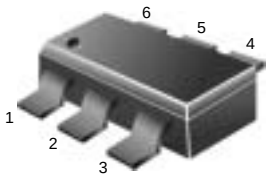
Dual Bias ResistorTransistors

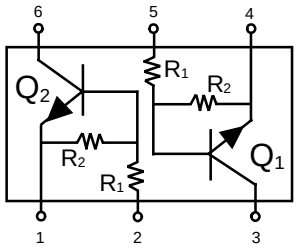
NPN Silicon Surface Mount Transistors with Monolithic Bias Resistor Network

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. These digital transistors are designed to replace a single device and its external resistor bias network. The BRT eliminates these individual components by integrating them into a single device. In the DWC3xx series, two BRT devices are housed in the SOT–363 package which is ideal for low power surface mount applications where board space is at a premium.

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- We declare that the material of product compliance with RoHS requirements.



SC-88/SOT-363



MAXIMUM RATINGS (T_A = 25°C unless otherwise noted, common for Q_1 and Q_2)

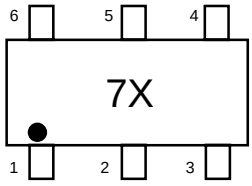
Rating	Symbol	Value	Unit
Collector-Base Voltage	V_{CBO}	50	Vdc
Collector-Emitter Voltage	V_{CEO}	50	Vdc
Collector Current	I_C	100	mAdc

THERMAL CHARACTERISTICS

Characteristic (One Junction Heated)	Symbol	Max	Unit
Total Device Dissipation T_A = 25°C	P_D	187 (Note 1.) 256 (Note 2.)	mW
Derate above 25°C		1.5 (Note 1.) 2.0 (Note 2.)	mW/°C
Thermal Resistance – Junction-to-Ambient	$R_{\theta JA}$	670 (Note 1.) 490 (Note 2.)	°C/W
Characteristic (Both Junctions Heated)	**Symbol**	**Max**	**Unit**
Total Device Dissipation T_A = 25°C	P_D	250 (Note 1.) 385 (Note 2.)	mW
Derate above 25°C		2.0 (Note 1.) 3.0 (Note 2.)	mW/°C
Thermal Resistance – Junction-to-Ambient	$R_{\theta JA}$	493 (Note 1.) 325 (Note 2.)	°C/W
Thermal Resistance – Junction-to-Lead	$R_{\theta JL}$	188 (Note 1.) 208 (Note 2.)	°C/W
Junction and Storage Temperature	T_J, T_{stg}	–55 to +150	°C

1. FR–4 @ Minimum Pad 2. FR–4 @ 1.0 x 1.0 inch Pad

MARKING DIAGRAM



7X = Device Marking
(See Page 2)

DEVICE MARKING INFORMATION

See specific marking information in he device marking table on page 2 of his data sheet.

DEVICE MARKING , RESISTOR VALUES AND ORDERING INFORMATION

Device	Package	Marking	R1(K)	R2(K)	Shipping
DWC301	SOT-363	7J	4.7	4.7	3000/Tape&Reel
DWC302	SOT-363	7A	10	10	3000/Tape&Reel
DWC303	SOT-363	7B	22	22	3000/Tape&Reel
DWC304	SOT-363	7C	47	47	3000/Tape&Reel
DWC305	SOT-363	7M	2.2	47	3000/Tape&Reel
DWC306	SOT-363	7K	4.7	47	3000/Tape&Reel
DWC307	SOT-363	7D	10	47	3000/Tape&Reel
DWC308	SOT-363	7L	22	47	3000/Tape&Reel
DWC309	SOT-363	7P	47	22	3000/Tape&Reel
DWC310	SOT-363	7F	4.7		3000/Tape&Reel
DWC311	SOT-363	7E	10		3000/Tape&Reel
DWC317	SOT-363	7H	2.2	2.2	3000/Tape&Reel
DWC322	SOT-363	7N	100	100	3000/Tape&Reel
DWC323	SOT-363	7G	1	1	3000/Tape&Reel

