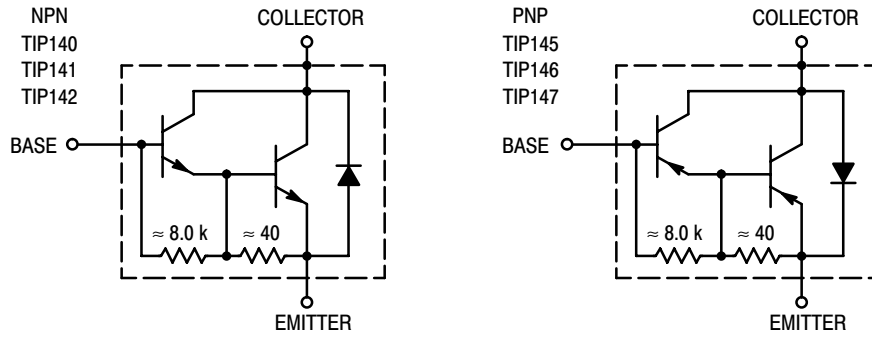


TIP140, TIP141, TIP142, (NPN); TIP145, TIP146, TIP147, (PNP)

DARLINGTON SCHEMATICS



ORDERING INFORMATION

Device	Package	Shipping
TIP140	SOT-93 (TO-218)	30 Units / Rail
TIP140G	SOT-93 (TO-218) (Pb-Free)	30 Units / Rail
TIP141	SOT-93 (TO-218)	30 Units / Rail
TIP141G	SOT-93 (TO-218) (Pb-Free)	30 Units / Rail
TIP142	SOT-93 (TO-218)	30 Units / Rail
TIP142G	SOT-93 (TO-218) (Pb-Free)	30 Units / Rail
TIP145	SOT-93 (TO-218)	30 Units / Rail
TIP145G	SOT-93 (TO-218) (Pb-Free)	30 Units / Rail
TIP146	SOT-93 (TO-218)	30 Units / Rail
TIP146G	SOT-93 (TO-218) (Pb-Free)	30 Units / Rail
TIP147	SOT-93 (TO-218)	30 Units / Rail
TIP147G	SOT-93 (TO-218) (Pb-Free)	30 Units / Rail

TIP140, TIP141, TIP142, (NPN); TIP145, TIP146, TIP147, (PNP)

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector–Emitter Sustaining Voltage (Note 2) ($I_C = 30\text{ mA}$, $I_B = 0$)	$V_{CEO(sus)}$	60 80 100	– – –	– – –	Vdc
Collector Cutoff Current ($V_{CE} = 30\text{ Vdc}$, $I_B = 0$) ($V_{CE} = 40\text{ Vdc}$, $I_B = 0$) ($V_{CE} = 50\text{ Vdc}$, $I_B = 0$)	I_{CEO}	– – –	– – –	2.0 2.0 2.0	mA
Collector Cutoff Current ($V_{CB} = 60\text{ V}$, $I_E = 0$) ($V_{CB} = 80\text{ V}$, $I_E = 0$) ($V_{CB} = 100\text{ V}$, $I_E = 0$)	I_{CBO}	– – –	– – –	1.0 1.0 1.0	mA
Emitter Cutoff Current ($V_{BE} = 5.0\text{ V}$)	I_{EBO}	–	–	2.0	mA

ON CHARACTERISTICS (Note 2)

DC Current Gain ($I_C = 5.0\text{ A}$, $V_{CE} = 4.0\text{ V}$) ($I_C = 10\text{ A}$, $V_{CE} = 4.0\text{ V}$)	h_{FE}	1000 500	– –	– –	–
Collector–Emitter Saturation Voltage ($I_C = 5.0\text{ A}$, $I_B = 10\text{ mA}$) ($I_C = 10\text{ A}$, $I_B = 40\text{ mA}$)	$V_{CE(sat)}$	– –	– –	2.0 3.0	Vdc
Base–Emitter Saturation Voltage ($I_C = 10\text{ A}$, $I_B = 40\text{ mA}$)	$V_{BE(sat)}$	–	–	3.5	Vdc
Base–Emitter On Voltage ($I_C = 10\text{ A}$, $V_{CE} = 4.0\text{ Vdc}$)	$V_{BE(on)}$	–	–	3.0	Vdc

