

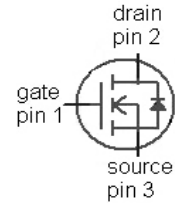
## OptiMOS<sup>®</sup> 2 Power-Transistor





### Features

- Ideal for high-frequency dc/dc converters
- Qualified according to JEDEC<sup>1)</sup> for target application
- N-channel, logic level
- Excellent gate charge x  $R_{DS(on)}$  product (FOM)
- Superior thermal resistance
- 175 °C operating temperature

### Product Summary

$V_{DS}$	25	V
$R_{DS(on),max}$	10.4	m $\Omega$
$I_D$	30	A



Type	IPD10N03LA	IPF10N03LA	IPS10N03LA	IPU10N03LA
				
<b>Package</b>	P-TO252-3-11	P-TO252-3-23	P-TO251-3-11	P-TO251-3-21
<b>Ordering Code</b>	Q67042-S4238	Q67042-S4239	Q67042-S4247	Q67042-S4242
<b>Marking</b>	10N03LA	10N03LA	10N03LA	10N03LA

Maximum ratings, at  $T_j=25\text{ °C}$ , unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	$I_D$	$T_C=25\text{ °C}^{2)}$	30	A
		$T_C=100\text{ °C}$	30	
Pulsed drain current	$I_{D,pulse}$	$T_C=25\text{ °C}^{3)}$	210	
Avalanche energy, single pulse	$E_{AS}$	$I_D=30\text{ A}$ , $R_{GS}=25\ \Omega$	80	mJ
Reverse diode $dv/dt$	$dv/dt$	$I_D=30\text{ A}$ , $V_{DS}=20\text{ V}$ , $di/dt=200\text{ A}/\mu\text{s}$ , $T_{j,max}=175\text{ °C}$	6	kV/ $\mu\text{s}$
Gate source voltage <sup>4)</sup>	$V_{GS}$		$\pm 20$	V
Power dissipation	$P_{tot}$	$T_C=25\text{ °C}$	52	W
Operating and storage temperature	$T_j$ , $T_{stg}$		-55 ... 175	°C
IEC climatic category; DIN IEC 68-1			55/175/56	

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

### Thermal characteristics

Thermal resistance, junction - case	$R_{thJC}$		-	-	2.9	K/W
SMD version, device on PCB	$R_{thJA}$	minimal footprint	-	-	75	
		6 cm <sup>2</sup> cooling area <sup>5)</sup>	-	-	50	

### Electrical characteristics, at $T_j=25\text{ }^\circ\text{C}$ , unless otherwise specified

#### Static characteristics

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}, I_D=1\text{ mA}$	25	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=20\text{ }\mu\text{A}$	1.2	1.6	2	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS}=25\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ }^\circ\text{C}$	-	0.1	1	$\mu\text{A}$
		$V_{DS}=25\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ }^\circ\text{C}$	-	10	100	
Gate-source leakage current	$I_{GSS}$	$V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$	-	10	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=4.5\text{ V}, I_D=20\text{ A}$	-	13.9	17.4	m $\Omega$
		$V_{GS}=10\text{ V}, I_D=30\text{ A}$	-	8.7	10.4	
Gate resistance	$R_G$		-	1	-	$\Omega$
Transconductance	$g_{fs}$	$ V_{DS} >2 I_D R_{DS(on)max}, I_D=30\text{ A}$	20	41	-	S

<sup>1)</sup> J-STD20 and JESD22

<sup>2)</sup> Current is limited by bondwire; with an  $R_{thJC}=2.9\text{ K/W}$  the chip is able to carry 53 A.

<sup>3)</sup> See figure 3

<sup>4)</sup>  $T_{j,max}=150\text{ }^\circ\text{C}$  and duty cycle  $D<0.25$  for  $V_{GS}<-5\text{ V}$

<sup>5)</sup> Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70  $\mu\text{m}$  thick) copper area for drain connection. PCB is vertical in still air.

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

#### Dynamic characteristics

Input capacitance	$C_{iss}$	$V_{GS}=0\text{ V}, V_{DS}=15\text{ V},$ $f=1\text{ MHz}$	-	1021	1358	pF
Output capacitance	$C_{oss}$		-	393	522	
Reverse transfer capacitance	$C_{rss}$		-	52	78	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=15\text{ V}, V_{GS}=10\text{ V},$ $I_D=15\text{ A}, R_G=2.7\ \Omega$	-	6.3	9.4	ns
Rise time	$t_r$		-	4.8	7.2	
Turn-off delay time	$t_{d(off)}$		-	18	27	
Fall time	$t_f$		-	2.8	4.2	

