

TRANSISTOR

FORMAL INFORMATION

DISSIPATION DERATING CURVE

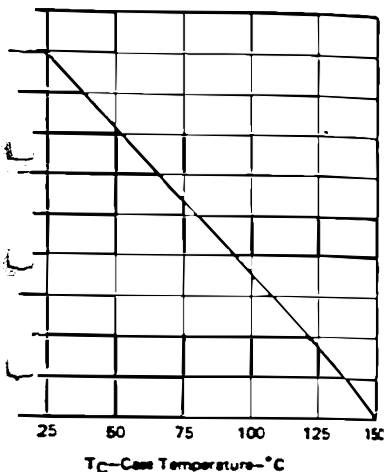


FIGURE 4

ION



switching from saturation to cutoff with a clamp

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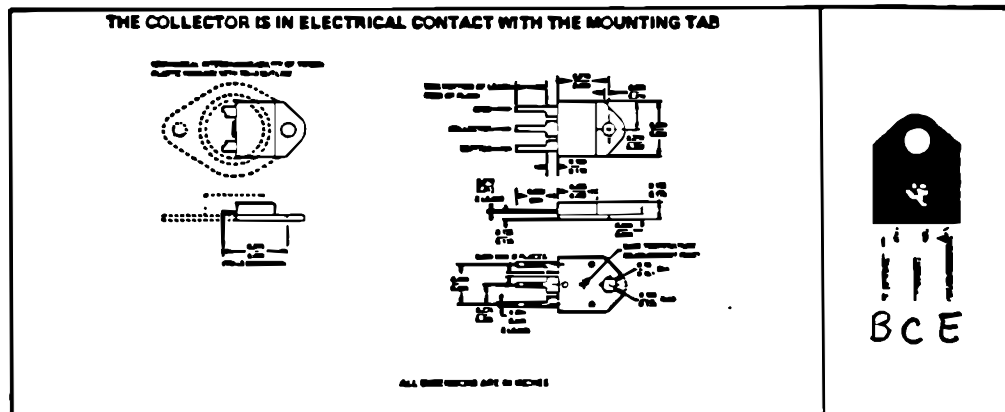
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TYPE TIP301 N-P-N SINGLE-DIFFUSED MESA SILICON POWER TRANSISTOR

FOR POWER AMPLIFIER AND HIGH-SPEED SWITCHING APPLICATIONS
PLASTIC-CASE REPLACEMENT FOR 2N3055

- 90 Watts at 25°C Case Temperature
- 15 A Rated Collector Current

mechanical data



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

Collector-Base Voltage	100 V
Collector-Emitter Voltage (See Note 1)	70 V
Emitter-Base Voltage	7 V
Continuous Collector Current	15 A
Continuous Base Current	7 A
Safe Operating Region at (or below) 25°C Case Temperature	See Figure 5
Continuous Device Dissipation at (or below) 25°C Case Temperature (See Note 2)	90 W
Continuous Device Dissipation at (or below) 25°C Free-Air Temperature (See Note 3)	3.5 W
Unclamped Inductive Load Energy (See Note 4)	62.5 mJ
Operating Collector Junction Temperature Range	-65°C to 150°C
Storage Temperature Range	-65°C to 150°C
Lead Temperature 1/8 Inch from Case For 10 Seconds	260°C

- NOTES: 1. This value applies when the base-emitter resistance $R_{BE} = 100 \Omega$.
 2. Derate linearly to 150°C case temperature at the rate of 0.72 W/°C.
 3. Derate linearly to 150°C free-air temperature at the rate of 28 mW/°C.
 4. This rating is based on the capability of the transistor to operate safely in the circuit of Figure 2. $L = 20 \text{ mH}$, $R_{BB2} = 100 \Omega$, $V_{BB2} = 0 \text{ V}$, $R_B = 0.1 \Omega$, $V_{CC} = 10 \text{ V}$, $\text{Energy} = I_C^2 L/2$.

