

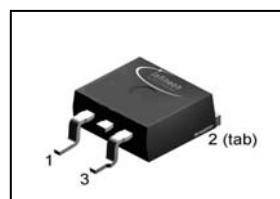
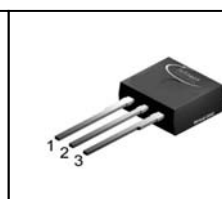
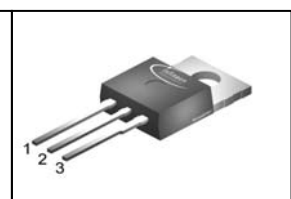
OptiMOS[®] 2 Power-Transistor

Features

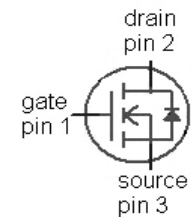
- Ideal for high-frequency dc/dc converters
- N-channel
- Logic level
- Excellent gate charge x $R_{DS(on)}$ product (FOM)
- Very low on-resistance $R_{DS(on)}$
- Superior thermal resistance
- 175 °C operating temperature
- dv/dt rated

Product Summary

V_{DS}	25	V
$R_{DS(on),max}$ (SMD version)	8.9	m Ω
I_D	50	A

P-TO263-3-2

P-TO262-3-1

P-TO220-3-1


Type	Package	Ordering Code	Marking
IPB09N03LA	P-TO263-3-2	Q67042-S4151	09N03LA
IPI09N03LA	P-TO262-3-1	Q67042-S4152	09N03LA
IPP09N03LA	P-TO220-3-1	Q67042-S4153	09N03LA



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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	$T_C=25\text{ °C}^1)$	50	A
		$T_C=100\text{ °C}$	46	
Pulsed drain current	$I_{D,pulse}$	$T_C=25\text{ °C}^2)$	350	
Avalanche energy, single pulse	E_{AS}	$I_D=45\text{ A}$, $R_{GS}=25\ \Omega$	75	mJ
Reverse diode dv/dt	dv/dt	$I_D=50\text{ A}$, $V_{DS}=20\text{ V}$, $di/dt=200\text{ A}/\mu\text{s}$, $T_{j,max}=175\text{ °C}$	6	kV/ μs
Gate source voltage ³⁾	V_{GS}		± 20	V
Power dissipation	P_{tot}	$T_C=25\text{ °C}$	63	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}		-	-	2.4	K/W
SMD version, device on PCB	R_{thJA}	minimal footprint	-	-	62	
		6 cm ² cooling area ⁴⁾	-	-	40	

Electrical characteristics, at $T_j=25\text{ °C}$, 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}	$V_{DS}=25\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$	-	0.1	1	μA
		$V_{DS}=25\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ °C}$	-	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	$R_{DS(on)}$	$V_{GS}=4.5\text{ V}, I_D=30\text{ A}$	-	12.4	15.5	m Ω
		$V_{GS}=4.5\text{ V}, I_D=30\text{ A},$ SMD version	-	12.1	15.1	
		$V_{GS}=10\text{ V}, I_D=30\text{ A}$	-	7.7	9.2	
		$V_{GS}=10\text{ V}, I_D=30\text{ A},$ SMD version	-	7.4	8.9	
Gate resistance	R_G		-	1	-	Ω
Transconductance	g_{fs}	$ V_{DS} >2 I_D R_{DS(on)max},$ $I_D=30\text{ A}$	21	42	-	S

¹⁾ Current is limited by bondwire; with an $R_{thJC}=2.4\text{ K/W}$ the chip is able to carry 64 A.

²⁾ See figure 3

³⁾ $T_{j,max}=150\text{ °C}$ and duty cycle $D<0.25$ for $V_{GS}<-5\text{ V}$

⁴⁾ Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm² (one layer, 70 μm 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}	$V_{GS}=0\text{ V}, V_{DS}=15\text{ V}, f=1\text{ MHz}$	-	1240	1649	pF
Output capacitance	C_{oss}		-	530	704	
Reverse transfer capacitance	C_{rss}		-	81	122	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=15\text{ V}, V_{GS}=10\text{ V}, I_D=25\text{ A}, R_G=2.7\ \Omega$	-	9	13	ns
Rise time	t_r		-	88	132	
Turn-off delay time	$t_{d(off)}$		-	22	33	
Fall time	t_f		-	4.2	6	

