

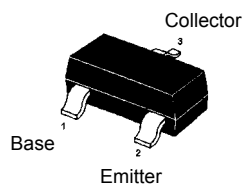
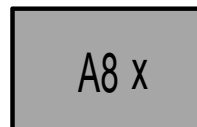
Features

Simplifies Circuit Design

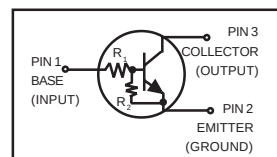
Reduces Board Space and Component Count

The SOT-23 package can be soldered using wave or reflow. The modified gull-winged leads absorb thermal stress during soldering eliminating the possibility of damage to the die.

Available in 8 mm embossed tape and reel. Use the Device Number to order the 7 inch/3000 unit reel. Replace "T1" with "T3" in the Device Number to order the 13 inch/10,000 unit reel.



SOT-23



MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

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

Rating	Symbol	Value	Unit
Collector-Base Voltage	V_{CBO}	50	Vdc
Collector-Emitter Voltage	V_{CEO}	50	Vdc
Collector Current	I_C	100	mAdc
Total Power Dissipation @ $T_A = 25^\circ\text{C}$ (Note 1.) Derate above 25°C	P_D	200 1.6	mW mW/ $^\circ\text{C}$
Thermal Resistance – Junction-to-Ambient (surface mounted)	$R_{\theta JA}$	625	$^\circ\text{C/W}$
Operating and Storage Temperature Range	T_J, T_{stg}	-65 to +150	$^\circ\text{C}$
Maximum Temperature for Soldering Purposes, Time in Solder Bath	T_L	260 10	$^\circ\text{C}$ Sec

ELECTRICAL CHARACTERISTICS (TA = 25°C unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
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 ($V_{EB} = 6.0\text{ V}$, $I_C = 0$)	I_{EBO}	—	—	0.5	mAdc
MMUN2211LT1G		—	—	0.2	
MMUN2212LT1G		—	—	0.1	
MMUN2213LT1G		—	—	0.2	
MMUN2214LT1G		—	—	0.9	
MMUN2215LT1G		—	—	1.9	
MMUN2216LT1G		—	—	4.3	
MMUN2230LT1G		—	—	2.3	
MMUN2231LT1G		—	—	1.5	
MMUN2232LT1G		—	—	0.18	
MMUN2233LT1G		—	—	0.13	
MMUN2234LT1G		—	—	0.2	
MMUN2235LT1G		—	—	4.0	
MMUN2238LT1G		—	—	0.1	
MMUN2241LT1G		—	—		
Collector-Base Breakdown Voltage ($I_C = 10\text{ }\mu\text{A}$, $I_E = 0$)	$V_{(BR)CBO}$	50	—	—	Vdc
Collector-Emitter Breakdown Voltage (Note 2.), ($I_C = 2.0\text{ mA}$, $I_B = 0$)	$V_{(BR)CEO}$	50	—	—	Vdc

ON CHARACTERISTICS (Note 2.)

DC Current Gain ($V_{CE} = 10\text{ V}$, $I_C = 5.0\text{ mA}$)	MMUN2211LT1G MMUN2212LT1G MMUN2213LT1G MMUN2214LT1G MMUN2215LT1G MMUN2216LT1G MMUN2230LT1G MMUN2231LT1G MMUN2232LT1G MMUN2233LT1G MMUN2234LT1G MMUN2235LT1G MMUN2238LT1G MMUN2241LT1G	h_{FE}	35 60 80 80 160 160 3.0 8.0 15 80 80 80 160 160	60 100 140 140 350 350 5.0 15 30 200 150 140 350 350	— — — — — — — — — — — — — —	
Collector-Emitter Saturation Voltage ($I_C = 10\text{ mA}$, $I_B = 0.3\text{ mA}$) ($I_C = 10\text{ mA}$, $I_B = 5\text{ mA}$) MMUN2230LT1G/MMUN2231LT1G ($I_C = 10\text{ mA}$, $I_B = 1\text{ mA}$) MMUN2215LT1G/MMUN2216LT1G MMUN2232LT1G/MMUN2233LT1G/MMUN2234LT1G/ MMUN2235LT1G/MMUN2238LT1G		$V_{CE(sat)}$	—	—	0.25	Vdc

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

ELECTRICAL CHARACTERISTICS (TA = 25°C unless otherwise noted.)

Characteristic		Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS (Note 3.)						
Output Voltage (on) (V _{CC} = 5.0 V, V _B = 2.5 V, R _L = 1.0 k Ω)	MMUN2211LT1G MMUN2212LT1G MMUN2213LT1G MMUN2214LT1G MMUN2215LT1G MMUN2216LT1G MMUN2230LT1G MMUN2231LT1G MMUN2232LT1G MMUN2233LT1G MMUN2234LT1G MMUN2235LT1G (V _{CC} = 5.0 V, V _B = 3.5 V, R _L = 1.0 k Ω) (V _{CC} = 5.0 V, V _B = 5.0 V, R _L = 1.0 k Ω)	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	Vdc
Output Voltage (off) (V _{CC} = 5.0 V, V _B = 0.5 V, R _L = 1.0 k Ω) (V _{CC} = 5.0 V, V _B = 0.050 V, R _L = 1.0 k Ω) (V _{CC} = 5.0 V, V _B = 0.25 V, R _L = 1.0 k Ω)	MMUN2230LT1G MMUN2215LT1G MMUN2216LT1G MMUN2233LT1G MMUN2238LT1G	V _{OH}	4.9	—	—	Vdc
Input Resistor	MMUN2211LT1G MMUN2212LT1G MMUN2213LT1G MMUN2214LT1G MMUN2215LT1G MMUN2216LT1G MMUN2230LT1G MMUN2231LT1G MMUN2232LT1G MMUN2233LT1G MMUN2234LT1G MMUN2235LT1G MMUN2238LT1G MMUN2241LT1G	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 1.54 70	10 22 47 10 10 4.7 1.0 2.2 4.7 4.7 22 2.2 2.2 100	13 28.6 61.1 13 13 6.1 1.3 2.9 6.1 6.1 28.6 2.86 2.88 130	kΩ
Resistor Ratio	MMUN2211LT1G/MMUN2212LT1G/MMUN2213LT1G MMUN2214LT1G MMUN2215LT1G/MMUN2216LT1G/MMUN2238LT1G MMUN2241LT1G MMUN2230LT1G/MMUN2231LT1G/MMUN2232LT1G MMUN2233LT1G MMUN2234LT1G MMUN2235LT1G	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	

