

BUK7L11-34ARC

TrenchPLUS standard level FET

Rev. 04 — 16 December 2005

Product data sheet

1. Product profile

1.1 General description

N-channel enhancement mode field-effect power transistor in a plastic package using Philips General-Purpose Automotive (GPA) TrenchMOS technology.

1.2 Features

- ESD and clamping diodes
- 175 °C rated
- Q101 compliant
- Internal gate resistor

1.3 Applications

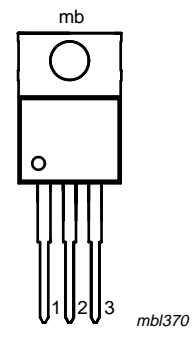
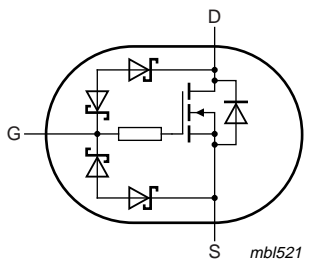
- Automotive systems
- Motors, lamps and solenoids
- General purpose power switching
- 12 V loads

1.4 Quick reference data

- $E_{DS(CL)S} \leq 465$ mJ
- $I_D \leq 75$ A
- $R_{DS(on)} = 8$ m Ω (typ)
- $P_{tot} \leq 172$ W

2. Pinning information

Table 1: Pinning

Pin	Description	Simplified outline	Symbol
1	gate (G)		
2	drain (D)		
3	source (S)		
mb	mounting base; connected to drain (D)		

SOT78C (TO-220)

PHILIPS

3. Ordering information

Table 2: Ordering information

Type number	Package		Version
	Name	Description	
BUK7L11-34ARC	3-lead TO-220	Plastic single-ended package; heatsink mounted; 1 mounting hole; 3 leads	SOT78C

4. Limiting values

Table 3: Limiting values

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

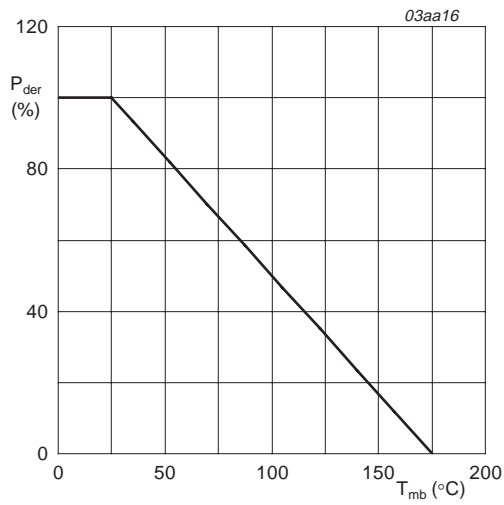
Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage (DC)		[1] -	34	V
V_{DGR}	drain-gate voltage (DC)	$R_{GS} = 20 \text{ k}\Omega$	[1] -	34	V
V_{GS}	gate-source voltage (DC)		-	± 20	V
I_D	drain current (DC)	$T_{mb} = 25 \text{ }^\circ\text{C}$; $V_{GS} = 10 \text{ V}$; Figure 2 and 3	[2] [4] -	89	A
			[3] -	75	A
		$T_{mb} = 100 \text{ }^\circ\text{C}$; $V_{GS} = 10 \text{ V}$; Figure 2	-	63	A
I_{DM}	peak drain current	$T_{mb} = 25 \text{ }^\circ\text{C}$; pulsed; $t_p \leq 10 \text{ }\mu\text{s}$; Figure 3	-	358	A
P_{tot}	total power dissipation	$T_{mb} = 25 \text{ }^\circ\text{C}$; Figure 1	-	172	W
$I_{DG(CL)}$	drain-gate clamping current	$t_p = 5 \text{ ms}$; $\delta = 0.01$	-	50	mA
$I_{GS(CL)}$	gate-source clamping current	continuous	-	10	mA
		$t_p = 5 \text{ ms}$; $\delta = 0.01$	-	50	mA
T_{stg}	storage temperature		-55	+175	$^\circ\text{C}$
T_j	junction temperature		-55	+175	$^\circ\text{C}$
Source-drain diode					
I_{DR}	reverse drain current (DC)	$T_{mb} = 25 \text{ }^\circ\text{C}$	[2] [4] -	89	A
			[3] -	75	A
I_{DRM}	peak reverse drain current	$T_{mb} = 25 \text{ }^\circ\text{C}$; pulsed; $t_p \leq 10 \text{ }\mu\text{s}$	-	358	A
Avalanche ruggedness					
$E_{DS(CL)S}$	non-repetitive drain-source clamped energy	unclamped inductive load; $I_D = 60 \text{ A}$; $V_{DS} \leq 34 \text{ V}$; $V_{GS} = 10 \text{ V}$; starting at $T_j = 25 \text{ }^\circ\text{C}$	-	465	mJ
Electrostatic discharge					
V_{esd}	electrostatic discharge voltage; all pins	human body model; $C = 100 \text{ pF}$; $R = 1.5 \text{ k}\Omega$	-	8	kV
		human body model; $C = 250 \text{ pF}$; $R = 1.5 \text{ k}\Omega$	-	6	kV

