

## 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

- Low conduction losses due to low on-state resistance
- Suitable for high frequency applications due to fast switching characteristics

### 1.3 Applications

- DC motor control
- DC-to-DC convertors
- Lithium-ion battery applications
- Notebook computers
- Portable equipment

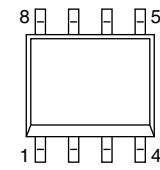
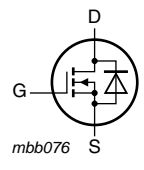
### 1.4 Quick reference data

Table 1. Quick reference

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	$T_{amb} = 25\text{ °C}$ ; pulsed; see <a href="#">Figure 1</a> and <a href="#">3</a>	-	-	10	A
$P_{tot}$	total power dissipation	$T_{amb} = 25\text{ °C}$ ; pulsed; see <a href="#">Figure 2</a>	-	-	2.5	W
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$V_{GS} = 10\text{ V}$ ; $I_D = 10\text{ A}$ ; $V_{DS} = 15\text{ V}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 12</a>	-	7	-	nC
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5\text{ V}$ ; $I_D = 5\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 10</a> and <a href="#">11</a>	-	15	20	mΩ
		$V_{GS} = 10\text{ V}$ ; $I_D = 10\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 10</a> and <a href="#">11</a>	-	11	13.5	mΩ

## 2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source	 <p>SOT96-1 (SO8)</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

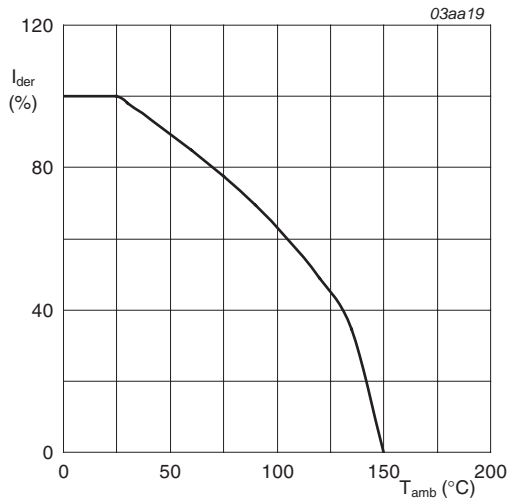
Type number	Package		
	Name	Description	Version
SI4410DY	SO8	plastic small outline package; 8 leads; body width 3.9 mm	SOT96-1

## 4. Limiting values

Table 4. Limiting values

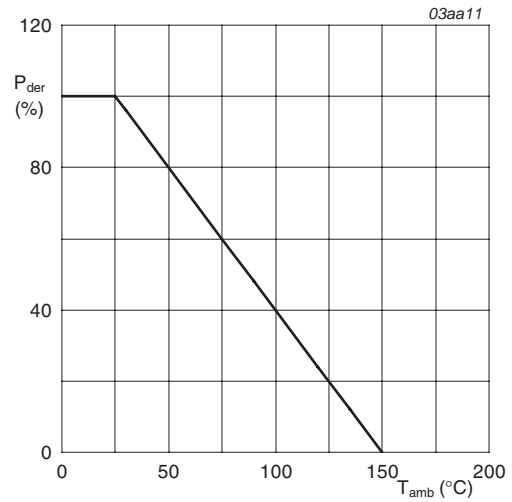
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 150\text{ °C}$	-	30	V
$V_{GS}$	gate-source voltage		-20	20	V
$I_D$	drain current	$T_{amb} = 70\text{ °C}$ ; pulsed; see <a href="#">Figure 1</a>	-	8	A
		$T_{amb} = 25\text{ °C}$ ; pulsed; see <a href="#">Figure 1</a> and <a href="#">3</a>	-	10	A
$I_{DM}$	peak drain current	$t_p \leq 10\text{ }\mu\text{s}$ ; $T_{amb} = 25\text{ °C}$ ; pulsed; see <a href="#">Figure 3</a>	-	50	A
$P_{tot}$	total power dissipation	$T_{amb} = 70\text{ °C}$ ; pulsed; see <a href="#">Figure 2</a>	-	1.6	W
		$T_{amb} = 25\text{ °C}$ ; pulsed; see <a href="#">Figure 2</a>	-	2.5	W
$T_{stg}$	storage temperature		-55	150	°C
$T_j$	junction temperature		-55	150	°C
<b>Source-drain diode</b>					
$I_S$	source current	$T_{amb} = 25\text{ °C}$ ; pulsed	-	2.3	A



