

# DTC114EM3T5G Series

## Digital Transistors (BRT)

### NPN Silicon Surface Mount Transistors 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 digital transistor contains a single transistor with a monolithic bias network consisting of two resistors; a series base resistor and a base-emitter resistor. The digital transistor eliminates these individual components by integrating them into a single device. The use of a digital transistor can reduce both system cost and board space. The device is housed in the SOT-723 package which is designed for low power surface mount applications.

#### Features

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- The SOT-723 Package can be Soldered using Wave or Reflow.
- Available in 4 mm, 8000 Unit Tape & Reel
- These are Pb-Free Devices

#### 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

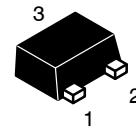
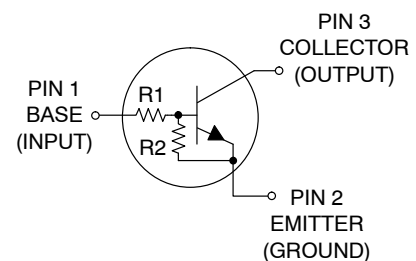
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.



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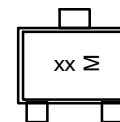
<http://onsemi.com>

### NPN SILICON DIGITAL TRANSISTORS



SOT-723  
CASE 631AA  
STYLE 1

#### MARKING DIAGRAM



xx = Specific Device Code  
(See Marking Table on page 2)  
M = Date Code

#### ORDERING INFORMATION

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

## DTC114EM3T5G Series

### DEVICE MARKING AND RESISTOR VALUES

Device	Marking	R1 (K)	R2 (K)	Package	Shipping†
DTC114EM3T5G	8A	10	10	SOT-723 (Pb-Free)	8000/Tape & Reel
DTC124EM3T5G	8B	22	22		
DTC144EM3T5G	8C	47	47		
DTC114YM3T5G	8D	10	47		
DTC114TM3T5G	8E	10	∞		
DTC143TM3T5G	8F	4.7	∞		
DTC123EM3T5G	8H	2.2	2.2		
DTC143EM3T5G	8J	4.7	4.7		
DTC143ZM3T5G*	8K	4.7	47		
DTC124XM3T5G*	8L	22	47		
DTC123JM3T5G	8M	2.2	47		
DTC115EM3T5G	8N	100	100		
DTC144WM3T5G*	8P	47	22		
DTC144TM3T5G	8T	47	∞		

†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.

\*Available upon request.

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation, FR-4 Board (Note 1) @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	260 2.0	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient (Note 1)	$R_{\theta JA}$	480	$^\circ\text{C}/\text{W}$
Total Device Dissipation, FR-4 Board (Note 2) @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	600 4.8	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	205	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$

1. FR-4 @ minimum pad.
2. FR-4 @  $1.0 \times 1.0$  inch pad.

## DTC114EM3T5G 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
	DTC114EM3T5G	–	–	0.2	
	DTC124EM3T5G	–	–	0.1	
	DTC144EM3T5G	–	–	0.2	
	DTC114YM3T5G	–	–	0.9	
	DTC114TM3T5G	–	–	1.9	
	DTC143TM3T5G	–	–	2.3	
	DTC123EM3T5G	–	–	1.5	
	DTC143EM3T5G	–	–	0.18	
	DTC143ZM3T5G	–	–	0.13	
	DTC124XM3T5G	–	–	0.2	
	DTC123JM3T5G	–	–	0.05	
	DTC115EM3T5G	–	–	0.13	
	DTC144WM3T5G	–	–	0.2	
	DTC144TM3T5G	–	–	–	
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	–	
	DTC114EM3T5G	60	100	–	
	DTC124EM3T5G	80	140	–	
	DTC144EM3T5G	80	140	–	
	DTC114YM3T5G	160	350	–	
	DTC114TM3T5G	160	350	–	
	DTC143TM3T5G	8.0	15	–	
	DTC123EM3T5G	15	30	–	
	DTC143EM3T5G	80	200	–	
	DTC143ZM3T5G	80	150	–	
	DTC124XM3T5G	80	140	–	
	DTC123JM3T5G	80	150	–	
	DTC115EM3T5G	80	140	–	
	DTC144WM3T5G	160	350	–	
	DTC144TM3T5G	–	–	–	
Collector–Emitter Saturation Voltage ( $I_C = 10\text{ mA}, I_B = 0.3\text{ mA}$ ) ( $I_C = 10\text{ mA}, I_B = 5\text{ mA}$ ) ( $I_C = 10\text{ mA}, I_B = 1\text{ mA}$ )	$V_{CE(sat)}$	–	–	0.25	Vdc
	DTC123EM3T5G				
	DTC143TM3T5G/DTC114TM3T5G/ DTC143EM3T5G/DTC143ZM3T5G/ DTC124XM3T5G/DTC144TM3T5G				
Output Voltage (on) ( $V_{CC} = 5.0\text{ V}, V_B = 2.5\text{ V}, R_L = 1.0\text{ k}\Omega$ )	$V_{OL}$	–	–	0.2	Vdc
	DTC114EM3T5G	–	–	0.2	
	DTC124EM3T5G	–	–	0.2	
	DTC114YM3T5G	–	–	0.2	
	DTC114TM3T5G	–	–	0.2	
	DTC143TM3T5G	–	–	0.2	
	DTC123EM3T5G	–	–	0.2	
	DTC143EM3T5G	–	–	0.2	
	DTC143ZM3T5G	–	–	0.2	
	DTC124XM3T5G	–	–	0.2	
	DTC123JM3T5G	–	–	0.2	
( $V_{CC} = 5.0\text{ V}, V_B = 3.5\text{ V}, R_L = 1.0\text{ k}\Omega$ )	DTC114EM3T5G	–	–	0.2	
	DTC144TM3T5G	–	–	0.2	
( $V_{CC} = 5.0\text{ V}, V_B = 5.5\text{ V}, R_L = 1.0\text{ k}\Omega$ )	DTC115EM3T5G	–	–	0.2	
( $V_{CC} = 5.0\text{ V}, V_B = 4.0\text{ V}, R_L = 1.0\text{ k}\Omega$ )	DTC144WM3T5G	–	–	0.2	