#### Gate Charge Characteristics+A40<sup>6)</sup>

Gate to source charge	$Q_{gs}$	$V_{DD}=15\text{ V}, I_D=15\text{ A},$ $V_{GS}=0\text{ to }5\text{ V}$	-	3.4	4.5	nC
Gate charge at threshold	$Q_{g(th)}$		-	1.6	2.2	
Gate to drain charge	$Q_{gd}$		-	2.3	3.5	
Switching charge	$Q_{sw}$		-	4.1	5.8	
Gate charge total	$Q_g$		-	8.2	11	
Gate plateau voltage	$V_{plateau}$		-	3.3	-	V
Gate charge total, sync. FET	$Q_{g(sync)}$	$V_{DS}=0.1\text{ V},$ $V_{GS}=0\text{ to }5\text{ V}$	-	7.2	9.6	nC
Output charge	$Q_{oss}$	$V_{DD}=15\text{ V}, V_{GS}=0\text{ V}$	-	8.5	11	

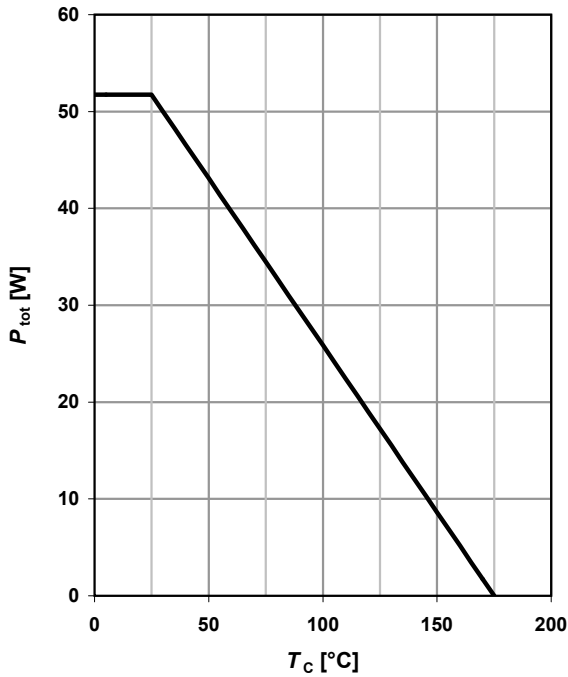
#### Reverse Diode

Diode continuous forward current	$I_S$	$T_C=25\text{ }^\circ\text{C}$	-	-	30	A
Diode pulse current	$I_{S,pulse}$		-	-	210	
Diode forward voltage	$V_{SD}$	$V_{GS}=0\text{ V}, I_F=30\text{ A},$ $T_j=25\text{ }^\circ\text{C}$	-	0.93	1.2	V
Reverse recovery charge	$Q_{rr}$	$V_R=15\text{ V}, I_F=I_S,$ $di_F/dt=400\text{ A}/\mu\text{s}$	-	-	10	nC

<sup>6)</sup> See figure 16 for gate charge parameter definition

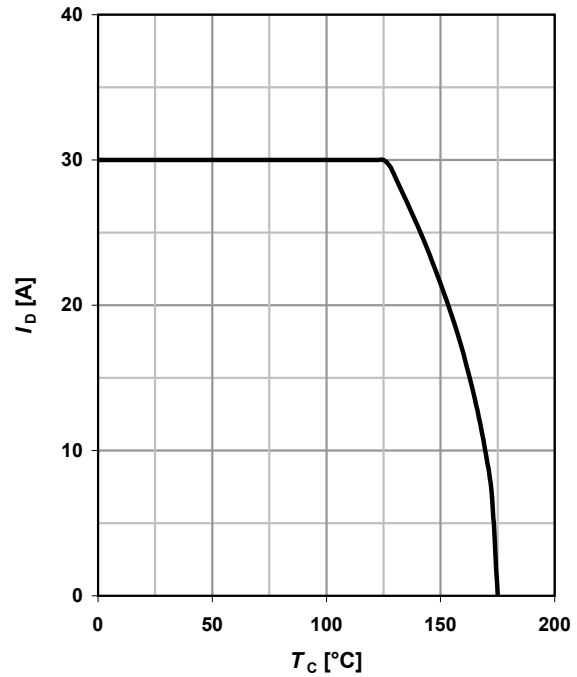
### 1 Power dissipation

$$P_{\text{tot}} = f(T_C)$$



### 2 Drain current

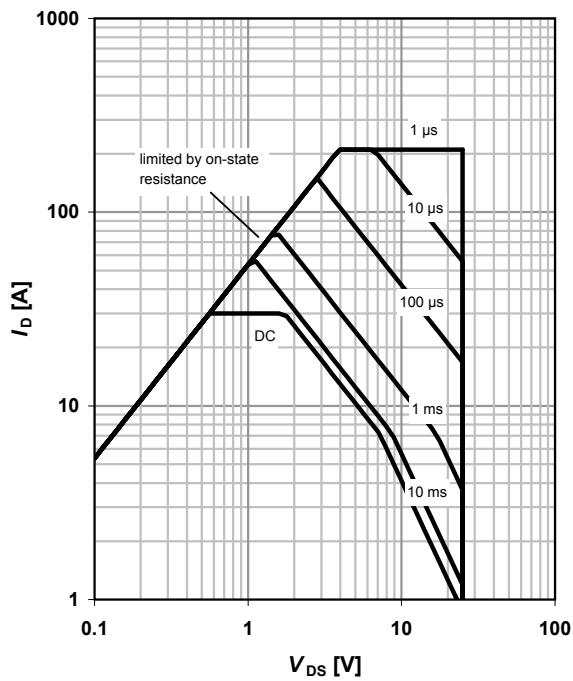
$$I_D = f(T_C); V_{GS} \geq 10 \text{ V}$$



