Dual Bias Resistor Transistors

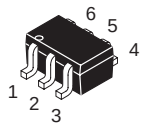
NPN Silicon Surface Mount Transistors with Monolithic Bias Resistor Network

MUN5211DW1T1 SERIES

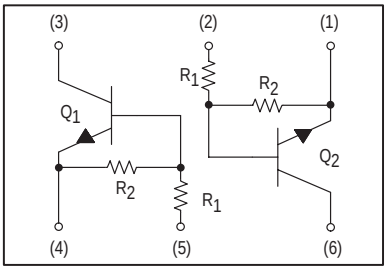
Motorola Preferred Devices

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.



CASE 419B–01, STYLE 1
SOT–363



MAXIMUM RATINGS (T_A = 25°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

Thermal Resistance — Junction-to-Ambient (surface mounted)	$R_{\theta JA}$	833	°C/W
Operating and Storage Temperature Range	T_J, T_{stg}	–65 to +150	°C
Total Package Dissipation @ T_A = 25°C(1)	P_D	150	mW

DEVICE MARKING AND RESISTOR VALUES: MUN5211DW1T1 SERIES

Device	Marking	R1 (K)	R2 (K)
MUN5211DW1T1	7A	10	10
MUN5212DW1T1	7B	22	22
MUN5213DW1T1	7C	47	47
MUN5214DW1T1	7D	10	47
MUN5215DW1T1(2)	7E	10	∞
MUN5216DW1T1(2)	7F	4.7	∞
MUN5230DW1T1(2)	7G	1.0	1.0
MUN5231DW1T1(2)	7H	2.2	2.2
MUN5232DW1T1(2)	7J	4.7	4.7
MUN5233DW1T1(2)	7K	4.7	47
MUN5234DW1T1(2)	7L	22	47
MUN5235DW1T1(2)	7M	2.2	47

1. Device mounted on a FR-4 glass epoxy printed circuit board using the minimum recommended footprint.
2. New resistor combinations. Updated curves to follow in subsequent data sheets.

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

REV 2

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted, common for Q_1 and Q_2)

Characteristic		Symbol	Min	Typ	Max	Unit
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	MUN5211DW1T1	I_{EBO}	—	—	0.5	mAdc
(V_{EB} = 6.0 V, I_C = 0)	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	
Collector-Base Breakdown Voltage (I_C = 10 μA, I_E = 0)		$V_{(BR)CBO}$	50	—	—	Vdc
Collector-Emitter Breakdown Voltage[3] (I_C = 2.0 mA, I_B = 0)		$V_{(BR)CEO}$	50	—	—	Vdc
ON CHARACTERISTICS[3]						
DC Current Gain	MUN5211DW1T1	h_{FE}	35	60	—	
(V_{CE} = 10 V, I_C = 5.0 mA)	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	—	
Collector-Emitter Saturation Voltage (I_C = 10 mA, I_B = 0.3 mA)		$V_{CE(sat)}$	—	—	0.25	Vdc
(I_C = 10 mA, I_B = 5 mA) MUN5230DW1T1/MUN5231DW1T1						
(I_C = 10 mA, I_B = 1 mA) MUN5215DW1T1/MUN5216DW1T1						
MUN5232DW1T1/MUN5233DW1T1/MUN5234DW1T1						
Output Voltage (on)		V_{OL}				Vdc
(V_{CC} = 5.0 V, V_B = 2.5 V, R_L = 1.0 kΩ)	MUN5211lDW1T1		—	—	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_{CC} = 5.0 V, V_B = 3.5 V, R_L = 1.0 kΩ)	MUN5213DW1T1		—	—	0.2	

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

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted, common for Q_1 and Q_2) (Continued)

Characteristic		Symbol	Min	Typ	Max	Unit
Output Voltage (off) (V_{CC} = 5.0 V, V_B = 0.5 V, R_L = 1.0 kΩ) (V_{CC} = 5.0 V, V_B = 0.050 V, R_L = 1.0 kΩ) (V_{CC} = 5.0 V, V_B = 0.25 V, R_L = 1.0 kΩ)	MUN5230DW1T1 MUN5215DW1T1 MUN5216DW1T1 MUN5233DW1T1	V_{OH}	4.9	—	—	Vdc
Input Resistor	MUN5211DW1T1	R1	7.0	10	13	k Ω
	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	
Resistor Ratio	MUN5211DW1T1/MUN5212DW1T1/MUN5213DW1T1	R1/R2	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	

