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Team Nexperia

BUK7E1R6-30E

N-channel TrenchMOS standard level FET

11 September 2012

Product data sheet

1. Product profile

1.1 General description

Standard level N-channel MOSFET in a SOT226 package using TrenchMOS technology. This product has been designed and qualified to AEC Q101 standard for use in high performance automotive applications.

1.2 Features and benefits

- AEC Q101 compliant
- Repetitive avalanche rated
- Suitable for thermally demanding environments due to 175 °C rating
- True standard level gate with VGS(th) rating of greater than 1V at 175 °C

1.3 Applications

- 12 V Automotive systems
- Electric and electro-hydraulic power steering
- Motors, lamps and solenoid control
- Start-Stop micro-hybrid applications
- Transmission control
- Ultra high performance power switching

1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V _{DS}	drain-source voltage	T _j ≥ 25 °C; T _j ≤ 175 °C		-	-	30	V
I _D	drain current	V _{GS} = 10 V; T _{mb} = 25 °C; Fig. 1	[1]	-	-	120	A
P _{tot}	total power dissipation	T _{mb} = 25 °C; Fig. 2		-	-	349	W
Static characteristics							
R _{DS(on)}	drain-source on-state resistance	V _{GS} = 10 V; I _D = 25 A; T _j = 25 °C; Fig. 11		-	1.25	1.6	mΩ
Dynamic characteristics							
Q _{GD}	gate-drain charge	V _{GS} = 10 V; I _D = 25 A; V _{DS} = 24 V; Fig. 13 ; Fig. 14		-	49.8	-	nC

[1] Continuous current is limited by package.

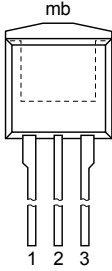
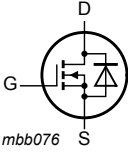


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2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 I2PAK (SOT226)	 mbb076
2	D	drain		
3	S	source		
mb	D	mounting base; connected to drain		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BUK7E1R6-30E	I2PAK	plastic single-ended package (I2PAK); TO-262	SOT226

