

8961726 TEXAS INSTR (OPTO)

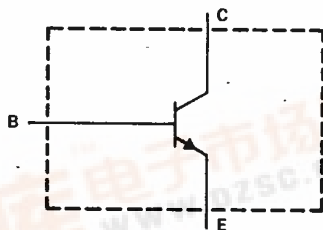
62C 36836 D

TIP55A, TIP56A, TIP57A, TIP58A
N-P-N SILICON POWER TRANSISTORS

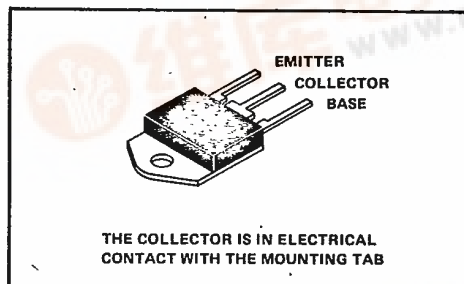
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REVISED OCTOBER 1984

- Min $V_{(BR)CEO}$ of 250 V to 400 V
- 50 W at 100°C Case Temperature
- 10 A Peak Collector Current
- Designed for Automotive Ignition and Switching Regulator Applications
- Characterized For Operation In Ignition and Switching Regulator Applications
- High-Voltage, High Forward and Reverse Energy

device schematic



TO-218AA PACKAGE



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

	TIP55A	TIP56A	TIP57A	TIP58A
Collector-base voltage	350 V	400 V	450 V	500 V
Collector-emitter voltage ($I_B = 0$)	250 V	300 V	350 V	400 V
Emitter-base voltage	8 V	8 V	8 V	8 V
Continuous collector current	7.5 A			
Peak collector current (see Note 1)	10 A			
Continuous base current	4 A			
Safe operating area	See Figure 8			
Continuous device dissipation at (or below) 100°C case temperature (see Note 2)	50 W			
Continuous device dissipation at (or below) 25°C free-air temperature (see Note 3)	3 W			
Operating collector junction and storage temperature range	-65°C to 150°C			
Lead temperature 3,2 mm (0.125 inch) from case for 10 seconds	300°C			

- NOTES:
1. This value applies for $t_w \leq 10$ ms, duty cycle $\leq 10\%$.
 2. Derate linearly to 150°C case temperature at the rate of 1 W/°C or refer to Dissipation Derating Curve, Figure 9.
 3. Derate linearly to 150°C free-air temperature at the rate of 24 mW/°C or refer to Dissipation Derating Curve, Figure 10.



TIP Devices

TEXAS INSTRUMENTS

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TIP55A, TIP56A, TIP57A, TIP58A
N-P-N SILICON POWER TRANSISTORS

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electrical characteristics at 25°C case temperature

PARAMETER	TEST CONDITIONS	TIP55A		TIP56A		TIP57A		TIP58A		UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	
$V_{(BR)CEO}$	$I_C = 20 \text{ mA}$, See Note 4	250		300		350		400		V
I_{CER}	$V_{CE} = 350 \text{ V}$, $R_{BE} = 27 \Omega$	100								μA
	$V_{CE} = 400 \text{ V}$, $R_{BE} = 27 \Omega$			100						
	$V_{CE} = 450 \text{ V}$, $R_{BE} = 27 \Omega$					100				
	$V_{CE} = 500 \text{ V}$, $R_{BE} = 27 \Omega$							100		
I_{EBO}	$V_{EB} = 8 \text{ V}$, $I_C = 0$	100		100		100		100		μA
h_{FE}	$V_{CE} = 2 \text{ V}$, $I_C = 1 \text{ A}$, See Notes 4 and 5	10	100	10	100	10	100	10	100	
	$V_{CE} = 2 \text{ V}$, $I_C = 5 \text{ A}$, See Notes 4 and 5	6		6		6		6		
$V_{BE(sat)}$	$I_B = 1 \text{ A}$, $I_C = 5 \text{ A}$, See Notes 4 and 5	1.5		1.5		1.5		1.5		V
$V_{CE(sat)}$	$I_B = 1 \text{ A}$, $I_C = 5 \text{ A}$, See Notes 4 and 5	1.2		1.2		1.2		1.2		V
	$I_B = 4 \text{ A}$, $I_C = 10 \text{ A}$, See Notes 4 and 5	2.5		2.5		2.5		2.5		

