PSMN057-200P

N-channel TrenchMOS SiliconMAX standard level FET

27 March 2023 Product data sheet

1. General description

SiliconMAX standard level N-channel enhancement mode Field-Effect Transistor (FET) in a plastic package using TrenchMOS technology. This product is designed and qualified for use in computing, communications, consumer and industrial applications only.

2. Features and benefits

- Higher operating power due to low thermal resistance
- Low conduction losses due to low on-state resistance
- Suitable for high frequency applications due to fast switching characteristics

3. Applications

- DC-to-DC converters
- Switched-mode power supplies

4. Quick reference data

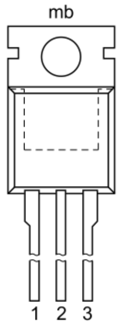
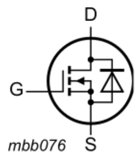
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	25 °C ≤ T_j ≤ 175 °C		-	-	200	V
I_D	drain current	T_{mb} = 100 °C		-	-	27.5	A
P_{tot}	total power dissipation	T_{mb} = 25 °C		-	-	250	W
Static characteristics							
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 17 A; T_j = 175 °C		-	-	165	mΩ
Dynamic characteristics							
Q_{GD}	gate-drain charge	I_D = 39 A; V_{DS} = 160 V; V_{GS} = 10 V; T_j = 25 °C		-	37	50	nC

nexperia

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 TO-220AB (SOT78)	
2	D	drain		
3	S	source		
mb	D	mounting base; connected to drain		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN057-200P	TO-220AB	plastic, single-ended package (heatsink mounted, 1 mounting hole); 3 leads; 2.54 mm pitch; 15.6 mm x 10 mm x 4.4 mm body	SOT78

7. Marking

Table 4. Marking codes

Type number	Marking code
PSMN057-200P	

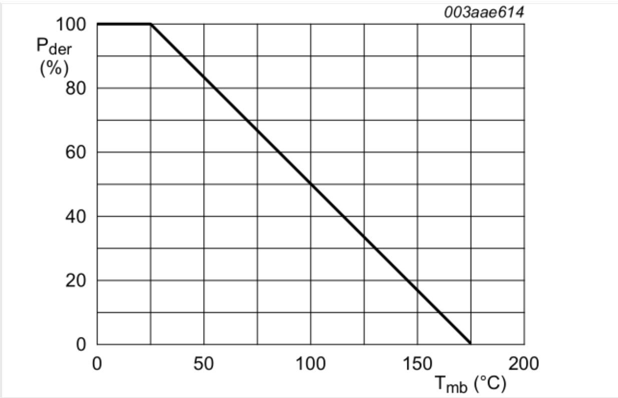
8. Limiting values

Table 5. Limiting values

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

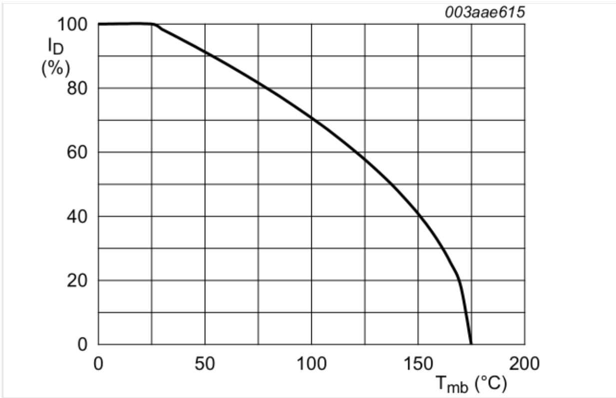
Symbol	Parameter	Conditions		Min	Max	Unit
V_{DS}	drain-source voltage	25 °C ≤ T_j ≤ 175 °C		-	200	V
V_{DGR}	drain-gate voltage	25 °C ≤ T_j ≤ 175 °C; R_{GS} = 20 kΩ		-	200	V
V_{GS}	gate-source voltage			-20	20	V
P_{tot}	total power dissipation	T_{mb} = 25 °C		-	250	W
I_D	drain current	T_{mb} = 100 °C		-	27.5	A
		T_{mb} = 25 °C		-	39	A
I_{DM}	peak drain current	pulsed; T_{mb} = 25 °C		-	156	A
T_{stg}	storage temperature			-55	175	°C
T_j	junction temperature			-55	175	°C
Source-drain diode						
I_S	source current	T_{mb} = 25 °C		-	39	A

