N6036G (PNP), 2N6038G, 2N6039G (NPN)

Plastic Darlington Complementary Silicon Power Transistors

Plastic Darlington complementary silicon power transistors are designed for general purpose amplifier and low−speed switching applications.

Features

- ESD Ratings: Machine Model, C; > 400 V
                      Human Body Model, 3B; > 8000 V
- Epoxy Meets UL 94 V−0 @ 0.125 in
- These Devices are Pb−Free and are RoHS Compliant*

MAXIMUM RATINGS

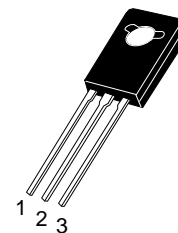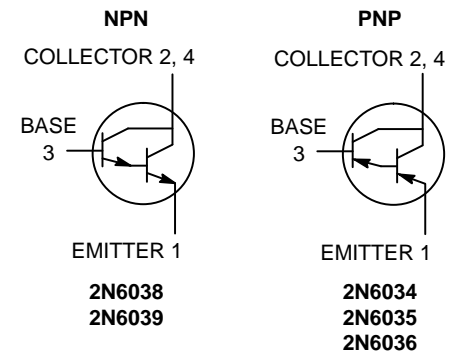| Rating	Symbol	Value	Unit
Collector−Emitter Voltage 2N6034G 2N6035G, 2N6038G 2N6036G, 2N6039G	V_{CEO}	 40 60 80	Vdc
Collector−Base Voltage 2N6034G 2N6035G, 2N6038G 2N6036G, 2N6039G	V_{CBO}	 40 60 80	Vdc
Emitter−Base Voltage	V_{EBO}	5.0	Vdc
Collector Current – Continuous	I_C	4.0	Adc
Collector Current – Peak	I_{CM}	8.0	Apk
Base Current	I_B	100	mAdc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	 40 320	 W 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}	−65 to +150	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL CHARACTERISTICS

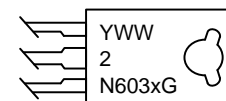| Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction−to−Case	$R_{\theta JC}$	3.12	°C/W
Thermal Resistance, Junction−to−Ambient	$R_{\theta JA}$	83.3	°C/W

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

ON Semiconductor®

http://onsemi.com

4.0 AMPERES DARLINGTON COMPLEMENTARY SILICON POWER TRANSISTORS 40, 60, 80 VOLTS, 40 WATTS

NPN
COLLECTOR 2, 4
BASE 3
EMITTER 1
2N6038
2N6039

PNP
COLLECTOR 2, 4
BASE 3
EMITTER 1
2N6034
2N6035
2N6036

**TO−225
CASE 77−09
STYLE 1**

1 2 3

MARKING DIAGRAM

YWW
2
N603xG

Y	= Year
WW	= Work Week
2N603x	= Device Code
	x = 4, 5, 6, 8, 9
G	= Pb−Free Package

ORDERING INFORMATION

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

2N6034G, 2N6035G, 2N6036G (PNP), 2N6038G, 2N6039G (NPN)

ELECTRICAL CHARACTERISTICS ($T_C = 25°C$ unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				

Collector–Emitter Sustaining Voltage
($I_C = 100$ mAdc, $I_B = 0$)
    2N6034G
    2N6035G, 2N6038G
    2N6036G, 2N6039G
	$V_{CEO(sus)}$	
		
		40
		60
		80
			
			–
			–
			–
				Vdc

Collector–Cutoff Current
($V_{CE} = 40$ Vdc, $I_B = 0$)
    2N6034G
($V_{CE} = 60$ Vdc, $I_B = 0$)
    2N6035G, 2N6038G
($V_{CE} = 80$ Vdc, $I_B = 0$)
    2N6036G, 2N6039G
	I_{CEO}	
		
