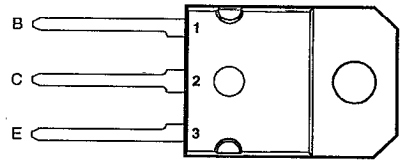
TIP33, TIP33A, TIP33B, TIP33C
NPN SILICON POWER TRANSISTORS

JULY 1968 - REVISED MAY 1995

- **Designed for Complementary Use with the TIP34 Series**
- **80 W at 25°C Case Temperature**
- **10 A Continuous Collector Current**
- **15 A Peak Collector Current**
- **Customer-Specified Selections Available**

SOT-93 PACKAGE
(TOP VIEW)



Pin 2 is in electrical contact with the mounting base.

MDTRAA

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

RATING		SYMBOL	VALUE	UNIT
Collector-base voltage (I_E = 0)	TIP33	V_{CBO}	80	V
	TIP33A		100	
	TIP33B		120	
	TIP33C		140	
Collector-emitter voltage (I_B = 0)	TIP33	V_{CEO}	40	V
	TIP33A		60	
	TIP33B		80	
	TIP33C		100	
Emitter-base voltage		V_{EBO}	5	V
Continuous collector current		I_C	10	A
Peak collector current (see Note 1)		I_{CM}	15	A
Continuous base current		I_B	3	A
Continuous device dissipation at (or below) 25°C case temperature (see Note 2)		P_{tot}	80	W
Continuous device dissipation at (or below) 25°C free air temperature (see Note 3)		P_{tot}	3.5	W
Unclamped inductive load energy (see Note 4)		$\frac{1}{2}LI_C^2$	62.5	mJ
Operating junction temperature range		T_j	-65 to +150	°C
Storage temperature range		T_{stg}	-65 to +150	°C
Lead temperature 3.2 mm from case for 10 seconds		T_L	250	°C

NOTES: 1. This value applies for $t_p \leq 0.3$ ms, duty cycle $\leq 10\%$.
2. Derate linearly to 150°C case temperature at the rate of 0.64 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 a circuit of: L = 20 mH, $I_{B(on)}$ = 0.4 A, R_{BE} = 100 Ω, $V_{BE(off)}$ = 0, R_S = 0.1 Ω, V_{CC} = 20 V.

JULY 1968 - REVISED MAY 1995

electrical characteristics at 25°C case temperature

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
$V_{(BR)CEO}$	Collector-emitter breakdown voltage	I_C = 30 mA (see Note 5)	I_B = 0	TIP33	40			V
				TIP33A	60			
				TIP33B	80			
				TIP33C	100			
I_{CES}	Collector-emitter cut-off current	V_{CE} = 80 V	V_{BE} = 0	TIP33			0.4	mA
		V_{CE} = 100 V	V_{BE} = 0	TIP33A			0.4	
		V_{CE} = 120 V	V_{BE} = 0	TIP33B			0.4	
		V_{CE} = 140 V	V_{BE} = 0	TIP33C			0.4	
I_{CEO}	Collector cut-off current	V_{CE} = 30 V	I_B = 0	TIP33/33A			0.7	mA
		V_{CE} = 60 V	I_B = 0	TIP33B/33C			0.7	
I_{EBO}	Emitter cut-off current	V_{EB} = 5 V	I_C = 0				1	mA
h_{FE}	Forward current transfer ratio	V_{CE} = 4 V	I_C = 1 A	(see Notes 5 and 6)	40			
		V_{CE} = 4 V	I_C = 3 A		20		100	
$V_{CE(sat)}$	Collector-emitter saturation voltage	I_B = 0.3 A	I_C = 3 A	(see Notes 5 and 6)			1	V
		I_B = 2.5 A	I_C = 10 A				4	
V_{BE}	Base-emitter voltage	V_{CE} = 4 V	I_C = 3 A	(see Notes 5 and 6)			1.6	V
		V_{CE} = 4 V	I_C = 10 A				3	
h_{fe}	Small signal forward current transfer ratio	V_{CE} = 10 V	I_C = 0.5 A	f = 1 kHz	20			
$\|h_{fe}\|$	Small signal forward current transfer ratio	V_{CE} = 10 V	I_C = 0.5 A	f = 1 MHz	3			

NOTES: 5. These parameters must be measured using pulse techniques, t_p = 300 µs, duty cycle ≤ 2%.
6. These parameters must be measured using voltage-sensing contacts, separate from the current carrying contacts.

