# BUK7L06-34ARC

## TrenchPLUS standard level FET

Rev. 04 — 13 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

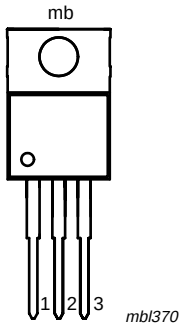
### 1.4 Quick reference data

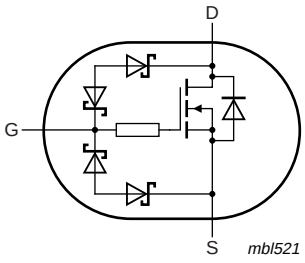
- $E_{DS(CL)S} \leq 1.0$ J
- $I_D \leq 75$ A
- $R_{DSon} = 5.1$ mΩ (typ)
- $P_{tot} \leq 250$ W

## 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)**

## 3. Ordering information

**Table 2: Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| BUK7L06-34ARC | 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 kΩ | [1] | - | 34 | 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 | [2] [4] | - | 147 | A |
| | | | [3] | - | 75 | A |
| | | $T_{mb}$ = 100 °C; $V_{GS}$ = 10 V; Figure 2 | [3] | - | 75 | A |
| $I_{DM}$ | peak drain current | $T_{mb}$ = 25 °C; pulsed; $t_p \leq 10$ µs; Figure 3 | | - | 590 | A |
| $P_{tot}$ | total power dissipation | $T_{mb}$ = 25 °C; Figure 1 | | - | 250 | W |
| $I_{DG(CL)}$ | drain-gate clamping current | $t_p$ = 5 ms; δ = 0.01 | | - | 50 | mA |
| $I_{GS(CL)}$ | gate-source clamping current | continuous | | - | 10 | mA |
| | | $t_p$ = 5 ms; δ = 0.01 | | - | 50 | mA |
| $T_{stg}$ | 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 | [2] [4] | - | 147 | A |
| | | | [3] | - | 75 | A |
| $I_{DRM}$ | peak reverse drain current | $T_{mb}$ = 25 °C; pulsed; $t_p \leq 10$ µs | | - | 590 | A |
| **Avalanche ruggedness** | | | | | | |
| $E_{DS(CL)S}$ | non-repetitive drain-source clamped energy | unclamped inductive load; $I_D$ = 75 A; $V_{DS} \leq 34$ V; $V_{GS}$ = 10 V; starting at $T_j$ = 25 °C | | - | 1.0 | J |
| **Electrostatic discharge** | | | | | | |
| $V_{esd}$ | electrostatic discharge voltage; all pins | human body model; C = 100 pF; R = 1.5 kΩ | | - | 8 | kV |
| | | human body model; C = 250 pF; R = 1.5 kΩ | | - | 8 | kV |

[1] Voltage is limited by clamping

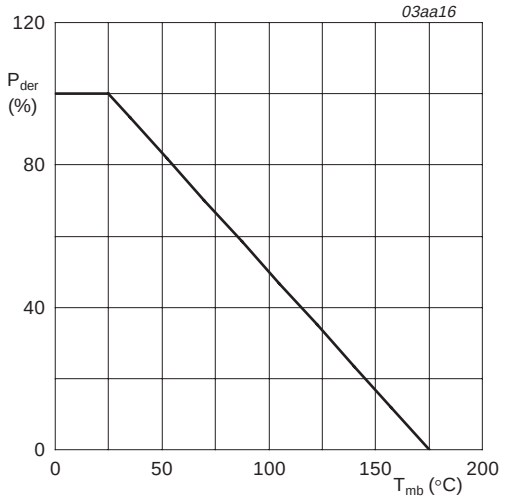
[2] Current is limited by power dissipation chip rating.

[3] Continuous current is limited by package.

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

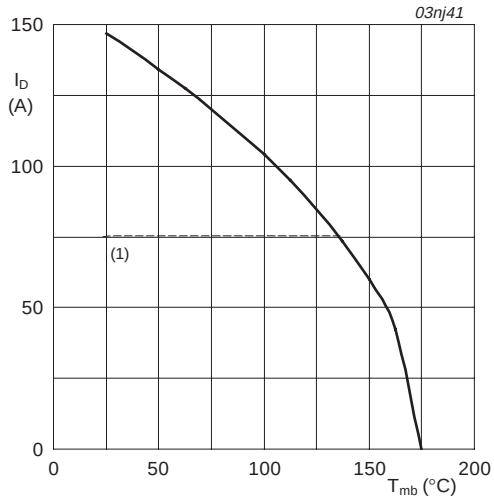


© Koninklijke Philips Electronics N.V. 2005. All rights reserved.