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

RATING AND CHARACTERISTIC CURVES

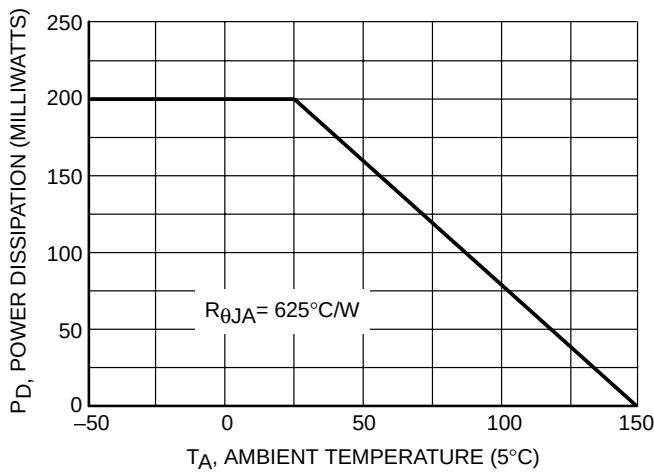


Figure 1. Derating Curve

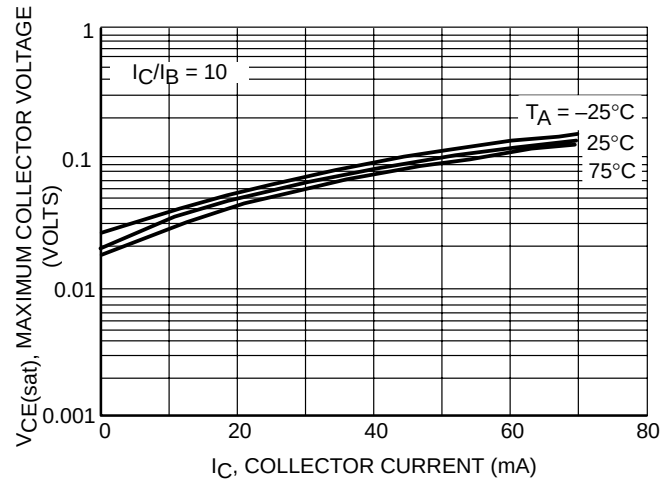


Figure 2. $V_{CE(sat)}$ vs. I_C

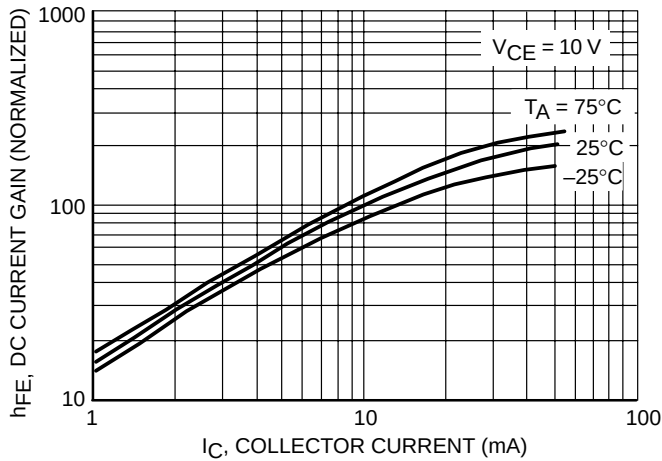


Figure 3. DC Current Gain

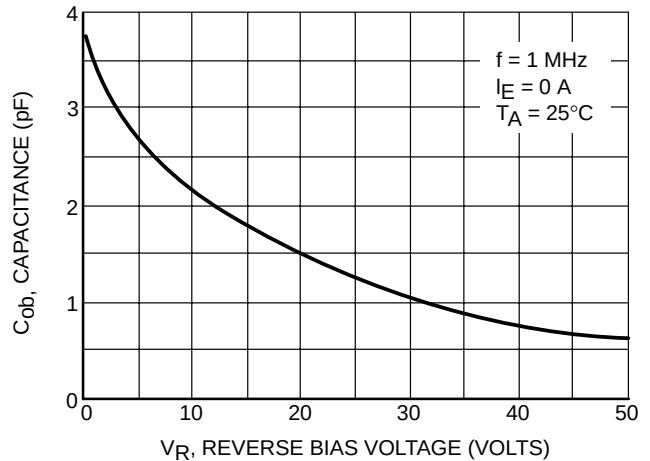


Figure 4. Output Capacitance

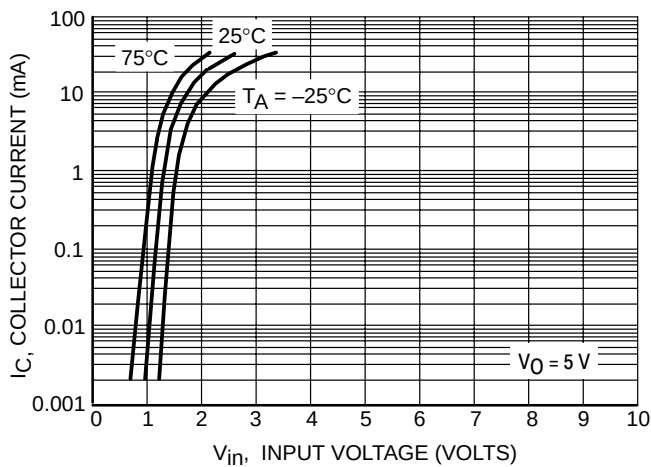


Figure 5. Output Current vs. Input Voltage

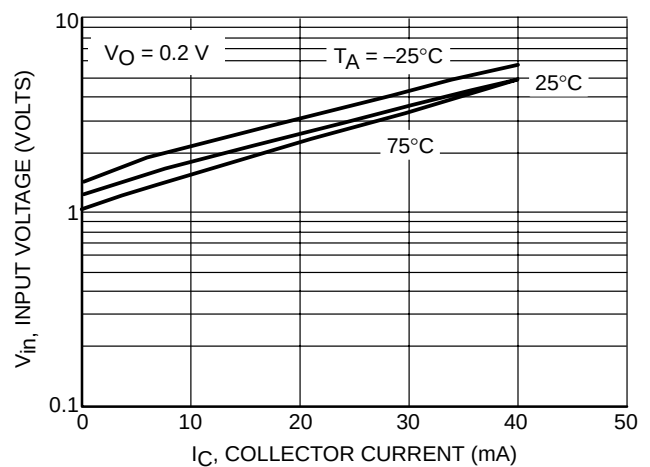


Figure 6. Input Voltage vs. Output Current

RATING AND CHARACTERISTIC CURVES

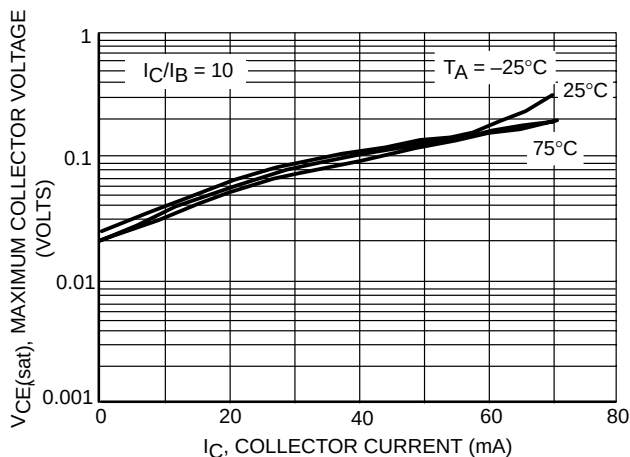


