

# 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 @ $T_A = 25^\circ\text{C}$ (1.) Derate above $25^\circ\text{C}$	$P_D$	350 2.81	mW mW/°C

#### THERMAL CHARACTERISTICS

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

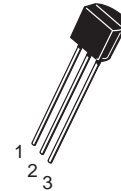
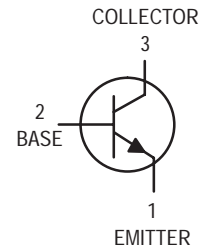
1. Device mounted on a FR-4 glass epoxy printed circuit board using the minimum recommended footprint.



ON Semiconductor

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### NPN SILICON BIAS RESISTOR TRANSISTOR



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

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

# DTC114E SERIES

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector–Base Cutoff Current (V <sub>CB</sub> = 50 V, I <sub>E</sub> = 0)	I <sub>CBO</sub>	—	—	100	nAdc
Collector–Emitter Cutoff Current (V <sub>CE</sub> = 50 V, I <sub>B</sub> = 0)	I <sub>CEO</sub>	—	—	500	nAdc
Emitter–Base Cutoff Current (V <sub>EB</sub> = 6.0 V, I <sub>C</sub> = 0)	I <sub>EBO</sub>	—	—	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 <sub>C</sub> = 10 μA, I <sub>E</sub> = 0)	V <sub>(BR)CBO</sub>	50	—	—	Vdc
Collector–Emitter Breakdown Voltage <sup>(2.)</sup> (I <sub>C</sub> = 2.0 mA, I <sub>B</sub> = 0)	V <sub>(BR)CEO</sub>	50	—	—	Vdc
<b>ON CHARACTERISTICS <sup>(2.)</sup></b>					
DC Current Gain (V <sub>CE</sub> = 10 V, I <sub>C</sub> = 5.0 mA)	h <sub>FE</sub>	35	60	—	
DTC114E		60	100	—	
DTC124E		80	140	—	
DTC144E		80	140	—	
DTC114Y		160	350	—	
DTC114T		160	350	—	
DTC143T		3.0	5.0	—	
DTD113E		8.0	15	—	
DTC123E		15	30	—	
DTC143E		80	200	—	
DTC143Z					
Collector–Emitter Saturation Voltage (I <sub>C</sub> = 10 mA, I <sub>E</sub> = 0.3 mA) DTC144E/DTC114Y DTD113E/DTC143E (I <sub>C</sub> = 10 mA, I <sub>B</sub> = 5 mA) DTC123E (I <sub>C</sub> = 10 mA, I <sub>B</sub> = 1 mA) DTC114T/DTC143T/ DTC143Z/DTC124E	V <sub>CE(sat)</sub>	—	—	0.25	Vdc
Output Voltage (on) (V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 2.5 V, R <sub>L</sub> = 1.0 kΩ)	V <sub>OL</sub>	—	—	0.2	Vdc
DTC114E		—	—	0.2	
DTC124E		—	—	0.2	
DTC114Y		—	—	0.2	
DTC114T		—	—	0.2	
DTC143T		—	—	0.2	
DTD113E		—	—	0.2	
DTC123E		—	—	0.2	
DTC143E		—	—	0.2	
DTC143Z		—	—	0.2	
(V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 3.5 V, R <sub>L</sub> = 1.0 kΩ) DTC144E		—	—	0.2	

