

TIP31, TIP31A, TIP31B, TIP31C, (NPN), TIP32, TIP32A, TIP32B, TIP32C, (PNP)



ON Semiconductor®

<http://onsemi.com>

Complementary Silicon Plastic Power Transistors

Designed for use in general purpose amplifier and switching applications.

- Collector-Emitter Saturation Voltage -
 $V_{CE(sat)} = 1.2 \text{ Vdc (Max) @ } I_C = 3.0 \text{ Adc}$
- Collector-Emitter Sustaining Voltage -
 $V_{CEO(sus)} = 40 \text{ Vdc (Min) - TIP31, TIP32}$
 $= 60 \text{ Vdc (Min) - TIP31A, TIP32A}$
 $= 80 \text{ Vdc (Min) - TIP31B, TIP32B}$
 $= 100 \text{ Vdc (Min) - TIP31C, TIP32C}$
- High Current Gain - Bandwidth Product
 $f_T = 3.0 \text{ MHz (Min) @ } I_C = 500 \text{ mAdc}$
- Compact TO-220 AB Package

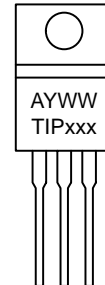
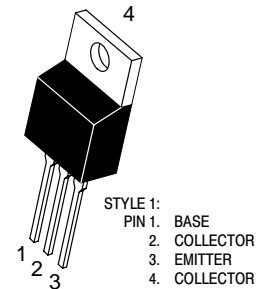
**3 AMPERE
POWER TRANSISTORS
COMPLEMENTARY
SILICON
40-60-80-100 VOLTS
40 WATTS**

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage TIP31, TIP32 TIP31A, TIP32A TIP31B, TIP32B TIP31C, TIP32C	V_{CEO}	40 60 80 100	Vdc
Collector-Base Voltage TIP31, TIP32 TIP31A, TIP32A TIP31B, TIP32B TIP31C, TIP32C	V_{CB}	40 60 80 100	Vdc
Emitter-Base Voltage	V_{EB}	5.0	Vdc
Collector Current Continuous Peak	I_C	3.0 5.0	Adc
Base Current	I_B	1.0	Adc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	40 0.32	Watts $\text{W}/^\circ\text{C}$
Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	2.0 0.016	Watts $\text{W}/^\circ\text{C}$
Unclamped Inductive Load Energy (Note 1)	E	32	mJ
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +150	$^\circ\text{C}$

1. $I_C = 1.8 \text{ A}$, $L = 20 \text{ mH}$, P.R.F. = 10 Hz, $V_{CC} = 10 \text{ V}$, $R_{BE} = 100 \Omega$.

MARKING DIAGRAM



**TO-220AB
CASE 221A-09
STYLE 1**

xxx = Specific Device Code:
31, 31A, 31B, 31C, 32, 32A, 32B, 32C
A = Assembly Location
Y = Year
WW = Work Week

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

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THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	62.5	$^{\circ}C/W$
Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.125	$^{\circ}C/W$

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

Characteristic	Symbol	Min	Max	Unit
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OFF CHARACTERISTICS

Collector-Emitter Sustaining Voltage (Note 2) ($I_C = 30$ mAdc, $I_B = 0$)	TIP31, TIP32 TIP31A, TIP32A TIP31B, TIP32B TIP31C, TIP32C	$V_{CE(sus)}$	40 60 80 100	- - - -	Vdc
Collector Cutoff Current ($V_{CE} = 30$ Vdc, $I_B = 0$) ($V_{CE} = 60$ Vdc, $I_B = 0$)	TIP31, TIP32, TIP31A, TIP32A TIP31B, TIP31C, TIP32B, TIP32C	I_{CEO}	- -	0.3 0.3	mAdc
Collector Cutoff Current ($V_{CE} = 40$ Vdc, $V_{EB} = 0$) ($V_{CE} = 60$ Vdc, $V_{EB} = 0$) ($V_{CE} = 80$ Vdc, $V_{EB} = 0$) ($V_{CE} = 100$ Vdc, $V_{EB} = 0$)	TIP31, TIP32 TIP31A, TIP32A TIP31B, TIP32B TIP31C, TIP32C	I_{CES}	- - - -	200 200 200 200	μ Adc
Emitter Cutoff Current ($V_{BE} = 5.0$ Vdc, $I_C = 0$)		I_{EBO}	-	1.0	mAdc

