



PBSS4330PAS

30 V, 3 A NPN low V_{CEsat} (BISS) transistor

11 September 2014

Product data sheet

1. General description

NPN low V_{CEsat} Breakthrough In Small Signal (BISS) transistor, encapsulated in an ultra thin DFN2020D-3 (SOT1061D) leadless small Surface-Mounted Device (SMD) plastic package with medium power capability and visible and solderable side pads.

PNP complement: PBSS5330PAS

2. Features and benefits

- Low collector-emitter saturation voltage V_{CEsat}
- High collector current capability I_C and I_{CM}
- High collector current gain (h_{FE}) at high I_C
- High efficiency due to less heat generation
- High temperature applications up to 175 °C
- Reduced Printed-Circuit Board (PCB) area requirements
- Leadless small SMD plastic package with solderable side pads
- Exposed heat sink for excellent thermal and electrical conductivity
- Suitable for Automatic Optical Inspection (AOI) of solder joint
- AEC-Q101 qualified

3. Applications

- Loadswitch
- Battery-driven devices
- Power management
- Charging circuits
- Power switches (e.g. motors, fans)

4. Quick reference data

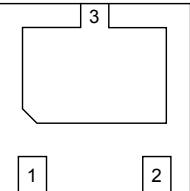
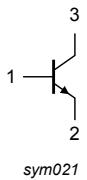
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V _{CEO}	collector-emitter voltage	open base		-	-	30	V
I _C	collector current			-	-	3	A
I _{CM}	peak collector current	single pulse; t _p ≤ 1 ms		-	-	5	A
R _{CEsat}	collector-emitter saturation resistance	I _C = 3 A; I _B = 300 mA; pulsed; t _p ≤ 300 µs; δ ≤ 0.02; T _{amb} = 25 °C		-	75	100	mΩ

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5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base		
2	E	emitter		
3	C	collector	 Transparent top view	 sym021

DFN2020D-3 (SOT1061D)

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBSS4330PAS	DFN2020D-3	DFN2020D-3: plastic thermal enhanced ultra thin small outline package; no leads; 3 terminals; body 2 x 2 x 0.65 mm	SOT1061D

7. Marking

Table 4. Marking codes

Type number	Marking code
PBSS4330PAS	E1

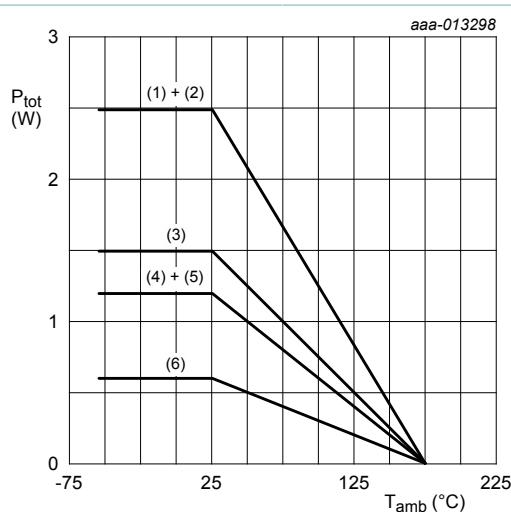
8. Limiting values

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		-	50	V
V_{CEO}	collector-emitter voltage	open base		-	30	V
V_{EBO}	emitter-base voltage	open collector		-	6	V
I_C	collector current			-	3	A
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms		-	5	A
I_B	base current			-	500	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	600	mW
			[2][3]	-	1.2	W
			[4]	-	1.5	W
			[5][6]	-	2.5	W
T_j	junction temperature			-	175	°C
T_{amb}	ambient temperature			-55	175	°C
T_{stg}	storage temperature			-65	175	°C

- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm².
- [3] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.
- [4] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm².
- [5] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.
- [6] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and mounting pad for collector 1 cm².



- (1) Ceramic PCB, single-sided copper, standard footprint
- (2) FR4 PCB, 4-layer copper, 1 cm²
- (3) FR4 PCB, single-sided copper, 6 cm²
- (4) FR4 PCB, single-sided copper, 1 cm²
- (5) FR4 PCB, 4-layer copper, standard footprint
- (6) FR4 PCB, single-sided copper, standard footprint

