

# NSS60600MZ4

## 60 V, 6.0 A, Low $V_{CE(sat)}$ PNP Transistor

ON Semiconductor's e<sup>2</sup>PowerEdge family of low  $V_{CE(sat)}$  transistors are surface mount devices featuring ultra low saturation voltage ( $V_{CE(sat)}$ ) and high current gain capability. These are designed for use in low voltage, high speed switching applications where affordable efficient energy control is important.

Typical applications are DC-DC converters and power management in portable and battery powered products such as cellular and cordless phones, PDAs, computers, printers, digital cameras and MP3 players. Other applications are low voltage motor controls in mass storage products such as disc drives and tape drives. In the automotive industry they can be used in air bag deployment and in the instrument cluster. The high current gain allows e<sup>2</sup>PowerEdge devices to be driven directly from PMU's control outputs, and the Linear Gain (Beta) makes them ideal components in analog amplifiers.

### Features

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

### MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ )

Rating	Symbol	Max	Unit
Collector-Emitter Voltage	$V_{CEO}$	-60	Vdc
Collector-Base Voltage	$V_{CBO}$	-100	Vdc
Emitter-Base Voltage	$V_{EBO}$	-6.0	Vdc
Collector Current – Continuous	$I_C$	-6.0	A
Collector Current – Peak	$I_{CM}$	-12.0	A

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$ (Note 1)	800	mW
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$ (Note 1)	155	$^\circ\text{C}/\text{W}$
Total Device Dissipation $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$ (Note 2)	2	W
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$ (Note 2)	64	$^\circ\text{C}/\text{W}$
Total Device Dissipation (Single Pulse < 10 sec.)	$P_{Dsingle}$ (Note 3)	710	mW
Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$

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.

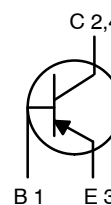
1. FR-4 @ 7.6 mm<sup>2</sup>, 1 oz. copper traces.
2. FR-4 @ 645 mm<sup>2</sup>, 1 oz. copper traces.
3. Thermal response.



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<http://onsemi.com>

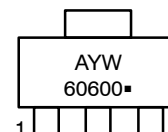
**-60 VOLTS, 6.0 AMPS  
2.0 WATTS  
PNP LOW  $V_{CE(sat)}$  TRANSISTOR  
EQUIVALENT  $R_{DS(on)} 50 \text{ m}\Omega$**



### MARKING DIAGRAM

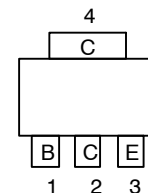


SOT-223  
CASE 318E  
STYLE 1



A = Assembly Location  
Y = Year  
W = Work Week  
60600 = Specific Device Code  
▪ = Pb-Free Package

### PIN ASSIGNMENT



Top View Pinout

### ORDERING INFORMATION

Device	Package	Shipping†
NSS60600MZ4T1G	SOT-223 (Pb-Free)	1000/ Tape & Reel
NSS60600MZ4T3G	SOT-223 (Pb-Free)	4000/ Tape & Reel

†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.

# NSS60600MZ4

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector–Emitter Breakdown Voltage ( $I_C = -10\text{ mAdc}$ , $I_B = 0$ )	$V_{(BR)CEO}$	-60			Vdc
Collector–Base Breakdown Voltage ( $I_C = -0.1\text{ mAdc}$ , $I_E = 0$ )	$V_{(BR)CBO}$	-100			Vdc
Emitter–Base Breakdown Voltage ( $I_E = -0.1\text{ mAdc}$ , $I_C = 0$ )	$V_{(BR)EBO}$	-6.0			Vdc
Collector Cutoff Current ( $V_{CB} = -100\text{ Vdc}$ , $I_E = 0$ )	$I_{CBO}$			-0.1	$\mu\text{Adc}$
Emitter Cutoff Current ( $V_{EB} = -6.0\text{ Vdc}$ )	$I_{EBO}$			-0.1	$\mu\text{Adc}$

