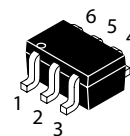
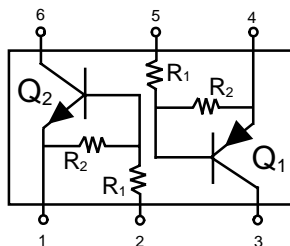


Dual Bias Resistor Transistor NPN+PNP Silicon

 Lead(Pb)-Free



SOT-363(SC-88)

Maximum Ratings ($T_A=25^\circ\text{C}$ unless otherwise noted, common for Q1 and Q2, -minus sign for Q1(PNP) omitted)

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

Thermal Characteristics

Characteristics(One Junction Heated)	Symbol	Max	Unit
Total Device Dissipation $T_A=25^\circ\text{C}$ Derate above 25°C	P_D	187(1) 256(2) 1.5(1) 2.0(2)	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	670(1) 490(2)	$^\circ\text{C}/\text{W}$
Characteristics(Both Junctions Heated)	Symbol	Max	Unit
Total Device Dissipation $T_A=25^\circ\text{C}$ Derate above 25°C	P_D	250(1) 385(2) 2.0(1) 3.0(2)	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	493(1) 325(2)	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Lead	$R_{\theta JL}$	188(1) 208(2)	$^\circ\text{C}/\text{W}$
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 x 1.0 inch Pad

Device Marking and Resistor Values

Device	Marking	R1(K)	R2(K)	Device	Marking	R1(K)	R2(K)
MUN5311DW	11	10	10	MUN5330DW	30	1.0	1.0
MUN5312DW	12	22	22	MUN5331DW	31	2.2	2.2
MUN5313DW	13	47	47	MUN5332DW	32	4.7	4.7
MUN5314DW	14	10	47	MUN5333DW	33	4.7	47
MUN5315DW	15	10	∞	MUN5334DW	34	22	47
MUN5316DW	16	4.7	∞	MUN5335DW	35	2.2	47

Electrical Characteristics (TA=25°C Unless Otherwise noted)

Characteristics	Symbol	Min	Typ	Max	Unit
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Off Characteristics

Collector-Base Breakdown Voltage ($I_C=10\ \mu A, I_E=0$)	V(BR)CBO	50	-	-	V
Collector-Emitter Breakdown Voltage ³ ($I_C=2.0mA, I_B=0$)	V(BR)CEO	50	-	-	V
Collector-Base Cutoff Voltage ($V_{CB}=50V, I_E=0$)	ICBO	-	-	100	nA
Collector-Emitter Cutoff Current ($V_{CE}=50V, I_B=0$)	ICEO	-	-	500	nA
Emitter-Base Cutoff Current ($V_{EB}=6.0V, I_C=0$)	MUN5311DW	IEBO	-	0.5	mA
	MUN5312DW	-	-	0.2	
	MUN5313DW	-	-	0.1	
	MUN5314DW	-	-	0.2	
	MUN5315DW	-	-	0.9	
	MUN5316DW	-	-	1.9	
	MUN5330DW	-	-	4.3	
	MUN5331DW	-	-	2.3	
	MUN5332DW	-	-	1.5	
	MUN5333DW	-	-	0.18	
	MUN5334DW	-	-	0.13	
MUN5335DW	-	-	0.2		

On Characteristics³

Collector-Emitter Saturation Voltage ($I_C=10mA, I_B=0.3mA$) ($I_C=10mA, I_B=5mA$) ($I_C=10mA, I_B=1mA$)	VCE(sat)	-	-	0.25	Vdc
MUN5330DW/MUN5331DW					
MUN5315DW/MUN5316DW					
MUN5332DW/MUN5333DW/MUN5334DW					

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

Electrical Characteristics

(TA=25 C Unless Otherwise noted, common for Q1 and Q2, -minus sign for Q1(PNP) omitted) (Continued)

Characteristics	Symbol	Min	Typ	Max	Unit
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On Characteristics³

DC Current Gain (VCE=-10V, IC=5.0mA)	MUN5311DW	hFE	35	60	-	
	MUN5312DW		60	100	-	
	MUN5313DW		80	140	-	
	MUN5314DW		80	140	-	
	MUN5315DW		160	350	-	
	MUN5316DW		160	350	-	
	MUN5330DW		3.0	5.0	-	
	MUN5331DW		8.0	15	-	
	MUN5332DW		15	30	-	
	MUN5333DW		80	200	-	
	MUN5334DW		80	150	-	
	MUN5335DW		80	140	-	
Output Voltage(on) (VCC=5.0V, VB=2.5V, RL=1.0kΩ)	MUN5311DW	VOL	-	-	0.2	Vdc
	MUN5312DW		-	-	0.2	
	MUN5314DW		-	-	0.2	
	MUN5315DW		-	-	0.2	
	MUN5316DW		-	-	0.2	
	MUN5330DW		-	-	0.2	
	MUN5331DW		-	-	0.2	
	MUN5332DW		-	-	0.2	
	MUN5333DW		-	-	0.2	
	MUN5334DW		-	-	0.2	
	MUN5335DW		-	-	0.2	
	(VCC=5.0V, VB=3.5V, RL=1.0kΩ)	MUN5313DW		-	-	
Output Voltage(off) (VCC=5.0V, VB=0.5V, RL=1.0kΩ) (VCC=5.0V, VB=0.05V, RL=1.0kΩ) (VCC=5.0V, VB=0.25V, RL=1.0kΩ)	MUN5330DW	VOH	4.9	-	-	Vdc
	MUN5315DW					
	MUN5316DW					
	MUN5333DW					

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

Electrical Characteristics (TA=25°C Unless Otherwise noted)

Characteristics	Symbol	Min	Typ	Max	Unit
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On Characteristics³

Input Resistor	MUN5311DW	R1	7.0	10	13	kΩ
	MUN5312DW		15.4	22	28.6	
	MUN5313DW		32.9	47	61.1	
	MUN5314DW		7.0	10	13	
	MUN5315DW		7.0	10	13	
	MUN5316DW		3.3	4.7	6.1	
	MUN5330DW		0.7	1.0	1.3	
	MUN5331DW		1.5	2.2	2.9	
	MUN5332DW		3.3	4.7	6.1	
	MUN5333DW		3.3	4.7	6.1	
	MUN5334DW		15.4	22	28.6	
	MUN5335DW		1.54	2.2	2.86	
Resistor Ratio	MUN5311DW/MUN5312DW/MUN5313DW	R1/R2	0.8	1.0	1.2	
	MUN5314DW		0.17	0.21	0.25	
	MUN5315DW/MUN5316DW		-	-	-	
	MUN5330DW/MUN5331DW/MUN5332DW		0.8	1.0	1.2	
	MUN5333DW		0.055	0.1	0.185	
	MUN5334DW		0.38	0.47	0.56	
	MUN5335DW		0.038	0.047	0.056	

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

MUN5311DW Series

ALL MUN5111DW SERIES DEVICES

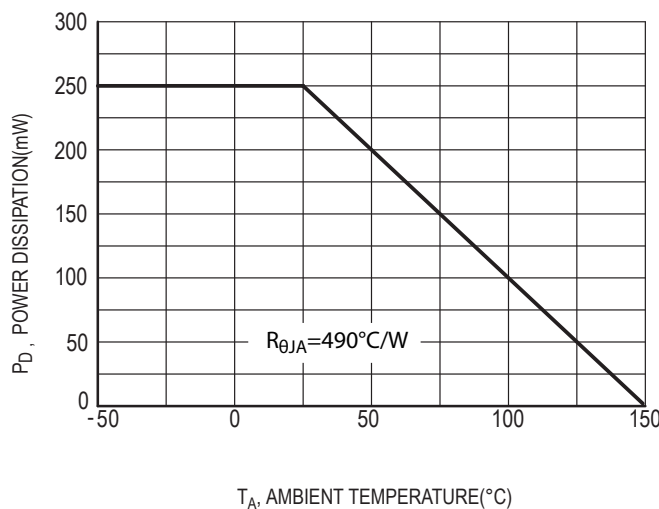


FIG.1 Derating Curve

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5311DW1T1 NPN TRANSISTOR

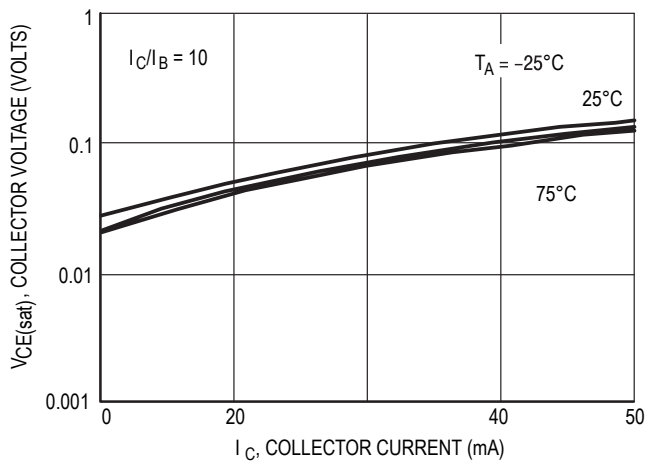


Figure 2. $V_{CE(sat)}$ versus I_C

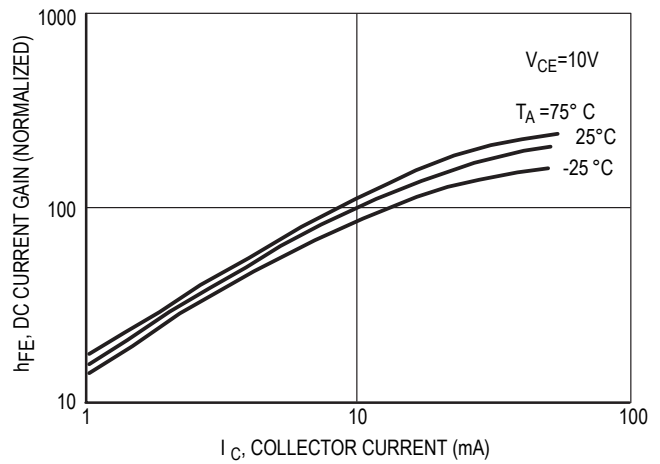


Figure 3. DC Current Gain

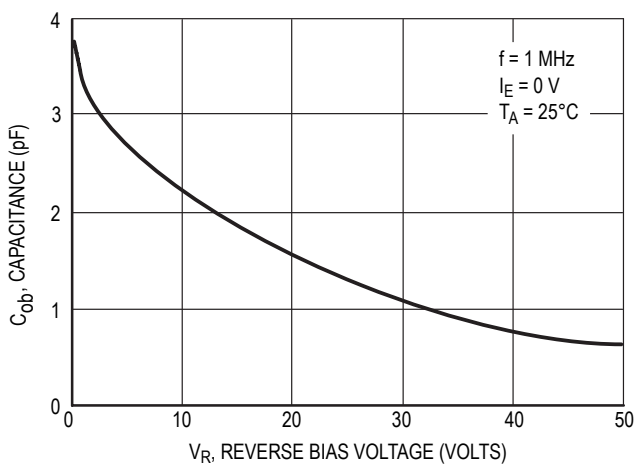


Figure 4. Output Capacitance

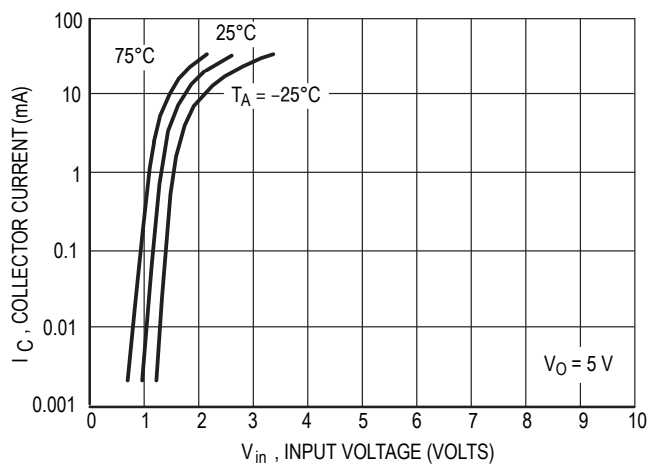


Figure 5. Output Current versus Input Voltage

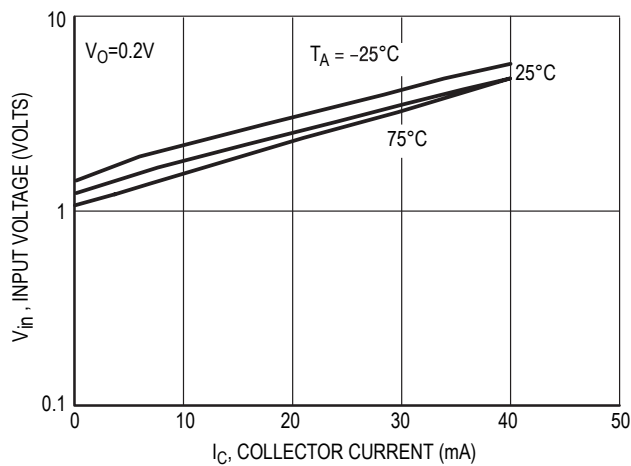


Figure 6. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5311DW1T1 PNP TRANSISTOR

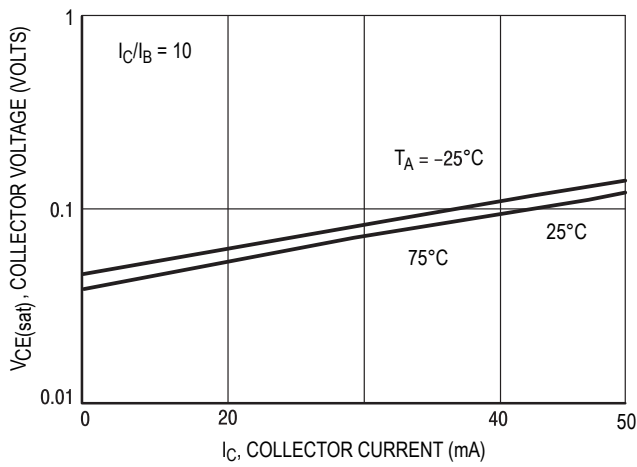


Figure 7. $V_{CE(sat)}$ versus I_C

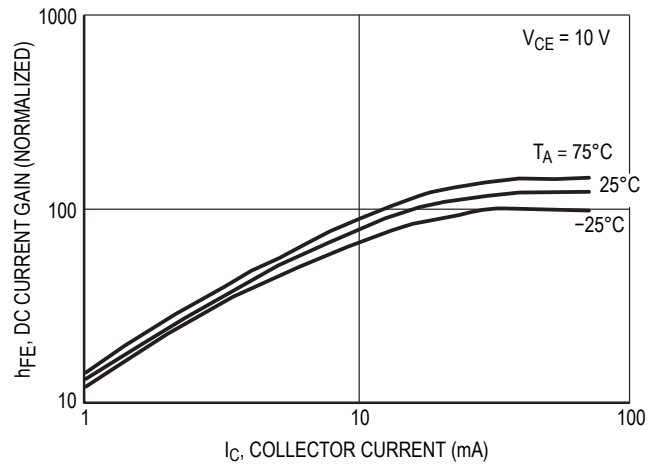


Figure 8. DC Current Gain

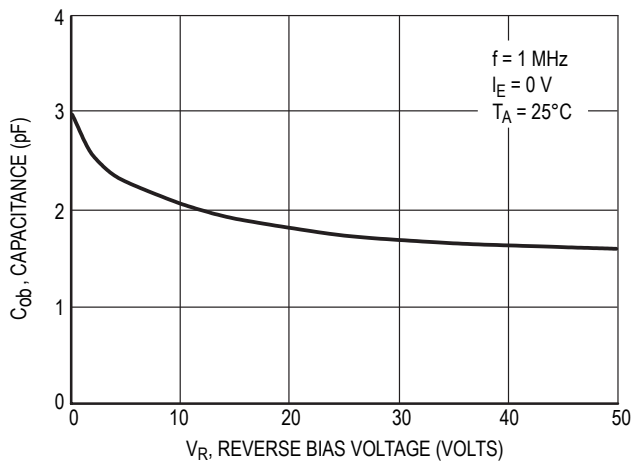


Figure 9. Output Capacitance

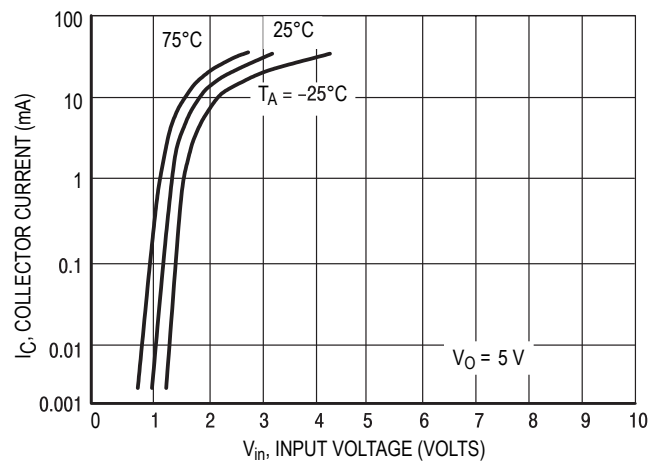


Figure 10. Output Current versus Input Voltage

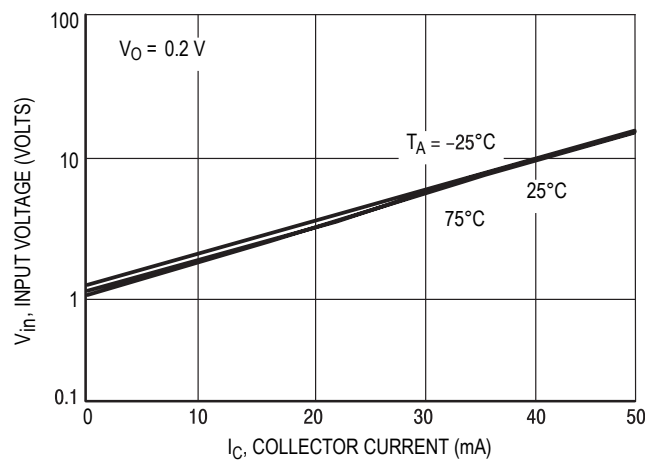


Figure 11. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5312DW1T1 NPN TRANSISTOR