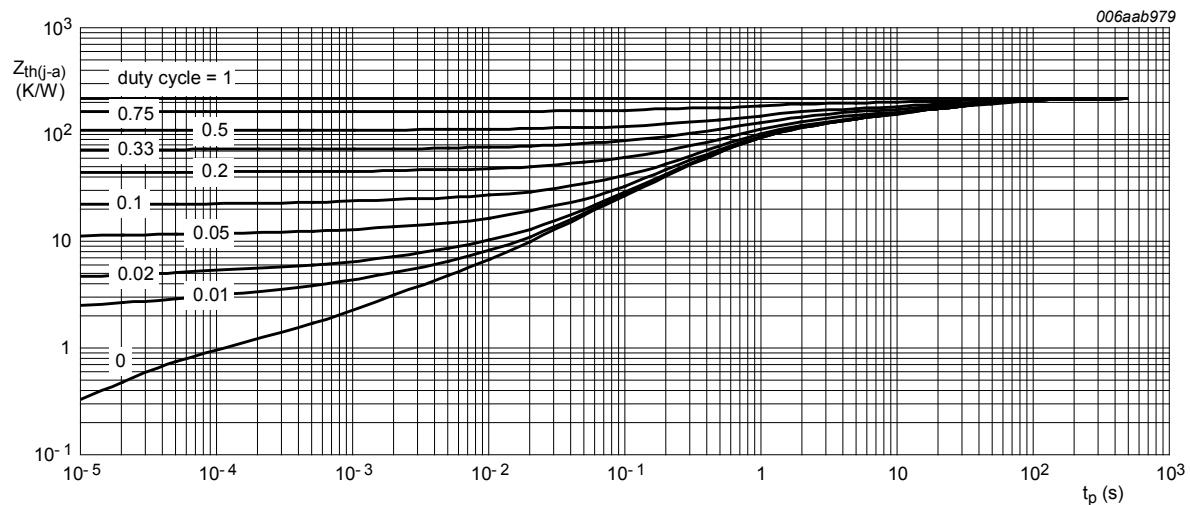
Fig. 1. Power derating curves

9. Thermal characteristics

Table 6. Thermal characteristics

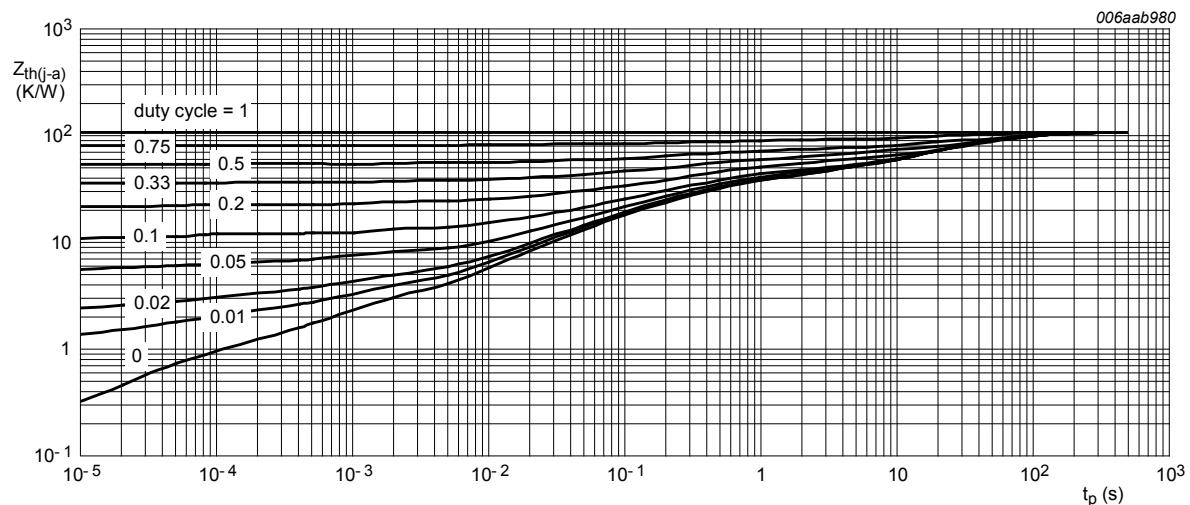
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	250	K/W
			[2][3]	-	-	125	K/W
			[4]	-	-	100	K/W
			[5][6]	-	-	60	K/W

- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm².
- [3] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.
- [4] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm².
- [5] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.
- [6] Device mounted on a FR4 PCB, 4-layer copper, tin-plated and mounting pad for collector 1 cm².