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

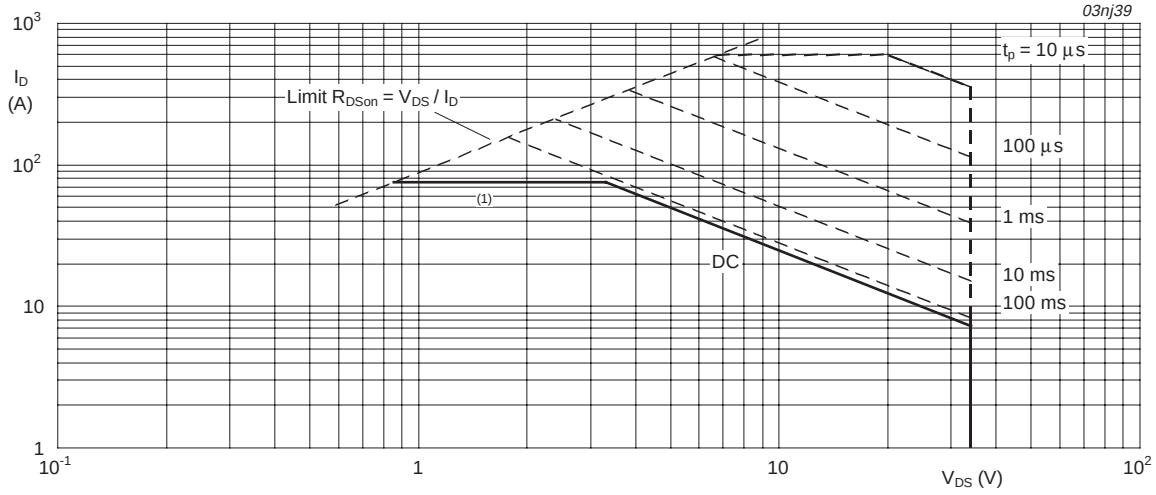
**Fig 1. Normalized total power dissipation as a function of mounting base temperature**




$V_{GS} \geq 10$ V

(1) Capped at 75 A due to package.

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




$T_{mb}$ = 25 °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**



© Koninklijke Philips Electronics N.V. 2005. All rights reserved.

# 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 | | - | 0.33 | 0.6 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | vertical in free air | - | 60 | - | K/W |

## 5.1 Transient thermal impedance

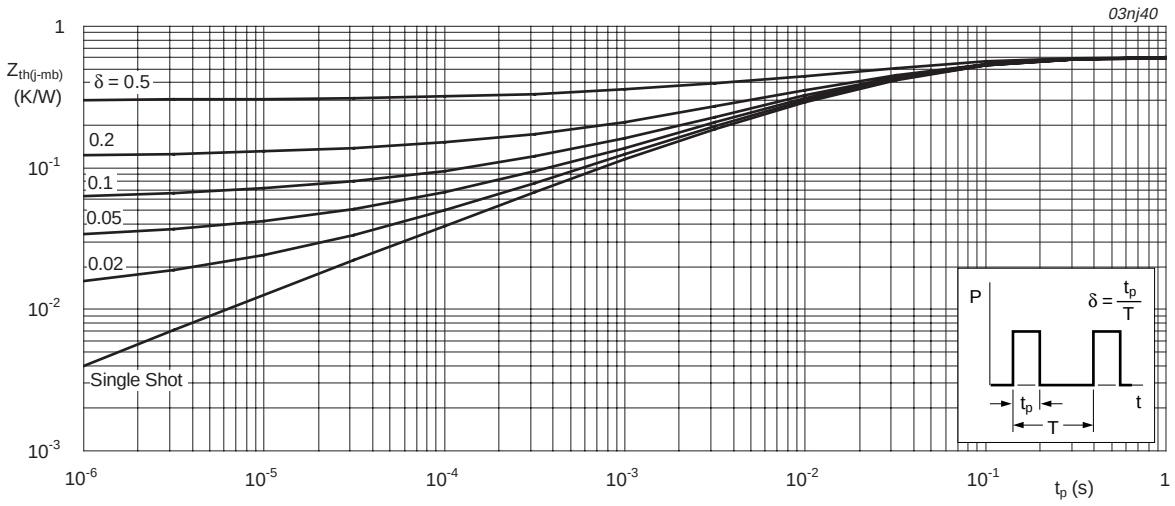



**Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration**


© Koninklijke Philips Electronics N.V. 2005. All rights reserved.

