

# Plastic Medium-Power Silicon Transistors

... designed for general-purpose amplifier and low-speed switching applications.

- High DC Current Gain —  
 $h_{FE} = 2500$  (Typ) @  $I_C$   
 $= 4.0$  Adc
- Collector-Emitter Sustaining Voltage — @ 100 mAdc  
 $V_{CEO(sus)} = 60$  Vdc (Min) — 2N6387  
 $= 80$  Vdc (Min) — 2N6388
- Low Collector-Emitter Saturation Voltage —  
 $V_{CE(sat)} = 2.0$  Vdc (Max) @  $I_C$   
 $= 5.0$  Adc — 2N6387, 2N6388
- Monolithic Construction with Built-In Base-Emitter Shunt Resistors
- TO-220AB Compact Package

**\*MAXIMUM RATINGS**

Rating	Symbol	2N6387	2N6388	Unit
Collector-Emitter Voltage	$V_{CEO}$	60	80	Vdc
Collector-Base Voltage	$V_{CB}$	60	80	Vdc
Emitter-Base Voltage	$V_{EB}$	5.0		Vdc
Collector Current — Continuous Peak	$I_C$	10 15	10 15	Adc
Base Current	$I_B$	250		mAdc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	65 0.52		Watts W/ $^\circ\text{C}$
Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	2.0 0.016		Watts W/ $^\circ\text{C}$
Operating and Storage Junction, Temperature Range	$T_J, T_{stg}$	-65 to +150		$^\circ\text{C}$

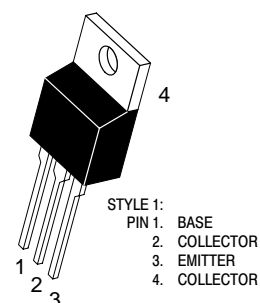
**THERMAL CHARACTERISTICS**

Characteristics	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.92	$^\circ\text{C/W}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	62.5	$^\circ\text{C/W}$

## 2N6387 2N6388\*

\*ON Semiconductor Preferred Device

**DARLINGTON  
8 AND 10 AMPERE  
NPN SILICON  
POWER TRANSISTORS  
60-80 VOLTS  
65 WATTS**



**CASE 221A-09  
TO-220AB**

Preferred devices are ON Semiconductor recommended choices for future use and best overall value.

