

BUK7905-40AI

TrenchPLUS standard level FET

Rev. 01 — 9 February 2004

Product data

1. Product profile

1.1 Description

N-channel enhancement mode field-effect power transistor in a plastic package using TrenchMOS™ technology, featuring very low on-state resistance and TrenchPLUS current sensing.

1.2 Features

- Integrated current sensor
- Standard level compatible.

1.3 Applications

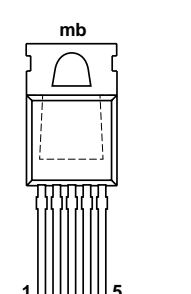
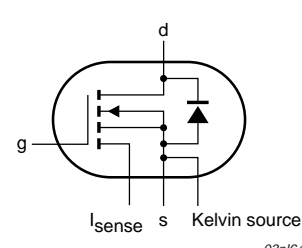
- Variable Valve Timing for engines
- Electrical Power Assisted Steering.

1.4 Quick reference data

- $V_{DS} \leq 40$ V
- $R_{DSon} = 4.5$ m Ω (typ)
- $I_D \leq 155$ A
- $I_D/I_{sense} = 500$ (typ).

2. Pinning information

Table 1: Pinning - SOT263B simplified outline and symbol

Pin	Description	Simplified outline	Symbol
1	gate (g)		
2	I_{sense} (I_s)		
3	drain (d)		
4	Kelvin source		
5	source (s)		
mb	mounting base; connected to drain (d)	SOT263B (TO-220)	



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3. Ordering information

Table 2: Ordering information

Type number	Package		Version
	Name	Description	
BUK7905-40AI	D ² -PAK	Plastic single ended package; heatsink mounted; 1 mounting hole; 5-lead TO-220	SOT263B

4. Limiting values

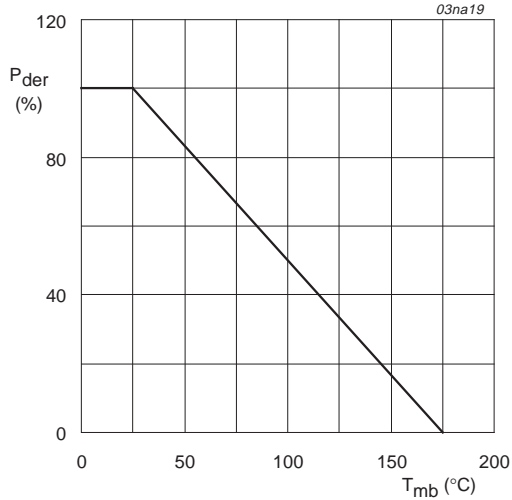
Table 3: Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V _{DS}	drain-source voltage (DC)		-	40	V
V _{DGR}	drain-gate voltage (DC)	R _{GS} = 20 kΩ	-	40	V
V _{GS}	gate-source voltage (DC)		-	±20	V
I _D	drain current (DC)	T _{mb} = 25 °C; V _{GS} = 10 V; Figure 2 and 3	[1] -	155	A
			[2] -	75	A
		T _{mb} = 100 °C; V _{GS} = 10 V; Figure 2	[2] -	75	A
I _{DM}	peak drain current	T _{mb} = 25 °C; pulsed; t _p ≤ 10 μs; Figure 3	-	620	A
P _{tot}	total power dissipation	T _{mb} = 25 °C; Figure 1	-	272	W
T _{stg}	storage temperature		-55	+175	°C
T _j	junction temperature		-55	+175	°C
Source-drain diode					
I _{DR}	reverse drain current (DC)	T _{mb} = 25 °C	[1] -	155	A
			[2] -	75	A
I _{DRM}	peak reverse drain current	T _{mb} = 25 °C; pulsed; t _p ≤ 10 μs	-	620	A
Avalanche ruggedness					
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	unclamped inductive load; I _D = 75 A; V _{DS} ≤ 40 V; V _{GS} = 10 V; R _{GS} = 50 Ω; starting T _j = 25 °C	-	1.46	J
Electrostatic discharge					
V _{esd}	electrostatic discharge voltage; all pins	Human Body Model; C = 100 pF; R = 1.5 kΩ	-	4	kV