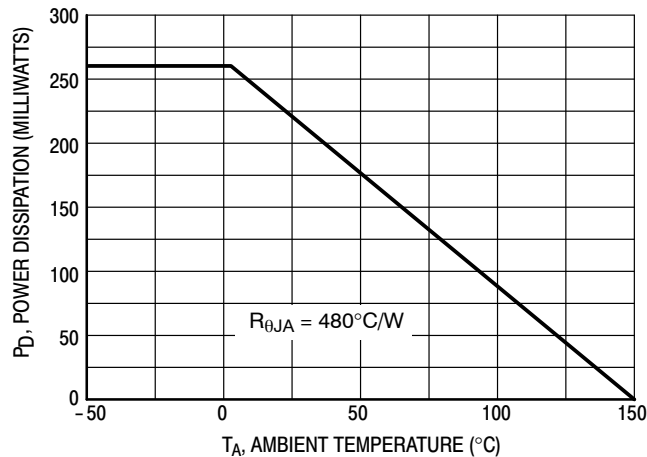
3. Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty Cycle < 2.0%.

# DTC114EM3T5G Series

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

Characteristic	Symbol	Min	Typ	Max	Unit	
<b>ON CHARACTERISTICS</b> (Note 4)						
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	
Input Resistor	DTC114EM3T5G DTC124EM3T5G DTC144EM3T5G DTC114YM3T5G DTC114TM3T5G DTC143TM3T5G DTC123EM3T5G DTC143EM3T5G DTC143ZM3T5G DTC124XM3T5G DTC123JM3T5G DTC115EM3T5G DTC144WM3T5G DTC144TM3T5G	R1	7.0 15.4 32.9 7.0 7.0 3.3 1.5 3.3 3.3 15.4 1.54 70 32.9 32.9	10 22 47 10 10 4.7 2.2 4.7 4.7 22 2.2 100 47 47	13 28.6 61.1 13 13 6.1 2.9 6.1 6.1 28.6 2.86 130 61.1 61.1	k $\Omega$
Resistor Ratio	DTC114EM3T5G/DTC124EM3T5G/ DTC144EM3T5G/DTC115EM3T5G DTC114YM3T5G DTC143TM3T5G/DTC114TM3T5G/DTC144TM3T5G DTC123EM3T5G/DTC143EM3T5G DTC143ZM3T5G DTC124XM3T5G DTC123JM3T5G DTC144WM3T5G	$R_1/R_2$	0.8 0.17 – 0.8 0.055 0.38 0.038 1.7	1.0 0.21 – 1.0 0.1 0.47 0.047 2.1	1.2 0.25 – 1.2 0.185 0.56 0.056 2.6	

