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PHK31NQ03LT

N-channel TrenchMOS logic level FET

Rev. 3 — 11 March 2011

Product data sheet

1. Product profile

1.1 General description

Logic level N-channel enhancement mode Field-Effect Transistor (FET) in a plastic package using TrenchMOS technology. This product is designed and qualified for use in computing, communications, consumer and industrial applications only.

1.2 Features and benefits

- High efficiency due to low switching and conduction losses
- Suitable for logic level gate drive sources

1.3 Applications

- DC-to-DC converters
- Switched-mode power supplies
- Notebook computers
- Voltage regulators

1.4 Quick reference data

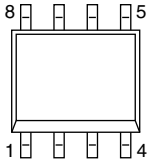
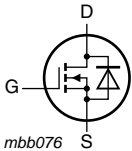
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 150\text{ °C}$	-	-	30	V
I_D	drain current	$T_{sp} = 25\text{ °C}; V_{GS} = 10\text{ V};$ see Figure 1 ; see Figure 3	-	-	30.4	A
P_{tot}	total power dissipation	$T_{sp} = 25\text{ °C};$ see Figure 2	-	-	6.9	W
Static characteristics						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 25\text{ A};$ $T_j = 25\text{ °C};$ see Figure 10 ; see Figure 11	-	3.45	4.4	m Ω
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 4.5\text{ V}; I_D = 25\text{ A};$ $V_{DS} = 12\text{ V};$ see Figure 12 ; see Figure 13	-	7.7	-	nC



2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source	 <p>SOT96-1 (SO8)</p>	 <p>mbb076</p>
2	S	source		
3	S	source		
4	G	gate		
5	D	drain		
6	D	drain		
7	D	drain		
8	D	drain		

3. Ordering information

Table 3. Ordering information

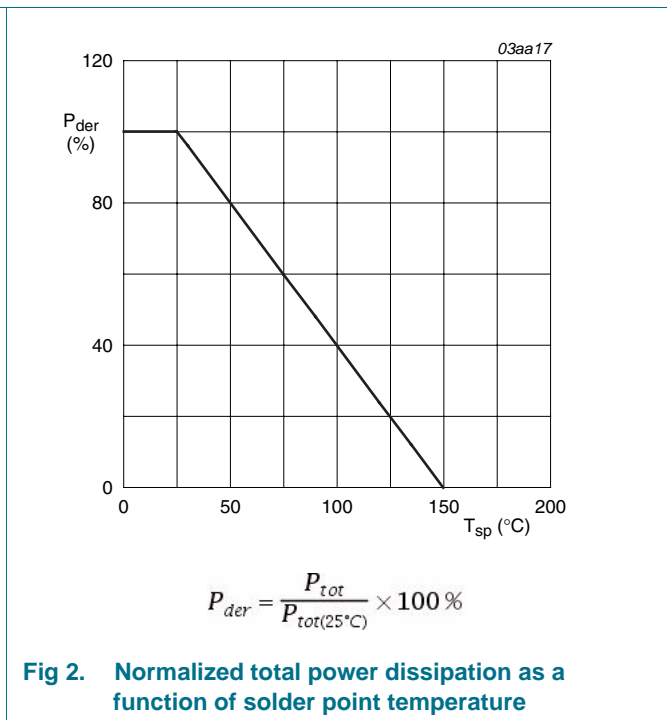
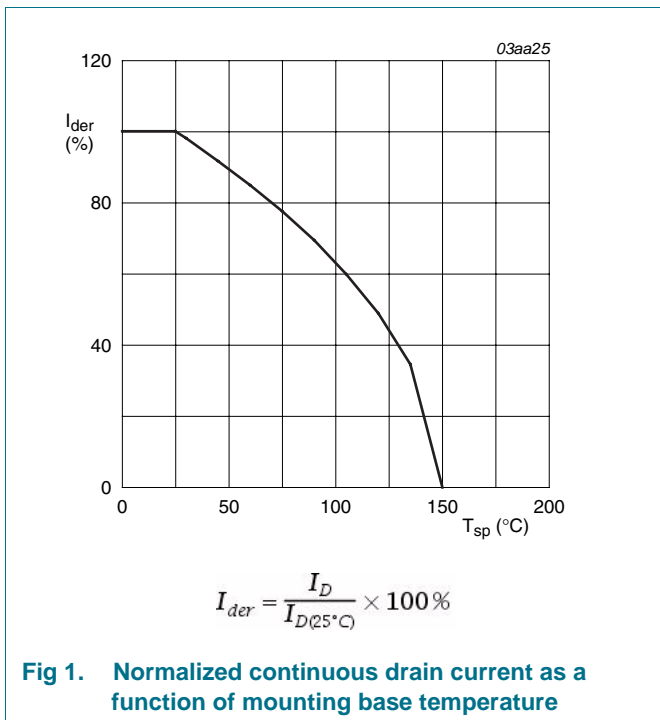
Type number	Package		
	Name	Description	Version
PHK31NQ03LT	SO8	plastic small outline package; 8 leads; body width 3.9 mm	SOT96-1

