

## COMPLEMENTARY SILICON HIGH-POWER TRANSISTORS

General Purpose-Amplifier and Switching Application..

### FEATURES:

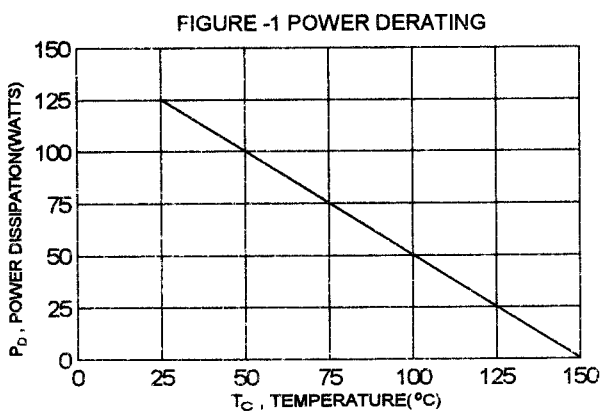
- \* Collector-Emitter Sustaining Voltage -  
 $V_{CEO(sus)}$  = 120V (Min)- TIP35D, TIP36D  
                   140V (Min)- TIP35E, TIP36E  
                   160V (Min)- TIP35F, TIP36F
- \* Current Gain-Bandwidth Product-  
 $f_T = 3.0\text{MHz}(\text{Min}) @ I_C = 1\text{A}$

### MAXIMUM RATINGS

Characteristic	Symbol	TIP35D TIP36D	TIP35E TIP36E	TIP35F TIP36F	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	$I_C$	25 40			A
Base Current	$I_B$	5			A
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	125 1.0			W W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{STG}$	-65 to +150			$^\circ\text{C}$

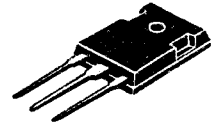
### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance Junction to Case	$R_{\theta jc}$	1.0	$^\circ\text{C}/\text{W}$

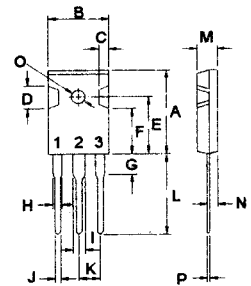


<b>NPN</b>	<b>PNP</b>
<b>TIP35D</b>	<b>TIP36D</b>
<b>TIP35E</b>	<b>TIP36E</b>
<b>TIP35F</b>	<b>TIP36F</b>

25 AMPERE  
COMPLEMENTARY SILICON  
POWER TRANSISTORS  
120-160 VOLTS  
125 WATTS



**TO-247 (3P)**



PIN 1.BASE  
2.COLLECTOR  
3.EMITTER  
4.COLLECTOR

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

TIP35D, TIP35E, TIP35F NPN / TIP36D, TIP36E, TIP36F 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) ( $I_c = 30\text{ mA}, I_B = 0$ )	TIP35D, TIP36D TIP35E, TIP36E TIP35F, TIP36F	$V_{(BR)CEO}$	120 140 160	V
Collector Cutoff Current ( $V_{CE} = 90\text{ V}, I_B = 0$ )		$I_{CEO}$		1.0 mA
Collector Cutoff Current ( $V_{CE} = 160\text{ V}, V_{BE} = 0$ ) ( $V_{CE} = 180\text{ V}, V_{BE} = 0$ ) ( $V_{CE} = 200\text{ V}, V_{BE} = 0$ )	TIP35D, TIP36D TIP35E, TIP36E TIP35F, TIP36F	$I_{CES}$		0.7 0.7 0.7 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 ( $I_c = 1.5\text{ A}, V_{CE} = 4.0\text{ V}$ ) ( $I_c = 15\text{ A}, V_{CE} = 4.0\text{ V}$ )		$h_{FE}$	25 8.0	
Collector-Emitter Saturation Voltage ( $I_c = 15\text{ A}, I_B = 3.0\text{ A}$ ) ( $I_c = 25\text{ A}, I_B = 6.25\text{ A}$ )		$V_{CE(sat)}$		2.5 5.0 V
Base-Emitter On Voltage ( $I_c = 15\text{ A}, V_{CE} = 4.0\text{ V}$ ) ( $I_c = 25\text{ A}, V_{CE} = 4.0\text{ V}$ )		$V_{BE(on)}$		2.0 4.0 V

**DYNAMIC CHARACTERISTICS**

Current-Gain-Bandwidth Product ( $I_c = 1.0\text{ A}, V_{CE} = 10\text{ V}, f = 1.0\text{ MHz}$ )		$f_T$	3.0	MHz
Small-Signal Current Gain ( $I_c = 1.0\text{ A}, V_{CE} = 4.0\text{ V}, f = 1.0\text{ KHz}$ )		$h_{fe}$	12	

**SWITCHING CHARACTERISTICS**

Turn On Time	$I_c = 15\text{ A}, I_{B1} = -I_{B2} = 1.5\text{ A}$ $V_{BE(off)} = 4.15\text{ V}, R_L = 2\ \Omega$	$t_{on}$	1.2	us
Off Time		$t_{off}$	0.9	us

