

# Dual Bias Resistor Transistors

## NPN and PNP 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 MUN5311DW1T1 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.

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- Available in 8 mm, 7 inch/3000 Unit Tape and Reel

**MAXIMUM RATINGS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted, common for Q 1 and Q 2, - minus sign for Q 1 (PNP) omitted)

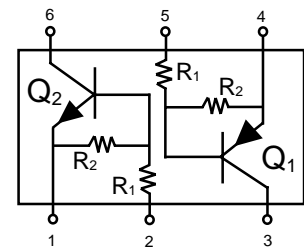
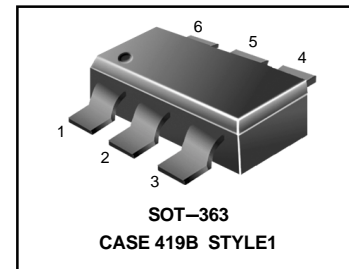
Rating	Symbol	Value	Unit
Collector-Base Voltage	$V_{CBO}$	50	Vdc
Collector-Emitter Voltage	$V_{CEO}$	50	Vdc
Collector Current	$I_C$	100	mAdc

### THERMAL CHARACTERISTICS

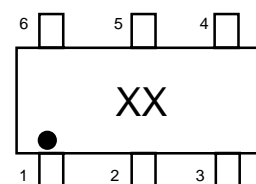
Characteristic (One Junction Heated)	Symbol	Max	Unit
Total Device Dissipation $T_A = 25^\circ\text{C}$	$P_D$	187 (Note 1.) 256 (Note 2.)	mW
Derate above $25^\circ\text{C}$		1.5 (Note 1.) 2.0 (Note 2.)	mW/ $^\circ\text{C}$
Thermal Resistance – Junction-to-Ambient	$R_{\theta JA}$	670 (Note 1.) 490 (Note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

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

## MUN5311DW1T1 Series



### MARKING DIAGRAM



xx = Device Marking  
(See Page 2)

### DEVICE MARKING INFORMATION

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

**MUN5311DW1T1 Series**

**DEVICE MARKING AND RESISTOR VALUES**

Device	Package	Marking	R <sub>1</sub> (K)	R <sub>2</sub> (K)	Shipping
MUN5311DW1T1	SOT-363	11	10	10	3000/Tape & Reel
MUN5312DW1T1	SOT-363	12	22	22	3000/Tape & Reel
MUN5313DW1T1	SOT-363	13	47	47	3000/Tape & Reel
MUN5314DW1T1	SOT-363	14	10	47	3000/Tape & Reel
MUN5315DW1T1 (Note 3.)	SOT-363	15	10	∞	3000/Tape & Reel
MUN5316DW1T1 (Note 3.)	SOT-363	16	4.7	∞	3000/Tape & Reel
MUN5330DW1T1 (Note 3.)	SOT-363	30	1.0	1.0	3000/Tape & Reel
MUN5331DW1T1 (Note 3.)	SOT-363	31	2.2	2.2	3000/Tape & Reel
MUN5332DW1T1 (Note 3.)	SOT-363	32	4.7	4.7	3000/Tape & Reel
MUN5333DW1T1 (Note 3.)	SOT-363	33	4.7	47	3000/Tape & Reel
MUN5334DW1T1 (Note 3.)	SOT-363	34	22	47	3000/Tape & Reel
MUN5335DW1T1 (Note 3.)	SOT-363	35	2.2	47	3000/Tape & Reel

**ELECTRICAL CHARACTERISTICS**

(T<sub>A</sub> = 25°C unless otherwise noted, common for Q<sub>1</sub> and Q<sub>2</sub>, – minus sign for Q<sub>1</sub> (PNP) omitted)

Characteristic	Symbol	Min	Typ	Max	Unit
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**OFF CHARACTERISTICS**

Collector-Base Cutoff Current (V <sub>CB</sub> = 50 V, I <sub>E</sub> = 0)	I <sub>CBO</sub>	–	–	100	nAdc	
Collector-Emitter Cutoff Current (V <sub>CE</sub> = 50 V, I <sub>B</sub> = 0)	I <sub>CEO</sub>	–	–	500	nAdc	
Emitter-Base Cutoff Current (V <sub>EB</sub> = 6.0 V, I <sub>C</sub> = 0)	MUN5311DW1T1	I <sub>EBO</sub>	–	–	0.5	mAdc
	MUN5312DW1T1		–	–	0.2	
	MUN5313DW1T1		–	–	0.1	
	MUN5314DW1T1		–	–	0.2	
	MUN5315DW1T1		–	–	0.9	
	MUN5316DW1T1		–	–	1.9	
	MUN5330DW1T1		–	–	4.3	
	MUN5331DW1T1		–	–	2.3	
	MUN5332DW1T1		–	–	1.5	
	MUN5333DW1T1		–	–	0.18	
MUN5334DW1T1		–	–	0.13		
MUN5335DW1T1		–	–	0.2		
Collector-Base Breakdown Voltage (I <sub>C</sub> = 10 μA, I <sub>E</sub> = 0)	V <sub>(BR)CBO</sub>	50	–	–	Vdc	
Collector-Emitter Breakdown Voltage (Note 4.) (I <sub>C</sub> = 2.0 mA, I <sub>B</sub> = 0)	V <sub>(BR)CEO</sub>	50	–	–	Vdc	

3. New resistor combinations. Updated curves to follow in subsequent data sheets.

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

**MUN5311DW1T1 Series**

**ELECTRICAL CHARACTERISTICS**

(T<sub>A</sub> = 25°C unless otherwise noted, common for Q<sub>1</sub> and Q<sub>2</sub>, – minus sign for Q<sub>1</sub> (PNP) omitted)  
(Continued)

Characteristic	Symbol	Min	Typ	Max	Unit
<b>ON CHARACTERISTICS</b> (Note 5.)					
DC Current Gain (V <sub>CE</sub> = 10 V, I <sub>C</sub> = 5.0 mA)	MUN5311DW1T1	h <sub>FE</sub>	35	60	–
	MUN5312DW1T1		60	100	–
	MUN5313DW1T1		80	140	–
	MUN5314DW1T1		80	140	–
	MUN5315DW1T1		160	350	–
	MUN5316DW1T1		160	350	–
	MUN5330DW1T1		3.0	5.0	–
	MUN5331DW1T1		8.0	15	–
	MUN5332DW1T1		15	30	–
	MUN5333DW1T1		80	200	–
	MUN5334DW1T1		80	150	–
	MUN5335DW1T1		80	140	–
Collector-Emitter Saturation Voltage (I <sub>C</sub> = 10 mA, I <sub>B</sub> = 0.3 mA)	V <sub>CE(sat)</sub>	–	–	0.25	Vdc
(I <sub>C</sub> = 10 mA, I <sub>B</sub> = 5 mA)	MUN5330DW1T1/MUN5331DW1T1				
(I <sub>C</sub> = 10 mA, I <sub>B</sub> = 1 mA)	MUN5315DW1T1/MUN5316DW1T1 MUN5332DW1T1/MUN5333DW1T1/MUN5334DW1T1				
Output Voltage (on) (V <sub>CC</sub> = 5.0V, V <sub>B</sub> = 2.5V, R <sub>L</sub> = 1.0 kΩ)	V <sub>OL</sub>				Vdc
	MUN5311DW1T1	–	–	0.2	
	MUN5312DW1T1	–	–	0.2	
	MUN5314DW1T1	–	–	0.2	
	MUN5315DW1T1	–	–	0.2	
	MUN5316DW1T1	–	–	0.2	
	MUN5330DW1T1	–	–	0.2	
	MUN5331DW1T1	–	–	0.2	
	MUN5332DW1T1	–	–	0.2	
	MUN5333DW1T1	–	–	0.2	
	MUN5334DW1T1	–	–	0.2	
	MUN5335DW1T1	–	–	0.2	
(V <sub>CC</sub> = 5.0V, V <sub>B</sub> = 3.5 V, R <sub>L</sub> = 1.0kΩ)	MUN5313DW1T1	–	–	0.2	