## ON CHARACTERISTICS

DC Current Gain (Note 4) ( $I_C = -500\text{ mA}$ , $V_{CE} = -2.0\text{ V}$ ) ( $I_C = -1.0\text{ A}$ , $V_{CE} = -2.0\text{ V}$ ) ( $I_C = -2.0\text{ A}$ , $V_{CE} = -2.0\text{ V}$ ) ( $I_C = -6.0\text{ A}$ , $V_{CE} = -2.0\text{ V}$ )	$h_{FE}$	150 120 100 70		360	
Collector–Emitter Saturation Voltage (Note 4) ( $I_C = -0.1\text{ A}$ , $I_B = -2.0\text{ mA}$ ) ( $I_C = -1.0\text{ A}$ , $I_B = -0.100\text{ A}$ ) ( $I_C = -2.0\text{ A}$ , $I_B = -0.200\text{ A}$ ) ( $I_C = -3.0\text{ A}$ , $I_B = -60\text{ mA}$ ) ( $I_C = -6.0\text{ A}$ , $I_B = -0.6\text{ A}$ )	$V_{CE(sat)}$		-0.050 -0.100	-0.050 -0.070 -0.120 -0.250 -0.350	V
Base–Emitter Saturation Voltage (Note 4) ( $I_C = -1.0\text{ A}$ , $I_B = -0.1\text{ A}$ )	$V_{BE(sat)}$			-1.0	V
Base–Emitter Turn–on Voltage (Note 4) ( $I_C = -1.0\text{ A}$ , $V_{CE} = -2.0\text{ V}$ )	$V_{BE(on)}$			-0.900	V
Cutoff Frequency ( $I_C = -500\text{ mA}$ , $V_{CE} = -10\text{ V}$ , $f = 1.0\text{ MHz}$ )	$f_T$	100			MHz
Input Capacitance ( $V_{EB} = 5.0\text{ V}$ , $f = 1.0\text{ MHz}$ )	$C_{ibo}$		360		pF
Output Capacitance ( $V_{CB} = 10\text{ V}$ , $f = 1.0\text{ MHz}$ )	$C_{obo}$		60		pF

## SWITCHING CHARACTERISTICS

Delay ( $V_{CC} = -30\text{ V}$ , $I_C = 750\text{ mA}$ , $I_{B1} = 15\text{ mA}$ )	$t_d$		100		ns
Rise ( $V_{CC} = -30\text{ V}$ , $I_C = 750\text{ mA}$ , $I_{B1} = 15\text{ mA}$ )	$t_r$		180		ns
Storage ( $V_{CC} = -30\text{ V}$ , $I_C = 750\text{ mA}$ , $I_{B1} = 15\text{ mA}$ )	$t_s$		540		ns
Fall ( $V_{CC} = -30\text{ V}$ , $I_C = 750\text{ mA}$ , $I_{B1} = 15\text{ mA}$ )	$t_f$		145		ns