[1] Voltage is limited by clamping.

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

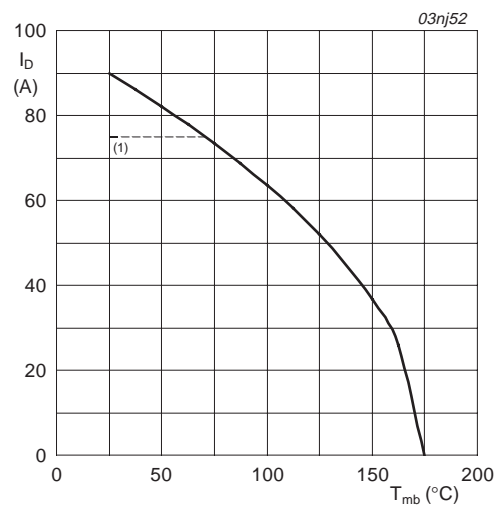
[3] Continuous current is limited by package.

[4] Refer to document 9397 750 12572 for further information.



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

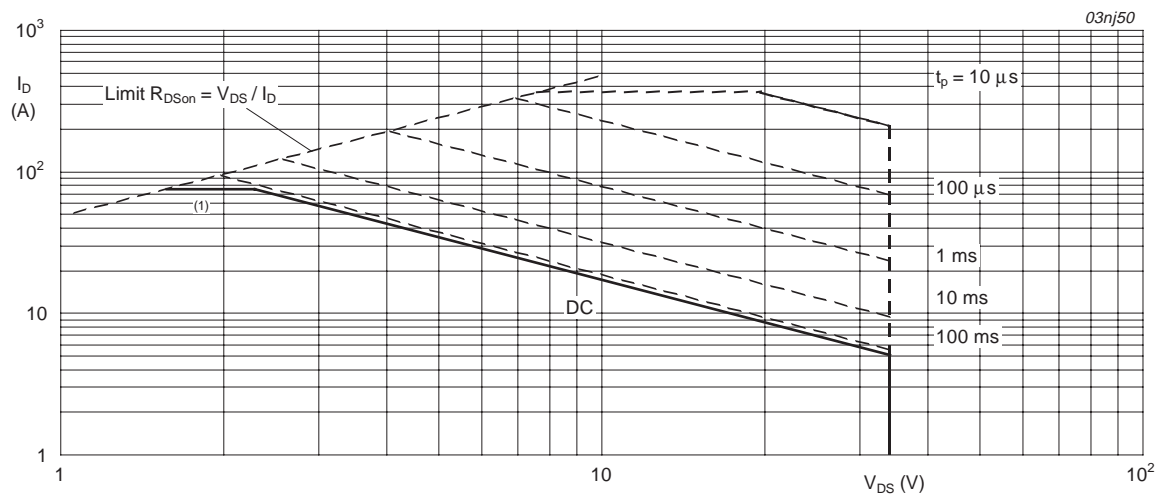
Fig 1. Normalized total power dissipation as a function of mounting base temperature



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

(1) Capped at 75 A due to package.

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



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

(1) Capped at 75 A due to package.

