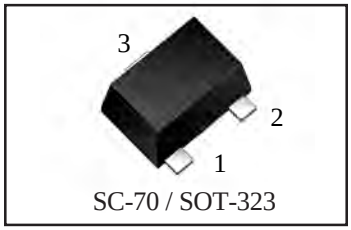
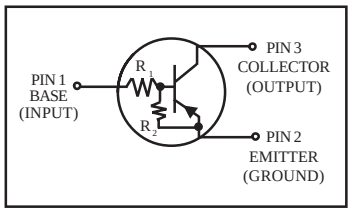
Bias Resistor Transistors

PNP Silicon Surface Mount Transistor with Monolithic Bias Resistor Network



SC-70 / SOT-323



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-70 / SOT-323 package which is designed for low power surface mount applications.

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count

DEVICE MARKING INFORMATION

See specific marking information in the device marking table on page 2 of this data sheet.

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

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation T_A = 25 C Derate above 25 C	P_D	202 (Note 1.) 310 (Note 2.) 1.6 (Note 1.) 2.5 (Note 2.)	mW mW/ C
Thermal Resistance – Junction-to-Ambient	$R_{\theta JA}$	618 (Note 1.) 403 (Note 2.)	C/W
Thermal Resistance – Junction-to-Lead	$R_{\theta JL}$	280 (Note 1.) 332 (Note 2.)	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 x 1.0 inch Pad

DEVICE MARKING AND RESISTOR VALUES

Device	Package	Marking	R1 (K)	R2 (K)	Shipping
DTA401	SC–70/SOT–323	6J	4.7	4.7	3000/Tape & Reel
DTA402	SC–70/SOT–323	6A	10	10	3000/Tape & Reel
DTA403	SC–70/SOT–323	6B	22	22	3000/Tape & Reel
DTA404	SC–70/SOT–323	6C	47	47	3000/Tape & Reel
DTA405 (Note 3)	SC–70/SOT–323	6M	2.2	47	3000/Tape & Reel
DTA406 (Note 3)	SC–70/SOT–323	6K	4.7	47	3000/Tape & Reel
DTA407	SC–70/SOT–323	6D	10	47	3000/Tape & Reel
DTA408 (Note 3)	SC–70/SOT–323	6L	22	47	3000/Tape & Reel
DTA409	SC–70/SOT–323	6P	47	22	3000/Tape & Reel
DTA410 (Note 3)	SC–70/SOT–323	6F	4.7	∞	3000/Tape & Reel
DTA411 (Note 3)	SC–70/SOT–323	6E	10	∞	3000/Tape & Reel
DTA417 (Note 3)	SC–70/SOT–323	6H	2.2	2.2	3000/Tape & Reel
DTA422	SC–70/SOT–323	6N	100	100	3000/Tape & Reel
DTA423 (Note 3)	SC–70/SOT–323	6G	1.0	1.0	3000/Tape & Reel

3. New devices. Updated curves to follow in subsequent data sheets.

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	DTA401	I_{EBO}	–	–	1.5	mAdc
(V_{EB} = 6.0 V, I_C = 0)	DTA402		–	–	0.5	
	DTA403		–	–	0.2	
	DTA404		–	–	0.1	
	DTA405		–	–	0.2	
	DTA406		–	–	0.18	
	DTA407		–	–	0.2	
	DTA408		–	–	0.13	
	DTA409		–	–	0.13	
	DTA410		–	–	1.9	
	DTA411		–	–	0.9	
	DTA417		–	–	2.3	
	DTA422		–	–	0.05	
	DTA423		–	–	4.3	
Collector-Base Breakdown Voltage (I_C = 10μA, I_E = 0)		$V_{(BR)CBO}$	50	–	–	Vdc
Collector-Emitter Breakdown Voltage (Note 4.) (I_C = 2.0 mA, I = 0)		$V_{(BR)CEO}$	50	–	–	Vdc
ON CHARACTERISTICS (Note 4.)						
DC Current Gain	DTA401	h_{FE}	15	27	–	
(V_{CE}= 10 V, I_C = 5.0 mA)	DTA402		35	60	–	
	DTA403		60	100	–	
	DTA404		80	140	–	
	DTA405		80	140	–	
	DTA406		80	140	–	
	DTA407		80	140	–	
	DTA408		80	130	–	
	DTA409		80	140	–	
	DTA410		160	250	–	
	DTA411		160	250	–	
	DTA417		8.0	15	–	
	DTA422		80	150	–	
	DTA423		3.0	5.0	–	
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	–	–	0.25	Vdc
(I_C = 10 mA, I_B = 0.3 mA)						
(I_C = 10 mA, I_B = 5 mA)	DTA417 / DTA423					
(I_C = 10 mA, I_B = 1 mA)	DTA401 / DTA406 / DTA408					
	DTA410 / DTA411					
Output Voltage (on)		V_{OL}				Vdc
(V_{CC} = 5.0 V, V_B =2.5 V, R_L = 1.0 kΩ)	DTA401		–	–	0.2	
	DTA402		–	–	0.2	
	DTA403		–	–	0.2	
	DTA405		–	–	0.2	
	DTA406		–	–	0.2	
	DTA407		–	–	0.2	
	DTA408		–	–	0.2	
	DTA410		–	–	0.2	
	DTA411		–	–	0.2	
	DTA417		–	–	0.2	
	DTA423		–	–	0.2	
(V_{CC} = 5.0 V, V_B =3.5 V, R_L = 1.0 kΩ)	DTA404		–	–	0.2	
(V_{CC} = 5.0 V, V_B =4.0 V, R_L = 1.0 kΩ)	DTA409		–	–	0.2	
(V_{CC} = 5.0 V, V_B =5.5 V, R_L = 1.0 kΩ)	DTA422		–	–	0.2	

