

# DTC114EET1 Series, SDTC114EET1 Series



ON Semiconductor®

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## 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 SC-75/SOT-416 package which is designed for low power surface mount applications.

### Features

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- The SC-75/SOT-416 Package Can be Soldered Using Wave or Reflow
- The Modified Gull-Winged Leads Absorb Thermal Stress During Soldering Eliminating the Possibility of Damage to the Die
- Pb-Free Packages are Available
- S Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable

### 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

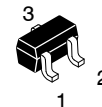
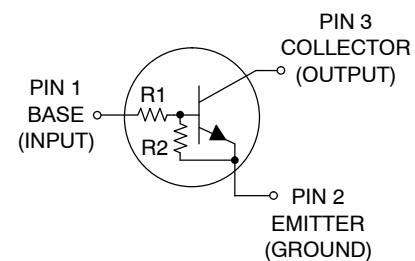
### THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Total Device Dissipation, FR-4 Board (Note 1) @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	200 1.6	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient (Note 1)	$R_{\theta JA}$	600	$^\circ\text{C}/\text{W}$
Total Device Dissipation, FR-4 Board (Note 2) @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	300 2.4	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	400	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature Range	$T_J, T_{stg}$	-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.

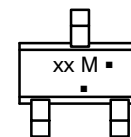
1. FR-4 @ Minimum Pad
2. FR-4 @ 1.0 x 1.0 Inch Pad

## NPN SILICON BIAS RESISTOR TRANSISTORS



SC-75 (SOT-416)  
CASE 463  
STYLE 1

### MARKING DIAGRAM



xx = Specific Device Code  
xx = (Refer to page 2)

M = Date Code\*

▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation may vary depending upon manufacturing location.

### ORDERING INFORMATION

See detailed ordering, marking, and shipping information in the package dimensions section on page 2 of this data sheet.

## DTC114EET1 Series, SDTC114EET1 Series

### ORDERING INFORMATION, DEVICE MARKING and RESISTOR VALUES

Device	Marking	R1 (K)	R2 (K)	Package	Shipping†
DTC114EET1	8A	10	10	SC-75/SOT-416	3000 Tape & Reel
DTC114EET1G				SC-75/SOT-416 (Pb-Free)	3000 Tape & Reel
SDTC114EET1G					
DTC124EET1	8B	22	22	SC-75/SOT-416	3000 Tape & Reel
DTC124EET1G				SC-75/SOT-416 (Pb-Free)	3000 Tape & Reel
SDTC124EET1G					
DTC144EET1	8C	47	47	SC-75/SOT-416	3000 Tape & Reel
DTC144EET1G				SC-75/SOT-416 (Pb-Free)	3000 Tape & Reel
DTC114YET1	8D	10	47	SC-75/SOT-416	3000 Tape & Reel
DTC114YET1G				SC-75/SOT-416 (Pb-Free)	3000 Tape & Reel
SDTC114YET1G					
DTC114TET1	94	10	∞	SC-75/SOT-416	3000 Tape & Reel
DTC114TET1G				SC-75/SOT-416 (Pb-Free)	3000 Tape & Reel
DTC143TET1	8F	4.7	∞	SC-75/SOT-416	3000 Tape & Reel
DTC143TET1G				SC-75/SOT-416 (Pb-Free)	3000 Tape & Reel
DTC123EET1	8H	2.2	2.2	SC-75/SOT-416	3000 Tape & Reel
DTC123EET1G				SC-75/SOT-416 (Pb-Free)	3000 Tape & Reel
DTC143EET1	8J	4.7	4.7	SC-75/SOT-416	3000 Tape & Reel
DTC143EET1G				SC-75/SOT-416 (Pb-Free)	3000 Tape & Reel
DTC143ZET1	8K	4.7	47	SC-75/SOT-416	3000 Tape & Reel
DTC143ZET1G				SC-75/SOT-416 (Pb-Free)	3000 Tape & Reel
DTC124XET1	8L	22	47	SC-75/SOT-416	3000 Tape & Reel
DTC124XET1G				SC-75/SOT-416 (Pb-Free)	3000 Tape & Reel
DTC123JET1	8M	2.2	47	SC-75/SOT-416	3000 Tape & Reel
DTC123JET1G				SC-75/SOT-416 (Pb-Free)	3000 Tape & Reel
DTC115EET1	8N	100	100	SC-75/SOT-416	3000 Tape & Reel
DTC115EET1G				SC-75/SOT-416 (Pb-Free)	3000 Tape & Reel
DTC144WET1	8P	47	22	SC-75/SOT-416	3000 Tape & Reel
DTC144WET1G				SC-75/SOT-416	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.

