

# DTC114E Series

Preferred Devices

## Bias Resistor Transistor

### NPN Silicon Surface Mount Transistor with Monolithic Bias Resistor Network

This new series of digital transistors is designed to replace a single device and its external resistor bias network. The BRT (Bias Resistor Transistor) contains a single transistor with a monolithic bias network consisting of two resistors; a series base resistor and a base-emitter resistor. The BRT eliminates these individual components by integrating them into a single device. The use of a BRT can reduce both system cost and board space. The device is housed in the TO-92 package which is designed for through hole applications.

#### MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	Value	Unit
Collector-Base Voltage	$V_{CBO}$	50	Vdc
Collector-Emitter Voltage	$V_{CEO}$	50	Vdc
Collector Current	$I_C$	100	mAdc
Total Power Dissipation @ $T_A = 25^\circ\text{C}$ (Note 1.) Derate above $25^\circ\text{C}$	$P_D$	350 2.81	mW mW/ $^\circ\text{C}$

#### THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Ambient (surface mounted)	$R_{\theta JA}$	357	$^\circ\text{C}/\text{W}$
Operating and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$
Maximum Temperature for Soldering Purposes, Time in Solder Bath	$T_L$	260 10	$^\circ\text{C}$ Sec

#### DEVICE MARKING AND RESISTOR VALUES

Device	Marking	R1 (K)	R2 (K)	Shipping
DTC114E	DTC114E	10	10	5000/Box
DTC124E	DTC124E	22	22	
DTC144E	DTC144E	47	47	
DTC114Y	DTC114Y	10	47	
DTC114T	DTC114T	10	$\infty$	
DTC143T	DTC143T	4.7	$\infty$	
DTD113E	DTD113E	1.0	1.0	
DTC123E	DTC123E	2.2	2.2	
DTC143E	DTC143E	4.7	4.7	
DTC143Z	DTC143Z	4.7	47	

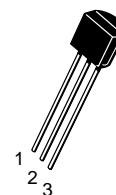
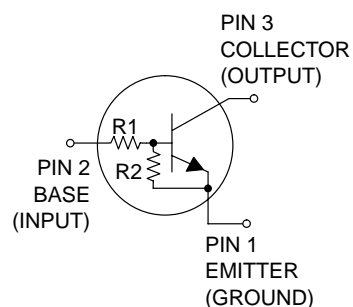
1. Device mounted on a FR-4 glass epoxy printed circuit board using the minimum recommended footprint.



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### NPN SILICON BIAS RESISTOR TRANSISTOR



CASE 29  
TO-92 (TO-226)  
STYLE 1

#### MARKING DIAGRAM



DTC1 = Specific Device Code  
xxx = (See Table)  
Y = Year  
WW = Work Week

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

## DTC114E Series

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector–Base Cutoff Current ( $V_{CB} = 50\text{ V}$ , $I_E = 0$ )	$I_{CBO}$	–	–	100	nAdc
Collector–Emitter Cutoff Current ( $V_{CE} = 50\text{ V}$ , $I_B = 0$ )	$I_{CEO}$	–	–	500	nAdc
Emitter–Base Cutoff Current ( $V_{EB} = 6.0\text{ V}$ , $I_C = 0$ )	$I_{EBO}$	–	–	0.5	mAdc
DTC114E		–	–	0.2	
DTC124E		–	–	0.1	
DTC144E		–	–	0.2	
DTC114Y		–	–	0.9	
DTC114T		–	–	1.9	
DTC143T		–	–	4.3	
DTD113E		–	–	2.3	
DTC123E		–	–	1.5	
DTC143E		–	–	0.18	
DTC143Z		–	–		
Collector–Base Breakdown Voltage ( $I_C = 10\ \mu\text{A}$ , $I_E = 0$ )	$V_{(BR)CBO}$	50	–	–	Vdc
Collector–Emitter Breakdown Voltage (Note 2.) ( $I_C = 2.0\text{ mA}$ , $I_B = 0$ )	$V_{(BR)CEO}$	50	–	–	Vdc