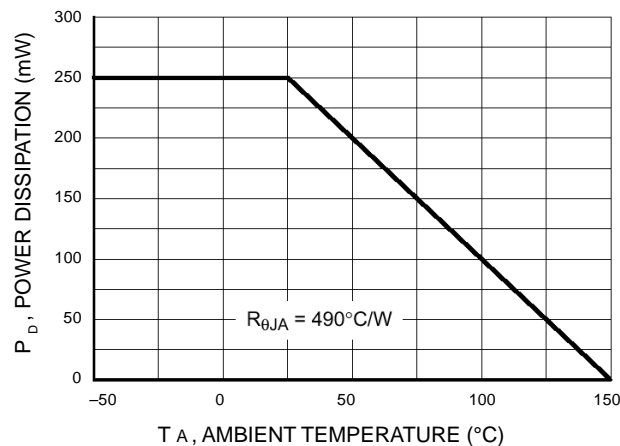
**MUN5311DW1T1 Series**

**ELECTRICAL CHARACTERISTICS**

(T<sub>A</sub> = 25°C unless otherwise noted, common for Q<sub>1</sub> and Q<sub>2</sub>, – minus sign for Q<sub>1</sub> (PNP) omitted)  
(Continued)

Characteristic	Symbol	Min	Typ	Max	Unit
<b>ON CHARACTERISTICS</b> (Note 5.)					
Output Voltage (off) (V <sub>CC</sub> =5.0V, V <sub>B</sub> =0.5V, R <sub>L</sub> =1.0kΩ) (V <sub>CC</sub> =5.0V, V <sub>B</sub> =0.050V, R <sub>L</sub> =1.0kΩ) MUN5330DW1T1 (V <sub>CC</sub> =5.0V, V <sub>B</sub> =0.25V, R <sub>L</sub> =1.0kΩ) MUN5315DW1T1 MUN5316DW1T1 MUN5333DW1T1	V <sub>OH</sub>	4.9	–	–	Vdc
Input Resistor MUN5311DW1T1 MUN5312DW1T1 MUN5313DW1T1 MUN5314DW1T1 MUN5315DW1T1 MUN5316DW1T1 MUN5330DW1T1 MUN5331DW1T1 MUN5332DW1T1 MUN5333DW1T1 MUN5334DW1T1 MUN5335DW1T1	R <sub>1</sub>	7.0 15.4 32.9 7.0 7.0 3.3 0.7 1.5 3.3 3.3 15.4 1.54	10 22 47 10 10 4.7 1.0 2.2 4.7 4.7	13 28.6 61.1 13 13 6.1 1.3 2.9 6.1 6.1 28.6 2.86	kΩ
Resistor Ratio MUN5311DW1T1/MUN5312DW1T1/MUN5313DW1T1 MUN5314DW1T1 MUN5315DW1T1/MUN5316DW1T1 MUN5330DW1T1/MUN5331DW1T1/MUN5332DW1T1 MUN5333DW1T1 MUN5334DW1T1 MUN5335DW1T1	R <sub>1</sub> / R <sub>2</sub>	0.8 0.17 – 0.8 0.055 0.38 0.038	1.0 0.21 – 1.0 0.1 0.47 0.047	1.2 0.25 – 1.2 0.185 0.56 0.056	

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



**Figure 1. Derating Curve**

MUN5311DW1T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5311DW1T1 NPN TRANSISTOR

