

# NPN Transistor with Zener Diode

## NSM6056MT1G

### Features

- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Typical Applications

- Driving Circuit
- Switching Applications

### MAXIMUM RATINGS – NPN TRANSISTOR

Rating	Symbol	Value	Unit
Collector – Emitter Voltage	$V_{CEO}$	40	V
Collector – Base Voltage	$V_{CBO}$	60	V
Emitter – Base Voltage	$V_{EBO}$	6.0	V
Collector Current – Continuous	$I_C$	600	mA
Collector Current – Peak	$I_{CM}$	900	mA

### MAXIMUM RATINGS – ZENER DIODE

Rating	Symbol	Value	Unit
Forward Voltage @ $I_F = 10\text{ mA}$	$V_F$	0.9	V

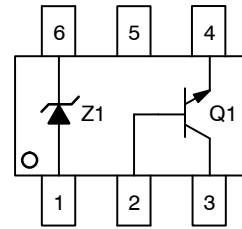
### THERMAL CHARACTERISTICS

Rating	Symbol	Max	Unit
Total Device Dissipation FR-5 Board, (Note 1) @ $T_A = 25^\circ\text{C}$	$P_D$	380	mW
Thermal Resistance from Junction-to-Ambient	$R_{\theta JA}$	328	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$

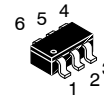
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. FR-4 Minimum Pad.

## NPN Transistor with Zener Diode

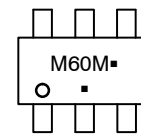


PINOUT:  
PIN 1. ANODE  
2. BASE  
3. COLLECTOR  
4. EMITTER  
5. NC/COLLECTOR  
6. CATHODE



SC-74  
CASE 318F

### MARKING DIAGRAM



M60 = Device Code  
M = Date Code\*  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation may vary depending upon manufacturing location.

### ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
NSM6056MT1G	SC-74 (Pb-Free)	3000/Tape & Reel

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

# NSM6056MT1G

## NPN TRANSISTOR – ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector – Emitter Breakdown Voltage (Note 3) (I <sub>C</sub> = 1.0 mA <sub>dc</sub> , I <sub>B</sub> = 0)	V <sub>(BR)CEO</sub>	40	–	V <sub>dc</sub>
Collector – Base Breakdown Voltage (I <sub>C</sub> = 0.1 mA <sub>dc</sub> , I <sub>E</sub> = 0)	V <sub>(BR)CBO</sub>	60	–	V <sub>dc</sub>
Emitter – Base Breakdown Voltage (I <sub>E</sub> = 0.1 mA <sub>dc</sub> , I <sub>C</sub> = 0)	V <sub>(BR)EBO</sub>	6.0	–	V <sub>dc</sub>
Base Cutoff Current (V <sub>CE</sub> = 35 V <sub>dc</sub> , V <sub>EB</sub> = 0.4 V <sub>dc</sub> )	I <sub>BEV</sub>	–	0.1	μA <sub>dc</sub>
Collector Cutoff Current (V <sub>CE</sub> = 35 V <sub>dc</sub> , V <sub>EB</sub> = 0.4 V <sub>dc</sub> )	I <sub>CEX</sub>	–	0.1	μA <sub>dc</sub>

### ON CHARACTERISTICS (Note 3)

DC Current Gain (I <sub>C</sub> = 0.1 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 V <sub>dc</sub> ) (I <sub>C</sub> = 1.0 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 V <sub>dc</sub> ) (I <sub>C</sub> = 10 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 V <sub>dc</sub> ) (I <sub>C</sub> = 150 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 V <sub>dc</sub> ) (I <sub>C</sub> = 500 mA <sub>dc</sub> , V <sub>CE</sub> = 2.0 V <sub>dc</sub> )	h <sub>FE</sub>	20 40 80 100 40	– – – 300 –	–
Collector – Emitter Saturation Voltage (I <sub>C</sub> = 150 mA <sub>dc</sub> , I <sub>B</sub> = 15 mA <sub>dc</sub> ) (I <sub>C</sub> = 500 mA <sub>dc</sub> , I <sub>B</sub> = 50 mA <sub>dc</sub> )	V <sub>CE(sat)</sub>	– –	0.4 0.75	V <sub>dc</sub>
Base – Emitter Saturation Voltage (I <sub>C</sub> = 150 mA <sub>dc</sub> , I <sub>B</sub> = 15 mA <sub>dc</sub> ) (I <sub>C</sub> = 500 mA <sub>dc</sub> , I <sub>B</sub> = 50 mA <sub>dc</sub> )	V <sub>BE(sat)</sub>	0.75 –	0.95 1.2	V <sub>dc</sub>

