NX3008CBKS

30 / 30 V, 350 / 200 mA N/P-channel Trench MOSFET

Rev. 1 — 29 July 2011 Product data sheet

1. Product profile

1.1 General description

Complementary N/P-channel enhancement mode Field-Effect Transistor (FET) in very small SOT363 (SC-88) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

1.2 Features and benefits

- Low threshold voltage
- Very fast switching
- Trench MOSFET technology
- ESD protection up to 2 kV
- AEC-Q101 qualified

1.3 Applications

- Level shifter
- Power supply converter
- Load switch
- Switching circuits

1.4 Quick reference data

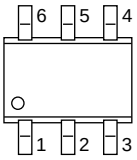
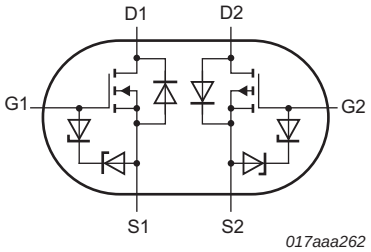
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
TR2 (P-channel)							
V_{DS}	drain-source voltage	T_j = 25 °C		-	-	-30	V
V_{GS}	gate-source voltage			-8	-	8	V
I_D	drain current	V_{GS} = -4.5 V; T_{amb} = 25 °C	[1]	-	-	-200	mA
TR1 (N-channel)							
V_{DS}	drain-source voltage	T_j = 25 °C		-	-	30	V
V_{GS}	gate-source voltage			-8	-	8	V
I_D	drain current	V_{GS} = 4.5 V; T_{amb} = 25 °C	[1]	-	-	350	mA
TR1 (N-channel), Static characteristics							
R_{DSon}	drain-source on-state resistance	V_{GS} = 4.5 V; I_D = 350 mA; T_j = 25 °C		-	1	1.4	Ω
TR2 (P-channel), Static characteristics							
R_{DSon}	drain-source on-state resistance	V_{GS} = -4.5 V; I_D = -200 mA; T_j = 25 °C		-	2.8	4.1	Ω

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for drain 1 cm^2.

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S1	source TR1	 SOT363 (SC-88)	
2	G1	gate TR1		
3	D2	drain TR2		
4	S2	source TR2		
5	G2	gate TR2		
6	D1	drain TR1		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
NX3008CBKS	SC-88	plastic surface-mounted package; 6 leads	SOT363

4. Marking

Table 4. Marking codes

Type number	Marking code[1]
NX3008CBKS	LD%

[1] % = placeholder for manufacturing site code.

5. Limiting values

Table 5. Limiting values

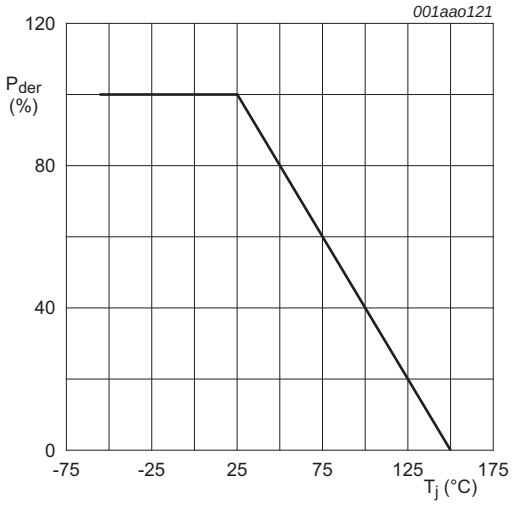
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
TR2 (P-channel)						
V_{DS}	drain-source voltage	T_j = 25 °C		-	-30	V
V_{GS}	gate-source voltage			-8	8	V
I_D	drain current	V_{GS} = -4.5 V; T_{amb} = 25 °C	[1]	-	-200	mA
		V_{GS} = -4.5 V; T_{amb} = 100 °C	[1]	-	-125	mA
I_{DM}	peak drain current	T_{amb} = 25 °C; single pulse; $t_p \leq 10$ µs		-	-0.8	A
P_{tot}	total power dissipation	T_{amb} = 25 °C	[2]	-	280	mW
			[1]	-	320	mW
		T_{sp} = 25 °C		-	990	mW
TR1 (N-channel)						
V_{DS}	drain-source voltage	T_j = 25 °C		-	30	V
V_{GS}	gate-source voltage			-8	8	V
I_D	drain current	V_{GS} = 4.5 V; T_{amb} = 25 °C	[1]	-	350	mA
		V_{GS} = 4.5 V; T_{amb} = 100 °C	[1]	-	230	mA
I_{DM}	peak drain current	T_{amb} = 25 °C; single pulse; $t_p \leq 10$ µs		-	1.4	A
P_{tot}	total power dissipation	T_{amb} = 25 °C	[2]	-	280	mW
			[1]	-	320	mW
		T_{sp} = 25 °C		-	990	mW
Per device						
P_{tot}	total power dissipation	T_{amb} = 25 °C	[2]	-	445	mW
T_j	junction temperature			-55	150	°C
T_{amb}	ambient temperature			-55	150	°C
T_{stg}	storage temperature			-65	150	°C
TR1 (N-channel), Source-drain diode						
I_S	source current	T_{amb} = 25 °C	[1]	-	300	mA
TR2 (P-channel), Source-drain diode						
I_S	source current	T_{amb} = 25 °C	[1]	-	-200	mA
TR1 N-channel), ESD maximum rating						
V_{ESD}	electrostatic discharge voltage	HBM	[3]	-	2000	V
TR2 (P-channel), ESD maximum rating						
V_{ESD}	electrostatic discharge voltage	HBM	[3]	-	2000	V

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for drain 1 cm^2.

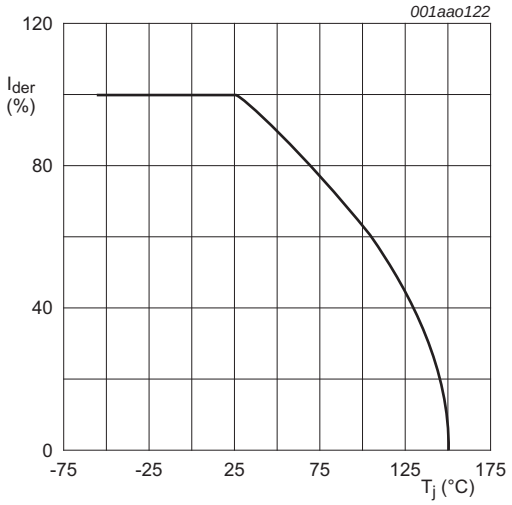
[2] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper; tin-plated and standard footprint.

[3] Measured between all pins.



