

Complementary Silicon High-Power Transistors

... for general-purpose power amplifier and switching applications.

- 25 A Collector Current
- Low Leakage Current —
 $I_{CEO} = 1.0 \text{ mA @ } 30 \text{ and } 60 \text{ V}$
- Excellent DC Gain —
 $h_{FE} = 40 \text{ Typ @ } 15 \text{ A}$
- High Current Gain Bandwidth Product —
 $|h_{fe}| = 3.0 \text{ min @ } I_C$
 $= 1.0 \text{ A, } f = 1.0 \text{ MHz}$

MAXIMUM RATINGS

Rating	Symbol	TIP35A TIP36A	TIP35B TIP36B	TIP35C TIP36C	Unit
Collector–Emitter Voltage	V_{CEO}	60 V	80 V	100 V	Vdc
Collector–Base Voltage	V_{CB}	60 V	80 V	100 V	Vdc
Emitter–Base Voltage	V_{EB}	5.0			Vdc
Collector Current — Continuous Peak (1)	I_C	25 40			Adc
Base Current — Continuous	I_B	5.0			Adc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	125 1.0			Watts W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{stg}	–65 to +150			$^\circ\text{C}$
Unclamped Inductive Load	E_{SB}	90			mJ

THERMAL CHARACTERISTICS

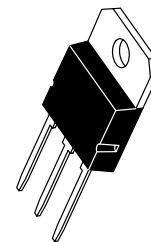
Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.0	$^\circ\text{C/W}$
Junction–To–Free–Air Thermal Resistance	$R_{\theta JA}$	35.7	$^\circ\text{C/W}$

(1) Pulse Test: Pulse Width = 10 ms, Duty Cycle $\leq 10\%$.

NPN
TIP35A
TIP35B*
TIP35C*
PNP
TIP36A
TIP36B*
TIP36C*

*ON Semiconductor Preferred Device

**25 AMPERE
 COMPLEMENTARY
 SILICON
 POWER TRANSISTORS
 60–100 VOLTS
 125 WATTS**



**CASE 340D–02
 TO–218AC**

Preferred devices are ON Semiconductor recommended choices for future use and best overall value.

TIP35A TIP35B TIP35C TIP36A TIP36B TIP36C

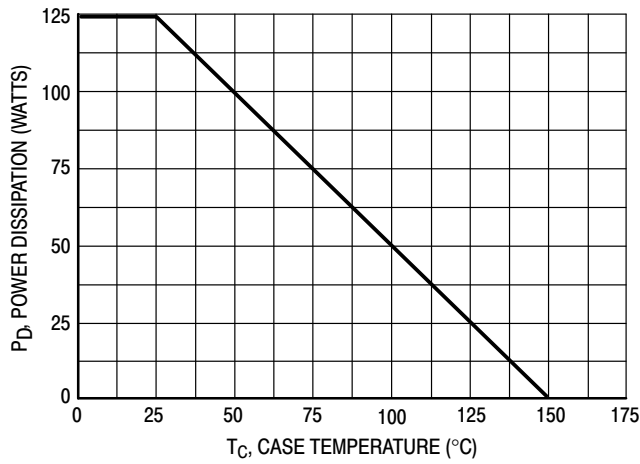


Figure 1. Power Derating

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector–Emitter Sustaining Voltage (1) ($I_C = 30\text{ mA}$, $I_B = 0$) TIP35A, TIP36A TIP35B, TIP36B TIP35C, TIP36C	$V_{CEO(sus)}$	60 80 100	—	Vdc
Collector–Emitter Cutoff Current ($V_{CE} = 30\text{ V}$, $I_B = 0$) ($V_{CE} = 60\text{ V}$, $I_B = 0$) TIP35A, TIP36A TIP35B, TIP35C, TIP36B, TIP36C	I_{CEO}	— —	1.0 1.0	mA
Collector–Emitter Cutoff Current ($V_{CE} = \text{Rated } V_{CEO}$, $V_{EB} = 0$)	I_{CES}	—	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 15	— 75	—
Collector–Emitter Saturation Voltage ($I_C = 15\text{ A}$, $I_B = 1.5\text{ A}$) ($I_C = 25\text{ A}$, $I_B = 5.0\text{ A}$)	$V_{CE(sat)}$	— —	1.8 4.0	Vdc
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	Vdc
DYNAMIC CHARACTERISTICS				
Small–Signal Current Gain ($I_C = 1.0\text{ A}$, $V_{CE} = 10\text{ V}$, $f = 1.0\text{ kHz}$)	h_{fe}	25	—	—
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