### 3 Safe operating area

$$I_D = f(V_{DS}); T_C = 25 \text{ °C}; D = 0$$

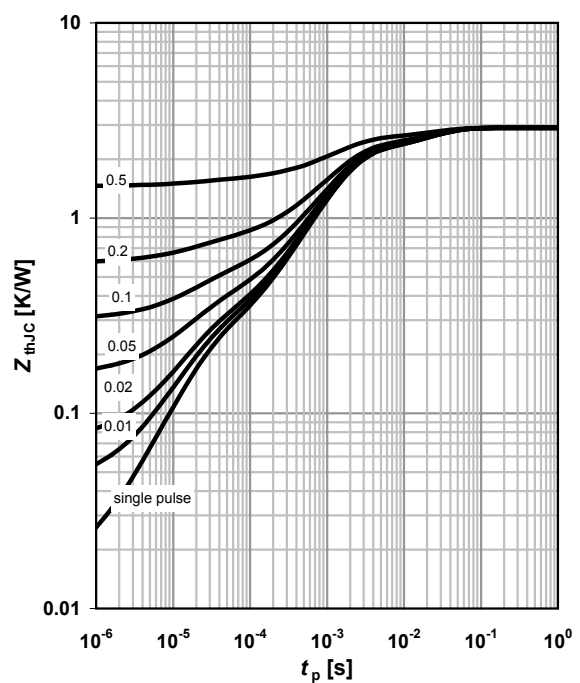
parameter:  $t_p$



### 4 Max. transient thermal impedance

$$Z_{\text{thJC}} = f(t_p)$$

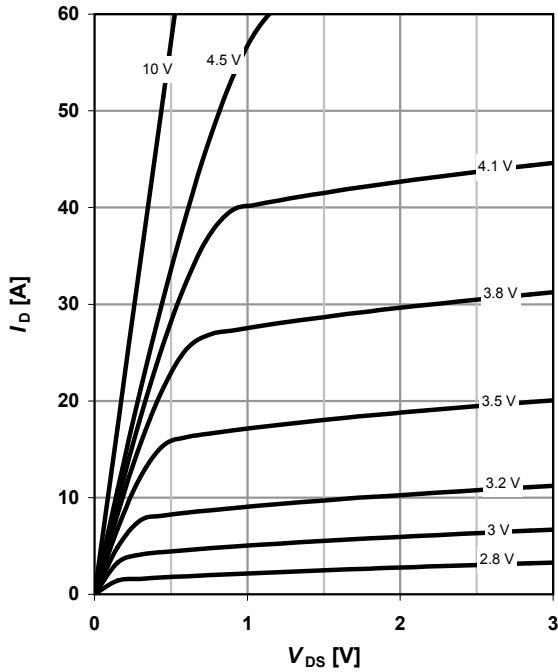
parameter:  $D = t_p/T$



**5 Typ. output characteristics**

$$I_D = f(V_{DS}); T_j = 25\text{ }^\circ\text{C}$$

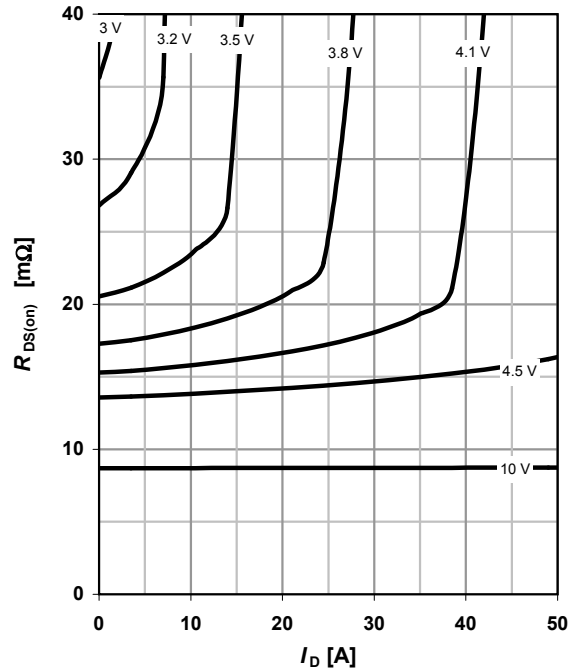
parameter:  $V_{GS}$



**6 Typ. drain-source on resistance**

$$R_{DS(on)} = f(I_D); T_j = 25\text{ }^\circ\text{C}$$

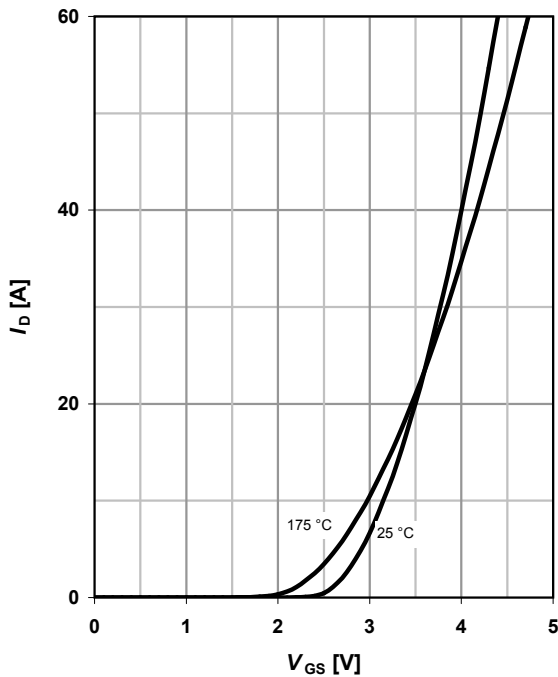
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

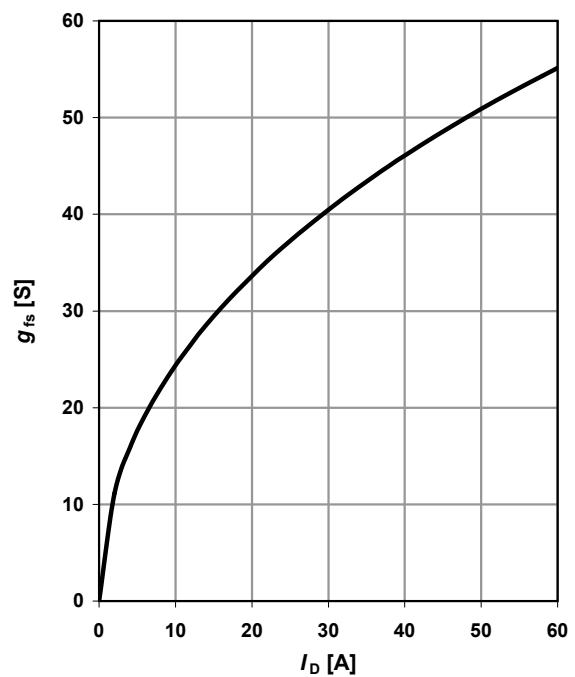
$$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$$