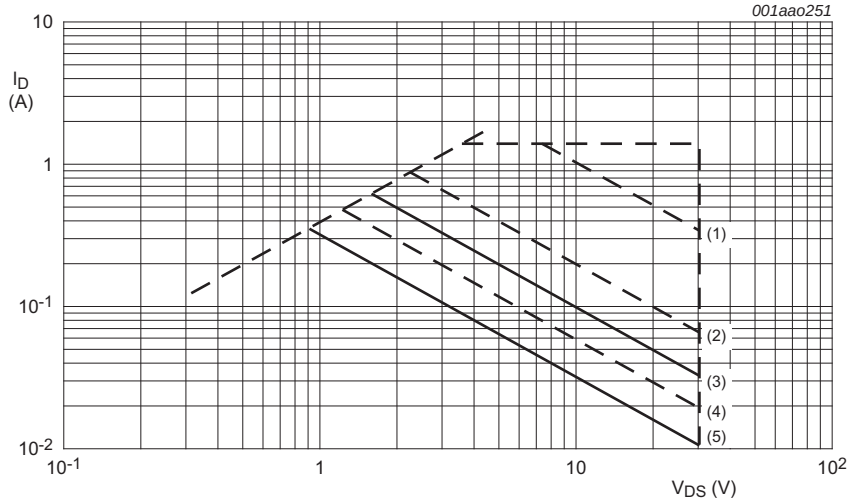
$$P_{der} = \frac{P_{tot}}{P_{tot(25°C)}} \times 100\,\%$$

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



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

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



I_{DM} is a single pulse

(1) t_p = 1 ms

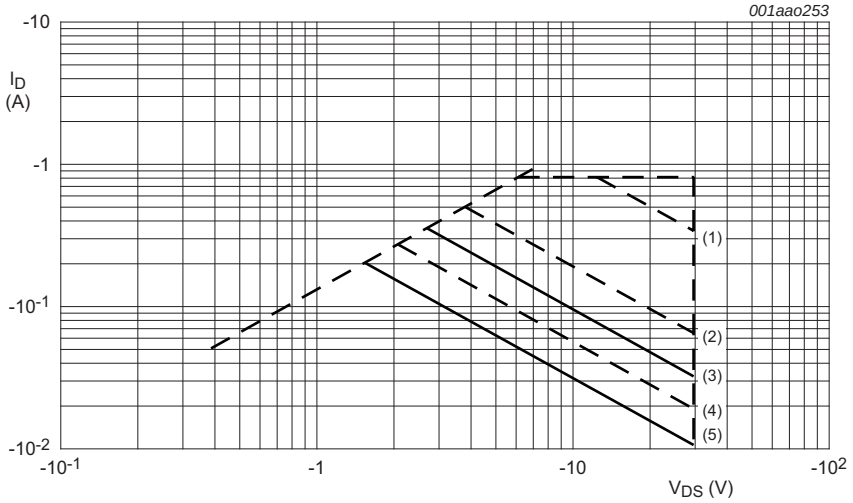
(2) t_p = 10 ms

(3) DC; T_{sp} = 25 °C

(4) t_p = 100 ms

(5) DC; T_{amb} = 25 °C; 1 cm^2 drain mounting pad

Fig 3. Safe operating area TR1 (N-channel); junction to ambient; continuous and peak drain currents as a function of drain-source voltage



I_{DM} is a single pulse

(1) t_p = 1 ms

(2) t_p = 10 ms

(3) DC; T_{sp} = 25 °C

(4) t_p = 100 ms

(5) DC; T_{amb} = 25 °C; 1 cm^2 drain mounting pad

Fig 4. Safe operating area TR2 (P-channel); junction to ambient; continuous and peak drain currents as a function of drain-source

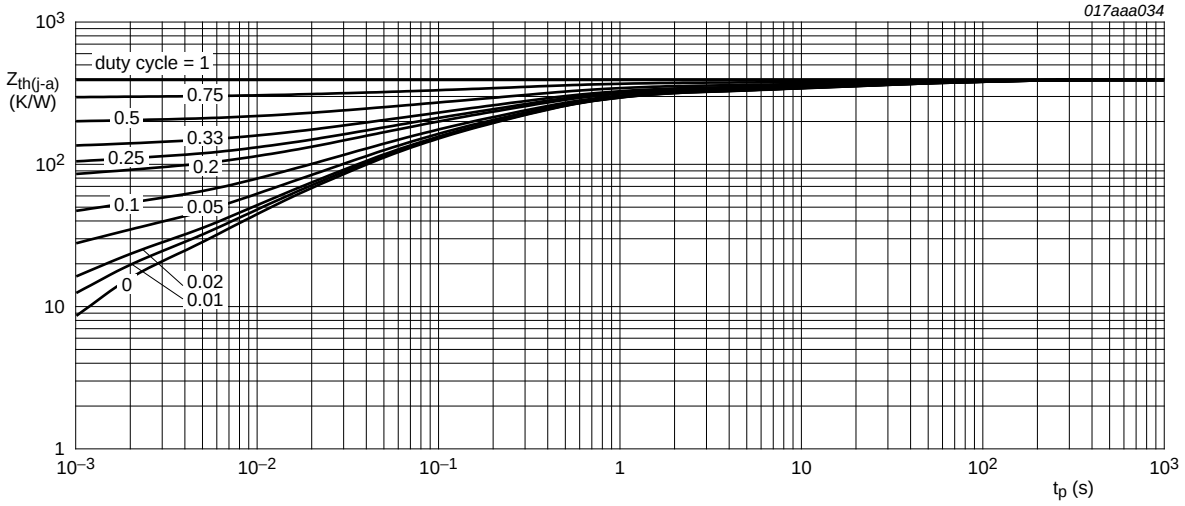
6. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Per device							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	300	K/W
TR1 (N-channel)							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	390	445	K/W
			[2]	-	340	390	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	130	K/W
TR2 (P-channel)							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	390	445	K/W
			[2]	-	340	390	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	130	K/W

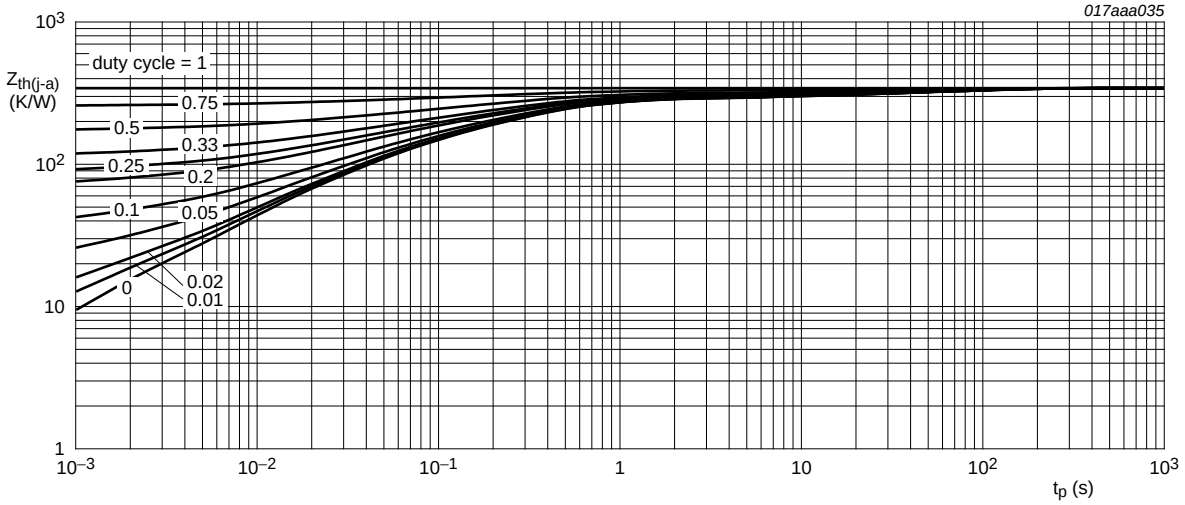
[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper; tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for drain 1 cm^2.