NOTES: 4. These parameters must be measured using pulse techniques, $t_w = 300 \mu\text{s}$, duty cycle $\leq 2\%$.
5. 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.

thermal characteristics

PARAMETER	MIN	TYP	MAX	UNIT
$R_{\theta JC}$			1	$^{\circ}\text{C/W}$
$R_{\theta JA}$			41.7	
$R_{\theta CHS}$ (see Note 6)			0.6	
$C_{\theta C}$			1.4	

NOTE 6: This parameter must be measured using a (0.003 inch) mica insulator with Dow-Corning 11 compound on both sides of the insulator, 6-32 mounting screws with bushing, and a mounting torque of 8 inch-pounds.

resistive-load switching characteristics at 25°C case temperature

PARAMETER	TEST CONDITIONS†	MIN	TYP	MAX	UNIT
t_d	$I_C = 5 \text{ A}$, $I_{B1} = 1 \text{ A}$, $I_{B2} = -1 \text{ A}$, $V_{BE(off)} = -4 \text{ V}$, $R_L = 40 \Omega$, See Figure 1	0.04			μs
t_r		0.13			
t_s		1.5			
t_f		0.2			

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

functional tests at 25°C free-air temperature

TEST	TEST CONDITIONS	LEVEL
Power ($V_{CE} \cdot I_C$)	$V_{CE} = 50 \text{ V}$, $I_C = 2 \text{ A}$, $t_{test} = 0.15 \text{ s}$	100 W
Reverse Pulse Energy $\left(\frac{I_C^2 L}{2}\right)$	$I_{CM} = 5 \text{ A}$, $L = 2 \text{ mH}$, $f = 10 \text{ Hz}$, $t_{test} = 0.5 \text{ s}$, See Figure 2	25 mJ
Forward Pulse Energy $\left(\frac{I_C^2 L}{2}\right)$	$I_{CM} = 10 \text{ A}$, $L = 5 \text{ mH}$, $V_{clamp} = V_{CEO \text{ max rating}}$, $f = 60 \text{ Hz}$, $t_{test} = 0.5 \text{ s}$, See Figure 3	250 mJ
Operation as Commutating Switch	$I_{load} = 5 \text{ A}$, $V_{CC} = 0.8 V_{CEO \text{ max rating}}$, $f = 20 \text{ kHz}$, $t_{test} = 0.5 \text{ s}$, See Figure 4	

TIP Devices

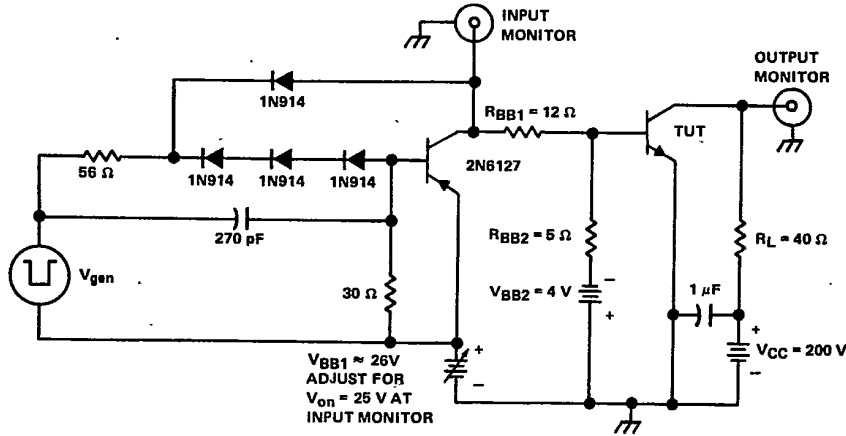
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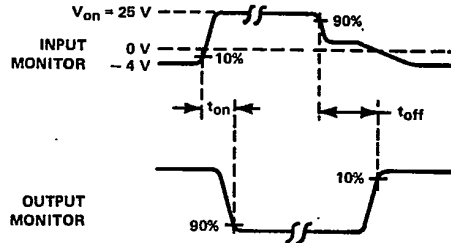
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N-P-N SILICON POWER TRANSISTORS

