T-33-15

TIPL757, TIPL757A
N-P-N SILICON POWER TRANSISTORS

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

PARAMETER	TEST CONDITIONS	TIPL757			TIPL757A			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
$V_{CEO(sus)}$	$I_C = 0.1$ A, $L = 25$ mH, See Note 2	375			420			V
I_{CEO}	$V_{CE} = 375$ V, $I_B = 0$			50				μA
	$V_{CE} = 420$ V, $I_B = 0$						50	
I_{CES}	$V_{CE} = 800$ V, $V_{BE} = 0$			50				μA
	$V_{CE} = 800$ V, $V_{BE} = 0$, $T_C = 100°C$			100				
	$V_{CE} = 1000$ V, $V_{BE} = 0$						50	
	$V_{CE} = 1000$ V, $V_{BE} = 0$, $T_C = 100°C$						100	
I_{EBO}	$V_{EB} = 10$ V, $I_C = 0$			1			1	mA
h_{FE}	$V_{CE} = 5$ V, $I_C = 0.5$ A, See Notes 3 and 4	15		60	15		60	
$V_{CE(sat)}$	$I_C = 5$ A, $I_B = 1$ A, See Notes 3 and 4			0.5			0.5	V
	$I_C = 10$ A, $I_B = 2$ A, See Notes 3 and 4			1			1	
	$I_C = 15$ A, $I_B = 3$ A, See Notes 3 and 4			2.5			2.5	
	$I_C = 15$ A, $I_B = 3$ A, $T_C = 100°C$, See Notes 3 and 4			5			5	
$V_{BE(sat)}$	$I_C = 5$ A, $I_B = 1$ A, See Notes 3 and 4			1.4			1.4	V
	$I_C = 10$ A, $I_B = 2$ A, See Notes 3 and 4			1.5			1.5	
	$I_C = 15$ A, $I_B = 3$ A, See Notes 3 and 4			1.7			1.7	
	$I_C = 15$ A, $I_B = 3$ A, $T_C = 100°C$, See Notes 3 and 4			1.8			1.8	
f_T	$V_{CE} = 10$ V, $I_C = 0.5$ A, See Note 5		11.5			11.5		MHz
C_{obo}	$V_{CB} = 20$ V, $I_E = 0$, $f = 0.1$ MHz		200			200		pF

NOTES:
2. Inductive loop switching measurement.
3. These parameters must be measured using pulse techniques, $t_w = 300\ \mu s$, duty cycle $\leq 2\%$.
4. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts and located within 3,2 mm (0.125 inch) from the device body.
5. To obtain f_T, the $|h_{fe}|$ response is extrapolated at the rate of − 6 dB per octave from f = 1 MHz to the frequency at which $|h_{fe}| = 1$.

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thermal characteristics

PARAMETER	MIN	TYP	MAX	UNIT
$R_{\theta JC}$			0.9	°C/W

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{on}	I_C = 15 A, V_{CC} = 250 V, See Figure 1, I_{B1} = 3 A, I_{B2} = −3.75 A, T = 25°C			0.75	μs
t_s				2.5	μs
t_f				0.6	μs
t_{on}	I_C = 15 A, V_{CC} = 250 V, See Figure 1, I_{B1} = 3 A, I_{B2} = −3.75 A, T_C = 100°C			1	μs
t_s				3	μs
t_f				1.2	μs

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{sv}	I_C = 15 A, $V_{BE(off)}$ = −10 V, See Figure 2, I_{B1} = 3 A, I_{B2} = −5 A, T_C = 25°C			2.6	μs
t_{rv}				0.2	μs
t_{fi}				0.3	μs
t_{ti}				0.05	μs
t_{xo}				0.5	μs
t_{sv}	I_C = 15 A, $V_{BE(off)}$ = −10 V, See Figure 2, I_{B1} = 3 A, I_{B2} = −5 A, T_C = 100°C			3	μs
t_{rv}				0.35	μs
t_{fi}				0.4	μs
t_{ti}				0.08	μs
t_{xo}				0.8	μs

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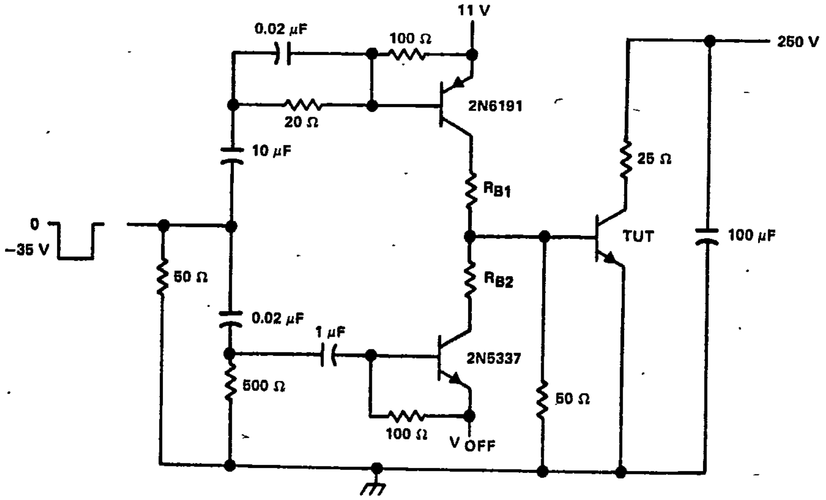
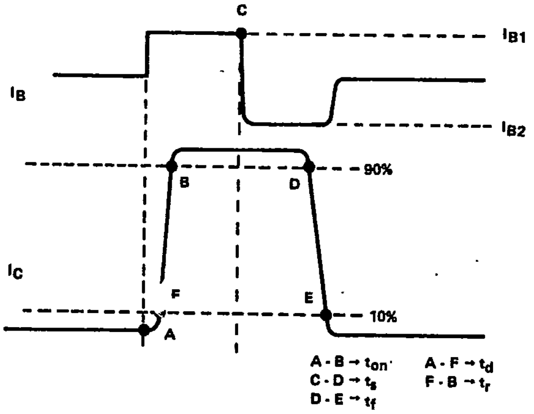
PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