4. Marking

Table 4. Marking codes

Type number	Marking code
BUK7E1R6-30E	BUK7E1R6-30E

5. Limiting values

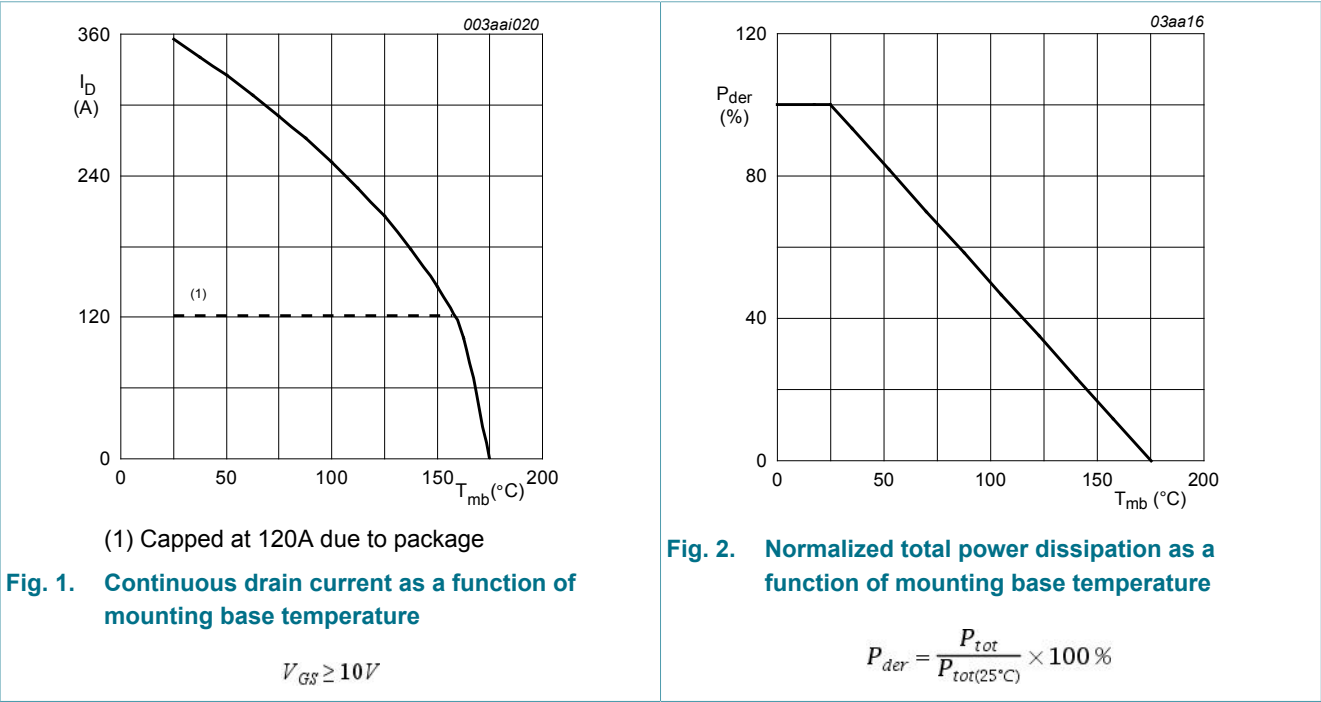
Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ }^{\circ}\text{C}$; $T_j \leq 175\text{ }^{\circ}\text{C}$		-	30	V
V_{DGR}	drain-gate voltage	$R_{GS} = 20\text{ k}\Omega$		-	30	V
V_{GS}	gate-source voltage	$T_j \leq 175\text{ }^{\circ}\text{C}$; DC		-20	20	V
I_D	drain current	$T_{mb} = 25\text{ }^{\circ}\text{C}$; $V_{GS} = 10\text{ V}$; Fig. 1	[1]	-	120	A
		$T_{mb} = 100\text{ }^{\circ}\text{C}$; $V_{GS} = 10\text{ V}$; Fig. 1	[1]	-	120	A
I_{DM}	peak drain current	$T_{mb} = 25\text{ }^{\circ}\text{C}$; pulsed; $t_p \leq 10\text{ }\mu\text{s}$; Fig. 4		-	1408	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ }^{\circ}\text{C}$; Fig. 2		-	349	W
T_{stg}	storage temperature			-55	175	$^{\circ}\text{C}$

Symbol	Parameter	Conditions		Min	Max	Unit
T _j	junction temperature			-55	175	°C
Source-drain diode						
I _S	source current	T _{mb} = 25 °C	[1]	-	120	A
I _{SM}	peak source current	pulsed; t _p ≤ 10 μs; T _{mb} = 25 °C		-	1408	A
Avalanche ruggedness						
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	I _D = 120 A; V _{sup} ≤ 30 V; R _{GS} = 50 Ω; V _{GS} = 10 V; T _{j(init)} = 25 °C; unclamped; Fig. 3	[2][3]	-	1405	mJ

- [1] Continuous current is limited by package.
- [2] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.
- [3] Refer to application note AN10273 for further information.



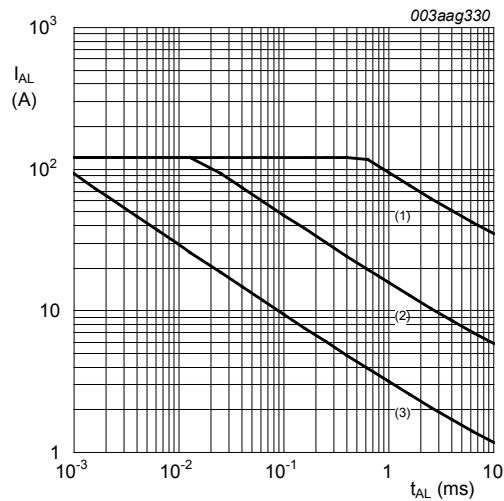


Fig. 3. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time

(1) $T_{j (init)} = 25^{\circ}C$; (2) $T_{j (init)} = 150^{\circ}C$; (3) Repetitive Avalanche