Figure 7. $V_{CE(sat)}$ vs. I_C

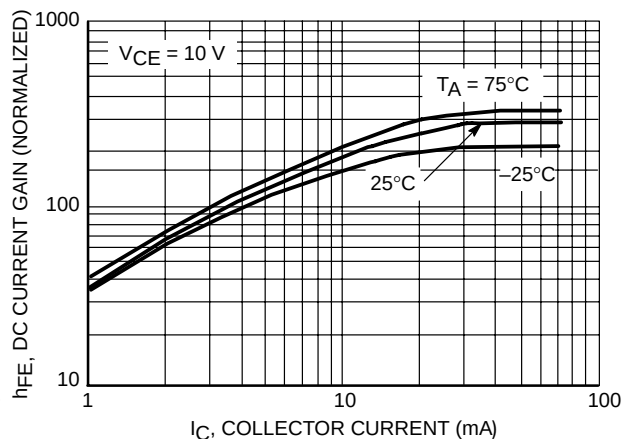


Figure 8. DC Current Gain

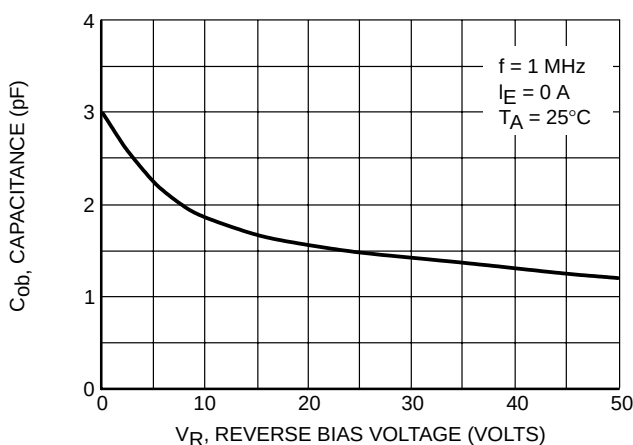


Figure 9. Output Capacitance

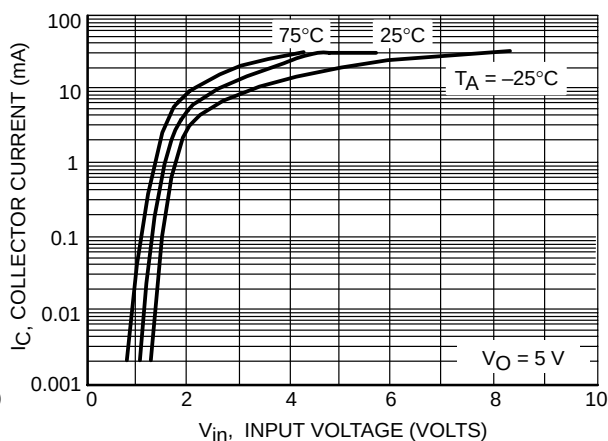


Figure 10. Output Current vs. Input Voltage

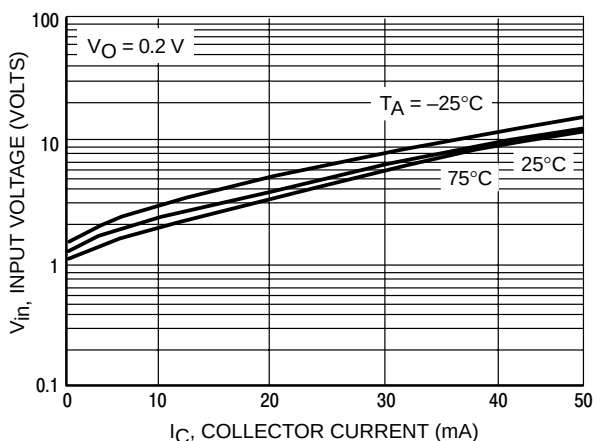


Figure 11. Input Voltage vs. Output Current

RATING AND CHARACTERISTIC CURVES

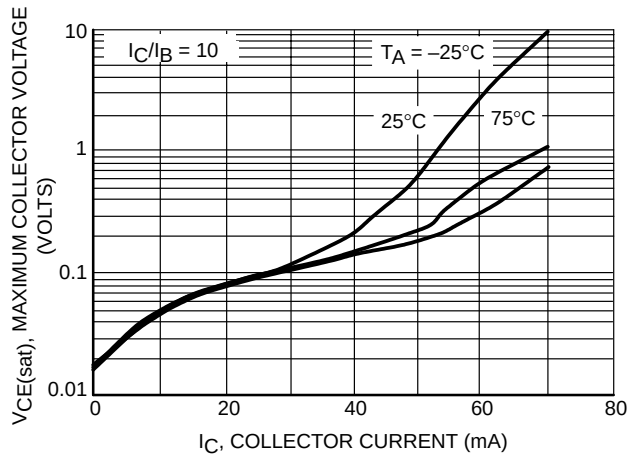


Figure 12. $V_{CE(sat)}$ vs. I_C

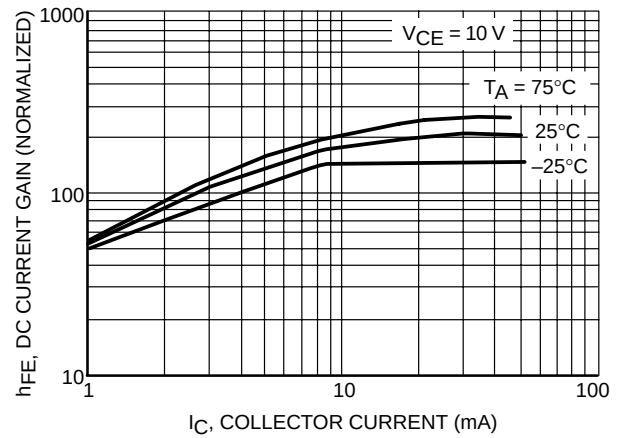


Figure 13. DC Current Gain

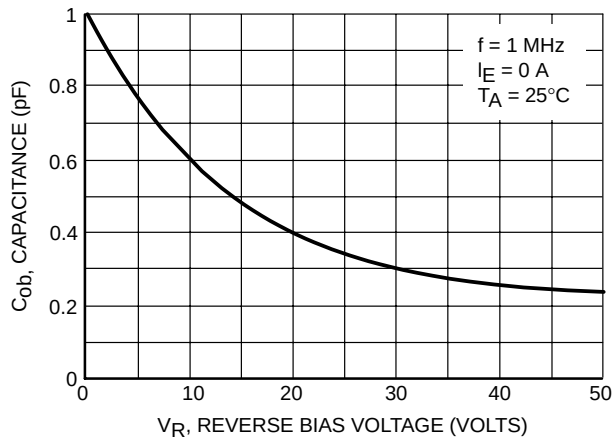


Figure 14. Output Capacitance

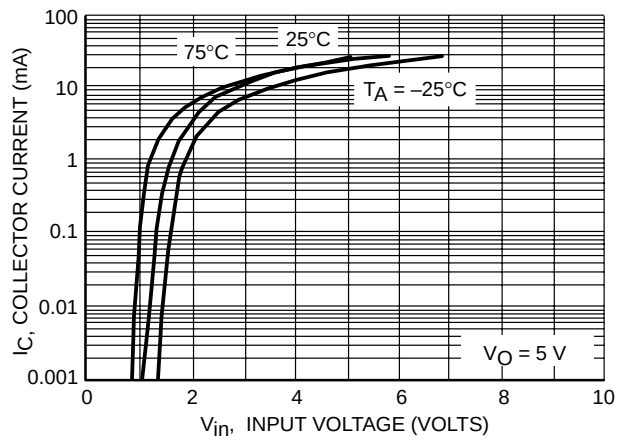