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TYPE TIP3055

N-P-N SINGLE-DIFFUSED MESA SILICON POWER TRANSISTOR

electrical characteristics at 25°C case temperature

PARAMETER		TEST CONDITIONS	MIN	MAX	UNIT
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	$I_C = 30 \text{ mA}$, $I_B = 0$, See Note 5	80		V
I_{CER}	Collector Cutoff Current	$V_{CE} = 70 \text{ V}$, $R_{BE} = 100 \Omega$		1	mA
I_{CEO}	Collector Cutoff Current	$V_{CE} = 30 \text{ V}$, $I_B = 0$		0.7	mA
I_{CEV}	Collector Cutoff Current	$V_{CE} = 100 \text{ V}$, $V_{BE} = -1.5 \text{ V}$		8	mA
I_{EBO}	Emitter Cutoff Current	$V_{EB} = 7 \text{ V}$, $I_C = 0$		5	mA
h_{FE}	Static Forward Current Transfer Ratio	$V_{CE} = 4 \text{ V}$, $I_C = 4 \text{ A}$, See Notes 5 and 6	20	70	
		$V_{CE} = 4 \text{ V}$, $I_C = 10 \text{ A}$, See Notes 5 and 6	5		
V_{BE}	Base-Emitter Voltage	$V_{CE} = 4 \text{ V}$, $I_C = 4 \text{ A}$, See Notes 5 and 6		1.8	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_B = 400 \text{ mA}$, $I_C = 4 \text{ A}$, See Notes 5 and 6		1.1	
		$I_B = 3.3 \text{ A}$, $I_C = 10 \text{ A}$, See Notes 5 and 6		2	V
h_{fe}	Small-Signal Common-Emitter Forward Current Transfer Ratio	$V_{CE} = 4 \text{ V}$, $I_C = 1 \text{ A}$, $f = 1 \text{ kHz}$	15		
f_{hfs}	Small-Signal Common-Emitter Forward Current Transfer Ratio Cutoff Frequency	$V_{CE} = 4 \text{ V}$, $I_C = 1 \text{ A}$, See Note 7	10		MHz

- NOTES: 5. These parameters must be measured using pulse techniques, $t_{pw} = 300 \mu\text{s}$, duty cycle $\leq 2\%$.
 6. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts.
 7. f_{hfs} is the frequency at which the magnitude of the small-signal forward current transfer ratio is 0.707 of its low-frequency value. For this device, the reference measurement is made at 1 kHz.

thermal characteristics

PARAMETER	MAX	UNIT
$R_{\theta JC}$ Junction-to-Case Thermal Resistance	1.39	$^{\circ}\text{C/W}$
$R_{\theta JA}$ Junction-to-Free-Air Thermal Resistance	35.7	

switching characteristics at 25°C case temperature

PARAMETER	TEST CONDITIONS†	TYF	UNIT
t_{on} Turn-On Time	$I_C = 6 \text{ A}$, $I_B(1) = 0.5 \text{ A}$, $I_B(2) = -0.5 \text{ A}$, $V_{BE(off)} = -4 \text{ V}$, $R_L = 5 \Omega$, See Figure 1	0.5	μs
t_{off} Turn-Off Time		1	

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

TYPE TIP3055 N-P-N SINGLE-DIFFUSED MESA SILICON POWER TRANSISTOR

PARAMETER MEASUREMENT INFORMATION

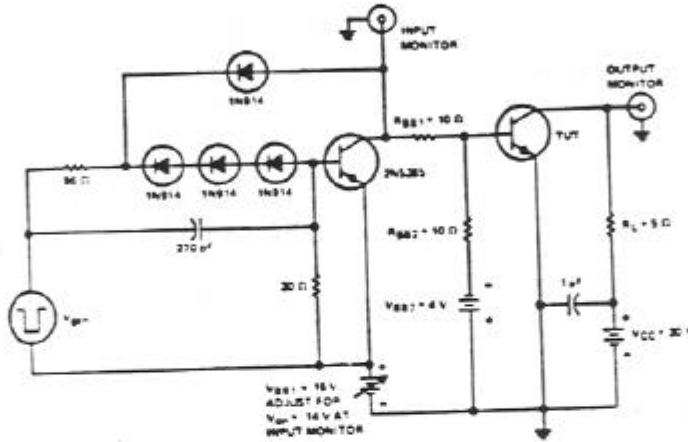
TRANSISTOR

PARAMETER	MIN	MAX	UNIT
$V_{CE(sat)}$ See Note 5	80		V
$I_{B(sat)}$		1	mA
$I_{C(sat)}$		0.7	mA
$V_{CE(sat)}$		5	mA
$V_{CE(sat)}$ See Notes 5 and 6	20	70	
$V_{CE(sat)}$ See Notes 5 and 6	5		
$V_{CE(sat)}$ See Notes 5 and 6	1.8		V
$V_{CE(sat)}$ See Notes 5 and 6	1.1		V
$V_{CE(sat)}$ See Notes 5 and 6	3		
$f = 1 \text{ kHz}$	15		
f See Note 7	10		kHz

