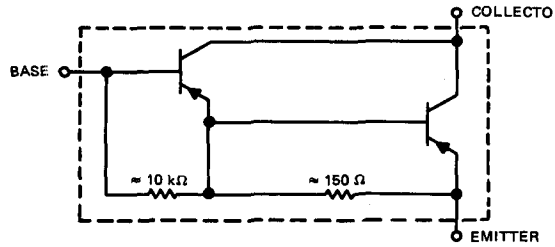
DESIGNED FOR COMPLEMENTARY USE WITH TIP640, TIP641, TIP642

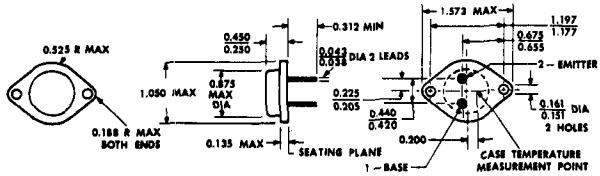
- 175 W at 25°C Case Temperature
- 10-A Rated Collector Current
- Min h_{FE} of 1000 at 4 V, 5 A
- 100 mJ Reverse Energy Rating

device schematic



mechanical data

ALL JEDEC TO-3 DIMENSIONS AND NOTES ARE APPLICABLE
THE COLLECTOR IS IN ELECTRICAL CONTACT WITH THE CASE



ALL DIMENSIONS ARE IN INCHES

absolute maximum ratings at 25°C case temperature (unless otherwise noted)

	TIP645	TIP646	TIP647
Collector-Base Voltage	−60 V	−80 V	−100 V
Collector-Emitter Voltage (See Note 1)	−60 V	−80 V	−100 V
Emitter-Base Voltage	−5 V	−5 V	−5 V
Continuous Collector Current	← −10 A →		
Peak Collector Current (See Note 2)	← −15 A →		
Continuous Base Current	← −0.5 A →		
Safe Operating Areas at (or below) 25°C Case Temperature	See Figures 7 and 8		
Continuous Device Dissipation at (or below) 25°C Case Temperature (See Note 3)	← 175 W →		
Continuous Device Dissipation at (or below) 25°C Free-Air Temperature (See Note 4)	← 5 W →		
Unclamped Inductive Load Energy (See Note 5)	← 100 mJ →		
Operating Collector Junction Temperature Range	−65°C to 200°C		
Storage Temperature Range	−65°C to 200°C		
Terminal Temperature 1/8 Inch from Case to 10 Seconds	← 260°C →		

NOTES:
1. These values apply when the base-emitter diode is open-circuited.
2. This value applies for $t_w \leq 0.3$ ms, duty cycle ≤ 10%.
3. Derate linearly to 200°C case temperature at the rate of 1 W/°C or refer to Dissipation Derating Curve, Figure 9.
4. Derate linearly to 200°C free-air temperature at the rate of 28.6 mW/°C or refer to Dissipation Derating Curve, Figure 10.
5. This rating is based on the capability of the transistors to operate safely in the circuit of Figure 2. L = 100 mH, R_{BB2} = 100 Ω, V_{BB2} = 0 V, R_S = 0.1 Ω, V_{CC} = 20 V. Energy ≈ $I_C^2 L/2$.

electrical characteristics at 25°C case temperature

PARAMETER		TEST CONDITIONS		TIP645 MIN	TIP645 MAX	TIP646 MIN	TIP646 MAX	TIP647 MIN	TIP647 MAX	UNIT
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	$I_C = -30$ mA, $I_B = 0$,	See Note 6	−60		−80		−100		V
I_{CEO}	Collector Cutoff Current	$V_{CE} = -30$ V, $I_B = 0$			−2					mA
		$V_{CE} = -40$ V, $I_B = 0$					−2			
		$V_{CE} = -50$ V, $I_B = 0$							−2	
I_{CBO}	Collector Cutoff Current	$V_{CB} = -60$ V, $I_E = 0$			−1					mA
		$V_{CB} = -80$ V, $I_E = 0$					−1			
		$V_{CB} = -100$ V, $I_E = 0$							−1	
I_{EBO}	Emitter Cutoff Current	$V_{EB} = -5$ V, $I_C = 0$			−2		−2		−2	mA
h_{FE}	Static Forward Current Transfer Ratio	$V_{CE} = -4$ V, $I_C = -5$ A	See Notes 6 and 7	1000		1000		1000		
		$V_{CE} = -4$ V, $I_C = -10$ A		500		500		500		
V_{BE}	Base-Emitter Voltage	$V_{CE} = -4$ V, $I_C = -10$ A,	See Notes 6 and 7		−3		−3		−3	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_B = -10$ mA, $I_C = -5$ A	See Notes 6 and 7		−2		−2		−2	V
		$I_B = -40$ mA, $I_C = -10$ A			−3		−3		−3	

