Elektronische Bauelemente

SMUN5311DW Series

NPN / PNP

Digital Small Signal Transistors

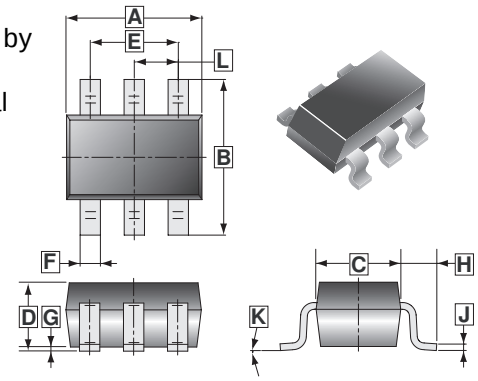
RoHS Compliant Product

A suffix of “-C” indicates halogen-free.

DESCRIPTION

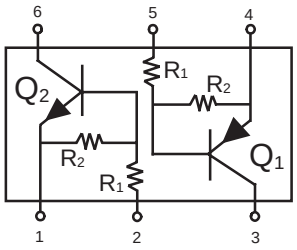
The Bias Resistor Transistor (BRT) contains a single transistor with a monolithic bias network consisting of two resistors; a series base resistor and a base−emitter resistor. These digital transistors are designed to replace a single device and its external resistor bias network. The BRT eliminates these individual components by integrating them into a single device. In the SMUN5311DW series, two complementary 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.

SOT-363



FEATURE

- Simplifies circuit design
- Reduces board space
- Reduces component count
- Available in 8 mm, 7 inch/3000 unit tape and reel
- The devices are Pb-Free



REF.	Millimeter		REF.	Millimeter	
	Min.	Max.		Min.	Max.
A	2.00	2.20	G	0.100 REF.	
B	2.15	2.45	H	0.525 REF.	
C	1.15	1.35	J	0.08	0.15
D	0.90	1.10	K	8°	
E	1.20	1.40	L	0.650 TYP.	
F	0.15	0.35			

MAXIMUM RATINGS AND THERMAL CHARACTERISTICS

(T_A = 25℃ unless otherwise noted, common for Q1 and Q 2, minus sign for Q1(PNP) omitted)

PARAMETER	SYMBOL	VALUE	UNIT
Collector - Base Voltage	V_{CBO}	50	Vdc
Collector - Emitter Voltage	V_{CEO}	50	Vdc
Collector Currrent – Continuous	I_C	100	mAdc
ONE JUNCTION HEATED THERMAL CHARACTERISTICS			
Total Device Dissipation, T_A=25℃	P_D	187(1) 256(2)	mW
Total Device Dissipation, Derate above 25℃		1.5(1) 2.0(2)	mW/℃
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	670(1) 490(2)	℃/W
BOTH JUNCTION HEATED THERMAL CHARACTERISTICS			
Total Device Dissipation, T_A=25℃	P_D	250(1) 385(2)	mW
Total Device Dissipation, Derate above 25℃		2.0(1) 3.0(2)	mW/℃
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	493(1) 325(2)	℃/W
Thermal Resistance, Junction to Lead	$R_{\theta JL}$	188(1) 208(2)	℃/W
Junction Temperature & Storage Temperature	T_J,T_{STG}	-55~150	℃

Note:

1. FR-4 @ minimum pad 2. FR-4 @ 1.0 x 1.0 inch pad

ELECTRICAL CHARACTERISTICS (T_A = 25℃ unless otherwise noted)

PARAMETER		SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
OFF CHARACTERISTICS							
Collector-Base Breakdown Voltage		$V_{(BR)CBO}$	50	-	-	V	I_C=10μA, I_E=0
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$	50	-	-	V	I_C =2mA, I_B = 0
Collector-Base Cutoff Voltage		I_{CBO}	-	-	100	nA	V_{CB}=50V, I_E=0
Collector-Emitter Cutoff Current		I_{CEO}	-	-	500	nA	V_{CE}=50V, I_B=0
Emitter-Base Cutoff Current	SMUN5311DW	I_{EBO}	-	-	0.5	mA	V_{EB}=6V, I_C=0
	SMUN5312DW		-	-	0.2		
	SMUN5313DW		-	-	0.1		
	SMUN5314DW		-	-	0.2		
	SMUN5315DW		-	-	0.9		
	SMUN5316DW		-	-	1.9		
	SMUN5330DW		-	-	4.3		
	SMUN5331DW		-	-	2.3		
	SMUN5332DW		-	-	1.5		
	SMUN5333DW		-	-	0.18		
	SMUN5334DW		-	-	0.13		
	SMUN5335DW		-	-	0.2		
ON CHARACTERISTICS [3]							
Collector-Emitter Saturation Voltage	SMUN5311DW	$V_{CE(sat)}$	-	-	0.25	Vdc	I_C=10mA, I_B=0.3mA
	SMUN5312DW		-	-	0.25		
	SMUN5313DW		-	-	0.25		
	SMUN5314DW		-	-	0.25		
	SMUN5335DW		-	-	0.25		
	SMUN5330DW		-	-	0.25		I_C=10mA, I_B=5mA
	SMUN5331DW		-	-	0.25		
	SMUN5315DW		-	-	0.25		I_C=10mA, I_B=1mA
	SMUN5316DW		-	-	0.25		
	SMUN5332DW		-	-	0.25		
	SMUN5333DW		-	-	0.25		
	SMUN5334DW		-	-	0.25		
DC Current Gain	SMUN5311DW	h_{FE}	35	60	-		V_{CE}=10V, I_C=5mA
	SMUN5312DW		60	100	-		
	SMUN5313DW		80	140	-		
	SMUN5314DW		80	140	-		
	SMUN5315DW		160	350	-		
	SMUN5316DW		160	350	-		
	SMUN5330DW		3.0	5.0	-		
	SMUN5331DW		8.0	15	-		
	SMUN5332DW		15	30	-		
	SMUN5333DW		80	200	-		
	SMUN5334DW		80	150	-		
	SMUN5335DW		80	140	-		

Note:
3. Pulse test: pulse width <300 μS, duty cycle<2.0%

ELECTRICAL CHARACTERISTICS (T_A = 25℃ unless otherwise noted)(Continued)

PARAMETER		SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
ON CHARACTERISTICS [3]							
Output Voltage(On)	SMUN5311DW	V_{OL}	-	-	0.2	Vdc	V_{CC}=5V, V_B=2.5V, R_L=1 KΩ
	SMUN5312DW		-	-	0.2		
	SMUN5314DW		-	-	0.2		
	SMUN5315DW		-	-	0.2		
	SMUN5316DW		-	-	0.2		
	SMUN5330DW		-	-	0.2		
	SMUN5331DW		-	-	0.2		
	SMUN5332DW		-	-	0.2		
	SMUN5333DW		-	-	0.2		
	SMUN5334DW		-	-	0.2		
	SMUN5335DW		-	-	0.2		
	SMUN5313DW		-	-	0.2		V_{CC}=5V, V_B=3.5V, R_L=1 KΩ
Output Voltage(Off)	SMUN5311DW	V_{OH}	4.9	-	-	Vdc	V_{CC}=5V, V_B=0.5V, R_L=1 KΩ
	SMUN5312DW		4.9	-	-		
	SMUN5313DW		4.9	-	-		
	SMUN5314DW		4.9	-	-		
	SMUN5333DW		4.9	-	-		
	SMUN5334DW		4.9	-	-		
	SMUN5335DW		4.9	-	-		
	SMUN5330DW		4.9	-	-		V_{CC}=5V, V_B=0.05V, R_L=1 KΩ
	SMUN5315DW		4.9	-	-		V_{CC}=5V, V_B=0.25V, R_L=1 KΩ
	SMUN5316DW		4.9	-	-		
	SMUN5331DW		4.9	-	-		
	SMUN5332DW		4.9	-	-		
Input Resistor	SMUN5311DW	R1	7.0	10	13	KΩ	
	SMUN5312DW		15.4	22	28.6		
	SMUN5313DW		32.9	47	61.1		
	SMUN5314DW		7.0	10	13		
	SMUN5315DW		7.0	10	13		
	SMUN5316DW		3.3	4.7	6.1		
	SMUN5330DW		0.7	1.0	1.3		
	SMUN5331DW		1.5	2.2	2.9		
	SMUN5332DW		3.3	4.7	6.1		
	SMUN5333DW		3.3	4.7	6.1		
	SMUN5334DW		15.4	22	28.6		
	SMUN5335DW		1.54	2.2	2.86		
Resistor Ratio	SMUN5311DW	R1/R2	0.8	1.0	1.2		
	SMUN5312DW		0.8	1.0	1.2		
	SMUN5313DW		0.8	1.0	1.2		
	SMUN5314DW		0.17	0.21	0.25		
	SMUN5315DW		-	-	-		
	SMUN5316DW		-	-	-		
	SMUN5330DW		0.8	1.0	1.2		
	SMUN5331DW		0.8	1.0	1.2		
	SMUN5332DW		0.8	1.0	1.2		
	SMUN5333DW		0.055	0.1	0.185		
	SMUN5334DW		0.38	0.47	0.56		
	SMUN5335DW		0.038	0.047	0.056		

Note:
3. Pulse test: pulse width <300 μS, duty cycle<2.0%

DEVICE MARKING AND RESISTOR VALUES

DEVICE	MARKING	R1(K)	R2(K)	DEVICE	MARKING	R1(K)	R2(K)
SMUN5311DW	11	10	10	SMUN5330DW	30	1.0	1.0
SMUN5312DW	12	22	22	SMUN5331DW	31	2.2	2.2
SMUN5313DW	13	47	47	SMUN5332DW	32	4.7	4.7
SMUN5314DW	14	10	47	SMUN5333DW	33	4.7	47
SMUN5315DW	15	10	∞	SMUN5334DW	34	22	47
SMUN5316DW	16	4.7	∞	SMUN5335DW	35	2.2	47

