

# BDW42 - NPN, BDW46, BDW47 - PNP

BDW42 and BDW47 are Preferred Devices

## Darlington Complementary Silicon Power Transistors

This series of plastic, medium-power silicon NPN and PNP Darlington transistors are designed for general purpose and low speed switching applications.

### Features

- High DC Current Gain –  $h_{FE} = 2500$  (typ) @  $I_C = 5.0$  Adc.
- Collector Emitter Sustaining Voltage @ 30 mAdc:  
 $V_{CEO(sus)} = 80$  Vdc (min) – BDW46  
 $100$  Vdc (min) – BDW42/BDW47
- Low Collector Emitter Saturation Voltage  
 $V_{CE(sat)} = 2.0$  Vdc (max) @  $I_C = 5.0$  Adc  
 $3.0$  Vdc (max) @  $I_C = 10.0$  Adc
- Monolithic Construction with Built-In Base Emitter Shunt resistors
- TO-220AB Compact Package
- Pb-Free Packages Are Available\*

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage BDW46 BDW42, BDW47	$V_{CEO}$	80 100	Vdc
Collector-Base Voltage BDW46 BDW42, BDW47	$V_{CB}$	80 100	Vdc
Emitter-Base Voltage	$V_{EB}$	5.0	Vdc
Collector Current	$I_C$	15	Adc
Base Current	$I_B$	0.5	Adc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	85 0.68	W W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	1.47	$^\circ\text{C}/\text{W}$

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

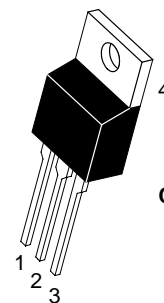
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



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## 15 AMP DARLINGTON COMPLEMENTARY SILICON POWER TRANSISTORS 80-100 VOLT, 85 WATT



TO-220AB  
CASE 221A-09  
STYLE 1

### MARKING DIAGRAM



BDWxx = Device Code  
x = 42, 46, or 47  
A = Assembly Location  
Y = Year  
WW = Work Week  
G = Pb-Free Package

### ORDERING INFORMATION

Device	Package	Shipping
BDW42	TO-220AB	50 Units/Rail
BDW42G	TO-220AB (Pb-Free)	50 Units/Rail
BDW46	TO-220AB	50 Units/Rail
BDW46G	TO-220AB (Pb-Free)	50 Units/Rail
BDW47	TO-220AB	50 Units/Rail
BDW47G	TO-220AB (Pb-Free)	50 Units/Rail

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

# BDW42 – NPN, BDW46, BDW47 – PNP

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

Characteristic	Symbol	Min	Max	Unit
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### OFF CHARACTERISTICS

Collector Emitter Sustaining Voltage (Note 1) ( $I_C = 30\text{ mAdc}$ , $I_B = 0$ )	BDW46 BDW42/BDW47	$V_{CEO(sus)}$	80 100	– –	Vdc
Collector Cutoff Current ( $V_{CE} = 40\text{ Vdc}$ , $I_B = 0$ ) ( $V_{CE} = 50\text{ Vdc}$ , $I_B = 0$ )	BDW46 BDW42/BDW47	$I_{CEO}$	– –	2.0 2.0	mAdc
Collector Cutoff Current ( $V_{CB} = 80\text{ Vdc}$ , $I_E = 0$ ) ( $V_{CB} = 100\text{ Vdc}$ , $I_E = 0$ )	BDW46 BDW42/BDW47	$I_{CBO}$	– –	1.0 1.0	mAdc
Emitter Cutoff Current ( $V_{BE} = 5.0\text{ Vdc}$ , $I_C = 0$ )		$I_{EBO}$	–	2.0	mAdc

### ON CHARACTERISTICS (Note 1)

DC Current Gain ( $I_C = 5.0\text{ Adc}$ , $V_{CE} = 4.0\text{ Vdc}$ ) ( $I_C = 10\text{ Adc}$ , $V_{CE} = 4.0\text{ Vdc}$ )	$h_{FE}$	1000 250	– –	
Collector–Emitter Saturation Voltage ( $I_C = 5.0\text{ Adc}$ , $I_B = 10\text{ mAdc}$ ) ( $I_C = 10\text{ Adc}$ , $I_B = 50\text{ mAdc}$ )	$V_{CE(sat)}$	– –	2.0 3.0	Vdc
Base–Emitter On Voltage ( $I_C = 10\text{ Adc}$ , $V_{CE} = 4.0\text{ Vdc}$ )	$V_{BE(on)}$	–	3.0	Vdc