## DTC114EET1 Series, SDTC114EET1 Series

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

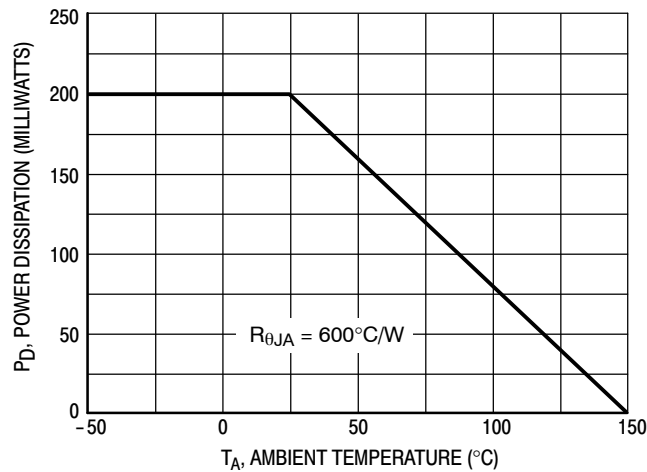
Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector–Base Cutoff Current ( $V_{CB} = 50\text{ V}$ , $I_E = 0$ )	$I_{CBO}$	–	–	100	nAdc
Collector–Emitter Cutoff Current ( $V_{CE} = 50\text{ V}$ , $I_B = 0$ )	$I_{CEO}$	–	–	500	nAdc
Emitter–Base Cutoff Current ( $V_{EB} = 6.0\text{ V}$ , $I_C = 0$ )	$I_{EBO}$	–	–	0.5	mAdc
DTC114EET1, SDTC114EET1		–	–	0.2	
DTC124EET1, SDTC124EET1		–	–	0.1	
DTC144EET1		–	–	0.2	
DTC114YET1, SDTC114YET1		–	–	0.9	
DTC114TET1		–	–	1.9	
DTC143TET1		–	–	2.3	
DTC123EET1		–	–	1.5	
DTC143EET1		–	–	0.18	
DTC143ZET1		–	–	0.13	
DTC124XET1		–	–	0.2	
DTC123JET1		–	–	0.05	
DTC115EET1		–	–	0.13	
DTC144WET1		–	–		
Collector–Base Breakdown Voltage ( $I_C = 10\ \mu\text{A}$ , $I_E = 0$ )	$V_{(BR)CBO}$	50	–	–	Vdc
Collector–Emitter Breakdown Voltage (Note 3) ( $I_C = 2.0\text{ mA}$ , $I_B = 0$ )	$V_{(BR)CEO}$	50	–	–	Vdc
<b>ON CHARACTERISTICS (Note 3)</b>					
DC Current Gain ( $V_{CE} = 10\text{ V}$ , $I_C = 5.0\text{ mA}$ )	$h_{FE}$	35	60	–	
DTC114EET1, SDTC114EET1		60	100	–	
DTC124EET1, SDTC124EET1		80	140	–	
DTC144EET1		80	140	–	
DTC114YET1, SDTC114YET1		80	140	–	
DTC114TET1		160	350	–	
DTC143TET1		160	350	–	
DTC123EET1		8.0	15	–	
DTC143EET1		15	30	–	
DTC143ZET1		80	200	–	
DTC124XET1		80	150	–	
DTC123JET1		80	140	–	
DTC115EET1		80	150	–	
DTC144WET1		80	140	–	
Collector–Emitter Saturation Voltage ( $I_C = 10\text{ mA}$ , $I_B = 0.3\text{ mA}$ ) ( $I_C = 10\text{ mA}$ , $I_B = 5\text{ mA}$ ) DTC123EET1 ( $I_C = 10\text{ mA}$ , $I_B = 1\text{ mA}$ ) DTC143TET1/DTC114TET1/ DTC143EET1/DTC143ZET1/DTC124XET1	$V_{CE(sat)}$	–	–	0.25	Vdc
Output Voltage (on) ( $V_{CC} = 5.0\text{ V}$ , $V_B = 2.5\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ )	$V_{OL}$				Vdc
DTC114EET1, SDTC114EET1		–	–	0.2	
DTC124EET1, SDTC124EET1		–	–	0.2	
DTC114YET1, SDTC114YET1		–	–	0.2	
DTC114TET1		–	–	0.2	
DTC143TET1		–	–	0.2	
DTC123EET1		–	–	0.2	
DTC143EET1		–	–	0.2	
DTC143ZET1		–	–	0.2	
DTC124XET1		–	–	0.2	
DTC123JET1		–	–	0.2	
( $V_{CC} = 5.0\text{ V}$ , $V_B = 3.5\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ )		–	–	0.2	
( $V_{CC} = 5.0\text{ V}$ , $V_B = 5.5\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ )		–	–	0.2	
( $V_{CC} = 5.0\text{ V}$ , $V_B = 4.0\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ )		–	–	0.2	
Output Voltage (off) ( $V_{CC} = 5.0\text{ V}$ , $V_B = 0.5\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ ) ( $V_{CC} = 5.0\text{ V}$ , $V_B = 0.25\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ )	$V_{OH}$	4.9	–	–	Vdc
DTC143TET1					
DTC143ZET1					
DTC114TET1					

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

# DTC114EET1 Series, SDTC114EET1 Series

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

Characteristic	Symbol	Min	Typ	Max	Unit	
Input Resistor	SDTC114EET1, SDTC114ET1 DTC124EET1, SDTC124EET1 DTC144EET1 DTC114YET1, SDTC114YET1 DTC114TET1 DTC143TET1 DTC123EET1 DTC143EET1 DTC143ZET1 DTC124XET1 DTC123JET1 DTC115EET1 DTC144WET1	R1	7.0	10	13	k $\Omega$
		15.4	22	28.6		
		32.9	47	61.1		
		7.0	10	13		
		7.0	10	13		
		3.3	4.7	6.1		
		1.5	2.2	2.9		
		3.3	4.7	6.1		
		3.3	4.7	6.1		
		15.4	22	28.6		
		1.54	2.2	2.86		
		70	100	130		
		32.9	47	61.1		
		Resistor Ratio	DTC114EET1/SDTC114EET1/DTC115EET1 DTC124EET1/SDTC124EET1/DTC144EET1 DTC114YET1/SDTC114YET1 DTC143TET1/DTC114TET1 DTC123EET1/DTC143EET1 DTC143ZET1 DTC124XET1 DTC123JET1 DTC144WET1D	R <sub>1</sub> /R <sub>2</sub>	0.8	
0.17	0.21			0.25		
–	–			–		
0.8	1.0			1.2		
0.055	0.1			0.185		
0.38	0.47			0.56		
0.038	0.047			0.056		
1.7	2.1			2.6		



