GANB1R2-040QBA

40 V, 1.2 mOhm bi-directional Gallium Nitride (GaN) FET in a 4.0 mm x 6.0 mm Very-Thin-Profile Quad Flat No-Lead Package (VQFN)

12 March 2025 **Product data sheet**

1. General description

The GANB1R2-040QBA is a 40 V, 1.2 mΩ bi-directional Gallium Nitride (GaN) High Electron-Mobility-Transistor (HEMT) in a Very-Thin-Profile Quad Flat No-Lead Package (VQFN) package. It is a normally-off e-mode device offering superior performance and very low on-state resistance.

2. Features and benefits

- Enhancement mode - normally-off power switch
- Bi-directional device
- Ultra high switching speed capability
- Ultra-low on-state resistance
- RoHS, Pb-free, REACH-compliant
- High efficiency and high power density
- Very-Thin-Profile Quad Flat No-Lead Package (VQFN) 4.0 mm x 6.0 mm

3. Applications

- High-side load switch
- OVP protection in smart phone USB port
- Power switch circuits
- Stand-by power system

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DD}	drain-drain voltage	-40 °C ≤ T_j ≤ 125 °C	[1]	-	-	40	V
I_D	drain current	T_{mb} ≤ 25 °C	[2]	-	-	100	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; Fig. 1		-	-	105	W
T_j	junction temperature			-40	-	125	°C
Static characteristics							
R_{DDon}	drain-drain on-state resistance	V_{GD2} = 5 V; V; I_{D1} = 10 A; T_j = 25 °C; Fig. 9; Fig. 10; Fig. 11	[1]	-	0.9	1.2	mΩ
		V_{GD2} = 5 V; V; I_{D1} = 10 A; T_j = 125 °C; Fig. 9; Fig. 12	[1]	-	1.6	-	mΩ
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	I_D = 10 A; V_{DS} = 20 V; V_{GS} = 5 V; T_j = 25 °C; Fig. 13; Fig. 14	[2]	-	60	-	nC

[1] This parameter applies for either polarity of bias; it is the same whether D1 is the source and D2 is the drain, or vice versa.
[2] D1 and D2 are symetrical with respect to the gate, G. Either can take the function of source or drain. For data sheet parameters, the source is defined as the terminal, D1 or D2, which has lower potential in the test circuit. The drain is the terminal with the higher potential.

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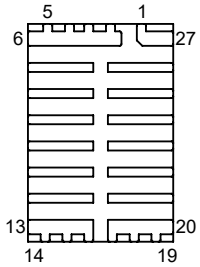
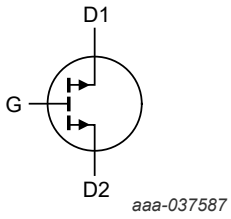
5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1, 27	G	gate	 Transparent top view **SOT8092-1**	
2 - 6, 8, 10, 12, 21, 23, 25	D1	drain1		
7, 9, 11, 13 - 20, 22, 24, 26	D2	drain2		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
GANB1R2-040QBA	VQFN16	very thin quad flatpack; no leads; 6 mm x 4 mm x 0.85 mm body	SOT8092-1

7. Marking

Table 4. Marking codes

Type number	Marking code
GANB1R2-040QBA	1R2AQBA

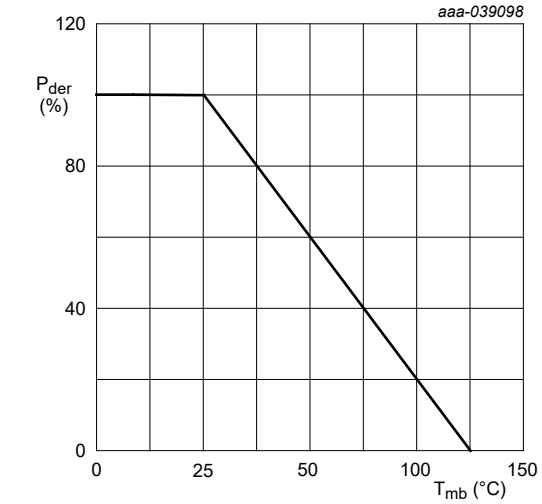
8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Tj = 25 °C unless otherwise stated.

