

# MUN5211DW1T1 Series

Preferred Devices

## Dual Bias Resistor Transistors

### NPN 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 MUN5211DW1T1 series, two 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  $Q_2$ )

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

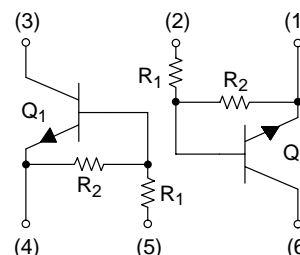
Characteristic (One Junction Heated)	Symbol	Max	Unit
Total Device Dissipation $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	187 (Note 1.) 256 (Note 2.) 1.5 (Note 1.) 2.0 (Note 2.)	mW mW/ $^\circ\text{C}$
Thermal Resistance – Junction-to-Ambient	$R_{\theta JA}$	670 (Note 1.) 490 (Note 2.)	$^\circ\text{C}/\text{W}$
Characteristic (Both Junctions Heated)	Symbol	Max	Unit
Total Device Dissipation $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	250 (Note 1.) 385 (Note 2.) 2.0 (Note 1.) 3.0 (Note 2.)	mW 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



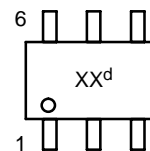
ON Semiconductor®

<http://onsemi.com>



SOT-363  
CASE 419B  
STYLE 1

#### MARKING DIAGRAM



XX = Specific Device Code  
<sup>d</sup> = Date Code  
(See Page 2)

#### DEVICE MARKING INFORMATION

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

**Preferred** devices are recommended choices for future use and best overall value.

## MUN5211DW1T1 Series

### DEVICE MARKING AND RESISTOR VALUES

Device	Package	Marking	R1 (K)	R2 (K)	Shipping
MUN5211DW1T1	SOT-363	7A	10	10	3000/Tape & Reel
MUN5212DW1T1	SOT-363	7B	22	22	3000/Tape & Reel
MUN5213DW1T1	SOT-363	7C	47	47	3000/Tape & Reel
MUN5214DW1T1	SOT-363	7D	10	47	3000/Tape & Reel
MUN5215DW1T1	SOT-363	7E	10	∞	3000/Tape & Reel
MUN5216DW1T1	SOT-363	7F	4.7	∞	3000/Tape & Reel
MUN5230DW1T1	SOT-363	7G	1.0	1.0	3000/Tape & Reel
MUN5231DW1T1	SOT-363	7H	2.2	2.2	3000/Tape & Reel
MUN5232DW1T1	SOT-363	7J	4.7	4.7	3000/Tape & Reel
MUN5233DW1T1	SOT-363	7K	4.7	47	3000/Tape & Reel
MUN5234DW1T1	SOT-363	7L	22	47	3000/Tape & Reel
MUN5235DW1T1	SOT-363	7M	2.2	47	3000/Tape & Reel
MUN5236DW1T1	SOT-363	7N	100	100	3000/Tape & Reel
MUN5237DW1T1	SOT-363	7P	47	22	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>)

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)	MUN5211DW1T1	-	-	0.5	mAdc
	MUN5212DW1T1	-	-	0.2	
	MUN5213DW1T1	-	-	0.1	
	MUN5214DW1T1	-	-	0.2	
	MUN5215DW1T1	-	-	0.9	
	MUN5216DW1T1	-	-	1.9	
	MUN5230DW1T1	-	-	4.3	
	MUN5231DW1T1	-	-	2.3	
	MUN5232DW1T1	-	-	1.5	
	MUN5233DW1T1	-	-	0.18	
	MUN5234DW1T1	-	-	0.13	
	MUN5235DW1T1	-	-	0.2	
	MUN5236DW1T1	-	-	0.05	
MUN5237DW1T1	-	-	0.13		
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 3.) (I <sub>C</sub> = 2.0 mA, I <sub>B</sub> = 0)	V <sub>(BR)CEO</sub>	50	-	-	Vdc

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

# MUN5211DW1T1 Series

## ELECTRICAL CHARACTERISTICS

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

Characteristic	Symbol	Min	Typ	Max	Unit	
<b>ON CHARACTERISTICS</b> (Note 4.)						
DC Current Gain ( $V_{CE} = 10\text{ V}$ , $I_C = 5.0\text{ mA}$ )	MUN5211DW1T1 MUN5212DW1T1 MUN5213DW1T1 MUN5214DW1T1 MUN5215DW1T1 MUN5216DW1T1 MUN5230DW1T1 MUN5231DW1T1 MUN5232DW1T1 MUN5233DW1T1 MUN5234DW1T1 MUN5235DW1T1 MUN5236DW1T1 MUN5237DW1T1	$h_{FE}$	35 60 80 80 160 160 3.0 8.0 15 80 80 80 80 80	60 100 140 140 350 350 5.0 15 30 200 150 140 150 140	– – – – – – – – – – – – – –	
Collector-Emitter Saturation Voltage ( $I_C = 10\text{ mA}$ , $I_B = 0.3\text{ mA}$ ) ( $I_C = 10\text{ mA}$ , $I_B = 5\text{ mA}$ ) MUN5230DW1T1/MUN5231DW1T1 ( $I_C = 10\text{ mA}$ , $I_B = 1\text{ mA}$ ) MUN5215DW1T1/MUN5216DW1T1 MUN5232DW1T1/MUN5233DW1T1/MUN5234DW1T1		$V_{CE(sat)}$	–	–	0.25	Vdc
Output Voltage (on) ( $V_{CC} = 5.0\text{ V}$ , $V_B = 2.5\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ )  ( $V_{CC} = 5.0\text{ V}$ , $V_B = 3.5\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ ) ( $V_{CC} = 5.0\text{ V}$ , $V_B = 5.5\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ ) ( $V_{CC} = 5.0\text{ V}$ , $V_B = 4.0\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ )	MUN5211DW1T1 MUN5212DW1T1 MUN5214DW1T1 MUN5215DW1T1 MUN5216DW1T1 MUN5230DW1T1 MUN5231DW1T1 MUN5232DW1T1 MUN5233DW1T1 MUN5234DW1T1 MUN5235DW1T1 MUN5213DW1T1 MUN5236DW1T1 MUN5237DW1T1	$V_{OL}$	– – – – – – – – – – – – – –	– – – – – – – – – – – – – –	0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2	Vdc
Output Voltage (off) ( $V_{CC} = 5.0\text{ V}$ , $V_B = 0.5\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ ) ( $V_{CC} = 5.0\text{ V}$ , $V_B = 0.050\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ ) ( $V_{CC} = 5.0\text{ V}$ , $V_B = 0.25\text{ V}$ , $R_L = 1.0\text{ k}\Omega$ )	MUN5230DW1T1 MUN5215DW1T1 MUN5216DW1T1 MUN5233DW1T1	$V_{OH}$	4.9	–	–	Vdc

4. Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty Cycle < 2.0%

# MUN5211DW1T1 Series

## ELECTRICAL CHARACTERISTICS

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

Characteristic	Symbol	Min	Typ	Max	Unit	
<b>ON CHARACTERISTICS</b> (Note 5.) (Continued)						
Input Resistor	MUN5211DW1T1	R1	7.0	10	13	k $\Omega$
	MUN5212DW1T1		15.4	22	28.6	
	MUN5213DW1T1		32.9	47	61.1	
	MUN5214DW1T1		7.0	10	13	
	MUN5215DW1T1		7.0	10	13	
	MUN5216DW1T1		3.3	4.7	6.1	
	MUN5230DW1T1		0.7	1.0	1.3	
	MUN5231DW1T1		1.5	2.2	2.9	
	MUN5232DW1T1		3.3	4.7	6.1	
	MUN5233DW1T1		3.3	4.7	6.1	
	MUN5234DW1T1		15.4	22	28.6	
	MUN5235DW1T1		1.54	2.2	2.86	
	MUN5236DW1T1		70	100	130	
	MUN5237DW1T1		32.9	47	61.1	
Resistor Ratio MUN5211DW1T1/MUN5212DW1T1/ MUN5213DW1T1/MUN5236DW1T1 MUN5214DW1T1 MUN5215DW1T1/MUN5216DW1T1 MUN5230DW1T1/MUN5231DW1T1/MUN5232DW1T1 MUN5233DW1T1 MUN5234DW1T1 MUN5235DW1T1 MUN5237DW1T1	R1/R2	0.8 0.17 - 0.8 0.055 0.38 0.038 1.7	1.0 0.21 - 1.0 0.1 0.47 0.047 2.1	1.2 0.25 - 1.2 0.185 0.56 0.056 2.6		

5. Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty Cycle < 2.0%

### ALL MUN5211DW1T1 SERIES DEVICES

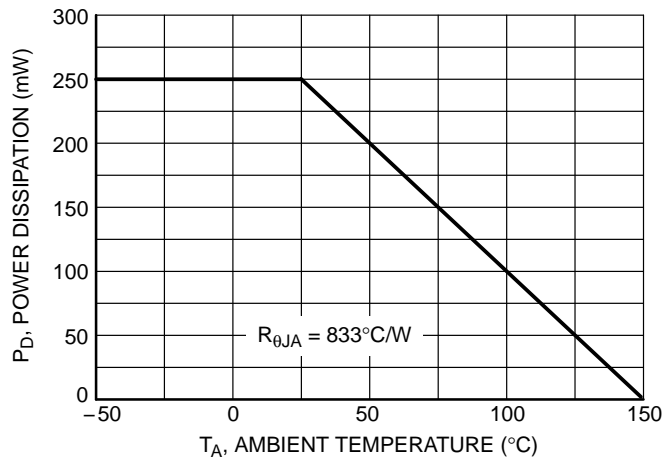


Figure 1. Derating Curve

# MUN5211DW1T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS — MUN5211DW1T1

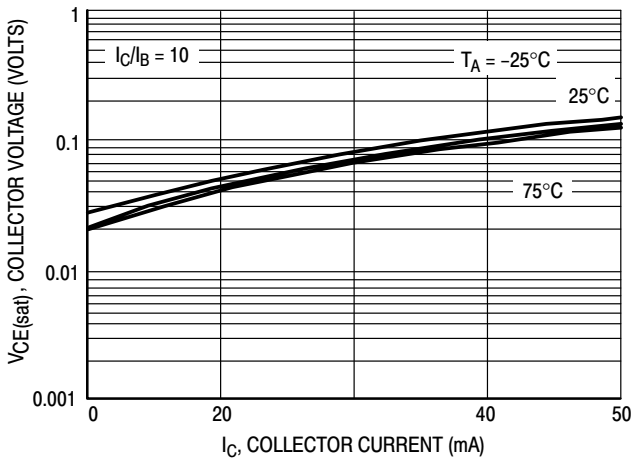


Figure 2.  $V_{CE(sat)}$  versus  $I_C$

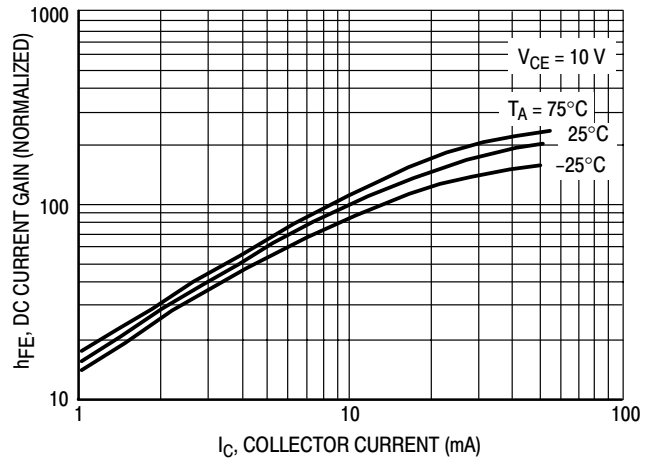


Figure 3. DC Current Gain

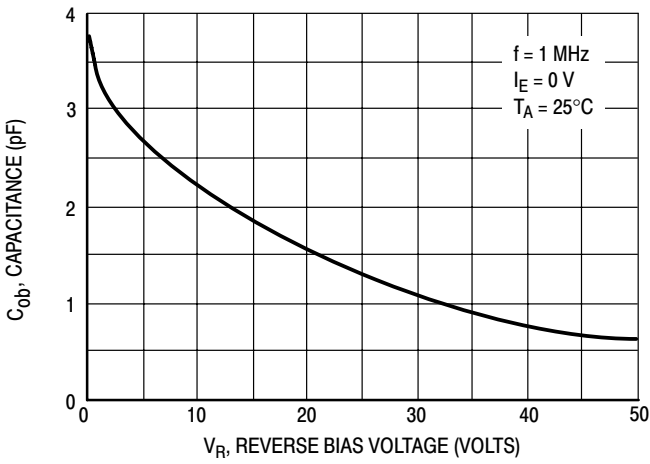


Figure 4. Output Capacitance

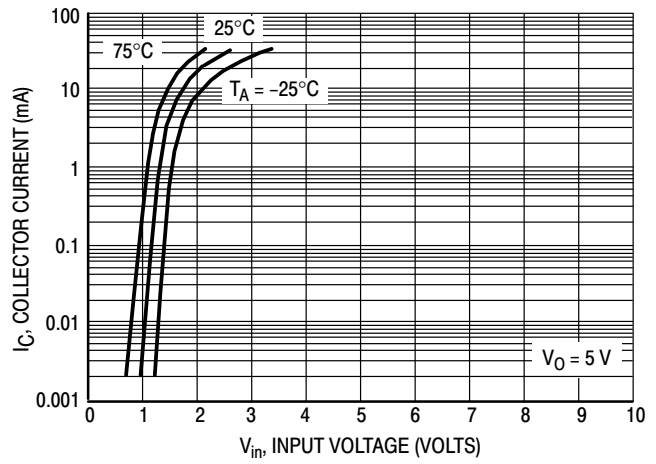


Figure 5. Output Current versus Input Voltage

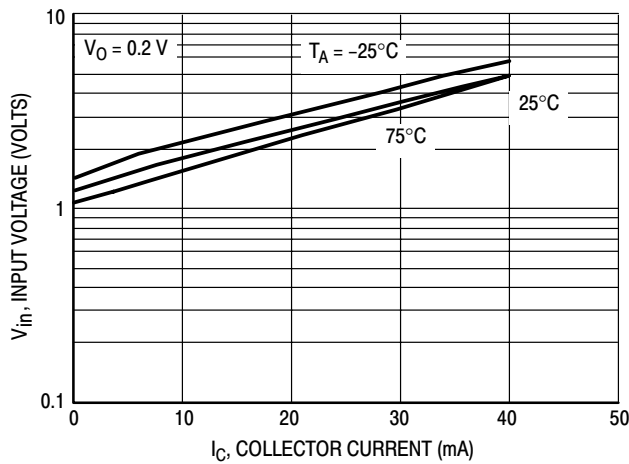


Figure 6. Input Voltage versus Output Current

# MUN5211DW1T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS — MUN5212DW1T1

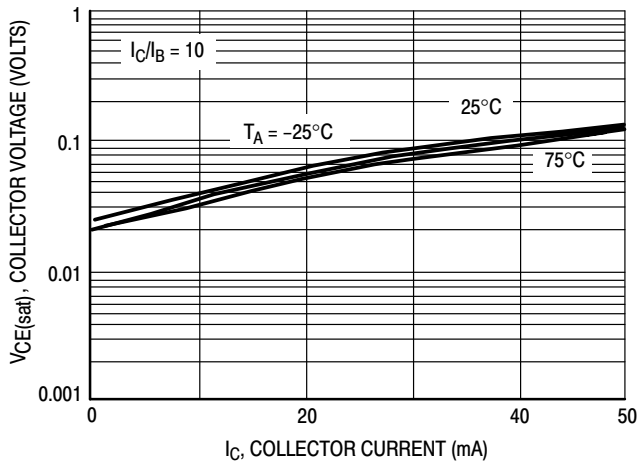


Figure 7.  $V_{CE(sat)}$  versus  $I_C$

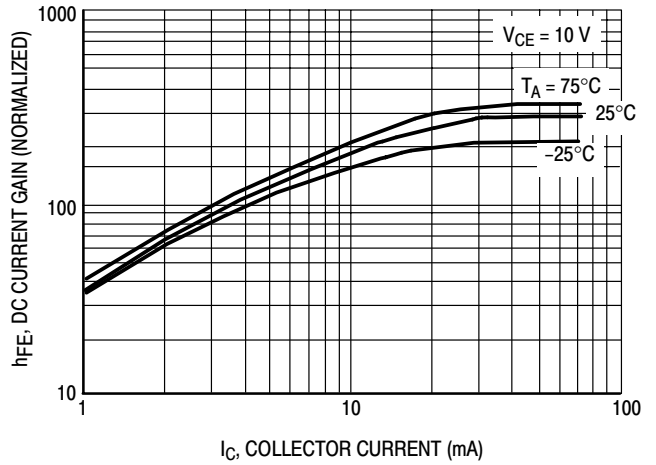


Figure 8. DC Current Gain

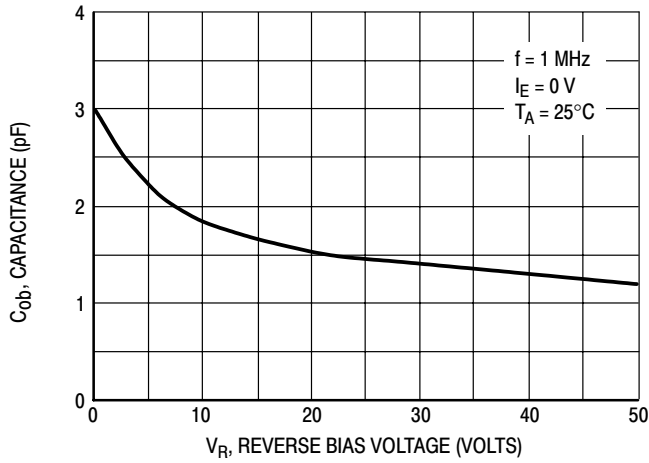


Figure 9. Output Capacitance

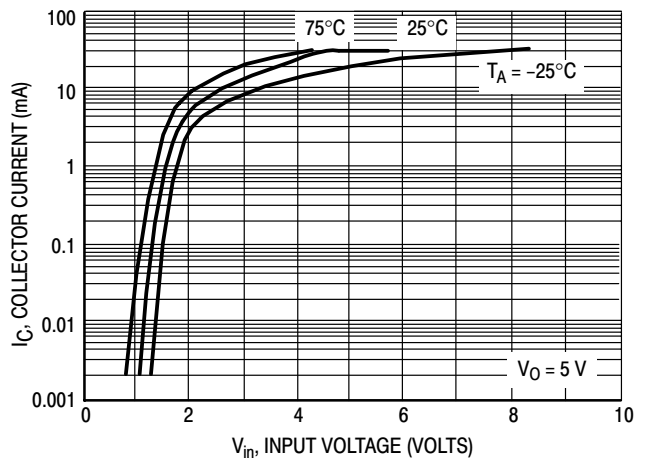


Figure 10. Output Current versus Input Voltage