thermal characteristics

PARAMETER		MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to case thermal resistance			1.56	°C/W
$R_{\theta JA}$	Junction to free air thermal resistance			35.7	°C/W

resistive-load-switching characteristics at 25°C case temperature

PARAMETER		TEST CONDITIONS †			MIN	TYP	MAX	UNIT
t_{on}	Turn-on time	I_C = 6 A	$I_{B(on)}$ = 0.6 A	$I_{B(off)}$ = -0.6 A		0.6		µs
t_{off}	Turn-off time	$V_{BE(off)}$ = -4 V	R_L = 5 Ω	t_p = 20 µs, dc ≤ 2%		1		µs

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

JULY 1968 - REVISED MAY 1995

TYPICAL CHARACTERISTICS

TYPICAL DC CURRENT GAIN
vs
COLLECTOR CURRENT

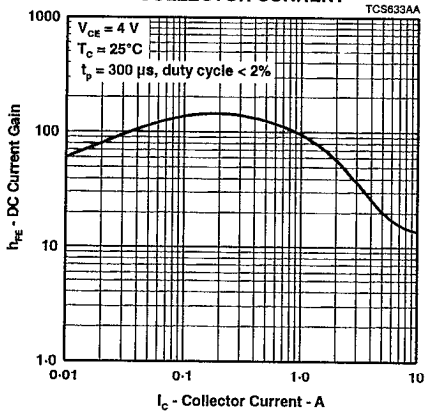


Figure 1.

COLLECTOR-EMITTER SATURATION VOLTAGE
vs
BASE CURRENT

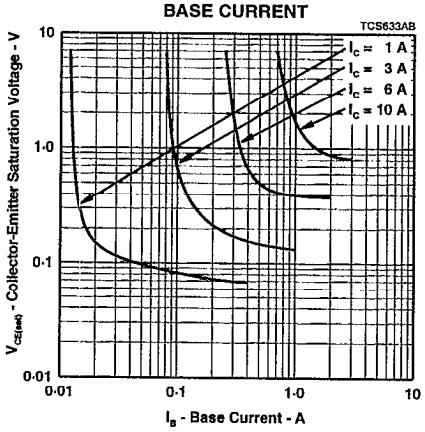


Figure 2.

BASE-EMITTER VOLTAGE
vs
COLLECTOR CURRENT

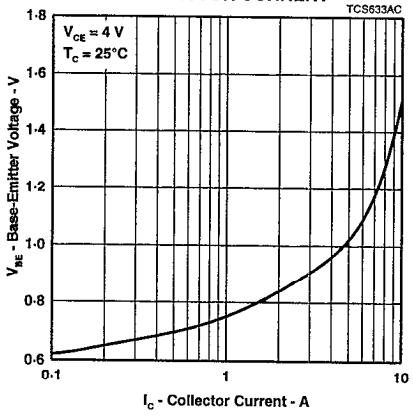


Figure 3.

MAXIMUM SAFE OPERATING REGIONS

MAXIMUM FORWARD-BIAS
SAFE OPERATING AREA

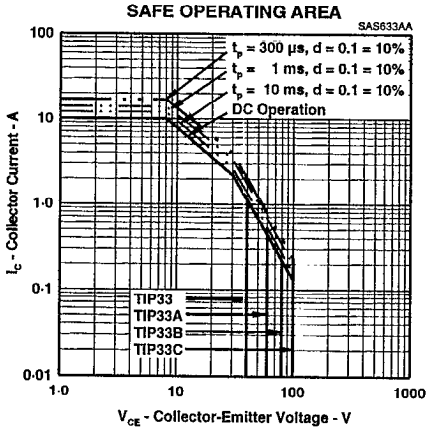


Figure 4.

THERMAL INFORMATION

MAXIMUM POWER DISSIPATION
vs
CASE TEMPERATURE

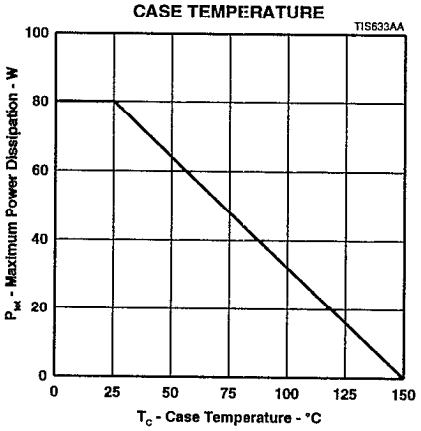


Figure 5.

