



PMST3904-Q

NPN switching transistor

28 February 2024

Product data sheet

1. General description

NPN switching transistor in a very small SOT323 (SC-70) Surface-Mounted Device (SMD) plastic package.

2. Features and benefits

- Collector current capability $I_C = 200$ mA
- Collector-emitter voltage $V_{CEO} = 40$ V
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. Applications

- General amplification and switching

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base	-	-	40	V
I_C	collector current		-	-	200	mA
h_{FE}	DC current gain	$V_{CE} = 1$ V; $I_C = 10$ mA; pulsed; $t_p \leq 300$ μ s; $\delta \leq 0.02$; $T_{amb} = 25$ °C	100	-	300	

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	<p>SC-70 (SOT323)</p>	<p>sym123</p>
2	E	emitter		
3	C	collector		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMST3904-Q	SC-70	plastic, surface-mounted package; 3 leads; 1.3 mm pitch; 2 mm x 1.25 mm x 0.95 mm body	SOT323

7. Marking

Table 4. Marking codes

Type number	Marking code[1]
PMST3904-Q	%1A

[1] % = placeholder for manufacturing site code

8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CBO}	collector-base voltage	open emitter	-	60	V
V_{CEO}	collector-emitter voltage	open base	-	40	V
V_{EBO}	emitter-base voltage	open collector	-	6	V
I_C	collector current		-	200	mA
I_{CM}	peak collector current		-	200	mA
I_{BM}	peak base current		-	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25\text{ °C}$	[1]	200	mW
T_j	junction temperature		-	150	°C
T_{amb}	ambient temperature		-65	150	°C
T_{stg}	storage temperature		-65	150	°C

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

9. Thermal characteristics

Table 6. Thermal characteristics

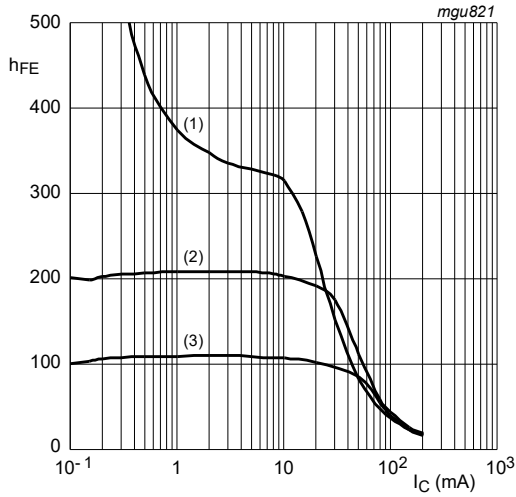
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	625	K/W

