



BUK7Y1R7-40H

N-channel 40 V, 1.7 mΩ standard level MOSFET in LFPAK56

9 May 2018

Product data sheet

1. General description

Automotive qualified N-channel MOSFET using the latest Trench 9 low ohmic superjunction technology, housed in a robust LFPAK56 package. This product has been fully designed and qualified to meet AEC-Q101 requirements delivering high performance and endurance.

2. Features and benefits

- Fully automotive qualified to AEC-Q101:
 - 175 °C rating suitable for thermally demanding environments
- Trench 9 Superjunction technology:
 - Reduced cell pitch enables enhanced power density and efficiency with lower R_{DSon} in same footprint
 - Improved SOA and avalanche capability compared to standard TrenchMOS
 - Tight $V_{GS(th)}$ limits enable easy paralleling of MOSFETs
- LFPAK Gull Wing leads:
 - High Board Level Reliability absorbing mechanical stress during thermal cycling, unlike traditional QFN packages
 - Visual (AOI) soldering inspection, no need for expensive x-ray equipment
 - Easy solder wetting for good mechanical solder joint
- LFPAK copper clip technology:
 - Improved reliability, with reduced R_{th} and R_{DSon}
 - Increases maximum current capability and improved current spreading

3. Applications

- 12 V automotive systems
- Motors, lamps and solenoid control
- Start-Stop micro-hybrid applications
- Transmission control
- Ultra high performance power switching

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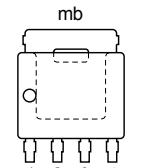
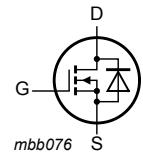
4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$25^{\circ}\text{C} \leq T_j \leq 175^{\circ}\text{C}$		-	-	40	V
I_D	drain current	$V_{GS} = 10\text{ V}; T_{mb} = 25^{\circ}\text{C}$		-	-	120	A
P_{tot}	total power dissipation	$T_{mb} = 25^{\circ}\text{C}$; Fig. 1		-	-	294	W
Static characteristics							
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 25\text{ A}; T_j = 25^{\circ}\text{C}$; Fig. 10		0.95	1.35	1.7	mΩ
Dynamic characteristics							
Q_{GD}	gate-drain charge	$I_D = 25\text{ A}; V_{DS} = 32\text{ V}; V_{GS} = 10\text{ V}$; Fig. 12 ; Fig. 13		-	10	25	nC
Source-drain diode							
Q_r	recovered charge	$I_S = 25\text{ A}; dI_S/dt = -100\text{ A}/\mu\text{s}; V_{GS} = 0\text{ V}; V_{DS} = 20\text{ V}$; Fig. 16		-	25	-	nC
S	softness factor	$I_S = 25\text{ A}; dI_S/dt = -100\text{ A}/\mu\text{s}; V_{GS} = 0\text{ V}; V_{DS} = 20\text{ V}; T_j = 25^{\circ}\text{C}$; Fig. 16		-	0.8	-	

5. Pinning information

Table 2. Pinning information

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

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BUK7Y1R7-40H	LFPAK56; Power-SO8	plastic, single-ended surface-mounted package; 4 terminals	SOT669

7. Marking

Table 4. Marking codes

Type number	Marking code
BUK7Y1R7-40H	71H740

8. 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	25 °C ≤ T _j ≤ 175 °C		-	40	V
V _{GS}	gate-source voltage	DC; T _j ≤ 175 °C		-10	20	V
P _{tot}	total power dissipation	T _{mb} = 25 °C; Fig. 1		-	294	W
I _D	drain current	V _{GS} = 10 V; T _{mb} = 25 °C		-	120	A
I _{DM}	peak drain current	pulsed; t _p ≤ 10 µs; T _{mb} = 25 °C; Fig. 2		-	600	A
T _{stg}	storage temperature			-55	175	°C
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		-	600	A
Avalanche ruggedness						
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	I _D = 120 A; V _{sup} ≤ 40 V; R _{GS} = 50 Ω; V _{GS} = 10 V; T _{j(init)} = 25 °C; unclamped; Fig. 3	[2] [3]	-	158	mJ

[1] 120A continuous current has been successfully demonstrated during application tests. Practically the current will be limited by PCB, thermal design and operating temperature

[2] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.

[3] Refer to application note AN10273 for further information.