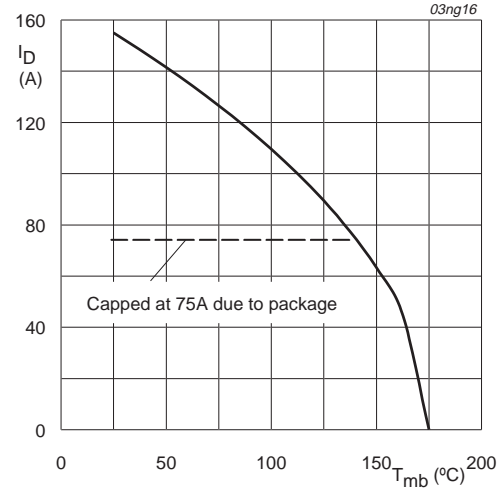
[1] Current is limited by power dissipation chip rating.

[2] Continuous current is limited by package.



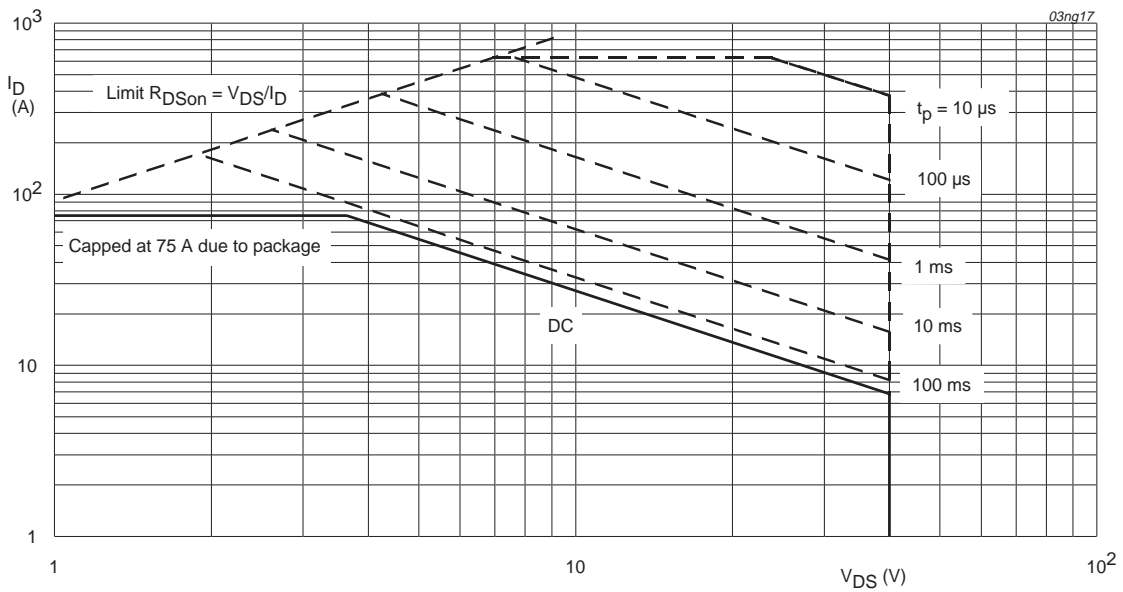
$$P_{der} = \frac{P_{tot}}{P_{tot(25^\circ C)}} \times 100\%$$

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



$V_{GS} \geq 10\text{ V}$

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



$T_{mb} = 25^\circ\text{C}$; I_{DM} single pulse.