parameter:  $T_j$



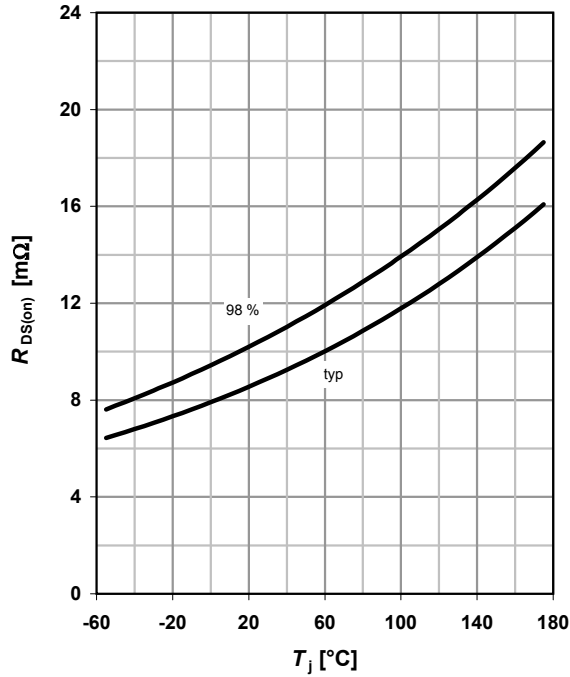
**8 Typ. forward transconductance**

$$g_{fs} = f(I_D); T_j = 25\text{ }^\circ\text{C}$$



### 9 Drain-source on-state resistance

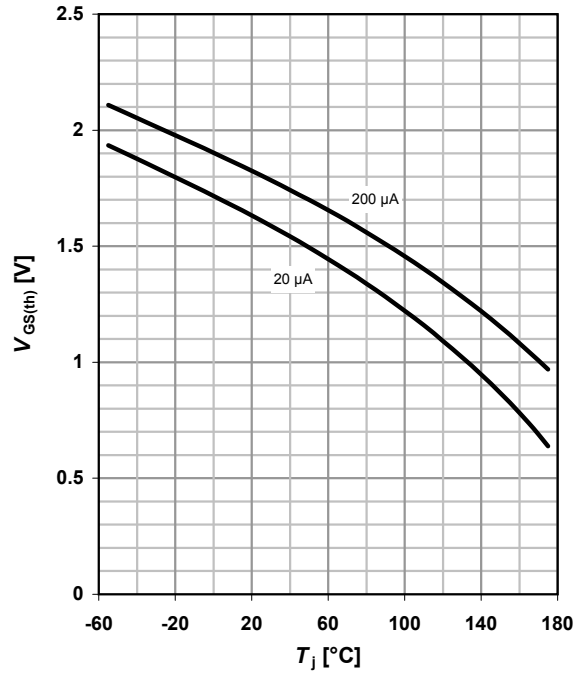
$$R_{DS(on)} = f(T_j); I_D = 30 \text{ A}; V_{GS} = 10 \text{ V}$$



### 10 Typ. gate threshold voltage

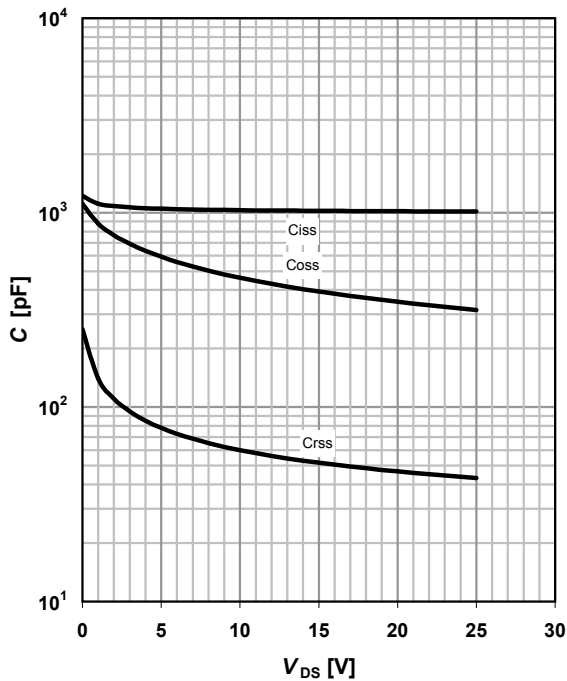
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$$

parameter:  $I_D$



### 11 Typ. capacitances

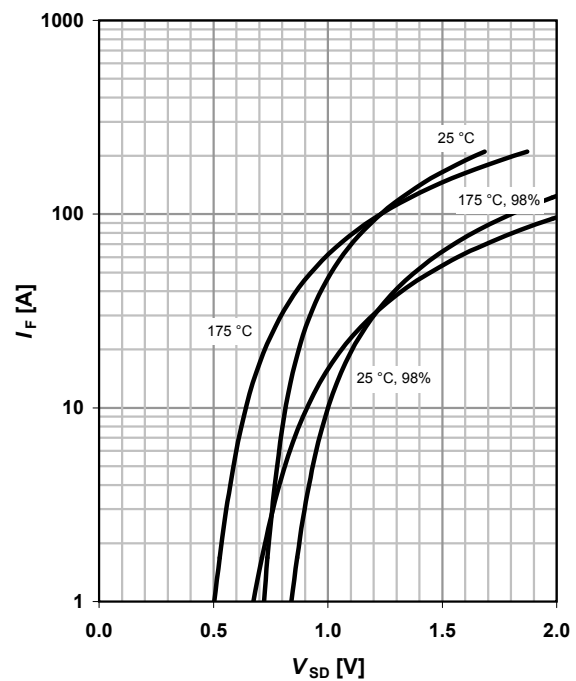
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$