## 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 |
| | | $T_j$ = –55 °C | - | - | 4.2 | 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 | - | 5 | 50 | µA |
| | | $T_j$ = 175 °C | - | 30 | 250 | 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 |
| $I_{GSS}$ | 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 | | | | |
| | | $T_j$ = 175 °C | - | - | 150 | µA |
| $R_{DSon}$ | drain-source on-state resistance | $V_{GS}$ = 10 V; $I_D$ = 30 A; Figure 6 and 8 | | | | |
| | | $T_j$ = 25 °C | - | 5.1 | 6 | mΩ |
| | | $T_j$ = 175 °C | - | - | 11.4 | mΩ |
| | | $V_{GS}$ = 16 V; $I_D$ = 30 A | - | 4.0 | 5.3 | mΩ |
| $R_G$ | Internal gate resistor | | - | 11 | - | Ω |
| **Dynamic characteristics** | | | | | | |
| $Q_{g(tot)}$ | total gate charge | $I_D$ = 25 A; $V_{DD}$ = 27 V; $V_{GS}$ = 10 V; Figure 14 | - | 82 | - | nC |
| $Q_{gs}$ | gate-source charge | | - | 15 | - | nC |
| $Q_{gd}$ | gate-drain (Miller) charge | | - | 31 | - | nC |
| $C_{iss}$ | input capacitance | $V_{GS}$ = 0 V; $V_{DS}$ = 25 V; f = 1 MHz; Figure 12 | - | 3400 | 4533 | pF |
| $C_{oss}$ | output capacitance | | - | 1080 | 1296 | pF |
| $C_{rss}$ | reverse transfer capacitance | | - | 660 | 904 | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS}$ = 30 V; $R_L$ = 1.2 Ω; $V_{GS}$ = 10 V; $R_G$ = 10 Ω | - | 27 | - | ns |
| $t_r$ | rise time | | - | 108 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 196 | - | ns |
| $t_f$ | fall time | | - | 167 | - | ns |


© Koninklijke Philips Electronics N.V. 2005. All rights reserved.

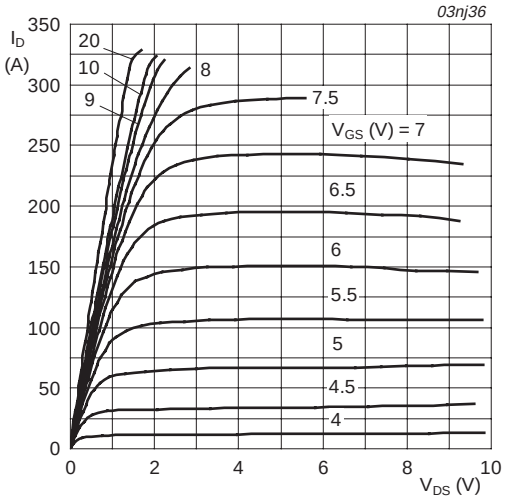
**Table 5: Characteristics** *...continued*

*$T_j$ = 25 °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 bond pad | - | 7.5 | - | nH |
| **Source-drain diode** | | | | | | |
| $V_{SD}$ | source-drain (diode forward) voltage | $I_S$ = 25 A; $V_{GS}$ = 0 V; Figure 15 | - | 0.85 | 1.2 | V |
| $t_{rr}$ | reverse recovery time | $I_S$ = 20 A; $dI_S/dt$ = –100 A/µs; $V_{GS}$ = 0 V; $V_R$ = 30 V | - | 62 | - | ns |
| $Q_r$ | recovered charge | | - | 44 | - | nC |