### SECOND BREAKDOWN (Note 2)

Second Breakdown Collector Current with Base Forward Biased BDW42	$I_{S/b}$	3.0	–	Adc
		$V_{CE} = 28.4\text{ Vdc}$	–	
		$V_{CE} = 40\text{ Vdc}$	1.2	–
BDW46/BDW47		$V_{CE} = 22.5\text{ Vdc}$	3.8	–
		$V_{CE} = 36\text{ Vdc}$	1.2	–

### DYNAMIC CHARACTERISTICS

Magnitude of common emitter small signal short circuit current transfer ratio ( $I_C = 3.0\text{ Adc}$ , $V_{CE} = 3.0\text{ Vdc}$ , $f = 1.0\text{ MHz}$ )	$f_T$	4.0	–	MHz
Output Capacitance ( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 0.1\text{ MHz}$ )	$C_{ob}$	– –	200 300	pF
	BDW42 BDW46/BDW47			
Small–Signal Current Gain ( $I_C = 3.0\text{ Adc}$ , $V_{CE} = 3.0\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{fe}$	300	–	

1. Pulse Test: Pulse Width = 300  $\mu\text{s}$ , Duty Cycle = 2.0%.
2. Pulse Test non repetitive: Pulse Width = 250 ms.

# BDW42 – NPN, BDW46, BDW47 – PNP

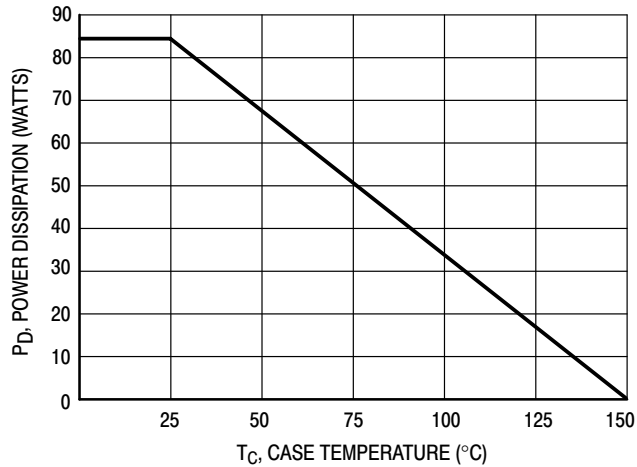


Figure 1. Power Temperature Derating Curve

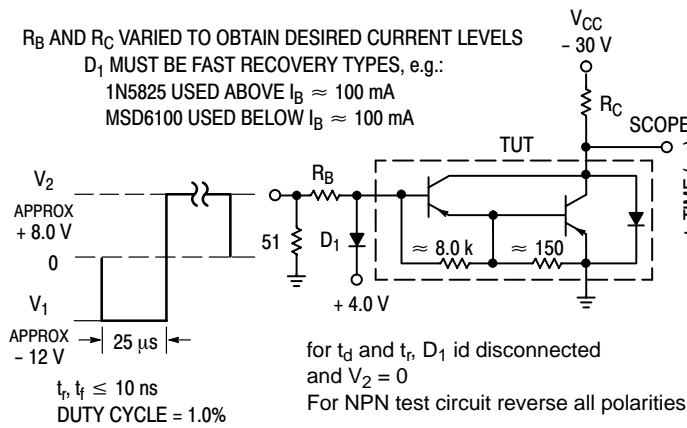


Figure 2. Switching Times Test Circuit

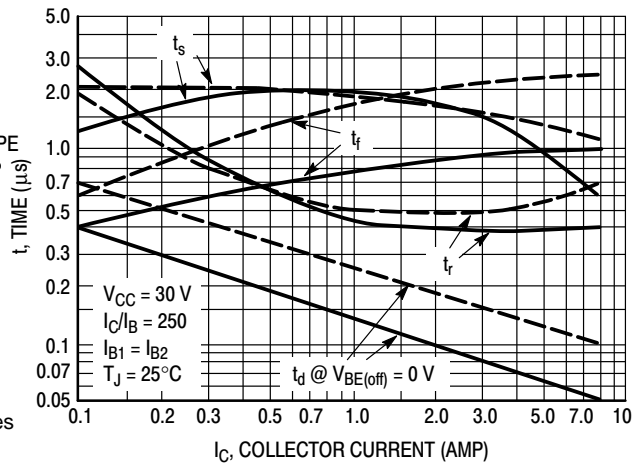


Figure 3. Switching Times

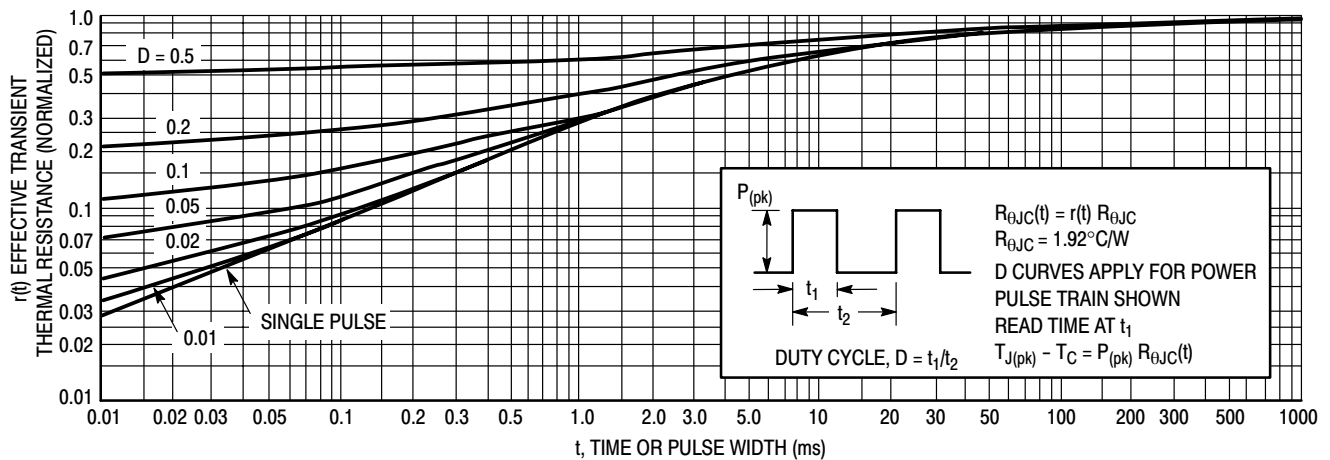


Figure 4. Thermal Response

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## ACTIVE-REGION SAFE OPERATING AREA