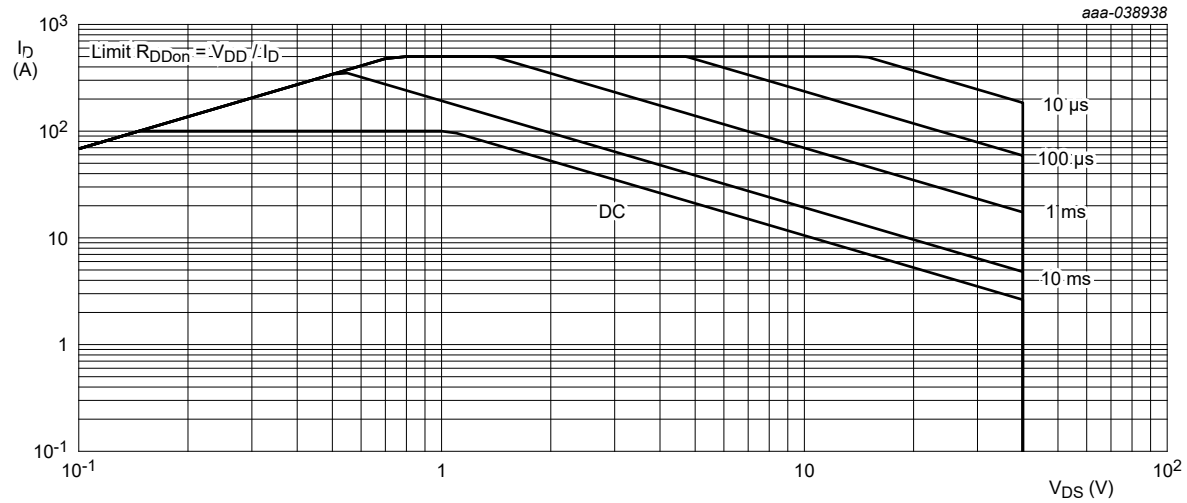
Symbol	Parameter	Conditions		Min	Max	Unit
V_{DD}	drain-drain voltage	-40 °C ≤ T_j ≤ 125 °C	[1]	-	40	V
V_{DG}	drain-gate voltage		[2]	-	40	V
V_{GD}	gate-drain voltage		[2]	-	6	V
I_D	drain current	V_{GD} = 5 V; T_{mb} = 25 °C	[2]	-	100	A
I_{DM}	peak drain current	pulsed; t_p ≤ 300 µs; T_{mb} = 25 °C; Fig. 2	[2]	-	500	A
$P_{(tot)}$	total power dissipation	T_{mb} = 25 °C; Fig. 1		-	105	W
T_{stg}	storage temperature			-40	150	°C
T_j	junction temperature			-40	125	°C
$T_{sld(M)}$	peak soldering temperature			-	260	°C

[1] This parameter applies for either polarity of bias; it is the same whether D1 is the source and D2 is the drain, or vice versa.
[2] D1 and D2 are symetrical with respect to the gate, G. Either can take the function of source or drain. For data sheet parameters, the source is defined as the terminal, D1 or D2, which has lower potential in the test circuit. The drain is the terminal with the higher potential.



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

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



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

Fig. 2. Safe operating area; continuous and peak drain currents as a function of drain-drain voltage

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-c)}$	thermal resistance from junction to case		[1]	-	-	14.26	K/W
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	Fig. 3		-	-	0.95	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[2]	-	-	52.12	K/W

[1] Thermal junction to top side of package.
[2] $R_{th(j-a)}$ is determined with the device mounted on one square inch of copper pad single layer 2 oz copper on FR4 board.