2. Pulse Test: Pulse Width < 300 μs, 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

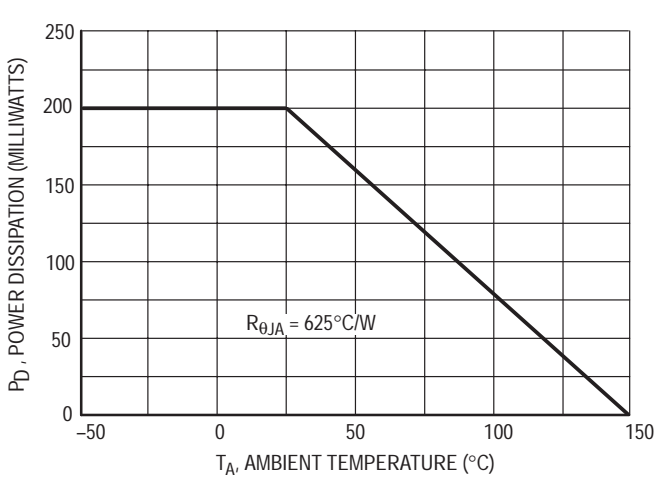


Figure 1. Derating Curve

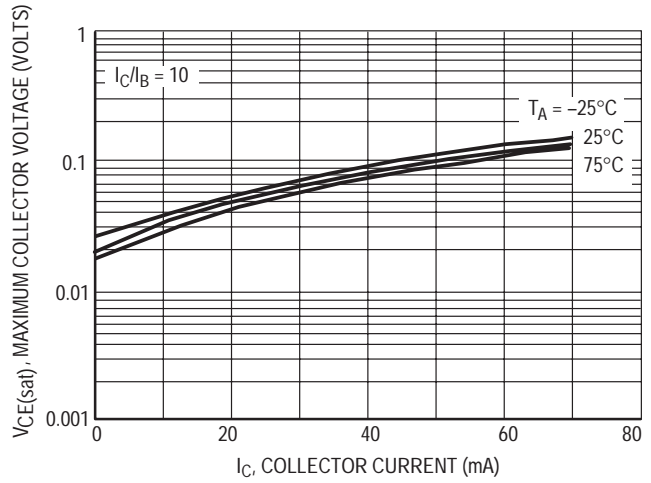


Figure 2.  $V_{CE(sat)}$  versus  $I_C$

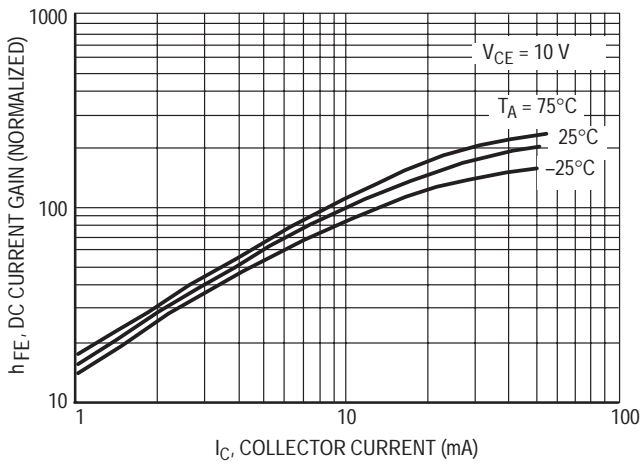


Figure 3. DC Current Gain

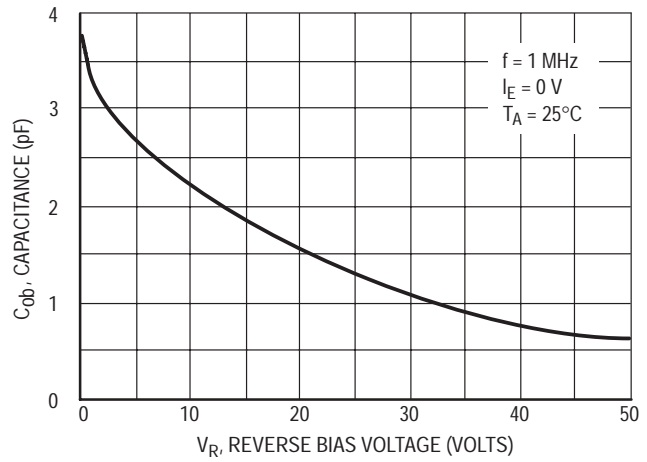


Figure 4. Output Capacitance