**Figure 1. Derating Curve**



**Figure 2. Normalized Thermal Response**

# DTC114EET1 Series, SDTC114EET1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS – DTC114EET1, SDTC114EET1

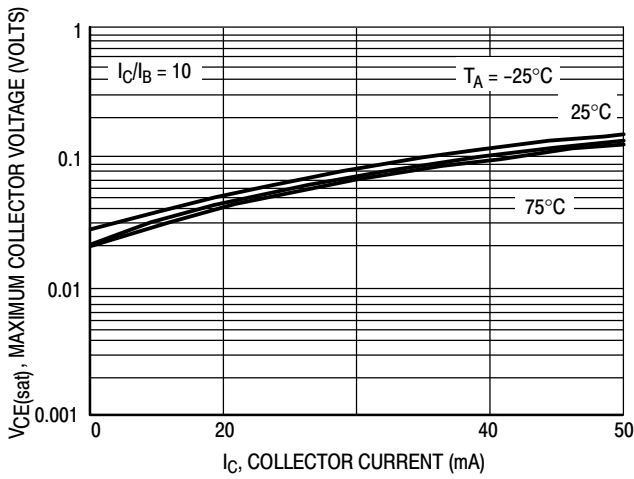


Figure 3.  $V_{CE(sat)}$  versus  $I_C$

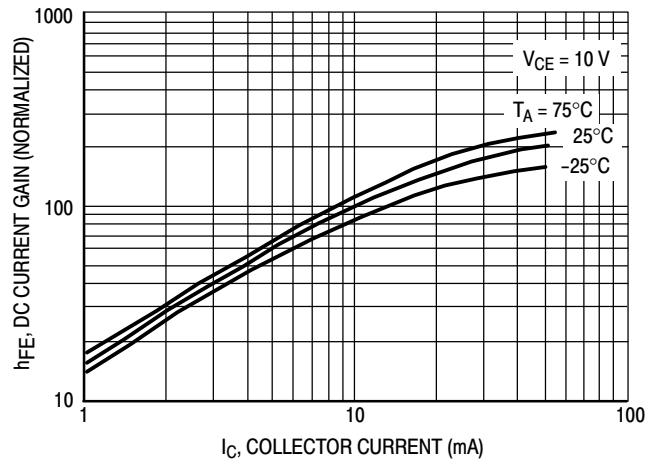


Figure 4. DC Current Gain

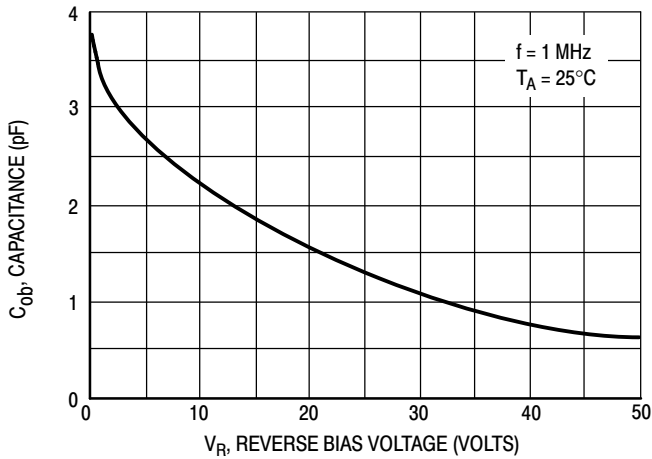


Figure 5. Output Capacitance

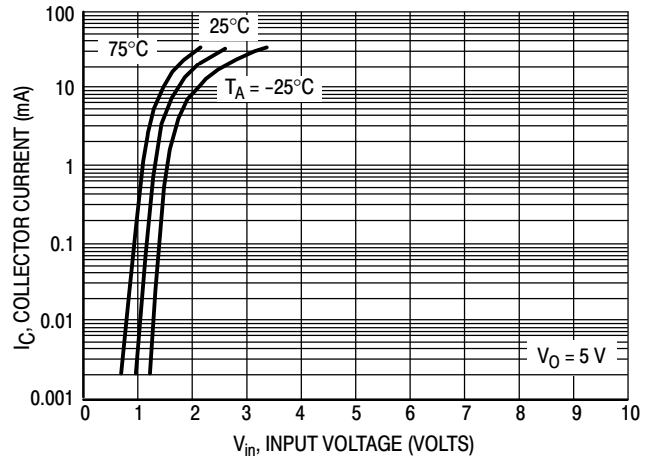


Figure 6. Output Current versus Input Voltage

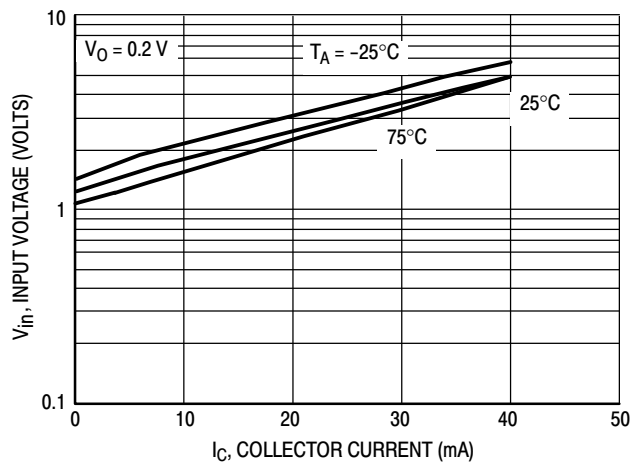


Figure 7. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS - DTC123EET1

