TIP120, TIP121, TIP122 (NPN); TIP125, TIP126, TIP127 (PNP)

Preferred Devices

Plastic Medium-Power Complementary Silicon Transistors

Designed for general−purpose amplifier and low−speed switching applications.

Features

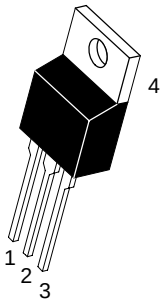
- High DC Current Gain −
  h_{FE} = 2500 (Typ) @ I_C = 4.0 Adc
- Collector−Emitter Sustaining Voltage − @ 100 mAdc
  $V_{CEO(sus)}$ = 60 Vdc (Min) − TIP120, TIP125
  = 80 Vdc (Min) − TIP121, TIP126
  = 100 Vdc (Min) − TIP122, TIP127
- Low Collector−Emitter Saturation Voltage −
  $V_{CE(sat)}$ = 2.0 Vdc (Max) @ I_C = 3.0 Adc
  = 4.0 Vdc (Max) @ I_C = 5.0 Adc
- Monolithic Construction with Built−In Base−Emitter Shunt Resistors
- Pb−Free Packages are Available*

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

ON Semiconductor®

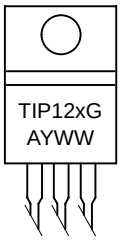
http://onsemi.com

DARLINGTON 5 AMPERE COMPLEMENTARY SILICON POWER TRANSISTORS 60−80−100 VOLTS, 65 WATTS



TO−220AB
CASE 221A
STYLE 1

MARKING DIAGRAM



TIP12x	= Device Code
x	= 0, 1, 2, 5, 6, or 7
A	= Assembly Location
Y	= Year
WW	= Work Week
G	= Pb−Free Package

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

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

MAXIMUM RATINGS

Rating	Symbol	TIP120, TIP125	TIP121, TIP126	TIP122, TIP127	Unit
Collector−Emitter Voltage	V_{CEO}	60	80	100	Vdc
Collector−Base Voltage	V_{CB}	60	80	100	Vdc
Emitter−Base Voltage	V_{EB}	5.0			Vdc
Collector Current − Continuous − Peak	I_C	5.0 8.0			Adc
Base Current	I_B	120			mAdc
Total Power Dissipation @ T_C = 25°C Derate above 25°C	P_D	65 0.52			W W/°C
Total Power Dissipation @ T_A = 25°C Derate above 25°C	P_D	2.0 0.016			W W/°C
Unclamped Inductive Load Energy (Note 1)	E	50			mJ
Operating and Storage Junction, Temperature Range	T_J, T_{stg}	−65 to +150			°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction−to−Case	$R_{\theta JC}$	1.92	°C/W
Thermal Resistance, Junction−to−Ambient	$R_{\theta JA}$	62.5	°C/W

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1. I_C = 1 A, L = 100 mH, P.R.F. = 10 Hz, V_{CC} = 20 V, R_{BE} = 100 Ω

ORDERING INFORMATION

Device	Package	Shipping
TIP120	TO−220	50 Units / Rail
TIP120G	TO−220 (Pb−Free)	50 Units / Rail
TIP121	TO−220	50 Units / Rail
TIP121G	TO−220 (Pb−Free)	50 Units / Rail
TIP122	TO−220	50 Units / Rail
TIP122G	TO−220 (Pb−Free)	50 Units / Rail
TIP125	TO−220	50 Units / Rail
TIP125G	TO−220 (Pb−Free)	50 Units / Rail
TIP126	TO−220	50 Units / Rail
TIP126G	TO−220 (Pb−Free)	50 Units / Rail
TIP127	TO−220	50 Units / Rail
TIP127G	TO−220 (Pb−Free)	50 Units / Rail

