

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)

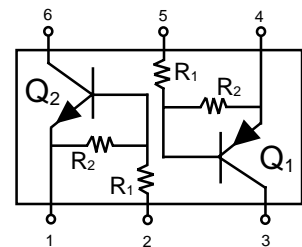
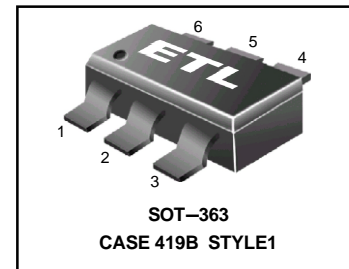
Rating	Symbol	Value	Unit
Collector-Base Voltage	V_{CBO}	50	Vdc
Collector-Emitter Voltage	V_{CEO}	50	Vdc
Collector Current	I_C	100	mAdc

THERMAL CHARACTERISTICS

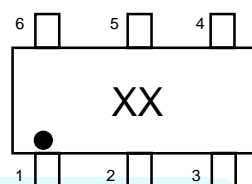
Characteristic (One Junction Heated)	Symbol	Max	Unit
Total Device Dissipation $T_A = 25^\circ\text{C}$	P_D	187 (Note 1.) 256 (Note 2.)	mW
Derate above 25°C		1.5 (Note 1.) 2.0 (Note 2.)	mW/ $^\circ\text{C}$
Thermal Resistance – Junction-to-Ambient	$R_{\theta JA}$	670 (Note 1.) 490 (Note 2.)	$^\circ\text{C}/\text{W}$
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°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 ₁ (K)	R ₂ (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_A = 25°C unless otherwise noted, common for Q₁ and Q₂, – minus sign for Q₁ (PNP) omitted)

Characteristic	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Collector-Base Cutoff Current (V _{CB} = 50 V, I _E = 0)	I _{CBO}	–	–	100	nAdc	
Collector-Emitter Cutoff Current (V _{CE} = 50 V, I _B = 0)	I _{CEO}	–	–	500	nAdc	
Emitter-Base Cutoff Current (V _{EB} = 6.0 V, I _C = 0)	MUN5311DW1T1	I _{EBO}	–	–	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 _C = 10 μA, I _E = 0)	V _{(BR)CBO}	50	–	–	Vdc	
Collector-Emitter Breakdown Voltage (Note 4.) (I _C = 2.0 mA, I _B = 0)	V _{(BR)CEO}	50	–	–	Vdc	

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

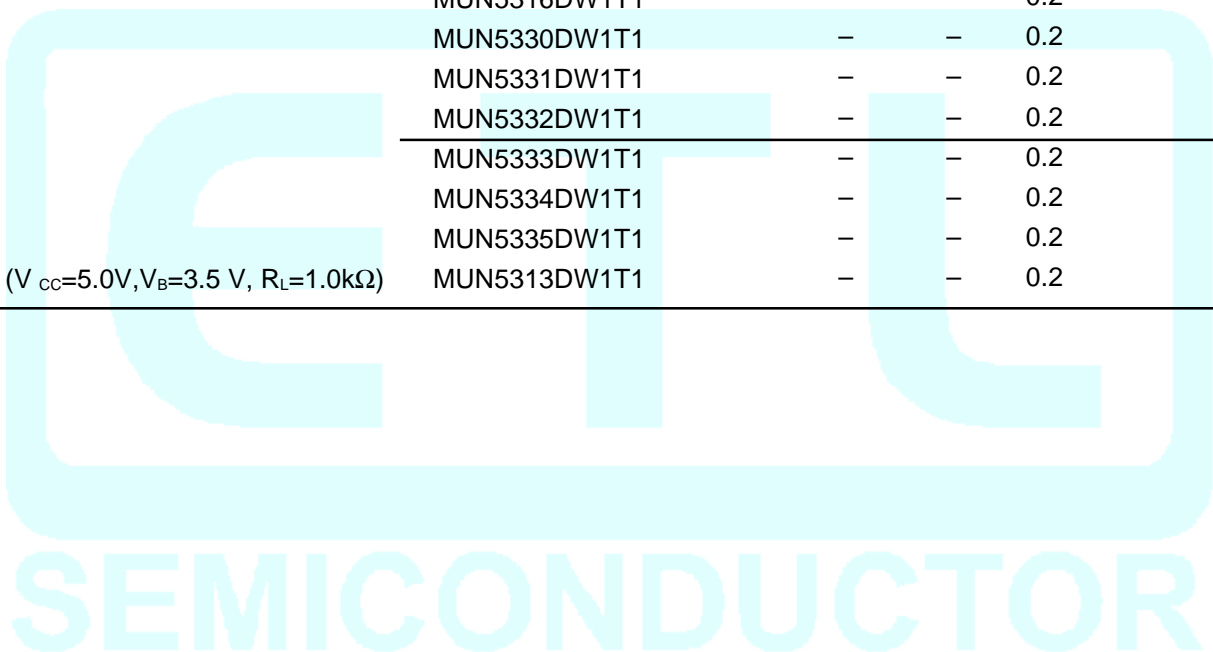
4. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2.0%

MUN5311DW1T1 Series

ELECTRICAL CHARACTERISTICS

($T_A = 25^\circ\text{C}$ unless otherwise noted, common for Q_1 and Q_2 , – minus sign for Q_1 (PNP) omitted)
(Continued)

Characteristic	Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS (Note 5.)					
DC Current Gain ($V_{CE} = 10\text{ V}$, $I_C = 5.0\text{ mA}$)	MUN5311DW1T1	h_{FE}	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 ($I_C = 10\text{ mA}$, $I_B = 0.3\text{ mA}$) ($I_C = 10\text{ mA}$, $I_B = 5\text{ mA}$) MUN5330DW1T1/MUN5331DW1T1 ($I_C = 10\text{ mA}$, $I_B = 1\text{ mA}$) MUN5315DW1T1/MUN5316DW1T1 MUN5332DW1T1/MUN5333DW1T1/MUN5334DW1T1	$V_{CE(sat)}$	–	–	0.25	Vdc
Output Voltage (on) ($V_{CC} = 5.0\text{ V}$, $V_B = 2.5\text{ V}$, $R_L = 1.0\text{ k}\Omega$)	V_{OL}				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	
($V_{CC} = 5.0\text{ V}$, $V_B = 3.5\text{ V}$, $R_L = 1.0\text{ k}\Omega$) MUN5313DW1T1		–	–	0.2	



MUN5311DW1T1 Series

ELECTRICAL CHARACTERISTICS

($T_A = 25^\circ\text{C}$ unless otherwise noted, common for Q_1 and Q_2 , – minus sign for Q_1 (PNP) omitted)
(Continued)