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

10. Characteristics

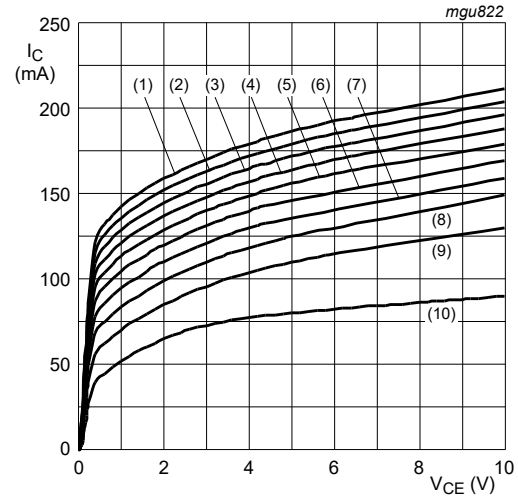
Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	$V_{CB} = 30\text{ V}$; $I_E = 0\text{ A}$; $T_{amb} = 25\text{ °C}$	-	-	50	nA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 6\text{ V}$; $I_C = 0\text{ A}$; $T_{amb} = 25\text{ °C}$	-	-	50	nA
h_{FE}	DC current gain	$V_{CE} = 1\text{ V}$; $I_C = 0.1\text{ mA}$; pulsed; $t_p \leq 300\text{ }\mu\text{s}$; $\delta \leq 0.02$; $T_{amb} = 25\text{ °C}$	60	-	-	
		$V_{CE} = 1\text{ V}$; $I_C = 1\text{ mA}$; pulsed; $t_p \leq 300\text{ }\mu\text{s}$; $\delta \leq 0.02$; $T_{amb} = 25\text{ °C}$	80	-	-	
		$V_{CE} = 1\text{ V}$; $I_C = 10\text{ mA}$; pulsed; $t_p \leq 300\text{ }\mu\text{s}$; $\delta \leq 0.02$; $T_{amb} = 25\text{ °C}$	100	-	300	
		$V_{CE} = 1\text{ V}$; $I_C = 50\text{ mA}$; pulsed; $t_p \leq 300\text{ }\mu\text{s}$; $\delta \leq 0.02$; $T_{amb} = 25\text{ °C}$	60	-	-	
		$V_{CE} = 1\text{ V}$; $I_C = 100\text{ mA}$; pulsed; $t_p \leq 300\text{ }\mu\text{s}$; $\delta \leq 0.02$; $T_{amb} = 25\text{ °C}$	30	-	-	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10\text{ mA}$; $I_B = 1\text{ mA}$; $T_{amb} = 25\text{ °C}$	-	-	200	mV
		$I_C = 50\text{ mA}$; $I_B = 5\text{ mA}$; $T_{amb} = 25\text{ °C}$	-	-	300	mV
V_{BEsat}	base-emitter saturation voltage	$I_C = 10\text{ mA}$; $I_B = 1\text{ mA}$; $T_{amb} = 25\text{ °C}$	650	-	850	mV
		$I_C = 50\text{ mA}$; $I_B = 5\text{ mA}$; $T_{amb} = 25\text{ °C}$	-	-	950	mV
C_c	collector capacitance	$V_{CB} = 5\text{ V}$; $I_E = 0\text{ A}$; $i_e = 0\text{ A}$; $f = 1\text{ MHz}$; $T_{amb} = 25\text{ °C}$	-	-	4	pF
C_e	emitter capacitance	$V_{EB} = 0.5\text{ V}$; $I_C = 0\text{ A}$; $i_c = 0\text{ A}$; $f = 1\text{ MHz}$; $T_{amb} = 25\text{ °C}$	-	-	8	pF
f_T	transition frequency	$V_{CE} = 10\text{ V}$; $I_C = 20\text{ mA}$; $f = 100\text{ MHz}$; $T_{amb} = 25\text{ °C}$	300	-	-	MHz
NF	noise figure	$V_{CE} = 5\text{ V}$; $I_C = 100\text{ }\mu\text{A}$; $R_S = 1\text{ k}\Omega$; $f = 10\text{ Hz to }15.7\text{ kHz}$; $T_{amb} = 25\text{ °C}$	-	-	5	dB
Switching times (between 10% and 90% levels)						
t_d	delay time	$I_C = 10\text{ mA}$; $I_{Bon} = 1\text{ mA}$; $I_{Boff} = -1\text{ mA}$; $T_{amb} = 25\text{ °C}$	-	-	35	ns
t_r	rise time		-	-	35	ns
t_s	storage time		-	-	200	ns
t_f	fall time		-	-	50	ns



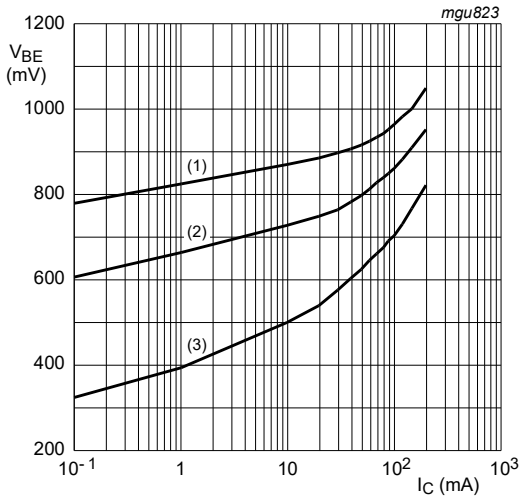
$V_{CE} = 1\text{ V}$
 (1) $T_{amb} = 150\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -55\text{ °C}$