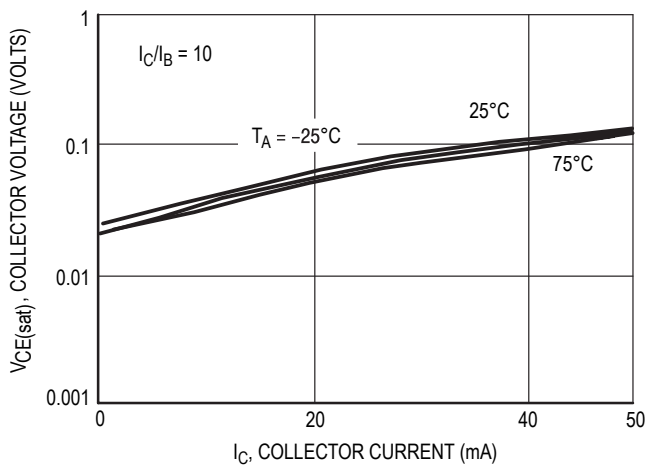


Figure 12. $V_{CE(sat)}$ versus I_C

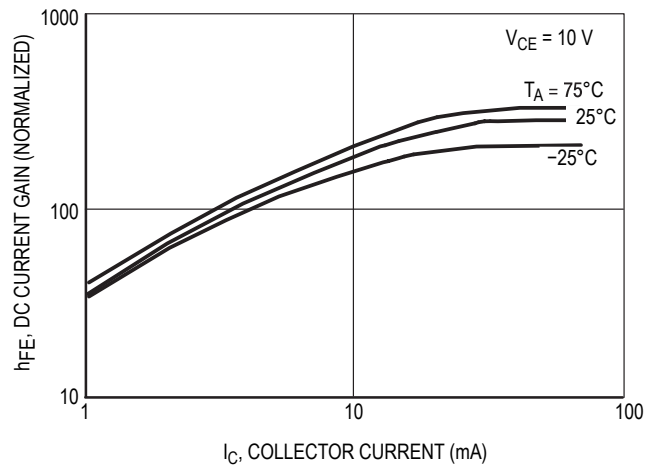


Figure 13. DC Current Gain

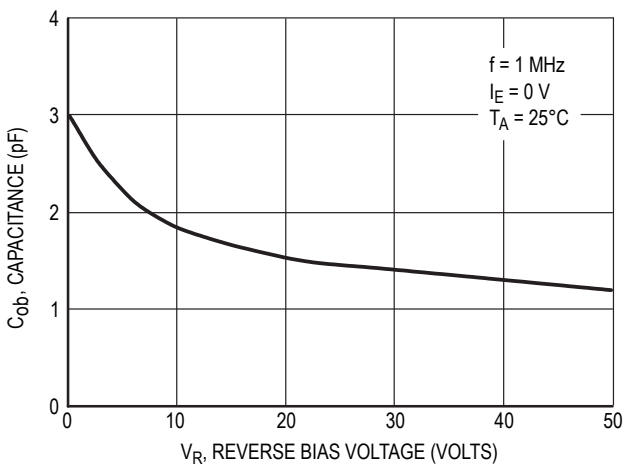


Figure 14. Output Capacitance

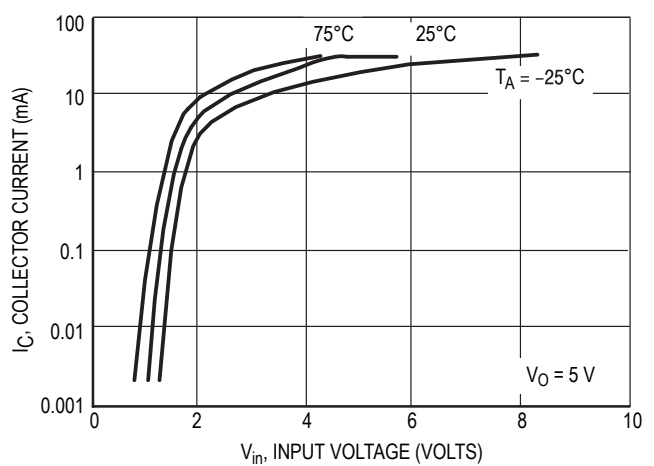


Figure 15. Output Current versus Input Voltage

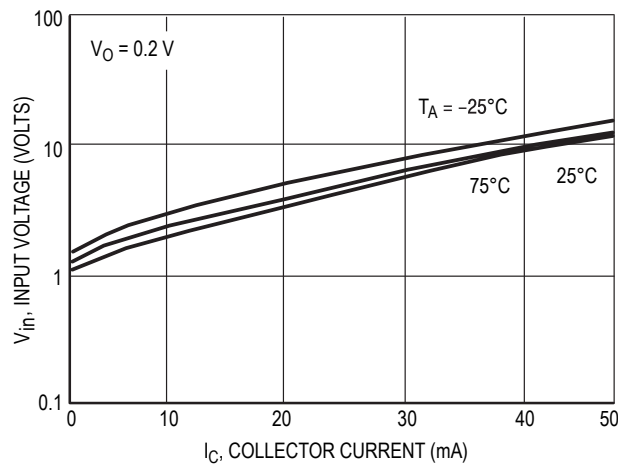


Figure 16. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5312DW1T1 PNP TRANSISTOR

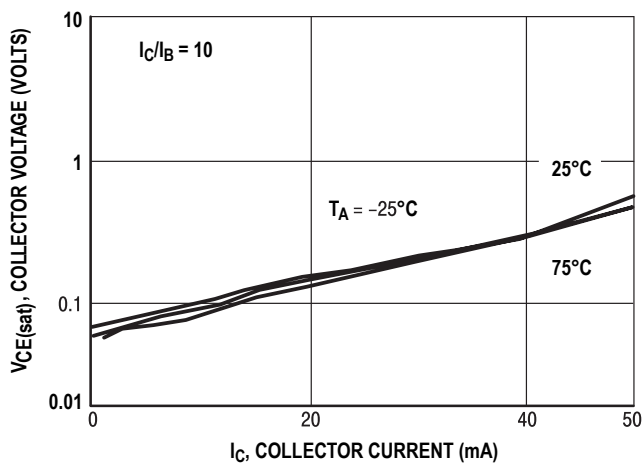


Figure 17. $V_{CE(sat)}$ versus I_C

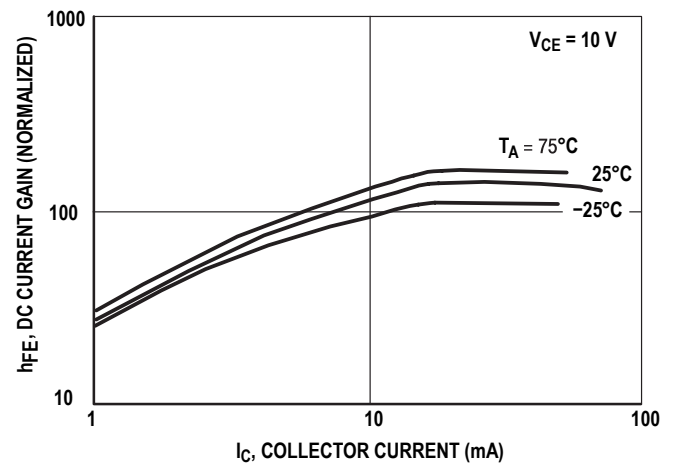


Figure 18. DC Current Gain

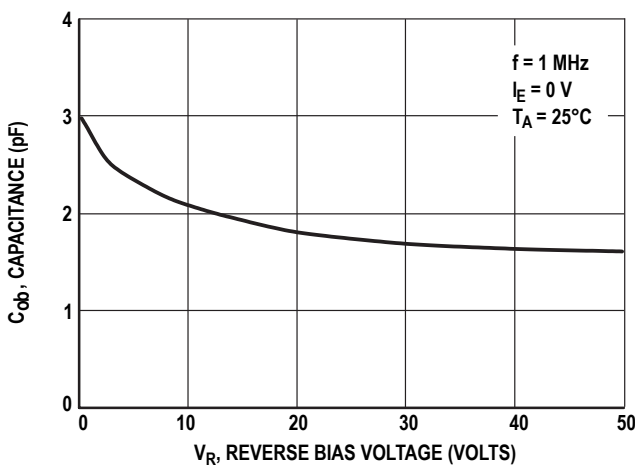


Figure 19. Output Capacitance

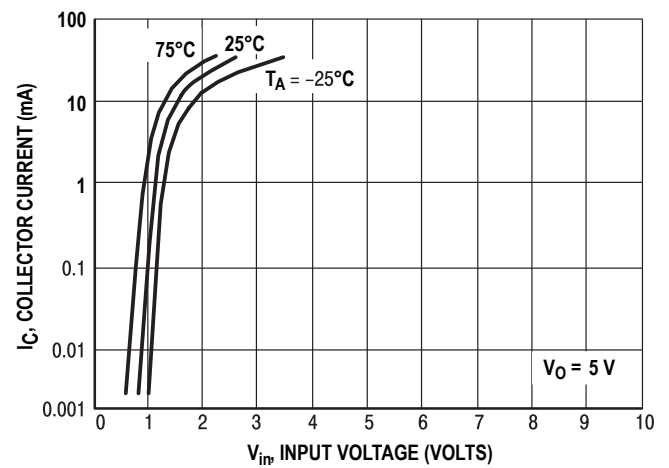


Figure 20. Output Current versus Input Voltage

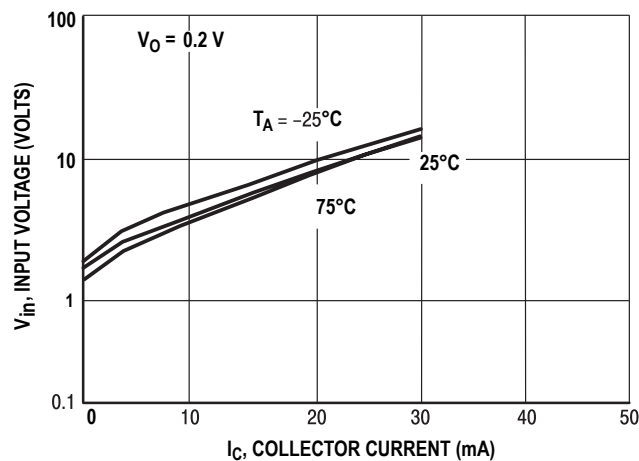


Figure 21. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5313DW1T1 NPN TRANSISTOR

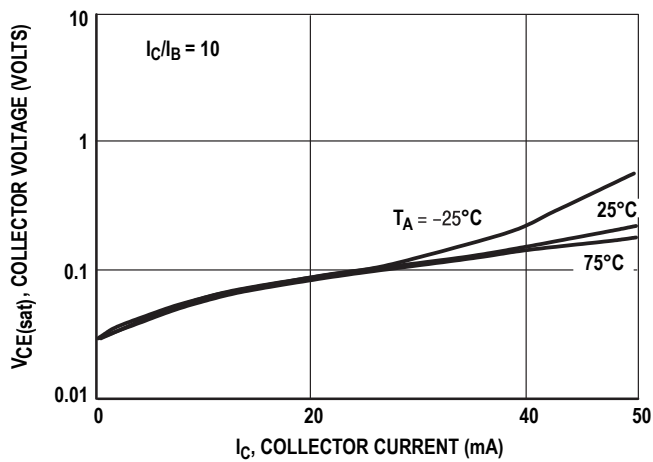


Figure 22. $V_{CE(sat)}$ versus I_C

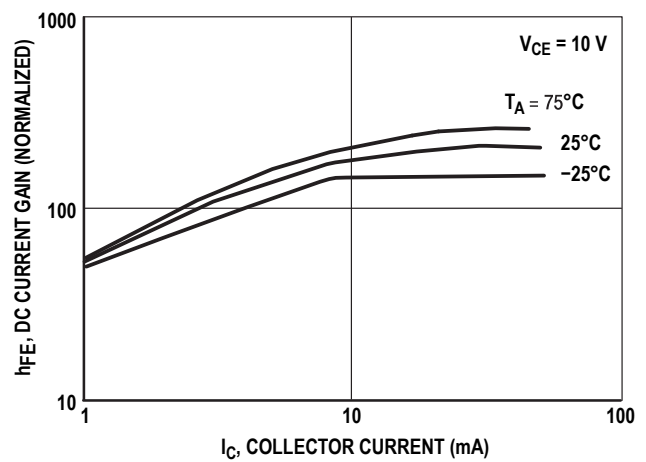


Figure 23. DC Current Gain

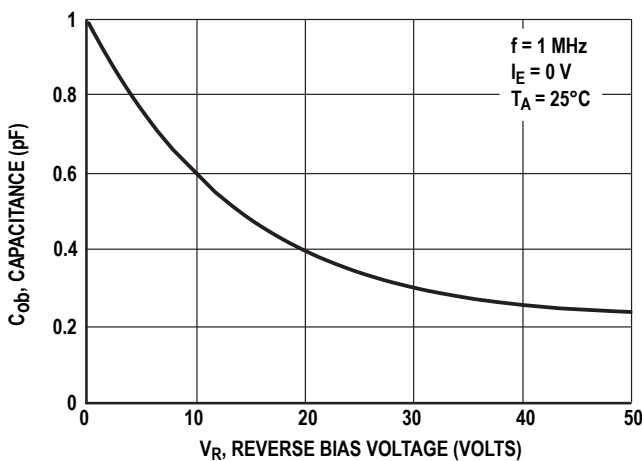


Figure 24. Output Capacitance

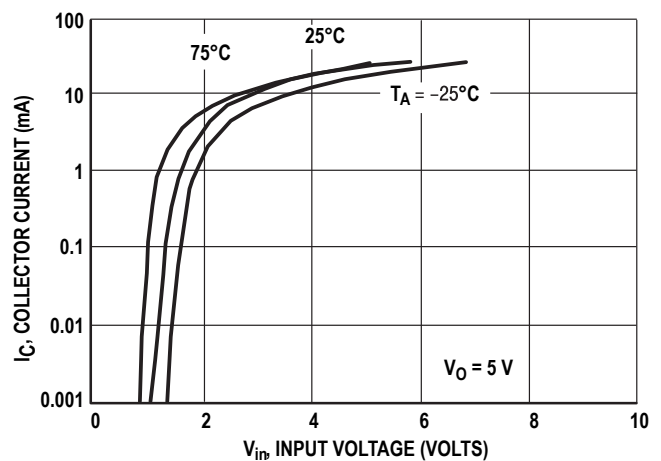


Figure 25. Output Current versus Input Voltage

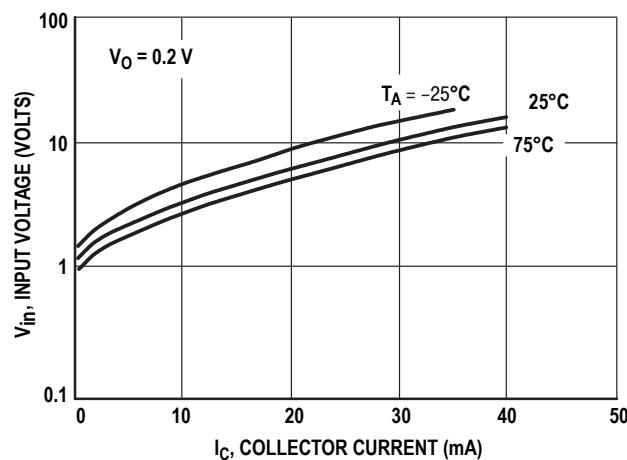


Figure 26. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5313DW1T1 PNP TRANSISTOR