### ON CHARACTERISTICS (Note 2.)

DC Current Gain ( $V_{CE} = 10\text{ V}$ , $I_C = 5.0\text{ mA}$ )	DTC114E DTC124E DTC144E DTC114Y DTC114T DTC143T DTD113E DTC123E DTC143E DTC143Z	$h_{FE}$	35 60 80 80 160 160 3.0 8.0 15 80	60 100 140 140 350 350 5.0 15 30 200	– – – – – – – – – –	
Collector–Emitter Saturation Voltage ( $I_C = 10\text{ mA}$ , $I_E = 0.3\text{ mA}$ ) DTC144E/DTC114Y DTD113E/DTC143E ( $I_C = 10\text{ mA}$ , $I_B = 5\text{ mA}$ ) DTC123E ( $I_C = 10\text{ mA}$ , $I_B = 1\text{ mA}$ ) DTC114T/DTC143T/ DTC143Z/DTC124E		$V_{CE(sat)}$	–	–	0.25	Vdc
Output Voltage (on) ( $V_{CC} = 5.0\text{ V}$ , $V_B = 2.5\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ )          ( $V_{CC} = 5.0\text{ V}$ , $V_B = 3.5\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ )	DTC114E DTC124E DTC114Y DTC114T DTC143T DTD113E DTC123E DTC143E DTC143Z DTC144E	$V_{OL}$	– – – – – – – – – –	– – – – – – – – – –	0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2	Vdc

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

## DTC114E Series

### ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted) (Continued)

Characteristic	Symbol	Min	Typ	Max	Unit	
Output Voltage (off) (V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 0.5 V, R <sub>L</sub> = 1.0 kΩ)  (V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 0.05 V, R <sub>L</sub> = 1.0 kΩ) (V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 0.25 V, R <sub>L</sub> = 1.0 kΩ)	DTC114E DTC124E DTC144E DTC114Y DTC123E DTC143E DTD113E DTC114T DTC143T DTC143Z	V <sub>OH</sub>	4.9	–	–	Vdc
Input Resistor	DTC114E DTC124E DTC144E DTC114Y DTC114T DTC143T DTD113E DTC123E DTC143E DTC143Z	R <sub>1</sub>	7.0 15.4 32.9 7.0 7.0 3.3 0.7 1.5 3.3 3.3	10 22 47 10 10 4.7 1.0 2.2 4.7 4.7	13 28.6 61.1 13 13 6.1 1.3 2.9 6.1 6.1	kΩ
Resistor Ratio	DTC114E/DTC124E/DTC144E DTC114Y DTC114T/DTC143T DTD113E/DTC123E/DTC143E DTC143Z	R <sub>1</sub> /R <sub>2</sub>	0.8 0.17 – 0.8 0.055	1.0 0.21 – 1.0 0.1	1.2 0.25 – 1.2 0.185	