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PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

- NOTES: A. V_{gen} is a -30-V pulse into a 50 Ω termination.
 B. The V_{gen} waveform is supplied by a generator with the following characteristics: $t_r < 15$ ns, $t_f < 15$ ns, $Z_{out} = 50 \Omega$, $t_w = 20 \mu s$, duty cycle $\leq 2\%$.
 C. Waveforms are monitored on an oscilloscope with the following characteristics: $t_r < 15$ ns, $R_{in} > 10$ M Ω , $C_{in} < 11.5$ pF.
 D. Resistors must be noninductive types.
 E. The d-c power supplies may require additional bypassing in order to minimize ringing.

FIGURE 1. RESISTIVE-LOAD SWITCHING

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TIP Devices

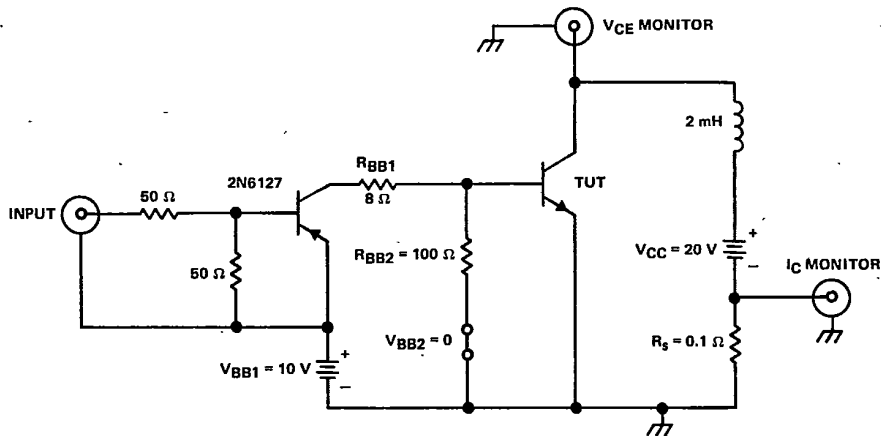
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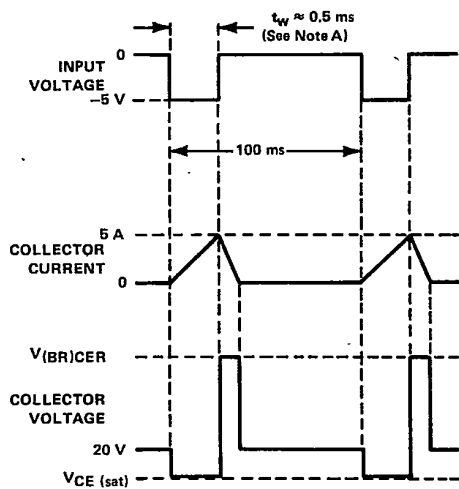
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N-P-N SILICON POWER TRANSISTORS

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FUNCTIONAL TEST INFORMATION



TEST CIRCUIT



VOLTAGE AND CURRENT WAVEFORMS

NOTE A: Input pulse duration is increased until $I_{CM} = 5 A$.

