

2N6547

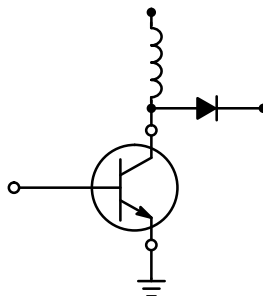
Designer's™ Data Sheet **Switchmode Series NPN Silicon Power Transistors**

The 2N6547 transistor is designed for high-voltage, high-speed, power switching in inductive circuits where fall time is critical. They are particularly suited for 115 and 220 volt line operated switch-mode applications such as:

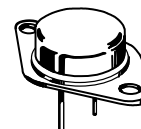
- Switching Regulators
- PWM Inverters and Motor Controls
- Solenoid and Relay Drivers
- Deflection Circuits

Specification Features —

High Temperature Performance Specified for:
Reversed Biased SOA with Inductive Loads
Switching Times with Inductive Loads
Saturation Voltages
Leakage Currents



**15 AMPERE
NPN SILICON
POWER TRANSISTORS
300 and 400 VOLTS
175 WATTS**



**CASE 1-07
TO-204AA
(TO-3)**

MAXIMUM RATINGS (1)

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CEO(sus)}$	400	Vdc
Collector-Emitter Voltage	$V_{CEX(sus)}$	450	Vdc
Collector-Emitter Voltage	V_{CEV}	850	Vdc
Emitter Base Voltage	V_{EB}	9.0	Vdc
Collector Current — Continuous	I_C	15	Adc
— Peak (2)	I_{CM}	30	
Base Current — Continuous	I_B	10	Adc
— Peak (2)	I_{BM}	20	
Emitter Current — Continuous	I_E	25	Adc
— Peak (2)	I_{EM}	35	
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$ Derate above 25°C	P_D	175 100 1.0	Watts W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +200	$^\circ\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.0	$^\circ\text{C/W}$
Maximum Lead Temperature for Soldering Purposes: 1/8" from Case for 5 Seconds	T_L	275	$^\circ\text{C}$

Designer's and SWITCHMODE are trademarks of Motorola, Inc.

Designer's Data for "Worst Case" Conditions — The Designer's Data Sheet permits the design of most circuits entirely from the information presented. SOA Limit curves — representing boundaries on device characteristics — are given to facilitate "worst case" design.

REV 4

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS (1)				
Collector–Emitter Sustaining Voltage ($I_C = 100\text{ mA}$, $I_B = 0$)	$V_{CEO(sus)}$	300 400	— —	Vdc
Collector–Emitter Sustaining Voltage ($I_C = 8.0\text{ A}$, $V_{clamp} = \text{Rated } V_{CEX}$, $T_C = 100^\circ\text{C}$)	$V_{CEX(sus)}$	350 450 200 300	— — — —	Vdc
Collector Cutoff Current ($V_{CEV} = \text{Rated Value}$, $V_{BE(off)} = 1.5\text{ Vdc}$) ($V_{CEV} = \text{Rated Value}$, $V_{BE(off)} = 1.5\text{ Vdc}$, $T_C = 100^\circ\text{C}$)	I_{CEV}	— —	1.0 4.0	mAdc
Collector Cutoff Current ($V_{CE} = \text{Rated } V_{CEV}$, $R_{BE} = 50\ \Omega$, $T_C = 100^\circ\text{C}$)	I_{CER}	—	5.0	mAdc
Emitter Cutoff Current ($V_{EB} = 9.0\text{ Vdc}$, $I_C = 0$)	I_{EBO}	—	1.0	mAdc

SECOND BREAKDOWN

Second Breakdown Collector Current with base forward biased $t = 1.0\text{ s}$ (non–repetitive) ($V_{CE} = 100\text{ Vdc}$)	$I_{S/b}$	0.2	—	Adc
--	-----------	-----	---	-----

ON CHARACTERISTICS (1)

