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°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

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.

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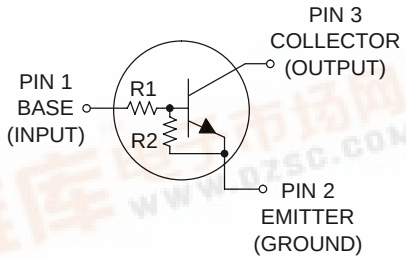
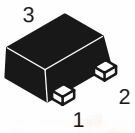
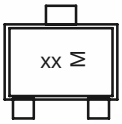
NPN SILICON DIGITAL TRANSISTORS





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.

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

1. FR−4 @ minimum pad.
2. FR−4 @ 1.0 × 1.0 inch pad.

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector−Base Cutoff Current (V_{CB} = 50 V, I_E = 0)		I_{CBO}	−	−	100	nAdc
Collector−Emitter Cutoff Current (V_{CE} = 50 V, I_B = 0)		I_{CEO}	−	−	500	nAdc
Emitter−Base Cutoff Current (V_{EB} = 6.0 V, I_C = 0)	DTC114EM3T5G	I_{EBO}	−	−	0.5	mAdc
	DTC124EM3T5G		−	−	0.2	
	DTC144EM3T5G		−	−	0.1	
	DTC114YM3T5G		−	−	0.2	
	DTC114TM3T5G		−	−	0.9	
	DTC143TM3T5G		−	−	1.9	
	DTC123EM3T5G		−	−	2.3	
	DTC143EM3T5G		−	−	1.5	
	DTC143ZM3T5G		−	−	0.18	
	DTC124XM3T5G		−	−	0.13	
	DTC123JM3T5G		−	−	0.2	
	DTC115EM3T5G		−	−	0.05	
	DTC144WM3T5G		−	−	0.13	
	DTC144TM3T5G		−	−	0.2	
Collector−Base Breakdown Voltage (I_C = 10 μA, I_E = 0)		$V_{(BR)CBO}$	50	−	−	Vdc
Collector−Emitter Breakdown Voltage (Note 3) (I_C = 2.0 mA, I_B = 0)		$V_{(BR)CEO}$	50	−	−	Vdc
ON CHARACTERISTICS (Note 3)						
DC Current Gain (V_{CE} = 10 V, I_C = 5.0 mA)	DTC114EM3T5G	h_{FE}	35	60	−	
	DTC124EM3T5G		60	100	−	
	DTC144EM3T5G		80	140	−	
	DTC114YM3T5G		80	140	−	
	DTC114TM3T5G		160	350	−	
	DTC143TM3T5G		160	350	−	
	DTC123EM3T5G		8.0	15	−	
	DTC143EM3T5G		15	30	−	
	DTC143ZM3T5G		80	200	−	
	DTC124XM3T5G		80	150	−	
	DTC123JM3T5G		80	140	−	
	DTC115EM3T5G		80	150	−	
	DTC144WM3T5G		80	140	−	
	DTC144TM3T5G		160	350	−	
Collector−Emitter Saturation Voltage (I_C = 10 mA, I_B = 0.3 mA) (I_C = 10 mA, I_B = 5 mA) (I_C = 10 mA, I_B = 1 mA)	DTC123EM3T5G DTC143TM3T5G/DTC114TM3T5G/ DTC143EM3T5G/DTC143ZM3T5G/ DTC124XM3T5G/DTC144TM3T5G	$V_{CE(sat)}$	−	−	0.25	Vdc
Output Voltage (on)		V_{OL}				Vdc
(V_{CC} = 5.0 V, V_B = 2.5 V, R_L = 1.0 kΩ)	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 V, V_B = 3.5 V, R_L = 1.0 kΩ)	DTC144EM3T5G		−	−	0.2	
	DTC144TM3T5G		−	−	0.2	
(V_{CC} = 5.0 V, V_B = 5.5 V, R_L = 1.0 kΩ)	DTC115EM3T5G		−	−	0.2	
(V_{CC} = 5.0 V, V_B = 4.0 V, R_L = 1.0 kΩ)	DTC144WM3T5G		−	−	0.2	

3. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2.0%.