ELECTRICAL CHARACTERISTICS

(T_A = 25°C unless otherwise noted, common for Q_1 and Q_2)

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)	DWC302	I_{EBO}	–	–	0.5	mAdc
	DWC303		–	–	0.2	
	DWC304		–	–	0.1	
	DWC307		–	–	0.2	
	DWC310		–	–	1.9	
	DWC311		–	–	0.9	
	DWC317		–	–	2.3	
	DWC323		–	–	4.3	
	DWC301		–	–	1.5	
	DWC306		–	–	0.18	
	DWC308		–	–	0.13	
	DWC305		–	–	0.2	
	DWC309		–	–	0.13	
	DWC322		–	–	0.05	
Collector-Base Breakdown Voltage (I_C = 10 µA, I_E = 0)		$V_{(BR)CBO}$	50	–	–	Vdc
Collector-Emitter Breakdown Voltage(Note 4.)(I_C = 2.0 mA,I_B=0)		$V_{(BR)CEO}$	50	–	–	Vdc

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

ELECTRICAL CHARACTERISTICS

(T_A = 25°C unless otherwise noted, common for Q_1 and Q_2,) (Continued)

Characteristic		Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS(Note 5.)						
DC Current Gain	DWC302	h_{FE}	35	60	–	
(V_{CE} = 10 V, I_C = 5.0 mA)	DWC303		60	100	–	
	DWC304		80	140	–	
	DWC307		80	140	–	
	DWC310		160	350	–	
	DWC311		160	350	–	
	DWC317		8.0	15	–	
	DWC323		3.0	5.0	–	
	DWC301		15	30	–	
	DWC306		80	200	–	
	DWC308		80	150	–	
	DWC305		80	140	–	
	DW309		80	150	–	
	DWC322		80	140	–	
Collector-Emitter Saturation Voltage (I_C= 10mA,I_B= 0.3 mA)		$V_{CE(sat)}$	–	–	0.25	Vdc
(I_C= 10mA, I_B= 5mA)	DWC317/DWC323					
(I_C= 10mA, I_B= 1mA)	DWC310/DWC311					
	DWC301/DWC306/DWC308					
Output Voltage (on)		V_{OL}				Vdc
(V_{CC} = 5.0 V, V_B = 2.5 V, R_L = 1.0 kΩ)	DWC302		–	–	0.2	
	DWC303		–	–	0.2	
	DWC307		–	–	0.2	
	DWC311		–	–	0.2	
	DWC301		–	–	0.2	
	DWC310		–	–	0.2	
	DWC317		–	–	0.2	
	DWC323		–	–	0.2	
	DWC305		–	–	0.2	
	DWC306		–	–	0.2	
	DWC308		–	–	0.2	
(V_{CC} = 5.0 V, V_B = 3.5 V, R_L = 1.0 kΩ)	DWC304		–	–	0.2	
(V_{CC} = 5.0 V, V_B = 5.5 V, R_L = 1.0 kΩ)	DWC309		–	–	0.2	
(V_{CC} = 5.0 V, V_B = 4.0 V, R_L = 1.0 kΩ)	DWC322		–	–	0.2	
Output Voltage (off) (V_{CC} = 5.0 V, V_B = 0.5 V, R_L = 1.0 kΩ)		V_{OH}	4.9	–	–	Vdc
(V_{CC} = 5.0 V, V_B = 0.05 V, R_L = 1.0 kΩ)	DWC323					
(V_{CC} = 5.0 V, V_B = 0.25 V, R_L = 1.0 kΩ)	DWC306					
	DWC310					
	DWC311					

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

ELECTRICAL CHARACTERISTICS

(T_A = 25°C unless otherwise noted, common for Q_1 and Q_2,) (Continued)