FIGURE 2. REVERSE PULSE ENERGY

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TIP Devices

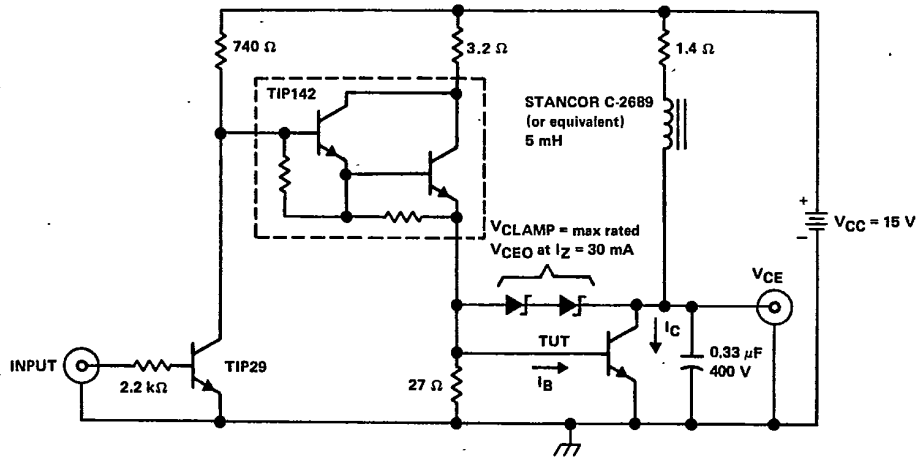
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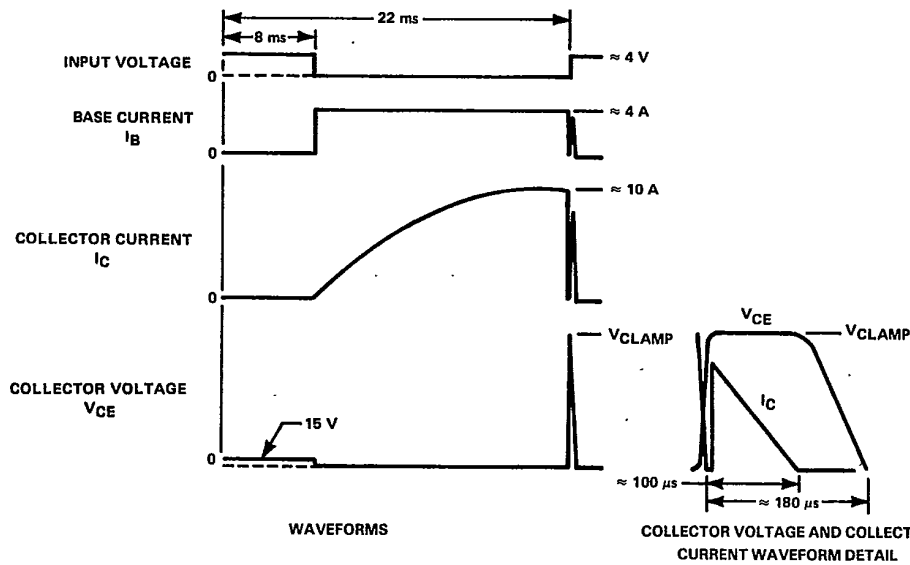
TIP55A, TIP56A, TIP57A, TIP58A
N-P-N SILICON POWER TRANSISTORS

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FUNCTIONAL TEST INFORMATION



TEST CIRCUIT



- NOTES: A. Base and collector currents are measured using current probes such as Tektronix types P6019, P6020, P6021, P6042 or the equivalent.
B. Waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq 20$ ns, $R_{in} \geq 10$ M Ω , $C_{in} \leq 11.5$ pF.