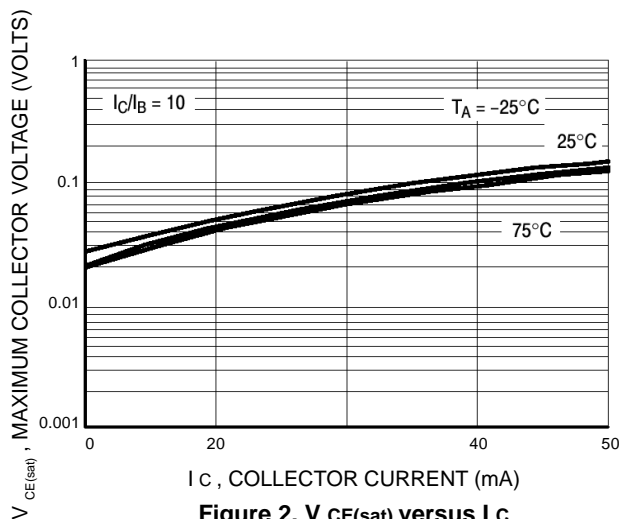


Figure 2.  $V_{CE(sat)}$  versus  $I_C$

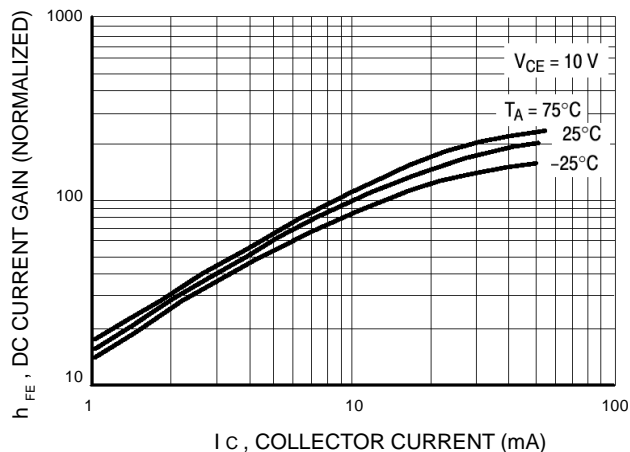


Figure 3. DC Current Gain

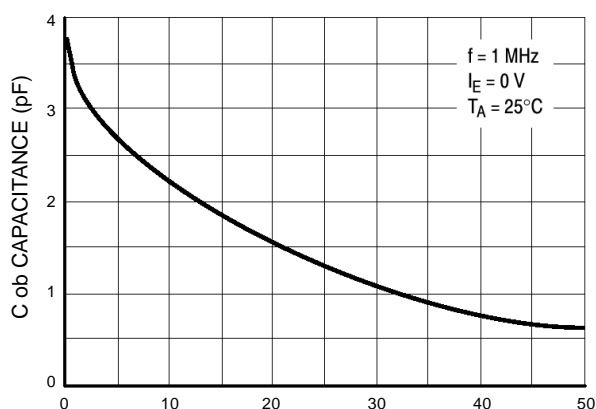


Figure 4. Output Capacitance

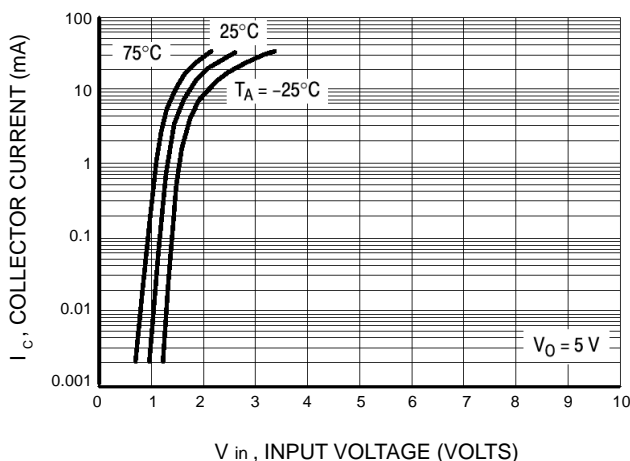


Figure 5. Output Current versus Input Voltage

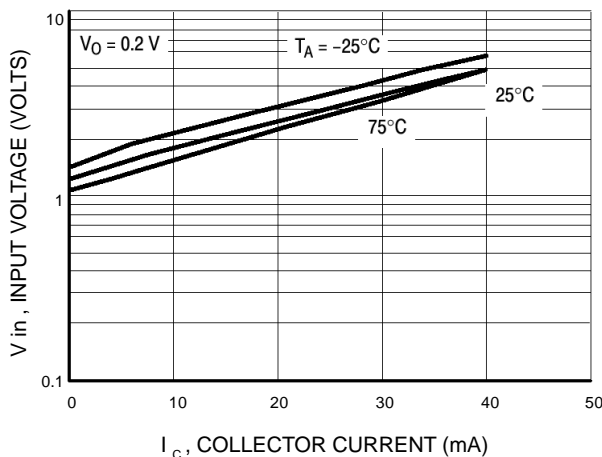


Figure 6. Input Voltage versus Output Current

MUN5311DW1T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5311DW1T1 PNP TRANSISTOR