Gate Charge Characteristics⁵⁾

Gate to source charge	Q_{gs}	$V_{DD}=15\text{ V}, I_D=25\text{ A}, V_{GS}=0\text{ to }5\text{ V}$	-	4.4	5.8	nC
Gate charge at threshold	$Q_{g(th)}$		-	2.0	2.6	
Gate to drain charge	Q_{gd}		-	3.1	4.7	
Switching charge	Q_{sw}		-	5.5	7.9	
Gate charge total	Q_g		-	10	14	
Gate plateau voltage	$V_{plateau}$		-	3.5	-	V
Gate charge total, sync. FET	$Q_{g(sync)}$	$V_{DS}=0.1\text{ V}, V_{GS}=0\text{ to }5\text{ V}$	-	9	12	nC
Output charge	Q_{oss}	$V_{DD}=15\text{ V}, V_{GS}=0\text{ V}$	-	11	15	

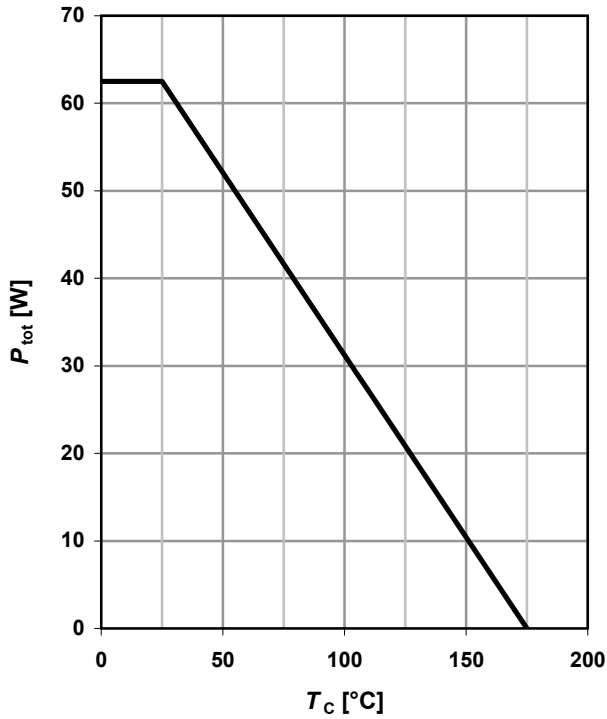
Reverse Diode

Diode continuous forward current	I_S	$T_C=25\text{ }^\circ\text{C}$	-	-	50	A
Diode pulse current	$I_{S,pulse}$		-	-	350	
Diode forward voltage	V_{SD}	$V_{GS}=0\text{ V}, I_F=50\text{ A}, T_J=25\text{ }^\circ\text{C}$	-	0.98	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