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

5. Thermal characteristics

Table 4: Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	vertical in still air				
	SOT263B		-	60	-	K/W
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	Figure 4	-	-	0.55	K/W

5.1 Transient thermal impedance

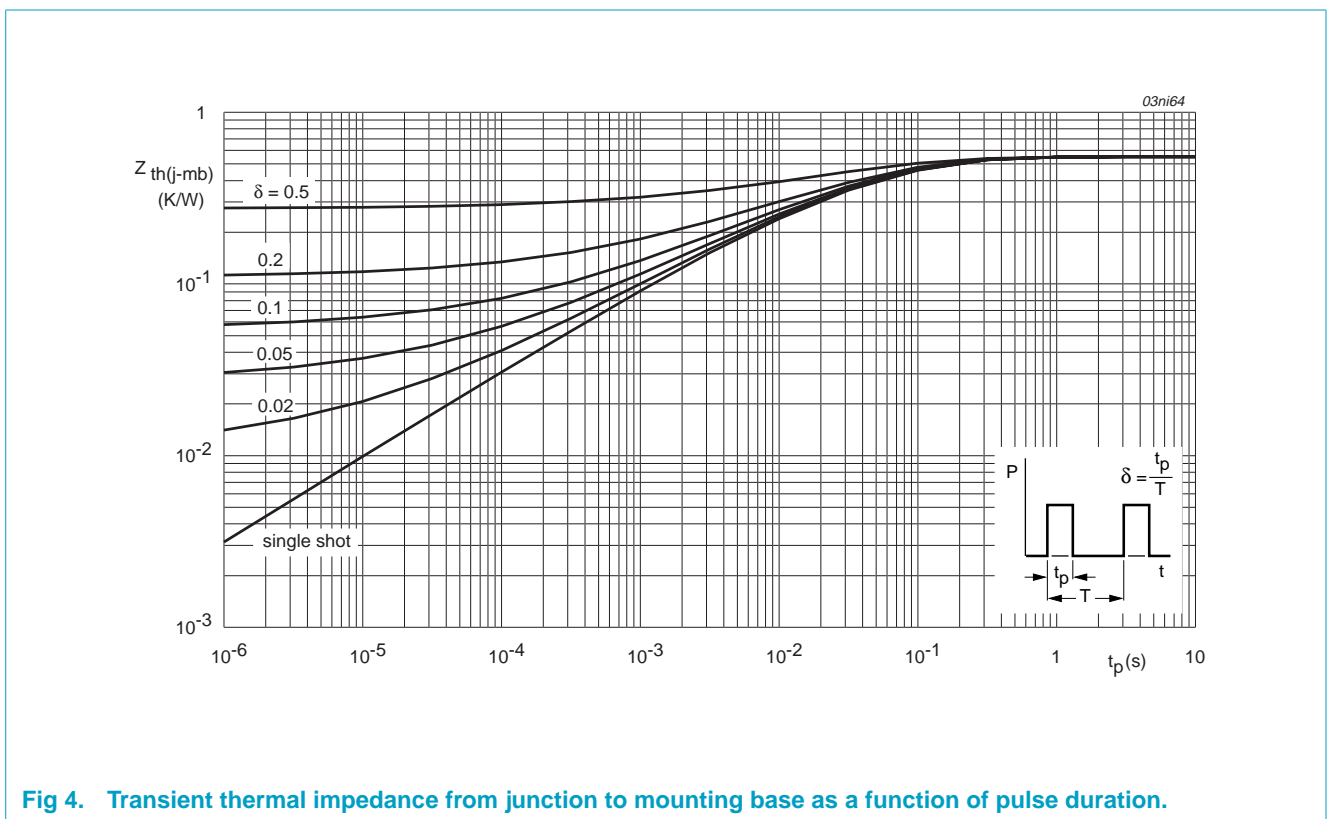


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration.