CURRENT WAVEFORMS

NOTES: A. The V_{gen} waveform is supplied by a generator with the following characteristics: $t_r \leq 15$ ns, $t_f \leq 15$ ns, $Z_{out} = 50\ \Omega$, $t_w = 20\ \mu s$, duty cycle ≤ 2%.

B. Waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq 15$ ns, $R_{in} \geq 10\ M\Omega$, $C_{in} \leq 11.5$ pF.

C. Resistors must be noninductive types.

FIGURE 1. RESISTIVE-LOAD SWITCHING

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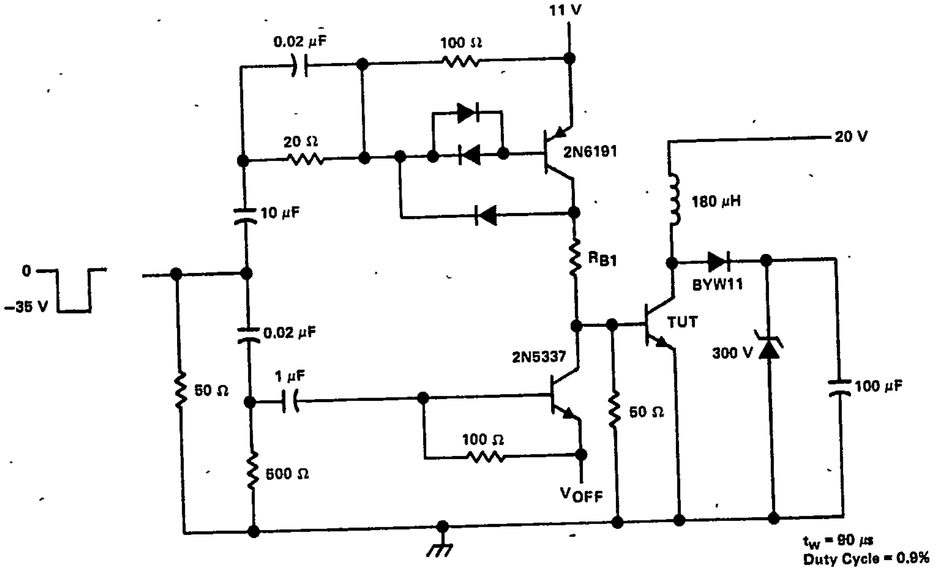
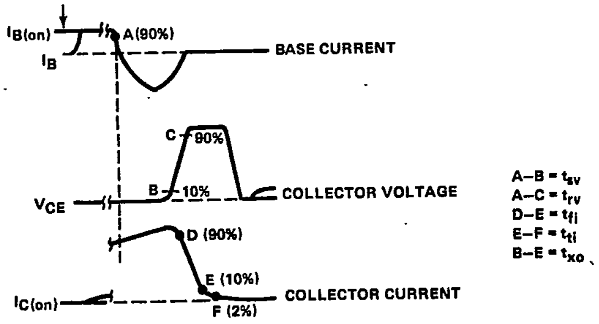
PARAMETER MEASUREMENT INFORMATION



t_w = 90 µs
Duty Cycle = 0.9%

TEST CIRCUIT



A–B = t_{sv}
A–C = t_{rv}
D–E = t_{fi}
E–F = t_{ti}
B–E = t_{xo}

VOLTAGE AND CURRENT WAVEFORMS

NOTES: A. Waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq 15$ ns, $R_{in} \geq 10$ MΩ, $C_{in} \leq 11.5$ pF.
B. Resistors must be noninductive types.

FIGURE 2. INDUCTIVE-LOAD SWITCHING

TIPL Devices

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TIPL757, TIPL757A
N-P-N SILICON POWER TRANSISTORS

