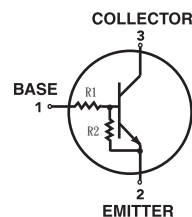


NPN Silicon Bias Resistor Transistor

 Lead(Pb)-Free



SC-59

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	50	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Collector Current-Continuous	I_C	100	mA _{dc}

THERMAL CHARACTERISTICS

Characteristics	Symbol	Max	Unit
Total Device Dissipation FR-5 Board (1) $T_A=25^{\circ}\text{C}$ Derate above 25°C	P_D	230	mW
		1.8	mW/ $^{\circ}\text{C}$
Thermal Resistance, Junction to Ambient ⁽¹⁾	$R_{\theta JA}$	540	$^{\circ}\text{C/W}$
Junction and Storage, Temperature	T_J, T_{stg}	-55 to +150	$^{\circ}\text{C}$

1. FR-4 @ minimum pad

Device Marking and Resistor Values

Device	Marking	R1(K)	R2(K)	Device	Marking	R1(K)	R2(K)
MUN2211	8A	10	10	MUN2232	8J	4.7	4.7
MUN2212	8B	22	22	MUN2233	8K	4.7	47
MUN2213	8C	47	47	MUN2234	8L	22	47
MUN2214	8D	10	47	MUN2236	8N	100	100
MUN2215	8E	10	∞	MUN2237	8P	47	22
MUN2216	8F	4.7	∞	MUN2240	8T	47	∞
MUN2230	8G	1.0	1.0	MUN2241	8U	100	∞
MUN2231	8H	2.2	2.2				

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Base Cutoff Current ($V_{CB} = 50\text{ V}$, $I_E = 0$)	I_{CBO}	-	-	100	nAdc
Collector-Emitter Cutoff Current ($V_{CE} = 50\text{ V}$, $I_B = 0$)	I_{CEO}	-	-	500	nAdc
Emitter-Base Cutoff Current ($V_{EB} = 6.0\text{ V}$, $I_C = 0$)	MUN2211	-	-	0.5	mAdc
	MUN2212	-	-	0.2	
	MUN2213	-	-	0.1	
	MUN2214	-	-	0.2	
	MUN2215	-	-	0.9	
	MUN2216	-	-	1.9	
	MUN2230	-	-	4.3	
	MUN2231	-	-	2.3	
	MUN2232	-	-	1.5	
	MUN2233	-	-	0.18	
	MUN2234	-	-	0.13	
	MUN2236	-	-	0.05	
	MUN2237	-	-	0.13	
	MUN2240	-	-	0.2	
	MUN2241	-	-	0.1	
Collector-Base Breakdown Voltage ($I_C = 10\text{ uA}$, $I_E = 0$)	$V_{(BR)CBO}$	50	-	-	Vdc
Collector-Emitter Breakdown Voltage (1) ($I_C = 2.0\text{ mA}$, $I_B = 0$)	$V_{(BR)CEO}$	50	-	-	Vdc

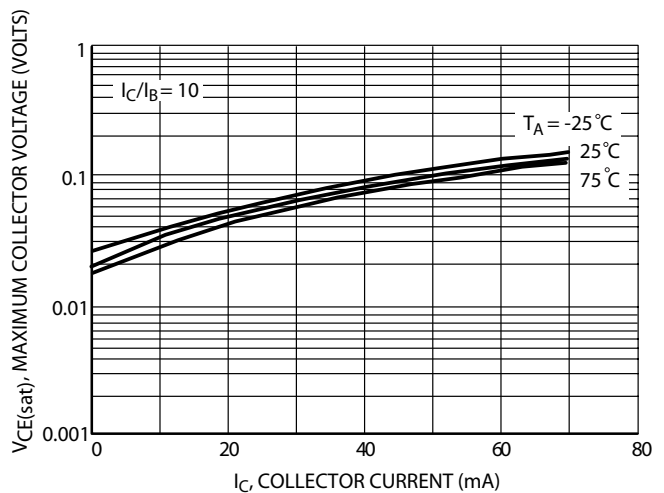
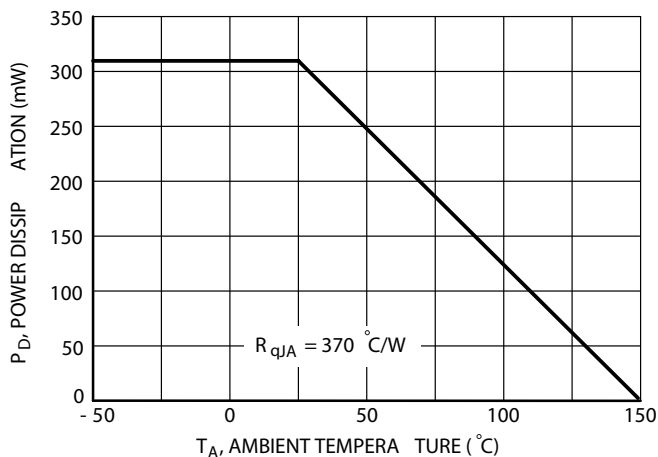
ON CHARACTERISTICS (1)