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
$R_{th(j-mb)}$	thermal resistance from junction to mounting base		-	0.55	0.87	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	vertical in free air	-	60	-	K/W

5.1 Transient thermal impedance

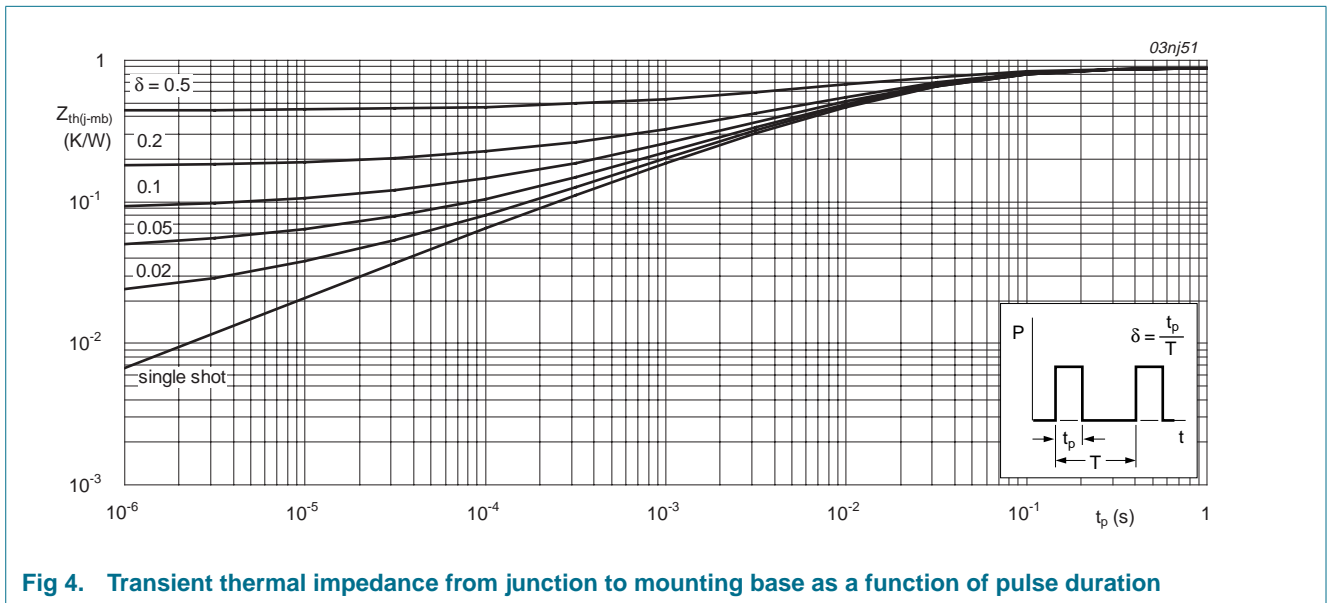


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

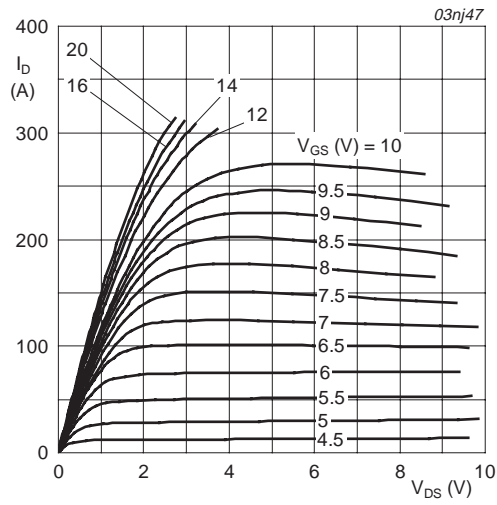
6. Characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
V _{(BR)DG}	drain-gate zener breakdown voltage	I _D = 2 mA; V _{GS} = 0 V				
		T _j = 25 °C	34	-	45	V
		T _j = -55 °C	34	-	45	V
V _{DSR(CL)}	drain-source clamping voltage (DC)	I _{GS(CL)} = -2 mA; I _D = 1 A; Figure 17 and 18	-	41	-	V
V _{GS(th)}	gate-source threshold voltage	I _D = 1 mA; V _{DS} = V _{GS} ; Figure 9 and 10				
		T _j = 25 °C	2.2	3	3.8	V
		T _j = 150 °C	1.5	-	-	V
		T _j = 175 °C	1.2	-	-	V
I _{DSS}	drain-source leakage current	V _{DS} = 16 V; V _{GS} = 0 V				
		T _j = 25 °C	-	0.1	2	μA
		T _j = 150 °C	-	3	50	μA
V _{(BR)GSS}	gate-source breakdown voltage	I _G = ±1 mA; -55 °C < T _j + 175 °C; Figure 18 and 19	20	22	-	V
		T _j = 175 °C	-	18	250	μA
		T _j = -55 °C	-	-	4.2	V
I _{GSS}	gate-source leakage current	V _{GS} = ±10 V; V _{DS} = 0 V				
		T _j = 25 °C	-	5	1000	nA
		T _j = 175 °C	-	-	50	μA
		V _{GS} = 16 V; V _{DS} = 0 V				
R _{DS(on)}	drain-source on-state resistance	V _{GS} = 10 V; I _D = 30 A; Figure 6 and 8				
		T _j = 25 °C	-	8	11	mΩ