TYPICAL CHARACTERISTICS

FORWARD CURRENT TRANSFER RATIO
vs
COLLECTOR CURRENT

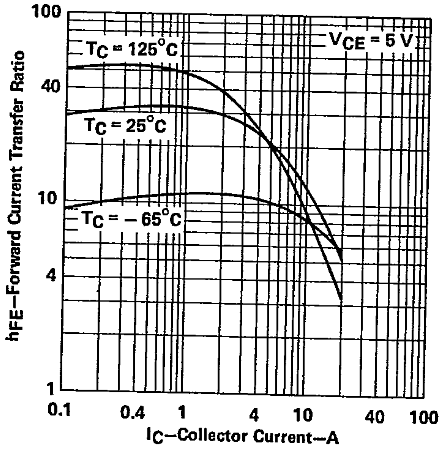

FIGURE 3

COLLECTOR CUTOFF CURRENT
vs
CASE TEMPERATURE

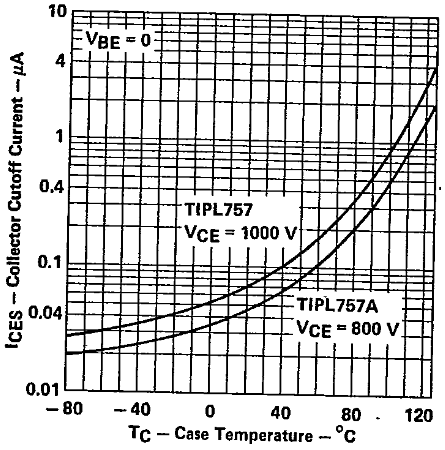

FIGURE 4

COLLECTOR-EMITTER SATURATION VOLTAGE
vs
BASE CURRENT

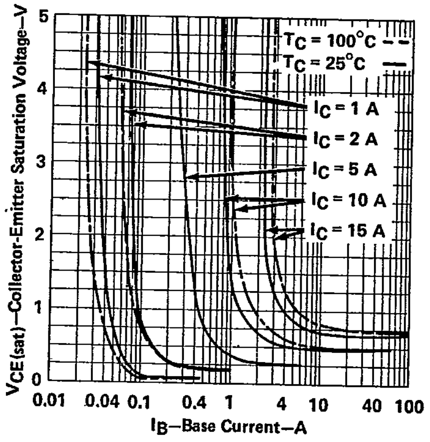

FIGURE 5

BASE-EMITTER SATURATION VOLTAGE
vs
BASE CURRENT

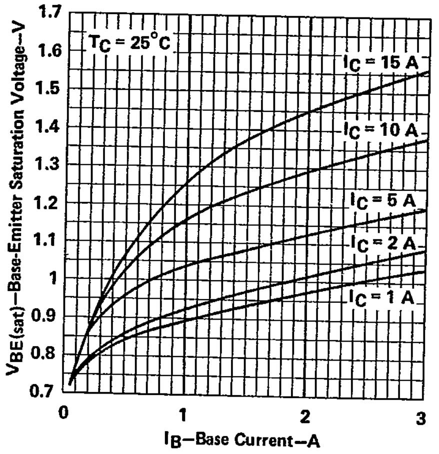

FIGURE 6

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TIPL757, TIPL757A
N-P-N SILICON POWER TRANSISTORS

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TYPICAL CHARACTERISTICS

RESISTIVE-LOAD
TURN-ON AND TURN-OFF TIMES
vs
COLLECTOR CURRENT

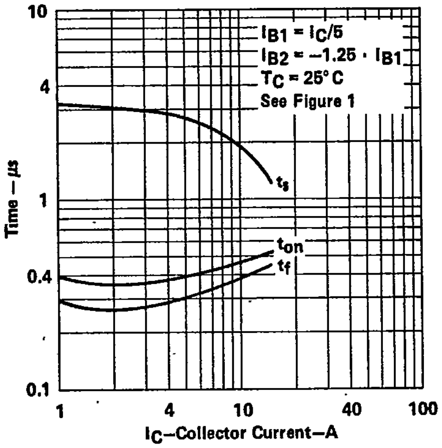

FIGURE 7

RESISTIVE-LOAD TURN-OFF TIME
vs
BASE CUTOFF CURRENT

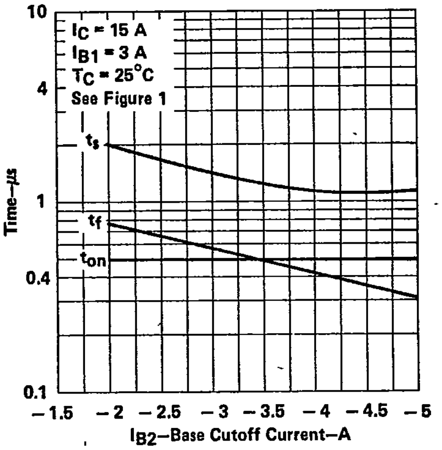

FIGURE 8

INDUCTIVE-LOAD TURN-OFF TIME
vs
BASE CUTOFF CURRENT

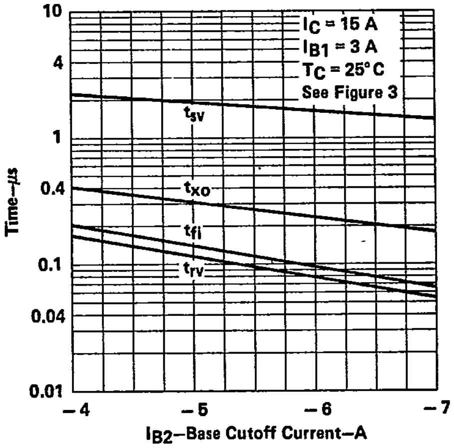

FIGURE 9

TIPL Devices

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TIPL757, TIPL757A
N-P-N SILICON POWER TRANSISTORS