CHARACTERISTIC CURVES

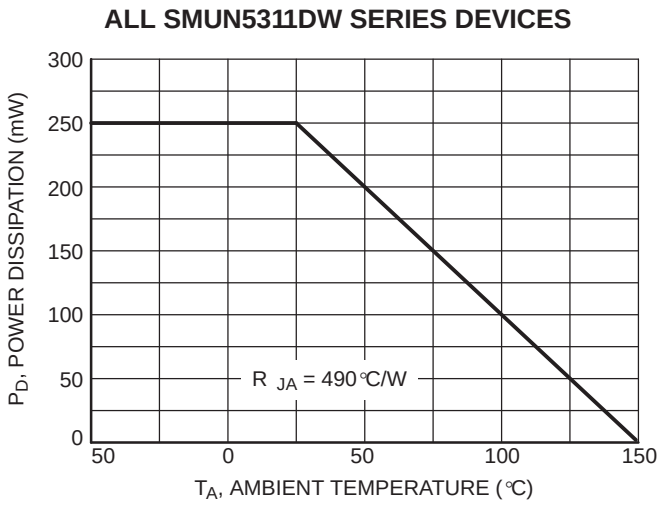


Figure 1. Derating Curve

CHARACTERISTIC CURVES

TYPICAL ELECTRICAL CHARACTERISTICS SMUN5311DW NPN TRANSISTOR

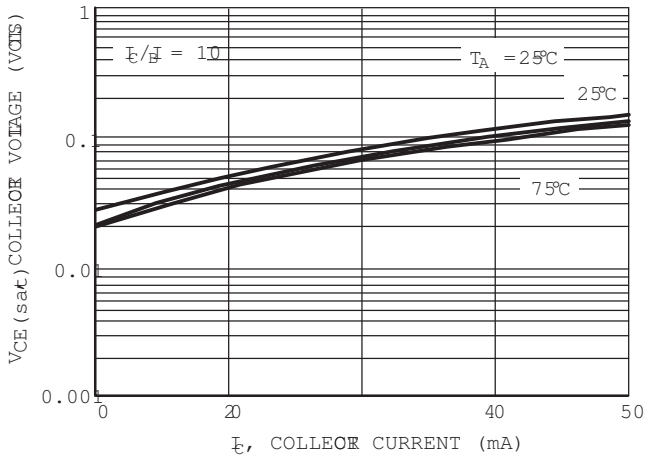


Figure 2. $V_{CE(sat)}$ versus I_C

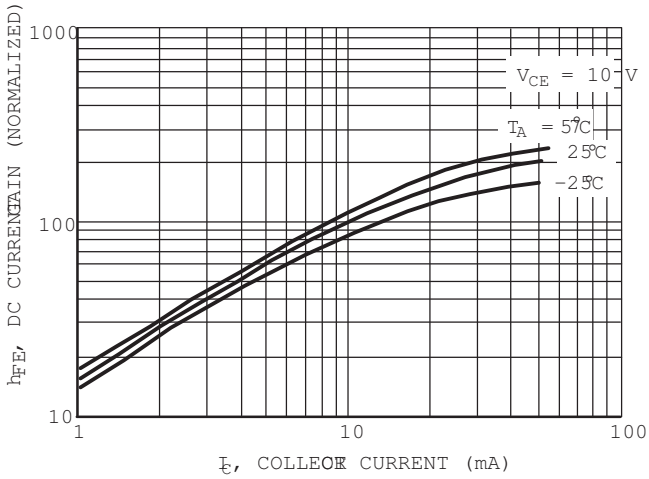


Figure 3. DC Current Gain

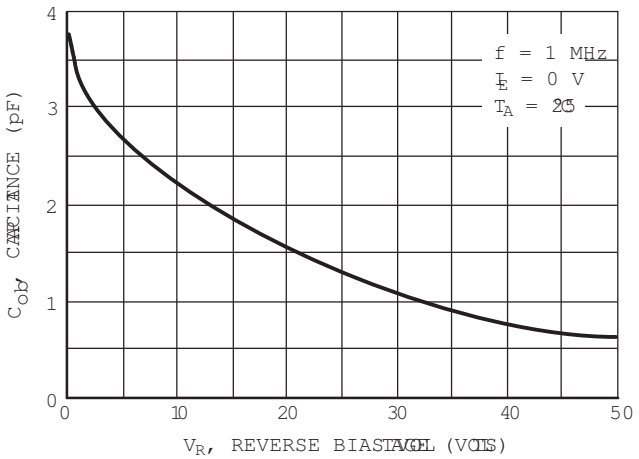


Figure 4. Output Capacitance

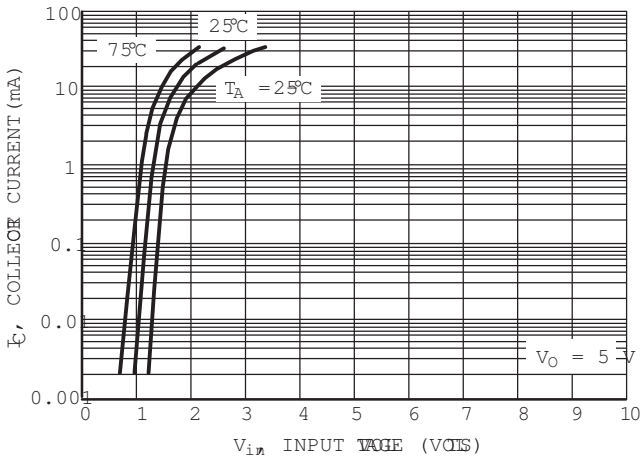


Figure 5. Output Current versus Input Voltage

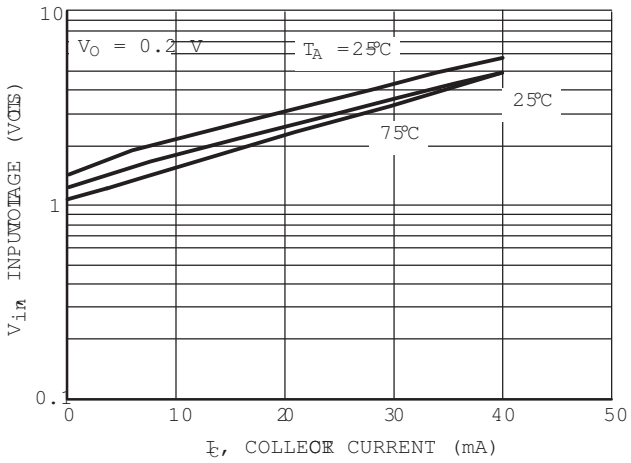


Figure 6. Input Voltage versus Output Current

CHARACTERISTIC CURVES

TYPICAL ELECTRICAL CHARACTERISTICS SMUN5311DW PNP TRANSISTOR

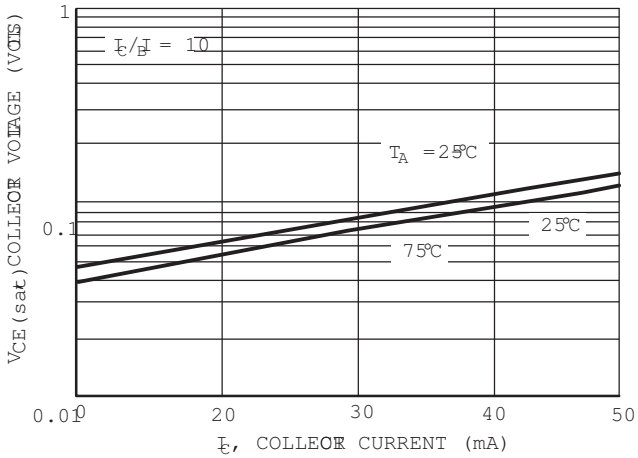


Figure 7. $V_{CE(sat)}$ versus I_C

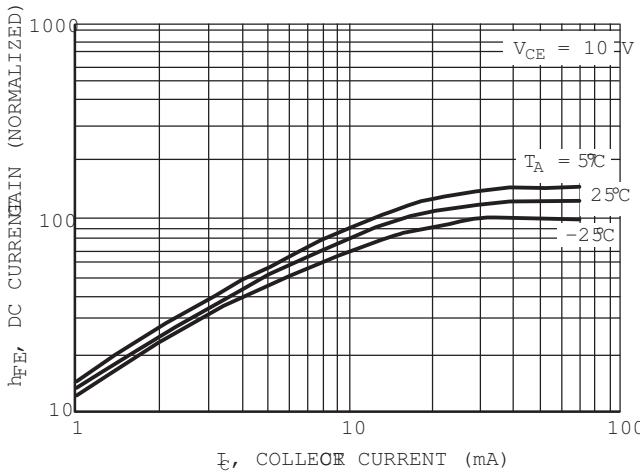


Figure 8. DC Current Gain

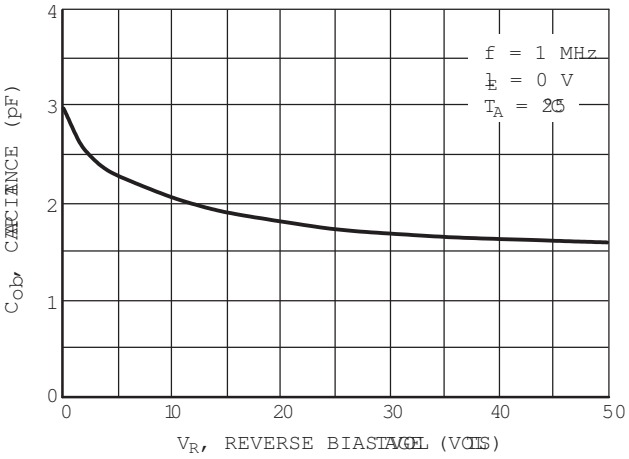


Figure 9. Output Capacitance

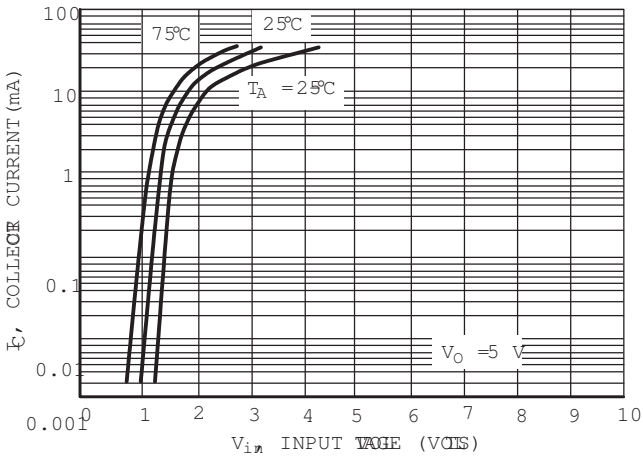


Figure 10. Output Current versus Input Voltage

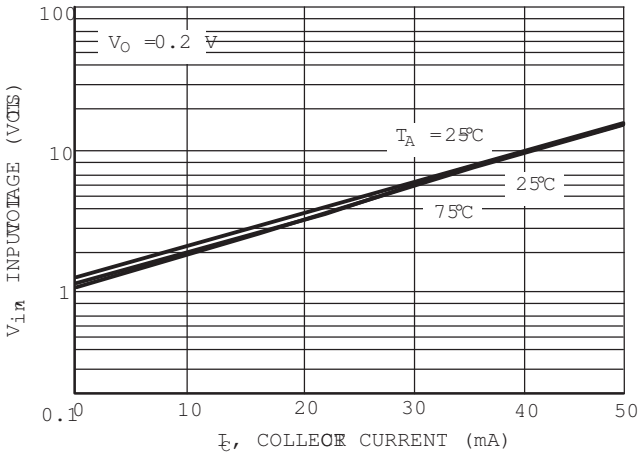


Figure 11. Input Voltage versus Output Current

CHARACTERISTIC CURVES

TYPICAL ELECTRICAL CHARACTERISTICS SMUN5312DW NPN TRANSISTOR

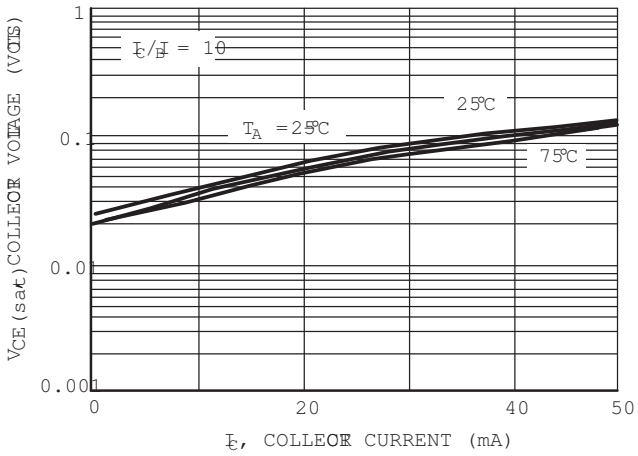


Figure 12. $V_{CE(sat)}$ versus I_C

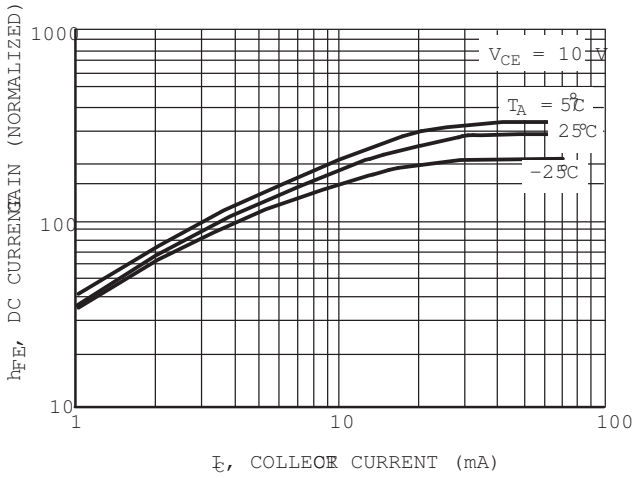


Figure 13. DC Current Gain

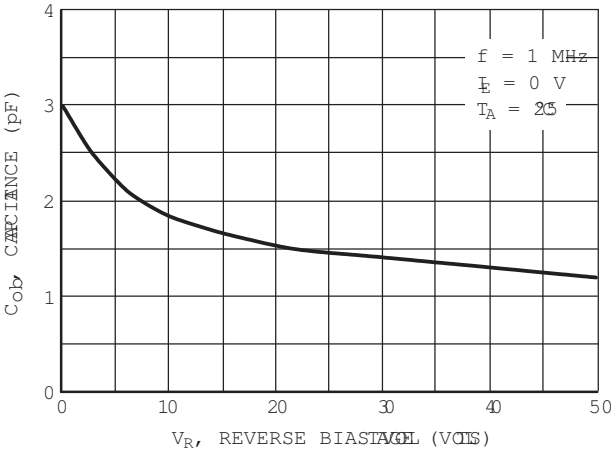


Figure 14. Output Capacitance

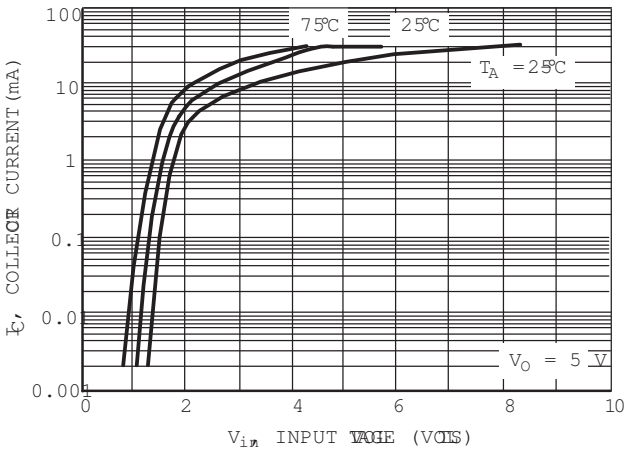


Figure 15. Output Current versus Input Voltage

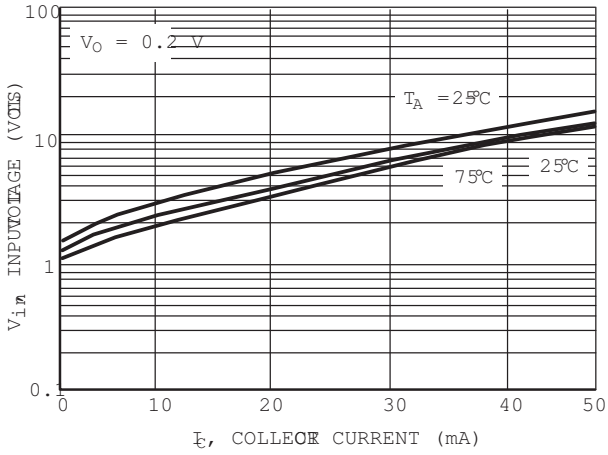


Figure 16. Input Voltage versus Output Current

CHARACTERISTIC CURVES

TYPICAL ELECTRICAL CHARACTERISTICS SMUN5312DW PNP TRANSISTOR