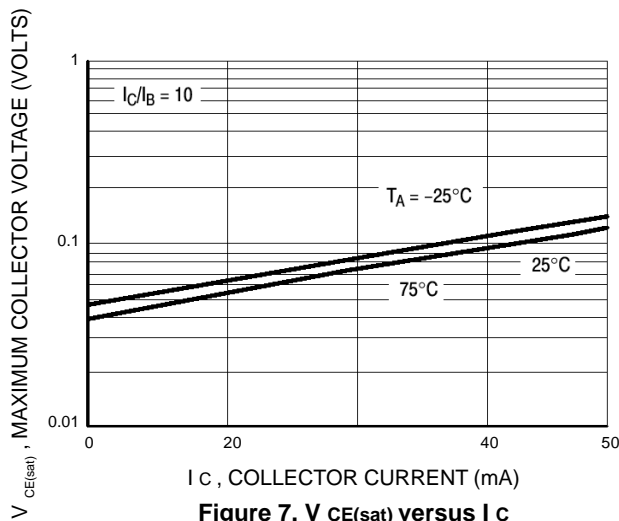


Figure 7.  $V_{CE(sat)}$  versus  $I_c$

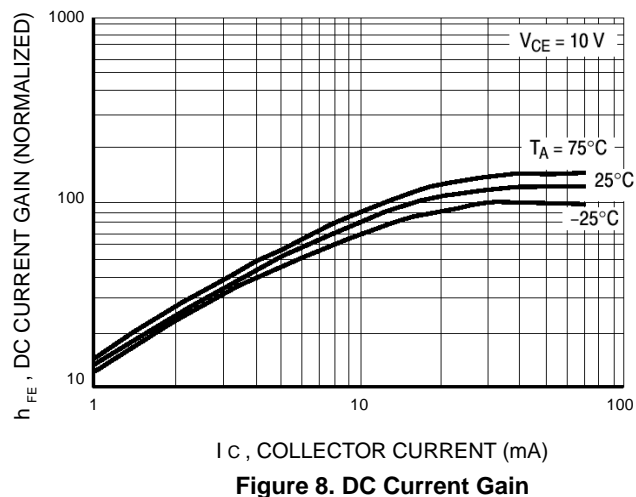


Figure 8. DC Current Gain

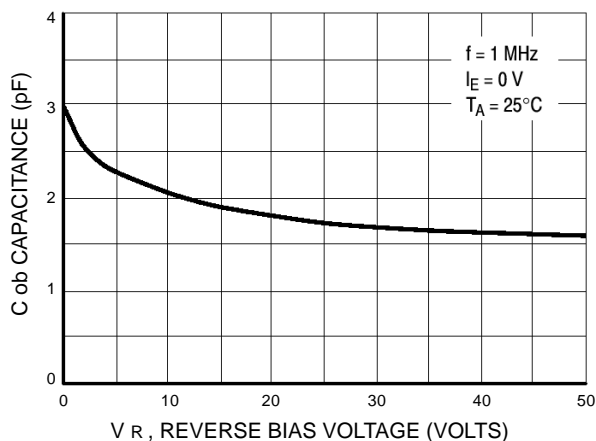


Figure 9. Output Capacitance

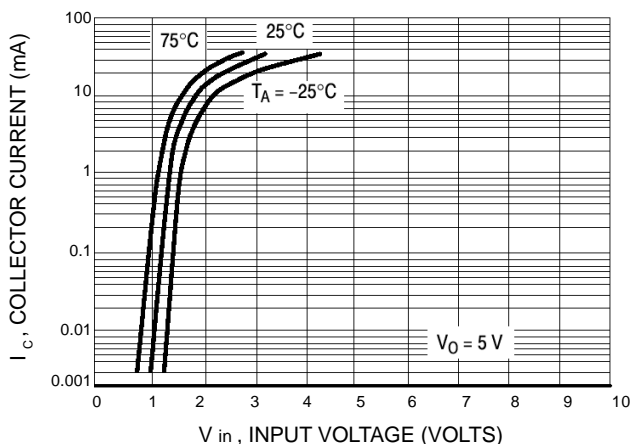


Figure 10. Output Current versus Input Voltage

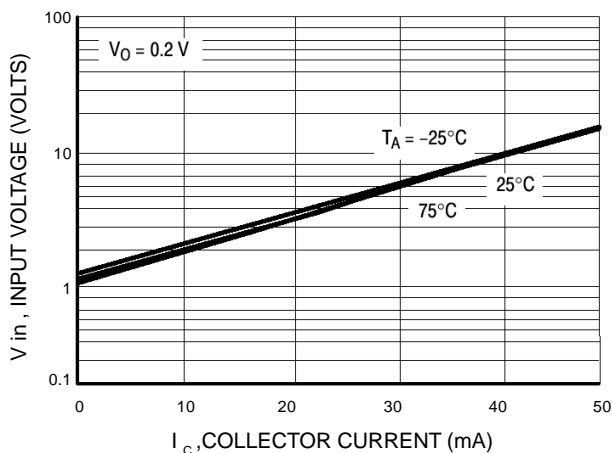
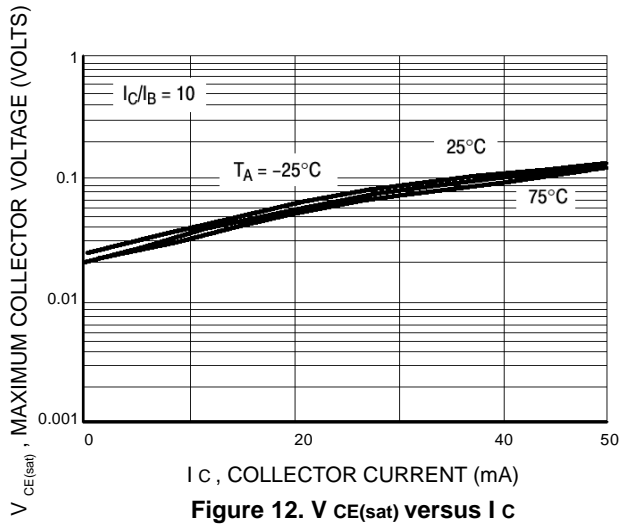


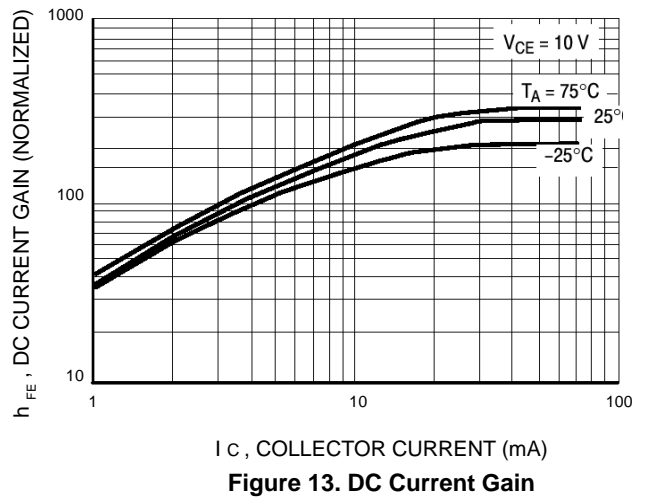
Figure 11. Input Voltage versus Output Current

MUN5311DW1T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5312DW1T1 NPN TRANSISTOR



$I_C$ , COLLECTOR CURRENT (mA)  
Figure 12.  $V_{CE(sat)}$  versus  $I_C$



$I_C$ , COLLECTOR CURRENT (mA)  
Figure 13. DC Current Gain

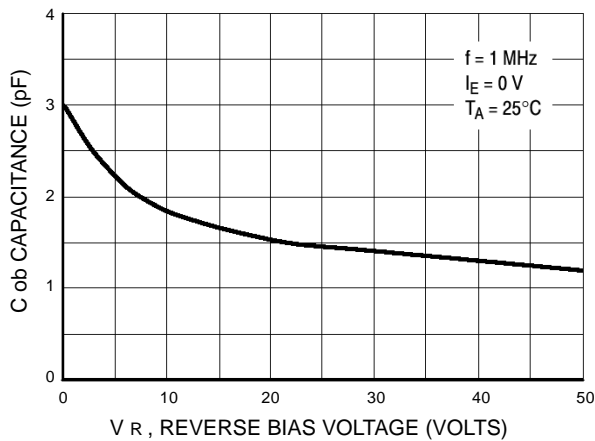


Figure 14. Output Capacitance

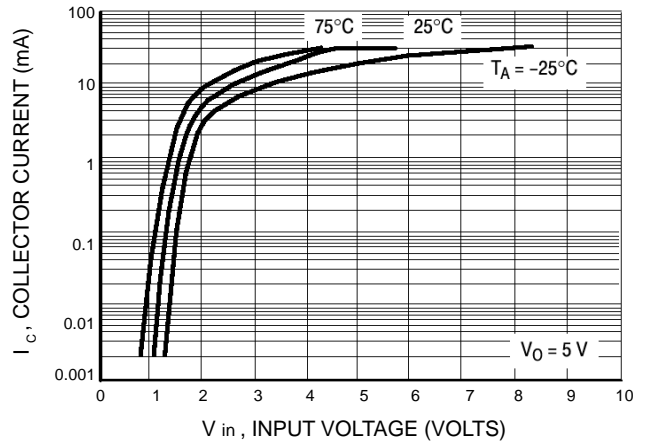


Figure 15. Output Current versus Input Voltage

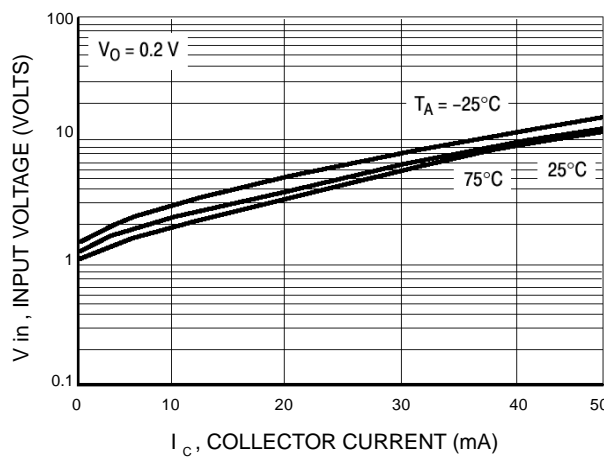


Figure 16. Input Voltage versus Output Current

MUN5311DW1T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5312DW1T1 PNP TRANSISTOR