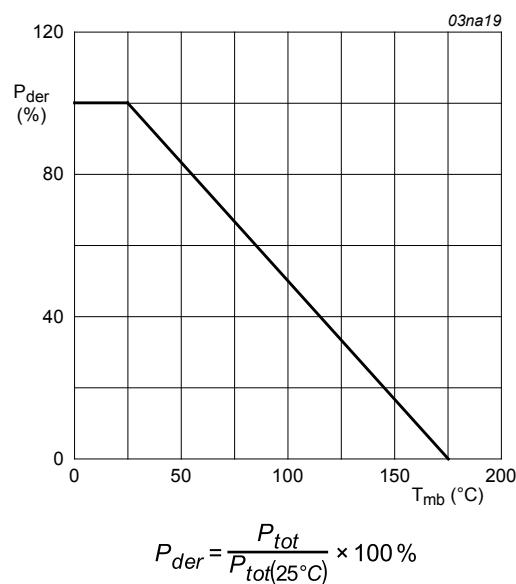
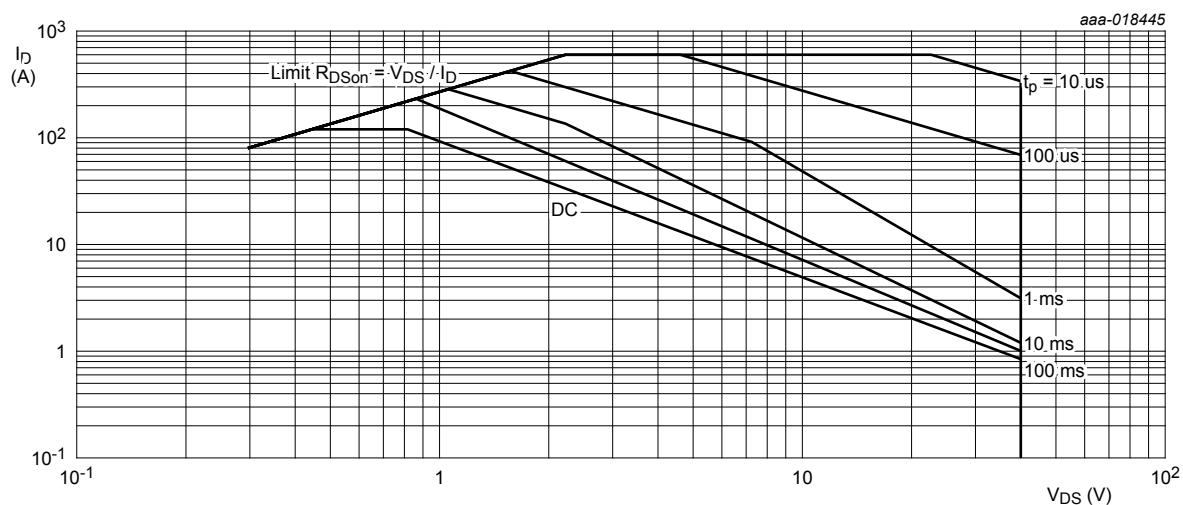
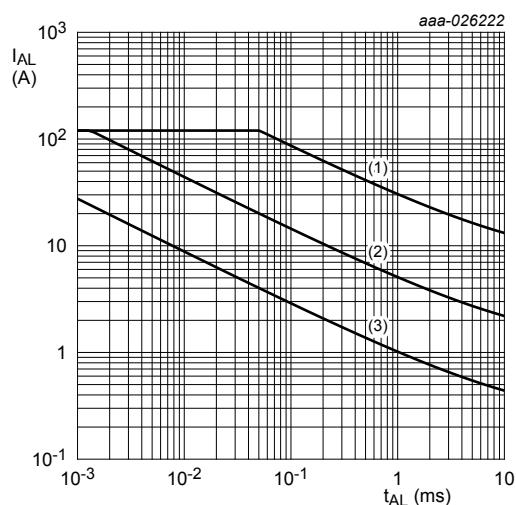


Fig. 1. Normalized total power dissipation as a function of mounting base temperature



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

Fig. 2. Safe operating area; continuous and peak drain currents as a function of drain-source voltage