# 2N6387 2N6388

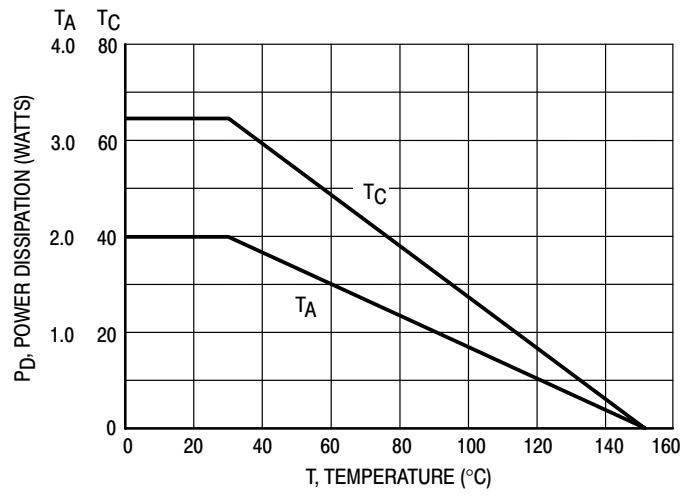


Figure 1. Power Derating

## 2N6387 2N6388

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

Characteristic	Symbol	Min	Max	Unit	
<b>OFF CHARACTERISTICS</b>					
Collector–Emitter Sustaining Voltage (1) ( $I_C = 200\text{ mA}$ , $I_B = 0$ )	2N6387 2N6388	$V_{CE(sus)}$	60 80	— —	Vdc
Collector Cutoff Current ( $V_{CE} = 60\text{ Vdc}$ , $I_B = 0$ ) ( $V_{CE} = 80\text{ Vdc}$ , $I_B = 0$ )	2N6387 2N6388	$I_{CEO}$	— —	1.0 1.0	mA
Collector Cutoff Current ( $V_{CE} = 60\text{ Vdc}$ , $V_{EB(off)} = 1.5\text{ Vdc}$ ) ( $V_{CE} = 80\text{ Vdc}$ , $V_{EB(off)} = 1.5\text{ Vdc}$ ) ( $V_{CE} = 60\text{ Vdc}$ , $V_{EB(off)} = 1.5\text{ Vdc}$ , $T_C = 125^\circ\text{C}$ ) ( $V_{CE} = 80\text{ Vdc}$ , $V_{EB(off)} = 1.5\text{ Vdc}$ , $T_C = 125^\circ\text{C}$ )	2N6387 2N6388 2N6387 2N6388	$I_{CEX}$	— — — —	300 300 3.0 3.0	$\mu\text{A}$  mA
Emitter Cutoff Current ( $V_{BE} = 5.0\text{ Vdc}$ , $I_C = 0$ )		$I_{EBO}$	—	5.0	mA

### ON CHARACTERISTICS (1)

DC Current Gain ( $I_C = 5.0\text{ A}$ , $V_{CE} = 3.0\text{ Vdc}$ ) ( $I_C = 1.0\text{ A}$ , $V_{CE} = 3.0\text{ Vdc}$ )	2N6387, 2N6388 2N6387, 2N6388	$h_{FE}$	1000 100	20,000 —	—
Collector–Emitter Saturation Voltage ( $I_C = 5.0\text{ A}$ , $I_B = 0.01\text{ A}$ ) ( $I_C = 1.0\text{ A}$ , $I_B = 0.1\text{ A}$ )	2N6387, 2N6388 2N6387, 2N6388	$V_{CE(sat)}$	— —	2.0 3.0	Vdc
Base–Emitter On Voltage ( $I_C = 5.0\text{ A}$ , $V_{CE} = 3.0\text{ Vdc}$ ) ( $I_C = 1.0\text{ A}$ , $V_{CE} = 3.0\text{ Vdc}$ )	2N6387, 2N6388 2N6387, 2N6388	$V_{BE(on)}$	— —	2.8 4.5	Vdc

### DYNAMIC CHARACTERISTICS

Small–Signal Current Gain ( $I_C = 1.0\text{ A}$ , $V_{CE} = 5.0\text{ Vdc}$ , $f_{test} = 1.0\text{ MHz}$ )	$ h_{fe} $	20	—	—
Output Capacitance ( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )	$C_{ob}$	—	200	$\mu\text{F}$
Small–Signal Current Gain ( $I_C = 1.0\text{ A}$ , $V_{CE} = 5.0\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{fe}$	1000	—	—