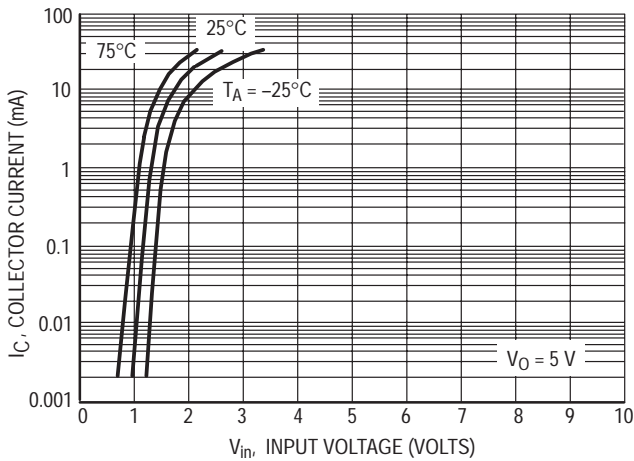


Figure 5.  $V_{CE(sat)}$  versus  $I_C$

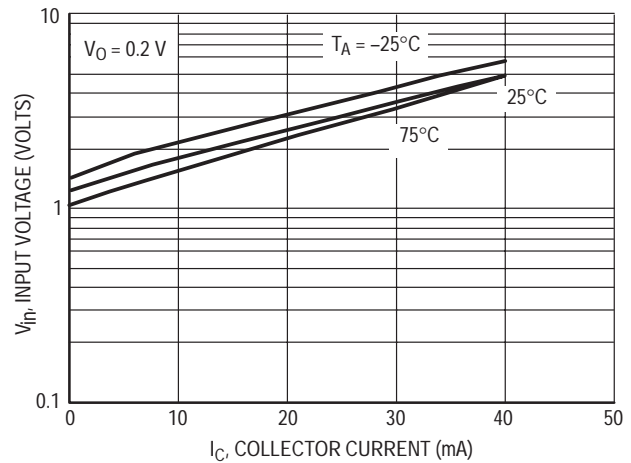


Figure 6.  $V_{CE(sat)}$  versus  $I_C$

# DTC114E SERIES

## TYPICAL ELECTRICAL CHARACTERISTICS DTC124E

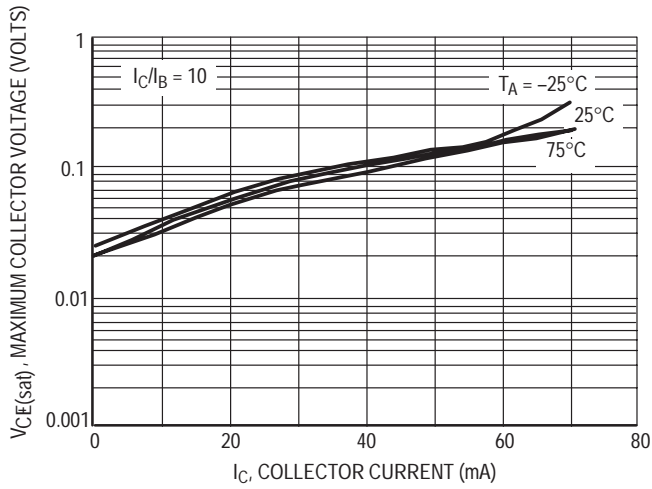


Figure 7.  $V_{CE(sat)}$  versus  $I_C$

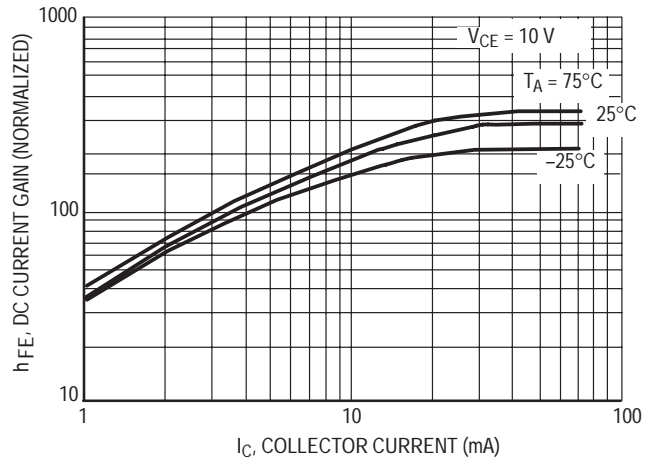


Figure 8. DC Current Gain