ON CHARACTERISTICS (Note 2)

DC Current Gain ($I_C = 1.0$ Adc, $V_{CE} = 4.0$ Vdc) ($I_C = 3.0$ Adc, $V_{CE} = 4.0$ Vdc)		h_{FE}	25 10	- 50	-
Collector-Emitter Saturation Voltage ($I_C = 3.0$ Adc, $I_B = 375$ mAdc)		$V_{CE(sat)}$	-	1.2	Vdc
Base-Emitter On Voltage ($I_C = 3.0$ Adc, $V_{CE} = 4.0$ Vdc)		$V_{BE(on)}$	-	1.8	Vdc

DYNAMIC CHARACTERISTICS

Current-Gain - Bandwidth Product ($I_C = 500$ mAdc, $V_{CE} = 10$ Vdc, $f_{test} = 1.0$ MHz)		f_T	3.0	-	MHz
Small-Signal Current Gain ($I_C = 0.5$ Adc, $V_{CE} = 10$ Vdc, $f = 1.0$ kHz)		h_{fe}	20	-	-

2. Pulse Test: Pulse Width ≤ 300 μ s, Duty Cycle $\leq 2.0\%$.

TIP31, TIP31A, TIP31B, TIP31C, (NPN), TIP32, TIP32A, TIP32B, TIP32C, (PNP)

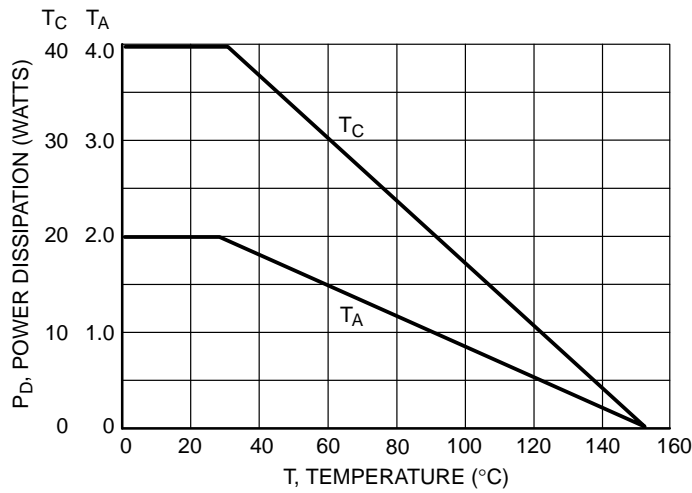
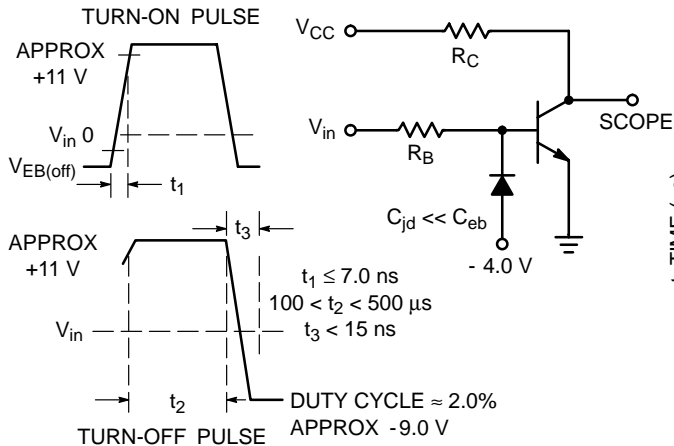


Figure 1. Power Derating



R_B and R_C VARIED TO OBTAIN DESIRED CURRENT LEVELS.