MAXIMUM SAFE OPERATING AREA

FORWARD-BIAS SAFE OPERATING AREA

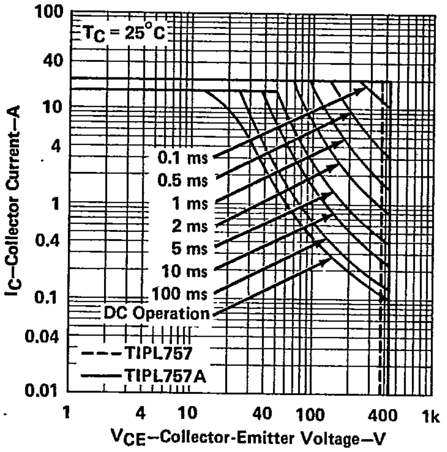

FIGURE 10

REVERSE-BIAS SAFE OPERATING AREA

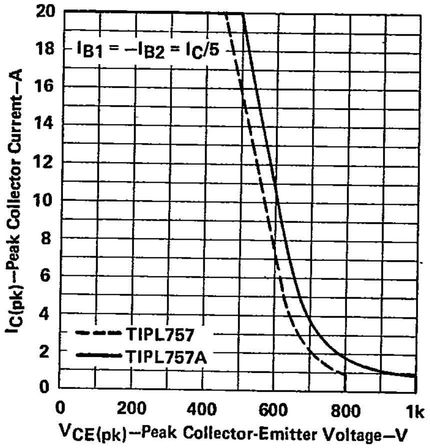

FIGURE 11

LIMITING CONDITIONS
FOR POWER-DOWN TRANSIENT

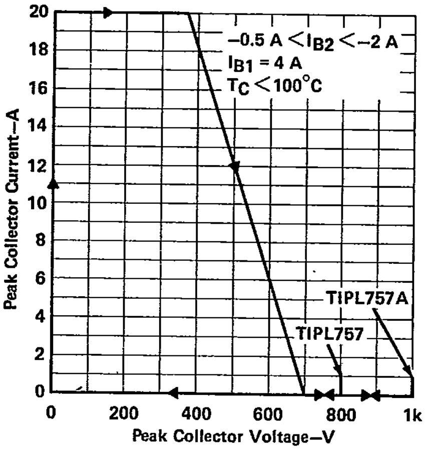

FIGURE 12

TIPL Devices

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MAXIMUM SAFE OPERATING AREA

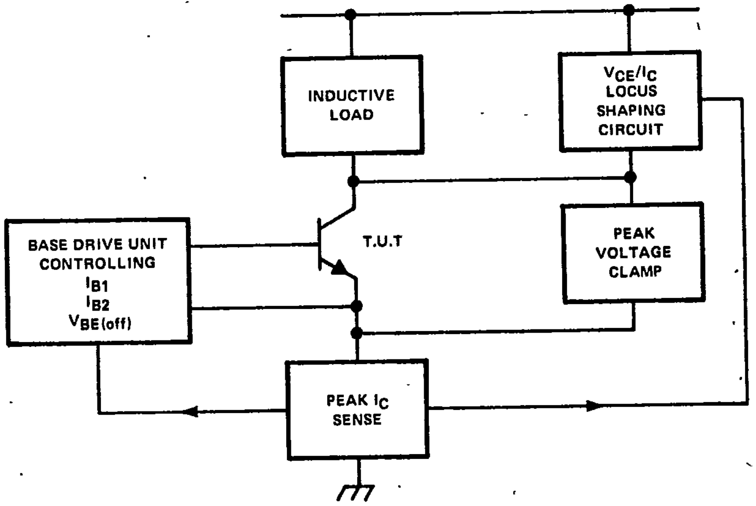

FIGURE 13. TEST CIRCUIT FOR LIMITING CONDITIONS FOR POWER-DOWN TRANSIENT

THERMAL INFORMATION

DISSIPATION DERATING CURVE

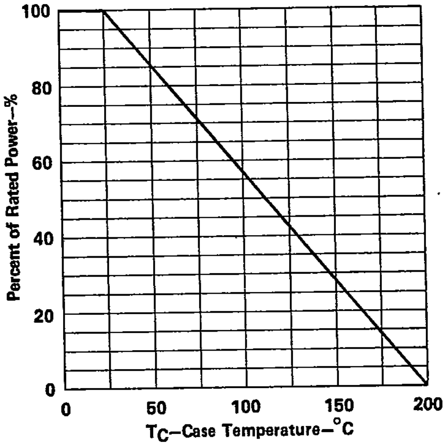

FIGURE 14

TEXAS INSTRUMENTS
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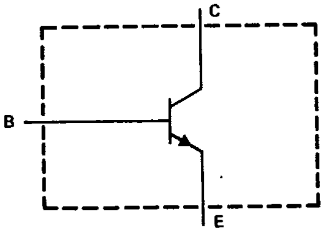
TIPL760, TIPL760A, TIPL761, TIPL761A
N-P-N SILICON POWER TRANSISTORS