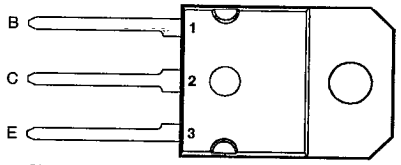
TEXAS INSTRUMENTS

TIP34, TIP34A, TIP34B, TIP34C
PNP SILICON POWER TRANSISTORS

JULY 1968 - REVISED MAY 1995

- **Designed for Complementary Use with the TIP33 Series**
- **80 W at 25°C Case Temperature**
- **10 A Continuous Collector Current**
- **15 A Peak Collector Current**
- **Customer-Specified Selections Available**

SOT-93 PACKAGE
(TOP VIEW)



Pin 2 is in electrical contact with the mounting base.

MDTRAA

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

RATING		SYMBOL	VALUE	UNIT
Collector-base voltage (I_E = 0)	TIP34	V_{CBO}	-80	V
	TIP34A		-100	
	TIP34B		-120	
	TIP34C		-140	
Collector-emitter voltage (I_B = 0)	TIP34	V_{CEO}	-40	V
	TIP34A		-60	
	TIP34B		-80	
	TIP34C		-100	
Emitter-base voltage		V_{EBO}	-5	V
Continuous collector current		I_C	-10	A
Peak collector current (see Note 1)		I_{CM}	-15	A
Continuous base current		I_B	-3	A
Continuous device dissipation at (or below) 25°C case temperature (see Note 2)		P_{tot}	80	W
Continuous device dissipation at (or below) 25°C free air temperature (see Note 3)		P_{tot}	3.5	W
Unclamped inductive load energy (see Note 4)		$½LI_C^2$	62.5	mJ
Operating junction temperature range		T_J	-65 to +150	°C
Storage temperature range		T_{stg}	-65 to +150	°C
Lead temperature 3.2 mm from case for 10 seconds		T_L	250	°C

NOTES: 1. This value applies for $t_p \leq 0.3$ ms, duty cycle $\leq 10\%$.
2. Derate linearly to 150°C case temperature at the rate of 0.64 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 a circuit of: L = 20 mH, $I_{B(on)}$ = -0.4 A, R_{BE} = 100 Ω, $V_{BE(off)}$ = 0, R_S = 0.1 Ω, V_{CC} = -20 V.

JULY 1968 - REVISED MAY 1995

electrical characteristics at 25°C case temperature

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
$V_{(BR)CEO}$	Collector-emitter breakdown voltage	I_C = -30 mA (see Note 5)	I_B = 0	TIP34	-40			V
				TIP34A	-60			
				TIP34B	-80			
				TIP34C	-100			
I_{CES}	Collector-emitter cut-off current	V_{CE} = -80 V	V_{BE} = 0	TIP34			-0.4	mA
		V_{CE} = -100 V	V_{BE} = 0	TIP34A			-0.4	
		V_{CE} = -120 V	V_{BE} = 0	TIP34B			-0.4	
		V_{CE} = -140 V	V_{BE} = 0	TIP34C			-0.4	
I_{CEO}	Collector cut-off current	V_{CE} = -30 V	I_B = 0	TIP34/34A			-0.7	mA
		V_{CE} = -60 V	I_B = 0	TIP34B/34C			-0.7	
I_{EBO}	Emitter cut-off current	V_{EB} = -5 V	I_C = 0				-1	mA
h_{FE}	Forward current transfer ratio	V_{CE} = -4 V	I_C = -1 A	(see Notes 5 and 6)	40			
		V_{CE} = -4 V	I_C = -3 A		20		100	
$V_{CE(sat)}$	Collector-emitter saturation voltage	I_B = -0.3 A	I_C = -3 A	(see Notes 5 and 6)			-1	V
		I_B = -2.5 A	I_C = -10 A				-4	
V_{BE}	Base-emitter voltage	V_{CE} = -4 V	I_C = -3 A	(see Notes 5 and 6)			-1.6	V
		V_{CE} = -4 V	I_C = -10 A				-3	
h_{fe}	Small signal forward current transfer ratio	V_{CE} = -10 V	I_C = -0.5 A	f = 1 kHz	20			
$\|h_{fe}\|$	Small signal forward current transfer ratio	V_{CE} = -10 V	I_C = -0.5 A	f = 1 MHz	3			

NOTES: 5. These parameters must be measured using pulse techniques, t_p = 300 µs, duty cycle ≤ 2%.
6. These parameters must be measured using voltage-sensing contacts, separate from the current carrying contacts.