DC Current Gain ($V_{CE} = 10\text{ V}$, $I_C = 5.0\text{ mA}$)	MUN2211	h_{FE}	35	60	-	
	MUN2212		60	100	-	
	MUN2213		80	140	-	
	MUN2214		80	140	-	
	MUN2215		160	350	-	
	MUN2216		160	350	-	
	MUN2230		3.0	5.0	-	
	MUN2231		8.0	15	-	
	MUN2232		15	30	-	
	MUN2233		80	200	-	
	MUN2234		80	150	-	
	MUN2236		80	150	-	
	MUN2237		80	140	-	
	MUN2240		160	350	-	
	MUN2241		160	350	-	
Collector-Emitter Saturation Voltage ($I_C = 10\text{ mA}$, $I_B = 0.3\text{ mA}$) ($I_C = 10\text{ mA}$, $I_B = 5\text{ mA}$) MUN2230/MUN2231 ($I_C = 10\text{ mA}$, $I_B = 1\text{ mA}$) MUN2215/MUN2216 MUN2232/MUN2233/MUN2234		$V_{CE(sat)}$	-	-	0.25	Vdc
Output Voltage (on) ($V_{CC} = 5.0\text{ V}$, $V_B = 2.5\text{ V}$, $R_L = 1.0\text{ k}\Omega$) ($V_{CC} = 5.0\text{ V}$, $V_B = 3.5\text{ V}$, $R_L = 1.0\text{ k}\Omega$) ($V_{CC} = 5.0\text{ V}$, $V_B = 5.5\text{ V}$, $R_L = 1.0\text{ k}\Omega$) ($V_{CC} = 5.0\text{ V}$, $V_B = 4.0\text{ V}$, $R_L = 1.0\text{ k}\Omega$) ($V_{CC} = 5.0\text{ V}$, $V_B = 5.0\text{ V}$, $R_L = 1.0\text{ k}\Omega$)	MUN2211	V_{OL}	-	-	0.2	Vdc
	MUN2212		-	-	0.2	
	MUN2214		-	-	0.2	
	MUN2215		-	-	0.2	
	MUN2216		-	-	0.2	
	MUN2230		-	-	0.2	
	MUN2231		-	-	0.2	
	MUN2232		-	-	0.2	
	MUN2233		-	-	0.2	
	MUN2234		-	-	0.2	
	MUN2213		-	-	0.2	
	MUN2240		-	-	0.2	
	MUN2236		-	-	0.2	
	MUN2237		-	-	0.2	
	MUN2241		-	-	0.2	

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted) (Continued)

Characteristic	Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS (Note 1) (Continued)					
Output Voltage (off) ($V_{CC} = 5.0\text{V}$, $V_B = 0.5\text{V}$, $R_L = 1.0\text{k}\Omega$) ($V_{CC} = 5.0\text{V}$, $V_B = 0.050\text{V}$, $R_L = 1.0\text{k}\Omega$) ($V_{CC} = 5.0\text{V}$, $V_B = 0.25\text{V}$, $R_L = 1.0\text{k}\Omega$) MUN2230 MUN2215 MUN2216 MUN2233 MUN2240	V_{OH}	4.9	-	-	Vdc
Input Resistor MUN2211 MUN2212 MUN2213 MUN2214 MUN2215 MUN2216 MUN2230 MUN2231 MUN2232 MUN2233 MUN2234 MUN2235 MUN2236 MUN2237 MUN2240 MUN2241	R_1	7.0 15.4 32.9 7.0 7.0 3.3 0.7 1.5 3.3 3.3 15.4 70 32.9 70 32.9 70	10 22 47 10 10 4.7 1.0 2.2 4.7 4.7 22 100 47 100 47 100	13 28.6 61.1 13 13 6.1 1.3 2.9 6.1 6.1 28.6 130 61.1 130 61.1 100	$\text{k}\Omega$
Resistor Ratio MUN2211/MUN2212/MUN2213 MUN2236 MUN2214 MUN2215/MUN2216/MUN2240 MUN2241 MUN2230/MUN2231/MUN2232 MUN2233 MUN2234 MUN2237	R_1/R_2	0.8 0.17 - 0.8 0.055 0.38 1.7	1.0 0.21 - 1.0 0.1 0.47 2.1	1.2 0.25 - 1.2 0.185 0.56 2.6	