Figure 15. Output Current vs. Input Voltage

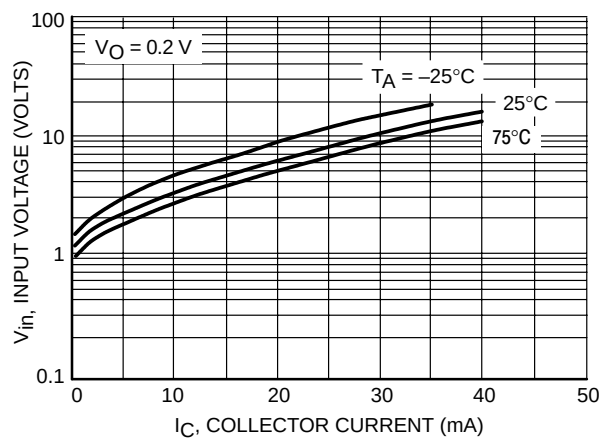


Figure 16. Input Voltage vs. Output Current

RATING AND CHARACTERISTIC CURVES

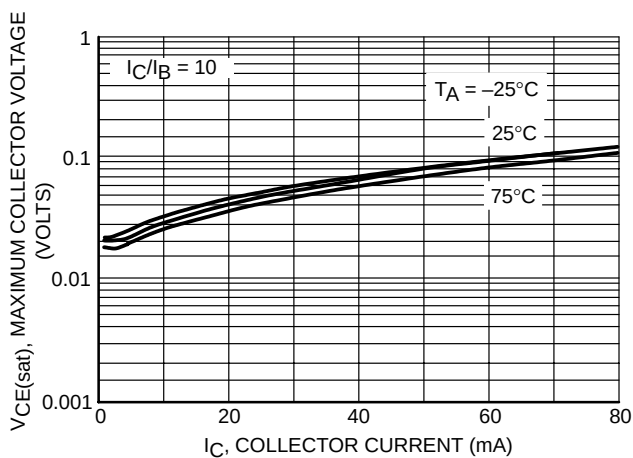


Figure 17. $V_{CE(sat)}$ vs. I_C

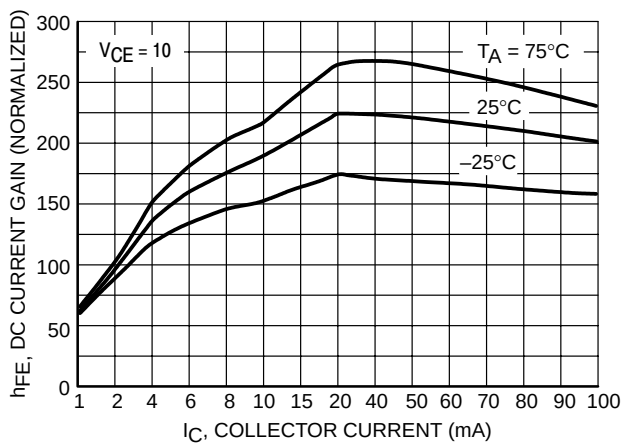


Figure 18. DC Current Gain

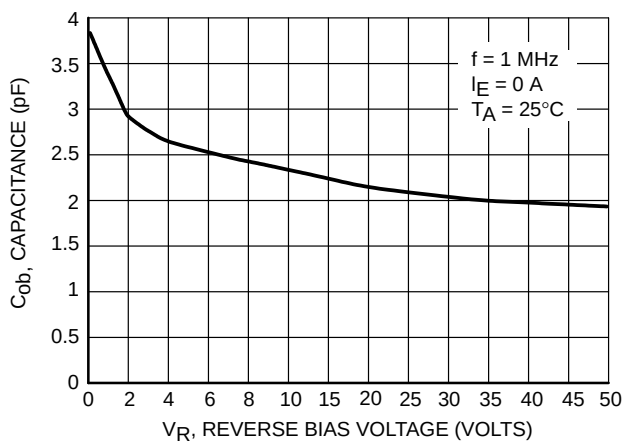


Figure 19. Output Capacitance

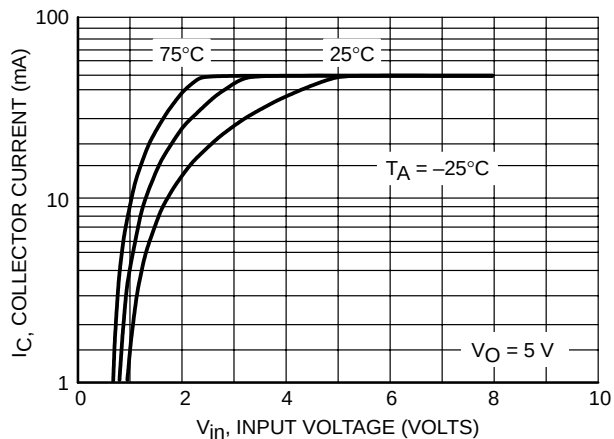


Figure 20. Output Current vs. Input Voltage

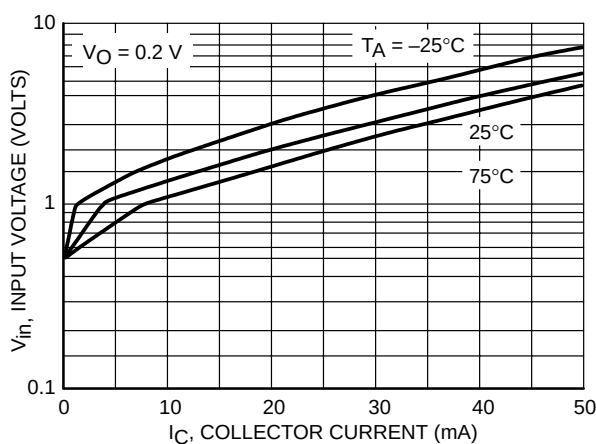


Figure 21. Input Voltage vs. Output Current

RATING AND CHARACTERISTIC CURVES

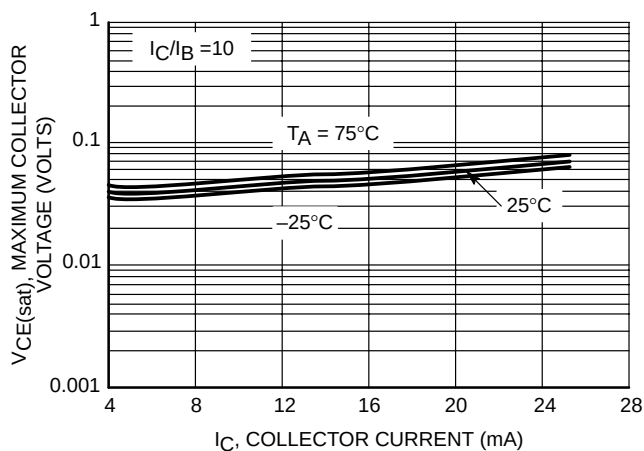