Characteristic		Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS(Note 6.)						
Input Resistor	DWC302	R_1	7.0	10	13	kΩ
	DWC303		15.4	22	28.6	
	DWC304		32.9	47	61.1	
	DWC307		7.0	10	13	
	DWC311		7.0	10	13	
	DWC310		3.3	4.7	6.1	
	DWC323		0.7	1.0	1.3	
	DWC317		1.5	2.2	2.9	
	DWC301		3.3	4.7	6.1	
	DWC306		3.3	4.7	6.1	
	DWC308		15.4	22	28.6	
	DWC305		1.54	2.2	2.86	
	DWC322		70	100	130	
	DWC309		32.9	47	61.1	
Resistor Ratio	DWC302/DWC303	R_1/R_2				
	DWC304/DWC322		0.8	1.0	1.2	
	DWC307/DWC311		0.17	0.21	0.25	
	DWC310/DWC323		–	–	–	
	DWC317/DWC301		0.8	1.0	1.2	
	DWC306		0.055	0.1	0.185	
	DWC308		0.38	0.47	0.56	
	DWC305		0.038	0.047	0.056	
	DWC309		1.7	2.1	2.6	

6. Pulse Test: Pulse Width < 300 ms, Duty Cycle < 2.0%

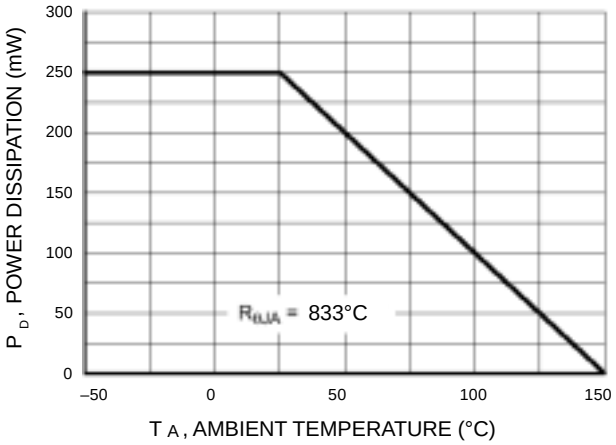


Figure 1. Derating Curve

TYPICAL ELECTRICAL CHARACTERISTICS – DWC302

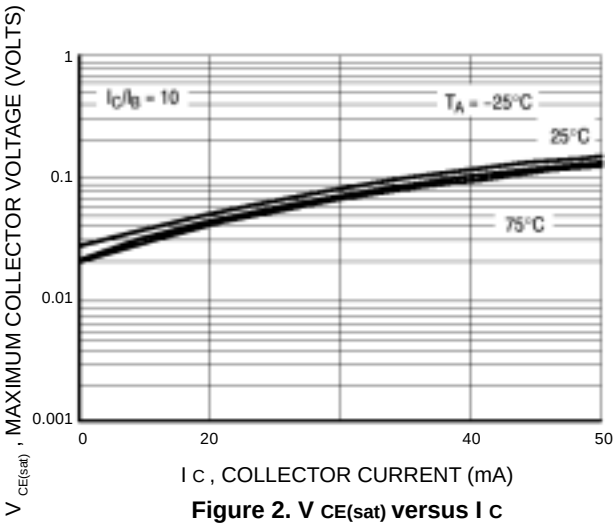


Figure 2. $V_{CE(sat)}$ versus I_C

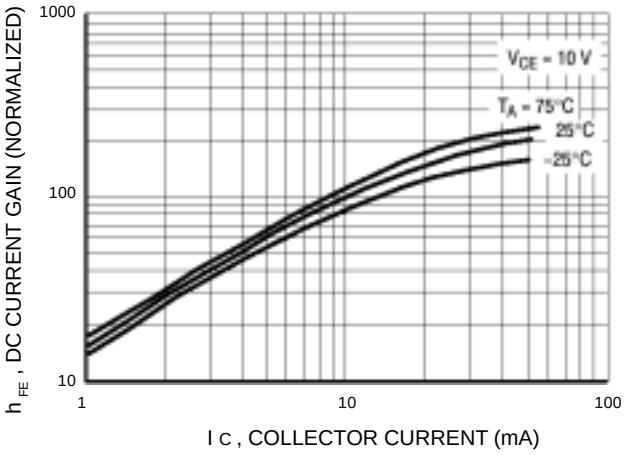


Figure 3. DC Current Gain