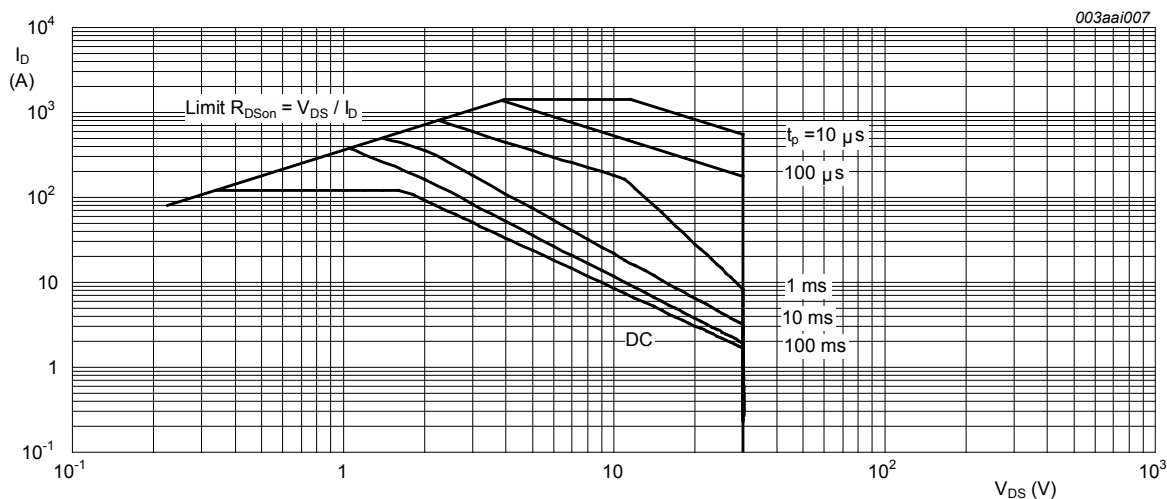


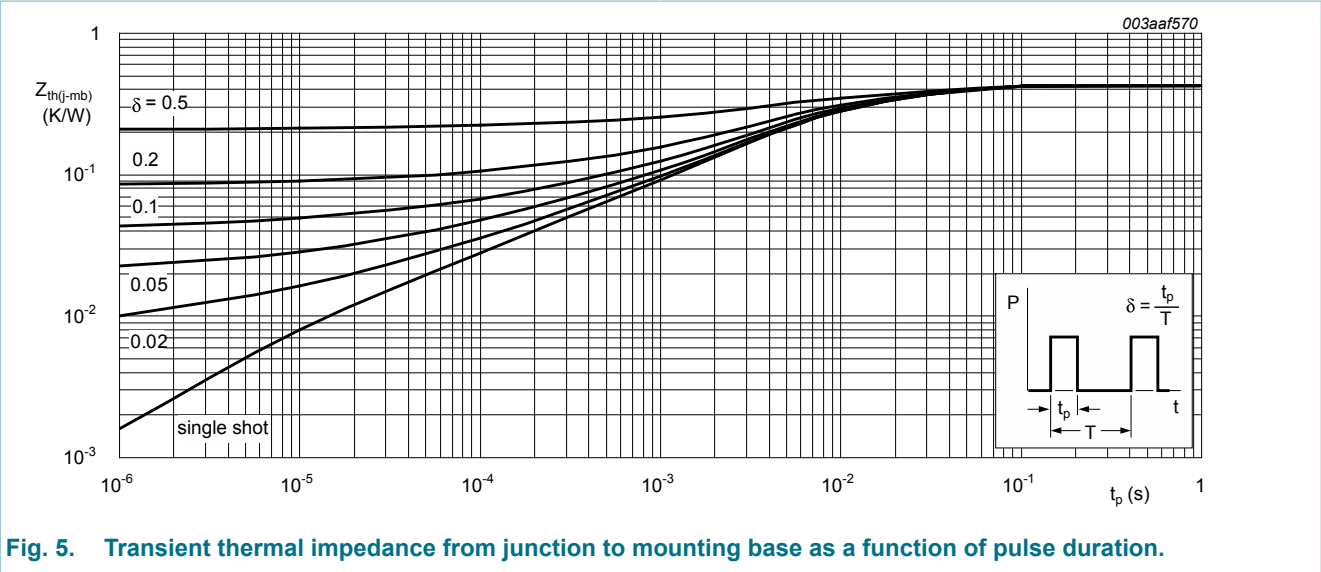
Fig. 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