### 12 Forward characteristics of reverse diode

$$I_F = f(V_{SD})$$

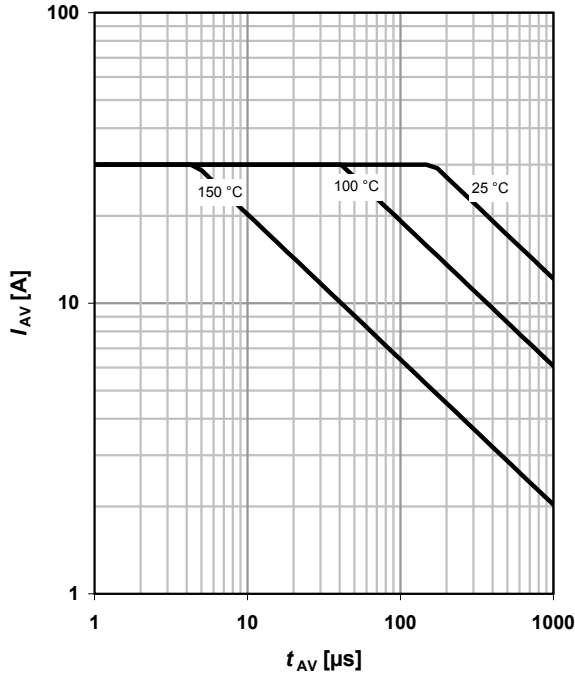
parameter:  $T_j$



### 13 Avalanche characteristics

$$I_{AS} = f(t_{AV}); R_{GS} = 25 \Omega$$

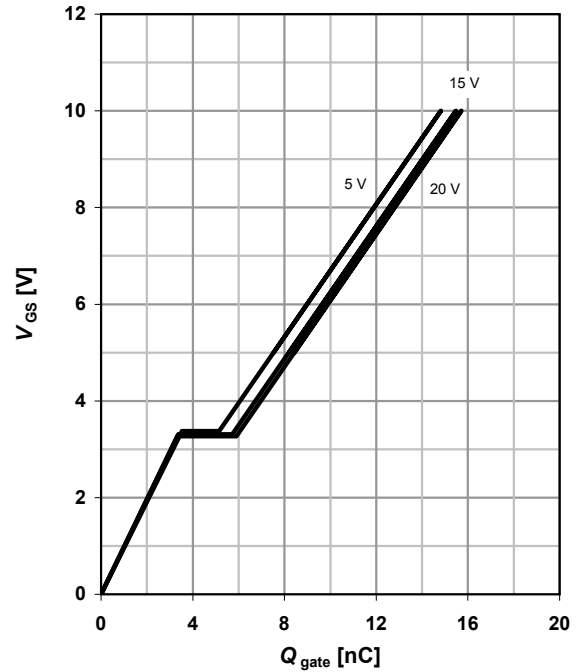
parameter:  $T_{j(\text{start})}$



### 14 Typ. gate charge

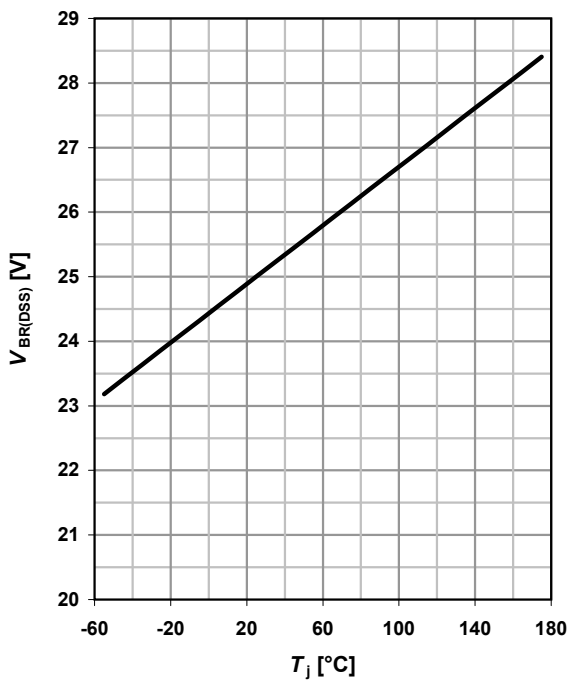
$$V_{GS} = f(Q_{\text{gate}}); I_D = 15 \text{ A pulsed}$$

