

# 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)

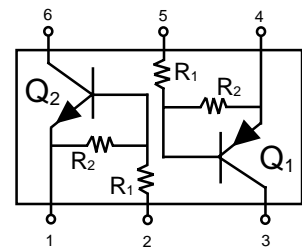
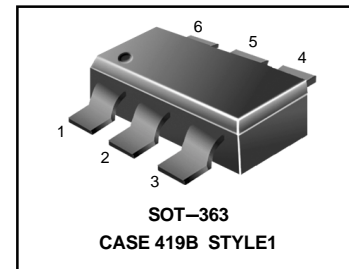
Rating	Symbol	Value	Unit
Collector-Base Voltage	$V_{CBO}$	50	Vdc
Collector-Emitter Voltage	$V_{CEO}$	50	Vdc
Collector Current	$I_C$	100	mAdc

### THERMAL CHARACTERISTICS

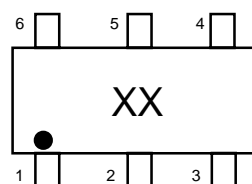
Characteristic (One Junction Heated)	Symbol	Max	Unit
Total Device Dissipation $T_A = 25^\circ\text{C}$	$P_D$	187 (Note 1.) 256 (Note 2.)	mW
Derate above $25^\circ\text{C}$		1.5 (Note 1.) 2.0 (Note 2.)	mW/ $^\circ\text{C}$
Thermal Resistance – Junction-to-Ambient	$R_{\theta JA}$	670 (Note 1.) 490 (Note 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	

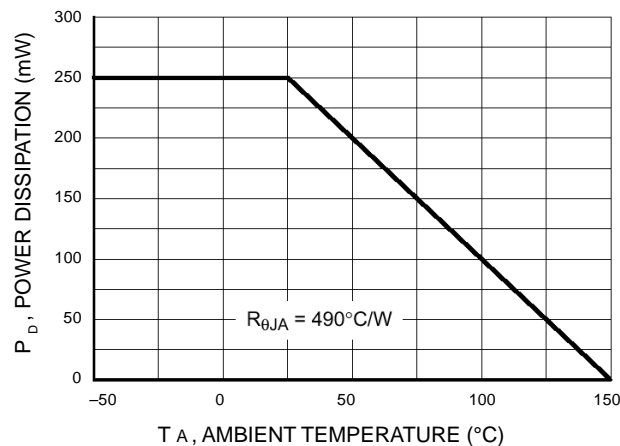
**MUN5311DW1T1 Series**

**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	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	

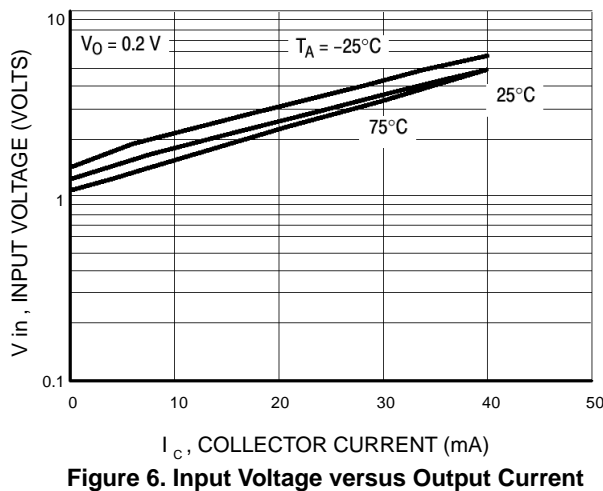
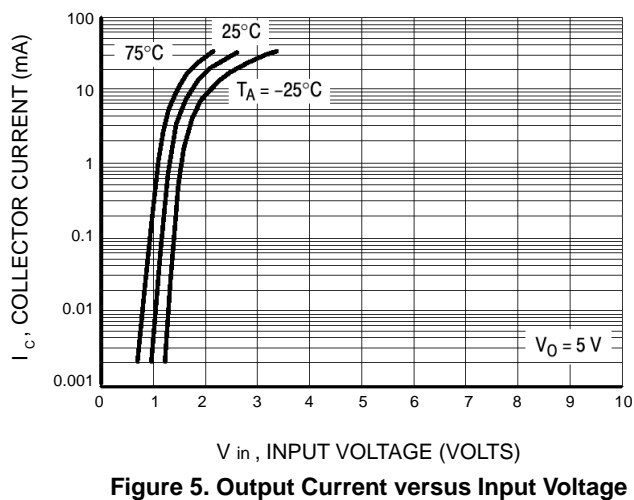
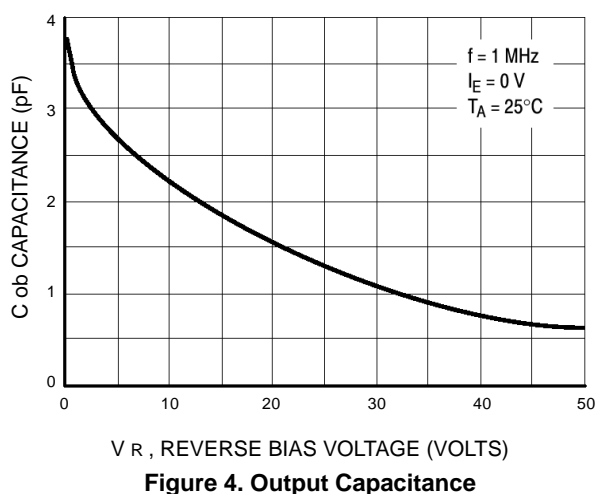
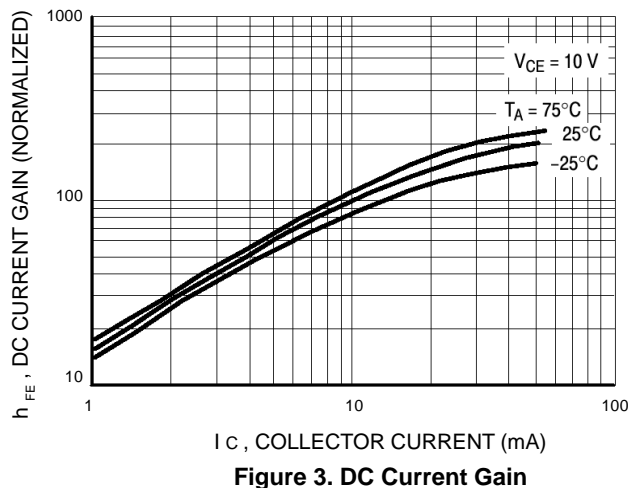
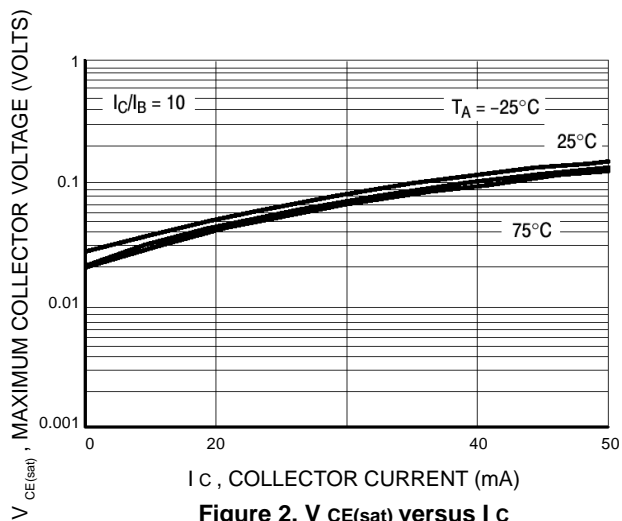
5. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2.0%