SWITCHING CHARACTERISTICS

Resistive Load (See Figure 1)						
Delay Time	$(V_{CC} = 30\text{ V}$, $I_C = 5.0\text{ A}$, $I_B = 20\text{ mA}$, Duty Cycle $\leq 2.0\%$, $I_{B1} = I_{B2}$, R_C & R_B Varied, $T_J = 25^\circ\text{C}$)	t_d	–	0.15	–	μs
Rise Time		t_r	–	0.55	–	μs
Storage Time		t_s	–	2.5	–	μs
Fall Time		t_f	–	2.5	–	μs

2. Pulse Test: Pulse Width = 300 μs , Duty Cycle $\leq 2.0\%$.

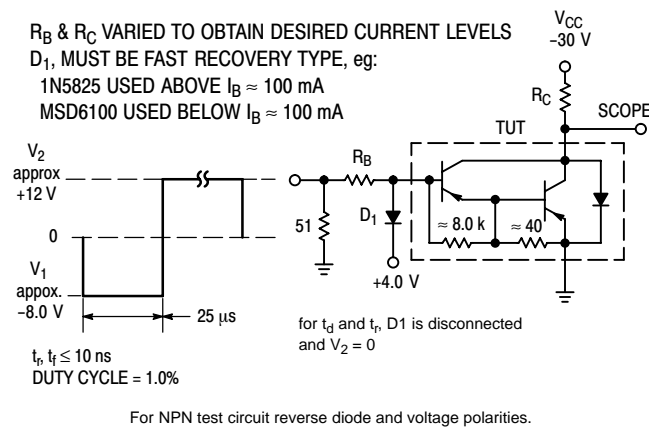


Figure 1. Switching Times Test Circuit

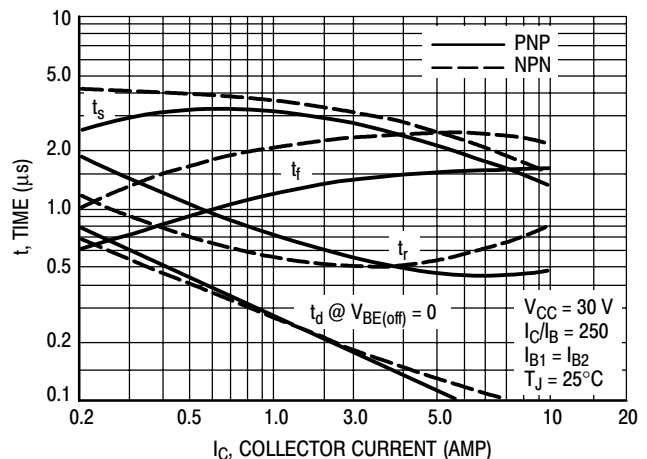


Figure 2. Switching Times

TIP140, TIP141, TIP142, (NPN); TIP145, TIP146, TIP147, (PNP)