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

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

FIG-2 DC CURRENT GAIN

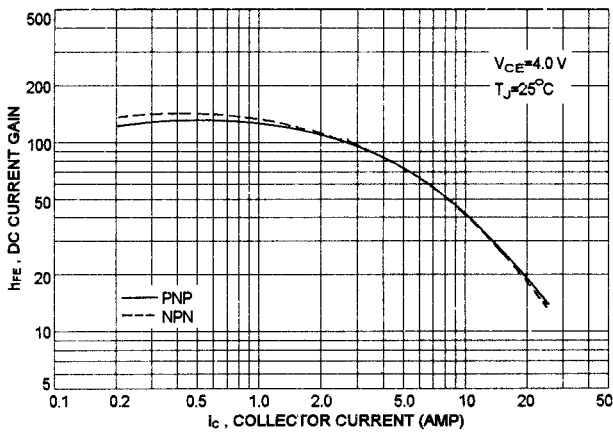


FIG-3 TURN-OFF TIME

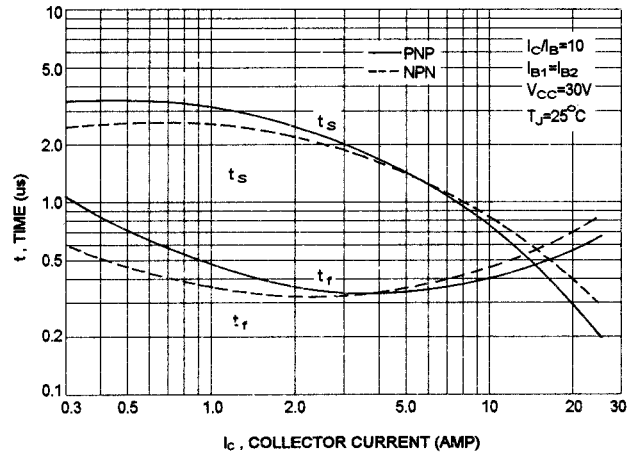


FIG-4 TURN-ON TIME

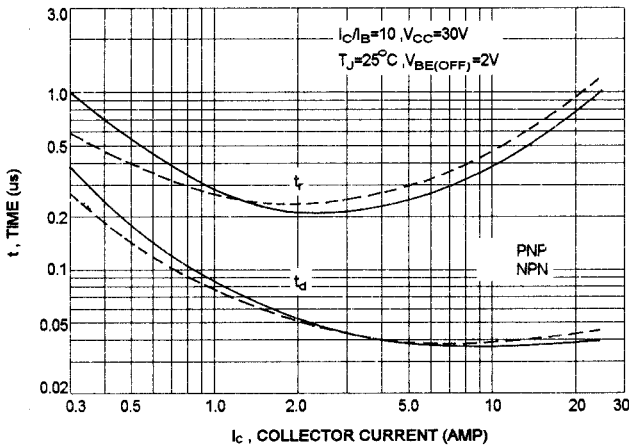


FIG-5 REVERSE BIASE SAFE OPERATING AREA

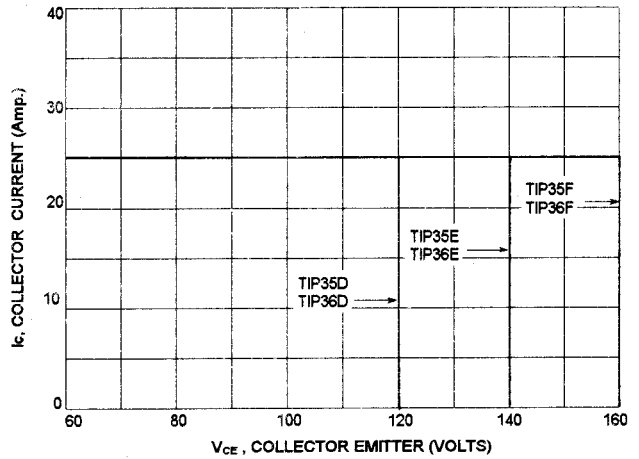
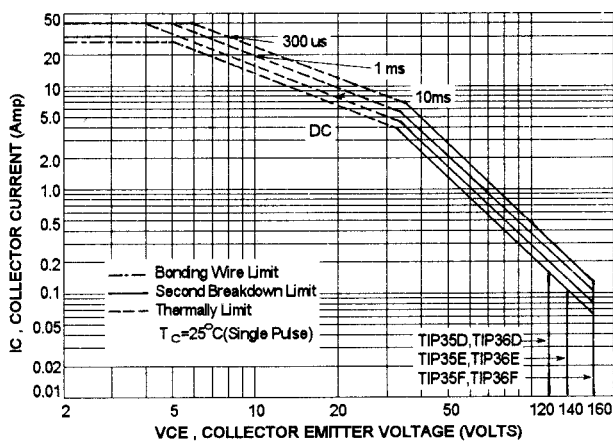


FIG-6 ACTIVE REGION SAFE OPERATING AREA



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-6 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.