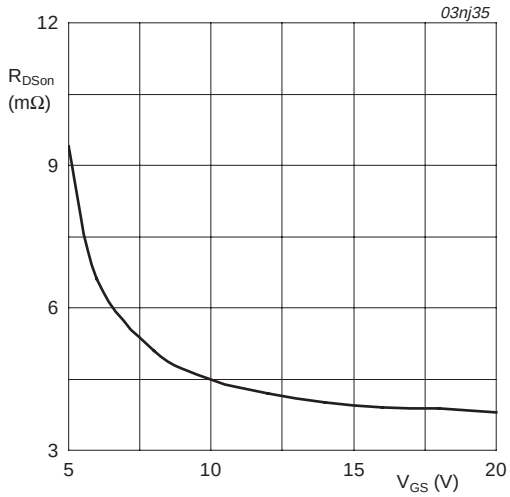


© Koninklijke Philips Electronics N.V. 2005. All rights reserved.



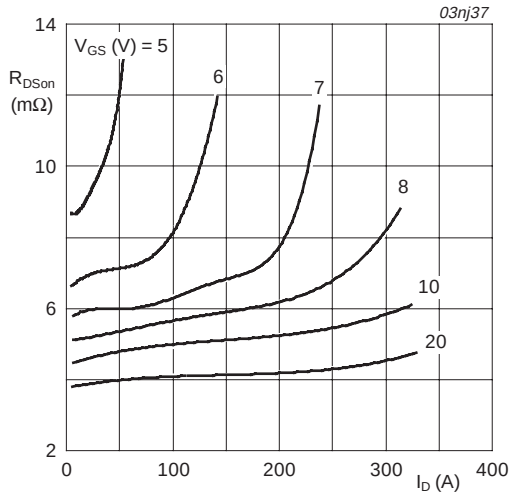

$T_j$ = 25 °C

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



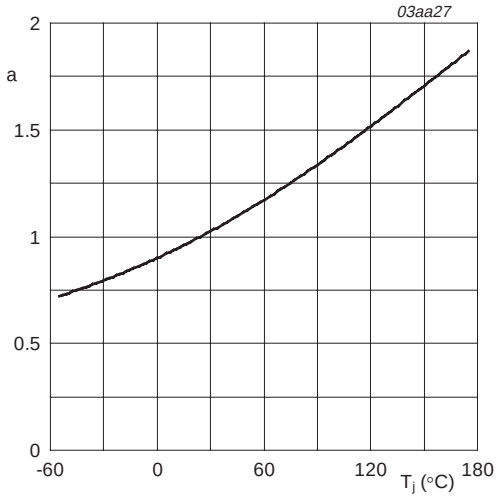

$T_j$ = 25 °C; $I_D$ = 30 A

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




$T_j$ = 25 °C

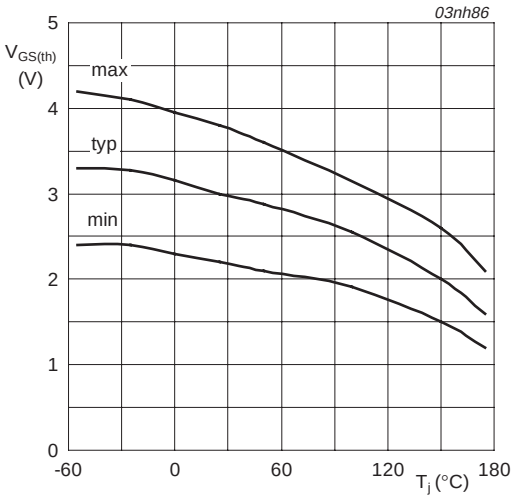
**Fig 7. Drain-source on-state resistance as a function of drain current; typical values**




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

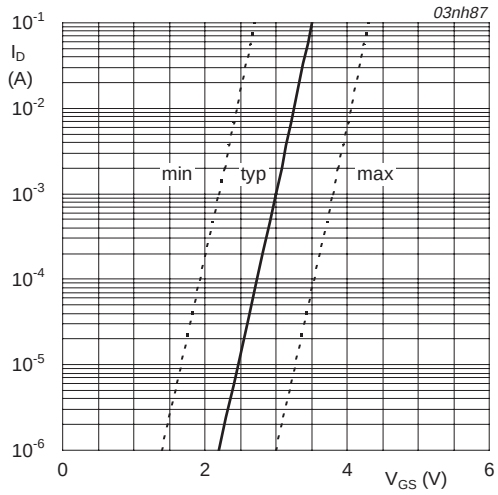
**Fig 8. Normalized drain-source on-state resistance factor as a function of junction temperature**


© Koninklijke Philips Electronics N.V. 2005. All rights reserved.