Characteristic	Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS (Note 5.)					
Output Voltage (off) ($V_{CC}=5.0\text{V}$, $V_B=0.5\text{V}$, $R_L=1.0\text{k}\Omega$) ($V_{CC}=5.0\text{V}$, $V_B=0.050\text{V}$, $R_L=1.0\text{k}\Omega$) MUN5330DW1T1 ($V_{CC}=5.0\text{V}$, $V_B=0.25\text{V}$, $R_L=1.0\text{k}\Omega$) MUN5315DW1T1 MUN5316DW1T1 MUN5333DW1T1	V_{OH}	4.9	–	–	Vdc
Input Resistor MUN5311DW1T1 MUN5312DW1T1 MUN5313DW1T1 MUN5314DW1T1 MUN5315DW1T1 MUN5316DW1T1 MUN5330DW1T1 MUN5331DW1T1 MUN5332DW1T1 MUN5333DW1T1 MUN5334DW1T1 MUN5335DW1T1	R_1	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	$\text{k}\Omega$
Resistor Ratio MUN5311DW1T1/MUN5312DW1T1/MUN5313DW1T1 MUN5314DW1T1 MUN5315DW1T1/MUN5316DW1T1 MUN5330DW1T1/MUN5331DW1T1/MUN5332DW1T1 MUN5333DW1T1 MUN5334DW1T1 MUN5335DW1T1	R_1 / R_2	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%

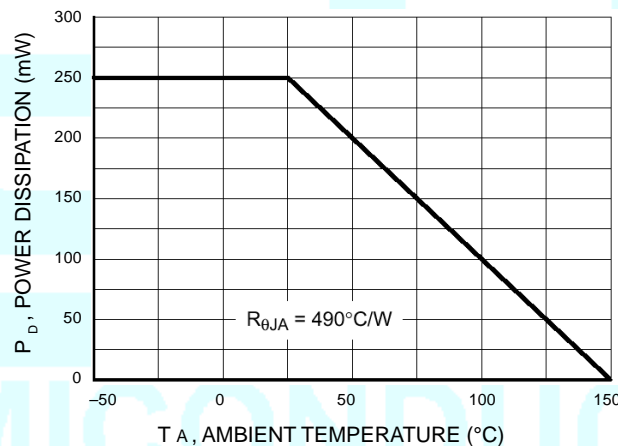
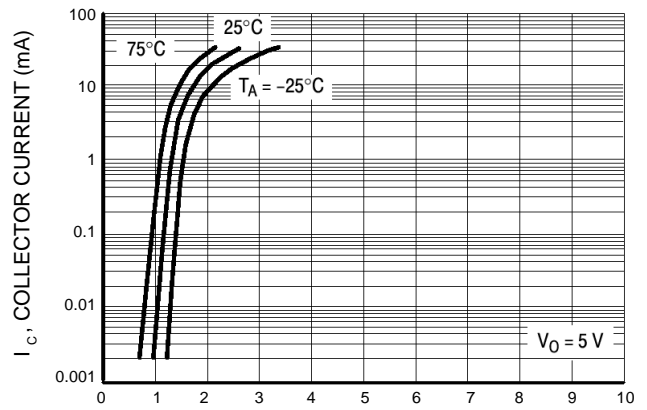
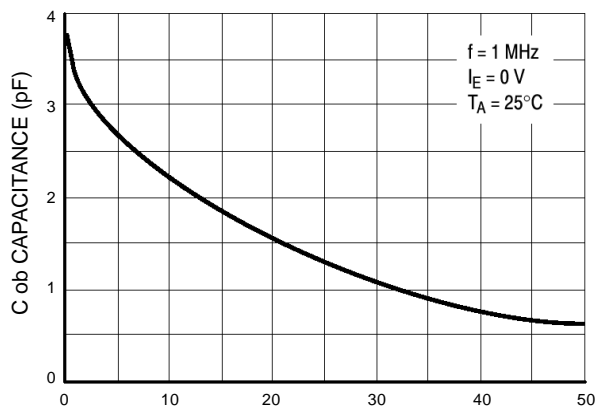
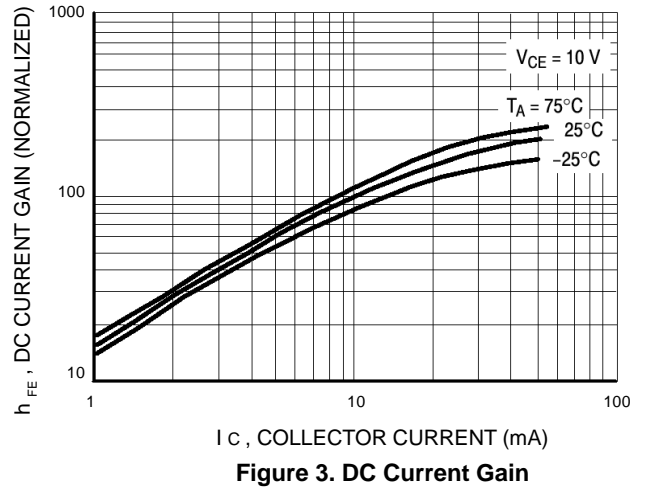
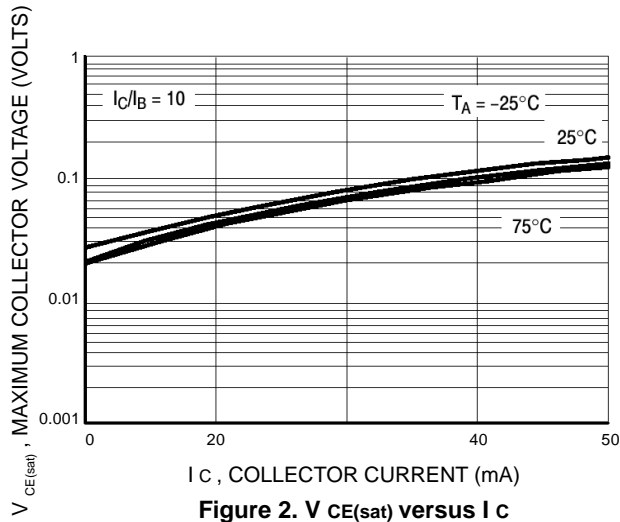


Figure 1. Derating Curve

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5311DW1T1 NPN TRANSISTOR



V_R , REVERSE BIAS VOLTAGE (VOLTS)
Figure 4. Output Capacitance

V_{in} , INPUT VOLTAGE (VOLTS)
Figure 5. Output Current versus Input Voltage

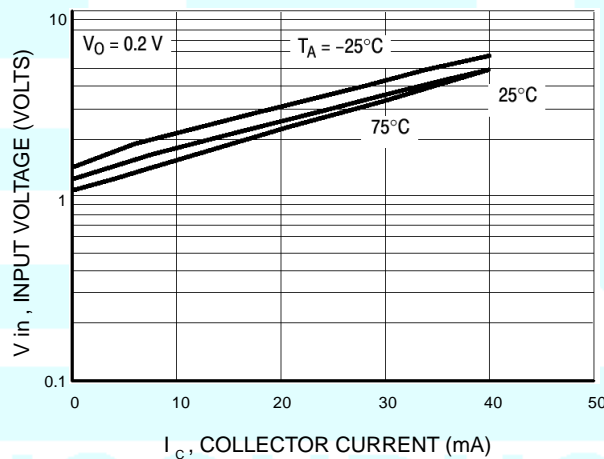


Figure 6. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5311DW1T1 PNP TRANSISTOR