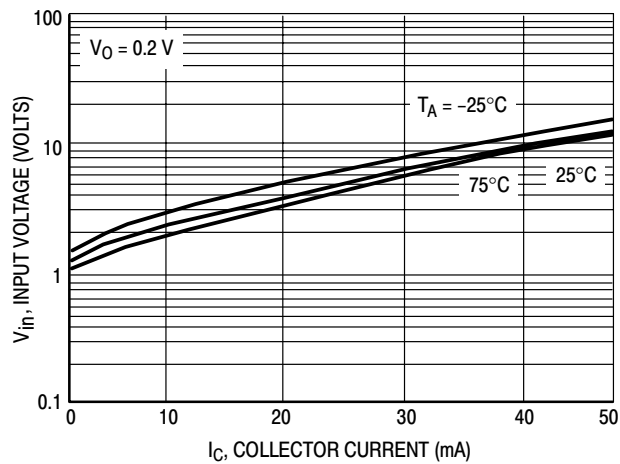


Figure 11. Input Voltage versus Output Current

# MUN5211DW1T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS — MUN5213DW1T1

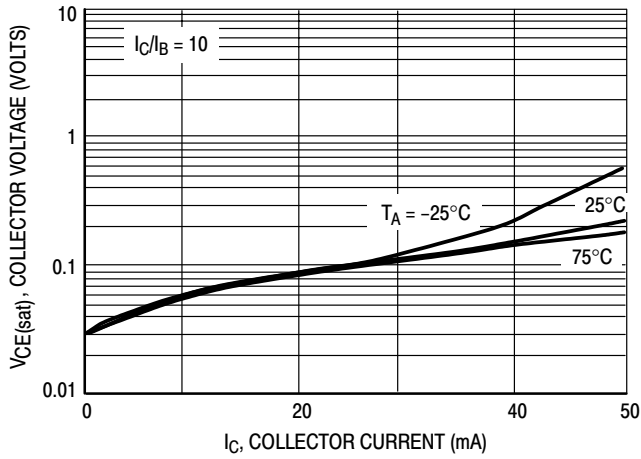


Figure 12.  $V_{CE(sat)}$  versus  $I_C$

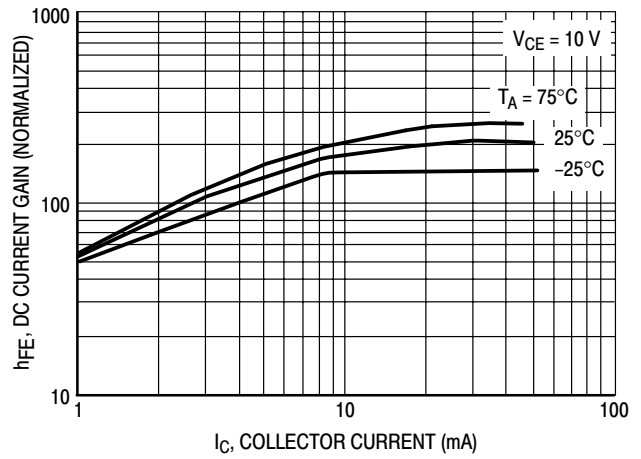


Figure 13. DC Current Gain

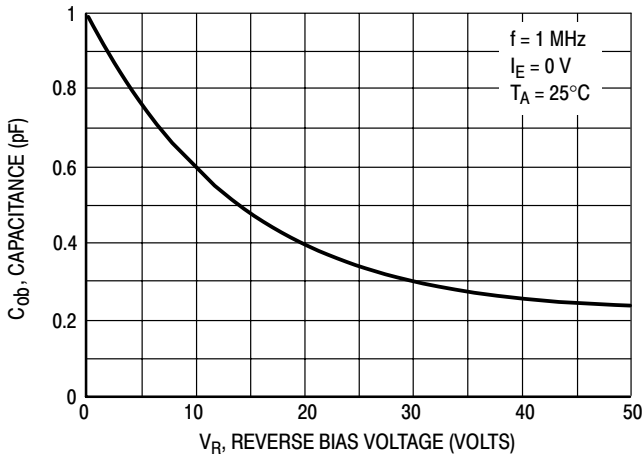


Figure 14. Output Capacitance

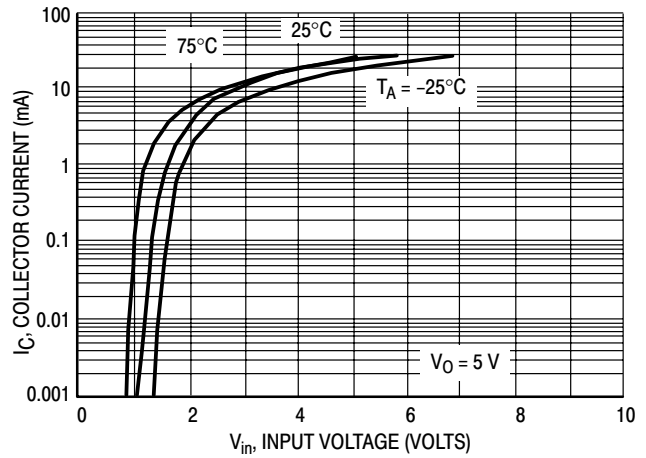


Figure 15. Output Current versus Input Voltage

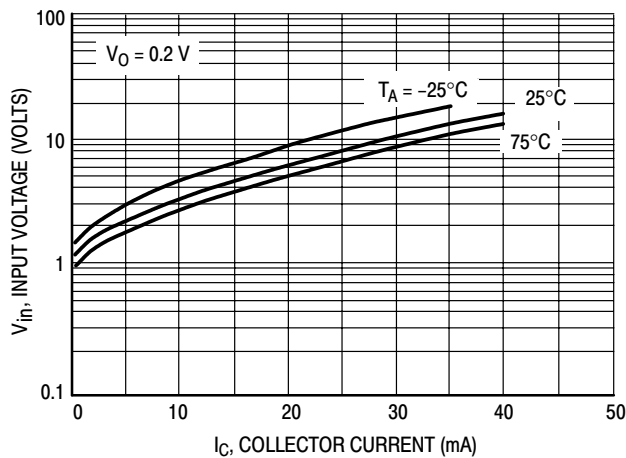


Figure 16. Input Voltage versus Output Current

# MUN5211DW1T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS — MUN5214DW1T1

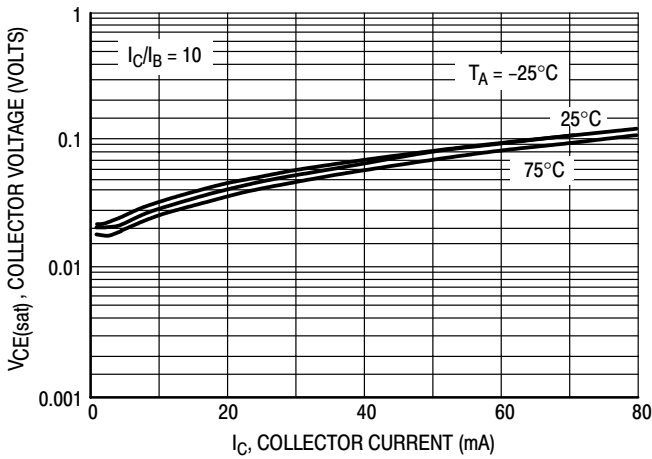


Figure 17.  $V_{CE(sat)}$  versus  $I_C$

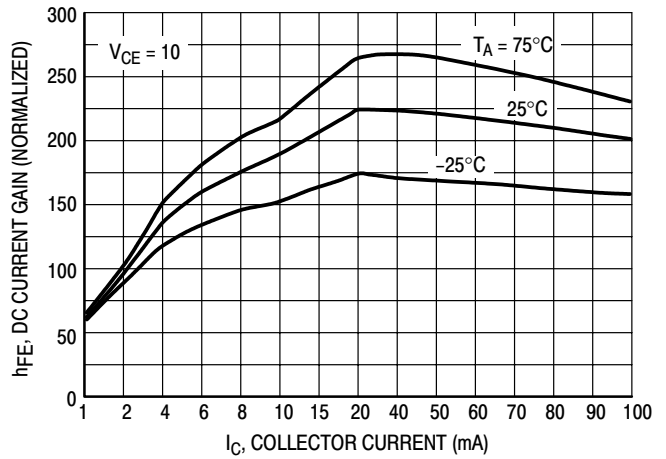


Figure 18. DC Current Gain

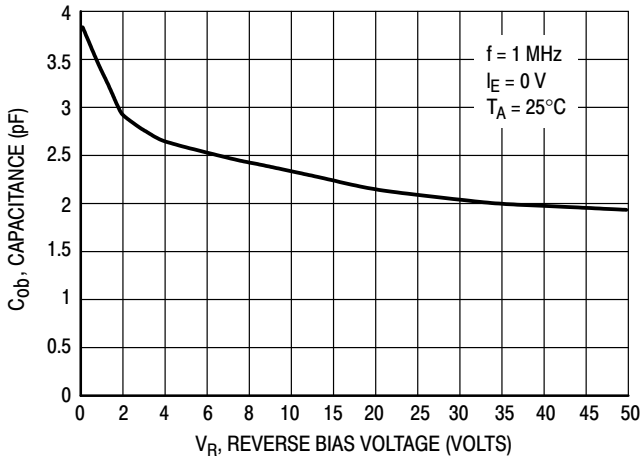


Figure 19. Output Capacitance

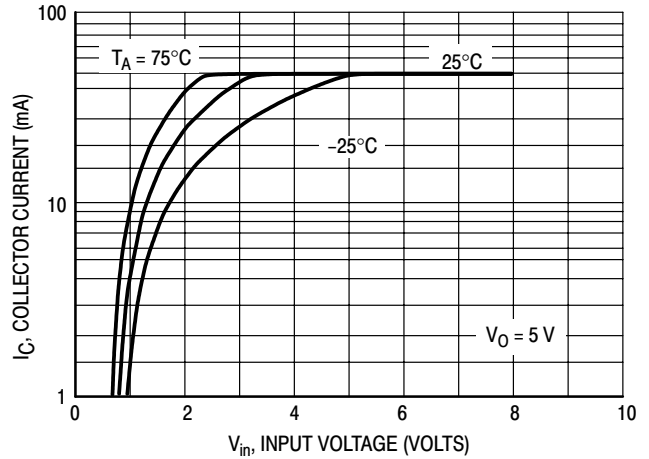


Figure 20. Output Current versus Input Voltage

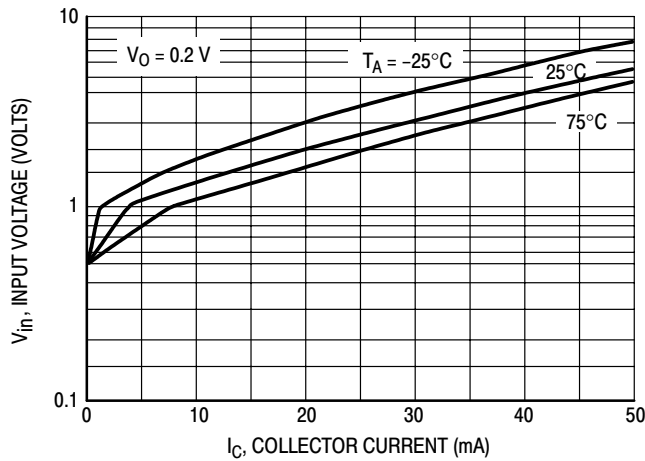


Figure 21. Input Voltage versus Output Current