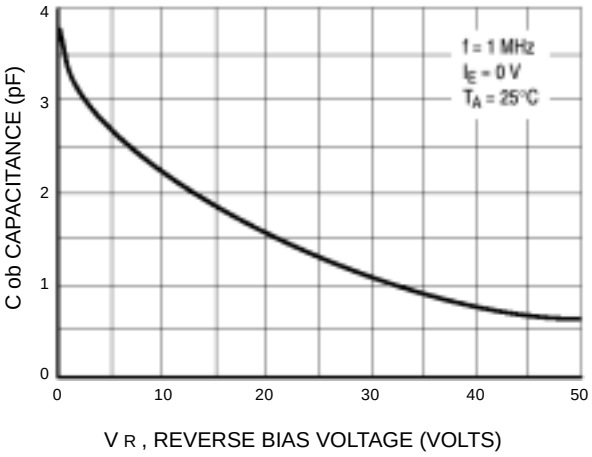


Figure 4. Output Capacitance

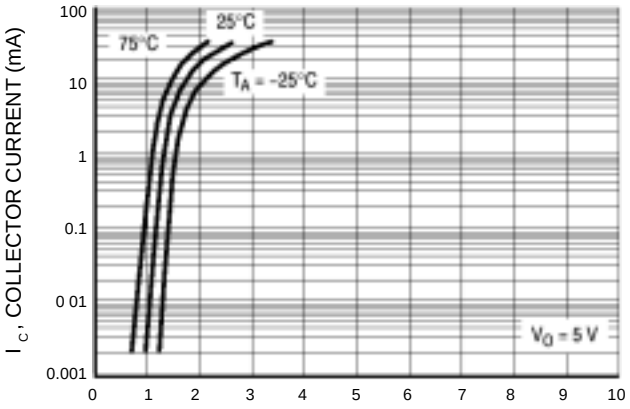


Figure 5. Output Current versus Input Voltage

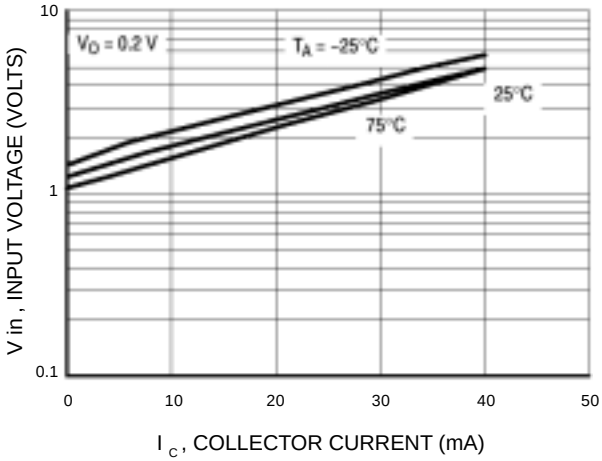


Figure 6. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – DWC303

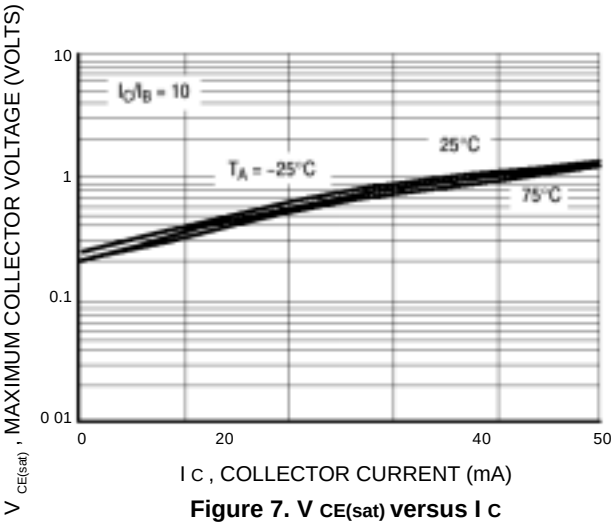


Figure 7. $V_{CE(sat)}$ versus I_C

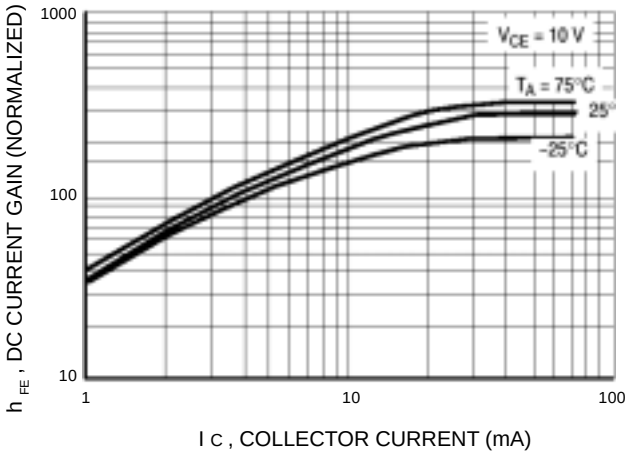


Figure 8. DC Current Gain

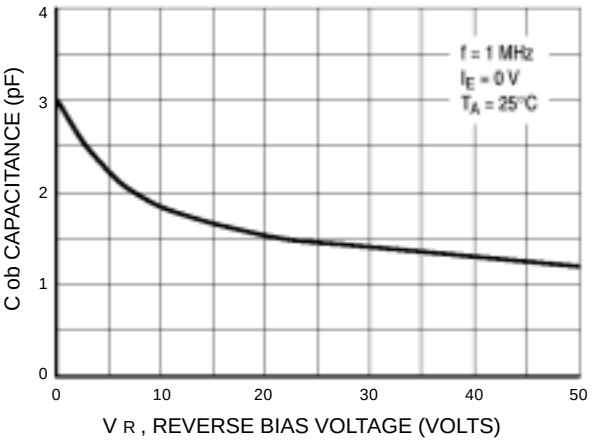


Figure 9. Output Capacitance