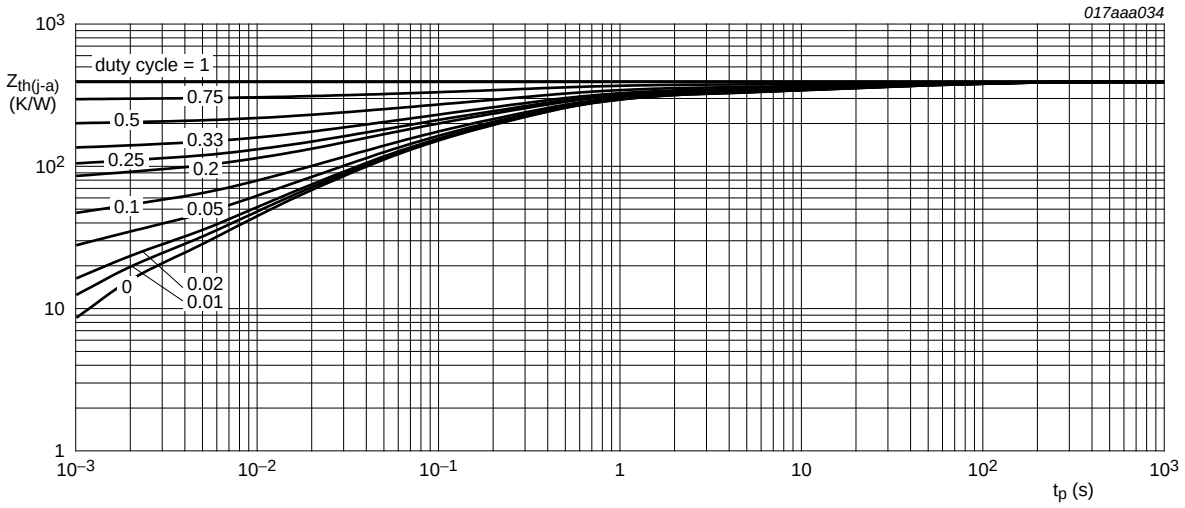
FR4 PCB, standard footprint

Fig 5. TR1: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



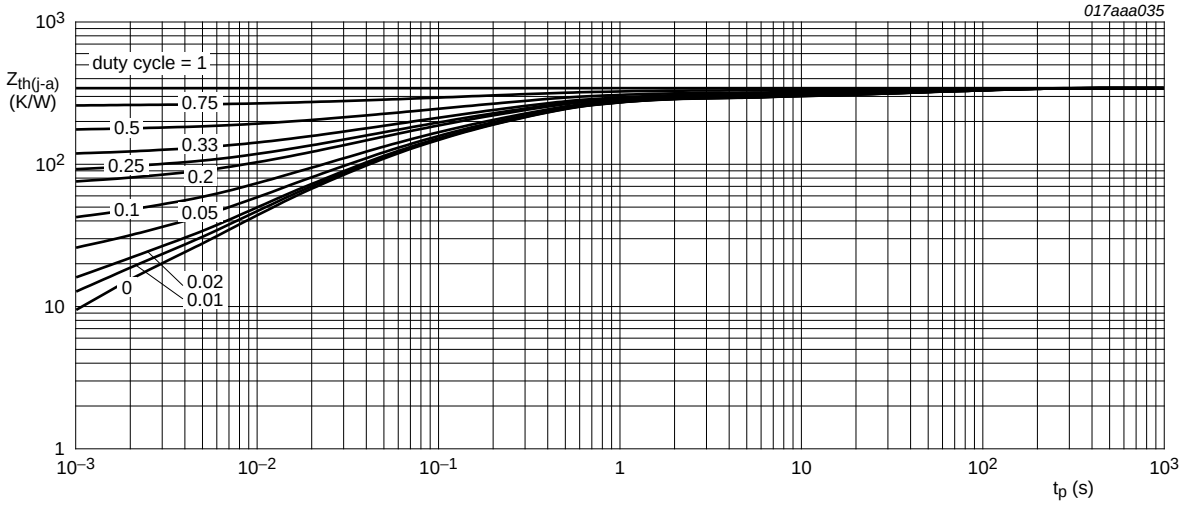
FR4 PCB, mounting pad for drain 1 cm^2.