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

TIP35A TIP35B TIP35C TIP36A TIP36B TIP36C

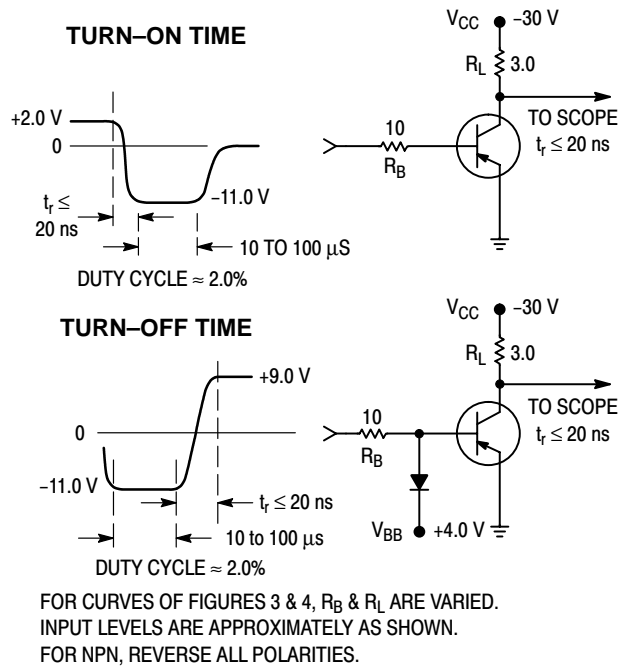


Figure 2. Switching Time Equivalent Test Circuits

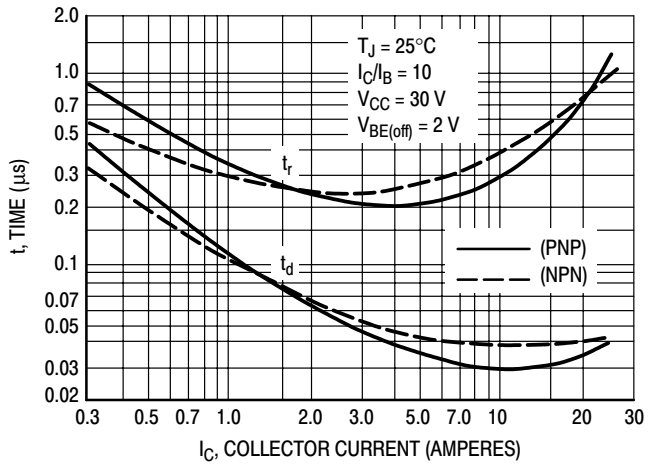


Figure 3. Turn-On Time

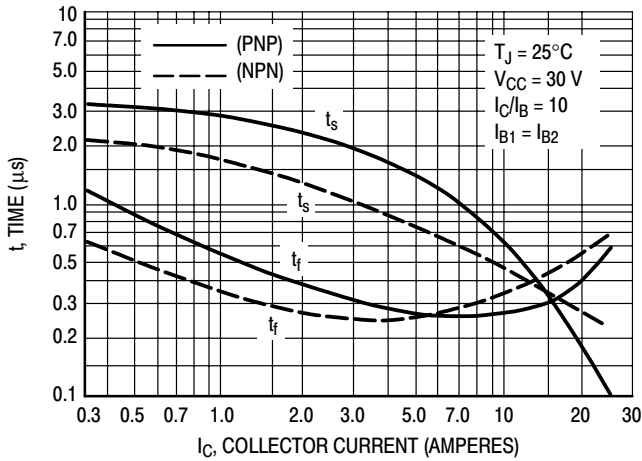


Figure 4. Turn-Off Time

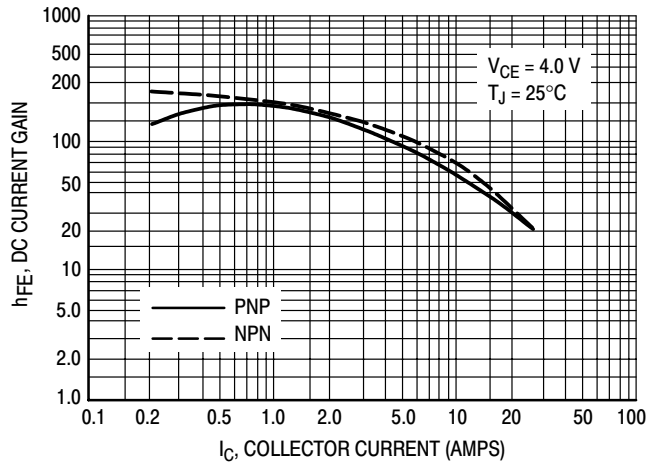


Figure 5. DC Current Gain

FORWARD BIAS

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 $T_C = 25^\circ\text{C}$; $T_{J(pk)}$ 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.