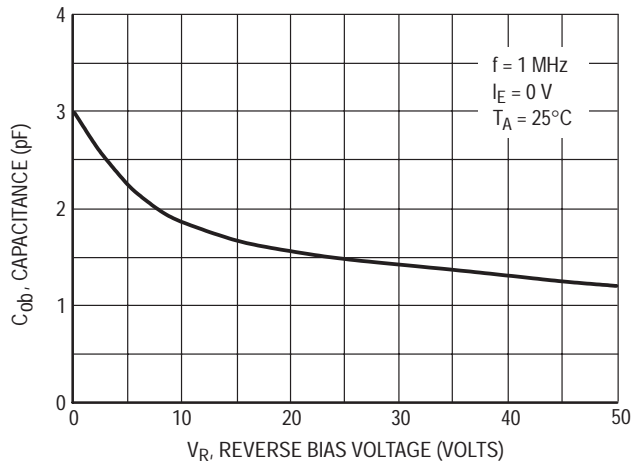


Figure 9. Output Capacitance

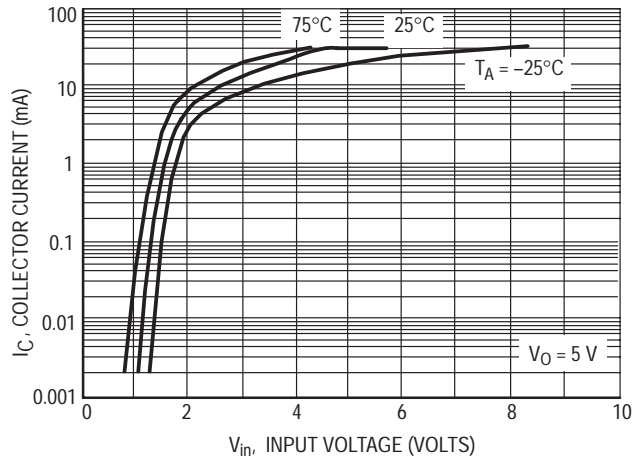


Figure 10. Output Current versus Input Voltage

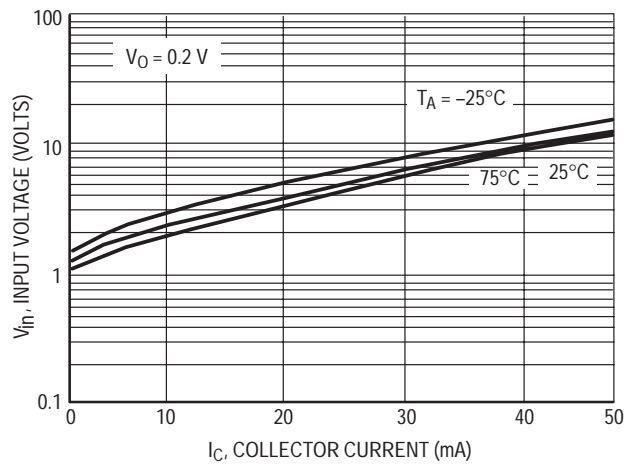


Figure 11. Input Voltage versus Output Current

# DTC114E SERIES

## TYPICAL ELECTRICAL CHARACTERISTICS DTC144E

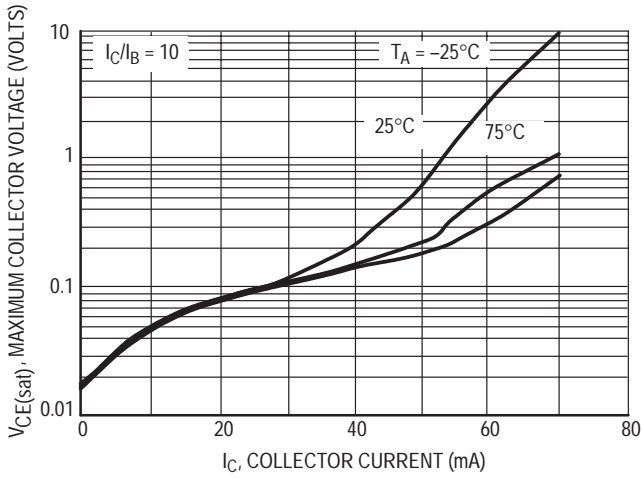


Figure 12.  $V_{CE(sat)}$  versus  $I_C$