Fig 6. TR1: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



FR4 PCB, standard footprint

Fig 7. TR2, Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



FR4 PCB, mounting pad for drain 1 cm^2

Fig 8. TR2, Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

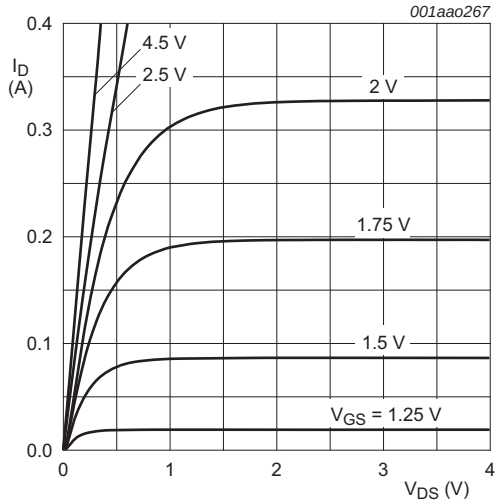
7. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
TR2 (P-channel), Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = -250 µA; V_{GS} = 0 V; T_j = 25 °C	-30	-	-	V
V_{GSth}	gate-source threshold voltage	I_D = -250 µA; V_{DS} = V_{GS}; T_j = 25 °C	-0.6	-0.9	-1.1	V
I_{DSS}	drain leakage current	V_{DS} = -30 V; V_{GS} = 0 V; T_j = 25 °C	-	-	-1	µA
		V_{DS} = -30 V; V_{GS} = 0 V; T_j = 150 °C	-	-	-10	µA
I_{GSS}	gate leakage current	V_{GS} = 8 V; V_{DS} = 0 V; T_j = 25 °C	-	-0.2	-1	µA
		V_{GS} = -8 V; V_{DS} = 0 V; T_j = 25 °C	-	-0.2	-1	µA
		V_{GS} = 4.5 V; V_{DS} = 0 V; T_j = 25 °C	-	-10	-	nA
		V_{GS} = -4.5 V; V_{DS} = 0 V; T_j = 25 °C	-	-10	-	nA
		V_{GS} = 2.5 V; V_{DS} = 0 V; T_j = 25 °C	-	-1	-	nA
		V_{GS} = -2.5 V; V_{DS} = 0 V; T_j = 25 °C	-	-1	-	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = -4.5 V; I_D = -200 mA; T_j = 25 °C	-	2.8	4.1	Ω
		V_{GS} = -2.5 V; I_D = -10 mA; T_j = 25 °C	-	5.3	6.5	Ω
		V_{GS} = -4.5 V; I_D = -200 mA; T_j = 150 °C	-	5.3	7.8	Ω
g_{fs}	transfer conductance	V_{DS} = -10 V; I_D = -200 mA; T_j = 25 °C	-	160	-	mS
TR1 (N-channel), Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 250 µA; V_{GS} = 0 V; T_j = 25 °C	30	-	-	V
V_{GSth}	gate-source threshold voltage	I_D = 250 µA; V_{DS} = V_{GS}; T_j = 25 °C	0.6	0.9	1.1	V
I_{DSS}	drain leakage current	V_{DS} = 30 V; V_{GS} = 0 V; T_j = 25 °C	-	-	1	µA
		V_{DS} = 30 V; V_{GS} = 0 V; T_j = 150 °C	-	-	10	µA
I_{GSS}	gate leakage current	V_{GS} = 8 V; V_{DS} = 0 V; T_j = 25 °C	-	0.2	1	µA
		V_{GS} = -8 V; V_{DS} = 0 V; T_j = 25 °C	-	0.2	1	µA
		V_{GS} = 4.5 V; V_{DS} = 0 V; T_j = 25 °C	-	10	-	nA
		V_{GS} = -4.5 V; V_{DS} = 0 V; T_j = 25 °C	-	10	-	nA
		V_{GS} = 2.5 V; V_{DS} = 0 V; T_j = 25 °C	-	1	-	nA
		V_{GS} = -2.5 V; V_{DS} = 0 V; T_j = 25 °C	-	1	-	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 4.5 V; I_D = 350 mA; T_j = 25 °C	-	1	1.4	Ω
		V_{GS} = 4.5 V; I_D = 350 mA; T_j = 150 °C	-	1.8	2.5	Ω
		V_{GS} = 2.5 V; I_D = 200 mA; T_j = 25 °C	-	1.4	2.1	Ω
		V_{GS} = 1.8 V; I_D = 10 mA; T_j = 25 °C	-	2	2.8	Ω
g_{fs}	transfer conductance	V_{DS} = 10 V; I_D = 350 mA; T_j = 25 °C	-	310	-	mS
TR1 (N-channel), Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	V_{DS} = 15 V; I_D = 350 mA; V_{GS} = 4.5 V; T_j = 25 °C	-	0.52	0.68	nC
Q_{GS}	gate-source charge		-	0.17	-	nC
Q_{GD}	gate-drain charge		-	0.08	-	nC

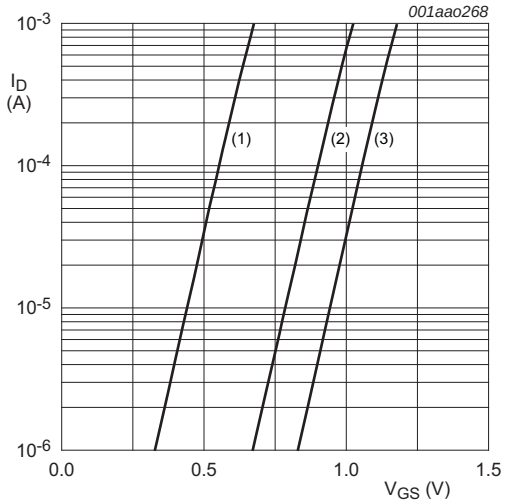
Table 7. Characteristics *...continued*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C_{iss}	input capacitance	V_{DS} = 15 V; f = 1 MHz; V_{GS} = 0 V; T_j = 25 °C	-	34	50	pF
C_{oss}	output capacitance		-	6.5	-	pF
C_{rss}	reverse transfer capacitance		-	2.2	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 20 V; R_L = 250 Ω; V_{GS} = 4.5 V; $R_{G(ext)}$ = 6 Ω; T_j = 25 °C	-	15	30	ns
t_r	rise time		-	11	-	ns
$t_{d(off)}$	turn-off delay time		-	69	138	ns
t_f	fall time		-	19	-	ns
TR2 (P-channel), Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	V_{DS} = -15 V; I_D = -200 mA; V_{GS} = -4.5 V; T_j = 25 °C	-	0.55	0.72	nC
Q_{GS}	gate-source charge		-	0.23	-	nC
Q_{GD}	gate-drain charge		-	0.09	-	nC
C_{iss}	input capacitance	V_{DS} = -15 V; f = 1 MHz; V_{GS} = 0 V; T_j = 25 °C	-	31	46	pF
C_{oss}	output capacitance		-	6.5	-	pF
C_{rss}	reverse transfer capacitance		-	2.3	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = -20 V; R_L = 250 Ω; V_{GS} = -4.5 V; $R_{G(ext)}$ = 6 Ω; T_j = 25 °C	-	19	38	ns
t_r	rise time		-	30	-	ns
$t_{d(off)}$	turn-off delay time		-	65	130	ns
t_f	fall time		-	38	-	ns
TR2 (P-channel), Source-drain diode characteristics						
V_{SD}	source-drain voltage	I_S = -200 mA; V_{GS} = 0 V; T_j = 25 °C	-0.47	-0.88	-1.2	V
TR1 (N-channel), Source-drain diode characteristics						
V_{SD}	source-drain voltage	I_S = 350 mA; V_{GS} = 0 V; T_j = 25 °C	0.47	0.85	1.2	V



T_j = 25 °C

Fig 9. TR1: Output characteristics: drain current as a function of drain-source voltage; typical values