### SMALL-SIGNAL CHARACTERISTICS

Current – Gain – Bandwidth Product (I <sub>C</sub> = 20 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> , f = 100 MHz)	f <sub>T</sub>	250	–	MHz
Collector – Base Capacitance (V <sub>CB</sub> = 5.0 V <sub>dc</sub> , I <sub>E</sub> = 0, f = 1.0 MHz)	C <sub>cb</sub>	–	6.5	pF
Emitter – Base Capacitance (V <sub>EB</sub> = 0.5 V <sub>dc</sub> , I <sub>C</sub> = 0, f = 1.0 MHz)	C <sub>eb</sub>	–	30	pF
Input Impedance (I <sub>C</sub> = 1.0 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> , f = 1.0 kHz)	h <sub>ie</sub>	1.0	15	kΩ
Voltage Feedback Ratio (I <sub>C</sub> = 1.0 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> , f = 1.0 kHz)	h <sub>re</sub>	0.1	8.0	X 10 <sup>-4</sup>
Small – Signal Current Gain (I <sub>C</sub> = 1.0 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> , f = 1.0 kHz)	h <sub>fe</sub>	40	500	–
Output Admittance (I <sub>C</sub> = 1.0 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> , f = 1.0 kHz)	h <sub>oe</sub>	1.0	30	μmhos

### SWITCHING CHARACTERISTICS

Delay Time	(V <sub>CC</sub> = 30 V <sub>dc</sub> , V <sub>EB</sub> = 2.0 V <sub>dc</sub> , I <sub>C</sub> = 150 mA <sub>dc</sub> , I <sub>B1</sub> = 15 mA <sub>dc</sub> )	t <sub>d</sub>	–	15	ns
Rise Time		t <sub>r</sub>	–	20	
Storage Time	(V <sub>CC</sub> = 30 V <sub>dc</sub> , I <sub>C</sub> = 150 mA <sub>dc</sub> , I <sub>B1</sub> = I <sub>B2</sub> = 15 mA <sub>dc</sub> )	t <sub>s</sub>	–	225	ns
Fall Time		t <sub>f</sub>	–	30	

2. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

### ZENER DIODE – ELECTRICAL CHARACTERISTICS (V<sub>F</sub> = 0.9 Max @ I<sub>F</sub> = 10 mA for all types)

Device	Test Current I <sub>zt</sub> mA	Zener Voltage V <sub>Z</sub>		Z <sub>ZK</sub> I <sub>Z</sub> = 0.5 mA Ω Max	Z <sub>ZT</sub> I <sub>Z</sub> = I <sub>ZT</sub> @ 10% Mod Ω Max	Max IR @ V <sub>R</sub>		dV <sub>Z</sub> /dt (mV/k) @ I <sub>ZT1</sub> = 5 mA		C pF Max @ V <sub>R</sub> = 0 f = 1 MHz
		Min	Max			μA	V	Min	Max	
NSM6056MT1G	5.0	5.49	5.73	200	40	1.0	2.0	-2.0	2.5	200