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit

ON CHARACTERISTICS (Note 4)

Characteristic		Symbol	Min	Typ	Max	Unit
Output Voltage (off) (V_{CC} = 5.0 V, V_B = 0.5 V, R_L = 1.0 kΩ) (V_{CC} = 5.0 V, V_B = 0.25 V, R_L = 1.0 kΩ)	DTC143TM3T5G DTC143ZM3T5G DTC114TM3T5G DTC144TM3T5G	V_{OH}	4.9	–	–	Vdc
Input Resistor	DTC114EM3T5G	R1	7.0	10	13	kΩ
	DTC124EM3T5G		15.4	22	28.6	
	DTC144EM3T5G		32.9	47	61.1	
	DTC114YM3T5G		7.0	10	13	
	DTC114TM3T5G		7.0	10	13	
	DTC143TM3T5G		3.3	4.7	6.1	
	DTC123EM3T5G		1.5	2.2	2.9	
	DTC143EM3T5G		3.3	4.7	6.1	
	DTC143ZM3T5G		3.3	4.7	6.1	
	DTC124XM3T5G		15.4	22	28.6	
	DTC123JM3T5G		1.54	2.2	2.86	
	DTC115EM3T5G		70	100	130	
	DTC144WM3T5G		32.9	47	61.1	
	DTC144TM3T5G		32.9	47	61.1	
Resistor Ratio		R_1/R_2				
	DTC114EM3T5G/DTC124EM3T5G/ DTC144EM3T5G/DTC115EM3T5G		0.8	1.0	1.2	
	DTC114YM3T5G		0.17	0.21	0.25	
	DTC143TM3T5G/DTC114TM3T5G/DTC144TM3T5G		–	–	–	
	DTC123EM3T5G/DTC143EM3T5G		0.8	1.0	1.2	
	DTC143ZM3T5G		0.055	0.1	0.185	
	DTC124XM3T5G		0.38	0.47	0.56	
	DTC123JM3T5G		0.038	0.047	0.056	
	DTC144WM3T5G		1.7	2.1	2.6	

4. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2.0%.