# DTC114E Series

## TYPICAL ELECTRICAL CHARACTERISTICS DTC114E

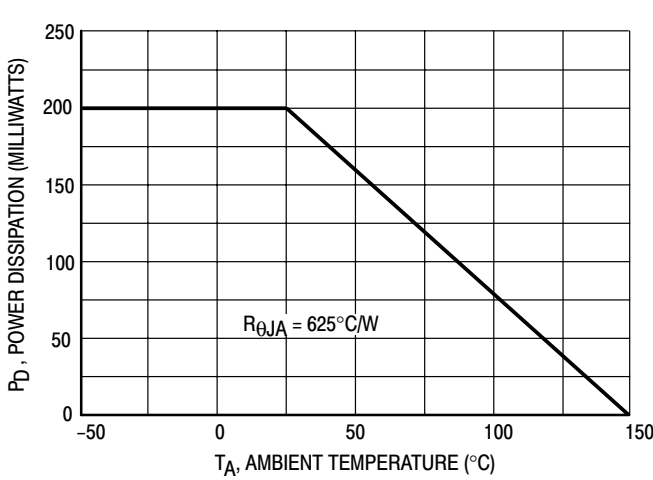


Figure 1. Derating Curve

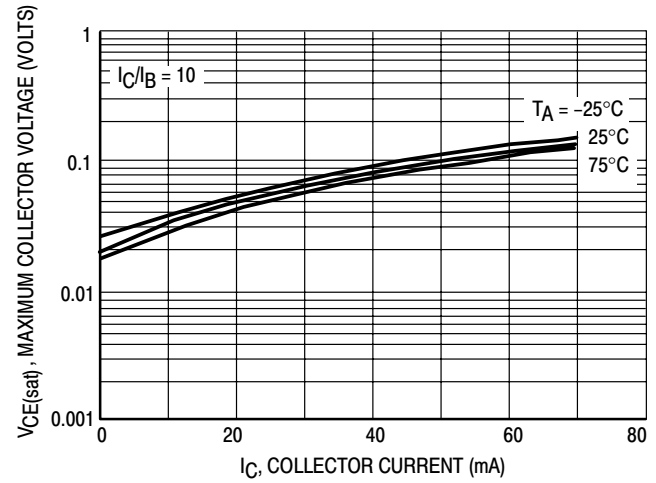


Figure 2.  $V_{CE(sat)}$  versus  $I_C$

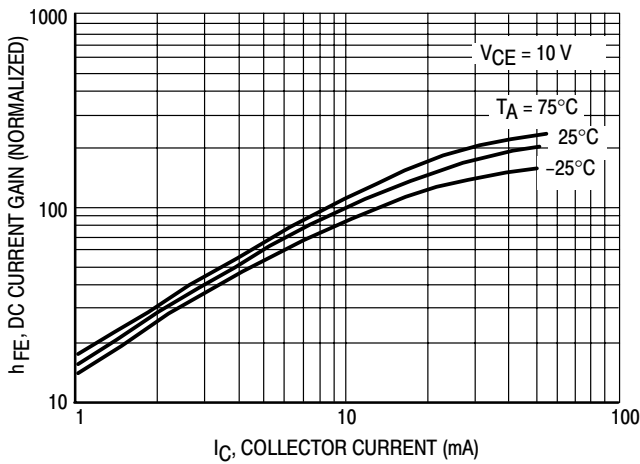


Figure 3. DC Current Gain

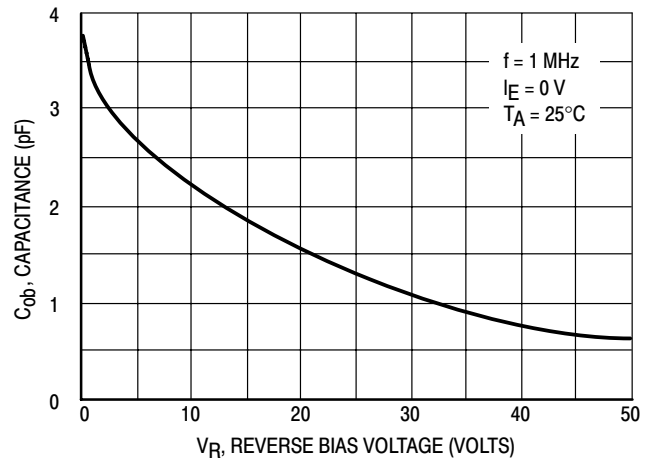


Figure 4. Output Capacitance

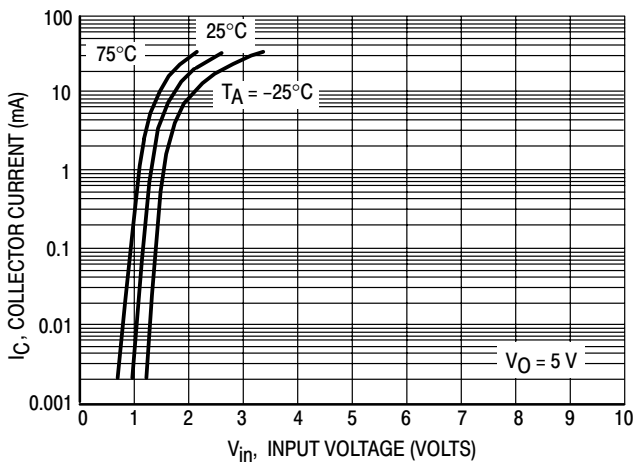


Figure 5.  $V_{CE(sat)}$  versus  $I_C$

