

# NPN Power Transistors

## 2N3773

The 2N3773 is a PowerBase power transistor designed for high power audio, disk head positioners and other linear applications. This device can also be used in power switching circuits such as relay or solenoid drivers, DC–DC converters or inverters.

### Features

- High Safe Operating Area (100% Tested) 150 W @ 100 V
- Completely Characterized for Linear Operation
- High DC Current Gain and Low Saturation Voltage
  - $h_{FE} = 15$  (Min) @ 8.0 A, 4.0 V
  - $V_{CE(sat)} = 1.4$  V (Max) @  $I_C = 8.0$  A,  $I_B = 0.8$  A
- For Low Distortion Complementary Designs
- This is a Pb–Free Device

### MAXIMUM RATINGS (Note 1)

Rating	Symbol	Value	Unit
Collector – Emitter Voltage	$V_{CEO}$	140	Vdc
Collector – Emitter Voltage	$V_{CEX}$	160	Vdc
Collector – Base Voltage	$V_{CBO}$	160	Vdc
Emitter – Base Voltage	$V_{EBO}$	7	Vdc
Collector Current – Continuous – Peak (Note 2)	$I_C$	16 30	Adc
Base Current – Continuous – Peak (Note 2)	$I_B$	4 15	Adc
Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	150 0.855	W W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	–65 to +200	$^\circ\text{C}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

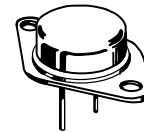
1. Indicates JEDEC Registered Data.
2. Pulse Test: Pulse Width = 5 ms, Duty Cycle  $\leq 10\%$ .

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction–to–Case	$R_{\theta JC}$	1.17	$^\circ\text{C/W}$

\*For additional information on our Pb–Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

## 16 A NPN POWER TRANSISTORS 140 V, 150 W



TO–204  
CASE 1–07

### MARKING DIAGRAM



- A = Assembly Location
- YY = Year
- WW = Work Week
- G = Pb–Free Package

### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

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

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b> (Note 3)				
Collector–Emitter Breakdown Voltage (Note 4) ( $I_C = 0.2\text{ A dc}$ , $I_B = 0$ )	$V_{CEO(sus)}$	140	–	Vdc
Collector–Emitter Sustaining Voltage (Note 4) ( $I_C = 0.1\text{ A dc}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ , $R_{BE} = 100\ \Omega$ )	$V_{CEX(sus)}$	160	–	Vdc
Collector–Emitter Sustaining Voltage ( $I_C = 0.2\text{ A dc}$ , $R_{BE} = 100\ \Omega$ )	$V_{CER(sus)}$	150	–	Vdc
Collector Cutoff Current (Note 4) ( $V_{CE} = 120\text{ Vdc}$ , $I_B = 0$ )	$I_{CEO}$	–	10	mAdc
Collector Cutoff Current (Note 4) ( $V_{CE} = 140\text{ Vdc}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ ) ( $V_{CE} = 140\text{ Vdc}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ , $T_C = 150^\circ\text{C}$ )	$I_{CEX}$	– –	2 10	mAdc
Collector Cutoff Current ( $V_{CB} = 140\text{ Vdc}$ , $I_E = 0$ )	$I_{CBO}$	–	2	mAdc
Emitter Cutoff Current (Note 4) ( $V_{BE} = 7\text{ Vdc}$ , $I_C = 0$ )	$I_{EBO}$	–	5	mAdc

**ON CHARACTERISTICS** (Note 3)

DC Current Gain ( $I_C = 8\text{ A dc}$ , $V_{CE} = 4\text{ Vdc}$ ) (Note 4) ( $I_C = 16\text{ A dc}$ , $V_{CE} = 4\text{ Vdc}$ )	$h_{FE}$	15 5	60 –	–
Collector–Emitter Saturation Voltage ( $I_C = 8\text{ A dc}$ , $I_B = 800\text{ mAdc}$ ) (Note 4) ( $I_C = 16\text{ A dc}$ , $I_B = 3.2\text{ A dc}$ )	$V_{CE(sat)}$	– –	1.4 4	Vdc
Base–Emitter On Voltage (Note 4) ( $I_C = 8\text{ A dc}$ , $V_{CE} = 4\text{ Vdc}$ )	$V_{BE(on)}$	–	2.2	Vdc

**DYNAMIC CHARACTERISTICS**

Magnitude of Common–Emitter Small–Signal, Short–Circuit, Forward Current Transfer Ratio ( $I_C = 1\text{ A}$ , $f = 50\text{ kHz}$ )	$ h_{fe} $	4	–	–
Small–Signal Current Gain (Note 4) ( $I_C = 1\text{ A dc}$ , $V_{CE} = 4\text{ Vdc}$ , $f = 1\text{ kHz}$ )	$h_{fe}$	40	–	–