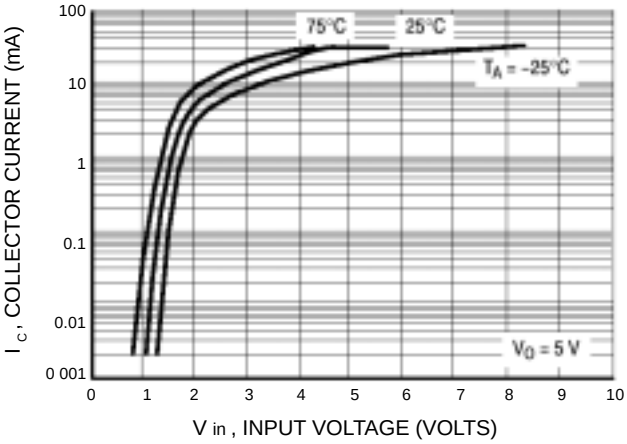


Figure 10. Output Current versus Input oltage

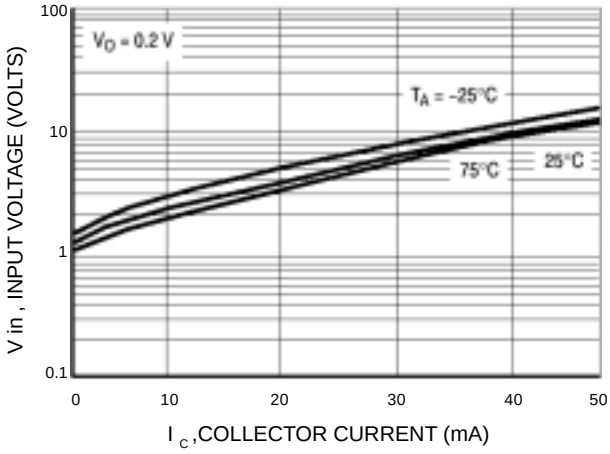


Figure 11. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – DWC304

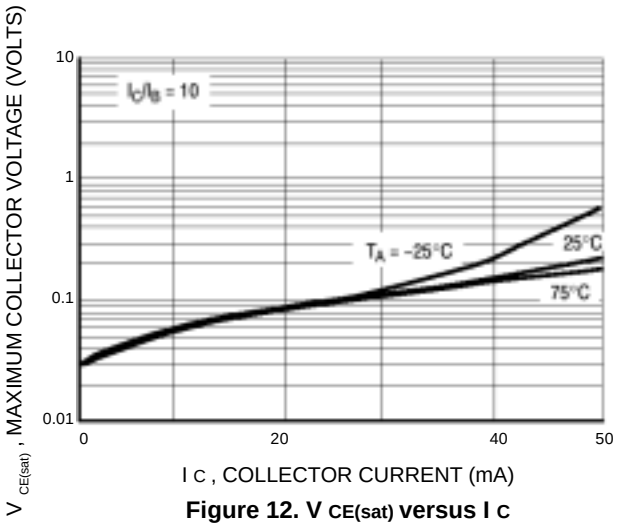


Figure 12. $V_{CE(sat)}$ versus I_C

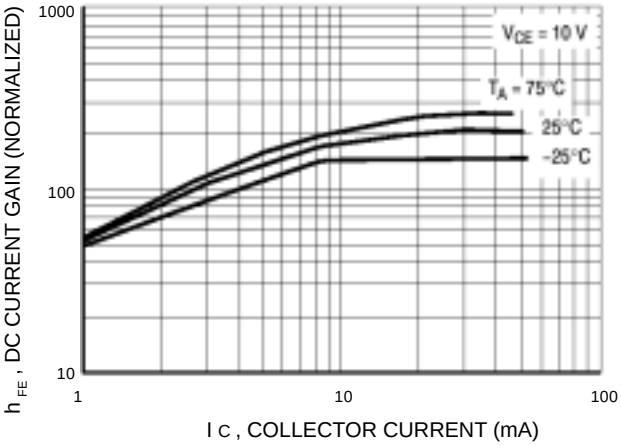


Figure 13. DC Current Gain

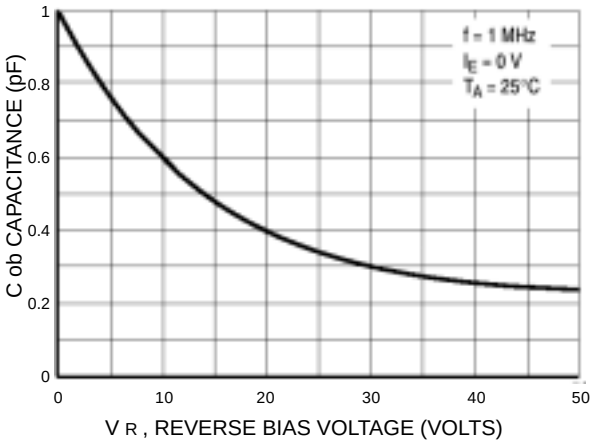


Figure 14. Output Capacitance

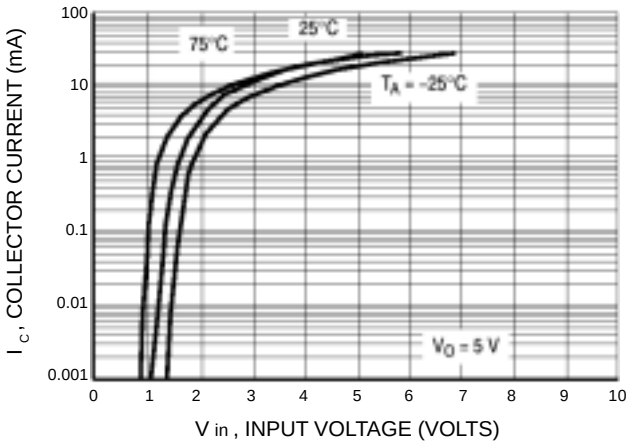


Figure 15. Output Current versus Input oltage