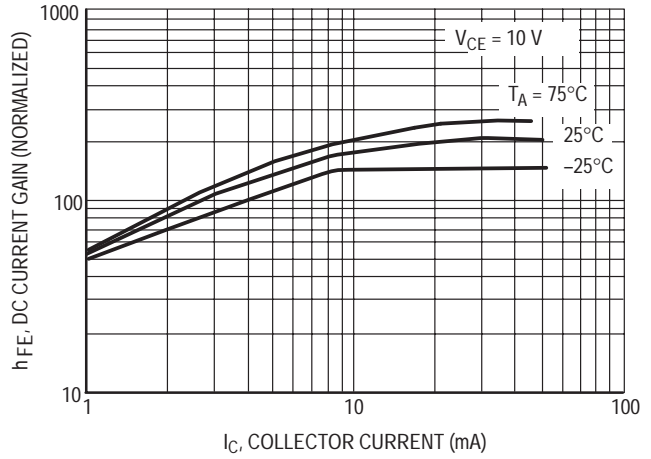


Figure 13. DC Current Gain

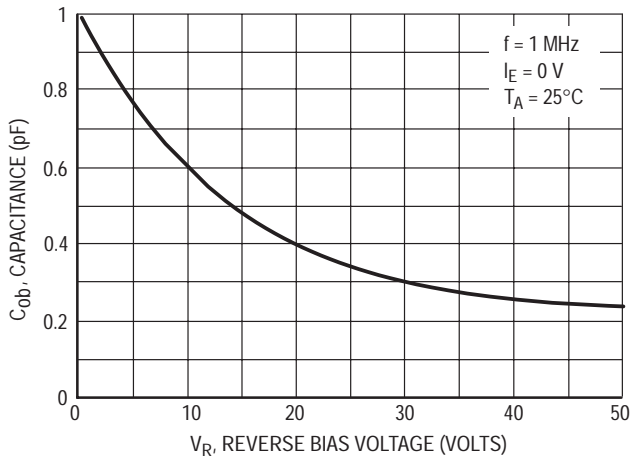


Figure 14. Output Capacitance

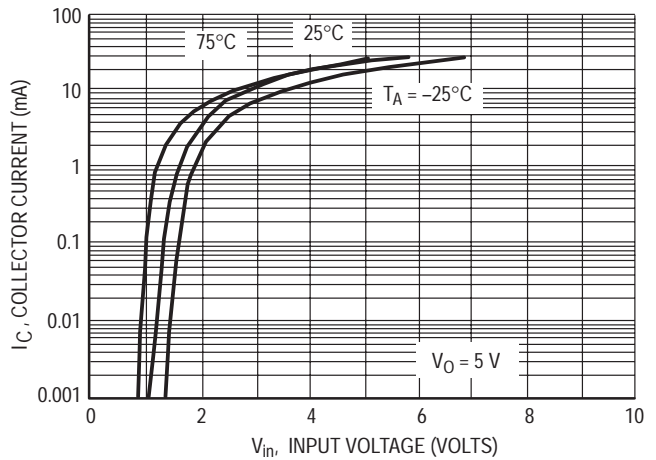


Figure 15. Output Current versus Input Voltage

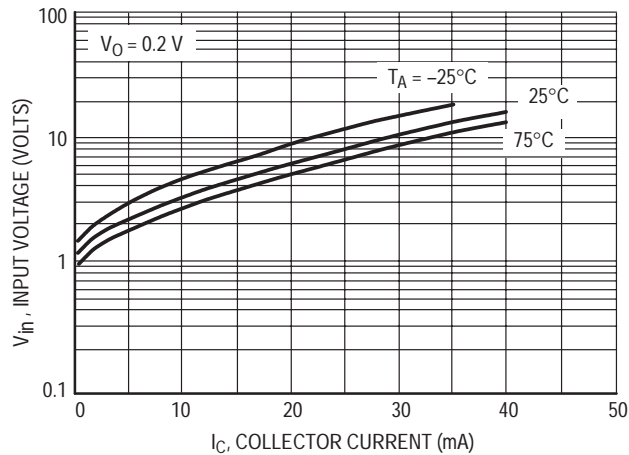


Figure 16. Input Voltage versus Output Current

# DTC114E SERIES

## TYPICAL ELECTRICAL CHARACTERISTICS DTC114Y

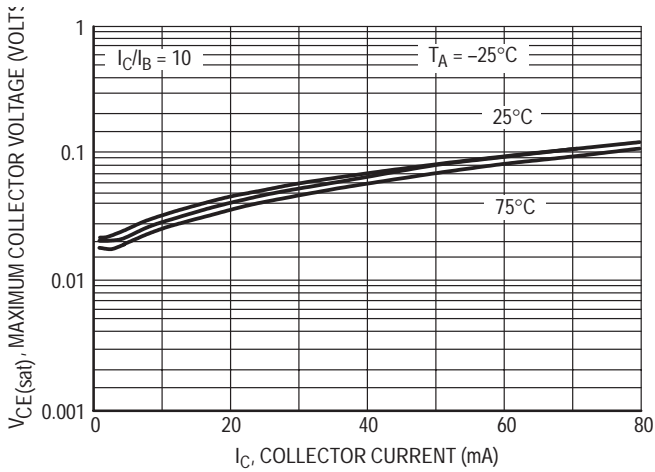