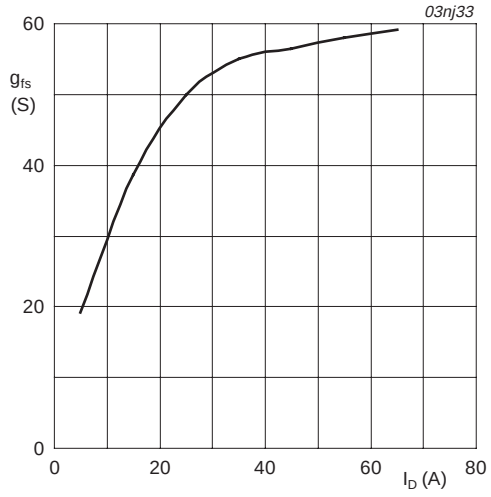

$I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$

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



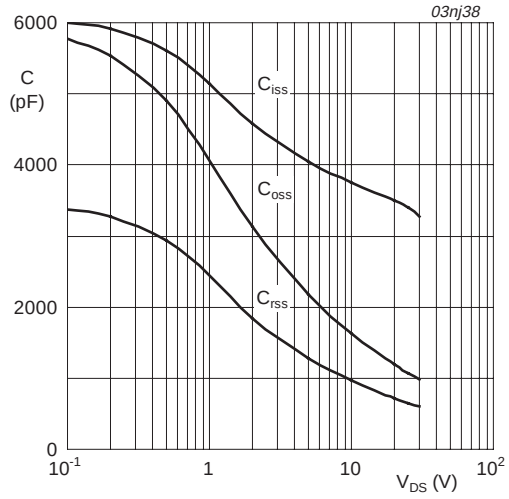

$T_j$ = 25 °C; $V_{DS}$ = $V_{GS}$

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




$T_j$ = 25 °C; $V_{DS}$ = 25 V

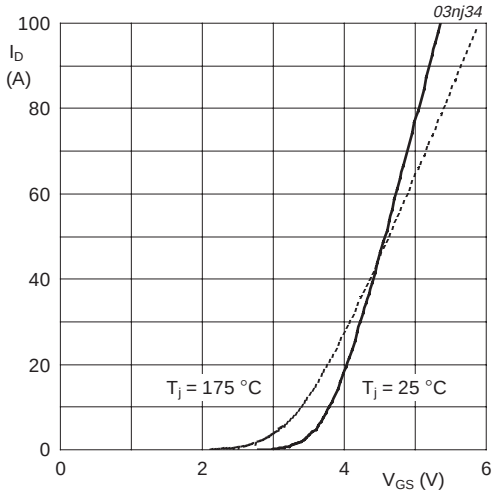
**Fig 11. Forward transconductance as a function of drain current; typical values**




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

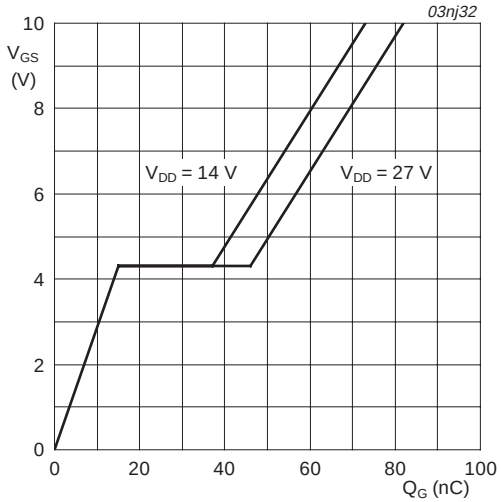
**Fig 12. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values**


© Koninklijke Philips Electronics N.V. 2005. All rights reserved.



