

# MJE15028, MJE15030 (NPN) MJE15029, MJE15031 (PNP)

## Complementary Silicon Plastic Power Transistors

These devices are designed for use as high-frequency drivers in audio amplifiers.

### Features

- DC Current Gain Specified to 4.0 A  
 $h_{FE} = 40$  (Min) @  $I_C = 3.0$  Adc  
 $= 20$  (Min) @  $I_C = 4.0$  Adc
- Collector–Emitter Sustaining Voltage –  
 $V_{CEO(sus)} = 120$  Vdc (Min); MJE15028, MJE15029  
 $= 150$  Vdc (Min); MJE15030, MJE15031
- High Current Gain – Bandwidth Product  
 $f_T = 30$  MHz (Min) @  $I_C = 500$  mAdc
- TO–220AB Compact Package
- Pb–Free Packages are Available\*

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Emitter Voltage MJE15028, MJE15029 MJE15030, MJE15031	$V_{CEO}$	120 150	Vdc
Collector–Base Voltage MJE15028, MJE15029 MJE15030, MJE15031	$V_{CB}$	120 150	Vdc
Emitter–Base Voltage	$V_{EB}$	5.0	Vdc
Collector Current – Continuous – Peak	$I_C$ $I_{CM}$	8.0 16	Adc
Base Current	$I_B$	2.0	Adc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	50 0.40	W W/ $^\circ\text{C}$
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	2.0 0.016	W 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	$R_{\theta JC}$	2.5	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction–to–Ambient	$R_{\theta JA}$	62.5	$^\circ\text{C}/\text{W}$

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

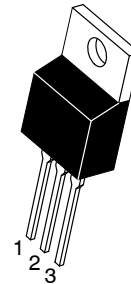
\*For additional information on our Pb–Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



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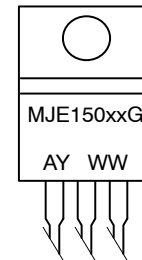
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**8 AMPERE  
POWER TRANSISTORS  
COMPLEMENTARY SILICON  
120–150 VOLTS, 50 WATTS**



TO–220AB  
CASE 221A–09  
STYLE 1

### MARKING DIAGRAM



MJE150xx = Device Code  
 x = 28, 29, 30, or 31  
 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 5 of this data sheet.

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

Characteristic	Symbol	Min	Max	Unit	
<b>OFF CHARACTERISTICS</b>					
Collector-Emitter Sustaining Voltage (Note 1) ( $I_C = 10\text{ mAdc}$ , $I_B = 0$ )	MJE15028, MJE15029 MJE15030, MJE15031	$V_{CE(sus)}$	120 150	- -	Vdc
Collector Cutoff Current ( $V_{CE} = 120\text{ Vdc}$ , $I_B = 0$ ) ( $V_{CE} = 150\text{ Vdc}$ , $I_B = 0$ )	MJE15028, MJE15029 MJE15030, MJE15031	$I_{CEO}$	- -	0.1 0.1	mAdc
Collector Cutoff Current ( $V_{CB} = 120\text{ Vdc}$ , $I_E = 0$ ) ( $V_{CB} = 150\text{ Vdc}$ , $I_E = 0$ )	MJE15028, MJE15029 MJE15030, MJE15031	$I_{CBO}$	- -	10 10	$\mu\text{Adc}$
Emitter Cutoff Current ( $V_{BE} = 5.0\text{ Vdc}$ , $I_C = 0$ )		$I_{EBO}$	-	10	$\mu\text{Adc}$
<b>ON CHARACTERISTICS (Note 1)</b>					
DC Current Gain ( $I_C = 0.1\text{ Adc}$ , $V_{CE} = 2.0\text{ Vdc}$ ) ( $I_C = 2.0\text{ Adc}$ , $V_{CE} = 2.0\text{ Vdc}$ ) ( $I_C = 3.0\text{ Adc}$ , $V_{CE} = 2.0\text{ Vdc}$ ) ( $I_C = 4.0\text{ Adc}$ , $V_{CE} = 2.0\text{ Vdc}$ )		$h_{FE}$	40 40 40 20	- - - -	-
DC Current Gain Linearity ( $V_{CE}$ From 2.0 V to 20 V, $I_C$ From 0.1 A to 3 A) (NPN to PNP)		$h_{FE}$	<b>Typ</b> 2 3		
Collector-Emitter Saturation Voltage ( $I_C = 1.0\text{ Adc}$ , $I_B = 0.1\text{ Adc}$ )		$V_{CE(sat)}$	-	0.5	Vdc
Base-Emitter On Voltage ( $I_C = 1.0\text{ Adc}$ , $V_{CE} = 2.0\text{ Vdc}$ )		$V_{BE(on)}$	-	1.0	Vdc
<b>DYNAMIC CHARACTERISTICS</b>					
Current Gain - Bandwidth Product (Note 2) ( $I_C = 500\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f_{test} = 10\text{ MHz}$ )		$f_T$	30	-	MHz

1. Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .
2.  $f_T = |h_{fe}| \cdot f_{test}$ .

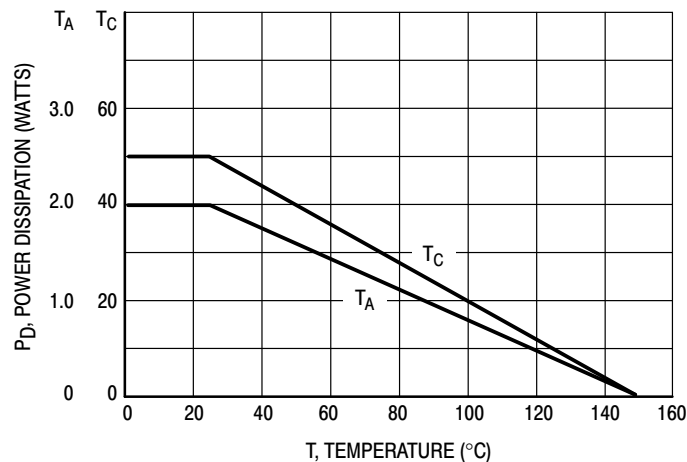


Figure 1. Power Derating

# MJE15028, MJE15030 (NPN) MJE15029, MJE15031 (PNP)

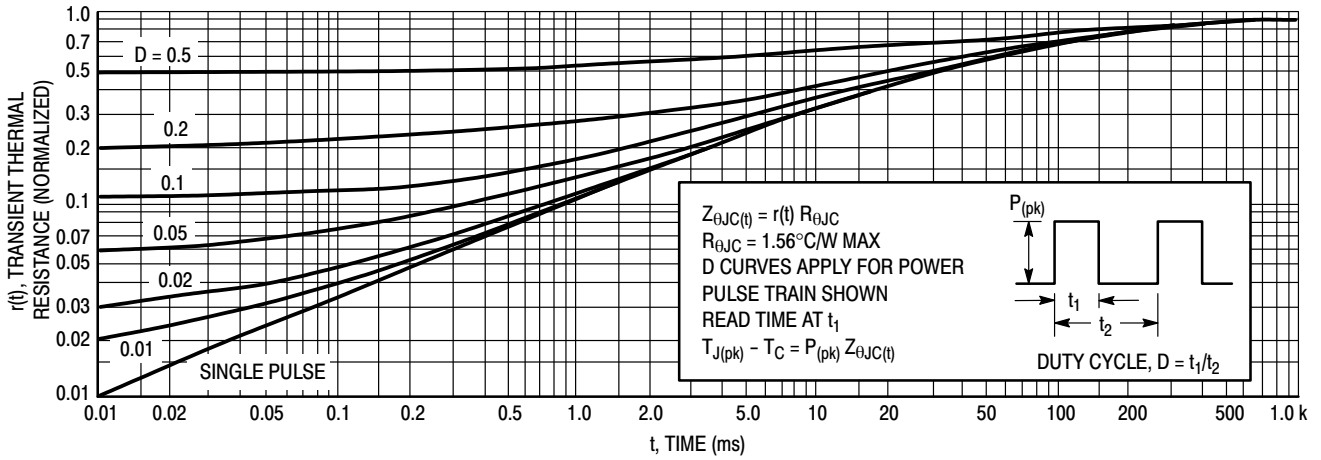


Figure 2. Thermal Response

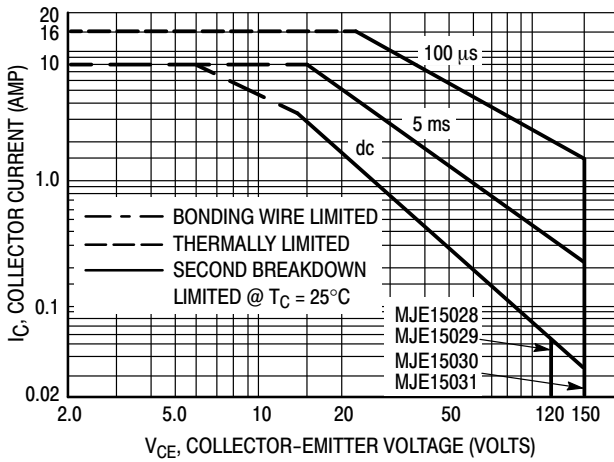


Figure 3. Forward Bias Safe Operating Area

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 Figures 3 and 4 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 2. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