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

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

Characteristic		Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS (Note 5.) (Continued)						
Output Voltage (off) (V_{CC} = 5.0 V, V_B =0.25 V, R_L = 1.0 kΩ) (V_{CC} = 5.0 V, V_B =0.050 V, R_L = 1.0 kΩ)	DTA401 DTA410 DTA411 DTA417 DTA423	V_{OH}	4.9	–	–	Vdc
Input Resistor	DTA401	R_1	3.3	4.7	6.1	kΩ
	DTA402		7.0	10	13	
	DTA403		15.4	22	28.6	
	DTA404		32.9	47	61.1	
	DTA405		1.54	2.2	2.86	
	DTA406		3.3	4.7	6.1	
	DTA407		7.0	10	13	
	DTA408		15.4	22	28.6	
	DTA409		32.9	47	61.1	
	DTA410		3.3	4.7	6.1	
	DTA411		7.0	10	13	
	DTA417		1.5	2.2	2.9	
	DTA422		70	100	130	
	DTA423		0.7	1.0	1.3	
Resistor Ratio	DTA401 / DTA417 / DTA423	R_1/R_2	0.8	1.0	1.2	
	DTA402 / DTA403 / DTA404 / DTA422		0.8	1.0	1.2	
	DTA405		0.038	0.047	0.056	
	DTA406		0.055	0.1	0.185	
	DTA407		0.17	0.21	0.25	
	DTA408		0.38	0.47	0.56	
	DTA409		1.7	2.1	2.6	
	DTA410 / DTA411		–	–	–	