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

6. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	Fig. 5	-	-	0.43	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	vertical in still air	-	65	-	K/W

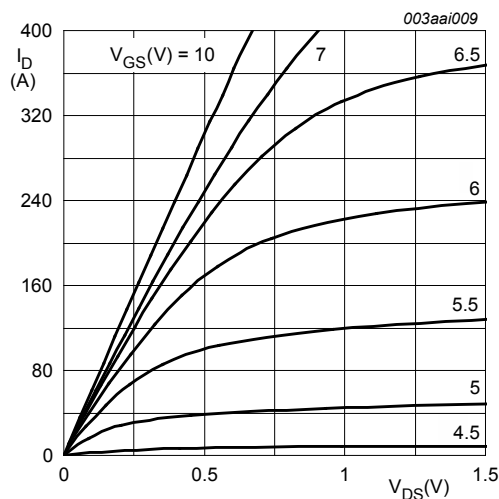


7. Characteristics

Table 7. Characteristics

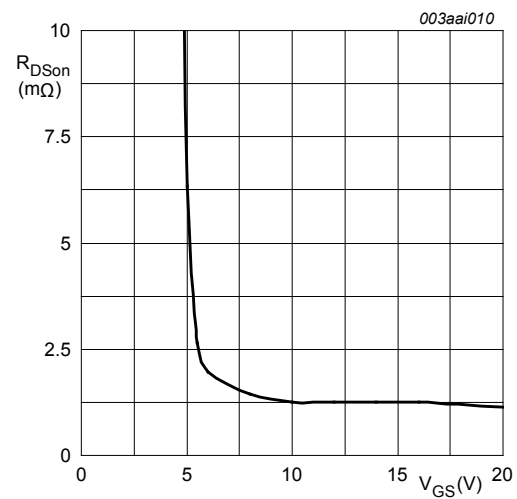
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
V _{(BR)DSS}	drain-source breakdown voltage	I _D = 250 μA; V _{GS} = 0 V; T _J = 25 °C		30	-	-	V
		I _D = 250 μA; V _{GS} = 0 V; T _J = -55 °C		27	-	-	V
V _{GS(th)}	gate-source threshold voltage	I _D = 1 mA; V _{DS} = V _{GS} ; T _J = 25 °C; Fig. 9 ; Fig. 10		2.4	3	4	V
		I _D = 1 mA; V _{DS} = V _{GS} ; T _J = -55 °C; Fig. 10		-	-	4.5	V
		I _D = 1 mA; V _{DS} = V _{GS} ; T _J = 175 °C; Fig. 10		1	-	-	V
I _{DSS}	drain leakage current	V _{DS} = 30 V; V _{GS} = 0 V; T _J = 25 °C		-	0.6	5	μA
		V _{DS} = 30 V; V _{GS} = 0 V; T _J = 175 °C		-	-	500	μA
I _{GSS}	gate leakage current	V _{GS} = 20 V; V _{DS} = 0 V; T _J = 25 °C		-	2	100	nA
		V _{GS} = -20 V; V _{DS} = 0 V; T _J = 25 °C		-	2	100	nA
R _{DSon}	drain-source on-state resistance	V _{GS} = 10 V; I _D = 25 A; T _J = 25 °C; Fig. 11		-	1.25	1.6	mΩ
		V _{GS} = 10 V; I _D = 25 A; T _J = 175 °C; Fig. 11 ; Fig. 12		-	-	2.8	mΩ
Dynamic characteristics							
Q _{G(tot)}	total gate charge	I _D = 25 A; V _{DS} = 24 V; V _{GS} = 10 V; Fig. 13 ; Fig. 14		-	154	-	nC
Q _{GS}	gate-source charge			-	39.2	-	nC
Q _{GD}	gate-drain charge			-	49.8	-	nC