6. Characteristics

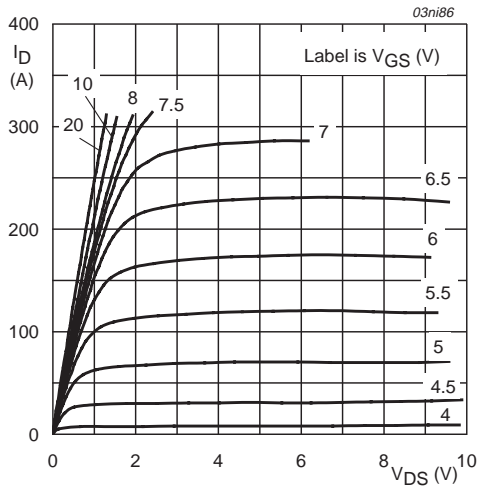
Table 5: Characteristics

$T_j = 25\text{ °C}$ unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 0.25\text{ mA}; V_{GS} = 0\text{ V}$				
		$T_j = 25\text{ °C}$	40	-	-	V
		$T_j = -55\text{ °C}$	36	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\text{ mA}; V_{DS} = V_{GS};$ Figure 9				
		$T_j = 25\text{ °C}$	2	3	4	V
		$T_j = 175\text{ °C}$	1	-	-	V
		$T_j = -55\text{ °C}$	-	-	4.4	V
I_{DSS}	drain-source leakage current	$V_{DS} = 40\text{ V}; V_{GS} = 0\text{ V}$				
		$T_j = 25\text{ °C}$	-	0.1	10	μA
		$T_j = 175\text{ °C}$	-	-	500	μA
I_{GSS}	gate-source leakage current	$V_{GS} = \pm 20\text{ V}; V_{DS} = 0\text{ V}$				
		$T_j = 25\text{ °C}$	-	2	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 50\text{ A};$ Figure 7 and 8				
		$T_j = 25\text{ °C}$	-	4.5	5	m Ω
		$T_j = 175\text{ °C}$	-	-	9.5	m Ω
$R_{D(I_s)on}$	drain- I_{sense} on-state resistance	$V_{GS} = 10\text{ V}; I_D = 25\text{ mA};$ Figure 16				
		$T_j = 25\text{ °C}$	0.98	1.08	1.18	Ω
		$T_j = 175\text{ °C}$	1.86	2.05	2.24	Ω
I_D/I_{sense}	ratio of drain current to sense current	$V_{GS} > 10\text{ V}; R_{sense} = 0\text{ }\Omega;$ $-55\text{ °C} < T_j < 175\text{ °C}$	450	500	550	
Dynamic characteristics						
$Q_{g(tot)}$	total gate charge	$V_{GS} = 10\text{ V}; V_{DS} = 32\text{ V};$ $I_D = 25\text{ A};$ Figure 14	-	120	127	nC
Q_{gs}	gate-source charge		-	19	22	nC
Q_{gd}	gate-drain (Miller) charge		-	50	60	nC
C_{iss}	input capacitance	$V_{GS} = 0\text{ V}; V_{DS} = 25\text{ V};$ $f = 1\text{ MHz};$ Figure 12	-	4300	5000	pF
C_{oss}	output capacitance		-	1400	1670	pF
C_{rss}	reverse transfer capacitance		-	820	1100	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 30\text{ V}; R_L = 1.2\text{ }\Omega;$ $V_{GS} = 10\text{ V}; R_G = 10\text{ }\Omega$	-	35	-	nS
t_r	rise time		-	115	-	nS
$t_{d(off)}$	turn-off delay time		-	155	-	nS
t_f	fall time		-	110	-	nS
L_d	internal drain inductance	measured from upper edge of drain mounting base to center of die	-	2.5	-	nH
L_s	internal source inductance	measured from source lead to source bond pad	-	7.5	-	nH