DC Current Gain ($I_C = 5.0\text{ Adc}$, $V_{CE} = 2.0\text{ Vdc}$) ($I_C = 10\text{ Adc}$, $V_{CE} = 2.0\text{ Vdc}$)	h_{FE}	12 6.0	60 30	—
Collector–Emitter Saturation Voltage ($I_C = 10\text{ Adc}$, $I_B = 2.0\text{ Adc}$) ($I_C = 15\text{ Adc}$, $I_B = 3.0\text{ Adc}$) ($I_C = 10\text{ Adc}$, $I_B = 2.0\text{ Adc}$, $T_C = 100^\circ\text{C}$)	$V_{CE(sat)}$	— — —	1.5 5.0 2.5	Vdc
Base–Emitter Saturation Voltage ($I_C = 10\text{ Adc}$, $I_B = 2.0\text{ Adc}$) ($I_C = 10\text{ Adc}$, $I_B = 2.0\text{ Adc}$, $T_C = 100^\circ\text{C}$)	$V_{BE(sat)}$	— —	1.6 1.6	Vdc

DYNAMIC CHARACTERISTICS

Current–Gain — Bandwidth Product ($I_C = 500\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$, $f_{test} = 1.0\text{ MHz}$)	f_T	6.0	28	MHz
Output Capacitance ($V_{CB} = 10\text{ Vdc}$, $I_E = 0$, $f_{test} = 1.0\text{ MHz}$)	C_{ob}	125	500	pF

SWITCHING CHARACTERISTICS

Resistive Load					
Delay Time	(V _{CC} = 250 V, I _C = 10 A, I _{B1} = I _{B2} = 2.0 A, t _p = 100 μs, Duty Cycle ≤ 2.0%)	t _d	—	0.05	μs
Rise Time		t _r	—	1.0	μs
Storage Time		t _s	—	4.0	μs
Fall Time		t _f	—	0.7	μs
Inductive Load, Clamped					
Storage Time	(I _C = 10 A(pk), V _{clamp} = Rated V _{CEX} , I _{B1} = 2.0 A, V _{BE(off)} = 5.0 Vdc, T _C = 100°C)	t _s	—	5.0	μs
Fall Time		t _f	—	1.5	μs
Typical					
Storage Time	(I _C = 10 A(pk), V _{clamp} = Rated V _{CEX} , I _{B1} = 2.0 A, V _{BE(off)} = 5.0 Vdc, T _C = 25°C)	t _s	2.0		μs
Fall Time		t _f	0.09		μs

* Indicates JEDEC Registered Data.

(1) Pulse Test: Pulse Width = 300 μs , Duty Cycle = 2%.

