



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

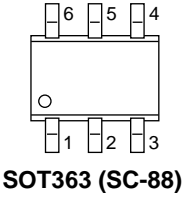
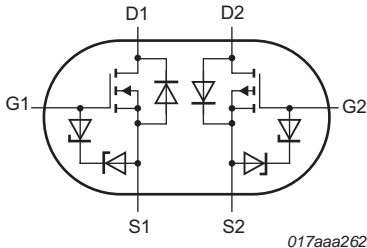
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
TR2 (P-channel)						
V_{DS}	drain-source voltage	$T_j = 25\text{ °C}$	-	-	-30	V
V_{GS}	gate-source voltage		-8	-	8	V
I_D	drain current	$V_{GS} = -4.5\text{ V}; T_{amb} = 25\text{ °C}$	[1] -	-	-200	mA
TR1 (N-channel)						
V_{DS}	drain-source voltage	$T_j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

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for drain 1 cm².



2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S1	source TR1	 <p>SOT363 (SC-88)</p>	 <p>017aaa262</p>
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

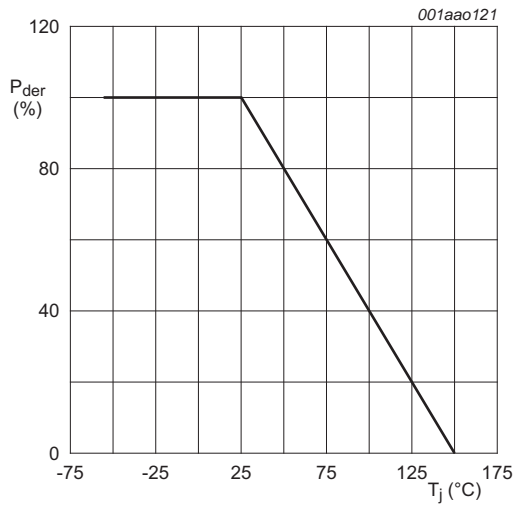
In accordance with the Absolute Maximum Rating System (IEC 60134).

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 ≤ 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 ≤ 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 cm².

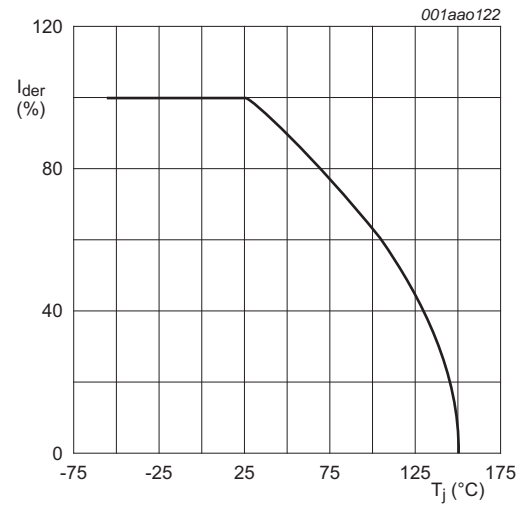
[2] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper; tin-plated and standard footprint.

[3] Measured between all pins.



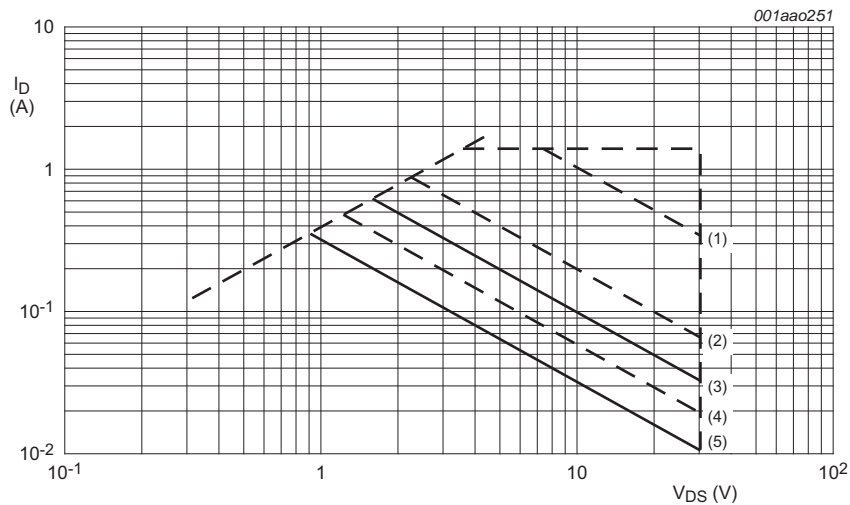
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}\text{C})}} \times 100\%$$

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



$$I_{der} = \frac{I_D}{I_{D(25^{\circ}\text{C})}} \times 100\%$$

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



I_{DM} is a single pulse

(1) $t_p = 1$ ms

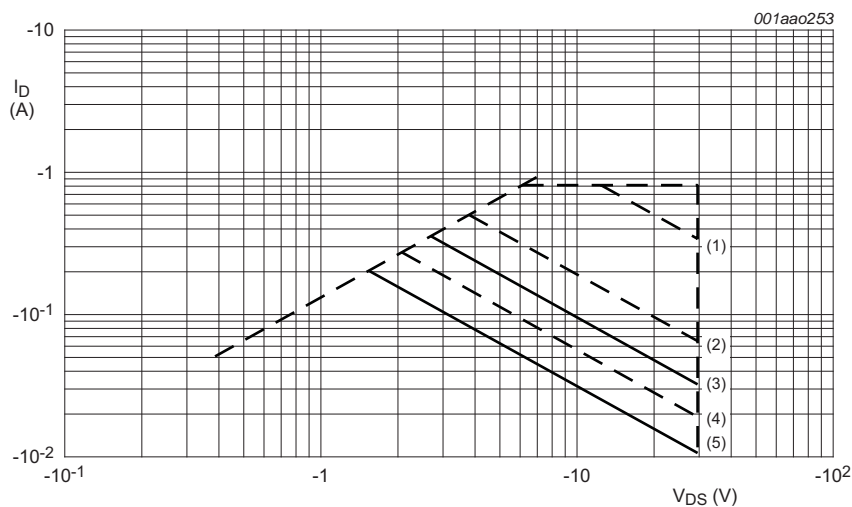
(2) $t_p = 10$ ms

(3) DC; $T_{sp} = 25^{\circ}\text{C}$

(4) $t_p = 100$ ms

(5) DC; $T_{amb} = 25^{\circ}\text{C}$; 1 cm² 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) $t_p = 1\text{ ms}$
(2) $t_p = 10\text{ ms}$
(3) DC; $T_{sp} = 25\text{ }^{\circ}\text{C}$
(4) $t_p = 100\text{ ms}$
(5) DC; $T_{amb} = 25\text{ }^{\circ}\text{C}$; 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 .