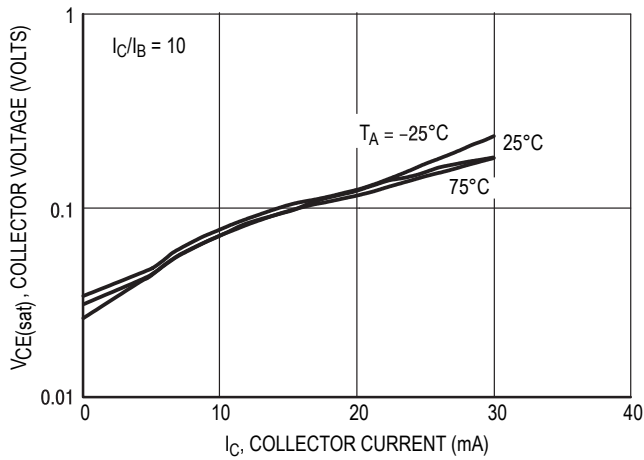


Figure 27. $V_{CE(sat)}$ versus I_C

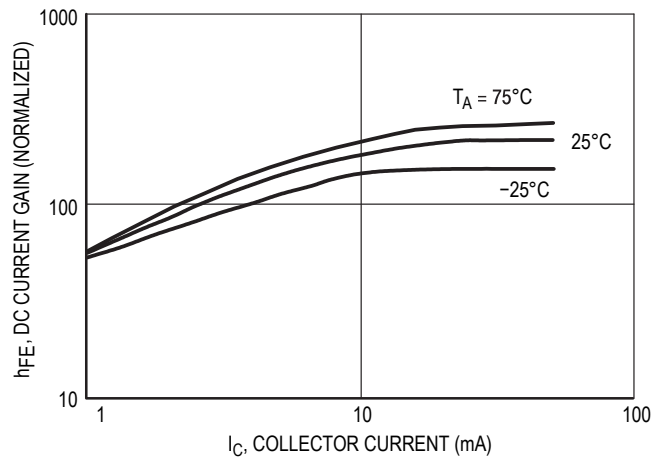


Figure 28. DC Current Gain

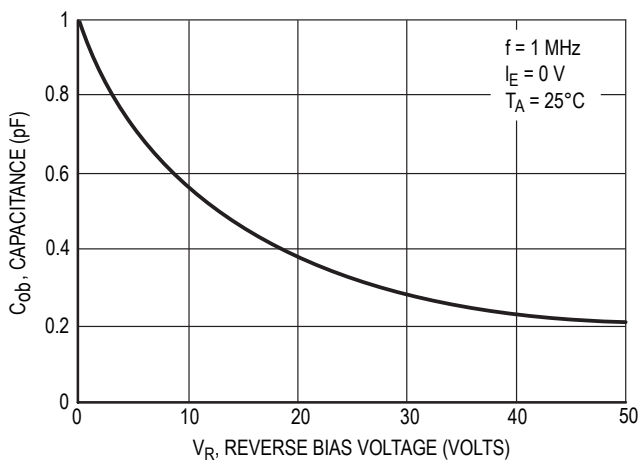


Figure 29. Output Capacitance

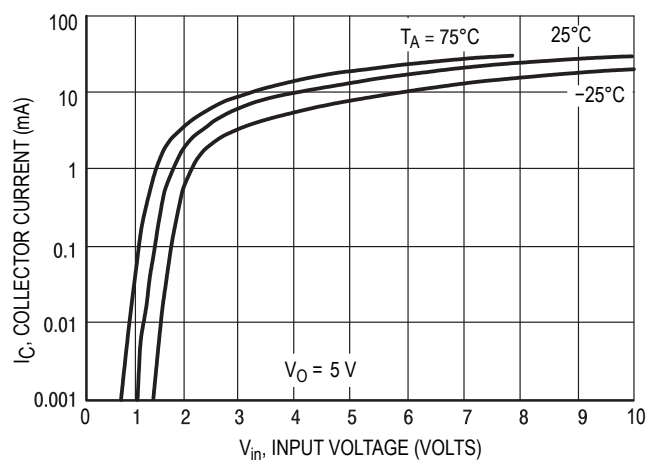


Figure 30. Output Current versus Input Voltage

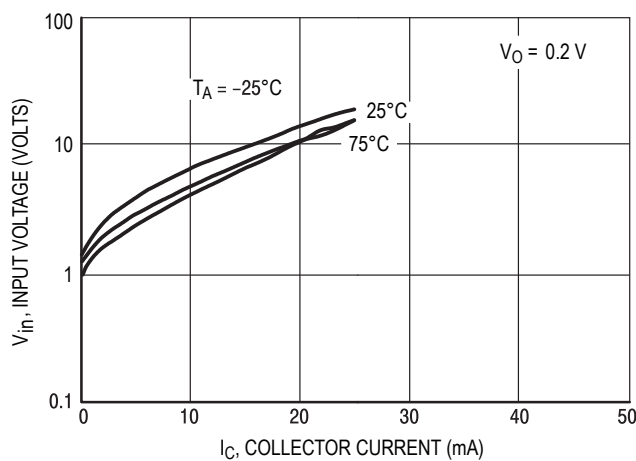


Figure 31. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5314DW1T1 NPN TRANSISTOR

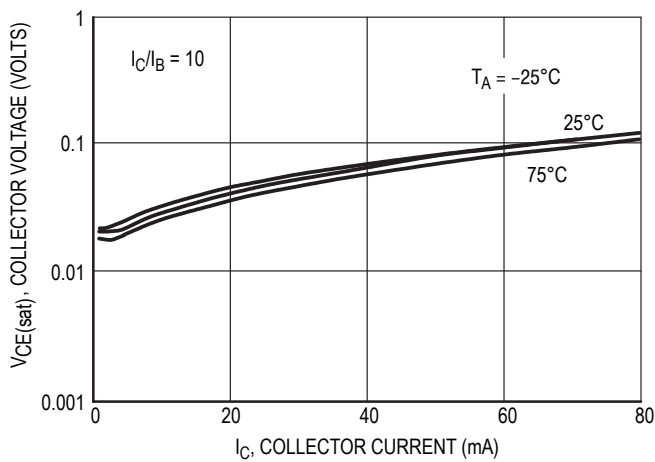


Figure 32. $V_{CE(sat)}$ versus I_C

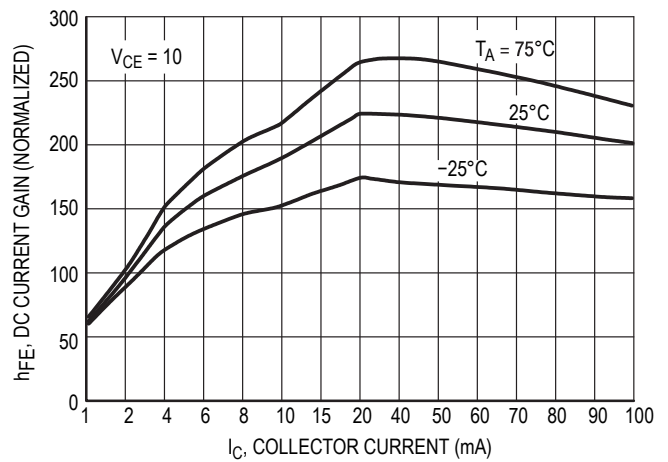


Figure 33. DC Current Gain

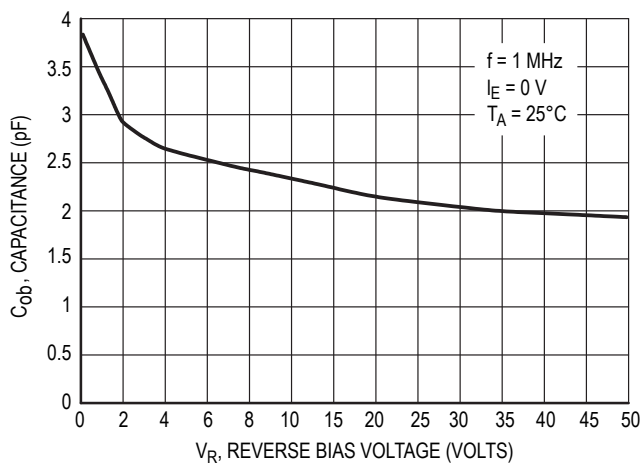


Figure 34. Output Capacitance

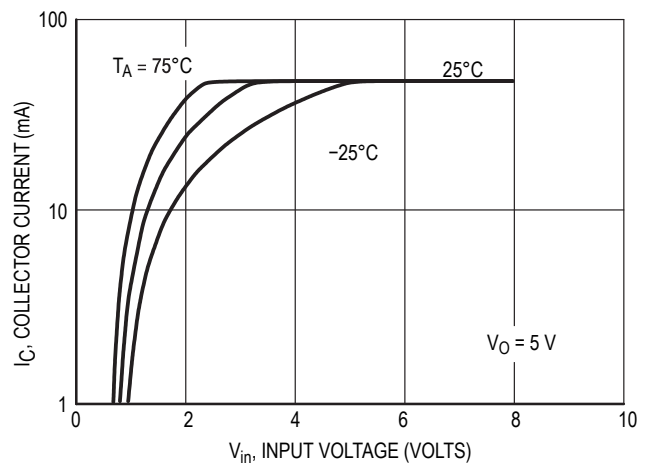


Figure 35. Output Current versus Input Voltage

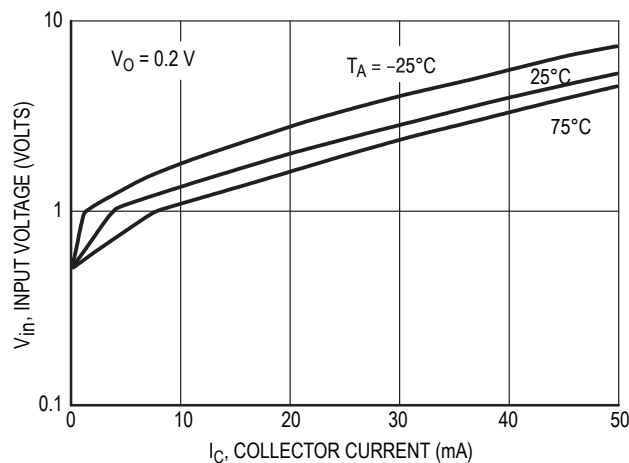


Figure 36. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5314DW1T1 PNP TRANSISTOR

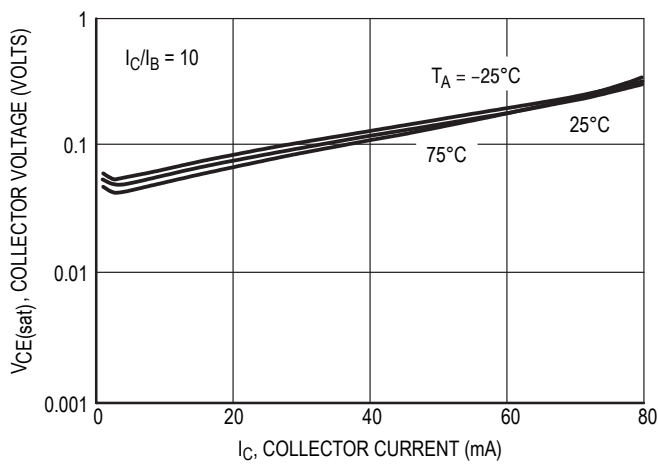


Figure 37. $V_{CE(sat)}$ versus I_C

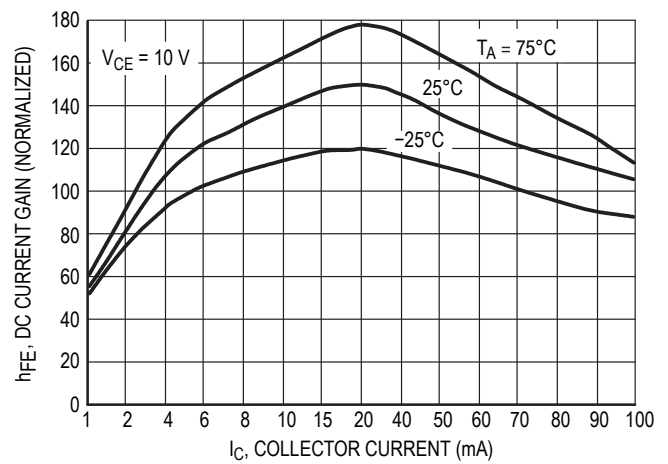


Figure 38. DC Current Gain

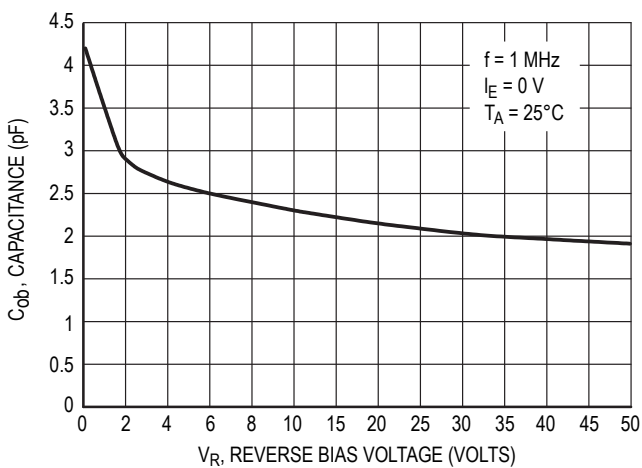


Figure 39. Output Capacitance

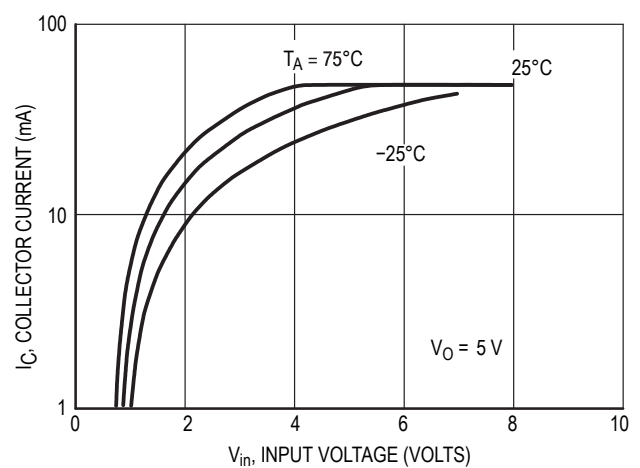


Figure 40. Output Current versus Input Voltage

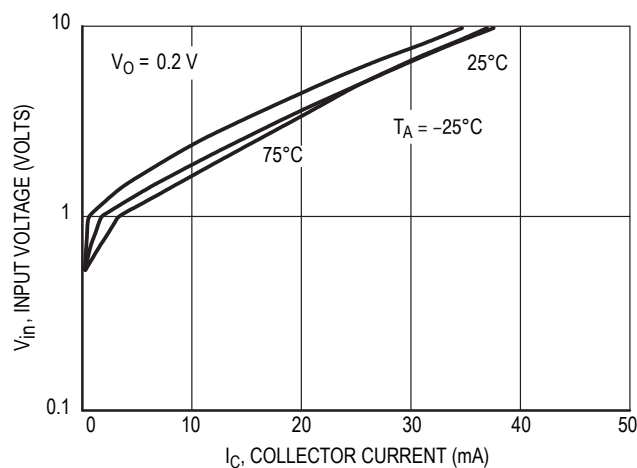


Figure 41. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5315DW1T1 NPN TRANSISTOR