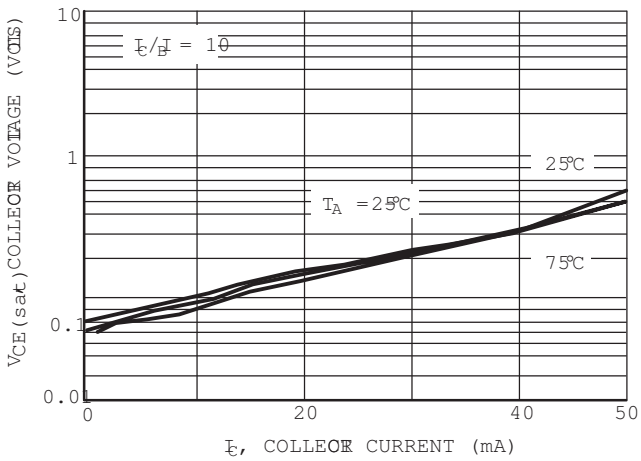


Figure 17. $V_{CE(sat)}$ versus I_C

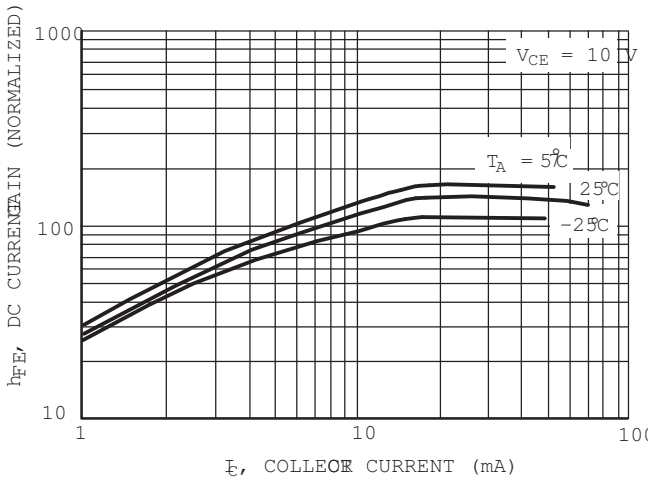


Figure 18. DC Current Gain

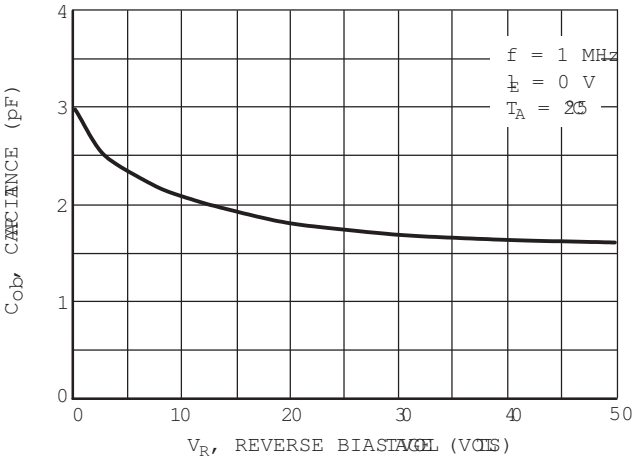


Figure 19. Output Capacitance

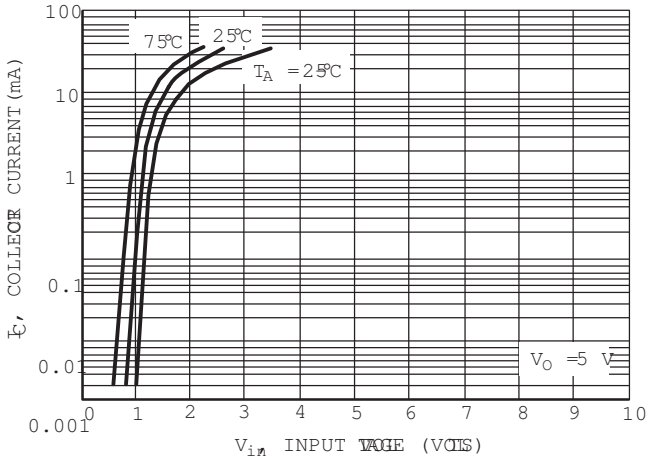


Figure 20. Output Current versus Input Voltage

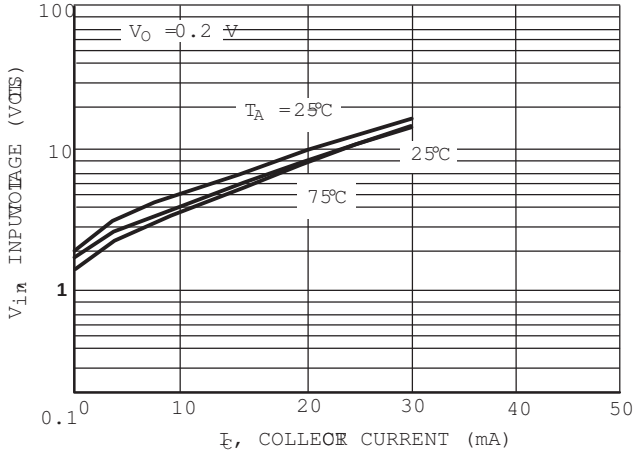


Figure 21. Input Voltage versus Output Current

CHARACTERISTIC CURVES

TYPICAL ELECTRICAL CHARACTERISTICS SMUN5313DW NPN TRANSISTOR

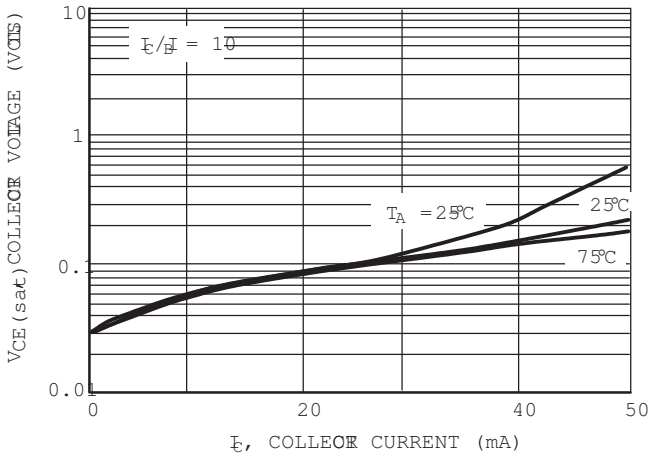


Figure 22. $V_{CE(sat)}$ versus I_C

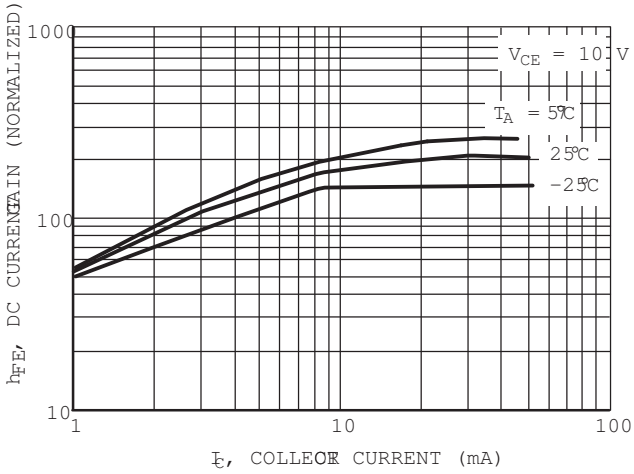


Figure 23. DC Current Gain

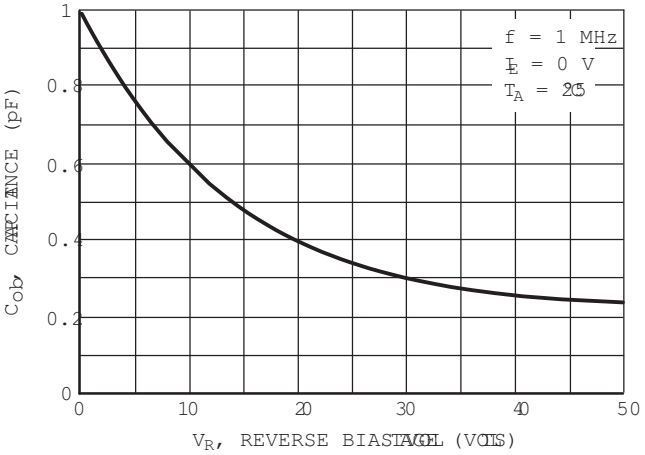


Figure 24. Output Capacitance

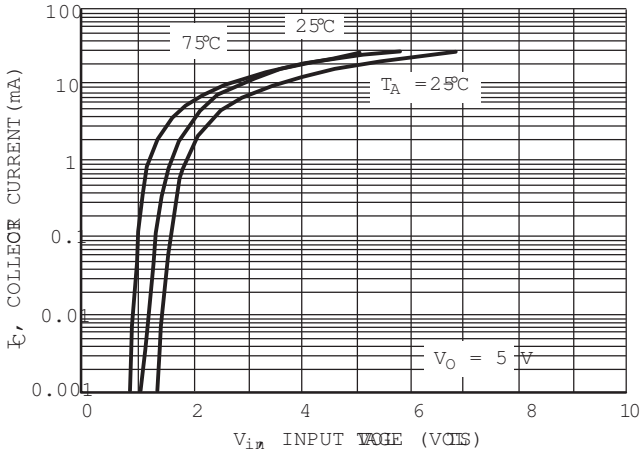


Figure 25. Output Current versus Input Voltage

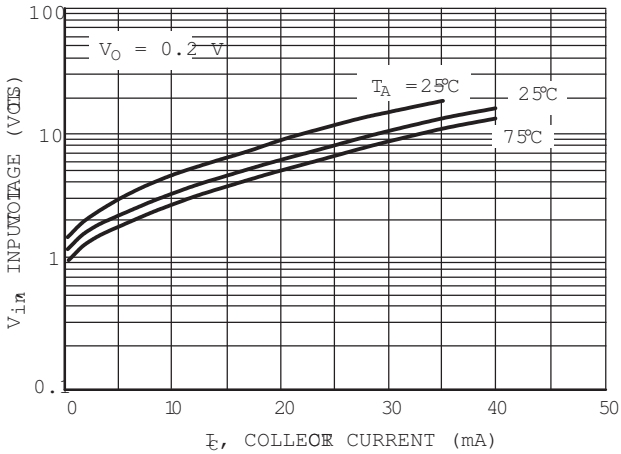


Figure 26. Input Voltage versus Output Current

CHARACTERISTIC CURVES

TYPICAL ELECTRICAL CHARACTERISTICS SMUN5313DW PNP TRANSISTOR

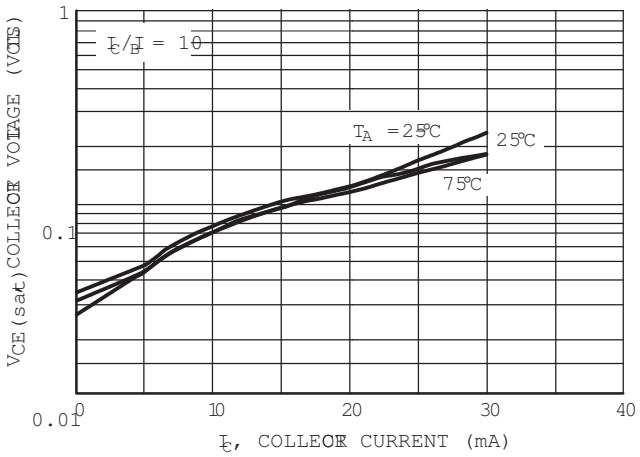


Figure 27. $V_{CE(sat)}$ versus I_C

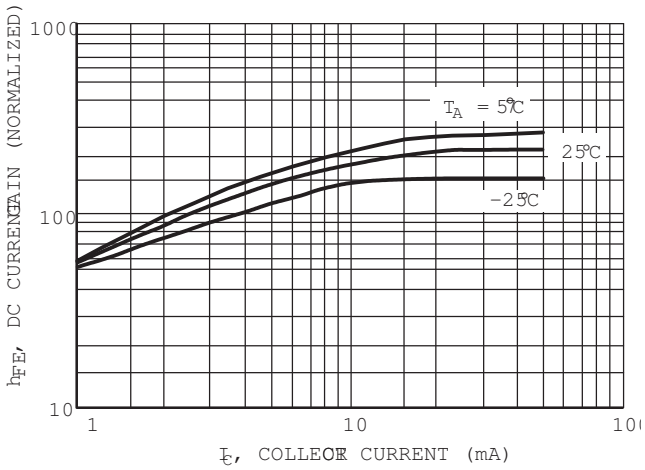


Figure 28. DC Current Gain

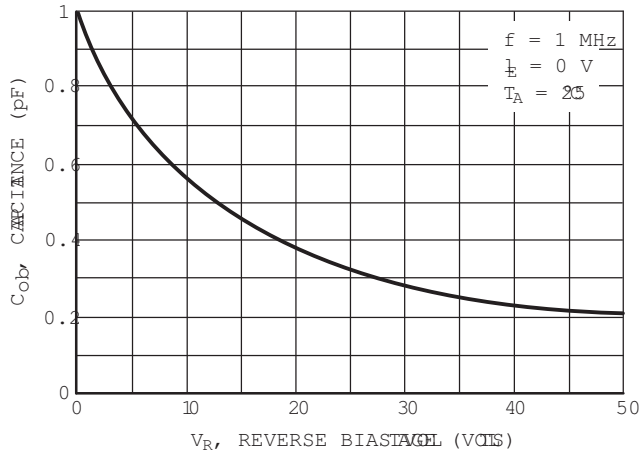


Figure 29. Output Capacitance

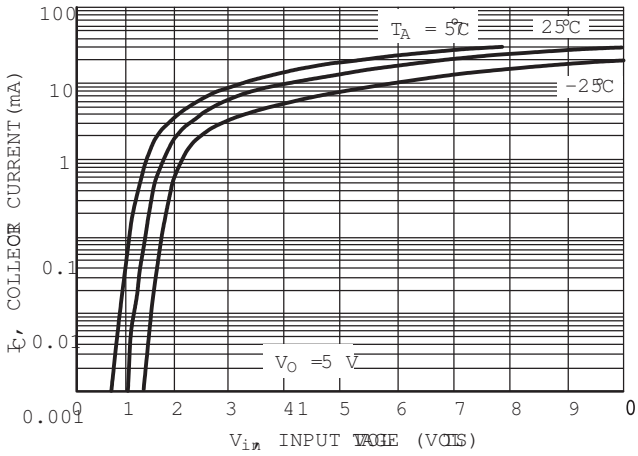


Figure 30. Output Current versus Input Voltage

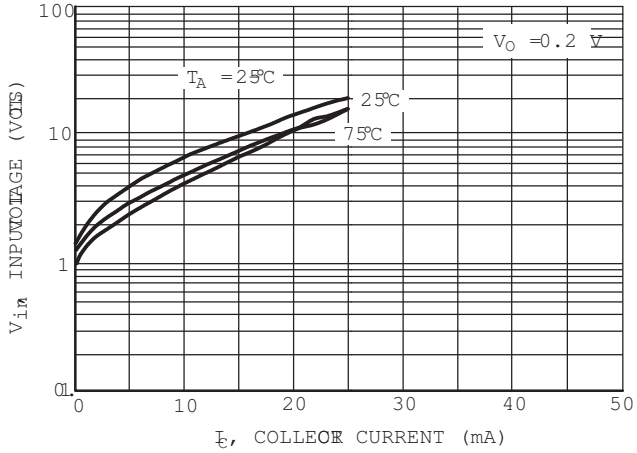


Figure 31. Input Voltage versus Output Current

CHARACTERISTIC CURVES

TYPICAL ELECTRICAL CHARACTERISTICS SMUN5314DW NPN TRANSISTOR

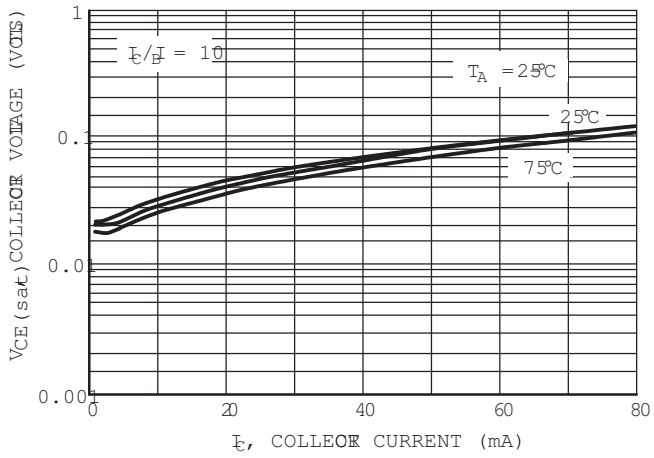


Figure 32. $V_{CE(sat)}$ versus I_C

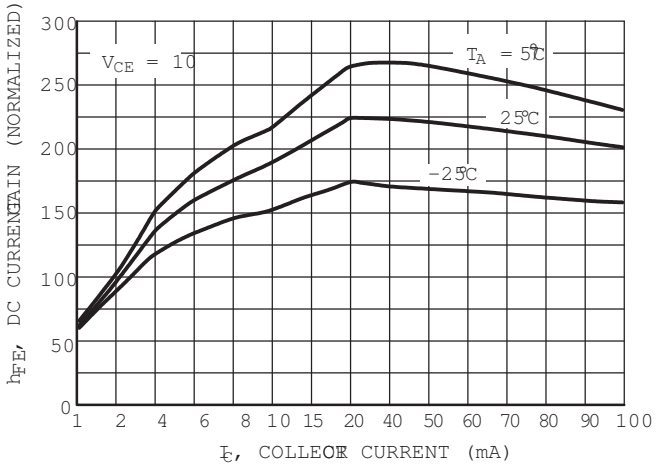


Figure 33. DC Current Gain

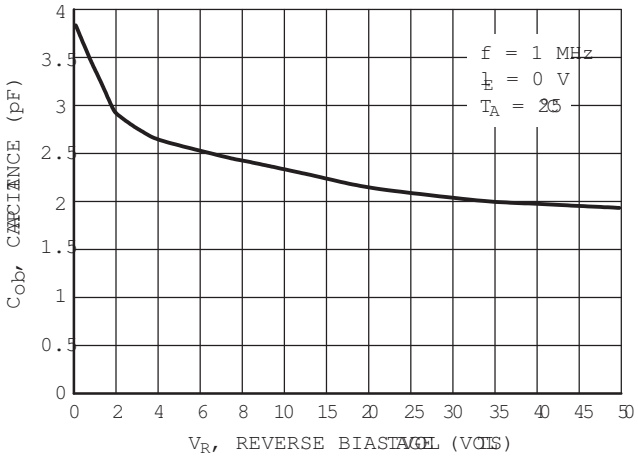