FIGURE 3. FORWARD PULSE ENERGY



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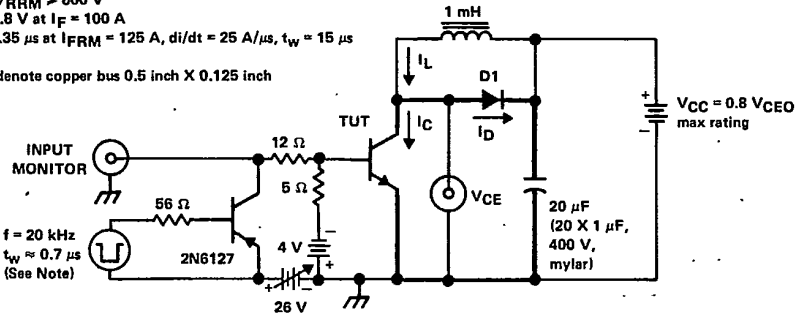
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N-P-N SILICON POWER TRANSISTORS

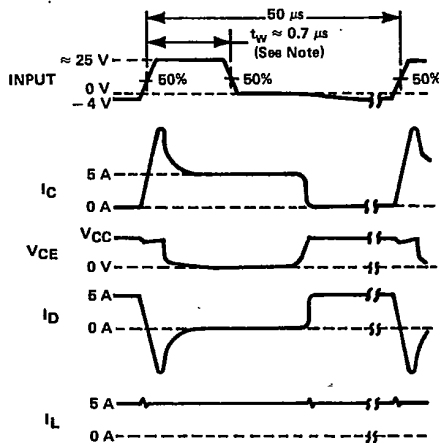
FUNCTIONAL TEST INFORMATION

D1: RCA 40960 (or equivalent)
Rated $I_{FM} \geq 125$ A
Rated $V_{RRM} \geq 600$ V
 $V_F < 1.8$ V at $I_F = 100$ A
 $t_{rr} < 0.35$ μ s at $I_{FRM} = 125$ A, $di/dt = 25$ A/ μ s, $t_W = 15$ μ s

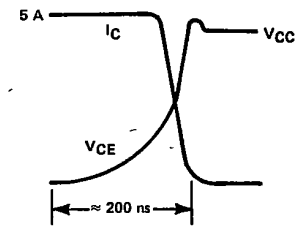
Heavy lines denote copper bus 0.5 inch X 0.125 inch



TEST CIRCUIT



WAVEFORMS



COLLECTOR VOLTAGE AND COLLECTOR CURRENT WAVEFORM DETAIL

NOTE: Increase pulse duration until $I_C = 5$ A following its peak.

FIGURE 4. OPERATION AS COMMUTATING SWITCH

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TIP55A, TIP56A, TIP57A, TIP58A
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TYPICAL CHARACTERISTICS