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector−Emitter Sustaining Voltage (Note 2)		$V_{CEO(sus)}$			Vdc
(I_C = 100 mAdc, I_B = 0)	TIP120, TIP125		60	–	
	TIP121, TIP126		80	–	
	TIP122, TIP127		100	–	
Collector Cutoff Current		I_{CEO}			mAdc
(V_{CE} = 30 Vdc, I_B = 0)	TIP120, TIP125		–	0.5	
(V_{CE} = 40 Vdc, I_B = 0)	TIP121, TIP126		–	0.5	
(V_{CE} = 50 Vdc, I_B = 0)	TIP122, TIP127		–	0.5	
Collector Cutoff Current		I_{CBO}			mAdc
(V_{CB} = 60 Vdc, I_E = 0)	TIP120, TIP125		–	0.2	
(V_{CB} = 80 Vdc, I_E = 0)	TIP121, TIP126		–	0.2	
(V_{CB} = 100 Vdc, I_E = 0)	TIP122, TIP127		–	0.2	
Emitter Cutoff Current		I_{EBO}	–	2.0	mAdc
(V_{BE} = 5.0 Vdc, I_C = 0)					
ON CHARACTERISTICS (Note 2)					
DC Current Gain		h_{FE}			–
(I_C = 0.5 Adc, V_{CE} = 3.0 Vdc)			1000	–	
(I_C = 3.0 Adc, V_{CE} = 3.0 Vdc)			1000	–	
Collector−Emitter Saturation Voltage		$V_{CE(sat)}$			Vdc
(I_C = 3.0 Adc, I_B = 12 mAdc)			–	2.0	
(I_C = 5.0 Adc, I_B = 20 mAdc)			–	4.0	
Base−Emitter On Voltage		$V_{BE(on)}$	–	2.5	Vdc
(I_C = 3.0 Adc, V_{CE} = 3.0 Vdc)					
DYNAMIC CHARACTERISTICS					
Small−Signal Current Gain		h_{fe}	4.0	–	–
(I_C = 3.0 Adc, V_{CE} = 4.0 Vdc, f = 1.0 MHz)					
Output Capacitance		C_{ob}			pF
(V_{CB} = 10 Vdc, I_E = 0, f = 0.1 MHz	TIP125, TIP126, TIP127		–	300	
	TIP120, TIP121, TIP122		–	200	

2. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%

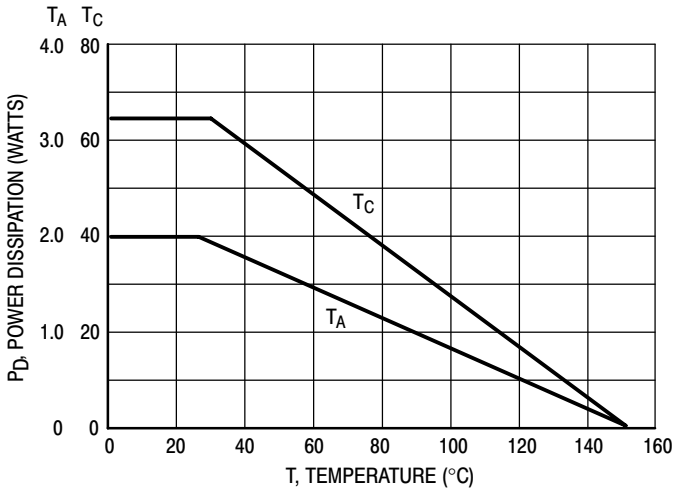


Figure 1. Power Derating

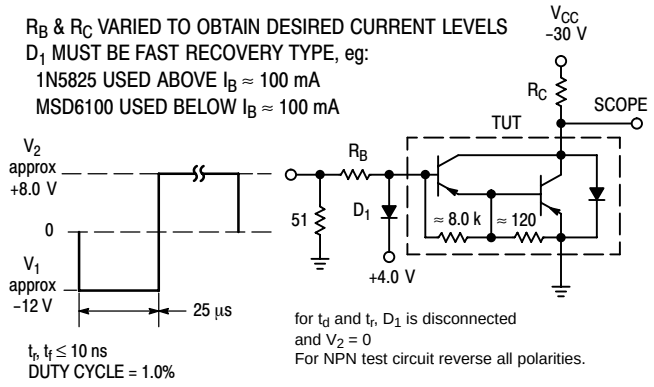


Figure 2. Switching Times Test Circuit

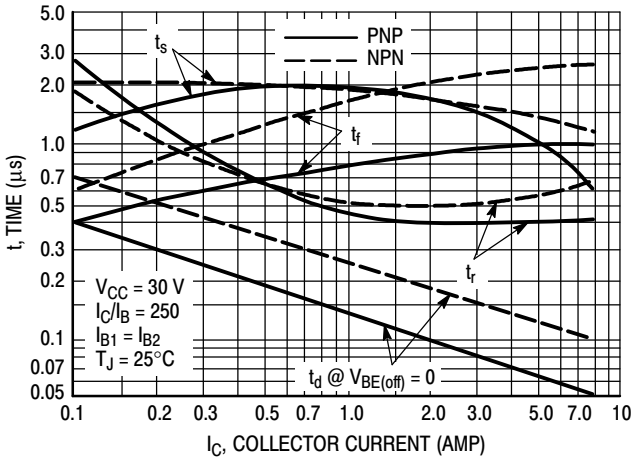


Figure 3. Switching Times

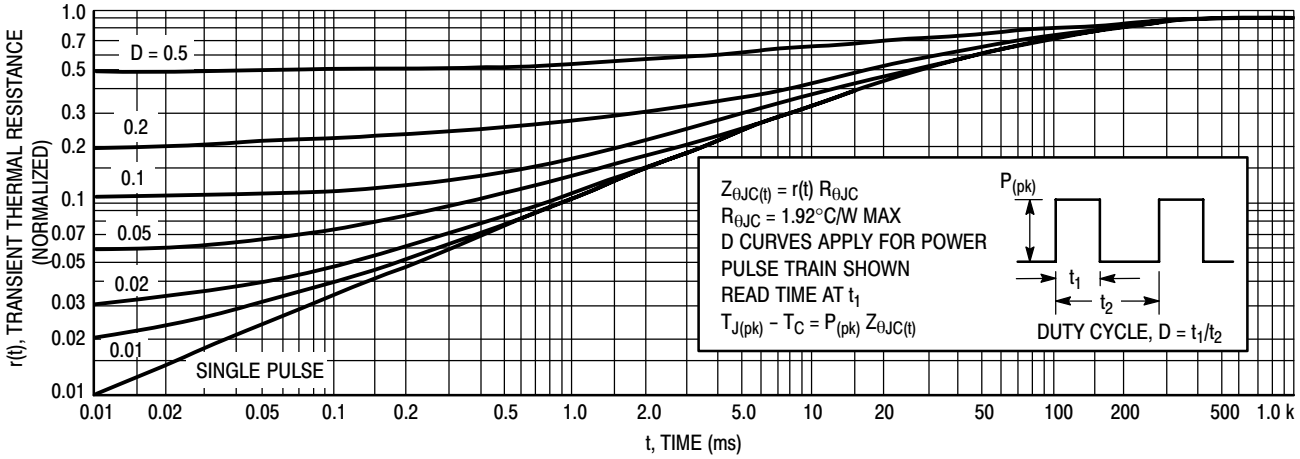


Figure 4. Thermal Response

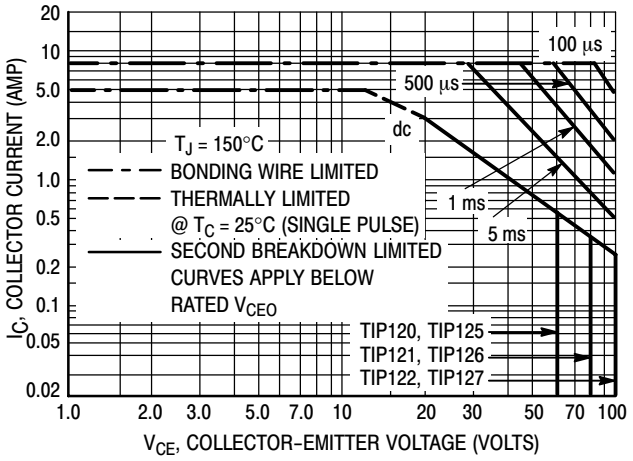


Figure 5. Active−Region Safe Operating Area

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°C; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)}$ < 150°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