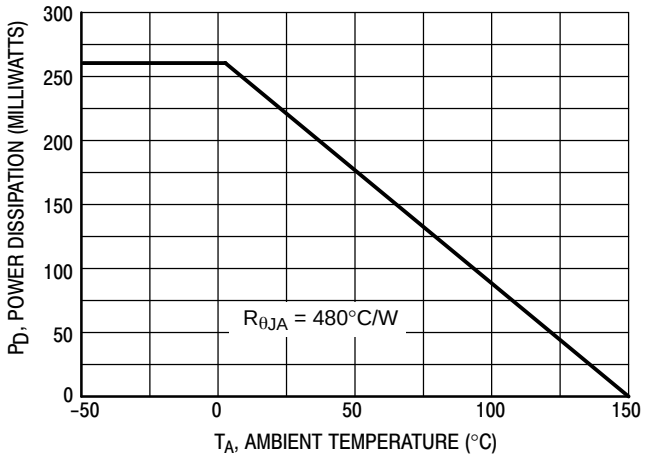


Figure 1. Derating Curve

TYPICAL ELECTRICAL CHARACTERISTICS − DTC114EM3T5G

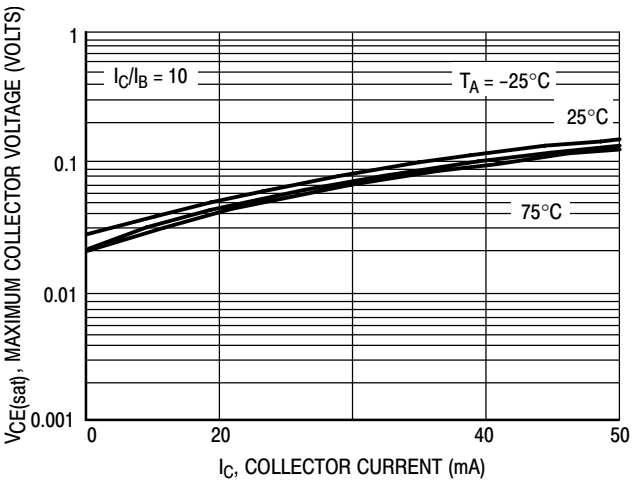


Figure 2. $V_{CE(sat)}$ versus I_C

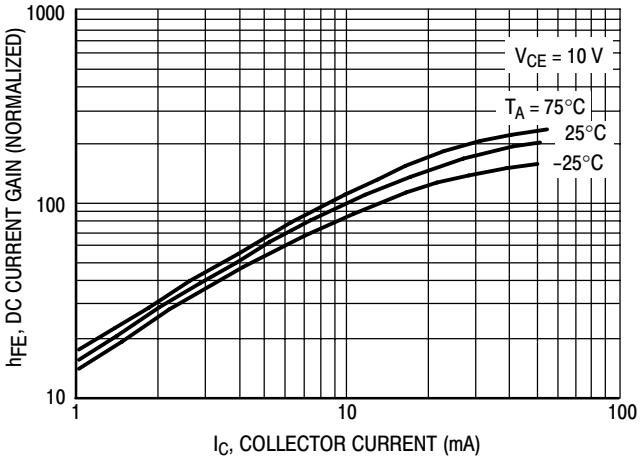


Figure 3. DC Current Gain

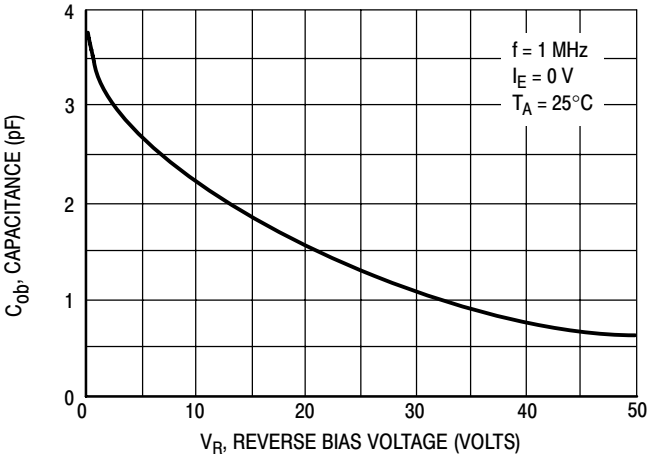


Figure 4. Output Capacitance

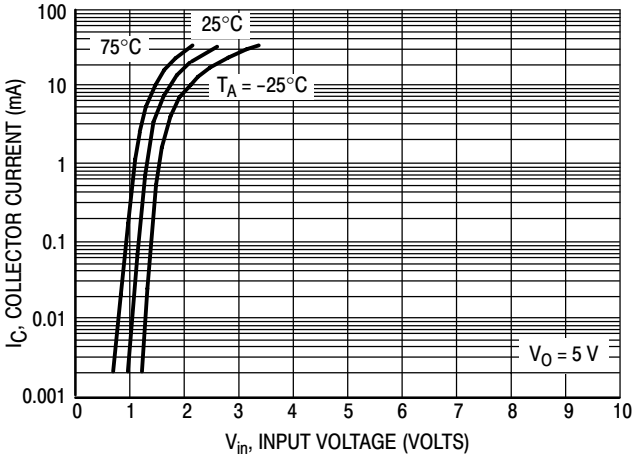


Figure 5. Output Current versus Input Voltage

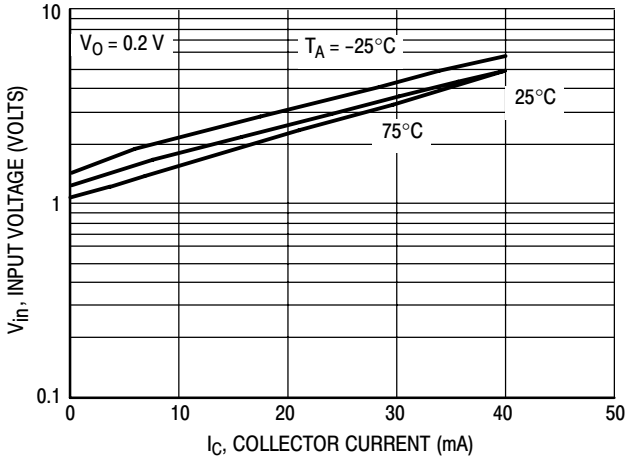