Symbol	Parameter	Conditions		Min	Max	Unit
I_{SM}	peak source current	pulsed; T_{mb} = 25 °C		-	156	A
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	I_D = 23 A; V_{sup} ≤ 50 V; R_{GS} = 50 Ω; V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; unclamped; t_p = 240 μs		-	925	mJ
I_{AS}	non-repetitive avalanche current	V_{sup} ≤ 50 V; V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; R_{GS} = 50 Ω; unclamped		-	23	A



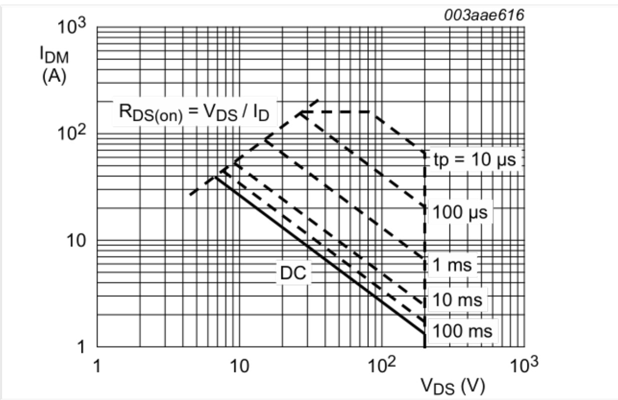
$$P_{der} = \frac{P_{tot}}{P_{tot(25°C)}} \times 100\,\%$$

Fig. 1. Normalized total power dissipation as a function of mounting base temperature



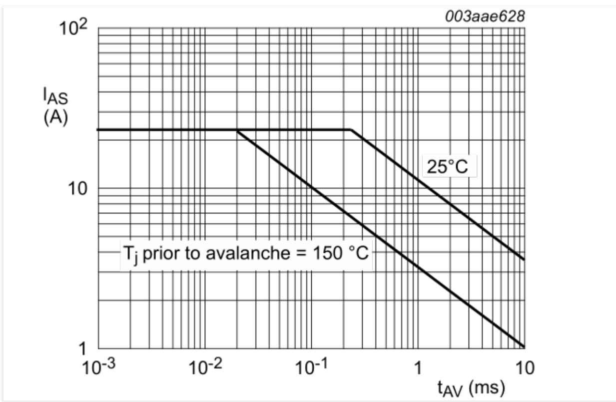
$$I_{der} = \frac{I_D}{I_{D(25°C)}} \times 100\,\%$$

Fig. 2. Normalized continuous drain current as a function of mounting base temperature



T_{mb} = 25 °C; I_{DM} is single pulse

Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage



unclamped inductive load

Fig. 4. Single-shot avalanche rating; avalanche current as a function of avalanche period

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base			-	-	0.6	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air		-	60	-	K/W

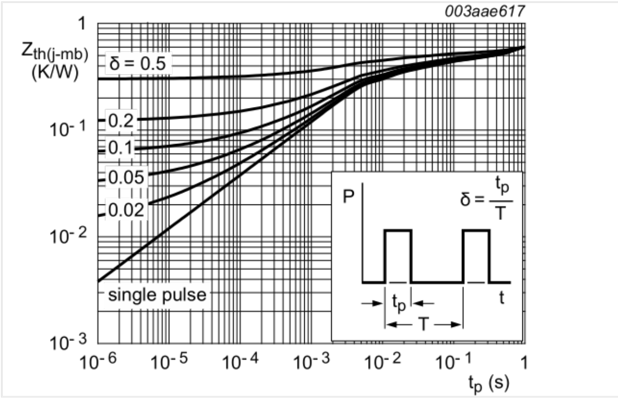


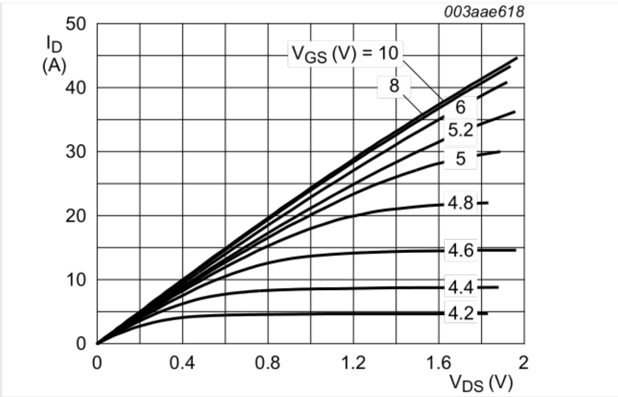
Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Characteristics