**Figure 1. Derating Curve**

MUN5311DW1T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5311DW1T1 NPN TRANSISTOR



MUN5311DW1T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5311DW1T1 PNP TRANSISTOR

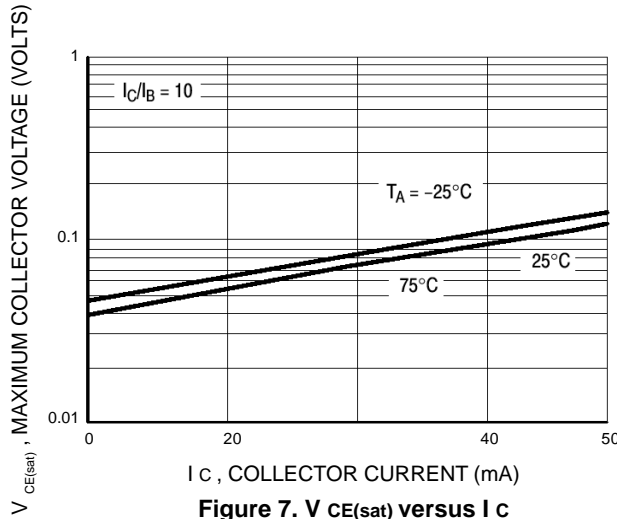


Figure 7.  $V_{CE(sat)}$  versus  $I_c$

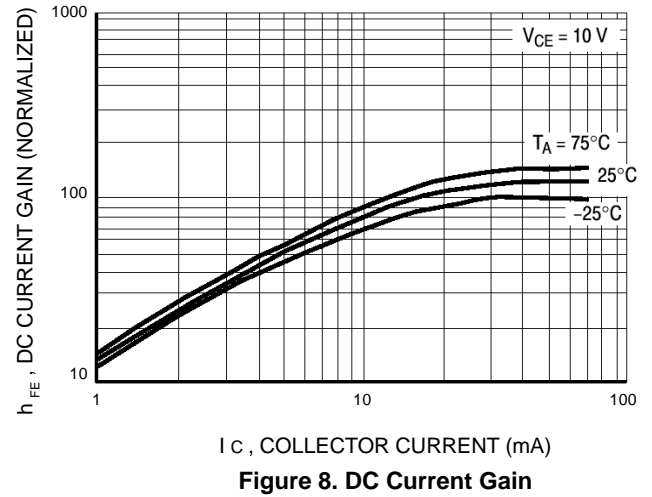


Figure 8. DC Current Gain

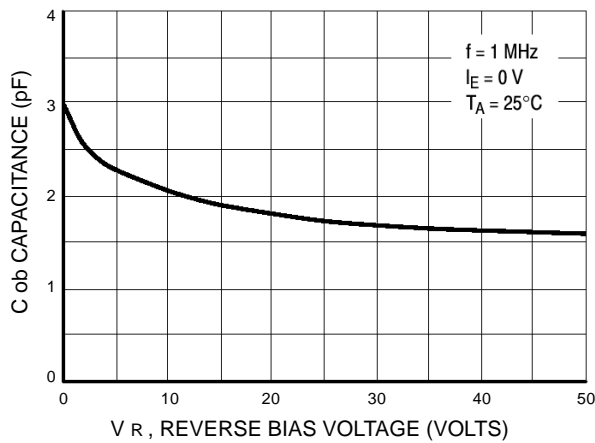


Figure 9. Output Capacitance

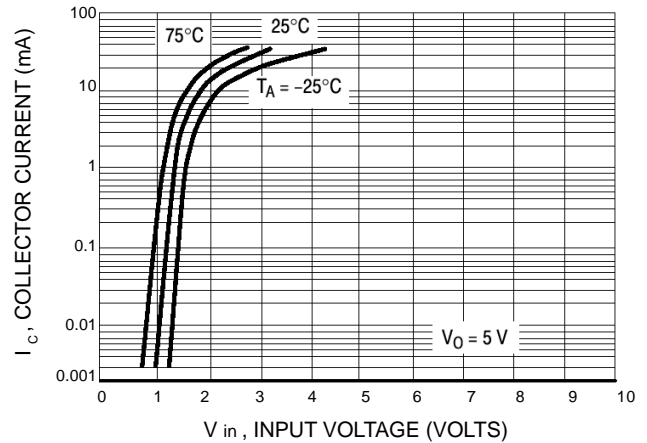


Figure 10. Output Current versus Input Voltage

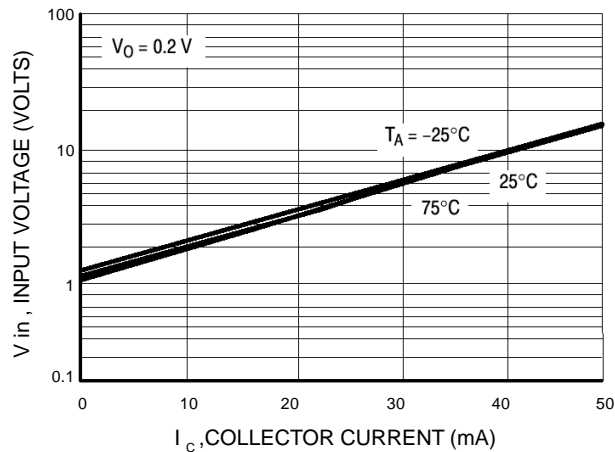


Figure 11. Input Voltage versus Output Current

MUN5311DW1T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5312DW1T1 NPN TRANSISTOR