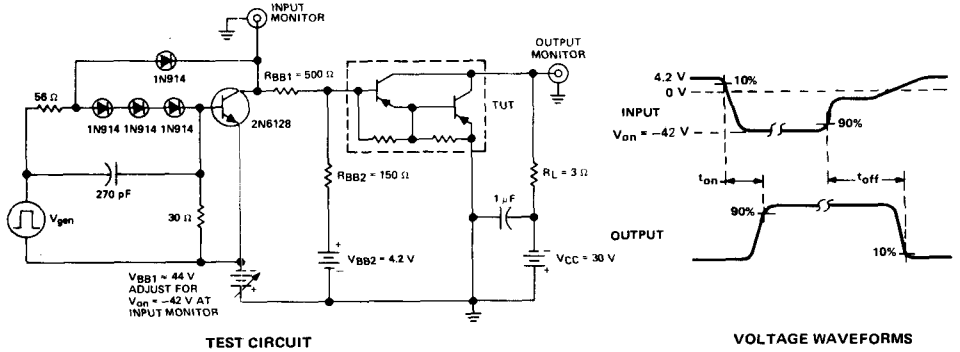
NOTES: 6. These parameters must be measured using pulse techniques. $t_w = 300\ \mu s$, duty cycle ≤ 2%.
7. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts and located within 0.125 inch from the device body.

switching characteristics at 25°C case temperature

PARAMETER		TEST CONDITIONS†		TYP	UNIT
t_{on}	Turn-On Time	$I_C = -10$ A, $I_{B(1)} = -40$ mA, $I_{B(2)} = 40$ mA,		0.9	μs
t_{off}	Turn-Off Time	$V_{BE(off)} = 4.2$ V, $R_L = 3\ \Omega$,	See Figure 1	11	

†Voltage and current values shown are nominal; exact values vary slightly with transistor parameters.

PARAMETER MEASUREMENT INFORMATION

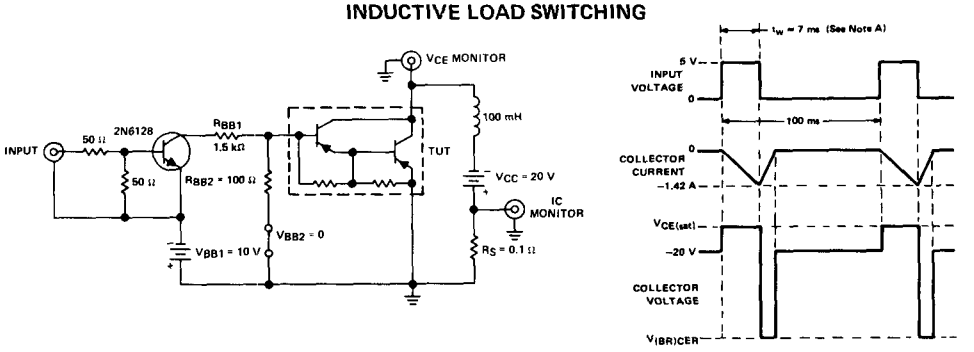


TEST CIRCUIT VOLTAGE WAVEFORMS

NOTES: A. V_{gen} is a 30-V pulse (from 0 V) into a 50-Ω termination.
B. The V_{gen} waveform is supplied by a generator with the following characteristics: $t_r \leq 15$ ns, $t_f \leq 15$ ns, $Z_{out} = 50\ \Omega$, $t_w = 20\ \mu s$, duty cycle ≤ 2%.
C. Waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq 15$ ns, $R_{in} \geq 10$ MΩ, $C_{in} \leq 11.5$ pF.
D. Resistors must be noninductive types.
E. The d-c power supplies may require additional bypassing in order to minimize ringing.

FIGURE 1

INDUCTIVE LOAD SWITCHING



NOTE A: Input pulse width is increased until $I_{CM} = -1.42$ A.

