

# BD237G (NPN), BD234G, BD238G (PNP)

## Plastic Medium Power Bipolar Transistors

Designed for use in 5.0 to 10 W audio amplifiers and drivers utilizing complementary or quasi complementary circuits.

### Features

- High DC Current Gain
- Epoxy Meets UL 94 V0 @ 0.125 in
- These Devices are Pb-Free and are RoHS Compliant\*

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage BD234G DB237G, BD238G	$V_{CE0}$	45 80	Vdc
Collector-Base Voltage BD234G DB237G, BD238G	$V_{CBO}$	60 100	Vdc
Emitter-Base Voltage	$V_{EBO}$	5.0	Vdc
Collector Current	$I_C$	2.0	Adc
Base Current	$I_B$	1.0	Adc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$	$P_D$	25	W
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$
ESD - Human Body Model	HBM	3B	V
ESD - Machine Model	MM	C	V

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

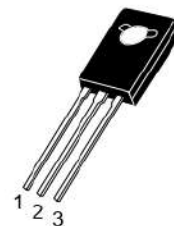
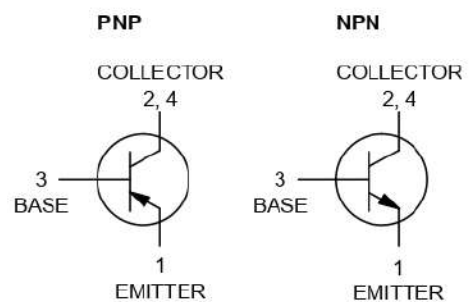
Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	5.0	$^\circ\text{C/W}$



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## 2.0 AMPERES POWER TRANSISTORS 25 WATTS



TO-225  
CASE 77-09  
STYLE 1

### MARKING DIAGRAM



Y = Year  
WW = Work Week  
BD23x = Device Code  
x = 4, 7 or 8  
G = Pb-Free Package

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 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.

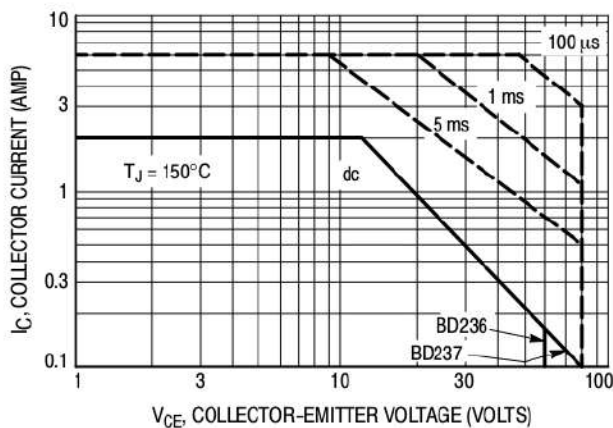
## BD237G (NPN), BD234G, BD238G (PNP)

### ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
Collector-Emitter Sustaining Voltage (Note 1) ( $I_C = 0.1\text{ A}$ , $I_B = 0$ ) BD237G, BD238G BD234G	$V_{(BR)CEO}$	80 45	— —	Vdc
Collector Cutoff Current ( $V_{CB} = 100\text{ Vdc}$ , $I_E = 0$ ) BD237G, BD238G ( $V_{CB} = 60\text{ Vdc}$ , $I_E = 0$ ) BD234G	$I_{CBO}$	— —	0.1 0.1	mAdc
Emitter Cutoff Current ( $V_{BE} = 5.0\text{ Vdc}$ , $I_C = 0$ )	$I_{EBO}$	—	1.0	mAdc
DC Current Gain ( $I_C = 0.15\text{ A}$ , $V_{CE} = 2.0\text{ V}$ ) ( $I_C = 1.0\text{ A}$ , $V_{CE} = 2.0\text{ V}$ )	$h_{FE1}$ $h_{FE2}$	40 25	— —	—
Collector-Emitter Saturation Voltage (Note 1) ( $I_C = 1.0\text{ A}$ , $I_B = 0.1\text{ A}$ )	$V_{CE(sat)}$	—	0.6	Vdc
Base-Emitter On Voltage (Note 1) ( $I_C = 1.0\text{ A}$ , $V_{CE} = 2.0\text{ Vdc}$ )	$V_{BE(on)}$	—	1.3	Vdc
Current-Gain – Bandwidth Product ( $I_C = 250\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ MHz}$ )	$f_T$	3.0	—	MHz

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.