# MUN5211DW1T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS — MUN5215DW1T1

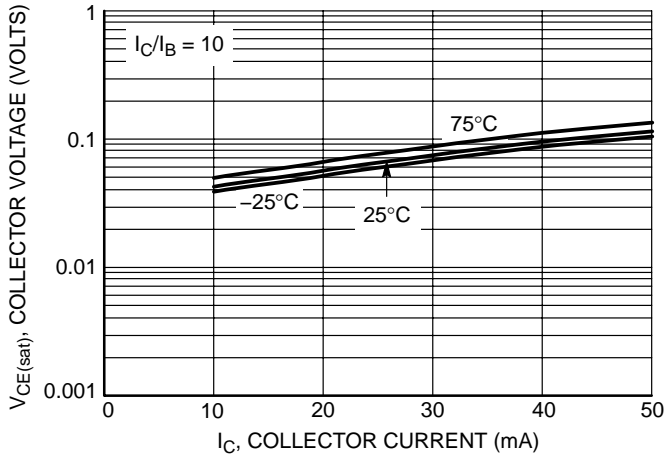


Figure 22.  $V_{CE(sat)}$  versus  $I_C$

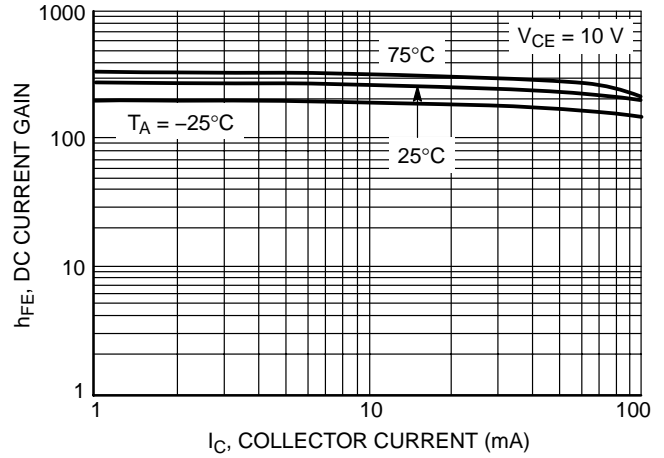


Figure 23. DC Current Gain

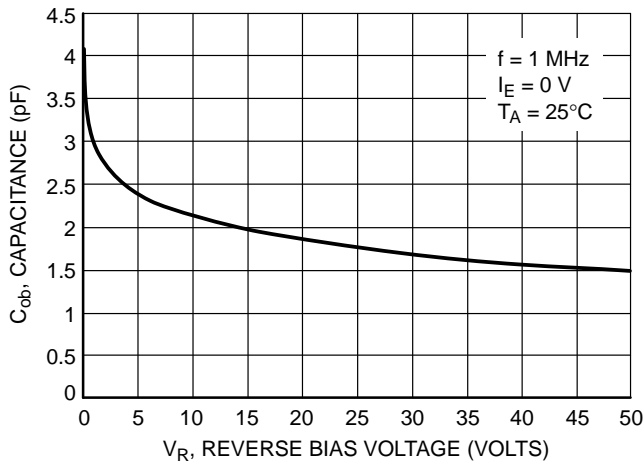


Figure 24. Output Capacitance

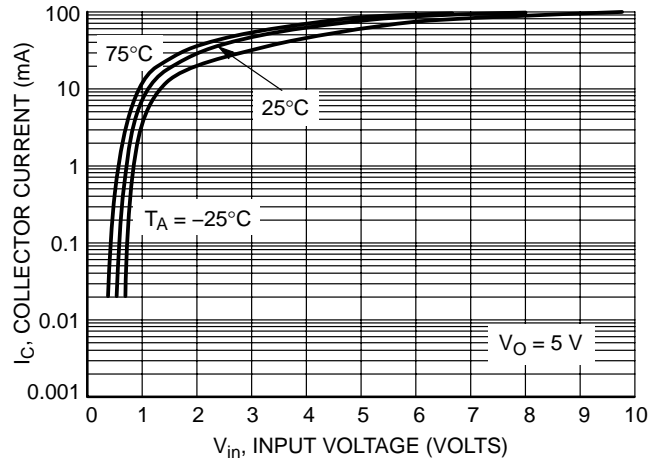


Figure 25. Output Current versus Input Voltage

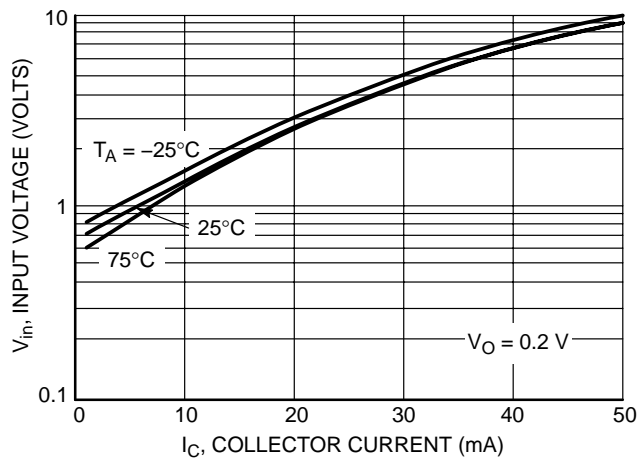


Figure 26. Input Voltage versus Output Current

# MUN5211DW1T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS — MUN5216DW1T1

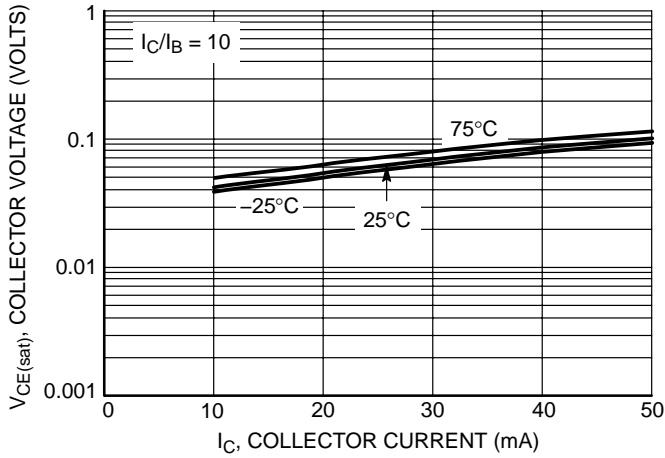


Figure 27.  $V_{CE(sat)}$  versus  $I_C$

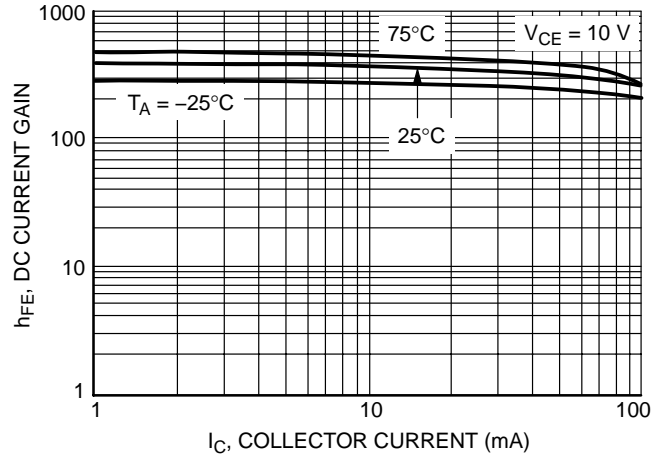


Figure 28. DC Current Gain

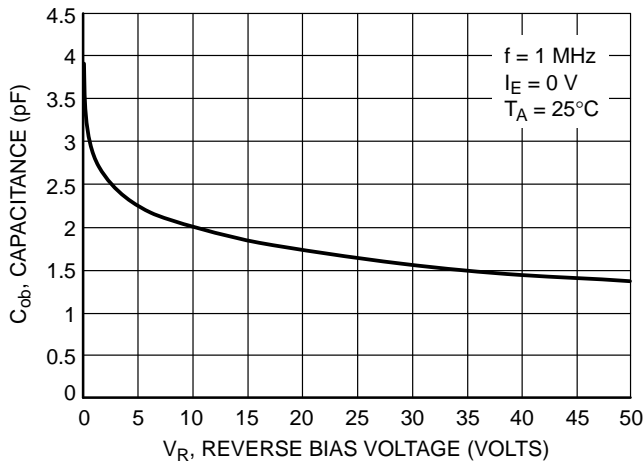


Figure 29. Output Capacitance

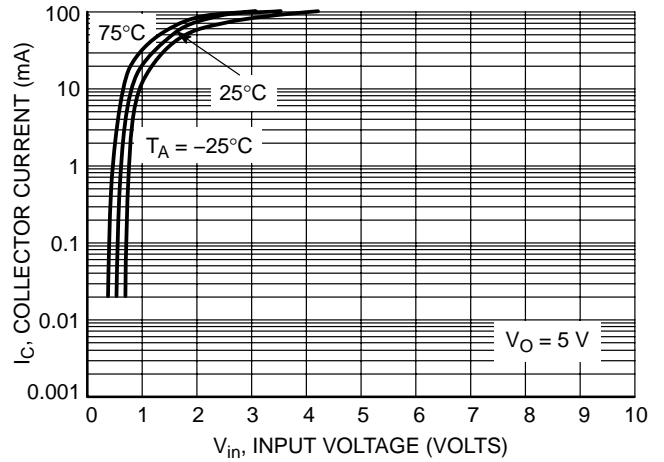


Figure 30. Output Current versus Input Voltage

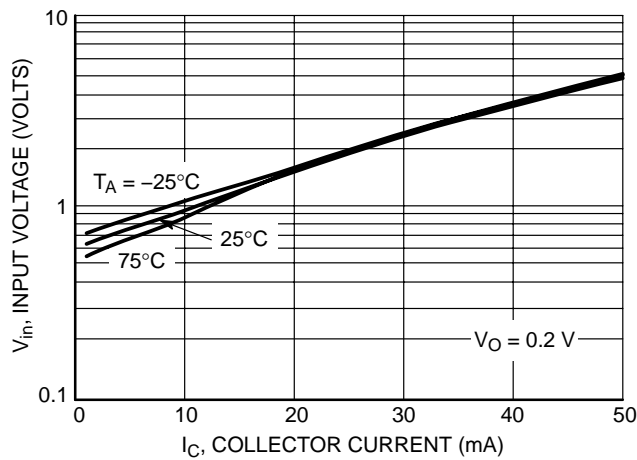


Figure 31. Input Voltage versus Output Current

# MUN5211DW1T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS — MUN5230DW1T1

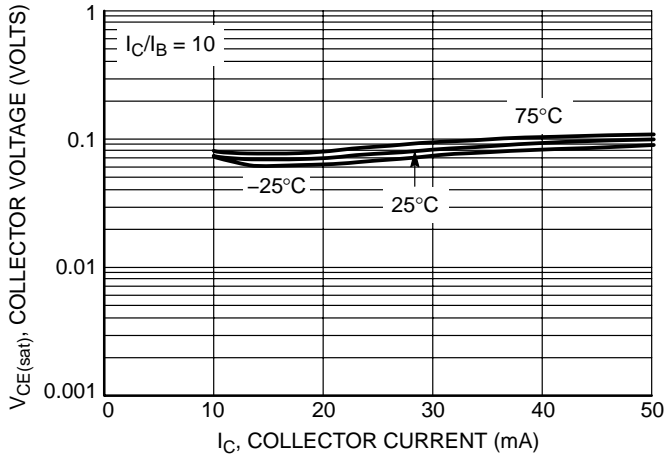


