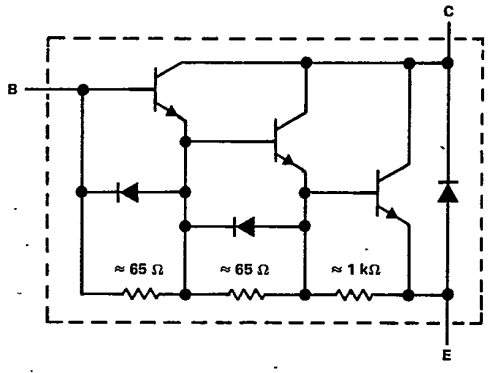
TIPL773, TIPL773A, TIPL773B
N-P-N SILICON TRIPLE TRANSISTOR ADVANCED POWER DARLINGTONS

REVISED OCTOBER 1984

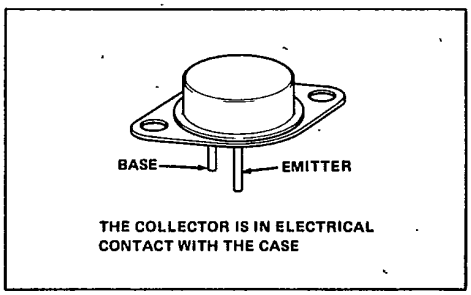
T-33-29

- 180 W at 25°C Case Temperature
- 20 A Continuous Collector Current
- 55 A Peak Collector Current
- Large RBSOA (up to 20 A at 800 V) Permits Snubberless Operation
- All Major Parameters Specified at 100°C

device schematic



TO-3 PACKAGE



THE COLLECTOR IS IN ELECTRICAL CONTACT WITH THE CASE

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

	TIPL773	TIPL773A	TIPL773B
Collector-base voltage (I_E = 0)	950 V	1050 V	1150 V
Collector-emitter voltage (V_{BE} = 0)	950 V	1050 V	1150 V
Collector-emitter voltage (I_B = 0)	600 V	700 C	800 V
Base-emitter voltage	6 V	6 V	6.5 V
Continuous collector current	20 A		
Peak collector current (see Note 1)	55 A		
Continuous base current	3 A		
Peak parallel diode forward current (see Note 1)	55 A		
Continuous device dissipation at 25°C case temperature (see Figure 27)	180 W		
Operating junction and storage temperature range	– 65°C to 200°C		

NOTE 1: This value applies for $t_w \leq 300\,\mu s$, duty cycle ≤ 2%.

TIPL773
N-P-N SILICON TRIPLE TRANSISTOR
ADVANCED POWER DARLINGTON

electrical characteristics at 25°C case temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS			TIPL773 MIN	TIPL773 TYP	TIPL773 MAX	UNIT
$V_{CEX(sus)}$	I_C = 6 A,	I_{B2} = 1 A,	See Figures 1 and 1a	710			V
$V_{CEO(sus)}$	I_C = 0.1 A,	L = 25 mH,	See Note 2	600			V
I_{CEO}	V_{CE} = 600 V,	I_B = 0				50	μA
I_{CES}	V_{CE} = 950 V,	V_{BE} = 0				0.1	mA
	V_{CE} = 950 V,	V_{BE} = 0,	T_C = 100°C			1	
I_{CEV}	V_{CE} = 950 V,	V_{BE} = −1.5 V to −6 V				0.1	mA
I_{EBO}	V_{EB} = 6 V,	I_C = 0				10	mA
$V_{CE(sat)}$	I_C = 3 A,	I_B = 60 mA,	See Notes 3 and 4			2	V
	I_C = 10 A,	I_B = 0.2 A,	See Notes 3 and 4			2.2	
	I_C = 15 A,	I_B = 0.3 A,	See Notes 3 and 4			2.5	
	I_C = 15 A,	I_B = 0.3 A,	T_C = 100°C, See Notes 3 and 4			2.5	
$V_{BE(sat)}$	I_C = 3 A,	I_B = 60 mA,	See Notes 3 and 4			3	V
	I_C = 10 A,	I_B = 0.2 A,	See Notes 3 and 4			3.5	
	I_C = 15 A,	I_B = 0.3 A,	See Notes 3 and 4			4	
	I_C = 15 A,	I_B = 0.3 A,	T_C = 100°C, See Notes 3 and 4			4	
V_F	I_F = 15 A,	See Notes 3 and 4				2	V
h_{FE}	V_{CE} = 5 V,	I_C = 0.5 A		50			
C_{obo}	V_{CB} = 5 V,	I_E = 0,	f = 0.1 MHz		185		pF

NOTES: 2. Inductive loop switching measurement.
3. These parameters must be measured using pulse techniques, $t_w \leq 300\ \mu s$, duty cycle ≤ 2%.
4. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts located within 3,2 mm (0.125 inch) from the device body.