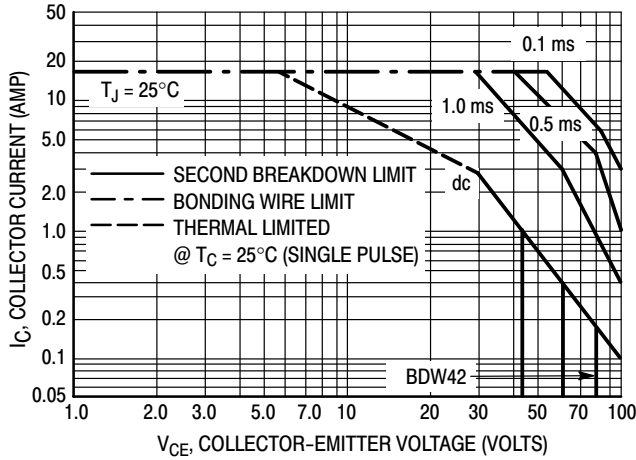


Figure 5. BDW42

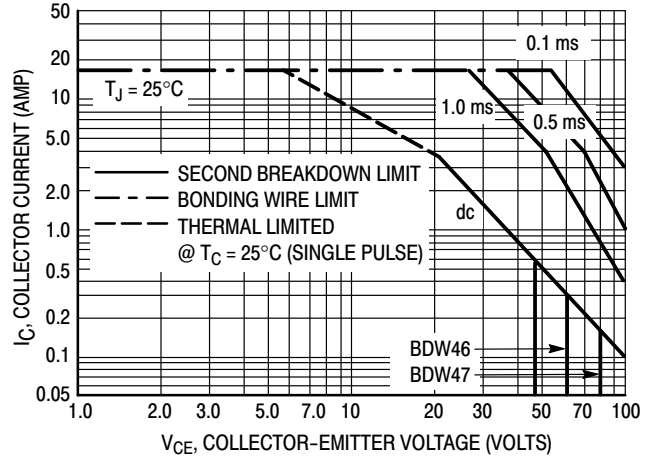


Figure 6. BDW46 and BDW47

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 Figure 5 and 6 is based on  $T_{J(pk)} = 200^\circ\text{C}$ ;  $T_C$  is variable depending on conditions.

Second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(pk)} \leq 200^\circ\text{C}$ .  $T_{J(pk)}$  may be calculated from the data in Figure 4. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