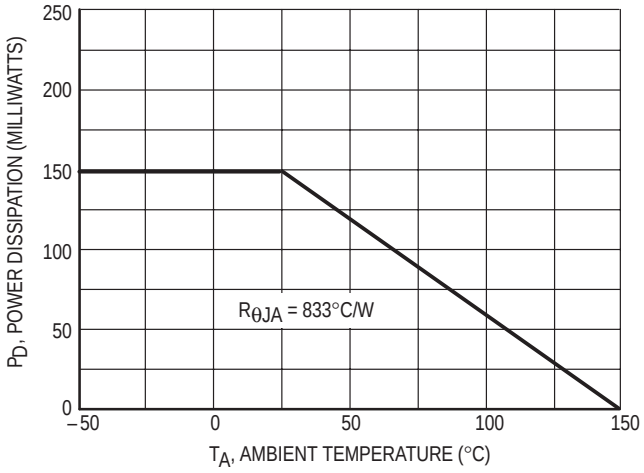


Figure 1. Derating Curve

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5211DW1T1

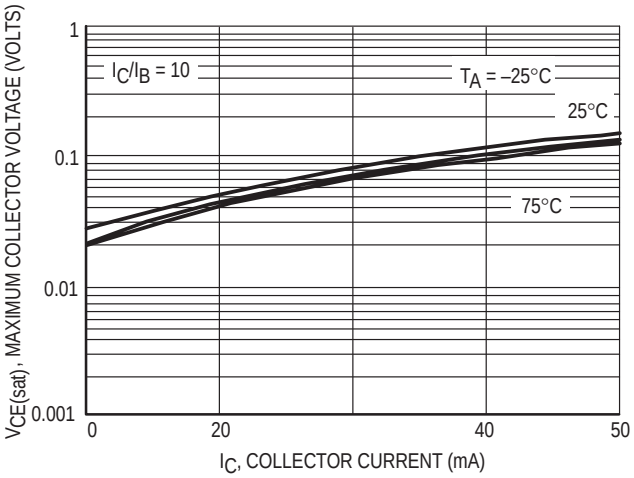


Figure 2. $V_{CE(sat)}$ versus I_C

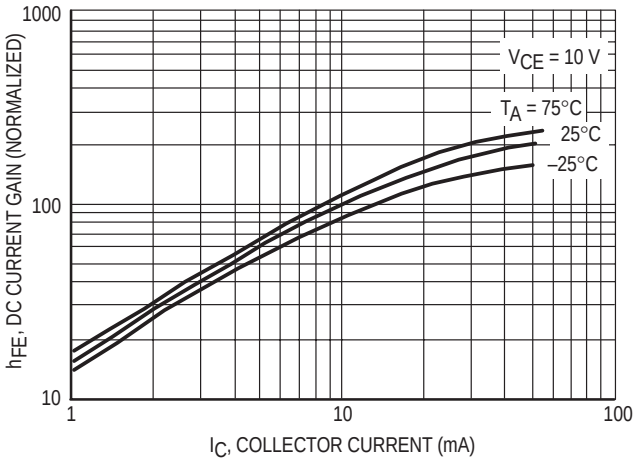


Figure 3. DC Current Gain

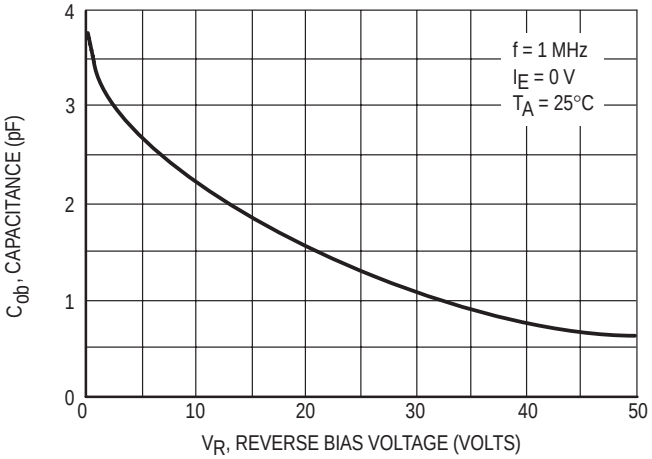


Figure 4. Output Capacitance