Figure 32.  $V_{CE(sat)}$  versus  $I_C$

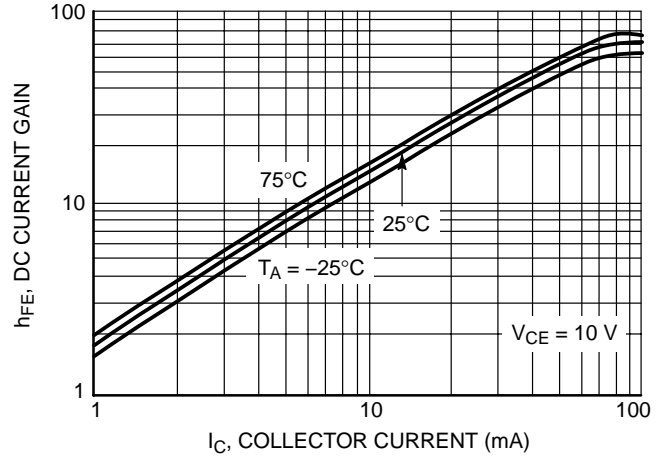


Figure 33. DC Current Gain

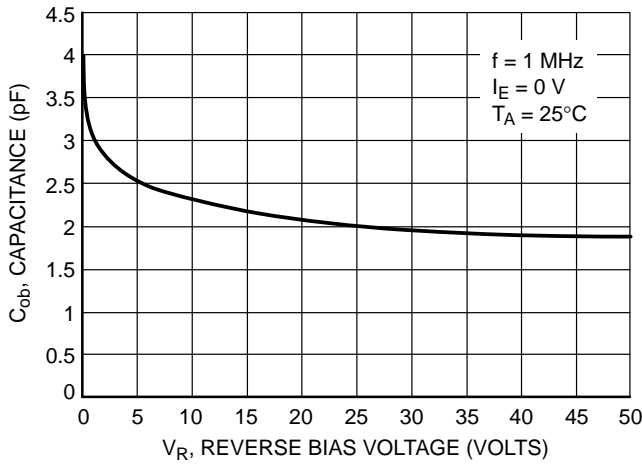


Figure 34. Output Capacitance

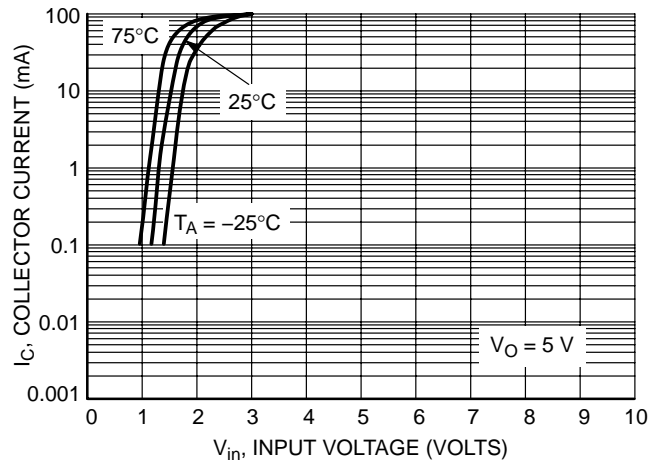


Figure 35. Output Current versus Input Voltage

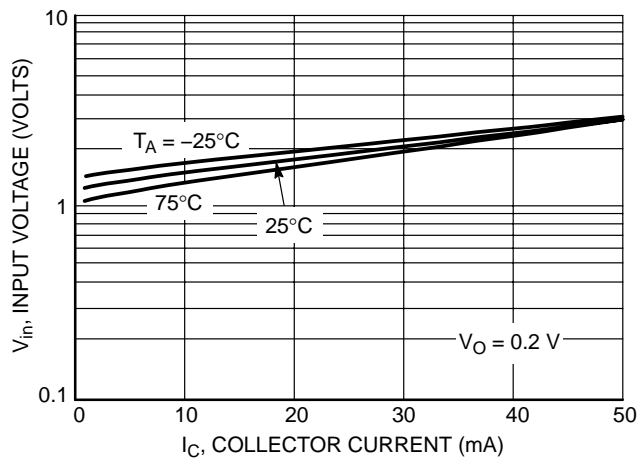


Figure 36. Input Voltage versus Output Current

# MUN5211DW1T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS — MUN5231DW1T1

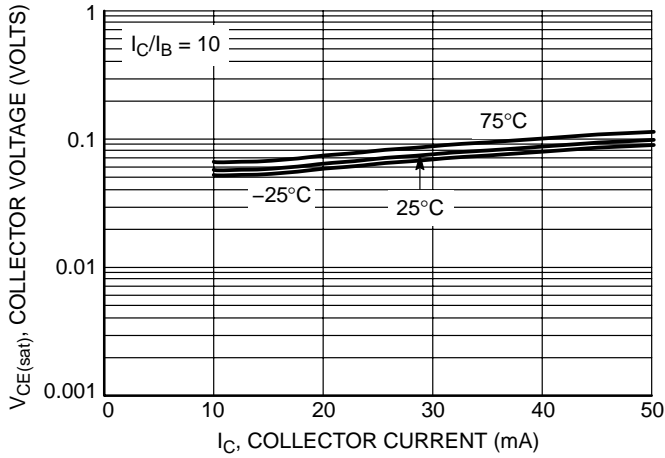


Figure 37.  $V_{CE(sat)}$  versus  $I_C$

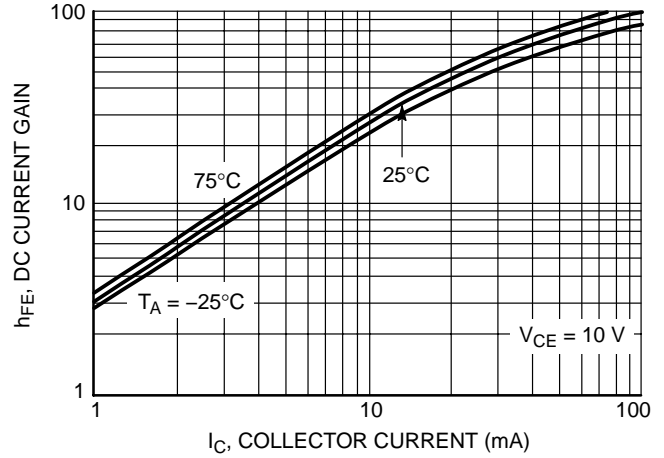


Figure 38. DC Current Gain

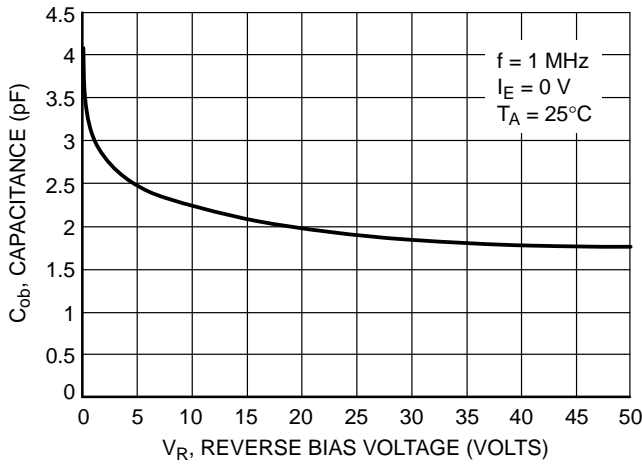


Figure 39. Output Capacitance

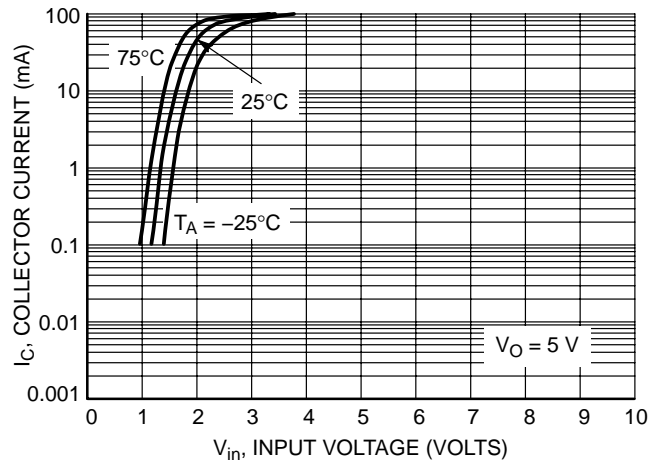


Figure 40. Output Current versus Input Voltage

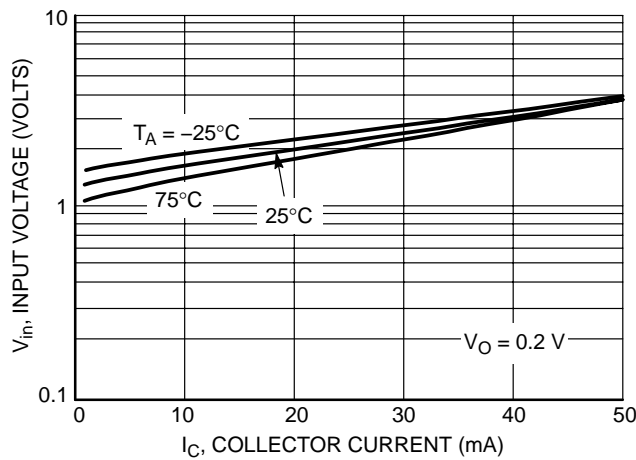


Figure 41. Input Voltage versus Output Current

# MUN5211DW1T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS — MUN5232DW1T1

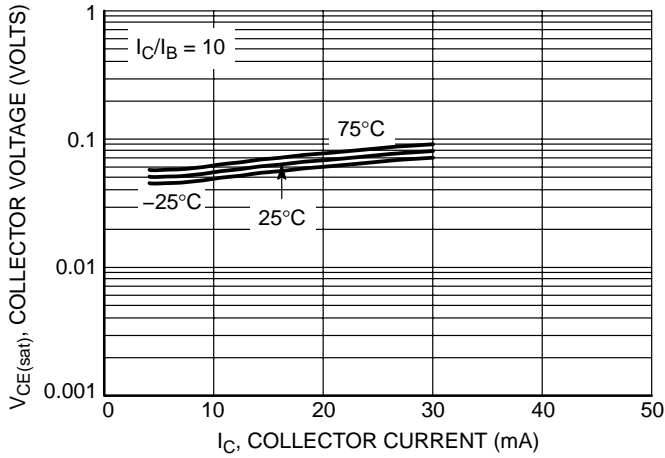


Figure 42.  $V_{CE(sat)}$  versus  $I_C$

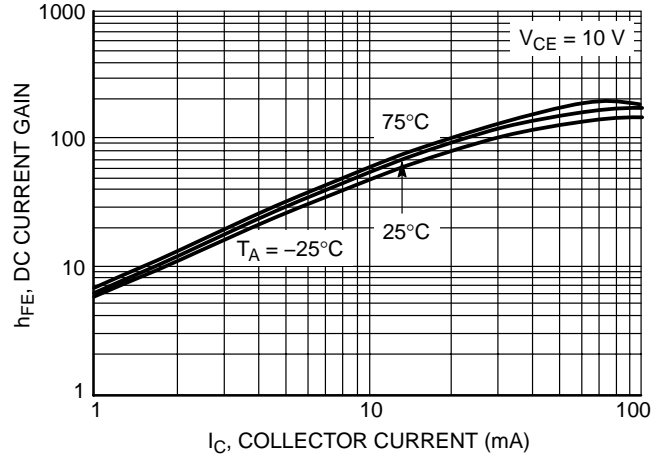


