

## COMPLEMENTARY SILICON HIGH-POWER TRANSISTORS

General Purpose-Amplifier and Switching Application..

### FEATURES:

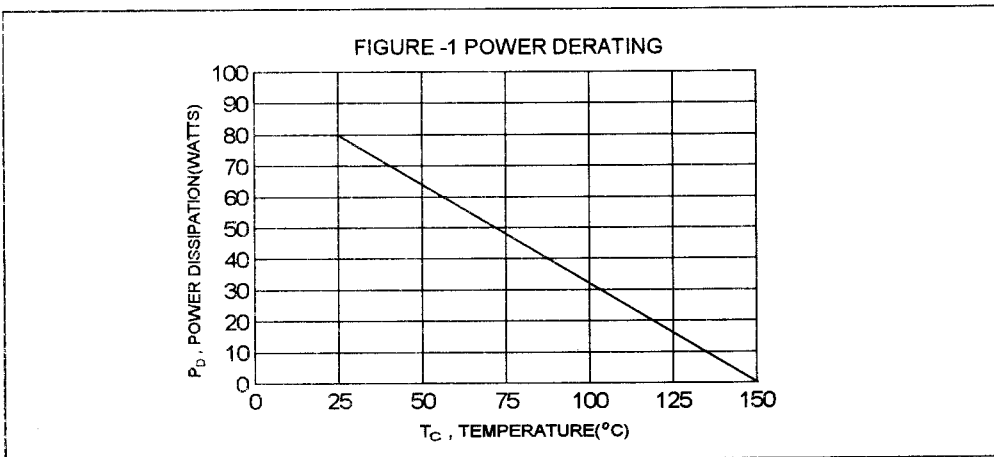
- \* Collector-Emitter Sustaining Voltage -  
 $V_{CEO(sus)} = 120V$  (Min)- TIP33D, TIP34D  
 $140V$  (Min)- TIP33E, TIP34E  
 $160V$  (Min)- TIP33F, TIP34F
- \* Current Gain-Bandwidth Product-  
 $f_T = 3.0MHz$ (Min)@ $I_C = 0.5 A$

### MAXIMUM RATINGS

Characteristic	Symbol	TIP33D TIP34D	TIP33E TIP34E	TIP33F TIP34F	Unit
Collector-Emitter Voltage	$V_{CEO}$	120	140	160	V
Collector-Base Voltage	$V_{CBO}$	160	180	200	V
Emitter-Base Voltage	$V_{EBO}$	5			V
Collector Current - Continuous - Peak	$I_C$	10 15			A
Base Current	$I_B$	3			A
Total Power Dissipation@ $T_C = 25^\circ C$ Derate above $25^\circ C$	$P_D$	80 0.64			W W/ $^\circ C$
Operating and Storage Junction Temperature Range	$T_J, T_{STG}$	-65 to +150			$^\circ C$

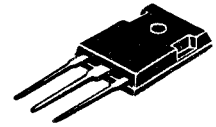
### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance Junction to Case	$R_{\theta jc}$	1.56	$^\circ C/W$

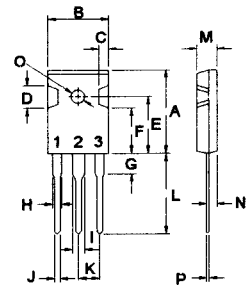


NPN	PNP
TIP33D	TIP34D
TIP33E	TIP34E
TIP33F	TIP34F

10 AMPERE  
COMPLEMENTARY SILICON  
POWER TRANSISTORS  
120-160 VOLTS  
80 WATTS



TO-247 (3P)



PIN 1.BASE  
2.COLLECTOR  
3.EMITTER

DIM	MILLIMETERS	
	MIN	MAX
A	20.63	22.38
B	15.38	16.20
C	1.90	2.70
D	5.10	6.10
E	14.81	15.22
F	11.72	12.84
G	4.20	4.50
H	1.82	2.46
I	2.92	3.23
J	0.89	1.53
K	5.26	5.66
L	18.50	21.50
M	4.76	5.24
O	3.25	3.65

TIP33D, TIP33E, TIP33F NPN / TIP34D, TIP34E, TIP34F PNP

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

Characteristic	Symbol	Min	Max	Unit
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**OFF CHARACTERISTICS**

Collector -Emitter Breakdown Voltage (1) ( $I_C = 30\text{ mA}$ , $I_B = 0$ )	TIP33D, TIP34D TIP33E, TIP34E TIP33F, TIP34F	$V_{(BR)CEO}$	120 140 160	V
Collector Cutoff Current ( $V_{CE} = 90\text{ V}$ , $I_B = 0$ )		$I_{CEO}$	0.7	mA
Collector Cutoff Current ( $V_{CE} = 160\text{ V}$ , $V_{BE} = 0$ ) ( $V_{CE} = 180\text{ V}$ , $V_{BE} = 0$ ) ( $V_{CE} = 200\text{ V}$ , $V_{BE} = 0$ )	TIP33D, TIP34D TIP33E, TIP34E TIP33F, TIP34F	$I_{CES}$	0.4 0.4 0.4	mA
Emitter-Base Cutoff Current ( $V_{EB} = 5.0\text{ V}$ , $I_C = 0$ )		$I_{EBO}$	1.0	mA