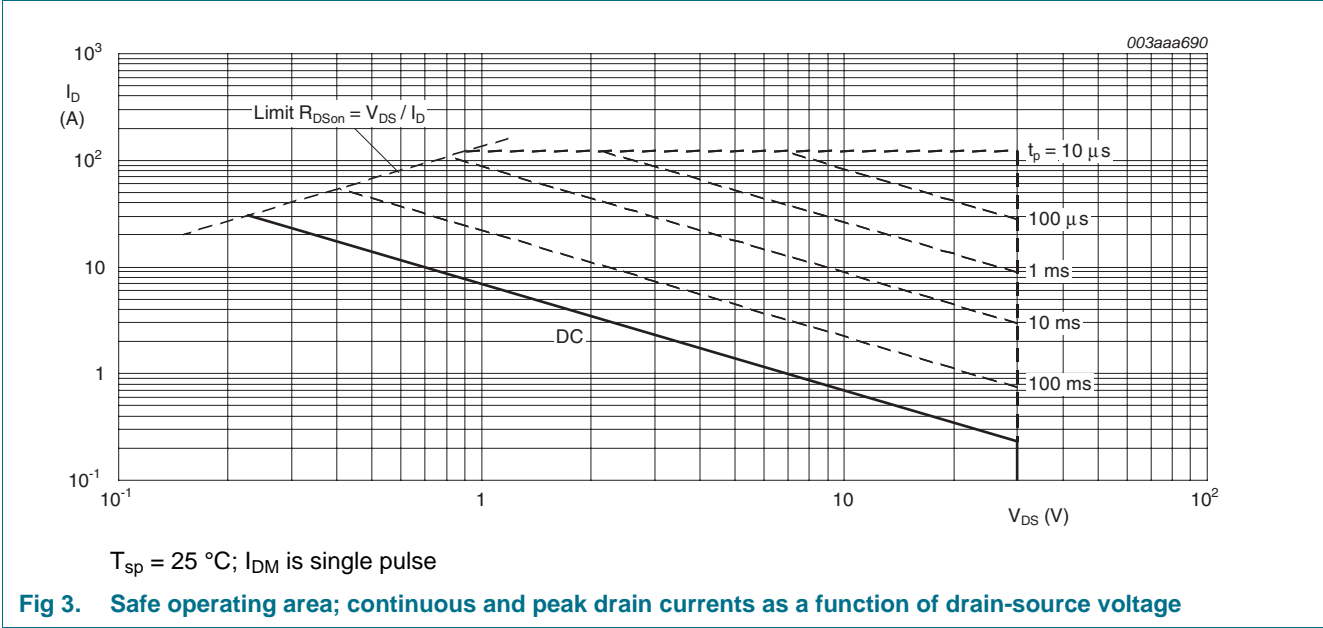
4. Limiting values

Table 4. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V _{DS}	drain-source voltage	T _j ≥ 25 °C; T _j ≤ 150 °C	-	30	V
V _{DGR}	drain-gate voltage	T _j ≥ 25 °C; T _j ≤ 150 °C; R _{GS} = 20 kΩ	-	30	V
V _{GS}	gate-source voltage		-20	20	V
I _D	drain current	T _{sp} = 25 °C; V _{GS} = 10 V; see Figure 1 ; see Figure 3	-	30.4	A
		T _{sp} = 100 °C; V _{GS} = 10 V; see Figure 1	-	17.2	A
I _{DM}	peak drain current	T _{sp} = 25 °C; pulsed; t _p ≤ 10 μs; see Figure 3	-	121.8	A
P _{tot}	total power dissipation	T _{sp} = 25 °C; see Figure 2	-	6.9	W
T _{stg}	storage temperature		-55	150	°C
T _j	junction temperature		-55	150	°C
Source-drain diode					
I _S	source current	T _{sp} = 25 °C	-	5.7	A
I _{SM}	peak source current	T _{sp} = 25 °C; pulsed; t _p ≤ 10 μs	-	23.1	A
Avalanche ruggedness					
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	V _{GS} = 10 V; T _{j(init)} = 25 °C; I _D = 35 A; V _{sup} ≤ 25 V; unclamped; t _p = 0.16 ms; R _{GS} = 50 Ω	-	120	mJ