Figure 2. Switching Time Equivalent Circuit

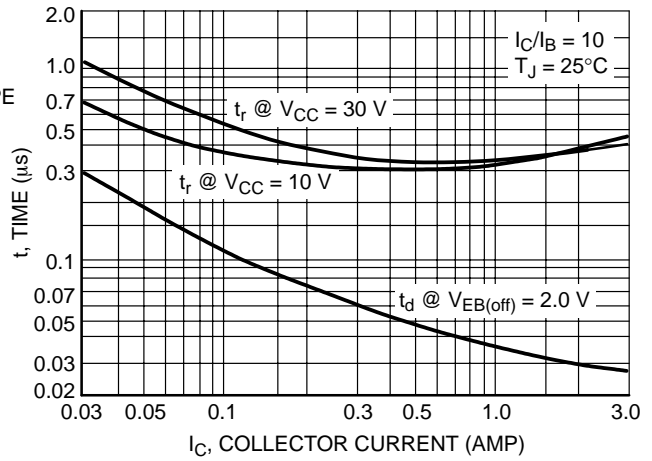


Figure 3. Turn-On Time

TIP31, TIP31A, TIP31B, TIP31C, (NPN), TIP32, TIP32A, TIP32B, TIP32C, (PNP)

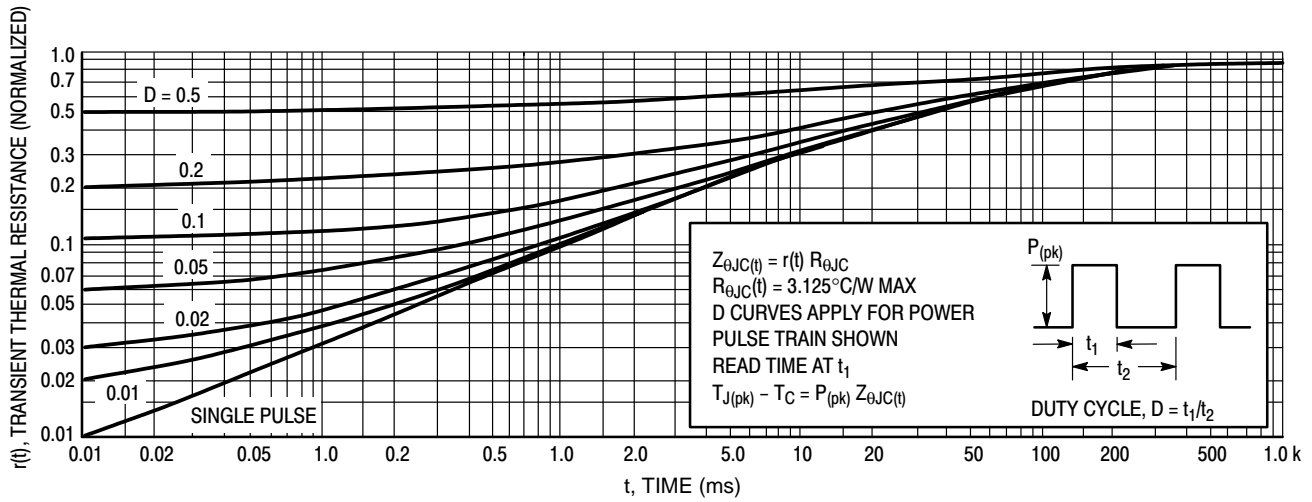


Figure 4. Thermal Response

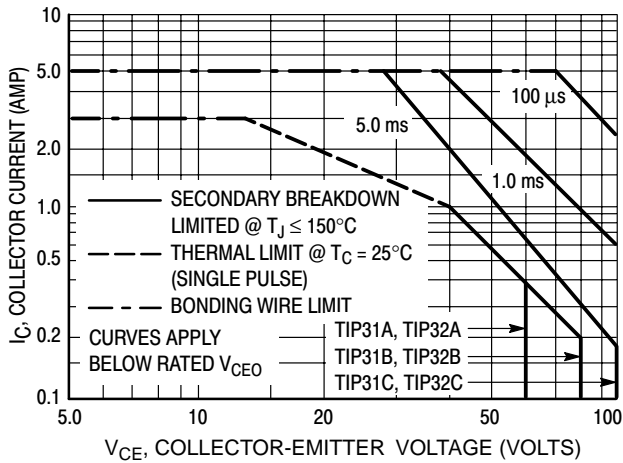


Figure 5. Active Region Safe Operating Area