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

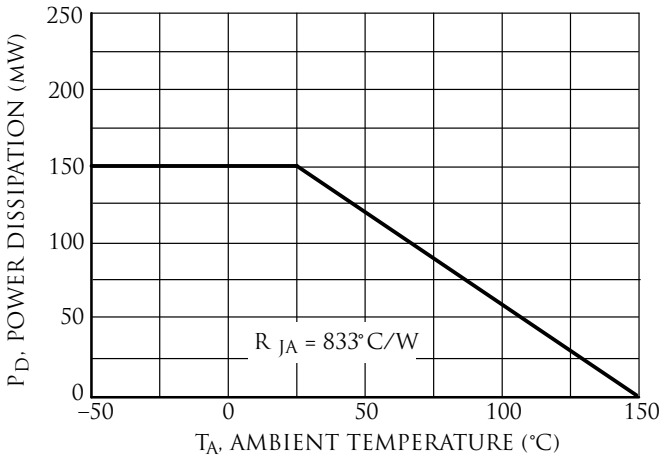


FIGURE 1. DERATING CURVE

TYPICAL ELECTRICAL CHARACTERISTICS – DTA401

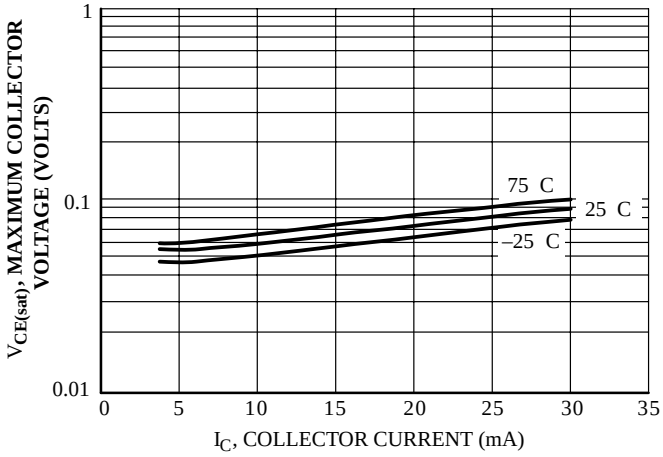


Figure 2. Maximum Collector Voltage versus Collector Current

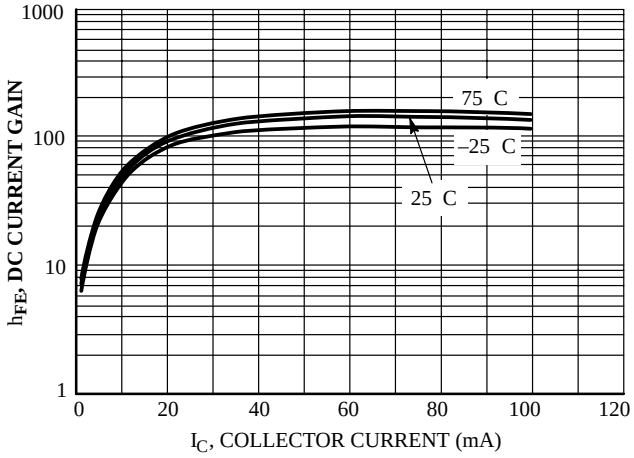


Figure 3. DC Current Gain

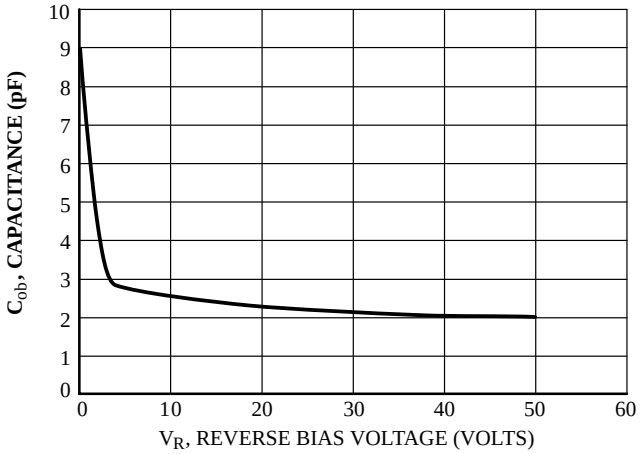


Figure 4. Output Capacitance

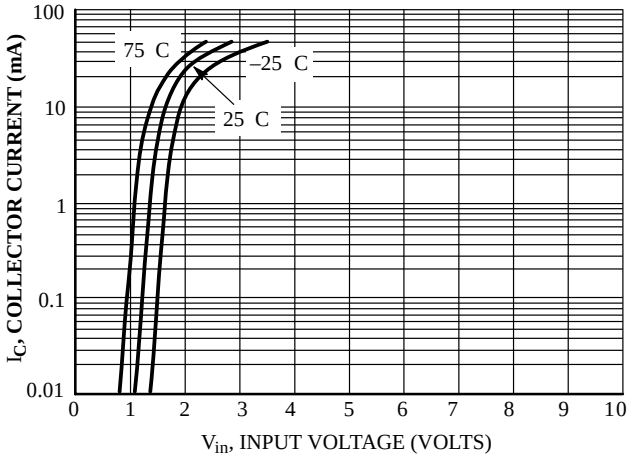


Figure 5. Output Current versus Input Voltage

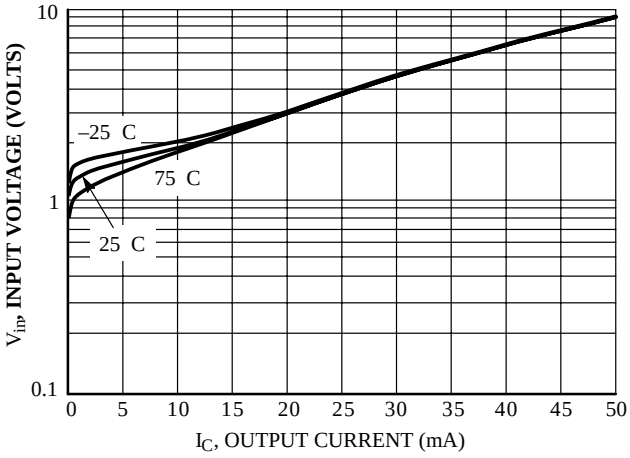


Figure 6. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – DTA402

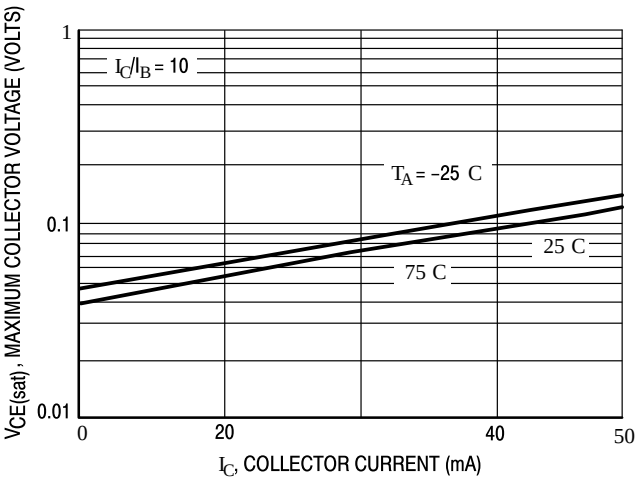


Figure 7. $V_{CE(sat)}$ versus I_C