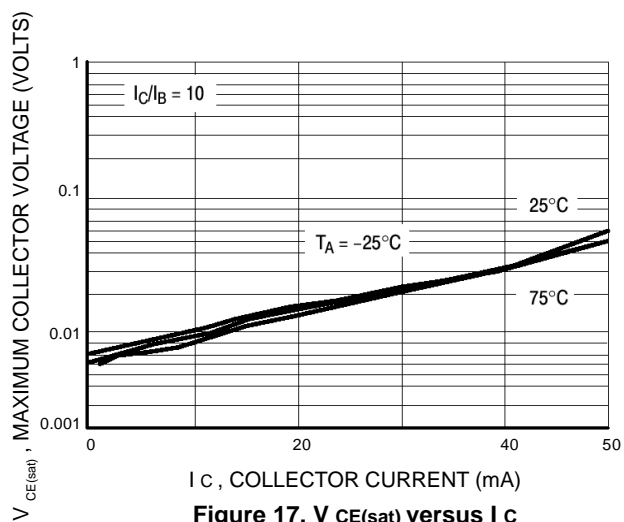


Figure 17.  $V_{CE(sat)}$  versus  $I_C$

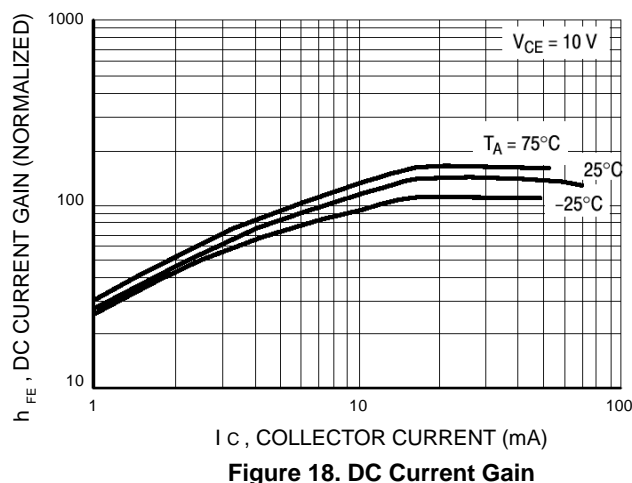


Figure 18. DC Current Gain

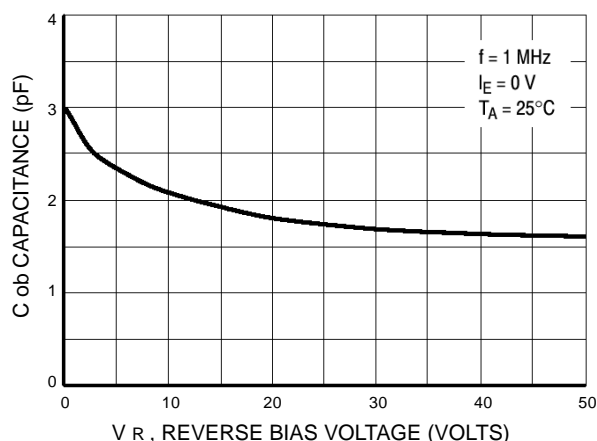


Figure 19. Output Capacitance

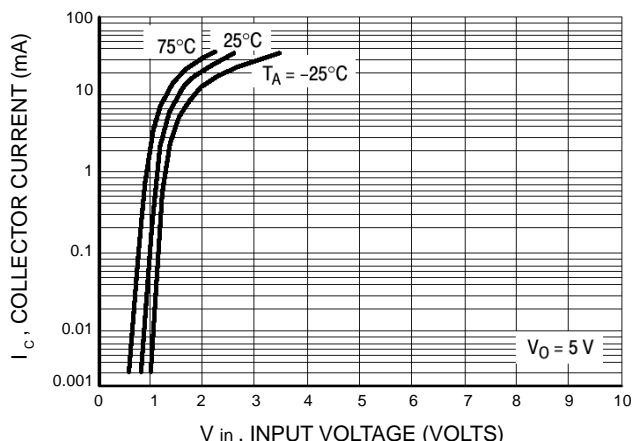


Figure 20. Output Current versus Input Voltage

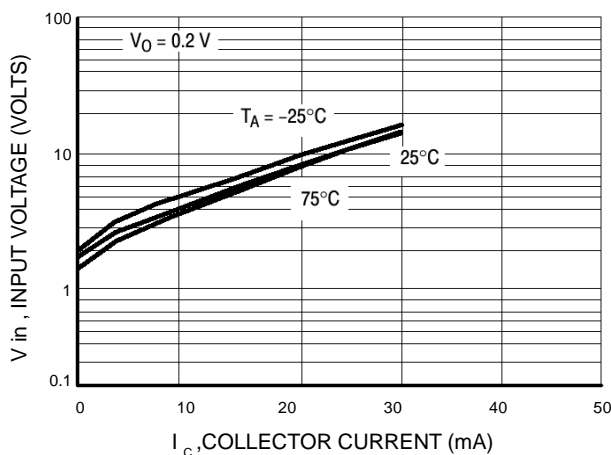


Figure 21. Input Voltage versus Output Current



MUN5311DW1T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5313DW1T1 NPN TRANSISTOR