\*Linear extrapolation

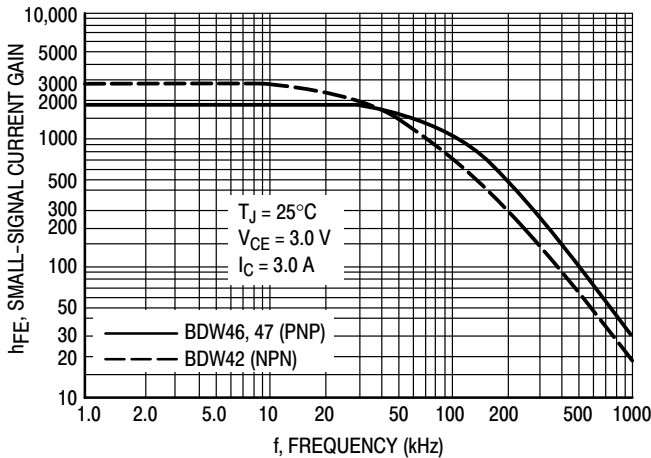


Figure 7. Small-Signal Current Gain

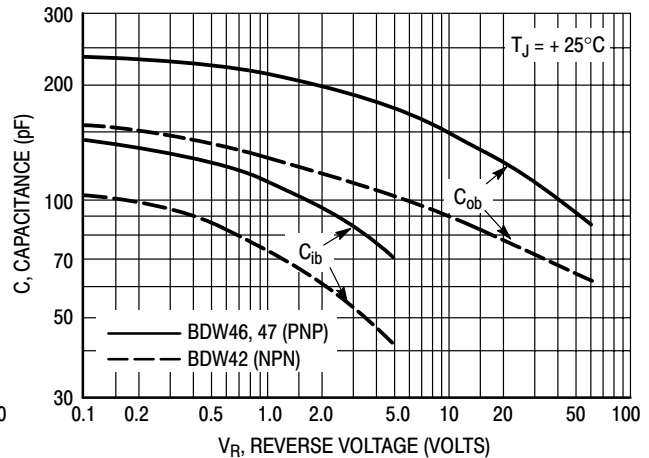
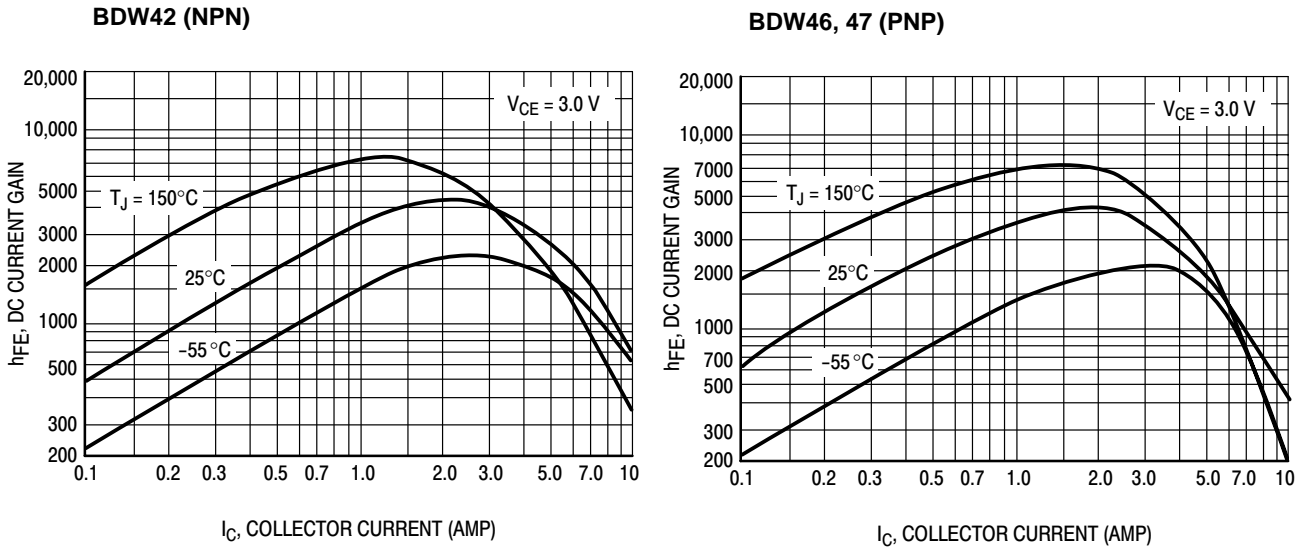
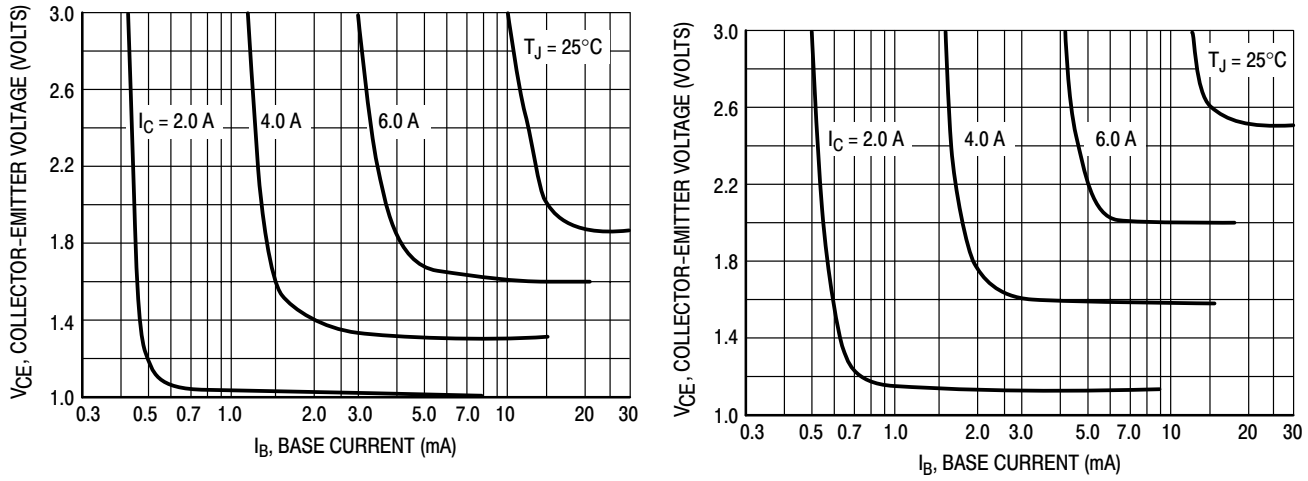