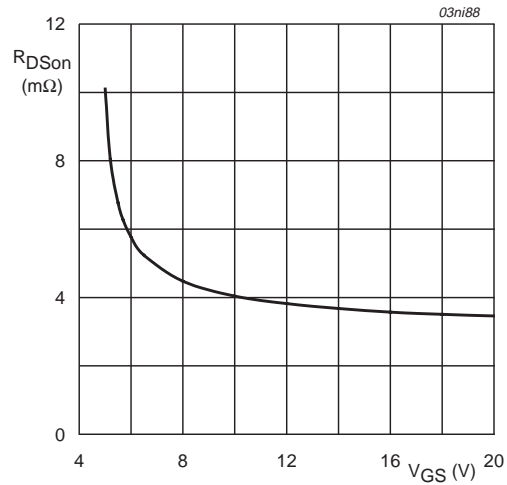
Table 5: Characteristics...continued*T_j = 25 °C unless otherwise specified.*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Source-drain diode						
V _{SD}	source-drain (diode forward) voltage	I _S = 40 A; V _{GS} = 0 V; Figure 17	-	0.85	1.2	V
t _{rr}	reverse recovery time	I _S = 20 A; dI _S /dt = -100 A/μs	-	96	-	ns
Q _r	recovered charge	V _{GS} = -10 V; V _{DS} = 30 V	-	224	-	nC



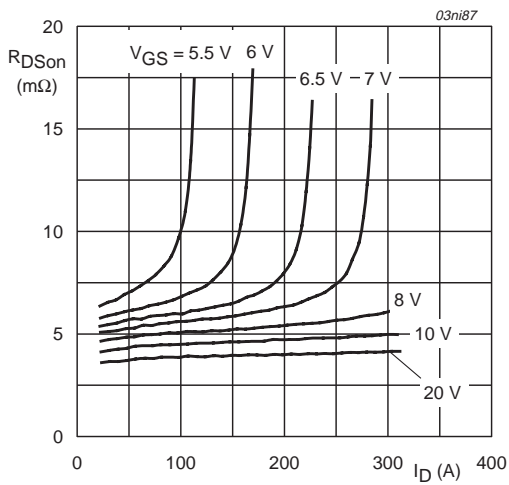
$T_j = 25\text{ }^\circ\text{C}; t_p = 300\text{ }\mu\text{s}$

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



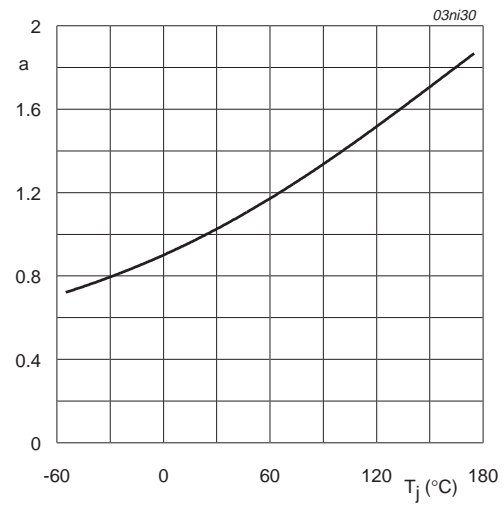
$T_j = 25\text{ }^\circ\text{C}; I_D = 50\text{ A}$

Fig 6. Drain-source on-state resistance as a function of gate-source voltage; typical values.



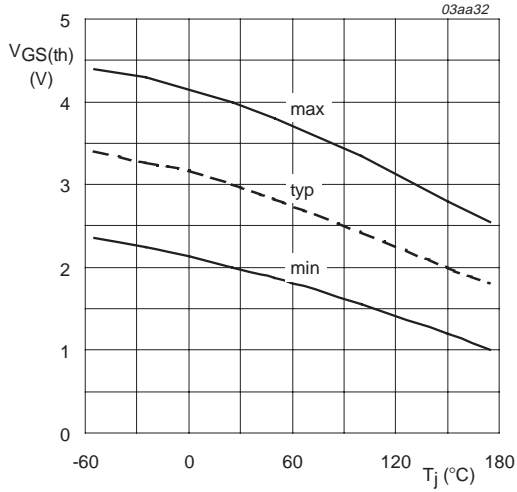
$T_j = 25\text{ }^\circ\text{C}; t_p = 300\text{ }\mu\text{s}$