Figure 6. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS − DTC124EM3T5G

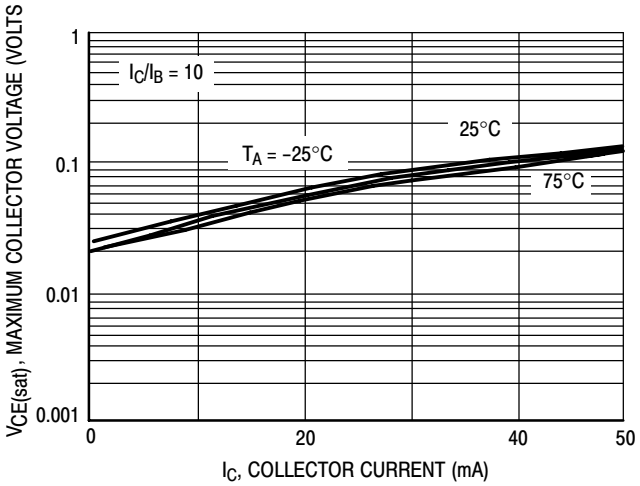


Figure 7. $V_{CE(sat)}$ versus I_C

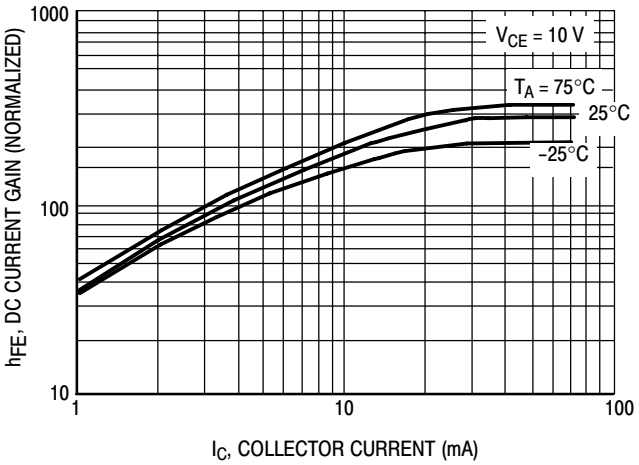


Figure 8. DC Current Gain

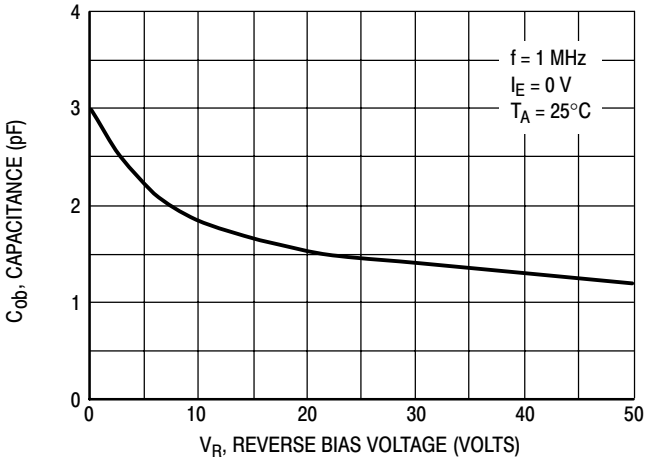


Figure 9. Output Capacitance

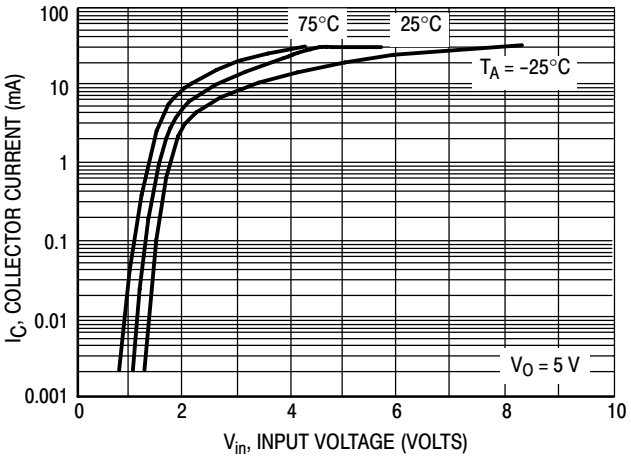


Figure 10. Output Current versus Input Voltage

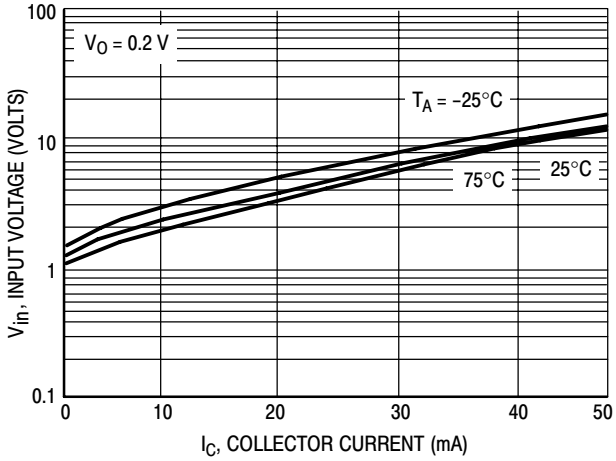


Figure 11. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS − DTC144EM3T5G