		–
		
		–
		
		–
			
			100
			
			100
			
			100
				µA

Collector–Cutoff Current
($V_{CE} = 40$ Vdc, $V_{BE(off)} = 1.5$ Vdc)
    2N6034G
($V_{CE} = 60$ Vdc, $V_{BE(off)} = 1.5$ Vdc)
    2N6035G, 2N6038G
($V_{CE} = 80$ Vdc, $V_{BE(off)} = 1.5$ Vdc)
    2N6036G, 2N6039G
($V_{CE} = 40$ Vdc, $V_{BE(off)} = 1.5$ Vdc, $T_C = 125°C$)
    2N6034G
($V_{CE} = 60$ Vdc, $V_{BE(off)} = 1.5$ Vdc, $T_C = 125°C$)
    2N6035G, 2N6038G
($V_{CE} = 80$ Vdc, $V_{BE(off)} = 1.5$ Vdc, $T_C = 125°C$)
    2N6036G, 2N6039G
	I_{CEX}	
		
		–
		
		–
		
		–
		
		–
		
		–
		
		–
			
			100
			
			100
			
			100
			
			500
			
			500
			
			500
				µA

Collector–Cutoff Current
($V_{CB} = 40$ Vdc, $I_E = 0$)
    2N6034G
($V_{CB} = 60$ Vdc, $I_E = 0$)
    2N6035G, 2N6038G
($V_{CB} = 80$ Vdc, $I_E = 0$)
    2N6036G, 2N6039G
	I_{CBO}	
		
		–
		
		–
		
		–
			
			0.5
			
			0.5
			
			0.5
				mAdc

Emitter–Cutoff Current ($V_{BE} = 5.0$ Vdc, $I_C = 0$)	I_{EBO}	–	2.0	mAdc
ON CHARACTERISTICS				
DC Current Gain ($I_C = 0.5$ Adc, $V_{CE} = 3.0$ Vdc) ($I_C = 2.0$ Adc, $V_{CE} = 3.0$ Vdc) ($I_C = 4.0$ Adc, $V_{CE} = 3.0$ Vdc)	h_{FE}	 500 750 100	 – 15,000 –	–
Collector–Emitter Saturation Voltage ($I_C = 2.0$ Adc, $I_B = 8.0$ mAdc) ($I_C = 4.0$ Adc, $I_B = 40$ mAdc)	$V_{CE(sat)}$	 – –	 2.0 3.0	Vdc
Base–Emitter Saturation Voltage ($I_C = 4.0$ Adc, $I_B = 40$ mAdc)	$V_{BE(sat)}$	–	4.0	Vdc
Base–Emitter On Voltage ($I_C = 2.0$ Adc, $V_{CE} = 3.0$ Vdc)	$V_{BE(on)}$	–	2.8	Vdc
DYNAMIC CHARACTERISTICS				
Small–Signal Current–Gain ($I_C = 0.75$ Adc, $V_{CE} = 10$ Vdc, $f = 1.0$ MHz)	$|h_{fe}|$	25	–	–

Output Capacitance
($V_{CB} = 10$ Vdc, $I_E = 0$, $f = 0.1$ MHz)
    2N6034G, 2N6035G, 2N6036G
    2N6038G, 2N6039G
	C_{ob}	
		
		–
		–
			
			200
			100
				pF

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.
*Indicates JEDEC Registered Data.
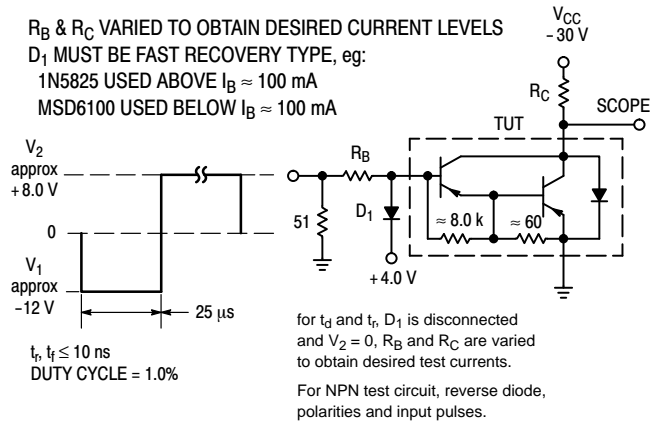
2N6034G, 2N6035G, 2N6036G (PNP), 2N6038G, 2N6039G (NPN)