Figure 17.  $V_{CE(sat)}$  versus  $I_C$

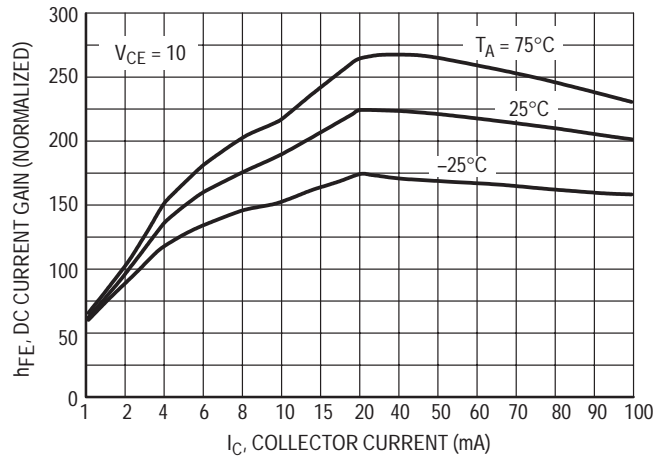


Figure 18. DC Current Gain

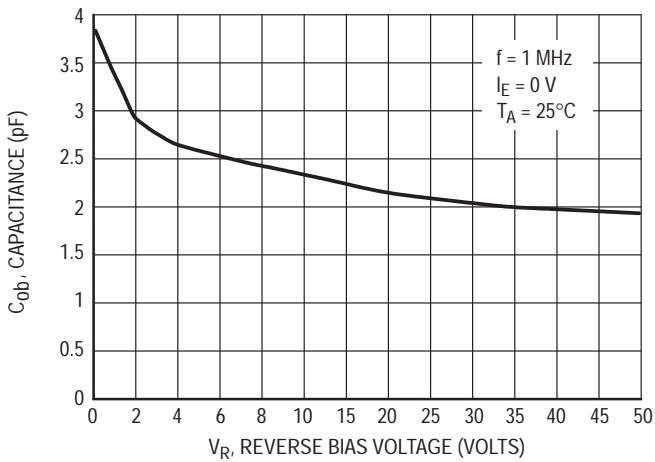


Figure 19. Output Capacitance

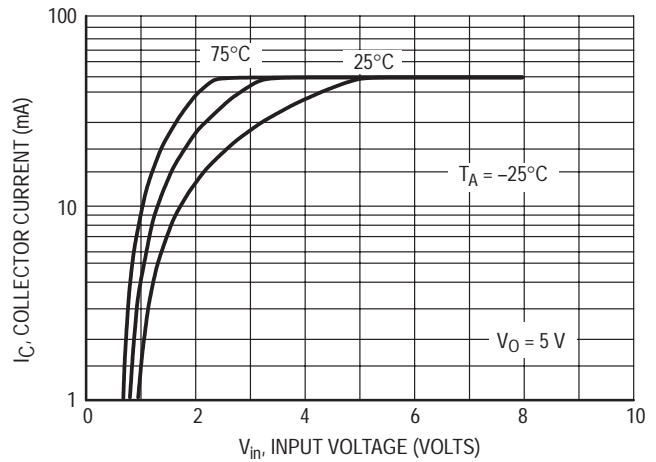


Figure 20. Output Current versus Input Voltage

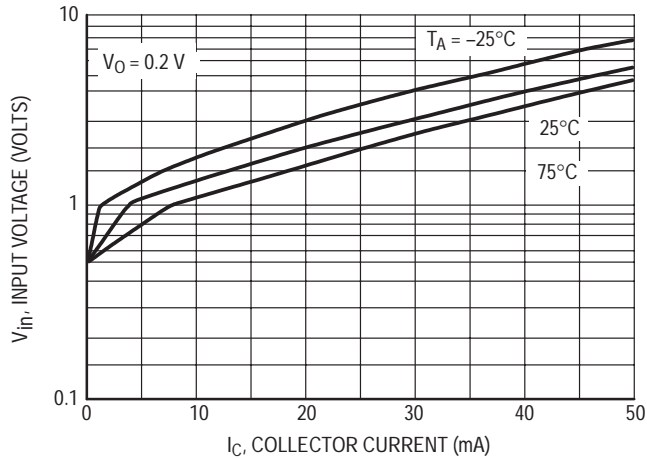


Figure 21. Input Voltage versus Output Current