# NSM6056MT1G

## TYPICAL ELECTRICAL CHARACTERISTICS – NPN TRANSISTOR

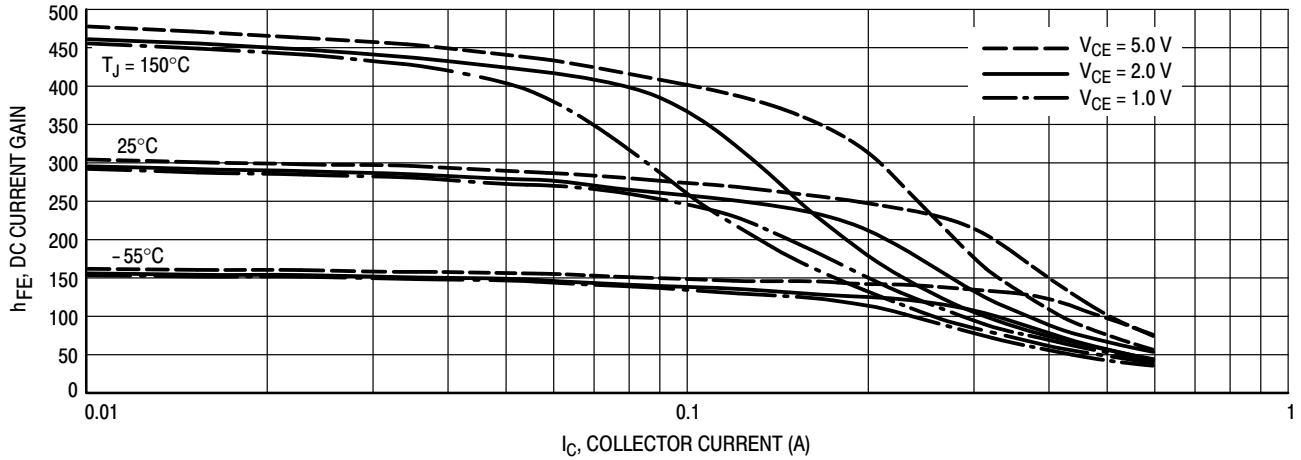


Figure 1. DC Current Gain

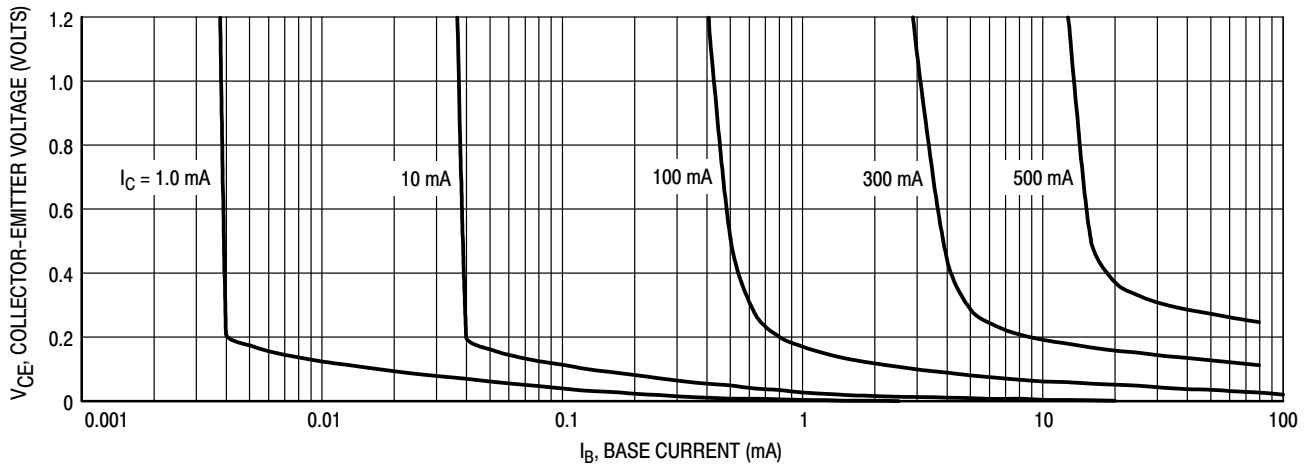


Figure 2. Collector Saturation Region

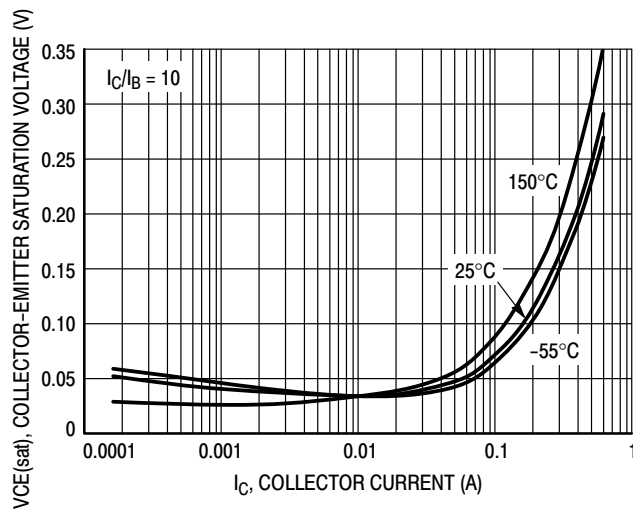


Figure 3. Collector-Emitter Saturation Voltage vs. Collector Current

# NSM6056MT1G

## TYPICAL ELECTRICAL CHARACTERISTICS – NPN TRANSISTOR

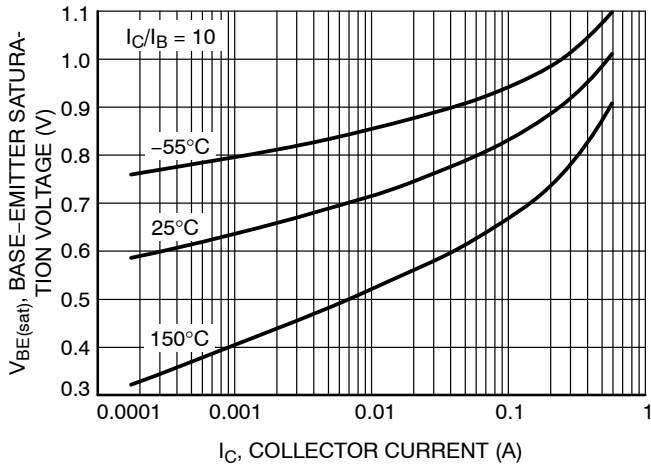


Figure 4. Base-Emitter Saturation Voltage vs. Collector Current

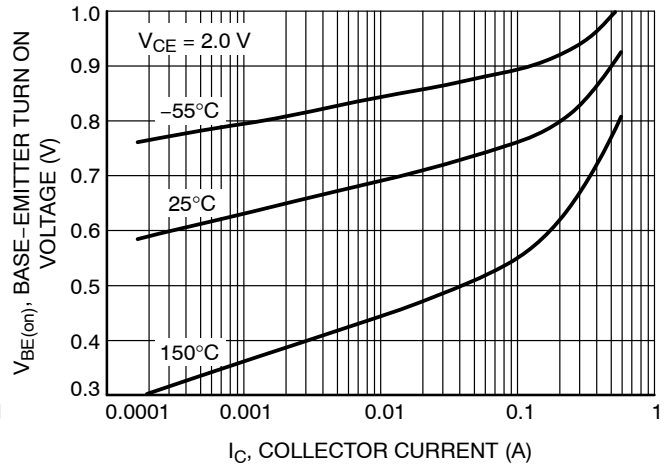