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



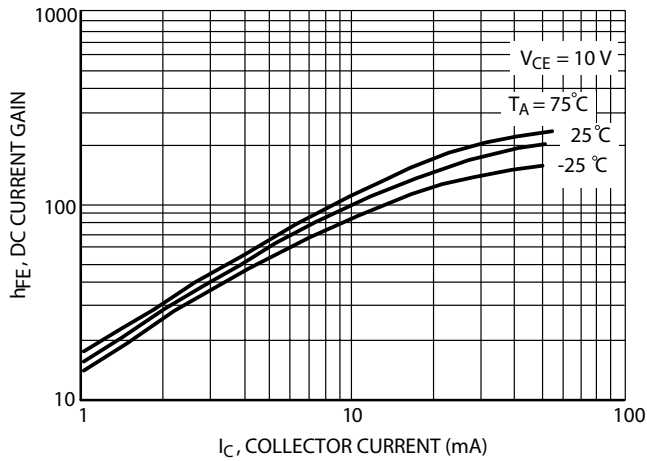


FIG3. DC Current Gain

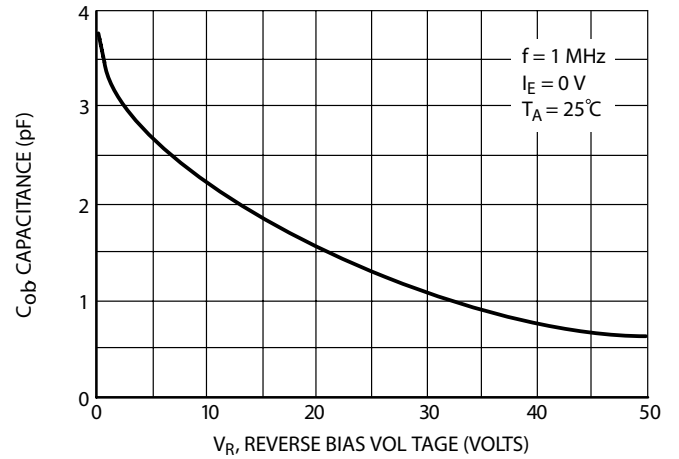


FIG4. Output Capacitance

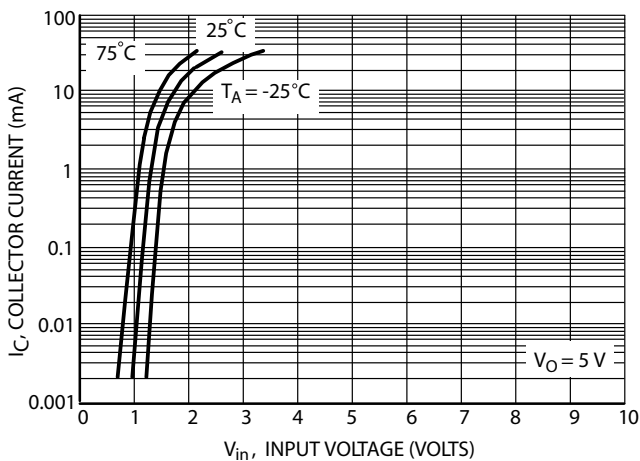


FIG5. Output Current versus Input Voltage

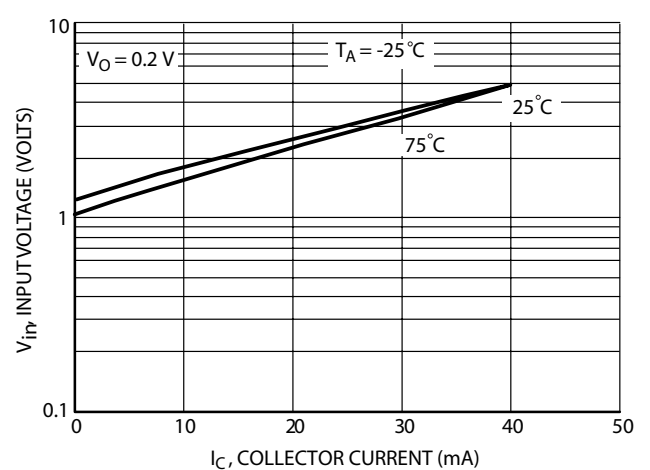