thermal characteristics

PARAMETER		MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to case thermal resistance			1.56	°C/W
$R_{\theta JA}$	Junction to free air thermal resistance			35.7	°C/W

resistive-load-switching characteristics at 25°C case temperature

PARAMETER		TEST CONDITIONS †			MIN	TYP	MAX	UNIT
t_{on}	Turn-on time	I_C = -6 A	$I_{B(on)}$ = -0.6 A	$I_{B(off)}$ = 0.6 A		0.4		µs
t_{off}	Turn-off time	$V_{BE(off)}$ = 4 V	R_L = 5 Ω	t_p = 20 µs, dc ≤ 2%		0.7		µs

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

JULY 1968 - REVISED MAY 1995

TYPICAL CHARACTERISTICS

TYPICAL DC CURRENT GAIN vs COLLECTOR CURRENT

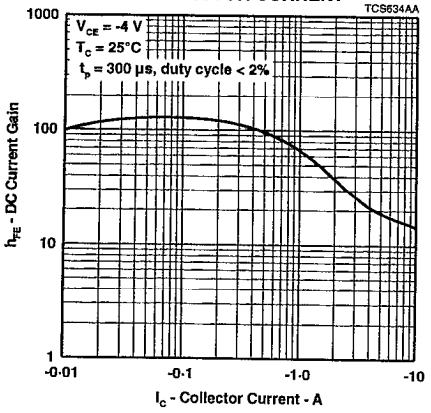


Figure 1.

COLLECTOR-EMITTER SATURATION VOLTAGE vs BASE CURRENT

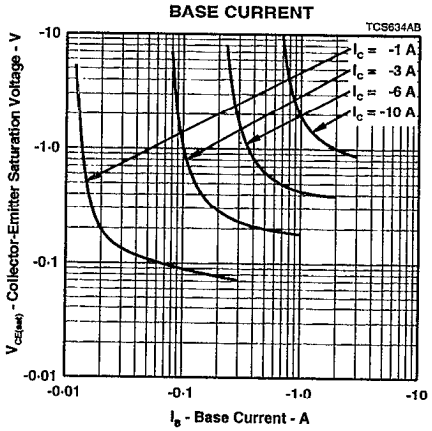


Figure 2.

BASE-EMITTER VOLTAGE vs COLLECTOR CURRENT

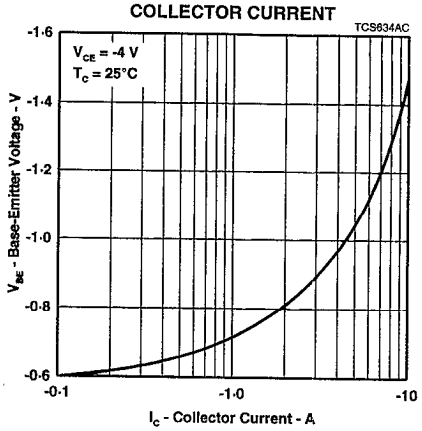


Figure 3.

MAXIMUM SAFE OPERATING REGIONS

MAXIMUM FORWARD-BIAS
SAFE OPERATING AREA

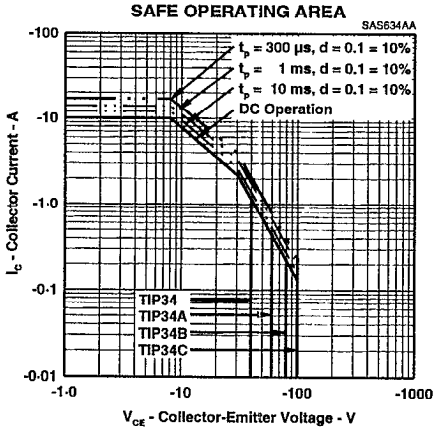


Figure 4.

THERMAL INFORMATION

MAXIMUM POWER DISSIPATION
VS
CASE TEMPERATURE

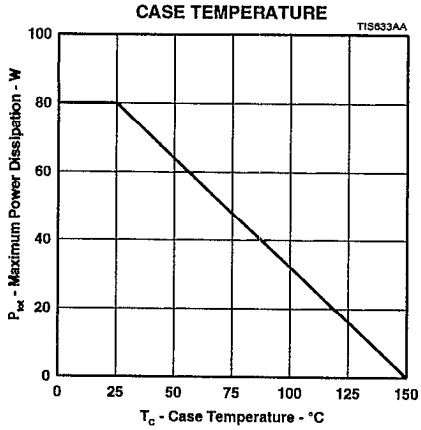


Figure 5.