Figure 5. Base-Emitter Turn On Voltage vs. Collector Current

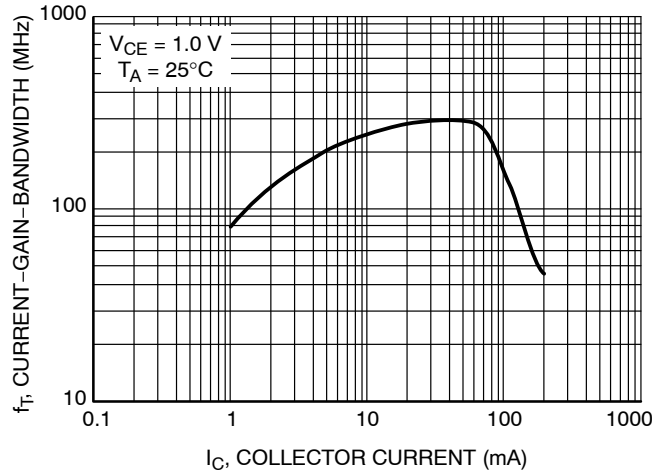


Figure 6. Current-Gain-Bandwidth Product

## TYPICAL ELECTRICAL CHARACTERISTICS – ZENER DIODE

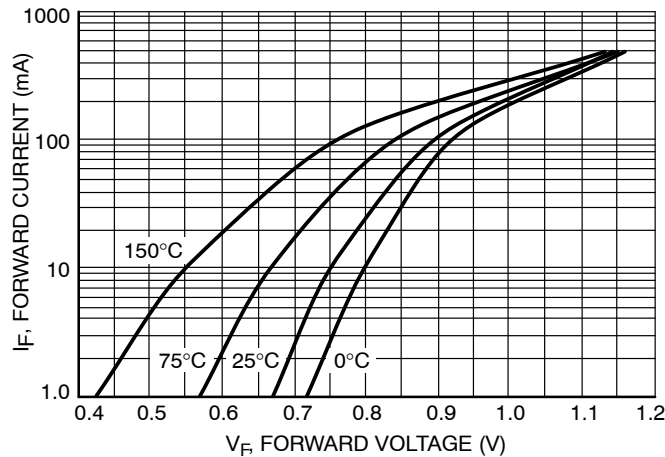


Figure 7. Typical Forward Voltage

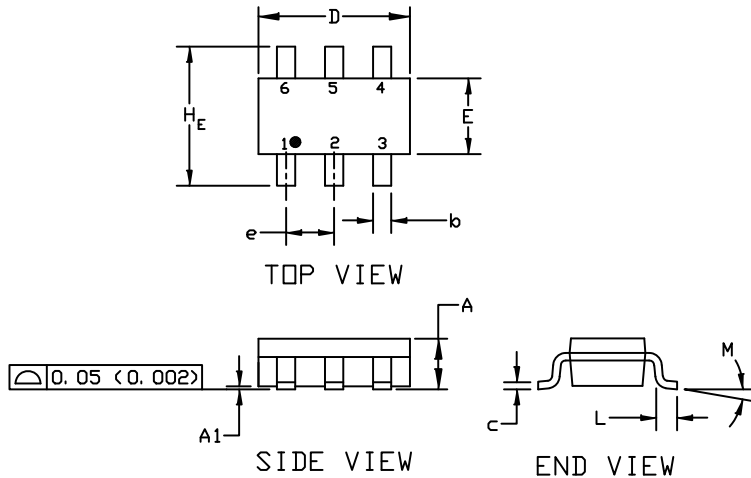
# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 2:1

SC-74  
CASE 318F  
ISSUE P

DATE 07 OCT 2021

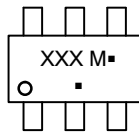


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994
2. CONTROLLING DIMENSION: INCHES
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.