Figure 22. $V_{CE(sat)}$ vs. I_C

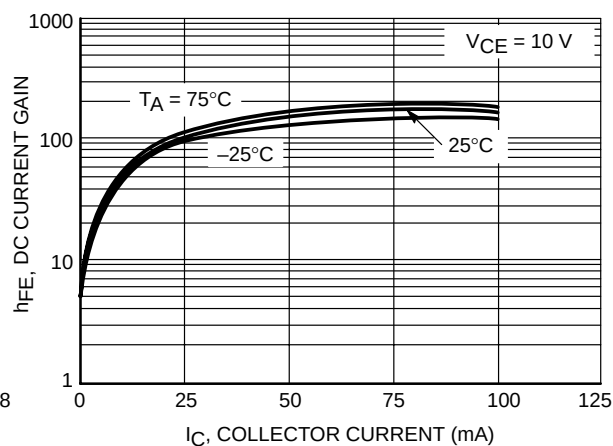


Figure 23. DC Current Gain

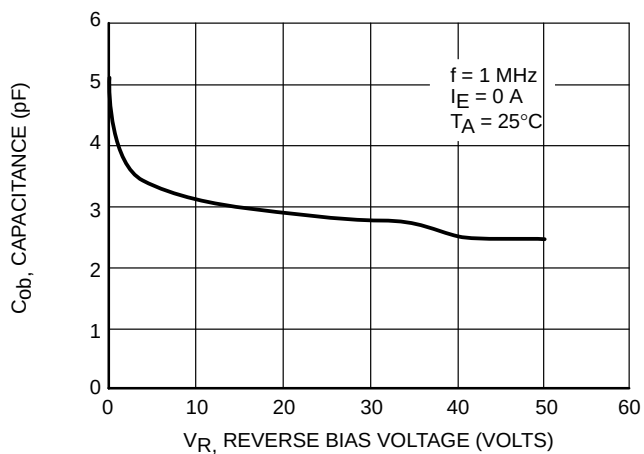


Figure 24. Output Capacitance

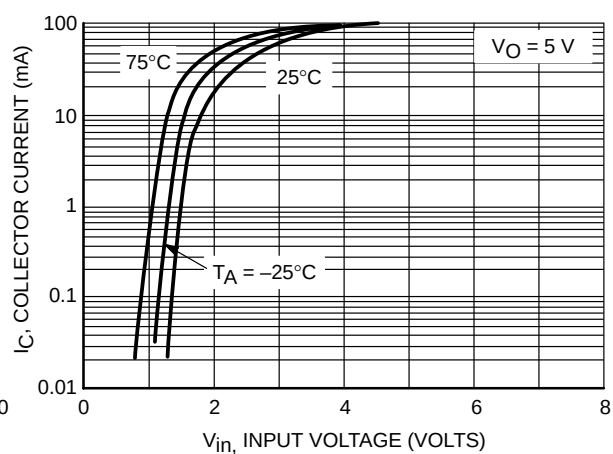


Figure 25. Output Current vs. Input Voltage

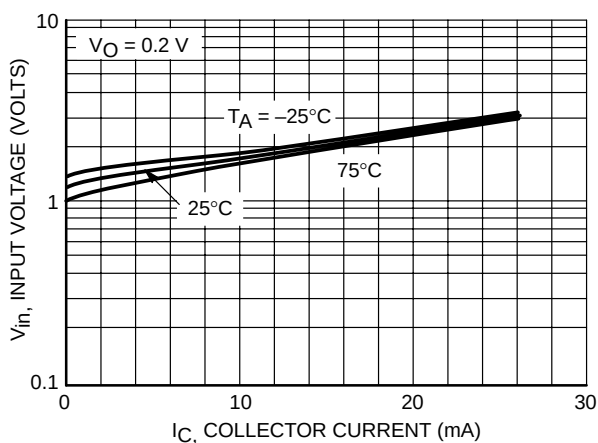


Figure 26. Output Voltage vs. Input Current

RATING AND CHARACTERISTIC CURVES

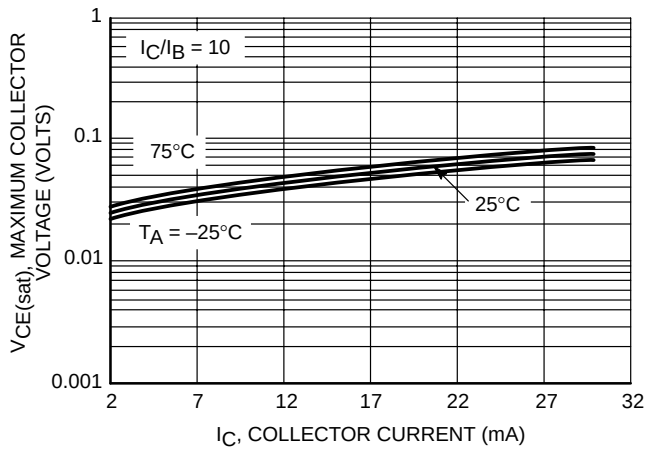


Figure 27. $V_{CE(sat)}$ vs. I_C

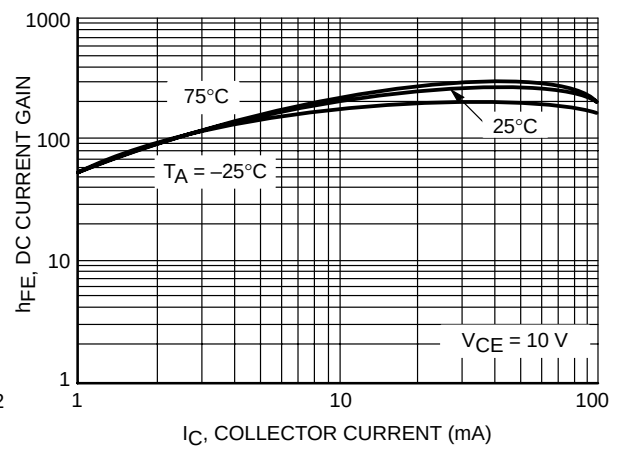


Figure 28. DC Current Gain

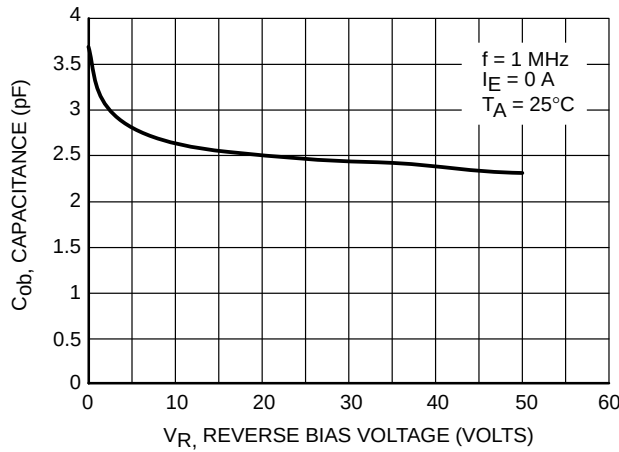


Figure 29. Output Capacitance

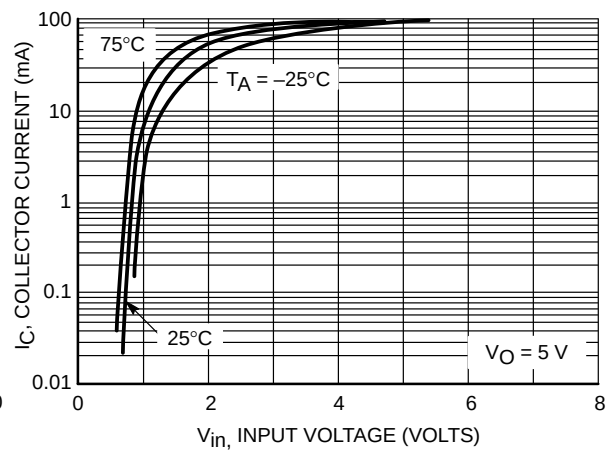