Figure 34. Output Capacitance

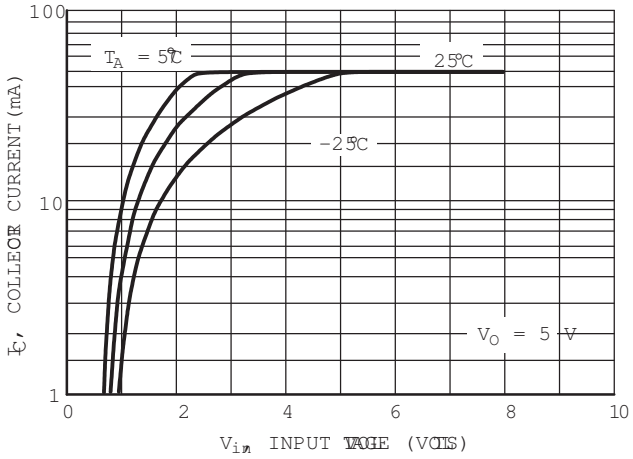


Figure 35. Output Current versus Input Voltage

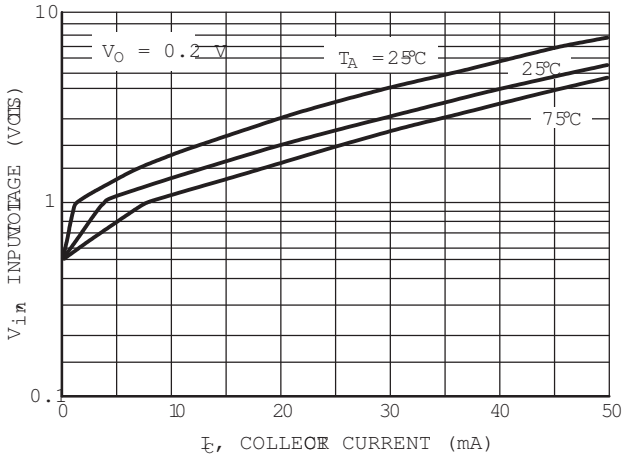


Figure 36. Input Voltage versus Output Current

CHARACTERISTIC CURVES

TYPICAL ELECTRICAL CHARACTERISTICS SMUN5314DW PNP TRANSISTOR

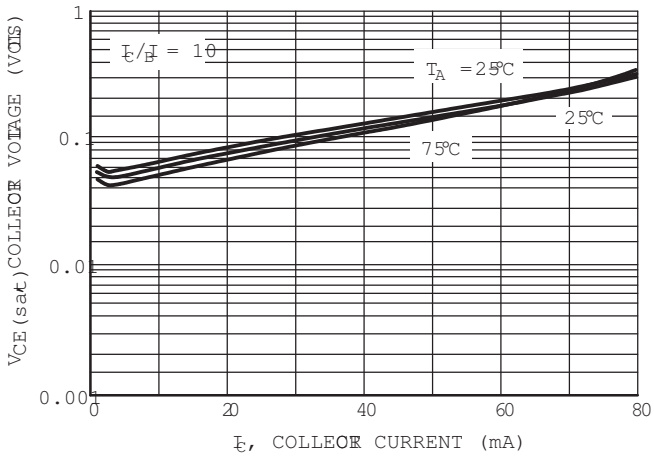


Figure 37. $V_{CE(sat)}$ versus I_C

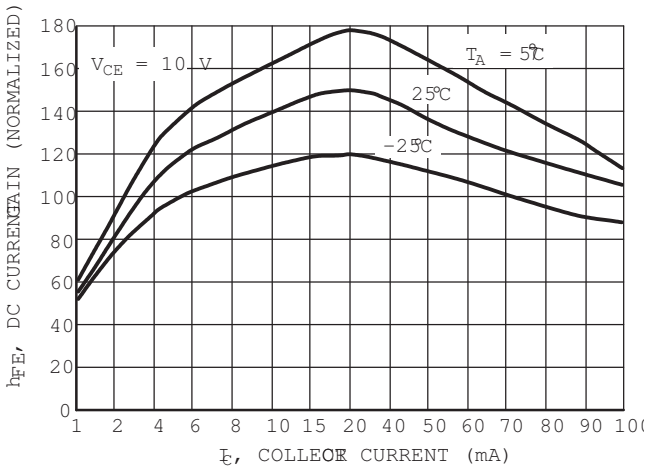


Figure 38. DC Current Gain

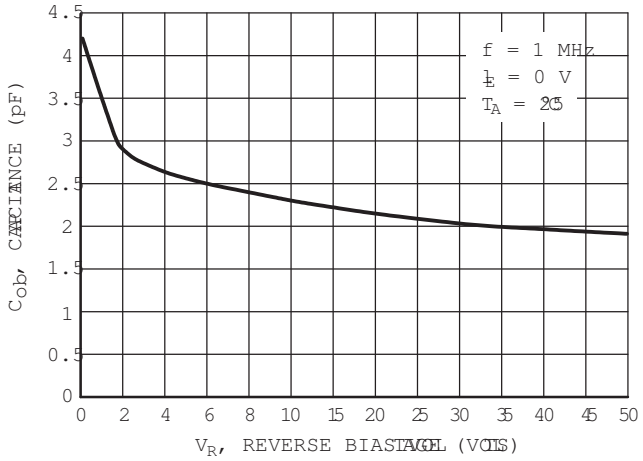


Figure 39. Output Capacitance

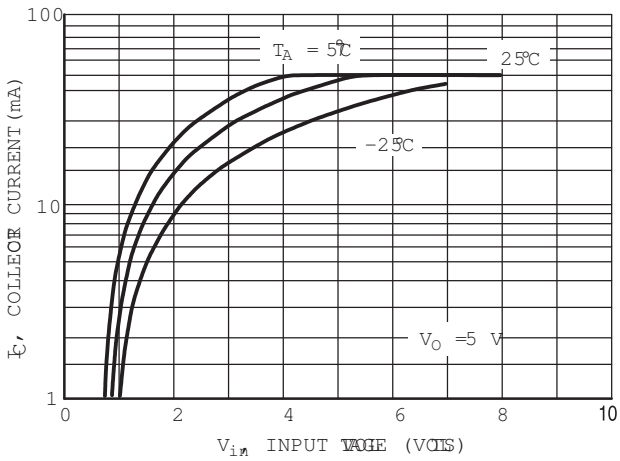


Figure 40. Output Current versus Input Voltage

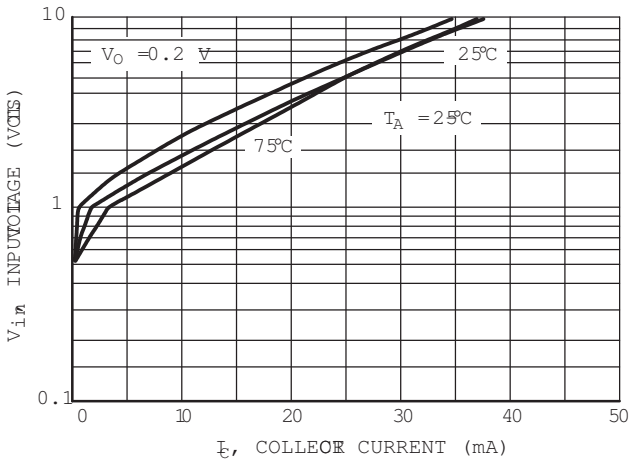


Figure 41. Input Voltage versus Output Current

CHARACTERISTIC CURVES

TYPICAL ELECTRICAL CHARACTERISTICS — SMUN5315DW NPN TRANSISTOR

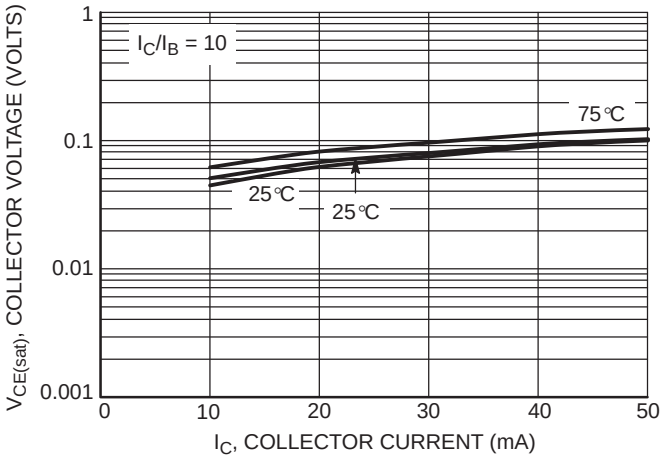


Figure 42. $V_{CE(sat)}$ versus I_C

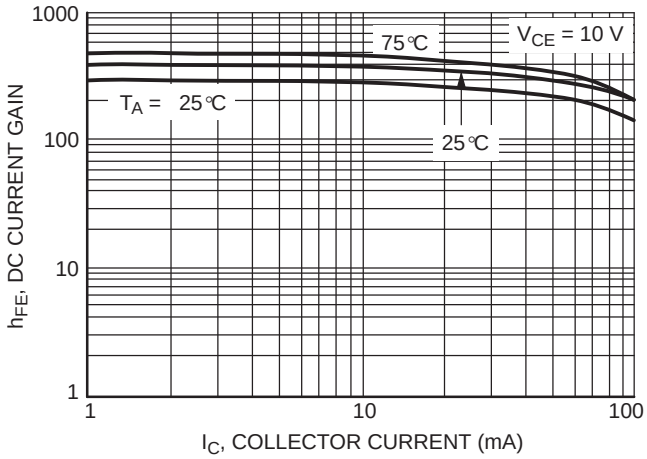


Figure 43. DC Current Gain

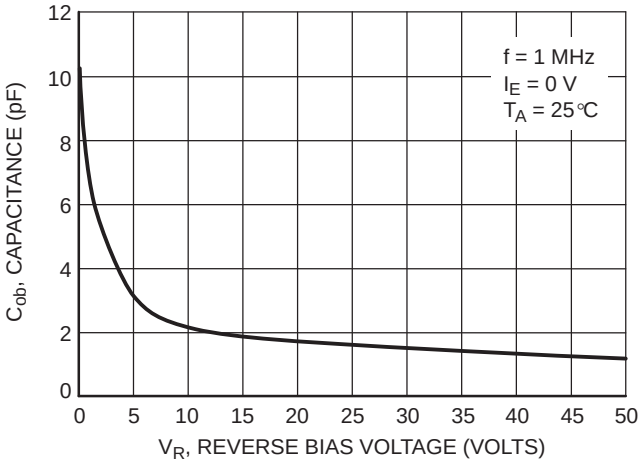


Figure 44. Output Capacitance

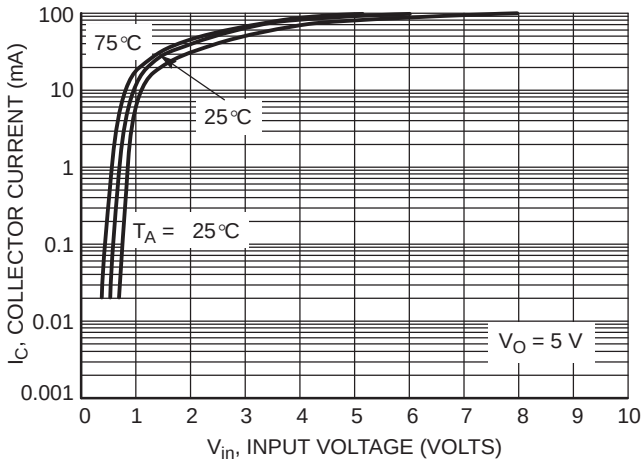


Figure 45. Output Current versus Input Voltage

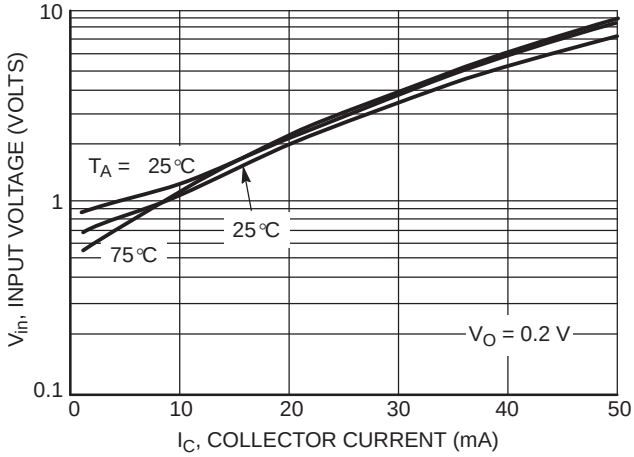


Figure 46. Input Voltage versus Output Current

CHARACTERISTIC CURVES

TYPICAL ELECTRICAL CHARACTERISTICS — SMUN5315DW PNP TRANSISTOR

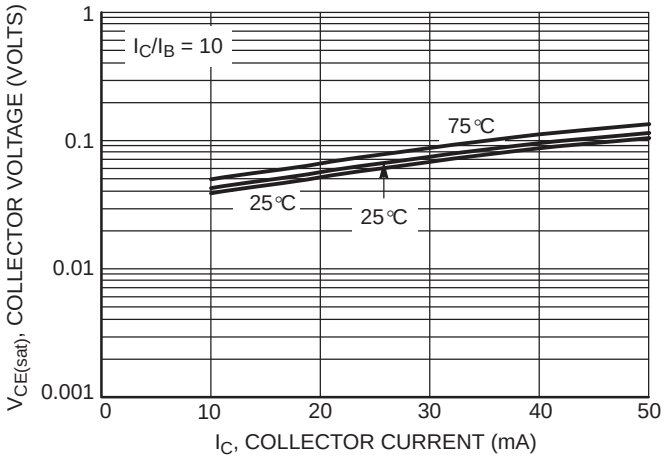


Figure 47. $V_{CE(sat)}$ versus I_C

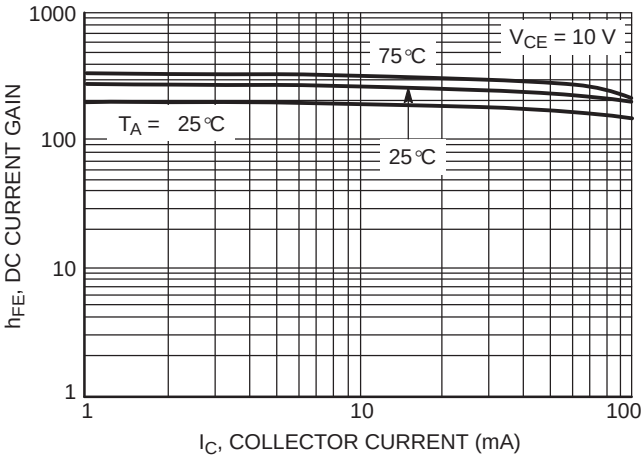


Figure 48. DC Current Gain

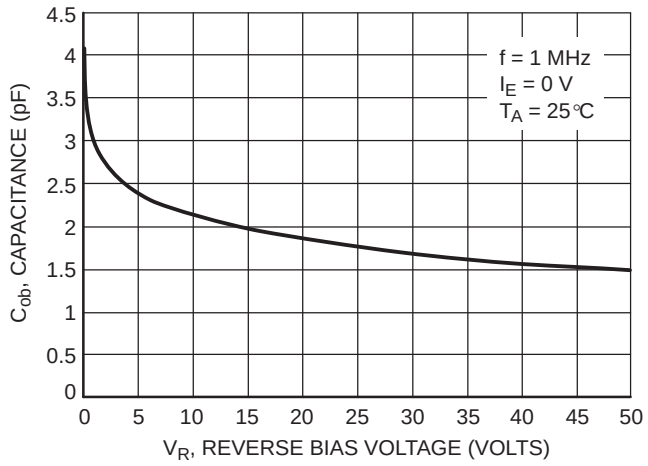


Figure 49. Output Capacitance

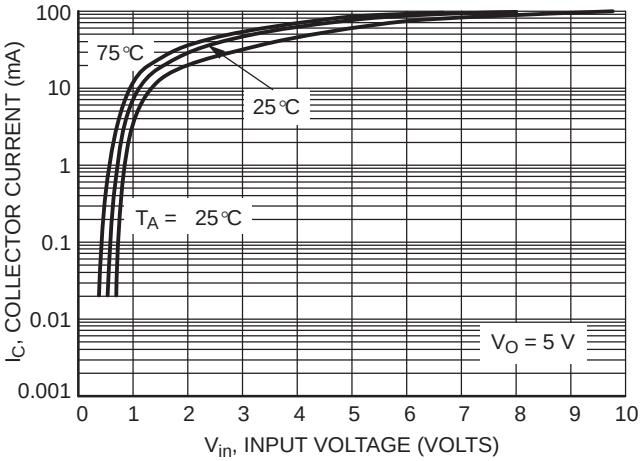


Figure 50. Output Current versus Input Voltage

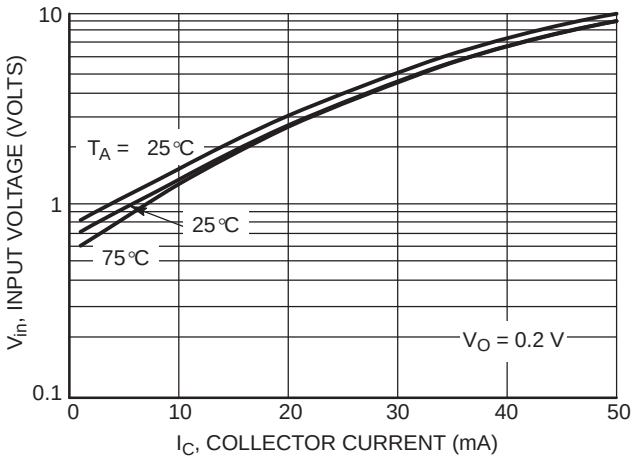


