

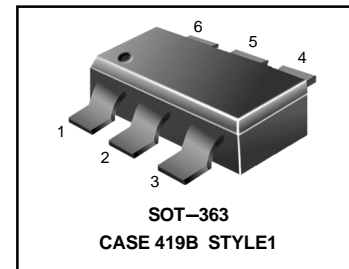
# Dual Bias Resistor Transistors

## 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.

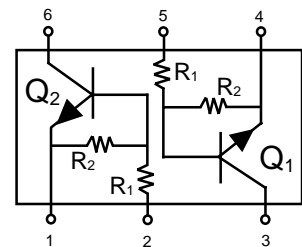
- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- Available in 8 mm, 7 inch/3000 Unit Tape and Reel

### MUN5211DW1T1 Series



#### MAXIMUM RATINGS (T<sub>A</sub> = 25°C unless otherwise noted, common for Q<sub>1</sub> and Q<sub>2</sub>)

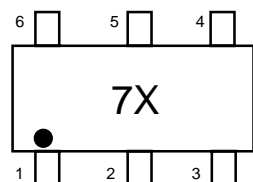
Rating	Symbol	Value	Unit
Collector-Base Voltage	V <sub>CBO</sub>	50	Vdc
Collector-Emitter Voltage	V <sub>CEO</sub>	50	Vdc
Collector Current	I <sub>C</sub>	100	mAdc



#### THERMAL CHARACTERISTICS

Characteristic (One Junction Heated)	Symbol	Max	Unit
Total Device Dissipation T <sub>A</sub> = 25°C	P <sub>D</sub>	187 (Note 1.) 256 (Note 2.)	mW
Derate above 25°C		1.5 (Note 1.) 2.0 (Note 2.)	mW/°C
Thermal Resistance – Junction-to-Ambient	R <sub>θJA</sub>	670 (Note 1.) 490 (Note 2.)	°C/W
Characteristic (Both Junctions Heated)	Symbol	Max	Unit
Total Device Dissipation T <sub>A</sub> = 25°C	P <sub>D</sub>	250 (Note 1.) 385 (Note 2.)	mW
Derate above 25°C		2.0 (Note 1.) 3.0 (Note 2.)	mW/°C
Thermal Resistance – Junction-to-Ambient	R <sub>θJA</sub>	493 (Note 1.) 325 (Note 2.)	°C/W
Thermal Resistance – Junction-to-Lead	R <sub>θJL</sub>	188 (Note 1.) 208 (Note 2.)	°C/W
Junction and Storage Temperature	T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C

#### MARKING DIAGRAM



7X = Device Marking  
(See Page 2)

#### DEVICE MARKING INFORMATION

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

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

**MUN5211DW1T1 Series**

**DEVICE MARKING AND RESISTOR VALUES**

Device	Package	Marking	R <sub>1</sub> (K)	R <sub>2</sub> (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 (Note 3.)	SOT-363	7E	10	∞	3000/Tape & Reel
MUN5216DW1T1 (Note 3.)	SOT-363	7F	4.7	∞	3000/Tape & Reel
MUN5230DW1T1 (Note 3.)	SOT-363	7G	1.0	1.0	3000/Tape & Reel
MUN5231DW1T1 (Note 3.)	SOT-363	7H	2.2	2.2	3000/Tape & Reel
MUN5232DW1T1 (Note 3.)	SOT-363	7J	4.7	4.7	3000/Tape & Reel
MUN5233DW1T1 (Note 3.)	SOT-363	7K	4.7	47	3000/Tape & Reel
MUN5234DW1T1 (Note 3.)	SOT-363	7L	22	47	3000/Tape & Reel
MUN5235DW1T1 (Note 3.)	SOT-363	7M	2.2	47	3000/Tape & Reel
MUN5236DW1T1 (Note 3.)	SOT-363	7N	100	100	3000/Tape & Reel
MUN5237DW1T1 (Note 3.)	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	I <sub>EBO</sub>	–	–	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 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%