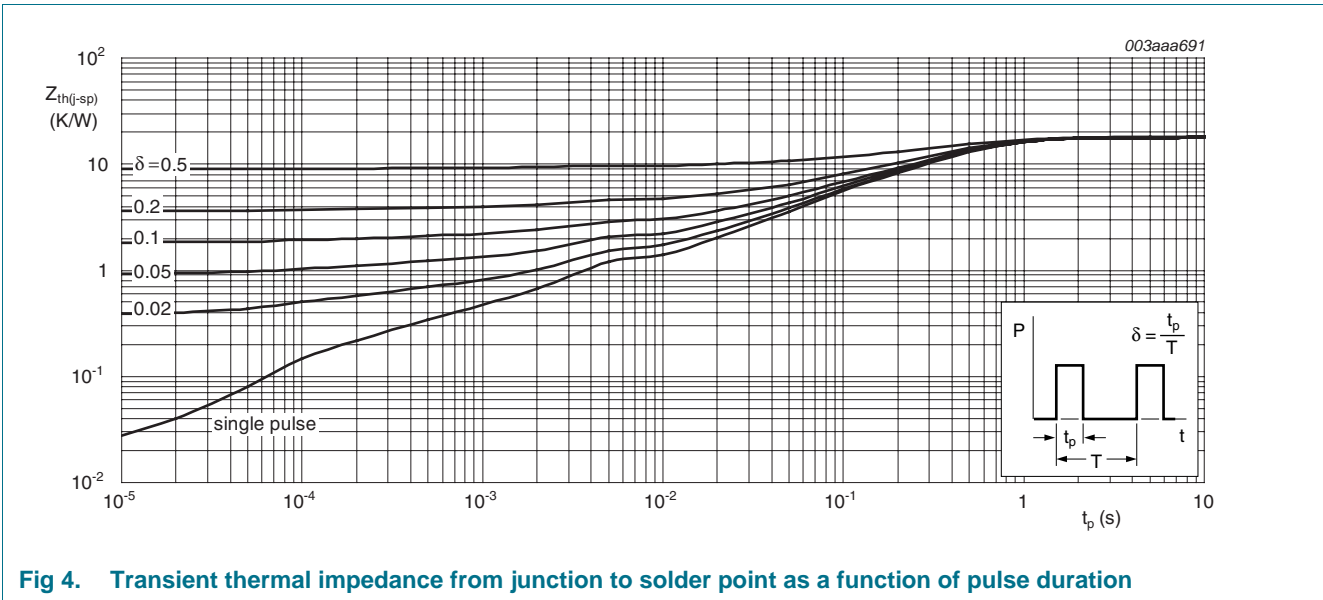




5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	-	18	K/W



6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	30	-	-	V
		$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 \text{ }^\circ C$	27	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ C$; see Figure 8 ; see Figure 9	1.3	1.7	2.15	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 150 \text{ }^\circ C$; see Figure 8 ; see Figure 9	0.8	-	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ C$; see Figure 8 ; see Figure 9	-	-	2.6	V
I_{DSS}	drain leakage current	$V_{DS} = 30 V; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	-	-	1	μA
		$V_{DS} = 30 V; V_{GS} = 0 V; T_j = 150 \text{ }^\circ C$	-	-	100	μA
I_{GSS}	gate leakage current	$V_{GS} = 16 V; V_{DS} = 0 V; T_j = 25 \text{ }^\circ C$	-	-	100	nA
		$V_{GS} = -16 V; V_{DS} = 0 V; T_j = 25 \text{ }^\circ C$	-	-	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10 V; I_D = 25 A; T_j = 25 \text{ }^\circ C$; see Figure 10 ; see Figure 11	-	3.45	4.4	m Ω
		$V_{GS} = 10 V; I_D = 25 A; T_j = 150 \text{ }^\circ C$; see Figure 10	-	5.85	7.5	m Ω
		$V_{GS} = 4.5 V; I_D = 25 A; T_j = 25 \text{ }^\circ C$; see Figure 10 ; see Figure 11	-	4.25	5.6	m Ω
R_G	gate resistance	$f = 1 \text{ MHz}; V_{GSS(AC)} = 150 \text{ mV}$	-	1.2	-	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 25 A; V_{DS} = 12 V; V_{GS} = 4.5 V$; see Figure 12 ; see Figure 13	-	33	-	nC
Q_{GS}	gate-source charge		-	13.6	-	nC