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 $T_{J(pk)} \leq 150^\circ\text{C}$. $T_{J(pk)}$ 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.

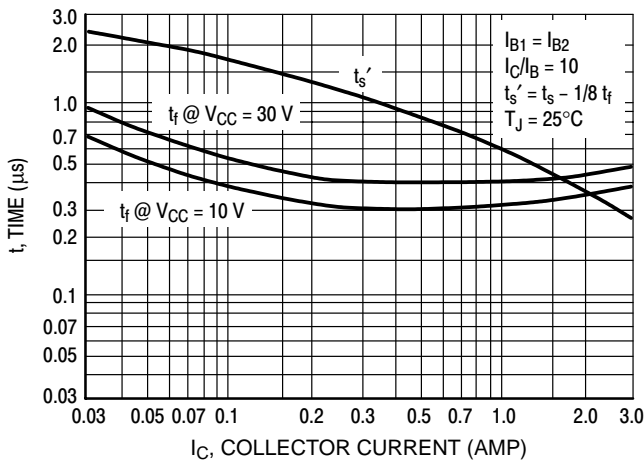


Figure 6. Turn-Off Time

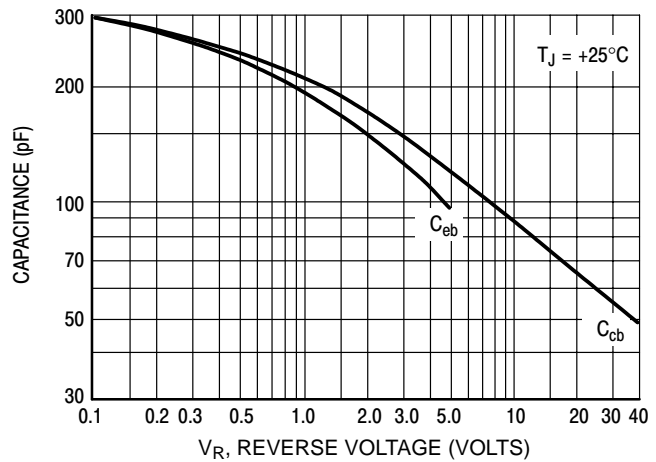


Figure 7. Capacitance

TIP31, TIP31A, TIP31B, TIP31C, (NPN), TIP32, TIP32A, TIP32B, TIP32C, (PNP)