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



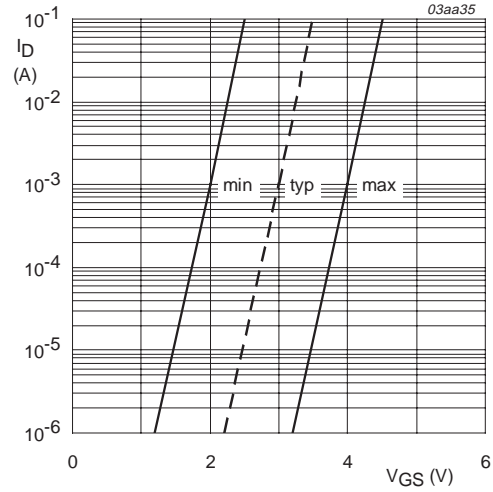
$$a = \frac{R_{DSon}}{R_{DSon(25^\circ\text{C})}}$$

Fig 8. Normalized drain-source on-state resistance factor as a function of junction temperature.



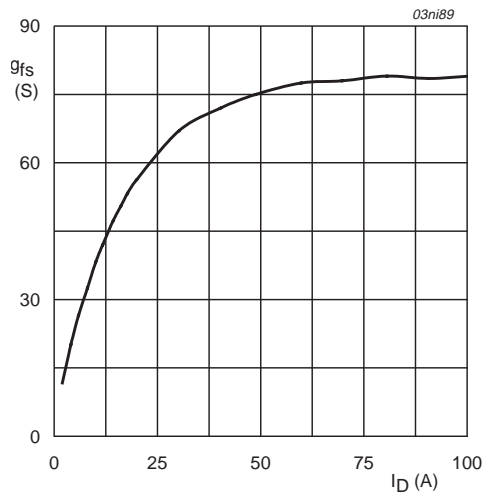
$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$

Fig 9. Gate-source threshold voltage as a function of junction temperature.



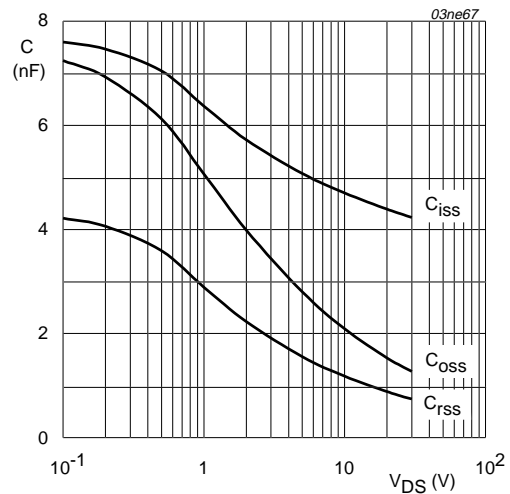
$T_j = 25 \text{ }^{\circ}C; V_{DS} = V_{GS}$

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



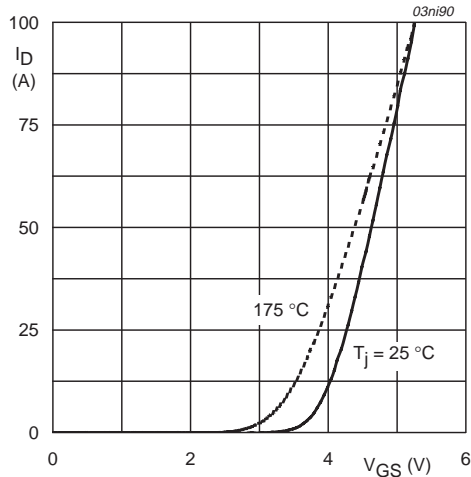
$T_j = 25 \text{ }^{\circ}C; V_{DS} = 25 \text{ V}$

Fig 11. Forward transconductance as a function of drain current; typical values.