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

Fig. 3. Avalanche rating; avalanche current as a function of avalanche time

9. 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. 4		-	0.39	0.51	K/W

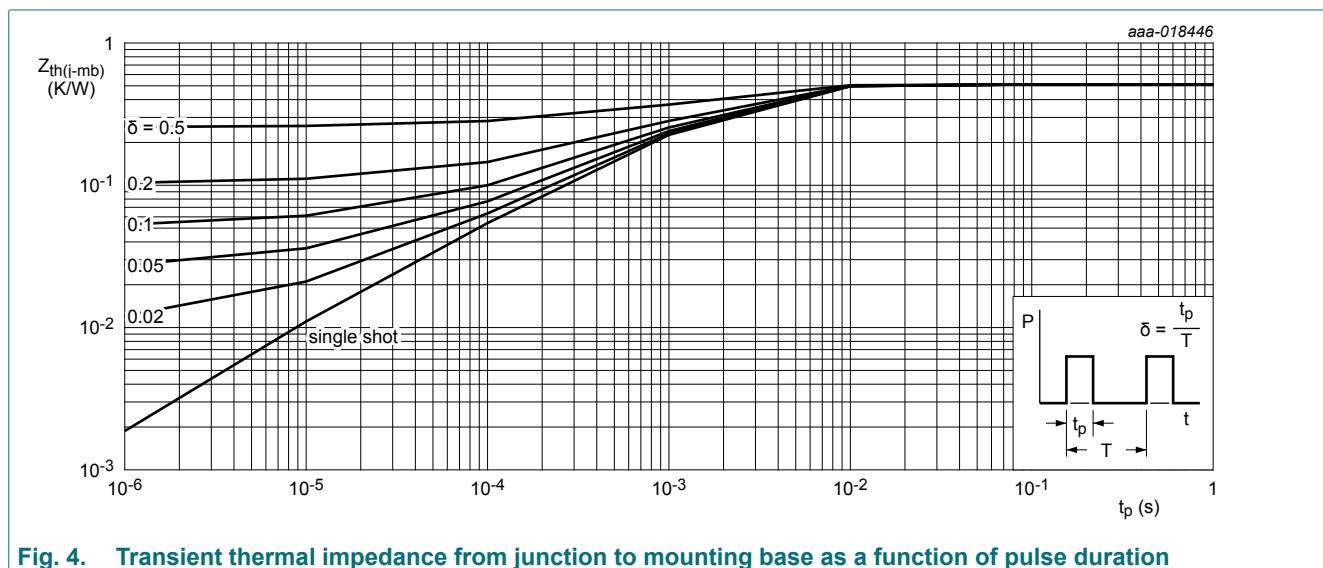


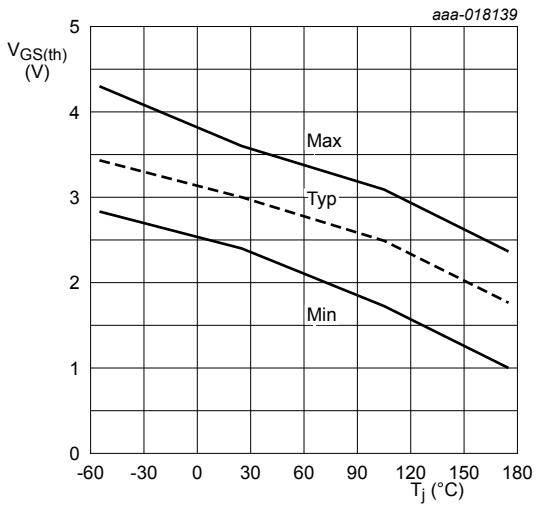
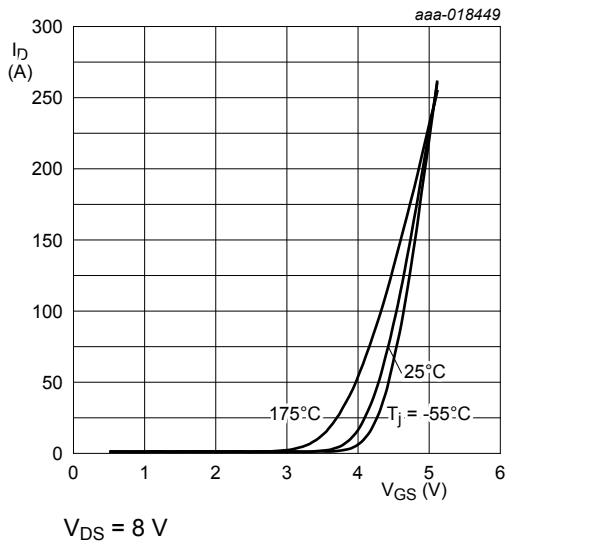
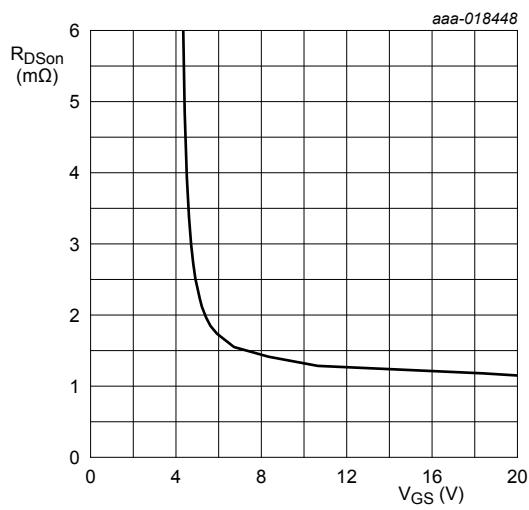
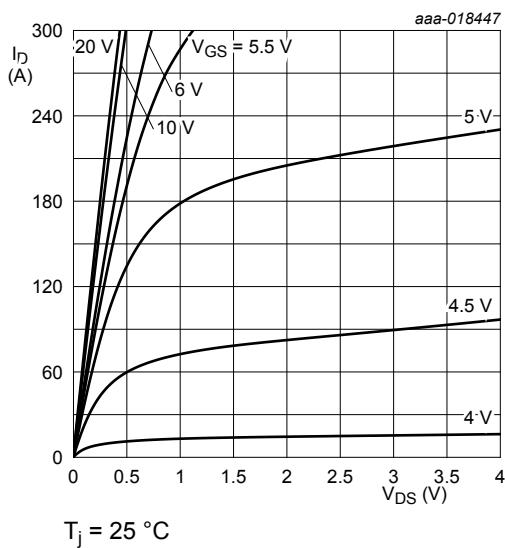
Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

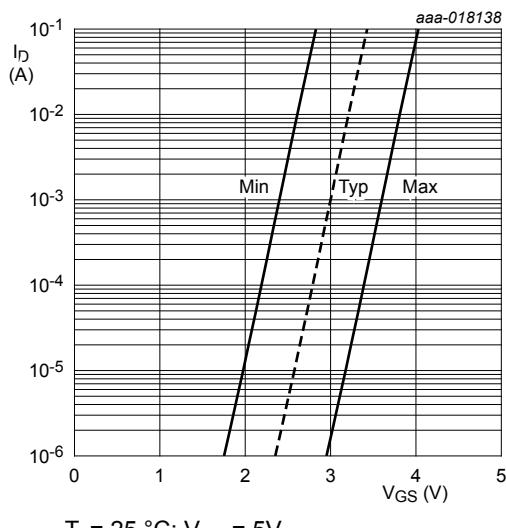
10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25^\circ C$		40	43	-	V
		$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -40^\circ C$		-	40.5	-	V
		$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55^\circ C$		36	40	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 mA; V_{DS}=V_{GS}; T_j = 25^\circ C$; Fig. 8 ; Fig. 9		2.4	3	3.6	V
		$I_D = 1 mA; V_{DS}=V_{GS}; T_j = -55^\circ C$; Fig. 8		-	-	4.3	V
		$I_D = 1 mA; V_{DS}=V_{GS}; T_j = 175^\circ C$; Fig. 8		1	-	-	V
I_{DSS}	drain leakage current	$V_{DS} = 40 V; V_{GS} = 0 V; T_j = 25^\circ C$		-	0.2	1	μA
		$V_{DS} = 16 V; V_{GS} = 0 V; T_j = 125^\circ C$		-	1.8	10	μA
		$V_{DS} = 40 V; V_{GS} = 0 V; T_j = 175^\circ C$		-	200	500	μA
I_{GSS}	gate leakage current	$V_{GS} = 20 V; V_{DS} = 0 V; T_j = 25^\circ C$		-	2	100	nA