Q_{GS1}	pre-threshold gate-source charge		-	6.5	-	nC
Q_{GS2}	post-threshold gate-source charge		-	7.1	-	nC
Q_{GD}	gate-drain charge		-	7.7	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$I_D = 25 A; V_{DS} = 12 V$; see Figure 12	-	2.85	-	V
C_{iss}	input capacitance	$V_{DS} = 0 V; V_{GS} = 0 V; f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ C$	-	4900	-	pF
		$V_{DS} = 12 V; V_{GS} = 0 V; f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ C$; see Figure 14	-	4235	-	pF
C_{oss}	output capacitance		-	840	-	pF
C_{rss}	reverse transfer capacitance		-	370	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 12 V; R_L = 0.5 \Omega; V_{GS} = 4.5 V; R_{G(ext)} = 5.6 \Omega$	-	37	-	ns
t_r	rise time		-	62	-	ns
$t_{d(off)}$	turn-off delay time		-	54	-	ns
t_f	fall time		-	26	-	ns

Table 6. Characteristics ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 25\text{ A}$; $V_{GS} = 0\text{ V}$; $T_j = 25\text{ }^\circ\text{C}$; see Figure 15	-	0.94	1.2	V
t_{rr}	reverse recovery time	$I_S = 20\text{ A}$; $di_S/dt = -100\text{ A}/\mu\text{s}$; $V_{GS} = 0\text{ V}$; $V_{DS} = 30\text{ V}$	-	52	-	ns
Q_r	recovered charge	$I_S = 20\text{ A}$; $di_S/dt = -100\text{ A}/\mu\text{s}$; $V_{GS} = 0\text{ V}$	-	30	-	nC

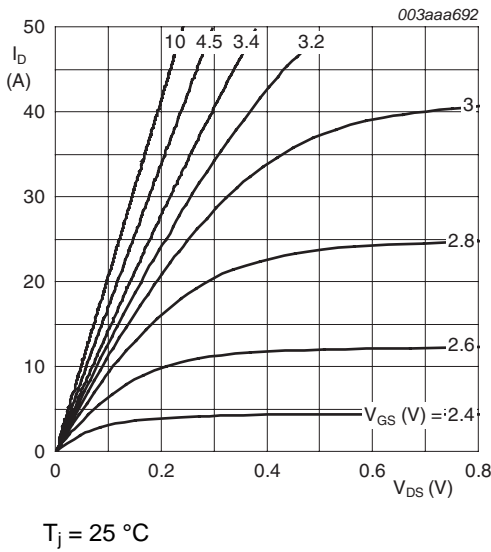


Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values

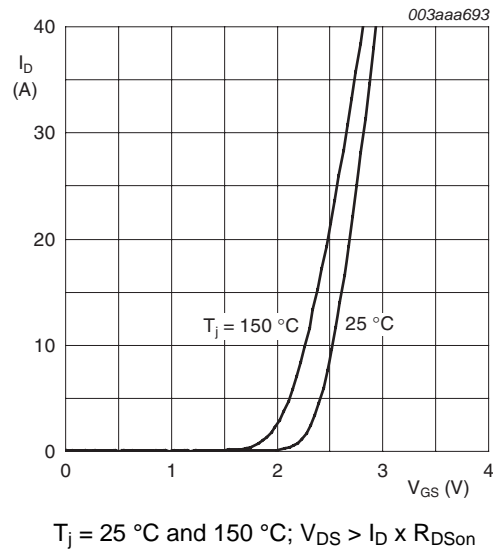


Fig 6. Transfer characteristics: drain current as a function of gate-source voltage; typical values