T- 33-13

REVISED OCTOBER 1984

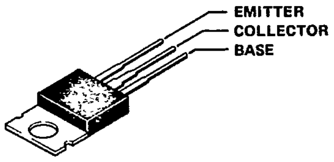
- 80 W/100 W at 25°C Case Temperature
- 4 A Continuous Collector Current
- Operation Characteristics Fully Guaranteed at 100°C
- Transient Power Dissipation Guaranteed at 100°C
- $I_{CES} < 100\ \mu A$ at Max V_{CE} at 100°C
- 1000 V Blocking Capability
- Designed for High-Voltage, Inductive-Load Switching Applications

device schematic



TO-220AB PACKAGE

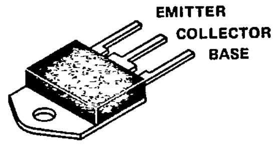
TIPL760, TIPL760A



THE COLLECTOR IS IN ELECTRICAL CONTACT WITH THE MOUNTING TAB

TO-218AA PACKAGE

TIPL761, TIPL761A



THE COLLECTOR IS IN ELECTRICAL CONTACT WITH THE MOUNTING TAB

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

	TIPL760	TIPL760A	TIPL761	TIPL761A
Collector-base voltage	800 V	1000 V	800 V	1000 V
Collector-emitter voltage ($V_{BE} = 0$)	800 V	1000 V	800 V	1000 V
Collector-emitter voltage ($I_B = 0$)	375 V	420 V	375 V	420 V
Continuous device dissipation at (or below) 25°C case temperature (see Figure 14)	80 W	80 W	100 W	100W
Base-emitter voltage	10 V			
Continuous collector current	4 A			
Peak collector current (see Note 1)	8 A			
Operating junction and storage temperature range	− 65°C to 150°C			

NOTE 1: This value applies for, $t_w \leq 10$ ms, duty cycle ≤ 2%.

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TIPL760, TIPL760A, TIPL761, TIPL761A N-P-N SILICON POWER TRANSISTORS

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

PARAMETER	TEST CONDITIONS	TIPL760 TIPL761 MIN	TIPL760 TIPL761 TYP	TIPL760 TIPL761 MAX	TIPL760A TIPL761A MIN	TIPL760A TIPL761A TYP	TIPL760A TIPL761A MAX	UNIT
$V_{CEO(sus)}$	I_C = 100 mA, L = 25 mH, See Note 2	375			420			V
I_{CEO}	V_{CE} = 375 V, I_B = 0			50				μA
	V_{CE} = 420 V, I_B = 0						50	
I_{CES}	V_{CE} = 800 V, V_{BE} = 0			50				μA
	V_{CE} = 800 V, V_{BE} = 0, T_C = 100°C			100				
	V_{CE} = 1000 V, V_{BE} = 0						50	
	V_{CE} = 1000 V, V_{BE} = 0, T_C = 100°C						100	
I_{EBO}	V_{EB} = 10 V, I_C = 0			1			1	mA
h_{FE}	V_{CE} = 5 V, I_C = 0.5 A, See Notes 3 and 4	20		60	20		60	
$V_{CE(sat)}$	I_C = 1 A, I_B = 0.2 A, See Notes 3 and 4			0.5			0.5	V
	I_C = 2.5 A, I_B = 0.5 A, See Notes 3 and 4			1			1	
	I_C = 4 A, I_B = 0.8 A, See Notes 3 and 4			2.5			2.5	
	I_C = 4 A, I_B = 0.8 A, T_C = 100°C, See Notes 3 and 4			5			5	
$V_{BE(sat)}$	I_C = 1 A, I_B = 0.2 A, See Notes 3 and 4			1			1	V
	I_C = 2.5 A, I_B = 0.5 A, See Notes 3 and 4			1.2			1.2	
	I_C = 4 A, I_B = 0.8 A, See Notes 3 and 4			1.4			1.4	
	I_C = 4 A, I_B = 0.8 A, T_C = 100°C, See Notes 3 and 4			1.3			1.3	
f_T	V_{CE} = 10 V, I_C = 0.5 A, See Note 5		12			12		MHz
C_{obo}	V_{CB} = 20 V, I_E = 0, f = 0.1 MHz		110			110		pF

NOTES:
2. Inductive loop switching measurement.
3. These parameters must be measured using pulse techniques, t_w = 300 μs, duty cycle ≤ 2 %.
4. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts and located within 3,2 mm (0.125 inch) from the device body.
5. To obtain f_T, the $|h_{fe}|$ response is extrapolated at the rate of − 6 dB per octave from f = 1 MHz to the frequency at which $|h_{fe}|$ = 1.

TEXAS INSTRUMENTS
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TIPL760, TIPL760A, TIPL761, TIPL761A
N-P-N SILICON POWER TRANSISTORS

T-33-13

thermal characteristics

PARAMETER	TIPL760 TIPL760A MIN	TIPL760 TIPL760A TYP	TIPL760 TIPL760A MAX	TIPL761 TIPL761A MIN	TIPL761 TIPL761A TYP	TIPL761 TIPL761A MAX	UNIT
$R_{\theta JC}$			1.56			1.25	°C/W

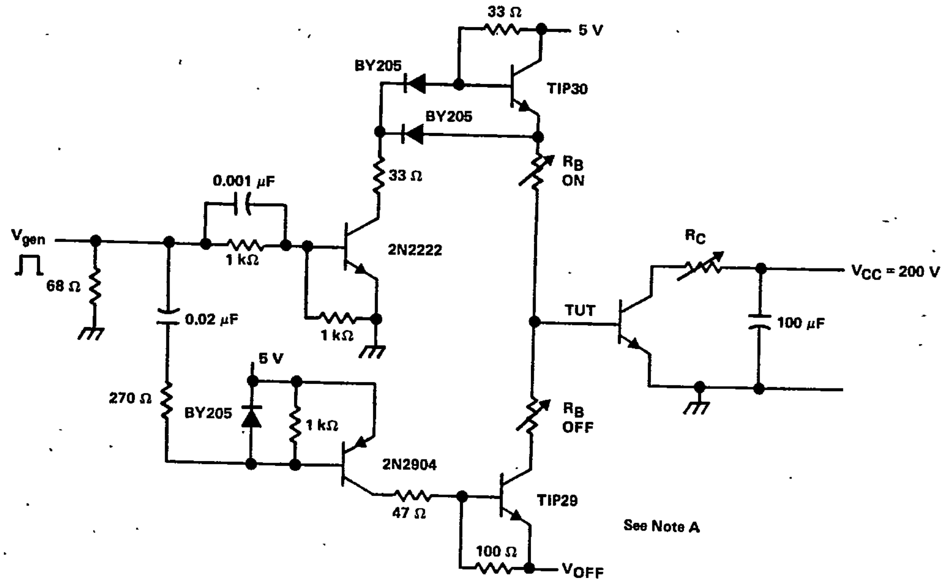
resistive-load switching characteristics