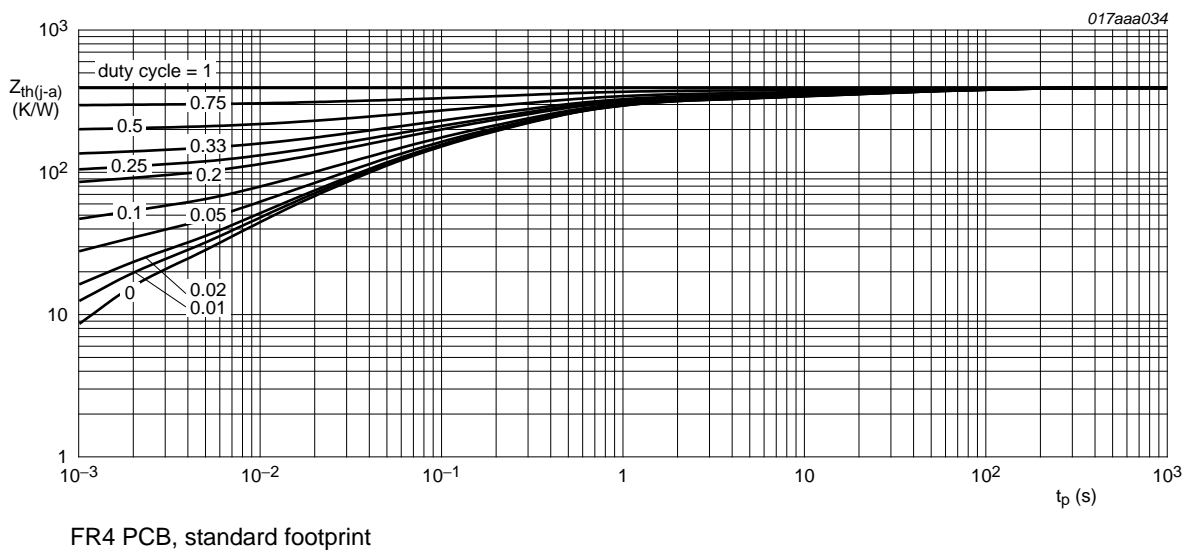


Fig 5. TR1: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

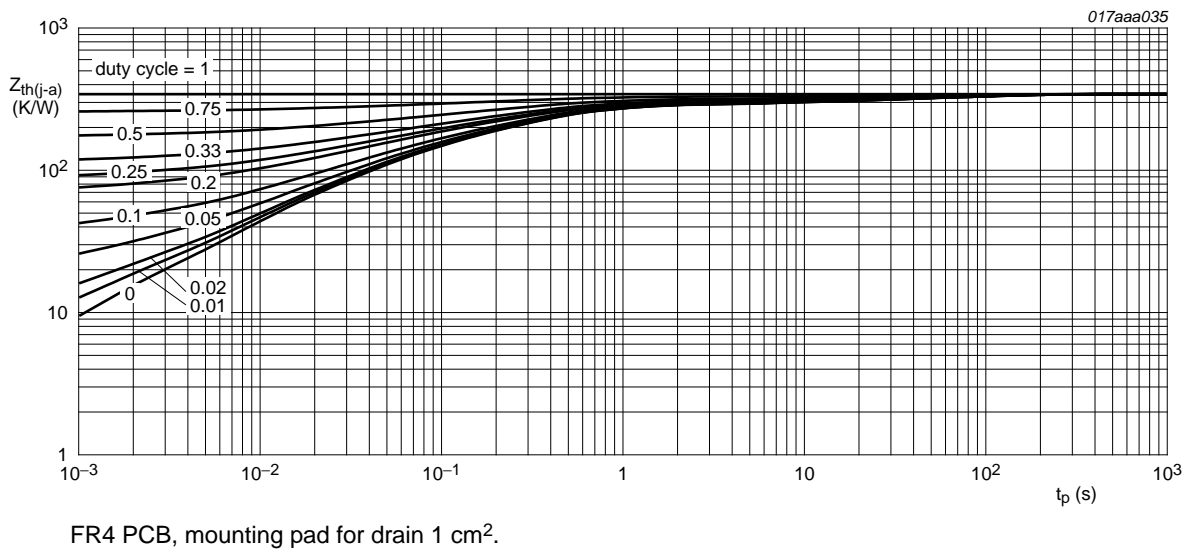
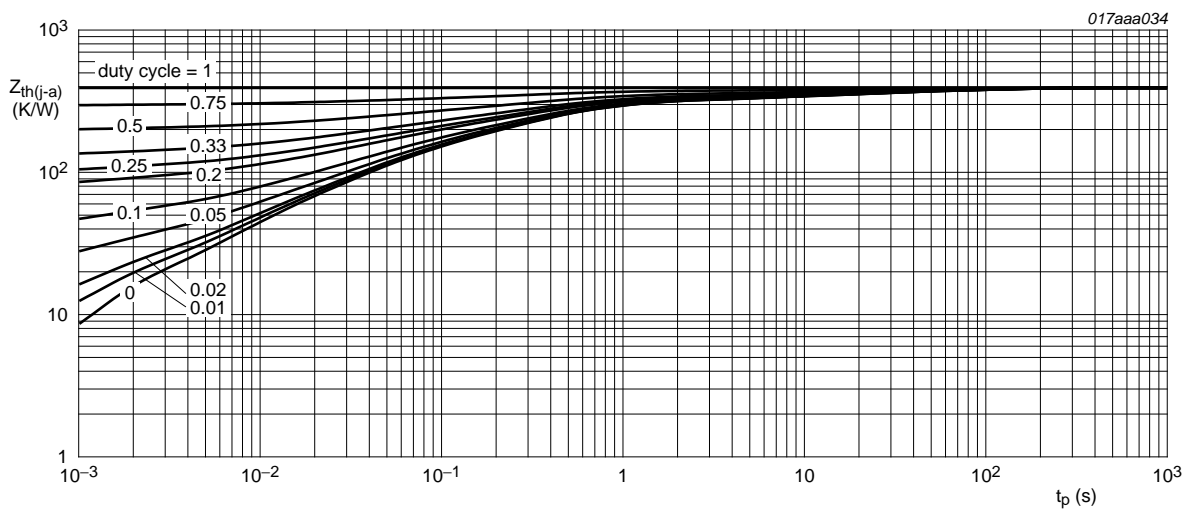
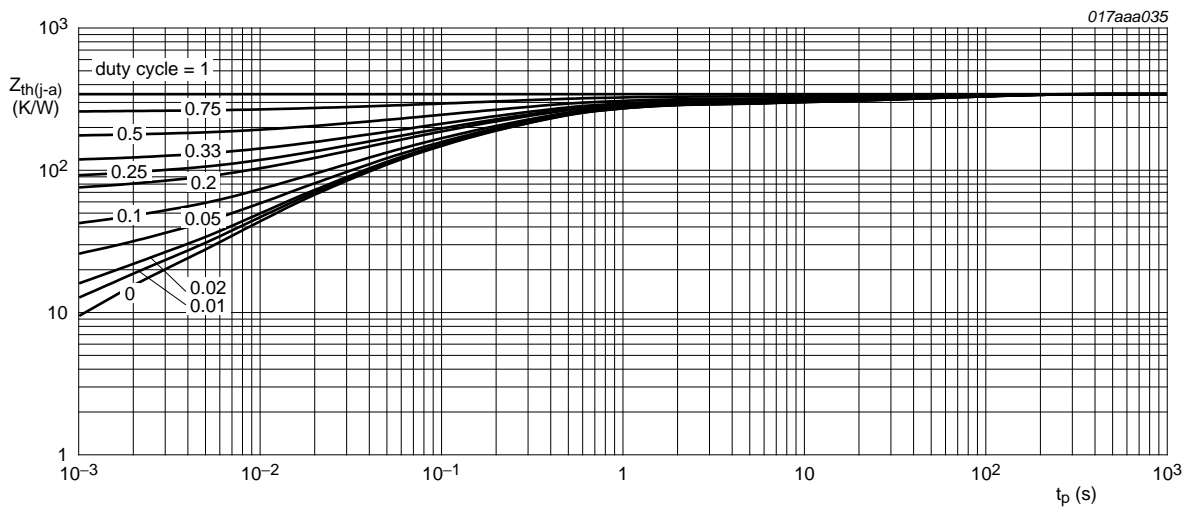