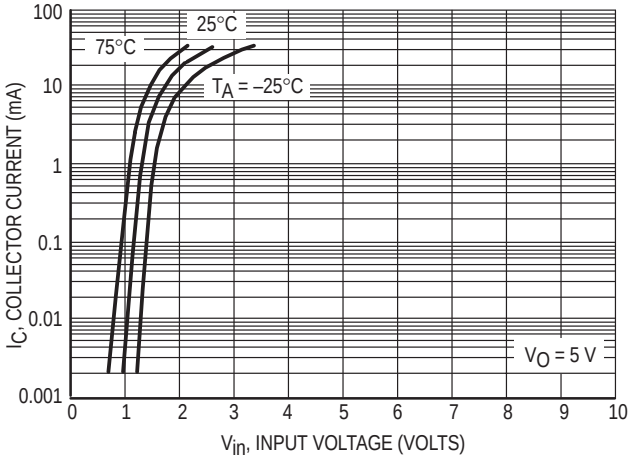


Figure 5. Output Current versus Input Voltage

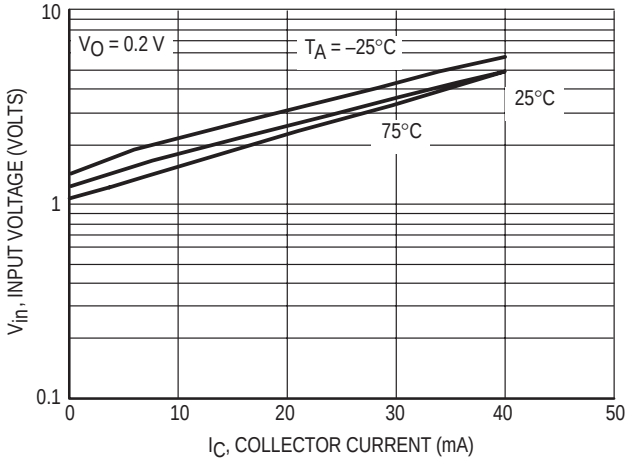


Figure 6. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5212DW1T1

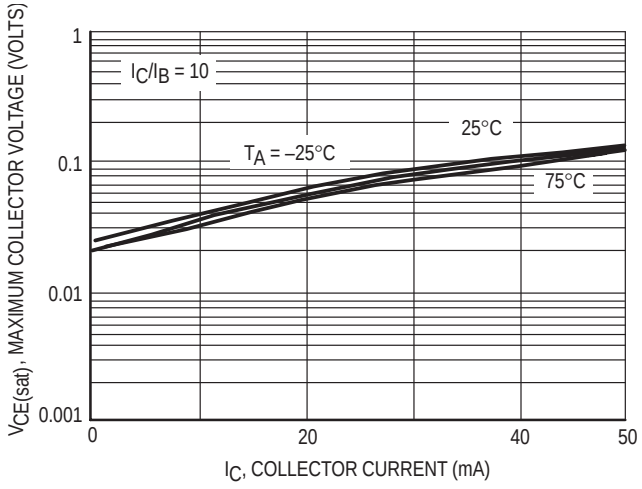


Figure 7. $V_{CE(sat)}$ versus I_C

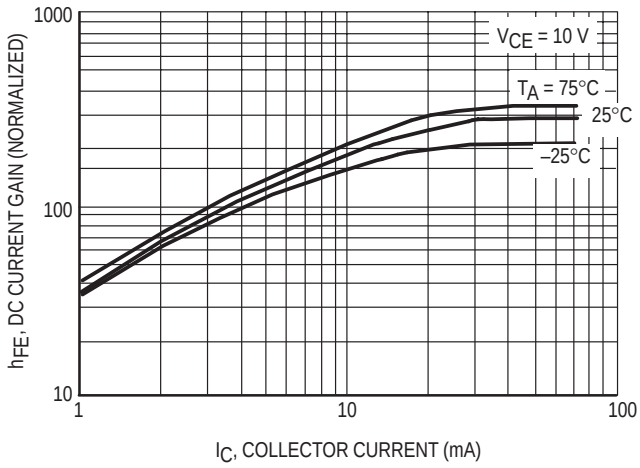