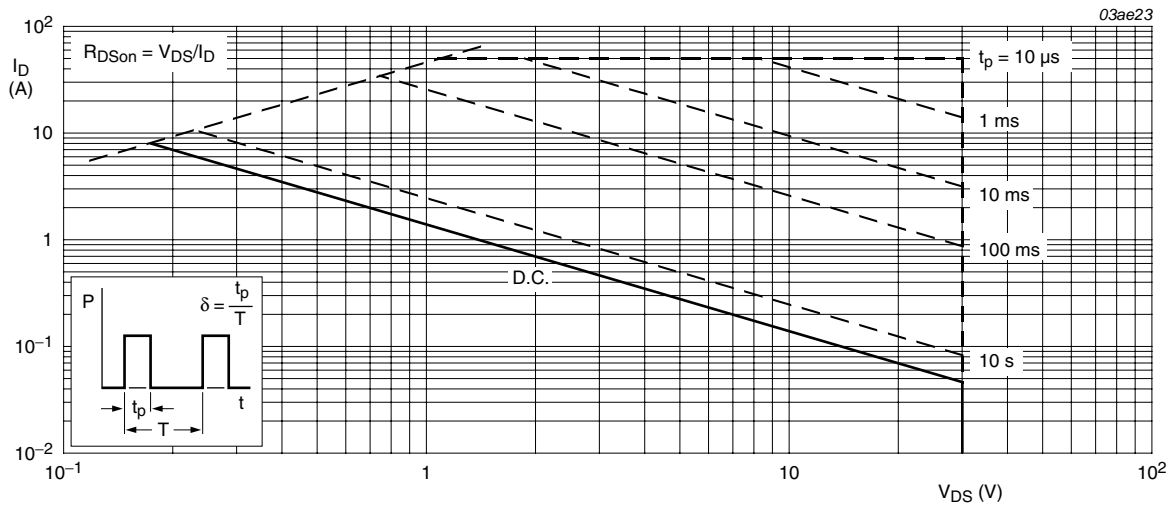
$$I_{der} = \frac{I_D}{I_{D(25^\circ\text{C})}} \times 100\%$$