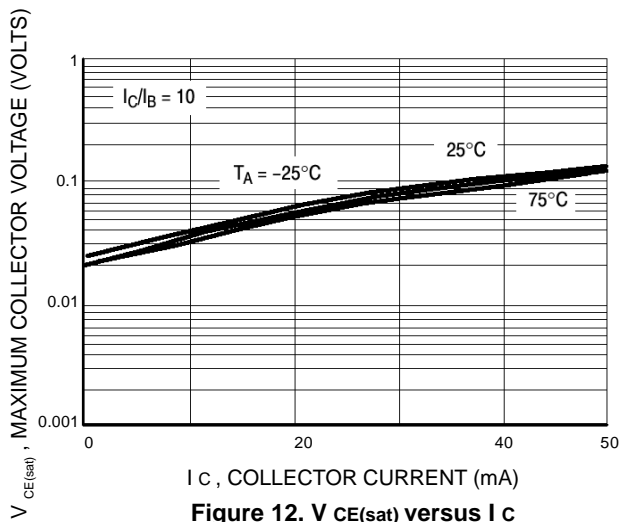


Figure 12.  $V_{CE(sat)}$  versus  $I_C$

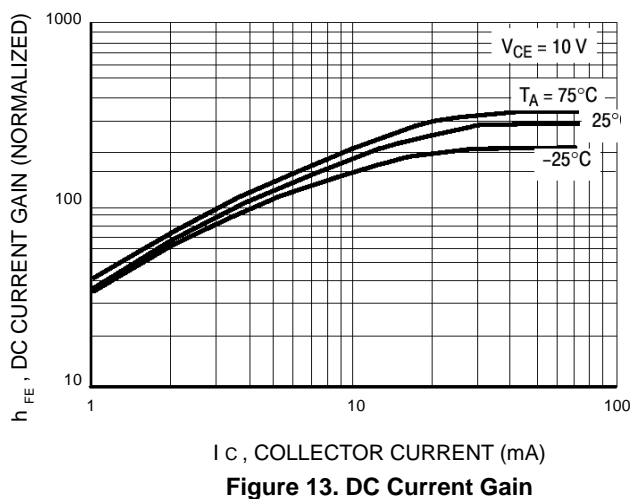


Figure 13. DC Current Gain

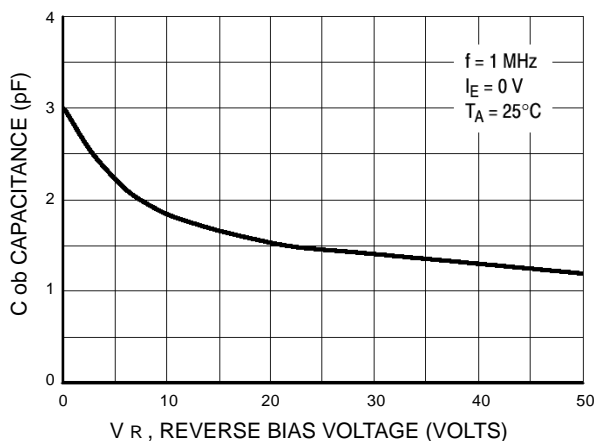


Figure 14. Output Capacitance

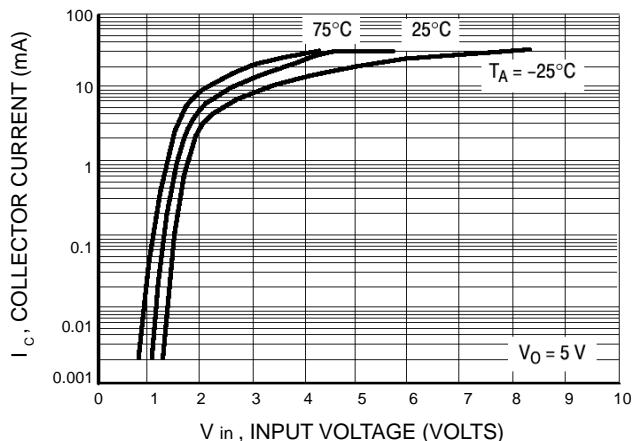


Figure 15. Output Current versus Input Voltage

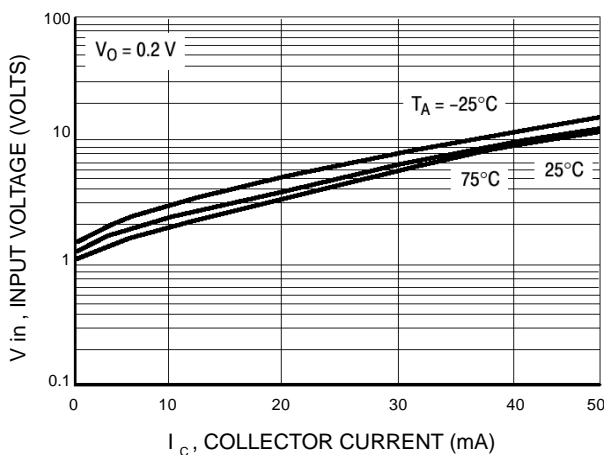
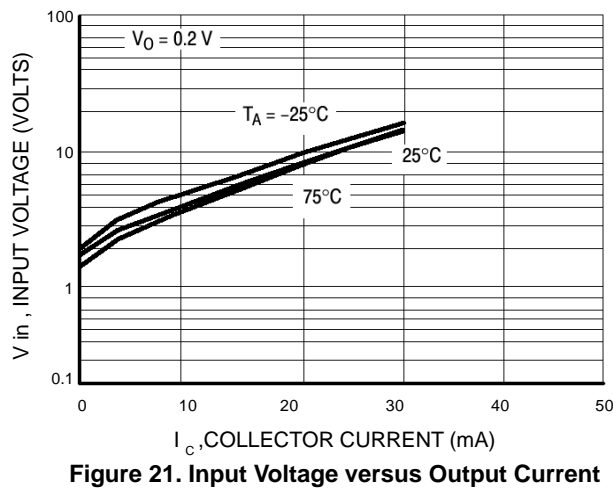