Figure 8. DC Current Gain

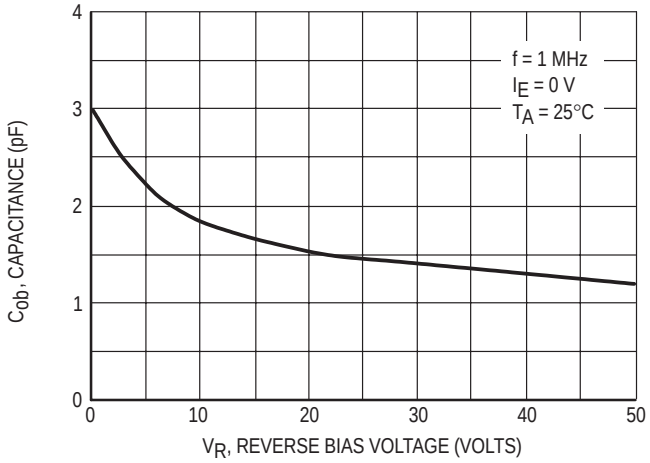


Figure 9. Output Capacitance

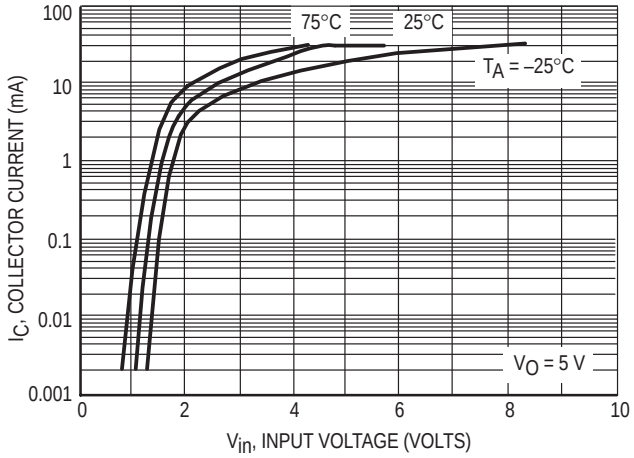


Figure 10. Output Current versus Input Voltage

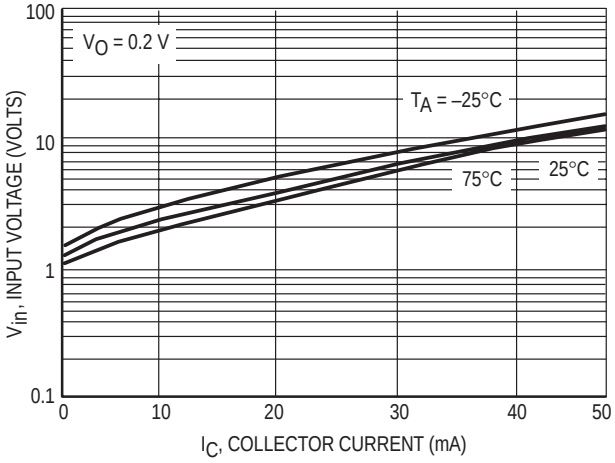


Figure 11. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5213DW1T1

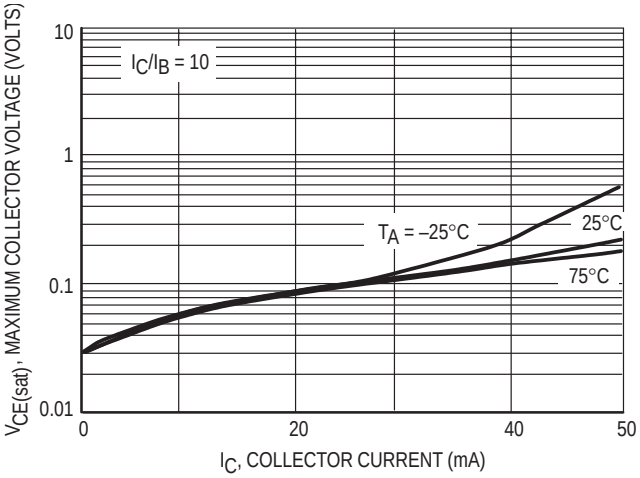