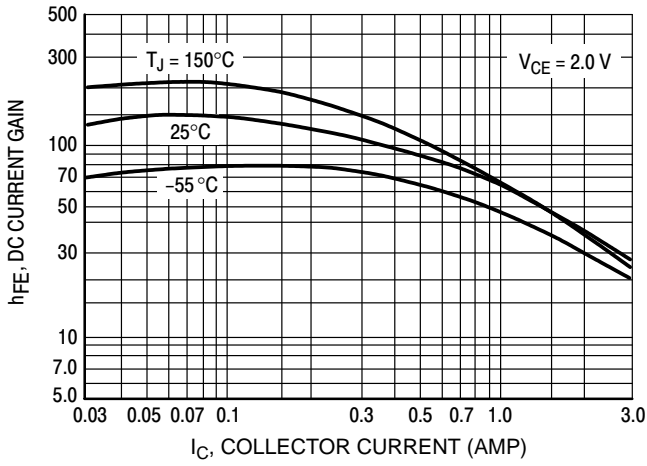


Figure 8. DC Current Gain

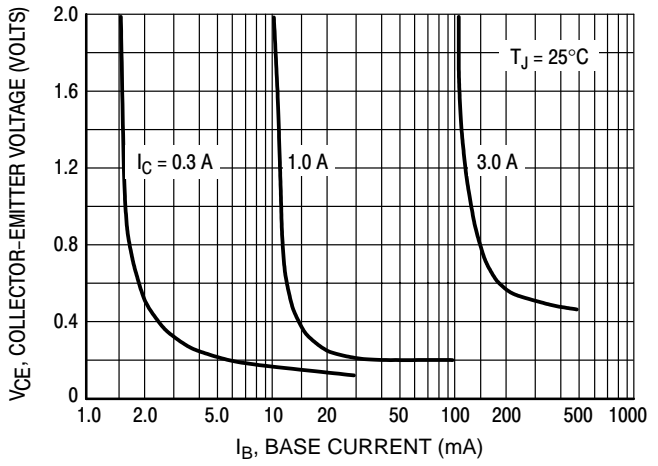


Figure 9. Collector Saturation Region

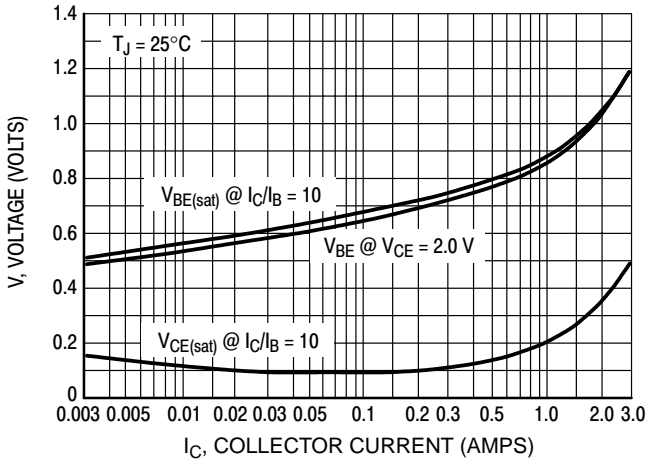


Figure 10. "On" Voltages

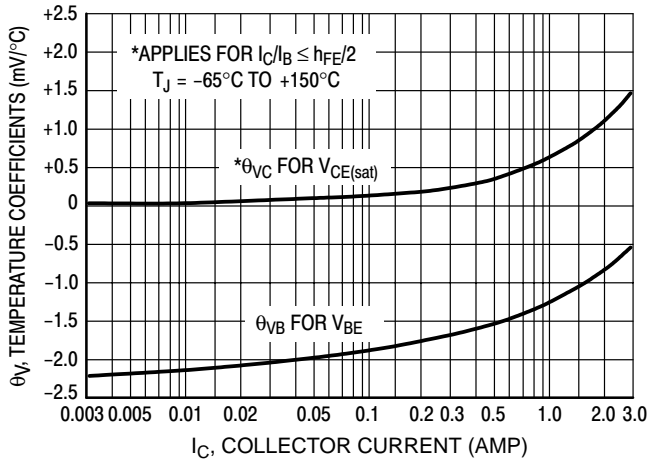


Figure 11. Temperature Coefficients

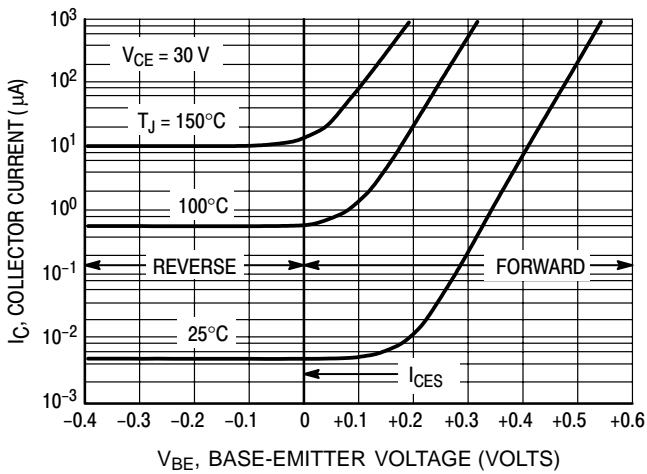


Figure 12. Collector Cut-Off Region

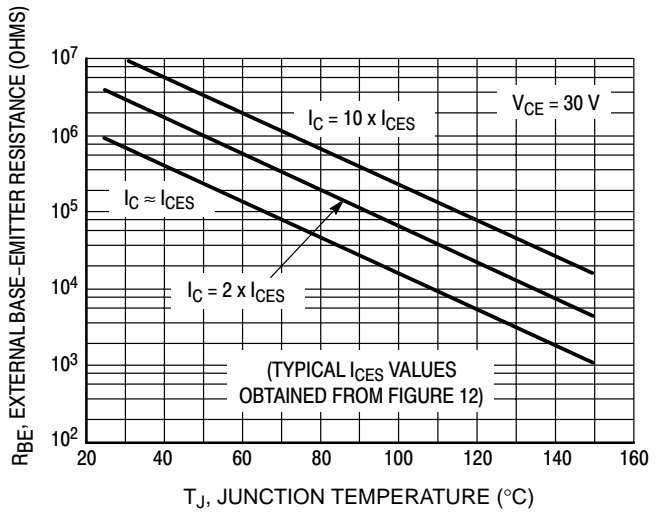


Figure 13. Effects of Base-Emitter Resistance

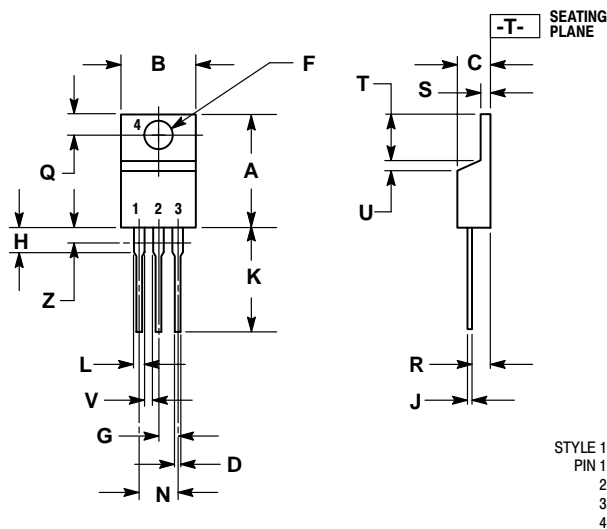
TIP31, TIP31A, TIP31B, TIP31C, (NPN), TIP32, TIP32A, TIP32B, TIP32C, (PNP)

ORDERING INFORMATION

Device	Package	Shipping
TIP31	TO-220AB	50 Units/Rail
TIP31A	TO-220AB	50 Units/Rail
TIP31B	TO-220AB	50 Units/Rail
TIP31C	TO-220AB	50 Units/Rail
TIP32	TO-220AB	50 Units/Rail
TIP32A	TO-220AB	50 Units/Rail
TIP32B	TO-220AB	50 Units/Rail
TIP32C	TO-220AB	50 Units/Rail

PACKAGE DIMENSIONS

TO-220AB 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.

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

STYLE 1:

1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

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