4. Pulsed Condition: Pulse Width = 300 msec, Duty Cycle  $\leq 2\%$ .

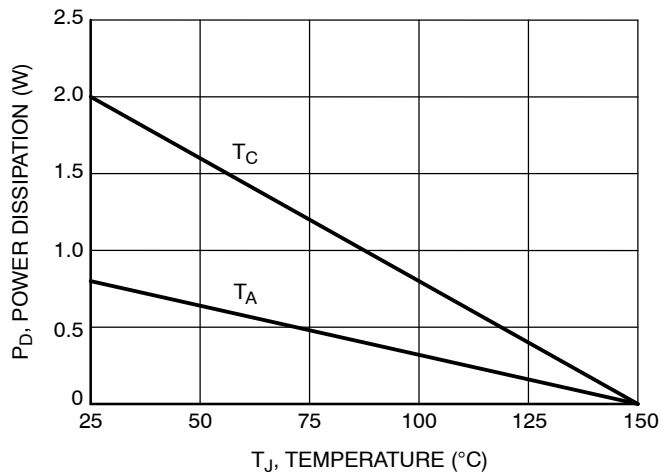


Figure 1. Power Derating

TYPICAL CHARACTERISTICS

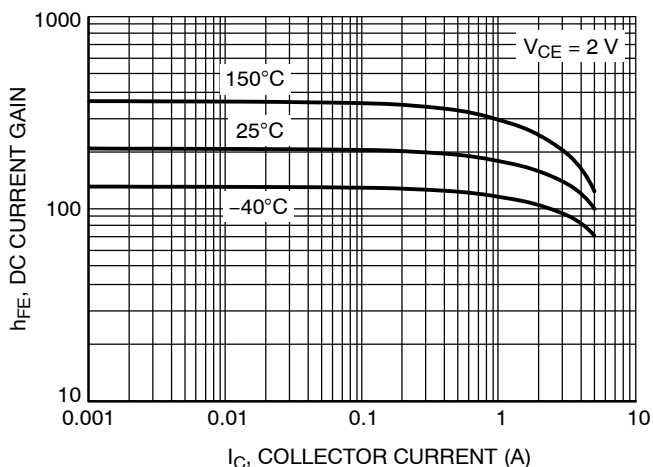


Figure 2. DC Current Gain

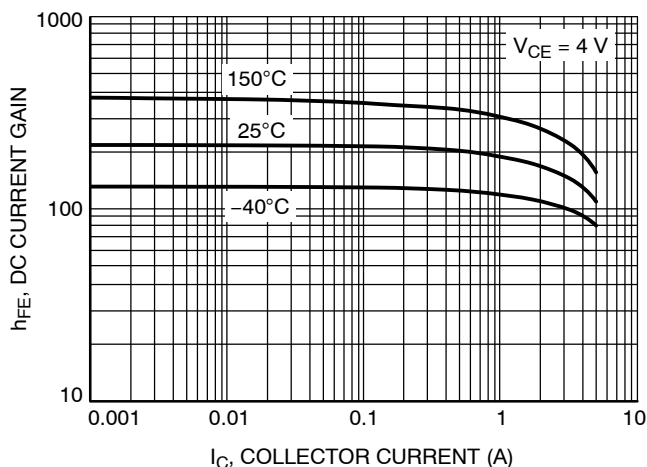


Figure 3. DC Current Gain

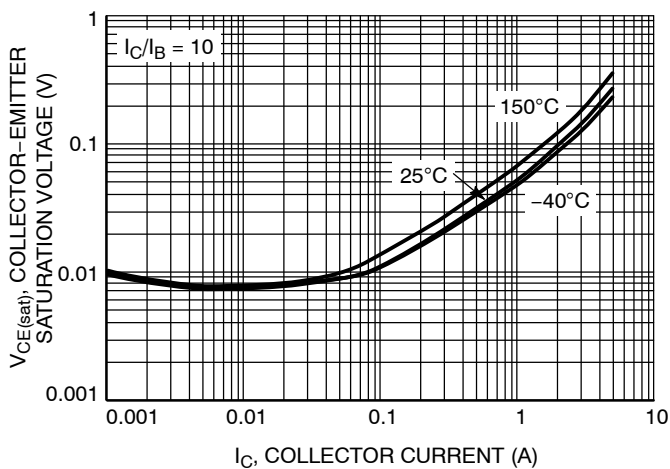


Figure 4. Collector-Emitter Saturation Voltage

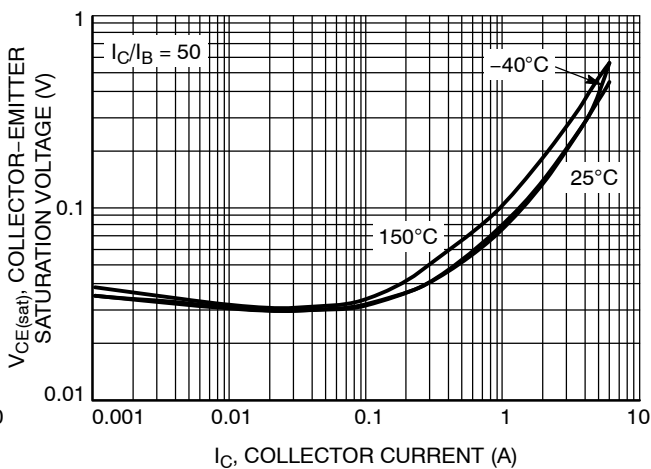


Figure 5. Collector-Emitter Saturation Voltage