# DTC114E SERIES

## TYPICAL APPLICATIONS FOR NPN BRTs

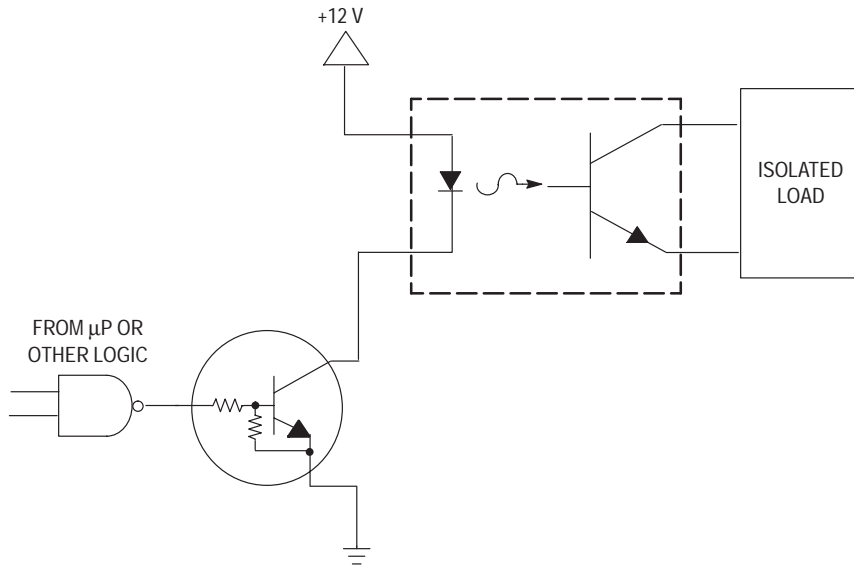


Figure 22. Level Shifter: Connects 12 or 24 Volt Circuits to Logic

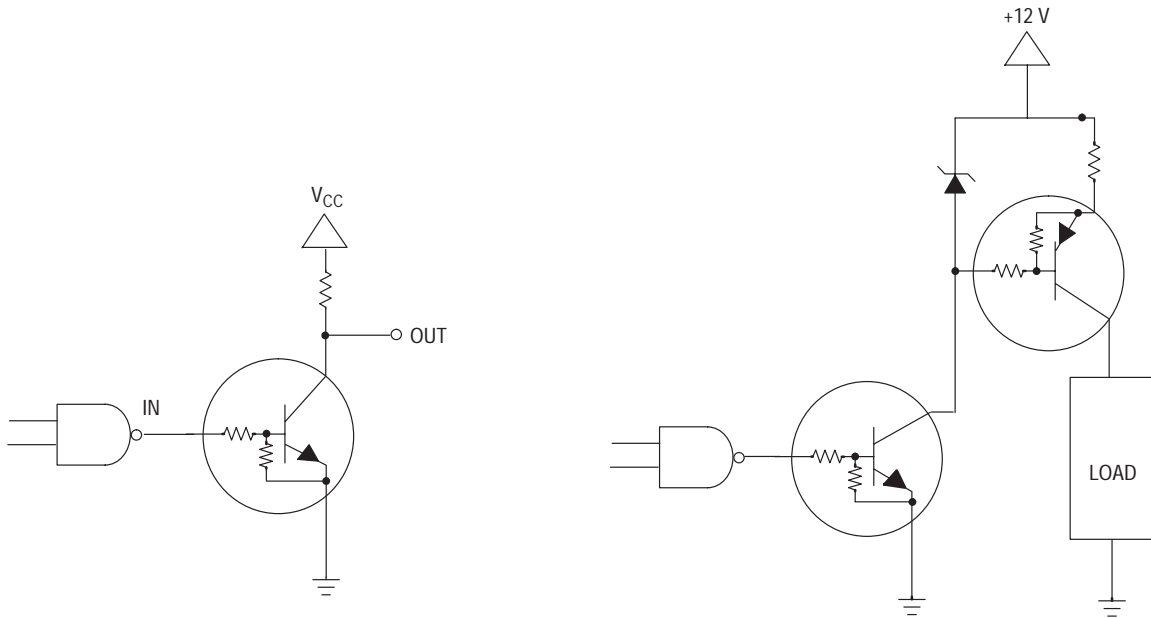


Figure 23. Open Collector Inverter: Inverts the Input Signal

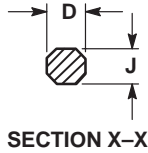
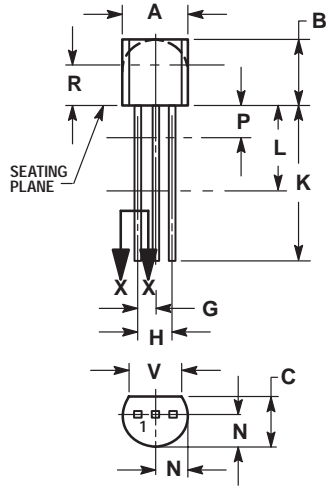
Figure 24. Inexpensive, Unregulated Current Source



# DTC114E SERIES

## PACKAGE DIMENSIONS

TO-92  
(TO-226)  
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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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


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

**Notes**

**Notes**

# DTC114E SERIES

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