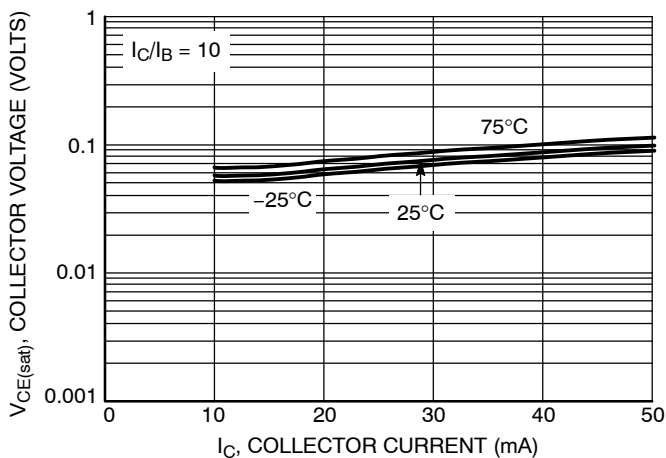


Figure 8.  $V_{CE(sat)}$  versus  $I_C$

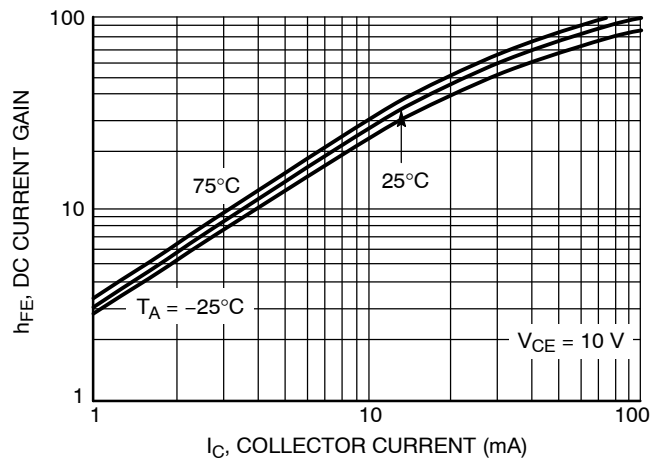


Figure 9. DC Current Gain

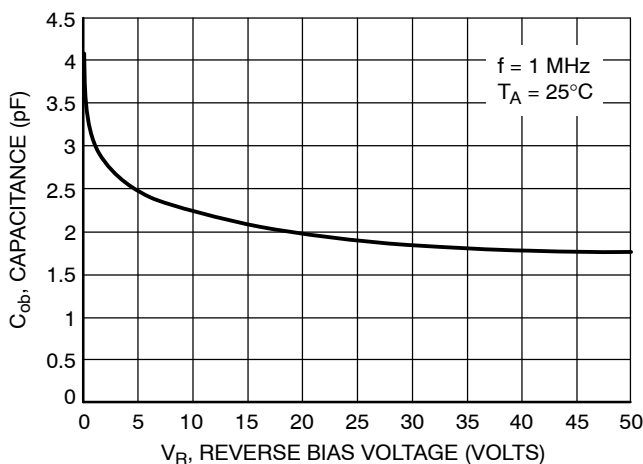


Figure 10. Output Capacitance

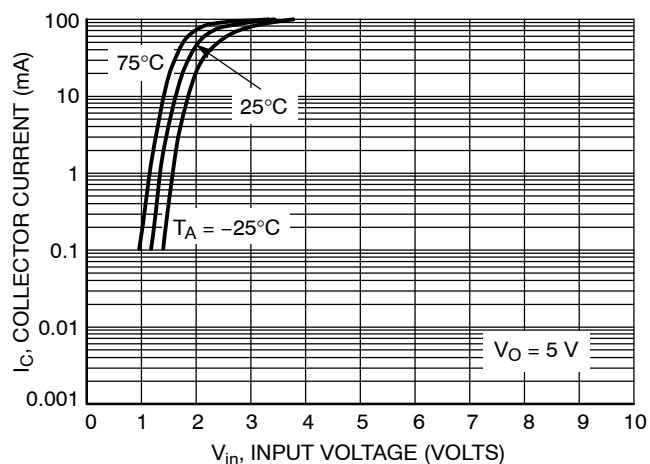


Figure 11. Output Current versus Input Voltage

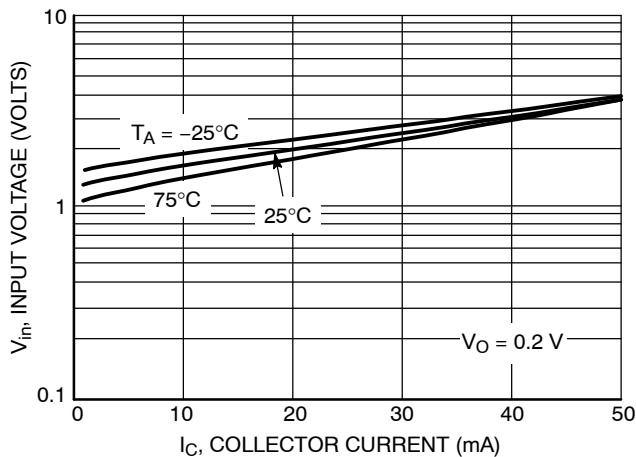


Figure 12. Input Voltage versus Output Current

# DTC114EET1 Series, SDTC114EET1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS – DTC124EET1, SDTC124EET1

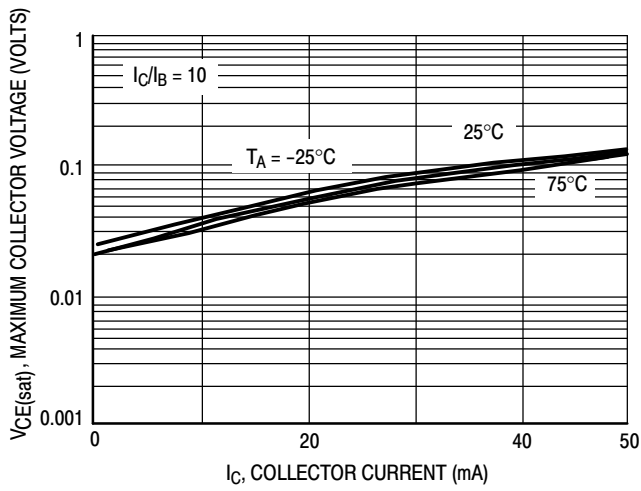


Figure 13.  $V_{CE(sat)}$  versus  $I_C$

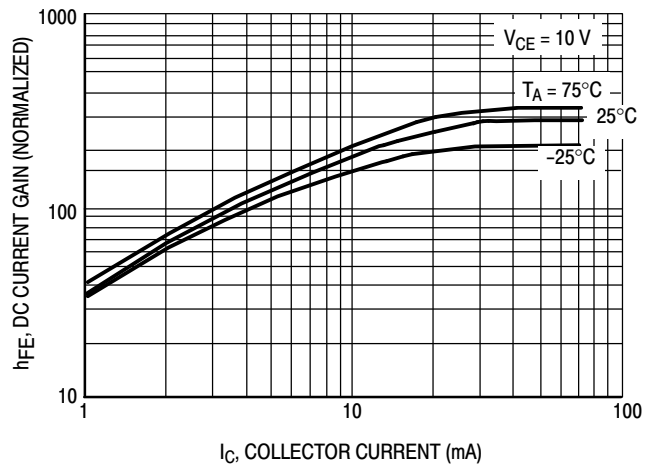