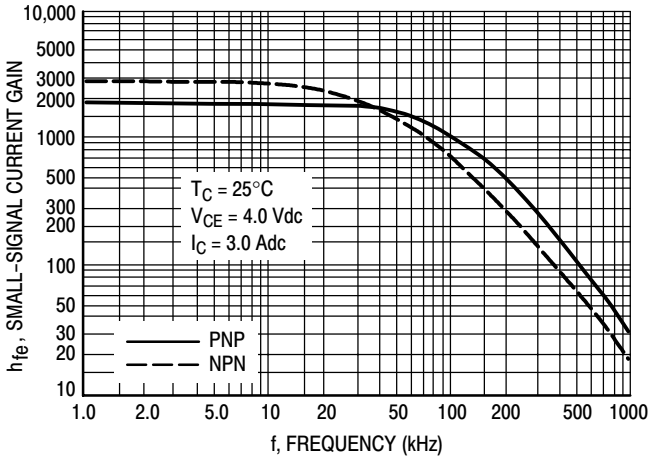


Figure 6. Small−Signal Current Gain

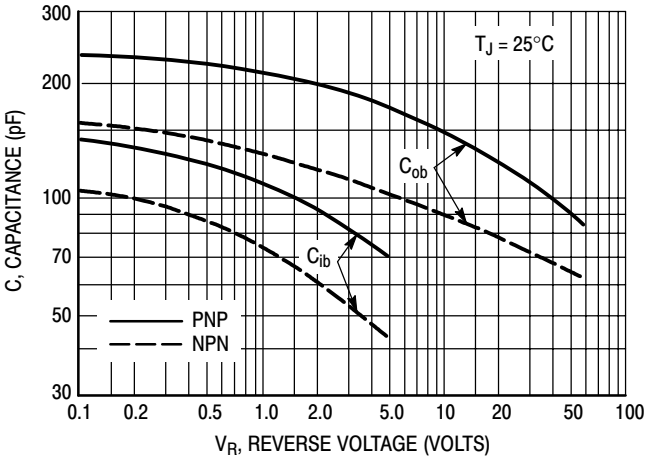
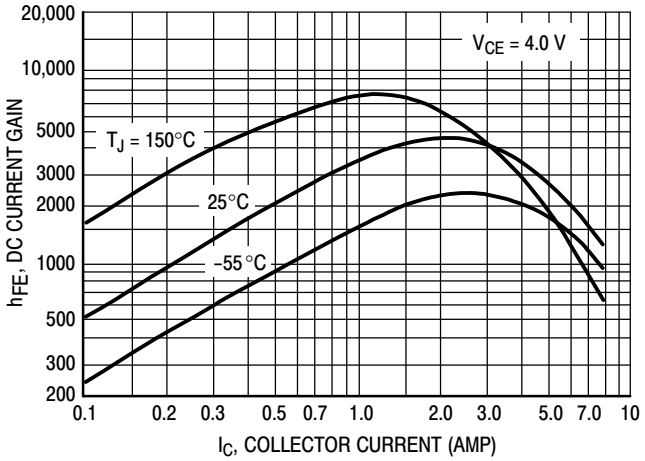


Figure 7. Capacitance

NPN
TIP120, TIP121, TIP122



PNP
TIP125, TIP126, TIP127

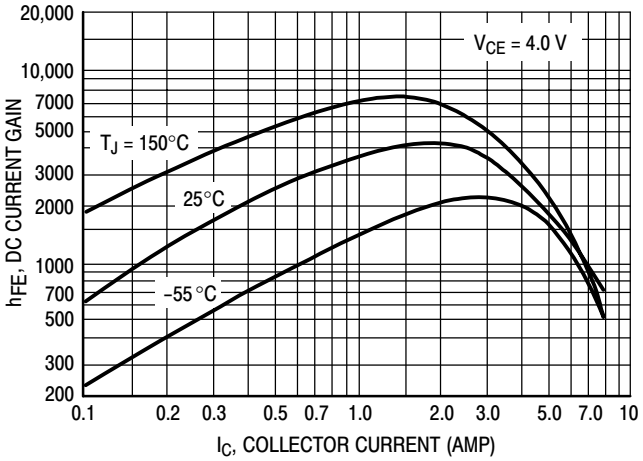
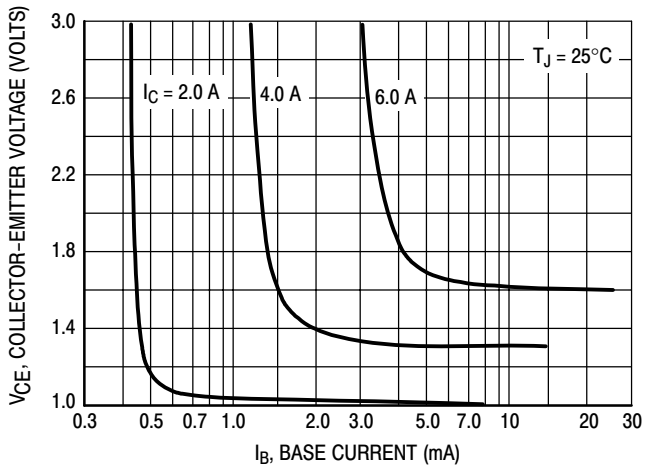