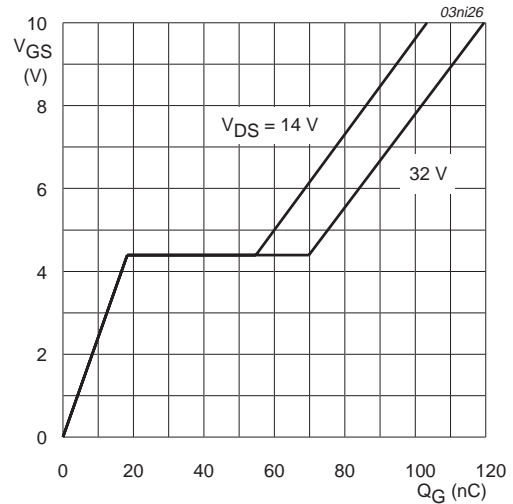
$V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$

Fig 12. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values.



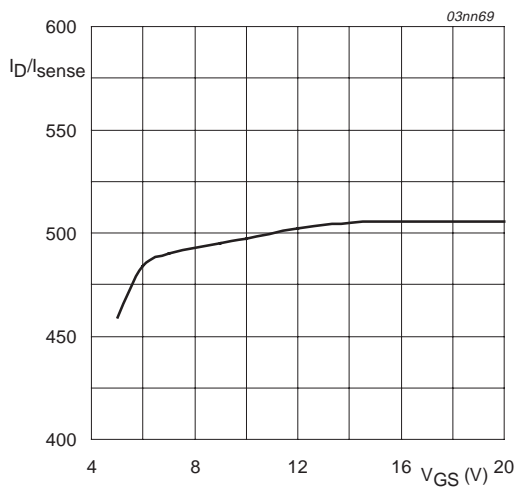
$V_{DS} = 25\text{ V}$

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



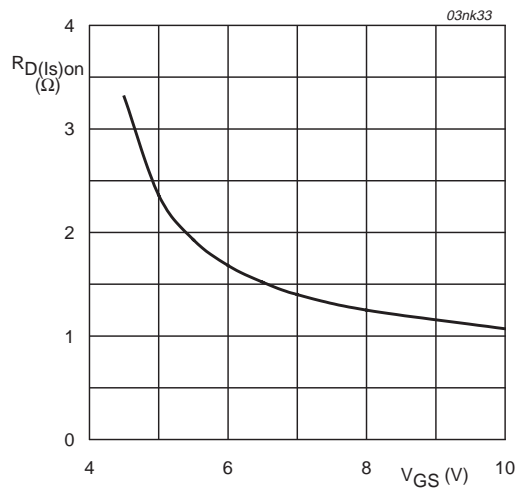
$T_j = 25\text{ °C}; I_D = 25\text{ A}$

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



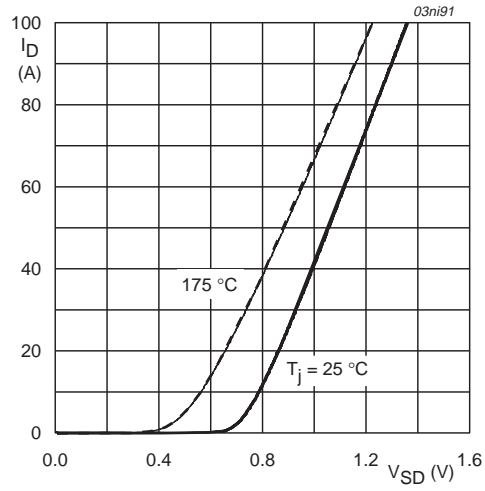
$I_D = 50\text{ A}; R_{sense} = 0\text{ }\Omega$

Fig 15. Drain-sense current ratio as a function of gate-source voltage; typical values.



$I_{sense} = 25\text{ mA}$

Fig 16. Drain- I_{sense} on-state resistance as function of gate-source voltage; typical values.



$V_{GS} = 0\text{ V}$

Fig 17. Drain current as a function of source-drain diode voltage; typical values.

7. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 5-lead TO-220

SOT263B

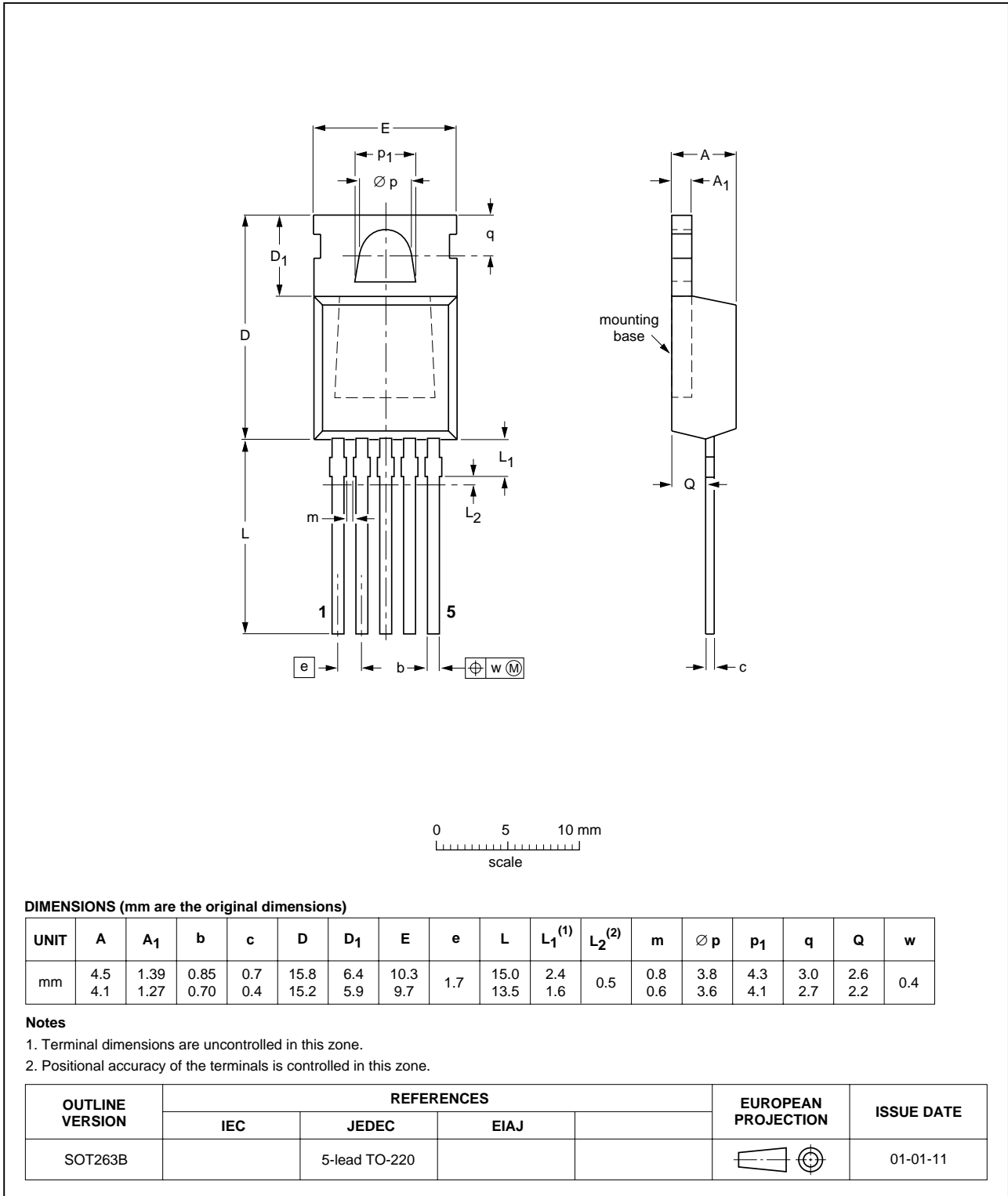


Fig 18. SOT263B (TO-220).

8. Revision history

Table 6: Revision history

Rev	Date	CPCN	Description
01	20040209	-	Product data; initial version

9. Data sheet status

Level	Data sheet status ^[1]	Product status ^{[2][3]}	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
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