Figure 14. DC Current Gain

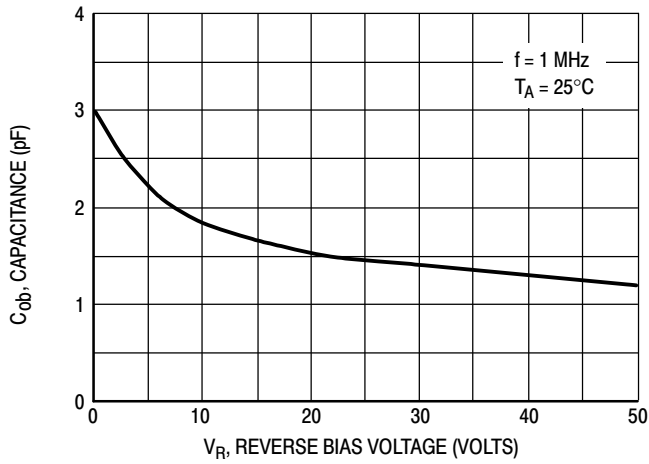


Figure 15. Output Capacitance

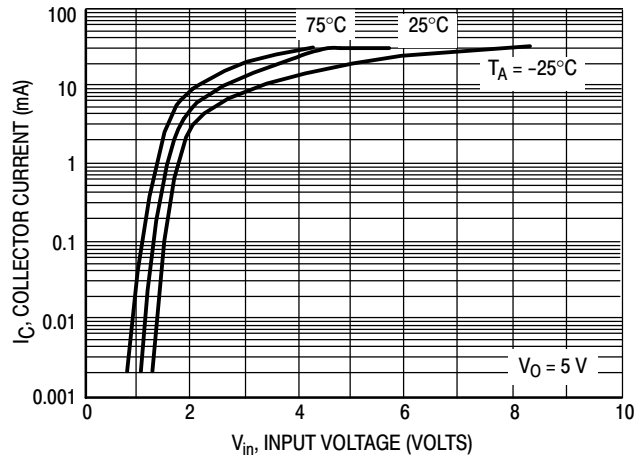


Figure 16. Output Current versus Input Voltage

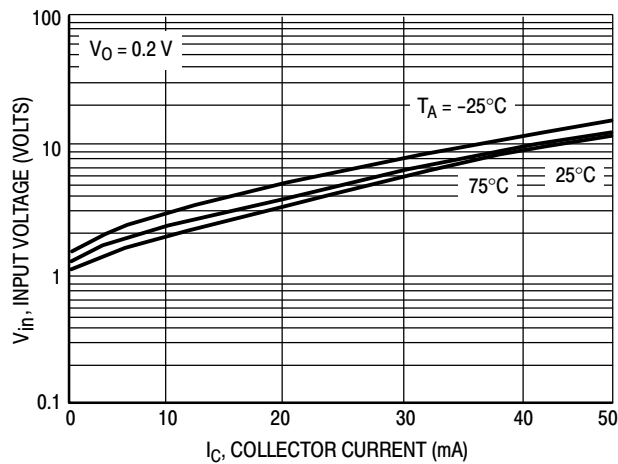


Figure 17. Input Voltage versus Output Current

# DTC114EET1 Series, SDTC114EET1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS - DTC144EET1



Figure 18.  $V_{CE(sat)}$  versus  $I_C$



Figure 19. DC Current Gain



Figure 20. Output Capacitance



Figure 21. Output Current versus Input Voltage

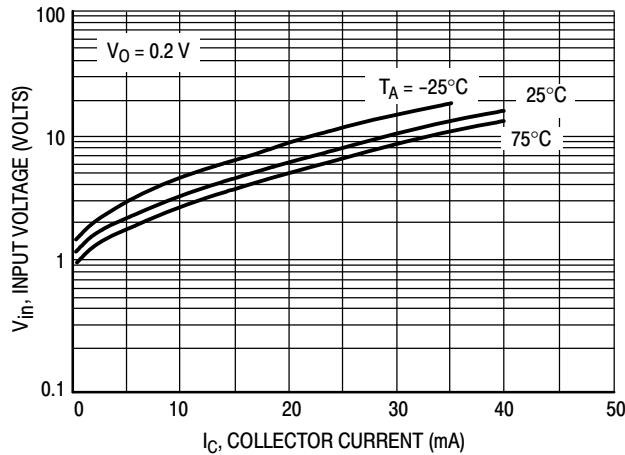


Figure 22. Input Voltage versus Output Current