Fig 6. TR1: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



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 cm²

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	$I_D = -250 \mu A$; $V_{GS} = 0 V$; $T_j = 25 ^\circ C$	-30	-	-	V
V_{GSth}	gate-source threshold voltage	$I_D = -250 \mu A$; $V_{DS} = V_{GS}$; $T_j = 25 ^\circ C$	-0.6	-0.9	-1.1	V
I_{DSS}	drain leakage current	$V_{DS} = -30 V$; $V_{GS} = 0 V$; $T_j = 25 ^\circ C$	-	-	-1	μA
		$V_{DS} = -30 V$; $V_{GS} = 0 V$; $T_j = 150 ^\circ C$	-	-	-10	μA
I_{GSS}	gate leakage current	$V_{GS} = 8 V$; $V_{DS} = 0 V$; $T_j = 25 ^\circ C$	-	-0.2	-1	μA
		$V_{GS} = -8 V$; $V_{DS} = 0 V$; $T_j = 25 ^\circ C$	-	-0.2	-1	μA
		$V_{GS} = 4.5 V$; $V_{DS} = 0 V$; $T_j = 25 ^\circ C$	-	-10	-	nA
		$V_{GS} = -4.5 V$; $V_{DS} = 0 V$; $T_j = 25 ^\circ C$	-	-10	-	nA
		$V_{GS} = 2.5 V$; $V_{DS} = 0 V$; $T_j = 25 ^\circ C$	-	-1	-	nA
		$V_{GS} = -2.5 V$; $V_{DS} = 0 V$; $T_j = 25 ^\circ C$	-	-1	-	nA
R_{DSon}	drain-source on-state resistance	$V_{GS} = -4.5 V$; $I_D = -200 mA$; $T_j = 25 ^\circ C$	-	2.8	4.1	Ω
		$V_{GS} = -2.5 V$; $I_D = -10 mA$; $T_j = 25 ^\circ C$	-	5.3	6.5	Ω
		$V_{GS} = -4.5 V$; $I_D = -200 mA$; $T_j = 150 ^\circ C$	-	5.3	7.8	Ω
g_{fs}	transfer conductance	$V_{DS} = -10 V$; $I_D = -200 mA$; $T_j = 25 ^\circ C$	-	160	-	mS
TR1 (N-channel), Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A$; $V_{GS} = 0 V$; $T_j = 25 ^\circ C$	30	-	-	V
V_{GSth}	gate-source threshold voltage	$I_D = 250 \mu A$; $V_{DS} = V_{GS}$; $T_j = 25 ^\circ C$	0.6	0.9	1.1	V
I_{DSS}	drain leakage current	$V_{DS} = 30 V$; $V_{GS} = 0 V$; $T_j = 25 ^\circ C$	-	-	1	μA
		$V_{DS} = 30 V$; $V_{GS} = 0 V$; $T_j = 150 ^\circ C$	-	-	10	μA
I_{GSS}	gate leakage current	$V_{GS} = 8 V$; $V_{DS} = 0 V$; $T_j = 25 ^\circ C$	-	0.2	1	μA
		$V_{GS} = -8 V$; $V_{DS} = 0 V$; $T_j = 25 ^\circ C$	-	0.2	1	μA
		$V_{GS} = 4.5 V$; $V_{DS} = 0 V$; $T_j = 25 ^\circ C$	-	10	-	nA
		$V_{GS} = -4.5 V$; $V_{DS} = 0 V$; $T_j = 25 ^\circ C$	-	10	-	nA
		$V_{GS} = 2.5 V$; $V_{DS} = 0 V$; $T_j = 25 ^\circ C$	-	1	-	nA
		$V_{GS} = -2.5 V$; $V_{DS} = 0 V$; $T_j = 25 ^\circ C$	-	1	-	nA
R_{DSon}	drain-source on-state resistance	$V_{GS} = 4.5 V$; $I_D = 350 mA$; $T_j = 25 ^\circ C$	-	1	1.4	Ω
		$V_{GS} = 4.5 V$; $I_D = 350 mA$; $T_j = 150 ^\circ C$	-	1.8	2.5	Ω
		$V_{GS} = 2.5 V$; $I_D = 200 mA$; $T_j = 25 ^\circ C$	-	1.4	2.1	Ω
		$V_{GS} = 1.8 V$; $I_D = 10 mA$; $T_j = 25 ^\circ C$	-	2	2.8	Ω
g_{fs}	transfer conductance	$V_{DS} = 10 V$; $I_D = 350 mA$; $T_j = 25 ^\circ C$	-	310	-	mS
TR1 (N-channel), Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$V_{DS} = 15 V$; $I_D = 350 mA$; $V_{GS} = 4.5 V$; $T_j = 25 ^\circ C$	-	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	$V_{DS} = 15\text{ V}; f = 1\text{ MHz}; V_{GS} = 0\text{ V};$ $T_j = 25\text{ }^{\circ}\text{C}$	-	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	$V_{DS} = 20\text{ V}; R_L = 250\text{ }\Omega; V_{GS} = 4.5\text{ V};$ $R_{G(ext)} = 6\text{ }\Omega; T_j = 25\text{ }^{\circ}\text{C}$	-	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	$V_{DS} = -15\text{ V}; I_D = -200\text{ mA};$ $V_{GS} = -4.5\text{ V}; T_j = 25\text{ }^{\circ}\text{C}$	-	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	$V_{DS} = -15\text{ V}; f = 1\text{ MHz}; V_{GS} = 0\text{ V};$ $T_j = 25\text{ }^{\circ}\text{C}$	-	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	$V_{DS} = -20\text{ V}; R_L = 250\text{ }\Omega; V_{GS} = -4.5\text{ V};$ $R_{G(ext)} = 6\text{ }\Omega; T_j = 25\text{ }^{\circ}\text{C}$	-	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	$I_S = -200\text{ mA}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^{\circ}\text{C}$	-0.47	-0.88	-1.2	V
TR1 (N-channel), Source-drain diode characteristics						
V_{SD}	source-drain voltage	$I_S = 350\text{ mA}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^{\circ}\text{C}$	0.47	0.85	1.2	V