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{on}	I_C = 4 A, $I_{B1} = -I_{B2}$ = 0.8 A, T_C = 25°C, V_{CC} = 200 V, See Figure 1			0.55	μs
t_s				2.5	
t_f				0.5	
t_{on}	I_C = 4 A, $I_{B1} = -I_{B2}$ = 0.8 A, T_C = 100°C, V_{CC} = 200 V, See Figure 1			0.65	μs
t_s				3	
t_f				1	

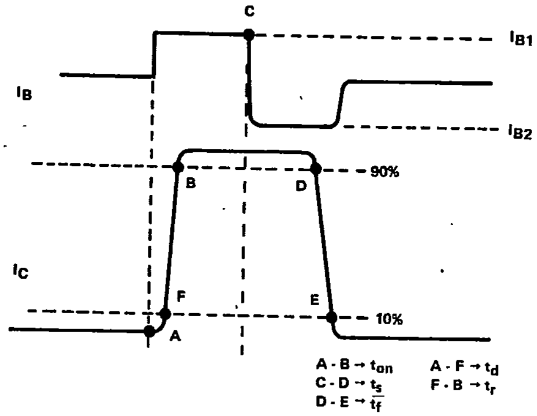
inductive-load switching characteristics

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{sv}	I_C = 4 A, I_{B1} = 0.8 A, T_C = 25°C, $V_{BE(off)}$ = −5 V, See Figure 2			2.5	μs
t_{rv}				0.3	
t_{fi}				0.25	
t_{ti}				0.15	
t_{xo}				0.4	
t_{sv}	I_C = 4 A, I_{B1} = 0.8 A, T_C = 100°C, $V_{BE(off)}$ = −5 V, See Figure 2			3	μs
t_{rv}				0.5	
t_{fi}				0.25	
t_{ti}				0.15	
t_{xo}				0.75	

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



CURRENT WAVEFORMS

NOTES: A. The V_{gen} waveform is supplied by the following characteristics: $t_r \leq 15$ ns, $t_f \leq 15$ ns, $Z_{out} = 50\ \Omega$, $t_w = 20\ \mu s$, duty cycle $\leq 2\%$.

B. Waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq 15$ ns, $R_{in} \geq 10\ M\Omega$, $C_{in} \leq 11.5$ pF.

C. Resistors must be noninductive types.

FIGURE 1. RESISTIVE-LOAD SWITCHING

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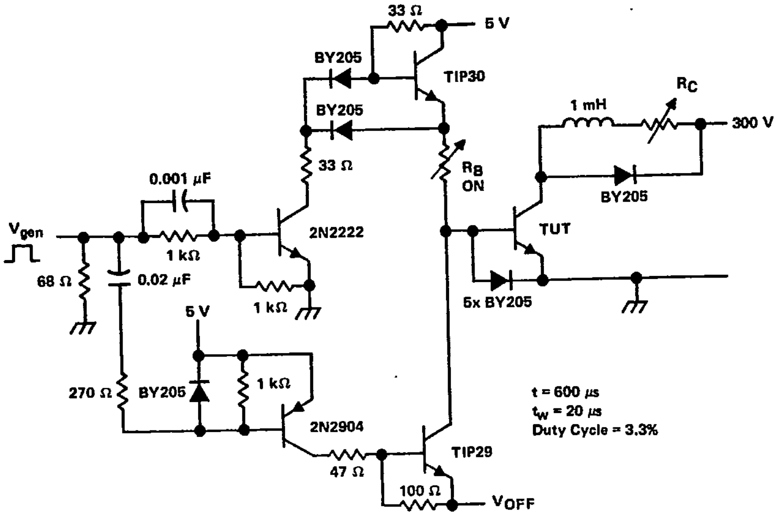
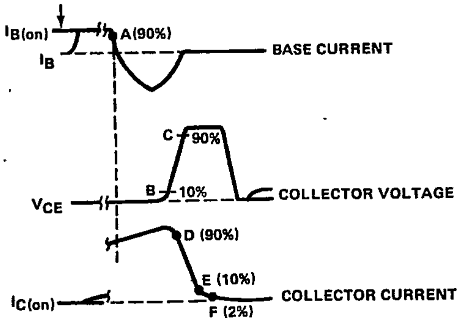
PARAMETER MEASUREMENT INFORMATION



ADJUST R_C FOR REQUIRED I_C

TEST CIRCUIT



A–B = t_{sv}
A–C = t_{rv}
D–E = t_{fi}
E–F = t_{ti}
B–E = t_{xo}

VOLTAGE AND CURRENT WAVEFORMS

NOTES: A. Waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq 15$ ns, $R_{in} \geq 10\ \Omega$, $C_{in} \leq 11.5$ pF.
B. Resistors must be noninductive types.