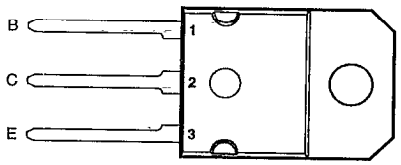
TEXAS INSTRUMENTS

TIP35, TIP35A, TIP35B, TIP35C
NPN SILICON POWER TRANSISTORS

JULY 1968 - REVISED MAY 1995

- **Designed for Complementary Use with the TIP36 Series**
- **125 W at 25°C Case Temperature**
- **25 A Continuous Collector Current**
- **40 A Peak Collector Current**
- **Customer-Specified Selections Available**

SOT-93 PACKAGE
(TOP VIEW)



Pin 2 is in electrical contact with the mounting base.

MDTRAA

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

RATING		SYMBOL	VALUE	UNIT
Collector-base voltage (I_E = 0)	TIP35	V_{CBO}	80	V
	TIP35A		100	
	TIP35B		120	
	TIP35C		140	
Collector-emitter voltage (I_B = 0)	TIP35	V_{CEO}	40	V
	TIP35A		60	
	TIP35B		80	
	TIP35C		100	
Emitter-base voltage		V_{EBO}	5	V
Continuous collector current		I_C	25	A
Peak collector current (see Note 1)		I_{CM}	40	A
Continuous base current		I_B	5	A
Continuous device dissipation at (or below) 25°C case temperature (see Note 2)		P_{tot}	125	W
Continuous device dissipation at (or below) 25°C free air temperature (see Note 3)		P_{tot}	3.5	W
Unclamped inductive load energy (see Note 4)		$½LI_C^2$	90	mJ
Operating junction temperature range		T_j	-65 to +150	°C
Storage temperature range		T_{stg}	-65 to +150	°C
Lead temperature 3.2 mm from case for 10 seconds		T_L	250	°C

NOTES: 1. This value applies for $t_p \leq 0.3$ ms, duty cycle $\leq 10\%$.
2. Derate linearly to 150°C case temperature at the rate of 1 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 a circuit of: L = 20 mH, $I_{B(on)}$ = 0.4 A, R_{BE} = 100 Ω, $V_{BE(off)}$ = 0, R_S = 0.1 Ω, V_{CC} = 20 V.

TEXAS INSTRUMENTS

JULY 1968 - REVISED MAY 1995

electrical characteristics at 25°C case temperature

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
$V_{(BR)CEO}$	Collector-emitter breakdown voltage	I_C = 30 mA (see Note 5)	I_B = 0	TIP35	40			V
				TIP35A	60			
				TIP35B	80			
				TIP35C	100			
I_{CES}	Collector-emitter cut-off current	V_{CE} = 80 V	V_{BE} = 0	TIP35			0.7	mA
		V_{CE} = 100 V	V_{BE} = 0	TIP35A			0.7	
		V_{CE} = 120 V	V_{BE} = 0	TIP35B			0.7	
		V_{CE} = 140 V	V_{BE} = 0	TIP35C			0.7	
I_{CEO}	Collector cut-off current	V_{CE} = 30 V	I_B = 0	TIP35/35A			1	mA
		V_{CE} = 60 V	I_B = 0	TIP35B/35C			1	
I_{EBO}	Emitter cut-off current	V_{EB} = 5 V	I_C = 0				1	mA
h_{FE}	Forward current transfer ratio	V_{CE} = 4 V	I_C = 1.5 A	(see Notes 5 and 6)	25			
		V_{CE} = 4 V	I_C = 15 A		10		50	
$V_{CE(sat)}$	Collector-emitter saturation voltage	I_B = 1.5 A	I_C = 15 A	(see Notes 5 and 6)			1.8	V
		I_B = 5 A	I_C = 25 A				4	
V_{BE}	Base-emitter voltage	V_{CE} = 4 V	I_C = 15 A	(see Notes 5 and 6)			2	V
		V_{CE} = 4 V	I_C = 25 A				4	
h_{fe}	Small signal forward current transfer ratio	V_{CE} = 10 V	I_C = 1 A	f = 1 kHz	25			
$\|h_{fe}\|$	Small signal forward current transfer ratio	V_{CE} = 10 V	I_C = 1 A	f = 1 MHz	3			

NOTES: 5. These parameters must be measured using pulse techniques, t_p = 300 µs, duty cycle ≤ 2%.
6. These parameters must be measured using voltage-sensing contacts, separate from the current carrying contacts.