Figure 30. Output Current vs. Input Voltage

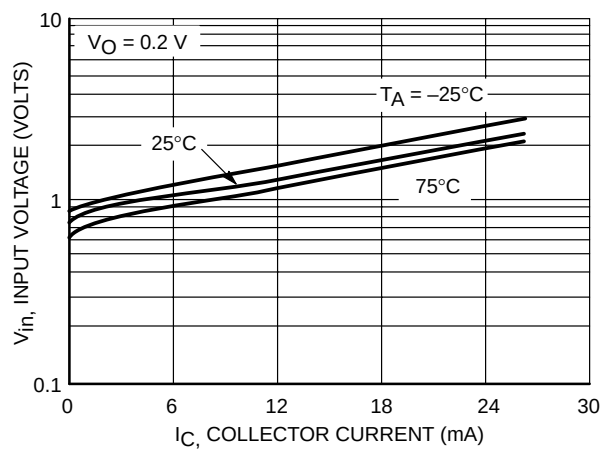


Figure 31. Input Voltage vs. Output Current

TYPICAL APPLICATIONS FOR NPN BRTs

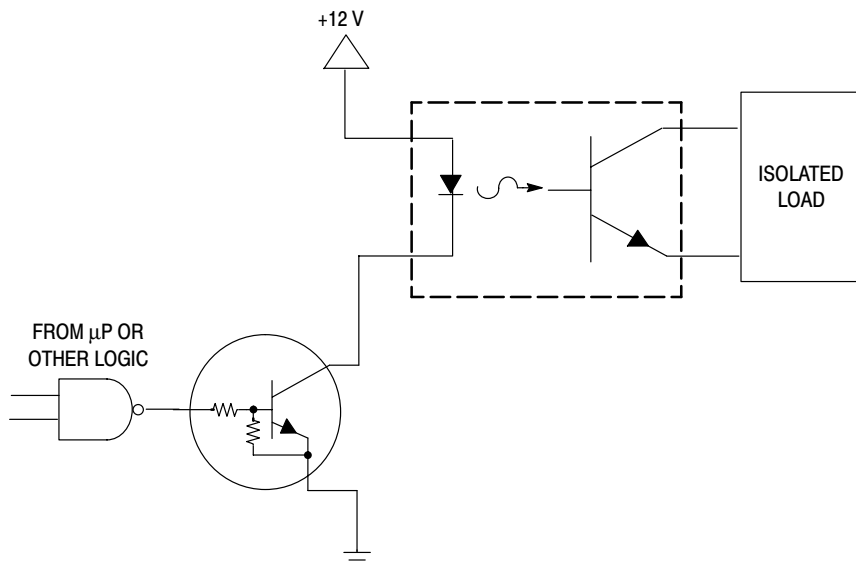


Figure 32. Level Shifter: Connects 12 or 24 Volt Circuits to Logic

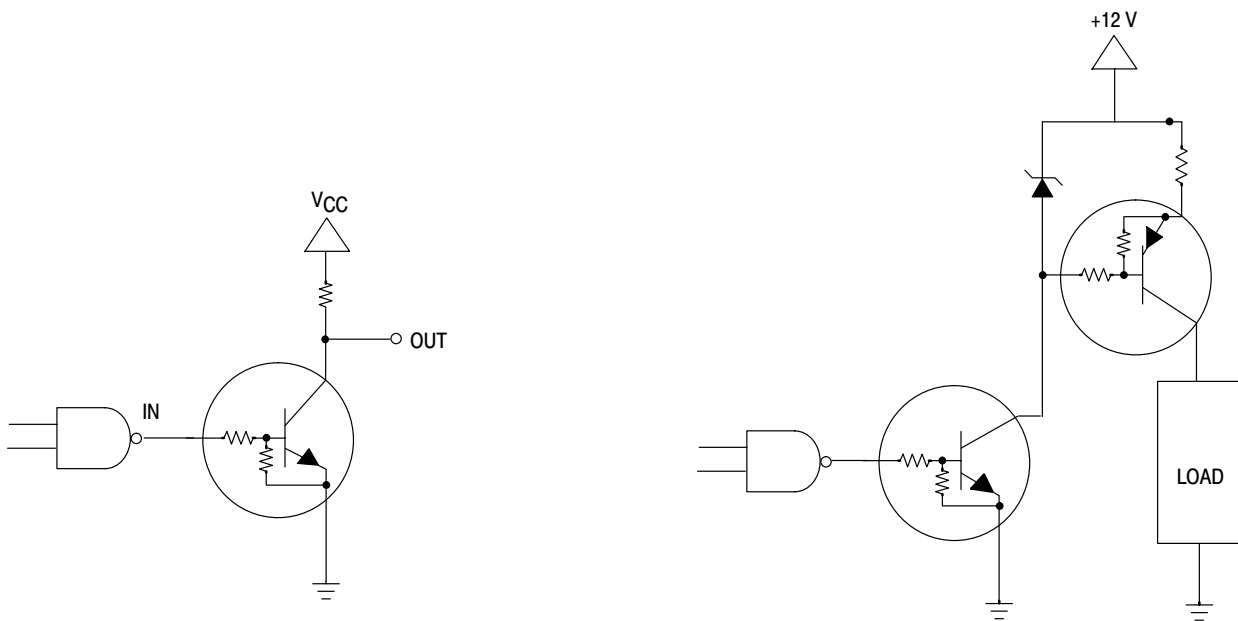


Figure 33. Open Collector Inverter: Inverts the Input Signal

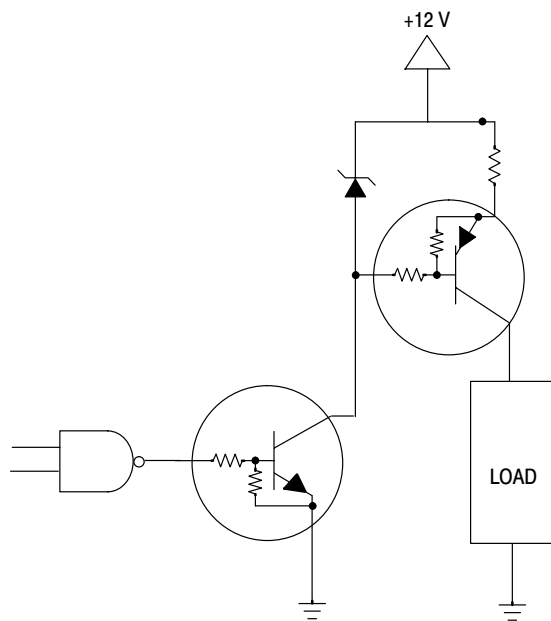
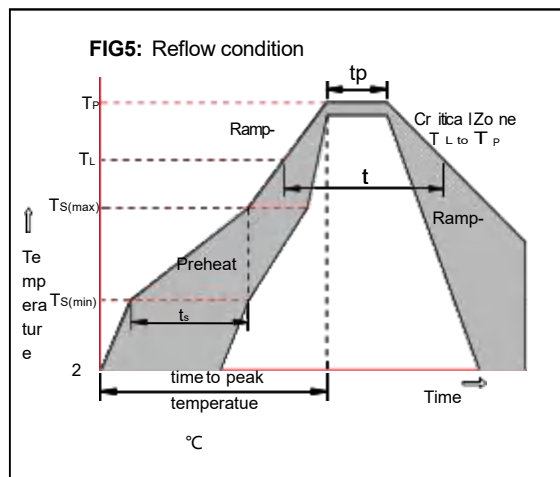


Figure 34. Inexpensive, Unregulated Current Source

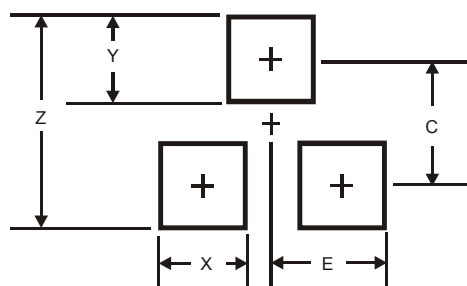
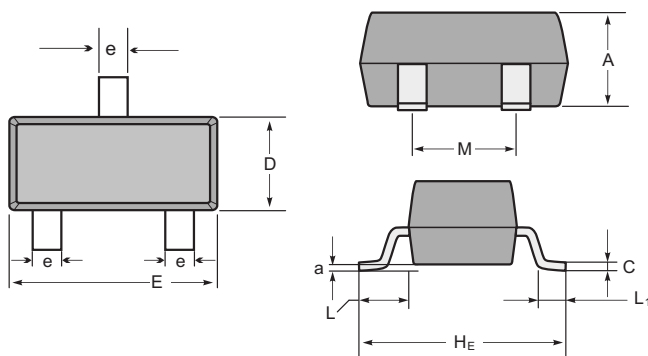
Soldering parameters