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 conditions during reverse biased turn-off. This rating is verified under clamped conditions so that the device is never subjected to an avalanche mode. Figure 7 gives RBSOA characteristics.

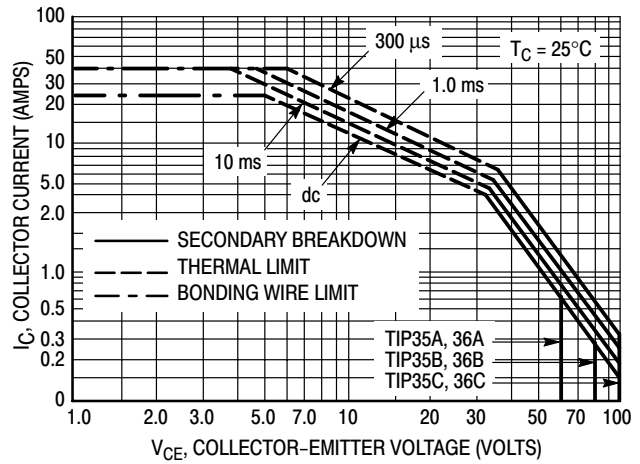


Figure 6. Maximum Rated Forward Bias Safe Operating Area

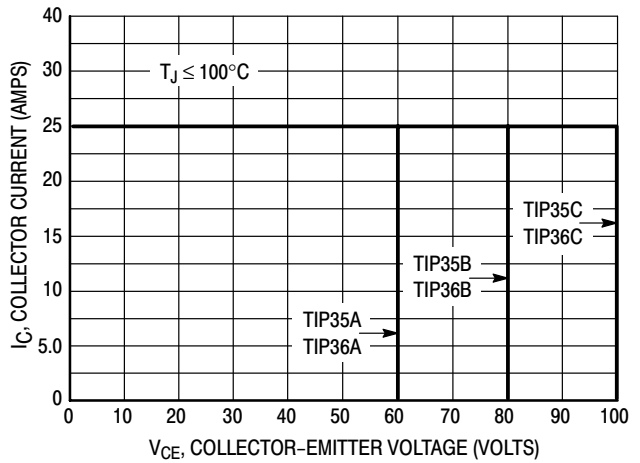
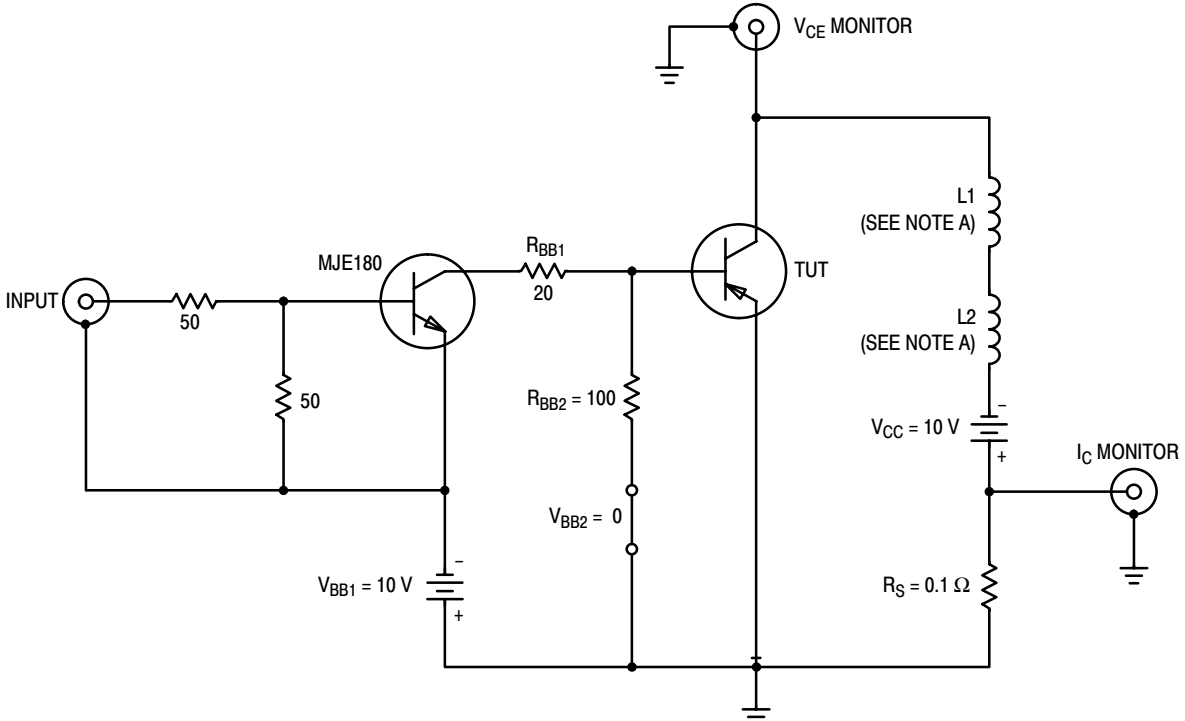
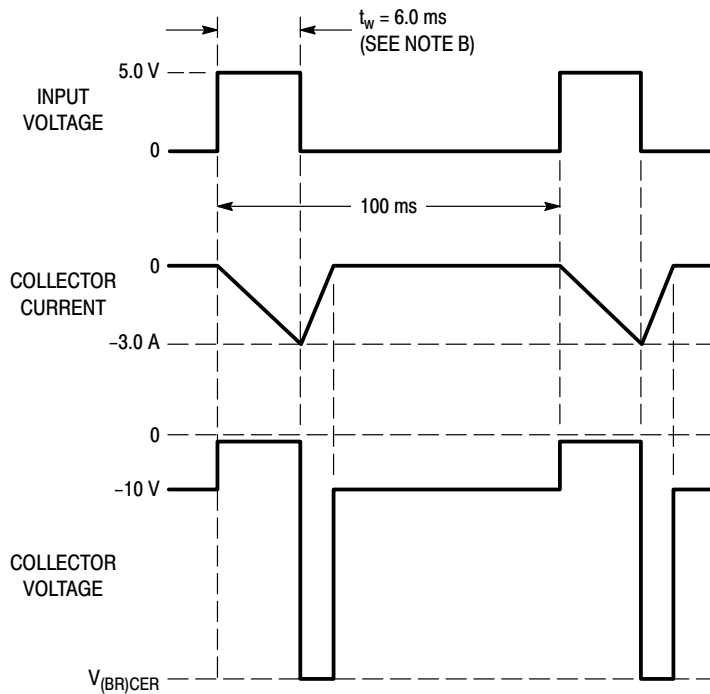