Figure 8. DC Current Gain



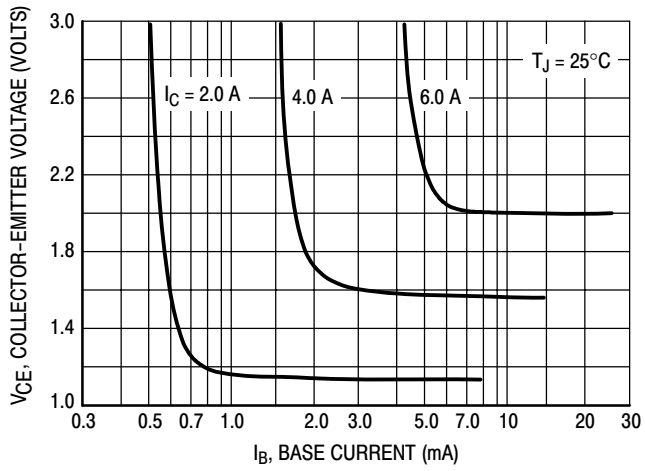
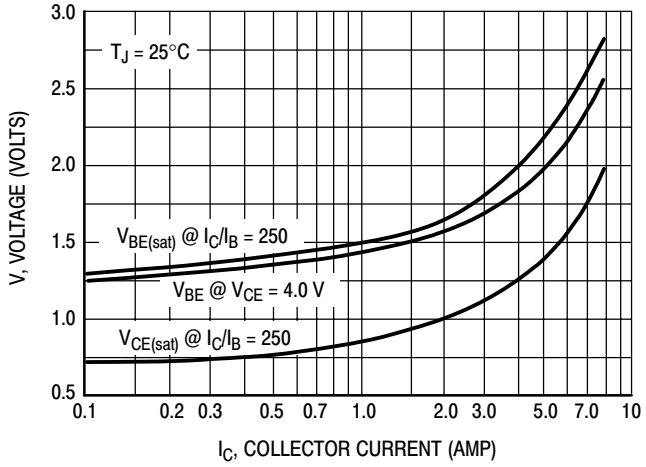


Figure 9. Collector Saturation Region



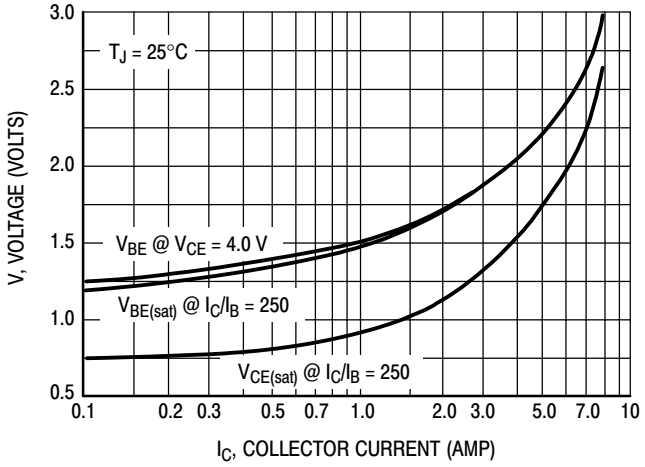
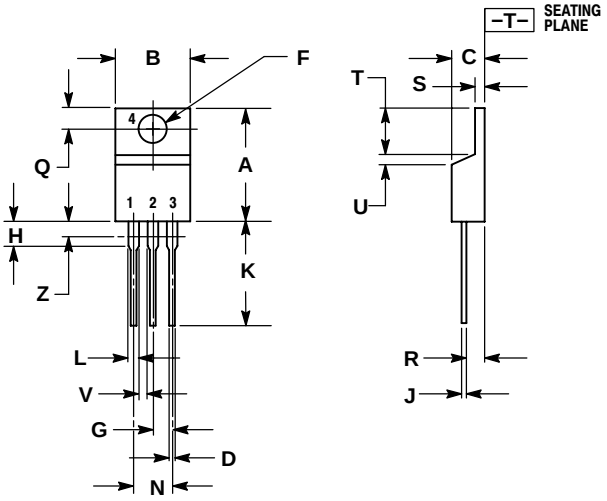


Figure 10. “On” Voltages

PACKAGE DIMENSIONS

TO−220
CASE 221A−09
ISSUE AA



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.

	INCHES		MILLIMETERS	
DIM	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

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

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
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For additional information, please contact your local Sales Representative.

TIP120/D