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



**Figure 1. Derating Curve**

# DTC114EM3T5G Series

## TYPICAL ELECTRICAL CHARACTERISTICS – DTC114EM3T5G

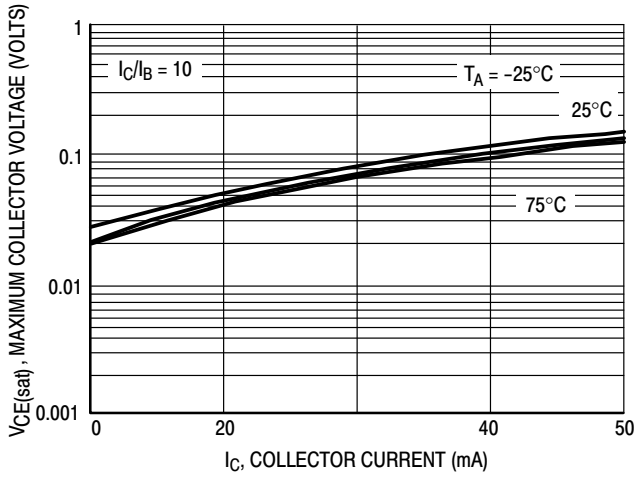


Figure 2.  $V_{CE(sat)}$  versus  $I_C$

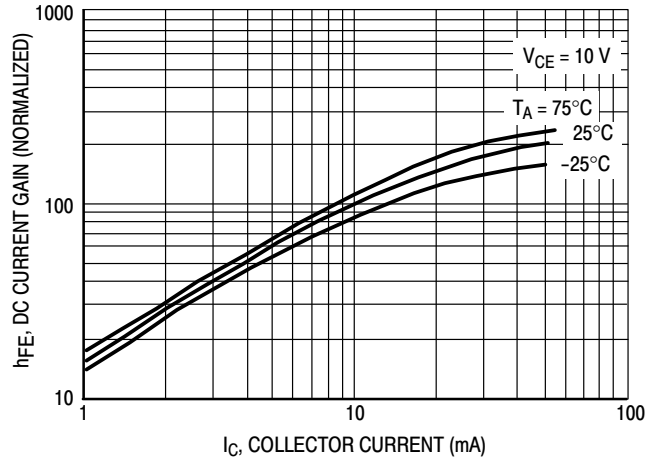


Figure 3. DC Current Gain

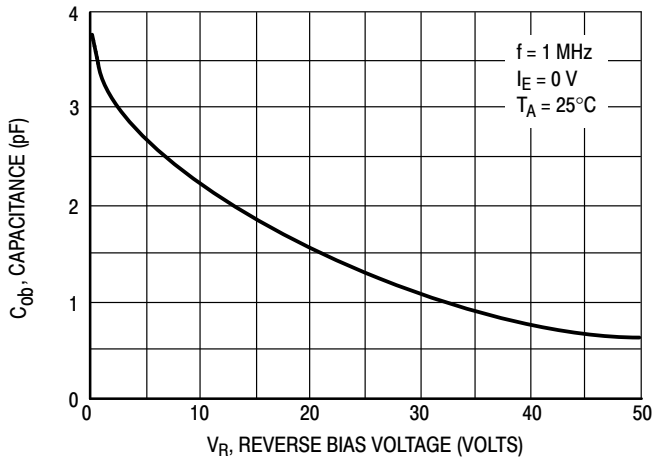


Figure 4. Output Capacitance

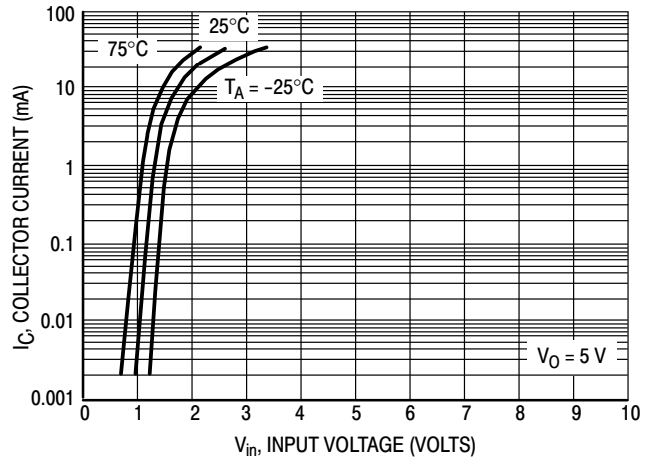


Figure 5. Output Current versus Input Voltage

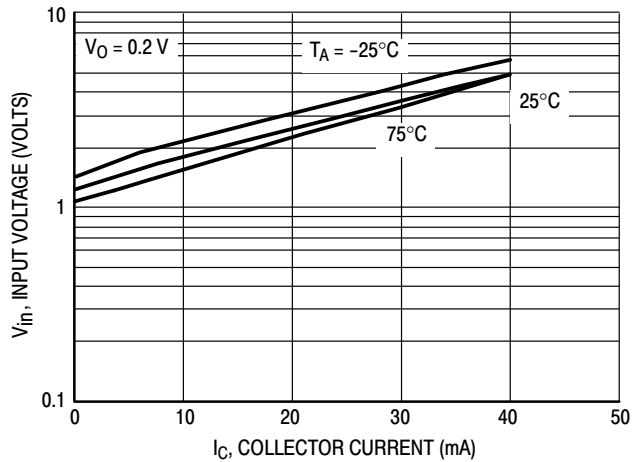


Figure 6. Input Voltage versus Output Current