thermal characteristics

PARAMETER		MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to case thermal resistance			1	°C/W
$R_{\theta JA}$	Junction to free air thermal resistance			35.7	°C/W

resistive-load-switching characteristics at 25°C case temperature

PARAMETER		TEST CONDITIONS †			MIN	TYP	MAX	UNIT
t_{on}	Turn-on time	I_C = 15 A	$I_{B(on)}$ = 1.5 A	$I_{B(off)}$ = -1.5 A		1.2		µs
t_{off}	Turn-off time	$V_{BE(off)}$ = -4.15 V	R_L = 2 Ω	t_p = 20 µs, dc ≤ 2%		0.9		µs

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

JULY 1968 - REVISED MAY 1995

TYPICAL CHARACTERISTICS

TYPICAL DC CURRENT GAIN vs COLLECTOR CURRENT

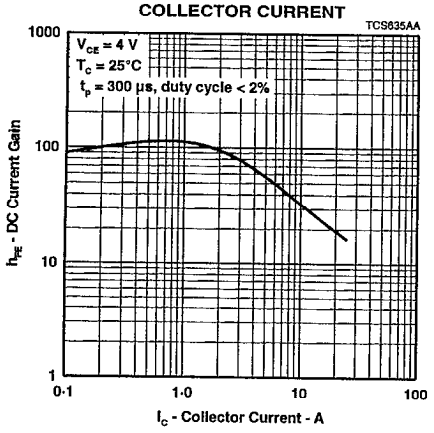


Figure 1.

COLLECTOR-EMITTER SATURATION VOLTAGE vs BASE CURRENT

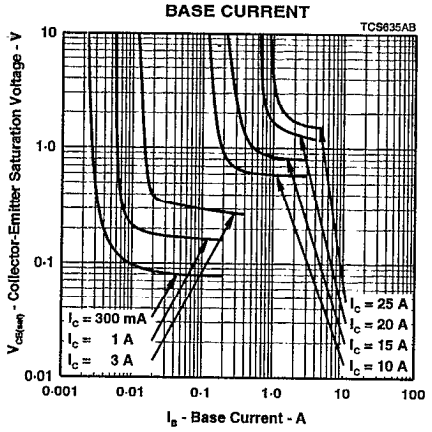


Figure 2.

BASE-EMITTER VOLTAGE vs COLLECTOR CURRENT

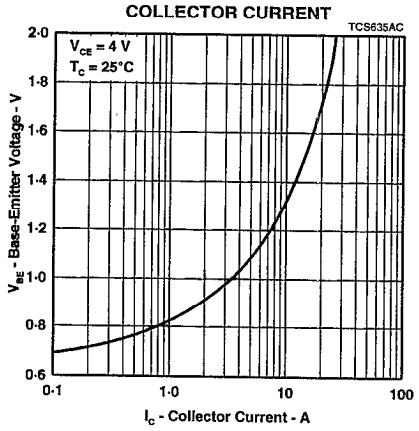


Figure 3.

MAXIMUM SAFE OPERATING REGIONS

MAXIMUM FORWARD-BIAS
SAFE OPERATING AREA

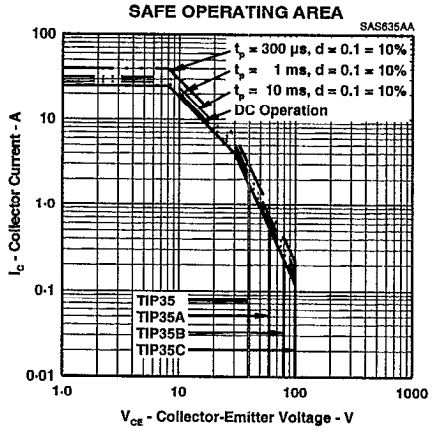


Figure 4.

THERMAL INFORMATION

MAXIMUM POWER DISSIPATION
vs
CASE TEMPERATURE

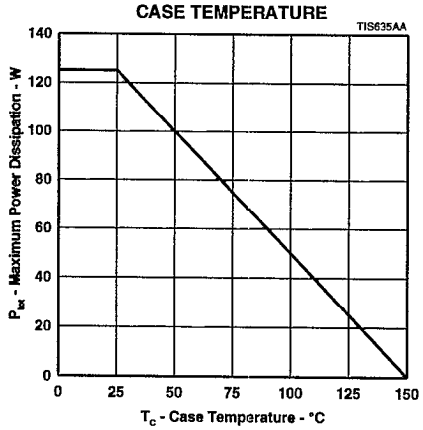


Figure 5.