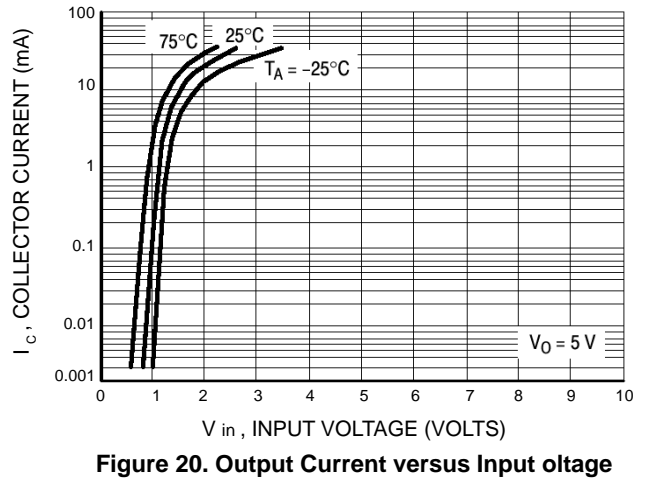
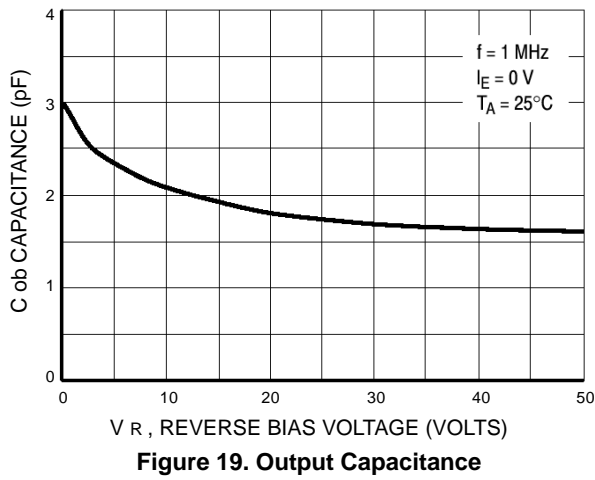
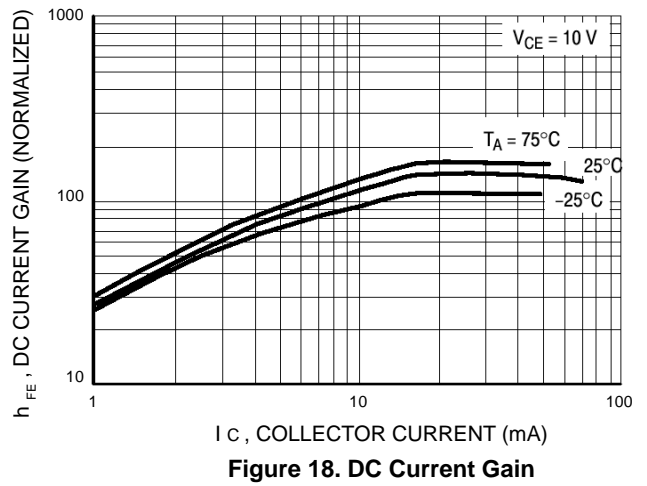
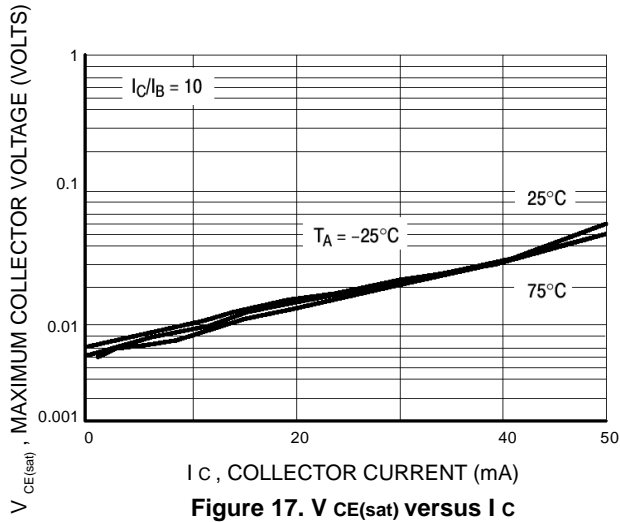


Figure 16. Input Voltage versus Output Current

MUN5311DW1T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5312DW1T1 PNP TRANSISTOR





MUN5311DW1T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5313DW1T1 NPN TRANSISTOR