STATIC FORWARD CURRENT TRANSFER RATIO
vs
COLLECTOR CURRENT

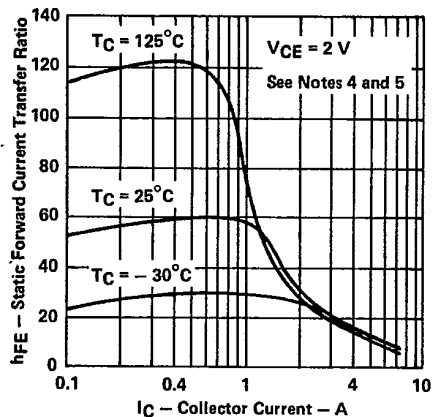


FIGURE 5

BASE-EMITTER VOLTAGE
vs
COLLECTOR CURRENT

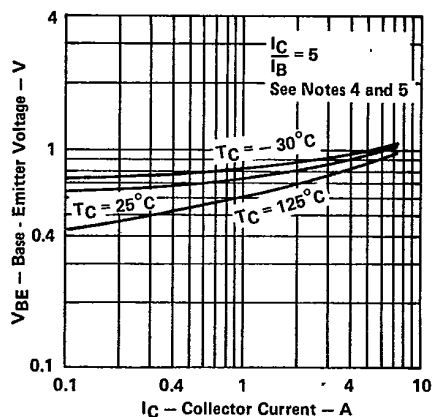


FIGURE 6

COLLECTOR-EMITTER SATURATION VOLTAGE
vs
COLLECTOR CURRENT

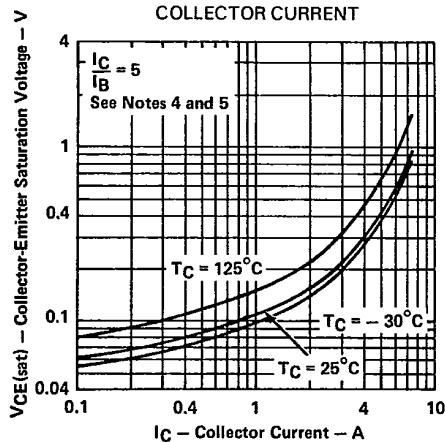


FIGURE 7

- NOTES: 4. These parameters must be measured using pulse techniques, $t_w = 300 \mu s$, duty cycle $\leq 2\%$.
5. 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.



TIP Devices

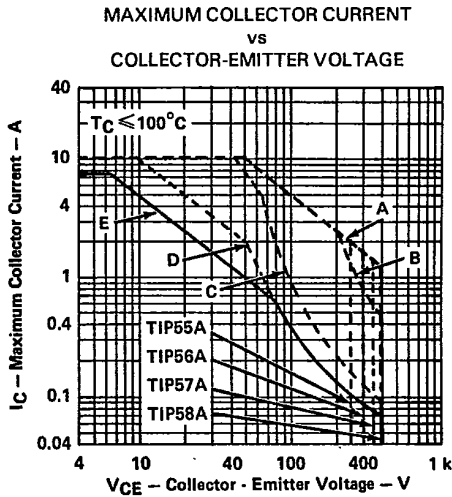
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TIP55A, TIP56A, TIP57A, TIP58A
N-P-N SILICON POWER TRANSISTORS

MAXIMUM SAFE OPERATING AREA



CURVE	CONDITIONS
A	$t_W = 100 \mu s, d = 0.1 = 10 \%$
B	$t_W = 1 ms, d = 0.1 = 10 \%$
C	$t_W = 10 ms, d = 0.1 = 10 \%$
D	$t_W = 150 ms, d = 0.01 = 1 \%$
E	D C OPERATION

FIGURE 8

THERMAL INFORMATION

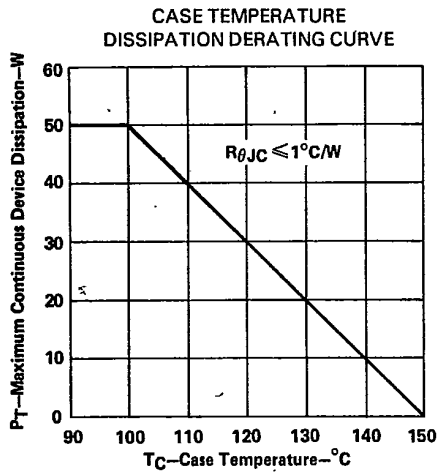


FIGURE 9

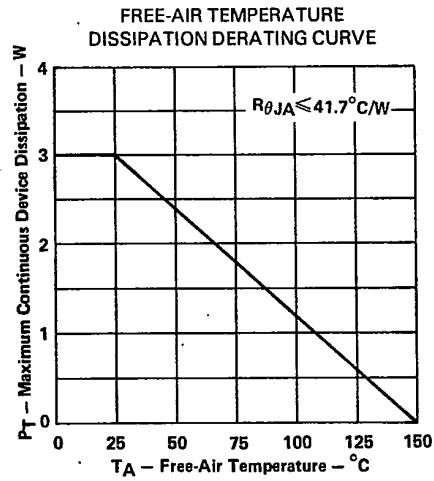


FIGURE 10



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