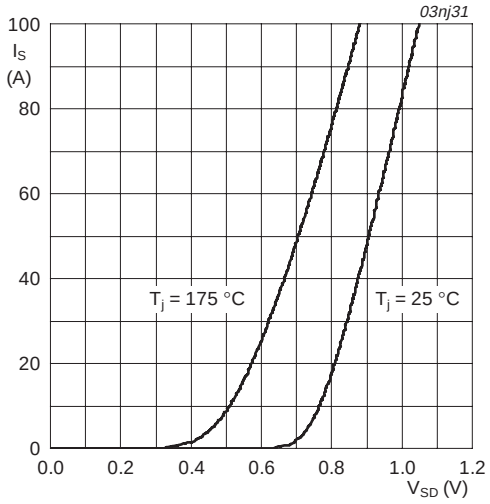

$V_{DS}$ = 25 V

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




$T_j$ = 25 °C; $I_D$ = 25 A

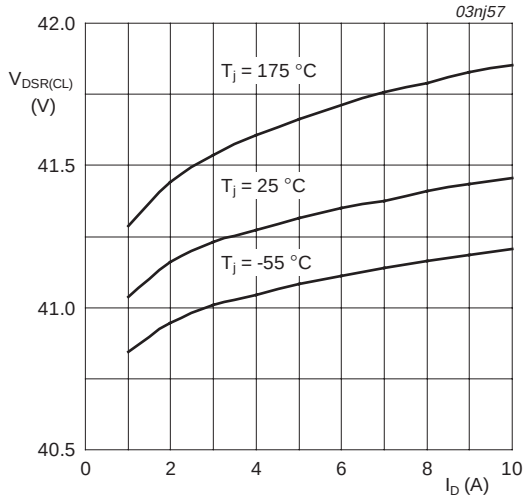
**Fig 14. Gate-source voltage as a function of gate charge; typical values**




$V_{GS}$ = 0 V

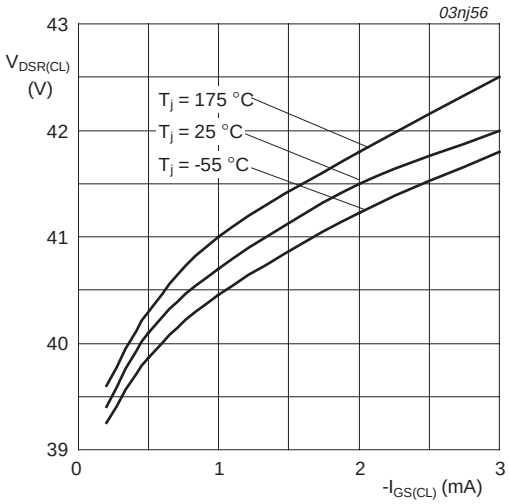
**Fig 15. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values**


© Koninklijke Philips Electronics N.V. 2005. All rights reserved.




$I_{GD(CL)}$ = –2 mA

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




$I_D$ = 10 A

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

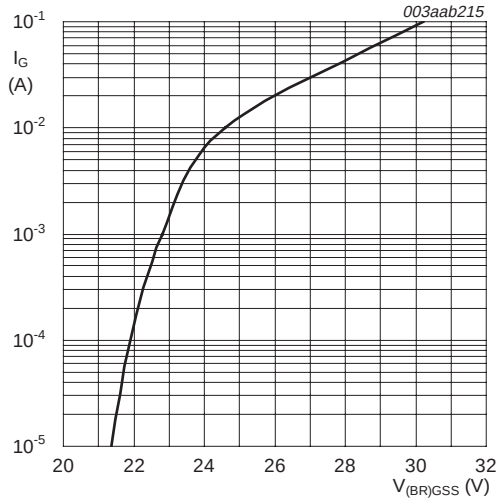
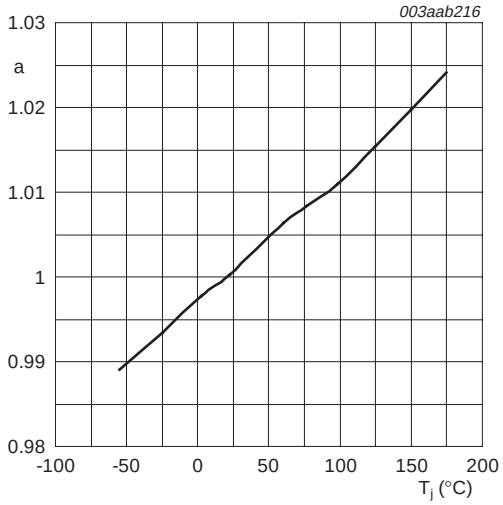