R_B & R_C VARIED TO OBTAIN DESIRED CURRENT LEVELS
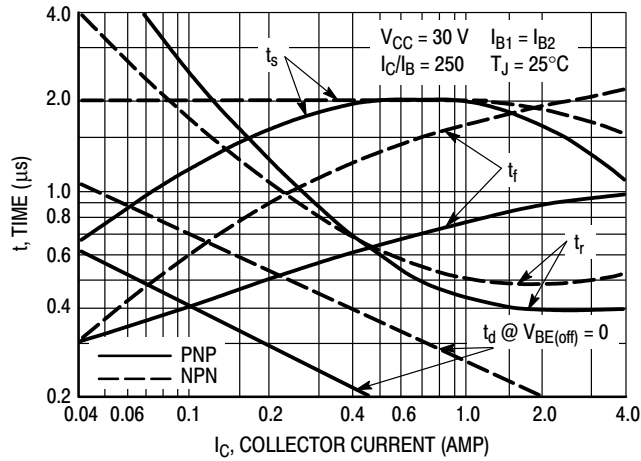D_1 MUST BE FAST RECOVERY TYPE, eg:
 1N5825 USED ABOVE $I_B \approx 100$ mA
 MSD6100 USED BELOW $I_B \approx 100$ mA

for t_d and t_r, D_1 is disconnected
and $V_2 = 0$, R_B and R_C are varied
to obtain desired test currents.

For NPN test circuit, reverse diode,
polarities and input pulses.

Figure 1. Switching Times Test Circuit

Figure 2. Switching Times

$\theta_{JC}(t) = r(t) \, \theta_{JC}$
$\theta_{JC} = 3.12°C/W$ MAX
D CURVES APPLY FOR POWER
PULSE TRAIN SHOWN
READ TIME AT t_1
$T_{J(pk)} - T_C = P_{(pk)} \, \theta_{JC}(t)$

DUTY CYCLE, $D = t_1/t_2$
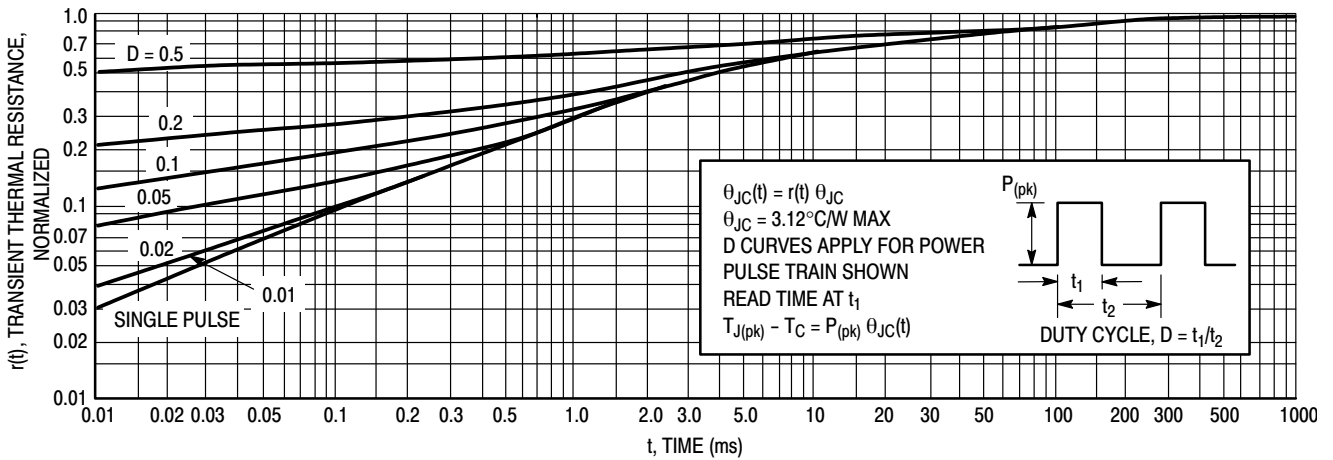
Figure 3. Thermal Response

2N6034G, 2N6035G, 2N6036G (PNP), 2N6038G, 2N6039G (NPN)