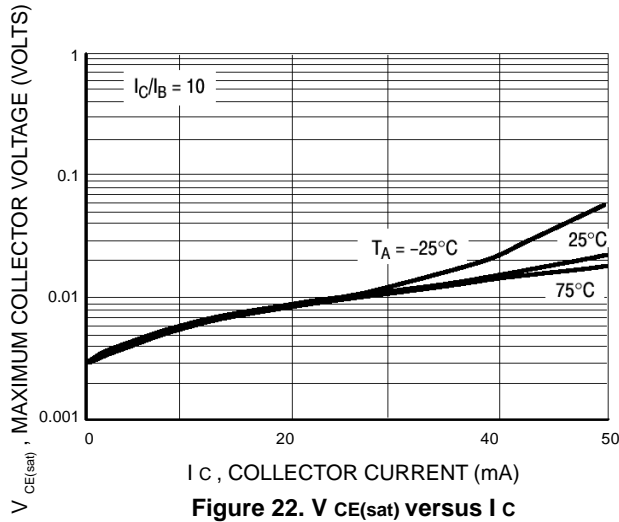


Figure 22.  $V_{CE(sat)}$  versus  $I_C$

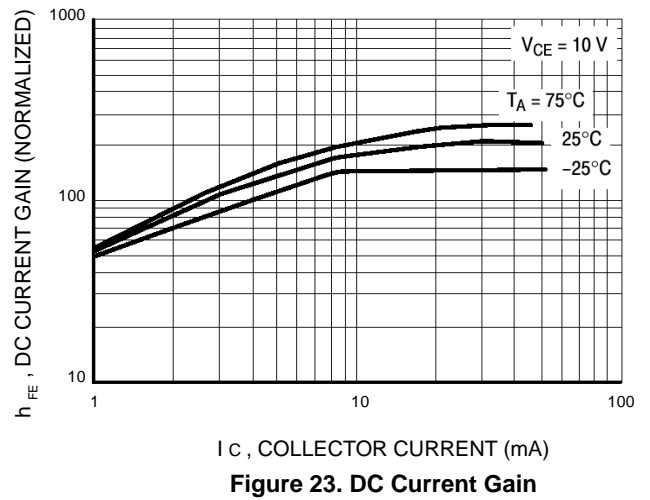


Figure 23. DC Current Gain

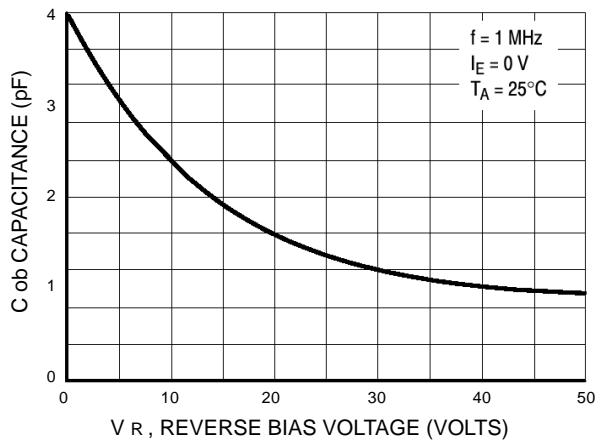


Figure 24. Output Capacitance

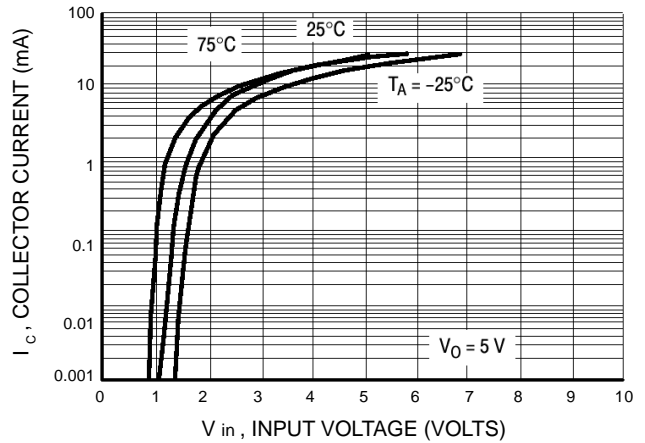


Figure 25. Output Current versus Input Voltage

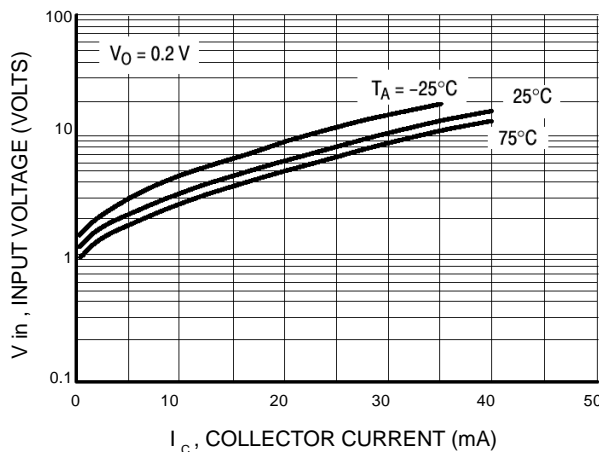


Figure 26. Input Voltage versus Output Current

MUN5311DW1T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5313DW1T1 PNP TRANSISTOR