**SECOND BREAKDOWN CHARACTERISTICS**

Second Breakdown Collector Current with Base Forward Biased $t = 1\text{ s}$ (non–repetitive), $V_{CE} = 100\text{ V}$ , See Figure 12	$I_{S/b}$	1.5	–	Adc
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Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

3. Pulse Test: Pulse Width =  $300\ \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

4. Indicates JEDEC Registered Data.

**ORDERING INFORMATION**

Device	Package	Shipping <sup>†</sup>
2N3773G	TO–204 (Pb–Free)	100 Unit / Tray

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

## NPN

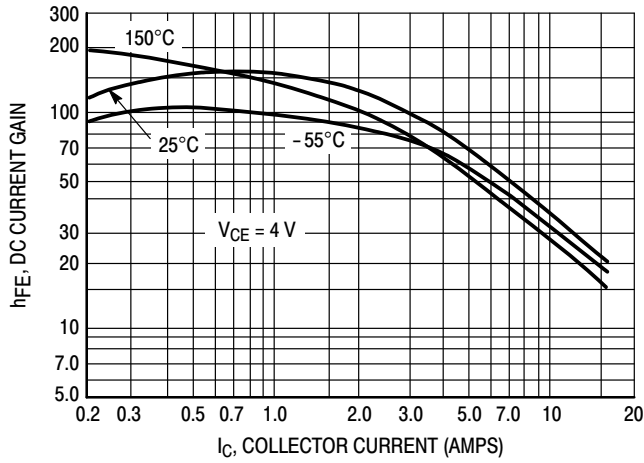


Figure 1. DC Current Gain

## PNP

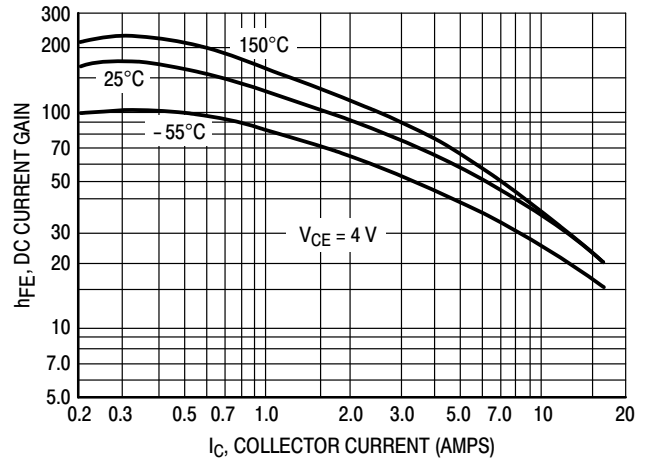


Figure 2. DC Current Gain

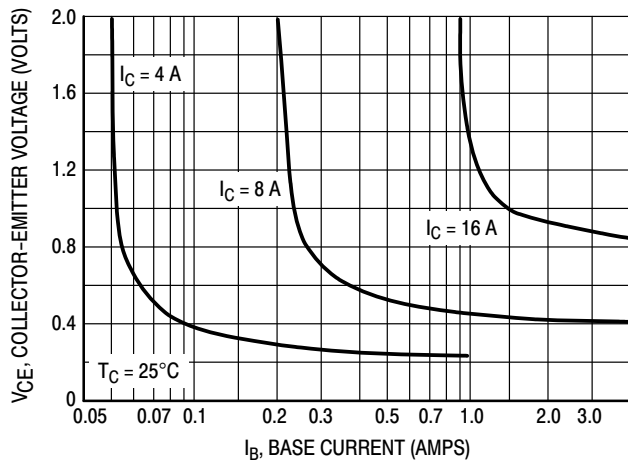


Figure 3. Collector Saturation Region

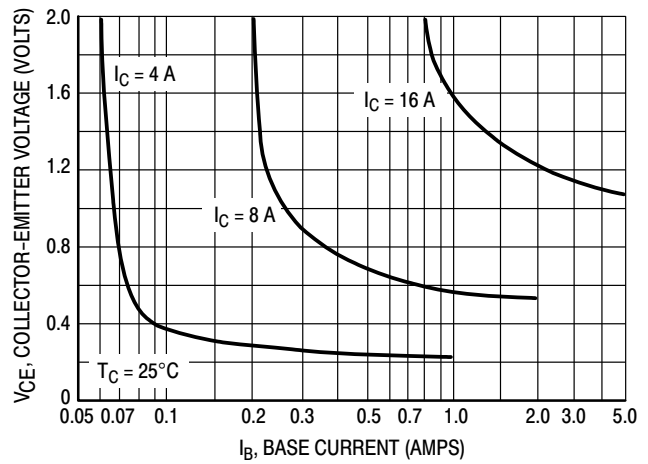


Figure 4. Collector Saturation Region

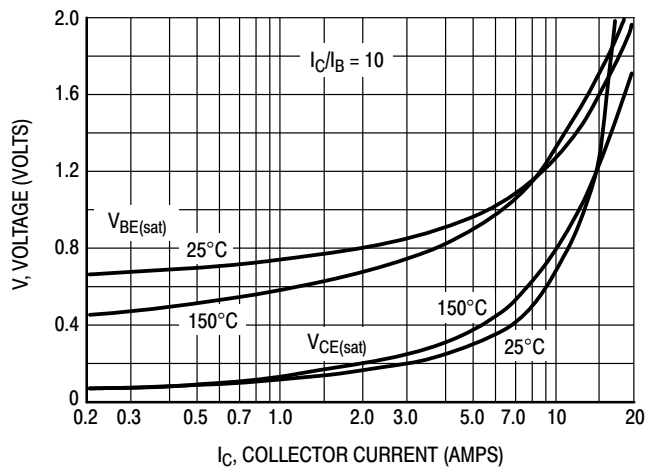