# DTC114EET1 Series, SDTC114EET1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS – DTC114YET1, SDTC114YET1

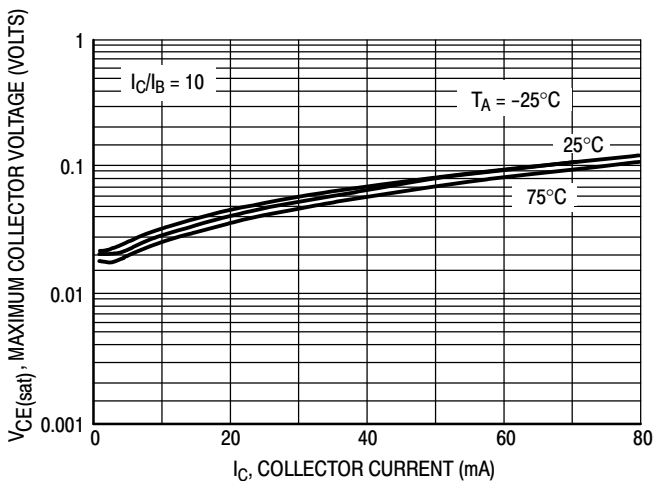


Figure 23.  $V_{CE(sat)}$  versus  $I_C$

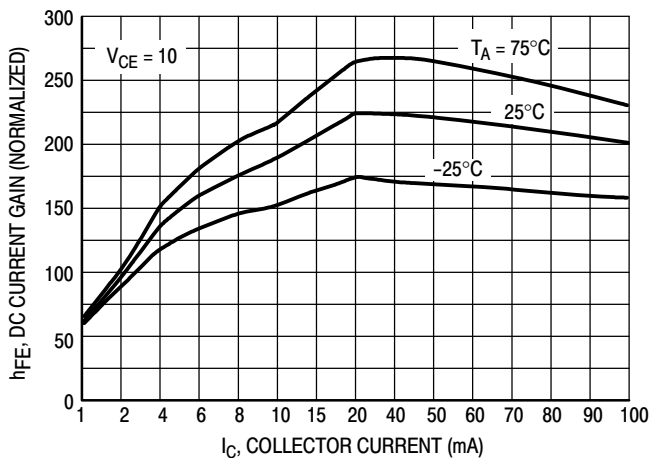


Figure 24. DC Current Gain

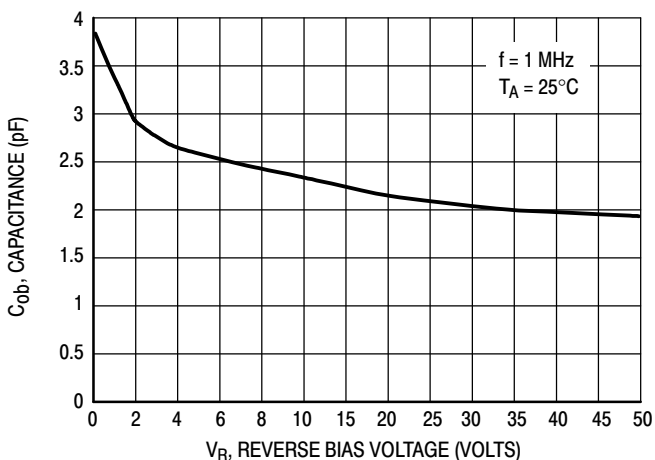


Figure 25. Output Capacitance

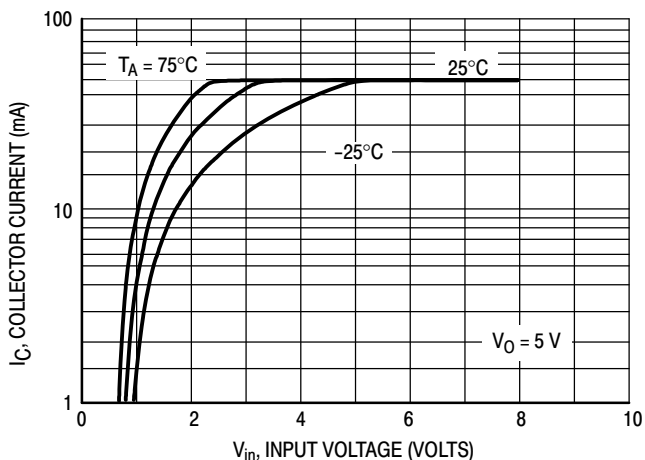


Figure 26. Output Current versus Input Voltage

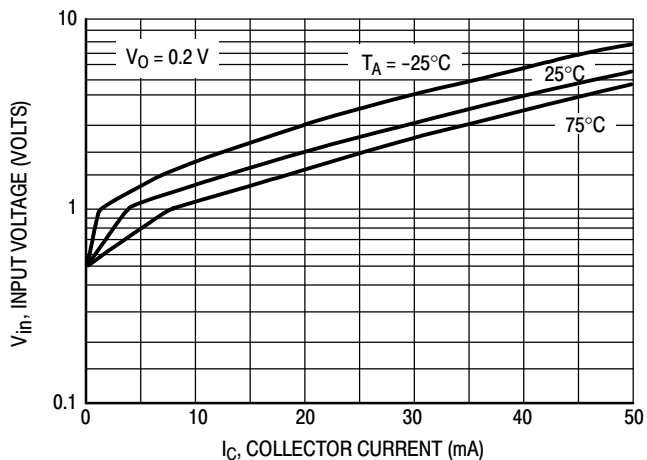


Figure 27. Input Voltage versus Output Current

DTC114EET1 Series, SDTC114EET1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – DTC123JET1G