TYPICAL CHARACTERISTICS

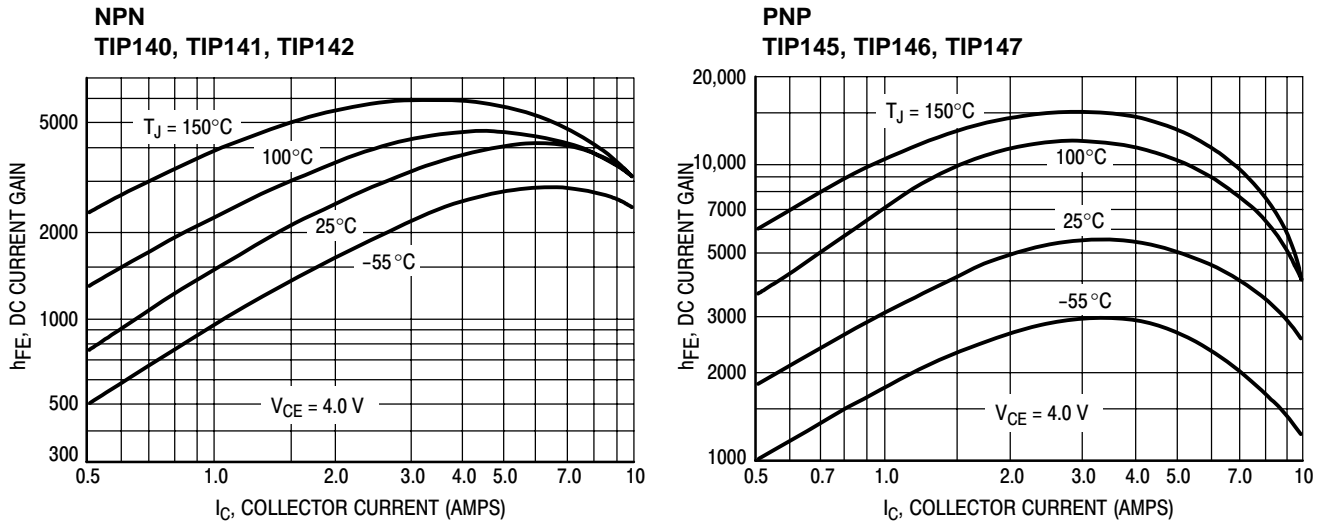


Figure 3. DC Current Gain versus Collector Current

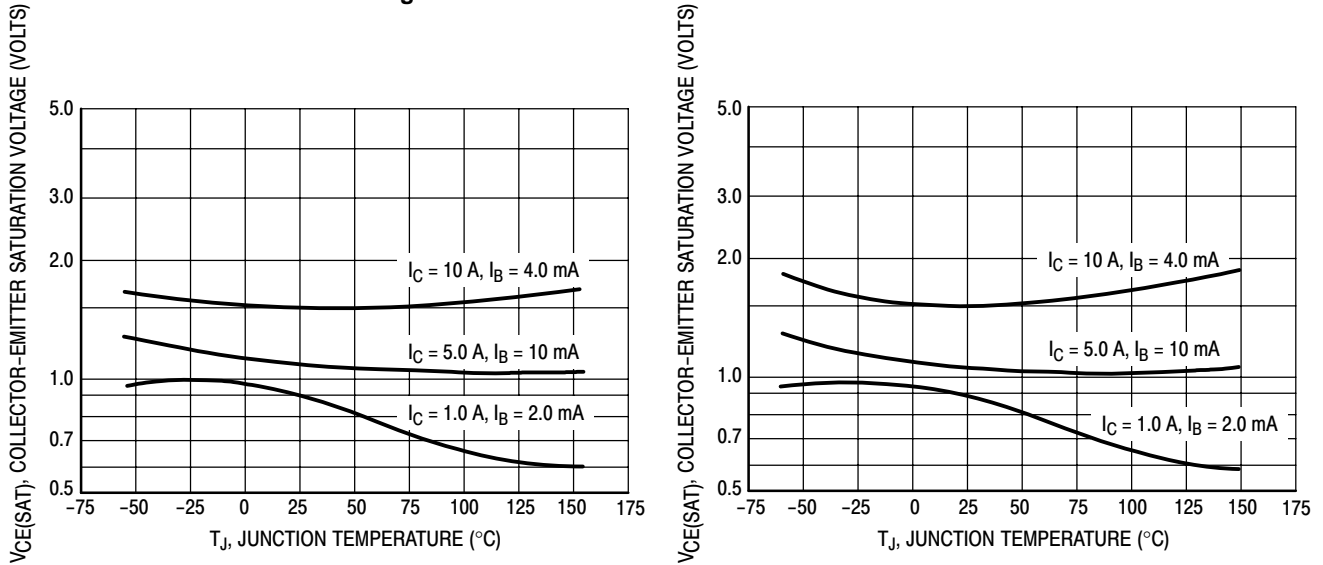


Figure 4. Collector-Emitter Saturation Voltage

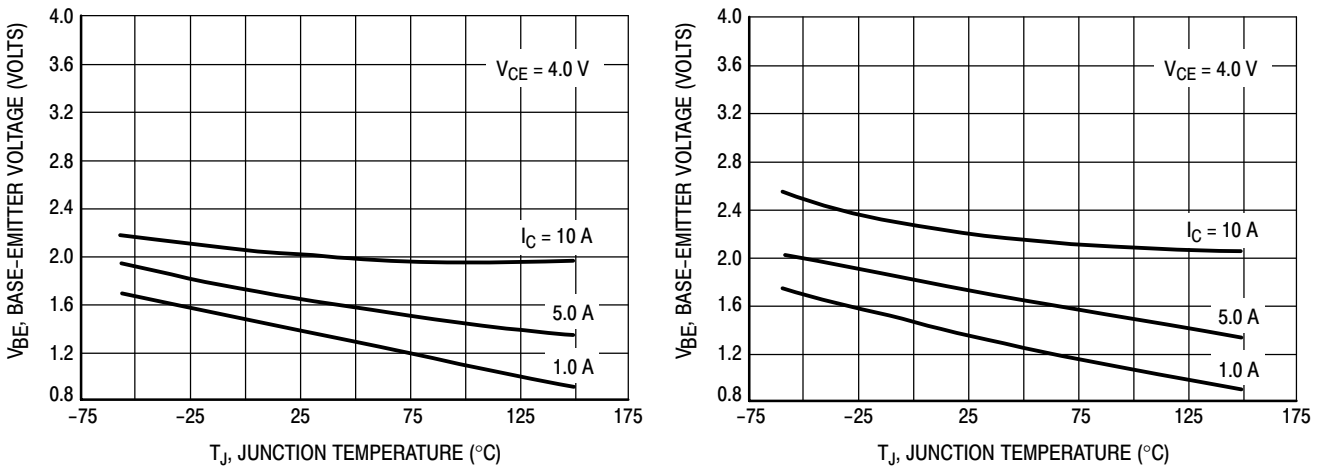


Figure 5. Base-Emitter Voltage

TIP140, TIP141, TIP142, (NPN); TIP145, TIP146, TIP147, (PNP)

ACTIVE-REGION SAFE OPERATING AREA

There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate $I_C - V_{CE}$ limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 6 is