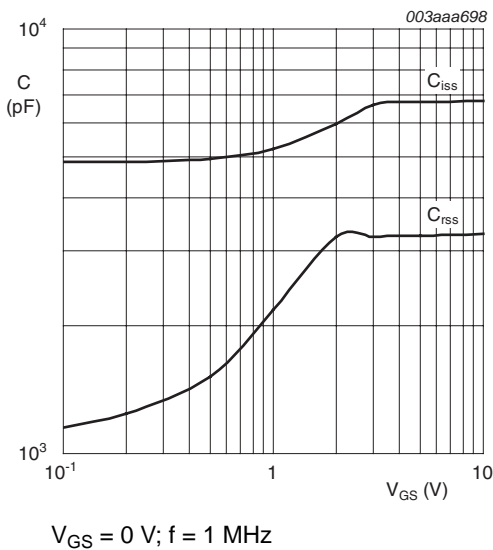


Fig 7. Input and reverse transfer capacitances as a function of gate-source voltage; typical values

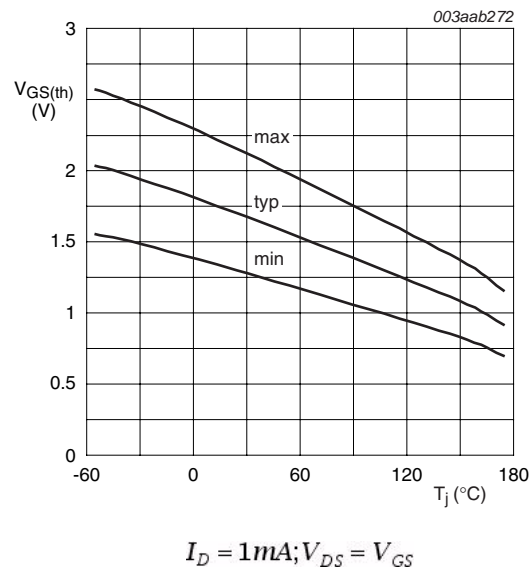
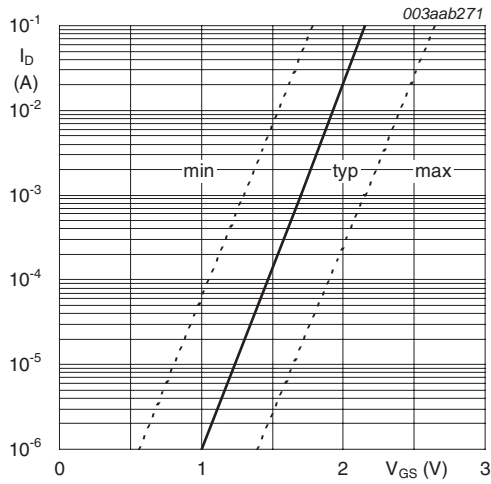
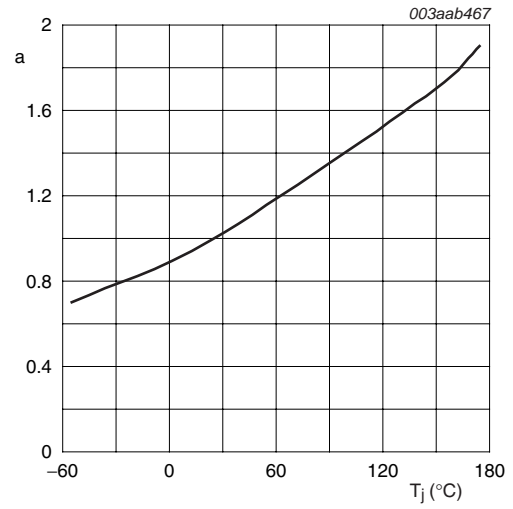


Fig 8. Gate-source threshold voltage as a function of junction temperature



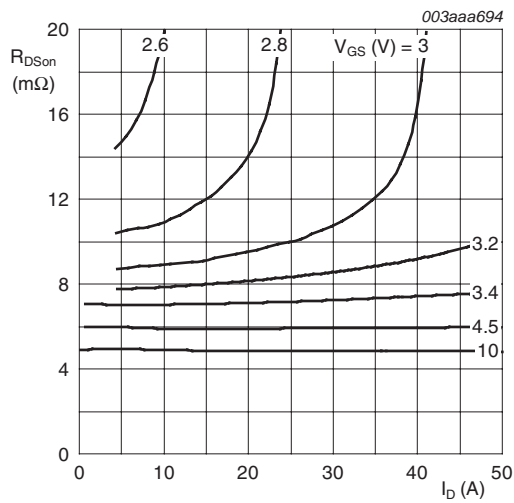
$T_j = 25^\circ\text{C}; V_{DS} = 5\text{V}$