**Fig 1. Normalized continuous drain current as a function of ambient temperature**



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

**Fig 2. Normalized total power dissipation as a function of ambient temperature**



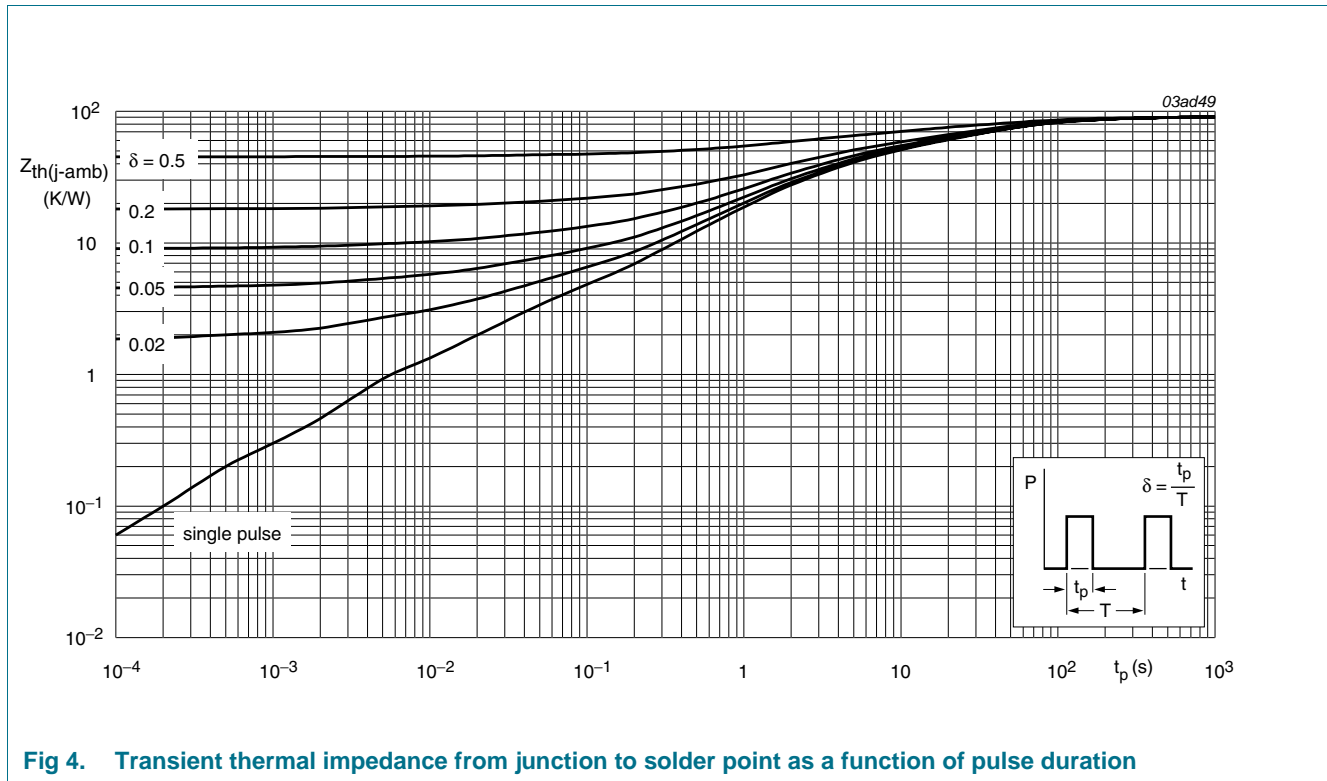
$T_{amb} = 25^\circ\text{C}; I_{DM}$  is single pulse

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

## 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		-	-	-	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	mounted on a printed-circuit board; minimum footprint; $t_p \leq 10$ s; see <a href="#">Figure 4</a>	-	-	50	K/W