FIG6. Input Voltage versus Output Current

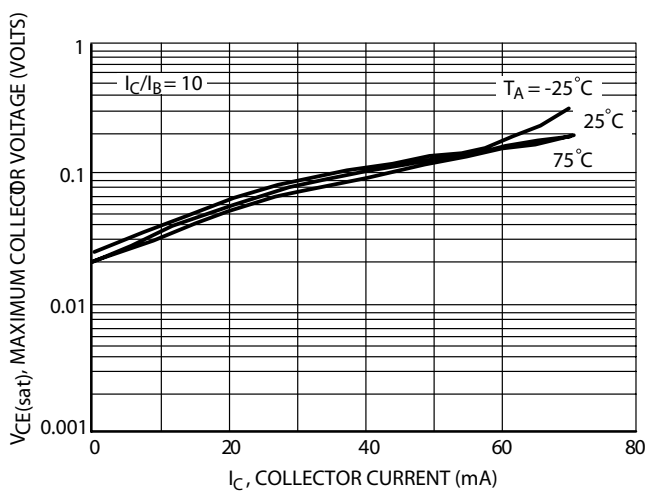


FIG. $V_{CE(sat)}$ versus I_C

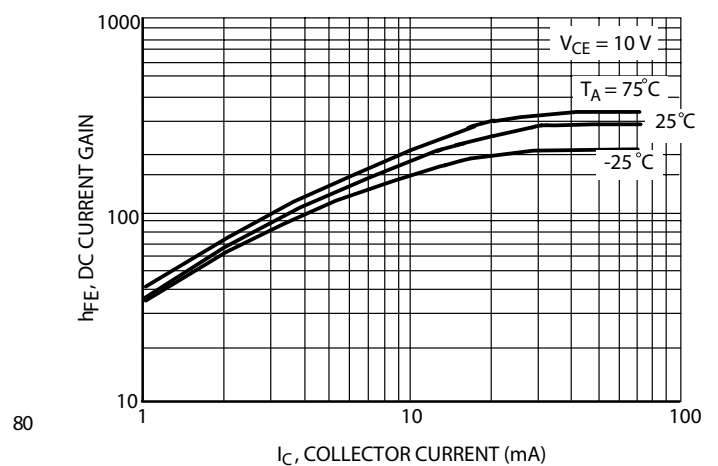
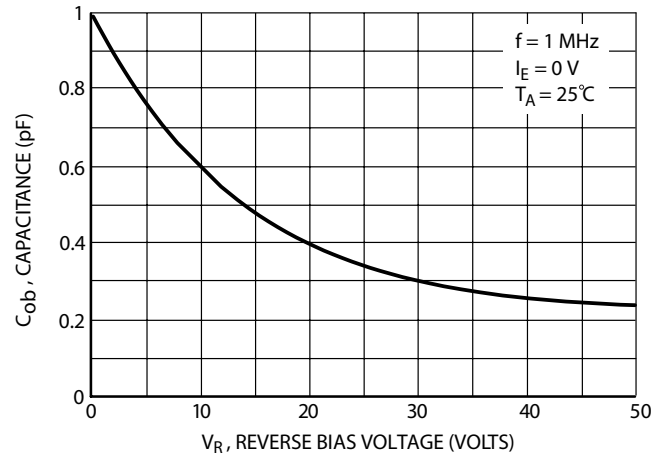
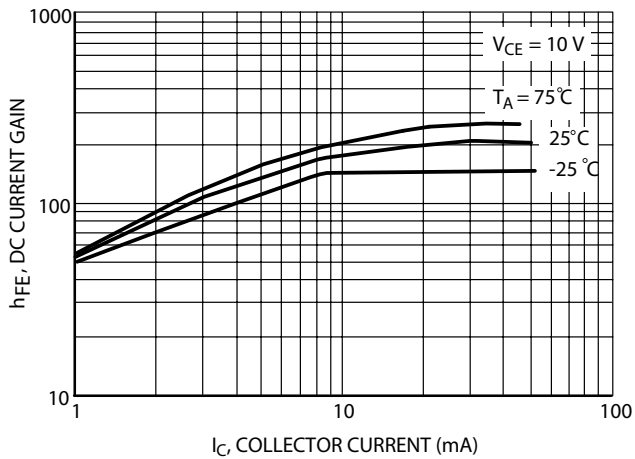
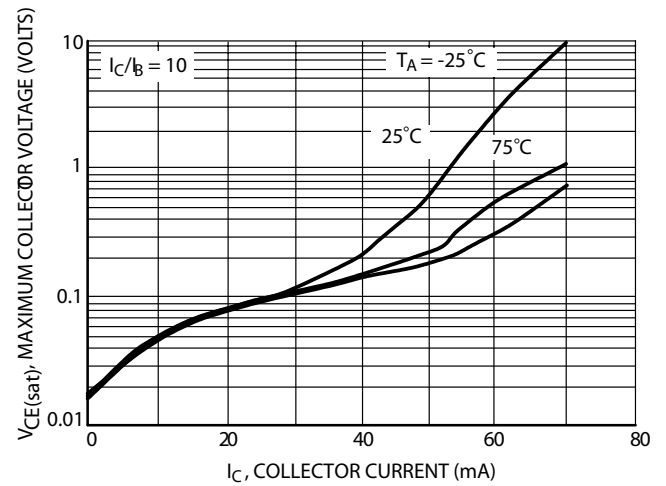
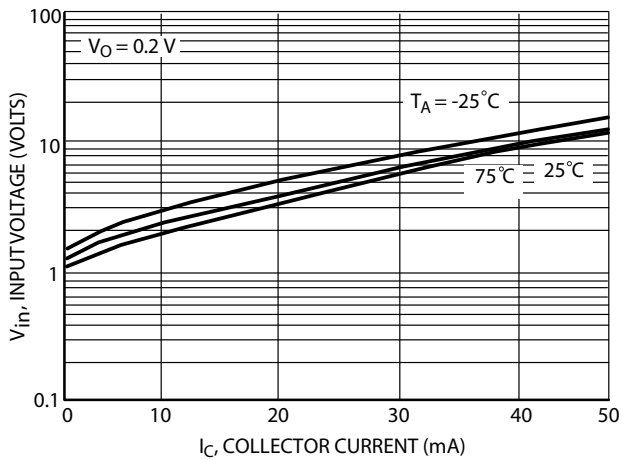