Fig. 1. DC current gain as a function of collector current; typical values



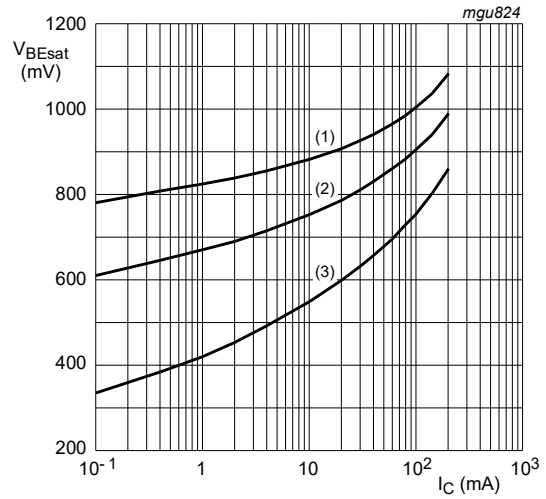
$T_{amb} = 25\text{ °C}$
 (1) $I_B = 5.0\text{ mA}$
 (2) $I_B = 4.5\text{ mA}$
 (3) $I_B = 4.0\text{ mA}$
 (4) $I_B = 3.5\text{ mA}$
 (5) $I_B = 3.0\text{ mA}$
 (6) $I_B = 2.5\text{ mA}$
 (7) $I_B = 2.0\text{ mA}$
 (8) $I_B = 1.5\text{ mA}$
 (9) $I_B = 1.0\text{ mA}$
 (10) $I_B = 0.5\text{ mA}$

Fig. 2. Collector current as a function of collector-emitter voltage; typical values



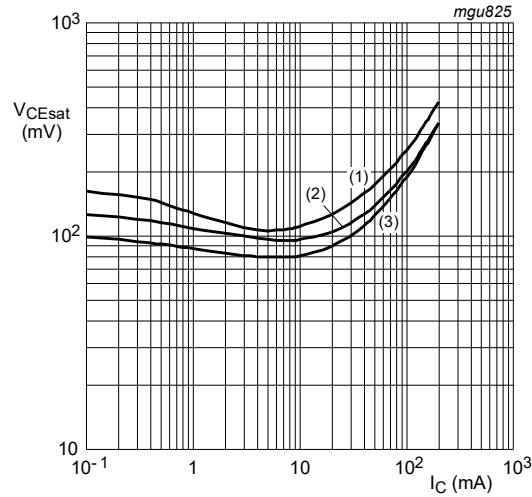
$V_{CE} = 1\text{ V}$
 (1) $T_{amb} = -55\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = 150\text{ °C}$

Fig. 3. Base-emitter voltage as a function of collector current; typical values



$I_C/I_B = 10$
 (1) $T_{amb} = -55\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = 150\text{ °C}$

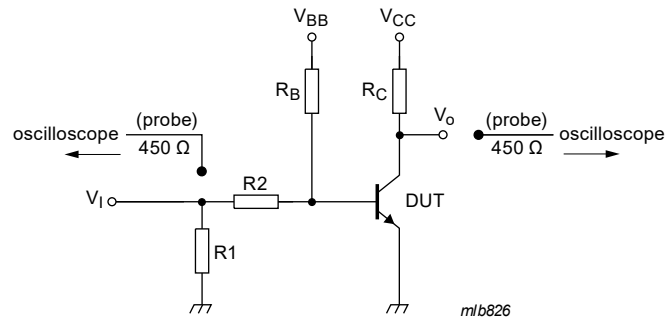
Fig. 4. Base-emitter saturation voltage as a function of collector current; typical values