ACTIVE−REGION SAFE−OPERATING AREA
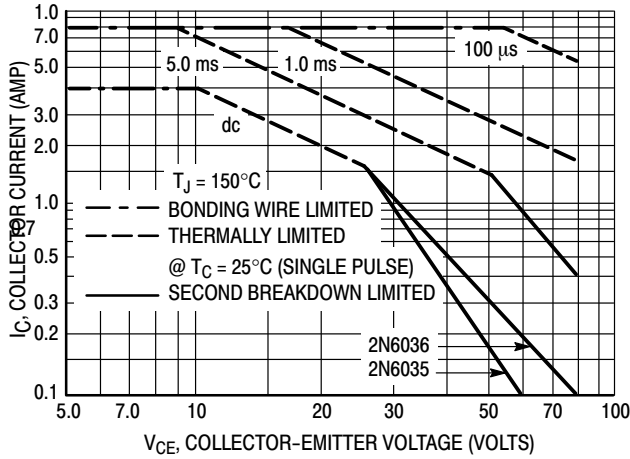
Figure 4. 2N6035, 2N6036
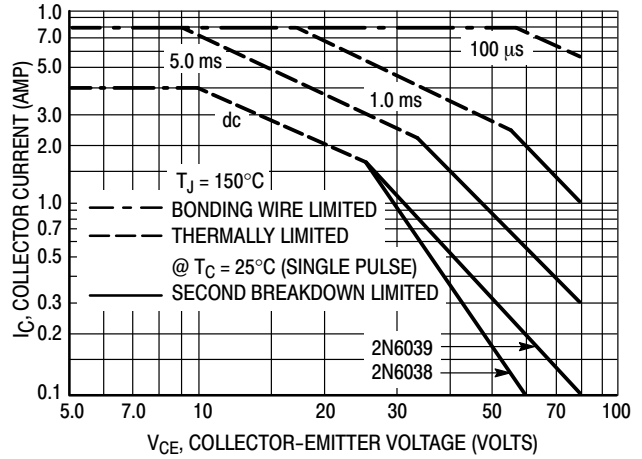
Figure 5. 2N6038, 2N6039

There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate $I_C - V_{CE}$ limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figures 4 and 5 is based on $T_{J(pk)} = 150°C$; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} < 150°C$. $T_{J(pk)}$ may be calculated from the data in Figure 3. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.
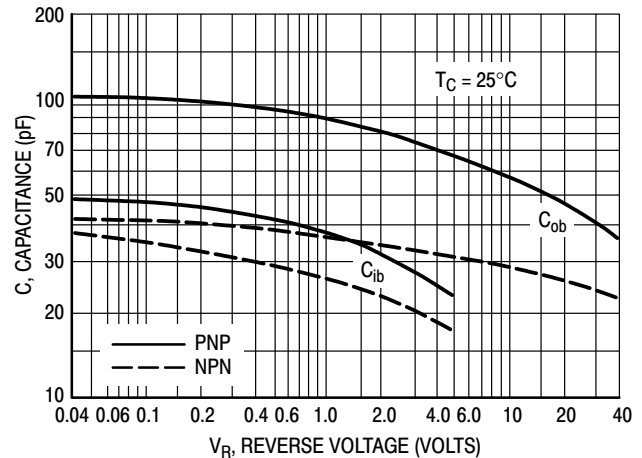
Figure 6. Capacitance

PNP
2N6034, 2N6035, 2N6036
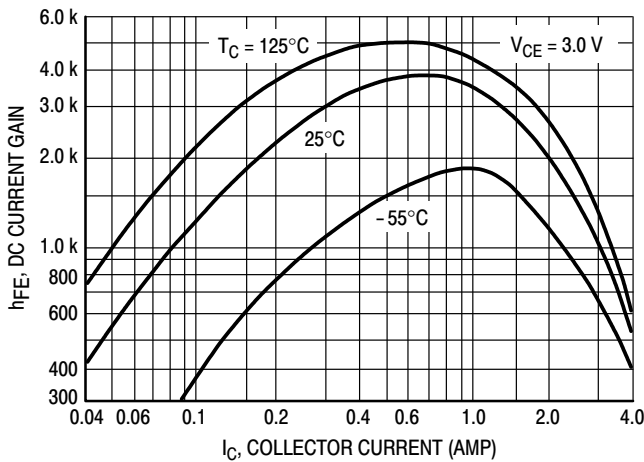
NPN
2N6038, 2N6039
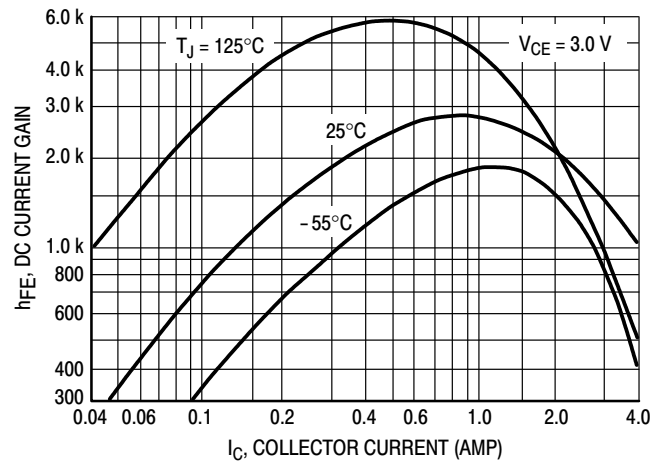
Figure 7. DC Current Gain