FIGURE 2. INDUCTIVE-LOAD SWITCHING

T-33-13

TIPL760, TIPL760A, TIPL761, TIPL761A
N-P-N SILICON POWER TRANSISTORS

TYPICAL CHARACTERISTICS

RESISTIVE-LOAD TURN-ON TIME
vs
COLLECTOR CURRENT

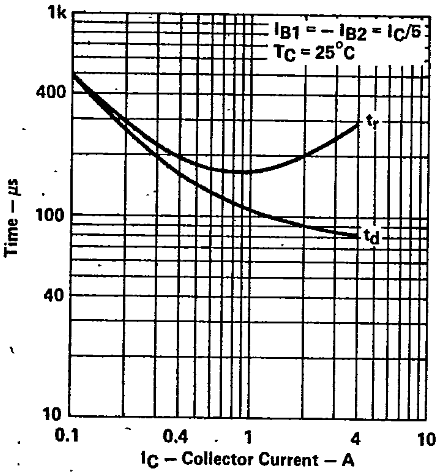


FIGURE 3

RESISTIVE-LOAD TURN-OFF TIME
vs
COLLECTOR CURRENT

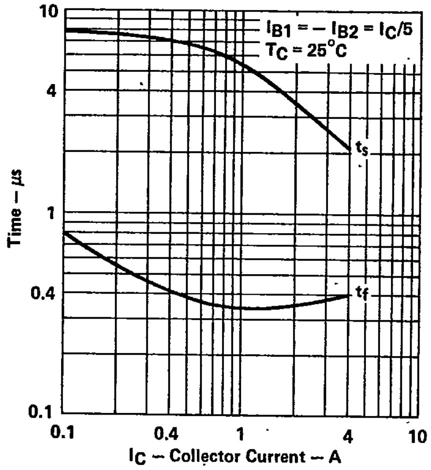


FIGURE 4

COLLECTOR-EMITTER SATURATION VOLTAGE
vs
BASE CURRENT

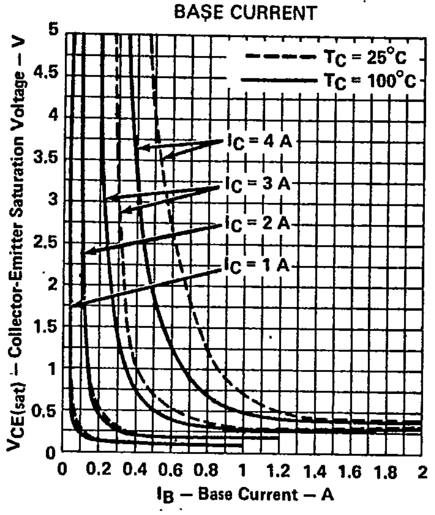


FIGURE 5

BASE-EMITTER SATURATION VOLTAGE
vs
BASE CURRENT

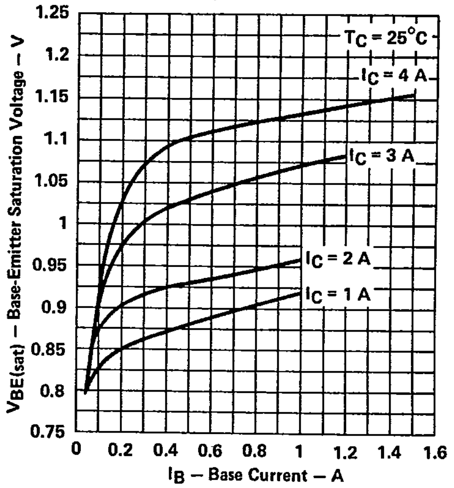


FIGURE 6

T-33-13

TYPICAL CHARACTERISTICS

FORWARD CURRENT TRANSFER RATIO
vs
COLLECTOR CURRENT

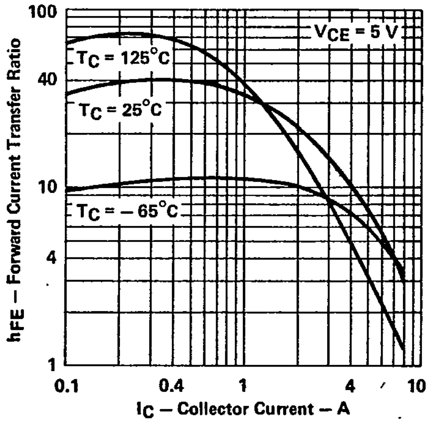


FIGURE 7

COLLECTOR CUTOFF CURRENT
vs
CASE TEMPERATURE

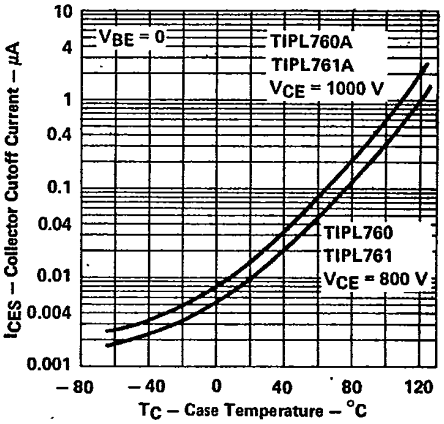


FIGURE 8

MAXIMUM SAFE OPERATING AREA

TIPL 760, TIPL 760A
FORWARD-BIAS SAFE OPERATING AREA