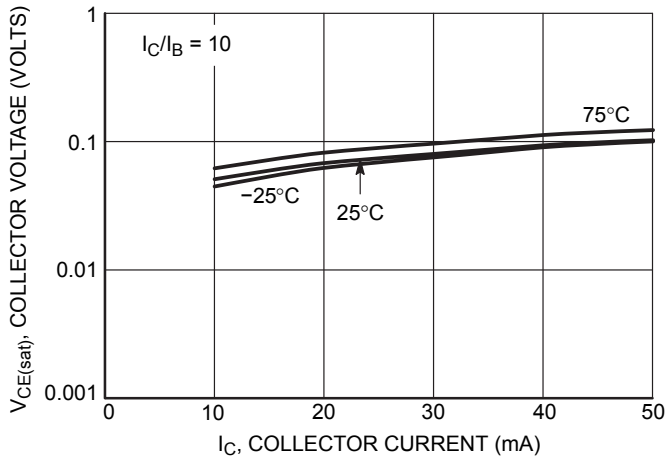


Figure 42. $V_{CE(sat)}$ versus I_C

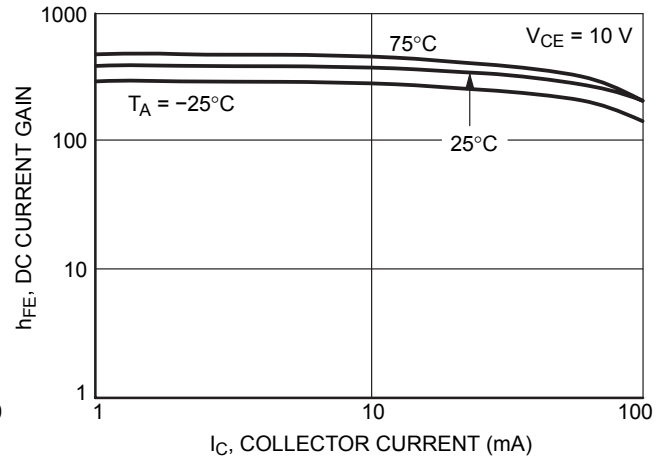


Figure 43. DC Current Gain

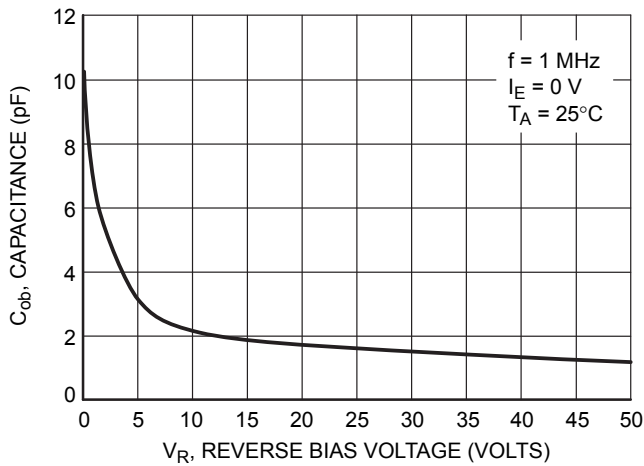


Figure 44. Output Capacitance

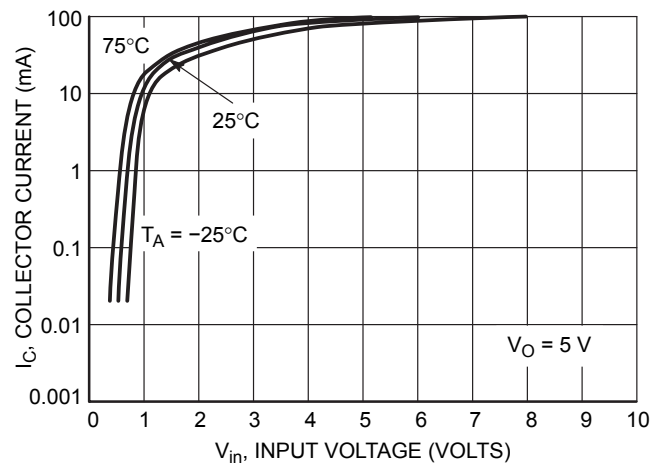


Figure 45. Output Current versus Input Voltage

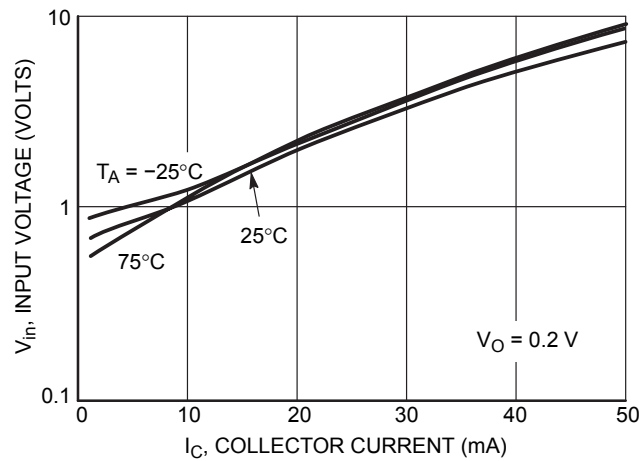


Figure 46. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5315DW1T1 PNP TRANSISTOR

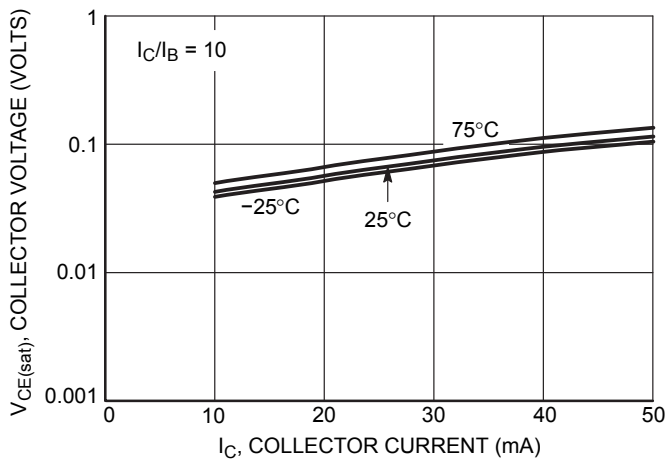


Figure 47. $V_{CE(sat)}$ versus I_C

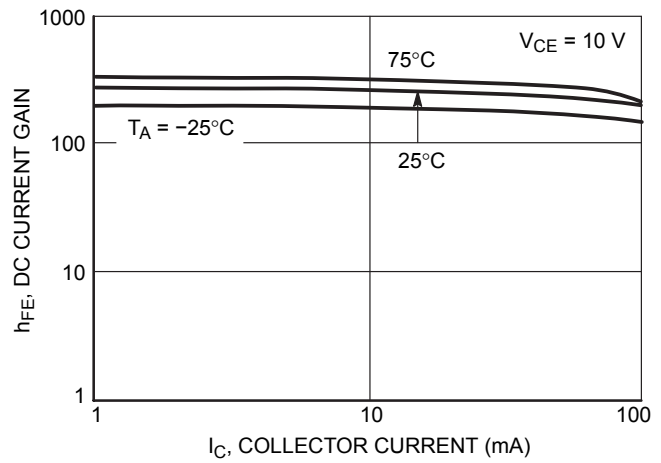


Figure 48. DC Current Gain

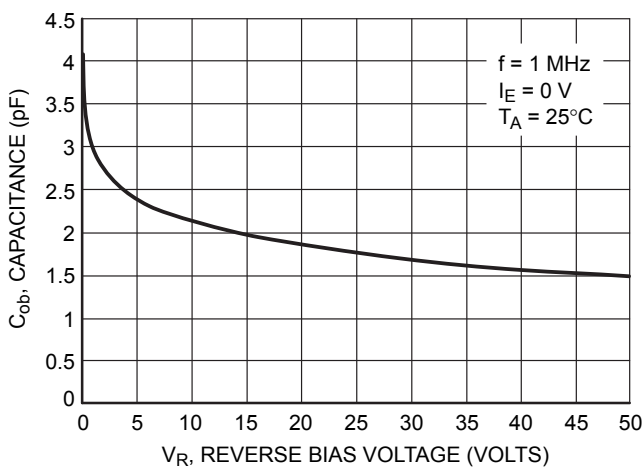


Figure 49. Output Capacitance

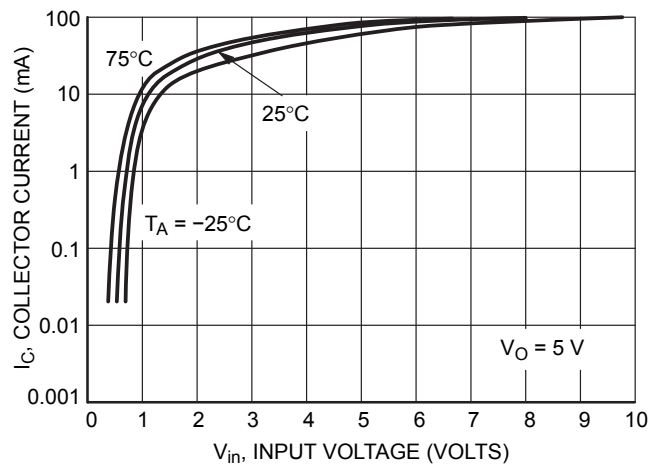


Figure 50. Output Current versus Input Voltage

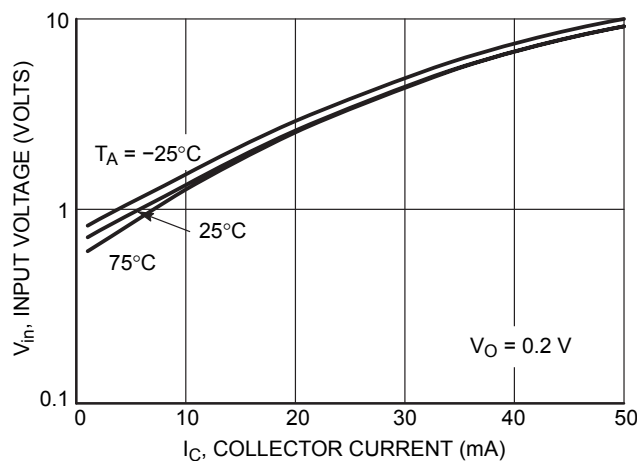


Figure 51. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5316DW1T1 NPN TRANSISTOR

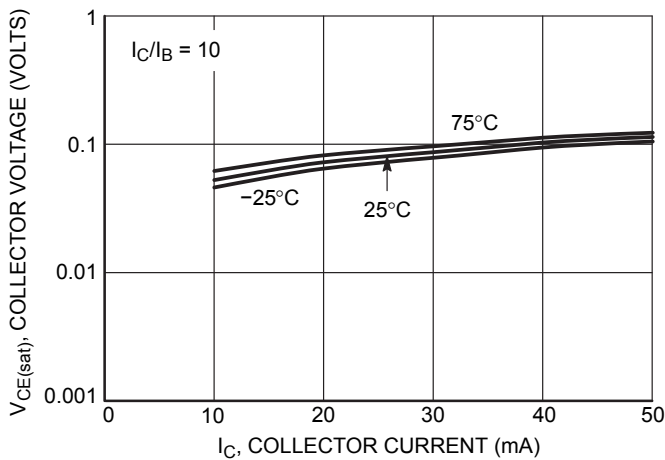


Figure 52. $V_{CE(sat)}$ versus I_C

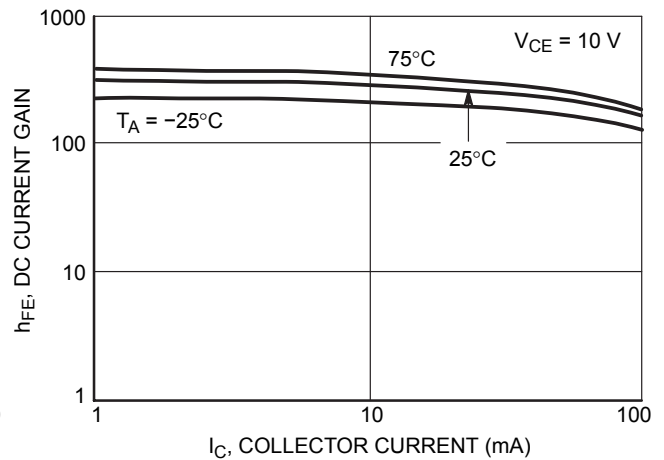


Figure 53. DC Current Gain

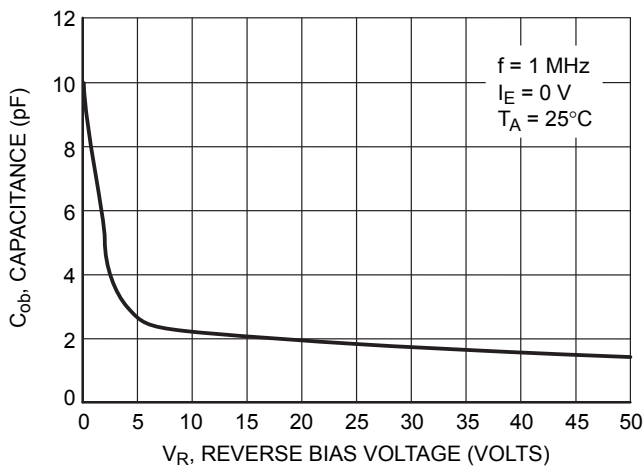


Figure 54. Output Capacitance

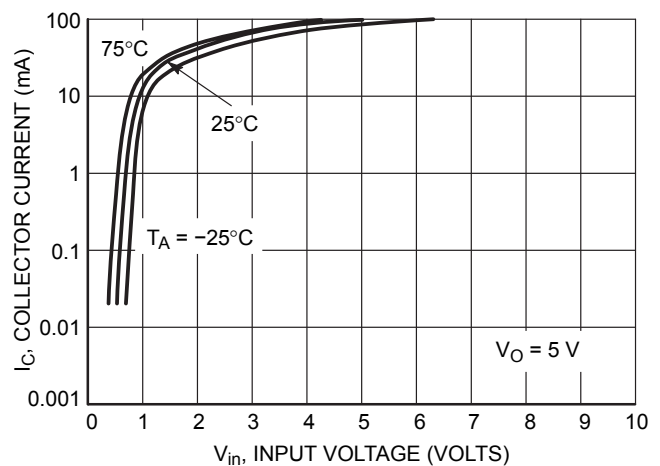


Figure 55. Output Current versus Input Voltage

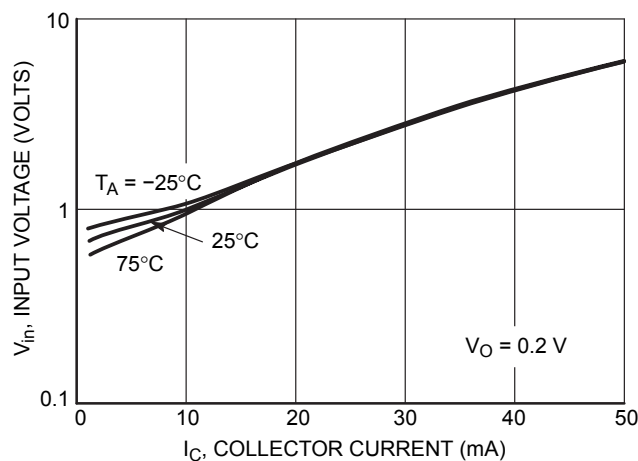


Figure 56. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5316DW1T1 PNP TRANSISTOR