\*Indicates JEDEC Registered Data

(1) Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

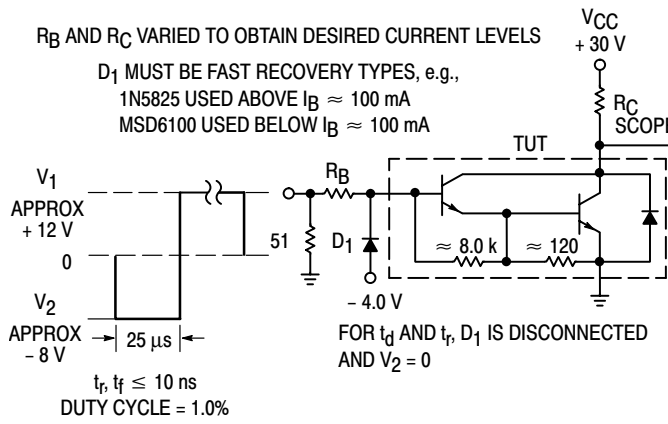


Figure 2. Switching Times Test Circuit

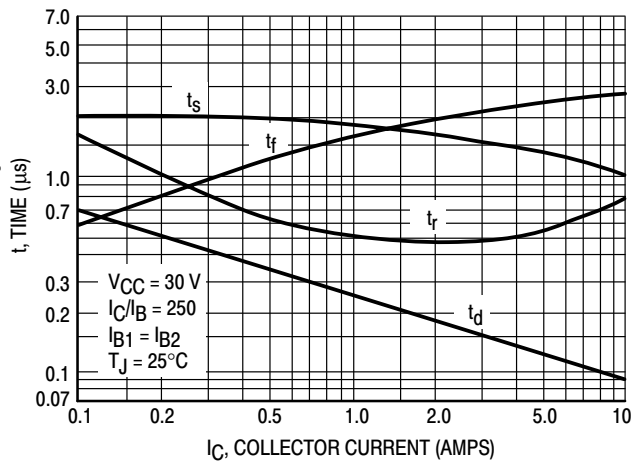


Figure 3. Switching Times

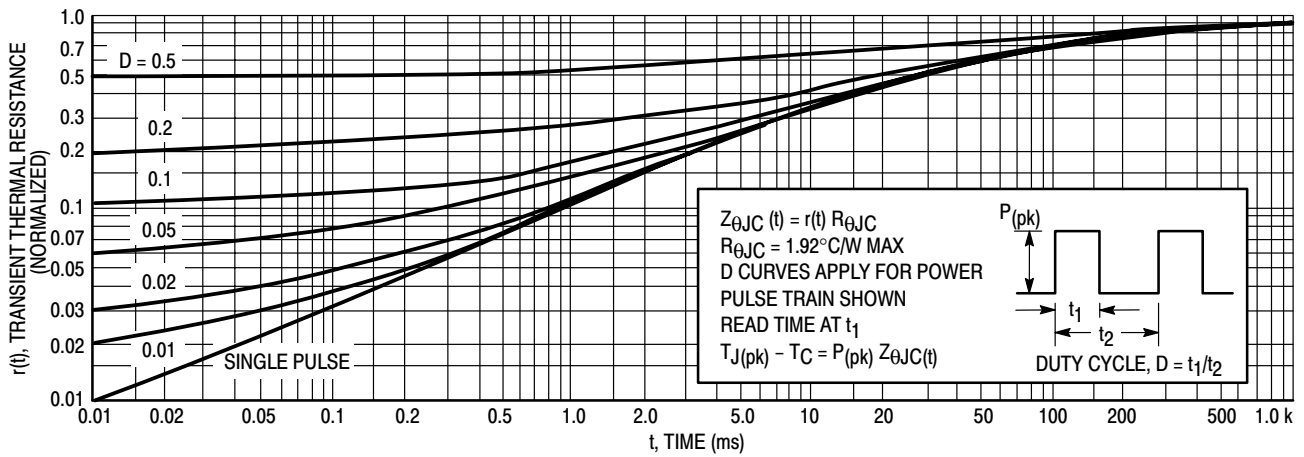


Figure 4. Thermal Response

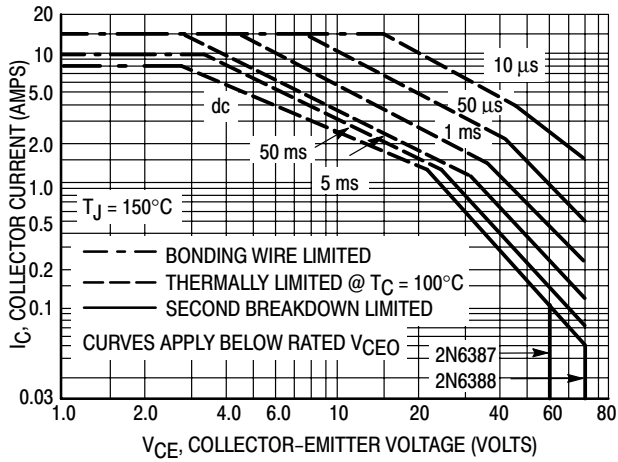


Figure 5. Active-Region Safe Operating Area

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 5 is based on  $T_{J(pk)} = 150^\circ\text{C}$ ;  $T_C$  is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(pk)} < 150^\circ\text{C}$ .  $T_{J(pk)}$  may be calculated from the data in Figure 4. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown