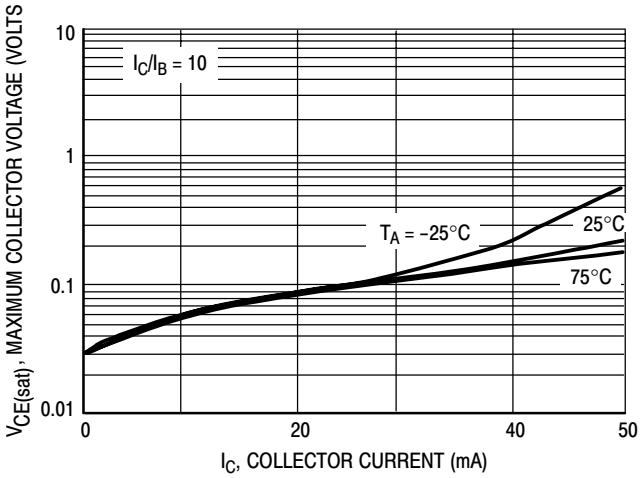


Figure 12. $V_{CE(sat)}$ versus I_C

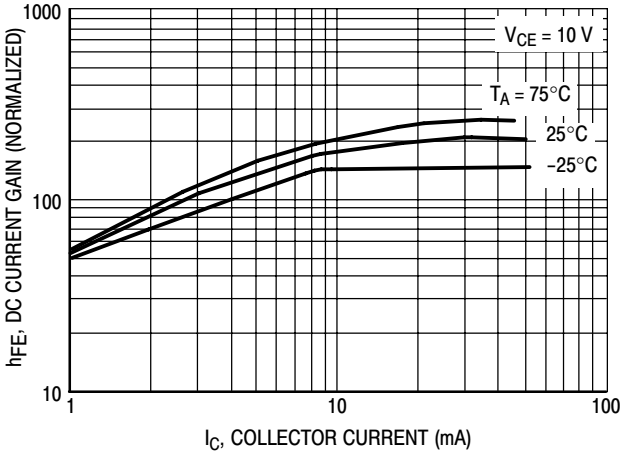


Figure 13. DC Current Gain

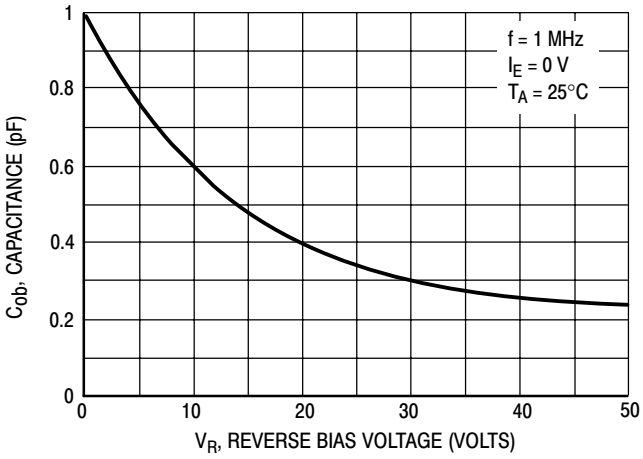


Figure 14. Output Capacitance

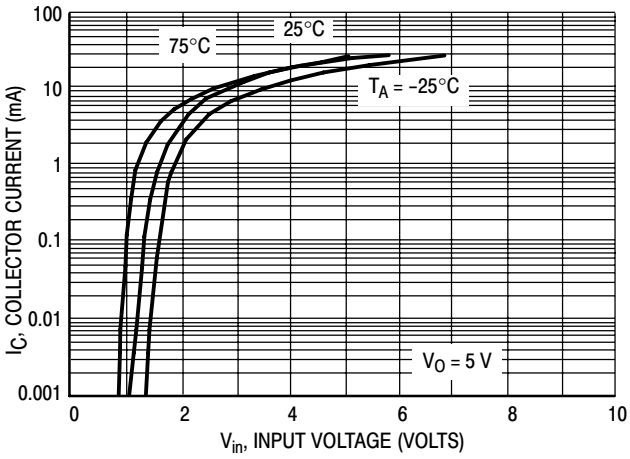


Figure 15. Output Current versus Input Voltage

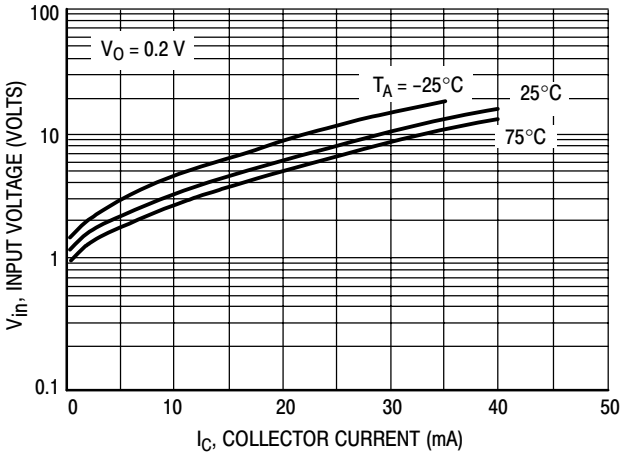


Figure 16. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS − DTC114YM3T5G

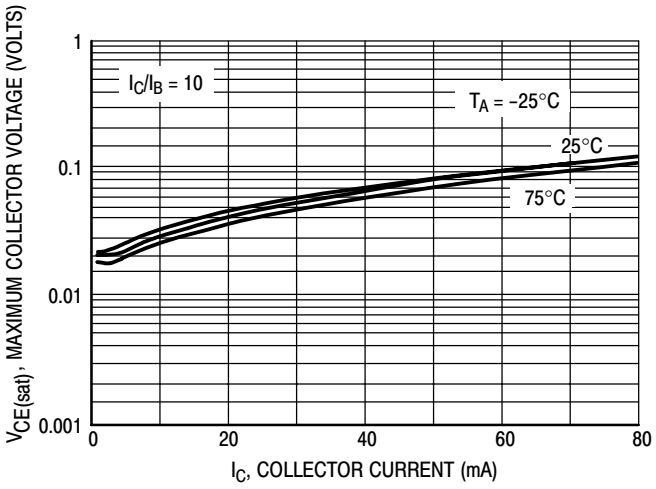