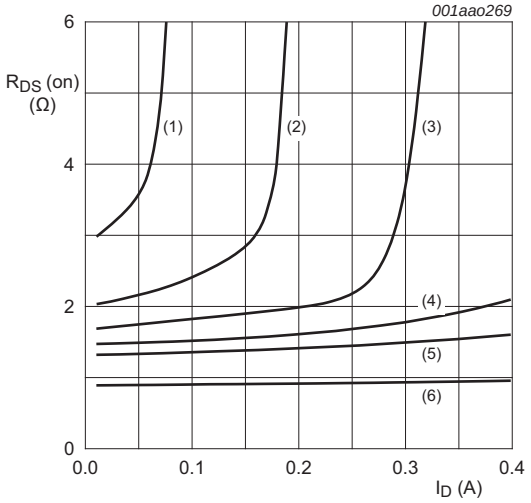
T_j = 25 °C; V_{DS} = 5 V

(1) minimum values

(2) typical values

(3) maximum values

Fig 10. TR1: Sub-threshold drain current as a function of gate-source voltage



T_j = 25 °C

(1) V_{GS} = 1.5 V

(2) V_{GS} = 1.75 V

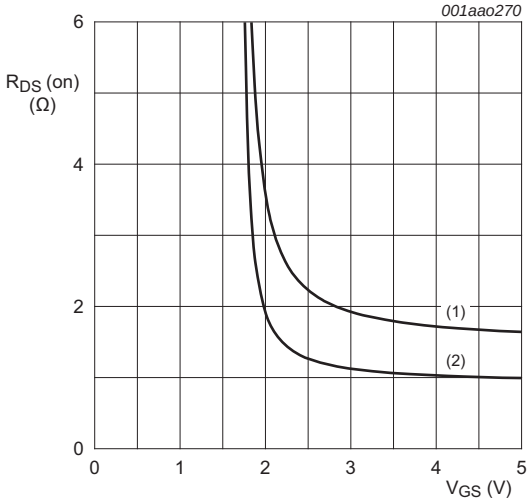
(3) V_{GS} = 2.0 V

(4) V_{GS} = 2.25 V

(5) V_{GS} = 2.5 V

(6) V_{GS} = 4.5 V

Fig 11. TR1: Drain-source on-state resistance as a function of drain current; typical values

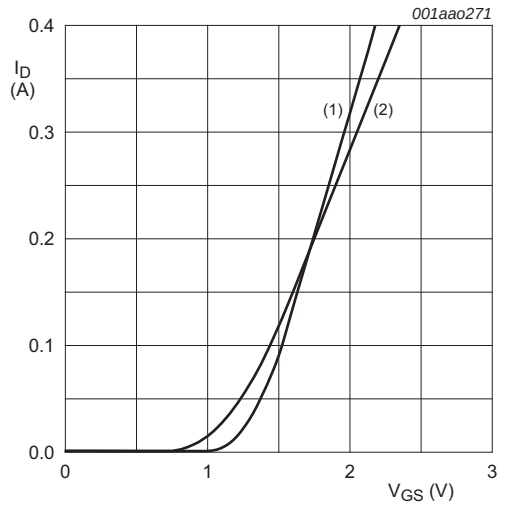


I_D = 350 mA

(1) T_j = 150 °C

(2) T_j = 25 °C

Fig 12. TR1: Drain-source on-state resistance as a function of gate-source voltage; typical values

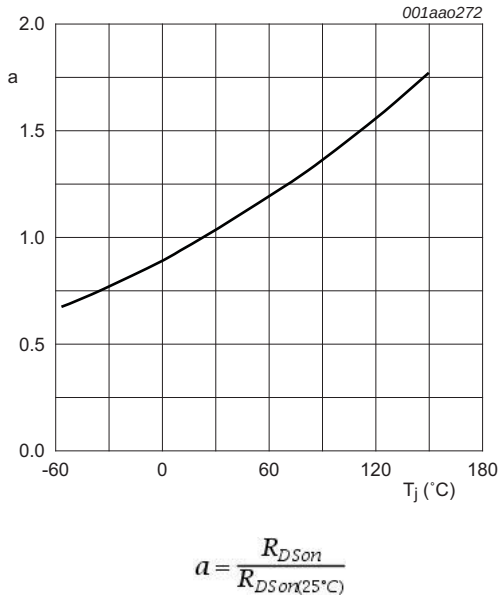


$V_{DS} > I_D \times R_{DSon}$

(1) T_j = 25 °C

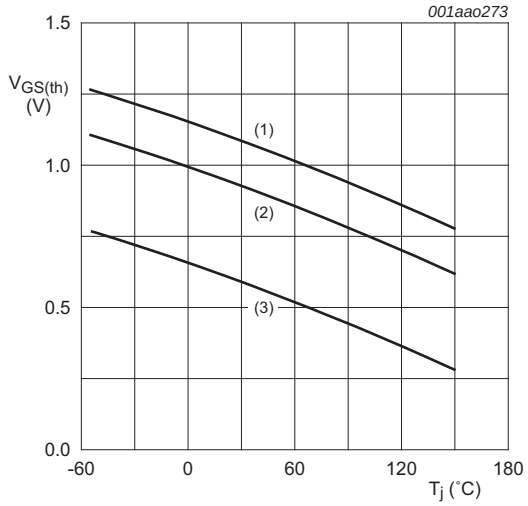
(2) T_j = 150 °C

Fig 13. TR1: Transfer characteristics: drain current as a function of gate-source voltage; typical values



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

Fig 14. TR1: Normalized drain-source on-state resistance as a function of junction temperature; typical values