Reflow Condition		Pb-Free assembly (see as below)
Pre Heat	-Temperature Min ($T_{s(min)}$)	+150°C
	-Temperature Max($T_{s(max)}$)	+200°C
	-Time (Min to Max) (ts)	60-180 secs.
Average ramp up rate (Liquid us Temp (T_L) to peak)		3°C/sec. Max
$T_{s(max)}$ to T_L - Ramp-up Rate		3°C/sec. Max
Reflow	-Temperature(T_L)(Liquid us)	+217°C
	-Temperature(t_L)	60-150 secs.
Peak Temp (T_P)		+260(+0/-5)°C
Time within 5°C of actual Peak Temp (t_P)		30 secs. Max
Ramp-down Rate		6°C/sec. Max
Time 25°C to Peak Temp (T_P)		8 min. Max
Do not exceed		+260°C



Package Dimensions & Suggested Pad Layout

SOT23

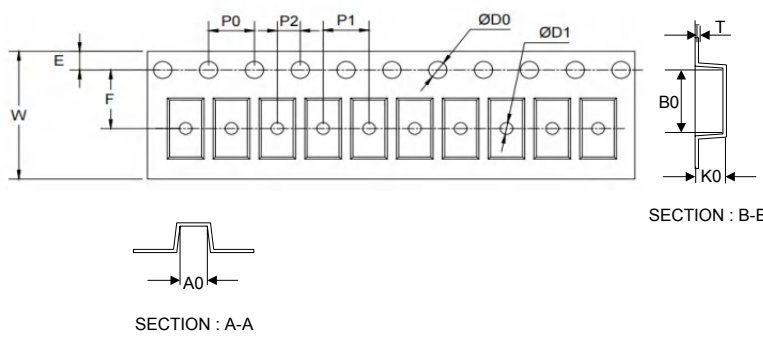