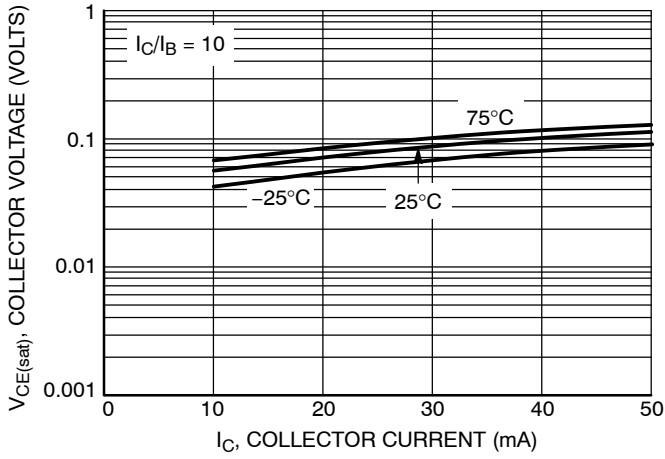


Figure 28.  $V_{CE(sat)}$  versus  $I_C$

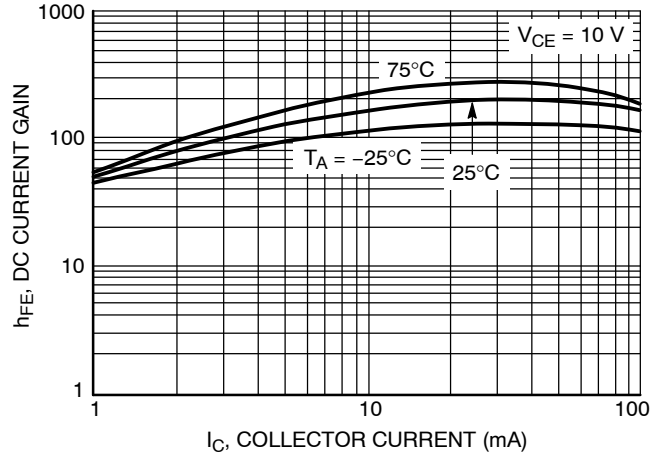


Figure 29. DC Current Gain

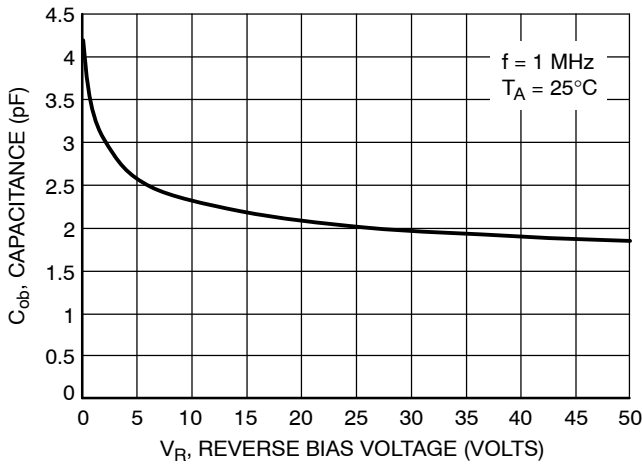


Figure 30. Output Capacitance

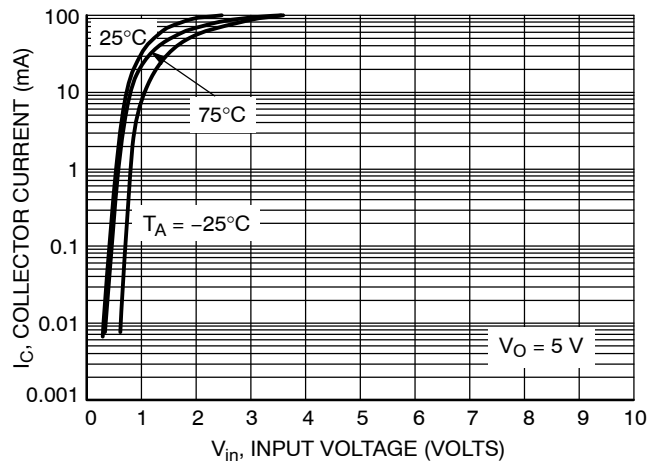


Figure 31. Output Current versus Input Voltage

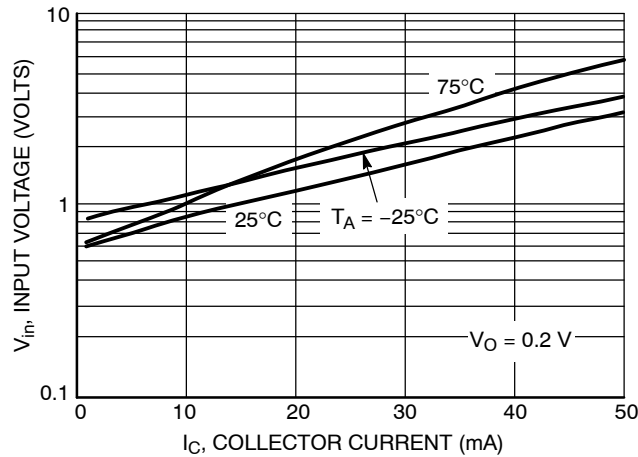


Figure 32. Input Voltage versus Output Current

# DTC114EET1 Series, SDTC114EET1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS - DTC143ZET1

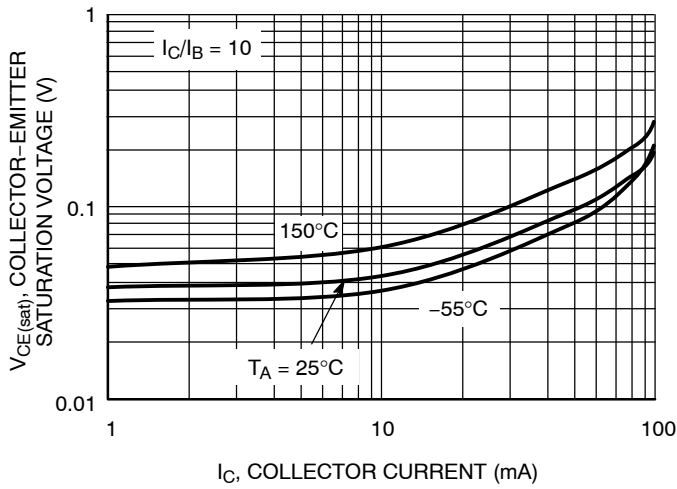


Figure 33.  $V_{CE(sat)}$  versus  $I_C$

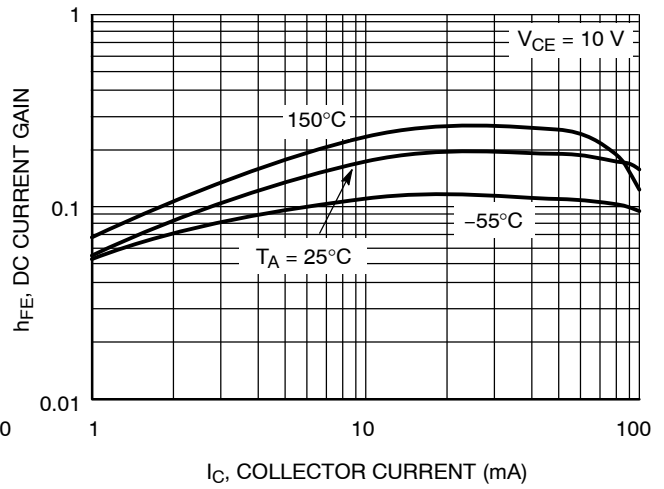


Figure 34. DC Current Gain

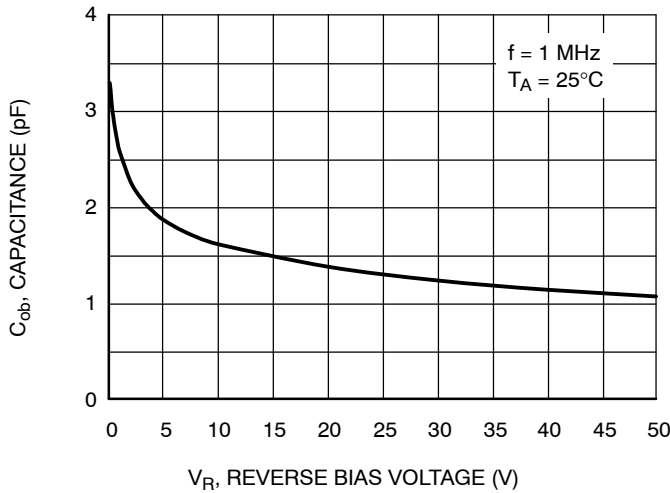


Figure 35. Output Capacitance

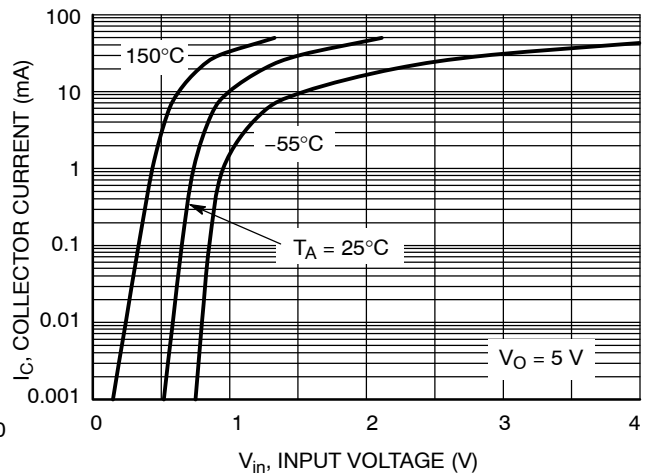


Figure 36. Output Current versus Input Voltage

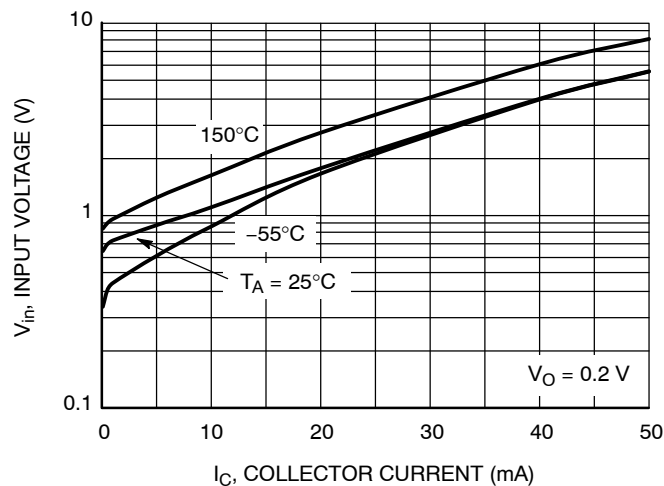


Figure 37. Input Voltage versus Output Current

# DTC114EET1 Series, SDTC114EET1 Series

## TYPICAL APPLICATIONS FOR NPN BRTs

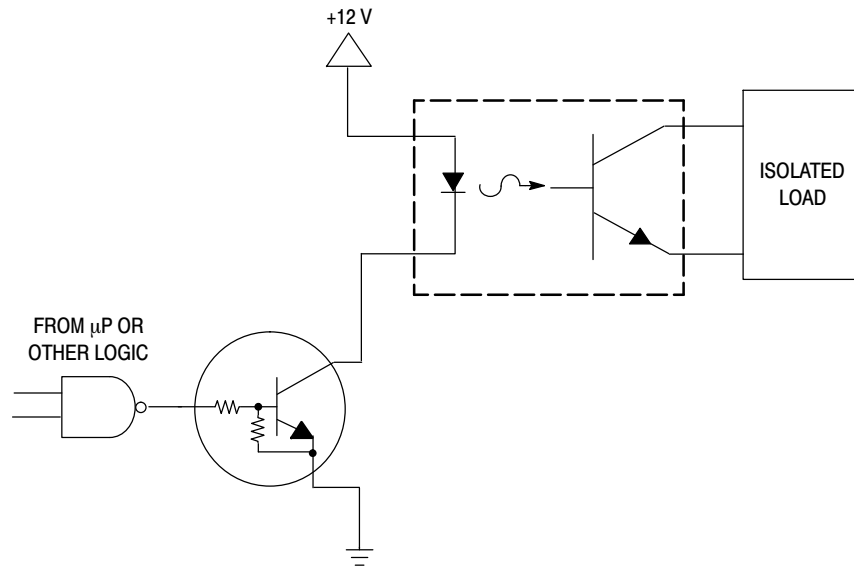