FIGURE 2

TYPICAL CHARACTERISTICS

STATIC FORWARD CURRENT TRANSFER RATIO vs COLLECTOR CURRENT

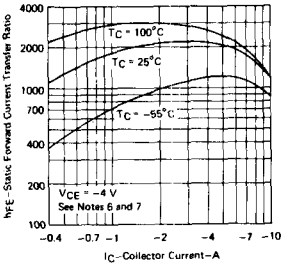


FIGURE 3

BASE EMITTER VOLTAGE vs CASE TEMPERATURE

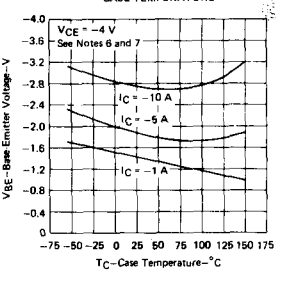


FIGURE 4

COLLECTOR-EMITTER SATURATION VOLTAGE vs CASE TEMPERATURE

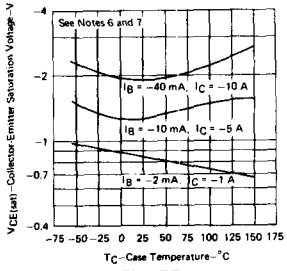


FIGURE 5

SMALL-SIGNAL COMMON-EMITTER FORWARD CURRENT TRANSFER RATIO vs FREQUENCY

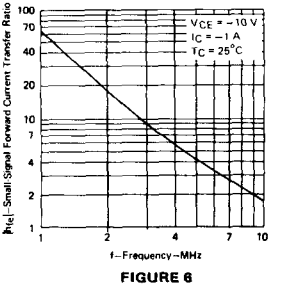


FIGURE 6

NOTES: 6. These parameters must be measured using pulse techniques, $t_w = 300$ μs, duty cycle ≤ 2%.

7. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts and located within 0.125 inch from the device body.

MAXIMUM SAFE OPERATING AREAS

MAXIMUM COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

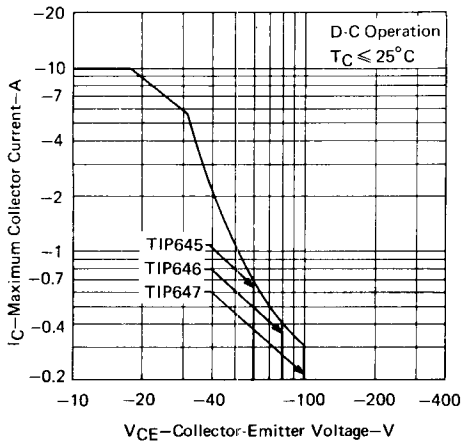


FIGURE 7

NOTE 8: Above this point the safe operating area has not been defined.