**Fig 18. Source-gate clamping current as a function of source-gate clamping voltage; typical values**



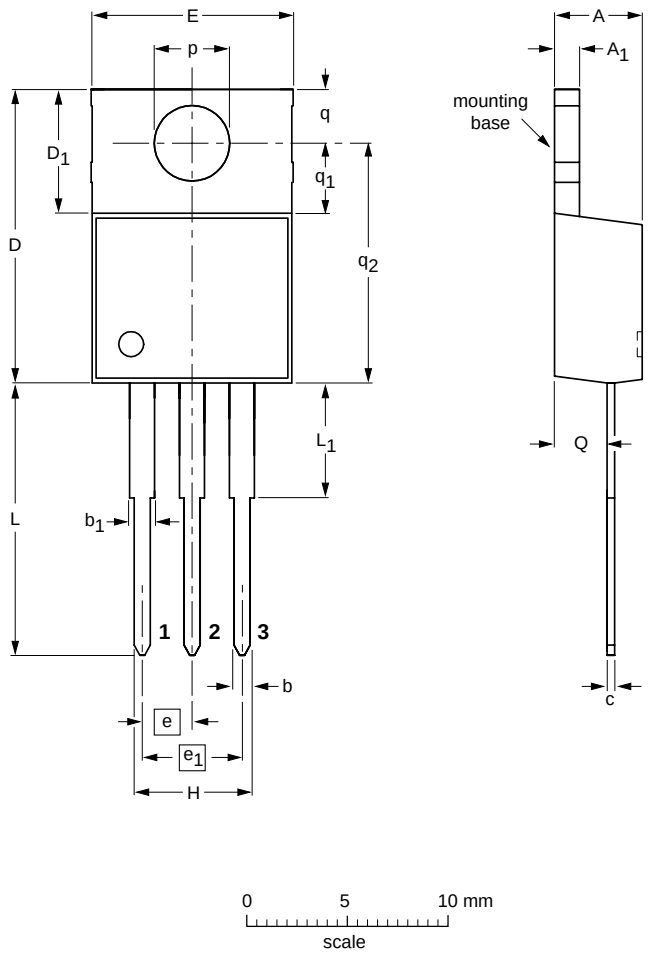

$$a = \frac{V_{(BR)GSS}}{V_{(BR)GSS(25\ ^\circ C)}}$$

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


© Koninklijke Philips Electronics N.V. 2005. All rights reserved.

## 7. Package outline

**Plastic single-ended package; heatsink mounted; 1 mounting hole; 3 leads** **SOT78C**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A | $A_1$ | b | $b_1$ | c | D | $D_1$ | E | e | $e_1$ | H | L | $L_1$ | p | Q | q | $q_1$ | $q_2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 4.58<br>4.31 | 1.33<br>1.21 | 0.87<br>0.76 | 1.33<br>1.21 | 0.44<br>0.33 | 15.07<br>14.80 | 6.47<br>6.22 | 10.40<br>10.00 | 2.64<br>2.44 | 5.16<br>5.00 | 6.03<br>5.76 | 14.00<br>13.50 | 6.10<br>5.58 | 3.90<br>3.78 | 2.72<br>2.40 | 2.95<br>2.69 | 3.80<br>3.42 | 12.40<br>12.00 |

**Notes**

1. Terminals in this zone are not tinned.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT78C | | 3-lead TO-220 | | | | ~~01-12-11~~<br>03-01-21 |

**Fig 20. Package outline SOT78C (TO-220)**


© Koninklijke Philips Electronics N.V. 2005. All rights reserved.

## 8. Revision history

**Table 6: Revision history**

| Document ID | Release date | Data sheet status | Change notice | Doc. number | Supersedes |
|---|---|---|---|---|---|
| BUK7L06-34ARC_4 | 20051213 | Product data sheet | - | - | BUK7L06_34ARC-03 |
| Modifications: | • The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors.<br>• Figure 18 and Figure 19 added. | | | | |
| BUK7L06_34ARC-03 | 20031203 | Product data sheet | - | 9397 750 12162 | BUK7L06_34ARC-02 |
| Modifications: | • Avalanche ruggedness parameter description in limiting values changed from: ‘non-repetitive drain-source avalanche energy’ to ‘non-repetitive drain-source clamp energy’. | | | | |
| BUK7L06_34ARC-02 | 20030521 | Product data sheet | - | 9397 750 11471 | BUK7L06_34ARC-01 |
| Modifications: | • Typical values of $I_{DSS}$ added to characteristics table. | | | | |
| BUK7L06_34ARC-01 | 20030414 | Product data sheet | - | 9397 750 11177 | |


© Koninklijke Philips Electronics N.V. 2005. All rights reserved.