Figure 12. $V_{CE(sat)}$ versus I_C

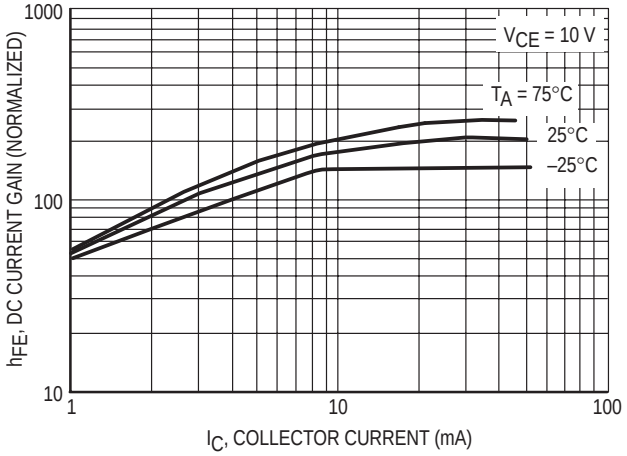


Figure 13. DC Current Gain

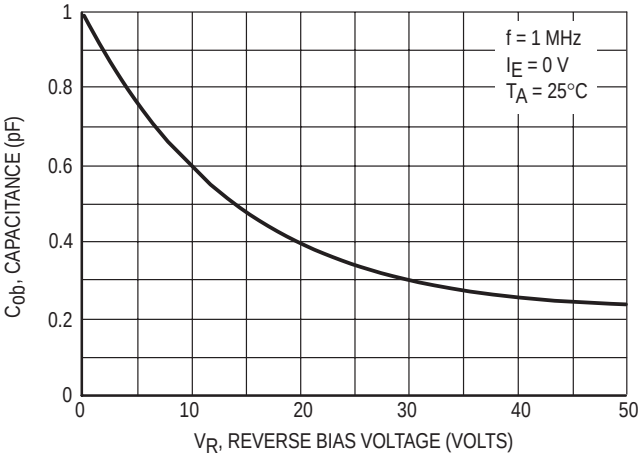


Figure 14. Output Capacitance

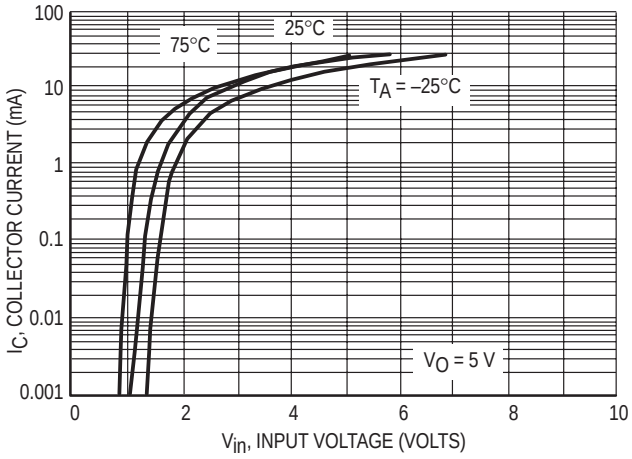


Figure 15. Output Current versus Input Voltage

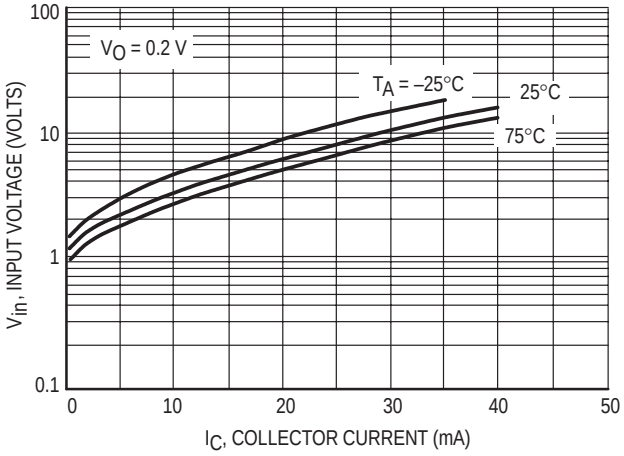


Figure 16. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5214DW1T1