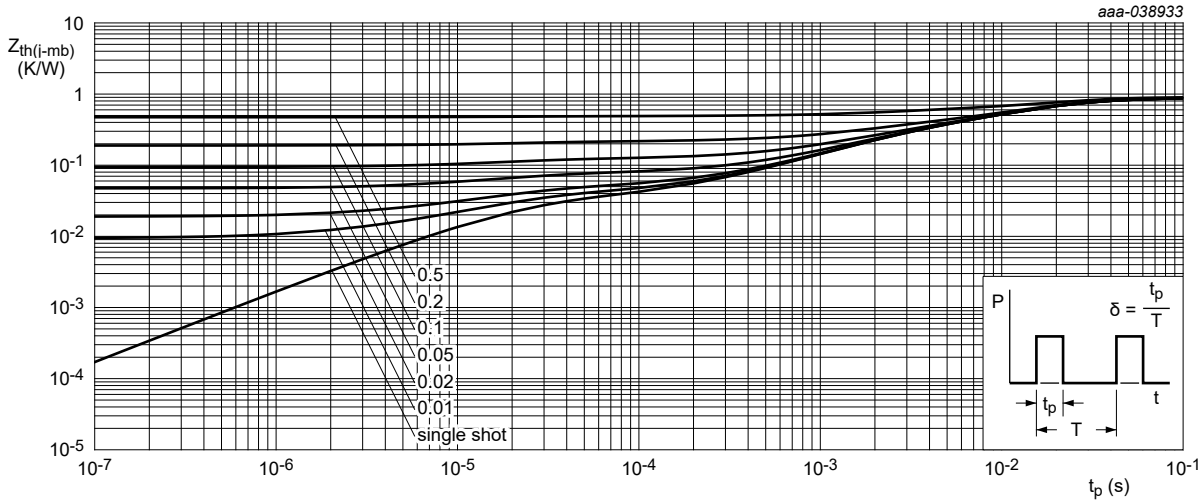


Fig. 3. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Characteristics

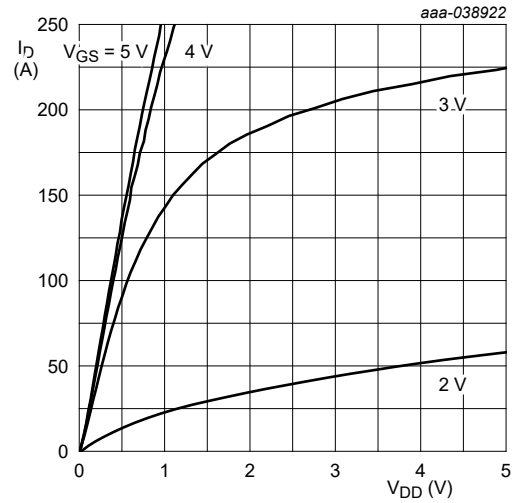
Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
BV_{DDS}	drain-drain breakdown voltage	I_{D1D2} = 500 µA; V_{D2} = V_G = 0 V; T_j = 25 °C	[1]	40	-	-	V
$V_{GD(th)}$	gate-drain threshold voltage	I_D = 1 mA; V_{D1} = 0 V; V_{D2} = V_G; T_j = 25 °C; Fig. 8	[1]	0.8	1.35	2.4	V
		I_D = 1 mA; V_{D1} = 0 V; V_{D2} = V_G; T_j = 125 °C; Fig. 8	[1]	-	1.1	-	V
I_{DDS}	drain-drain leakage current	V_{DD} = 40 V; V_{GD} = 0 V; T_j = 25 °C	[1]	-	1	50	µA
I_{GDS}	gate-drain leakage current	V_{GD} = 5 V; V_{DD} = 0 V; T_j = 25 °C	[1]	-	0.5	5	µA
		V_{GD} = -5 V; V_{DD} = 0 V; T_j = 25 °C		-30	-	-	µA
		V_{GD} = 6 V; V_{DD} = 0 V; T_j = 25 °C	[1]	-	5	30	µA
		V_{GD} = -6 V; V_{DD} = 0 V; T_j = 25 °C		-40		-	µA
R_{DDon}	drain-drain on-state resistance	V_{GD2} = 5 V; I_{D1} = 10 A; T_j = 25 °C; Fig. 9; Fig. 10; Fig. 11	[1]	-	0.9	1.2	mΩ
		V_{GD2} = 5 V; I_{D1} = 10 A; T_j = 125 °C; Fig. 9; Fig. 12		-	1.6	-	mΩ
R_G	gate resistance	f = 1 MHz; T_j = 25 °C		-	8.7	-	Ω
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	V_{DS} = 20 V; V_{GS} = 5 V; I_D = 10 A; T_j = 25 °C; Fig. 13; Fig. 14	[2]	-	60	-	nC
Q_{GS}	gate-source charge		[2]	-	6.2	-	nC
Q_{GD}	gate-drain charge		[2]	-	32	-	nC
C_{iss}	input capacitance	V_{DS} = 20 V; V_{GS} = 0 V; f = 1 MHz; T_j = 25 °C; Fig. 15	[2]	-	3500	-	pF
C_{oss}	output capacitance			-	1600	-	pF
C_{rss}	reverse transfer capacitance			-	1000	-	pF
Q_{oss}	output charge	V_{DS} = 20 V; V_{GD} = 0 V; T_j = 25 °C; Fig. 7	[2][3]	-	45	-	nC

[1] Parameters are understood to apply for either polarity of bias. For example, V_{DD} is the same whether D1 is the source and D2 is the drain or vice versa.

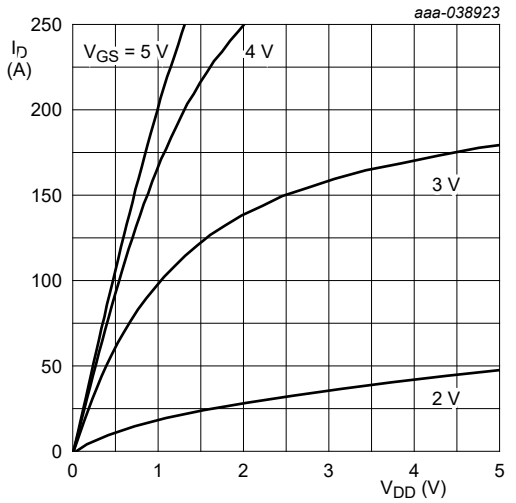
[2] D1 and D2 are symetrical with respect to the gate, G. Either can take the function of source or drain. For data sheet parameters, the source is defined as the terminal, D1 or D2, which has lower potential in the test circuit. The drain is the terminal with the higher potential.