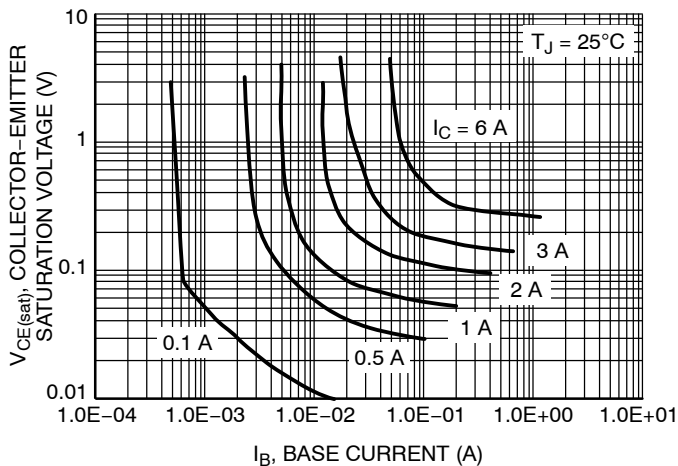


Figure 6. Collector Saturation Region

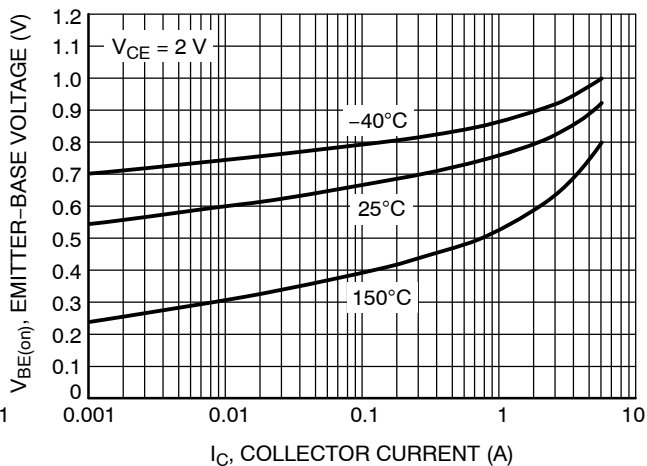


Figure 7.  $V_{BE(on)}$  Voltage

TYPICAL CHARACTERISTICS

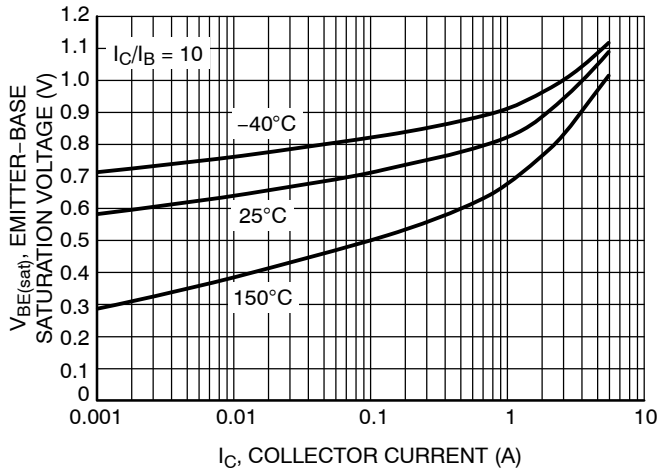


Figure 8. Base-Emitter Saturation Voltage

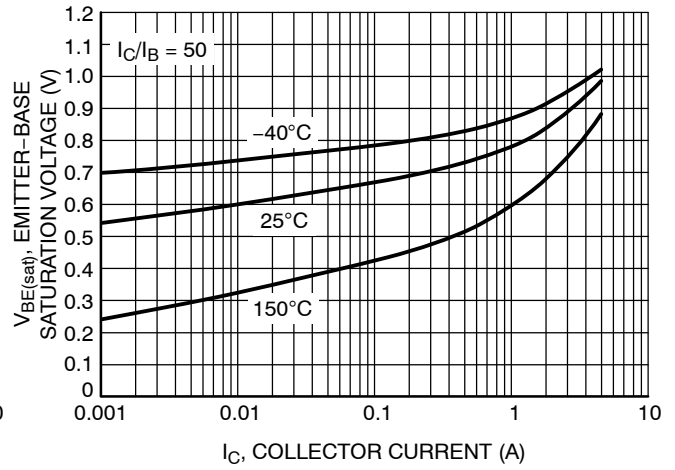


Figure 9. Base-Emitter Saturation Voltage

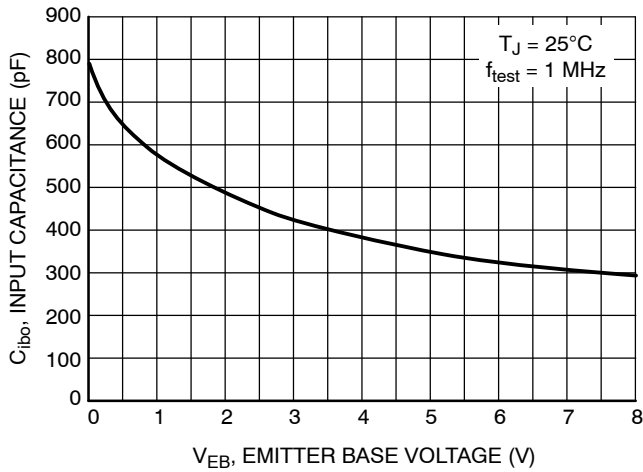


Figure 10. Input Capacitance

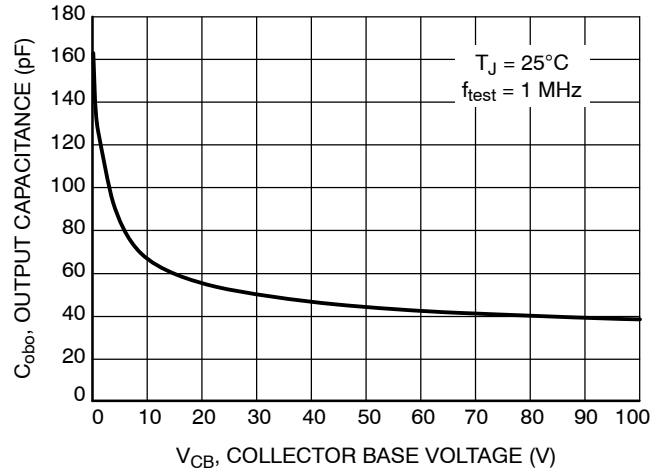