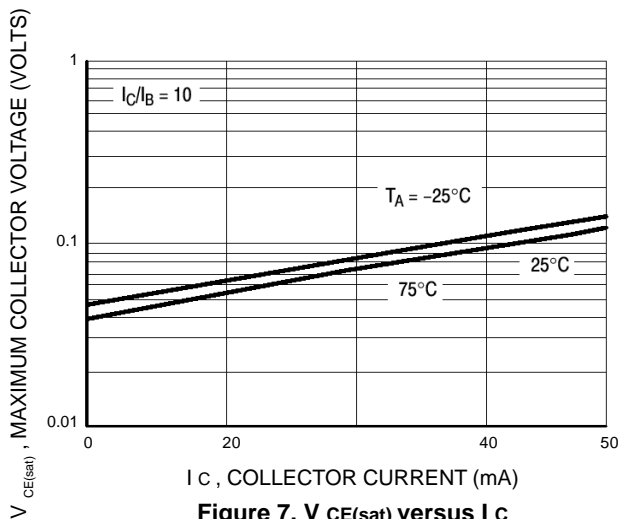


Figure 7. $V_{CE(sat)}$ versus I_C

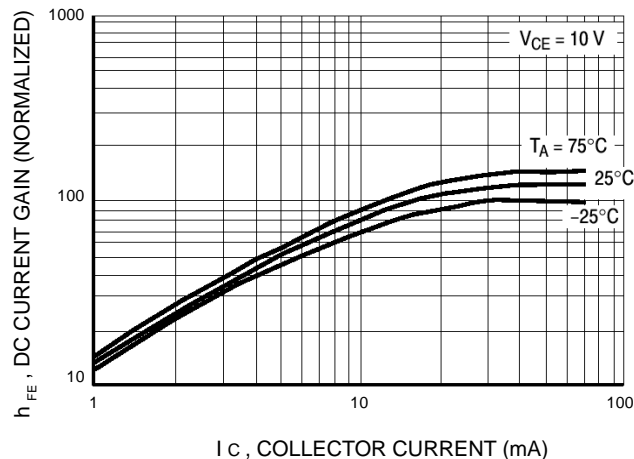


Figure 8. DC Current Gain

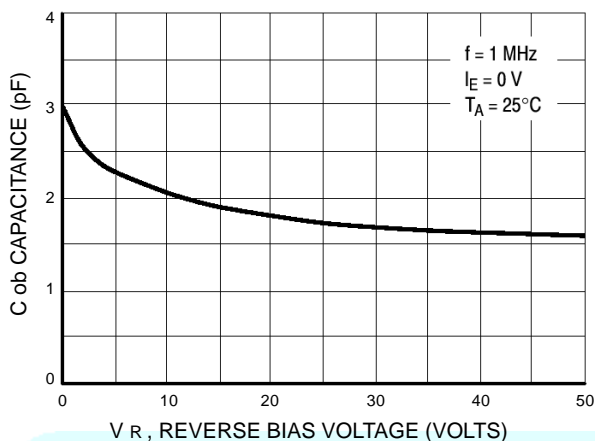


Figure 9. Output Capacitance

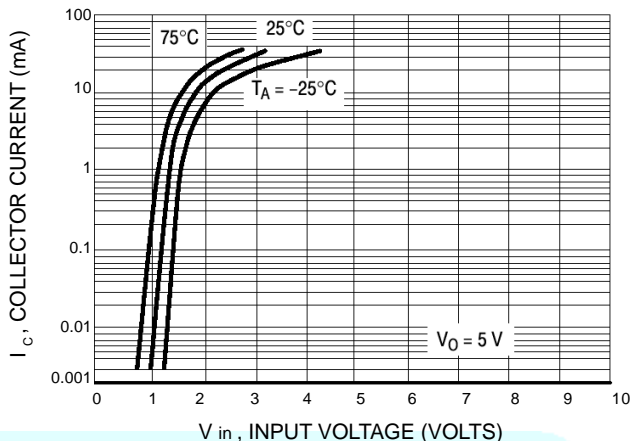


Figure 10. Output Current versus Input Voltage

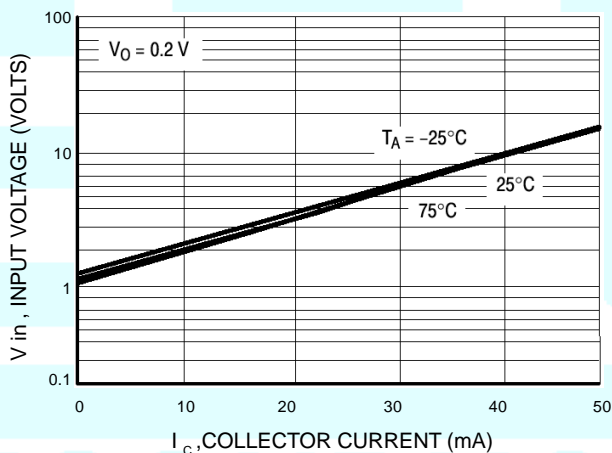
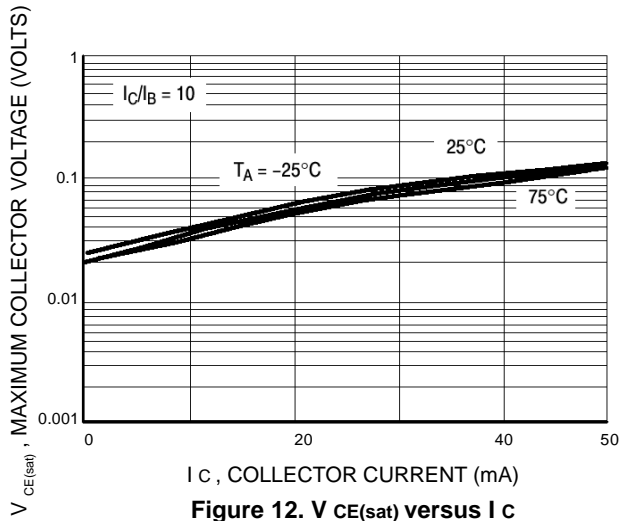
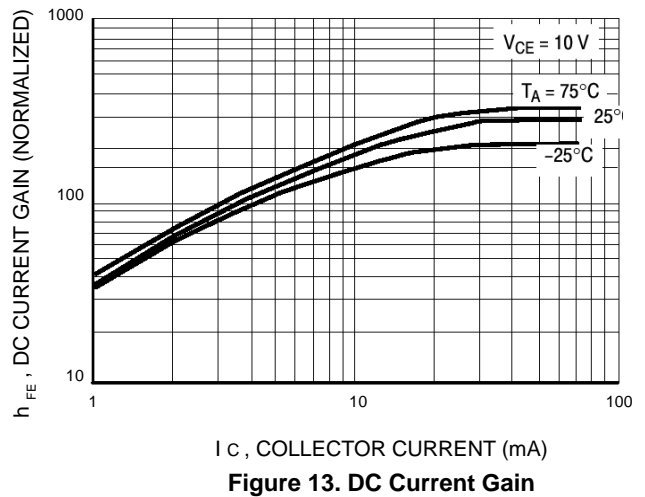