		T _j = 175 °C	-	-	20.9	mΩ
R _G	internal gate resistor	V _{GS} = 16 V; I _D = 30 A	-	7	9.7	mΩ
			-	11	-	Ω
Dynamic characteristics						
Q _{g(tot)}	total gate charge	I _D = 25 A; V _{DD} = 27 V; V _{GS} = 10 V; Figure 14	-	53	-	nC
Q _{gs}	gate-source charge		-	11	-	nC
Q _{gd}	gate-drain (Miller) charge		-	20	-	nC
C _{iss}	input capacitance	V _{GS} = 0 V; V _{DS} = 25 V; f = 1 MHz; Figure 12	-	1880	2506	pF
C _{oss}	output capacitance		-	640	768	pF
C _{rss}	reverse transfer capacitance		-	400	548	pF
t _{d(on)}	turn-on delay time	V _{DS} = 30 V; R _L = 1.2 Ω;	-	20	-	ns
t _r	rise time	V _{GS} = 10 V; R _G = 10 Ω	-	92	-	ns
t _{d(off)}	turn-off delay time		-	127	-	ns
t _f	fall time		-	118	-	ns

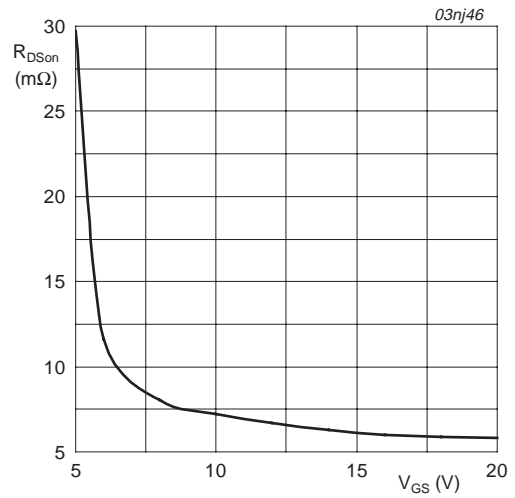
Table 5: Characteristics ...continued
 $T_j = 25^\circ\text{C}$ unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
L_d	internal drain inductance	from drain lead 6 mm from package to center of die	-	4.5	-	nH
		from contact screw on mounting base to center of die	-	3.5	-	nH
L_s	internal source inductance	from source lead to source bonding pad	-	7.5	-	nH
Source-drain diode						
V_{SD}	source-drain (diode forward) voltage	$I_S = 25\text{ A}$; $V_{GS} = 0\text{ V}$; Figure 15	-	0.85	1.2	V
t_{rr}	reverse recovery time	$I_S = 20\text{ A}$; $di_S/dt = -100\text{ A}/\mu\text{s}$; $V_{GS} = 0\text{ V}$; $V_R = 30\text{ V}$	-	52	-	ns
Q_r	recovered charge	$V_{GS} = 0\text{ V}$; $V_R = 30\text{ V}$	-	28	-	nC