Figure 51. Input Voltage versus Output Current

CHARACTERISTIC CURVES

TYPICAL ELECTRICAL CHARACTERISTICS — SMUN5316DW NPN TRANSISTOR

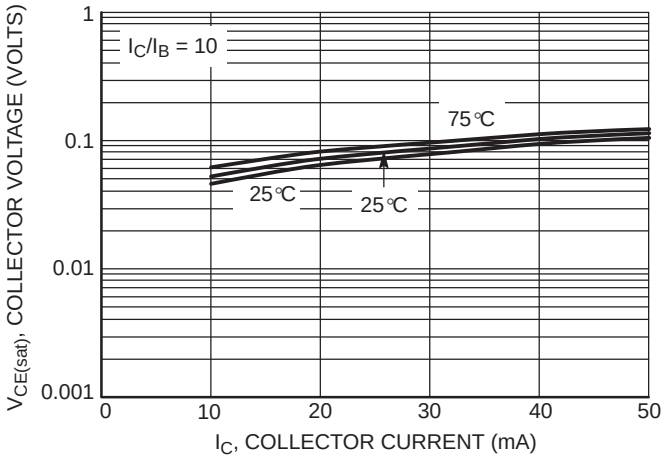


Figure 52. $V_{CE(sat)}$ versus I_C

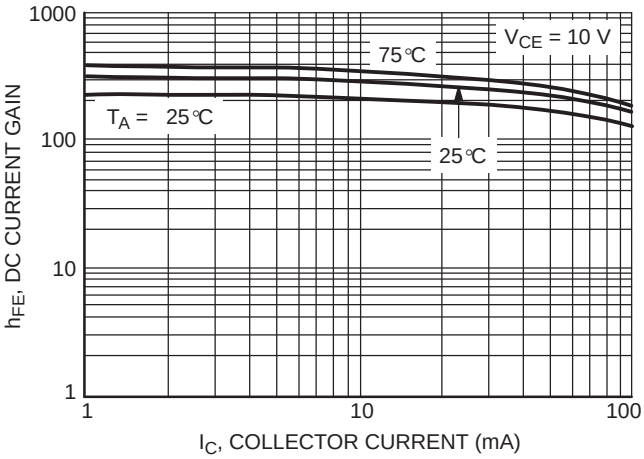


Figure 53. DC Current Gain

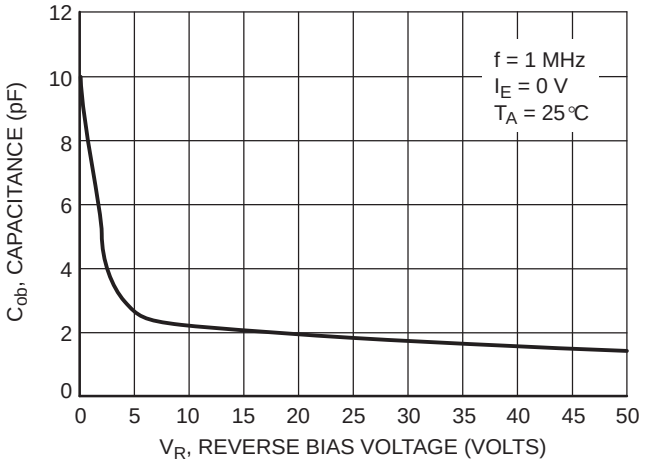


Figure 54. Output Capacitance

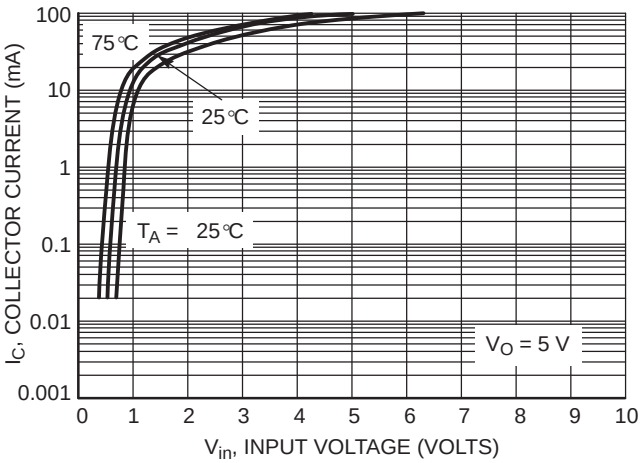


Figure 55. Output Current versus Input Voltage

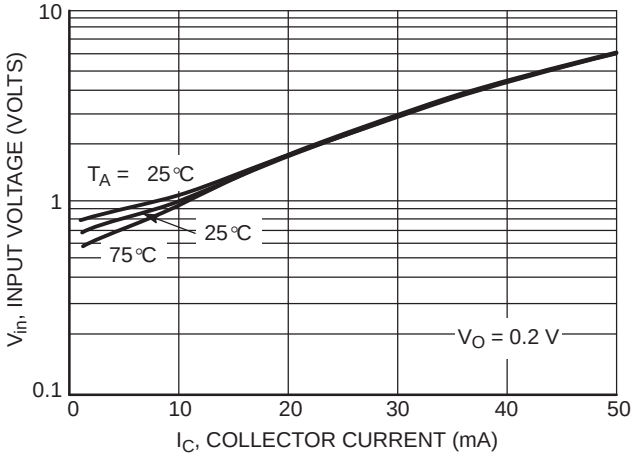


Figure 56. Input Voltage versus Output Current

CHARACTERISTIC CURVES

TYPICAL ELECTRICAL CHARACTERISTICS — SMUN5316DW PNP TRANSISTOR

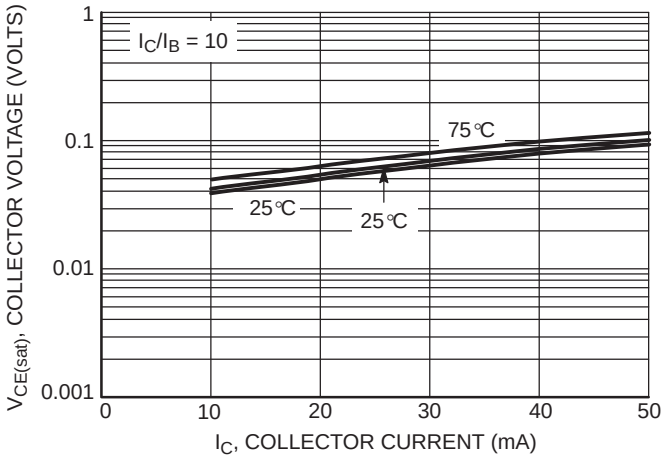


Figure 57. $V_{CE(sat)}$ versus I_C

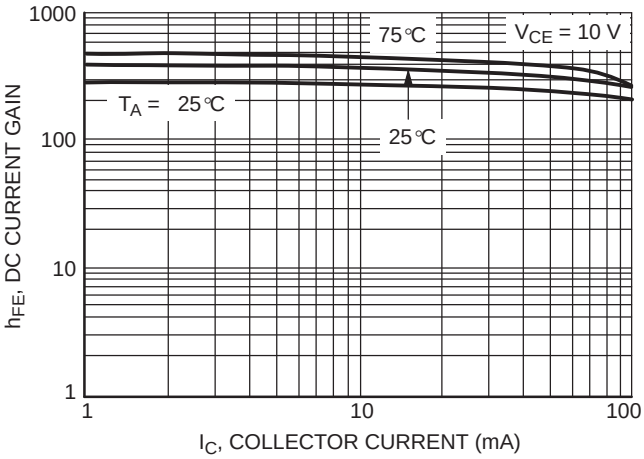


Figure 58. DC Current Gain

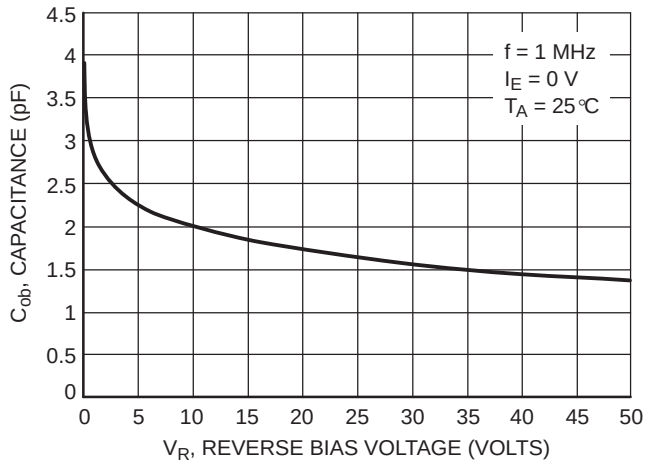


Figure 59. Output Capacitance

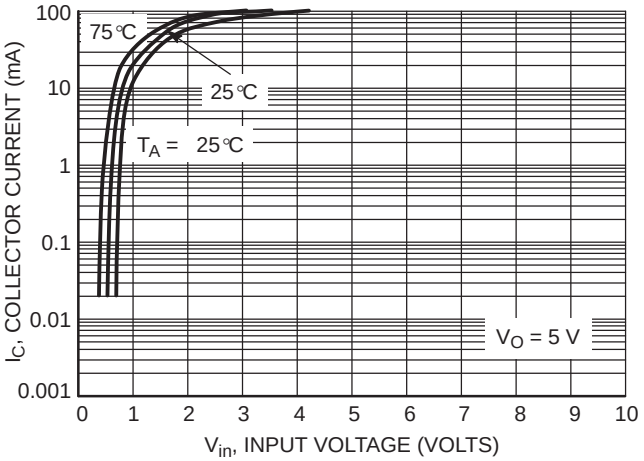


Figure 60. Output Current versus Input Voltage

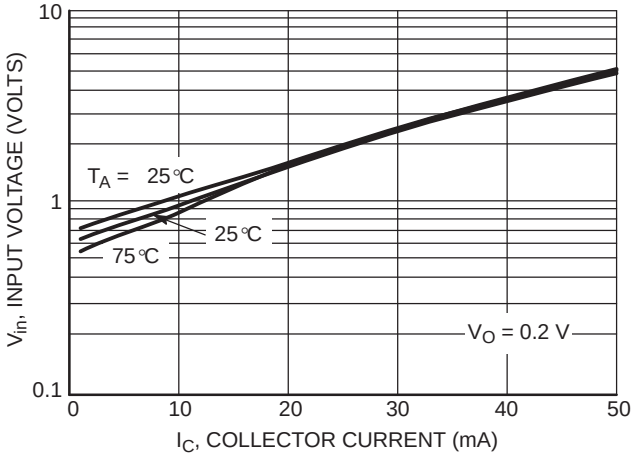


Figure 61. Input Voltage versus Output Current

CHARACTERISTIC CURVES

TYPICAL ELECTRICAL CHARACTERISTICS — SMUN5330DW NPN TRANSISTOR

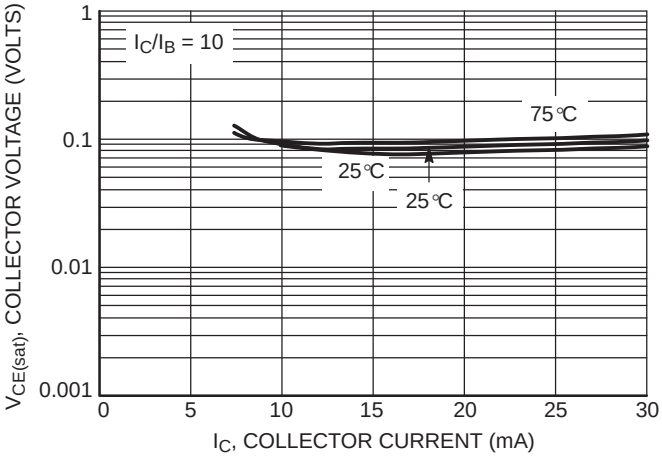


Figure 62. $V_{CE(sat)}$ versus I_C

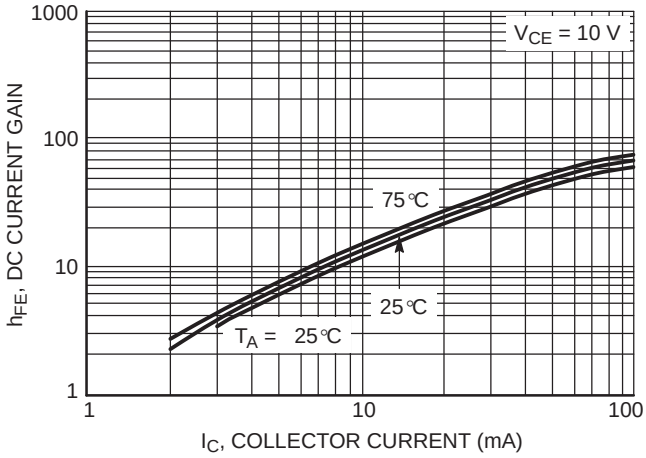


Figure 63. DC Current Gain

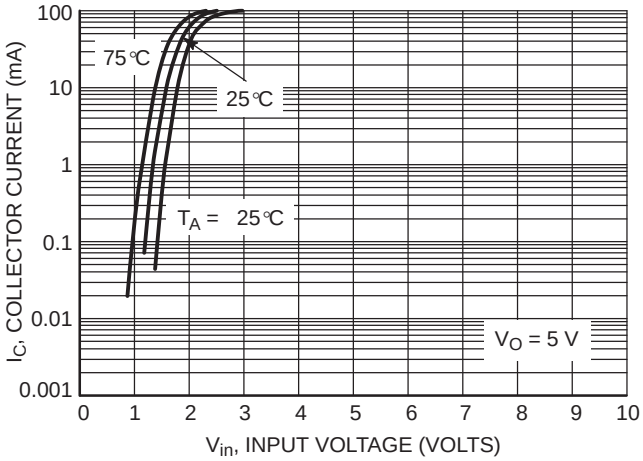


Figure 64. Output Current versus Input Voltage

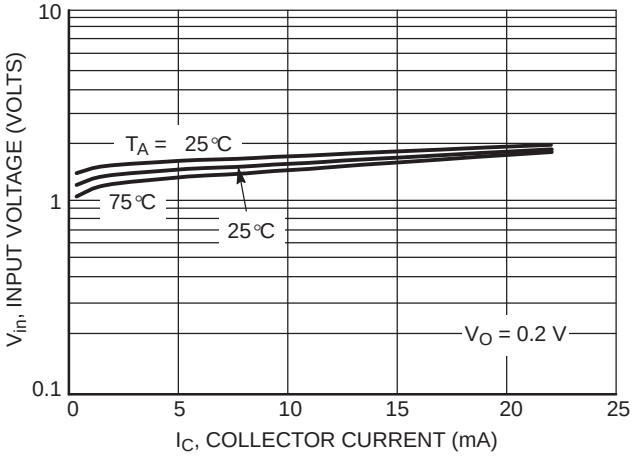


Figure 65. Input Voltage versus Output Current

CHARACTERISTIC CURVES

TYPICAL ELECTRICAL CHARACTERISTICS — SMUN5330DW PNP TRANSISTOR

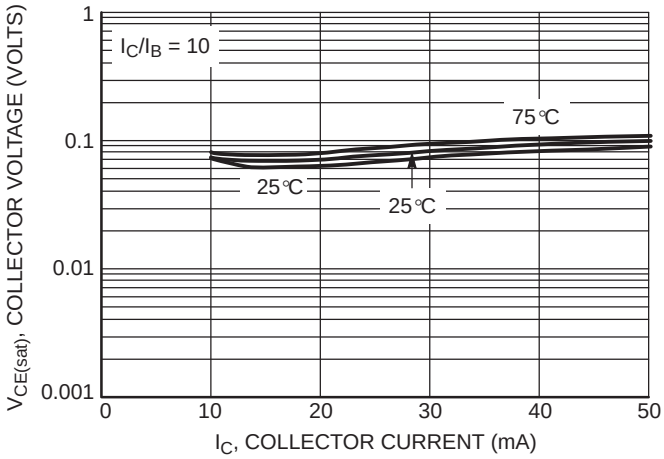


Figure 66. $V_{CE(sat)}$ versus I_C

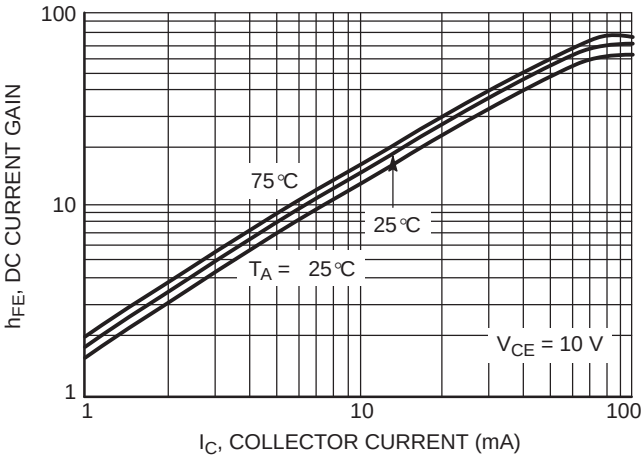