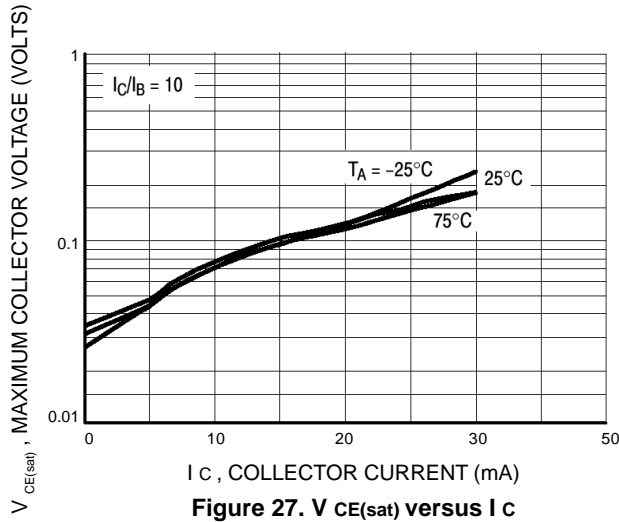


Figure 27.  $V_{CE(sat)}$  versus  $I_c$

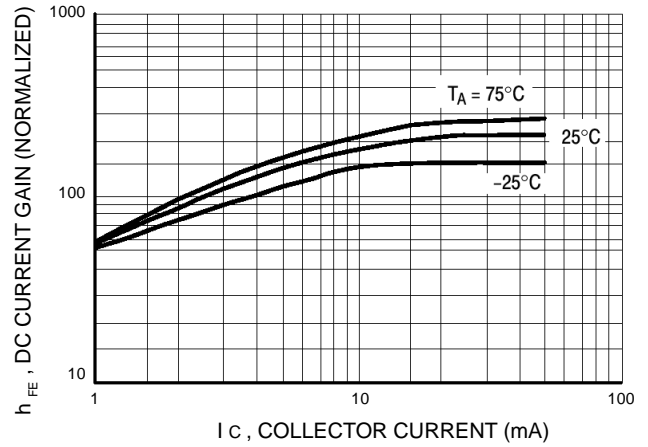


Figure 28. DC Current Gain

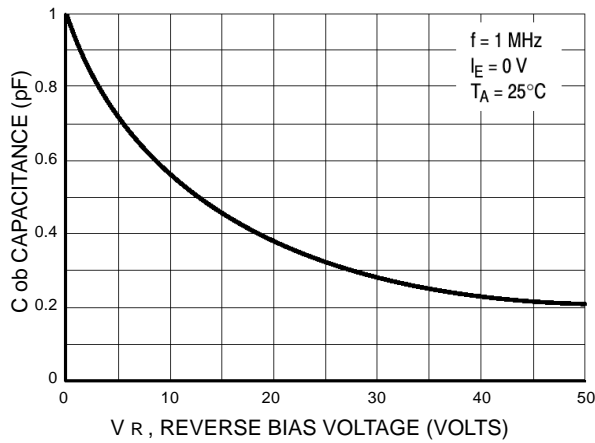


Figure 29. Output Capacitance

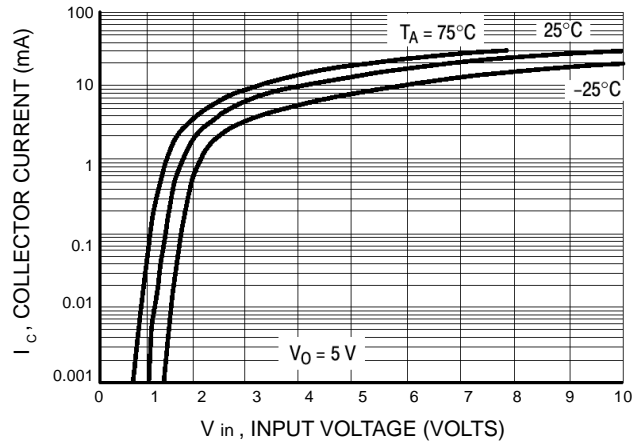