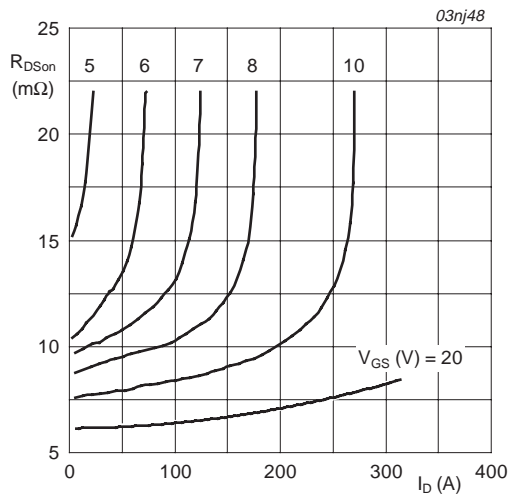
$T_j = 25\text{ }^\circ\text{C}$

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



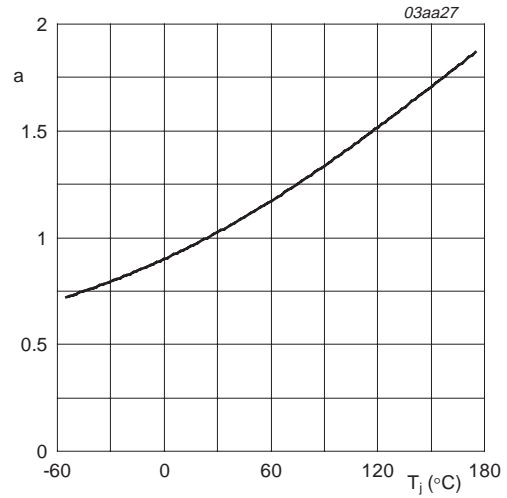
$T_j = 25\text{ }^\circ\text{C}; I_D = 30\text{ A}$

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



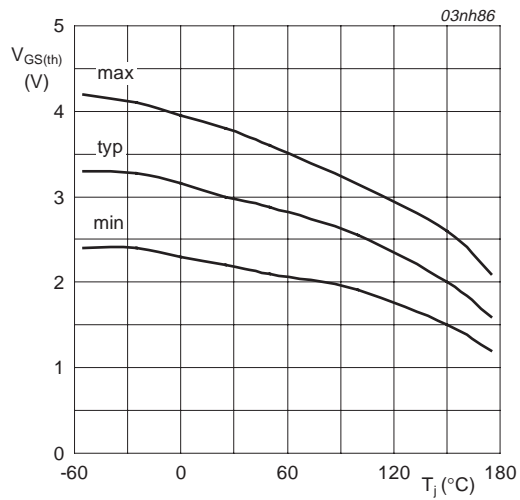
$T_j = 25\text{ }^\circ\text{C}$

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



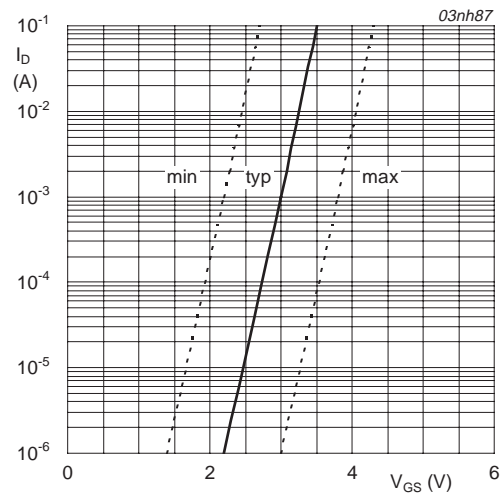
$$a = \frac{R_{DS(on)}}{R_{DS(on)(25\text{ }^\circ\text{C})}}$$

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



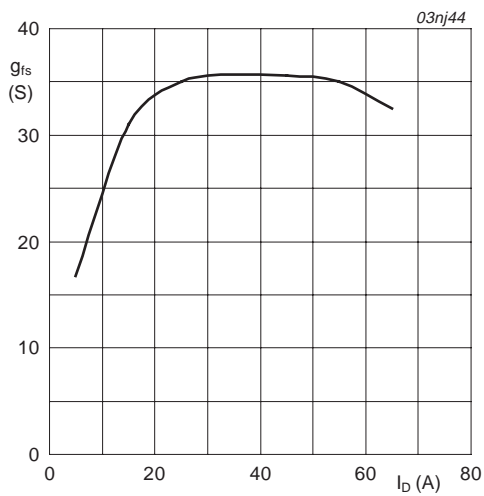
$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$