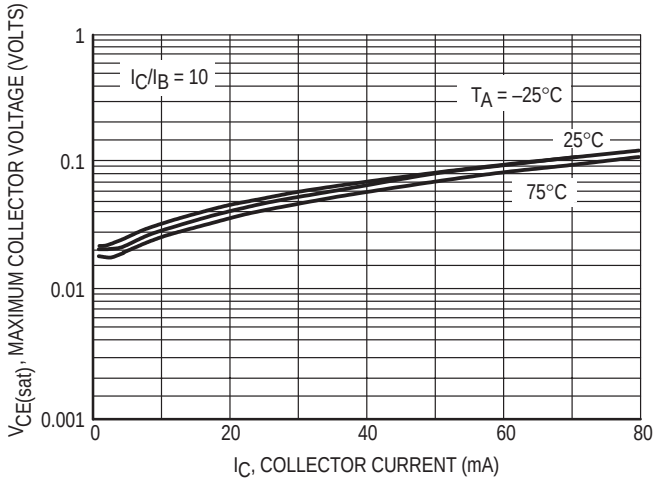


Figure 17. $V_{CE(sat)}$ versus I_C

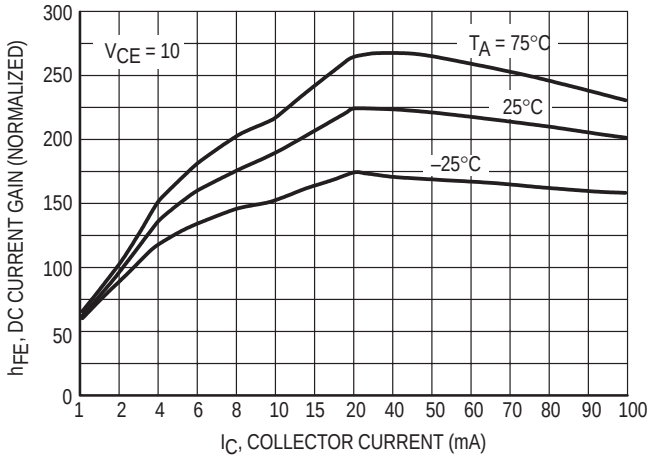


Figure 18. DC Current Gain

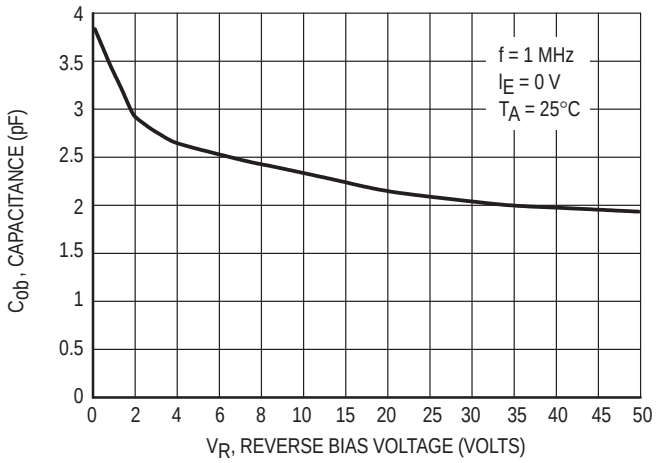


Figure 19. Output Capacitance

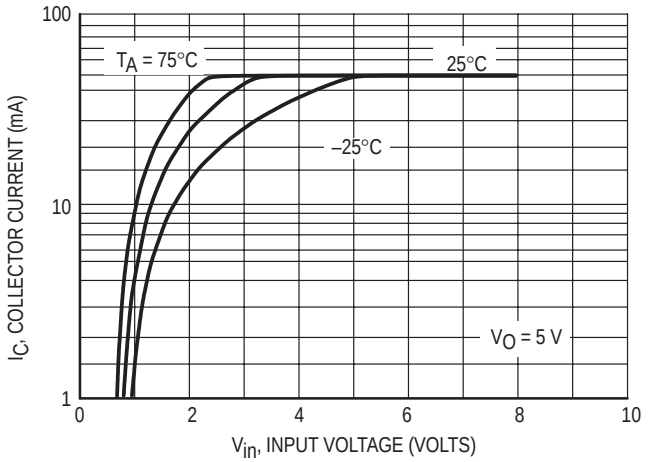


Figure 20. Output Current versus Input Voltage