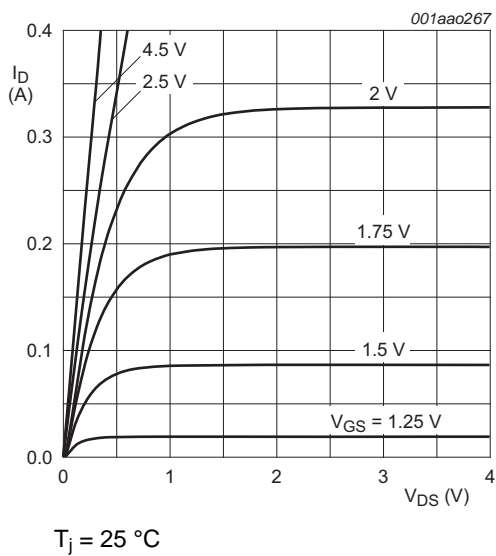


Fig 9. TR1: Output characteristics: drain current as a function of drain-source voltage; typical values

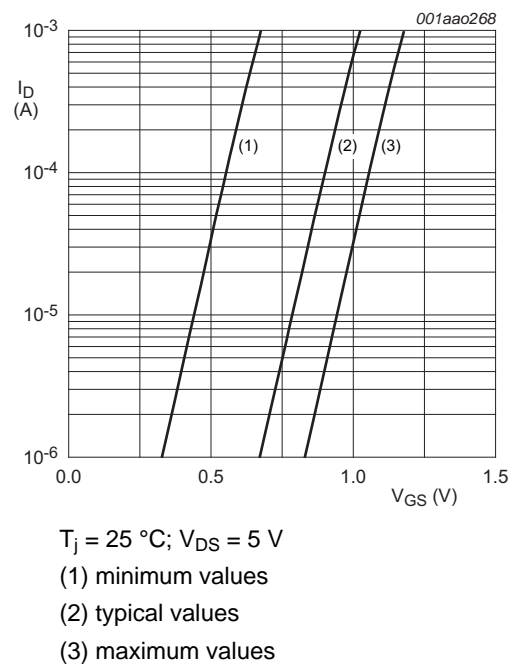


Fig 10. TR1: Sub-threshold drain current as a function of gate-source voltage

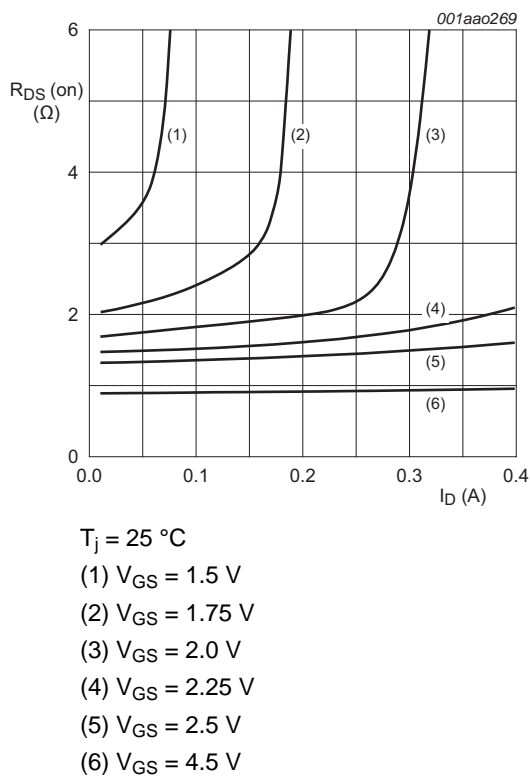


Fig 11. TR1: Drain-source on-state resistance as a function of drain current; typical values

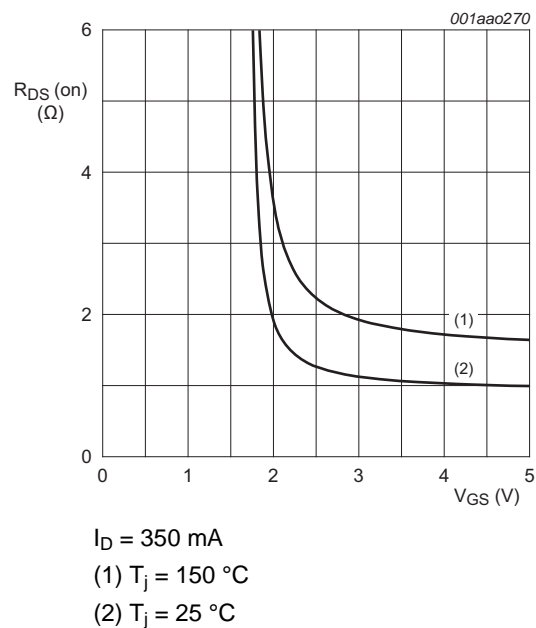
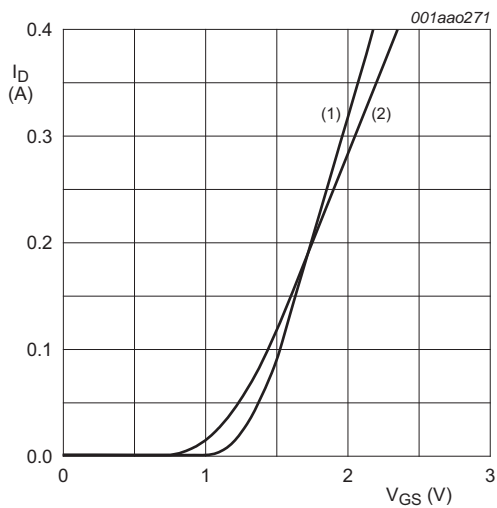
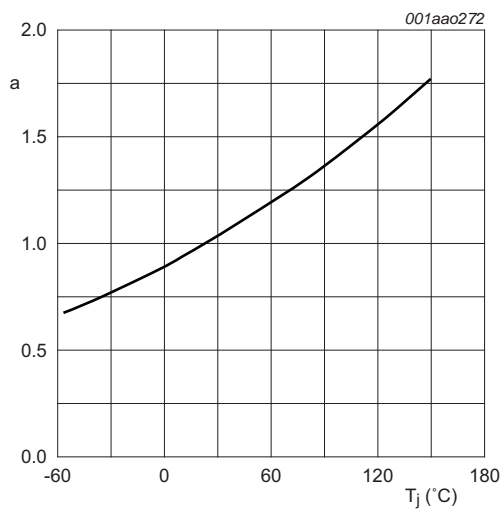