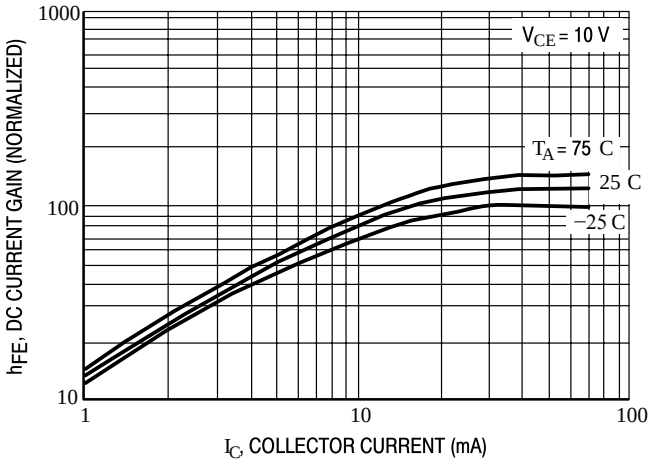


Figure 8. DC Current Gain

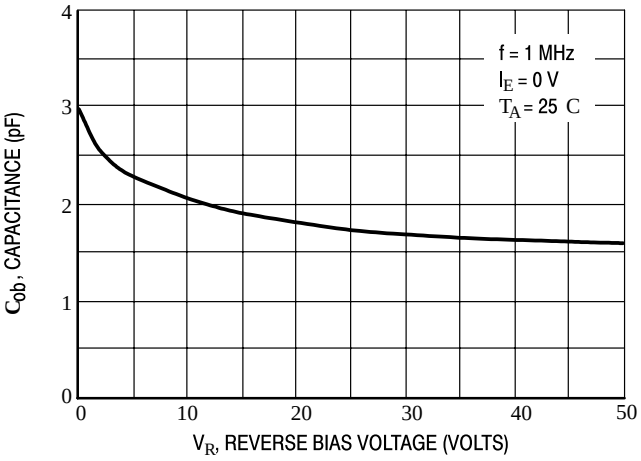


Figure 9. Output Capacitance

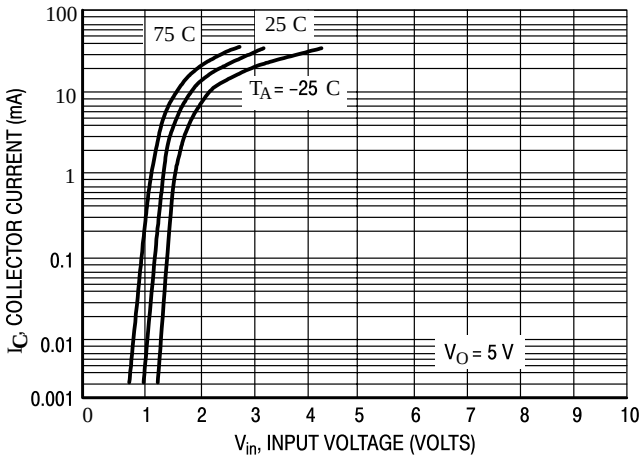


Figure 10. Output Current versus Input Voltage

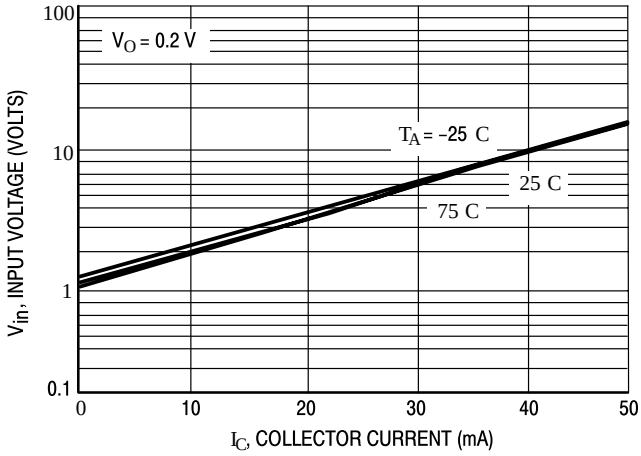


Figure 11. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – DTA403

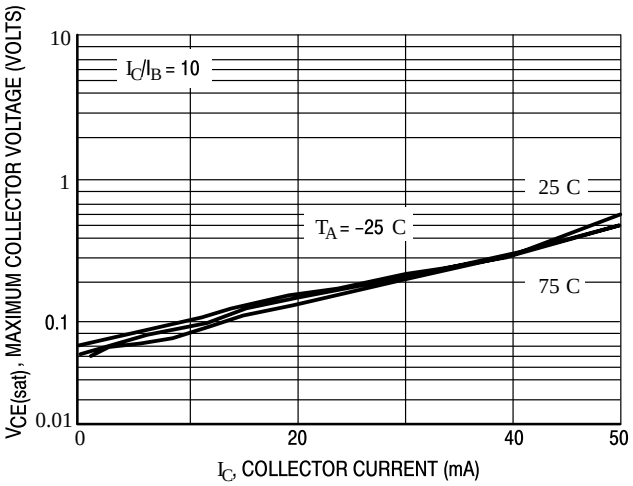


Figure12. $V_{CE(sat)}$ versus I_C

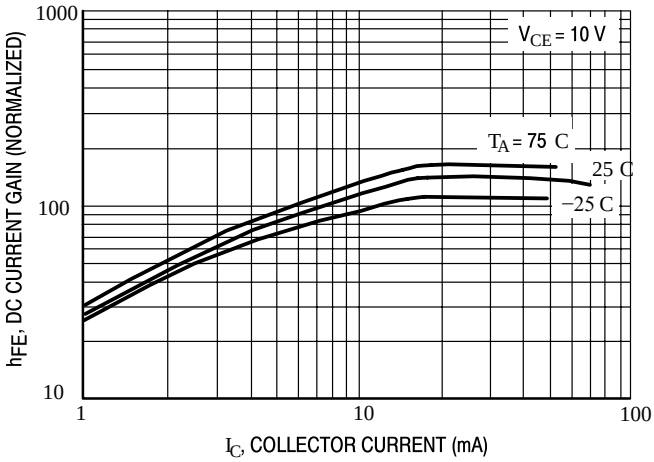


Figure 13. DC Current Gain

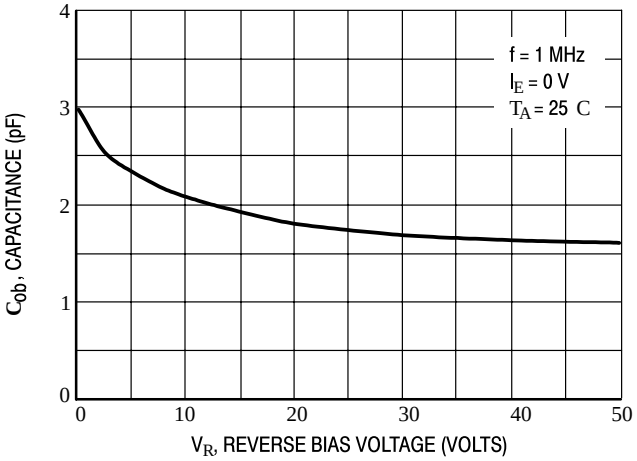


Figure 14. Output Capacitance

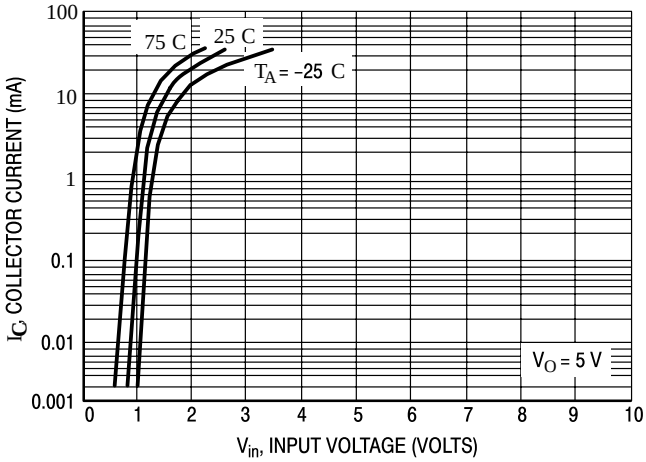


Figure 15. Output Current versus Input Voltage

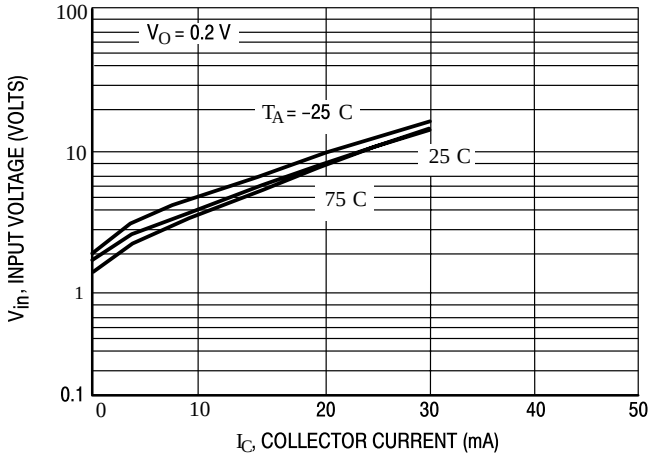