parameter:  $V_{DD}$



### 15 Drain-source breakdown voltage

$$V_{BR(DSS)} = f(T_j); I_D = 1 \text{ mA}$$

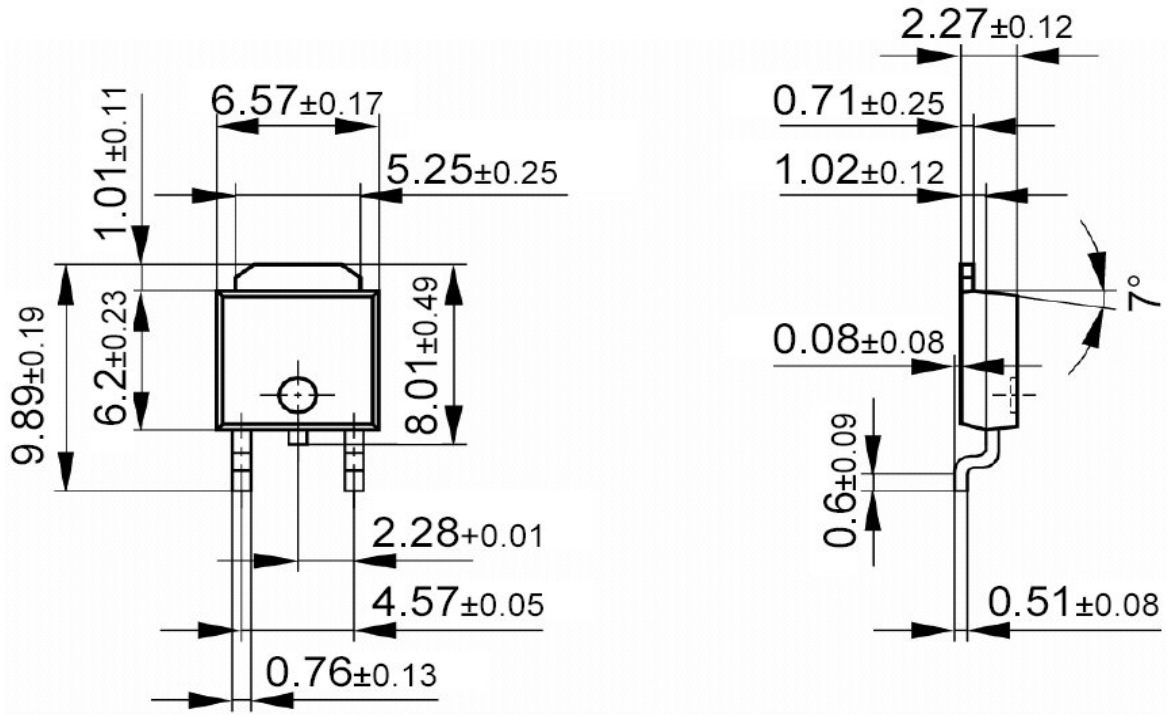


### 16 Gate charge waveforms

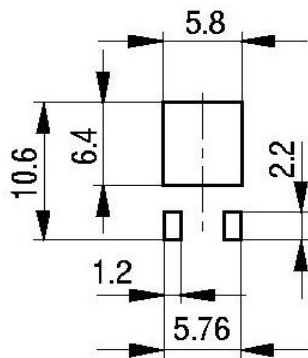


Package Outline

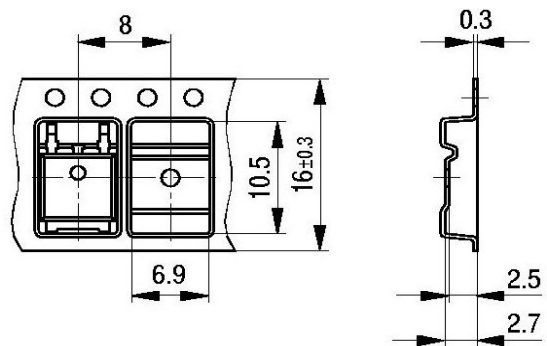
P-TO252-3-11: Outline



Footprint:



Packaging:

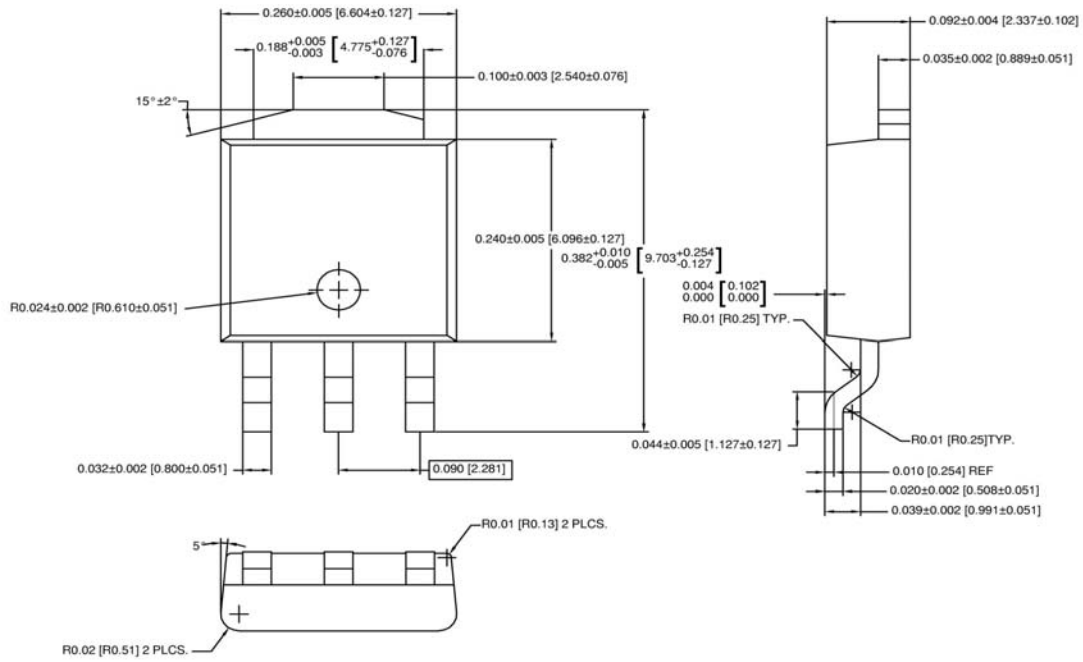


Dimensions in mm

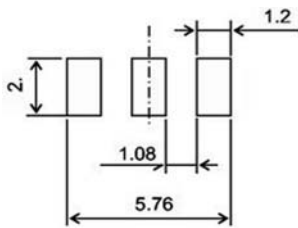


Package Outline

P-TO252-3-23: Outline



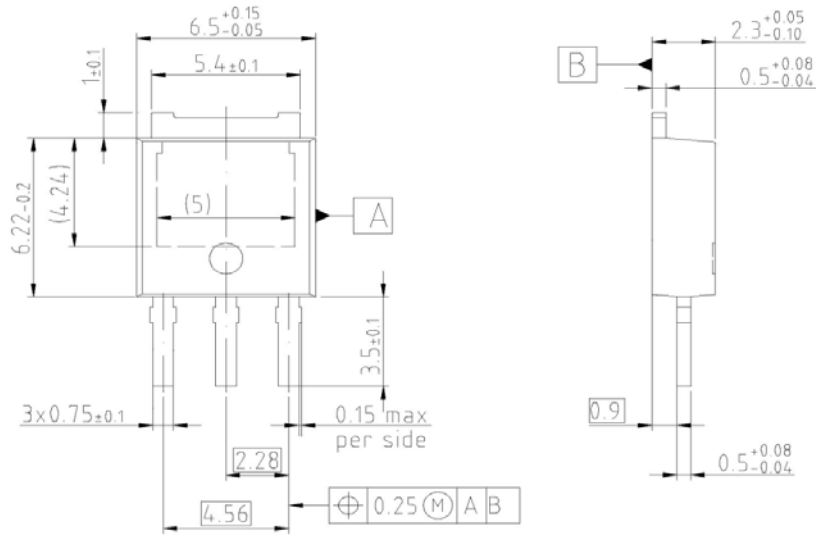
Footprint:



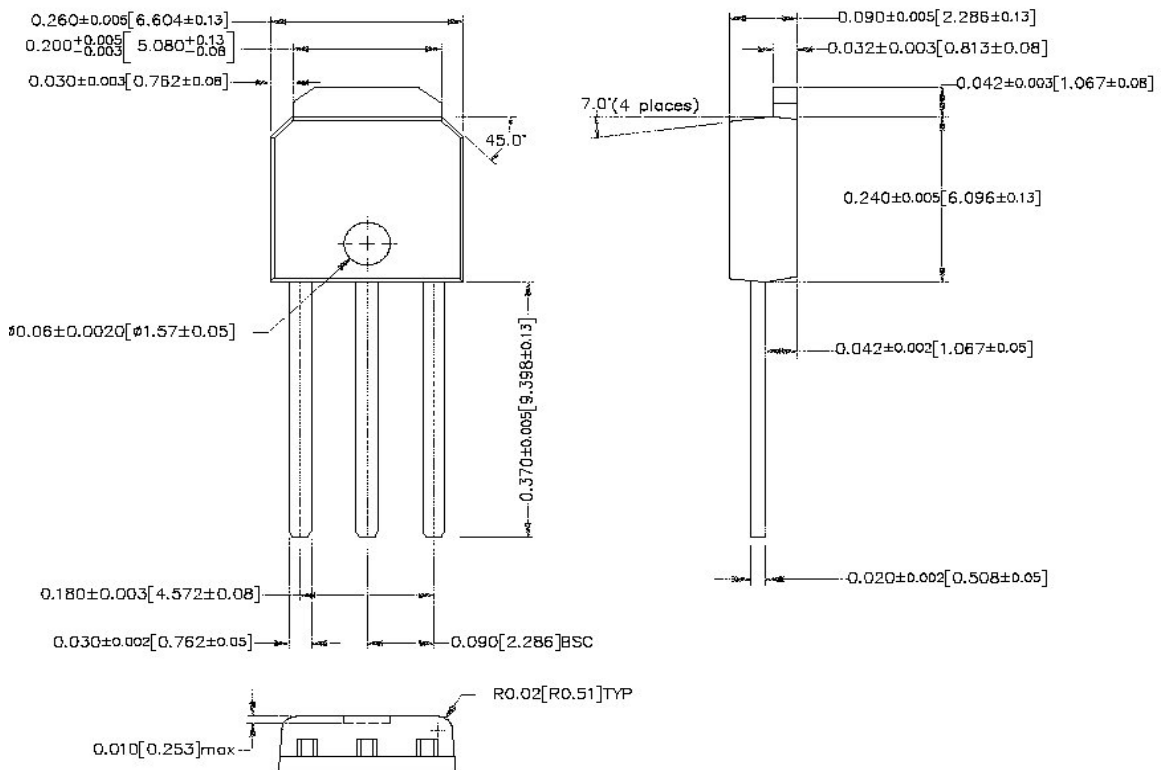
Dimensions in inch [mm]

Package Outline

P-TO252-3-11



P-TO251-3-21



Dimensions in inch [mm]



**Published by**  
**Infineon Technologies AG**  
**Bereich Kommunikation**  
**St.-Martin-Straße 53**  
**D-81541 München**  
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