⁵⁾ See figure 16 for gate charge parameter definition

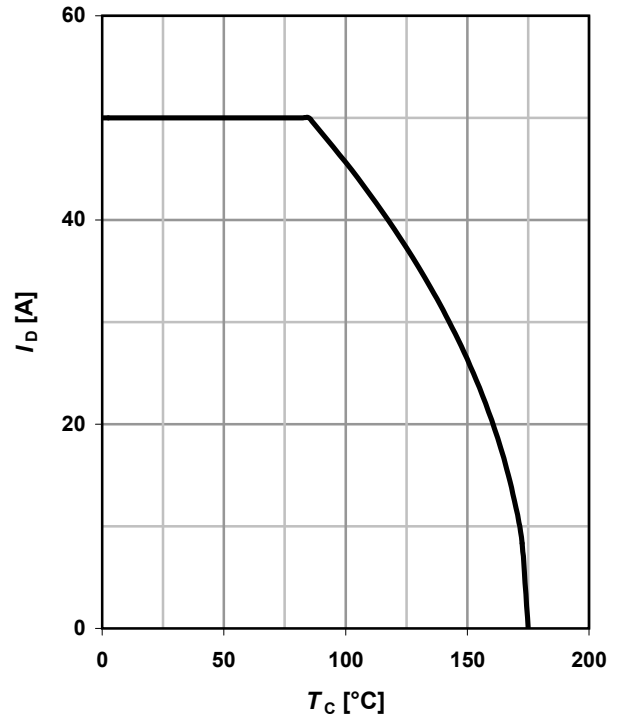
1 Power dissipation

$P_{tot}=f(T_C)$



2 Drain current

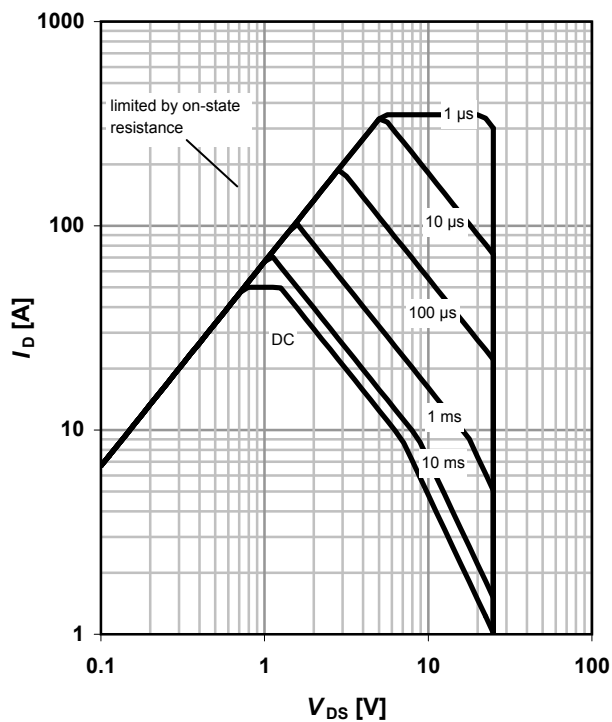
$I_D=f(T_C); V_{GS} \geq 10\text{ V}$



3 Safe operation area

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

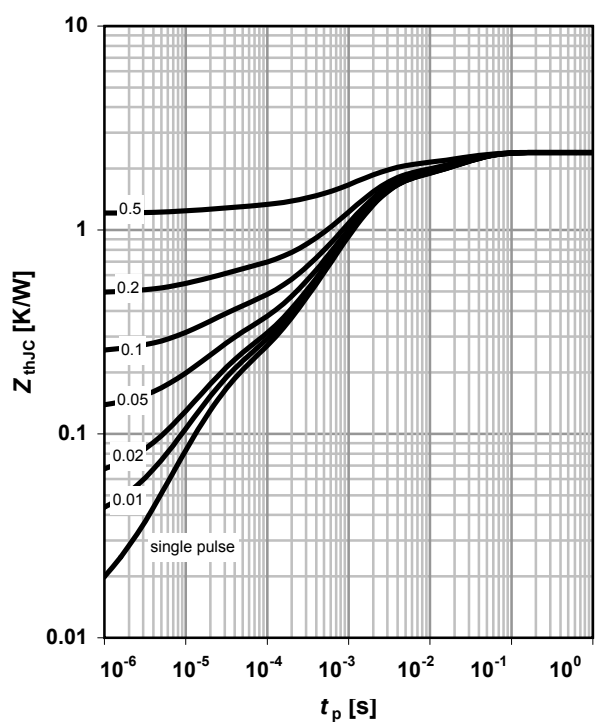
parameter: t_p



4 Max. transient thermal impedance