Figure 43. DC Current Gain

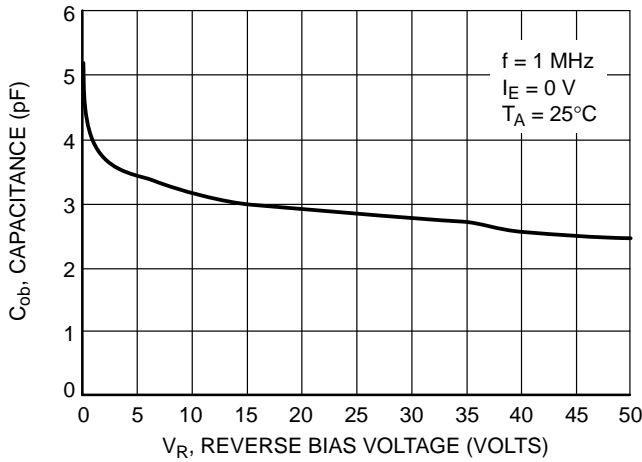


Figure 44. Output Capacitance

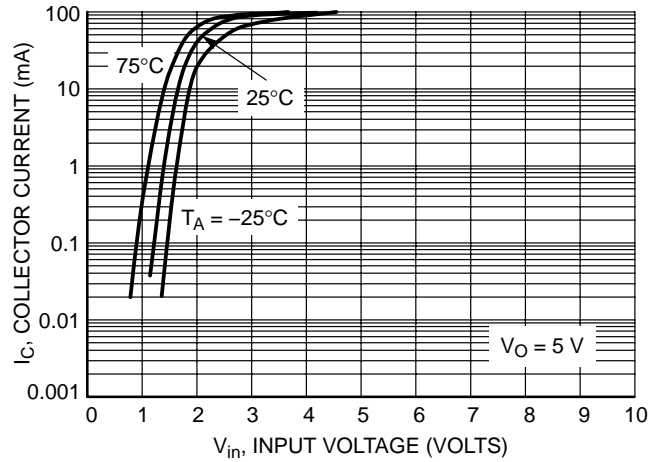


Figure 45. Output Current versus Input Voltage

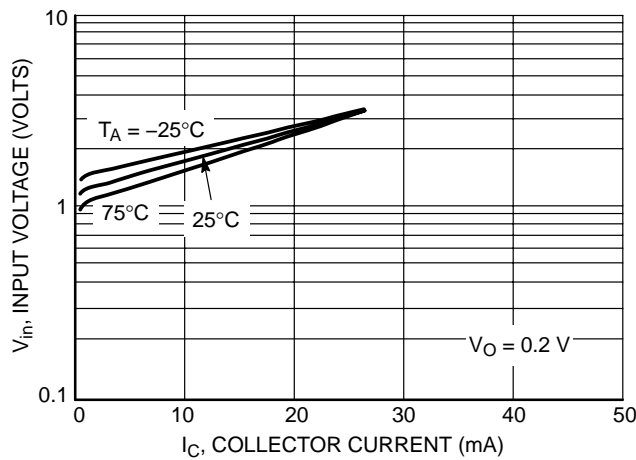


Figure 46. Input Voltage versus Output Current

# MUN5211DW1T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS — MUN5233DW1T1

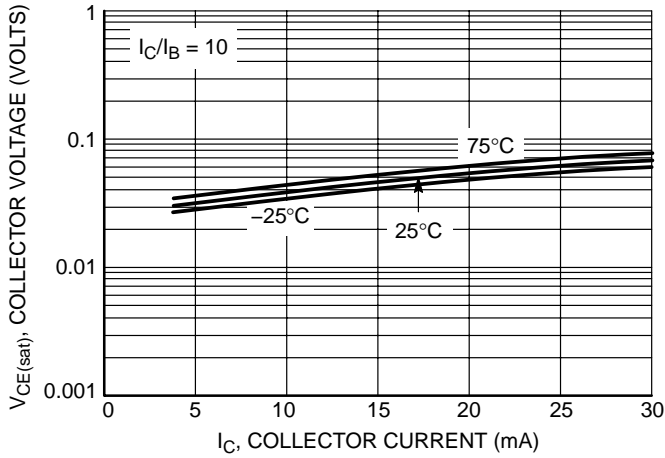


Figure 47.  $V_{CE(sat)}$  versus  $I_C$

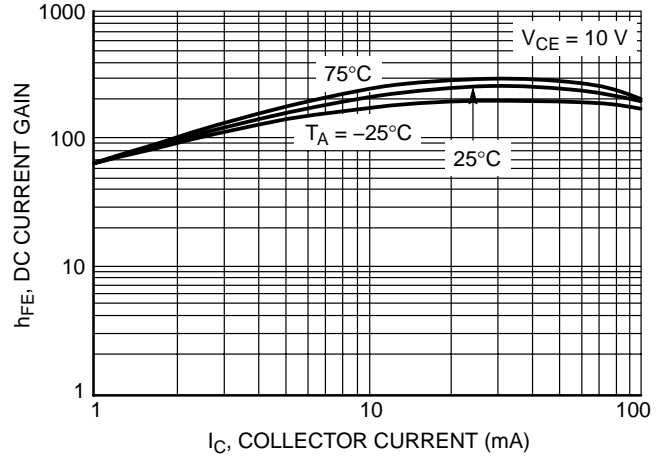


Figure 48. DC Current Gain

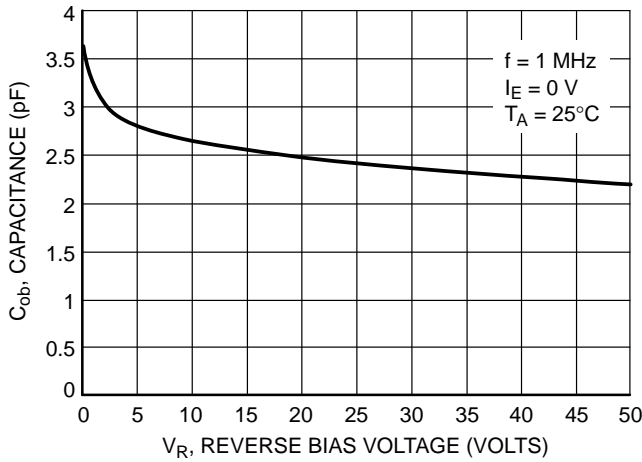


Figure 49. Output Capacitance

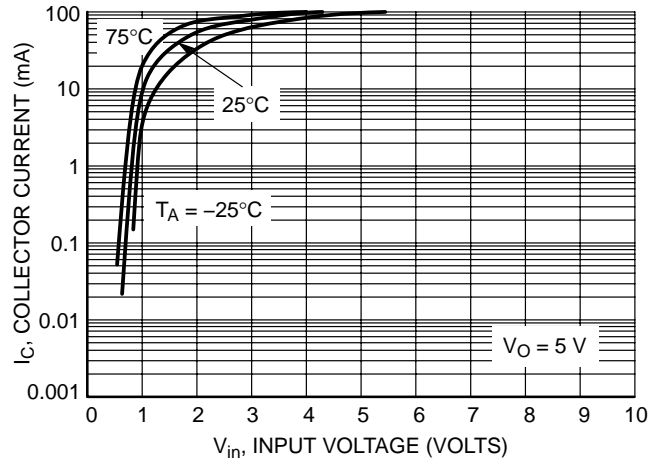


Figure 50. Output Current versus Input Voltage

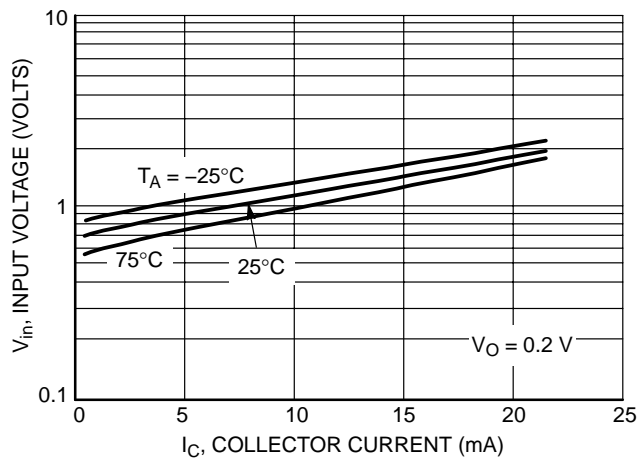


Figure 51. Input Voltage versus Output Current

# MUN5211DW1T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS — MUN5234DW1T1

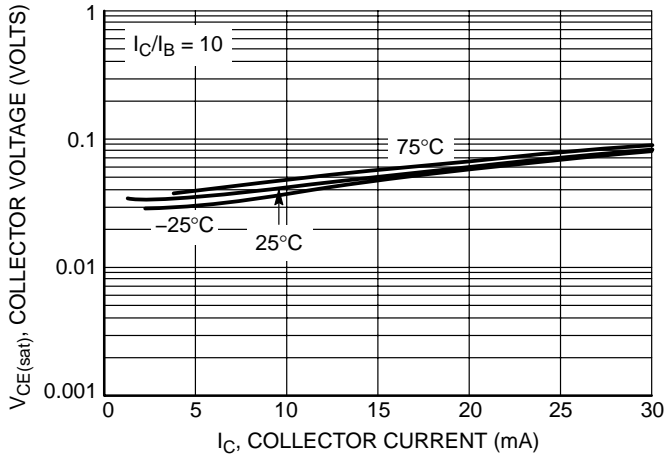


Figure 52.  $V_{CE(sat)}$  versus  $I_C$

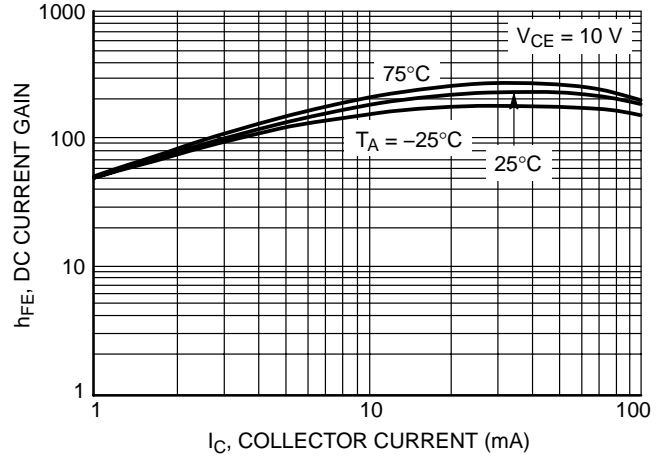
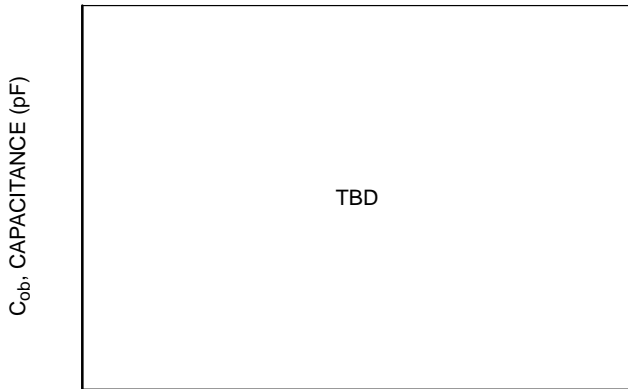
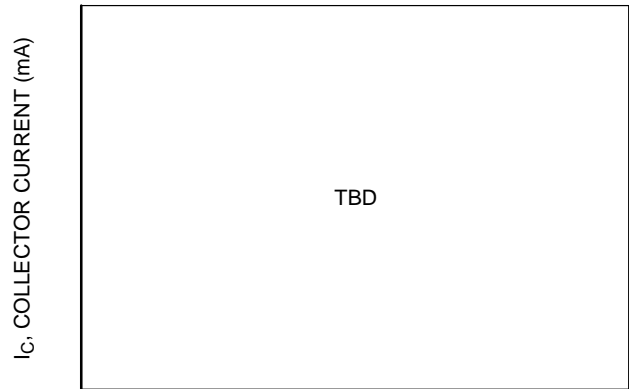