Figure 5. "On" Voltage

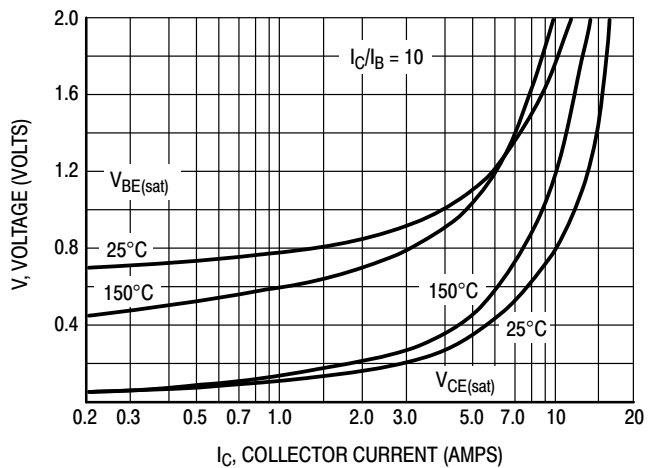


Figure 6. "On" Voltage

## TYPICAL CHARACTERISTICS

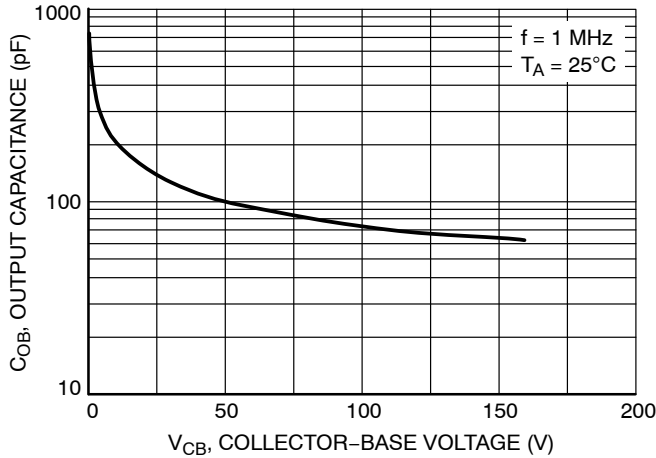


Figure 7. Output Capacitance

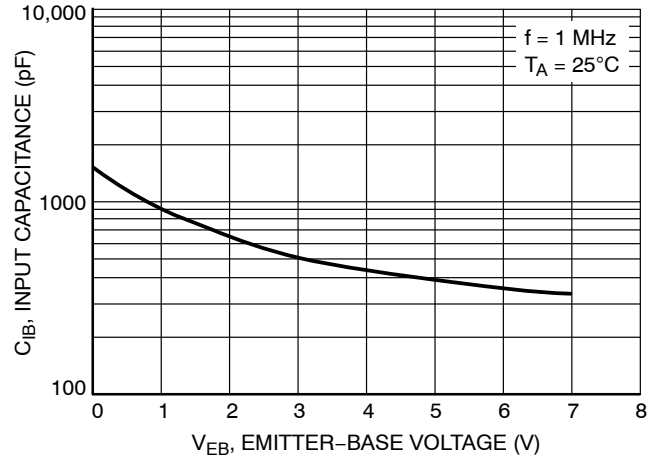


Figure 8. Input Capacitance

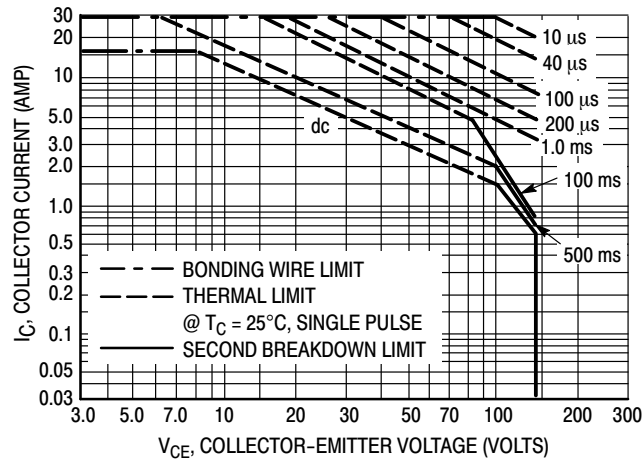


Figure 9. Forward Bias Safe Operating Area

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 9 is based on  $T_{J(pk)} = 200^\circ\text{C}$ ;  $T_C$  is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(pk)} < 200^\circ\text{C}$ . At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

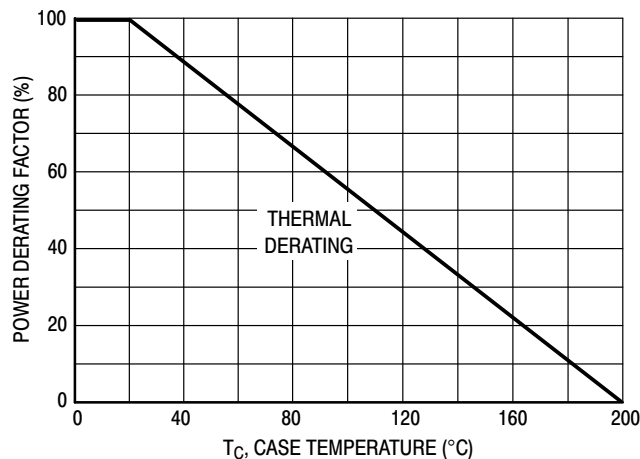
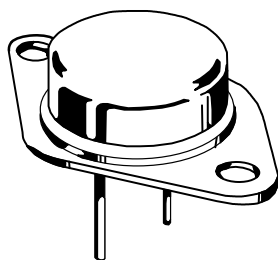


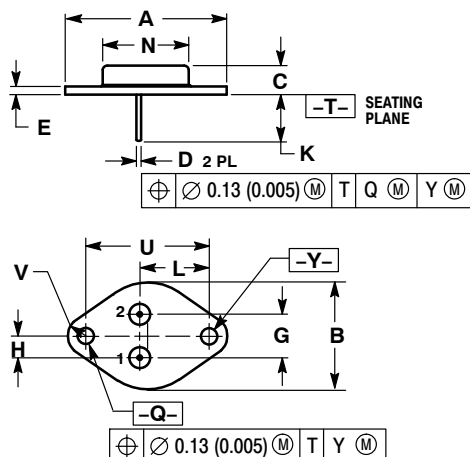
Figure 10. Power Derating



TO-204 (TO-3)  
CASE 1-07  
ISSUE Z

DATE 10 MAR 2000

SCALE 1:1



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. ALL RULES AND NOTES ASSOCIATED WITH REFERENCED TO-204AA OUTLINE SHALL APPLY.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.550 REF		39.37 REF	