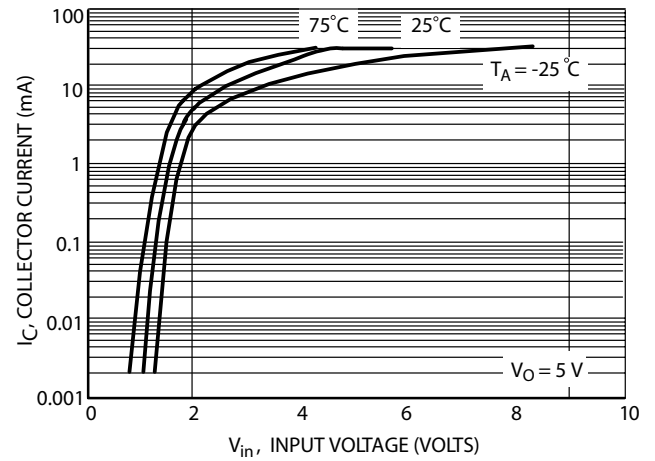
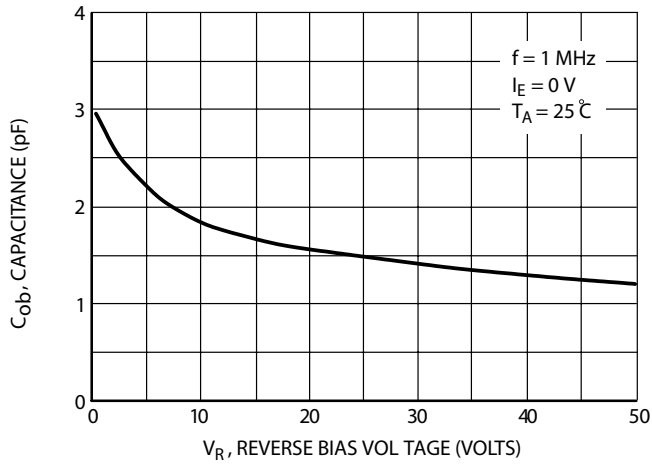
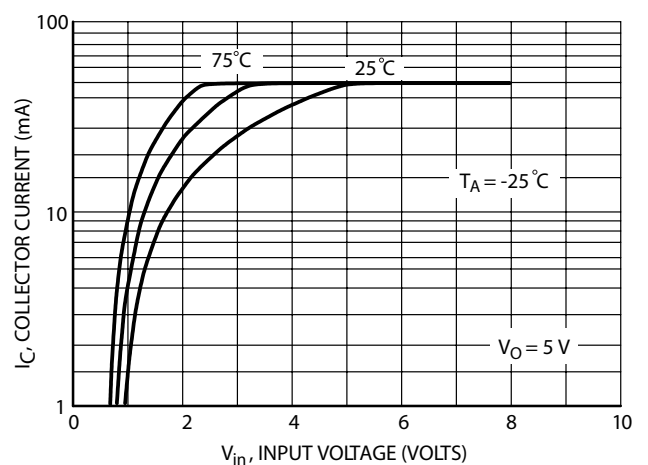
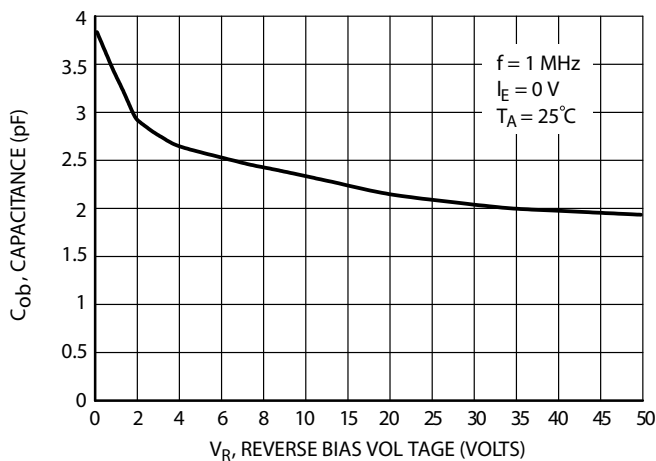
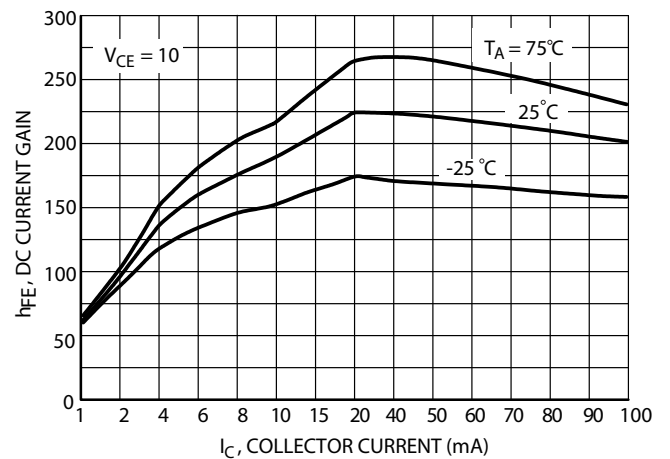
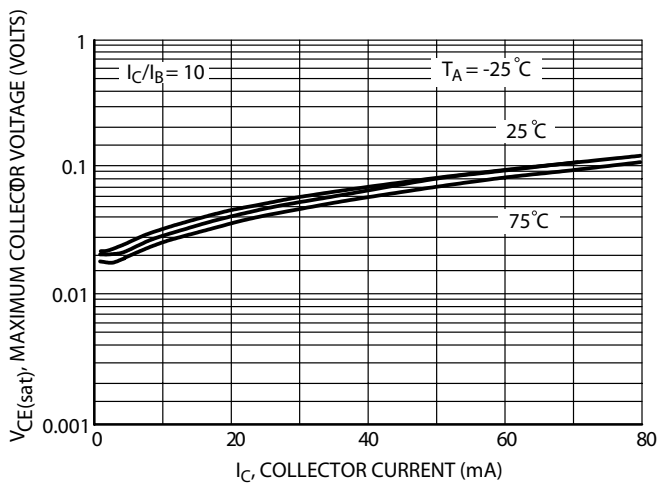
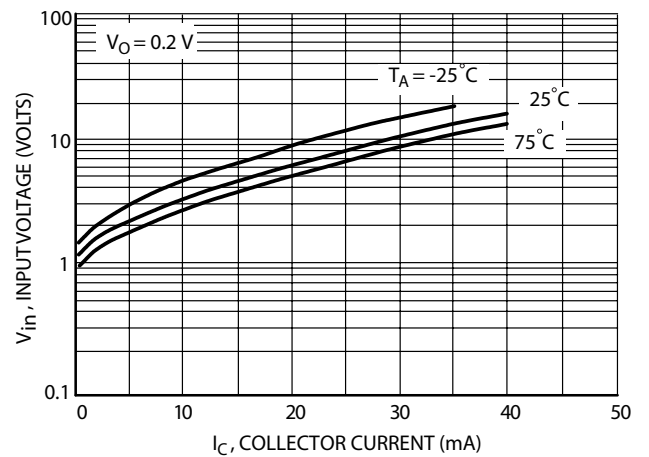
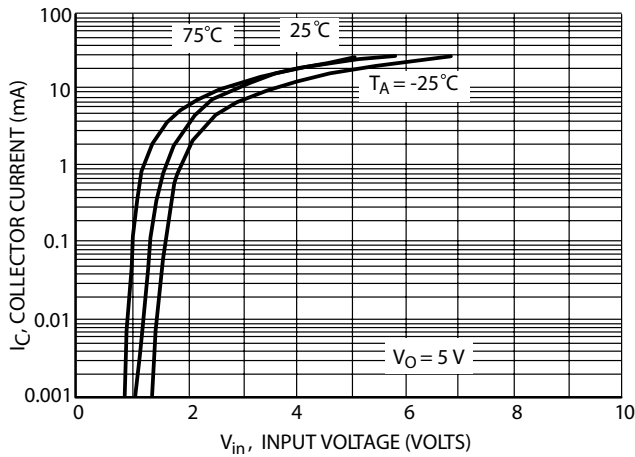