1. Pulse Test: Pulse Width  $\leq 300\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .



**Figure 1. Active Region Safe Operating Area**

The Safe Operating Area Curves indicate  $I_C$ - $V_{CE}$  limits below which the device will not enter secondary breakdown. Collector load lines for specific circuits must fall within the applicable Safe Area to avoid causing a catastrophic failure. To insure operation below the maximum  $T_J$ , power-temperature derating must be observed for both steady state and pulse power conditions.

## BD237G (NPN), BD234G, BD238G (PNP)

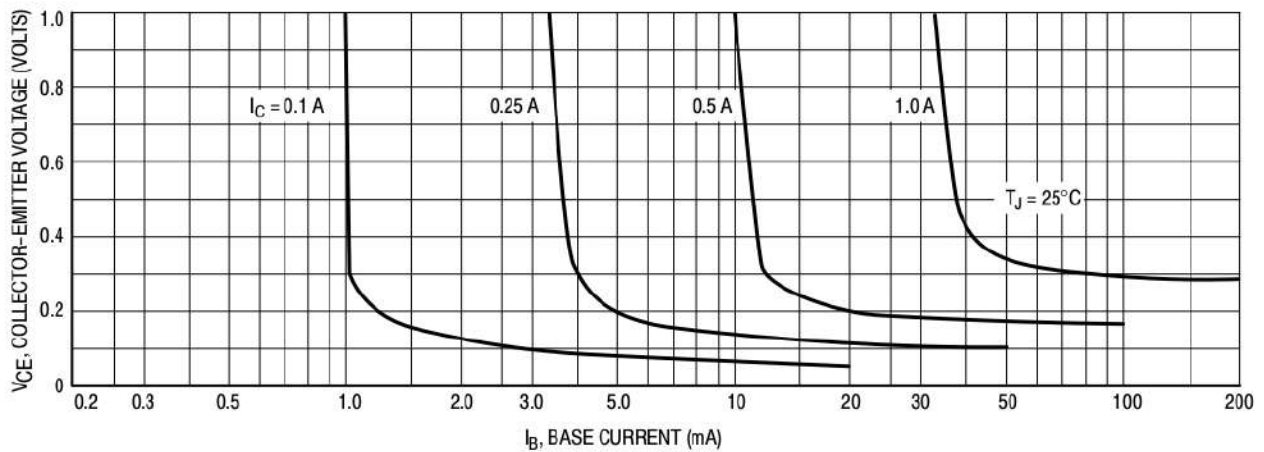


Figure 2. Collector Saturation Region

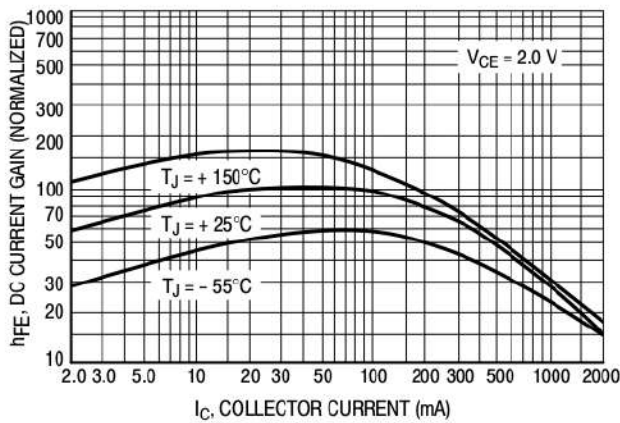


Figure 3. Current Gain

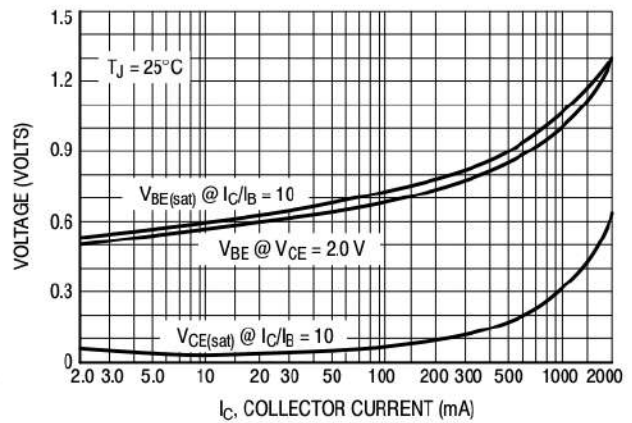


Figure 4. "On" Voltages

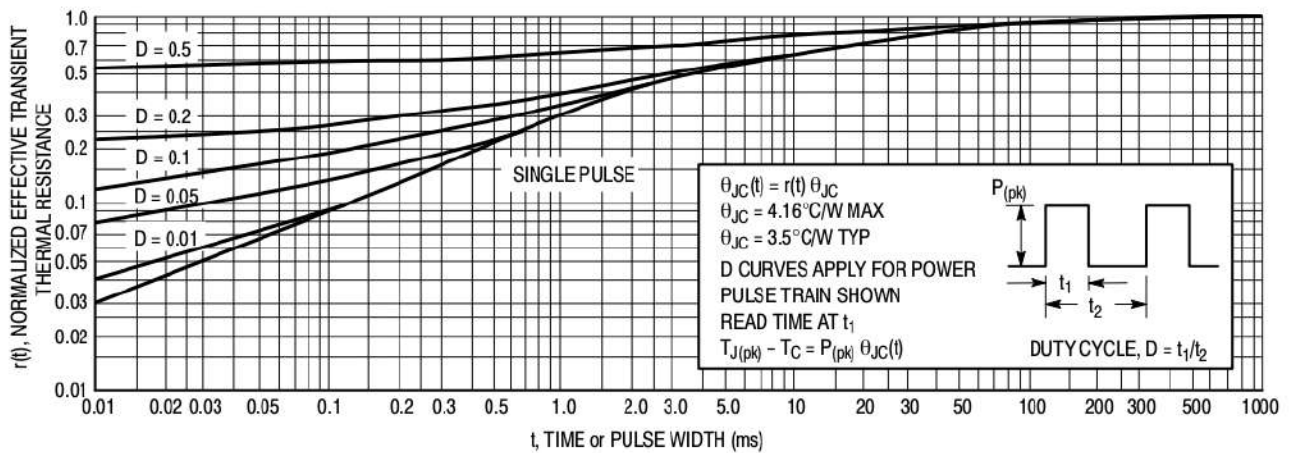


Figure 5. Thermal Response

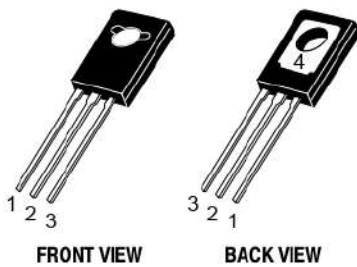
## BD237G (NPN), BD234G, BD238G (PNP)