Fig 12. TR1: Drain-source on-state resistance as a function of gate-source voltage; typical values



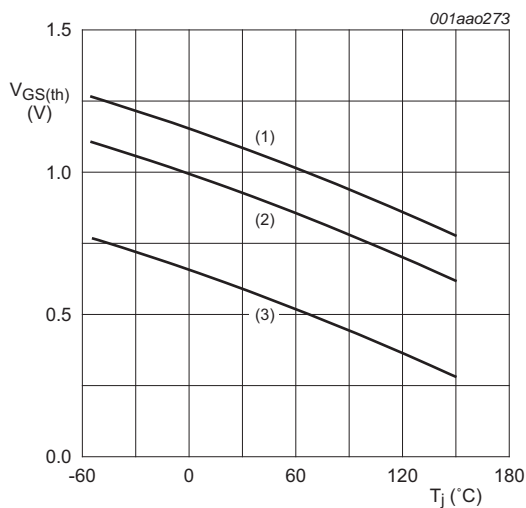
$V_{DS} > I_D \times R_{DSon}$
(1) $T_j = 25\text{ }^{\circ}\text{C}$
(2) $T_j = 150\text{ }^{\circ}\text{C}$

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



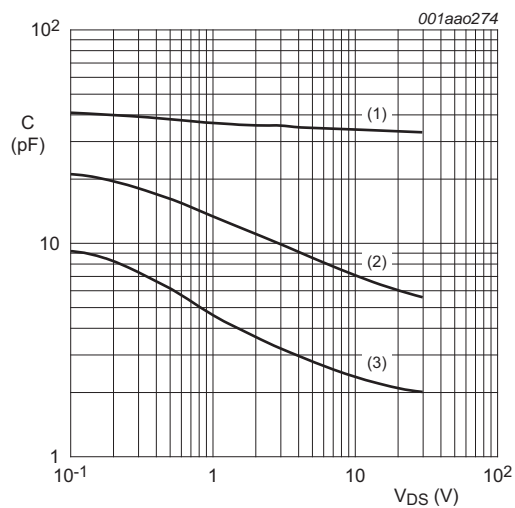
$$a = \frac{R_{DSon}}{R_{DSon}(25^{\circ}\text{C})}$$

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



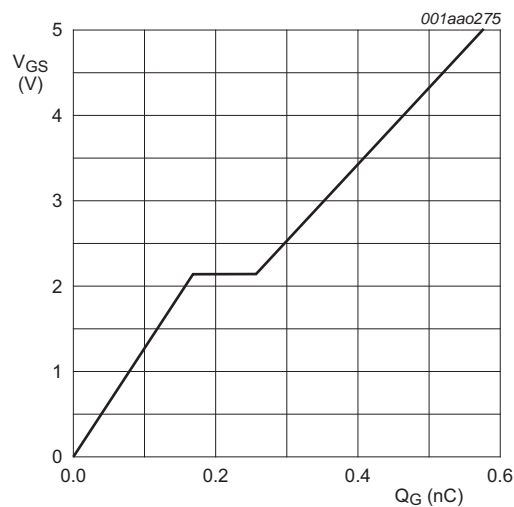
$I_D = 0.25\text{ mA}$; $V_{DS} = V_{GS}$
(1) maximum values
(2) typical values
(3) minimum values

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



$f = 1\text{ MHz}$; $V_{GS} = 0\text{ V}$
(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



$I_D = 350 \text{ mA}$; $V_{DS} = 15 \text{ V}$; $T_{amb} = 25 \text{ }^{\circ}\text{C}$

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

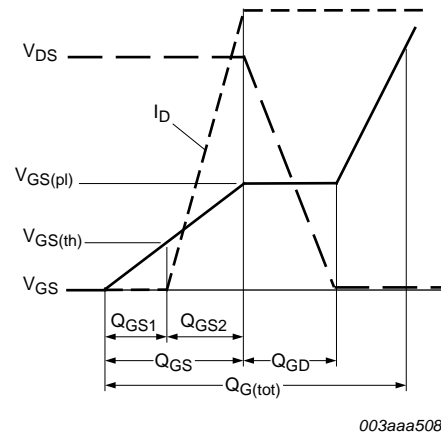
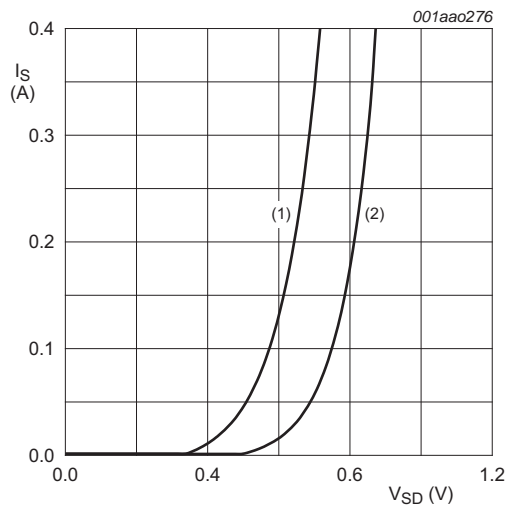
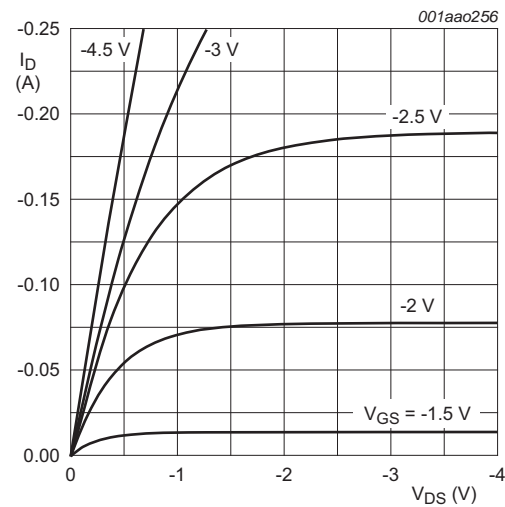