## 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. |
| II | Preliminary data | Qualification | This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product. |
| III | Product data | Production | This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN). |

[1] Please consult the most recently issued data sheet before initiating or completing a design.

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL http://www.semiconductors.philips.com.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

## 10. Definitions

**Short-form specification —** The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

**Limiting values definition —** Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

**Application information —** Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

## 11. Disclaimers

**Life support —** These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips Semiconductors customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips Semiconductors for any damages resulting from such application.

**Right to make changes —** Philips Semiconductors reserves the right to make changes in the products - including circuits, standard cells, and/or software - described or contained herein in order to improve design and/or performance. When the product is in full production (status 'Production'), relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN). Philips Semiconductors assumes no responsibility or liability for the use of any of these products, conveys no licence or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified.

## 12. Trademarks

**Notice —** All referenced brands, product names, service names and trademarks are the property of their respective owners.
**TrenchMOS —** is a trademark of Koninklijke Philips Electronics N.V.

## 13. Contact information

For additional information, please visit: **http://www.semiconductors.philips.com**

For sales office addresses, send an email to: **sales.addresses@www.semiconductors.philips.com**


© Koninklijke Philips Electronics N.V. 2005. All rights reserved.

## 14. Contents


| | | |
|---|---|---|
| **1** | **Product profile** | **1** |
| 1.1 | General description | 1 |
| 1.2 | Features | 1 |
| 1.3 | Applications | 1 |
| 1.4 | Quick reference data | 1 |
| **2** | **Pinning information** | **1** |
| **3** | **Ordering information** | **2** |
| **4** | **Limiting values** | **2** |
| **5** | **Thermal characteristics** | **4** |
| 5.1 | Transient thermal impedance | 4 |
| **6** | **Characteristics** | **5** |
| **7** | **Package outline** | **11** |
| **8** | **Revision history** | **12** |
| **9** | **Data sheet status** | **13** |
| **10** | **Definitions** | **13** |
| **11** | **Disclaimers** | **13** |
| **12** | **Trademarks** | **13** |
| **13** | **Contact information** | **13** |


**© Koninklijke Philips Electronics N.V. 2005**

All rights are reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent- or other industrial or intellectual property rights.

**Date of release: 13 December 2005**

**Document number: BUK7L06-34ARC_4**

**Published in The Netherlands**

ENTEGRECİ

Bu belge www.entegreci.com üzerinden sunulmaktadır.

# Elektronik komponent tedarikinde Entegreci

Entegreci, Eskişehir merkezli, Türkiye geneline satış yapan bir elektronik komponent mağazasıdır. Entegreler (IC), mikrodenetleyiciler, transistörler, diyotlar, pasif elemanlar, konnektörler, modüller ve geliştirme kartları tek adetten seri üretim adetlerine kadar satılır. Ürün sayfalarında güncel stok durumunu, fiyatı ve datasheet bağlantısını bulabilirsiniz.

### Parça koduyla arama

Üretici parça numarasını yazın; stok ve fiyatı hemen görün.

**www.entegreci.com**

### Ürün kategorileri

Entegreden kapasitöre tüm elektronik komponent kategorileri.

**Kategorilere göz atın**

### Üreticiler

Aradığınız üreticinin ürünlerini tek sayfada inceleyin.

**Üreticileri görün**

### Toplu alım ve teklif

Listede olmayan ya da yüksek adetli parçalar için teklif isteyin.

**Teklif isteyin**

**www.entegreci.com** | **destek@entegreci.com** | **0850 305 90 34**

Entegreci is an online electronic components store based in Türkiye. Search by manufacturer part number to see stock, prices and datasheets for integrated circuits, microcontrollers, transistors, passive components and connectors, or request a quote for parts that are not listed.

Bu sayfa Entegreci tarafından eklenmiştir. Belgenin önceki sayfaları asıl yayıncısına aittir ve içeriği değiştirilmemiştir; en güncel sürüm için belgenin yayıncısına başvurun.