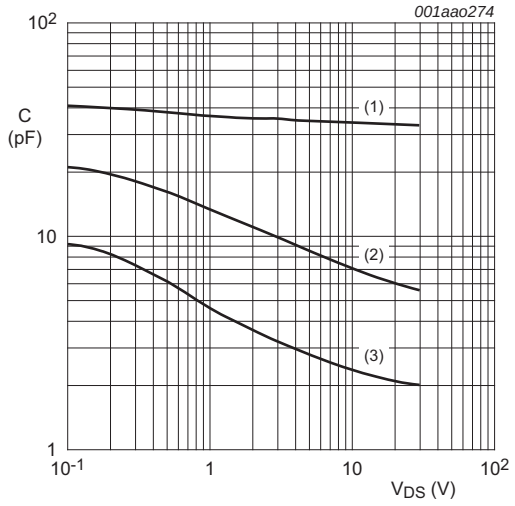
I_D = 0.25 mA; $V_{DS} = V_{GS}$

(1) maximum values

(2) typical values

(3) minimum values

Fig 15. TR1: Gate-source threshold voltage as a function of junction temperature



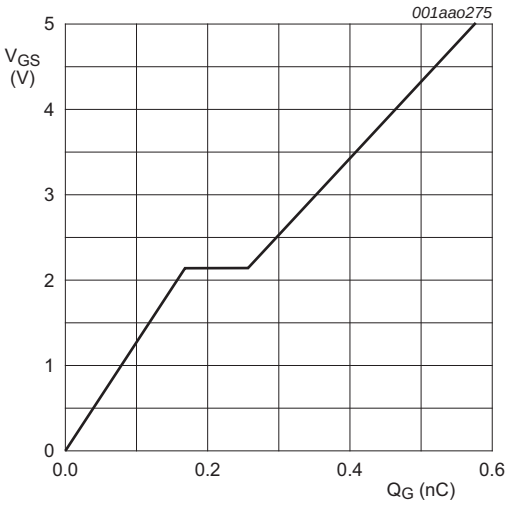
f = 1 MHz; V_{GS} = 0 V

(1)C_{iss}

(2)C_{oss}

(3)C_{rss}

Fig 16. TR1: Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



I_D = 350 mA; V_{DS} = 15 V; T_{amb} = 25 °C

Fig 17. TR1: Gate-source voltage as a function of gate charge; typical values

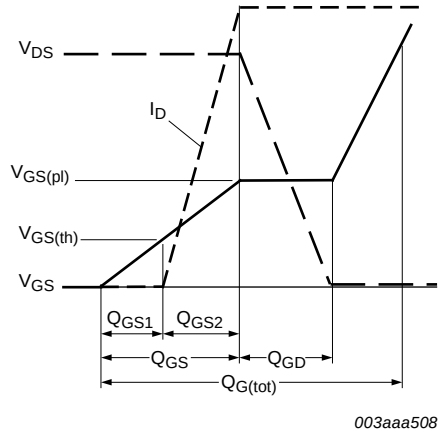
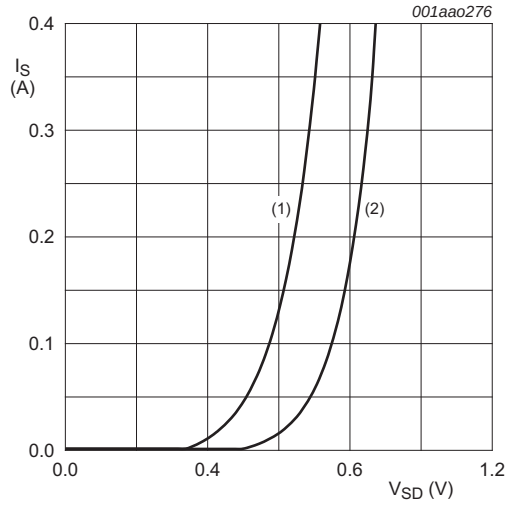


Fig 18. Gate charge waveform definitions

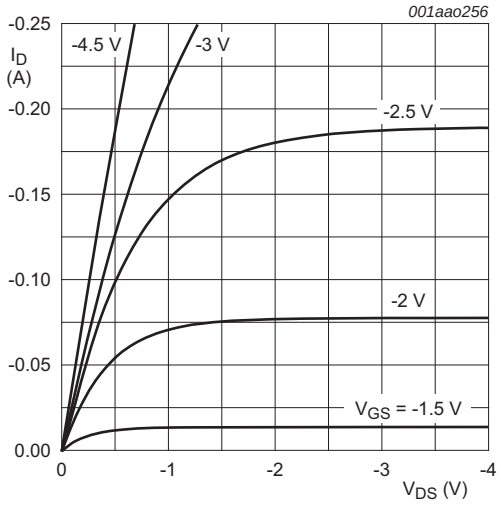


V_{GS} = 0 V

(1) T_j = 150 °C

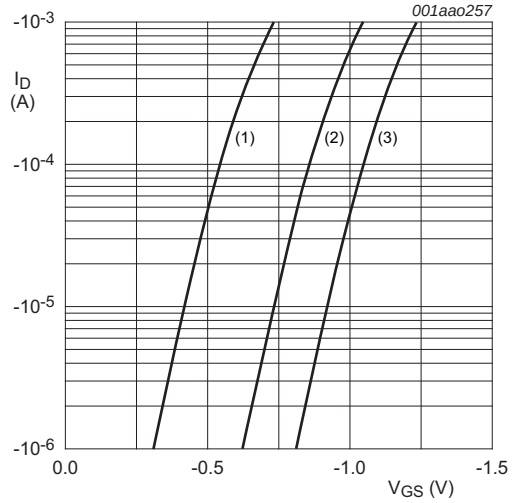
(2) T_j = 25 °C

Fig 19. TR1: Source current as a function of source-drain voltage; typical values



T_j = 25 °C

Fig 20. TR2: Output characteristics: drain current as a function of drain-source voltage; typical values



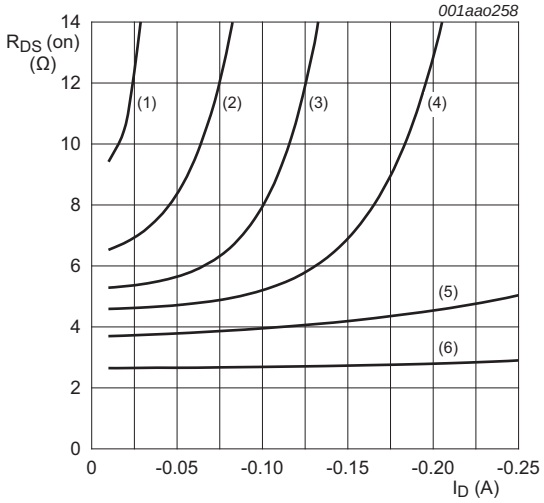
T_j = 25 °C; V_{DS} = -5 V

(1) minimum values

(2) typical values

(3) maximum values

Fig 21. TR2: Sub-threshold drain current as a function of gate-source voltage



T_j = 25 °C

(1) V_{GS} = -1.75 V

(2) V_{GS} = -2.0 V

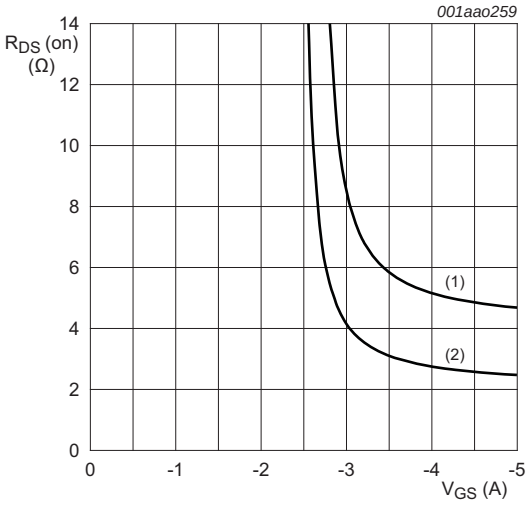
(3) V_{GS} = -2.25 V

(4) V_{GS} = -2.5 V

(5) V_{GS} = -3.0 V

(6) V_{GS} = -4.5 V

Fig 22. TR2: Drain-source on-state resistance as a function of drain current; typical values

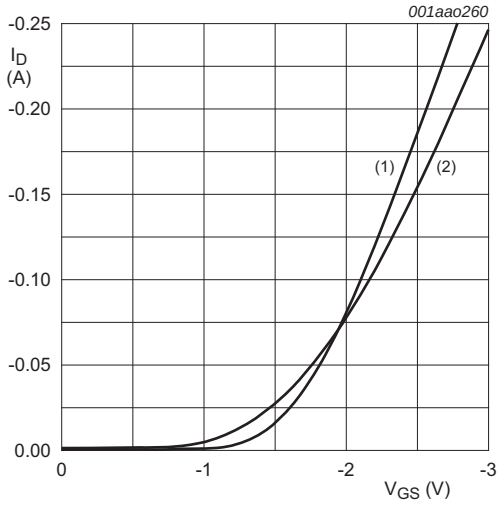


I_D = -200 mA

(1) T_j = 150 °C

(2) T_j = 25 °C

Fig 23. TR2: Drain-source on-state resistance as a function of gate-source voltage; typical values