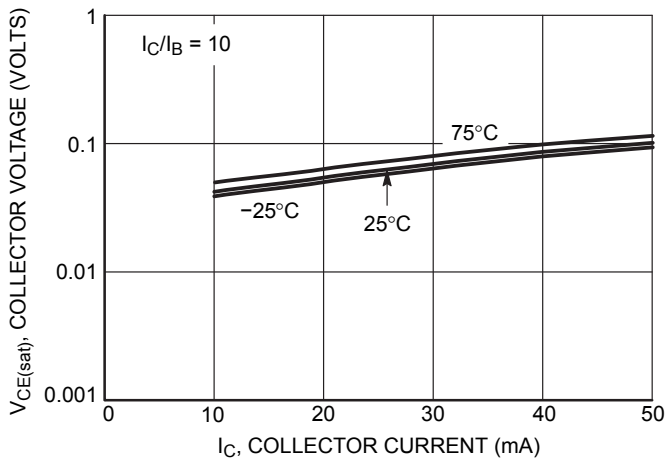


Figure 57. $V_{CE(sat)}$ versus I_C

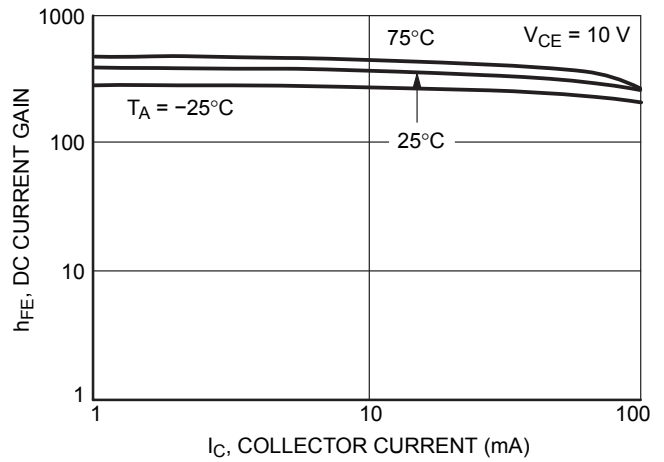


Figure 58. DC Current Gain

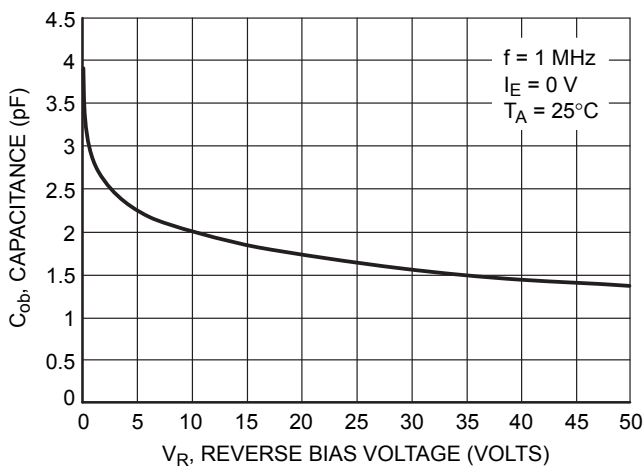


Figure 59. Output Capacitance

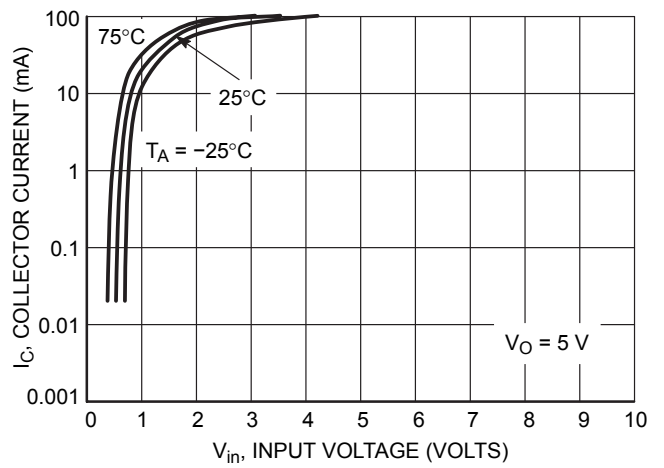


Figure 60. Output Current versus Input Voltage

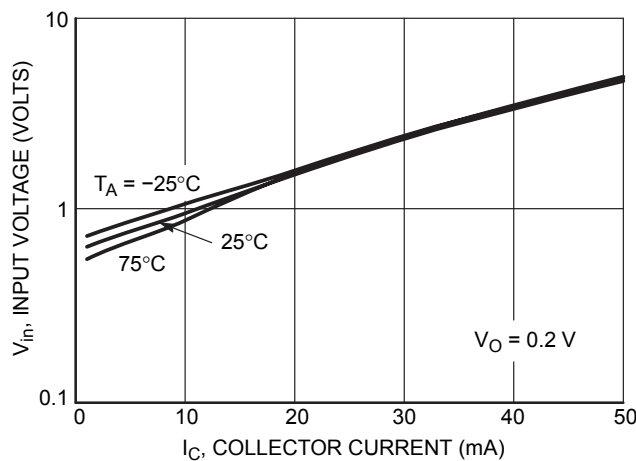


Figure 61. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5330DW1T1 NPN TRANSISTOR

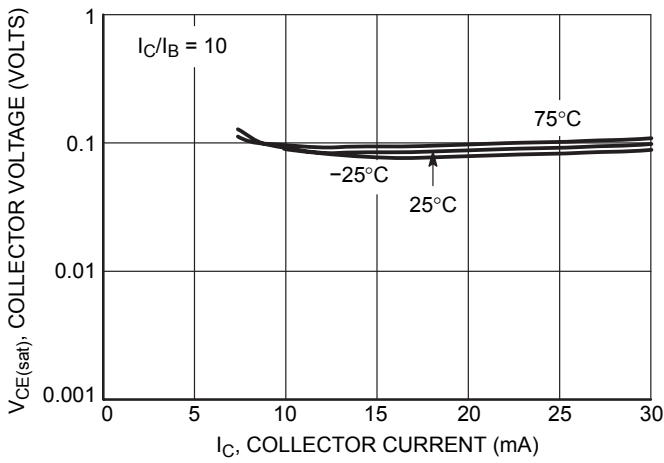


Figure 62. $V_{CE(sat)}$ versus I_C

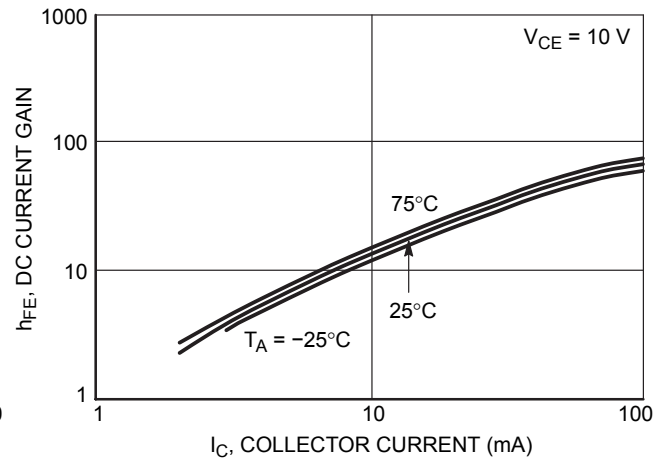


Figure 63. DC Current Gain

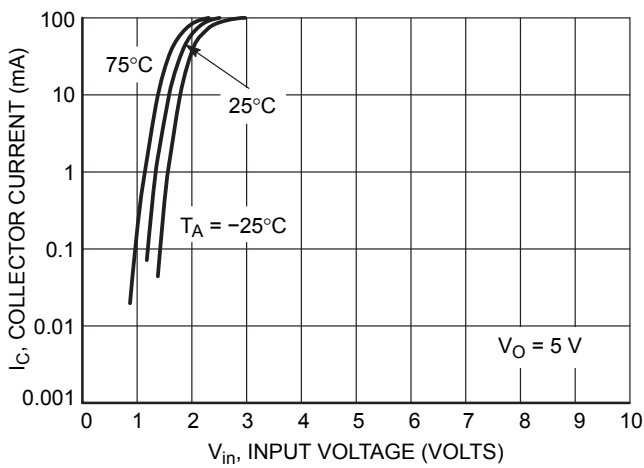


Figure 64. Output Current versus Input Voltage

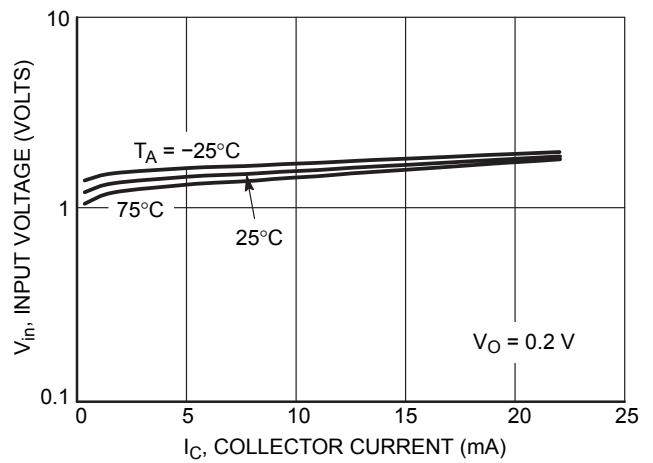


Figure 65. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5330DW1T1 PNP TRANSISTOR

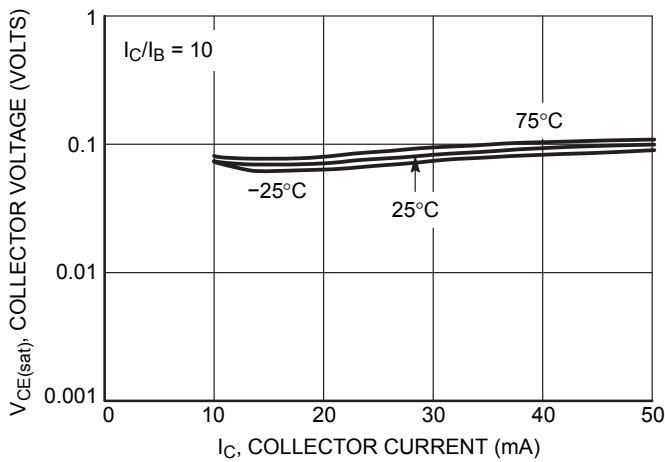


Figure 66. $V_{CE(sat)}$ versus I_C

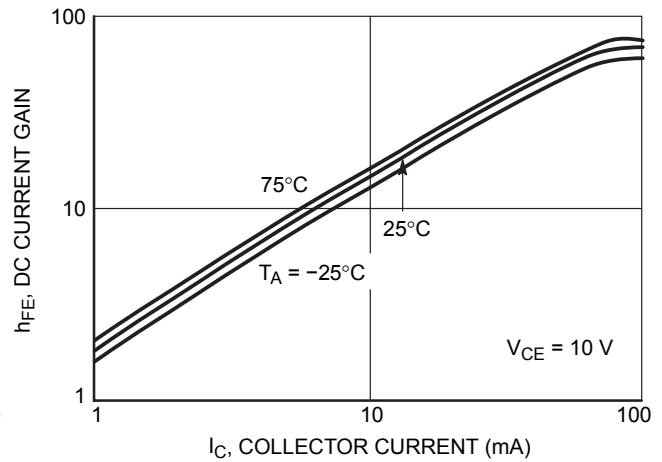


Figure 67. DC Current Gain

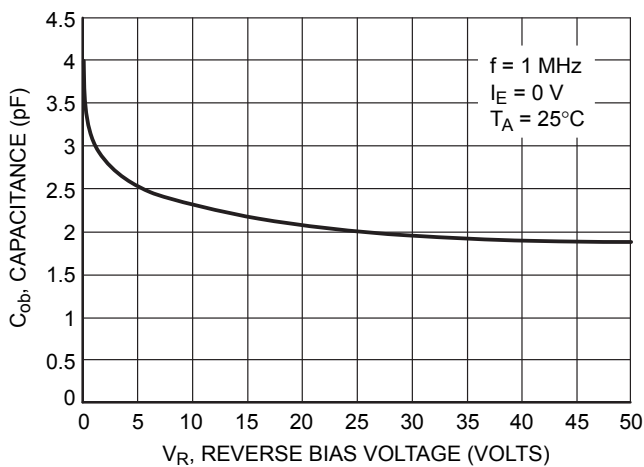


Figure 68. Output Capacitance

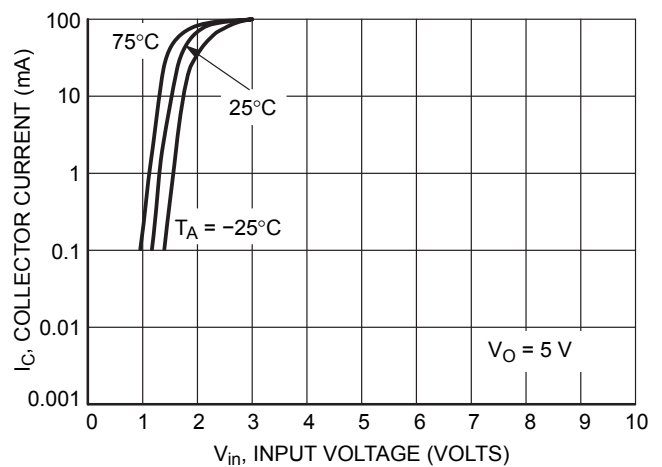


Figure 69. Output Current versus Input Voltage

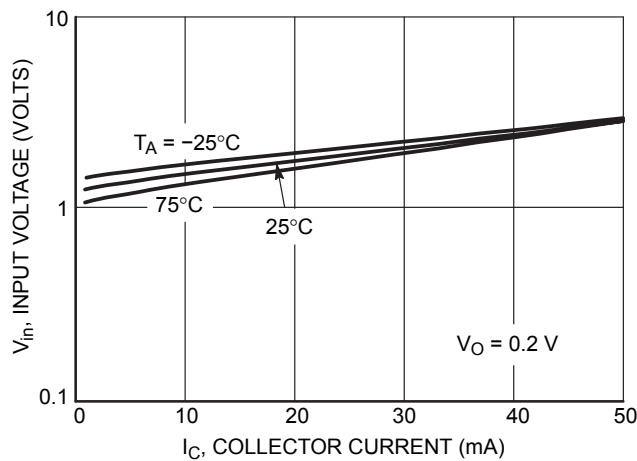


Figure 70. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5331DW1T1 NPN TRANSISTOR