# DTC114EM3T5G Series

## TYPICAL ELECTRICAL CHARACTERISTICS – DTC124EM3T5G

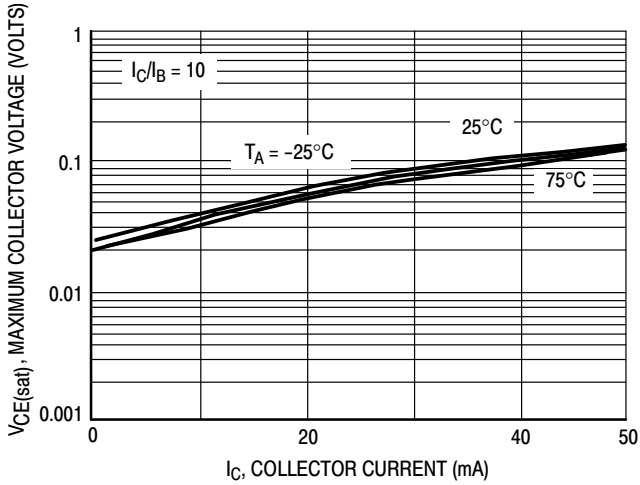


Figure 7.  $V_{CE(sat)}$  versus  $I_C$

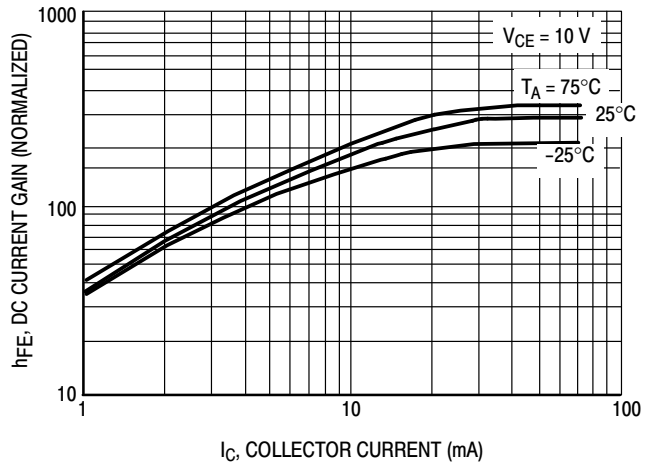


Figure 8. DC Current Gain

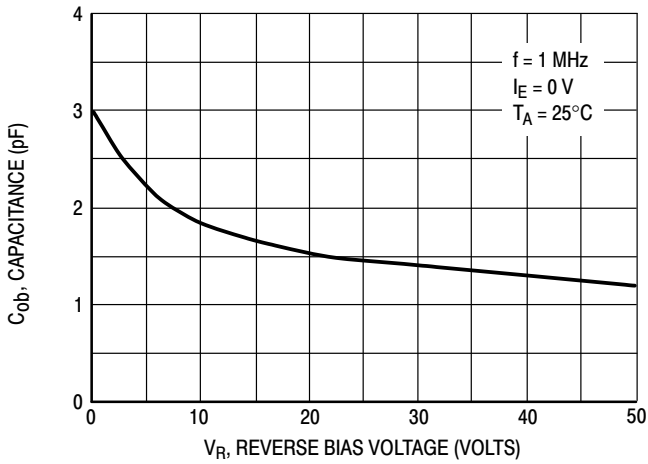


Figure 9. Output Capacitance

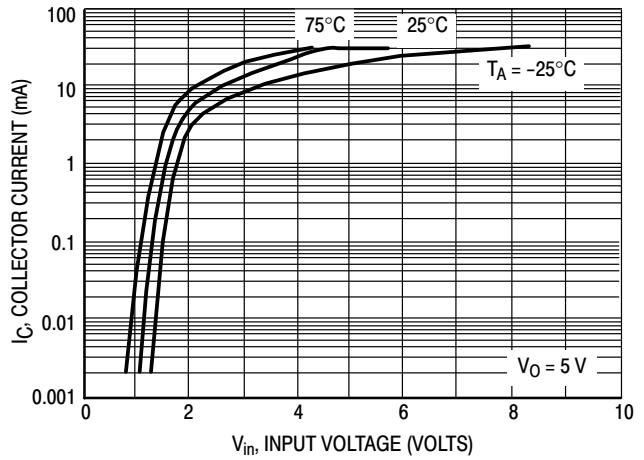


Figure 10. Output Current versus Input Voltage

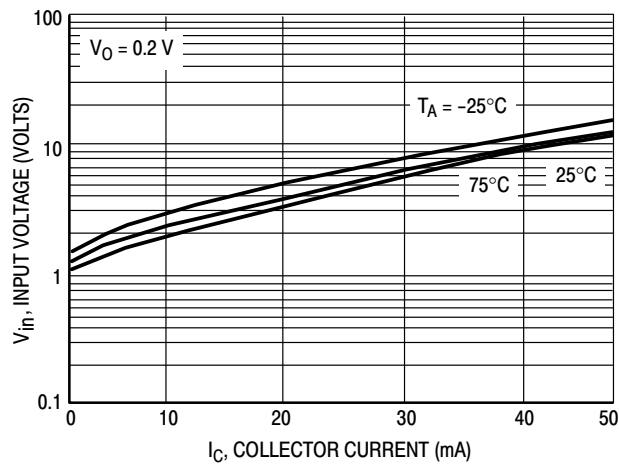


Figure 11. Input Voltage versus Output Current

# DTC114EM3T5G Series

## TYPICAL ELECTRICAL CHARACTERISTICS – DTC144EM3T5G

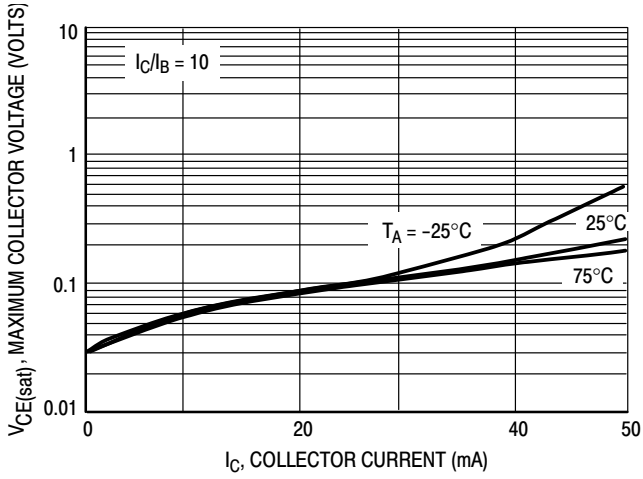