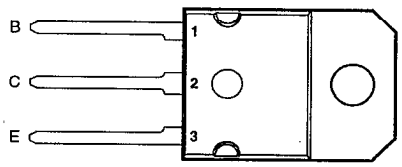
TEXAS INSTRUMENTS

TIP36, TIP36A, TIP36B, TIP36C
PNP SILICON POWER TRANSISTORS

JULY 1968 - REVISED MAY 1995

- **Designed for Complementary Use with the TIP35 Series**
- **125 W at 25°C Case Temperature**
- **25 A Continuous Collector Current**
- **40 A Peak Collector Current**
- **Customer-Specified Selections Available**

SOT-93 PACKAGE
(TOP VIEW)



Pin 2 is in electrical contact with the mounting base.

MDTRAA

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

RATING		SYMBOL	VALUE	UNIT
Collector-base voltage (I_E = 0)	TIP36	V_{CBO}	-80	V
	TIP36A		-100	
	TIP36B		-120	
	TIP36C		-140	
Collector-emitter voltage (I_B = 0)	TIP36	V_{CEO}	-40	V
	TIP36A		-60	
	TIP36B		-80	
	TIP36C		-100	
Emitter-base voltage		V_{EBO}	-5	V
Continuous collector current		I_C	-25	A
Peak collector current (see Note 1)		I_{CM}	-40	A
Continuous base current		I_B	-5	A
Continuous device dissipation at (or below) 25°C case temperature (see Note 2)		P_{tot}	125	W
Continuous device dissipation at (or below) 25°C free air temperature (see Note 3)		P_{tot}	3.5	W
Unclamped inductive load energy (see Note 4)		$½LI_C^2$	90	mJ
Operating junction temperature range		T_j	-65 to +150	°C
Storage temperature range		T_{stg}	-65 to +150	°C
Lead temperature 3.2 mm from case for 10 seconds		T_L	250	°C

NOTES: 1. This value applies for $t_p \leq 0.3$ ms, duty cycle $\leq 10\%$.
2. Derate linearly to 150°C case temperature at the rate of 1 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 a circuit of: L = 20 mH, $I_{B(on)}$ = -0.4 A, R_{BE} = 100 Ω, $V_{BE(off)}$ = 0, R_S = 0.1 Ω, V_{CC} = -20 V.

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electrical characteristics at 25°C case temperature

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
$V_{(BR)CEO}$	Collector-emitter breakdown voltage	I_C = -30 mA (see Note 5)	I_B = 0	TIP36	-40			V
				TIP36A	-60			
				TIP36B	-80			
				TIP36C	-100			
I_{CES}	Collector-emitter cut-off current	V_{CE} = -80 V	V_{BE} = 0	TIP36			-0.7	mA
		V_{CE} = -100 V	V_{BE} = 0	TIP36A			-0.7	
		V_{CE} = -120 V	V_{BE} = 0	TIP36B			-0.7	
		V_{CE} = -140 V	V_{BE} = 0	TIP36C			-0.7	
I_{CEO}	Collector cut-off current	V_{CE} = -30 V	I_B = 0	TIP36/36A			-1	mA
		V_{CE} = -60 V	I_B = 0	TIP36B/36C			-1	
I_{EBO}	Emitter cut-off current	V_{EB} = -5 V	I_C = 0				-1	mA
h_{FE}	Forward current transfer ratio	V_{CE} = -4 V	I_C = -1.5 A	(see Notes 5 and 6)	25			
		V_{CE} = -4 V	I_C = -15 A		10		50	
$V_{CE(sat)}$	Collector-emitter saturation voltage	I_B = -1.5 A	I_C = -15 A	(see Notes 5 and 6)			-1.8	V
		I_B = -5 A	I_C = -25 A				-4	
V_{BE}	Base-emitter voltage	V_{CE} = -4 V	I_C = -15 A	(see Notes 5 and 6)			-2	V
		V_{CE} = -4 V	I_C = -25 A				-4	
h_{fe}	Small signal forward current transfer ratio	V_{CE} = -10 V	I_C = -1 A	f = 1 kHz	25			
$\|h_{fe}\|$	Small signal forward current transfer ratio	V_{CE} = -10 V	I_C = -1 A	f = 1 MHz	3			

NOTES: 5. These parameters must be measured using pulse techniques, t_p = 300 µs, duty cycle ≤ 2%.
6. These parameters must be measured using voltage-sensing contacts, separate from the current carrying contacts.