based on $T_{J(pk)} = 150^\circ\text{C}$; T_C is variable depending on conditions. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

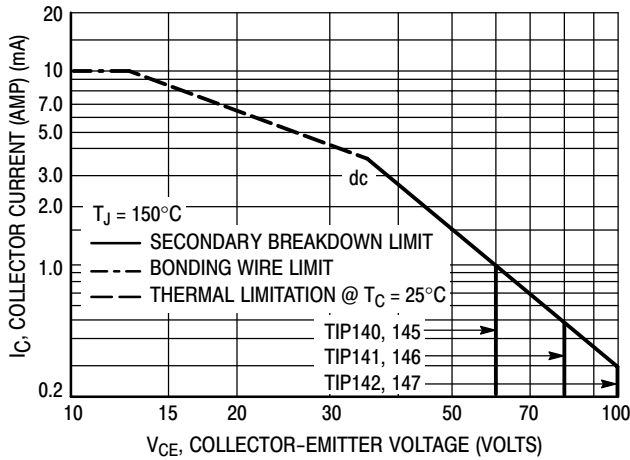


Figure 6. Active-Region Safe Operating Area

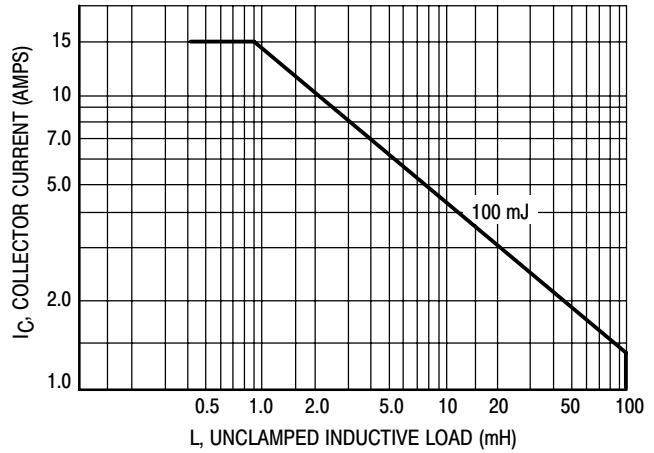
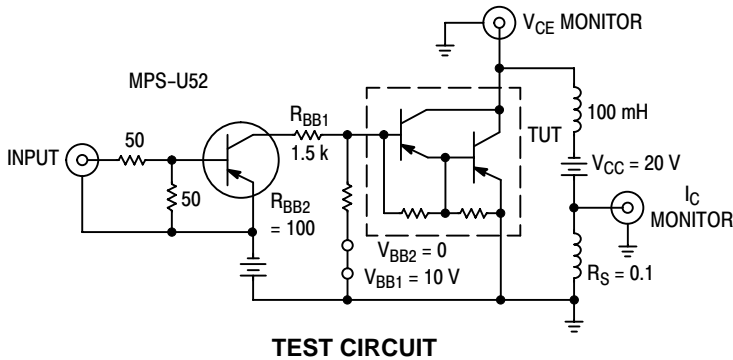
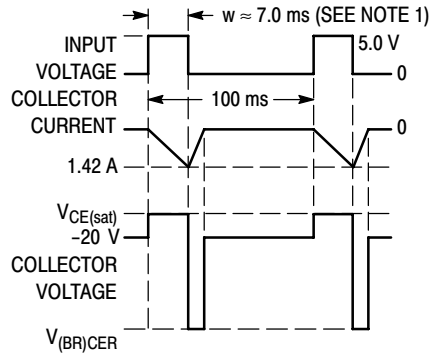


Figure 7. Unclamped Inductive Load



TEST CIRCUIT

NOTE 1: Input pulse width is increased until $I_{CM} = 1.42\text{ A}$.
NOTE 2: For NPN test circuit reverse polarities.