**ON CHARACTERISTICS (1)**

DC Current Gain ( $I_C = 1.0\text{ A}$ , $V_{CE} = 4.0\text{ V}$ ) ( $I_C = 3.0\text{ A}$ , $V_{CE} = 4.0\text{ V}$ )		$h_{FE}$	40 20	
Collector-Emitter Saturation Voltage ( $I_C = 3.0\text{ A}$ , $I_B = 0.3\text{ A}$ ) ( $I_C = 10\text{ A}$ , $I_B = 3.3\text{ A}$ )		$V_{CE(sat)}$	1.0 4.0	V
Base-Emitter On Voltage ( $I_C = 3.0\text{ A}$ , $V_{CE} = 4.0\text{ V}$ ) ( $I_C = 10\text{ A}$ , $V_{CE} = 4.0\text{ V}$ )		$V_{BE(on)}$	1.6 3.0	V

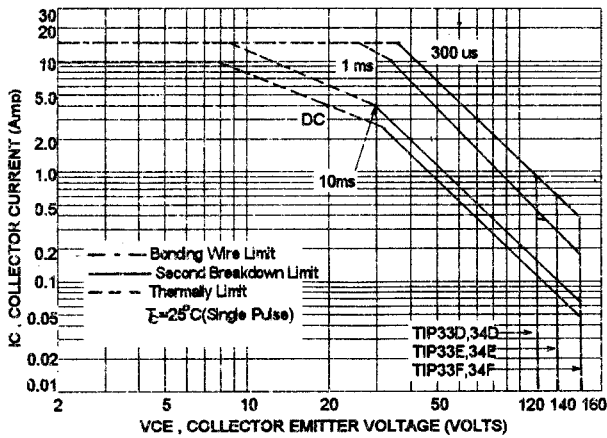
**DYNAMIC CHARACTERISTICS**

Current-Gain-Bandwidth Product ( $I_C = 0.5\text{ A}$ , $V_{CE} = 10\text{ V}$ , $f = 1.0\text{ MHz}$ )		$f_T$	3.0	MHz
Small-Signal Current Gain ( $I_C = 0.5\text{ A}$ , $V_{CE} = 10\text{ V}$ , $f = 1.0\text{ KHz}$ )		$h_{fe}$	12	

(1) Pulse Test: Pulse width  $\leq 300\text{ us}$ , Duty Cycle  $\leq 2.0\%$

(2)  $f_T = |h_{fe}| \cdot f_{TEST}$

FIG-2 ACTIVE- REGION SAFE OPERATING AREA

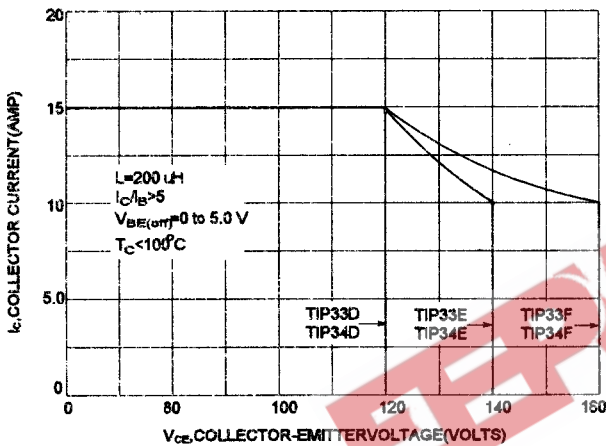


FORWARD BIAS

There are two limitation 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 curves indicate.

The data of FIG-2 is base on:  $T_C = 25^\circ\text{C}$ ;  $T_{J(PK)}$  is variable depending on power level. Second breakdown pulse limits are valid for duty cycles to 10% but must be derated when  $T_C \geq 25^\circ\text{C}$ , second breakdown limitations do not derate the same as thermal limitations.

FIG-3 REVERSE BIAS SAFE OPERATING AREA



REVERSE BIAS

For inductive loads, high voltage and high current must be sustained simultaneously during turn-off, in most cases with the base-to-emitter junction reverse biased under these conditions the collector voltage must be held to a safe level at or below a specific value of collector current. This can be accomplished by several means such as active clamping, RC snubbing, load line shaping, etc. the safe level for these devices is specified as Reverse Bias Safe Operating Area and represents the voltage-current condition allowable during reverse biased turn-off. This rating is verified under clamped conditions so that the device is never subjected to an avalanche mode. FIG-3 gives the RBSOA characteristics.

FIG-4 DC CURRENT GAIN