Figure 8. Capacitance

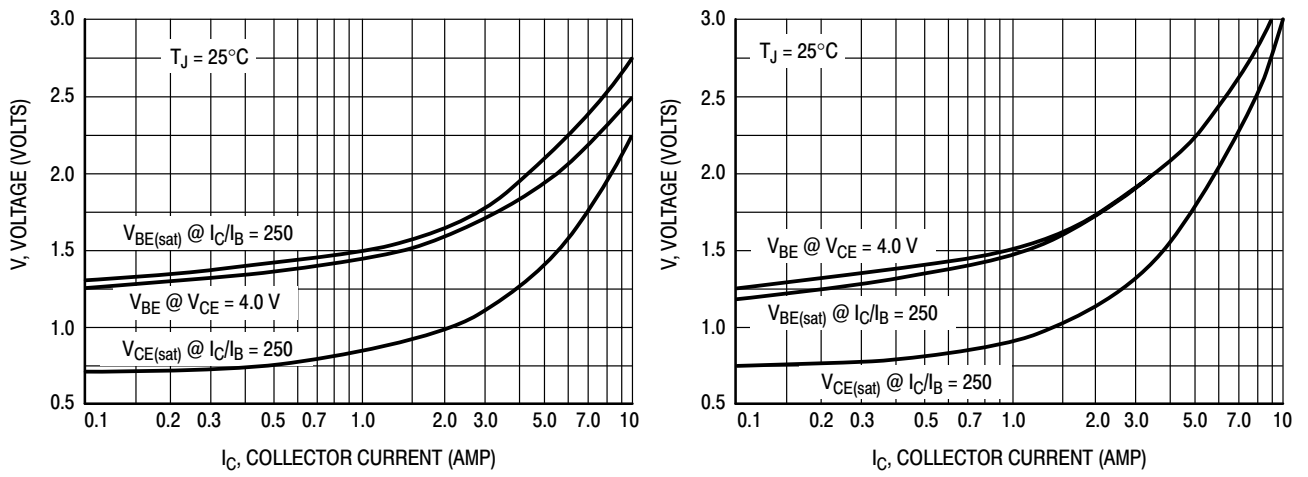
# BDW42 – NPN, BDW46, BDW47 – PNP



**Figure 9. DC Current Gain**



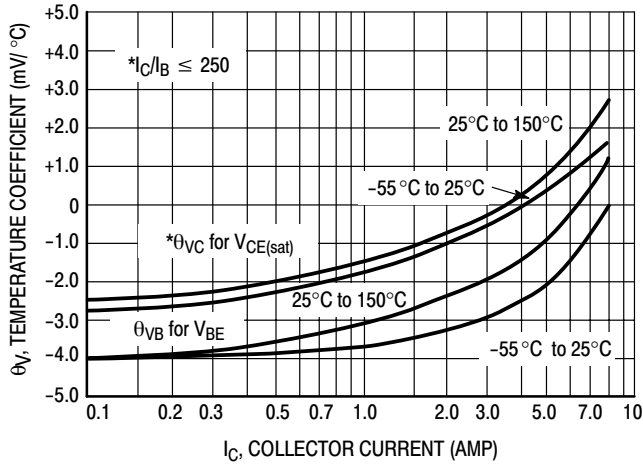
**Figure 10. Collector Saturation Region**



**Figure 11. "On" Voltages**

# BDW42 – NPN, BDW46, BDW47 – PNP

BDW42 (NPN)



BDW46, 47 (PNP)