Figure 17. $V_{CE(sat)}$ versus I_C

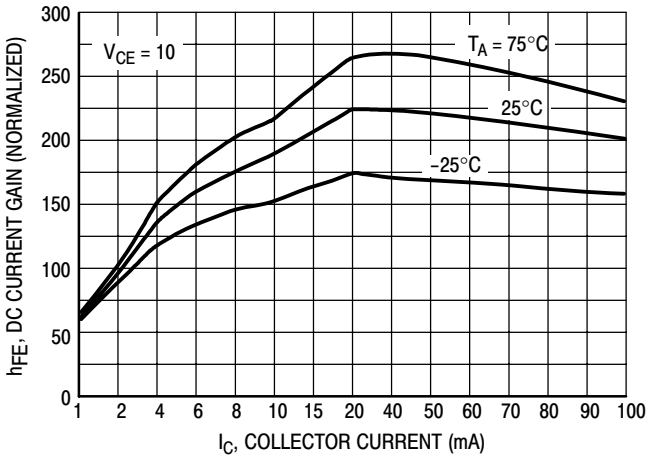


Figure 18. DC Current Gain

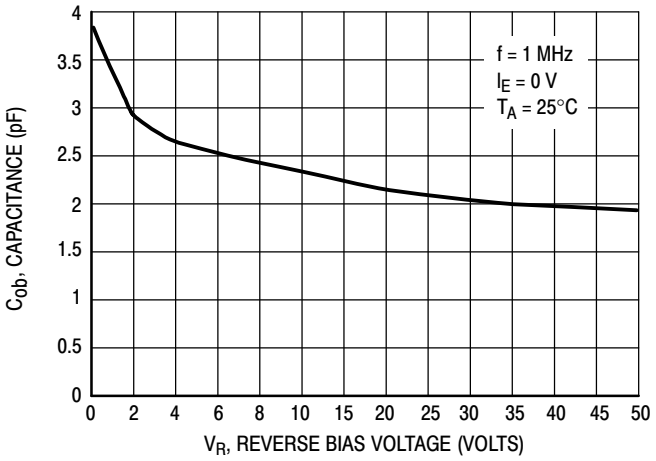


Figure 19. Output Capacitance

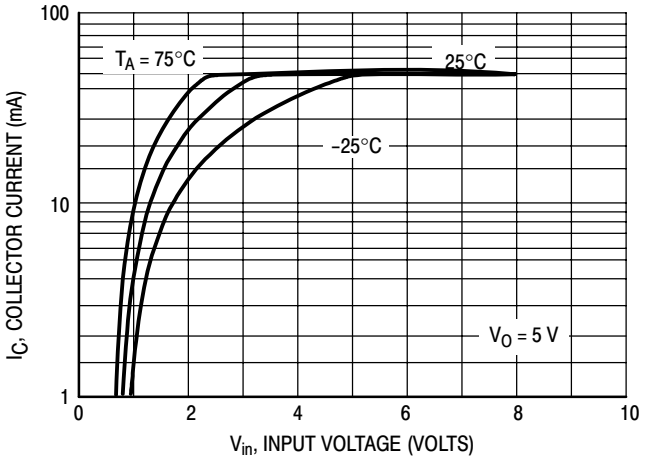


Figure 20. Output Current versus Input Voltage

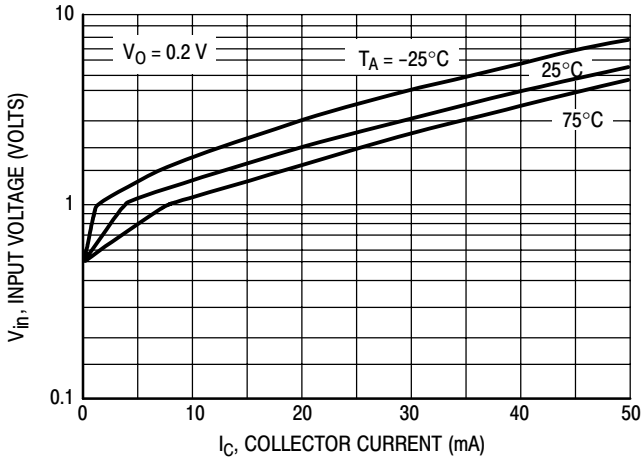


Figure 21. Input Voltage versus Output Current

TYPICAL APPLICATIONS FOR NPN BRTs

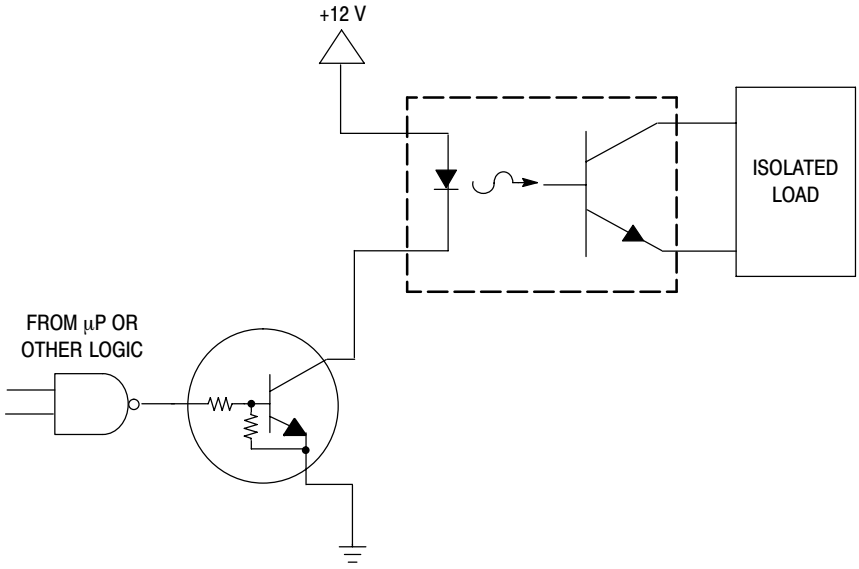


Figure 22. Level Shifter: Connects 12 or 24 Volt Circuits to Logic