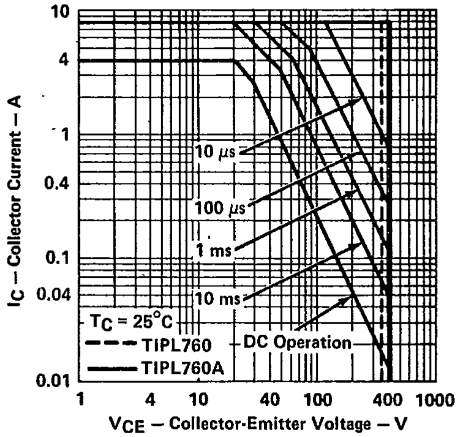


FIGURE 9

TIPL 761, TIPL 761A
FORWARD-BIAS SAFE OPERATING AREA

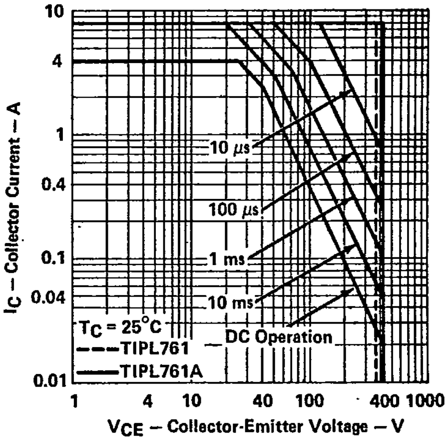


FIGURE 10

T-33-13

TIPL760, TIPL760A, TIPL761, TIPL761A
N-P-N SILICON POWER TRANSISTORS

THERMAL INFORMATION

TIPL761, TIPL761A
THERMAL RESPONSE

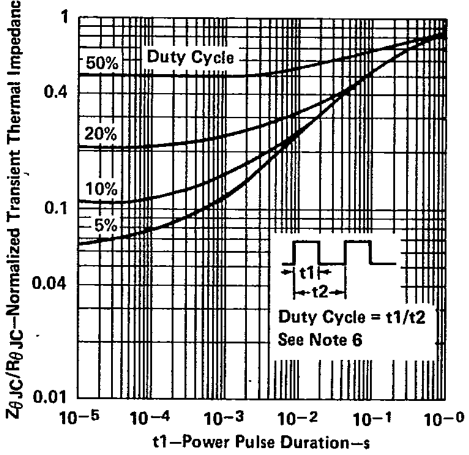


FIGURE 11

TIPL760, TIPL760A
THERMAL RESPONSE

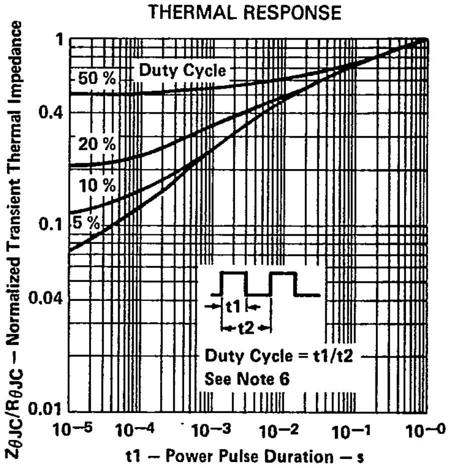


FIGURE 12

LIMITING CONDITIONS
FOR POWER-DOWN TRANSIENT

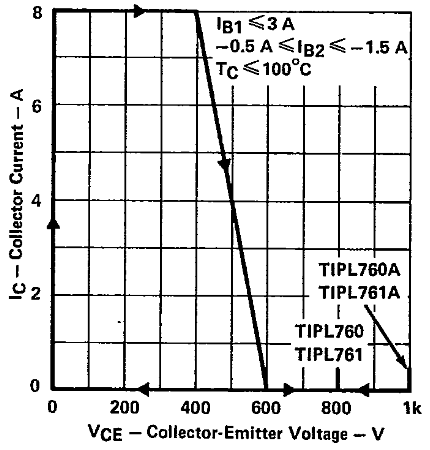


FIGURE 13

DISSIPATION DERATING CURVE

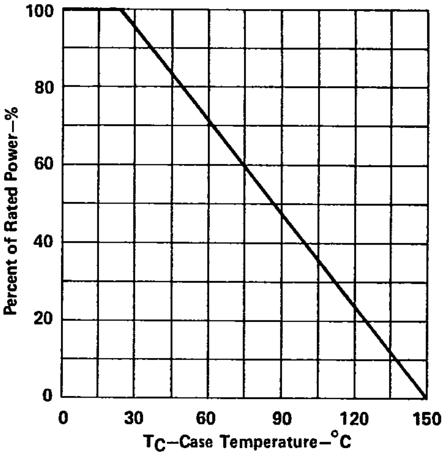


FIGURE 14

NOTE 6: Read time at end of t_1, $T_{J(max)}$ $T_J - T_C = P_{D(peak)} \cdot \left(\frac{Z_{\theta JC}}{R_{\theta JC}}\right) \cdot R_{\theta JC(max)}$.

TEXAS INSTRUMENTS
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