**MUN5211DW1T1 Series**

**ELECTRICAL CHARACTERISTICS**

(T<sub>A</sub> = 25°C unless otherwise noted, common for Q<sub>1</sub> and Q<sub>2</sub>.) (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)	MUN5211DW1T1	h <sub>FE</sub>	35	60	–	
	MUN5212DW1T1		60	100	–	
	MUN5213DW1T1		80	140	–	
	MUN5214DW1T1		80	140	–	
	MUN5215DW1T1		160	350	–	
	MUN5216DW1T1		160	350	–	
	MUN5230DW1T1		3.0	5.0	–	
	MUN5231DW1T1		8.0	15	–	
	MUN5232DW1T1		15	30	–	
	MUN5233DW1T1		80	200	–	
	MUN5234DW1T1		80	150	–	
	MUN5235DW1T1		80	140	–	
	MUN5235DW1T1		80	150	–	
MUN5235DW1T1		80	140	–		
Collector-Emitter Saturation Voltage (I <sub>C</sub> = 10mA, I <sub>B</sub> = 0.3 mA) (I <sub>C</sub> = 10mA, I <sub>B</sub> = 5mA) (I <sub>C</sub> = 10mA, I <sub>B</sub> = 1mA)	V <sub>CE(sat)</sub>	–	–	0.25	Vdc	
MUN5230DW1T1/MUN5231DW1T1 MUN5215DW1T1/MUN5216DW1T1 MUN5232DW1T1/MUN5233DW1T1/MUN5234DW1T1						
Output Voltage (on) (V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 2.5 V, R <sub>L</sub> = 1.0 kΩ)	V <sub>OL</sub>	–	–	0.2	Vdc	
MUN5211DW1T1		–	–	0.2		
MUN5212DW1T1		–	–	0.2		
MUN5214DW1T1		–	–	0.2		
MUN5215DW1T1		–	–	0.2		
MUN5216DW1T1		–	–	0.2		
MUN5230DW1T1		–	–	0.2		
MUN5231DW1T1		–	–	0.2		
MUN5232DW1T1		–	–	0.2		
MUN5233DW1T1		–	–	0.2		
MUN5234DW1T1		–	–	0.2		
MUN5235DW1T1		–	–	0.2		
(V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 3.5 V, R <sub>L</sub> = 1.0 kΩ)		–	–	0.2		
(V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 5.5 V, R <sub>L</sub> = 1.0 kΩ)		–	–	0.2		
(V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 4.0 V, R <sub>L</sub> = 1.0 kΩ)		–	–	0.2		
Output Voltage (off) (V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 0.5 V, R <sub>L</sub> = 1.0 kΩ)	V <sub>OH</sub>	4.9	–	–	Vdc	
(V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 0.05 V, R <sub>L</sub> = 1.0 kΩ)						
(V <sub>CC</sub> = 5.0 V, V <sub>B</sub> = 0.25 V, R <sub>L</sub> = 1.0 kΩ)						
MUN5230DW1T1						
MUN5215DW1T1						
MUN5216DW1T1						
MUN5233DW1T1						

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

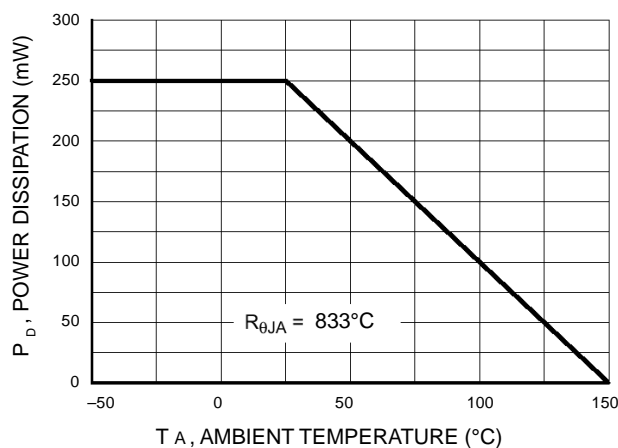
**MUN5211DW1T1 Series**

**ELECTRICAL CHARACTERISTICS**

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

Characteristic	Symbol	Min	Typ	Max	Unit	
<b>ON CHARACTERISTICS</b> (Note 6.)						
Input Resistor	MUN5211DW1T1	R <sub>1</sub>	7.0	10	13	kΩ
	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	R <sub>1</sub> /R <sub>2</sub>	0.8	1.0	1.2	
	MUN5214DW1T1		0.17	0.21	0.25	
	MUN5215DW1T1/MUN5216DW1T1		—	—	—	
	MUN5230DW1T1/MUN5231DW1T1/MUN5232DW1T1		0.8	1.0	1.2	
	MUN5233DW1T1		0.055	0.1	0.185	
	MUN5234DW1T1		0.38	0.47	0.56	
	MUN5235DW1T1		0.038	0.047	0.056	
	MUN5237DW1T1		1.7	2.1	2.6	