2N6034G, 2N6035G, 2N6036G (PNP), 2N6038G, 2N6039G (NPN)
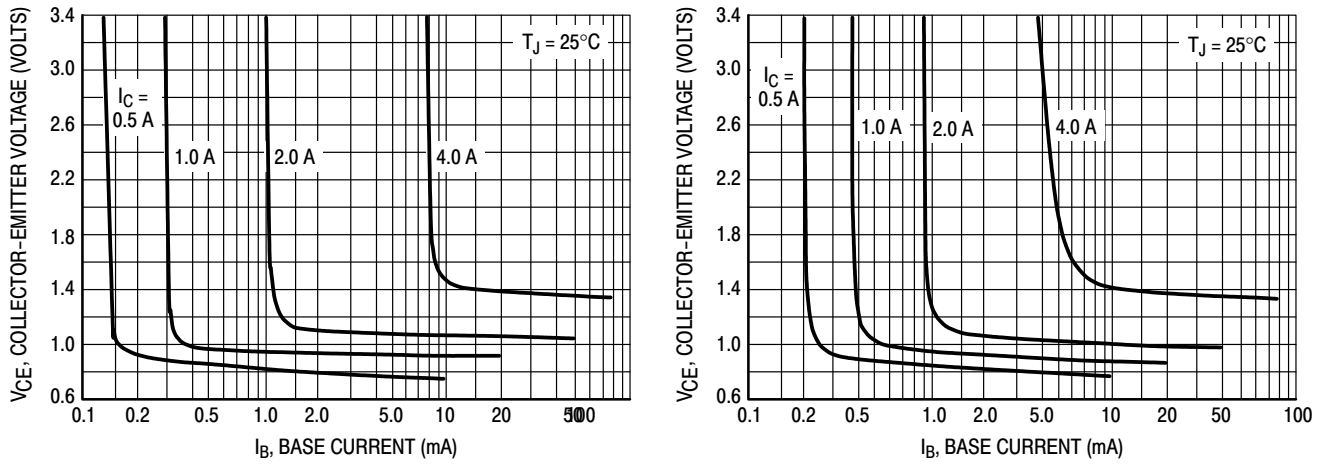
Figure 8. Collector Saturation Region
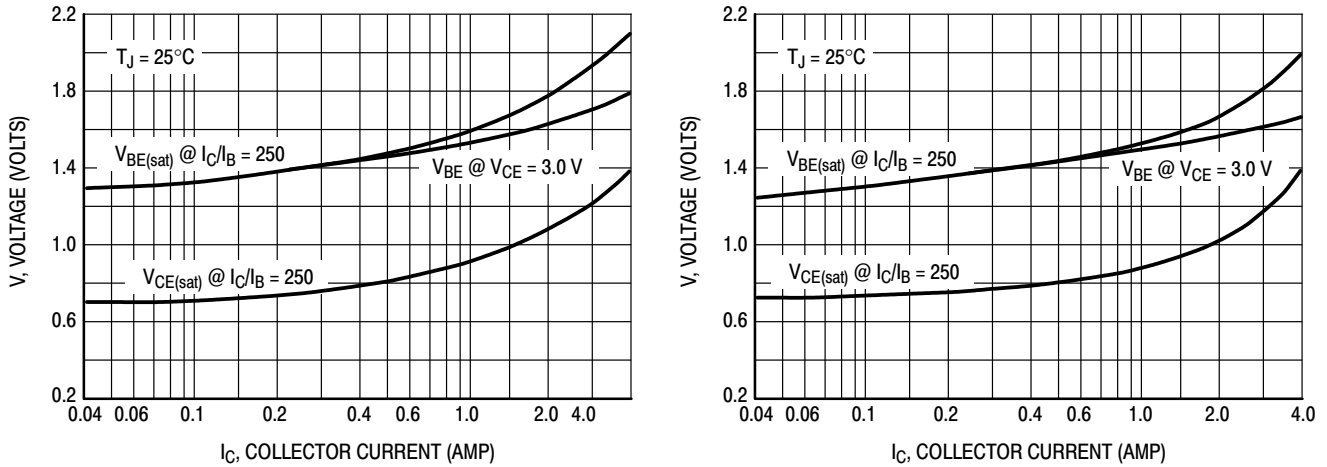
Figure 9. "On" Voltages