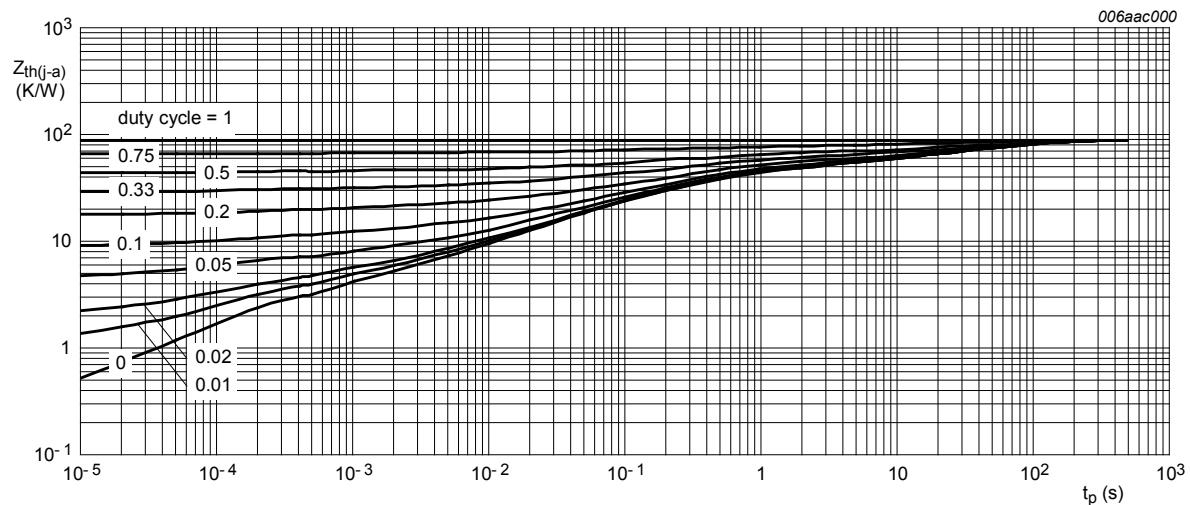
FR4 PCB, standard footprint

Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



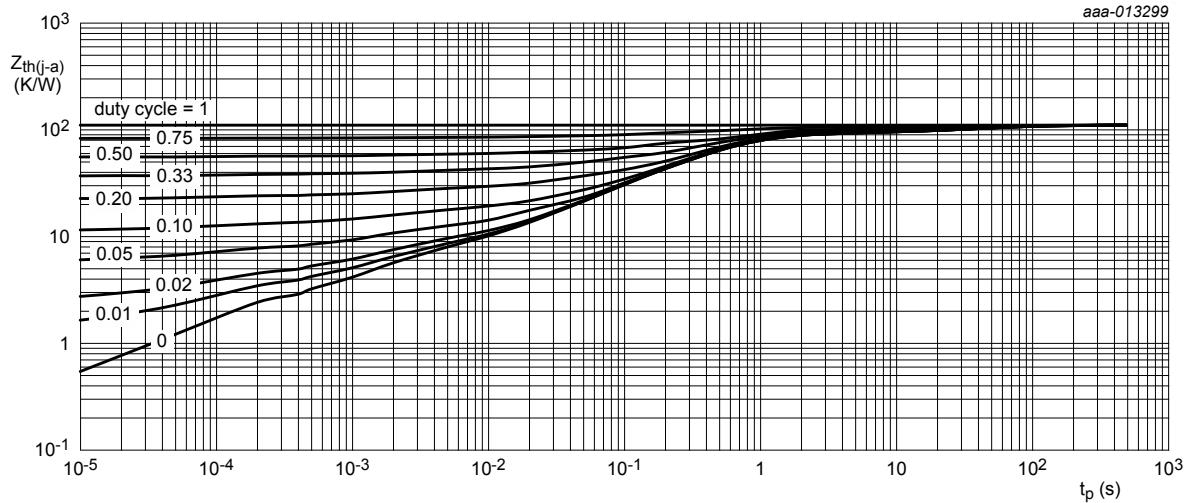
FR4 PCB, mounting pad for collector 1 cm^2

Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



FR4 PCB, mounting pad for collector 6 cm^2

Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



FR4 PCB, 4-layer copper, standard footprint

Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

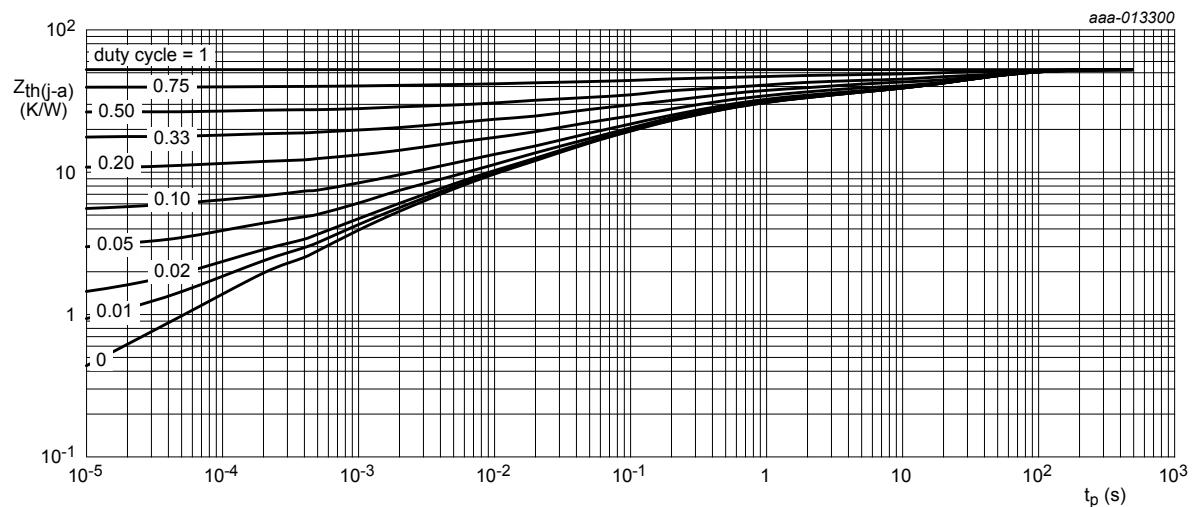


Fig. 6. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

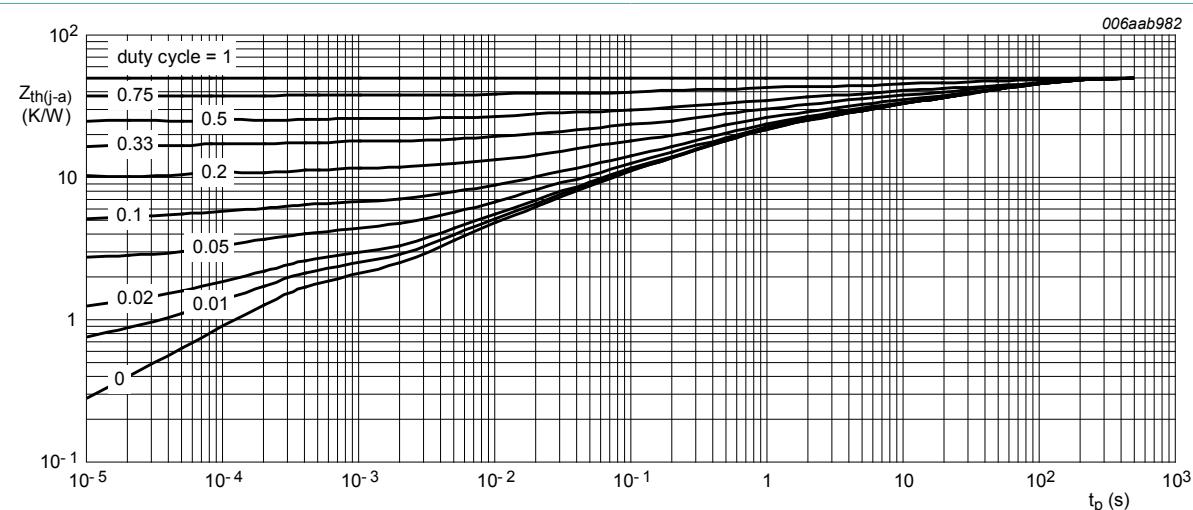


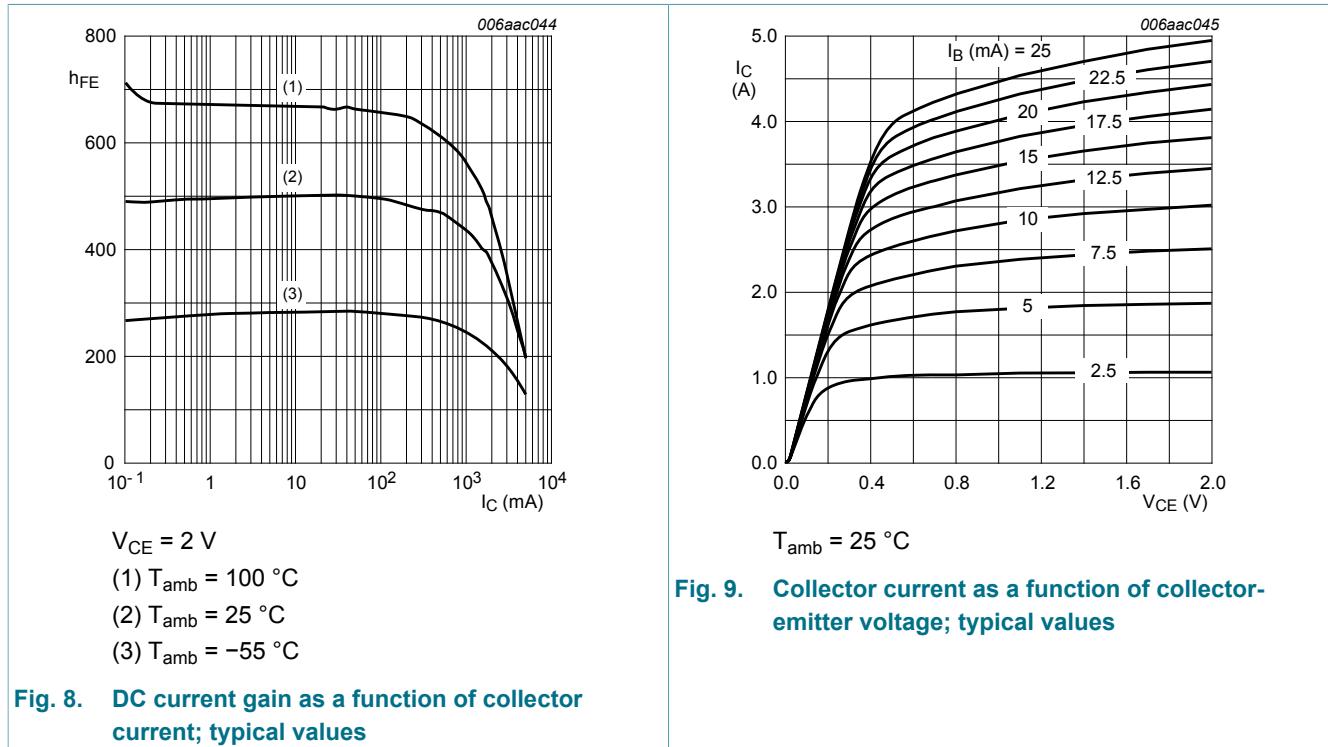
Fig. 7. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	$V_{CB} = 24 \text{ V}; I_E = 0 \text{ A}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	100	nA
		$V_{CB} = 24 \text{ V}; I_E = 0 \text{ A}; T_j = 150 \text{ }^\circ\text{C}$	-	-	50	µA
I_{CES}	collector-emitter cut-off current	$V_{CE} = 24 \text{ V}; V_{BE} = 0 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	100	nA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 5 \text{ V}; I_C = 0 \text{ A}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	-	100	nA
h_{FE}	DC current gain	$V_{CE} = 2 \text{ V}; I_C = 0.5 \text{ A}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	300	465	-	
		$V_{CE} = 2 \text{ V}; I_C = 1 \text{ A}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	270	435	700	
		$V_{CE} = 2 \text{ V}; I_C = 2 \text{ A}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	230	370	-	
		$V_{CE} = 2 \text{ V}; I_C = 3 \text{ A}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	180	310	-	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 0.5 \text{ A}; I_B = 50 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	-	40	60	mV
		$I_C = 1 \text{ A}; I_B = 50 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	-	80	110	mV
		$I_C = 2 \text{ A}; I_B = 100 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	-	155	220	mV
		$I_C = 3 \text{ A}; I_B = 300 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	-	220	300	mV
R_{CEsat}	collector-emitter saturation resistance	$I_C = 2 \text{ A}; I_B = 100 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	-	75	100	mΩ
V_{BEsat}	base-emitter saturation voltage	$I_C = 2 \text{ A}; I_B = 100 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	-	0.95	1.1	V
		$I_C = 3 \text{ A}; I_B = 300 \text{ mA}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	-	1.07	1.2	V
V_{BEon}	base-emitter turn-on voltage	$V_{CE} = 2 \text{ V}; I_C = 1 \text{ A}; \text{pulsed}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{amb} = 25 \text{ }^\circ\text{C}$	-	0.76	1	V
t_d	delay time	$V_{CC} = 9 \text{ V}; I_C = 2 \text{ A}; I_{Bon} = 0.1 \text{ A}; I_{Boff} = -0.1 \text{ A}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	11	-	ns
t_r	rise time		-	52	-	ns
t_{on}	turn-on time		-	63	-	ns
t_s	storage time		-	230	-	ns
t_f	fall time		-	40	-	ns
t_{off}	turn-off time		-	270	-	ns