Table 7. Characteristics

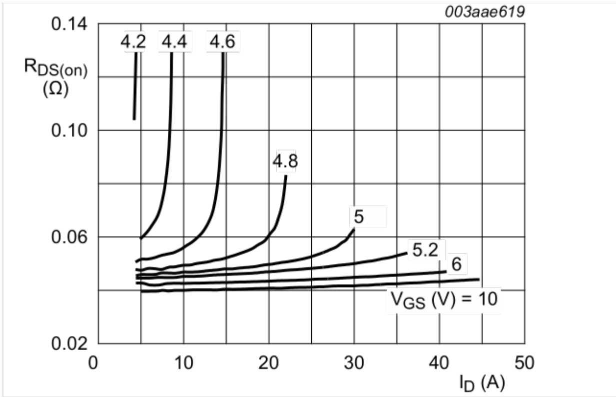
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 0.25 mA; V_{GS} = 0 V; T_j = -55 °C		178	-	-	V
		I_D = 0.25 mA; V_{GS} = 0 V; T_j = 25 °C		200	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS}=V_{GS}; T_j = -55 °C		-	-	6	V
		I_D = 1 mA; V_{DS}=V_{GS}; T_j = 175 °C		1	-	-	V
		I_D = 1 mA; V_{DS}=V_{GS}; T_j = 25 °C		2	3	4	V
I_{DSS}	drain leakage current	V_{DS} = 200 V; V_{GS} = 0 V; T_j = 25 °C		-	0.03	10	µA
		V_{DS} = 200 V; V_{GS} = 0 V; T_j = 175 °C		-	-	500	µA
I_{GSS}	gate leakage current	V_{GS} = 10 V; V_{DS} = 0 V; T_j = 25 °C		-	2	100	nA
		V_{GS} = -10 V; V_{DS} = 0 V; T_j = 25 °C		-	2	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 17 A; T_j = 175 °C		-	-	165	mΩ
		V_{GS} = 10 V; I_D = 17 A; T_j = 25 °C		-	41	57	mΩ
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	I_D = 39 A; V_{DS} = 160 V; V_{GS} = 10 V; T_j = 25 °C		-	96	-	nC
Q_{GS}	gate-source charge			-	13	-	nC
Q_{GD}	gate-drain charge			-	37	50	nC
C_{iss}	input capacitance	V_{DS} = 25 V; V_{GS} = 0 V; f = 1 MHz; T_j = 25 °C		-	3750	-	pF
C_{oss}	output capacitance			-	385	-	pF
C_{rss}	reverse transfer capacitance			-	180	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 100 V; R_L = 2.7 Ω; V_{GS} = 10 V; $R_{G(ext)}$ = 5.6 Ω; T_j = 25 °C		-	18	-	ns
t_r	rise time			-	58	-	ns
$t_{d(off)}$	turn-off delay time			-	105	-	ns
t_f	fall time			-	78	-	ns
L_D	internal drain inductance	measured from drain lead to centre of die; T_j = 25 °C		-	4.5	-	nH
		measured from tab to centre of die; T_j = 25 °C		-	3.5	-	nH
L_S	internal source inductance	measured from source lead to source bond pad; T_j = 25 °C		-	7.5	-	nH

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Source-drain diode							
V_{SD}	source-drain voltage	I_S = 25 A; V_{GS} = 0 V; T_j = 25 °C		-	0.85	1.2	V
t_{rr}	reverse recovery time	I_S = 20 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 30 V; T_j = 25 °C		-	133	-	ns
Q_r	recovered charge			-	895	-	nC



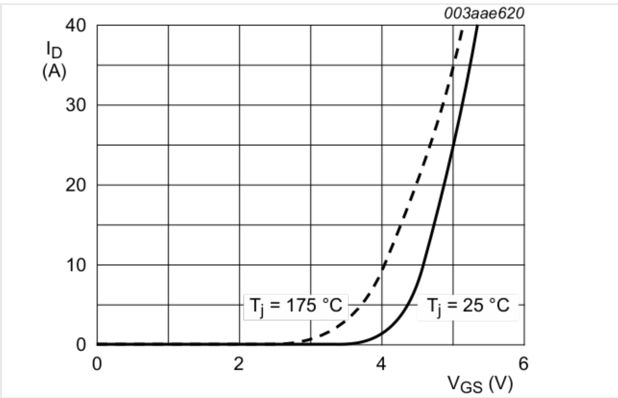
T_j = 25 °C

Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values



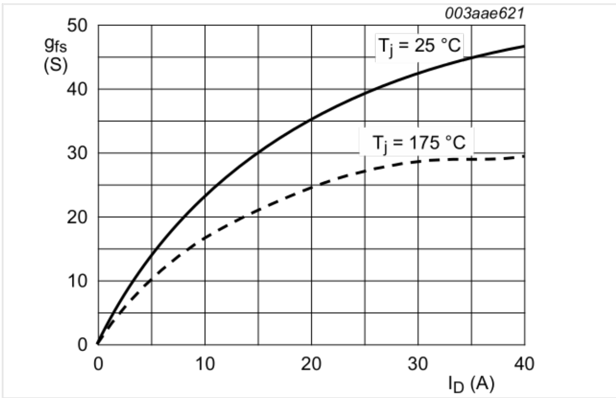
T_j = 25 °C

Fig. 7. Drain-source on-state resistance as a function of drain current; typical values