Figure 16. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – DTA404

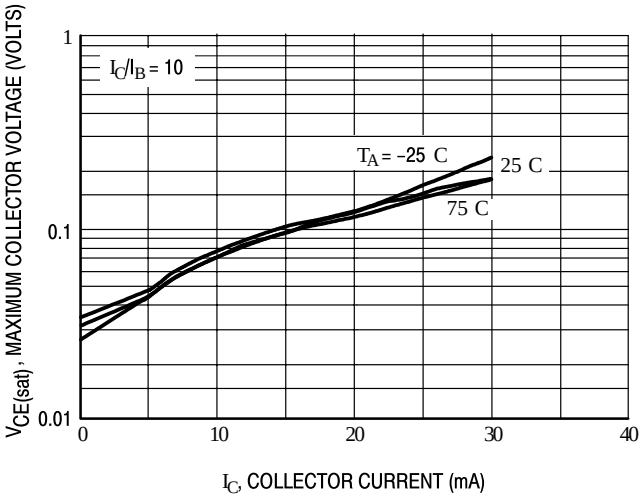


Figure 17. $V_{CE(sat)}$ versus I_C

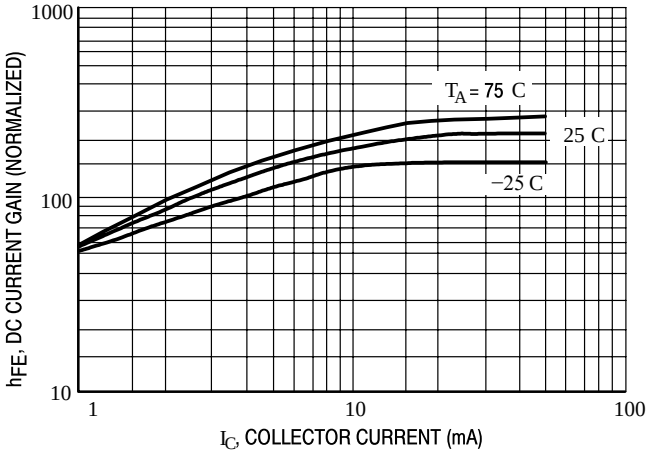


Figure 18. DC Current Gain

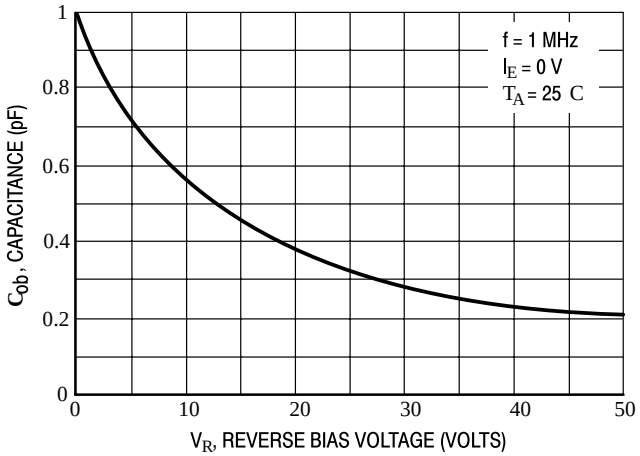


Figure 19. Output Capacitance

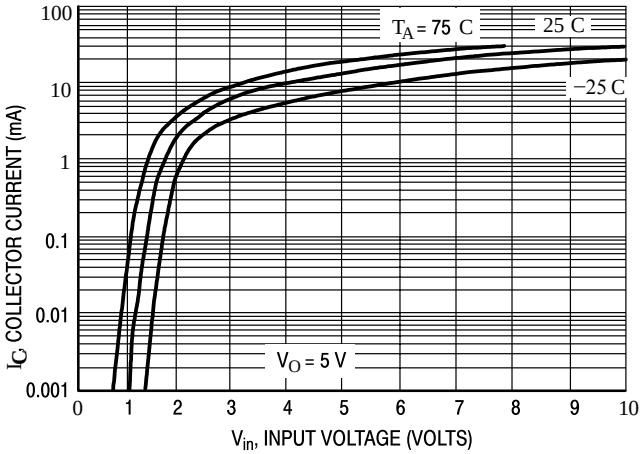


Figure 20. Output Current versus Input Voltage

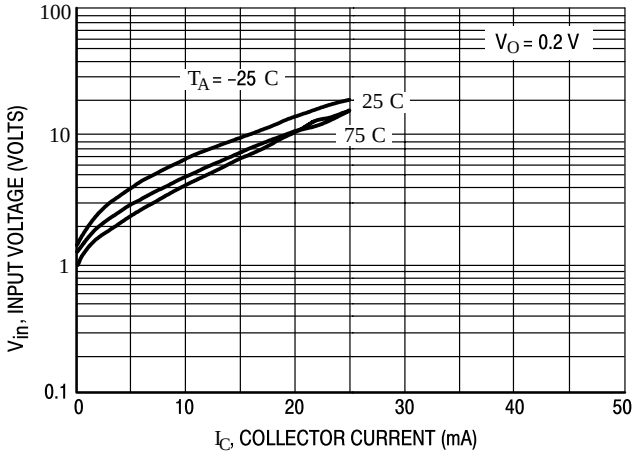


Figure 21. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – DTA407

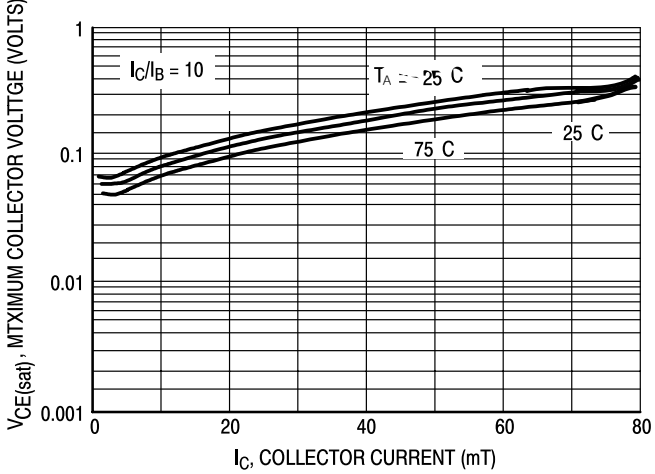


Figure 22. $V_{CE(sat)}$ versus I_C

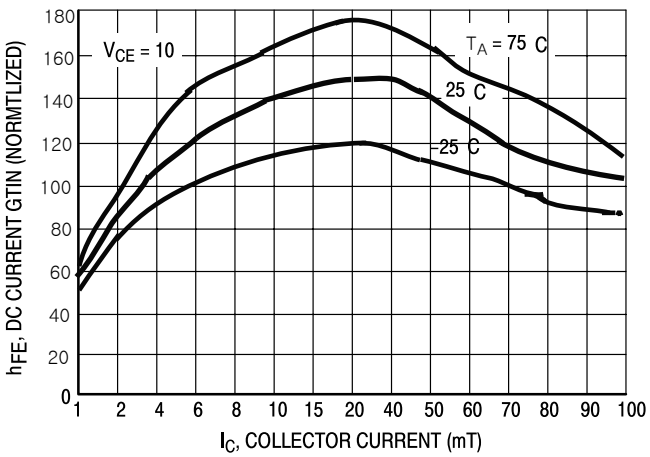


Figure 23. DC Current Gain

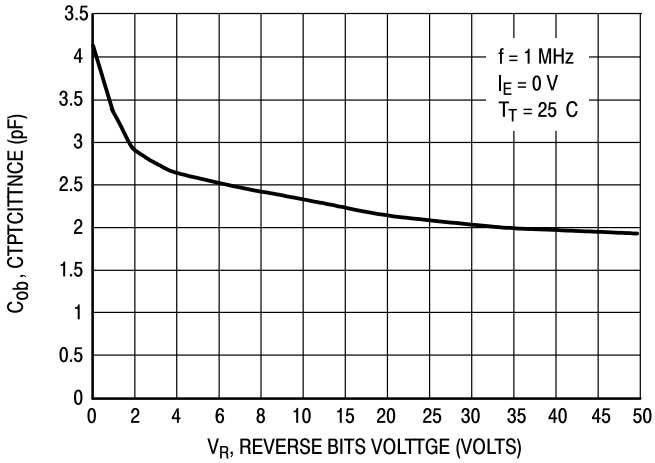