		$V_{GS} = -10 V; V_{DS} = 0 V; T_j = 25^\circ C$		-	2	100	nA
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10 V; I_D = 25 A; T_j = 25^\circ C$; Fig. 10		0.95	1.35	1.7	$m\Omega$
		$V_{GS} = 10 V; I_D = 25 A; T_j = 105^\circ C$; Fig. 11		1.34	2.05	2.7	$m\Omega$
		$V_{GS} = 10 V; I_D = 25 A; T_j = 125^\circ C$; Fig. 11		1.48	2.24	3	$m\Omega$
		$V_{GS} = 10 V; I_D = 25 A; T_j = 175^\circ C$; Fig. 11		1.86	2.78	3.7	$m\Omega$
R_G	gate resistance	$f = 1 \text{ MHz}; T_j = 25^\circ C$		0.4	1.02	2.5	Ω
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	$I_D = 25 A; V_{DS} = 32 V; V_{GS} = 10 V$; Fig. 12 ; Fig. 13		-	56	96	nC
Q_{GS}	gate-source charge			-	16	24	nC
Q_{GD}	gate-drain charge			-	10	25	nC
C_{iss}	input capacitance	$V_{DS} = 25 V; V_{GS} = 0 V; f = 1 \text{ MHz}$; $T_j = 25^\circ C$; Fig. 14		-	4095	6142	pF
C_{oss}	output capacitance			-	1083	1516	pF
C_{rss}	reverse transfer capacitance			-	178	393	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 30 V; R_L = 1.2 \Omega; V_{GS} = 10 V$; $R_{G(ext)} = 5 \Omega$		-	14.6	-	ns
t_r	rise time			-	12.6	-	ns
$t_{d(off)}$	turn-off delay time			-	35.2	-	ns
t_f	fall time			-	16.6	-	ns
Source-drain diode							
V_{SD}	source-drain voltage	$I_S = 25 A; V_{GS} = 0 V; T_j = 25^\circ C$; Fig. 15		-	0.8	1.2	V