Fig 18. Gate charge waveform definitions



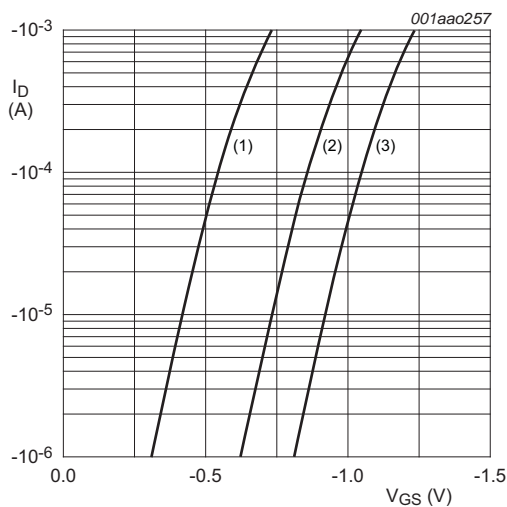
$V_{GS} = 0 \text{ V}$
(1) $T_j = 150 \text{ }^{\circ}\text{C}$
(2) $T_j = 25 \text{ }^{\circ}\text{C}$

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



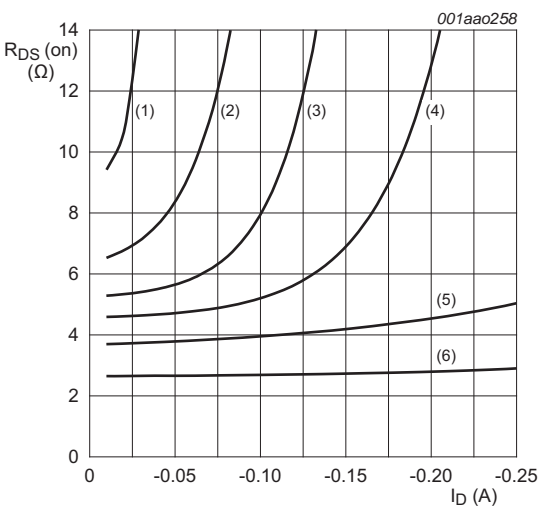
$T_j = 25 \text{ }^{\circ}\text{C}$

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



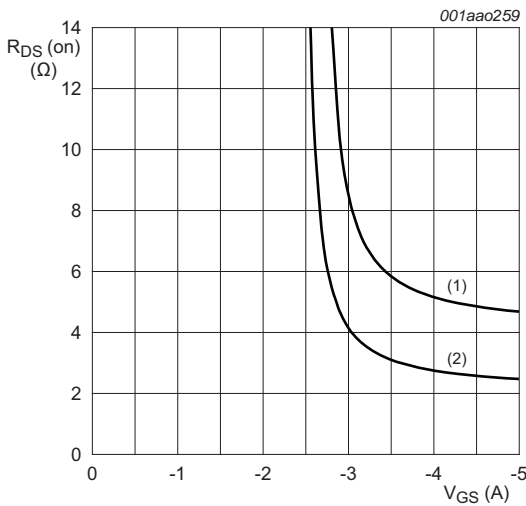
$T_j = 25\text{ }^{\circ}\text{C}$; $V_{DS} = -5\text{ V}$
(1) minimum values
(2) typical values
(3) maximum values

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



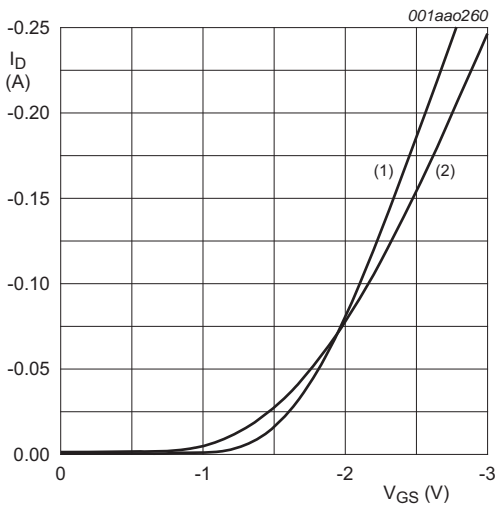
$T_j = 25\text{ }^{\circ}\text{C}$
(1) $V_{GS} = -1.75\text{ V}$
(2) $V_{GS} = -2.0\text{ V}$
(3) $V_{GS} = -2.25\text{ V}$
(4) $V_{GS} = -2.5\text{ V}$
(5) $V_{GS} = -3.0\text{ V}$
(6) $V_{GS} = -4.5\text{ V}$

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



$I_D = -200\text{ mA}$
(1) $T_j = 150\text{ }^{\circ}\text{C}$
(2) $T_j = 25\text{ }^{\circ}\text{C}$

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



$V_{DS} > I_D \times R_{DS(on)}$
(1) $T_j = 25\text{ }^{\circ}\text{C}$
(2) $T_j = 150\text{ }^{\circ}\text{C}$

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

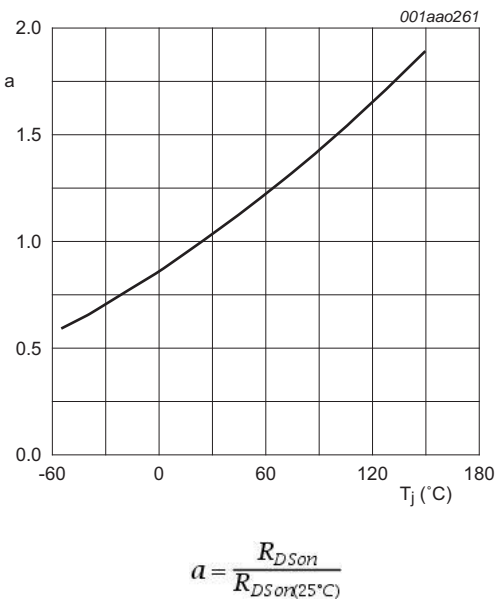


Fig 25. TR2: Normalized drain-source on-state resistance as a function of junction temperature; typical values