thermal characteristics

PARAMETER	MIN	TYP	MAX	UNIT
$R_{\theta JC}$			0.97	°C/W

resistive-load switching characteristics at 25°C case temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS			TIPL773 MIN	TIPL773 TYP	TIPL773 MAX	UNIT
t_{on}	I_C = 15 A,	V_{CE} = 250 V,	I_{B2} = −1.5 A,			1.25	μs
t_s	T_C = 25°C,	See Figures 1 and 1c				3	μs
t_f						1	μs
t_{on}	I_C = 15 A,	V_{CE} = 250 V,	I_{B2} = −1.5 A,			2	μs
t_s	T_C = 100°C,	See Figures 1 and 1c				4	μs
t_f						2	μs

inductive-load switching characteristics at 25°C case temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS			TIPL773 MIN	TIPL773 TYP	TIPL773 MAX	UNIT
t_{sv}	I_C = 15 A,	V_{CE} = 300 V,	I_{B2} = −1.5 A,			2.8	μs
t_{rv}	T_C = 25°C,	See Figures 1, 1b, and 2				0.5	μs
t_{fi}						0.3	μs
t_{xo}						0.8	μs
t_{ti}						0.1	μs
t_{sv}	I_C = 15 A,	V_{CE} = 300 V,	I_{B2} = −1.5 A,			4.8	μs
t_{rv}	T_C = 100°C,	See Figures 1, 1b, and 2				1.5	μs
t_{fi}						0.5	μs
t_{xo}						2	μs
t_{ti}						0.15	μs

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TIPL773A
N-P-N SILICON TRIPLE TRANSISTOR
ADVANCED POWER DARLINGTON

electrical characteristics at 25°C case temperature (unless otherwise noted)

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PARAMETER	TEST CONDITIONS				TIPL773A MIN	TIPL773A TYP	TIPL773A MAX	UNIT
$V_{CEX(sus)}$	I_C = 6 A,	I_{B2} = 1 A,	See Figures 1 and 1a		860			V
$V_{CEO(sus)}$	I_C = 0.1 A,	L = 25 mH,	See Note 2		700			V
I_{CEO}	V_{CE} = 700 V,	I_B = 0					50	μA
I_{CES}	V_{CE} = 1050 V,	V_{BE} = 0					0.1	mA
	V_{CE} = 1050 V,	V_{BE} = 0,	T_C = 100°C				1	
I_{CEV}	V_{CE} = 1050 V,	V_{BE} = −1.5 V to −6 V					0.1	mA
I_{EBO}	V_{EB} = 6 V,	I_C = 0					10	mA
$V_{CE(sat)}$	I_C = 2.5 A,	I_B = 50 mA,	See Notes 3 and 4				2	V
	I_C = 7.5 A,	I_B = 0.15 A,	See Notes 3 and 4				2.2	
	I_C = 12.5 A,	I_B = 0.25 A,	See Notes 3 and 4				2.5	
	I_C = 12.5 A,	I_B = 0.25 A,	T_C = 100°C,	See Notes 3 and 4			2.5	
$V_{BE(sat)}$	I_C = 2.5 A,	I_B = 50 mA,	See Notes 3 and 4				3	V
	I_C = 7.5 A,	I_B = 0.15 A,	See Notes 3 and 4				3.5	
	I_C = 12.5 A,	I_B = 0.25 A,	See Notes 3 and 4				4	
	I_C = 12.5 A,	I_B = 0.25 A,	T_C = 100°C,	See Notes 3 and 4			4	
V_F	I_F = 15 A,	See Notes 3 and 4					2	V
h_{FE}	V_{CE} = 5 V,	I_C = 0.5 A			50			
C_{obo}	V_{CB} = 5 V,	I_E = 0,	f = 0.1 MHz			185		pF

NOTES: 2. Inductive loop switching measurement.
3. These parameters must be measured using pulse techniques, $t_w \leq 300\ \mu s$, duty cycle ≤ 2%.
4. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts located within 3,2 mm (0.125 inch) from the device body.

thermal characteristics

PARAMETER	MIN	TYP	MAX	UNIT
$R_{\theta JC}$			0.97	°C/W

resistive-load switching characteristics at 25°C case temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS				TIPL773A MIN	TIPL773A TYP	TIPL773A MAX	UNIT
t_{on}	I_C = 12.5 A,	V_{CE} = 250 V,	I_{B2} = −1.5 A,				1.25	μs
t_s	T_C = 25°C,	See Figures 1 and 1c					3.5	μs
t_f							1	μs
t_{on}	I_C = 12.5 A,	V_{CE} = 250 V,	I_{B2} = −1.5 A,				2	μs
t_s	T_C = 100°C,	See Figures 1 and 1c					5	μs
t_f							2	μs