Figure 12.  $V_{CE(sat)}$  versus  $I_C$

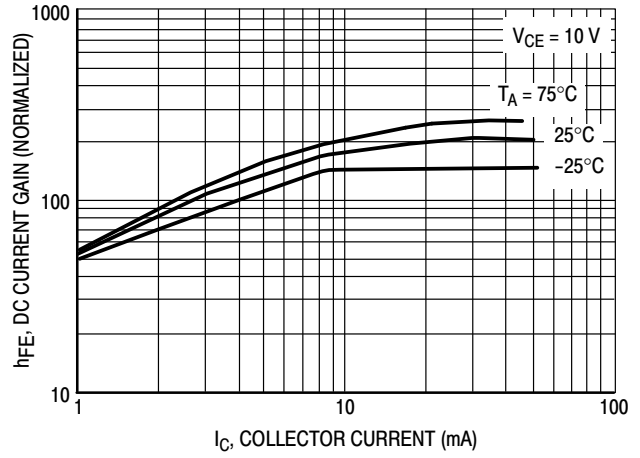


Figure 13. DC Current Gain

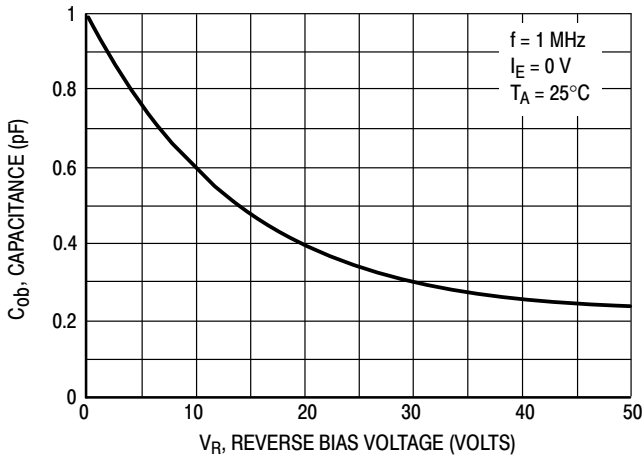


Figure 14. Output Capacitance

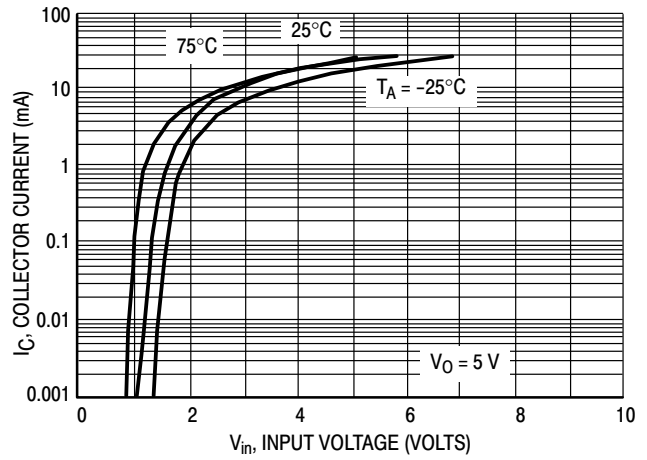


Figure 15. Output Current versus Input Voltage

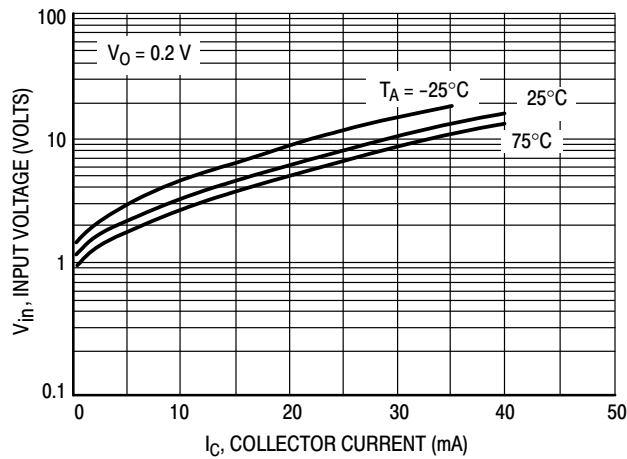


Figure 16. Input Voltage versus Output Current

# DTC114EM3T5G Series

## TYPICAL ELECTRICAL CHARACTERISTICS – DTC114YM3T5G

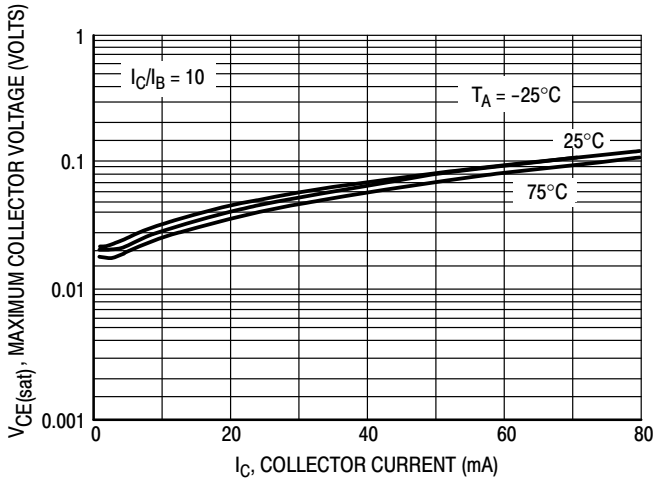


Figure 17.  $V_{CE(sat)}$  versus  $I_C$

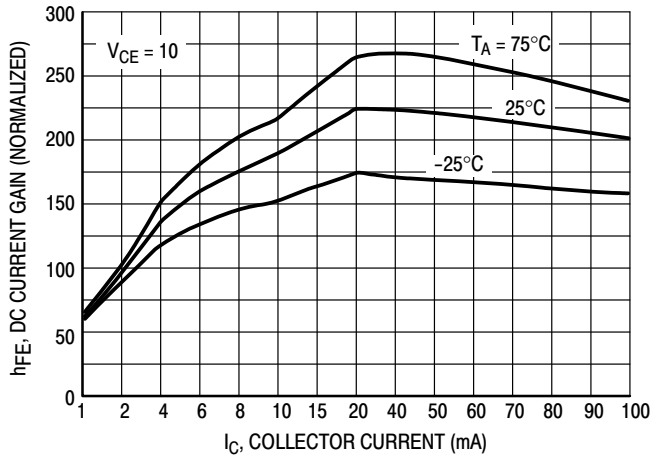


Figure 18. DC Current Gain