B	---	1.050	---	26.67
C	0.250	0.335	6.35	8.51
D	0.038	0.043	0.97	1.09
E	0.055	0.070	1.40	1.77
G	0.430 BSC		10.92 BSC	
H	0.215 BSC		5.46 BSC	
K	0.440	0.480	11.18	12.19
L	0.665 BSC		16.89 BSC	
N	---	0.830	---	21.08
Q	0.151	0.165	3.84	4.19
U	1.187 BSC		30.15 BSC	
V	0.131	0.188	3.33	4.77

STYLE 1:  
PIN 1. BASE  
2. EMITTER  
CASE: COLLECTOR

STYLE 2:  
PIN 1. BASE  
2. COLLECTOR  
CASE: EMITTER

STYLE 3:  
PIN 1. GATE  
2. SOURCE  
CASE: DRAIN

STYLE 4:  
PIN 1. GROUND  
2. INPUT  
CASE: OUTPUT

STYLE 5:  
PIN 1. CATHODE  
2. EXTERNAL TRIP/DELAY  
CASE: ANODE

STYLE 6:  
PIN 1. GATE  
2. EMITTER  
CASE: COLLECTOR

STYLE 7:  
PIN 1. ANODE  
2. OPEN  
CASE: CATHODE

STYLE 8:  
PIN 1. CATHODE #1  
2. CATHODE #2  
CASE: ANODE

STYLE 9:  
PIN 1. ANODE #1  
2. ANODE #2  
CASE: CATHODE

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