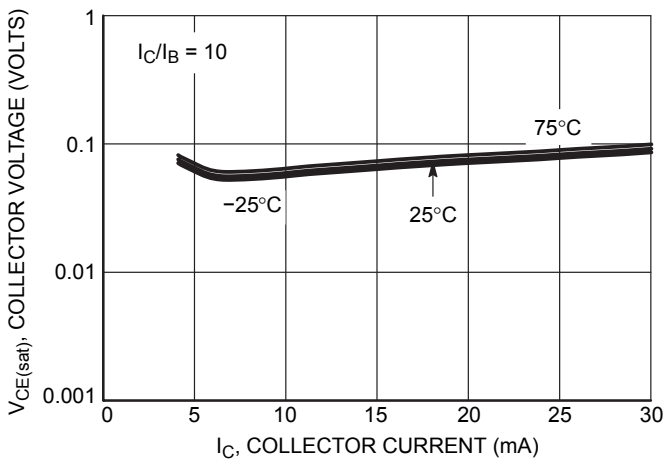


Figure 71. $V_{CE(sat)}$ versus I_C

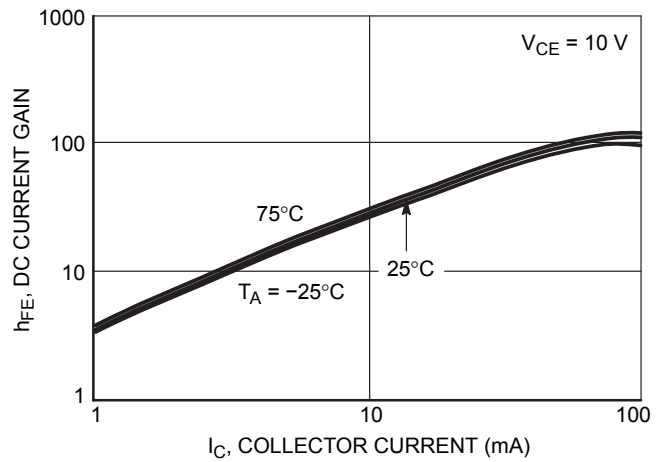


Figure 72. DC Current Gain

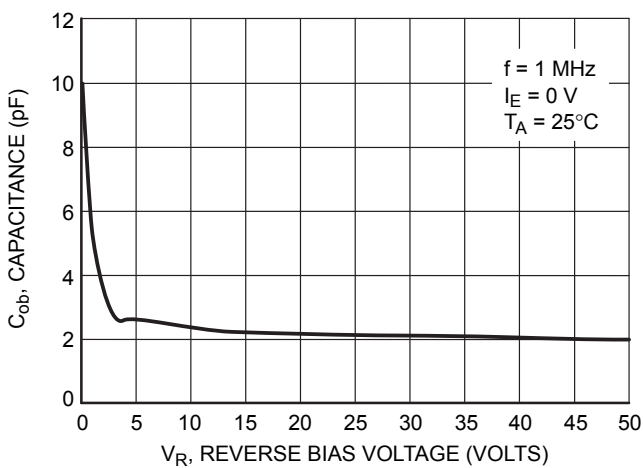


Figure 73. Output Capacitance

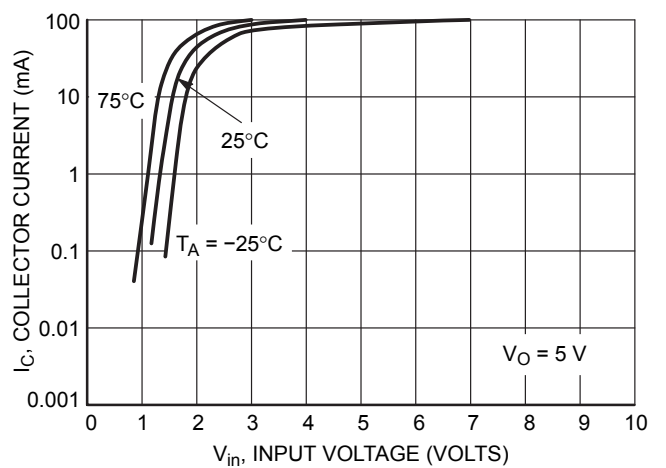


Figure 74. Output Current versus Input Voltage

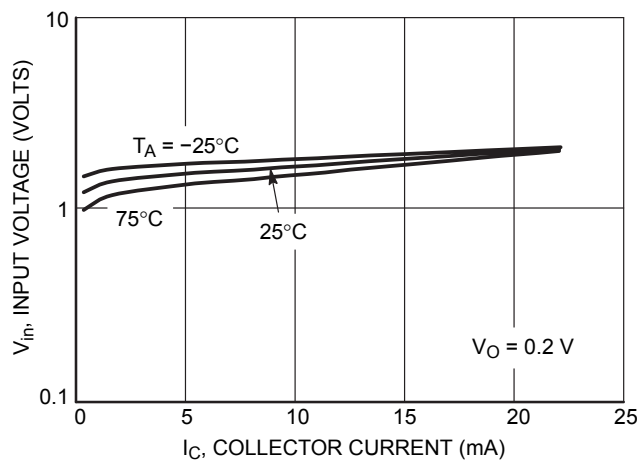


Figure 75. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5311DW1T1 PNP TRANSISTOR

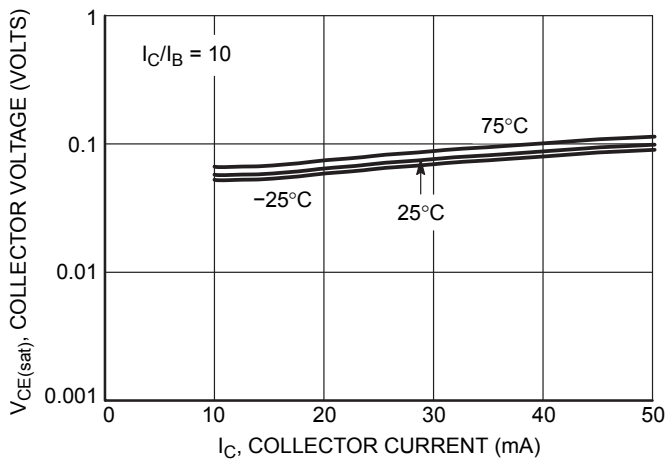


Figure 76. $V_{CE(sat)}$ versus I_C

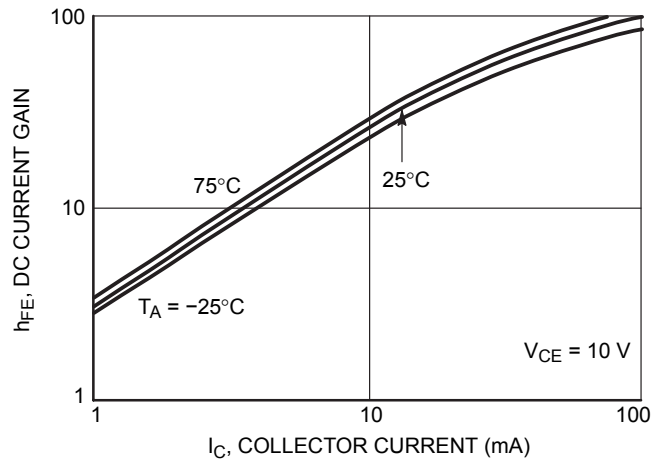


Figure 77. DC Current Gain

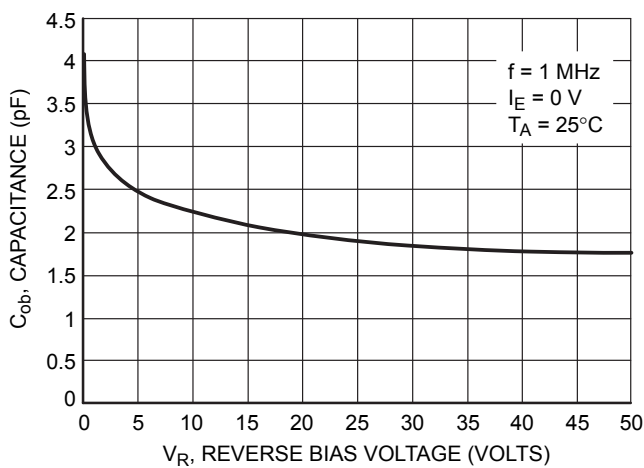


Figure 78. Output Capacitance

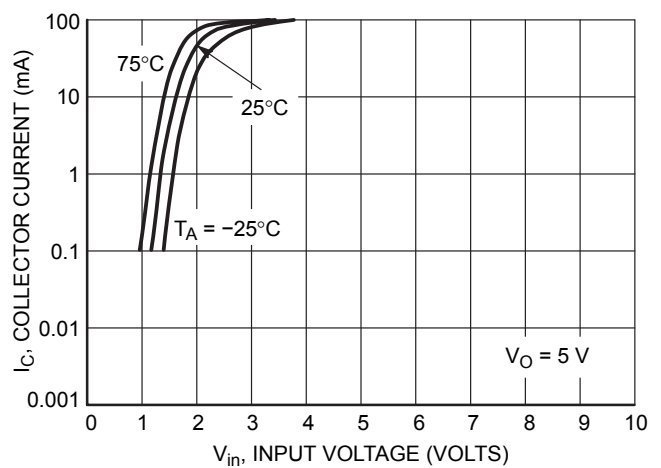


Figure 79. Output Current versus Input Voltage

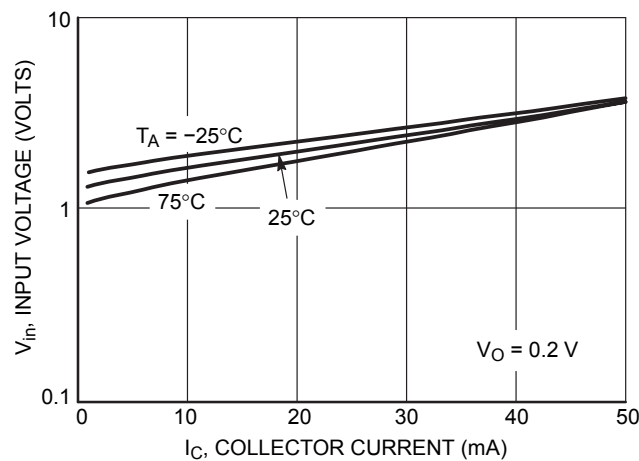


Figure 80. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5332DW1T1 NPN TRANSISTOR

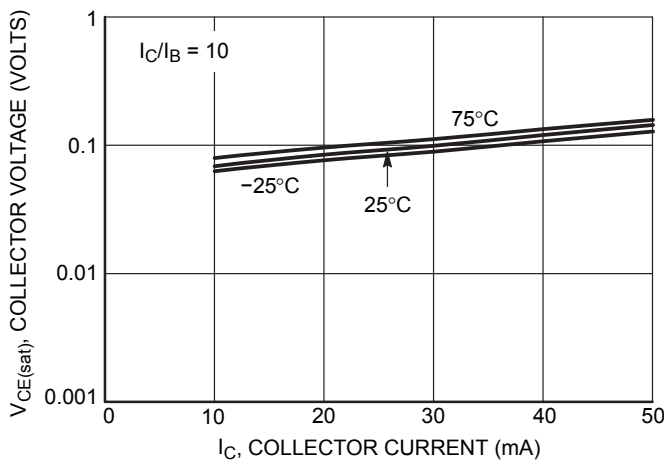


Figure 81. $V_{CE(sat)}$ versus I_C

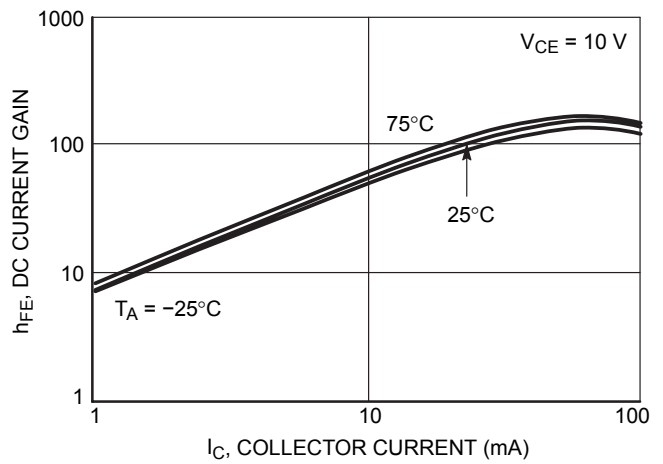


Figure 82. DC Current Gain

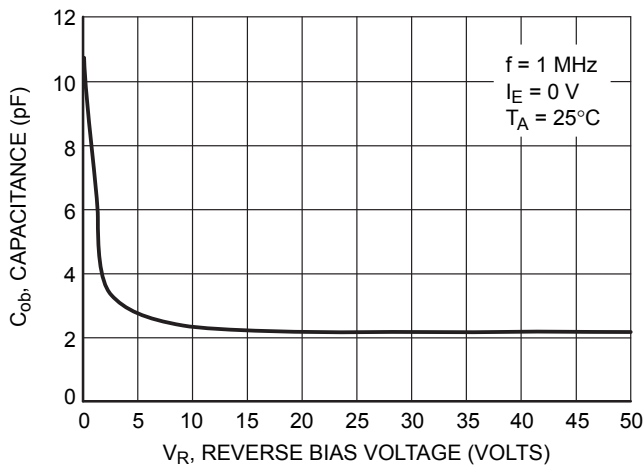


Figure 83. Output Capacitance

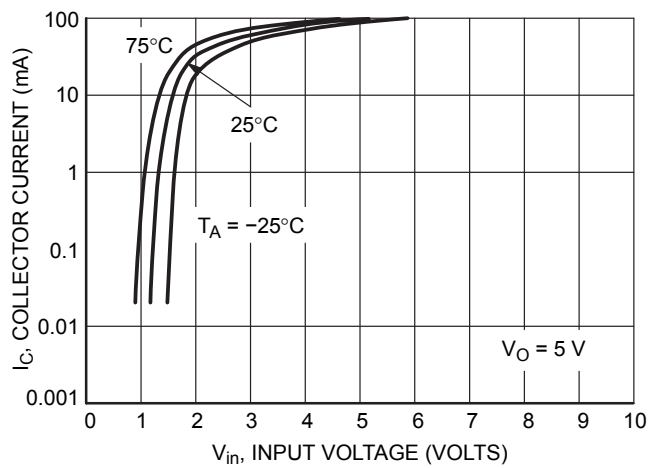


Figure 84. Output Current versus Input Voltage

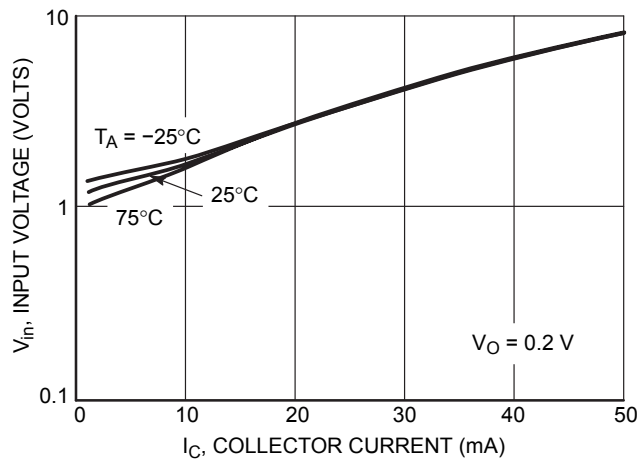


Figure 85. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5332DW1T1 PNP TRANSISTOR