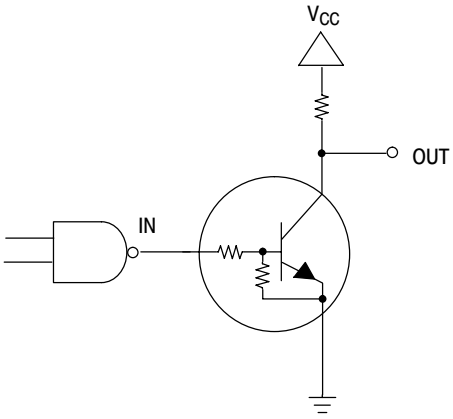


Figure 23. Open Collector Inverter: Inverts the Input Signal

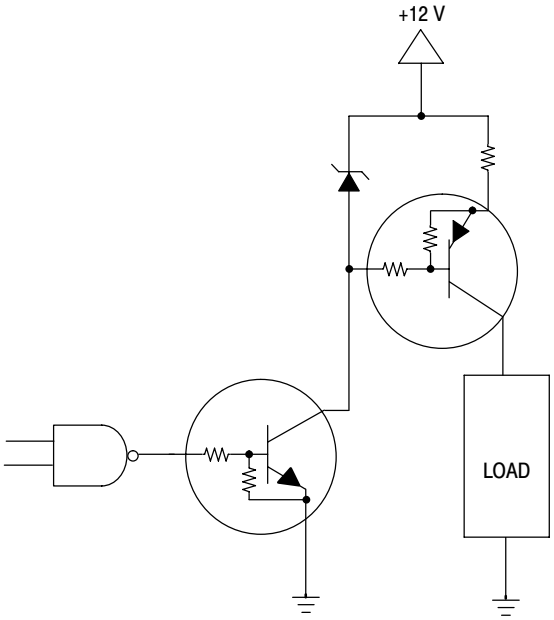
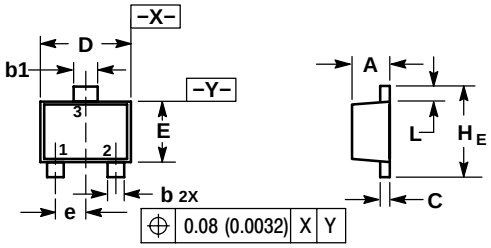


Figure 24. Inexpensive, Unregulated Current Source

PACKAGE DIMENSIONS

SOT−723
CASE 631AA−01
ISSUE B

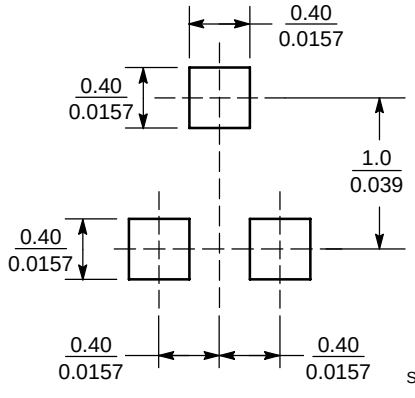


STYLE 1:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
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.

	MILLIMETERS			INCHES		
DIM	MIN	NOM	MAX	MIN	NOM	MAX
A	0.45	0.50	0.55	0.018	0.020	0.022
b	0.15	0.21	0.27	0.0059	0.0083	0.0106
b1	0.25	0.31	0.37	0.010	0.012	0.015
C	0.07	0.12	0.17	0.0028	0.0047	0.0067
D	1.15	1.20	1.25	0.045	0.047	0.049
E	0.75	0.80	0.85	0.03	0.032	0.034
e		0.40 BSC			0.016 BSC	
H_E	1.15	1.20	1.25	0.045	0.047	0.049
L	0.15	0.20	0.25	0.0059	0.0079	0.0098

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.

PUBLICATION ORDERING INFORMATION

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