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
C_{iss}	input capacitance	$V_{GS} = 0\text{ V}$; $V_{DS} = 25\text{ V}$; $f = 1\text{ MHz}$;		-	8970	11960	pF
C_{oss}	output capacitance	$T_j = 25\text{ }^{\circ}\text{C}$; Fig. 15		-	2020	2430	pF
C_{rss}	reverse transfer capacitance			-	1170	1600	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 25\text{ V}$; $R_L = 1\text{ }\Omega$; $V_{GS} = 10\text{ V}$; $R_{G(ext)} = 5\text{ }\Omega$		-	42	-	ns
t_r	rise time			-	64	-	ns
$t_{d(off)}$	turn-off delay time			-	113	-	ns
t_f	fall time			-	83	-	ns
L_D	internal drain inductance	from upper edge of drain mounting base to center of die		-	2.5	-	nH
		from drain lead 6mm from package to centre of die		-	4.5	-	nH
L_S	internal source inductance	from source lead to source bonding pad		-	7.5	-	nH
Source-drain diode							
V_{SD}	source-drain voltage	$I_S = 25\text{ A}$; $V_{GS} = 0\text{ V}$; $T_j = 25\text{ }^{\circ}\text{C}$; Fig. 16		-	0.77	1.2	V
t_{rr}	reverse recovery time	$I_S = 20\text{ A}$; $dI_S/dt = -100\text{ A}/\mu\text{s}$; $V_{GS} = 0\text{ V}$;		-	58	-	ns
Q_r	recovered charge	$V_{DS} = 25\text{ V}$		-	93	-	nC



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

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



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

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

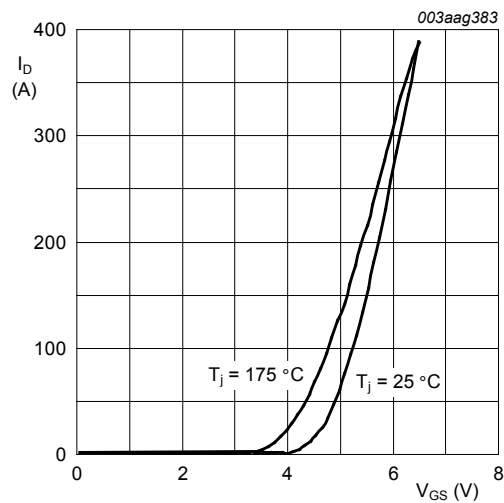


Fig. 8. Transfer characteristics: drain current as a function of gate-source voltage; typical values