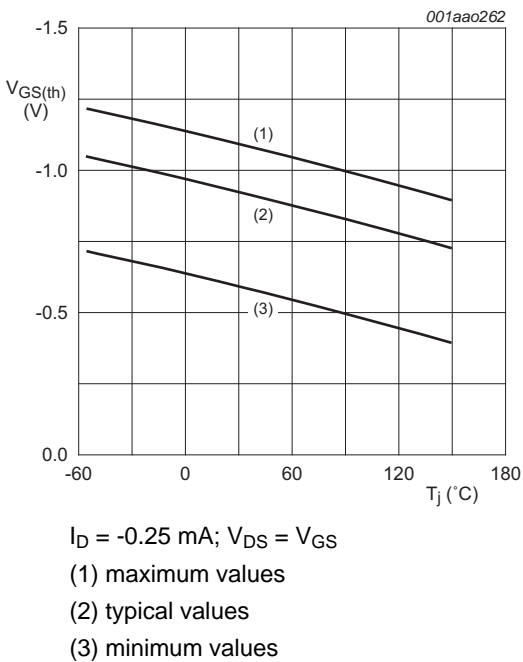


Fig 26. TR2: Gate-source threshold voltage as a function of junction temperature

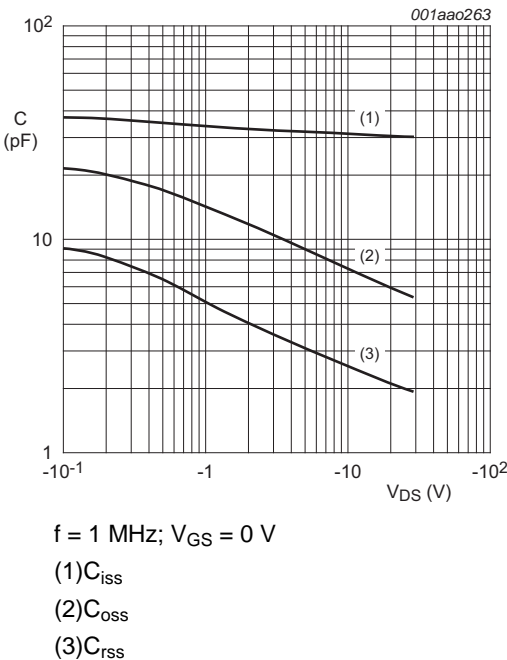


Fig 27. TR2: Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

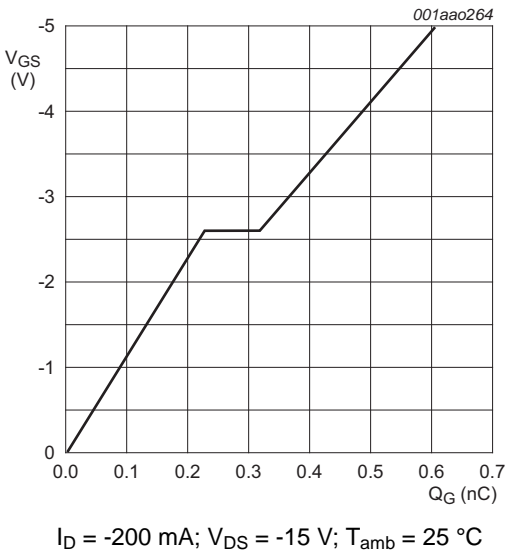


Fig 28. Gate-source voltage as a function of gate charge; typical values

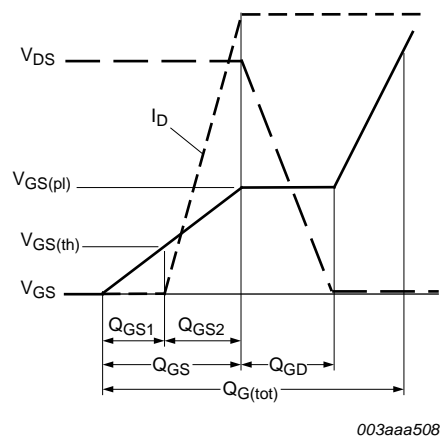


Fig 29. Gate charge waveform definitions

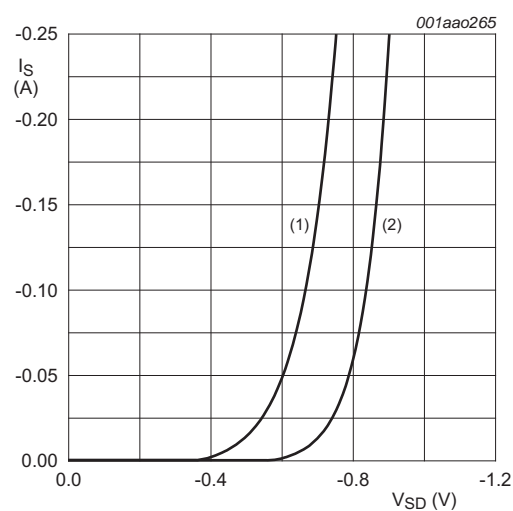


Fig 30. TR2: Source current as a function of source-drain voltage; typical values