[3] Q_r is not specified separately from Q_{oss} for e-mode GaN FETs, since Q_r = Q_{oss} + Q_D, and Q_D = 0. (Q_D is charge associated with diffusion of minority carriers. Since there is no body diode, no minority carriers in excess of Q_{oss} have to be transferred for e-mode GaN FETs.)



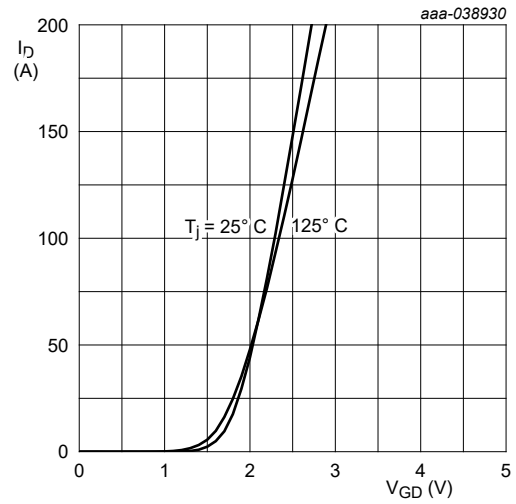
T_j = 25 °C

Fig. 4. Output characteristics; drain current as a function of drain-drain voltage; typical values



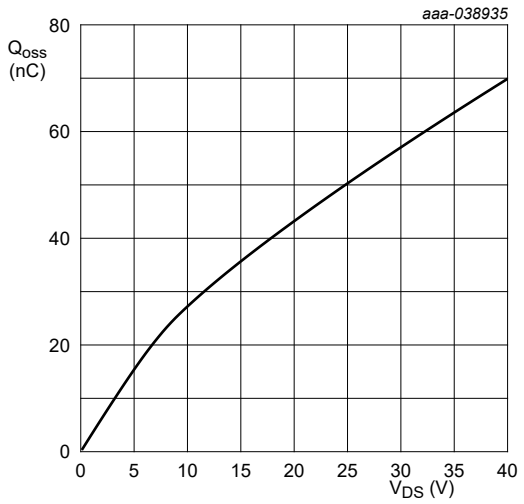
T_j = 125 °C

Fig. 5. Output characteristics; drain current as a function of drain-drain voltage; typical values



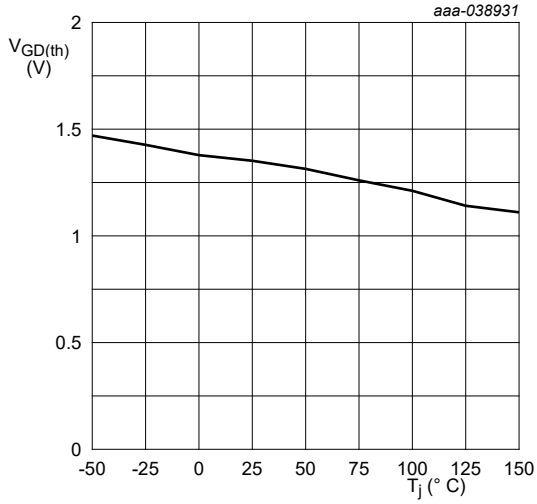
V_{DD} = 3 V

Fig. 6. Transfer characteristics; drain current as a function of gate-drain voltage; typical values



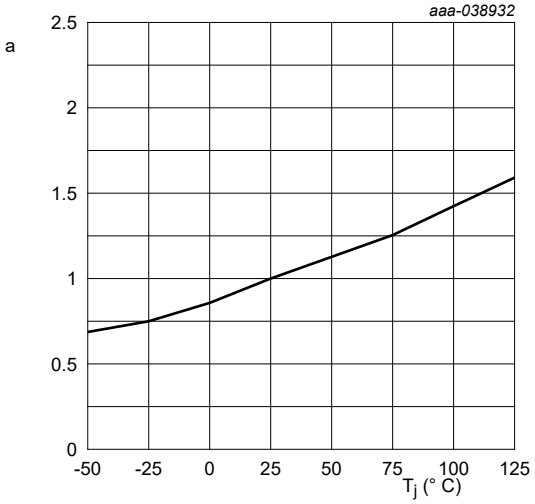
f = 1 MHz

Fig. 7. Output charge as a function of drain-source voltage; typical values



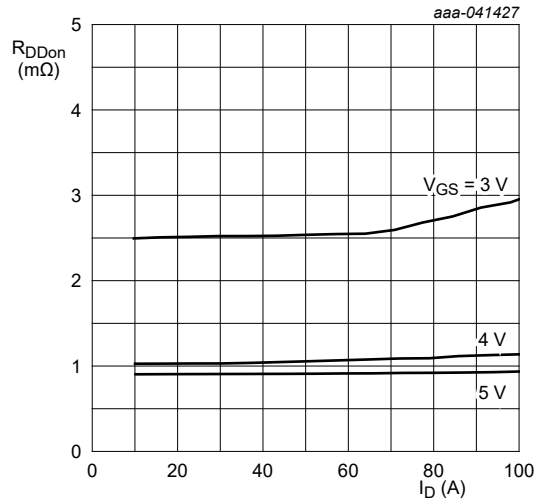
I_D = 1 mA ; V_{DD} = V_{GD}

Fig. 8. Gate-drain threshold voltage as a function of junction temperature; typical values