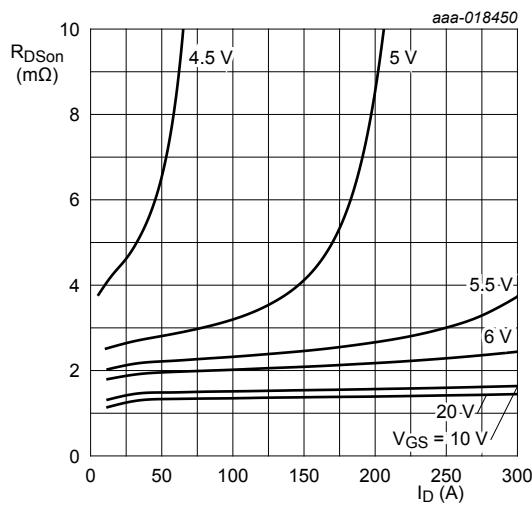
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
t_{rr}	reverse recovery time	$I_S = 25 \text{ A}$; $dI_S/dt = -100 \text{ A}/\mu\text{s}$; $V_{GS} = 0 \text{ V}$; $V_{DS} = 20 \text{ V}$; Fig. 16		-	32	-	ns
Q_r				-	25	-	nC
S	softness factor	$I_S = 25 \text{ A}$; $dI_S/dt = -100 \text{ A}/\mu\text{s}$; $V_{GS} = 0 \text{ V}$; $V_{DS} = 20 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$; Fig. 16		-	0.8	-	
		$I_S = 25 \text{ A}$; $dI_S/dt = -500 \text{ A}/\mu\text{s}$; $V_{GS} = 0 \text{ V}$; $V_{DS} = 20 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$; Fig. 16		-	0.7	-	





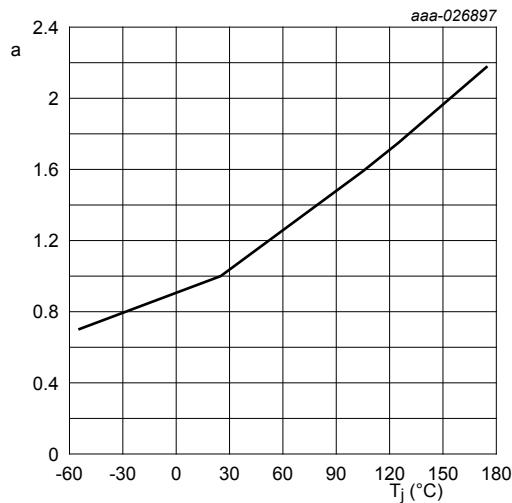
$T_j = 25^\circ\text{C}$; $V_{DS} = 5\text{V}$