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
f_T	transition frequency	$V_{CE} = 5 \text{ V}$; $I_C = 100 \text{ mA}$; $f = 100 \text{ MHz}$; $T_{amb} = 25 \text{ }^\circ\text{C}$	100	210	-	MHz
C_c	collector capacitance	$V_{CB} = 10 \text{ V}$; $I_E = 0 \text{ A}$; $i_e = 0 \text{ A}$; $f = 1 \text{ MHz}$; $T_{amb} = 25 \text{ }^\circ\text{C}$	-	21	30	pF



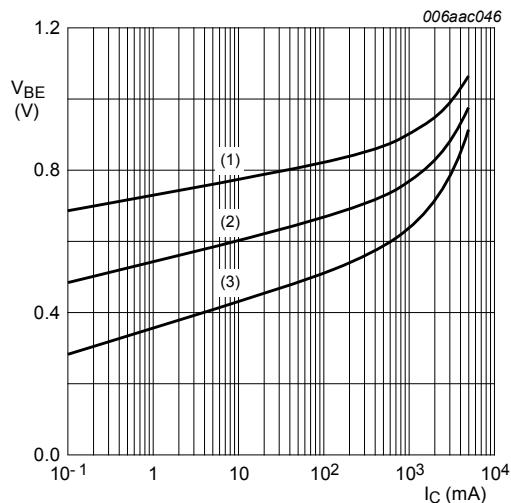


Fig. 10. Base-emitter voltage as a function of collector current; typical values

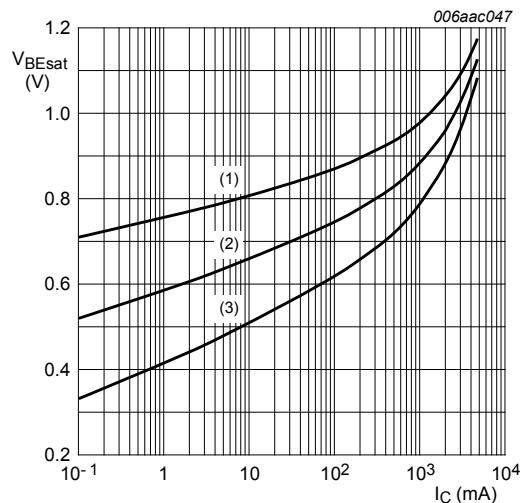


Fig. 11. Base-emitter saturation voltage as a function of collector current; typical values