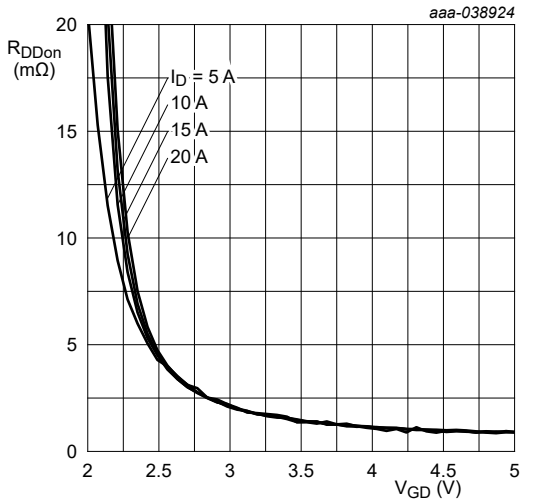
$$a = \frac{R_{DDon}}{R_{DDon\ (25°C)}}$$

Fig. 9. Normalized drain-drain on-state resistance factor as a function of junction temperature; typical values



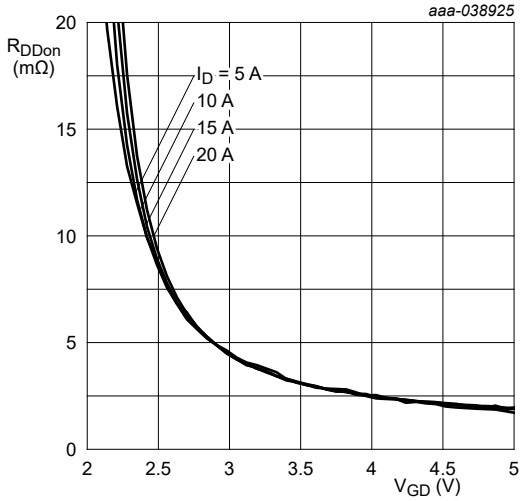
T_j = 25 °C

Fig. 10. Drain-drain on-state resistance as a function of drain current; typical values



T_j = 25 °C

Fig. 11. Drain-drain on-state resistance as a function of gate-drain voltage; typical values



T_j = 125 °C

Fig. 12. Drain-drain on-state resistance as a function of gate-drain voltage; typical values

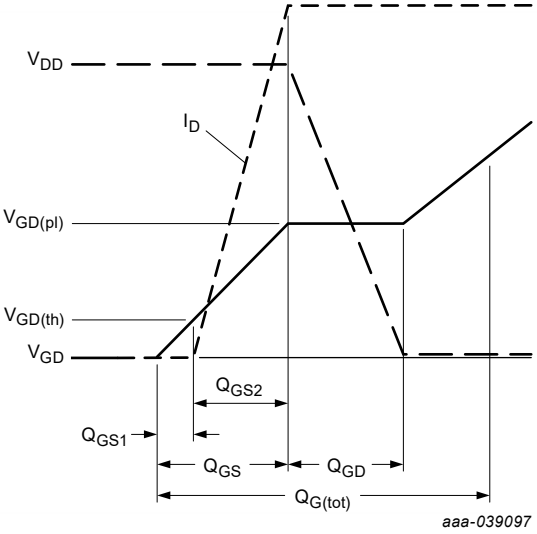
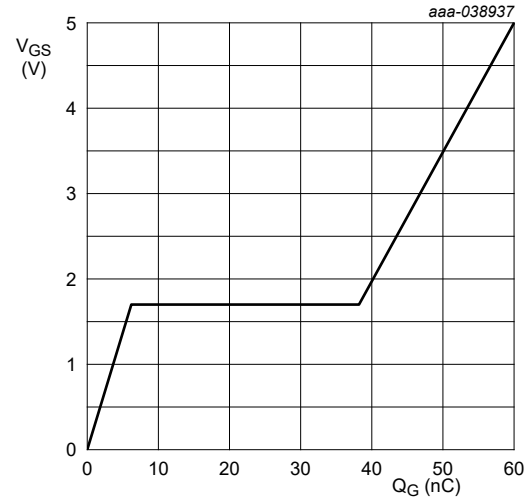
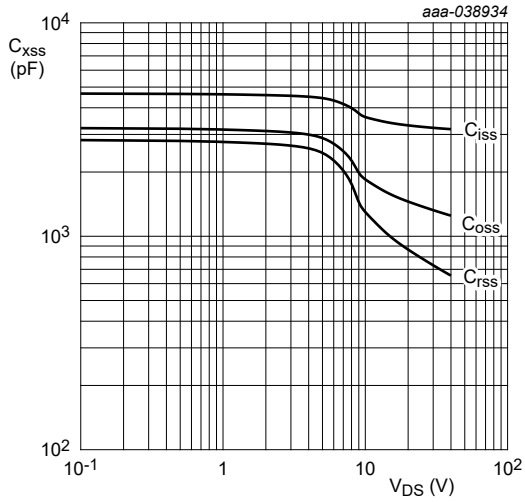