thermal characteristics

PARAMETER		MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to case thermal resistance			1	°C/W
$R_{\theta JA}$	Junction to free air thermal resistance			35.7	°C/W

resistive-load-switching characteristics at 25°C case temperature

PARAMETER		TEST CONDITIONS †			MIN	TYP	MAX	UNIT
t_{on}	Turn-on time	I_C = -15 A	$I_{B(on)}$ = -1.5 A	$I_{B(off)}$ = 1.5 A		1.1		µs
t_{off}	Turn-off time	$V_{BE(off)}$ = 4.15 V	R_L = 2 Ω	t_p = 20 µs, dc ≤ 2%		0.8		µs

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

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TYPICAL CHARACTERISTICS

TYPICAL DC CURRENT GAIN
vs
COLLECTOR CURRENT

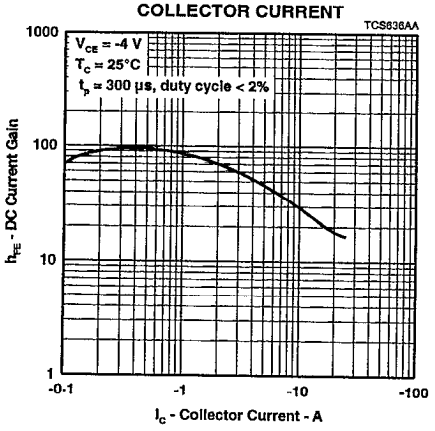

Figure 1.

COLLECTOR-EMITTER SATURATION VOLTAGE
vs
BASE CURRENT

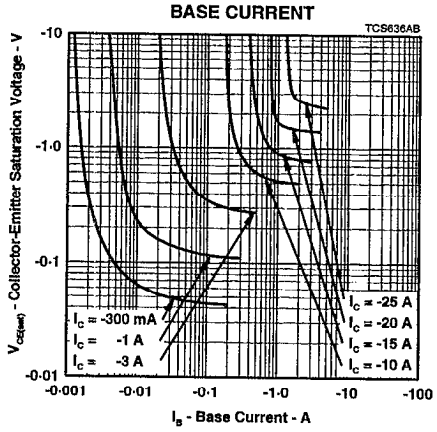

Figure 2.

BASE-EMITTER VOLTAGE
vs
COLLECTOR CURRENT

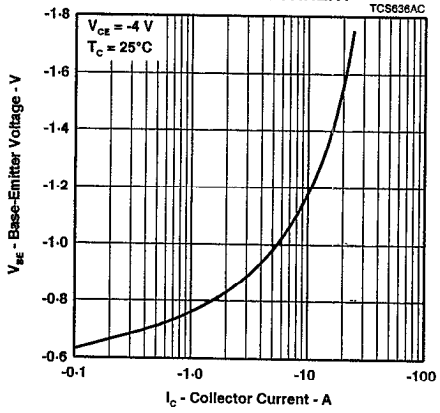

Figure 3.

MAXIMUM SAFE OPERATING REGIONS

MAXIMUM FORWARD-BIAS
SAFE OPERATING AREA

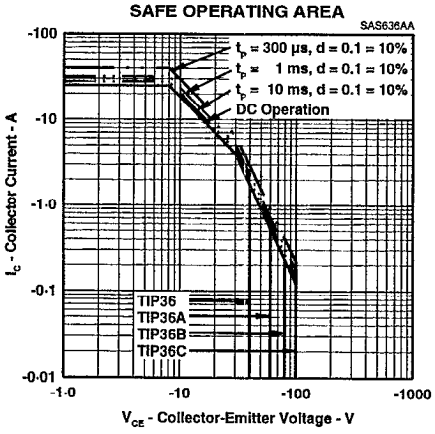

Figure 4.

THERMAL INFORMATION

MAXIMUM POWER DISSIPATION
VS
CASE TEMPERATURE

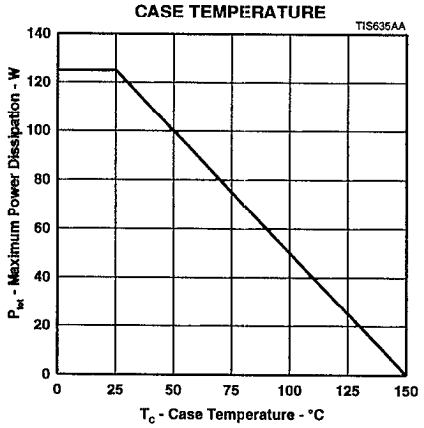

Figure 5.

TEXAS INSTRUMENTS