Fig 9. Sub-threshold drain current as a function of gate-source voltage



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

Fig 10. Normalized drain-source on-state resistance factor as a function of junction temperature



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

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

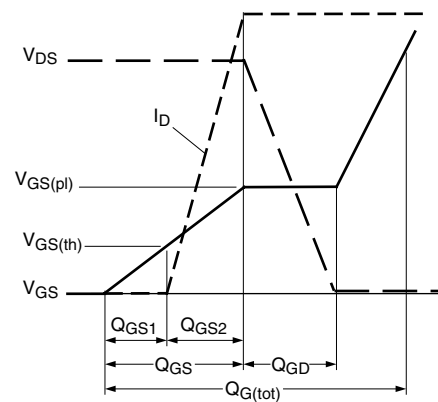
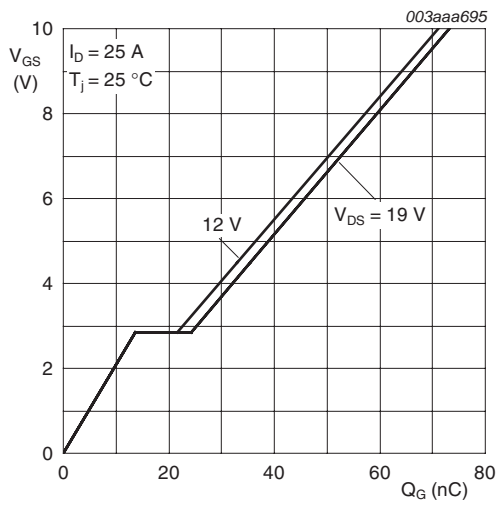
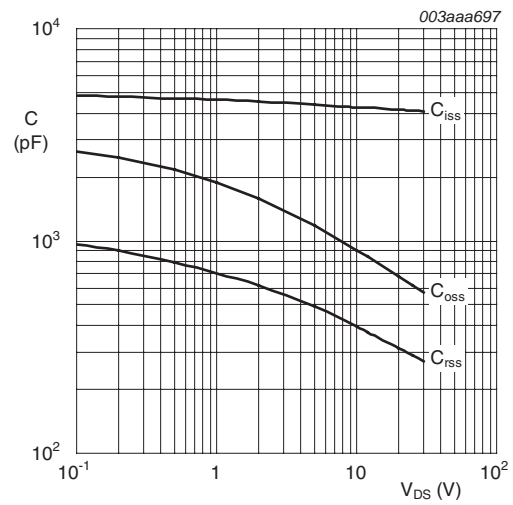


Fig 12. Gate charge waveform definitions



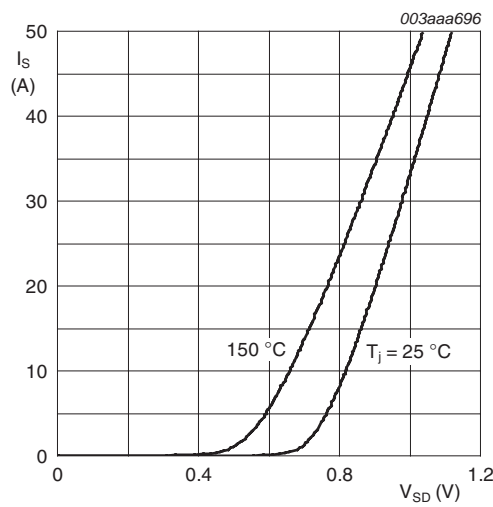
$I_D = 25 \text{ A}$; $V_{DS} = 12 \text{ V}$ and 19 V

Fig 13. Gate-source voltage as a function of gate charge; typical values



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

Fig 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



$T_j = 25 \text{ }^\circ\text{C}$ and $150 \text{ }^\circ\text{C}$; $V_{GS} = 0 \text{ V}$