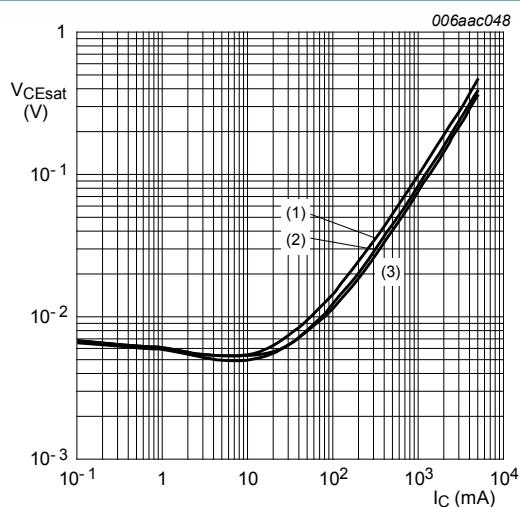


Fig. 12. Collector-emitter saturation voltage as a function of collector current; typical values

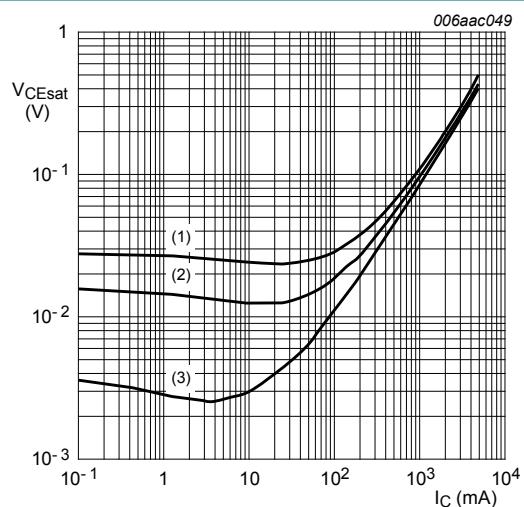


Fig. 13. Collector-emitter saturation voltage as a function of collector current; typical values

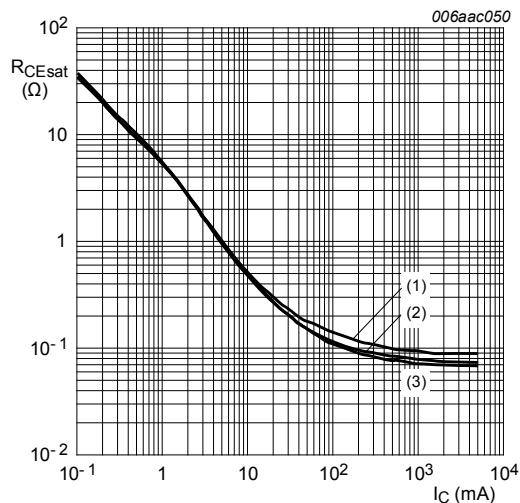


Fig. 14. Collector-emitter saturation resistance as a function of collector current; typical values

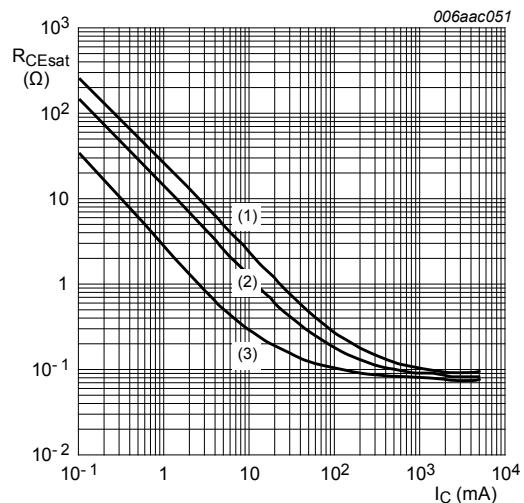


Fig. 15. Collector-emitter saturation resistance as a function of collector current; typical values