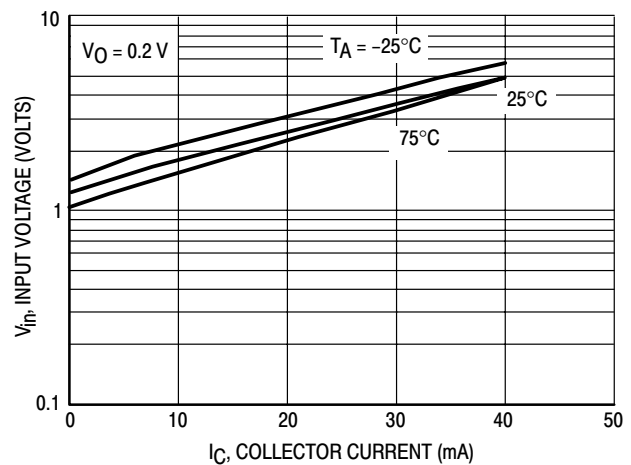


Figure 6.  $V_{CE(sat)}$  versus  $I_C$

# DTC114E Series

## TYPICAL ELECTRICAL CHARACTERISTICS DTC124E

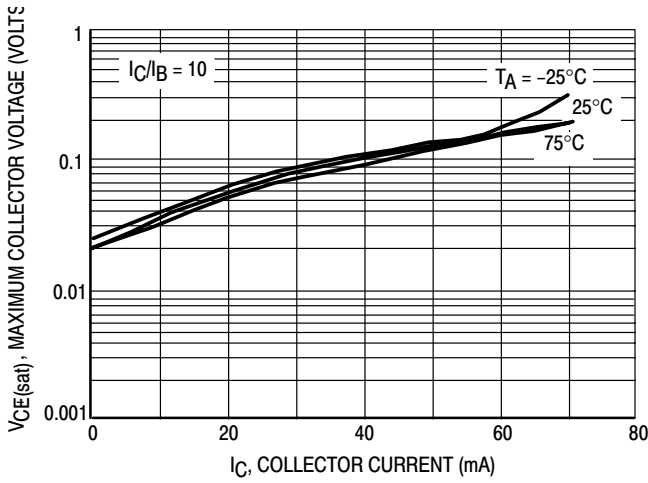


Figure 7.  $V_{CE(sat)}$  versus  $I_C$

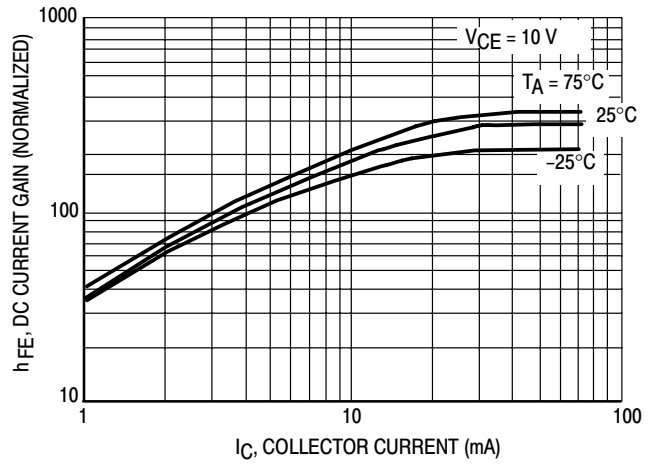


Figure 8. DC Current Gain

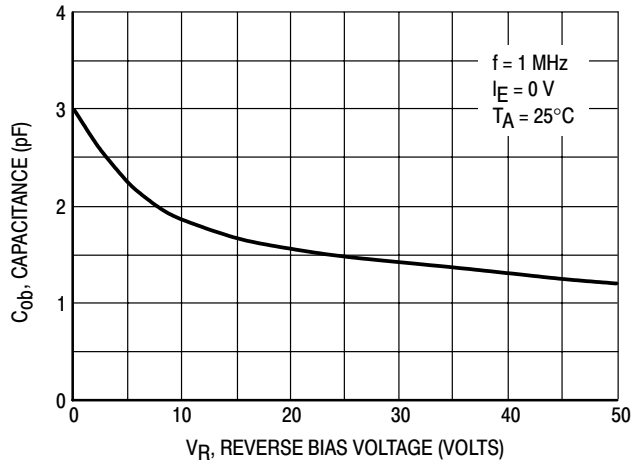


Figure 9. Output Capacitance

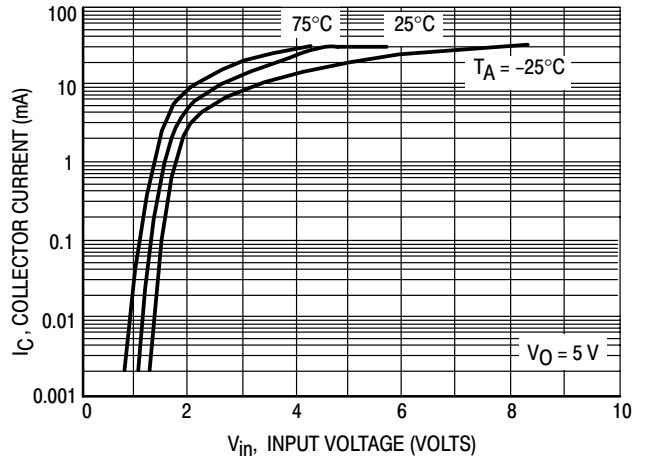