Figure 67. DC Current Gain

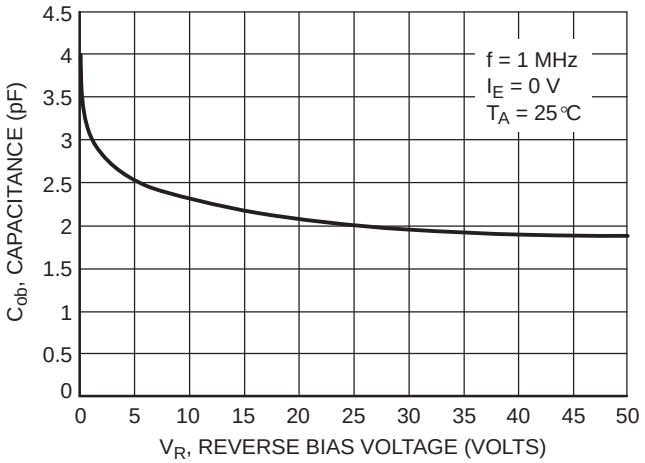


Figure 68. Output Capacitance

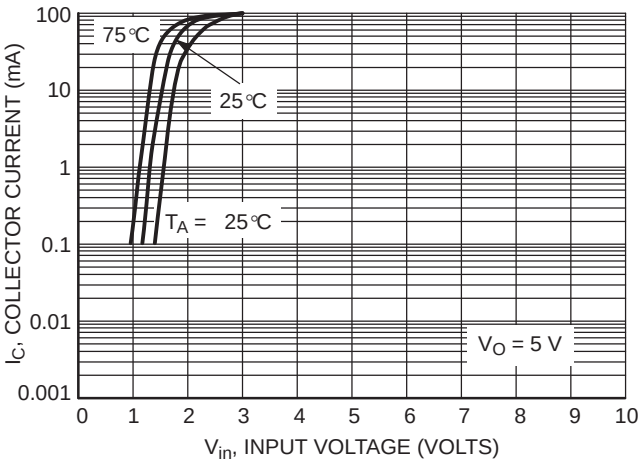


Figure 69. Output Current versus Input Voltage

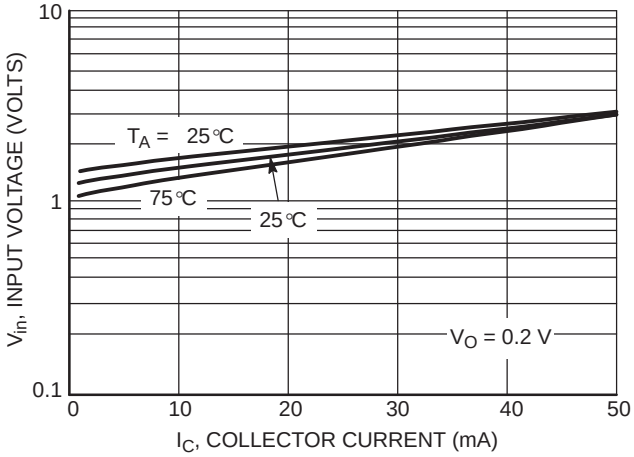


Figure 70. Input Voltage versus Output Current

CHARACTERISTIC CURVES

TYPICAL ELECTRICAL CHARACTERISTICS — SMUN5331DW NPN TRANSISTOR

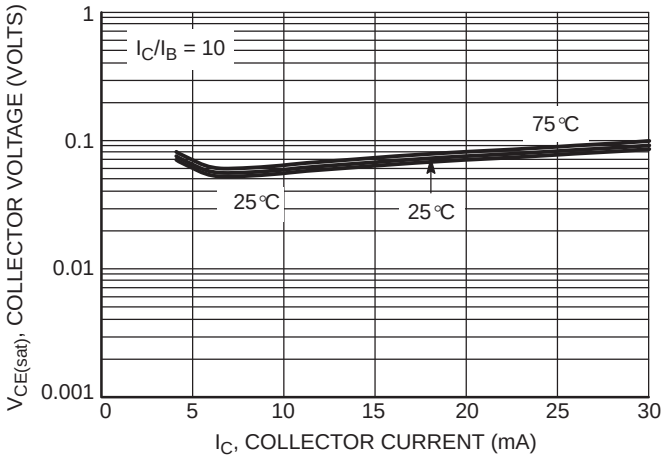


Figure 71. $V_{CE(sat)}$ versus I_C

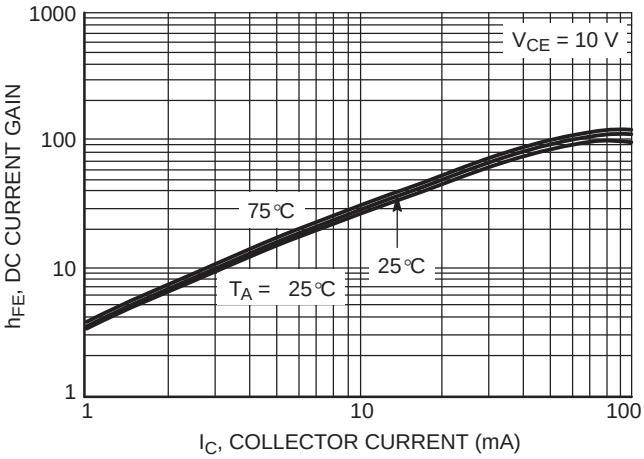


Figure 72. DC Current Gain

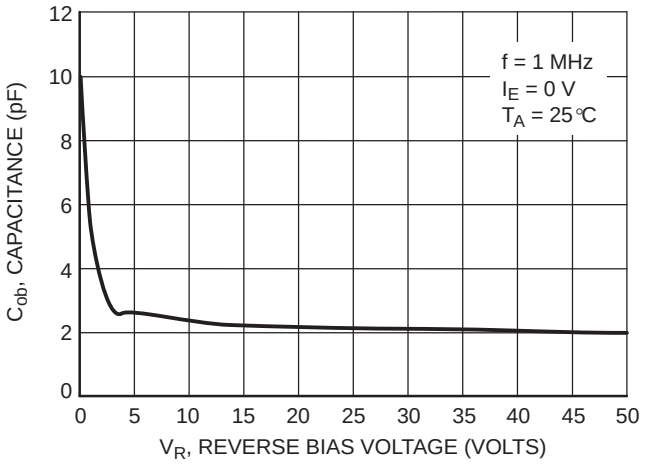


Figure 73. Output Capacitance

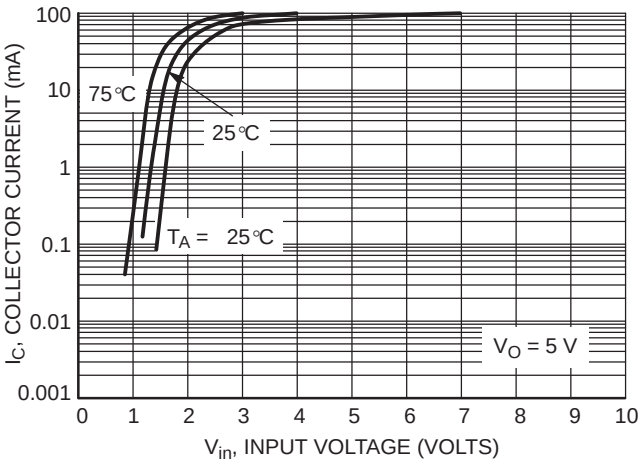


Figure 74. Output Current versus Input Voltage

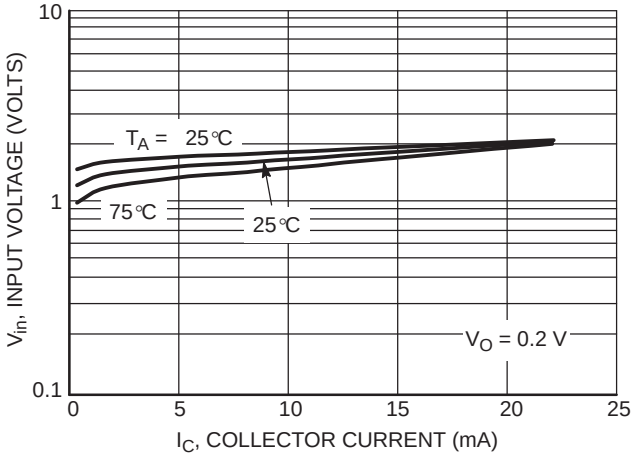


Figure 75. Input Voltage versus Output Current

CHARACTERISTIC CURVES

TYPICAL ELECTRICAL CHARACTERISTICS — SMUN5331DW PNP TRANSISTOR

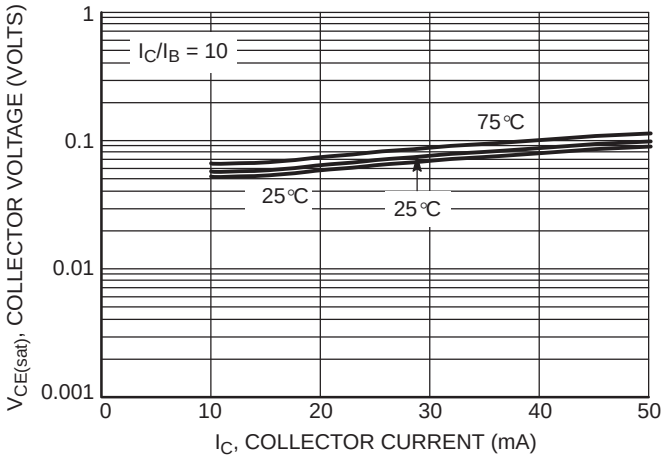


Figure 76. $V_{CE(sat)}$ versus I_C

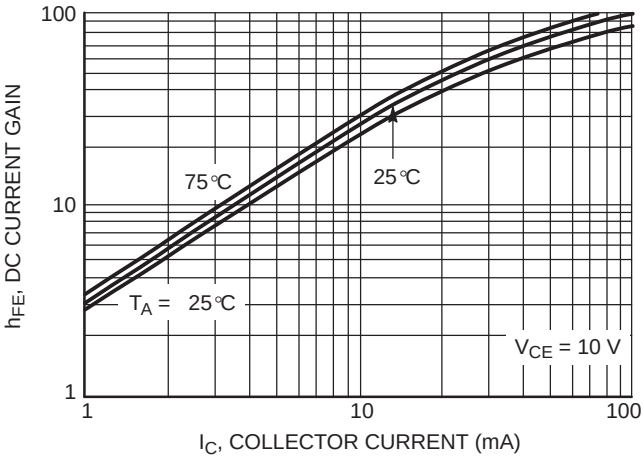


Figure 77. DC Current Gain

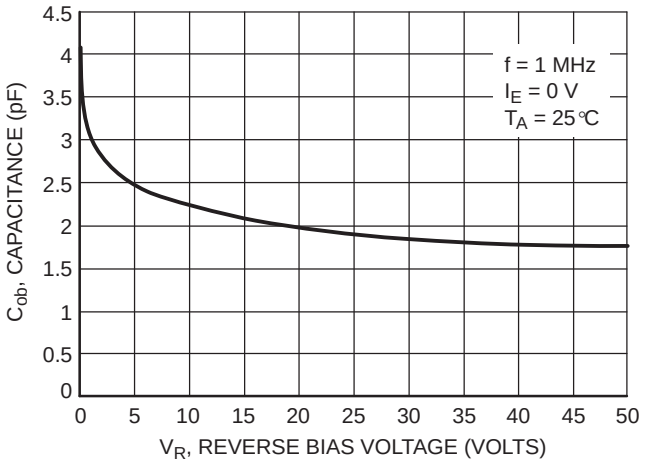


Figure 78. Output Capacitance

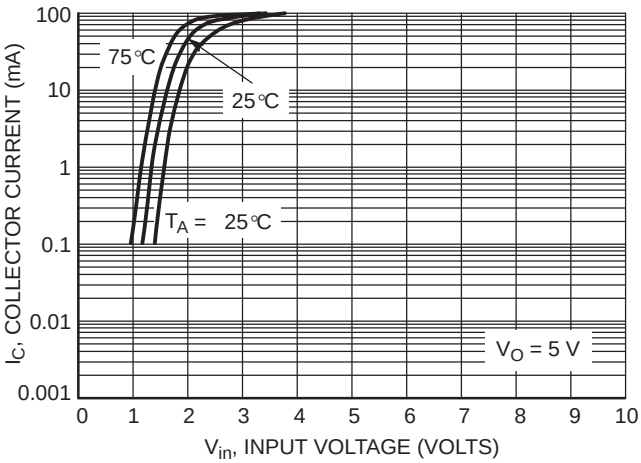


Figure 79. Output Current versus Input Voltage

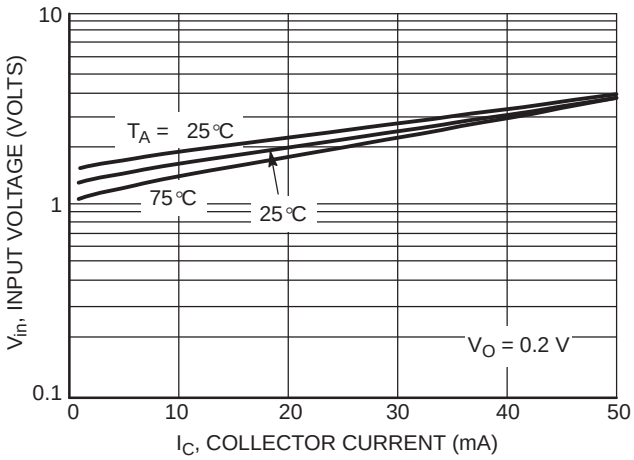


Figure 80. Input Voltage versus Output Current

CHARACTERISTIC CURVES

TYPICAL ELECTRICAL CHARACTERISTICS — SMUN5332DW NPN TRANSISTOR

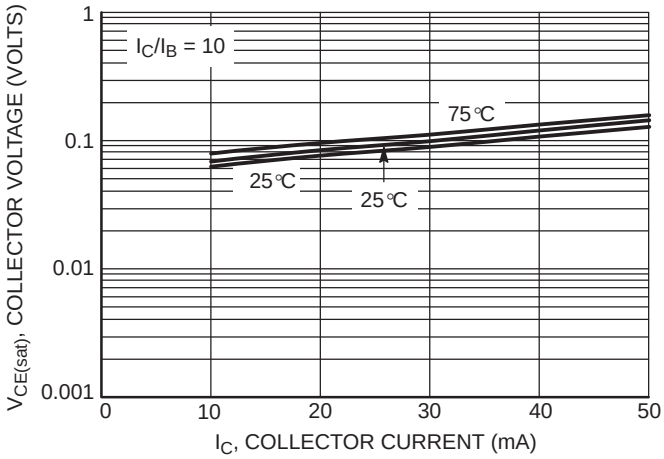


Figure 81. $V_{CE(sat)}$ versus I_C

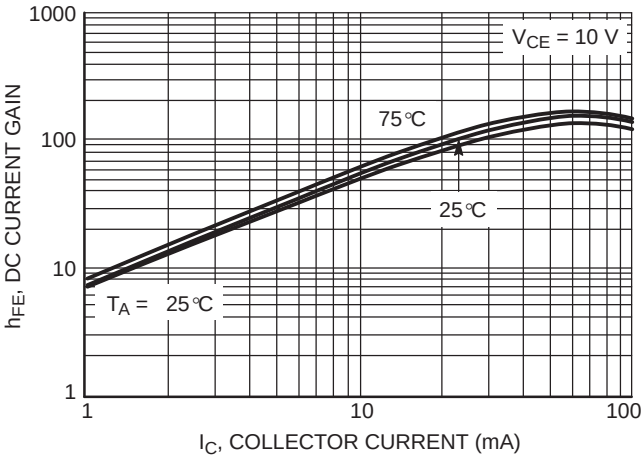


Figure 82. DC Current Gain

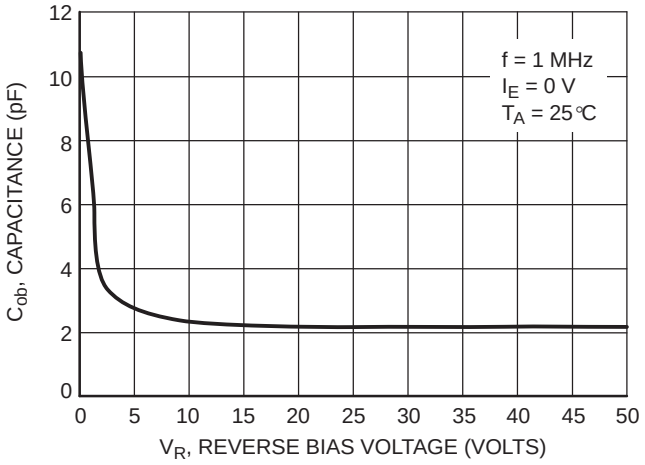


Figure 83. Output Capacitance

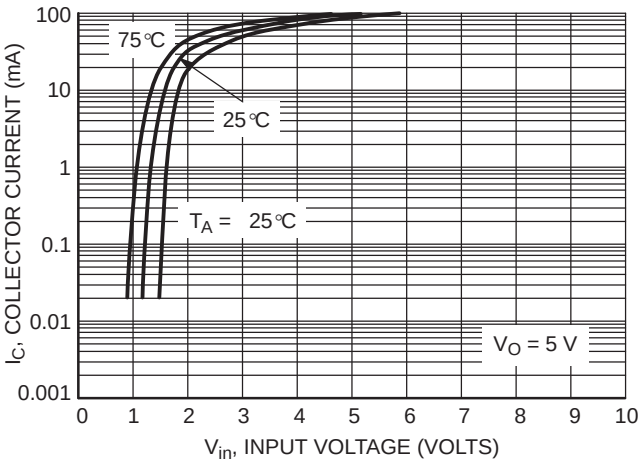


Figure 84. Output Current versus Input Voltage