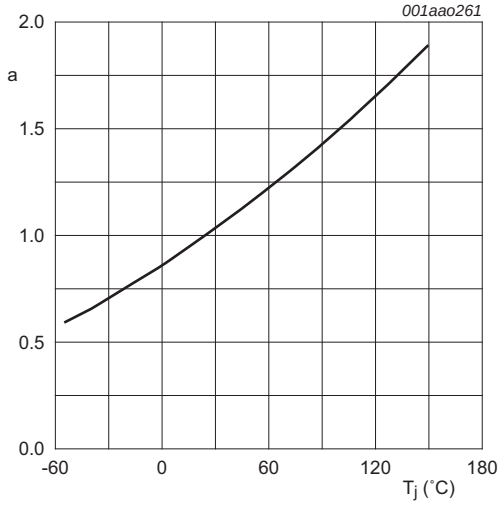


$V_{DS} > I_D \times R_{DSon}$

(1) T_j = 25 °C

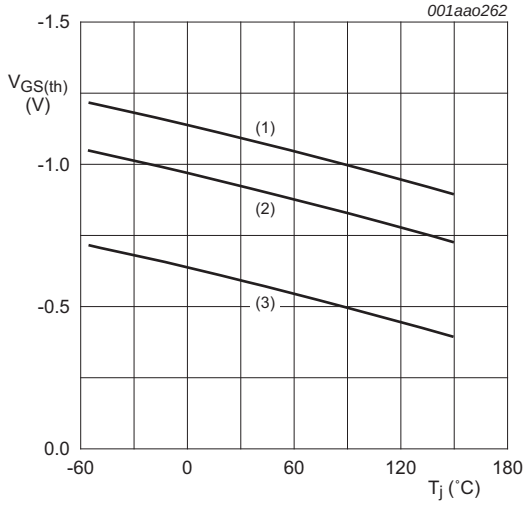
(2) T_j = 150 °C

Fig 24. TR2: Transfer characteristics: drain current as a function of gate-source voltage; typical values



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

Fig 25. TR2: Normalized drain-source on-state resistance as a function of junction temperature; typical values



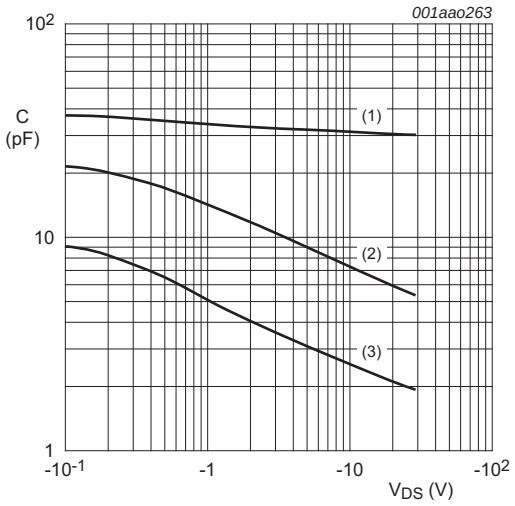
I_D = -0.25 mA; V_{DS} = V_{GS}

(1) maximum values

(2) typical values

(3) minimum values

Fig 26. TR2: Gate-source threshold voltage as a function of junction temperature



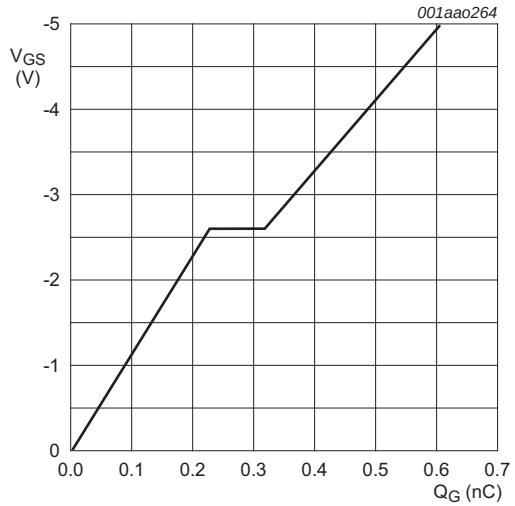
f = 1 MHz; V_{GS} = 0 V

(1)C_{iss}

(2)C_{oss}

(3)C_{rss}

Fig 27. TR2: Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



I_D = -200 mA; V_{DS} = -15 V; T_{amb} = 25 °C

Fig 28. Gate-source voltage as a function of gate charge; typical values

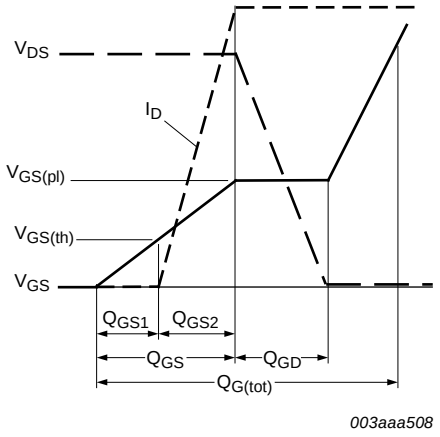
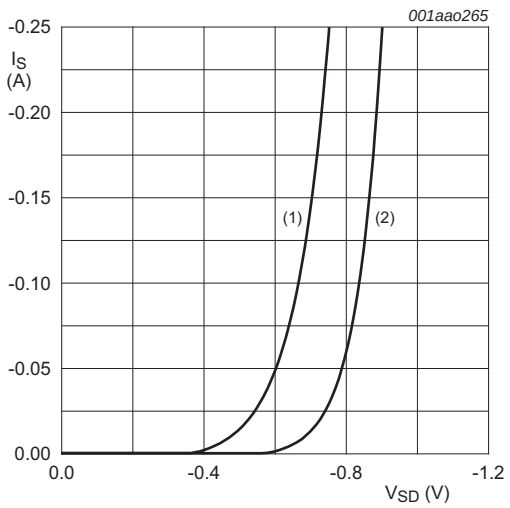


Fig 29. Gate charge waveform definitions



V_{GS} = 0 V

(1) T_j = 150 °C

(2) T_j = 25 °C

Fig 30. TR2: Source current as a function of source-drain voltage; typical values