Figure 10. Output Current versus Input Voltage

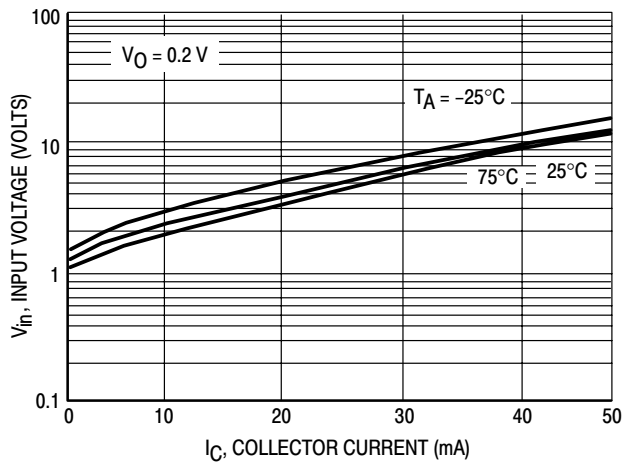


Figure 11. Input Voltage versus Output Current

# DTC114E Series

## TYPICAL ELECTRICAL CHARACTERISTICS DTC144E

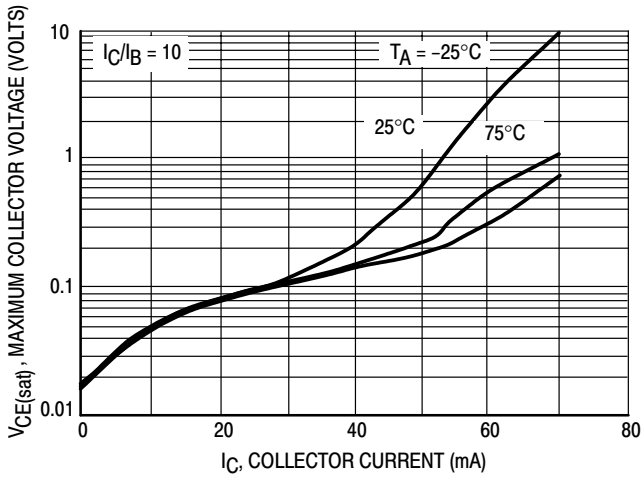


Figure 12.  $V_{CE(sat)}$  versus  $I_C$

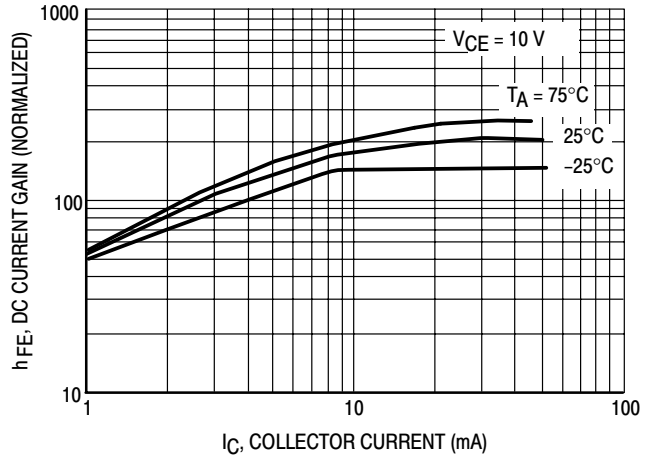


Figure 13. DC Current Gain

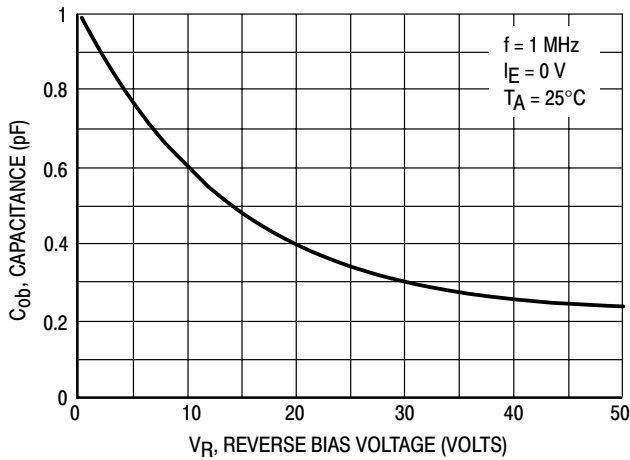


Figure 14. Output Capacitance

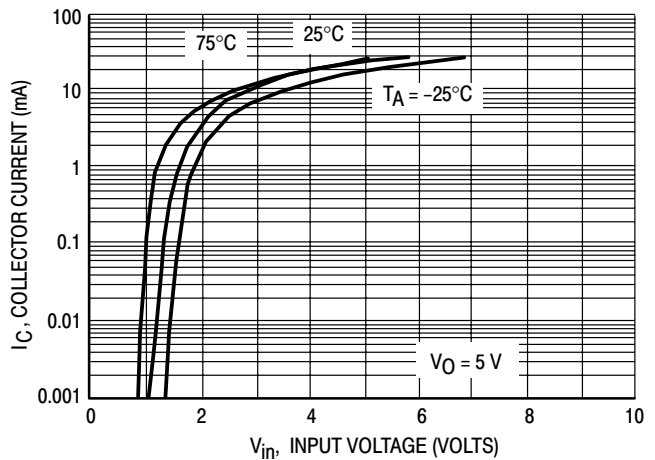