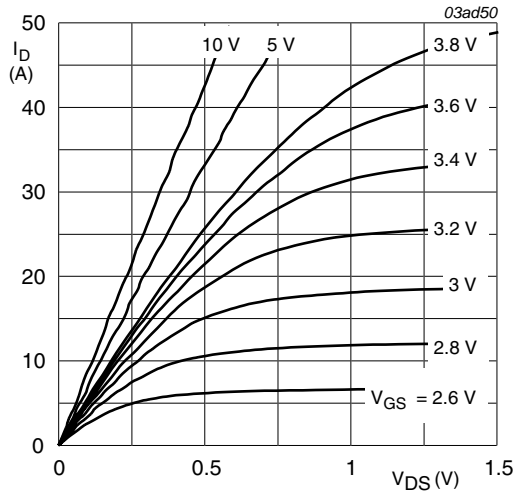


**Fig 4. Transient thermal impedance from junction to solder point as a function of pulse duration**

## 6. Characteristics

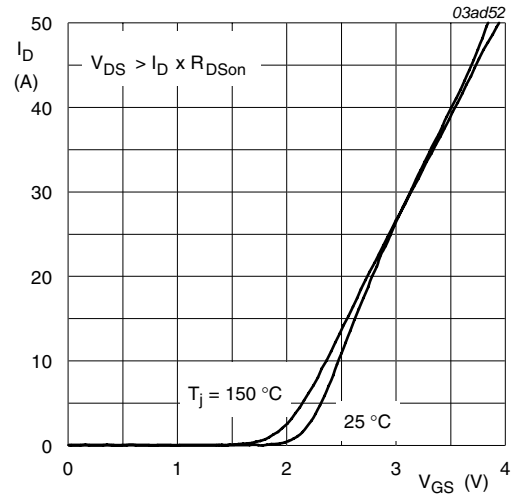
**Table 6. Characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 250 \mu A$ ; $V_{DS} = V_{GS}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 9</a>	1	-	-	V
$I_{DSS}$	drain leakage current	$V_{DS} = 30 \text{ V}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	-	1	$\mu A$
		$V_{DS} = 30 \text{ V}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 55 \text{ }^\circ\text{C}$	-	-	25	$\mu A$
$I_{GSS}$	gate leakage current	$V_{GS} = 20 \text{ V}$ ; $V_{DS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	-	100	nA
		$V_{GS} = -20 \text{ V}$ ; $V_{DS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	-	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5 \text{ V}$ ; $I_D = 5 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 10</a> and <a href="#">11</a>	-	15	20	m $\Omega$
		$V_{GS} = 10 \text{ V}$ ; $I_D = 10 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 10</a> and <a href="#">11</a>	-	11	13.5	m $\Omega$
$I_{D(on)}$	on-state drain-source current	$V_{DS} \geq 5 \text{ V}$ ; $V_{GS} = 10 \text{ V}$	20	-	-	A
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 10 \text{ A}$ ; $V_{DS} = 15 \text{ V}$ ; $V_{GS} = 5 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 12</a>	-	21.5	34	nC
		$I_D = 10 \text{ A}$ ; $V_{DS} = 15 \text{ V}$ ; $V_{GS} = 10 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 12</a>	-	40	60	nC
$Q_{GS}$	gate-source charge	$T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 12</a>	-	8	-	nC
$Q_{GD}$	gate-drain charge		-	7	-	nC
$t_{d(on)}$	turn-on delay time	$V_{DS} = 25 \text{ V}$ ; $R_L = 25 \text{ } \Omega$ ; $V_{GS} = 10 \text{ V}$ ; $R_{G(ext)} = 6 \text{ } \Omega$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	13.5	30	ns
$t_r$	rise time		-	9	20	ns
$t_{d(off)}$	turn-off delay time		-	70	100	ns
$t_f$	fall time		-	30	80	ns
$g_{fs}$	transfer conductance	$V_{DS} = 15 \text{ V}$ ; $I_D = 10 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 13</a>	-	34	-	S
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 2.3 \text{ A}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 14</a>	-	0.7	1.1	V
$t_{rr}$	reverse recovery time	$I_S = 2.3 \text{ A}$ ; $di_S/dt = -100 \text{ A}/\mu\text{s}$ ; $V_{GS} = 0 \text{ V}$ ; $V_{DS} = 25 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	50	80	ns