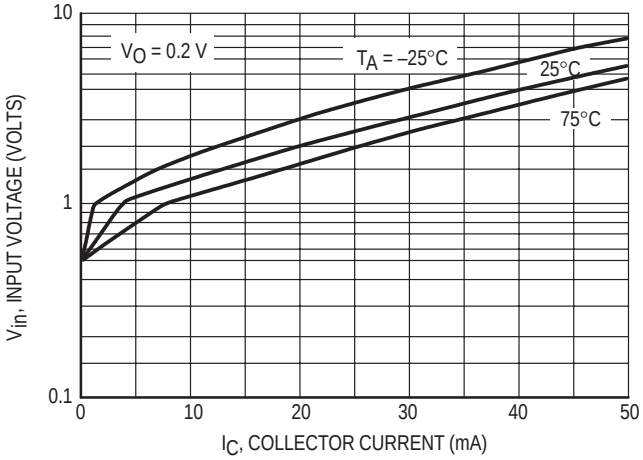


Figure 21. Input Voltage versus Output Current

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5215DW1T1

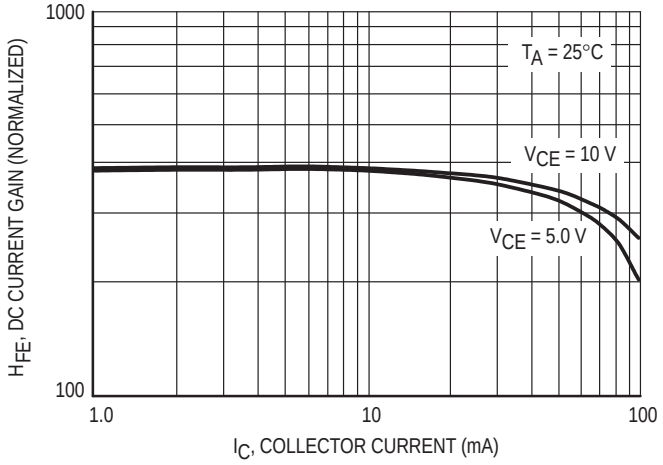


Figure 22. DC Current Gain

TYPICAL ELECTRICAL CHARACTERISTICS — MUN5216DW1T1

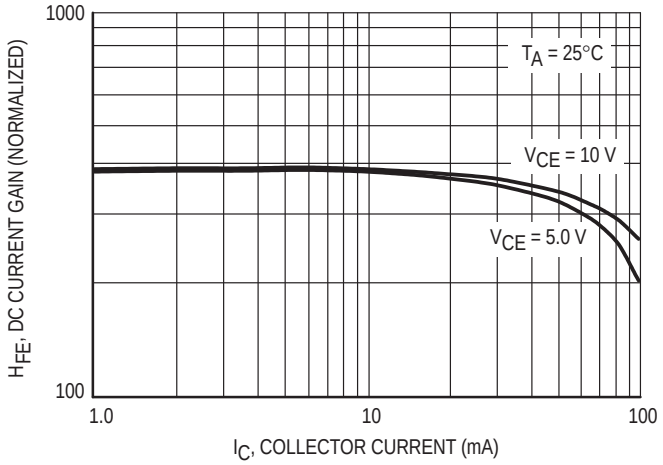


Figure 23. DC Current Gain