Fig. 13. Gate charge waveform definitions



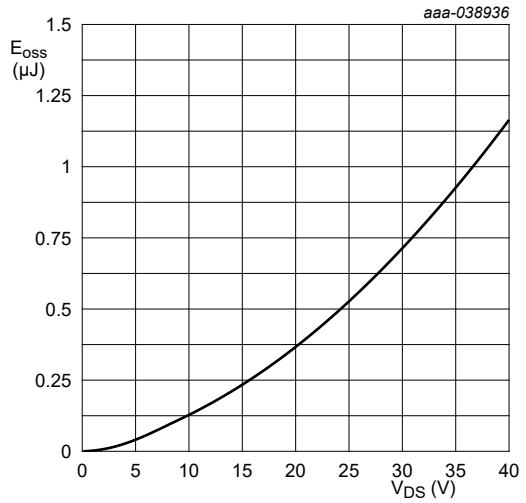
T_j = 25 °C; I_D = 10 A

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



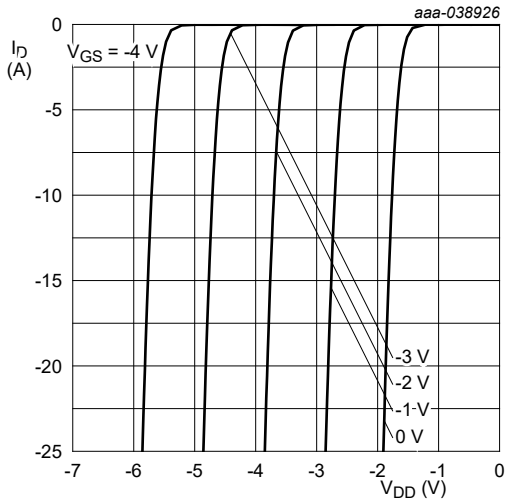
V_{GD} = 0 V; f = 1 MHz

Fig. 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



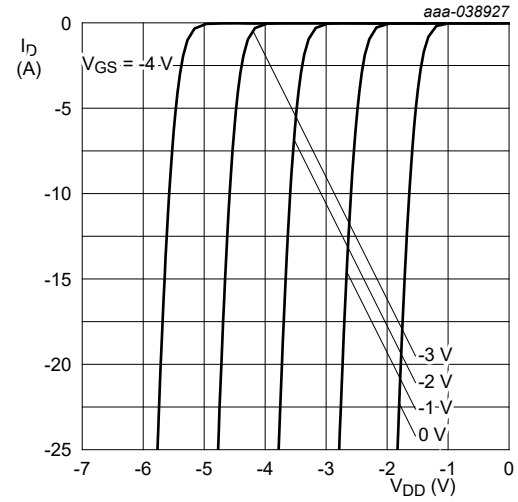
f = 1 MHz

Fig. 16. C_{OSS} stored energy as a function of drain-source voltage; typical values



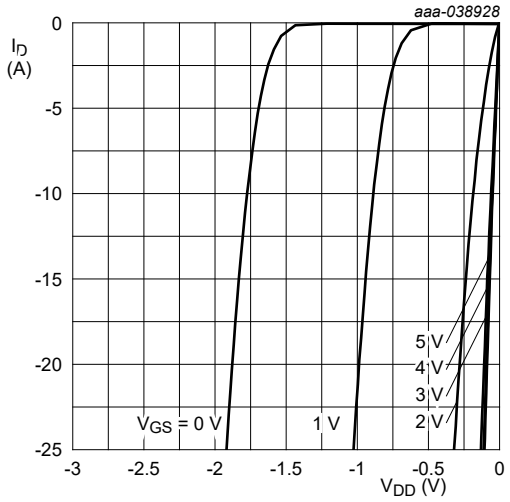
T_j = 25 °C

Fig. 17. Reverse drain current as a function of drain-drain voltage; typical values



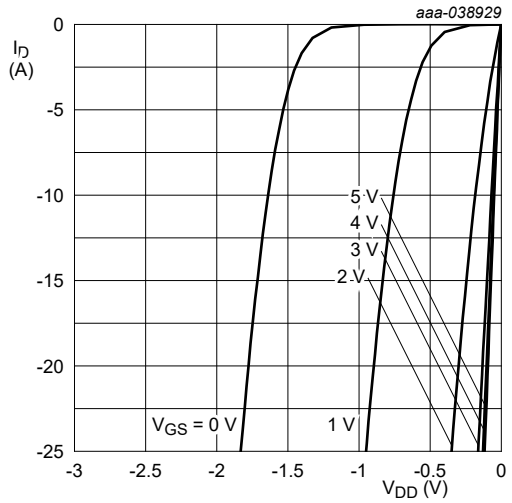
T_j = 125 °C

Fig. 18. Reverse drain current as a function of drain-drain voltage; typical values