$V_{DS} = 12\text{ V}$

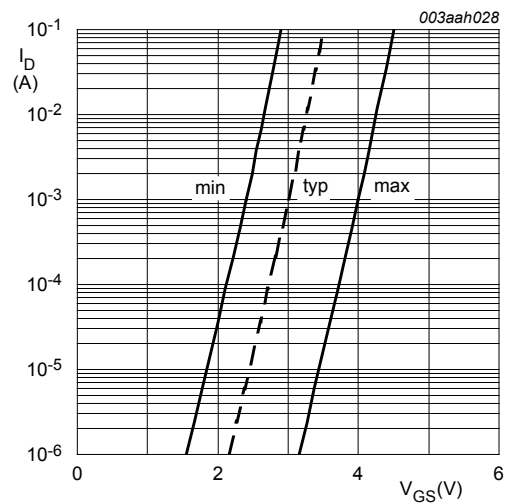


Fig. 9. Sub-threshold drain current as a function of gate-source voltage

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

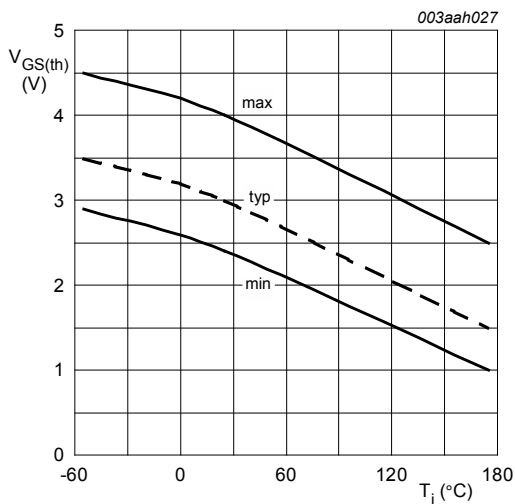


Fig. 10. Gate-source threshold voltage as a function of junction temperature

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

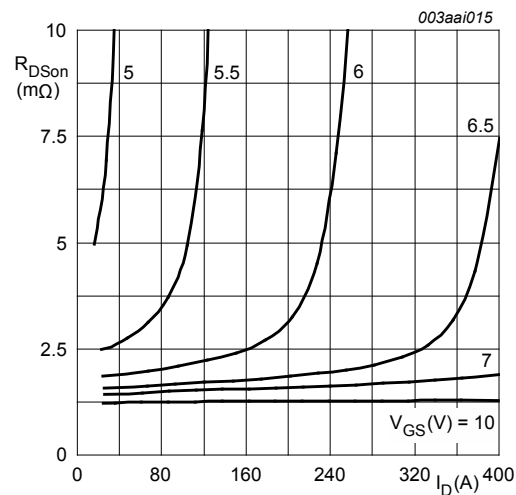


Fig. 11. Drain-source on-state resistance as a function of drain current; typical values

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

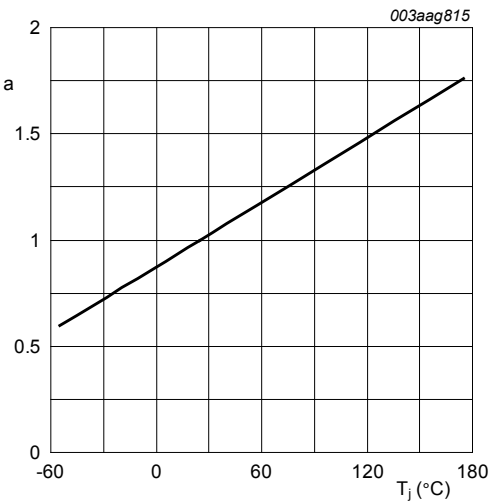
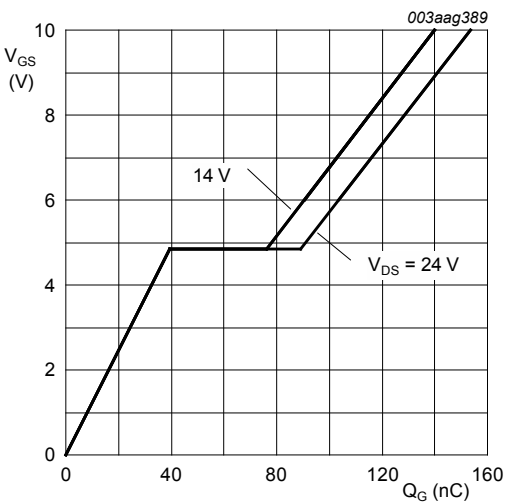


Fig. 12. Normalized drain-source on-state resistance factor as a function of junction temperature