$Z_{thJC}=f(t_p)$

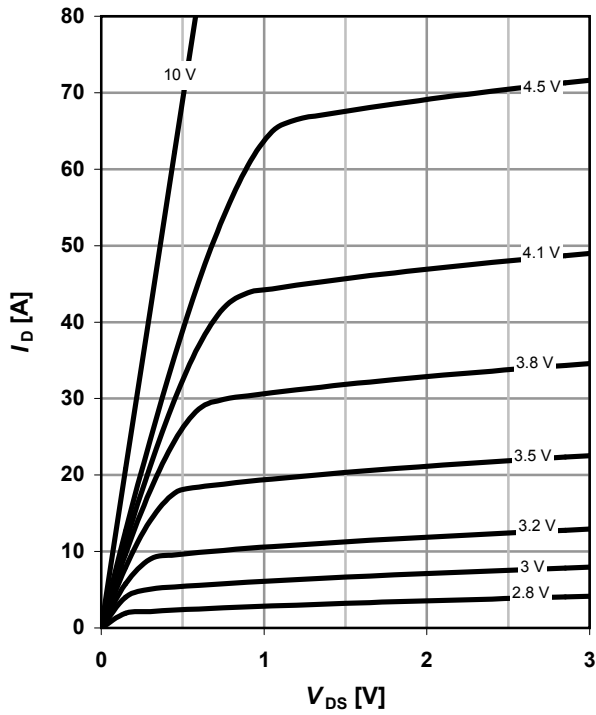
parameter: $D=t_p/T$



5 Typ. output characteristics

$I_D = f(V_{DS}); T_j = 25\text{ °C}$

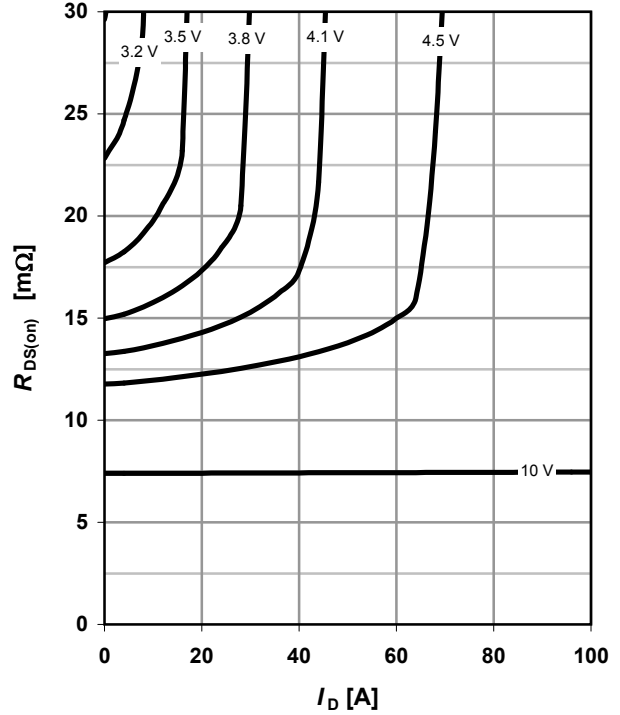
parameter: V_{GS}



6 Typ. drain-source on resistance

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

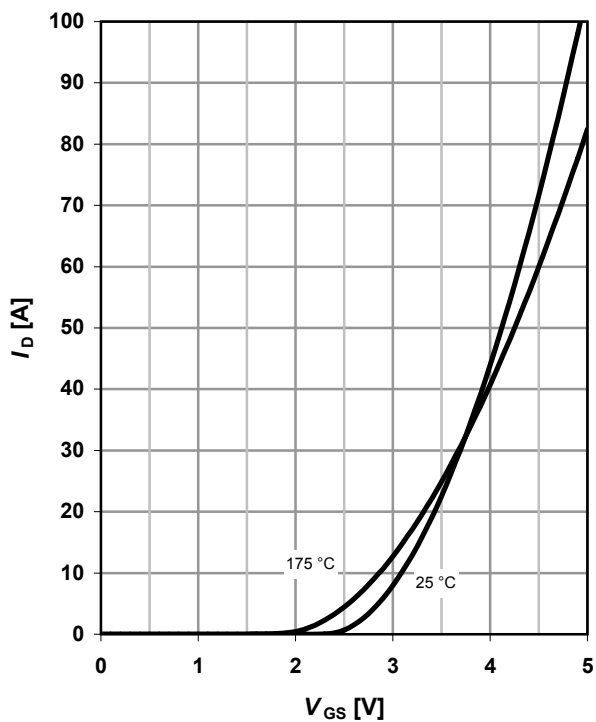
parameter: V_{GS}



7 Typ. transfer characteristics