Figure 38. Level Shifter: Connects 12 or 24 Volt Circuits to Logic



Figure 39. Open Collector Inverter: Inverts the Input Signal

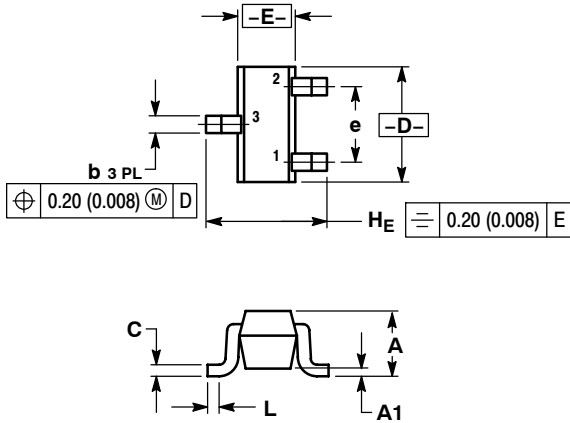


Figure 40. Inexpensive, Unregulated Current Source

# DTC114EET1 Series, SDTC114EET1 Series

## PACKAGE DIMENSIONS

SC-75/SOT-416  
CASE 463  
ISSUE F



### NOTES:

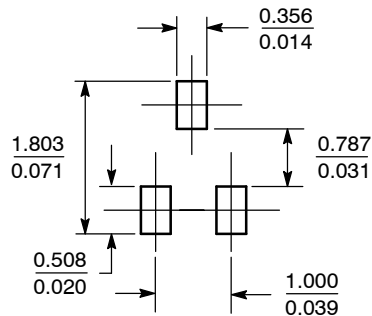
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.70	0.80	0.90	0.027	0.031	0.035
A1	0.00	0.05	0.10	0.000	0.002	0.004
b	0.15	0.20	0.30	0.006	0.008	0.012
C	0.10	0.15	0.25	0.004	0.006	0.010
D	1.55	1.60	1.65	0.059	0.063	0.067
E	0.70	0.80	0.90	0.027	0.031	0.035
e	1.00 BSC			0.04 BSC		
L	0.10	0.15	0.20	0.004	0.006	0.008
HE	1.50	1.60	1.70	0.061	0.063	0.065

### STYLE 1:

1. BASE
2. EMITTER
3. COLLECTOR

## SOLDERING FOOTPRINT\*



SCALE 10:1 (mm/inches)

\*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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