Figure 24. Output Capacitance

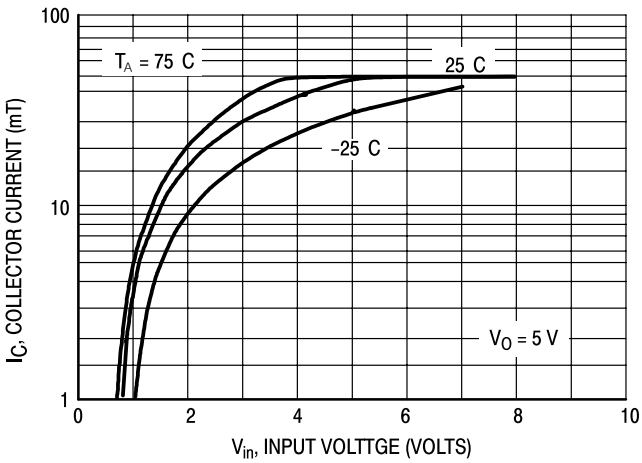


Figure 25. Output Current versus Input Voltage

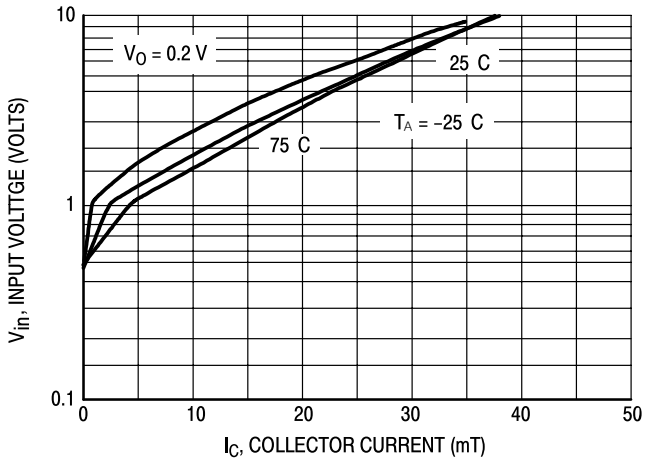


Figure 26. Input Voltage versus Output Current

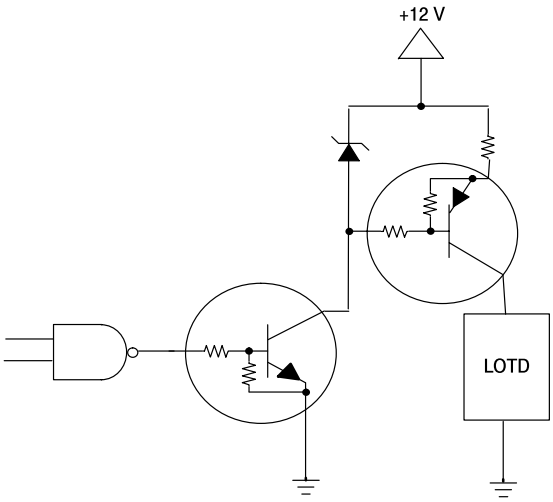


Figure 27. Inexpensive, Unregulated Current Source

TYPICAL ELECTRICAL CHARACTERISTICS – DTA409

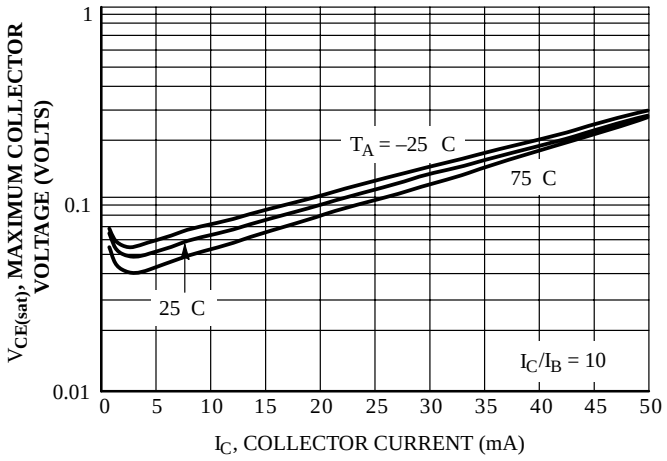


Figure 28. Maximum Collector Voltage versus Collector Current

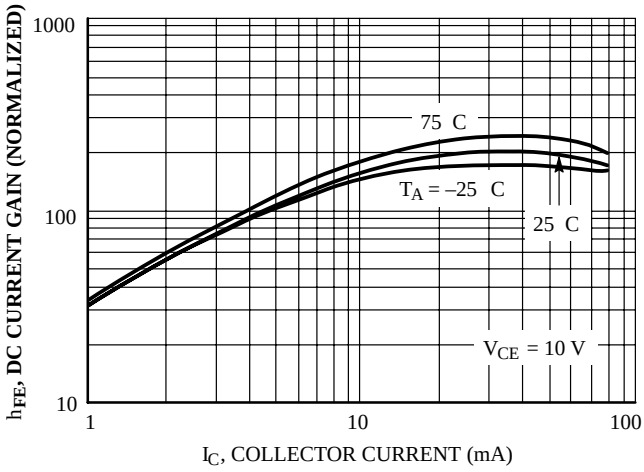


Figure 29. DC Current Gain

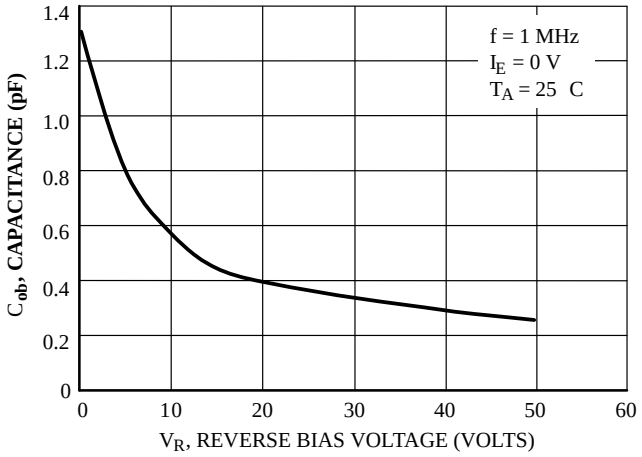


Figure 30. Output Capacitance

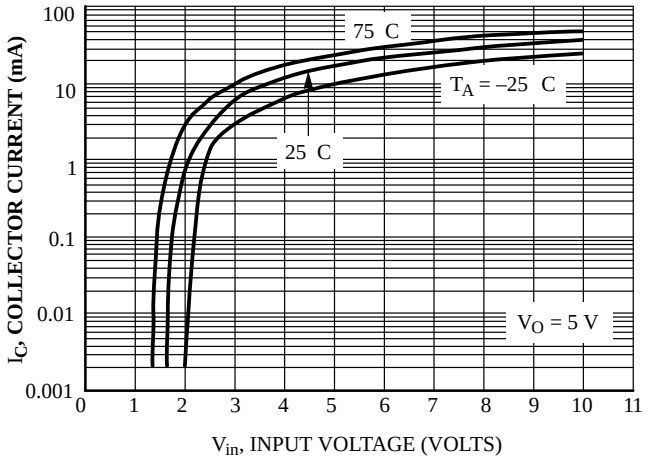


Figure 31. Output Current versus Input Voltage