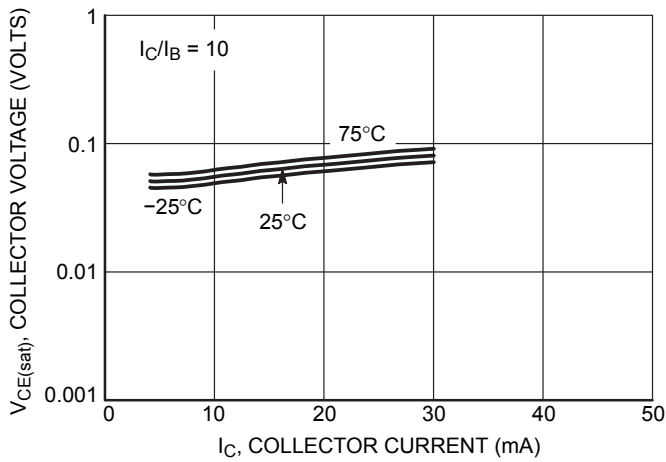


Figure 86. $V_{CE(sat)}$ versus I_C

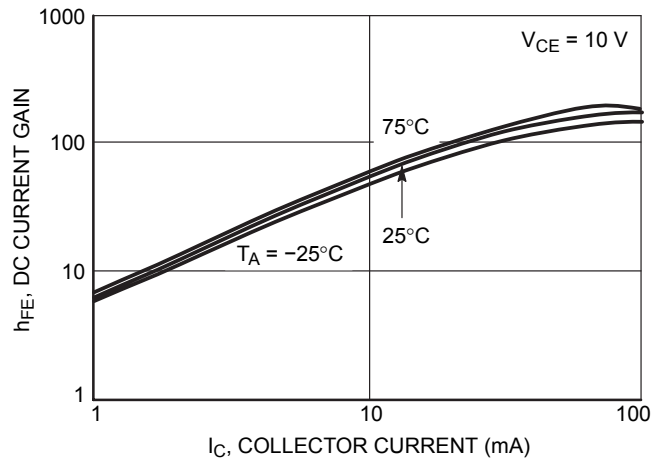


Figure 87. DC Current Gain

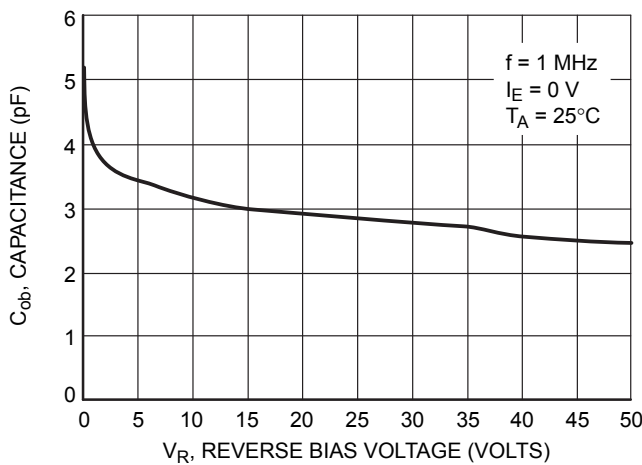


Figure 88. Output Capacitance

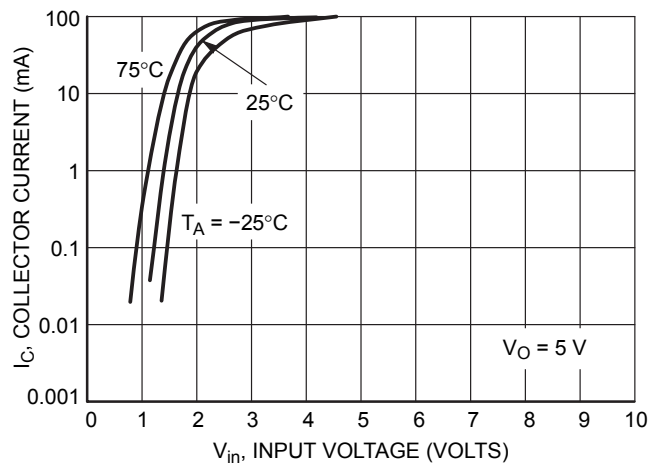


Figure 89. Output Current versus Input Voltage

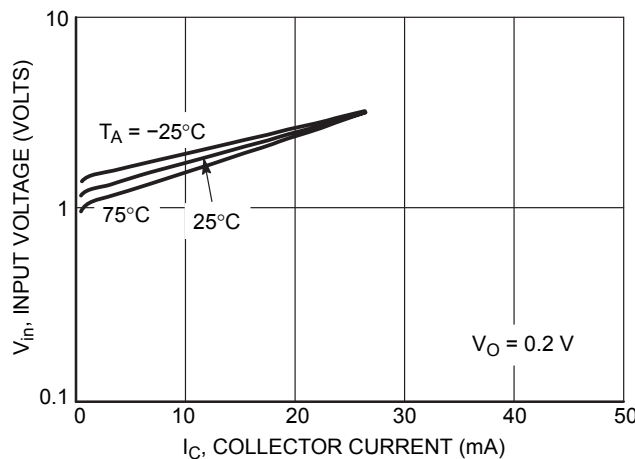


Figure 90. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5333DW1T1 NPN TRANSISTOR

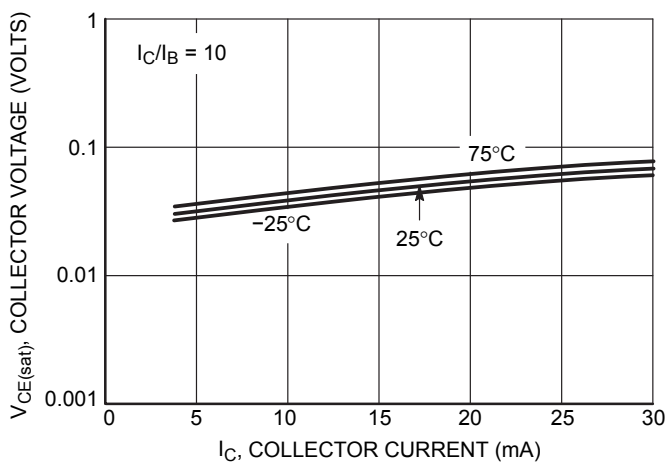


Figure 91. $V_{CE(sat)}$ versus I_C

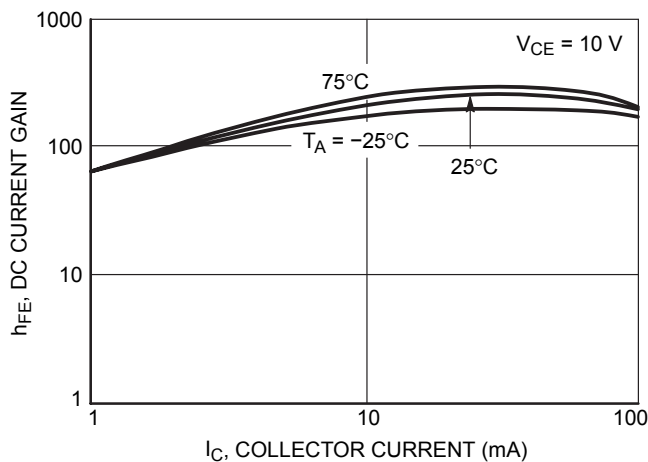


Figure 92. DC Current Gain

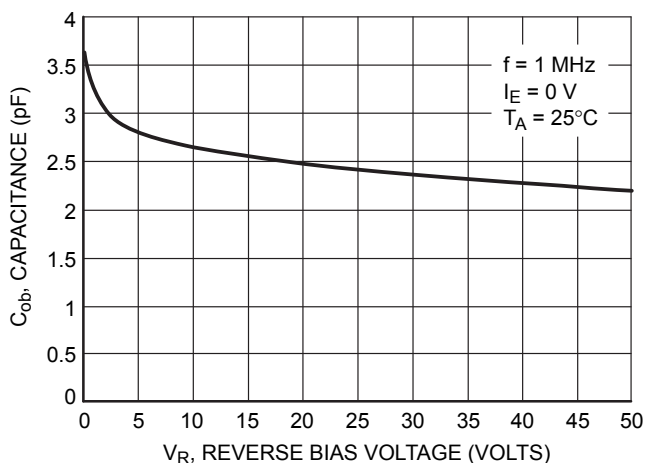


Figure 93. Output Capacitance

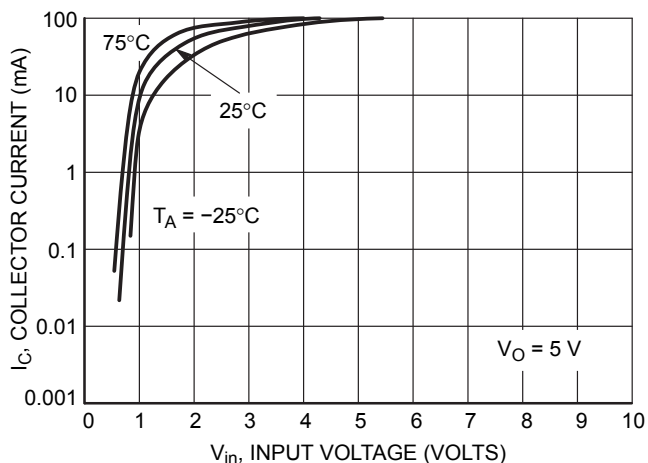


Figure 94. Output Current versus Input Voltage

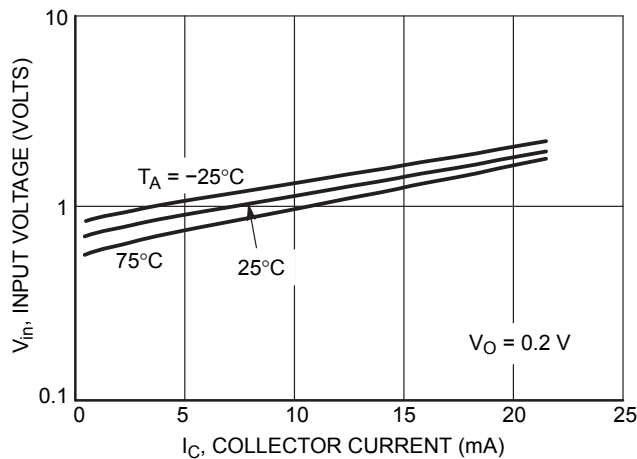


Figure 95. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5333DW1T1 PNP TRANSISTOR

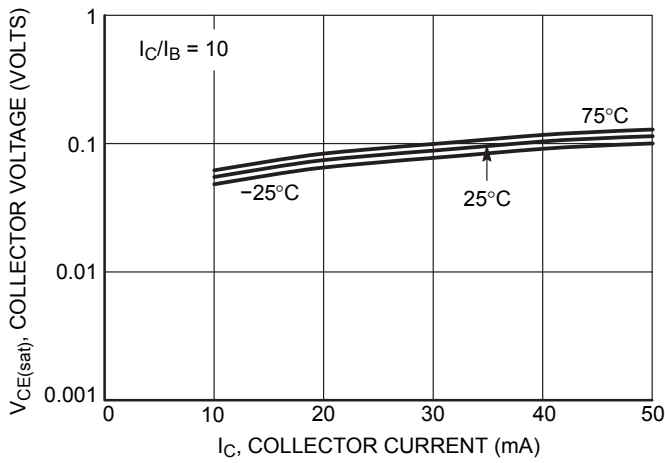


Figure 96. $V_{CE(sat)}$ versus I_C

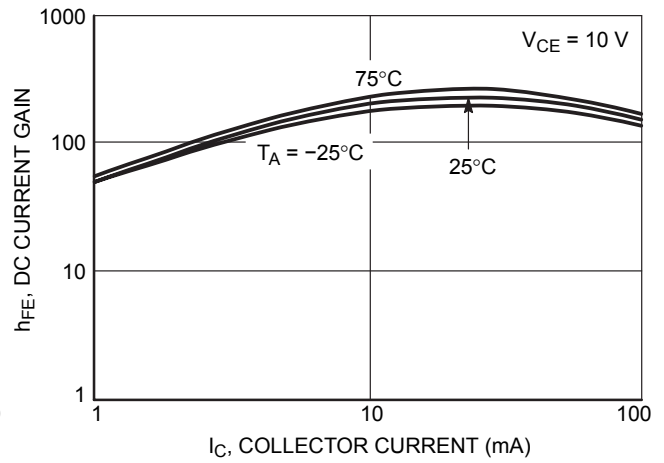


Figure 97. DC Current Gain

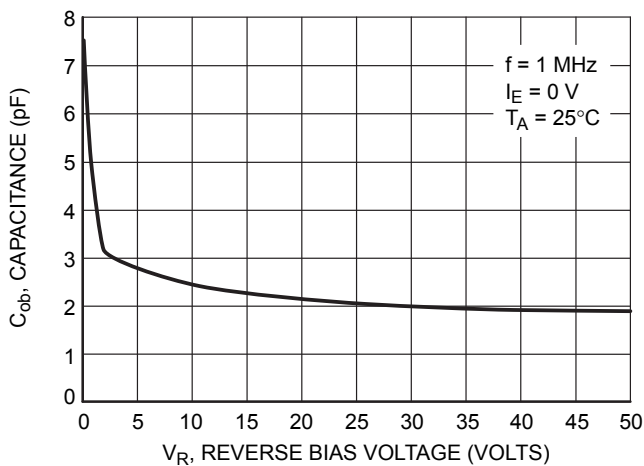


Figure 98. Output Capacitance

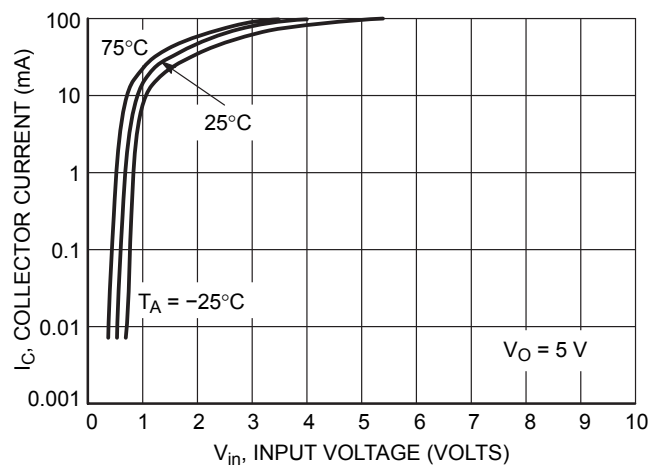


Figure 99. Output Current versus Input Voltage

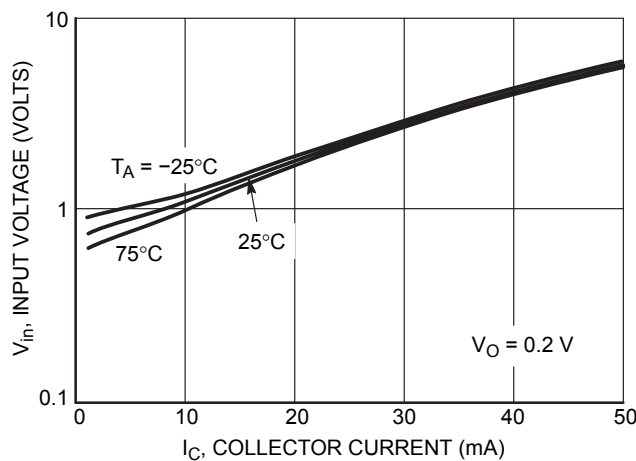


Figure 100. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5334DW1T1 NPN TRANSISTOR