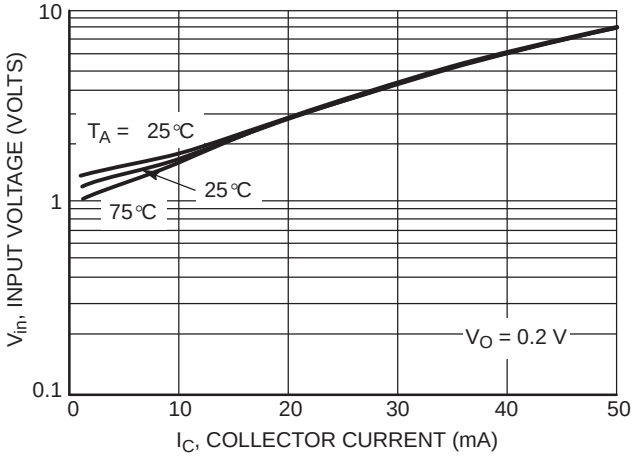


Figure 85. Input Voltage versus Output Current

CHARACTERISTIC CURVES

TYPICAL ELECTRICAL CHARACTERISTICS — SMUN5332DW PNP TRANSISTOR

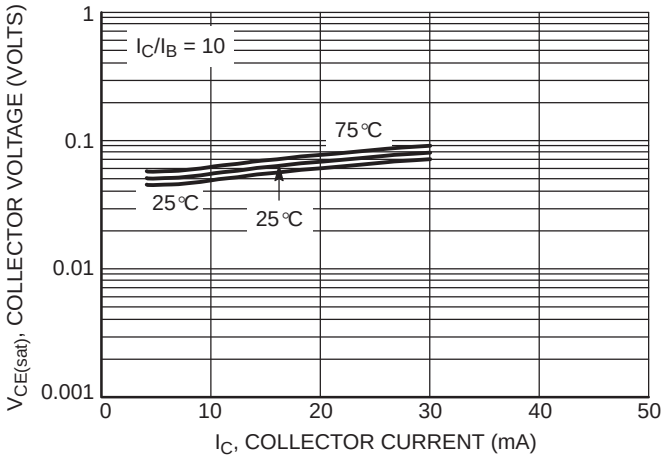


Figure 86. $V_{CE(sat)}$ versus I_C

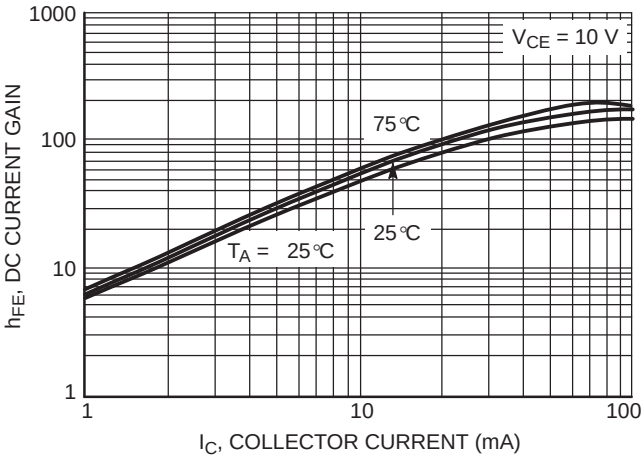


Figure 87. DC Current Gain

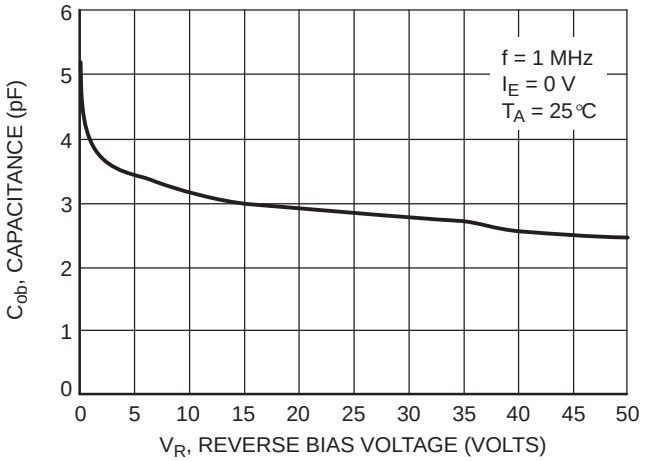


Figure 88. Output Capacitance

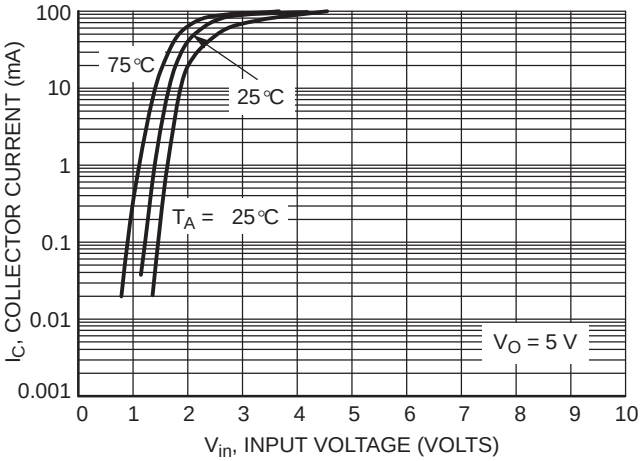


Figure 89. Output Current versus Input Voltage

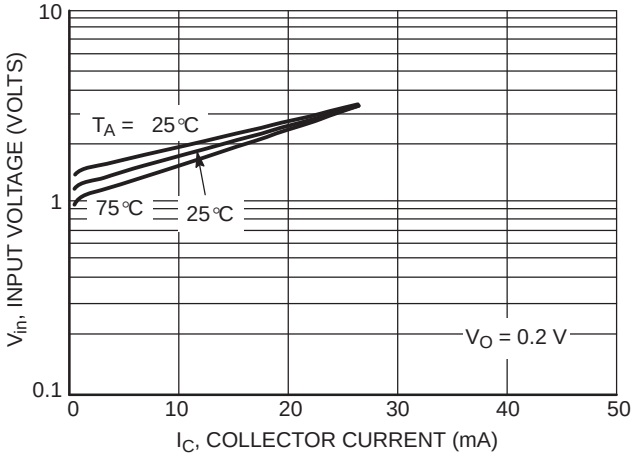


Figure 90. Input Voltage versus Output Current

CHARACTERISTIC CURVES

TYPICAL ELECTRICAL CHARACTERISTICS — SMUN5333DW NPN TRANSISTOR

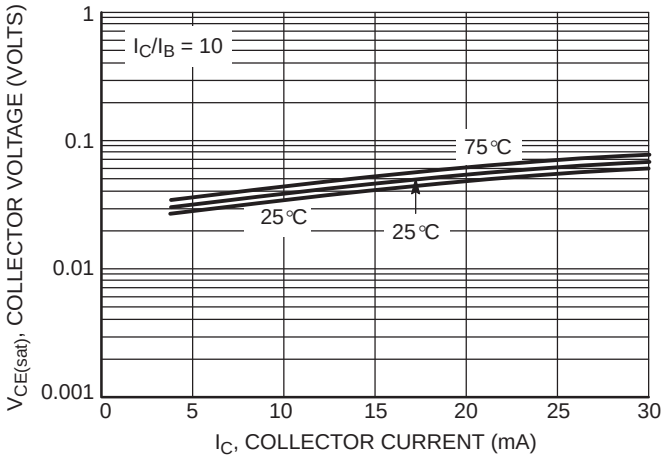


Figure 91. $V_{CE(sat)}$ versus I_C

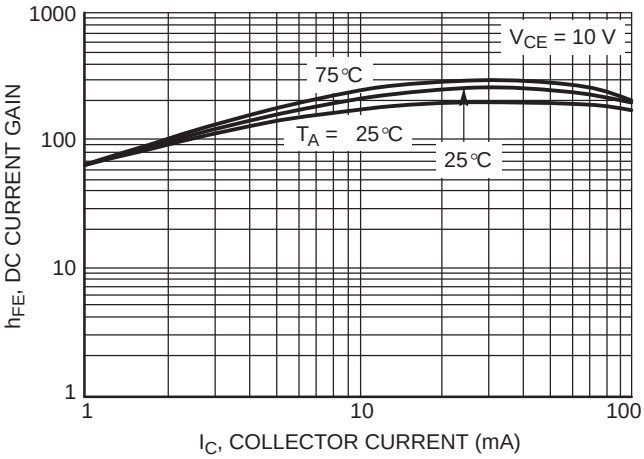


Figure 92. DC Current Gain

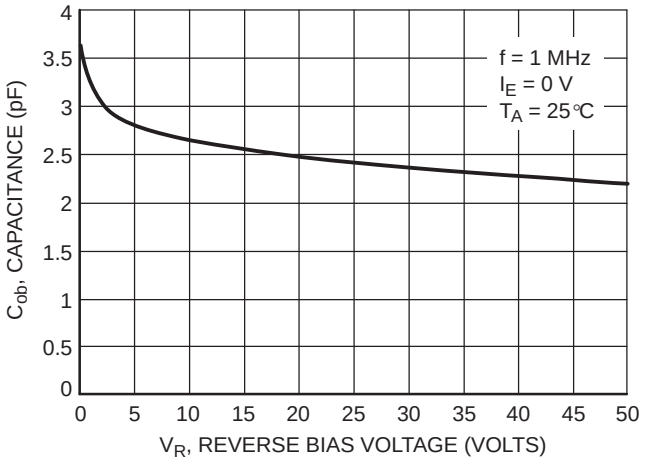


Figure 93. Output Capacitance

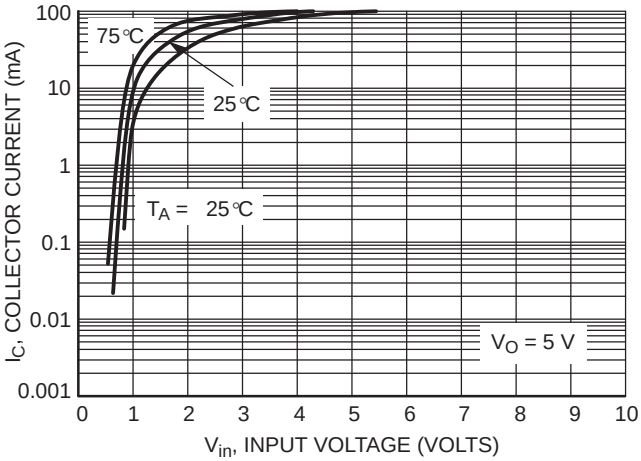


Figure 94. Output Current versus Input Voltage

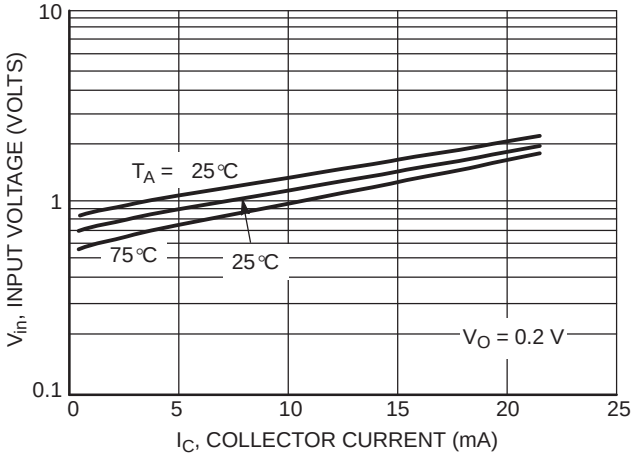


Figure 95. Input Voltage versus Output Current

CHARACTERISTIC CURVES

TYPICAL ELECTRICAL CHARACTERISTICS — SMUN5333DW PNP TRANSISTOR

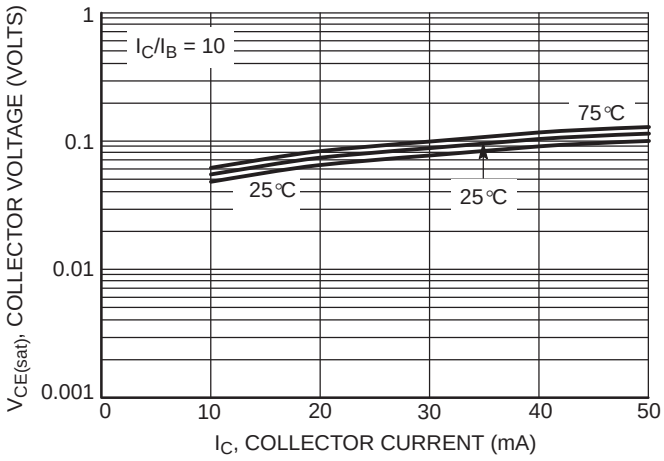


Figure 96. $V_{CE(sat)}$ versus I_C

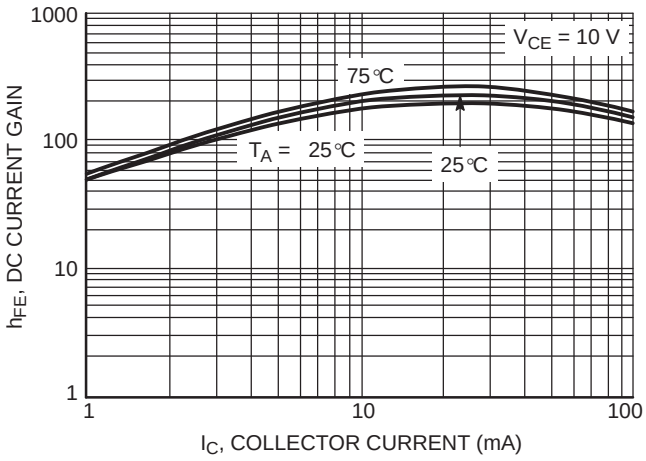


Figure 97. DC Current Gain

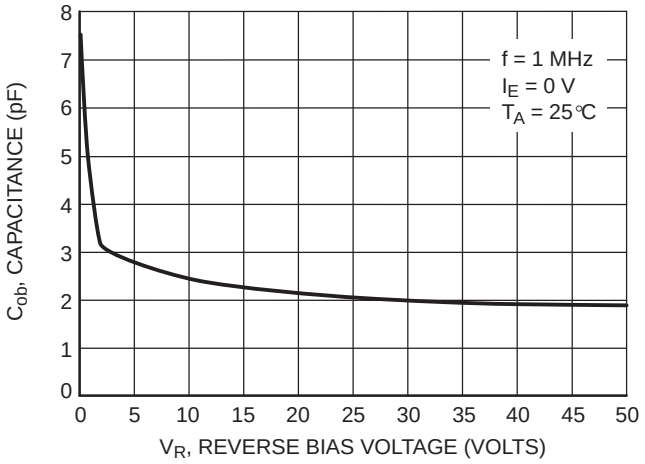


Figure 98. Output Capacitance

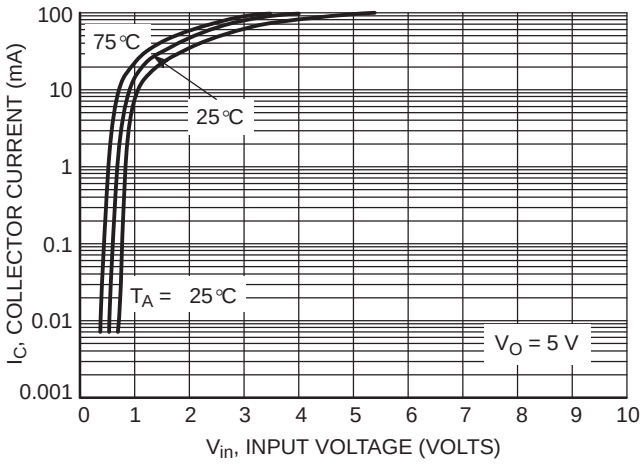


Figure 99. Output Current versus Input Voltage

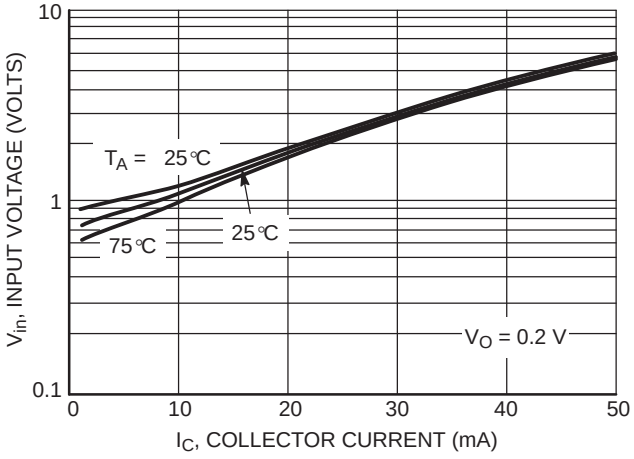


Figure 100. Input Voltage versus Output Current

CHARACTERISTIC CURVES

TYPICAL ELECTRICAL CHARACTERISTICS — SMUN5334DW NPN TRANSISTOR