TYPICAL ELECTRICAL CHARACTERISTICS

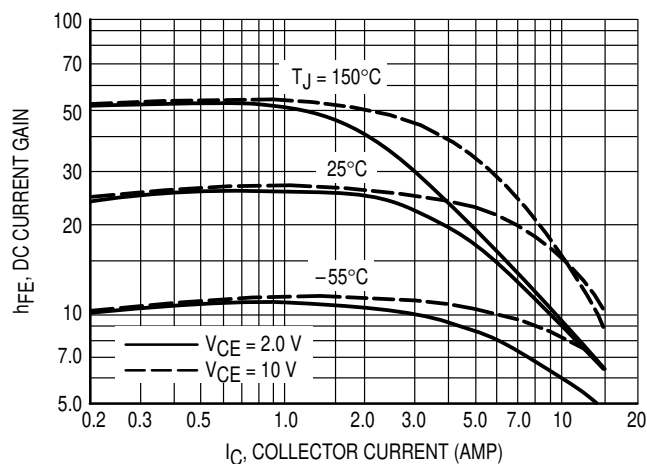


Figure 1. DC Current Gain

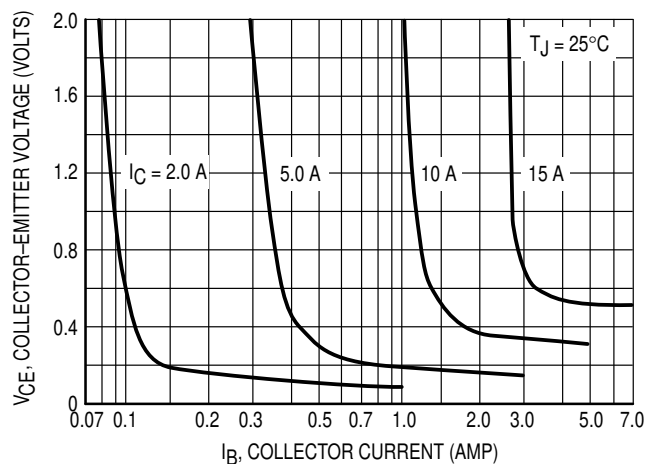


Figure 2. Collector Saturation Region

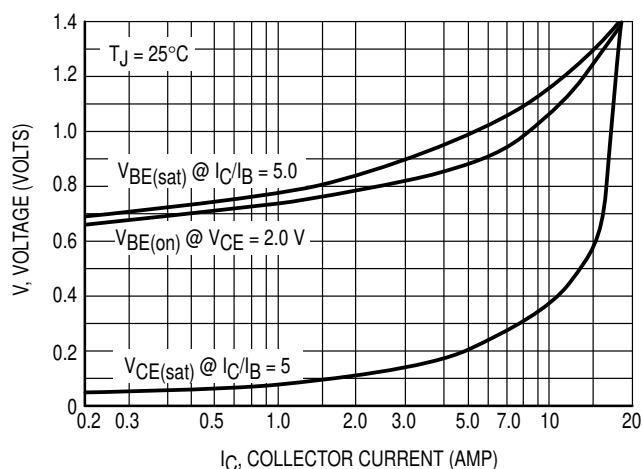


Figure 3. "On" Voltages

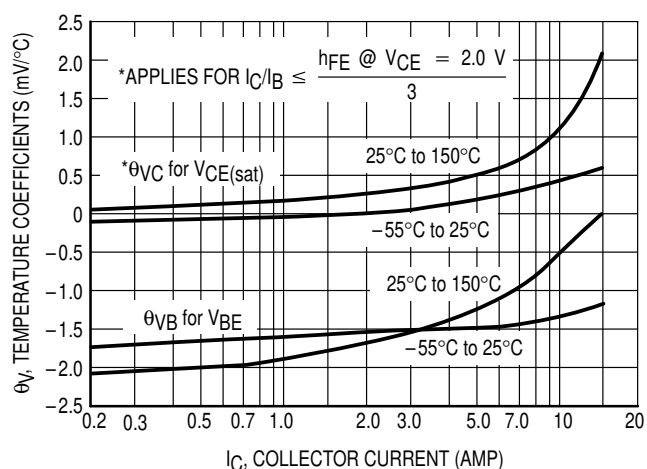


Figure 4. Temperature Coefficients

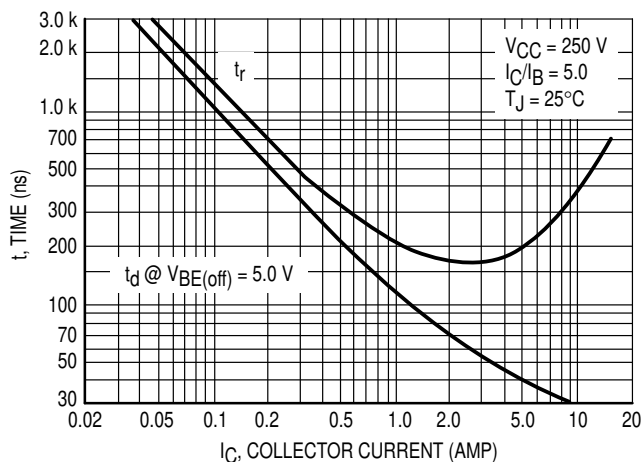


Figure 5. Turn-On Time

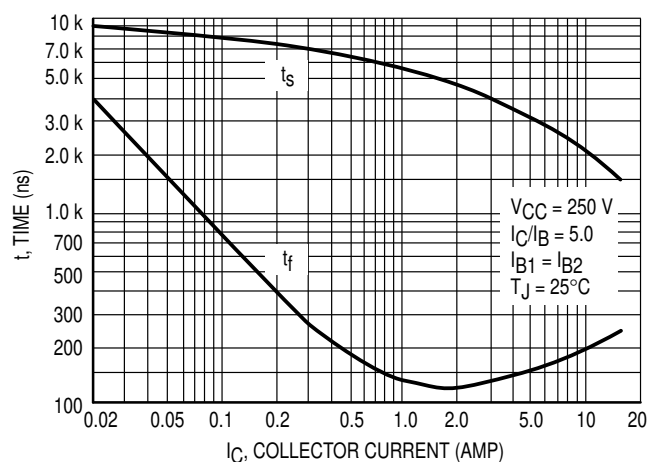


Figure 6. Turn-Off Time

MAXIMUM RATED SAFE OPERATING AREAS

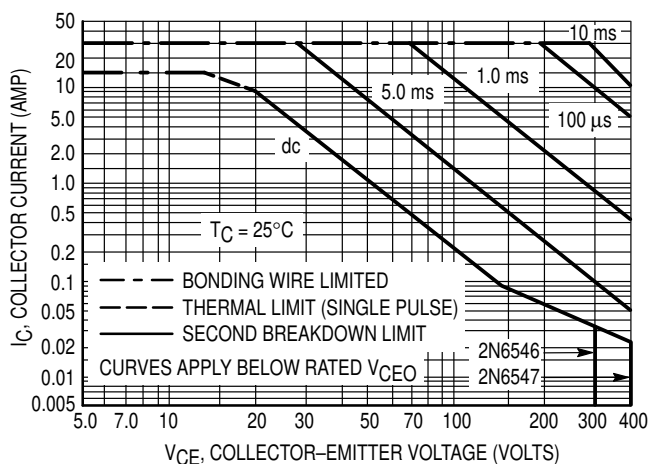


Figure 7. Forward Bias Safe Operating Area