FIG8. DC Current Gain





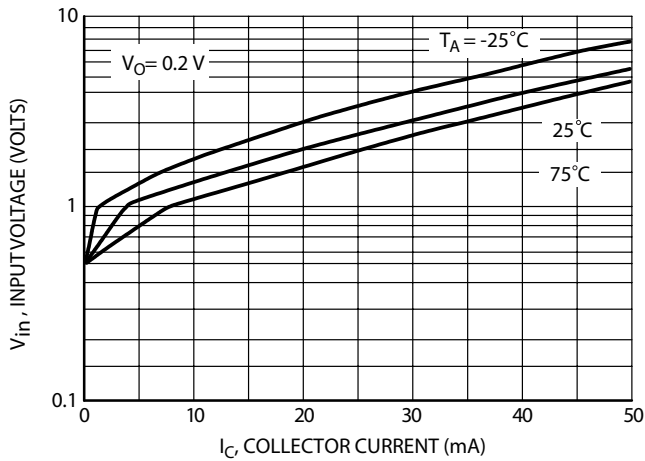


FIG21. Input Voltage versus Output Current

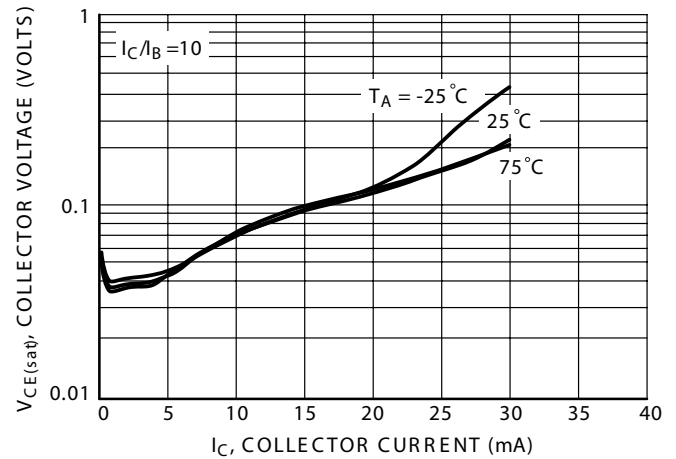


FIG22. $V_{CE(sat)}$ versus I_C

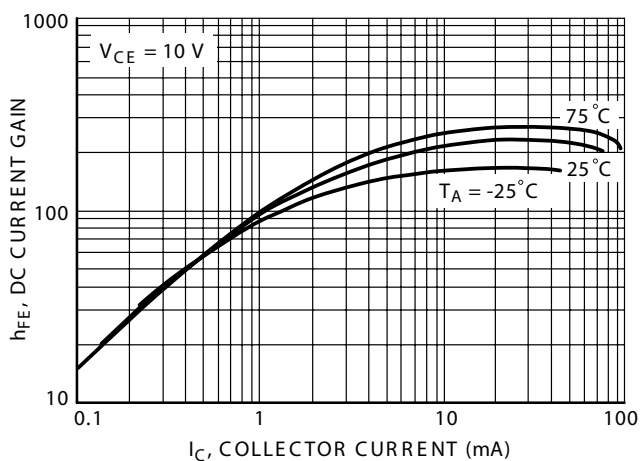


FIG23. DC Current Gain

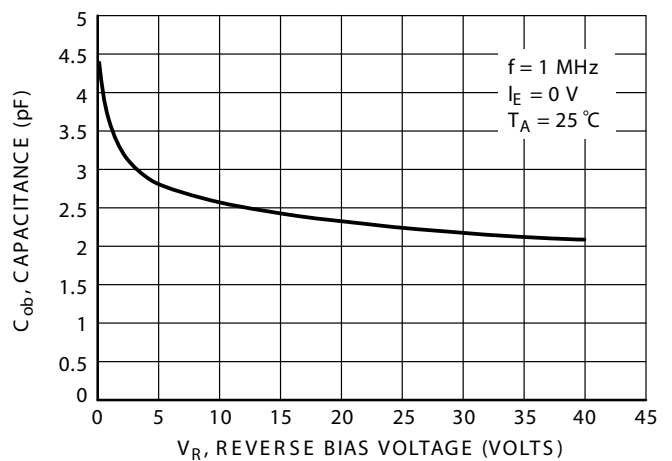


FIG24. Output Capacitance

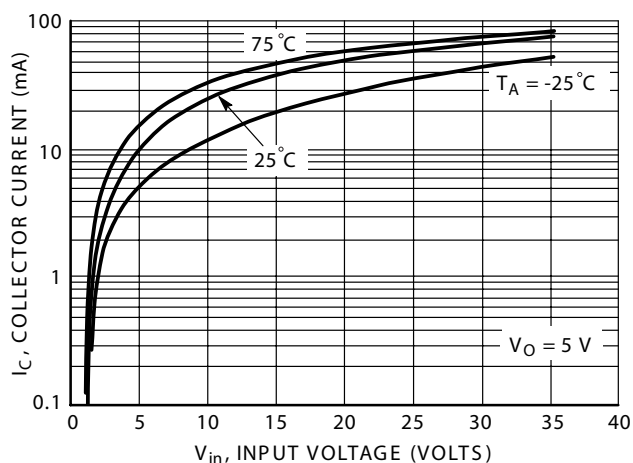


FIG25. Output Current versus Input Voltage

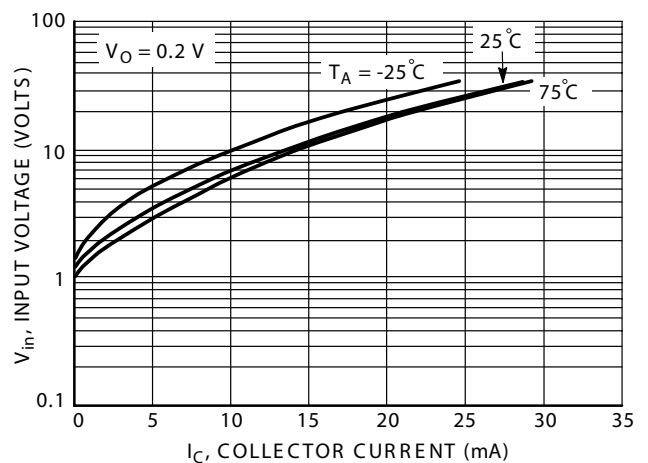


FIG26. Input Voltage versus Output Current