Figure 11. Input Voltage versus Output Current

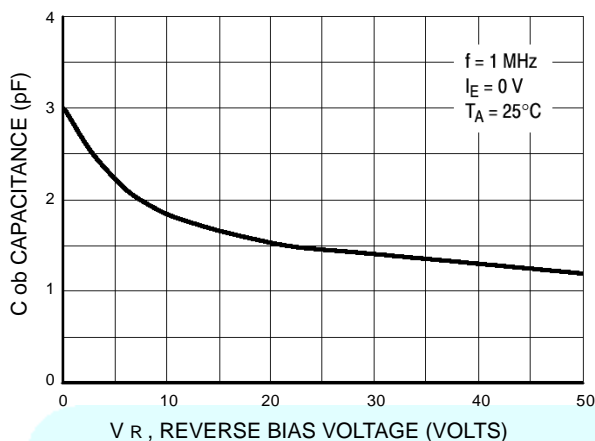
TYPICAL ELECTRICAL CHARACTERISTICS – MUN5312DW1T1 NPN TRANSISTOR



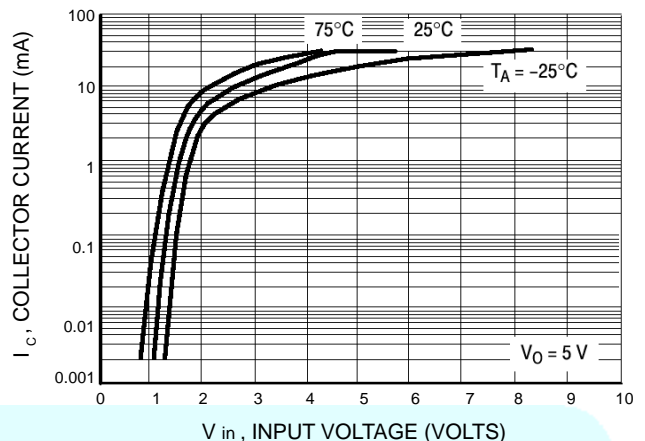
I C, COLLECTOR CURRENT (mA)
Figure 12. V CE(sat) versus I C



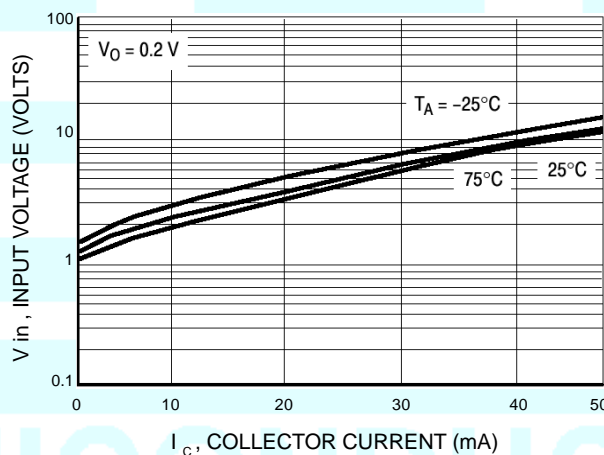
I C, COLLECTOR CURRENT (mA)
Figure 13. DC Current Gain



V R, REVERSE BIAS VOLTAGE (VOLTS)
Figure 14. Output Capacitance



V in, INPUT VOLTAGE (VOLTS)
Figure 15. Output Current versus Input Voltage



I C, COLLECTOR CURRENT (mA)
Figure 16. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5312DW1T1 PNP TRANSISTOR