T_j = 25 °C

Fig. 19. Reverse drain current as a function of drain-drain voltage; typical values

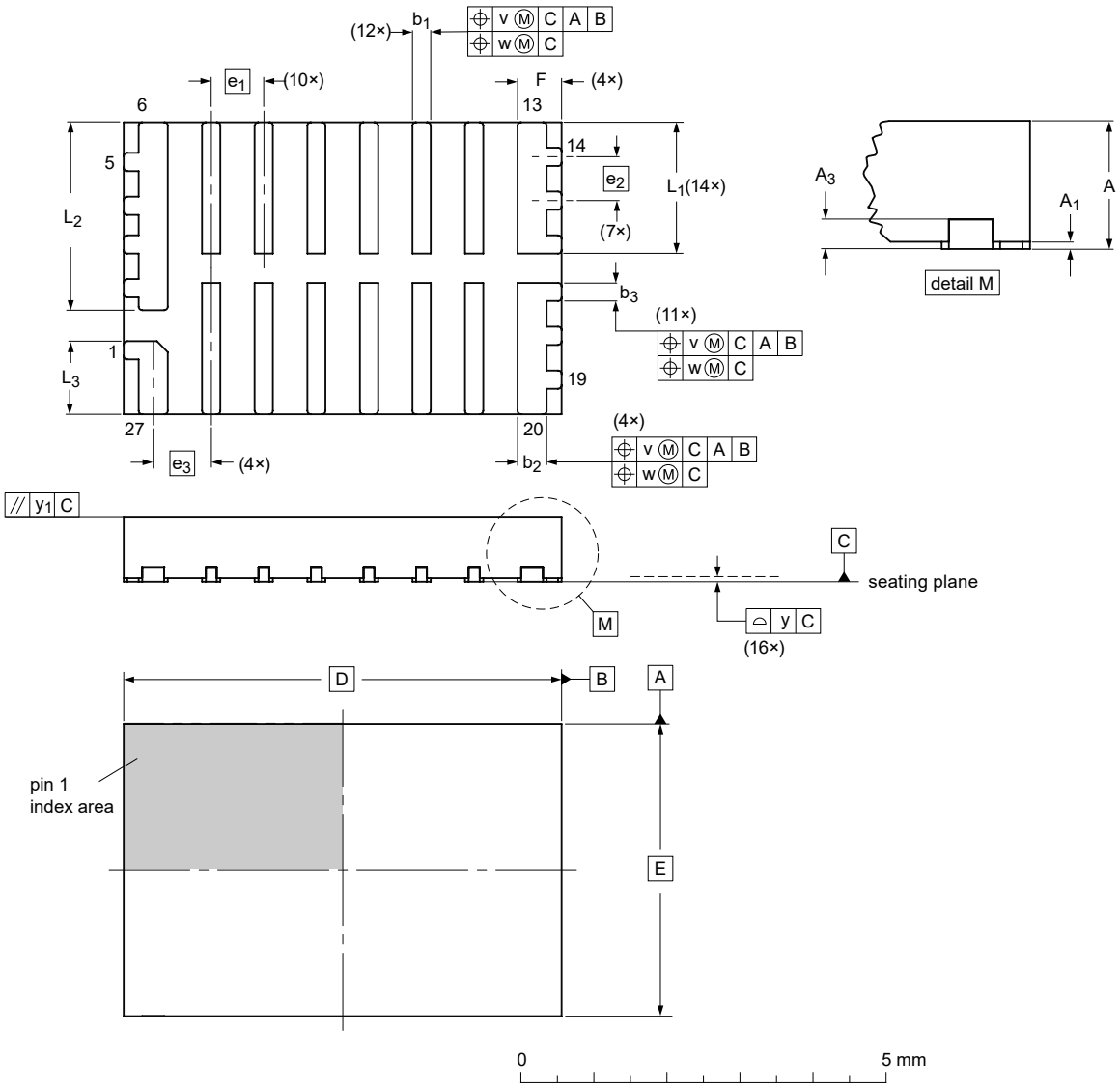


T_j = 125 °C

Fig. 20. Reverse drain current as a function of drain-drain voltage; typical values

11. Package outline

VQFN15: very thin quad flatpack; no leads; 6 mm x 4 mm x 0.85 mm body **SOT8092-1**



Dimensions (mm are the original dimensions)