### ORDERING INFORMATION

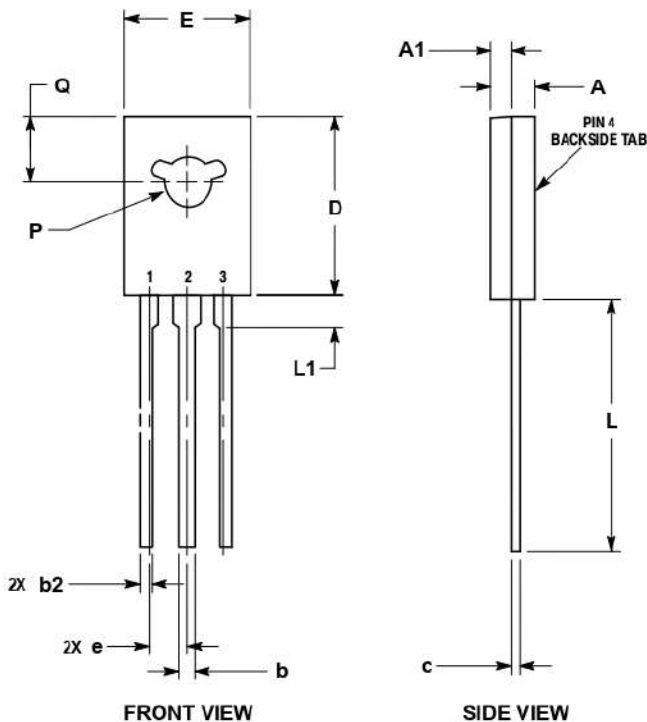
Device	Package	Shipping
BD234G	TO-225 (Pb-Free)	500 Units / Box
BD237G	TO-225 (Pb-Free)	500 Units / Box
BD238G	TO-225 (Pb-Free)	500 Units / Box

# BD237G (NPN), BD234G, BD238G (PNP)

## PACKAGE DIMENSIONS



TO-225  
CASE 77-09  
ISSUE AC




### 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	0.80	0.90
b2	0.51	0.88
c	0.39	0.63
D	10.80	11.10
E	7.40	7.80
e	2.04	2.54
L	14.50	18.63
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

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Sales Representative

BD237/D

# MMBTA92L, SMMBTA92L, MMBTA93L

## High Voltage Transistors

### PNP Silicon

#### Features

- S Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

#### MAXIMUM RATINGS

Rating	Symbol	92	93	Unit
Collector - Emitter Voltage	$V_{CEO}$	-300	-200	Vdc
Collector - Base Voltage	$V_{CBO}$	-300	-200	Vdc
Emitter - Base Voltage	$V_{EBO}$	-5.0	-5.0	Vdc
Collector Current — Continuous	$I_C$	-500		mAdc

#### DEVICE MARKING

MMBTA92L, SMMBTA92L = 2D; MMBTA93LT1 = 2E

#### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation FR-5 Board (Note 1) $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	225	mW
		1.8	mW/ $^\circ\text{C}$
Total Device Dissipation (Note 2) Alumina Substrate, <sup>(2)</sup> $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	300	mW
		2.4	mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	556	$^\circ\text{C/W}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	417	$^\circ\text{C/W}$
Junction and Storage Temperature	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$

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.

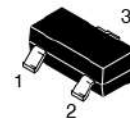
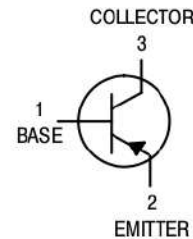
1. FR-5 = 1.0 x 0.75 x 0.062 in.

2. Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.



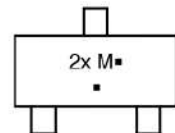
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SOT-23 (TO-236AF)  
CASE 318  
STYLE 6

#### MARKING DIAGRAM



2x = Specific Device Code

M = Date Code\*

■ = Pb-Free Package

(\*Note: Microdot may be in either location)

\*Date Code orientation and/or overbar may vary depending upon manufacturing location.

#### ORDERING INFORMATION

Device	Package	Shipping†
MMBTA92LT1G	SOT-23 (Pb-Free)	3000 / Tape & Reel
SMMBTA92LT1G	SOT-23 (Pb-Free)	3000 / Tape & Reel
MMBTA92LT3G	SOT-23 (Pb-Free)	10000 / Tape & Reel
SMMBTA92LT3G	SOT-23 (Pb-Free)	10000 / Tape & Reel
MMBTA93LT1G	SOT-23 (Pb-Free)	3000 / 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.