$\leq 2\%$
1-carrying contacts.
water ratio is 0.707 of its low-frequency value

PARAMETER	MAX	UNIT
θ_{JA}	1.29	$^{\circ}\text{C/W}$
θ_{JC}	35.7	

PARAMETER	TYP	UNIT
I_{CM}	0.6	A
I_{CM}	1	A



TEST CIRCUIT

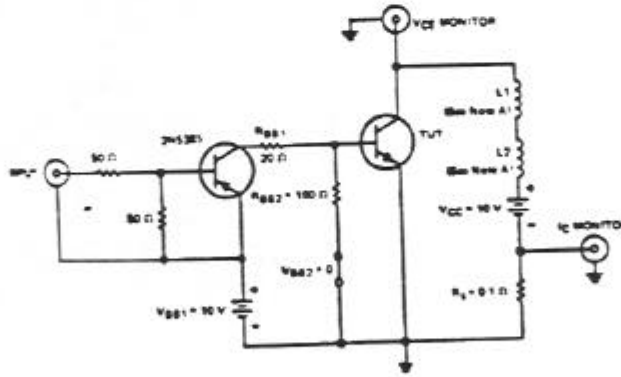


VOLTAGE WAVEFORMS

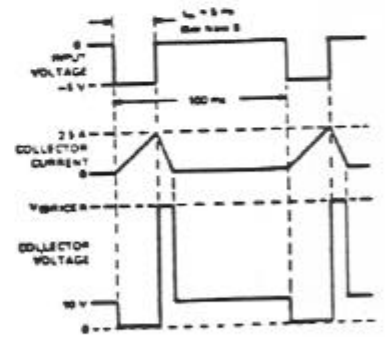
- NOTES
- V_{gen} is a -30-V pulse (from 0 V) into a $50\text{-}\Omega$ termination.
 - The V_{gen} waveform is supplied by a generator with the following characteristics: $t_r \leq 15 \text{ ns}$, $t_f \leq 15 \text{ ns}$, $Z_{out} = 50 \Omega$, $t_{on} = 20 \mu\text{s}$, duty cycle $\leq 2\%$.
 - Waveforms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

FIGURE 1

INDUCTIVE LOAD SWITCHING



TEST CIRCUIT



VOLTAGE AND CURRENT WAVEFORMS

- NOTES
- L_1 and L_2 are 10 mH, 0.11 Ω , Chicago Standard Transformer Corporation C-2688, or equivalent.
 - Input pulse width is increased until $I_{CM} = 2.5 \text{ A}$.

FIGURE 2

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TYPE TIP3055 N-P-N SINGLE-DIFFUSED MESA SILICON POWER TRANSISTOR

TYPICAL CHARACTERISTICS STATIC FORWARD CURRENT TRANSFER RATIO vs COLLECTOR CURRENT

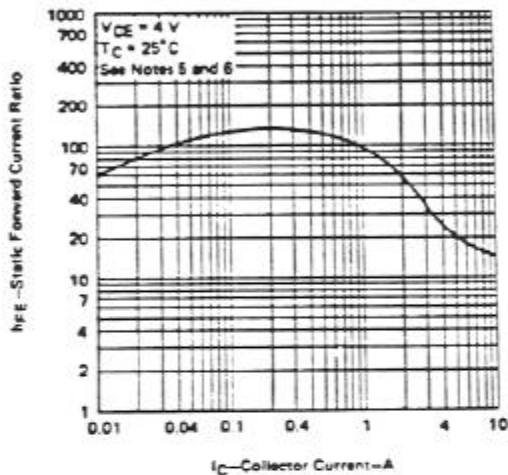


FIGURE 3

- NOTES: 5. These parameters must be measured using pulse techniques. $t_{on} = 300 \mu\text{s}$, duty cycle $\leq 2\%$.
6. These parameters are measured with voltage sensing contacts separate from the current-carrying contacts.

THERMAL INFORMATION

DISSIPATION DERATING CURVE

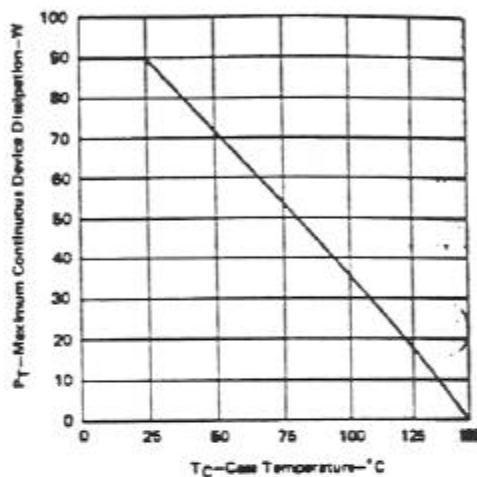


FIGURE 4

MAXIMUM SAFE OPERATING REGION

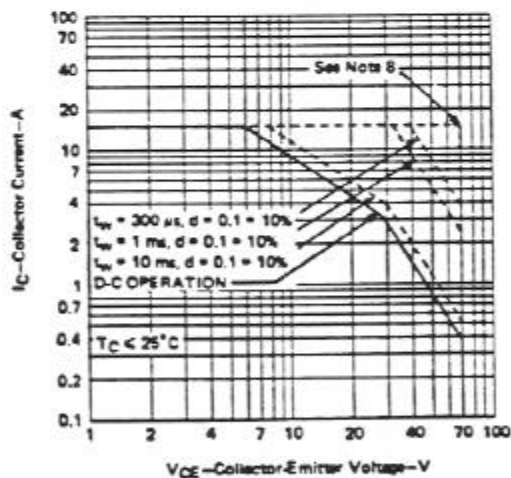


FIGURE 5

- NOTE 8: This combination of maximum voltage and current may be achieved only when switching from saturation to cutoff with a stored inductive load.

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