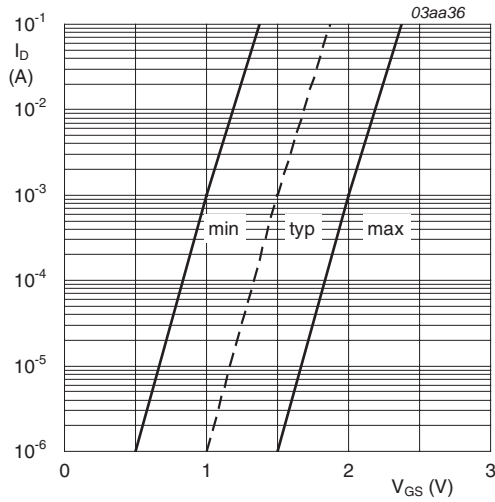


$T_j = 25\text{ }^\circ\text{C}$

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

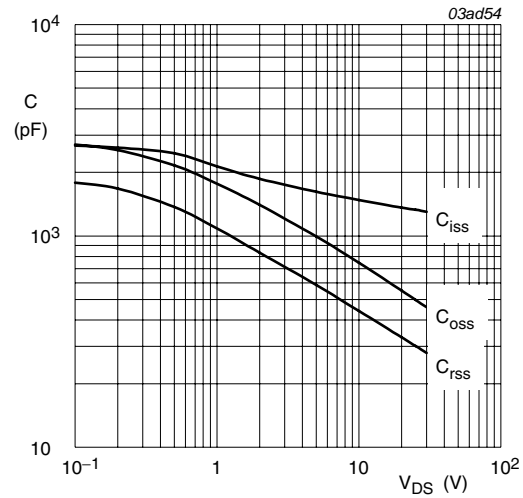


**Fig 6. Transfer characteristics: drain current as a function of gate-source voltage; typical values**



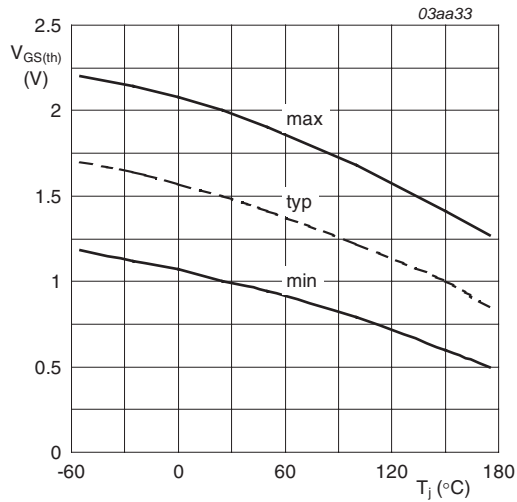
$T_j = 25\text{ }^\circ\text{C}; V_{DS} = 5\text{ V}$