Figure 30. Output Current versus Input Voltage

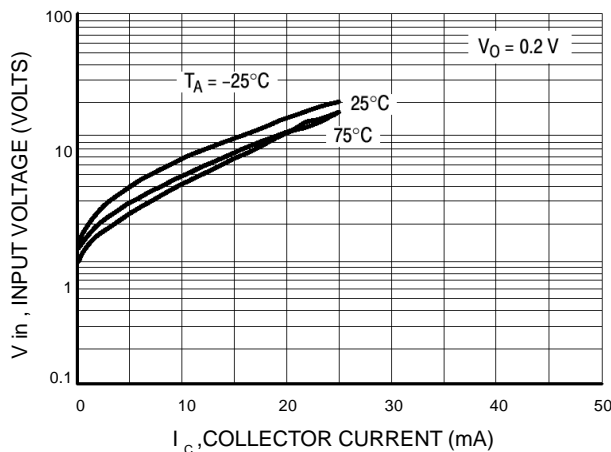
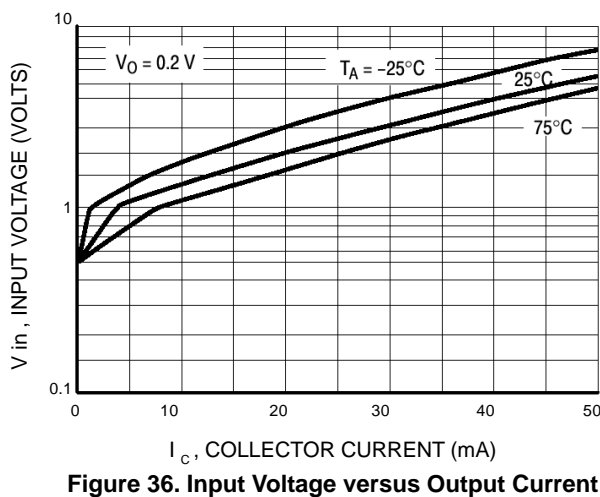
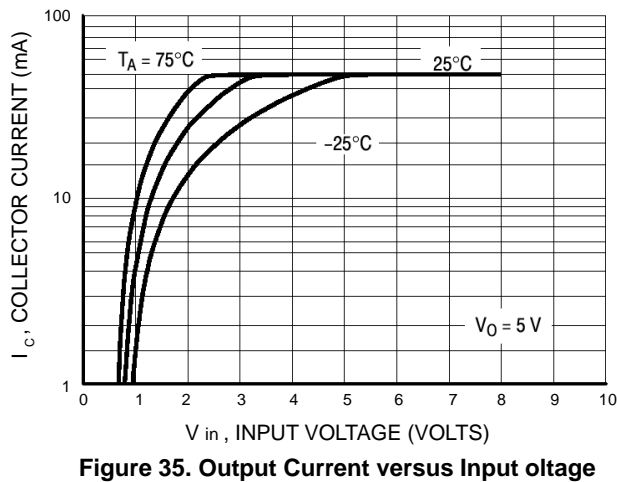
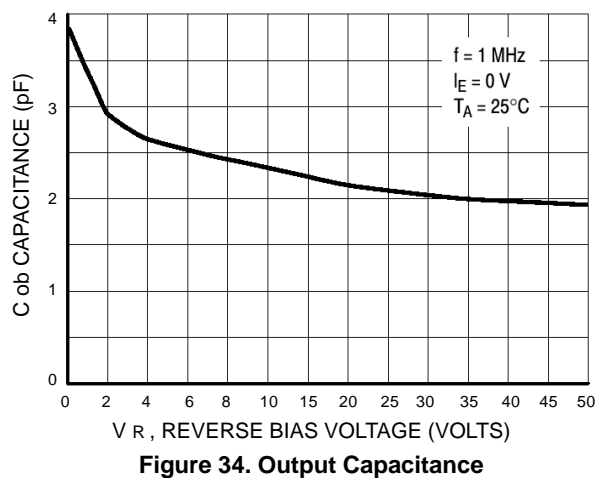
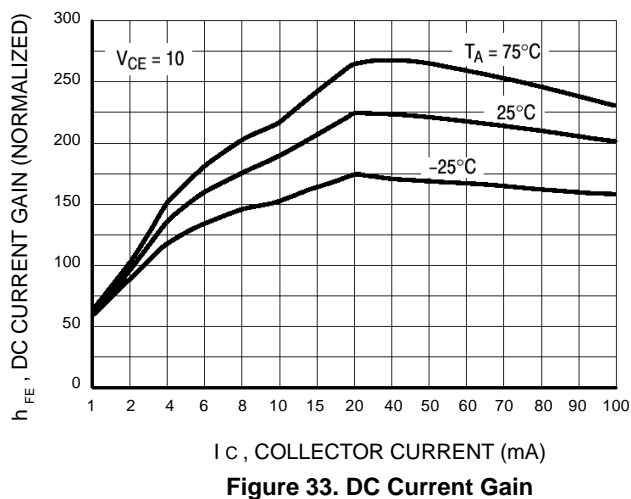
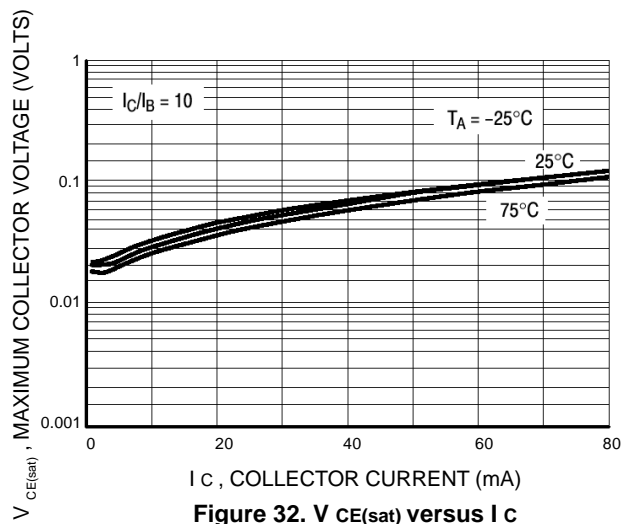