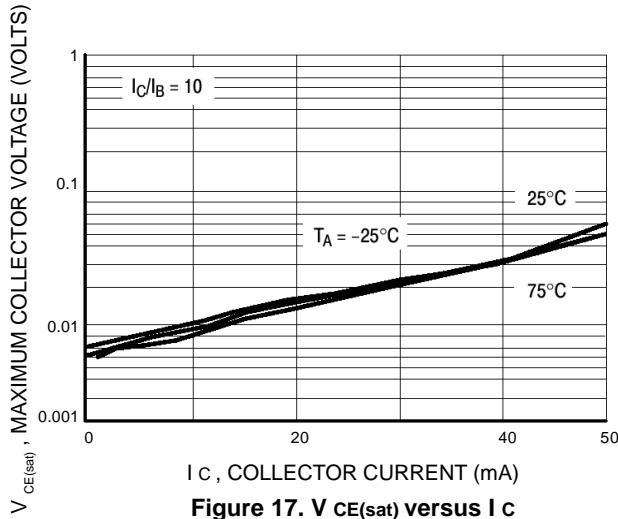


Figure 17. $V_{CE(sat)}$ versus I_C

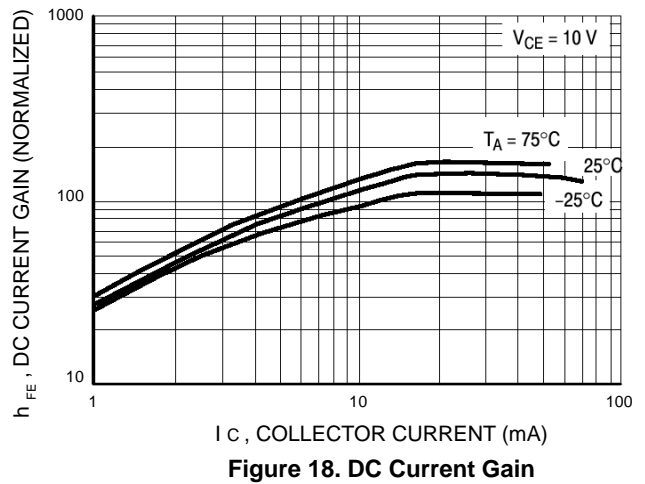


Figure 18. DC Current Gain

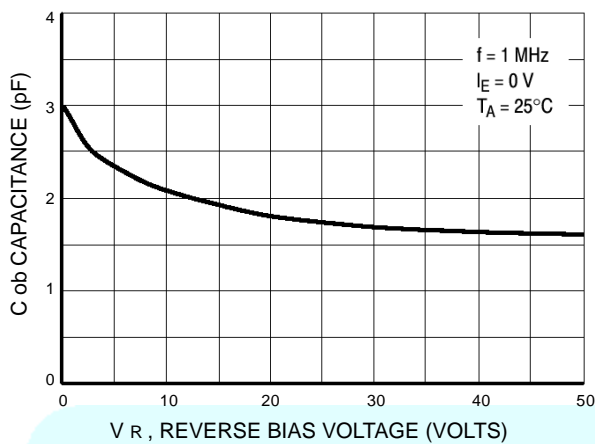


Figure 19. Output Capacitance

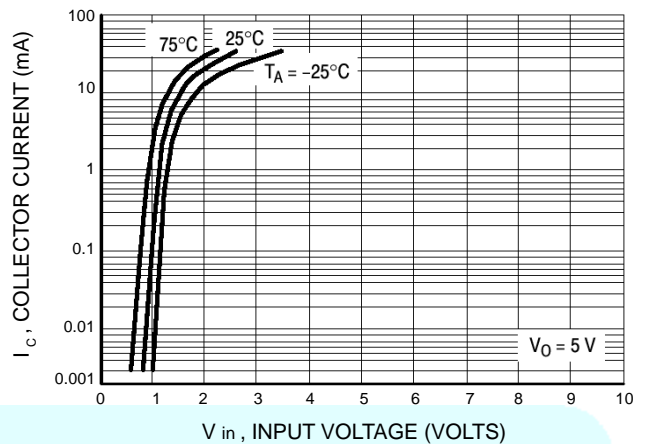


Figure 20. Output Current versus Input Voltage

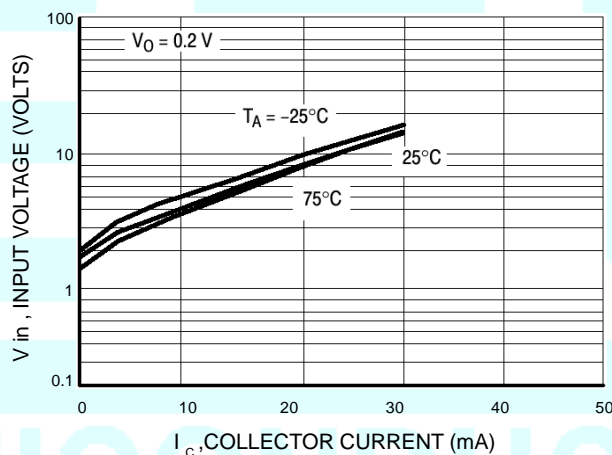
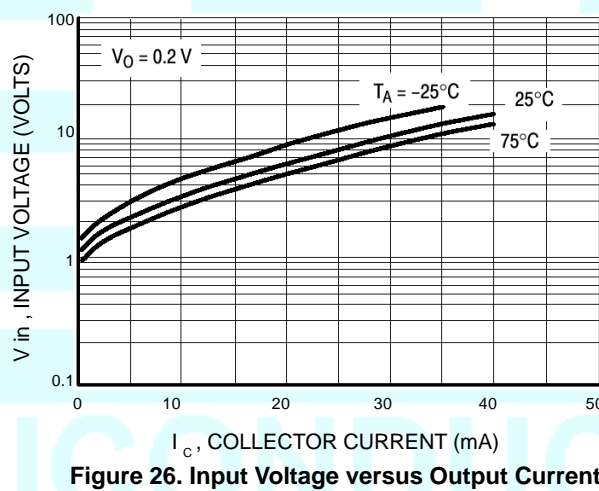
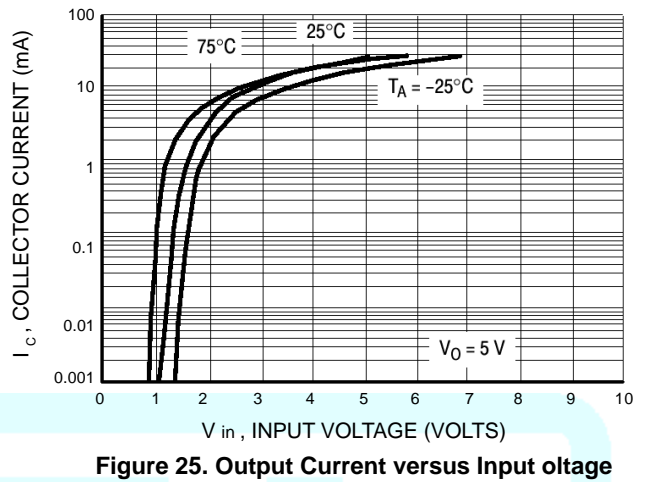