$I_C/I_B = 10$
 (1) $T_{amb} = 150\text{ °C}$
 (2) $T_{amb} = 25\text{ °C}$
 (3) $T_{amb} = -55\text{ °C}$

Fig. 5. Collector-emitter saturation voltage as a function of collector current; typical values

11. Test information



$V_1 = 5\text{ V}$; $t = 600\text{ }\mu\text{s}$; $t_p = 10\text{ }\mu\text{s}$; $t_r = t_f \leq 3\text{ ns}$
 $R_1 = 56\text{ }\Omega$; $R_2 = 2.5\text{ k}\Omega$; $R_B = 3.9\text{ k}\Omega$; $R_C = 270\text{ }\Omega$
 $V_{BB} = -1.9\text{ V}$; $V_{CC} = 3\text{ V}$
 Oscilloscope: input impedance $Z_i = 50\text{ }\Omega$

Fig. 6. Test circuit for switching times

Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - *Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

12. Package outline

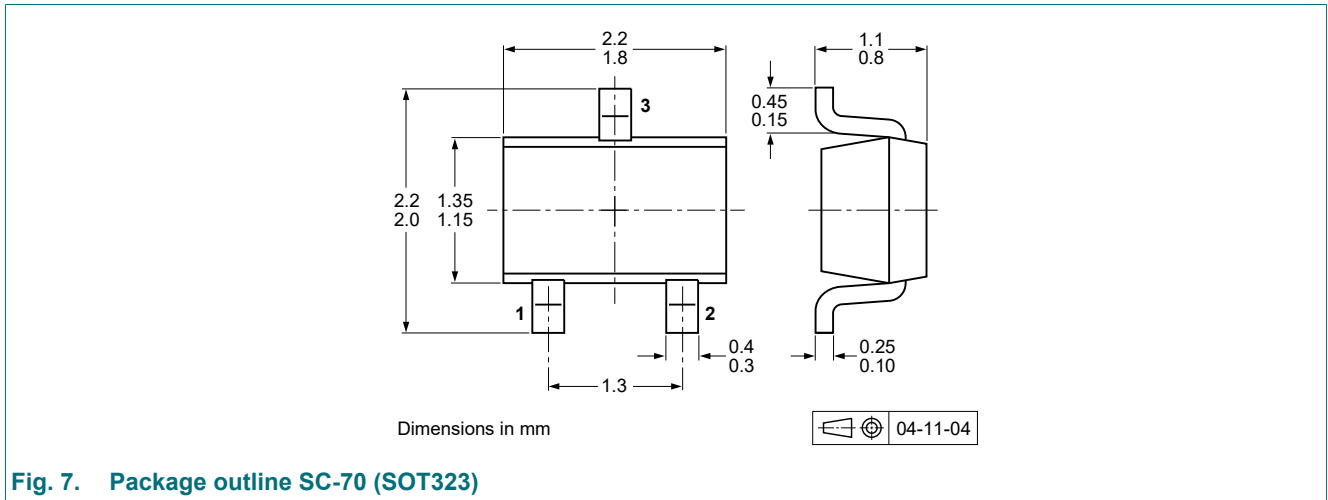


Fig. 7. Package outline SC-70 (SOT323)