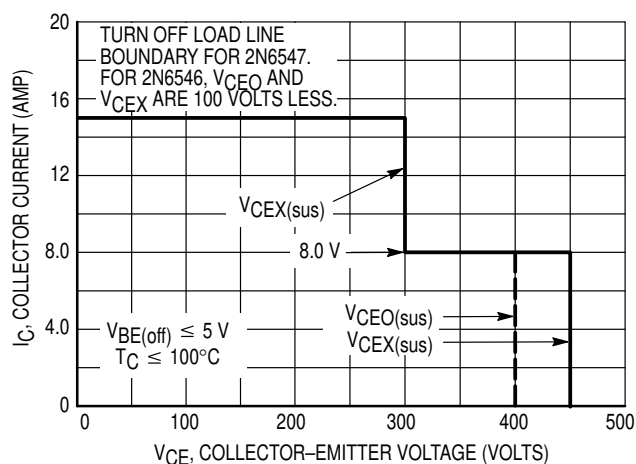


Figure 8. Reverse Bias Safe Operating Area

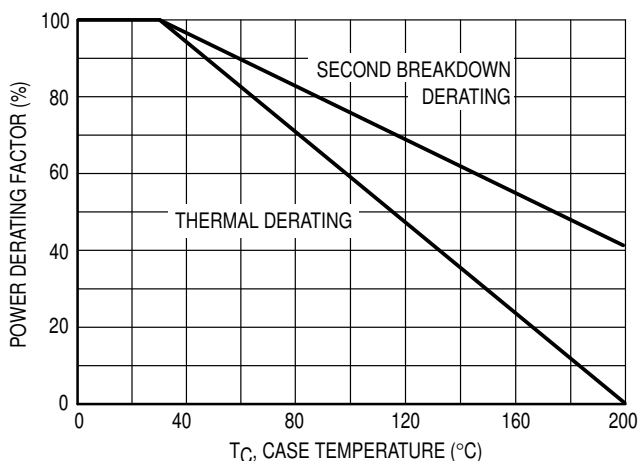


Figure 9. Power Derating

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 7 is based on $T_C = 25^\circ\text{C}$; $T_{J(pk)}$ is variable depending on power level. Second breakdown pulse limits are valid for duty cycles to 10% but must be derated when $T_C \geq 25^\circ\text{C}$. Second breakdown limitations do not derate the same as thermal limitations. Allowable current at the voltages shown on Figure 7 may be found at any case temperature by using the appropriate curve on Figure 9.