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



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

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

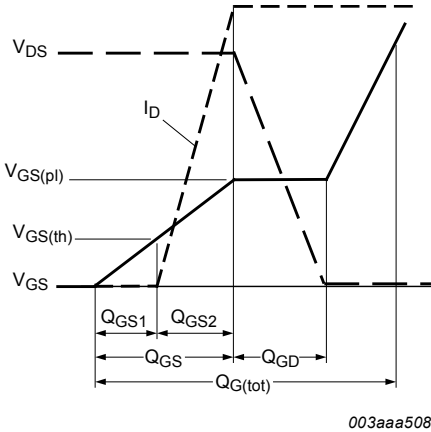
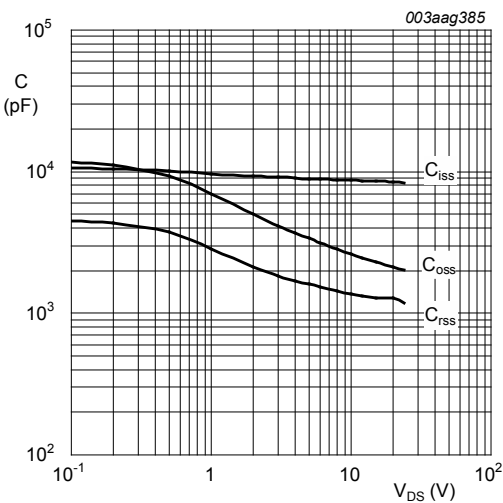
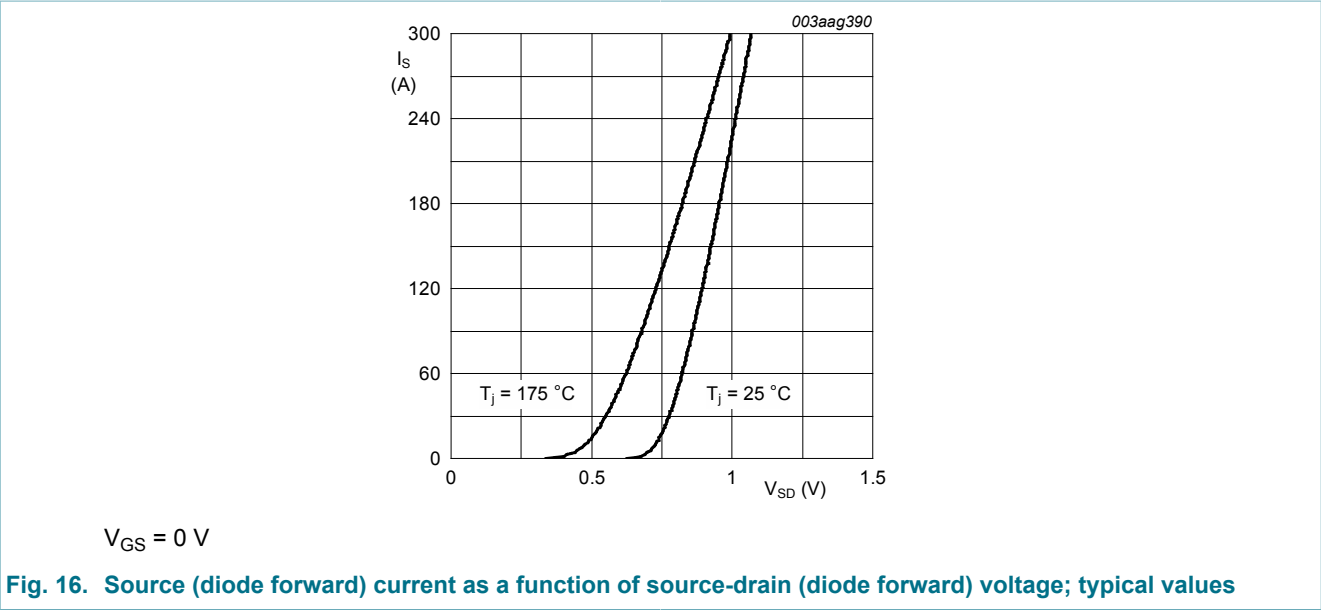