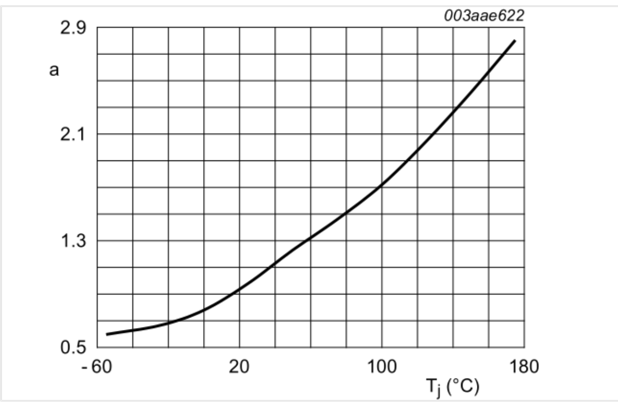
$V_{DS} > I_D \times R_{DSon}$

Fig. 8. Transfer characteristics: drain current as a function of gate-source voltage; typical values



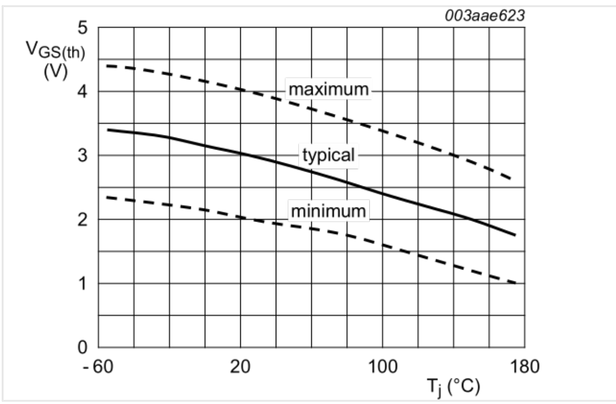
$V_{DS} > I_D \times R_{DSon}$

Fig. 9. Forward transconductance as a function of drain current; typical values



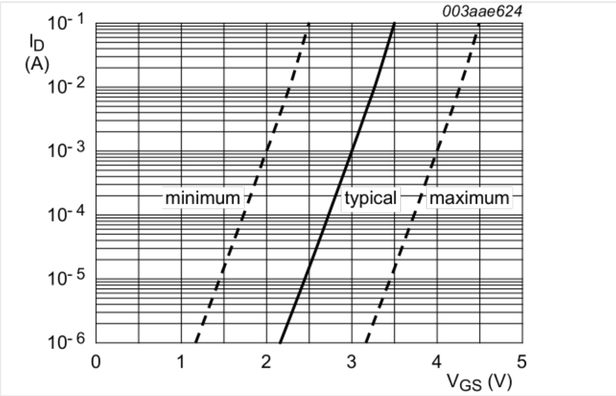
$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

Fig. 10. Normalized drain-source on-state resistance factor as a function of junction temperature