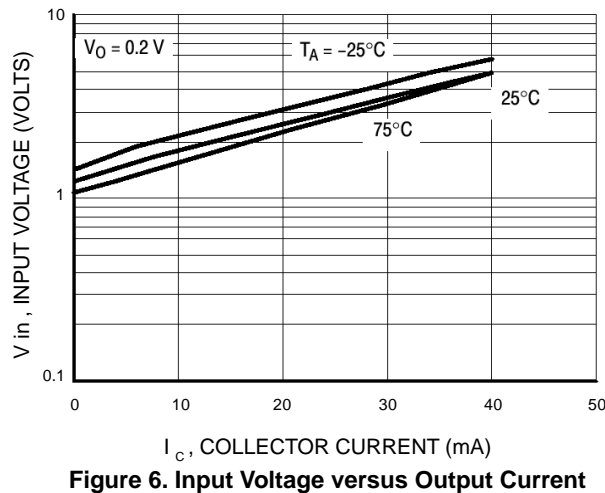
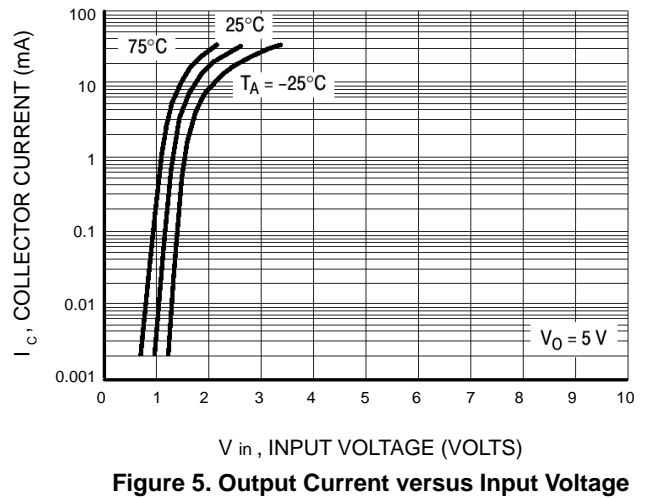
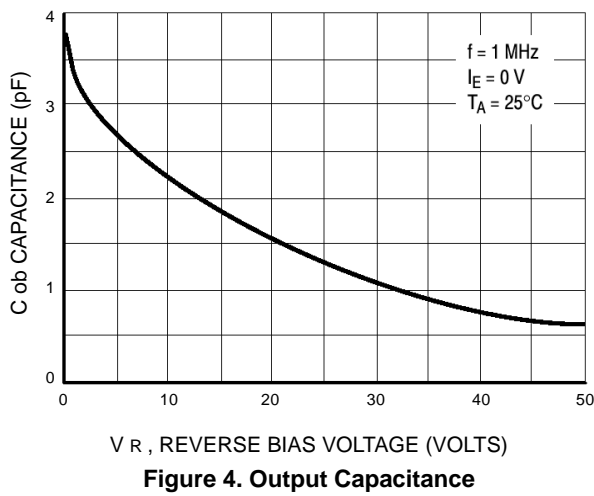
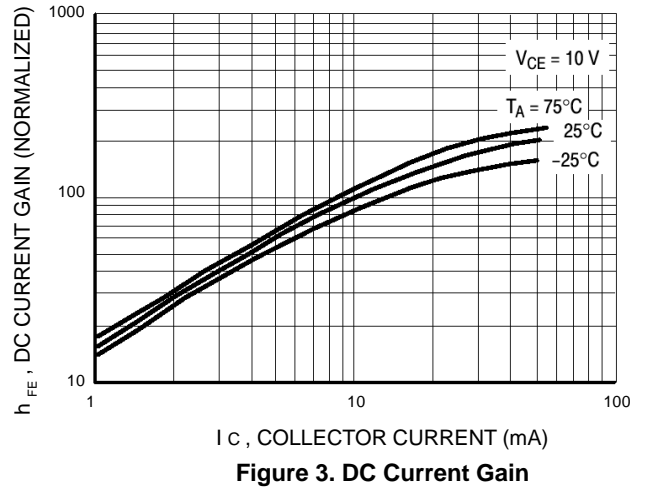
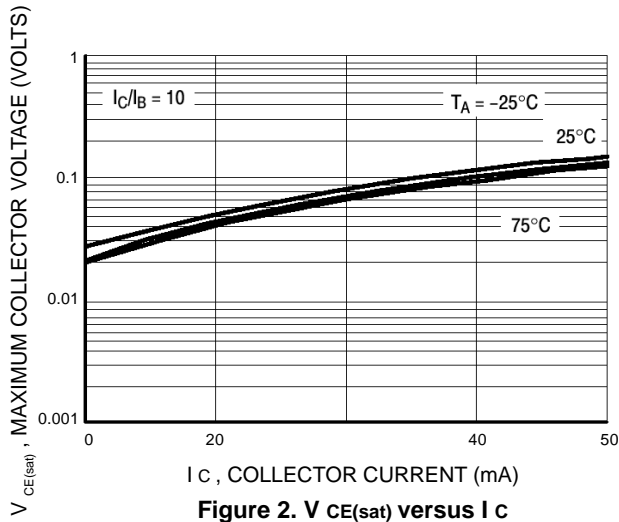
6. Pulse Test: Pulse Width < 300 ms, Duty Cycle < 2.0%