ORDERING INFORMATION

Device	Package	Shipping
2N6034G	TO−225 (Pb−Free)	500 Units / Box
2N6035G	TO−225 (Pb−Free)	500 Units / Box
2N6036G	TO−225 (Pb−Free)	500 Units / Box
2N6038G	TO−225 (Pb−Free)	500 Units / Box
2N6039G	TO−225 (Pb−Free)	500 Units / Box

2N6034G, 2N6035G, 2N6036G (PNP), 2N6038G, 2N6039G (NPN)

PACKAGE DIMENSIONS
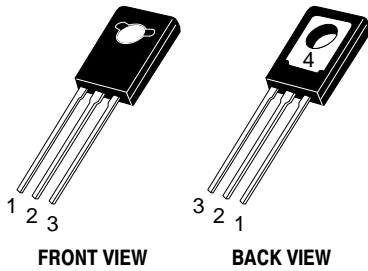
TO−225
CASE 77−09
ISSUE AC

FRONT VIEW

BACK VIEW
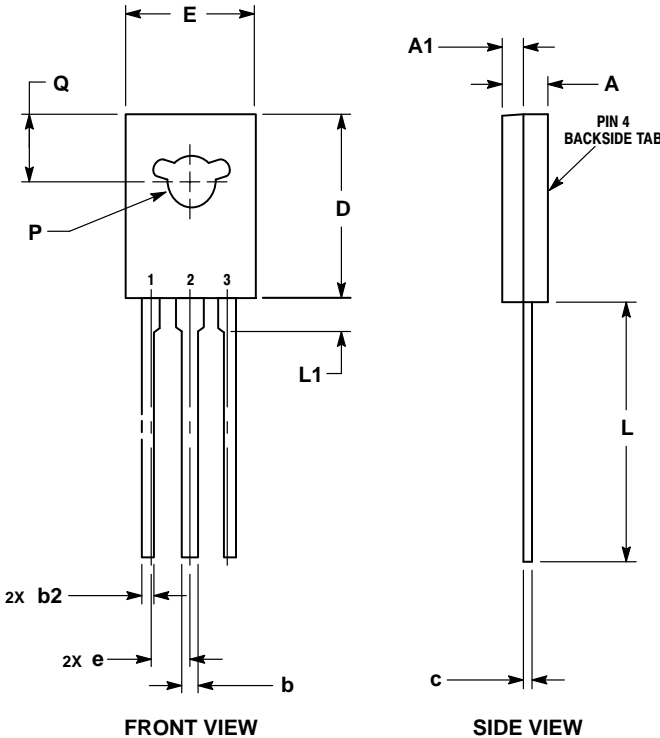
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. NUMBER AND SHAPE OF LUGS OPTIONAL.

DIM	MILLIMETERS	
---	MIN	MAX
A	2.40	3.00
A1	1.00	1.50
b	0.60	0.90
b2	0.51	0.88
c	0.39	0.63
D	10.60	11.10
E	7.40	7.80
e	2.04	2.54
L	14.50	16.63
L1	1.27	2.54
P	2.90	3.30
Q	3.80	4.20

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

PIN 4 BACKSIDE TAB

FRONT VIEW

SIDE VIEW

PUBLICATION ORDERING INFORMATION

2N6035/D