Figure 53. DC Current Gain



$V_R$ , REVERSE BIAS VOLTAGE (VOLTS)

Figure 54. Output Capacitance



$V_{in}$ , INPUT VOLTAGE (VOLTS)

Figure 55. Output Current versus Input Voltage

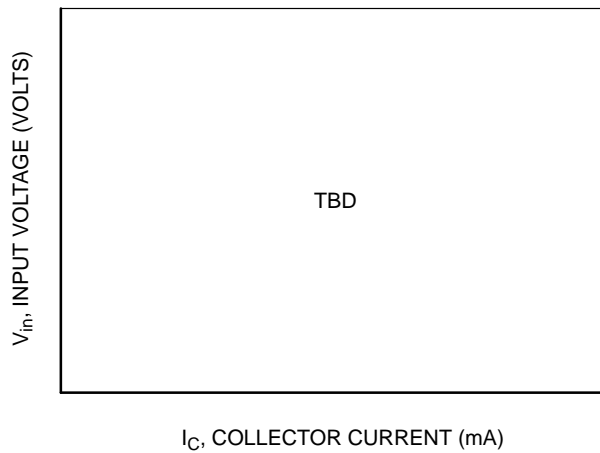


Figure 56. Input Voltage versus Output Current

# MUN5211DW1T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS — MUN5235DW1T1

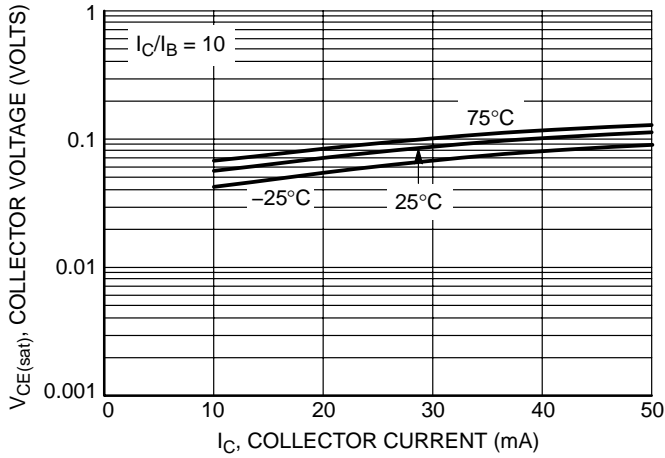


Figure 57.  $V_{CE(sat)}$  versus  $I_C$

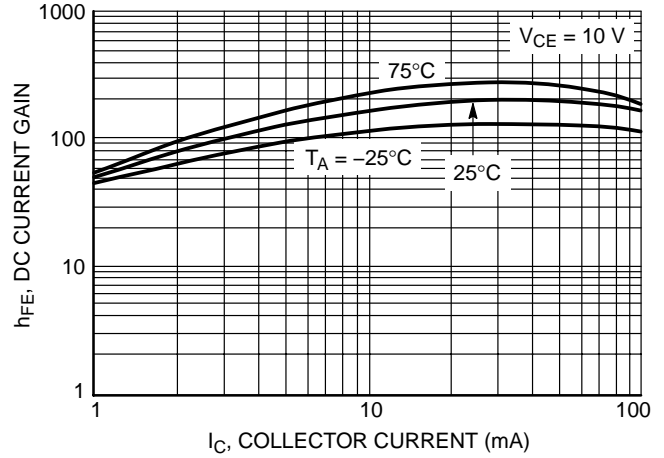


Figure 58. DC Current Gain

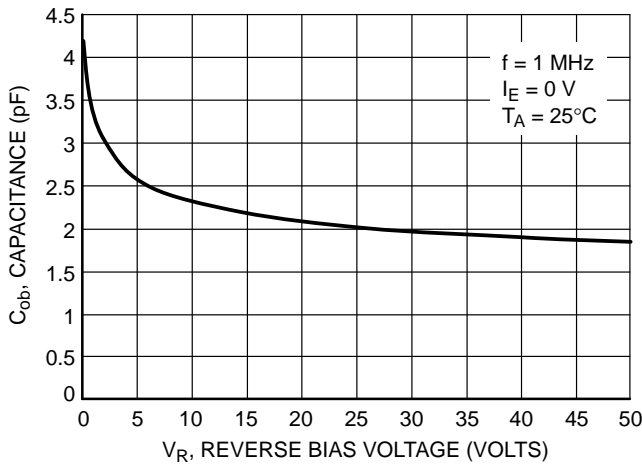


Figure 59. Output Capacitance

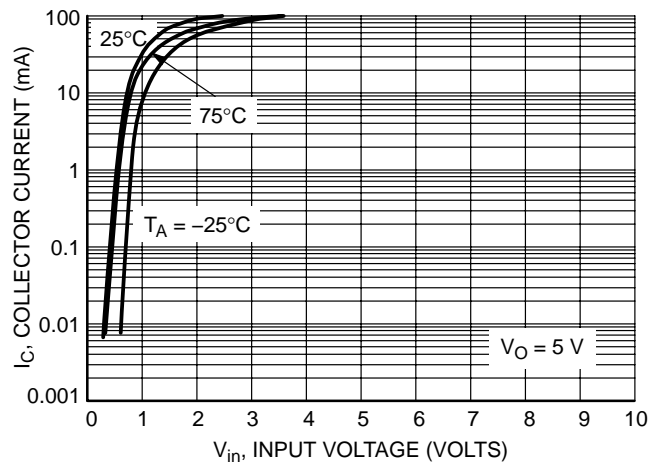


Figure 60. Output Current versus Input Voltage

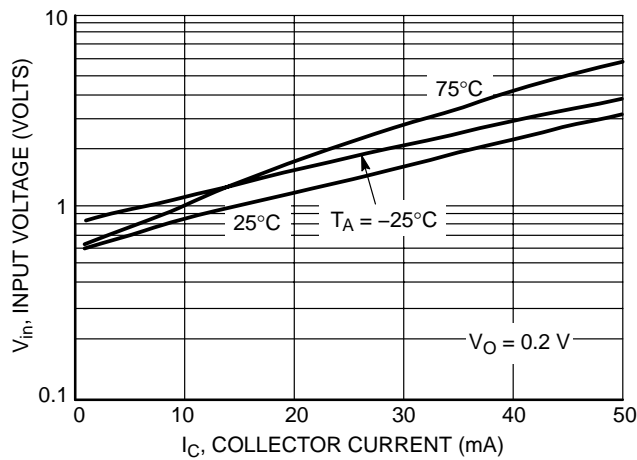


Figure 61. Input Voltage versus Output Current



# MUN5211DW1T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS — MUN5236DW1T1

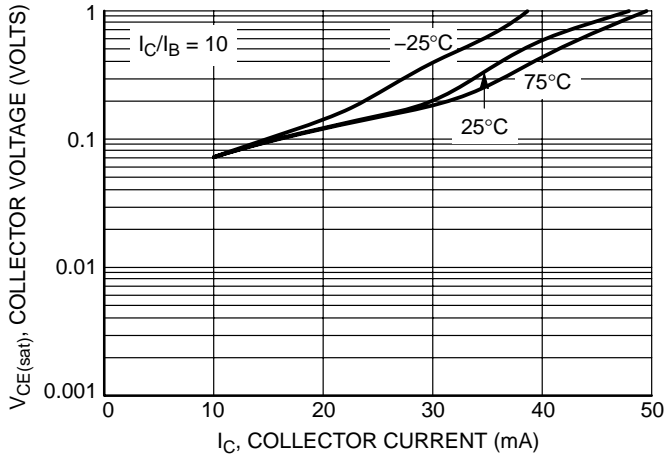


Figure 62.  $V_{CE(sat)}$  versus  $I_C$

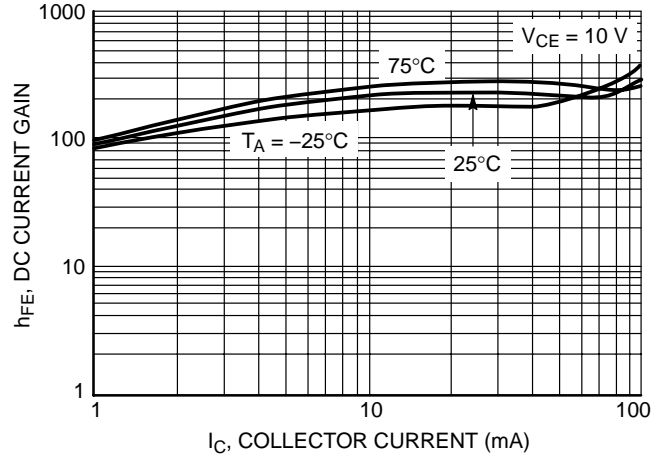


Figure 63. DC Current Gain

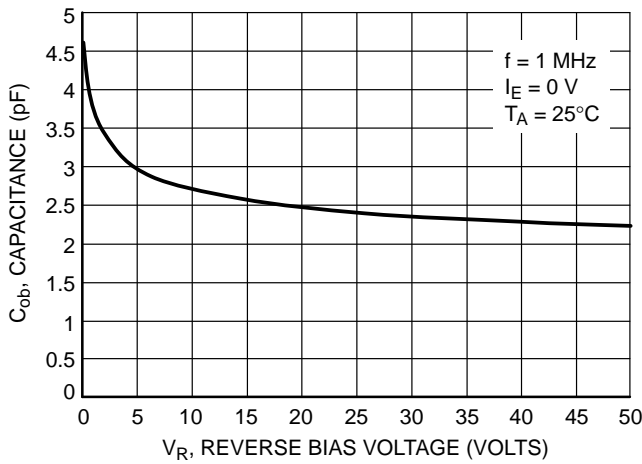


Figure 64. Output Capacitance

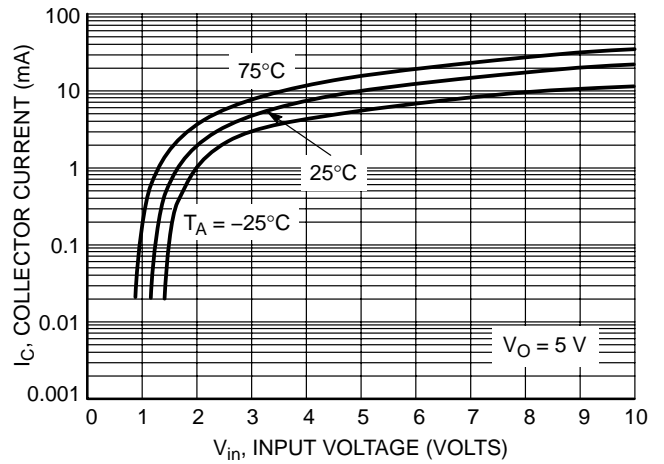


Figure 65. Output Current versus Input Voltage

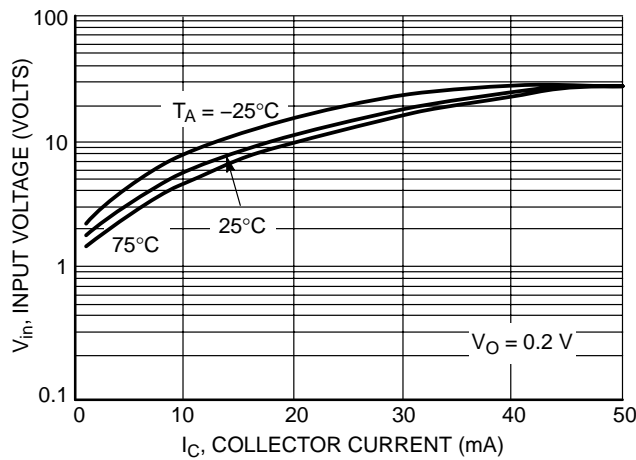


Figure 66. Input Voltage versus Output Current