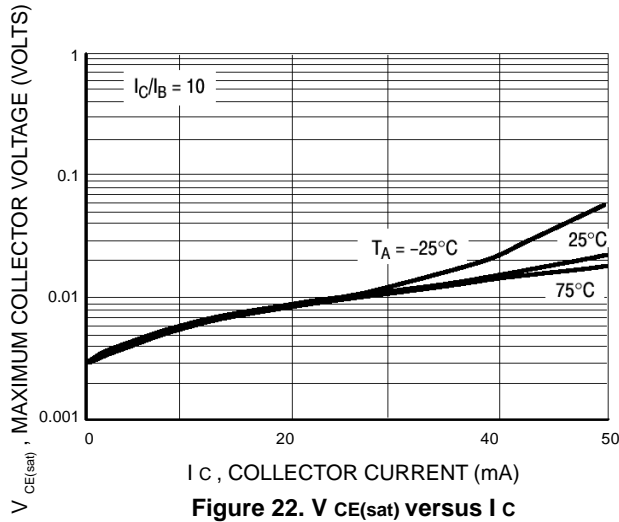


Figure 22.  $V_{CE(sat)}$  versus  $I_C$

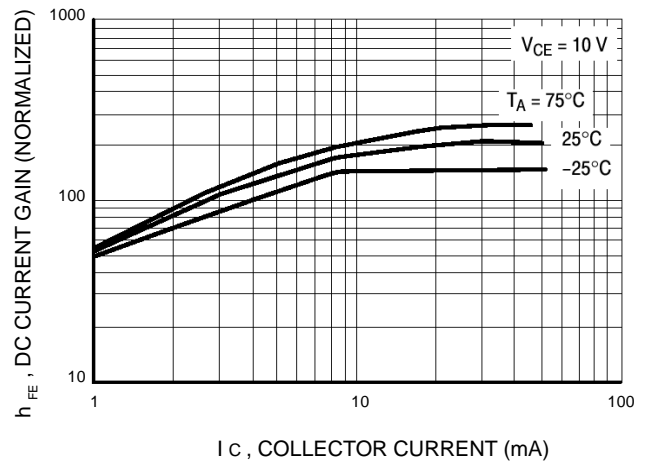


Figure 23. DC Current Gain

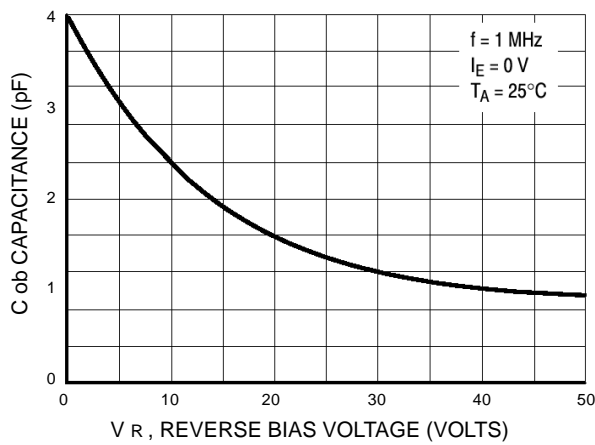


Figure 24. Output Capacitance

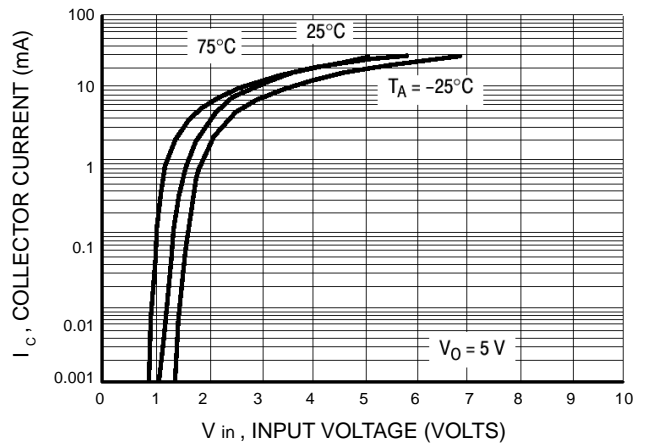


Figure 25. Output Current versus Input Voltage

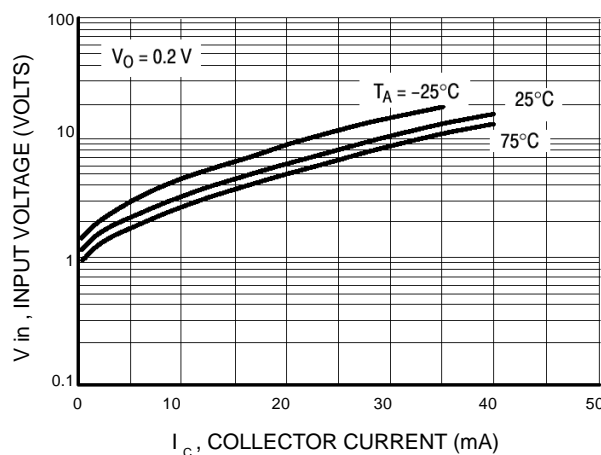


Figure 26. Input Voltage versus Output Current

MUN5311DW1T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5313DW1T1 PNP TRANSISTOR