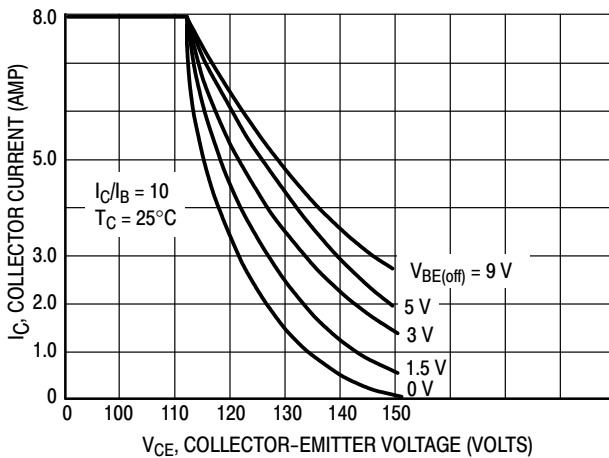


Figure 4. Reverse-Bias Switching Safe Operating Area

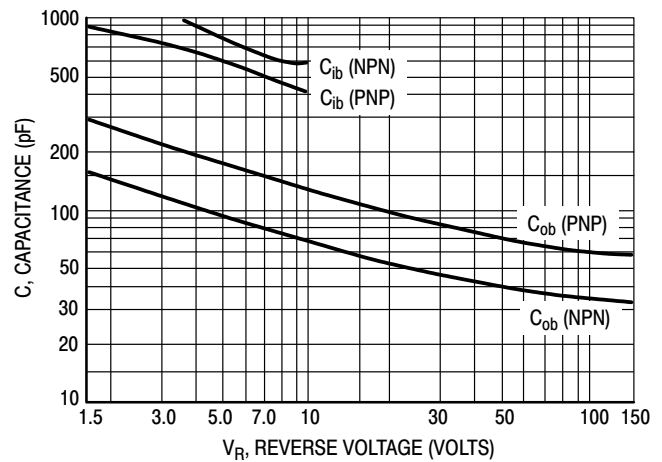


Figure 5. Capacitances

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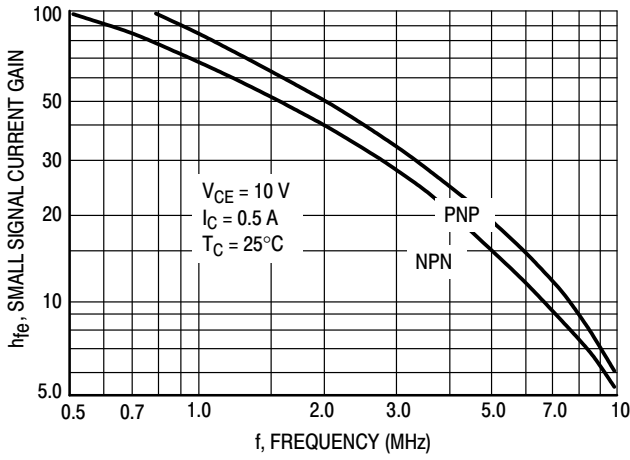