**Fig 7. Sub-threshold drain current as a function of gate-source voltage**



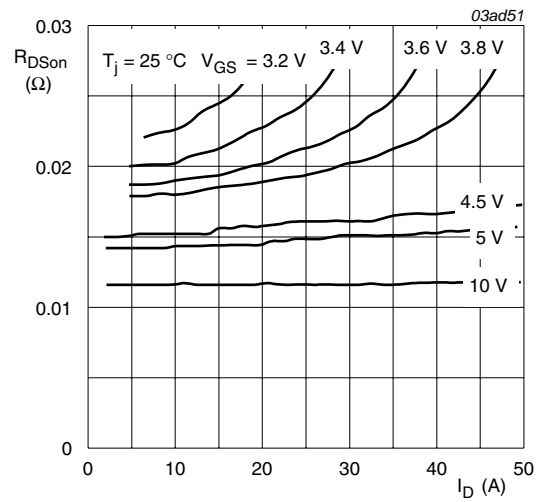
$V_{GS} = 0\text{V}; f = 1\text{MHz}$

**Fig 8. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values**



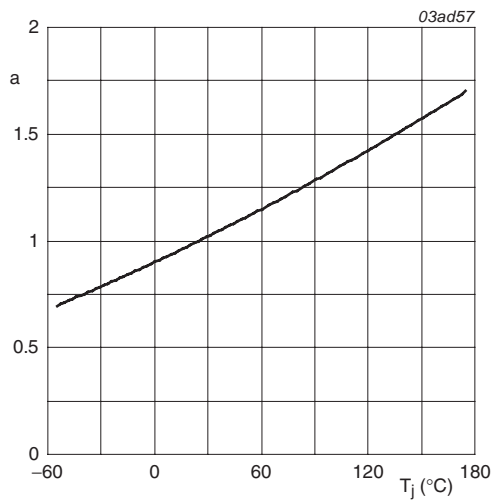
$$I_D = 1\text{ mA}; V_{DS} = V_{GS}$$

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



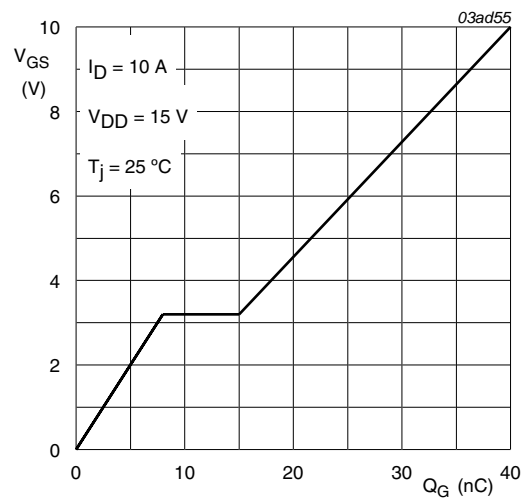
$$T_j = 25\text{ °C}$$

Fig 10. Drain-source on-state resistance as a function of drain current; typical values



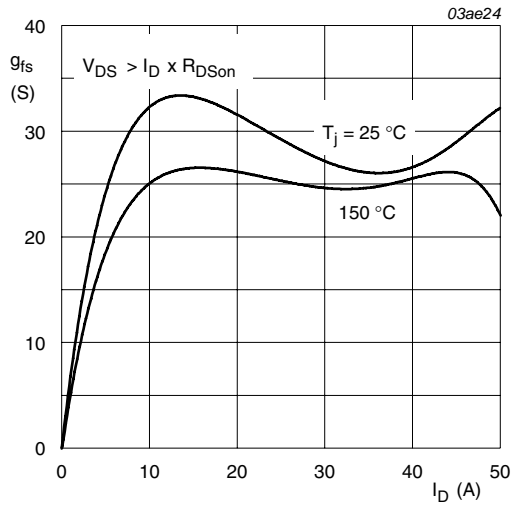
$$a = \frac{R_{DS(on)}}{R_{DS(on)(25\text{ °C})}}$$

Fig 11. Normalized drain-source on-state resistance factor as a function of junction temperature



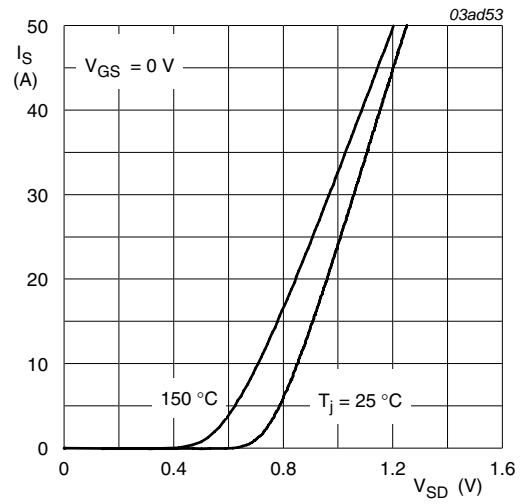
$$I_D = 10\text{ A}; V_{DD} = 15\text{ V}$$

Fig 12. Gate-source voltage as a function of gate charge; typical values



$T_j = 25^\circ\text{C}$  and  $150^\circ\text{C}$ ;  $V_{DS} > I_D \times R_{DSon}$