inductive-load switching characteristics at 25°C case temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS				TIPL773A MIN	TIPL773A TYP	TIPL773A MAX	UNIT
t_{sv}	I_C = 12.5 A,	V_{CE} = 300 V,	I_{B2} = −1.5 A,				3	μs
t_{rv}	T_C = 25°C,	See Figures 1, 1b, and 2					0.5	μs
t_{fi}							0.3	μs
t_{xo}							0.8	μs
t_{ti}							0.1	μs
t_{sv}	I_C = 12.5 A,	V_{CE} = 300 V,	I_{B2} = −1.5 A,				5	μs
t_{rv}	T_C = 100°C,	See Figures 1, 1b, and 2					1.5	μs
t_{fi}							0.5	μs
t_{xo}							2	μs
t_{ti}							0.5	μs

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ADVANCED POWER DARLINGTON

electrical characteristics at 25°C case temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS				TIPL773B MIN	TIPL773B TYP	TIPL773B MAX	UNIT
$V_{CEX(sus)}$	I_C = 6 A,	I_{B2} = 1 A,	See Figures 1 and 1a		970			V
$V_{CEO(sus)}$	I_C = 0.1 A,	L = 25 mH,	See Note 2		800			V
I_{CEO}	V_{CE} = 800 V,	I_B = 0					50	μA
I_{CES}	V_{CE} = 1150 V,	V_{BE} = 0					0.1	mA
	V_{CE} = 1150 V,	V_{BE} = 0,	T_C = 100°C				1	
I_{CEV}	V_{CE} = 1150 V,	V_{BE} = −1.5 V to −6 V					0.1	mA
I_{EBO}	V_{EB} = 6 V,	I_C = 0					10	mA
$V_{CE(sat)}$	I_C = 1 A,	I_B = 20 mA,	See Notes 3 and 4				2	V
	I_C = 5 A,	I_B = 0.1 A,	See Notes 3 and 4				2.2	
	I_C = 10 A,	I_B = 0.2 A,	See Notes 3 and 4				2.5	
	I_C = 10 A,	I_B = 0.2 A,	T_C = 100°C,	See Notes 3 and 4			2.5	
$V_{BE(sat)}$	I_C = 1 A,	I_B = 20 mA,	See Notes 3 and 4				3	V
	I_C = 5 A,	I_B = 0.1 A,	See Notes 3 and 4				3.5	
	I_C = 10 A,	I_B = 0.2 A,	See Notes 3 and 4				4	
	I_C = 10 A,	I_B = 0.2 A,	T_C = 100°C,	See Notes 3 and 4			4	
V_F	I_F = 15 A,	See Notes 3 and 4					2	V
h_{FE}	V_{CE} = 5 V,	I_C = 0.5 A			50			
C_{obo}	V_{CB} = 5 V,	I_E = 0,	f = 0.1 MHz			185		pF

NOTES: 2. Inductive loop switching measurement.
3. These parameters must be measured using pulse techniques, $t_w \leq 300\ \mu s$, duty cycle ≤ 2%.
4. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts located within 3,2 mm (0.125 inch) from the device body.

thermal characteristics

PARAMETER	MIN	TYP	MAX	UNIT
$R_{\theta JC}$			0.97	°C/W

resistive-load switching characteristics at 25°C case temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS				TIPL773B MIN	TIPL773B TYP	TIPL773B MAX	UNIT
t_{on}	I_C = 10 A,	V_{CE} = 250 V,	I_{B2} = −1.5 A,				1.25	μs
t_s	T_C = 25°C,	See Figures 1 and 1c					4	μs
t_f							1	μs
t_{on}	I_C = 10 A,	V_{CE} = 250 V,	I_{B2} = −1.5 A,				2	μs
t_s	T_C = 100°C,	See Figures 1 and 1c					6	μs
t_f							2	μs

inductive-load switching characteristics at 25°C case temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS				TIPL773B MIN	TIPL773B TYP	TIPL773B MAX	UNIT
t_{sv}	I_C = 10 A,	V_{CE} = 300 V,	I_{B2} = −1.5 A,				3.2	μs
t_{rv}	T_C = 25°C,	See Figures 1, 1b, and 2					0.5	μs
t_{fi}							0.3	μs
t_{xo}							0.8	μs
t_{ti}							0.1	μs
t_{sv}	I_C = 10 A,	V_{CE} = 300 V,	I_{B2} = −1.5 A,				5.2	μs
t_{rv}	T_C = 100°C,	See Figures 1, 1b, and 2					1.5	μs
t_{fi}							0.5	μs
t_{xo}							2	μs
t_{ti}							0.15	μs