13. Soldering

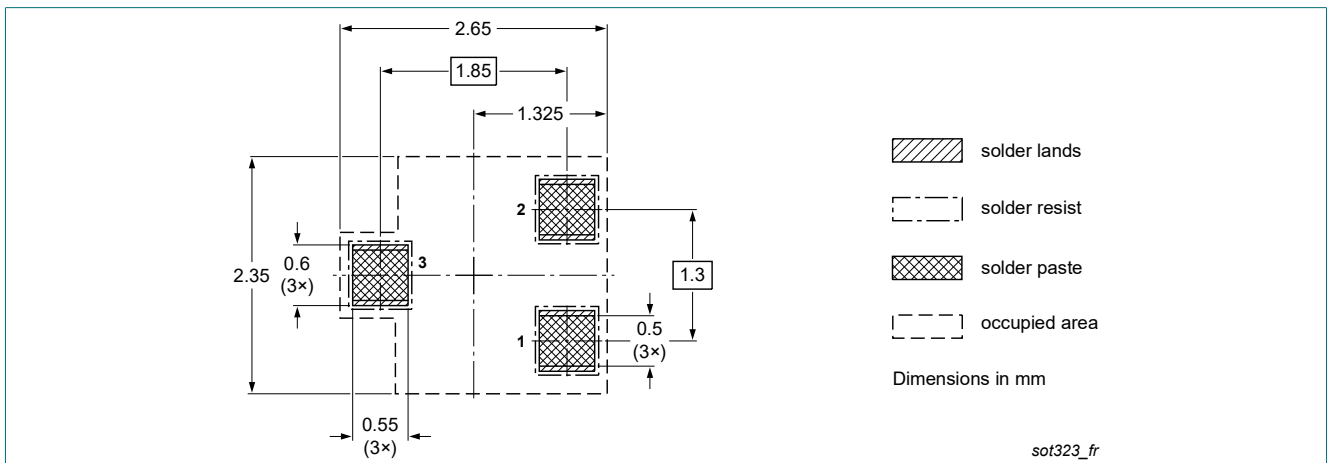


Fig. 8. Reflow soldering footprint for SC-70 (SOT323)

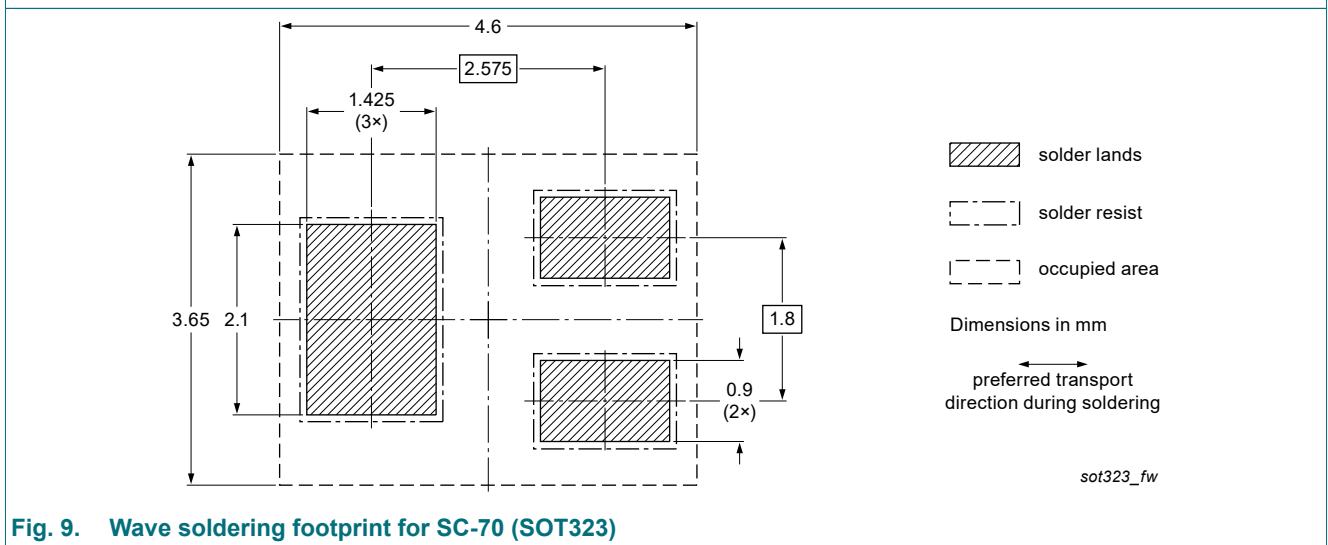


Fig. 9. Wave soldering footprint for SC-70 (SOT323)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMST3904-Q v.1	20240228	Product data sheet	-	-

15. Legal information

Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

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