11. Test information

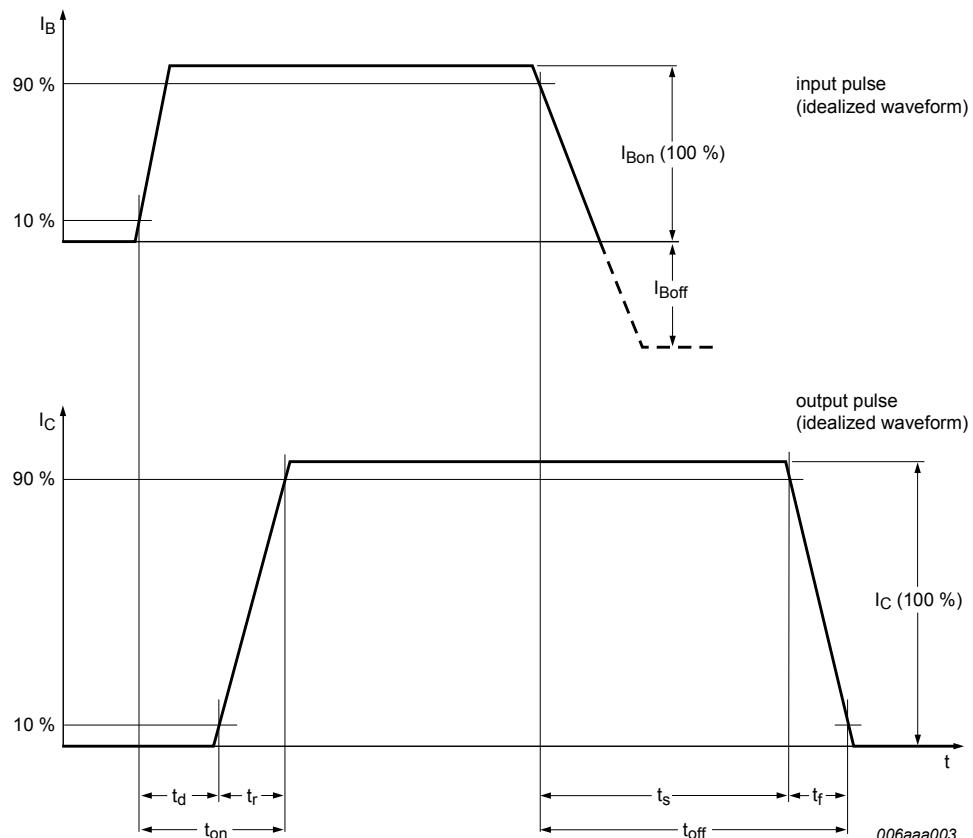


Fig. 16. BISS transistor switching time definition

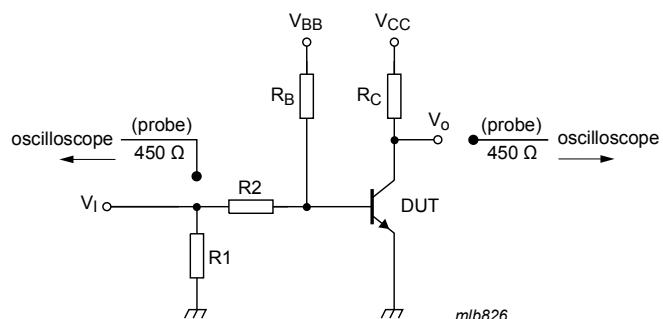


Fig. 17. Test circuit for switching times

11.1 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

DFN2020D-3: plastic thermal enhanced ultra thin small outline package; no leads; 3 terminals; body 2 x 2 x 0.65 mm