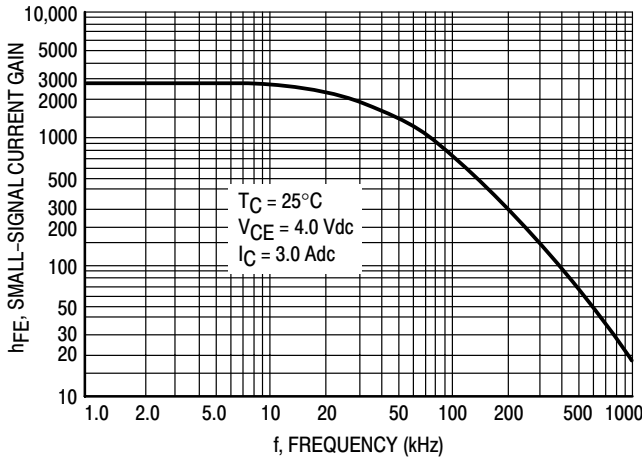


Figure 6. Small-Signal Current Gain

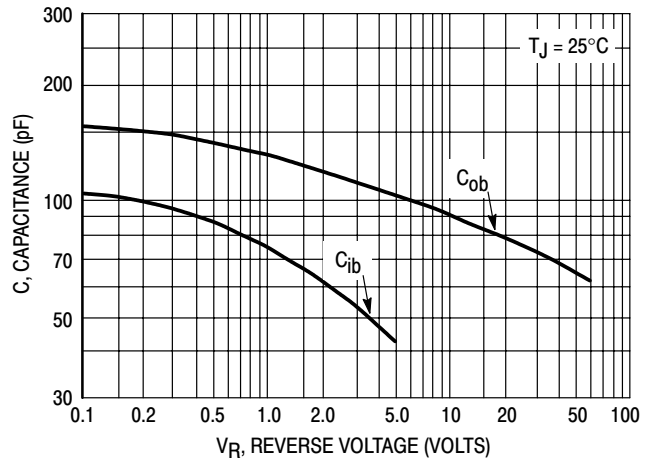


Figure 7. Capacitance

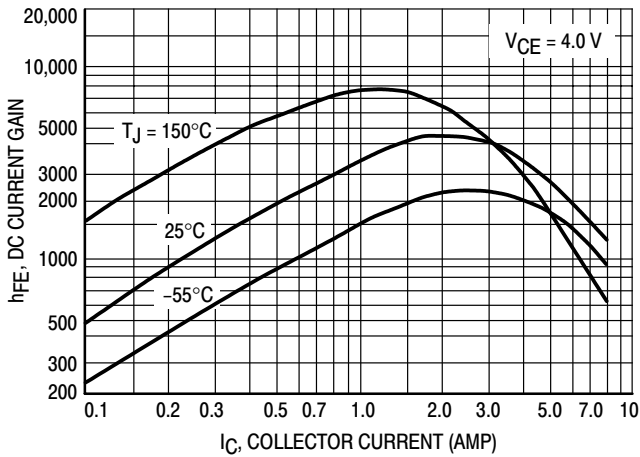


Figure 8. DC Current Gain

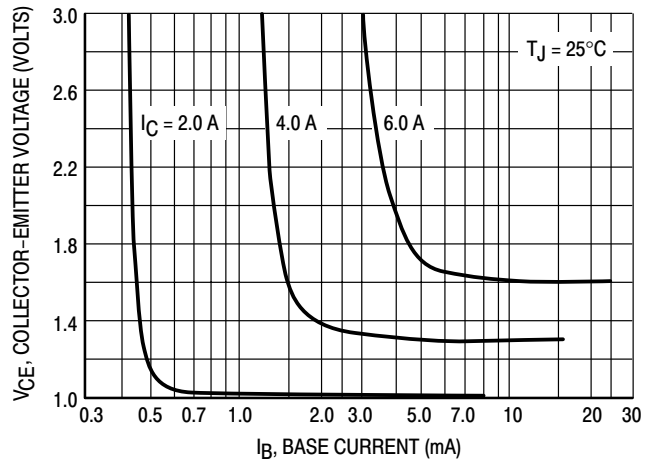


Figure 9. Collector Saturation Region

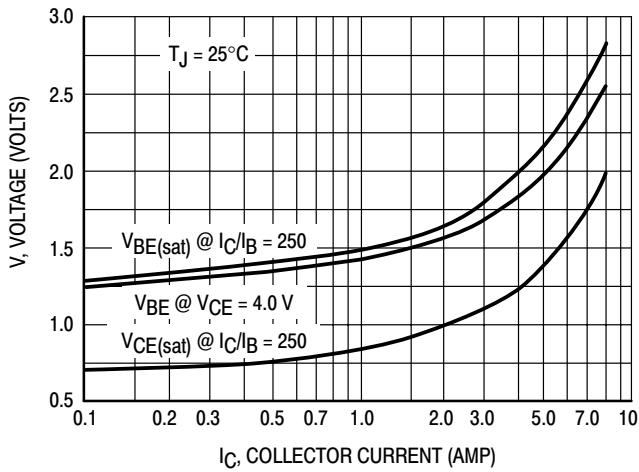


Figure 10. "On" Voltages

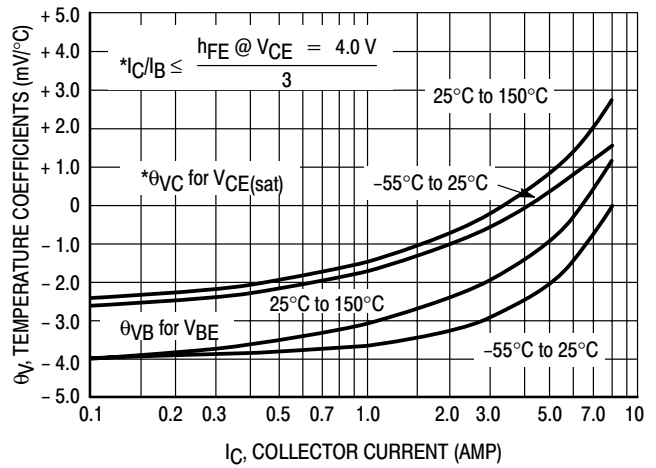


Figure 11. Temperature Coefficients