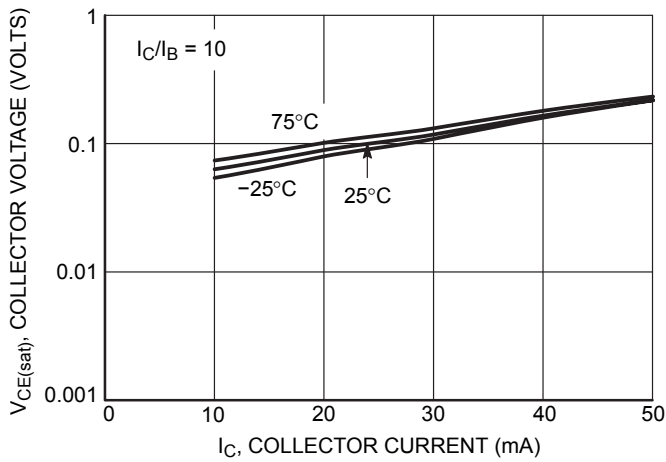


Figure 101. $V_{CE(sat)}$ versus I_C

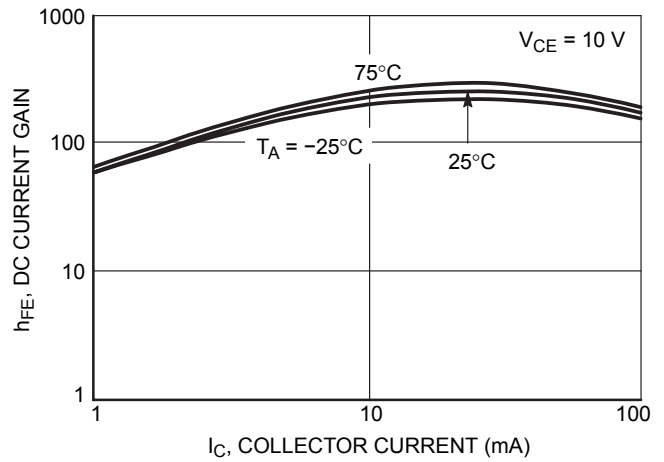


Figure 102. DC Current Gain

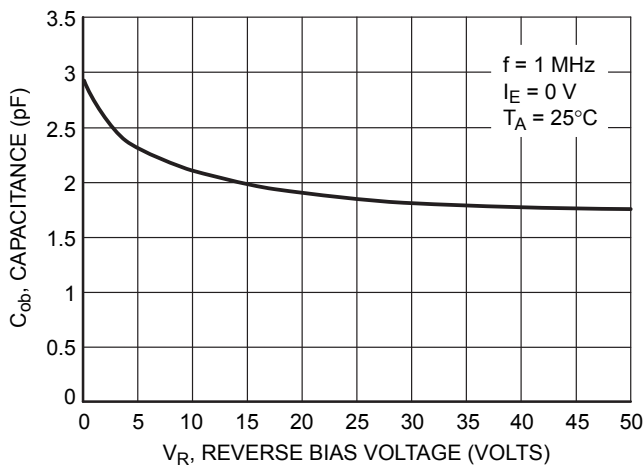


Figure 103. Output Capacitance

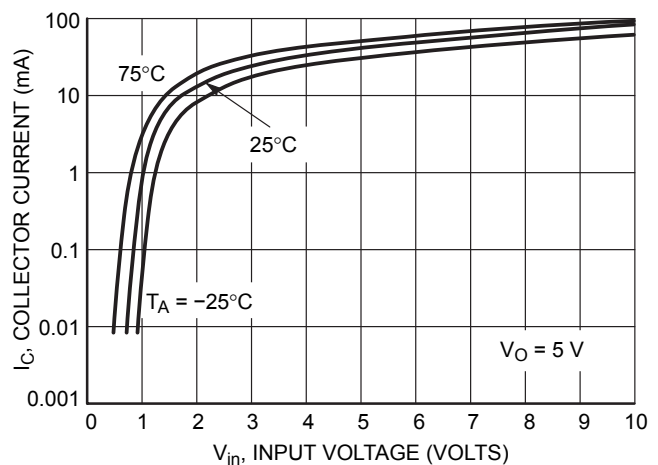


Figure 104. Output Current versus Input Voltage

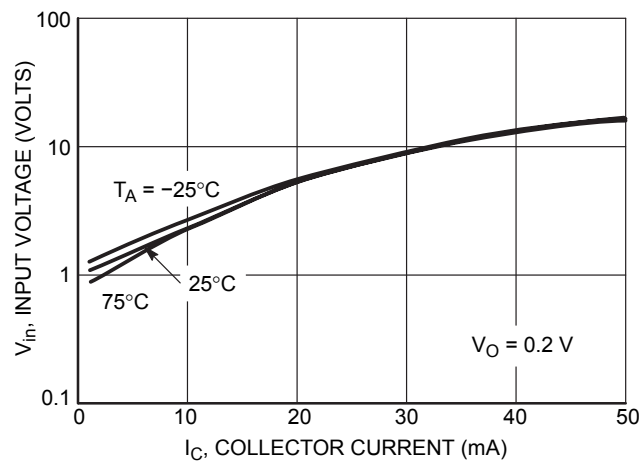


Figure 105. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5334DW1T1 PNP TRANSISTOR

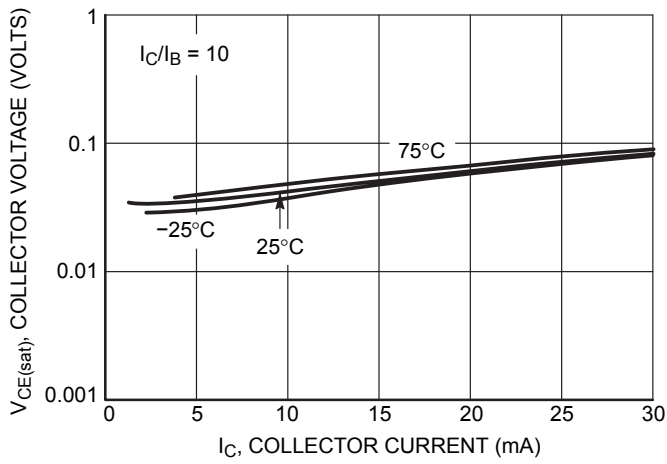


Figure 106. $V_{CE(sat)}$ versus I_C

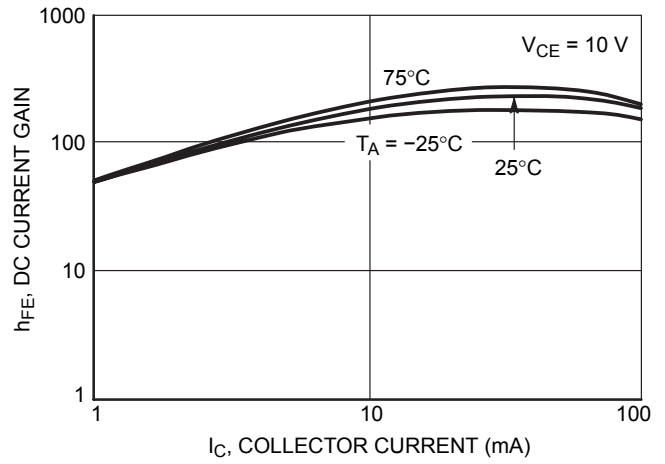


Figure 107. DC Current Gain

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5335DW1T1 NPN TRANSISTOR

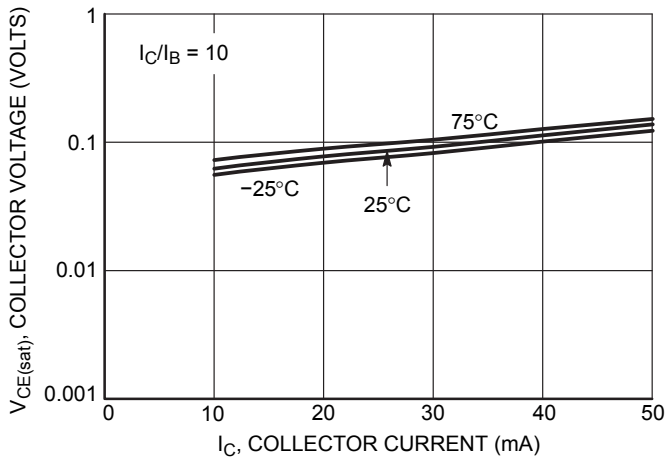


Figure 108. $V_{CE(sat)}$ versus I_C

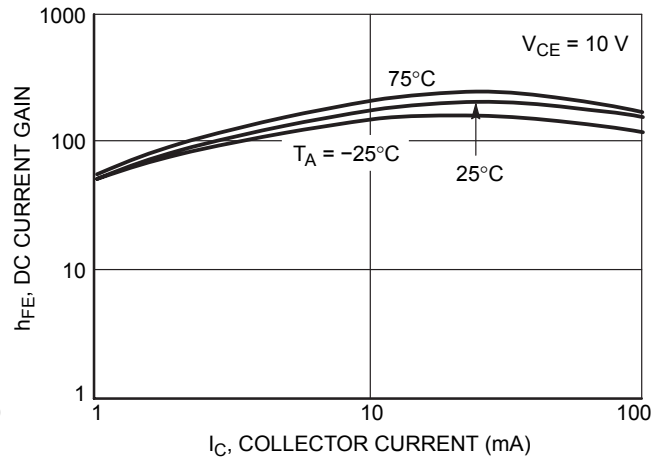


Figure 109. DC Current Gain

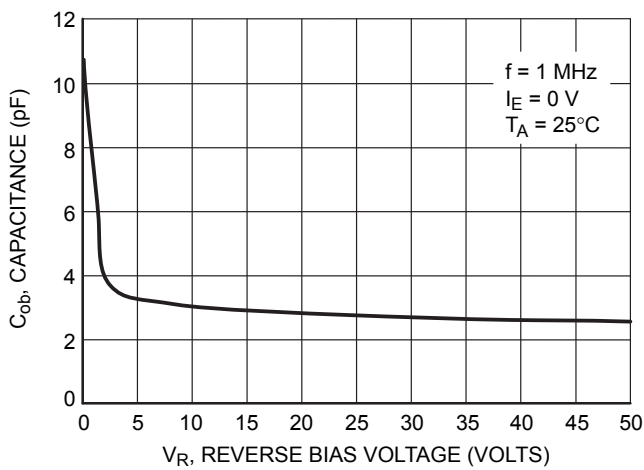


Figure 110. Output Capacitance

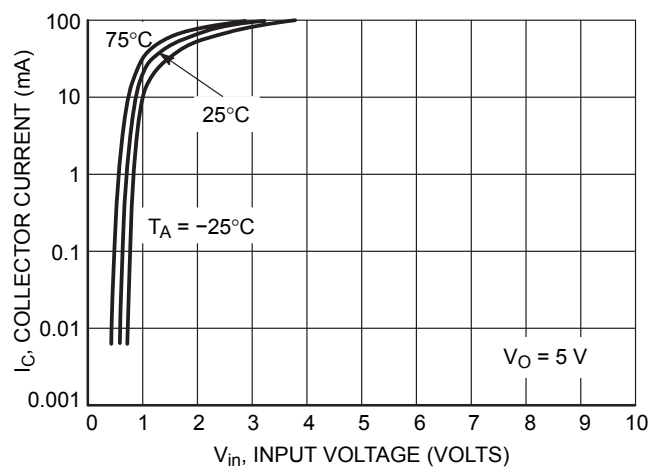


Figure 111. Output Current versus Input Voltage

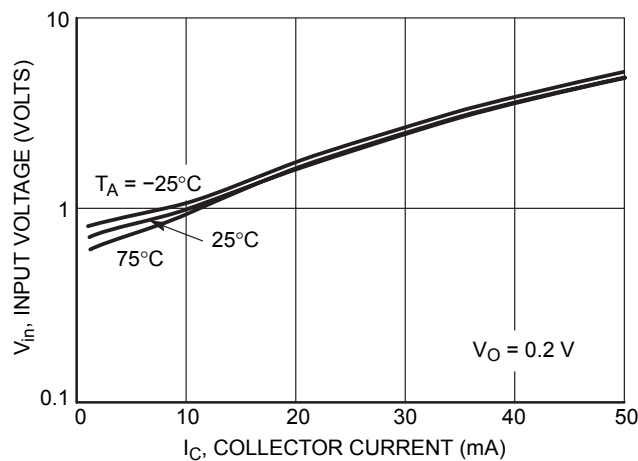


Figure 112. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5335DW1T1 PNP TRANSISTOR

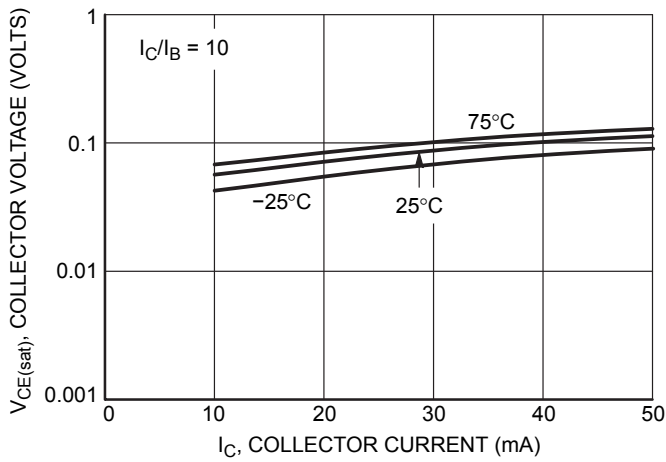


Figure 113. $V_{CE(sat)}$ versus I_C

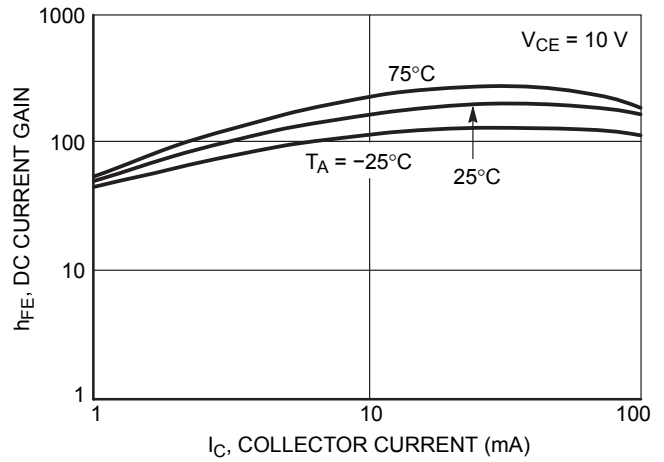


Figure 114. DC Current Gain

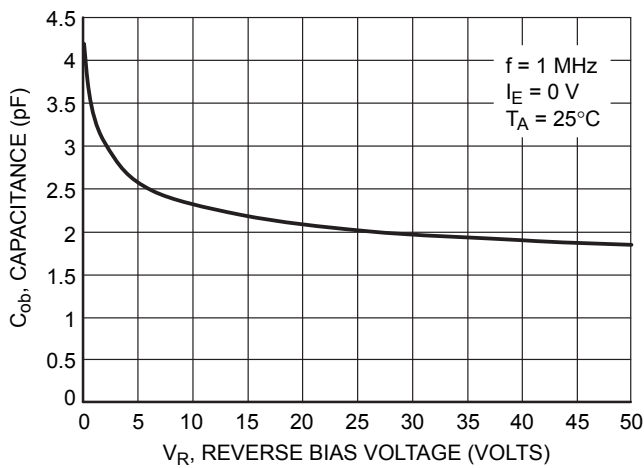


Figure 115. Output Capacitance

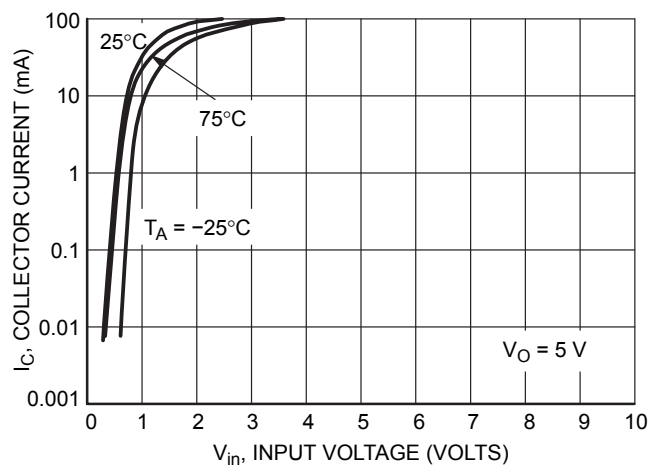


Figure 116. Output Current versus Input Voltage

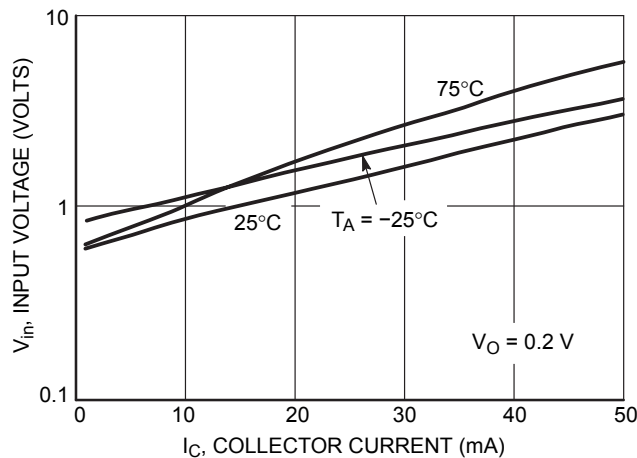
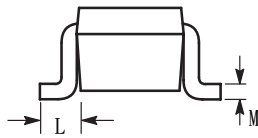
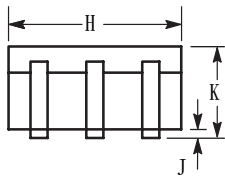
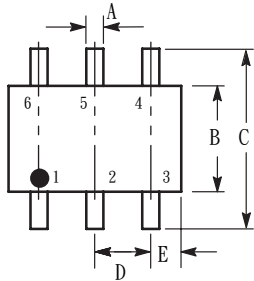


Figure 117. Input Voltage versus Output Current

SOT-363 Package Outline Dimensions

Unit:mm



SOT-363		
Dim	Min	Max
A	0.10	0.30
B	1.15	1.35
C	2.00	2.20
D	0.65 REF	
E	0.30	0.40
H	1.80	2.20
J	-	0.10
K	0.80	1.10
L	0.25	0.40
M	0.10	0.25