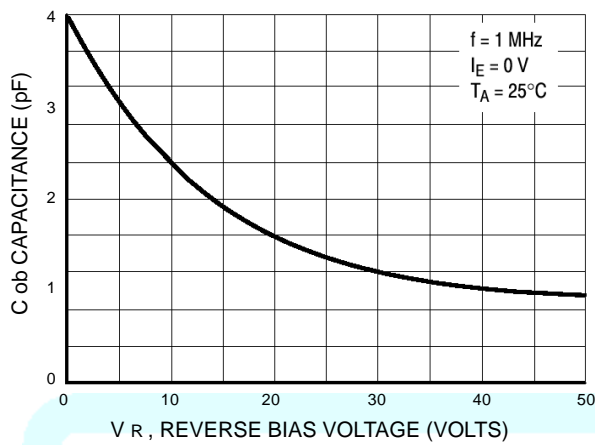
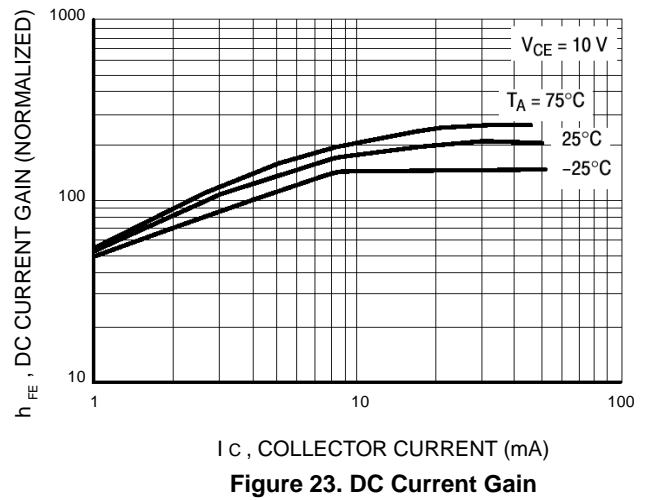
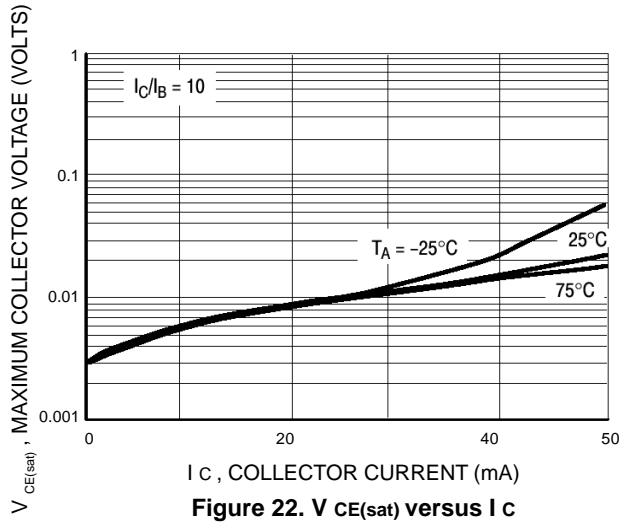
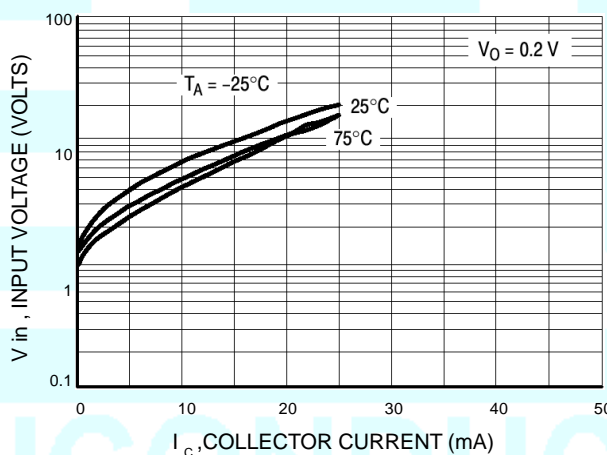
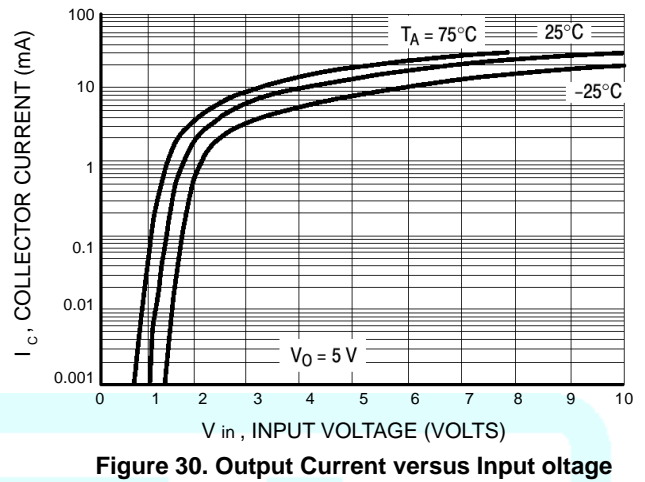
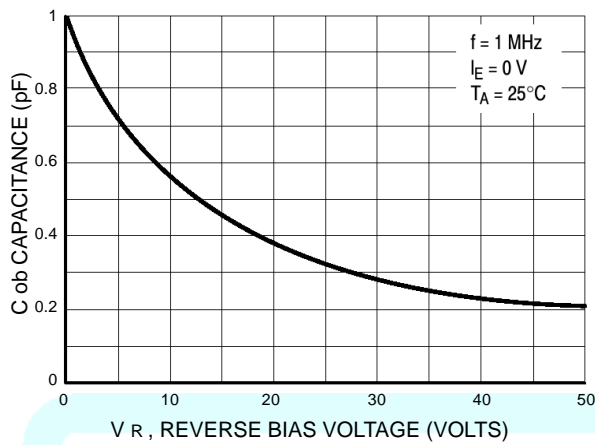
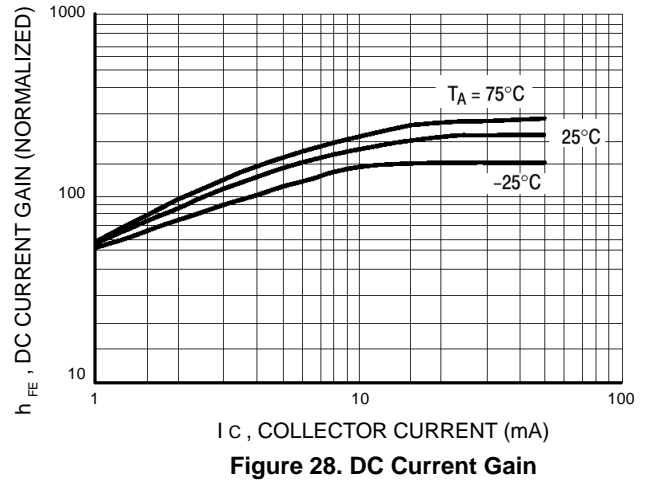
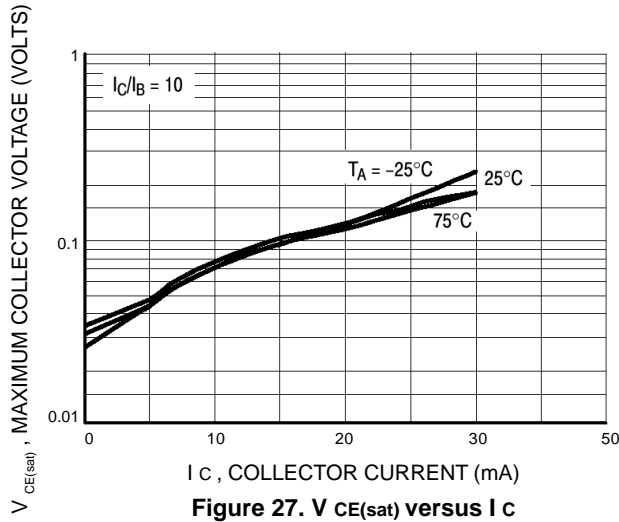


Figure 21. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5313DW1T1 NPN TRANSISTOR