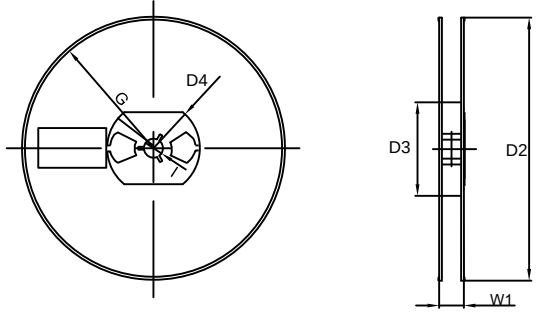


SOT-23 mechanical data

UNIT	A	C	D	E	HE	e	M	L	L1	a
mm	max	1.1	0.15	1.4	3.0	2.6	0.5	1.95	0.55 (ref)	0.36 (ref)
	min	0.9	0.08	1.2	2.8	2.2	0.3	1.7		0.15
mil	max	43	6	55	118	102	20	77	22 (ref)	14 (ref)
	min	35	3	47	110	87	12	67		6

Dimensions	SOT23
Z	2.9
X	0.8
Y	0.9
C	2.0
E	1.35

Tape & reel specification

Tape		Symbol	Dimension (mm)
		P0	4.00±0.10
		P1	4.00±0.10
		P2	2.00±0.10
		D0	1.55±0.10
		D1	1.05±0.10
		E	1.55±0.10
		F	3.60±0.10
		W	8.00±0.10
		A0	3.80±0.20
		B0	3.25±0.20
		K0	1.45±0.10
		T	0.25±0.05
		D2	178.0±3.0
		D3	55Min.
		D4	R24.0±3.0
7" Reel		G	R82.0±3.0
		I	13.0±2.0
		W1	11.0±3.0
		Quantity: 3000PCS	