Figure 31. Input Voltage versus Output Current

MUN5311DW1T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5314DW1T1 NPN TRANSISTOR



MUN5311DW1T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5314DW1T1 PNP TRANSISTOR

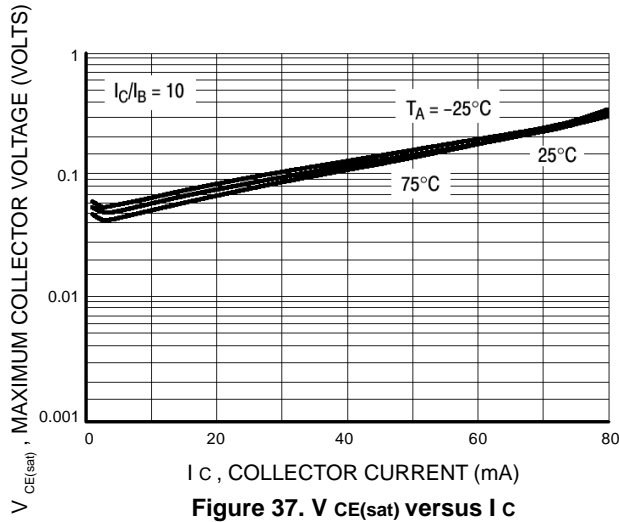


Figure 37.  $V_{CE(sat)}$  versus  $I_C$

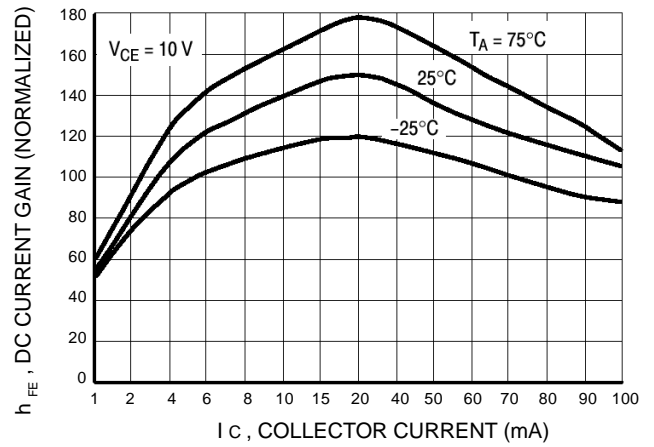


Figure 38. DC Current Gain

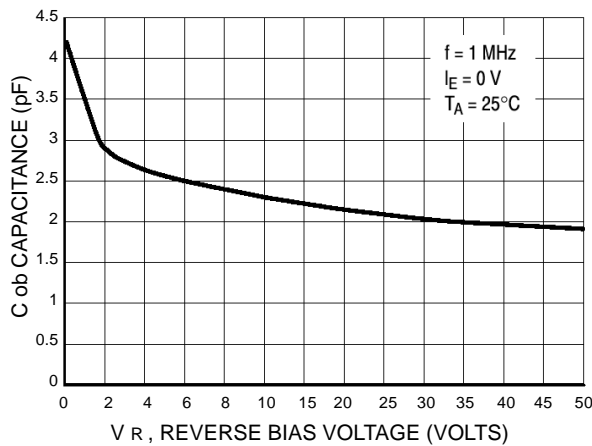


Figure 39. Output Capacitance

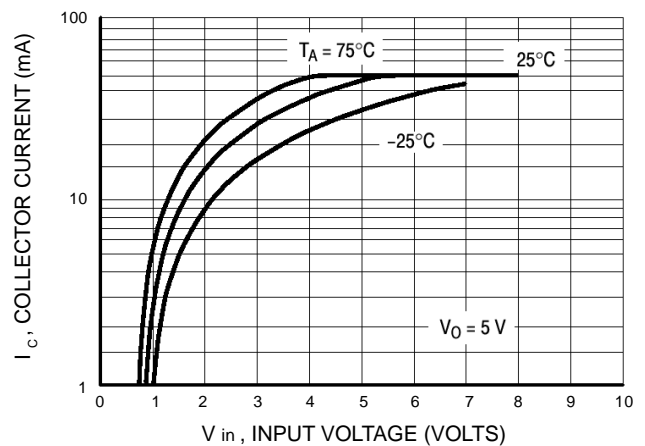


Figure 40. Output Current versus Input Voltage

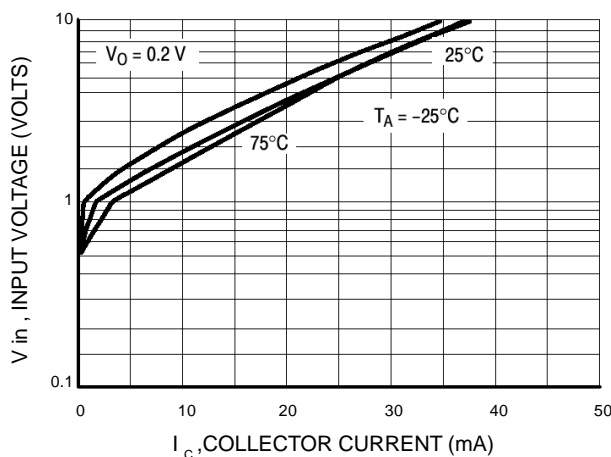


Figure 41. Input Voltage versus Output Current

MUN5311DW1T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5315DW1T1

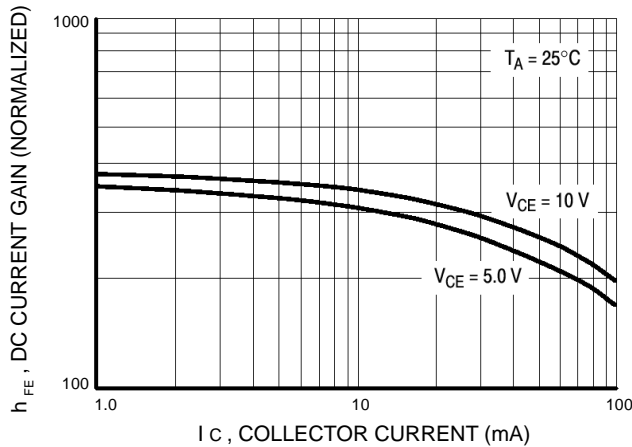


Figure 42. DC Current Gain-PNP

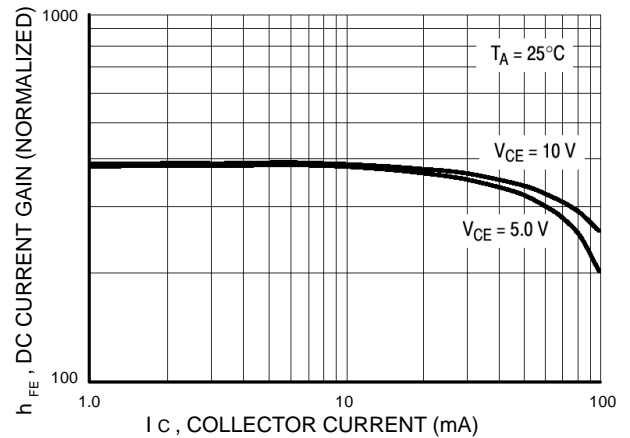


Figure 43. DC Current Gain-NPN

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5316DW1T1

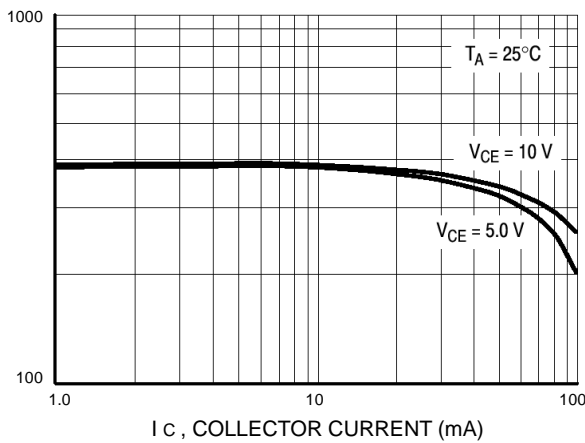


Figure 44. DC Current Gain-PNP

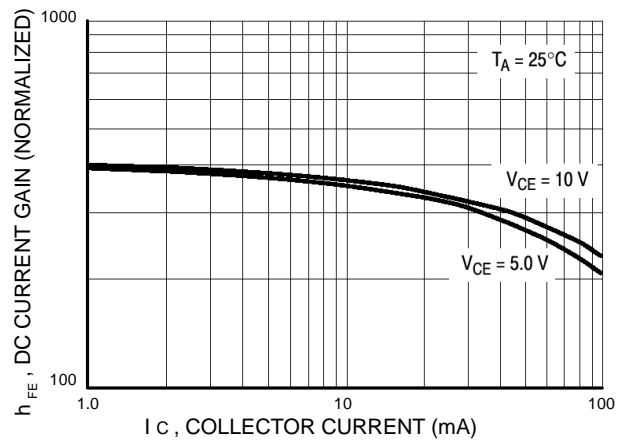


Figure 45. DC Current Gain-NPN