VOLTAGE AND CURRENT WAVEFORMS

Figure 8. Inductive Load

TIP140, TIP141, TIP142, (NPN); TIP145, TIP146, TIP147, (PNP)

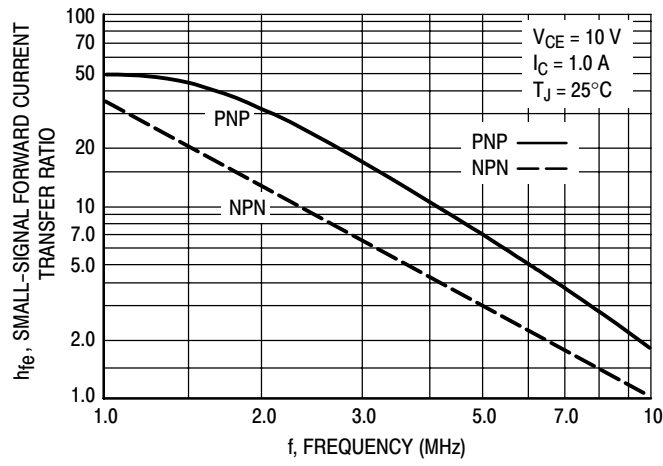


Figure 9. Magnitude of Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio

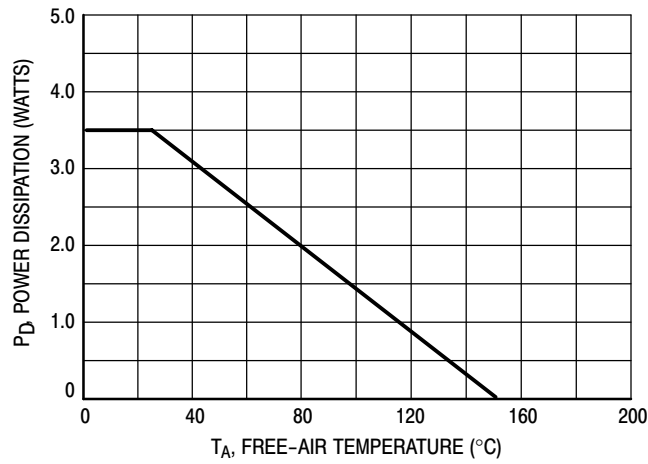
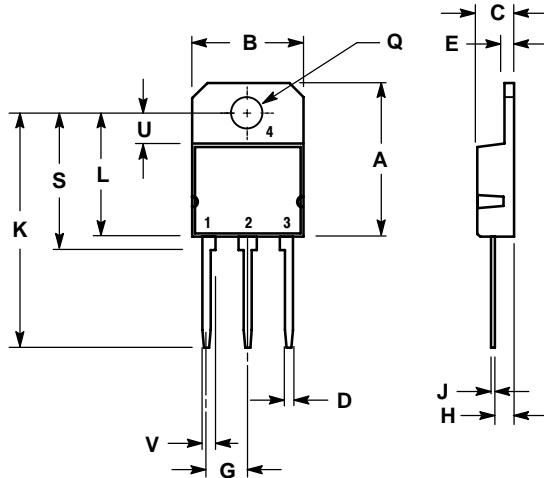


Figure 10. Free-Air Temperature Power Derating

TIP140, TIP141, TIP142, (NPN); TIP145, TIP146, TIP147, (PNP)

PACKAGE DIMENSIONS

SOT-93 (TO-218)
CASE 340D-02
ISSUE E




NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	---	20.35	---	0.801
B	14.70	15.20	0.579	0.598
C	4.70	4.90	0.185	0.193
D	1.10	1.30	0.043	0.051
E	1.17	1.37	0.046	0.054
G	5.40	5.55	0.213	0.219
H	2.00	3.00	0.079	0.118
J	0.50	0.78	0.020	0.031
K	31.00 REF		1.220 REF	
L	---	16.20	---	0.638
Q	4.00	4.10	0.158	0.161
S	17.80	18.20	0.701	0.717
U	4.00 REF		0.157 REF	
V	1.75 REF		0.069	

STYLE 1:

- PIN 1. BASE
- COLLECTOR
- EMITTER
- COLLECTOR

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TIP140/D