$T_{J(pk)}$ may be calculated from the data in Figure 10. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

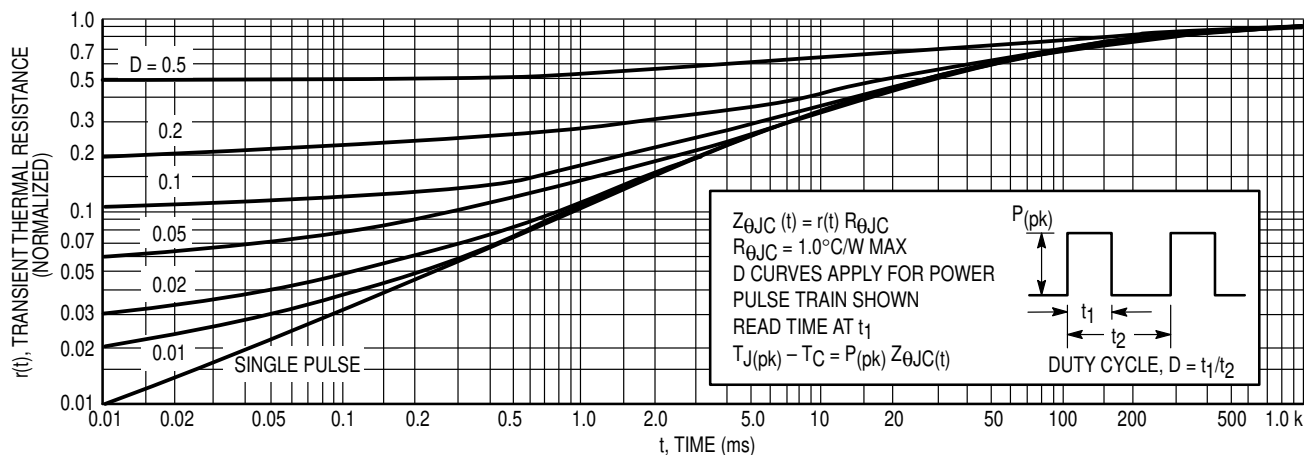
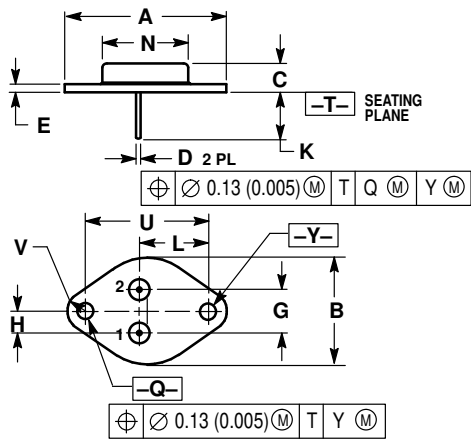


Figure 10. Thermal Response

PACKAGE DIMENSIONS



- 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

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

Motorola reserves the right to make changes without further notice to any products herein. Motorola makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Motorola assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters can and do vary in different applications. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. Motorola does not convey any license under its patent rights nor the rights of others. Motorola products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Motorola was negligent regarding the design or manufacture of the part. Motorola and  are registered trademarks of Motorola, Inc. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

How to reach us:

USA / EUROPE: Motorola Literature Distribution;
P.O. Box 20912; Phoenix, Arizona 85036. 1-800-441-2447

MFAX: RMFAX0@email.sps.mot.com – TOUCHTONE (602) 244-6609
INTERNET: <http://Design-NET.com>

JAPAN: Nippon Motorola Ltd.; Tatsumi-SPD-JLDC, Toshikatsu Otsuki,
6F Seibu-Butsuryu-Center, 3-14-2 Tatsumi Koto-Ku, Tokyo 135, Japan. 03-3521-8315

HONG KONG: Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298