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



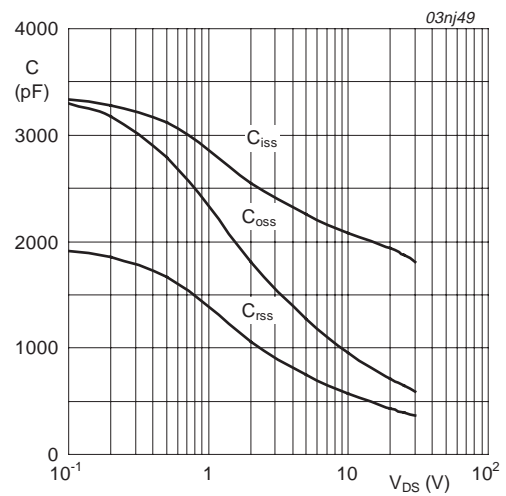
$T_j = 25 \text{ °C}; V_{DS} = V_{GS}$

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



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

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

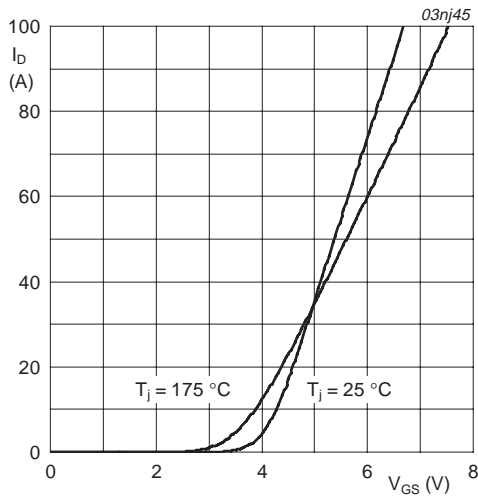


Fig 13. Transfer characteristics: drain current as a function of gate-source voltage; typical values

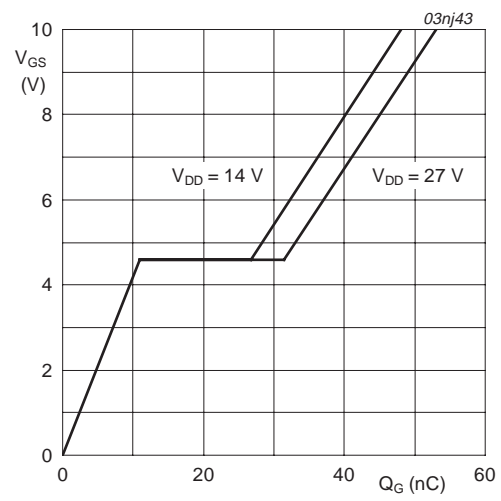


Fig 14. Gate-source voltage as a function of gate charge; typical values

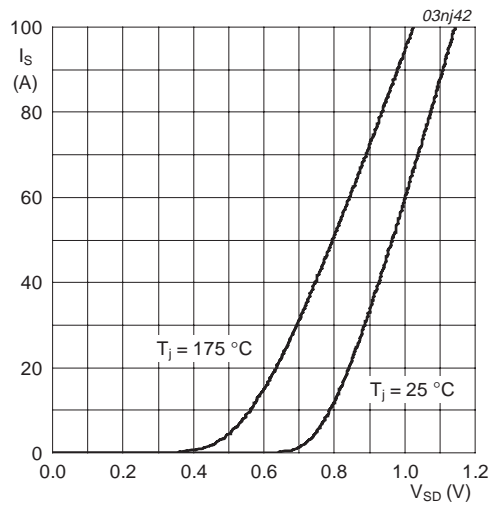


Fig 15. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

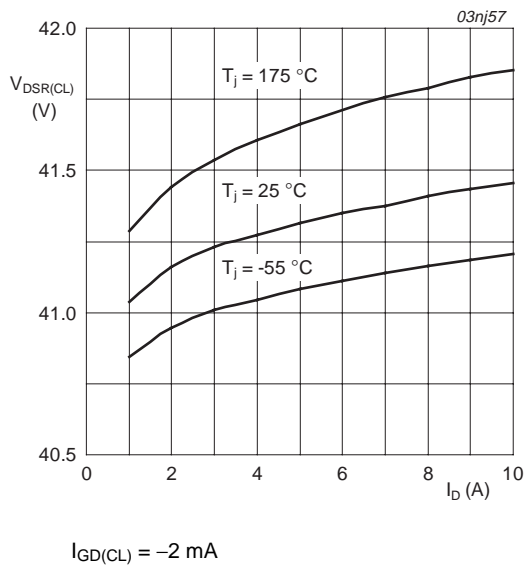


Fig 16. Drain-source clamping voltage as a function of drain current; typical values