TYPICAL ELECTRICAL CHARACTERISTICS – MUN5313DW1T1 PNP TRANSISTOR



TYPICAL ELECTRICAL CHARACTERISTICS – MUN5314DW1T1 NPN TRANSISTOR

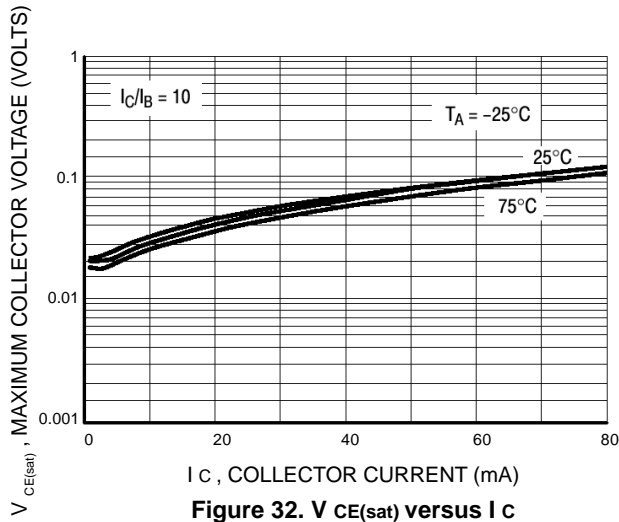


Figure 32. $V_{CE(sat)}$ versus I_c

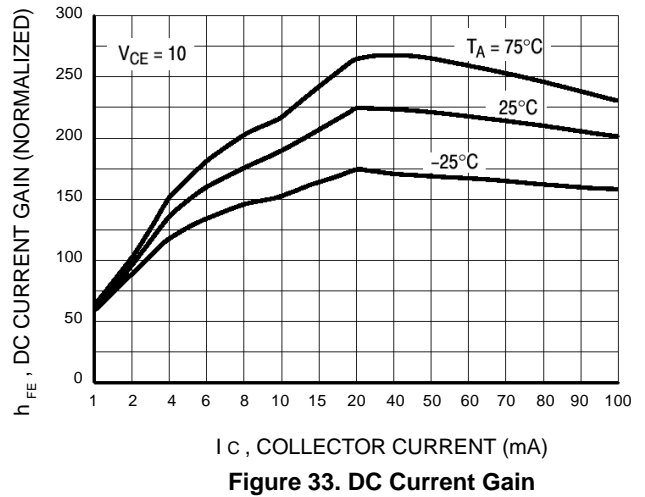


Figure 33. DC Current Gain

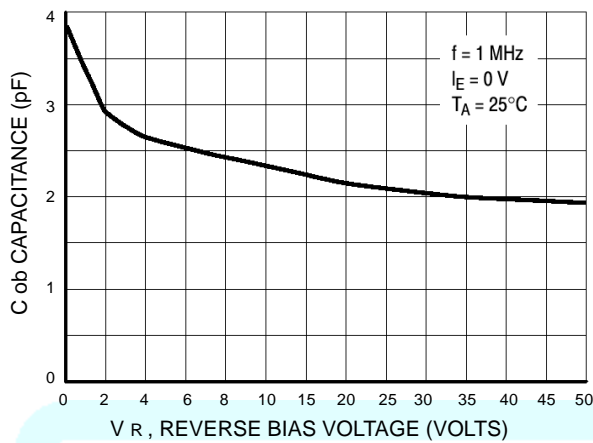


Figure 34. Output Capacitance

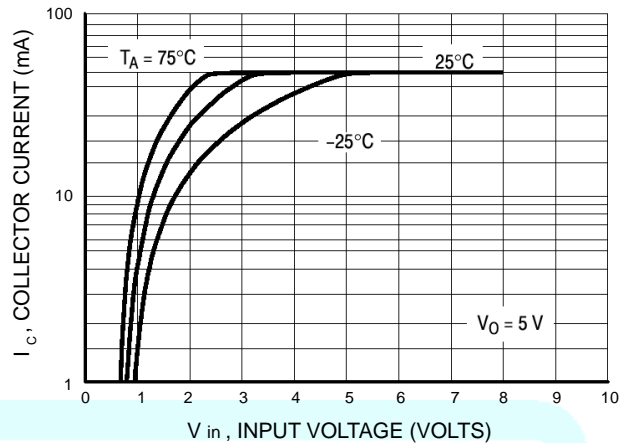


Figure 35. Output Current versus Input Voltage

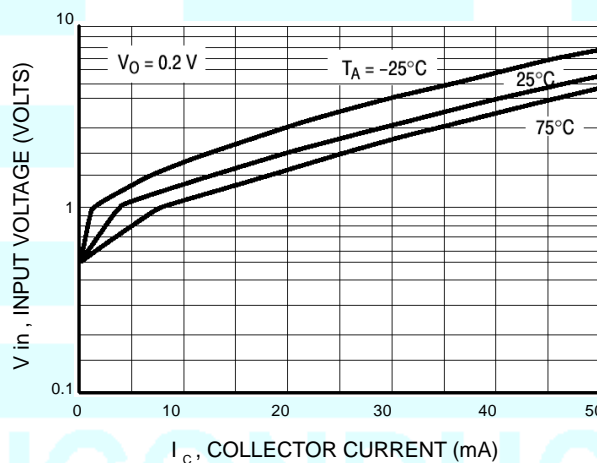
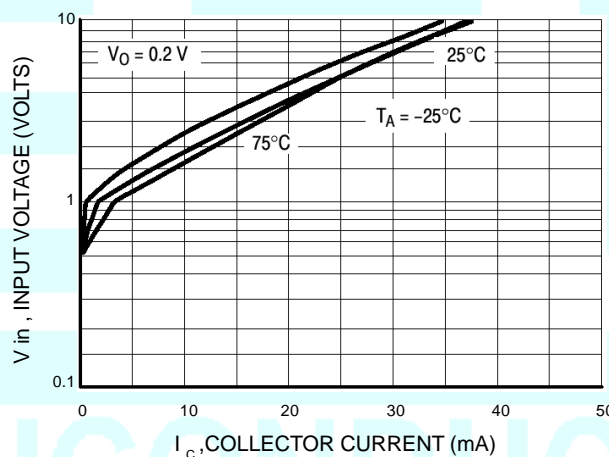
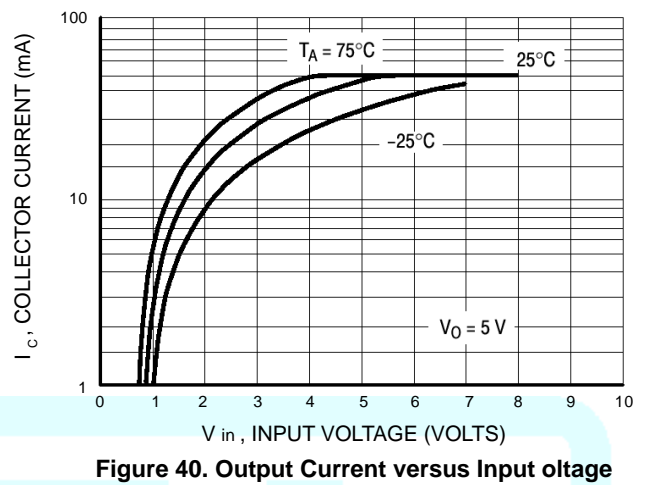
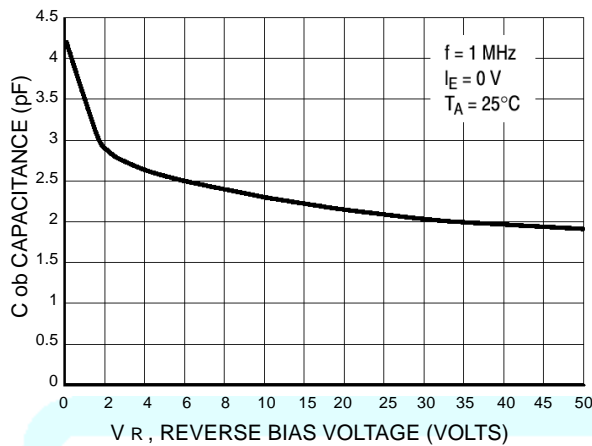
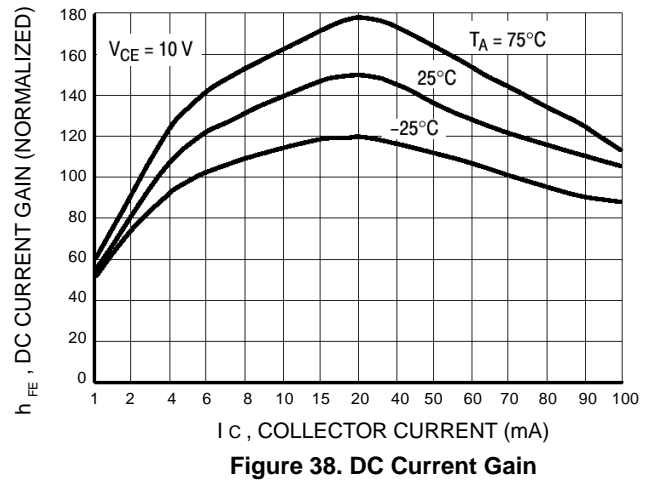
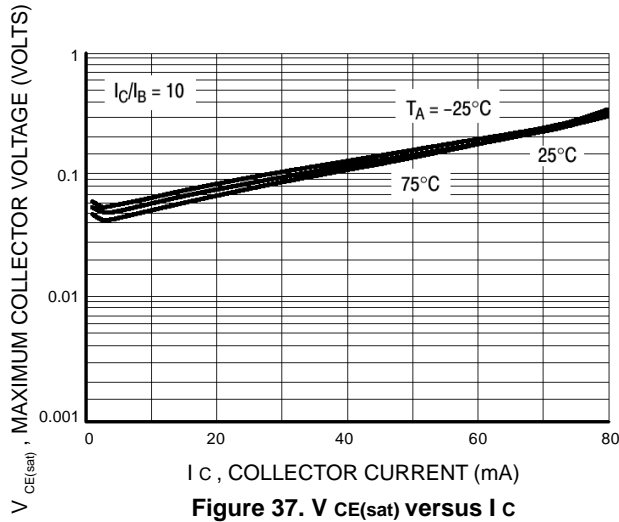