Figure 15. Output Current versus Input Voltage

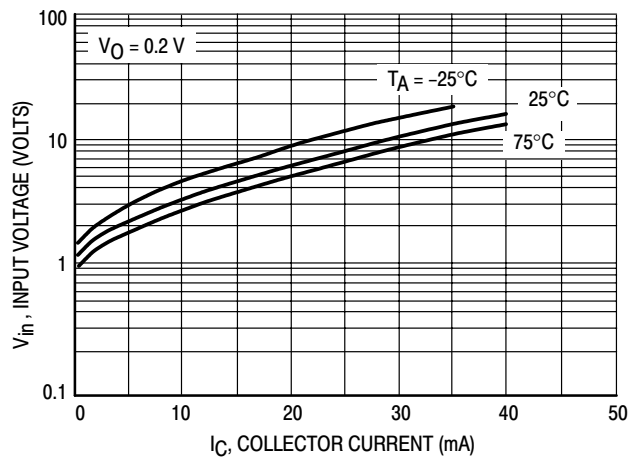


Figure 16. Input Voltage versus Output Current

# DTC114E Series

## TYPICAL ELECTRICAL CHARACTERISTICS DTC114Y

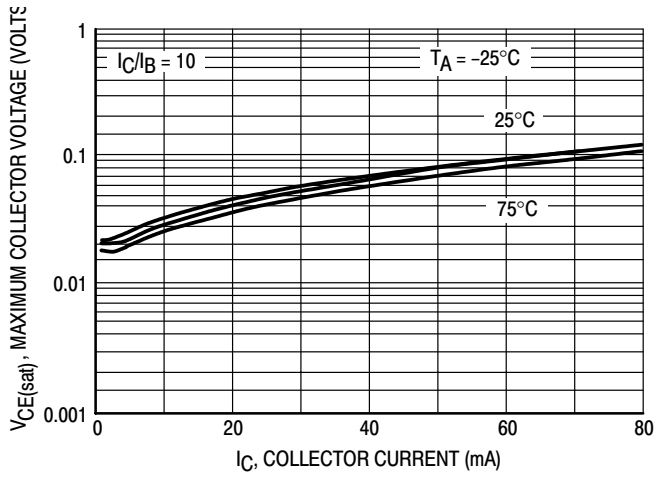


Figure 17.  $V_{CE(sat)}$  versus  $I_C$

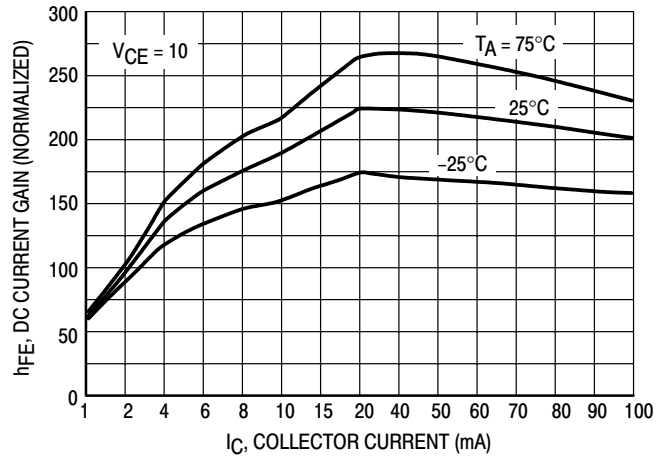


Figure 18. DC Current Gain

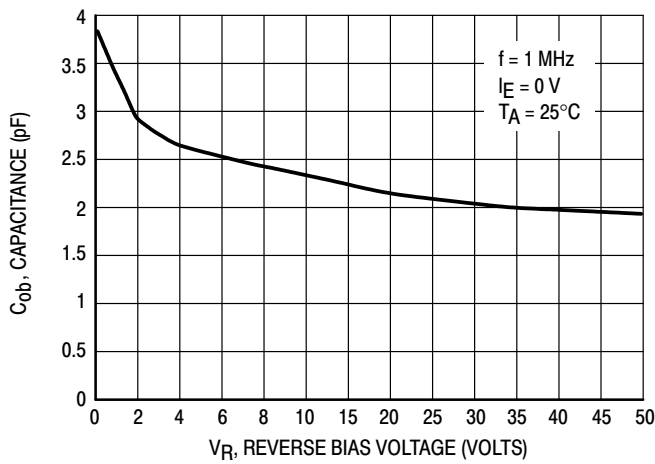


Figure 19. Output Capacitance