MAXIMUM COLLECTOR CURRENT
vs
UNCLAMPED INDUCTIVE LOAD

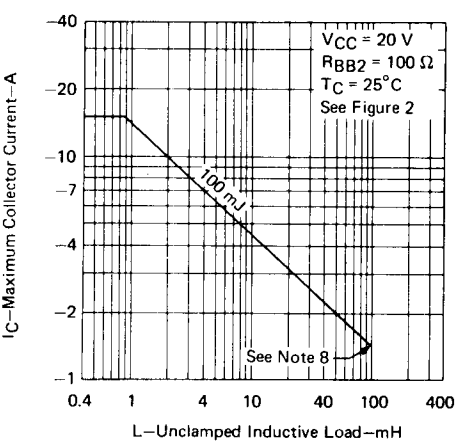


FIGURE 8

THERMAL INFORMATION

CASE TEMPERATURE
DISSIPATION DERATING CURVE

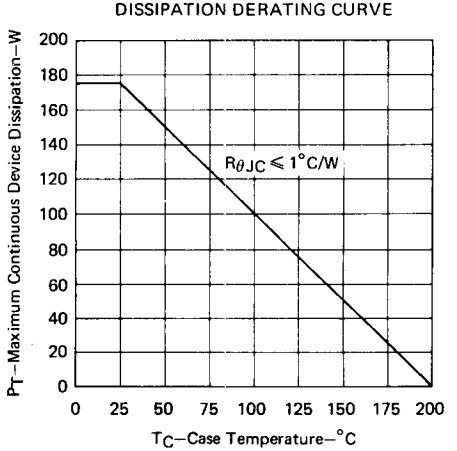


FIGURE 9

FREE-AIR TEMPERATURE
DISSIPATION DERATING CURVE

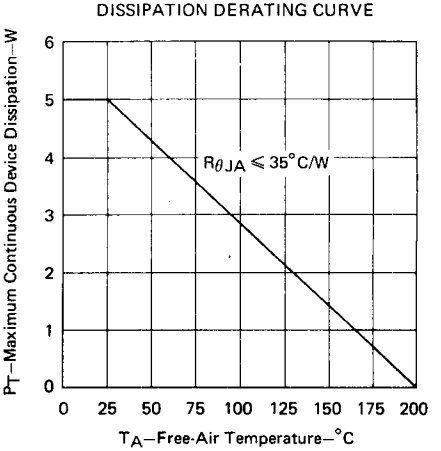


FIGURE 10

Typ type PNP	NPN	P_{tot} @ T_A=25 °C (100 °C) W	T_C=25 °C (100 °C) W	V_{CEO} min V	I_{CD} max A	min	h_{FE} max	@ I_C A
TIP 527		4	(60)	−200	− 8	20	100	−4
TIP 544		5	150	−100	− 6	25	100	−3
TIP 545		5	150	−120	− 6	20	80	−3
TIP 546		5	150	−140	− 6	16	60	−3
TIP 645	TIP 640	5	175	− 60	−10	10^3		−5
TIP 646	TIP 641	5	175	− 80	−10	10^3		−5
TIP 647	TIP 647	5	175	−100	−10	10^3		−5
2N 3789			150	− 60	−10	25	90	−1
2N 3790			150	− 80	−10	25	90	−1
2N 3791			150	− 60	−10	50	180	−1
2N 3792			150	− 80	−10	50	180	−1
2N 4901			87,5	− 40	− 5	20	80	−1
2N 4902			87,5	− 60	− 5	20	80	−1
2N 4903			87,5	− 80	− 5	20	80	−1
2N 4904			87,5	− 40	− 5	25	100	−1
2N 4905			87,5	− 60	− 5	25	100	−1
2N 4906			87,5	− 80	− 5	25	100	−1
2N 4999		2	(20)	80	2	30	90	1
2N 5001		2	(20)	80	2	70	200	1
2N 5003			(33,3)	80	5	30	90	2,5
2N 5005			(33,3)	80	5	70	200	2,5
2N 5147		1	(4)	80	2	30	90	1
2N 5149		1	(4)	80	2	70	200	1
2N 5151		1	(6,7)	80	5	30	90	2,5
2N 5153		1	(6,7)	80	5	70	200	2,5
2N 5333			(15)	− 80	− 5	30	120	−1
2N 5683		5	300	− 60	−50	15		−25
2N 5684		5	300	− 80	−50	15		−25
2N 6329		5	200	− 60	−30	12		−15
2N 6330		5	200	− 80	−30	12		−15
2N 6331		5	200	−100	−20	12		−15

f_T min MHz	I_{CES} @ (I_{CEO}) µA	V_{CE} V	Gehäuse package	Anwendungen, Bemerkungen applications, remarks
40	(– 500)	–100	TO-3	Verstärker, schneller Schalter amplifier, switch
1	(– 5000)	– 50	TO-3	
1	(– 5000)	– 60	TO-3	Verstärker, Schalter amplifier, switch
1	(– 5000)	– 70	TO-3	Komplementär zu 2N 5758, 2N 5759, 2N 5760 complementary to 2N 5758, 2N 5759, 2N 5760
1	(– 2000)	– 30	TO-3	Verstärker, Schalter, Anwendung in Netzger.
1	(– 2000)	– 40	TO-3	Komplementär zu TIP 640, TIP 641, TIP 642
1	(– 2000)	– 50		amplifier, switch, power supply complementary to TIP 640, TIP 641, TIP 642
	(–10000)	– 30	TO-3	Verstärker, Schalter
	(–10000)	– 40	TO-3	amplifier, switch
	(–10000)	– 30	TO-3	
	(–10000)	– 40	TO-3	
	(– 1000)	– 40	TO-3	
	(– 1000)	– 60	TO-3	
	(– 1000)	– 80	TO-3	
	(– 1000)	– 40	TO-3	
	(– 1000)	– 60	TO-3	
	(– 1000)	– 80	TO-3	
50	(0,05)	40	TO-59	Für Computeranwendung
60	(0,05)	40	TO-59	komplementär zu 2N 4998, 2N 5000 computer application complementary to 2N 4998, 2N 5000
60	(0,05)	40	TO-59	Für Computeranwendung
70	(0,05)	40	TO-59	komplementär zu 2N 5002, 2N 5004 computer application complementary to 2N 5002, 2N 5004
50	(0,05)	40	TO-39	Für Computeranwendung
60	(0,05)	40	TO-39	komplementär zu 2N 5148, 2N 5150 computer application complementary to 2N 5148, 2N 5150
60	(0,05)	40	TO-39	Für Computeranwendung
70	(0,05)	40	TO-39	komplementär zu 2N 5152, 2N 5154 computer application complementary to 2N 5152, 2N 5154
30	– 10	– 90	TO-5	Verstärker, Schalter amplifier, switch
2	(– 1000)	– 30	TO-3	Verstärker, schneller Schalter
2	(– 1000)	– 40	TO-3	komplementär zu 2N 5685, 2N 5686 amplifier, high-speed switch complementary to 2N 5685, 2N 5686
3	(– 1000)	– 30	TO-3	Verstärker, schneller Schalter
3	(– 1000)	– 40	TO-3	komplementär zu 2N 6326, 2N 6327, 2N 6328
3	(– 1000)	– 50	TO-3	amplifier, high-speed switch complementary to 2N 6326, 2N 6327, 2N 6328