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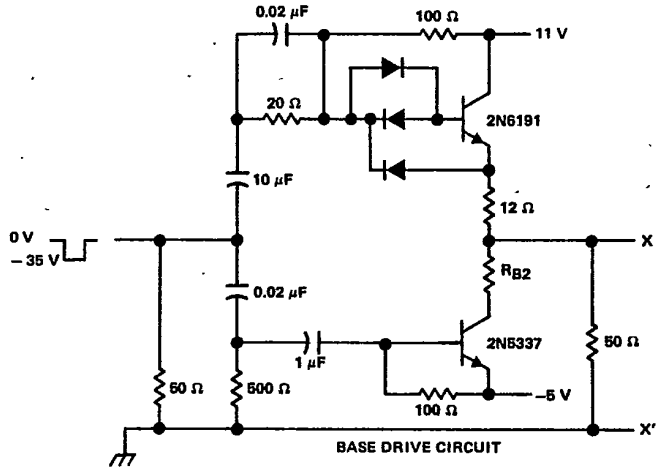
N-P-N SILICON TRIPLE TRANSISTOR
ADVANCED POWER DARLINGTONS

PARAMETER MEASUREMENT INFORMATION



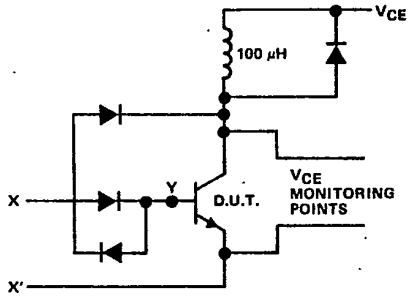


FIGURE 1a. $V_{CEX(sus)}$

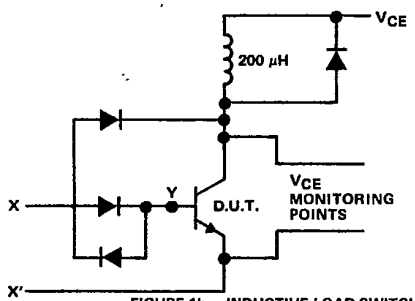


FIGURE 1b. INDUCTIVE-LOAD SWITCHING

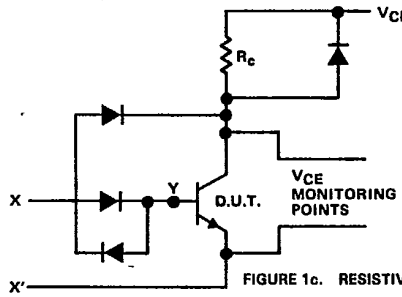


FIGURE 1c. RESISTIVE-LOAD SWITCHING

FIGURE 1. SWITCHING TEST CIRCUITS

NOTES: A. Waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq 15$ ns, $R_{in} \leq 10$ MΩ, $C_{in} \leq 11.5$ pf.
B. Resistors must be noninductive types.
C. V_{CE} waveforms to be monitored within 3,2 mm (0.125 inch) of the device body.

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PARAMETER MEASUREMENT INFORMATION