Figure 6. Small-Signal Current Gain

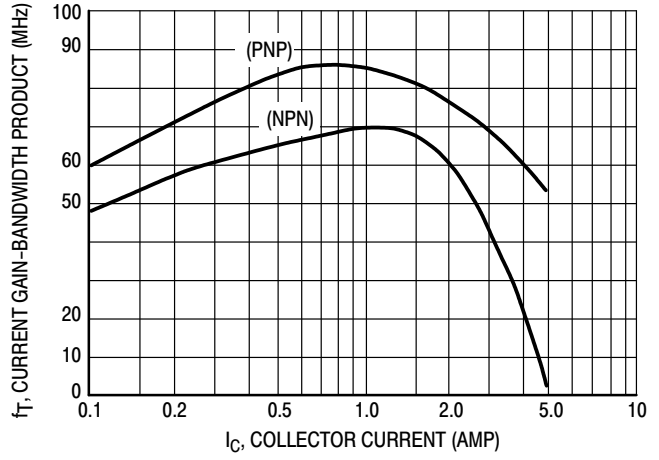
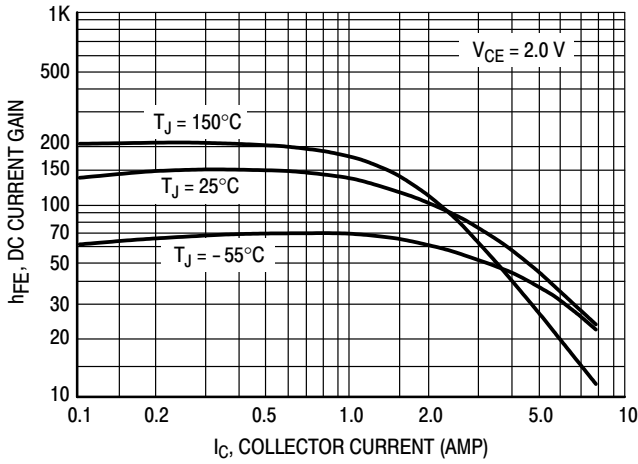


Figure 7. Current Gain-Bandwidth Product

NPN — MJE15028 MJE15030



PNP — MJE15029 MJE15031

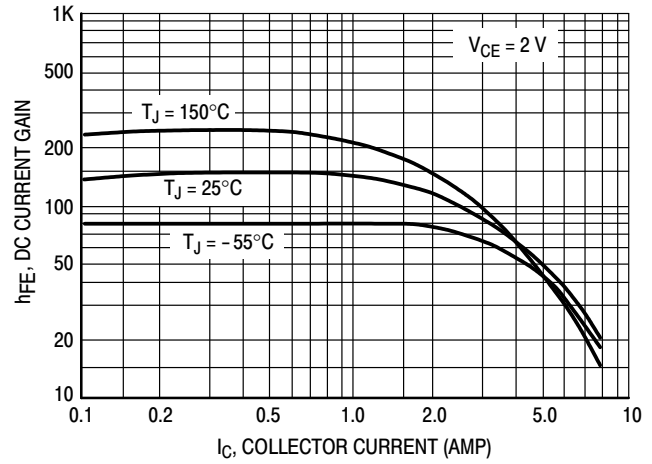
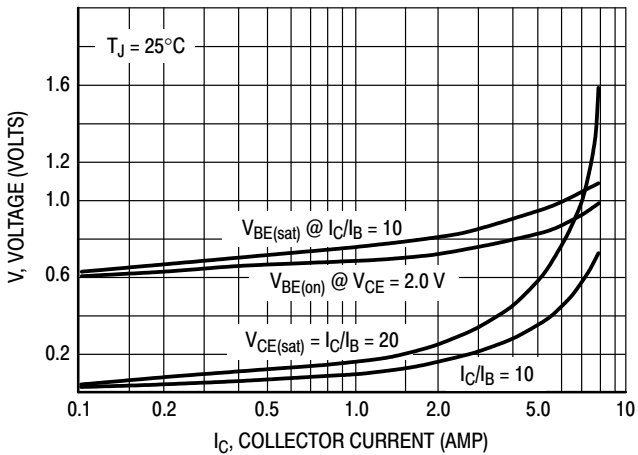