# MUN5211DW1T1 Series

## TYPICAL ELECTRICAL CHARACTERISTICS — MUN5237DW1T1

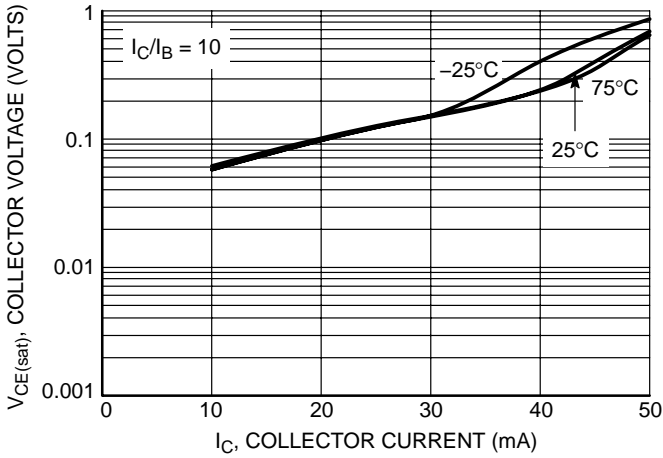


Figure 67.  $V_{CE(sat)}$  versus  $I_C$

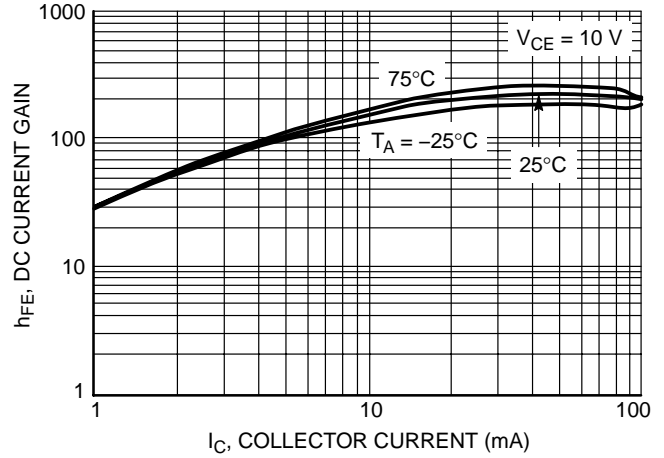


Figure 68. DC Current Gain

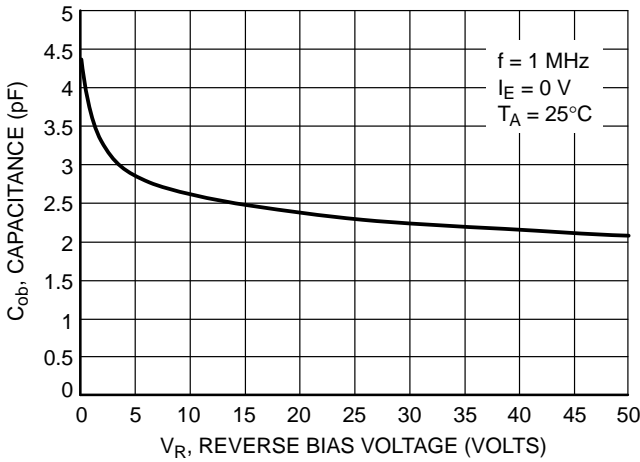


Figure 69. Output Capacitance

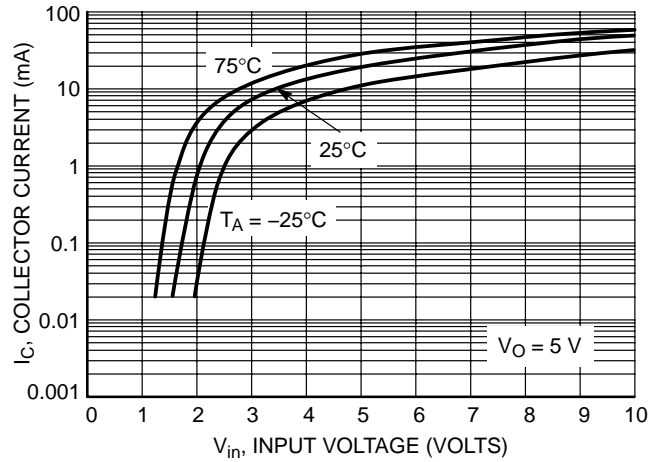


Figure 70. Output Current versus Input Voltage

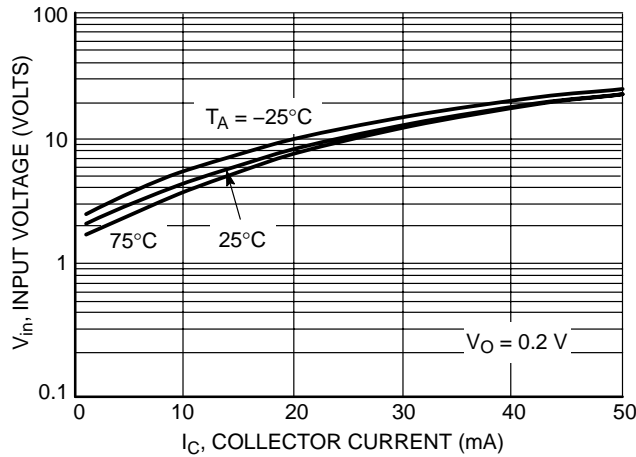
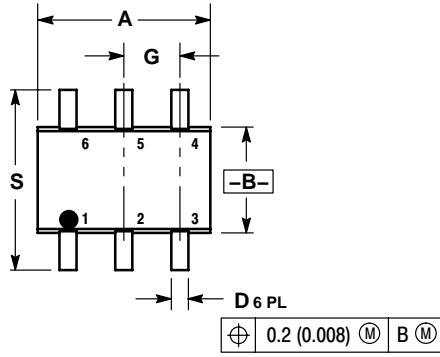


Figure 71. Input Voltage versus Output Current

# MUN5211DW1T1 Series

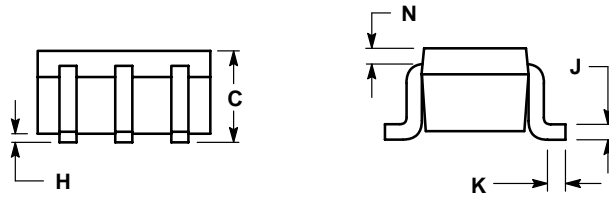
## PACKAGE DIMENSIONS

SC-88 (SOT-363)  
CASE 419B-02  
ISSUE T



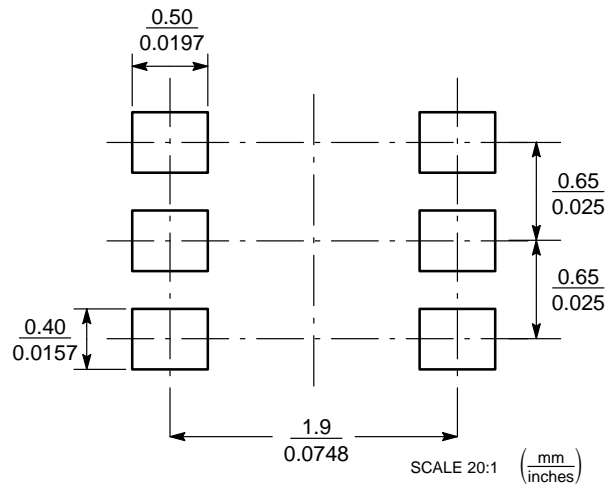
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. 419B-01 OBSOLETE, NEW STANDARD 419B-02.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.071	0.087	1.80	2.20
B	0.045	0.053	1.15	1.35
C	0.031	0.043	0.80	1.10
D	0.004	0.012	0.10	0.30
G	0.026 BSC		0.65 BSC	
H	---	0.004	---	0.10
J	0.004	0.010	0.10	0.25
K	0.004	0.012	0.10	0.30
N	0.008 REF		0.20 REF	
S	0.079	0.087	2.00	2.20



- STYLE 1:  
PIN 1. EMITTER 2  
2. BASE 2  
3. COLLECTOR 1  
4. EMITTER 1  
5. BASE 1  
6. COLLECTOR 2

### SOLDERING FOOTPRINT\*



\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# MUN5211DW1T1 Series

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