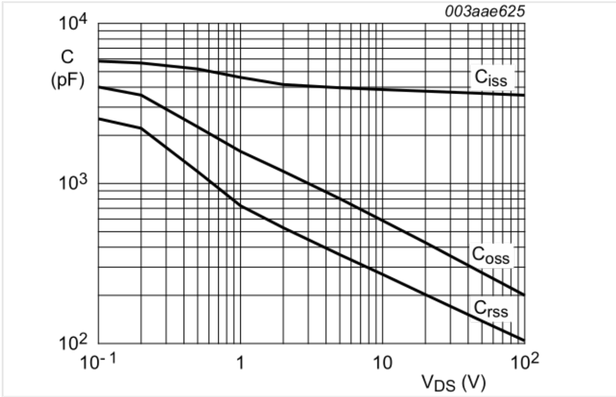
I_D = 1 mA; $V_{DS} = V_{GS}$

Fig. 11. Gate-source threshold voltage as a function of junction temperature



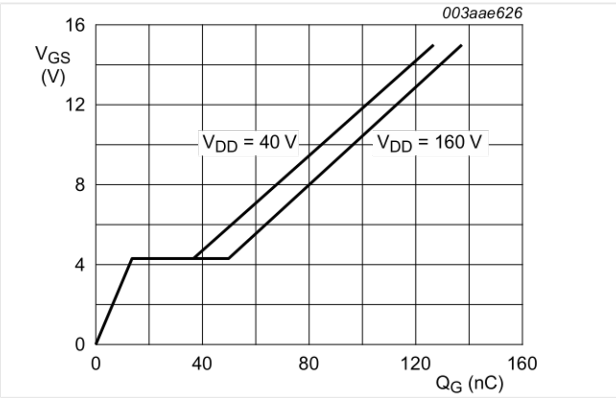
T_j = 25 °C; V_{DS} = V_{GS}

Fig. 12. Sub-threshold drain current as a function of gate-source voltage



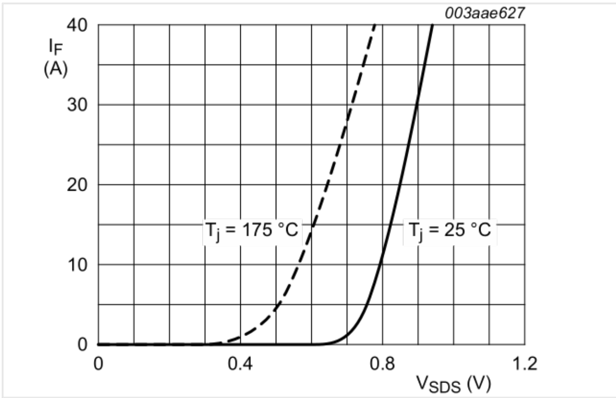
V_{GS} = 0 V; f = 1 MHz

Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



T_j = 25 °C; I_D = 39 A

Fig. 14. Gate-source voltage as a function of gate charge; typical values

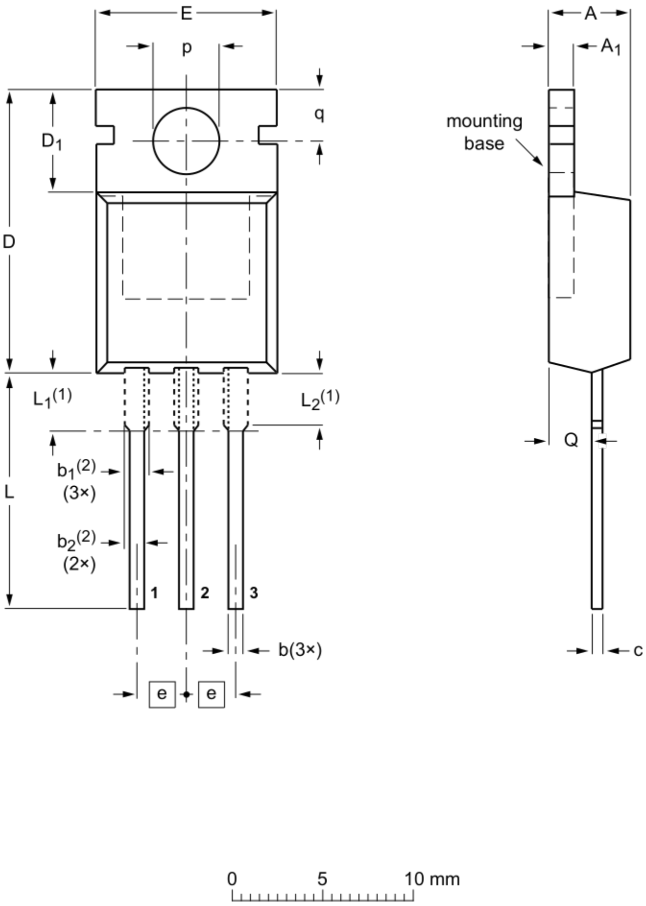


V_{GS} = 0 V

Fig. 15. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

11. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB **SOT78**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b	$b_1^{(2)}$	$b_2^{(2)}$	c	D	D_1	E	e	L	$L_1^{(1)}$	$L_2^{(1)}$ max.	p	q	Q
mm	4.7 4.1	1.40 1.25	0.9 0.6	1.6 1.0	1.3 1.0	0.7 0.4	16.0 15.2	6.6 5.9	10.3 9.7	2.54	15.0 12.8	3.30 2.79	3.0	3.8 3.5	3.0 2.7	2.6 2.2

Notes

1. Lead shoulder designs may vary.
2. Dimension includes excess dambar.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT78		3-lead TO-220AB	SC-46			~~08-04-23~~ 08-06-13

Fig. 16. Package outline TO-220AB (SOT78)

12. Legal information

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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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