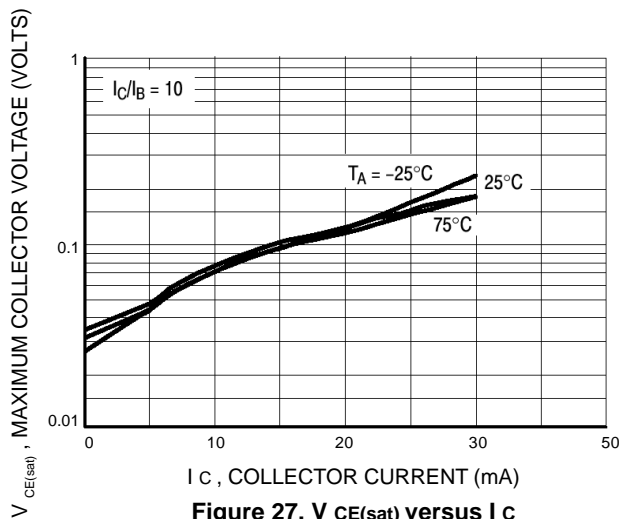


Figure 27.  $V_{CE(sat)}$  versus  $I_c$

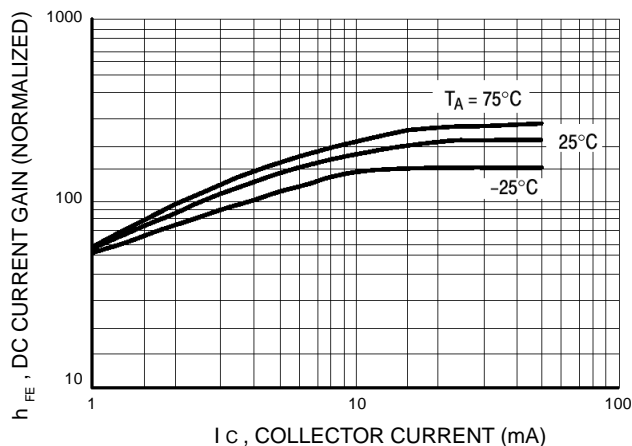


Figure 28. DC Current Gain

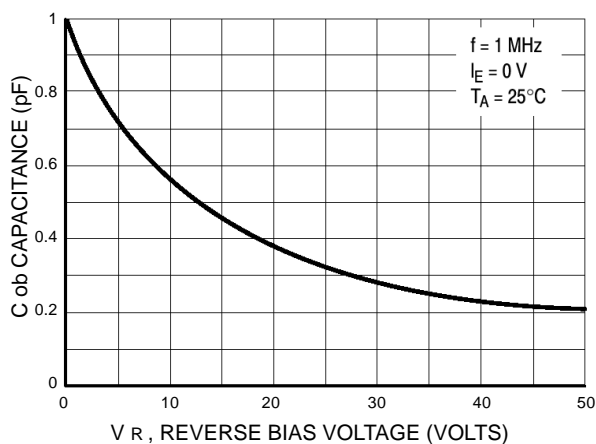


Figure 29. Output Capacitance

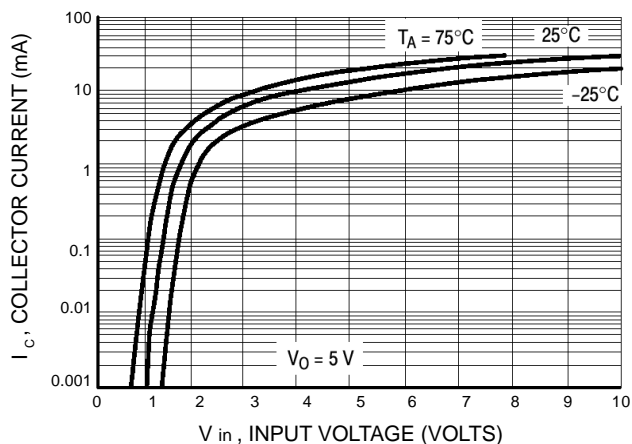


Figure 30. Output Current versus Input Voltage

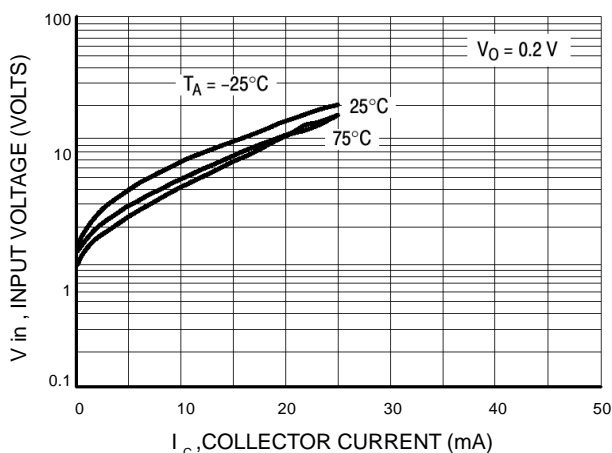
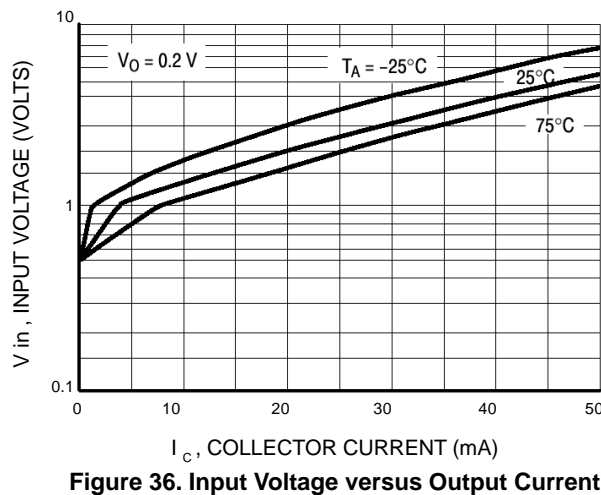
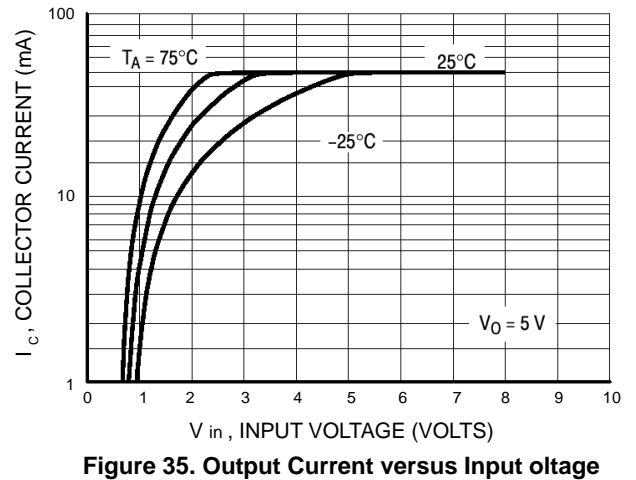
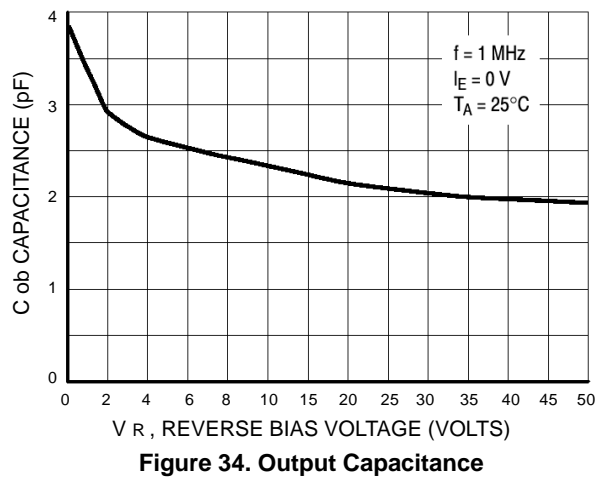
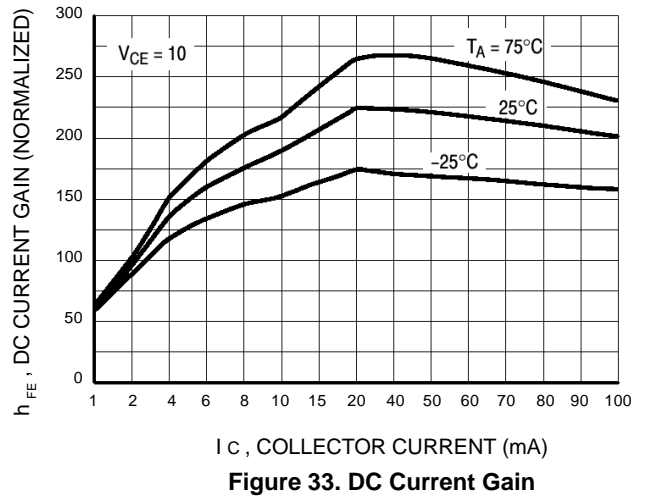
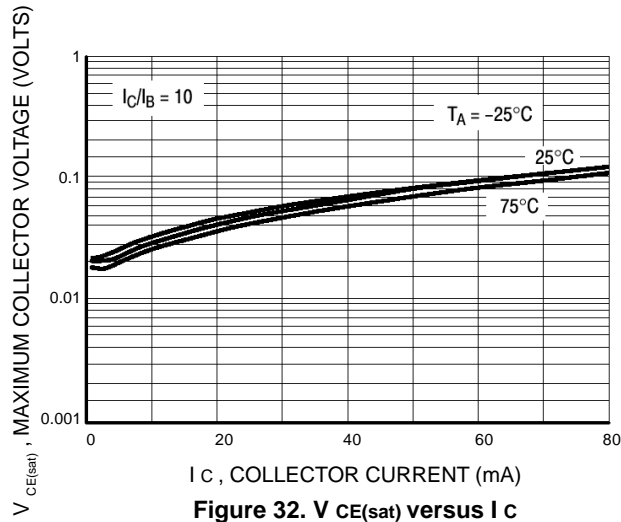


Figure 31. Input Voltage versus Output Current

MUN5311DW1T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5314DW1T1 NPN TRANSISTOR



MUN5311DW1T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5314DW1T1 PNP TRANSISTOR