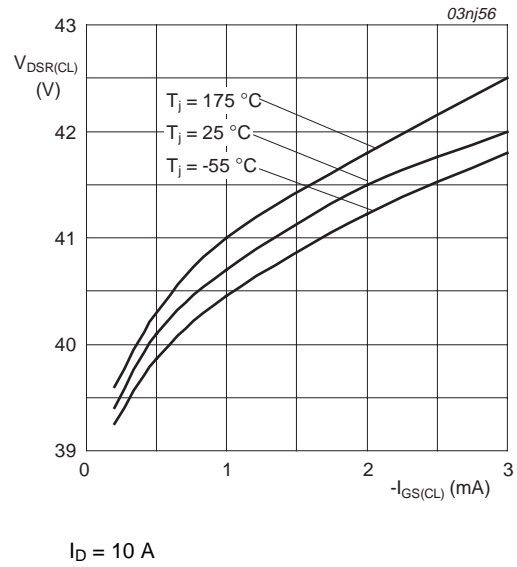


Fig 17. Drain-source clamping voltage as a function of gate-source clamping current; typical values

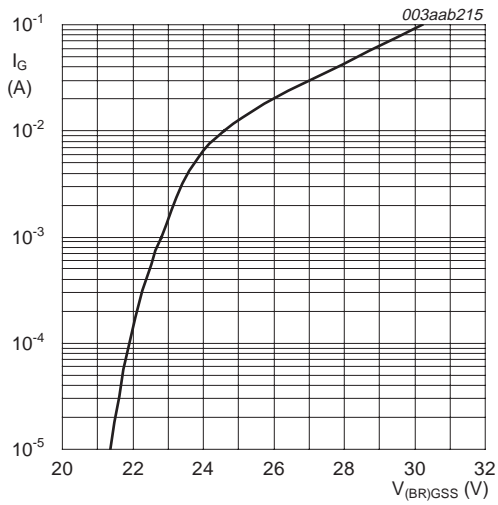
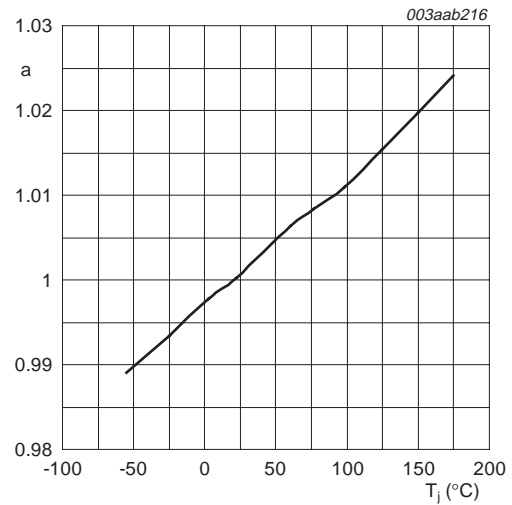


Fig 18. Source-gate clamping current as a function of source-gate clamping voltage; typical values



$$a = \frac{V_{(BR)GSS}}{V_{(BR)GSS(25\text{ }^\circ\text{C})}}$$

Fig 19. Normalized source-gate clamping voltage as a function of junction temperature; typical values

7. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3 leads

SOT78C

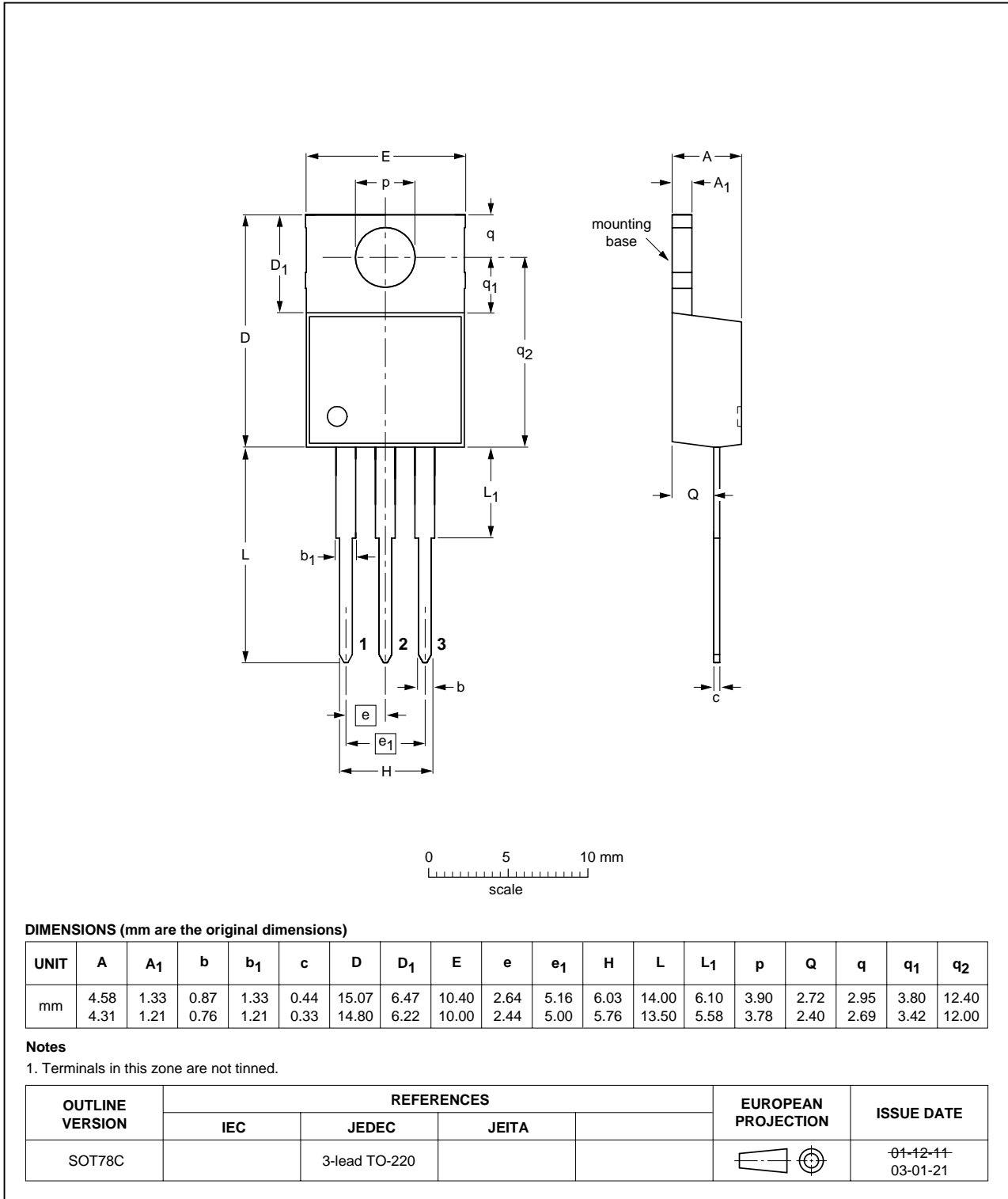


Fig 20. Package outline SOT78C (3-lead TO-220)

8. Revision history

Table 6: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
BUK7L11-34ARC_4	20051216	Product data sheet	-	-	BUK7L11_34ARC-03
Modifications:					<ul style="list-style-type: none"> The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors. Figure 18 and Figure 19 added.
BUK7L11_34ARC-03	20031203	Product data	-	9397 750 12163	BUK7L11_34ARC-02
Modifications:					<ul style="list-style-type: none"> Avalanche ruggedness parameter description in limiting values changed from: 'non-repetitive drain-source avalanche energy' to 'non-repetitive drain-source clamp energy'.
BUK7L11_34ARC-02	20030522	Product data	-	9397 750 11472	BUK7L11_34ARC-01
Modifications:					<ul style="list-style-type: none"> Typical values of I_{DSS} added to characteristics table.
BUK7L11_34ARC-01	20030423	Product data	-	9397 750 11178	-

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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