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

7. Package outline

S08: plastic small outline package; 8 leads; body width 3.9 mm

SOT96-1

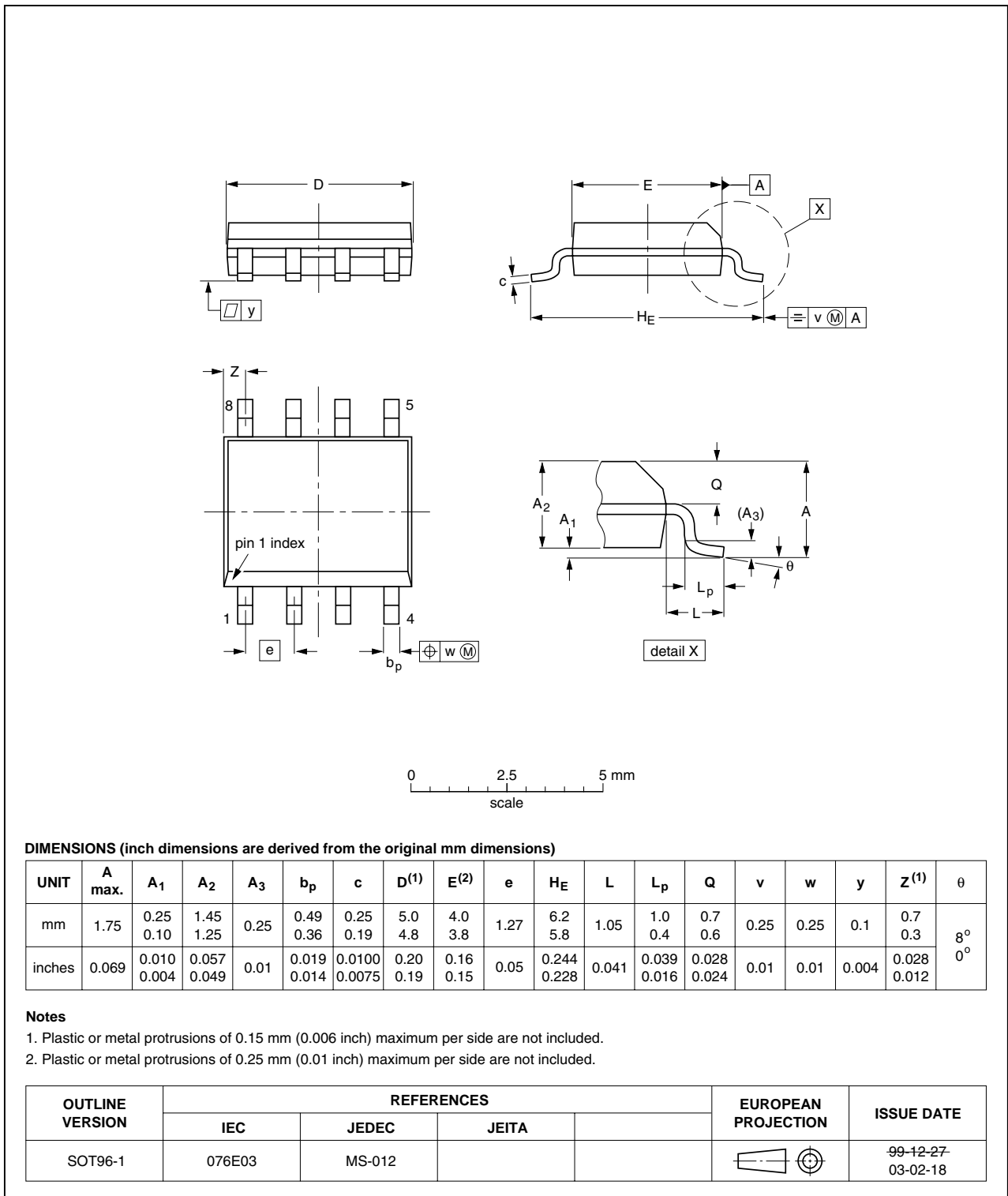


Fig 16. Package outline SOT96-1 (S08)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PHK31NQ03LT v.3	20110311	Product data sheet	-	PHK31NQ03LT v.2
Modifications:	• Various changes to content.			
PHK31NQ03LT v.2	20101220	Product data sheet	-	PHK31NQ03LT v.1

9. Legal information

9.1 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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