8. Test information

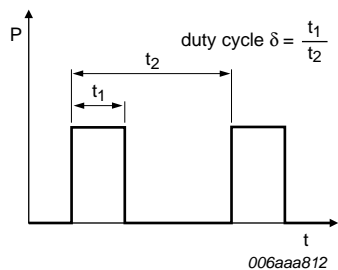


Fig 31. Duty cycle definition

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 leadsSOT363

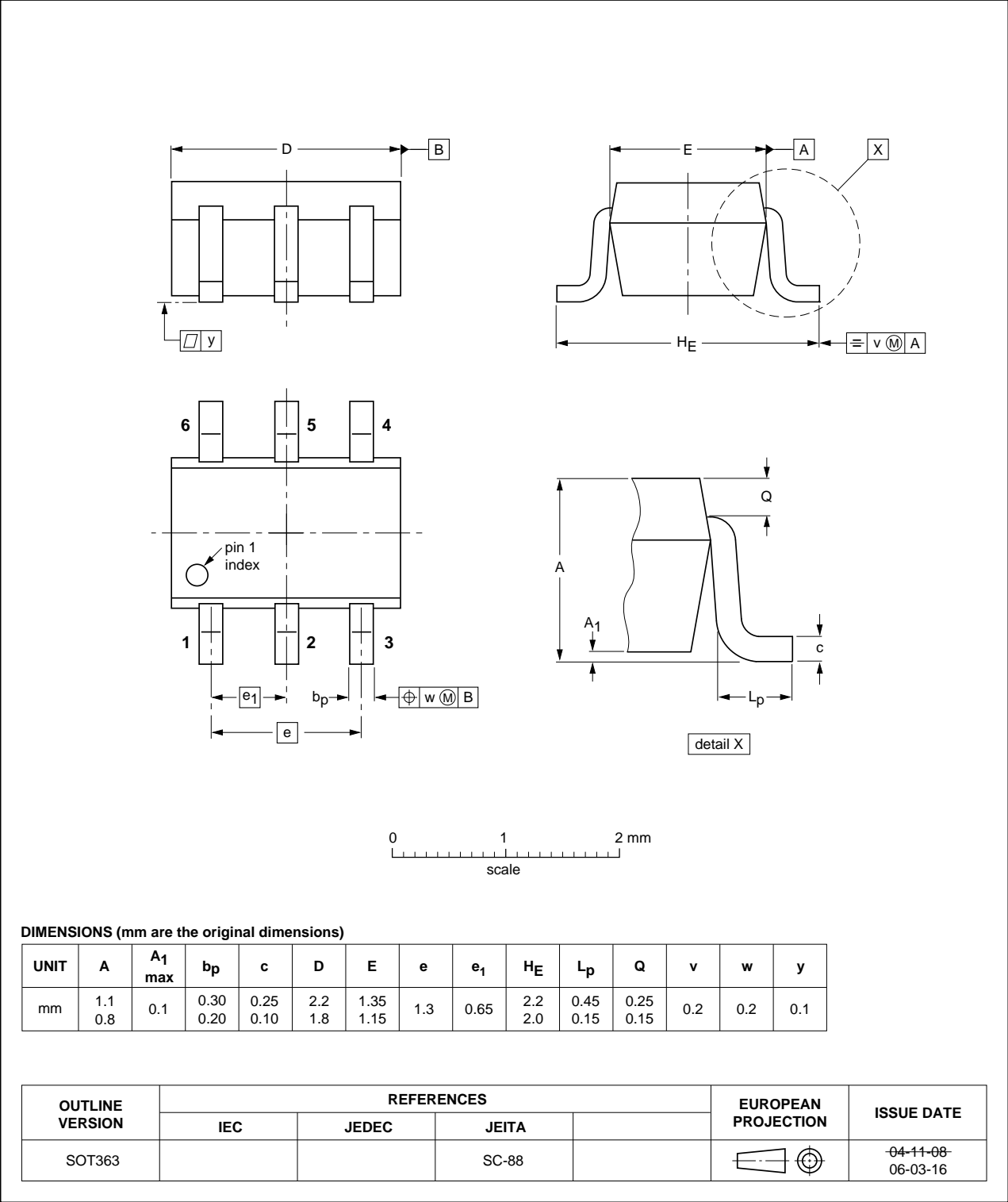
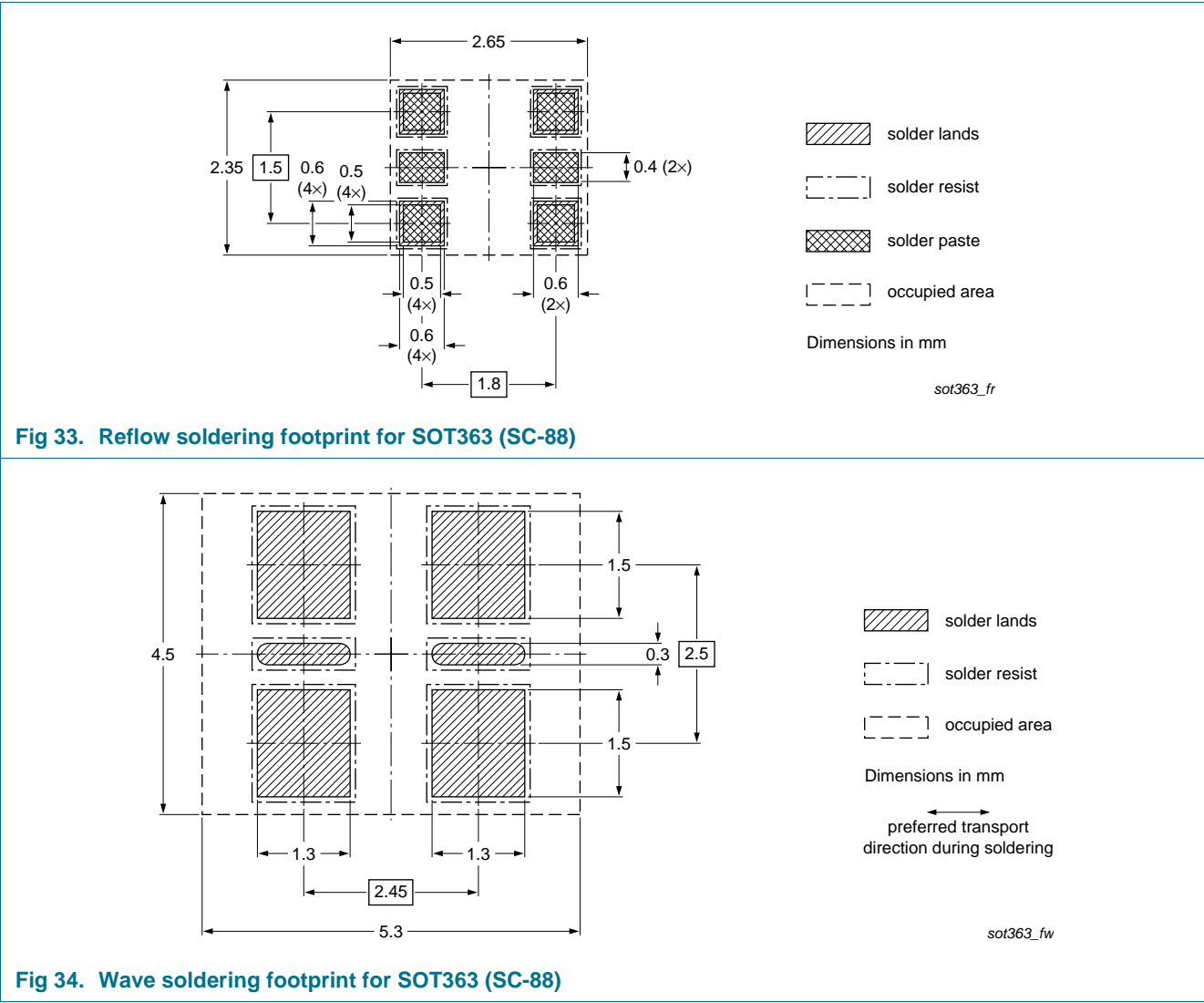


Fig 32. Package outline SOT363 (SC-88)

10. Soldering



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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