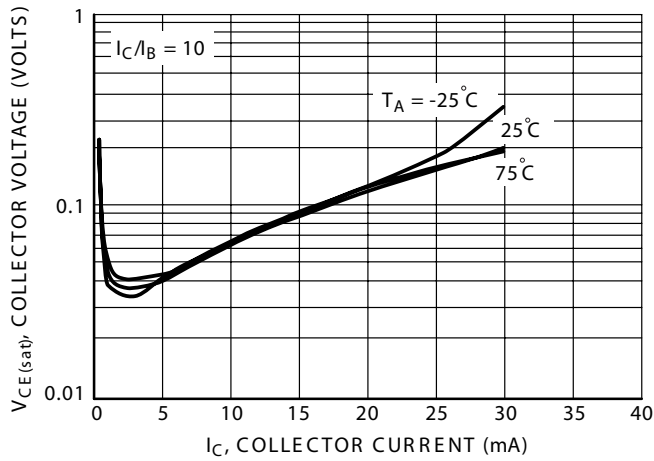


FIG27. $V_{CE(sat)}$ versus I_C

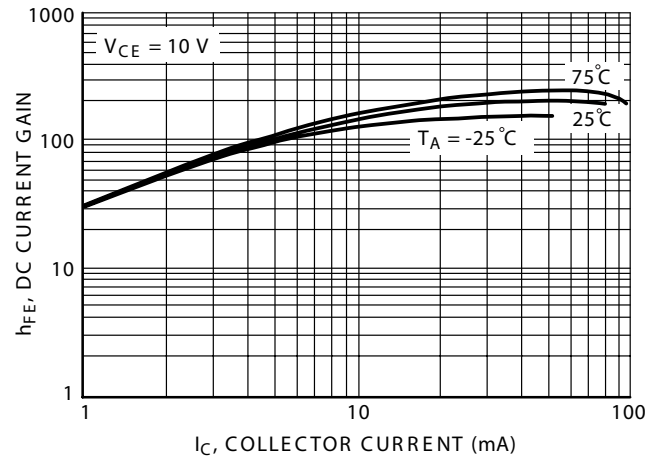


FIG28. DC Current Gain

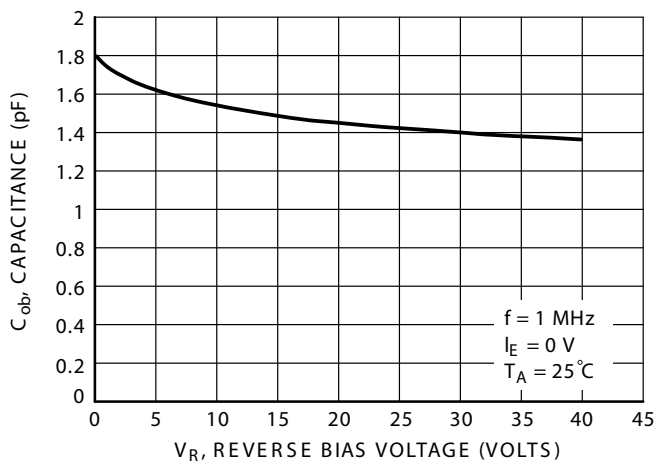


FIG29. Output Capacitance

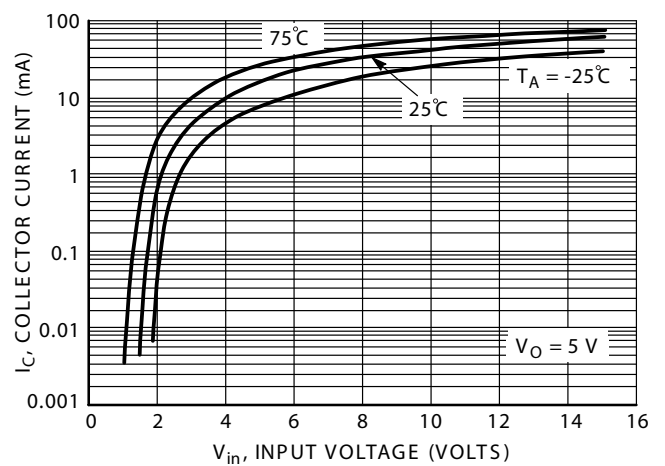


FIG30. Output Current versus Input Voltage

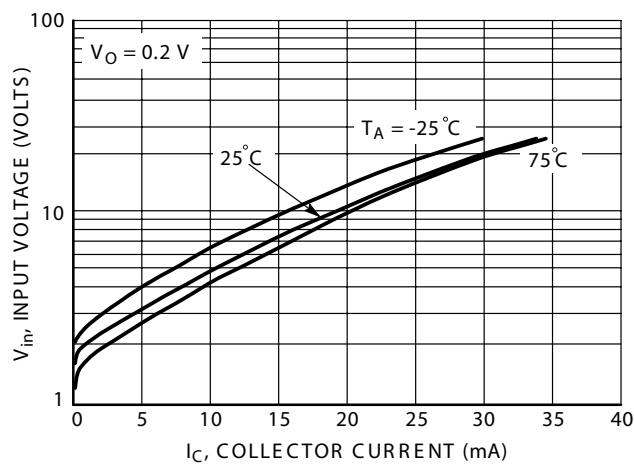


FIG31. Input Voltage versus Output Current

TYPICAL APPLICATIONS FOR NPN BJT's

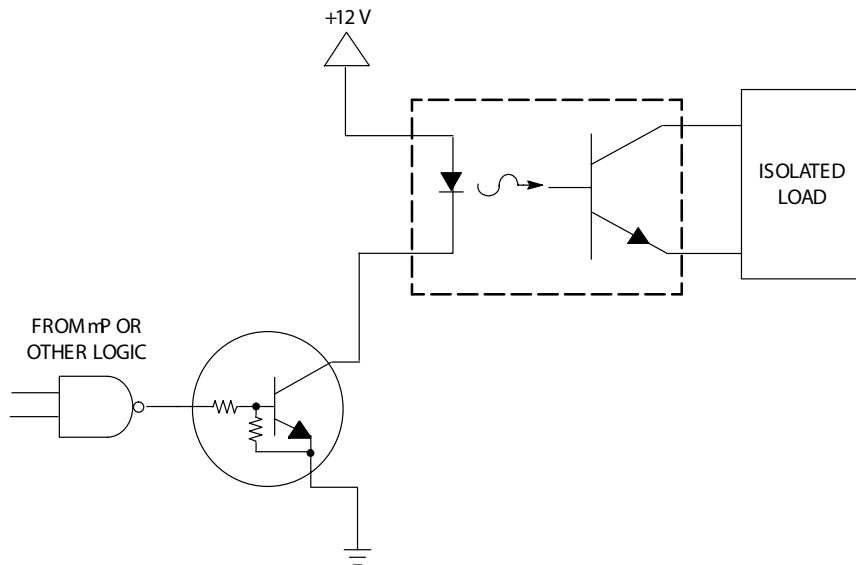