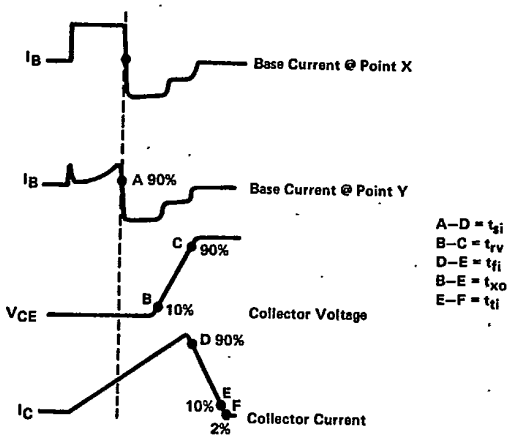

FIGURE 2. INDUCTIVE SWITCHING WAVEFORMS

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TYPICAL CHARACTERISTICS

TIPL773
INDUCTIVE-LOAD TURN-OFF TIMES
vs
OFF-STATE BASE CURRENT

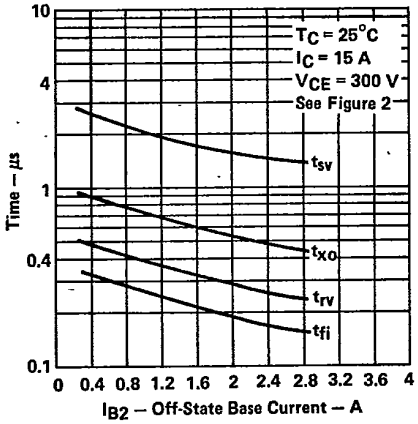

FIGURE 3

TIPL773A
INDUCTIVE-LOAD TURN-OFF TIMES
vs
OFF-STATE BASE CURRENT

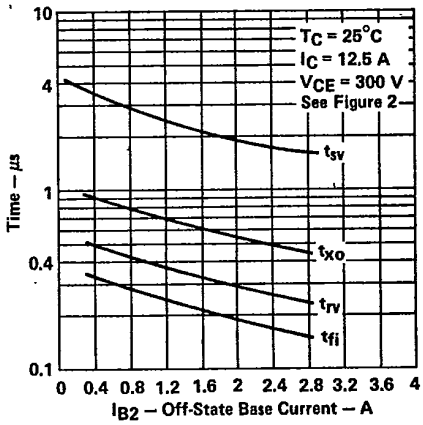

FIGURE 4

TIPL773B
INDUCTIVE-LOAD TURN-OFF TIMES
vs
OFF-STATE BASE CURRENT

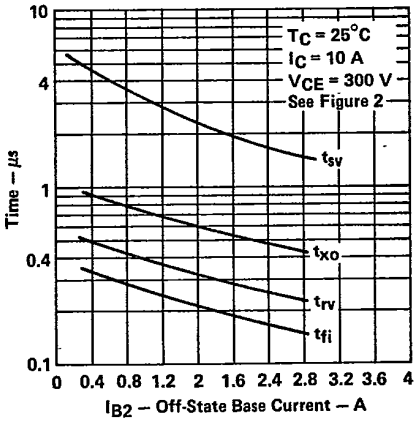

FIGURE 5

TIPL773
INDUCTIVE-LOAD TURN-OFF TIMES
vs
COLLECTOR CURRENT

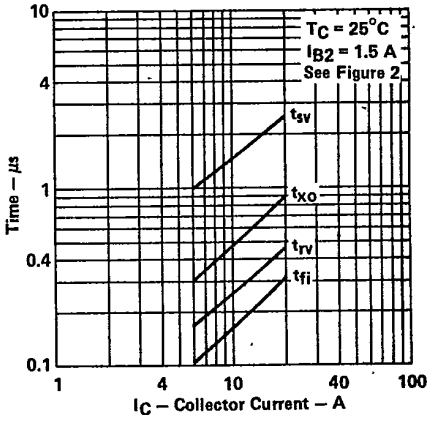

FIGURE 6

TIPL773, TIPL773A, TIPL773B
N-P-N SILICON TRIPLE TRANSISTOR
ADVANCED POWER DARLINGTONS

TYPICAL CHARACTERISTICS

TIPL773A
INDUCTIVE-LOAD TURN-OFF TIME
vs
COLLECTOR CURRENT

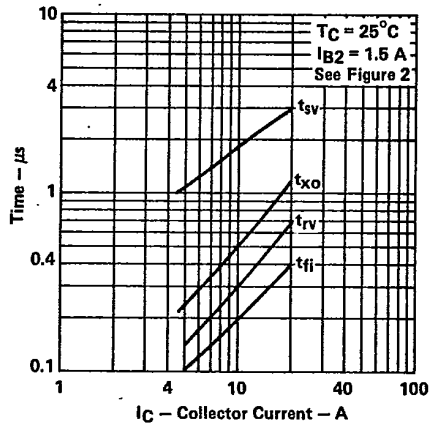

FIGURE 7

TIPL773B
INDUCTIVE-LOAD TURN-OFF TIME
vs
COLLECTOR CURRENT

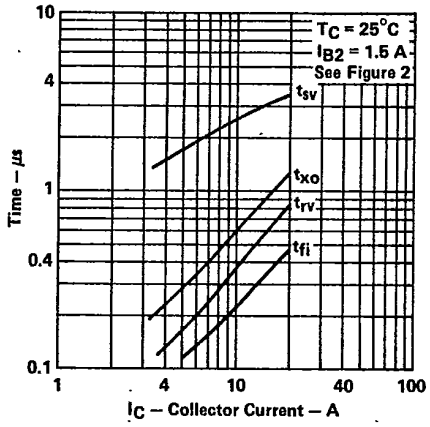

FIGURE 8

TIPL773
MAXIMUM COLLECTOR-EMITTER
SATURATION VOLTAGE
vs
BASE CURRENT

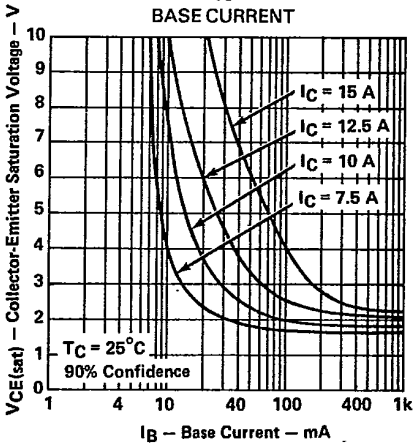

FIGURE 9

TIPL773A
MAXIMUM COLLECTOR-EMITTER
SATURATION VOLTAGE
vs
BASE CURRENT

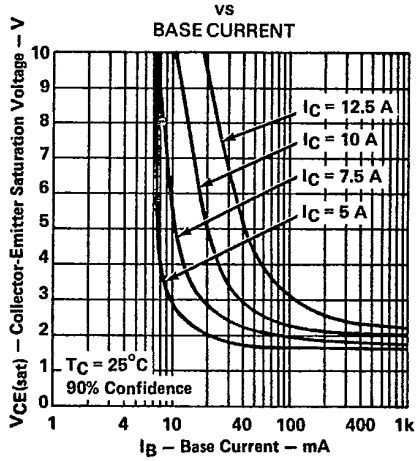

FIGURE 10

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N-P-N SILICON TRIPLE TRANSISTOR
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TYPICAL CHARACTERISTICS