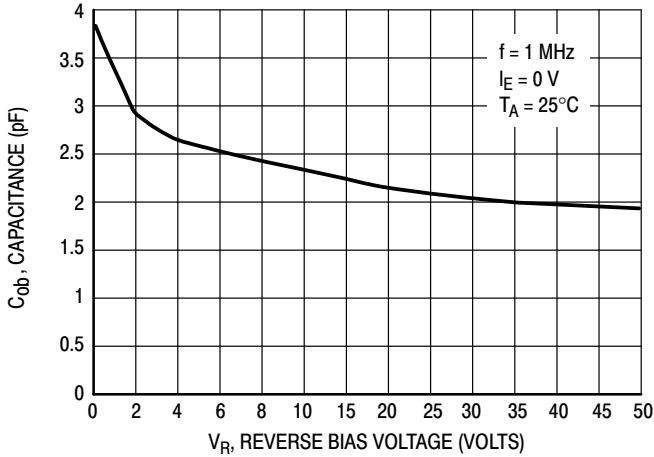


Figure 19. Output Capacitance

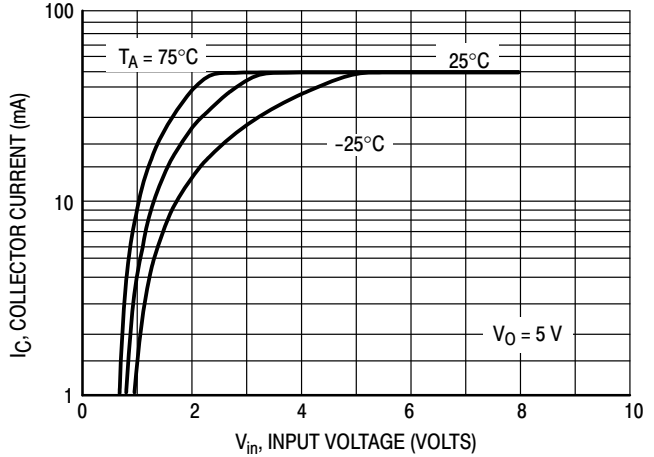


Figure 20. Output Current versus Input Voltage

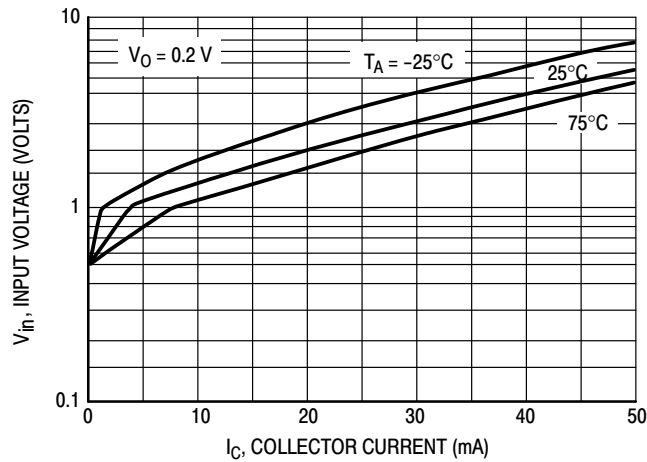


Figure 21. Input Voltage versus Output Current



# DTC114EM3T5G Series

## TYPICAL ELECTRICAL CHARACTERISTICS - DTC123JM3T5G

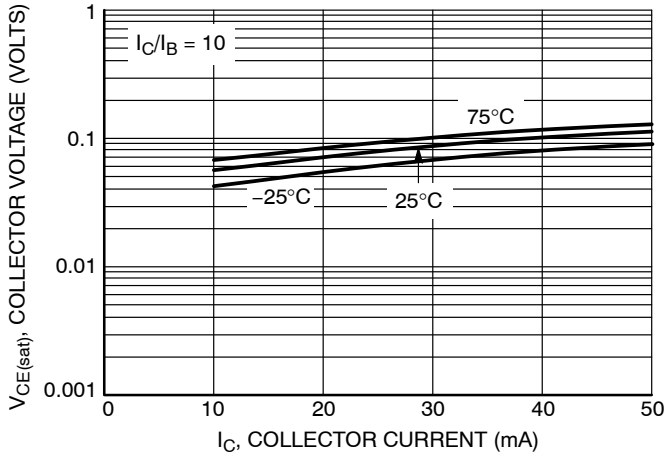


Figure 22.  $V_{CE(sat)}$  versus  $I_C$

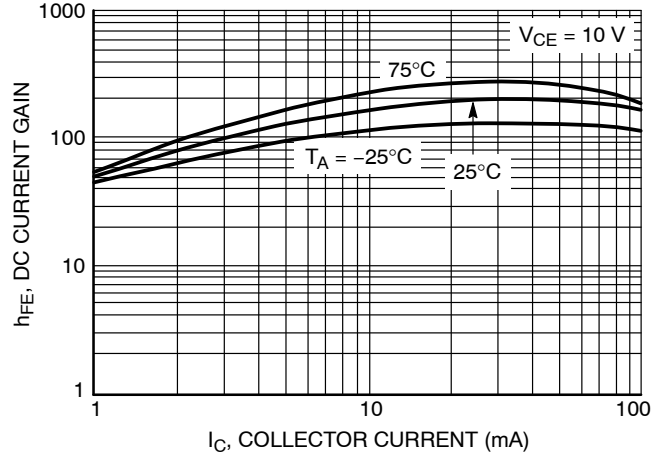


Figure 23. DC Current Gain

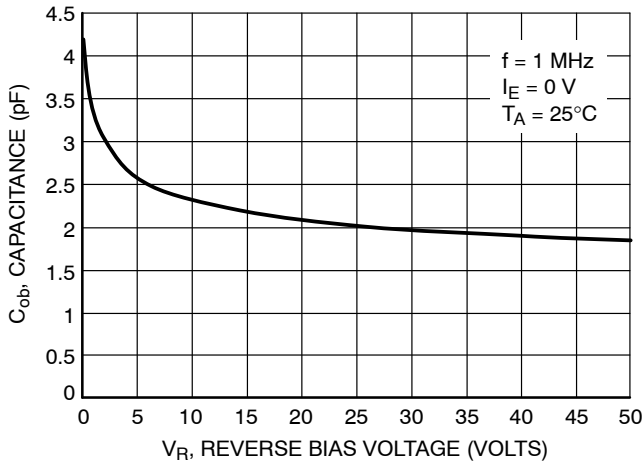


Figure 24. Output Capacitance