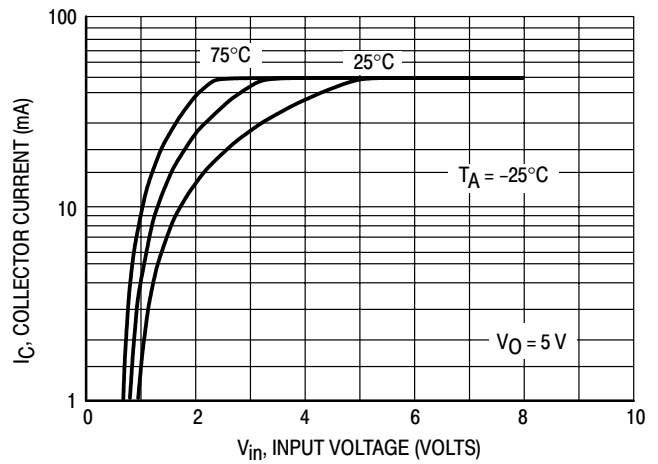


Figure 20. Output Current versus Input Voltage

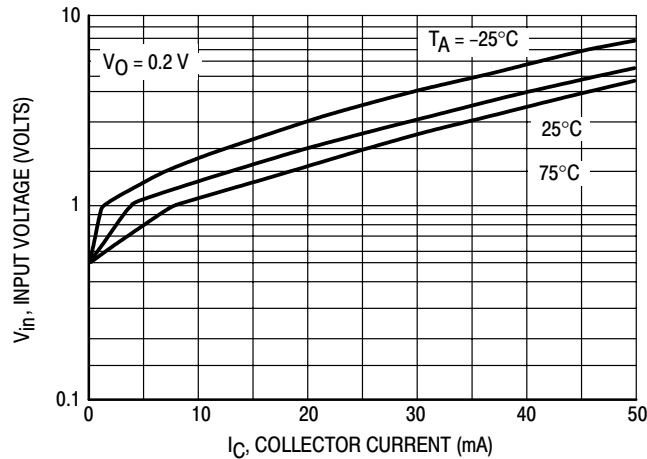


Figure 21. Input Voltage versus Output Current

# DTC114E Series

## TYPICAL APPLICATIONS FOR NPN BRTs

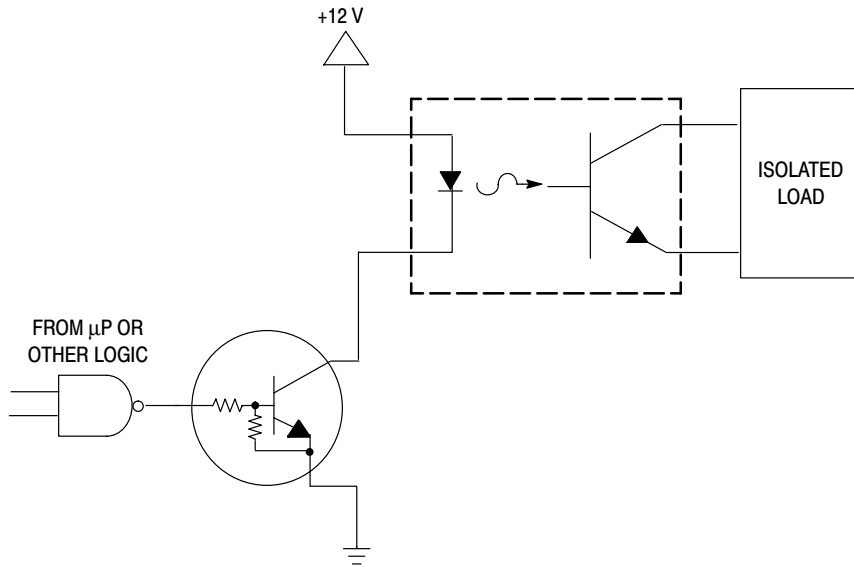


Figure 22. Level Shifter: Connects 12 or 24 Volt Circuits to Logic

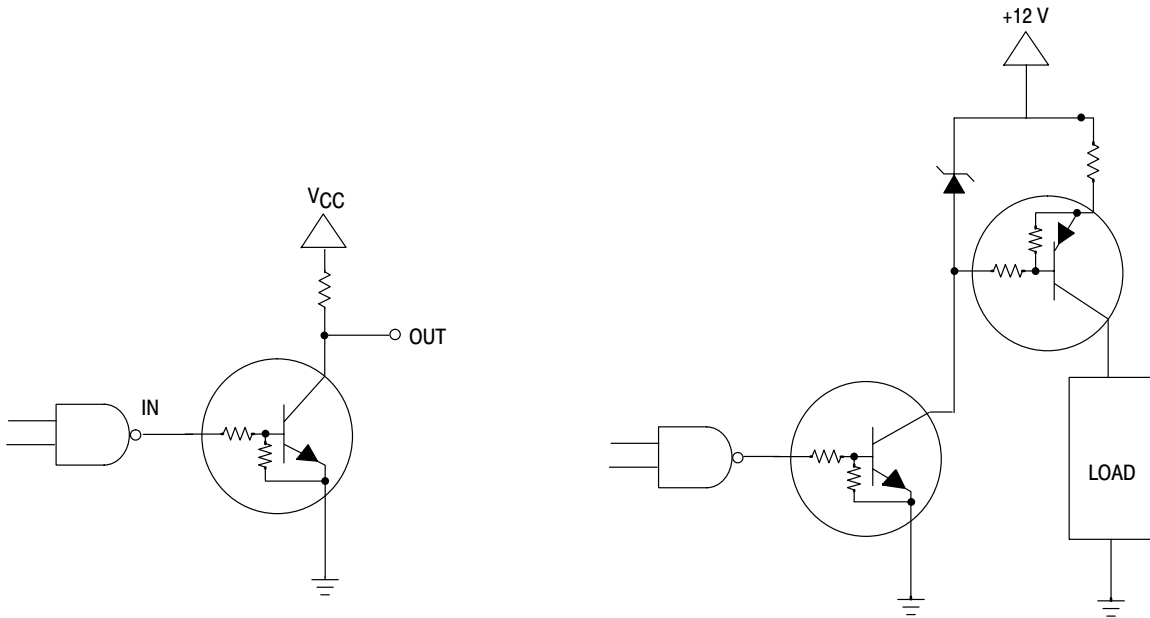


Figure 23. Open Collector Inverter: Inverts the Input Signal

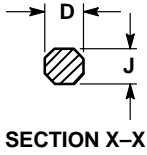
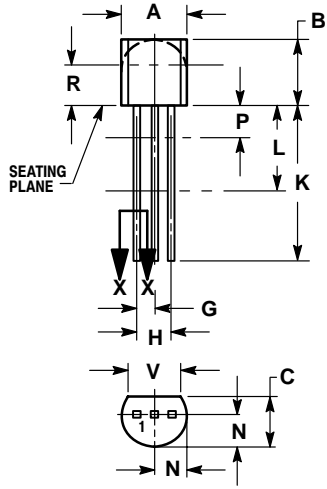
Figure 24. Inexpensive, Unregulated Current Source



# DTC114E Series

## PACKAGE DIMENSIONS

TO-92  
TO-226AA  
CASE 29-11  
ISSUE AL



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	---


STYLE 1:

- PIN 1. EMITTER
2. BASE
3. COLLECTOR

**Notes**

## Notes

## DTC114E Series

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