**Figure 1. Derating Curve**

MUN5211DW1T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5211DW1T1



MUN5211DW1T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5212DW1T1

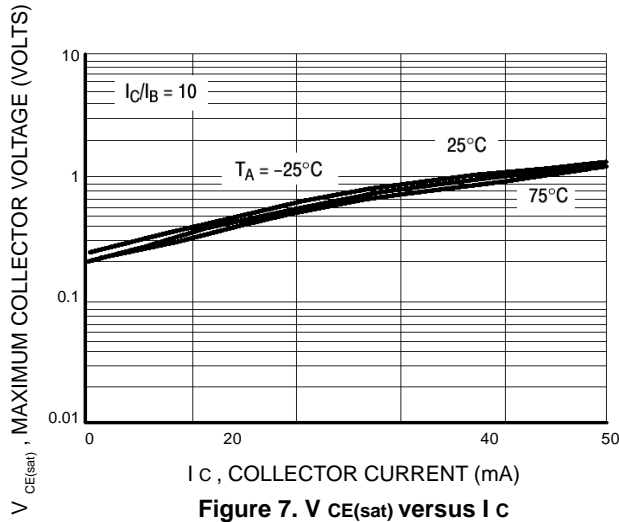


Figure 7.  $V_{CE(sat)}$  versus  $I_C$

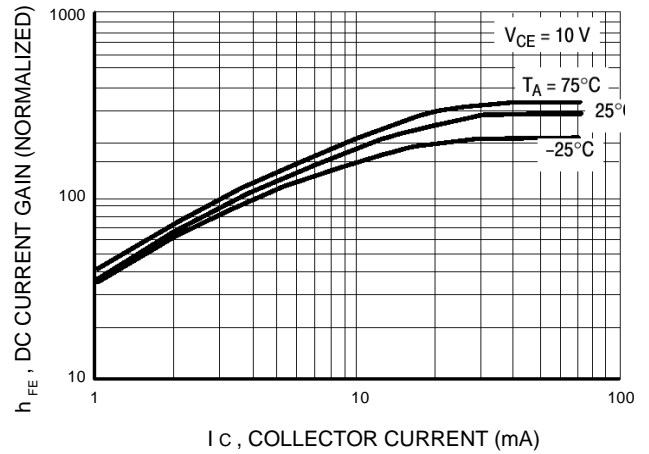


Figure 8. DC Current Gain

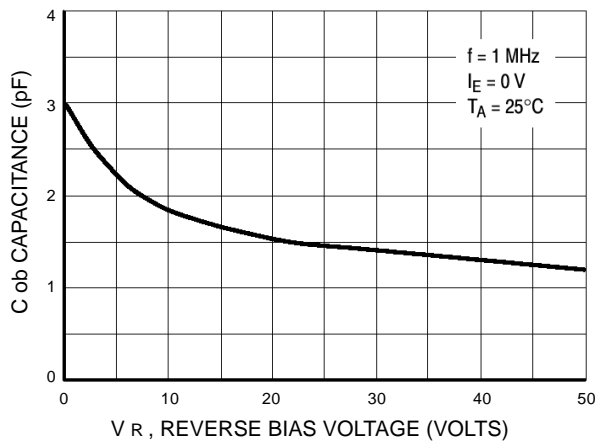