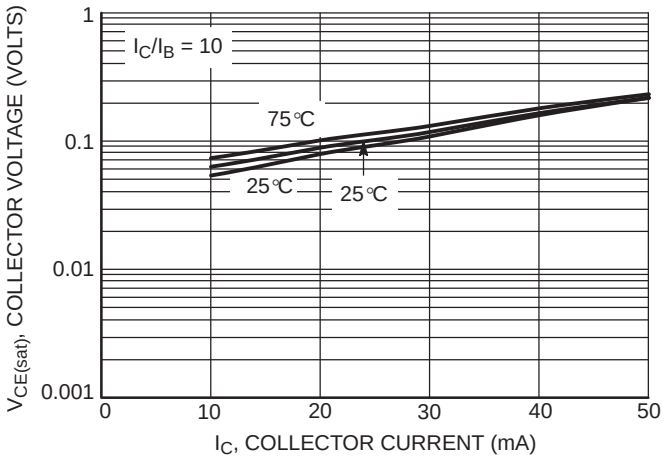


Figure 101. $V_{CE(sat)}$ versus I_C

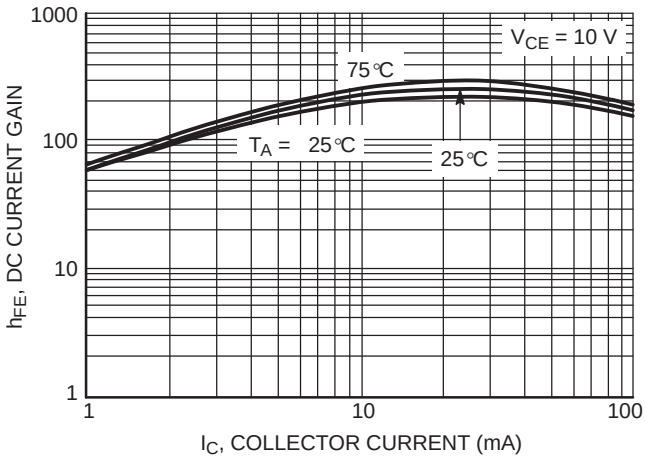


Figure 102. DC Current Gain

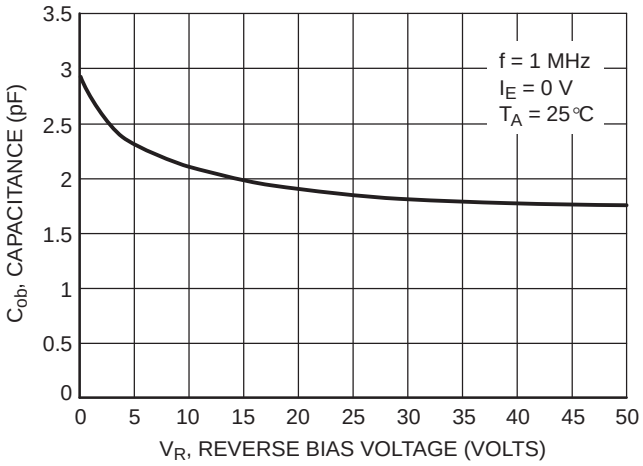


Figure 103. Output Capacitance

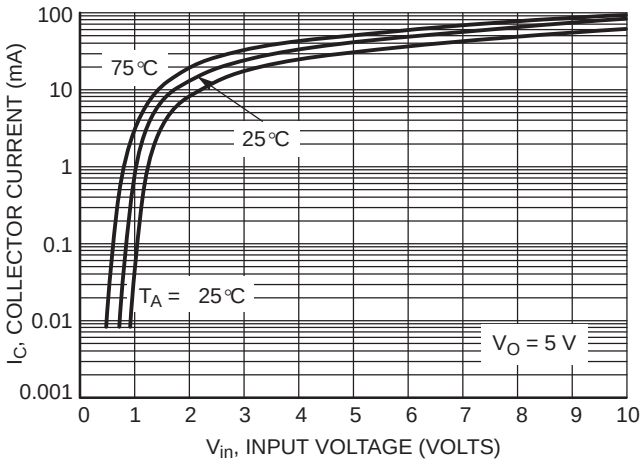


Figure 104. Output Current versus Input Voltage

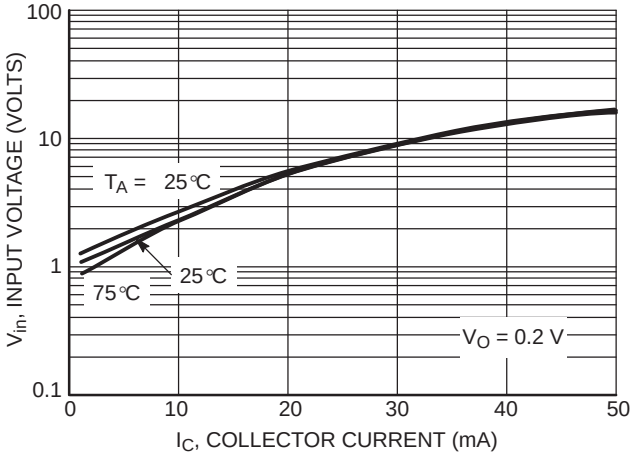


Figure 105. Input Voltage versus Output Current

CHARACTERISTIC CURVES

TYPICAL ELECTRICAL CHARACTERISTICS — SMUN5334DW PNP TRANSISTOR

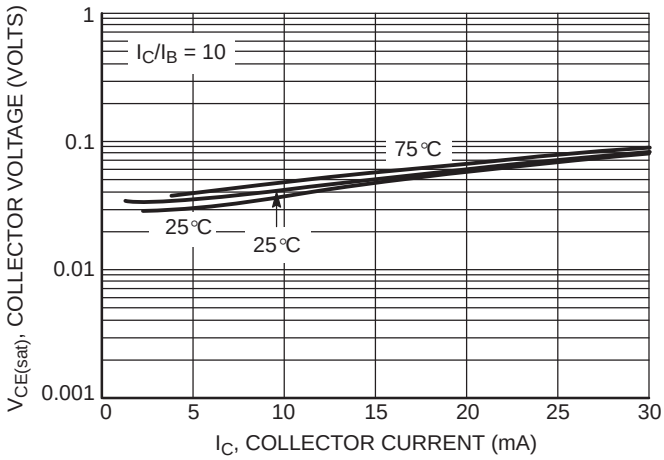


Figure 106. $V_{CE(sat)}$ versus I_C

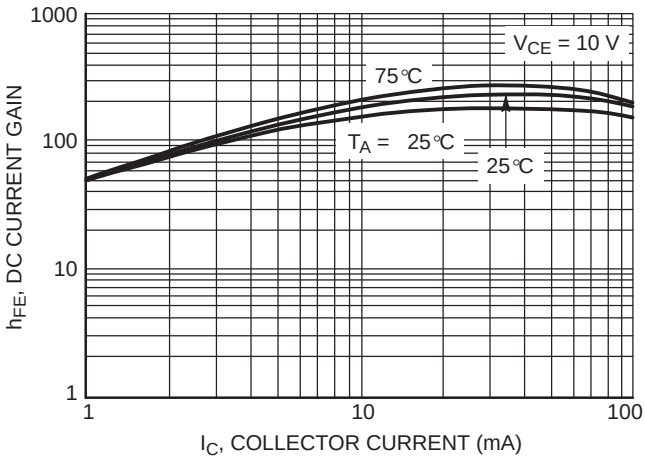


Figure 107. DC Current Gain

CHARACTERISTIC CURVES

TYPICAL ELECTRICAL CHARACTERISTICS — SMUN5335DW NPN TRANSISTOR

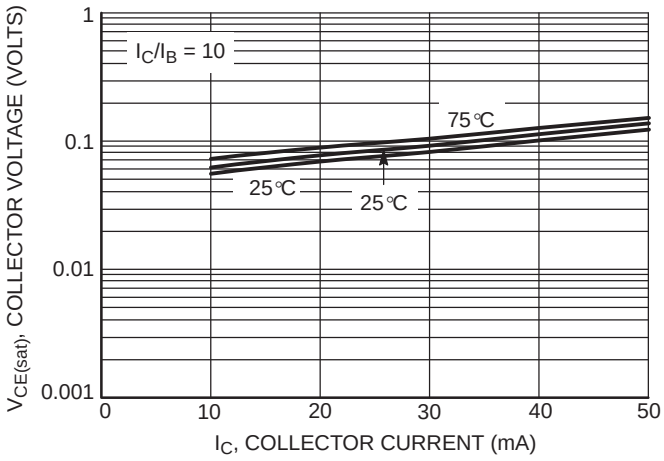


Figure 108. $V_{CE(sat)}$ versus I_C

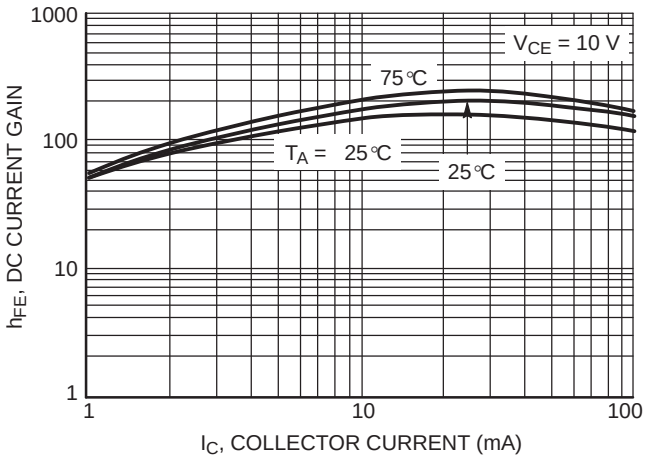


Figure 109. DC Current Gain

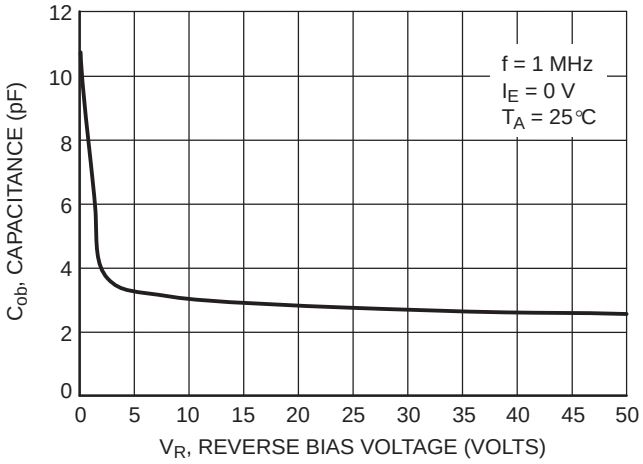


Figure 110. Output Capacitance

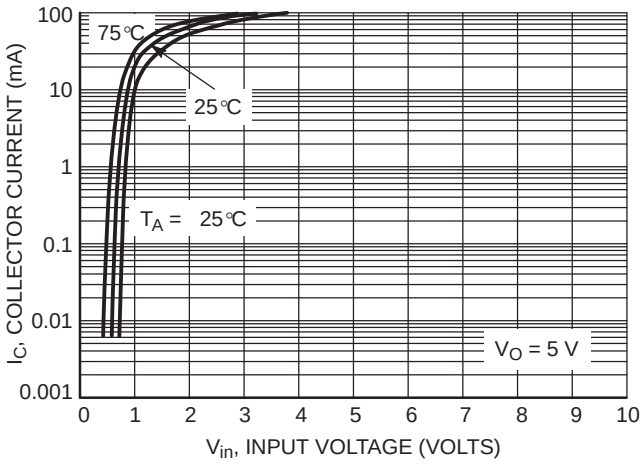


Figure 111. Output Current versus Input Voltage

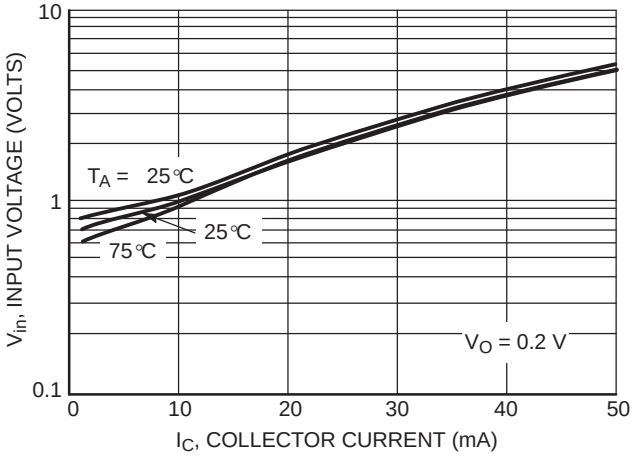


Figure 112. Input Voltage versus Output Current

CHARACTERISTIC CURVES

TYPICAL ELECTRICAL CHARACTERISTICS — SMUN5335DW PNP TRANSISTOR

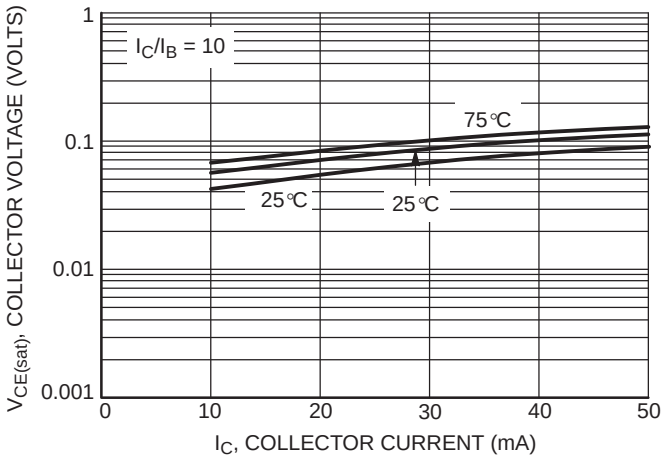


Figure 113. $V_{CE(sat)}$ versus I_C

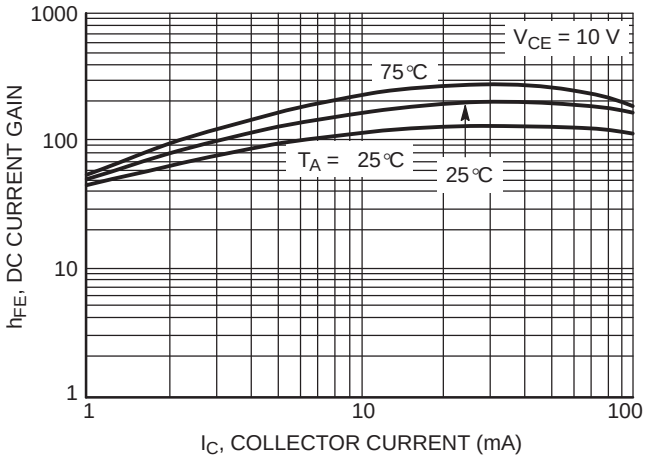


Figure 114. DC Current Gain

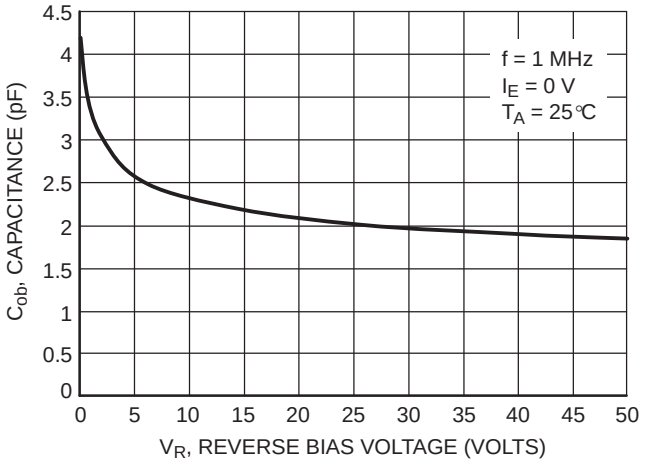


Figure 115. Output Capacitance

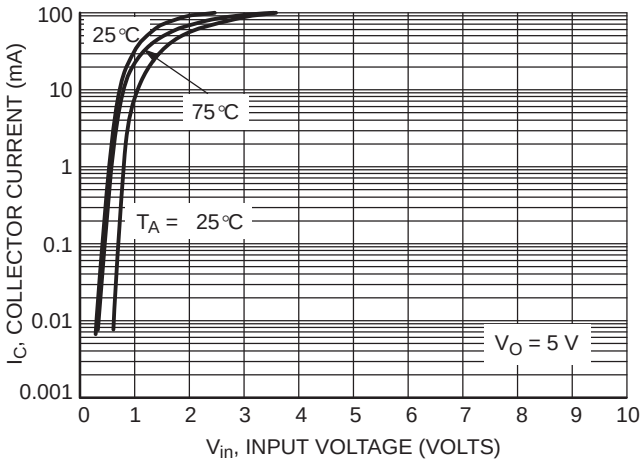


Figure 116. Output Current versus Input Voltage

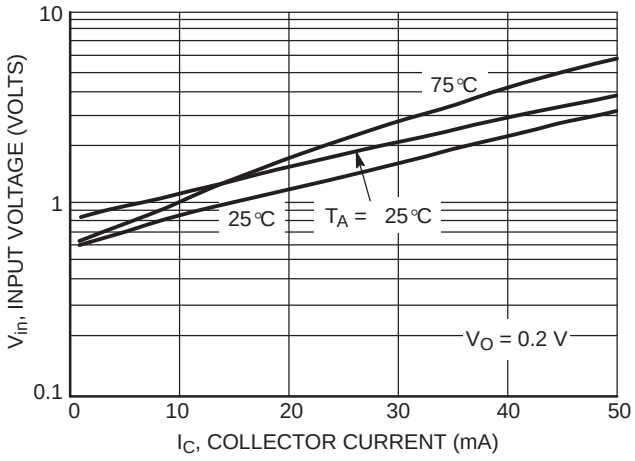


Figure 117. Input Voltage versus Output Current