Figure 36. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5314DW1T1 PNP TRANSISTOR



TYPICAL ELECTRICAL CHARACTERISTICS – MUN5315DW1T1

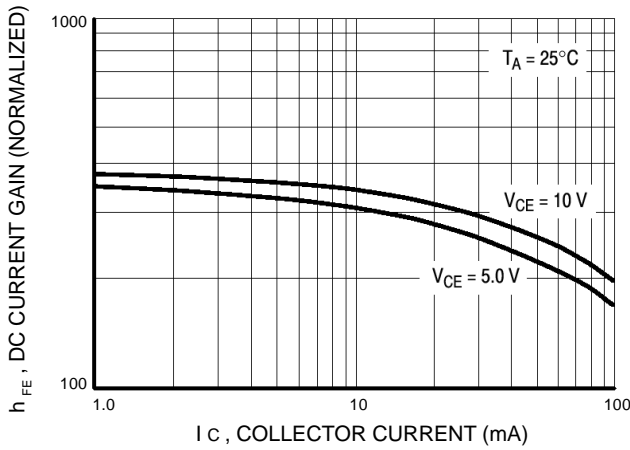


Figure 42. DC Current Gain-PNP

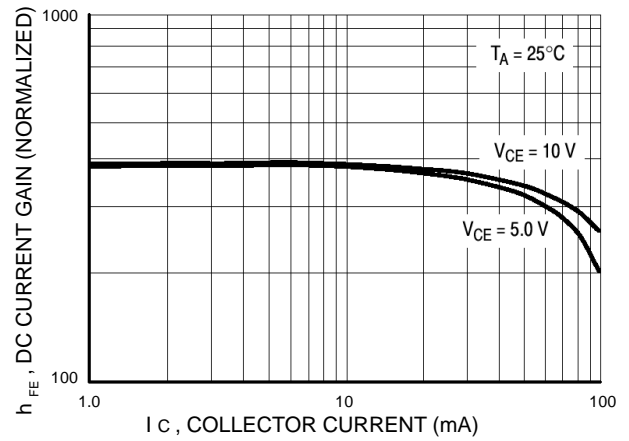


Figure 43. DC Current Gain-NPN

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5316DW1T1

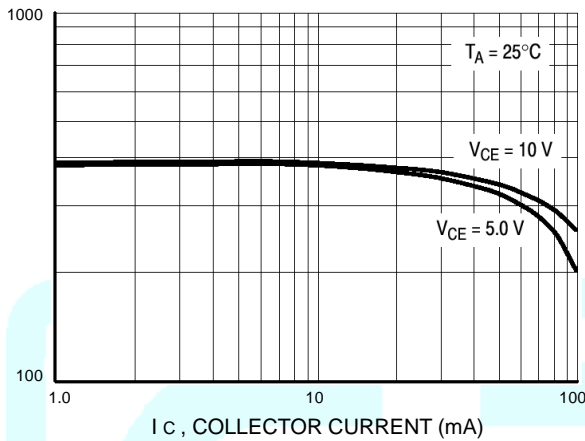


Figure 44. DC Current Gain-PNP

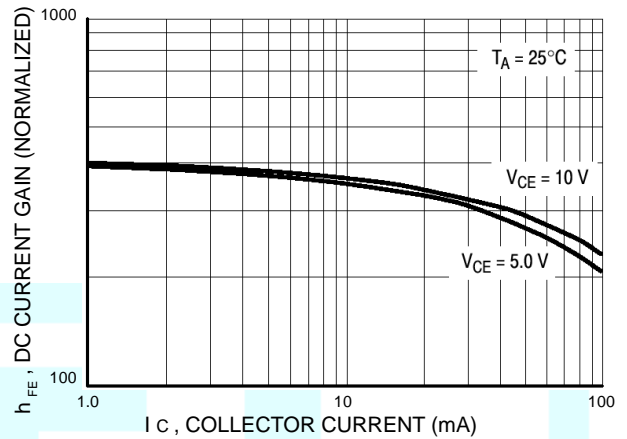


Figure 45. DC Current Gain-NPN