8. Test information

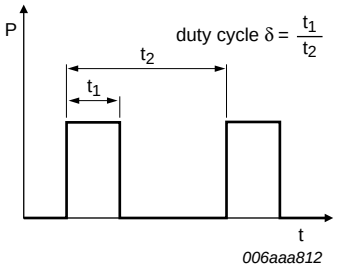


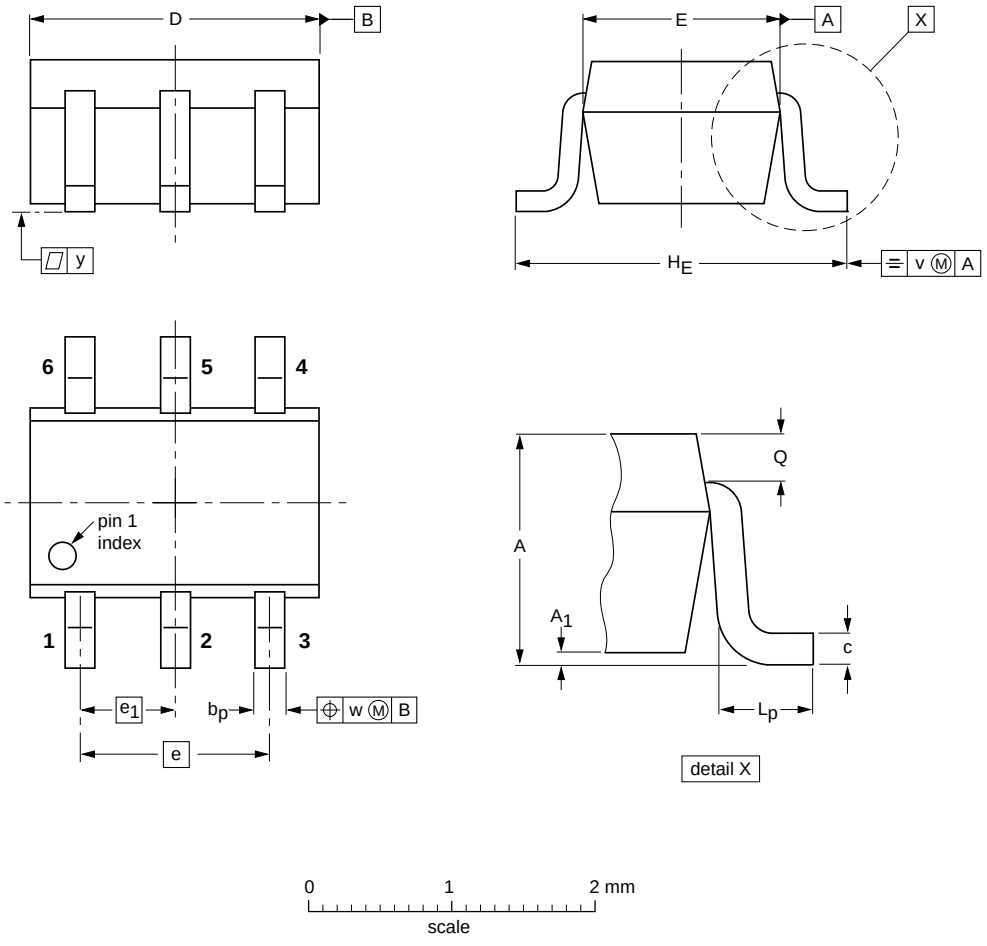
Fig 31. Duty cycle definition

8.1 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.

9. Package outline

Plastic surface-mounted package; 6 leads **SOT363**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1 max	b_p	c	D	E	e	e_1	H_E	L_p	Q	v	w	y
mm	1.1 0.8	0.1	0.30 0.20	0.25 0.10	2.2 1.8	1.35 1.15	1.3	0.65	2.2 2.0	0.45 0.15	0.25 0.15	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT363			SC-88			~~04-11-08~~ 06-03-16

Fig 32. Package outline SOT363 (SC-88)

10. Soldering

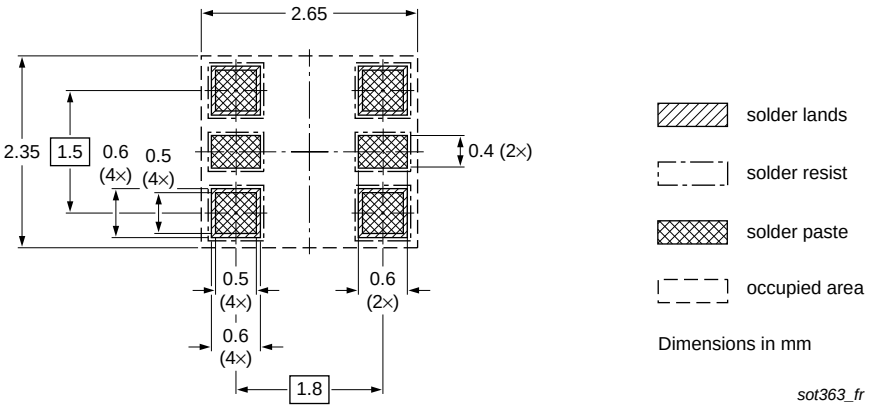


Fig 33. Reflow soldering footprint for SOT363 (SC-88)

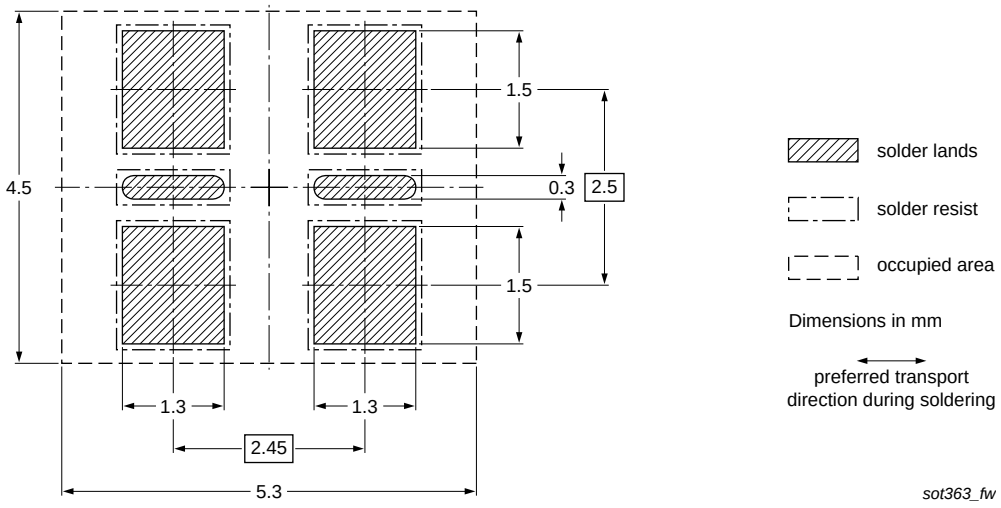


Fig 34. Wave soldering footprint for SOT363 (SC-88)

11. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
NX3008CBKS v.1	20110729	Product data sheet	-	-

12. Legal information

12.1 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.

[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".

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14. Contents

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