Figure 8. DC Current Gain

NPN



PNP

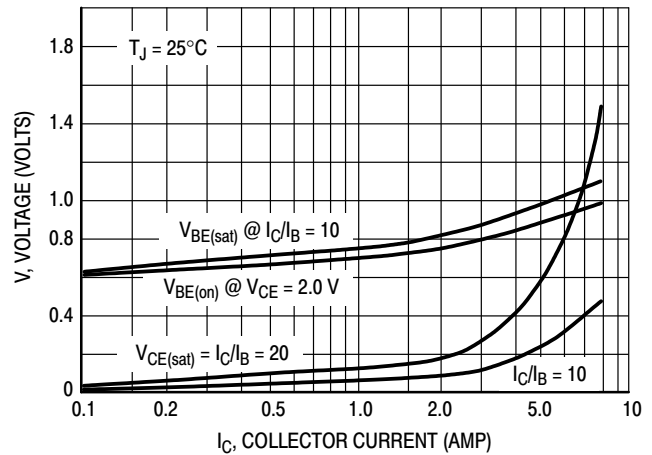
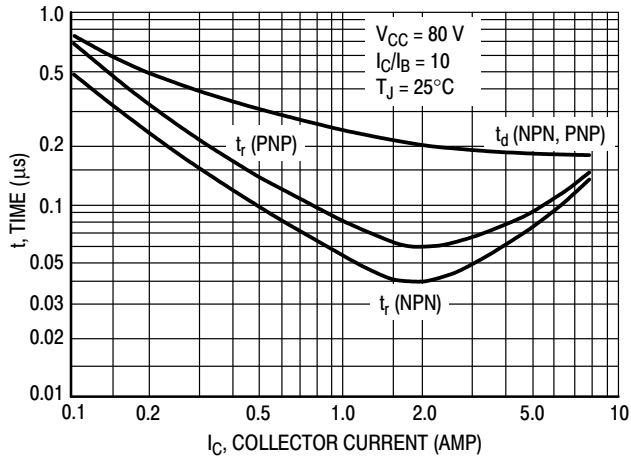
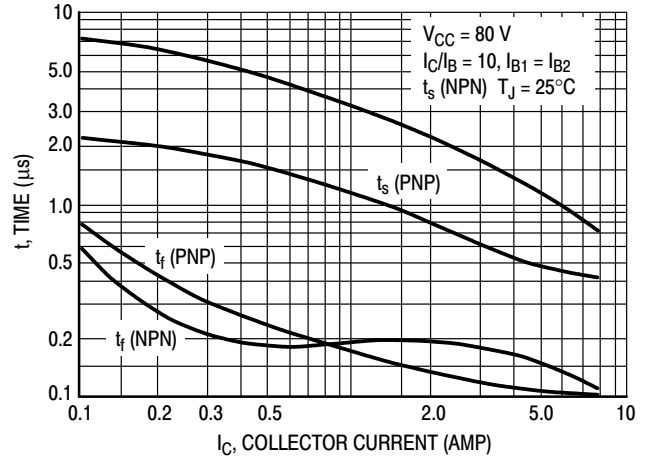


Figure 9. "On" Voltage

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**Figure 10. Turn-On Times**



**Figure 11. Turn-Off Times**

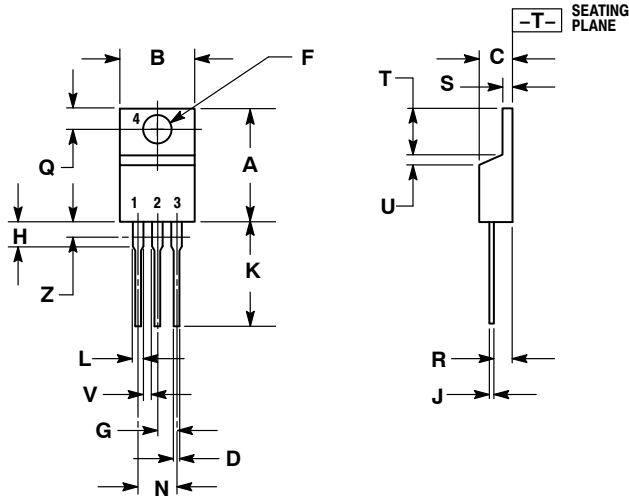
### ORDERING INFORMATION

Device	Package	Shipping
MJE15028	TO-220	50 Units / Rail
MJE15028G	TO-220 (Pb-Free)	50 Units / Rail
MJE15029	TO-220	50 Units / Rail
MJE15029G	TO-220 (Pb-Free)	50 Units / Rail
MJE15030	TO-220	50 Units / Rail
MJE15030G	TO-220 (Pb-Free)	50 Units / Rail
MJE15031	TO-220	50 Units / Rail
MJE15031G	TO-220 (Pb-Free)	50 Units / Rail

# MJE15028, MJE15030 (NPN) MJE15029, MJE15031 (PNP)

## PACKAGE DIMENSIONS

### TO-220 CASE 221A-09 ISSUE AG




#### 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	0.036	0.64	0.91
F	0.142	0.161	3.61	4.09
G	0.095	0.105	2.42	2.66
H	0.110	0.161	2.80	4.10
J	0.014	0.025	0.36	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

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