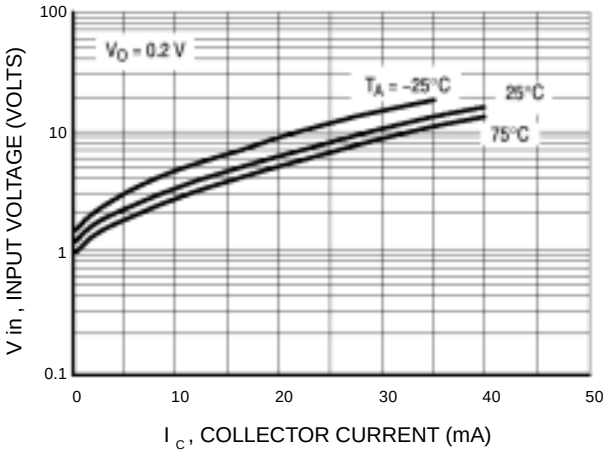


Figure 16. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – DWC307

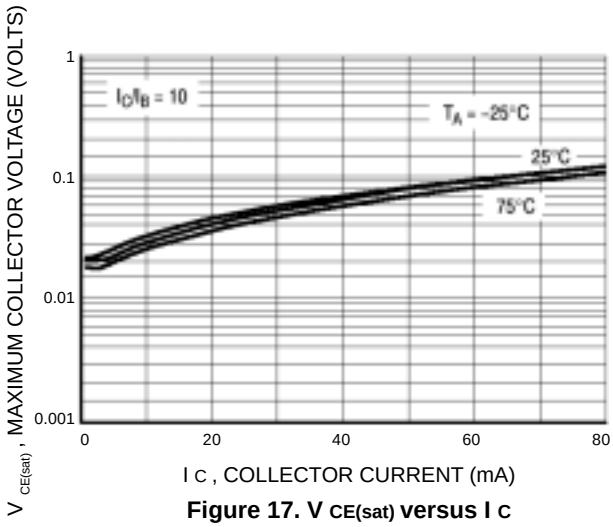


Figure 17. $V_{CE(sat)}$ versus I_C

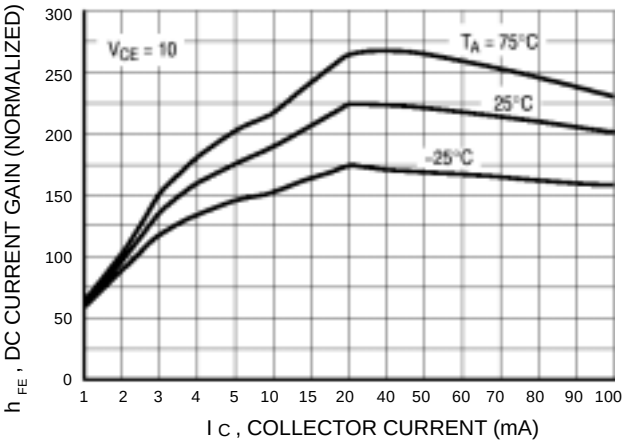


Figure 18. DC Current Gain

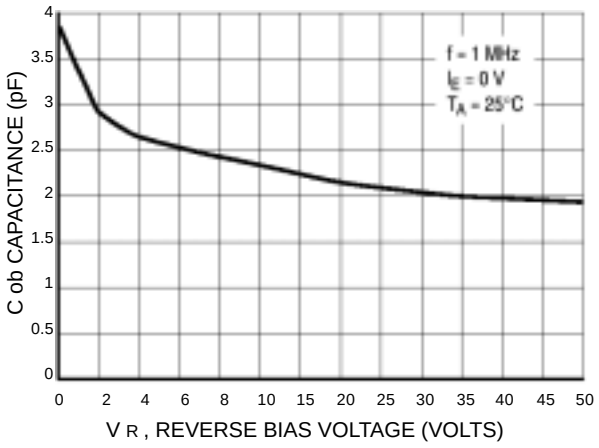


Figure 19. Output Capacitance

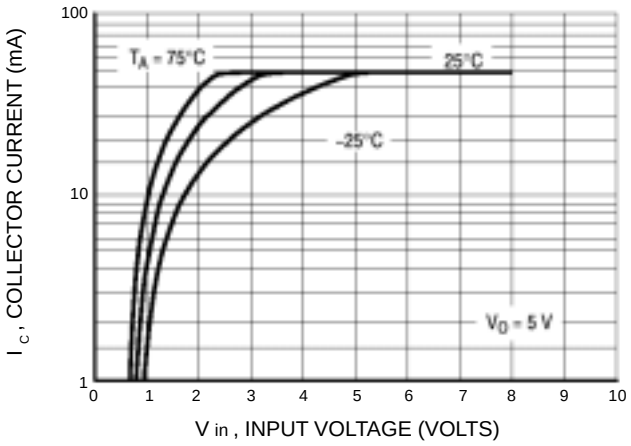


Figure 20. Output Current versus Input oltage

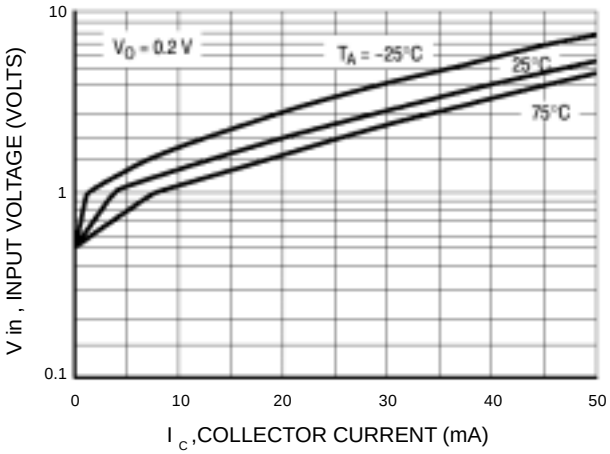
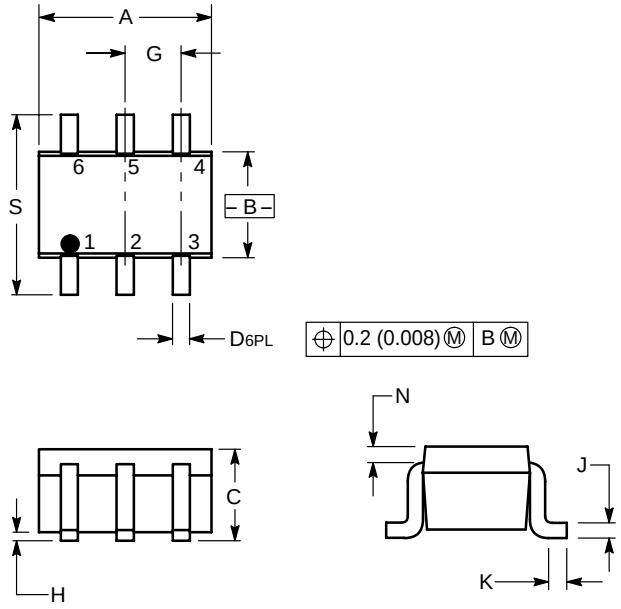


Figure 21. Input Voltage versus Output Current

SC−88/SOT−363



NOTES:

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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.071	0.087	1.80	2.20
B	0.045	0.053	1.15	1.35
C	0.031	0.043	0.80	1.10
D	0.004	0.012	0.10	0.30
G	0.026 BSC		0.65 BSC	
H	---	0.004	---	0.10
J	0.004	0.010	0.10	0.25
K	0.004	0.012	0.10	0.30
N	0.008 REF		0.20 REF	
S	0.079	0.087	2.00	2.20

PIN 1. EMITTER 2
2. BASE 2
3. COLLECTOR 1
4. EMITTER 1
5. BASE 1
6. COLLECTOR 2