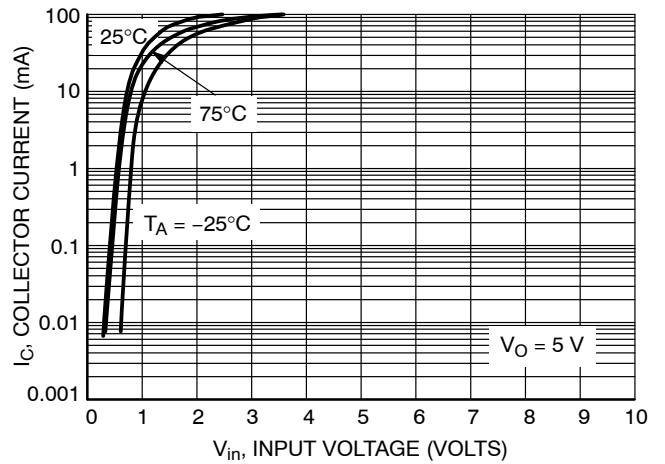


Figure 25. Output Current versus Input Voltage

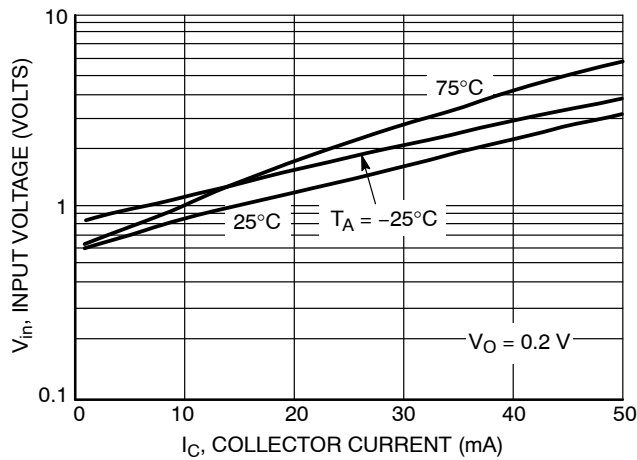


Figure 26. Input Voltage versus Output Current

# DTC114EM3T5G Series

## TYPICAL APPLICATIONS FOR NPN BRTs

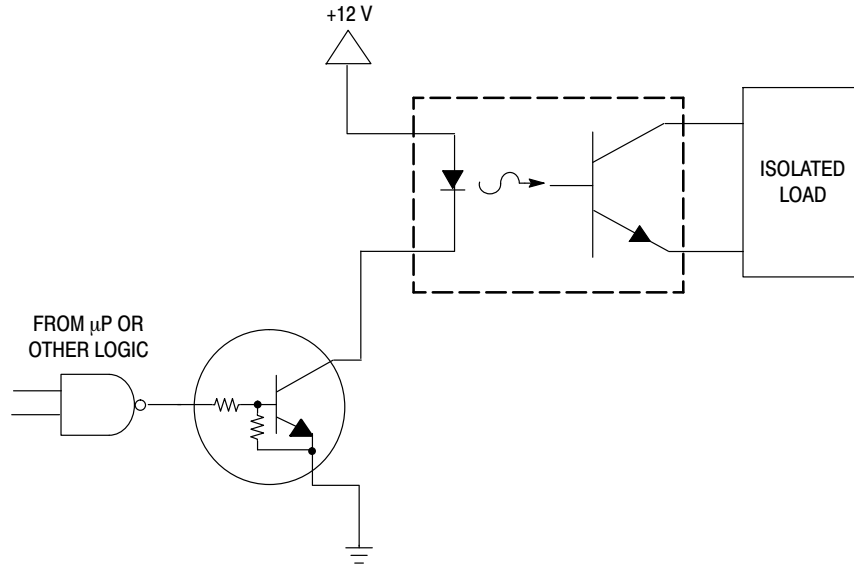


Figure 27. Level Shifter: Connects 12 or 24 Volt Circuits to Logic

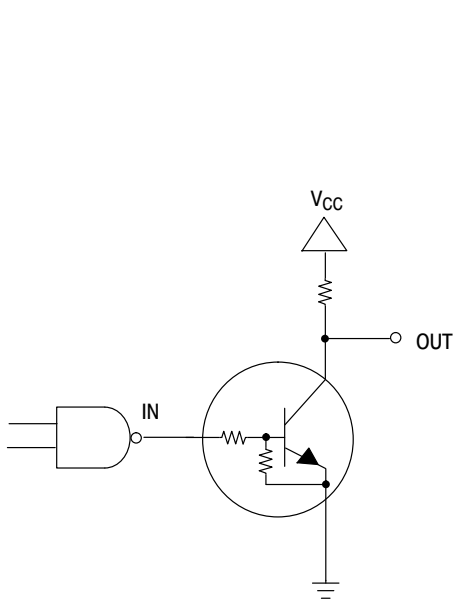


Figure 28. Open Collector Inverter: Inverts the Input Signal

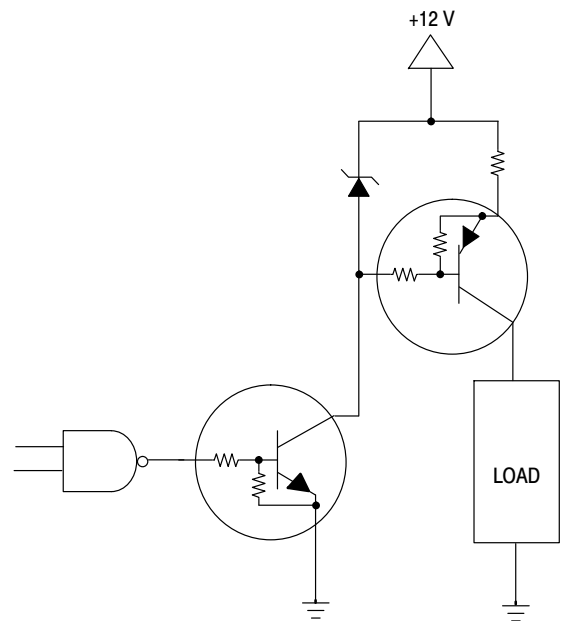
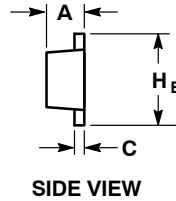
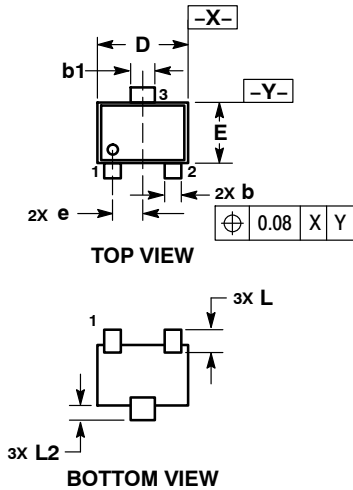