DIM	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.90	1.00	1.10	0.035	0.039	0.043
A1	0.01	0.06	0.10	0.001	0.002	0.004
b	0.25	0.37	0.50	0.010	0.015	0.020
c	0.10	0.18	0.26	0.004	0.007	0.010
D	2.90	3.00	3.10	0.114	0.118	0.122
E	1.30	1.50	1.70	0.051	0.059	0.067
e	0.85	0.95	1.05	0.034	0.037	0.041
HE	2.50	2.75	3.00	0.099	0.108	0.118
L	0.20	0.40	0.60	0.008	0.016	0.024
M	0*	---	10*	0*	---	10*

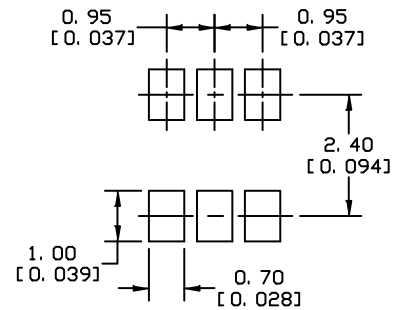
GENERIC MARKING DIAGRAM\*



- XXX = Specific Device Code
- M = Date Code
- = Pb-Free Package

(Note: Microdot may be in either location)

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.



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

SOLDERING FOOTPRINT

- |   |  |   |  |   |   |
|---|--|---|--|---|---|
| <p>STYLE 1:<br/>PIN 1. CATHODE<br/>2. ANODE<br/>3. CATHODE<br/>4. CATHODE<br/>5. ANODE<br/>6. CATHODE</p>     | <p>STYLE 2:<br/>PIN 1. NO CONNECTION<br/>2. COLLECTOR<br/>3. EMITTER<br/>4. NO CONNECTION<br/>5. COLLECTOR<br/>6. BASE</p> | <p>STYLE 3:<br/>PIN 1. EMITTER 1<br/>2. BASE 1<br/>3. COLLECTOR 2<br/>4. EMITTER 2<br/>5. BASE 2<br/>6. COLLECTOR 1</p> | <p>STYLE 4:<br/>PIN 1. COLLECTOR 2<br/>2. EMITTER 1/EMITTER 2<br/>3. COLLECTOR 1<br/>4. EMITTER 3<br/>5. BASE 1/BASE 2/COLLECTOR 3<br/>6. BASE 3</p> | <p>STYLE 5:<br/>PIN 1. CHANNEL 1<br/>2. ANODE<br/>3. CHANNEL 2<br/>4. CHANNEL 3<br/>5. CATHODE<br/>6. CHANNEL 4</p> | <p>STYLE 6:<br/>PIN 1. CATHODE<br/>2. ANODE<br/>3. CATHODE<br/>4. CATHODE<br/>5. CATHODE<br/>6. CATHODE</p> |
| <p>STYLE 7:<br/>PIN 1. SOURCE 1<br/>2. GATE 1<br/>3. DRAIN 2<br/>4. SOURCE 2<br/>5. GATE 2<br/>6. DRAIN 1</p> | <p>STYLE 8:<br/>PIN 1. EMITTER 1<br/>2. BASE 2<br/>3. COLLECTOR 2<br/>4. EMITTER 2<br/>5. BASE 1<br/>6. COLLECTOR 1</p>    | <p>STYLE 9:<br/>PIN 1. EMITTER 2<br/>2. BASE 2<br/>3. COLLECTOR 1<br/>4. EMITTER 1<br/>5. BASE 1<br/>6. COLLECTOR 2</p> | <p>STYLE 10:<br/>PIN 1. ANODE/CATHODE<br/>2. BASE<br/>3. EMITTER<br/>4. COLLECTOR<br/>5. ANODE<br/>6. CATHODE</p>                                    | <p>STYLE 11:<br/>PIN 1. EMITTER<br/>2. BASE<br/>3. ANODE/CATHODE<br/>4. ANODE<br/>5. CATHODE<br/>6. COLLECTOR</p>   |   |

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