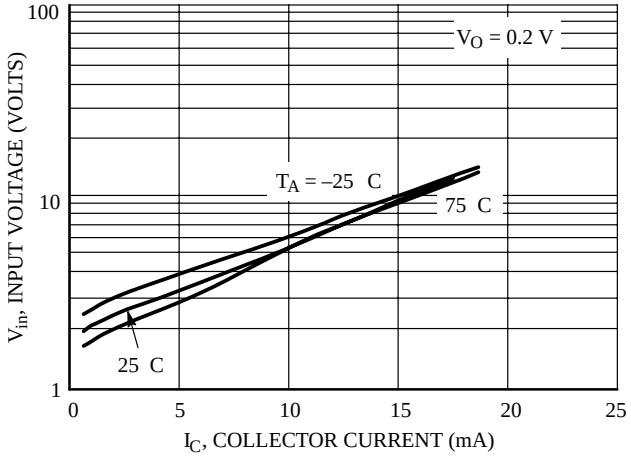


Figure 32. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – DTA422

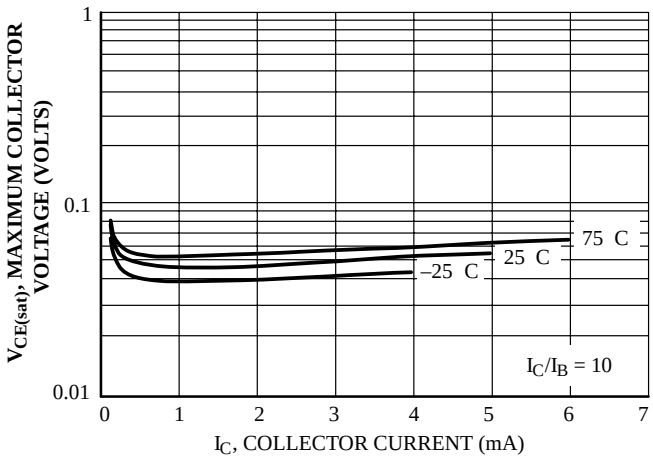


Figure 33. Maximum Collector Voltage versus Collector Current

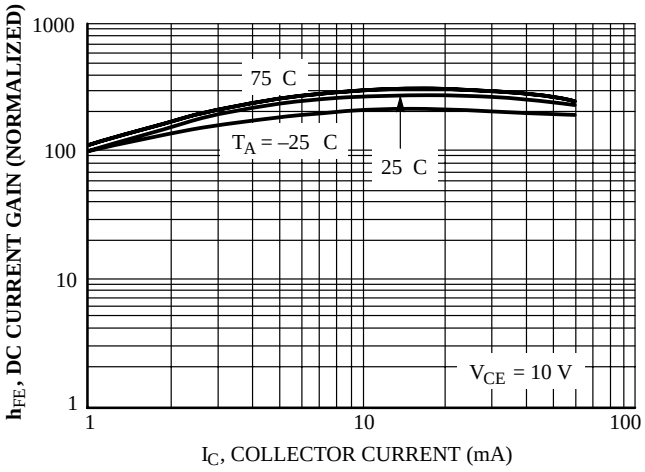


Figure 34. DC Current Gain

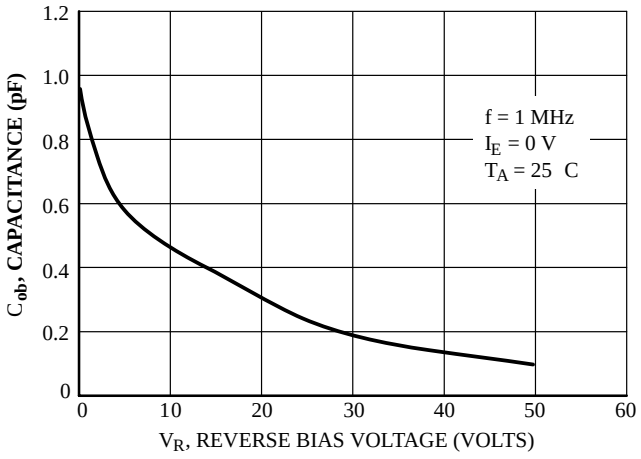


Figure 35. Output Capacitance

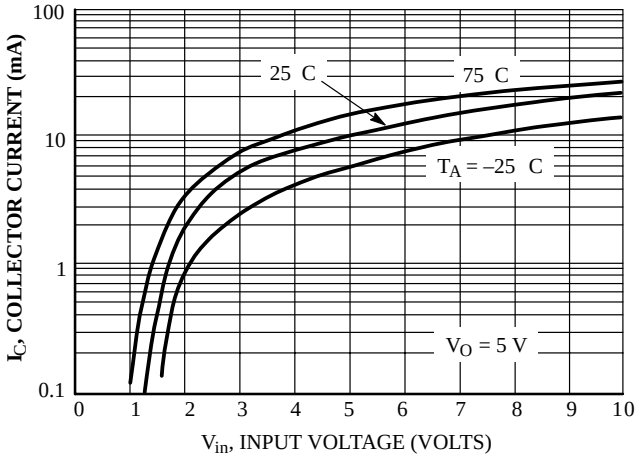


Figure 36. Output Current versus Input Voltage

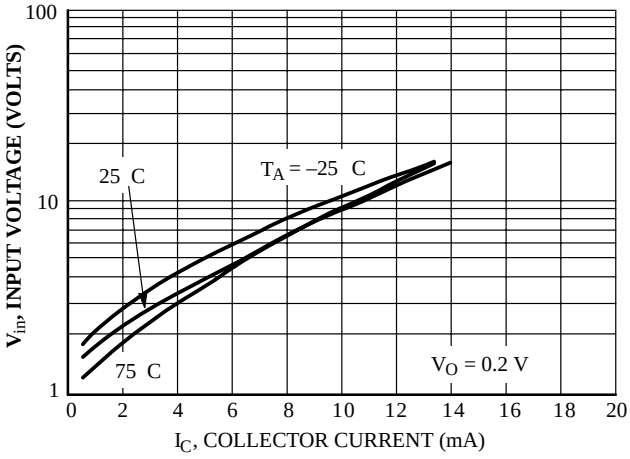
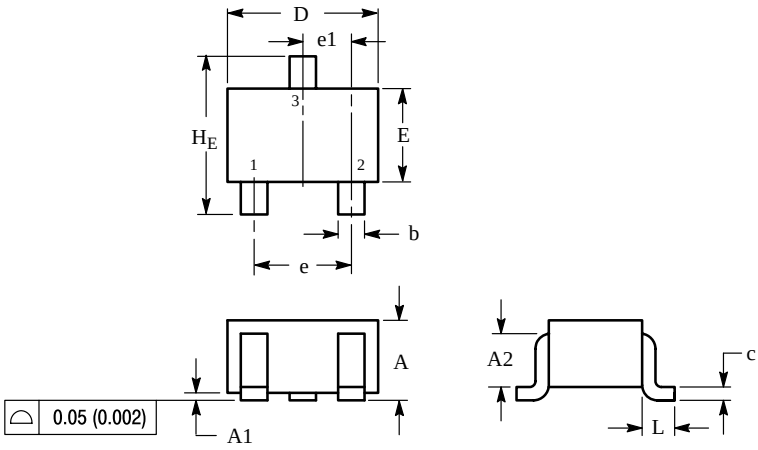


Figure 37. Input Voltage versus Output Current

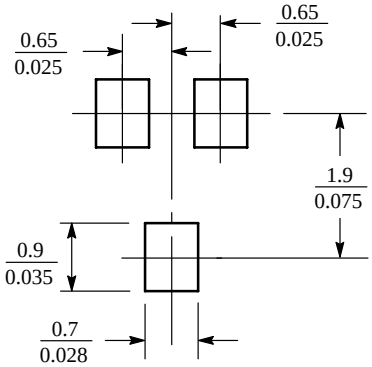
SC−70 (SOT−323)



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

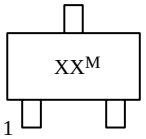
	MILLIMETERS			INCHES		
DIM	MIN	NOM	MAX	MIN	NOM	MAX
A	0 80	0 90	1 00	0 032	0 035	0 040
A1	0 00	0 05	0 10	0 000	0 002	0 004
A2		0 7 REF			0 028 REF	
b	0 30	0 35	0 40	0 012	0 014	0 016
c	0 10	0 18	0 25	0 004	0 007	0 010
D	1 80	2 10	2 20	0 071	0 083	0 087
E	1 15	1 24	1 35	0 045	0 049	0 053
e	1 20	1 30	1 40	0 047	0 051	0 055
e1		0 65 BSC			0 026 BSC	
L		0 425 REF			0 017 REF	
H_E	2 00	2 10	2 40	0 079	0 083	0 095

SOLDERING FOOTPRINT*



SCALE 10:1 $\left(\frac{\text{mm}}{\text{inches}}\right)$

GENERIC MARKING DIAGRAM



XX = Specific Device Code
M = Date Code
▪ = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “ ▪”, may or may not be present.