# MMBTA92L, SMMBTA92L, MMBTA93L

## 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 3) ( $I_C = -1.0\text{ mA}$ , $I_B = 0$ )	$V_{(BR)CEO}$	-300 -200	- -	Vdc
Collector – Base Breakdown Voltage ( $I_C = -100\text{ }\mu\text{A}$ , $I_E = 0$ )	$V_{(BR)CBO}$	-300 -200	- -	Vdc
Emitter – Base Breakdown Voltage ( $I_E = -100\text{ }\mu\text{A}$ , $I_C = 0$ )	$V_{(BR)EBO}$	-5.0	-	Vdc
Collector Cutoff Current ( $V_{CB} = -200\text{ Vdc}$ , $I_E = 0$ ) ( $V_{CB} = -160\text{ Vdc}$ , $I_E = 0$ )	$I_{CBO}$	- -	-0.25 -0.25	$\mu\text{Adc}$
Emitter Cutoff Current ( $V_{EB} = -3.0\text{ Vdc}$ , $I_C = 0$ )	$I_{EBO}$	-	-0.1	$\mu\text{Adc}$

## ON CHARACTERISTICS (Note 3)

DC Current Gain ( $I_C = -1.0\text{ mA}$ , $V_{CE} = -10\text{ Vdc}$ ) ( $I_C = -10\text{ mA}$ , $V_{CE} = -10\text{ Vdc}$ )  ( $I_C = -30\text{ mA}$ , $V_{CE} = -10\text{ Vdc}$ )	Both Types Both Types MMBTA92, SMMBTA92 MMBTA93	$\beta_{FE}$	25 40 25 25	- - - -	-
Collector – Emitter Saturation Voltage ( $I_C = -20\text{ mA}$ , $I_B = -2.0\text{ mA}$ )	MMBTA92, SMMBTA92 MMBTA93	$V_{CE(sat)}$	- -	-0.5 -0.5	Vdc
Base – Emitter Saturation Voltage ( $I_C = -20\text{ mA}$ , $I_B = -2.0\text{ mA}$ )		$V_{BE(sat)}$	-	-0.9	Vdc

## SMALL – SIGNAL CHARACTERISTICS

Current – Gain — Bandwidth Product ( $I_C = -10\text{ mA}$ , $V_{CE} = -20\text{ Vdc}$ , $f = 100\text{ MHz}$ )		$f_T$	50	-	MHz
Collector – Base Capacitance ( $V_{CB} = -20\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )	MMBTA92, SMMBTA92 MMBTA93	$C_{cb}$	- -	6.0 8.0	pF