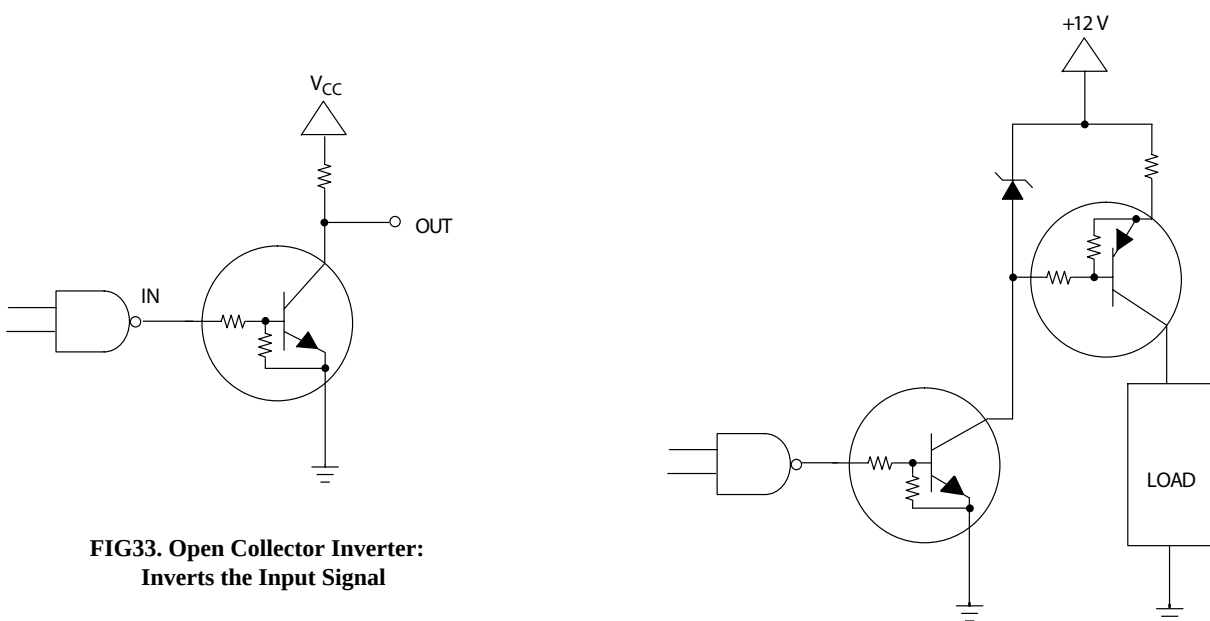


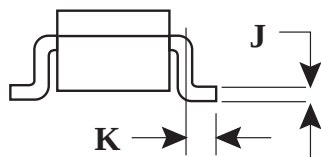
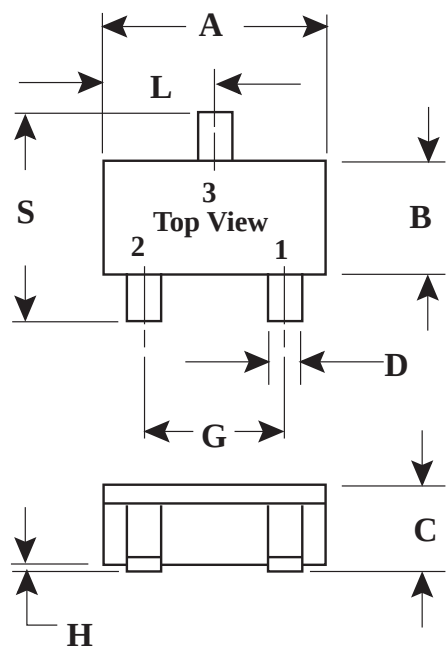
FIG32. Level Shifter: Connects 12 or 24 Volt Circuits to Logic



**FIG33. Open Collector Inverter:
Inverts the Input Signal**

FIG34. Inexpensive, Unregulated Current Source

SC-59 Outline Dimension



SC-59		
Dim	Min	Max
A	2.70	3.10
B	1.30	1.70
C	1.00	1.30
D	0.35	0.50
G	1.70	2.30
H	0.00	0.10
J	0.10	0.26
K	0.20	0.60
L	1.25	1.65
S	2.25	3.00
All Dimension in mm		