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



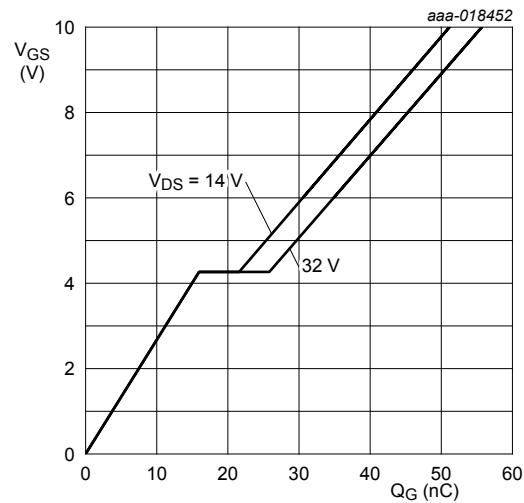
$T_j = 25^\circ\text{C}$

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



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

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



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

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

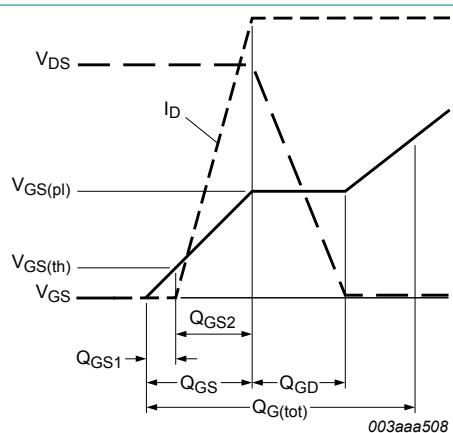


Fig. 13. Gate charge waveform definitions

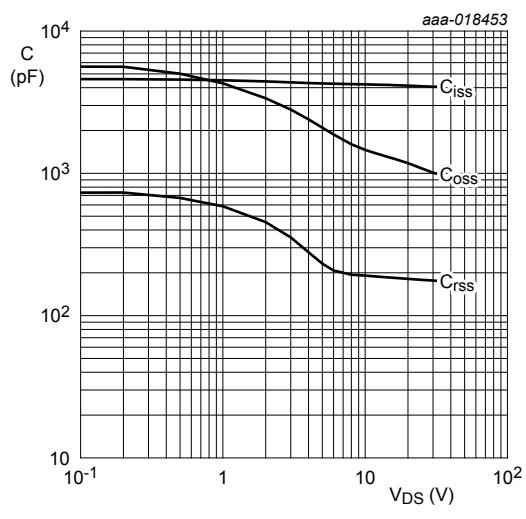


Fig. 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

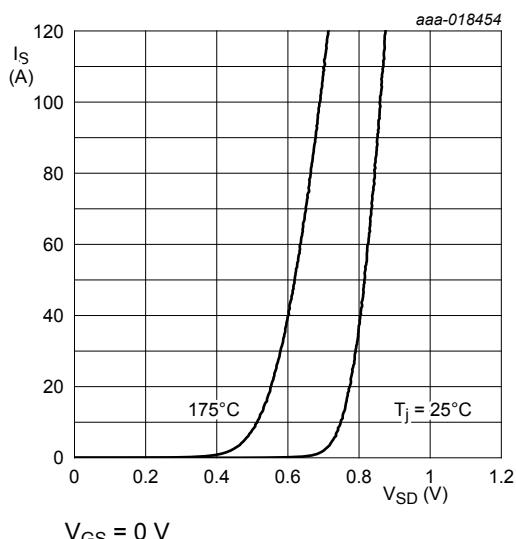


Fig. 15. Source-drain (diode forward) current as a function of source-drain (diode forward) voltage; typical values