Fig. 13. Gate charge waveform definitions



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

Fig. 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



8. Package outline

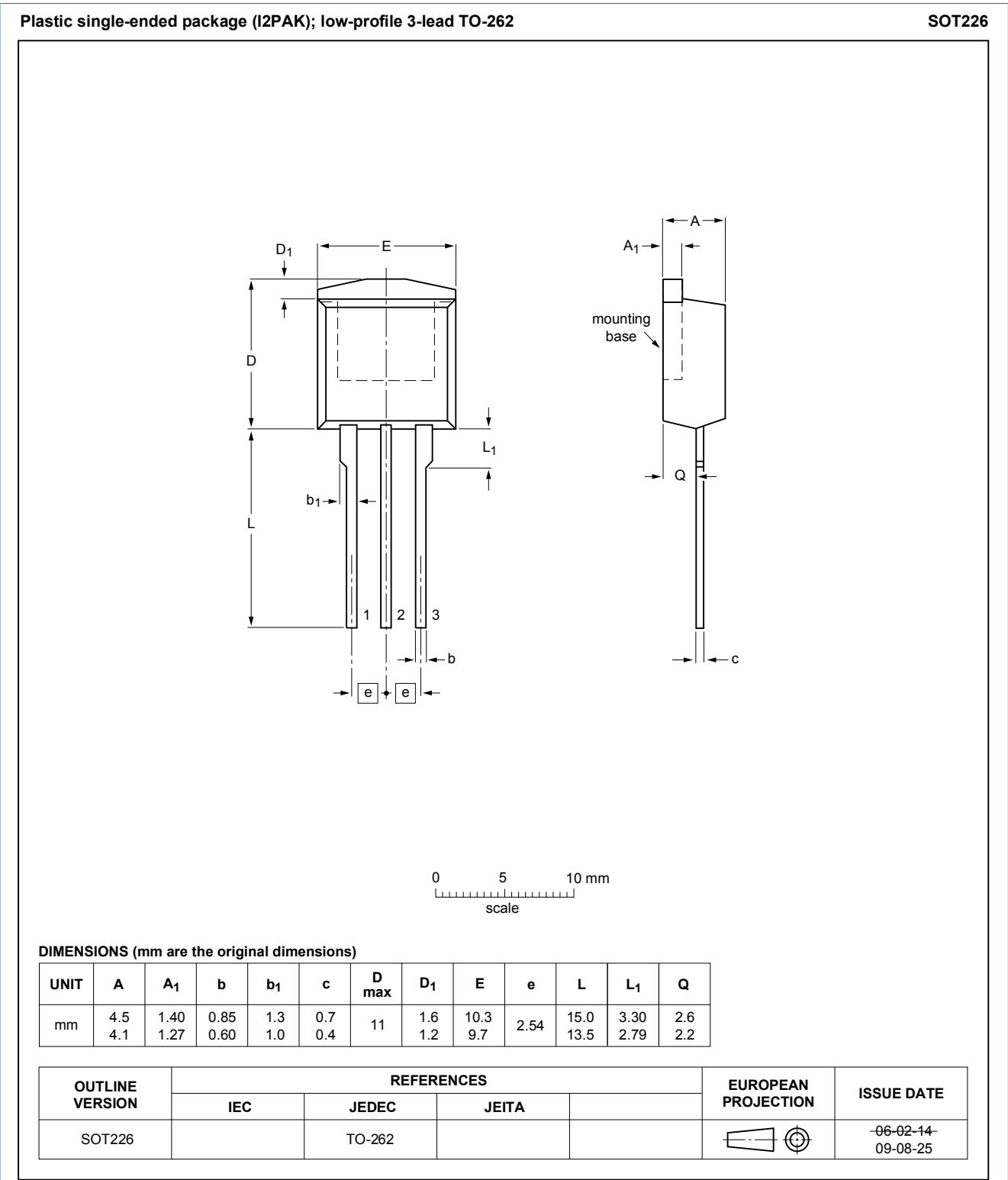


Fig. 17. Package outline I2PAK (SOT226)

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.
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