TIPL773B
MAXIMUM COLLECTOR-EMITTER SATURATION VOLTAGE
vs
BASE CURRENT

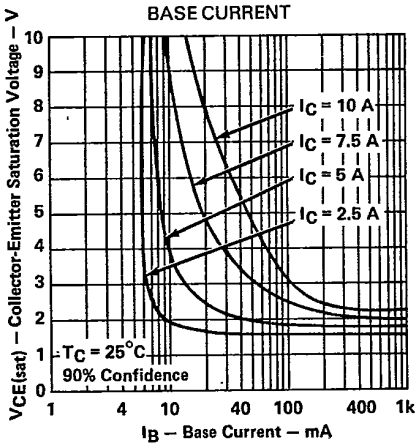

FIGURE 11

TIPL773
BASE-EMITTER SATURATION VOLTAGE
vs
BASE CURRENT

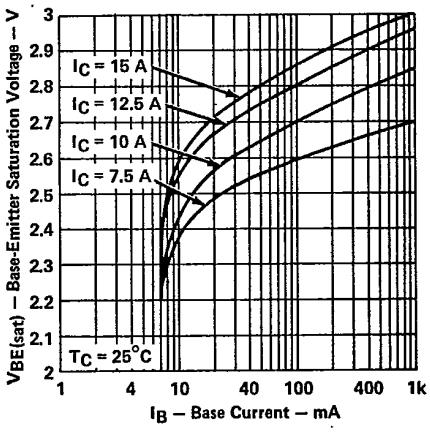

FIGURE 12

TIPL773A
BASE-EMITTER SATURATION VOLTAGE
vs
BASE CURRENT

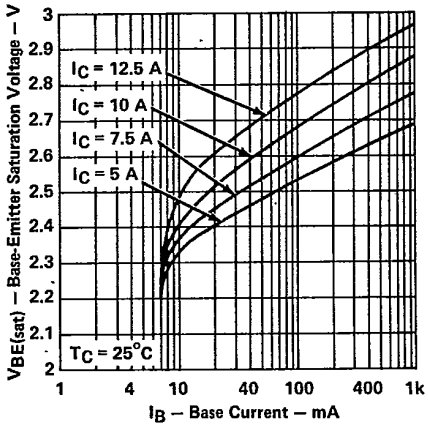

FIGURE 13

TIPL773B
BASE-EMITTER SATURATION VOLTAGE
vs
BASE CURRENT

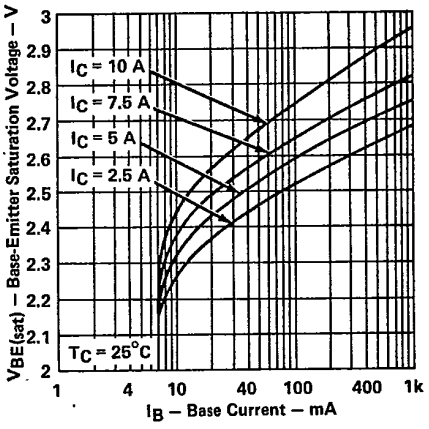

FIGURE 14

TIPL773, TIPL773A, TIPL773B
N-P-N SILICON TRIPLE TRANSISTOR
ADVANCED POWER DARLINGTONS

TYPICAL CHARACTERISTICS

TIPL773
FORWARD CURRENT TRANSFER RATIO
vs
COLLECTOR CURRENT

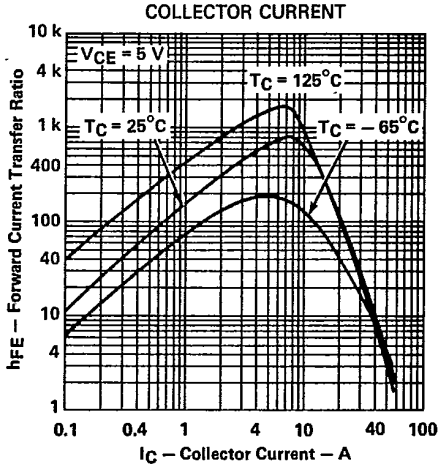

FIGURE 15

TIPL773A
FORWARD CURRENT TRANSFER RATIO