SOT1061D

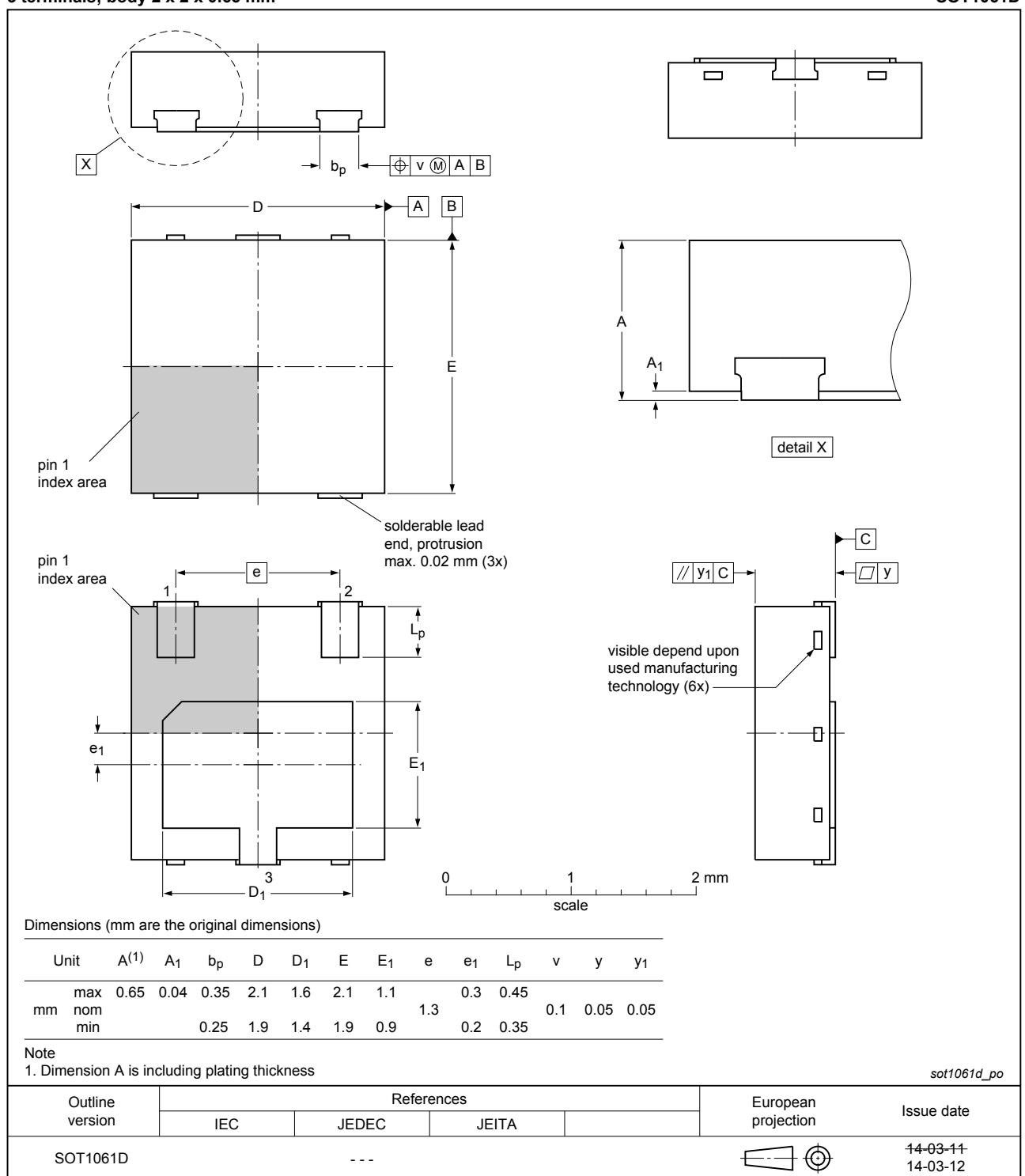


Fig. 18. Package outline DFN2020D-3 (SOT1061D)

13. Soldering

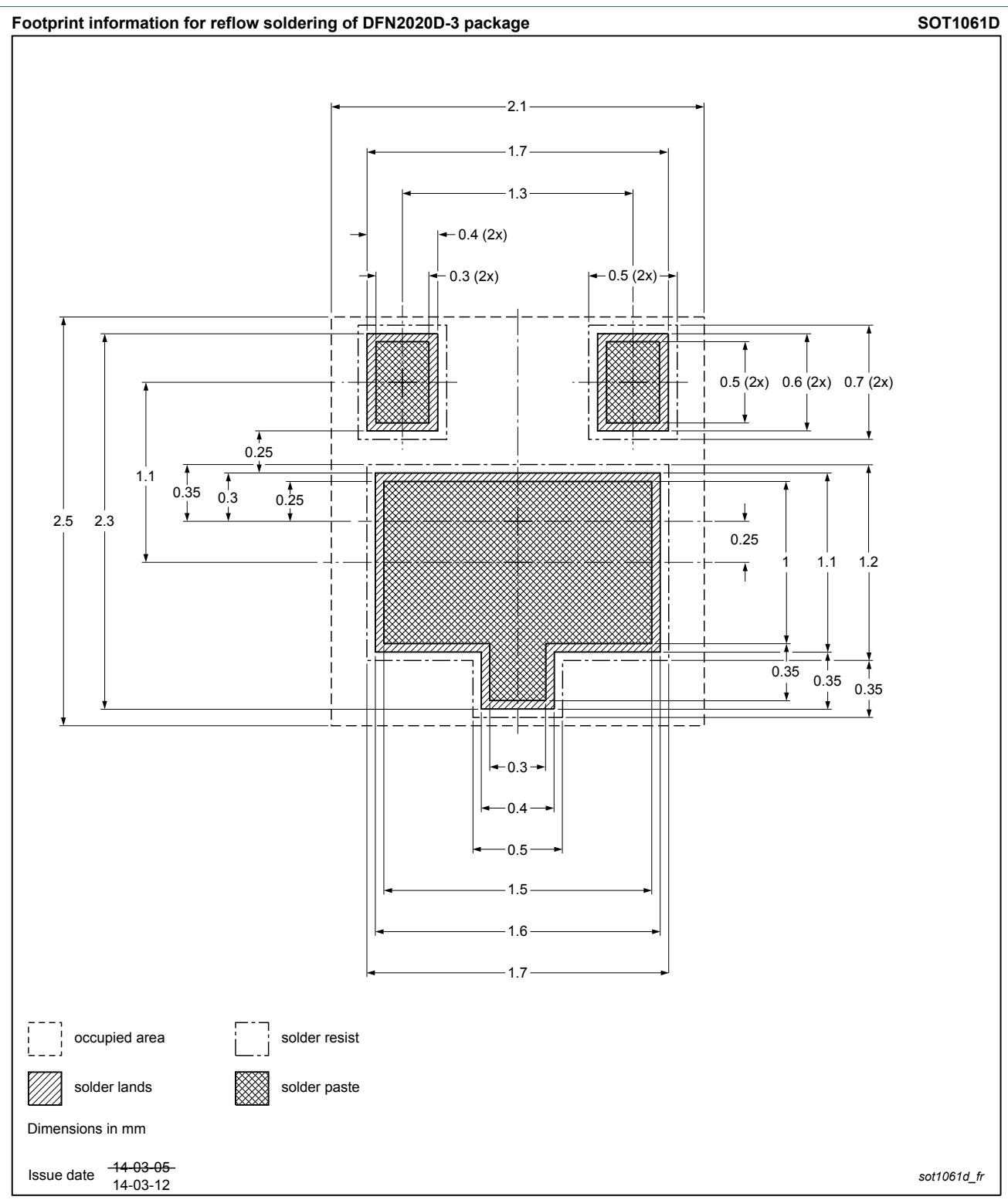


Fig. 19. Reflow soldering footprint for DFN2020D-3 (SOT1061D)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBSS4330PAS v.1	20140911	Product data sheet	-	-

15. Legal information

15.1 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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