3. Pulse Test: Pulse Width  $\leq 300\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

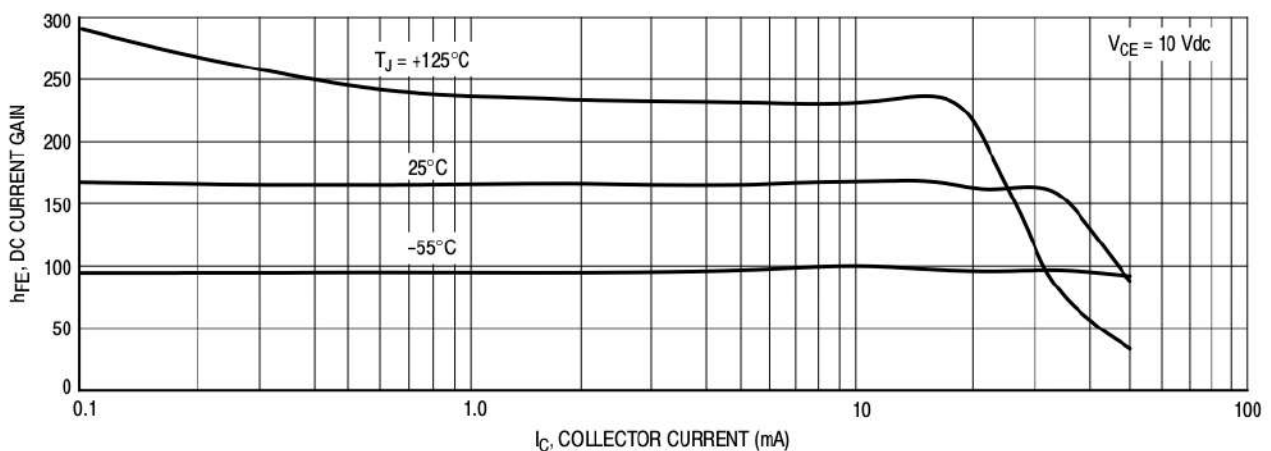


Figure 1. DC Current Gain

# MMBTA92L, SMMBTA92L, MMBTA93L

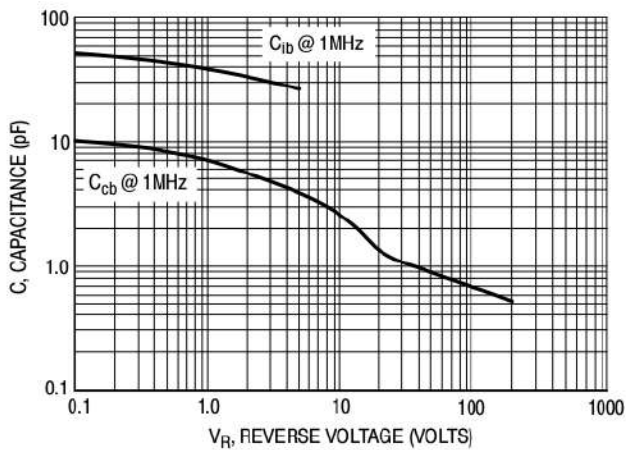


Figure 2. Capacitance

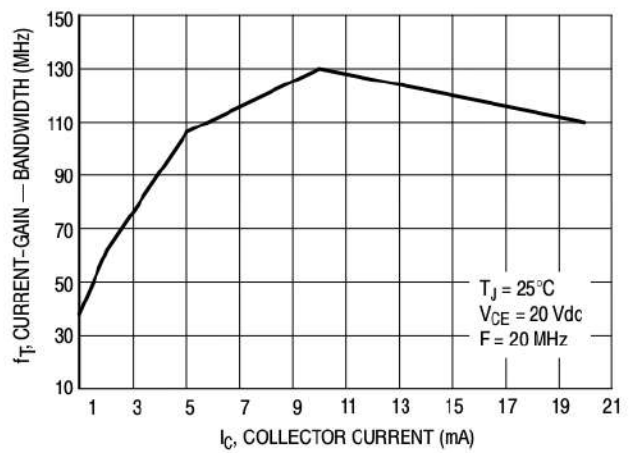


Figure 3. Current-Gain - Bandwidth

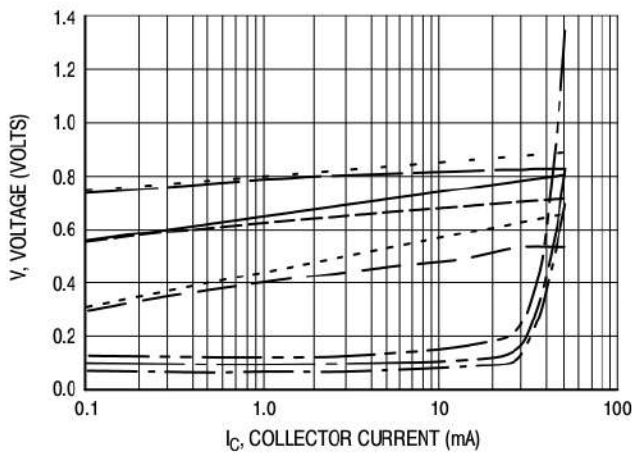


Figure 4. "ON" Voltages

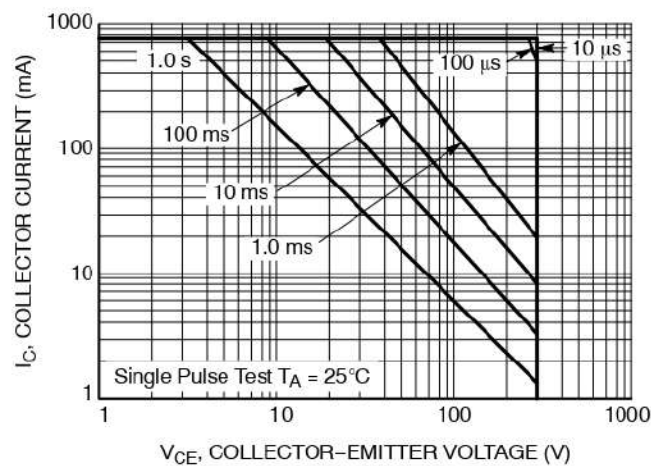


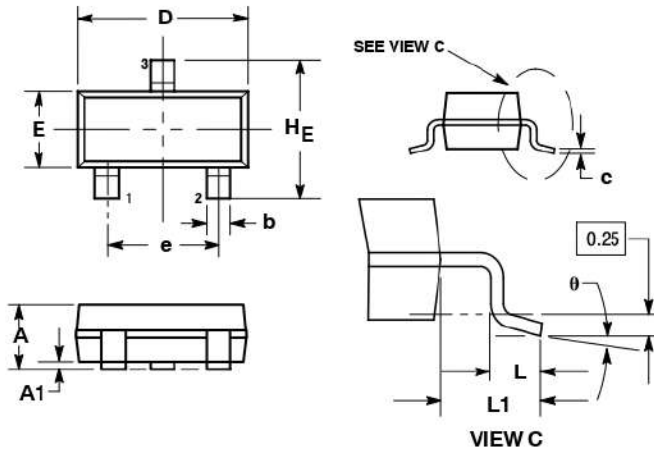
Figure 5. Safe Operating Area



# MMBTA92L, SMMBTA92L, MMBTA93L

## PACKAGE DIMENSIONS

SOT-23 (TO-236)  
CASE 318-08  
ISSUE AP