Figure 29. Inexpensive, Unregulated Current Source

# DTC114EM3T5G Series

## PACKAGE DIMENSIONS

**SOT-723**  
CASE 631AA-01  
ISSUE D



**NOTES:**

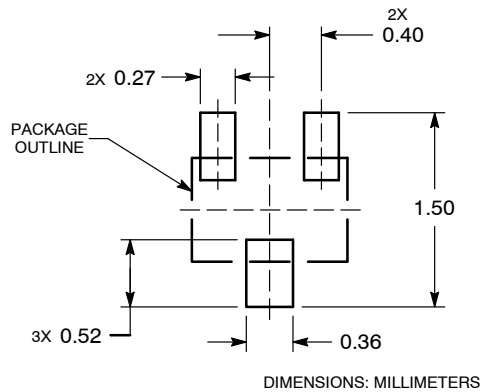
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.45	0.50	0.55
b	0.15	0.21	0.27
b1	0.25	0.31	0.37
C	0.07	0.12	0.17
D	1.15	1.20	1.25
E	0.75	0.80	0.85
e	0.40 BSC		
H <sub>E</sub>	1.15	1.20	1.25
L	0.29 REF		
L2	0.15	0.20	0.25

**STYLE 1:**

1. BASE
2. EMITTER
3. COLLECTOR

### RECOMMENDED SOLDERING FOOTPRINT\*



\*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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