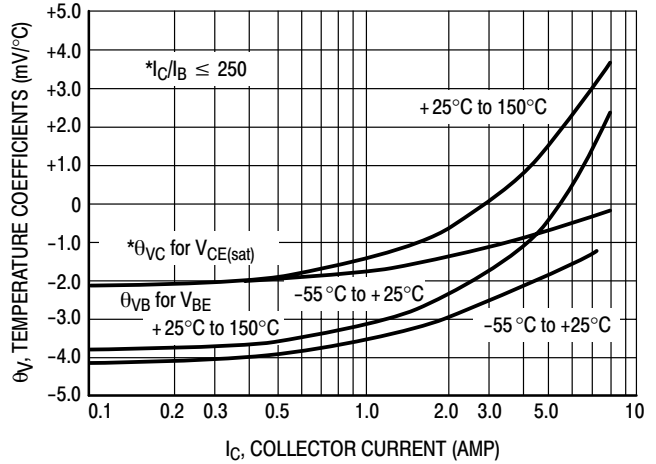


Figure 12. Temperature Coefficients

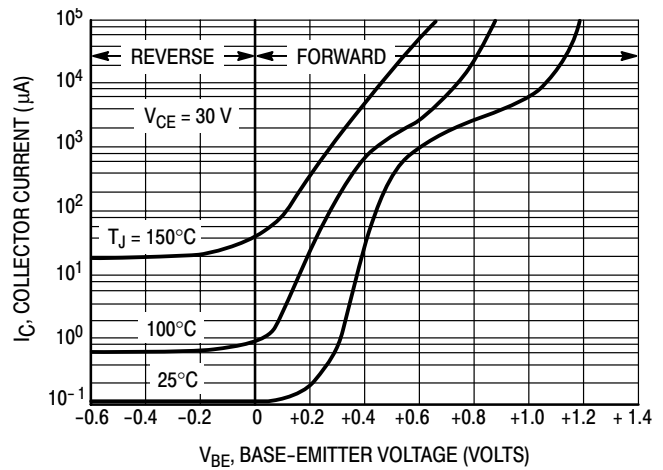
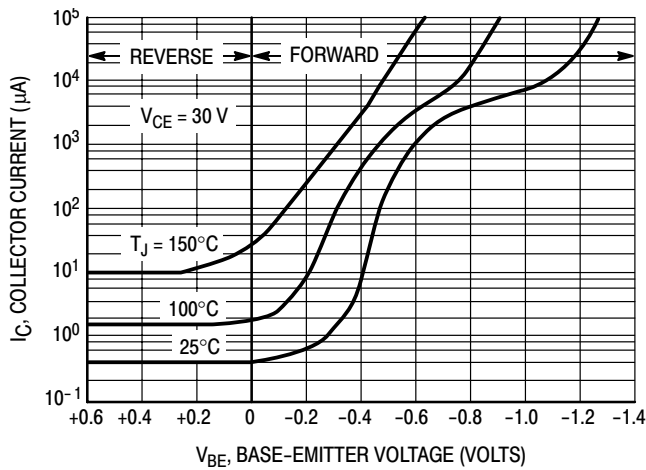


Figure 13. Collector Cut-Off Region

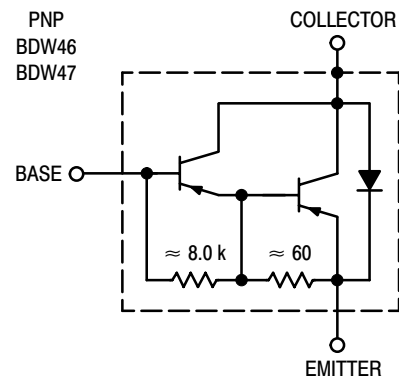
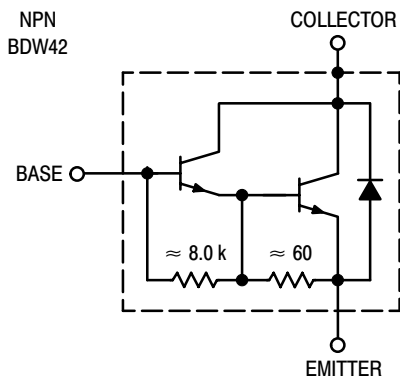
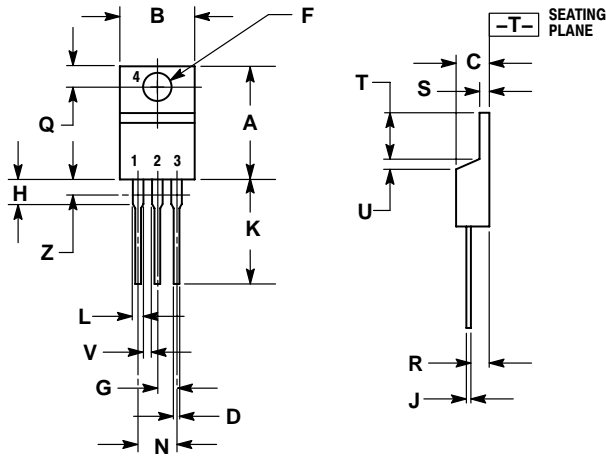


Figure 14. Darlington Schematic

# BDW42 – NPN, BDW46, BDW47 – PNP

## PACKAGE DIMENSIONS

TO-220  
CASE 221A-09  
ISSUE AA



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	---	1.15	---
Z	---	0.080	---	2.04

STYLE 1:

1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

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