Figure 7. Maximum Rated Forward Bias Safe Operating Area

TEST CIRCUIT



VOLTAGE AND CURRENT WAVEFORMS



NOTES:

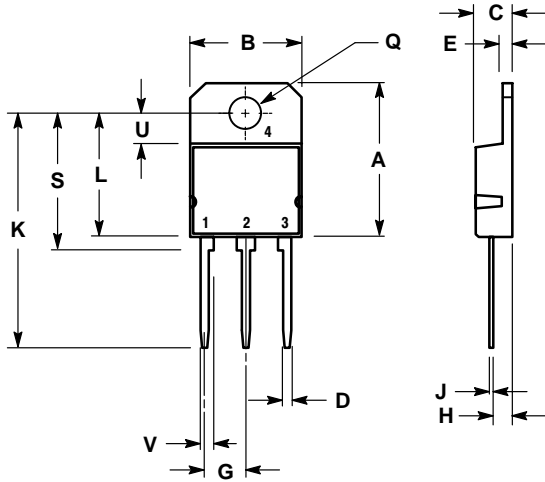
- A. L1 and L2 are 10 mH, 0.11 Ω , Chicago Standard Transformer Corporation C-2688, or equivalent.
- B. Input pulse width is increased until $I_{CM} = -3.0$ A.
- C. For NPN, reverse all polarities.

Figure 8. Inductive Load Switching

TIP35A TIP35B TIP35C TIP36A TIP36B TIP36C

PACKAGE DIMENSIONS

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
2. COLLECTOR
3. EMITTER
4. COLLECTOR

Notes

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer.

PUBLICATION ORDERING INFORMATION

Literature Fulfillment:

Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: ONlit@hibbertco.com

N. American Technical Support: 800-282-9855 Toll Free USA/Canada

JAPAN: ON Semiconductor, Japan Customer Focus Center
4-32-1 Nishi-Gotanda, Shinagawa-ku, Tokyo, Japan 141-0031
Phone: 81-3-5740-2700
Email: r14525@onsemi.com

ON Semiconductor Website: <http://onsemi.com>

For additional information, please contact your local Sales Representative.