vs
COLLECTOR CURRENT

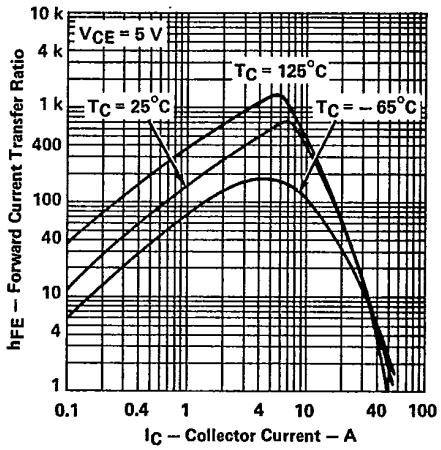

FIGURE 16

TIPL773B
FORWARD CURRENT TRANSFER RATIO
vs
COLLECTOR CURRENT

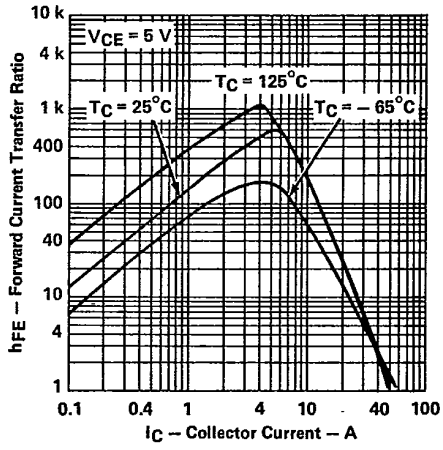

FIGURE 17

FORWARD VOLTAGE OF PARALLEL DIODE

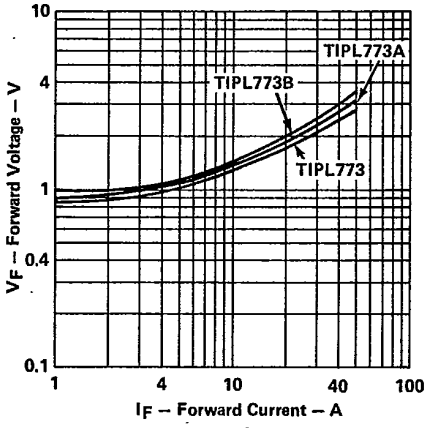

FIGURE 18

TIPL Devices

TEXAS INSTRUMENTS
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TYPICAL CHARACTERISTICS

COLLECTOR CUTOFF CURRENT
vs
CASE TEMPERATURE

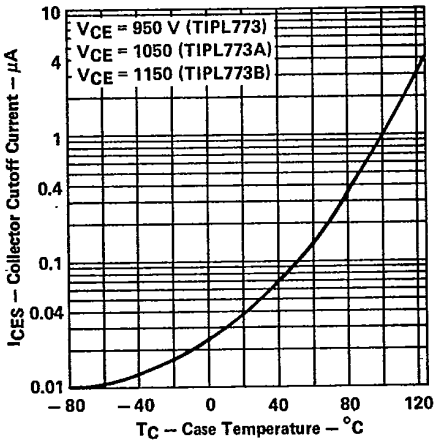

FIGURE 19

MAXIMUM SAFE OPERATING AREA

FORWARD-BIAS SAFE OPERATING AREA

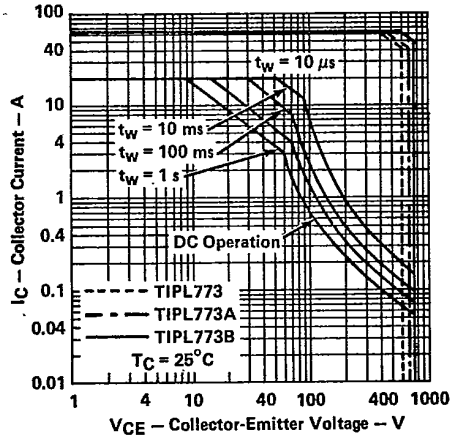

FIGURE 20

REVERSE-BIAS SAFE OPERATING AREA

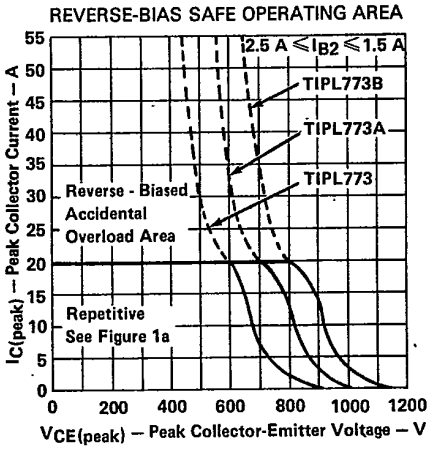

FIGURE 21

TIPL773, TIPL773A, TIPL773B