**Fig 13. Forward transconductance as a function of drain current; typical values**



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

**Fig 14. Source current as a function of source-drain voltage; typical values**



7. Package outline

SO8: plastic small outline package; 8 leads; body width 3.9 mm

SOT96-1

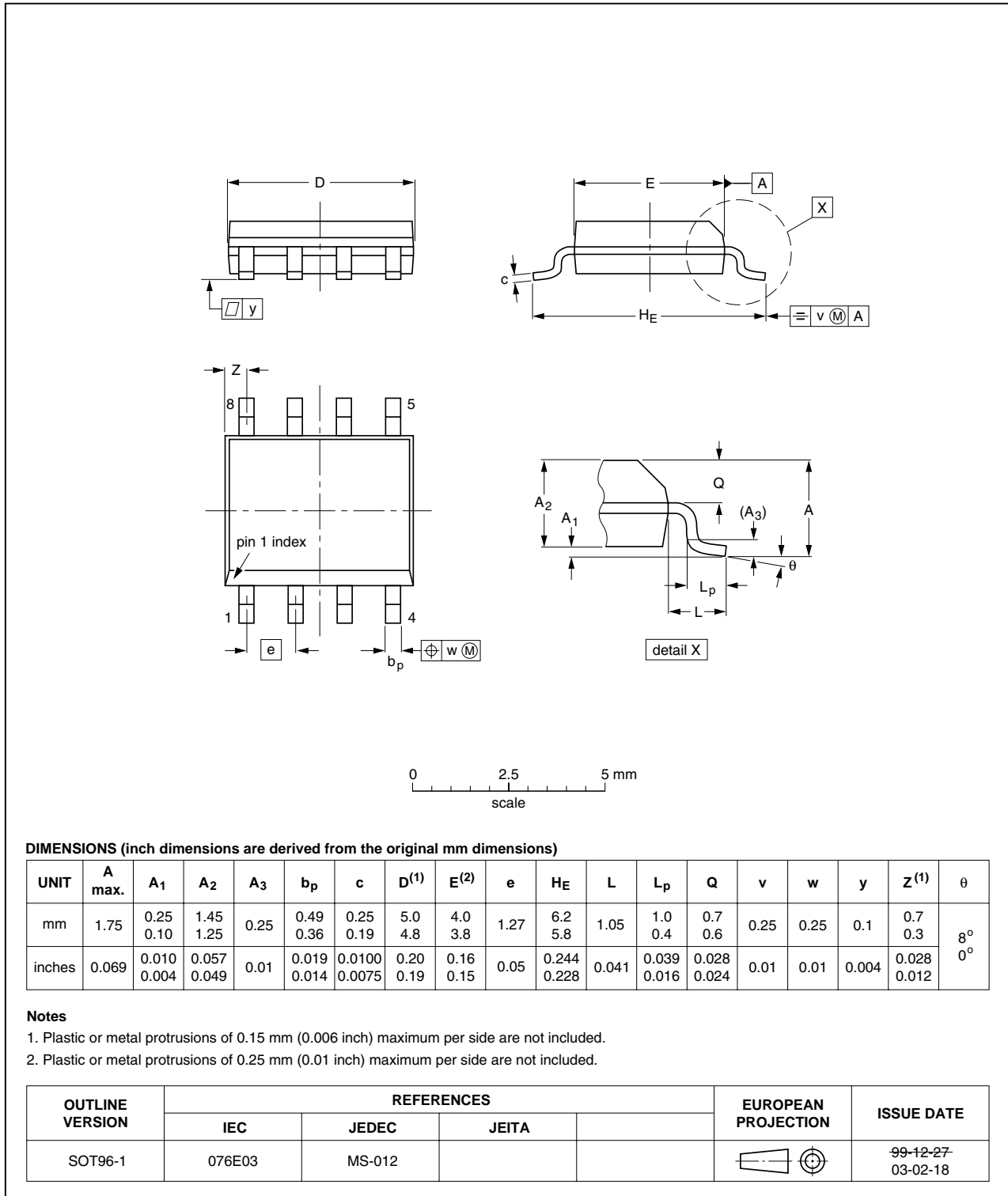


Fig 15. Package outline SOT96-1 (SO8)

## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
SI4410DY_3	20091204	Product data sheet	-	SI4410DY-02
Modifications:		<ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li><li>Legal texts have been adapted to the new company name where appropriate.</li></ul>		
SI4410DY-02	20010705	Product specification	-	SI4410DY-01
SI4410DY-01	20010220	Product specification	-	-

## 9. Legal information

### 9.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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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