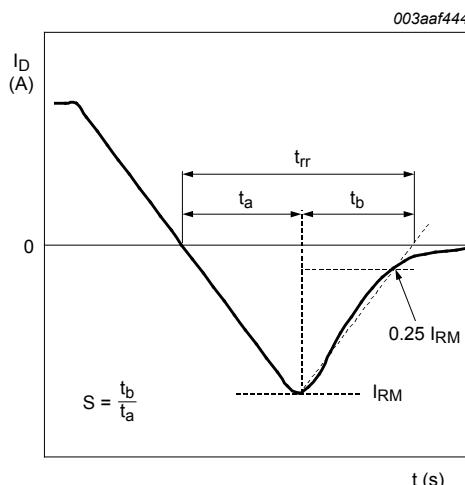
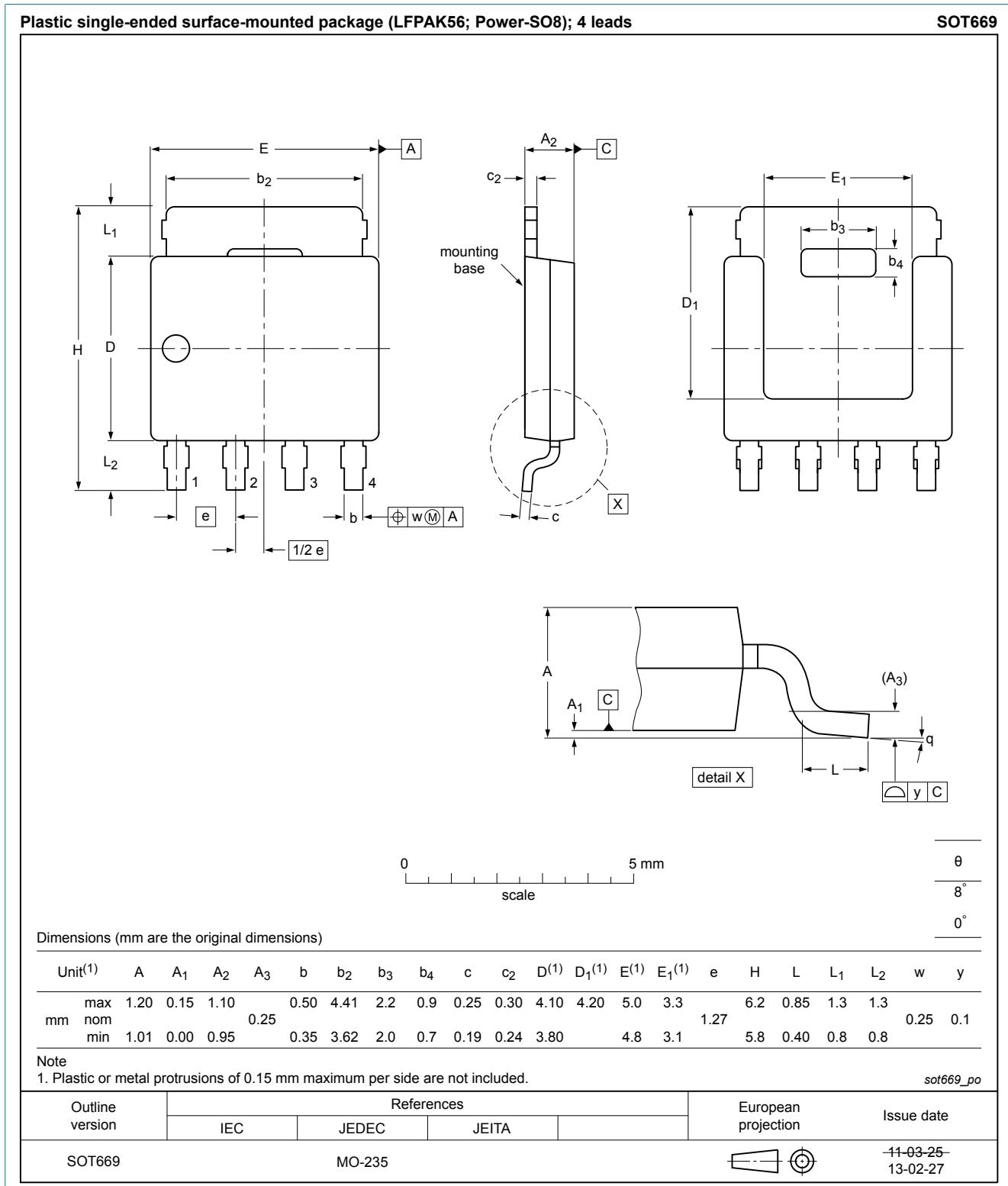


Fig. 16. Reverse recovery waveform definitions

11. Package outline



12. Legal information

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Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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