Figure 9. Output Capacitance

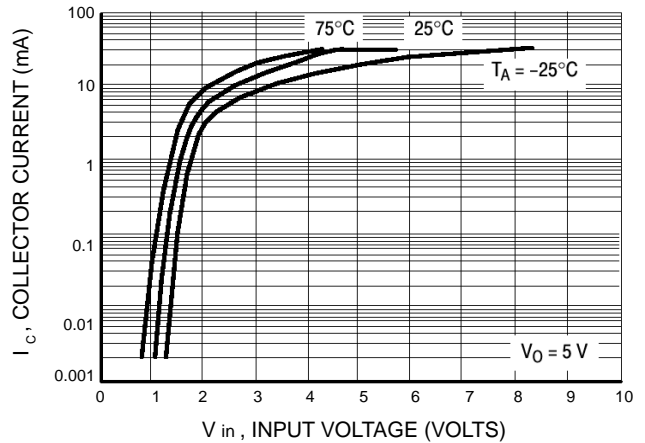


Figure 10. Output Current versus Input Voltage

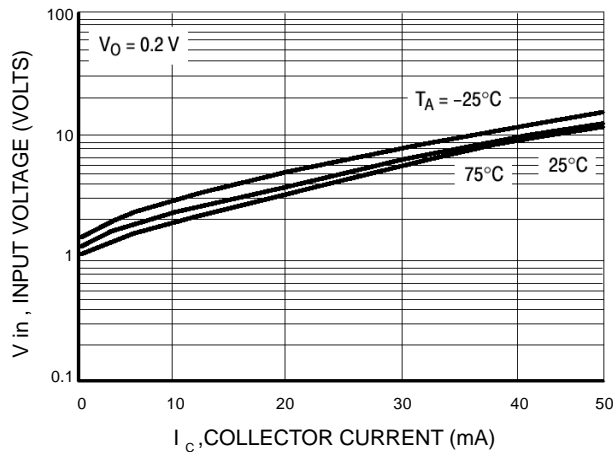


Figure 11. Input Voltage versus Output Current

MUN5211DW1T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5213DW1T1

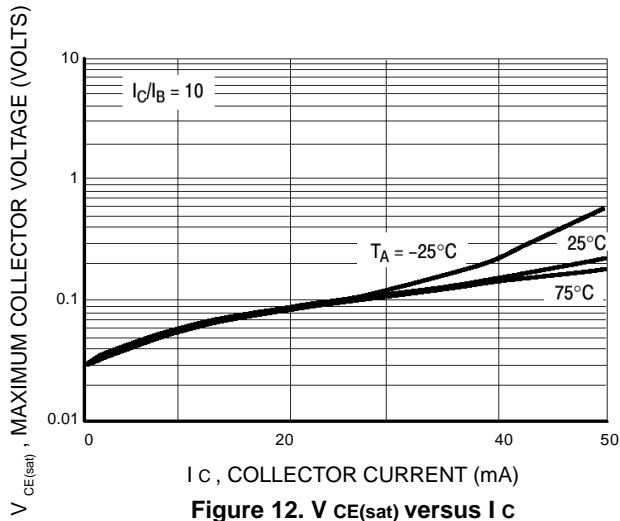


Figure 12.  $V_{CE(sat)}$  versus  $I_C$