N-P-N SILICON TRIPLE TRANSISTOR
ADVANCED POWER DARLINGTONS

MAXIMUM SAFE OPERATING AREA

TIPL773
LIMITING CONDITIONS
FOR POWER-DOWN TRANSIENT

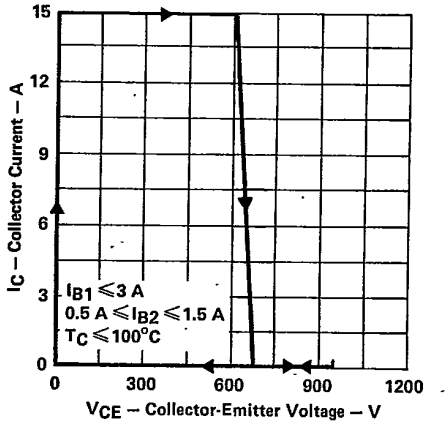

FIGURE 22

TIPL773A
LIMITING CONDITIONS
FOR POWER-DOWN TRANSIENT

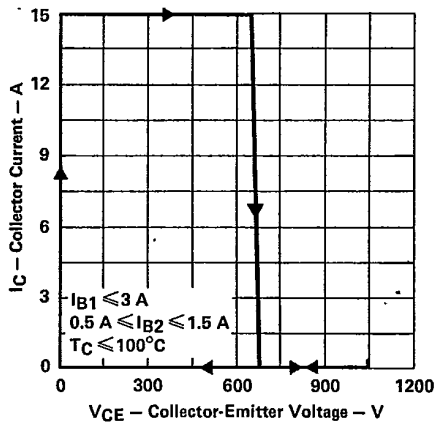

FIGURE 23

TIPL773B
LIMITING CONDITIONS
FOR POWER-DOWN TRANSIENT

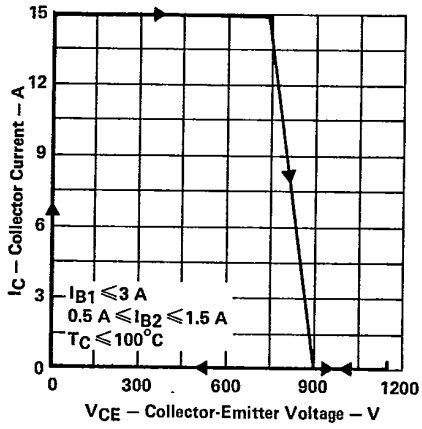

FIGURE 24

TEXAS INSTRUMENTS
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MAXIMUM SAFE OPERATING AREA

T-33-29

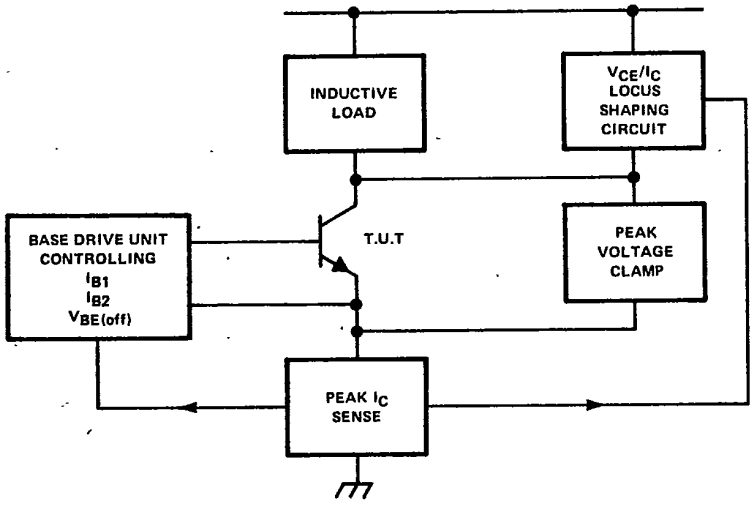

FIGURE 25 TEST CIRCUIT FOR POWER-DOWN TRANSIENT

THERMAL INFORMATION

DISSIPATION DERATING CURVE

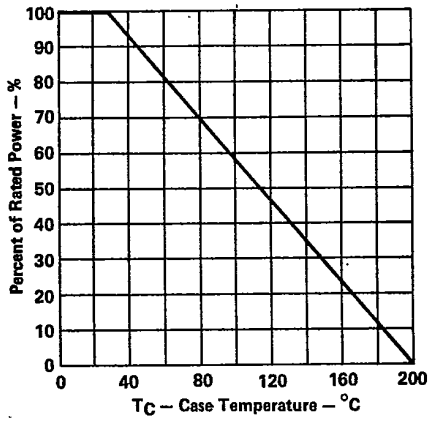

FIGURE 26