Figure 11. Output Capacitance

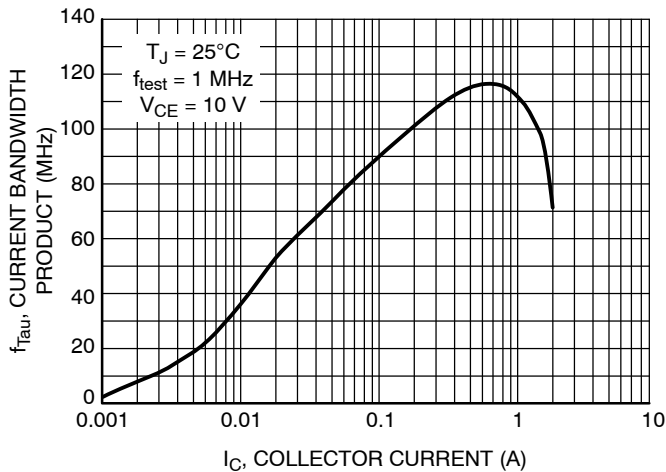


Figure 12. Current-Gain Bandwidth Product

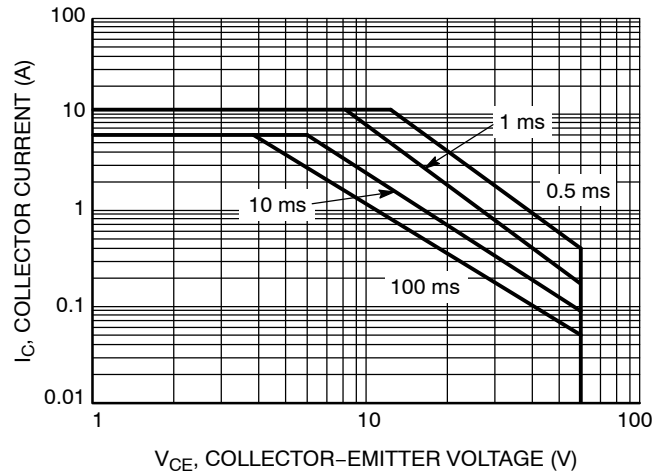
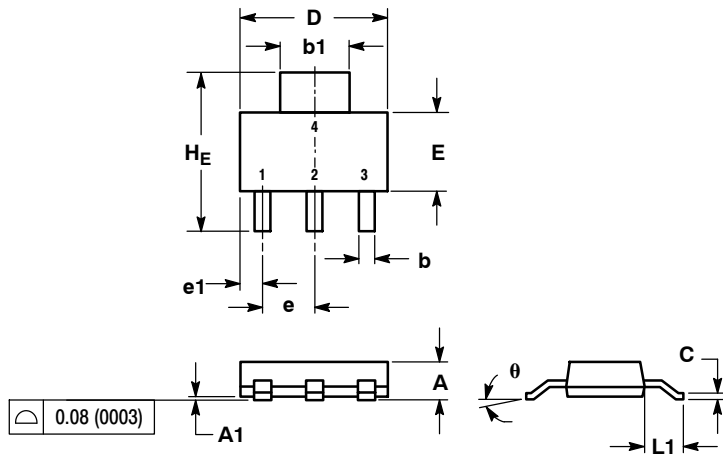


Figure 13. Safe Operating Area

# NSS60600MZ4

## PACKAGE DIMENSIONS

SOT-223 (TO-261)  
CASE 318E-04  
ISSUE L



NOTES:

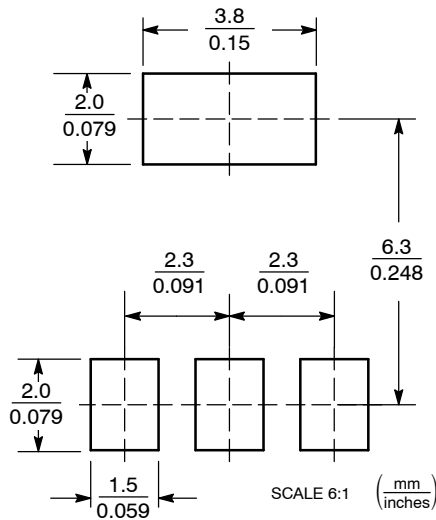
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.50	1.63	1.75	0.060	0.064	0.068
A1	0.02	0.06	0.10	0.001	0.002	0.004
b	0.60	0.75	0.89	0.024	0.030	0.035
b1	2.90	3.06	3.20	0.115	0.121	0.126
c	0.24	0.29	0.35	0.009	0.012	0.014
D	6.30	6.50	6.70	0.249	0.256	0.263
E	3.30	3.50	3.70	0.130	0.138	0.145
e	2.20	2.30	2.40	0.087	0.091	0.094
e1	0.85	0.94	1.05	0.033	0.037	0.041
L1	1.50	1.75	2.00	0.060	0.069	0.078
HE	6.70	7.00	7.30	0.264	0.276	0.287
θ	0°	-	10°	0°	-	10°

STYLE 1:

- PIN 1. BASE
- COLLECTOR
- EMITTER
- COLLECTOR

### SOLDERING FOOTPRINT



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