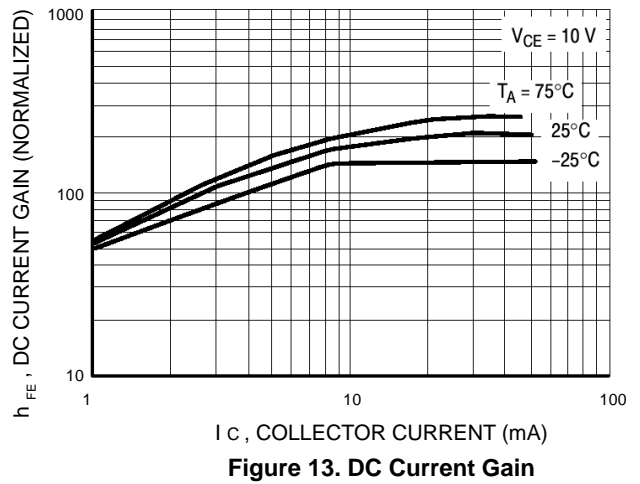


Figure 13. DC Current Gain

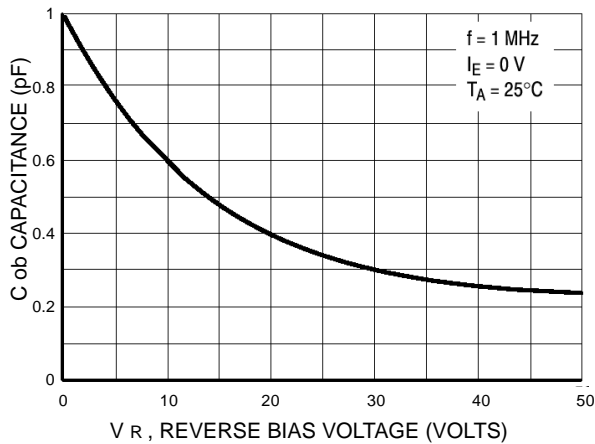


Figure 14. Output Capacitance

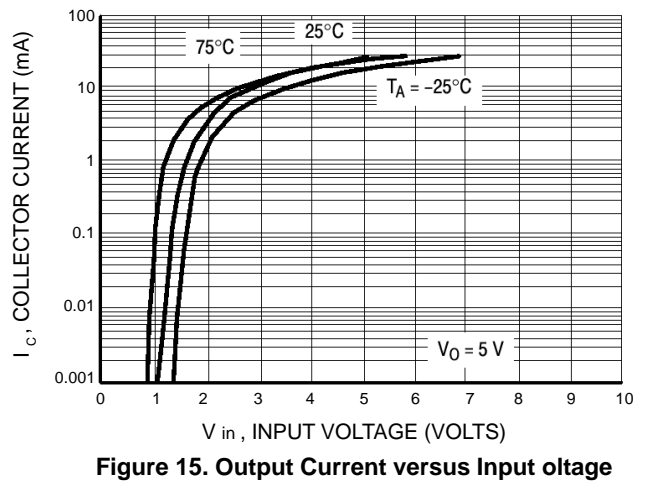


Figure 15. Output Current versus Input Voltage

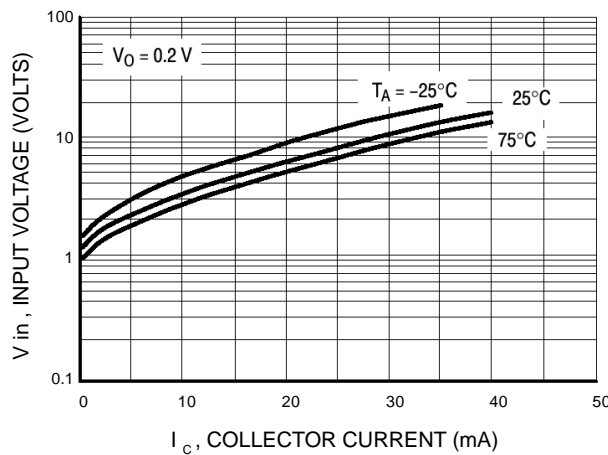


Figure 16. Input Voltage versus Output Current

MUN5211DW1T1 Series

TYPICAL ELECTRICAL CHARACTERISTICS – MUN5214DW1T1