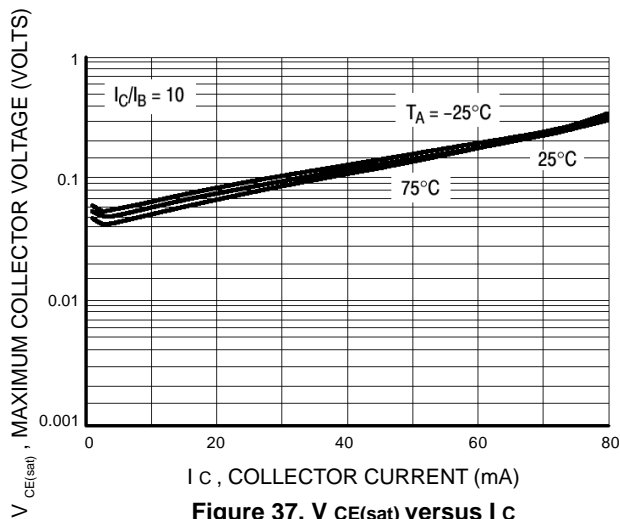


Figure 37.  $V_{CE(sat)}$  versus  $I_C$

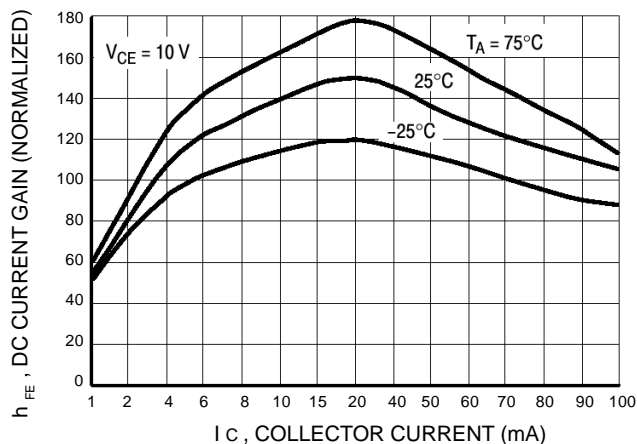


Figure 38. DC Current Gain

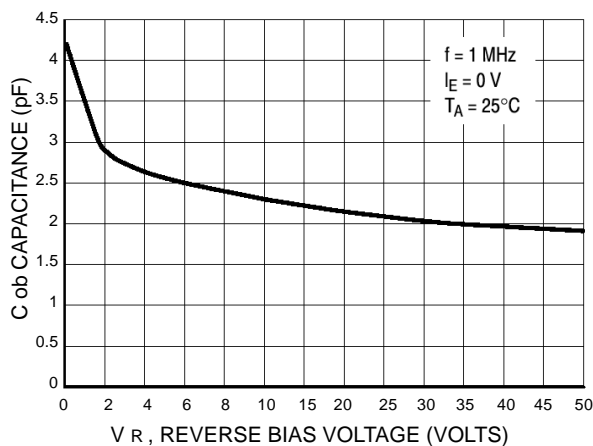


Figure 39. Output Capacitance

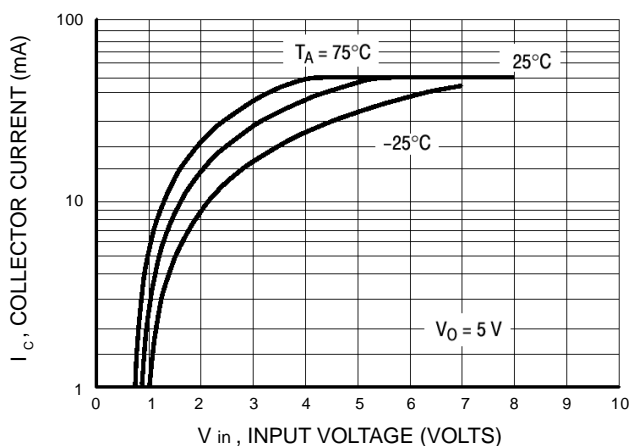


Figure 40. Output Current versus Input Voltage

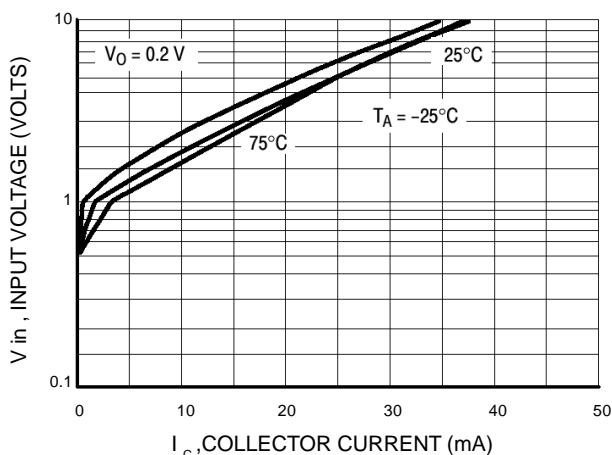


Figure 41. Input Voltage versus Output Current

MUN5311DW1T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5315DW1T1

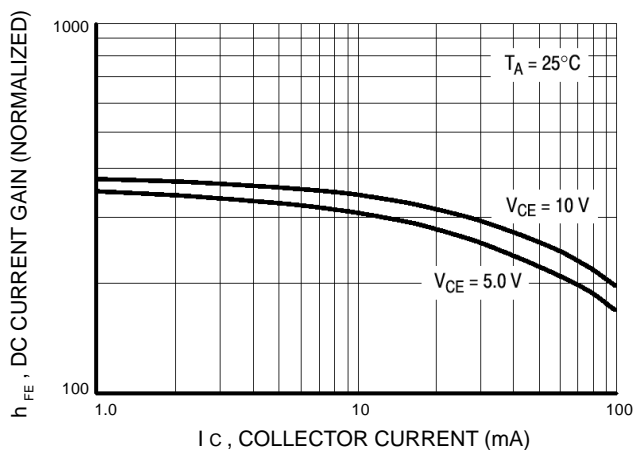


Figure 42. DC Current Gain-PNP

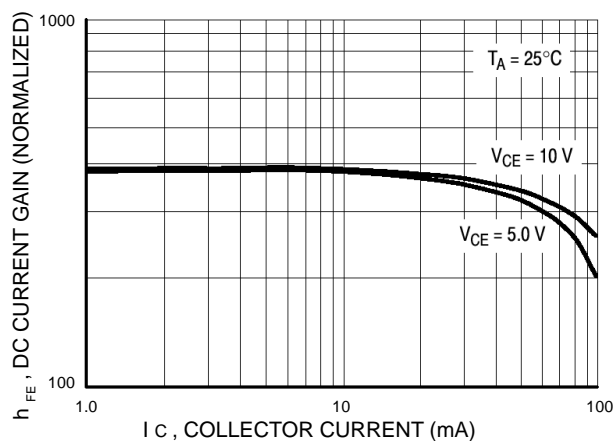


Figure 43. DC Current Gain-NPN

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5316DW1T1

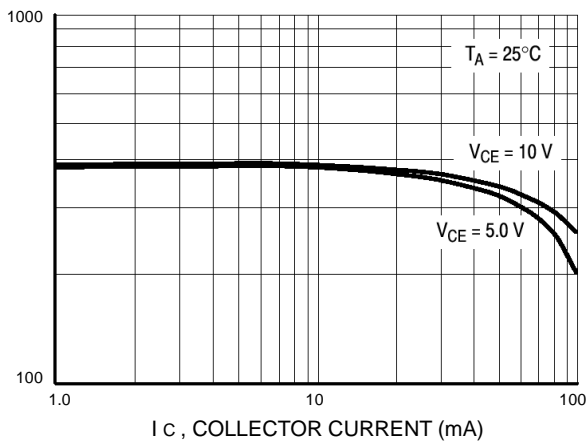


Figure 44. DC Current Gain-PNP

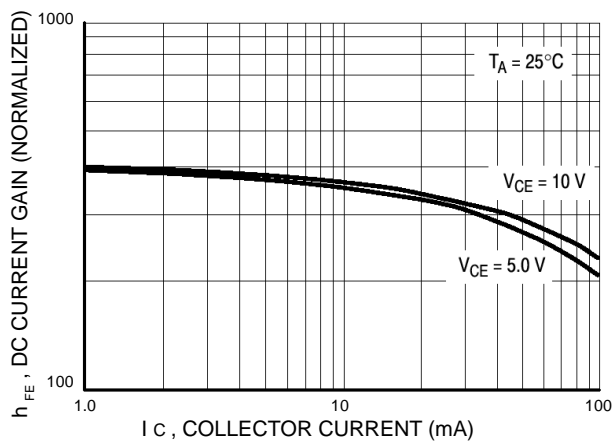


Figure 45. DC Current Gain-NPN