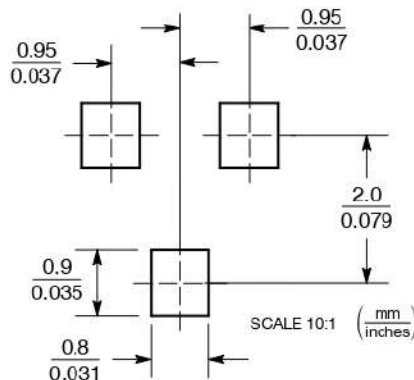


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
  4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.89	1.00	1.11	0.035	0.040	0.044
A1	0.01	0.06	0.10	0.001	0.002	0.004
b	0.37	0.44	0.50	0.015	0.018	0.020
c	0.09	0.13	0.18	0.003	0.005	0.007
D	2.80	2.90	3.04	0.110	0.114	0.120
E	1.20	1.30	1.40	0.047	0.051	0.055
e	1.78	1.90	2.04	0.070	0.075	0.081
L	0.10	0.20	0.30	0.004	0.008	0.012
L1	0.35	0.54	0.80	0.014	0.021	0.029
H_E	2.10	2.40	2.64	0.083	0.094	0.104
θ	0°	---	10°	0°	---	10°

STYLE 6:  
PIN 1. BASE  
2. EMITTER  
3. COLLECTOR

## SOLDERING FOOTPRINT



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