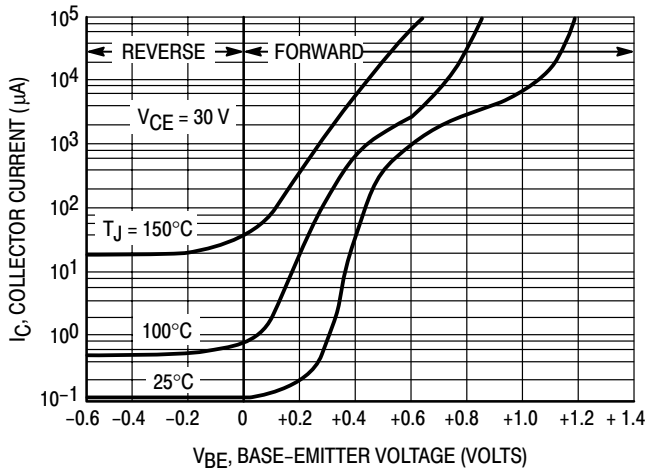


Figure 12. Collector Cut-Off Region

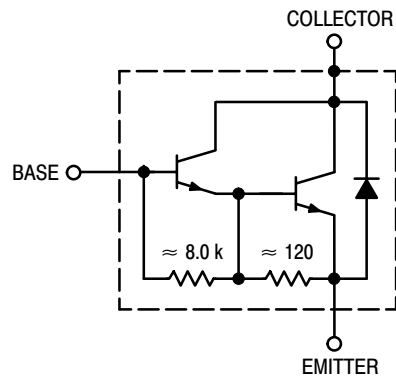
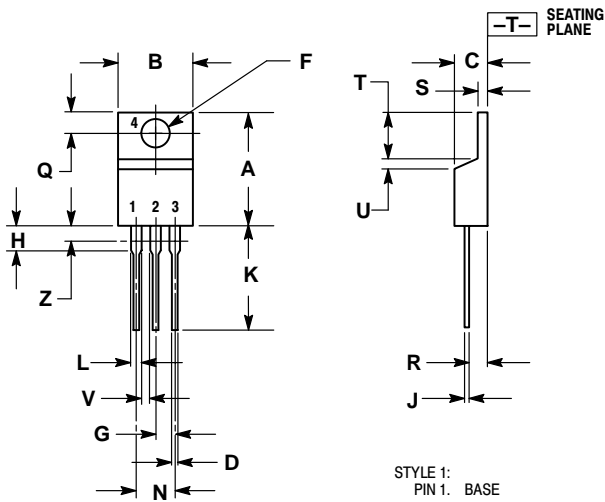


Figure 13. Darlington Schematic

# 2N6387 2N6388

## PACKAGE DIMENSIONS

### TO-220AB CASE 221A-09 ISSUE AA



STYLE 1:  
PIN 1. BASE  
2. COLLECTOR  
3. EMITTER  
4. COLLECTOR

- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	---	1.15	---
Z	---	0.080	---	2.04

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