Unit[1]		A	A_1	A_3	b_1	b_2	b_3	D	E	e_1	e_2	e_3	F	L_1	L_2	L_3	v	w	y	y_1
mm	max	0.95	0.05	0.203 REF	0.30	0.50	0.30	6.10	4.10	0.72 BSC	0.60 BSC	0.795 BSC	0.705	1.90	2.675	1.10	0.10	0.05	0.08	0.10
	nom	0.85	0.02		0.25	0.40	0.25	6.00	4.00				0.605	1.80	2.575	1.00				
	min	0.75	0.00		0.20	0.30	0.20	5.90	3.90				0.505	1.70	2.475	0.90				

sot8092-1_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT8092-1						25-01-08

Fig. 21. Package outline SOT8092-1

12. Soldering

Footprint information for reflow soldering of VQFN15 package **SOT8092-1**

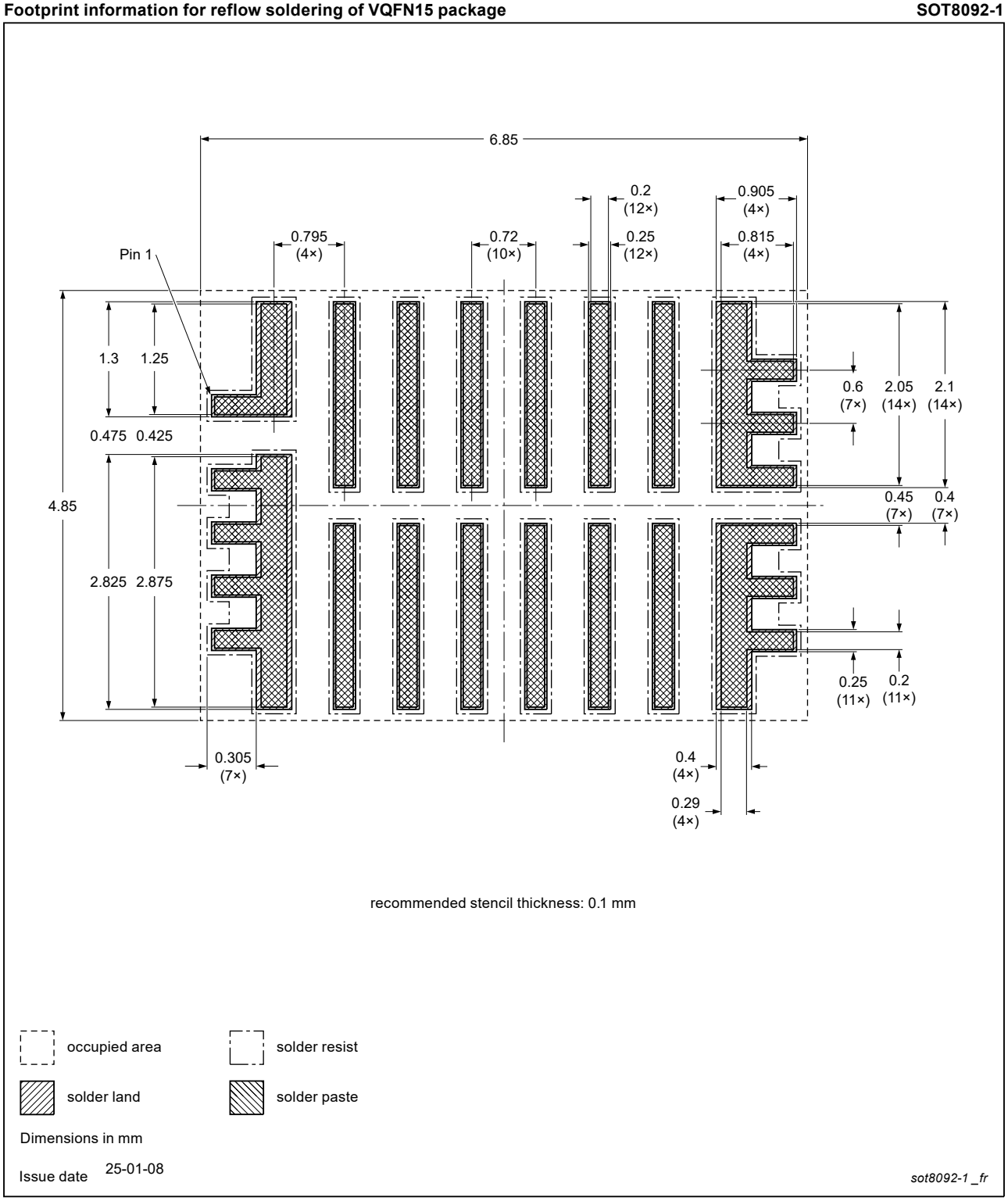


Fig. 22. Reflow soldering footprint for SOT8092-1

13. 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.

[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term 'short data sheet' is explained in section "Definitions".
[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at https://www.nexperia.com.

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Date of release: 12 March 2025