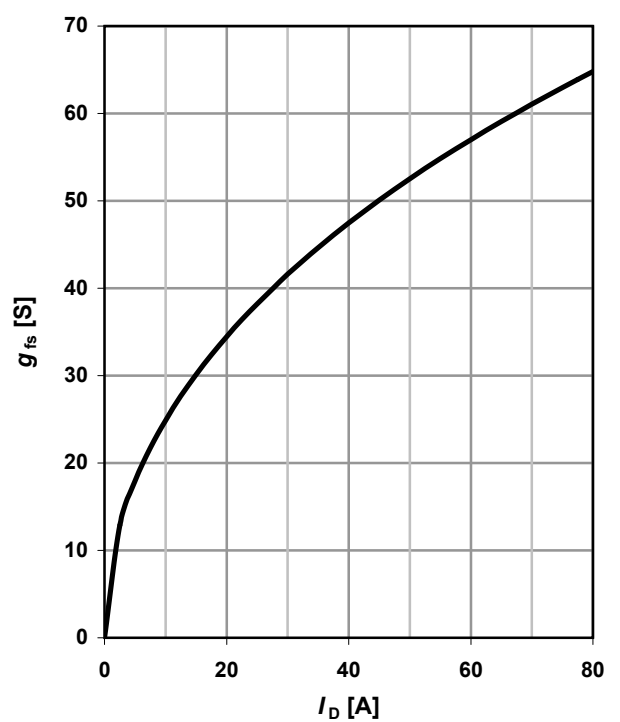
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$

parameter: T_j



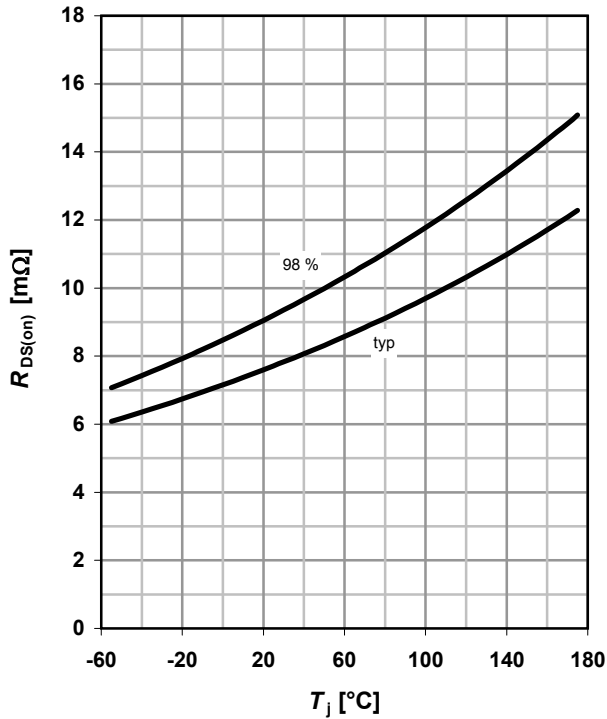
8 Typ. forward transconductance

$g_{fs} = f(I_D); T_j = 25\text{ °C}$



9 Drain-source on-state resistance

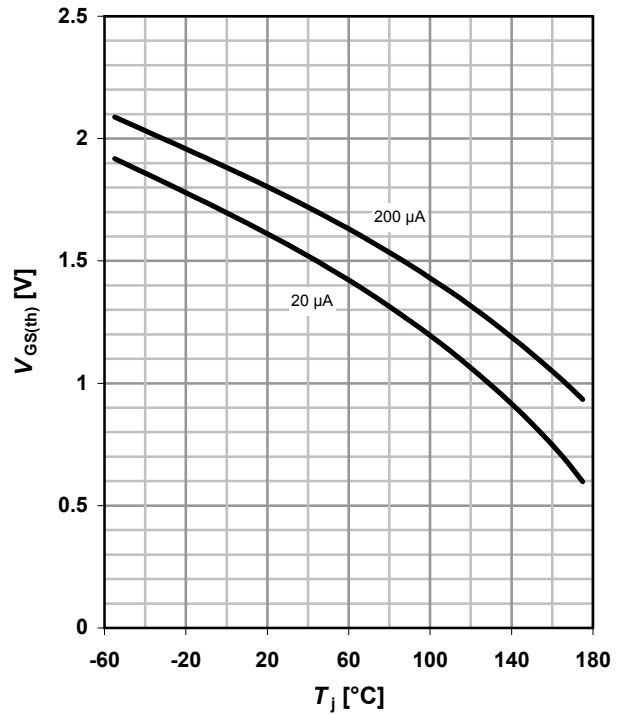
$R_{DS(on)} = f(T_j); I_D = 30 \text{ A}; V_{GS} = 10 \text{ V}$



10 Typ. gate threshold voltage

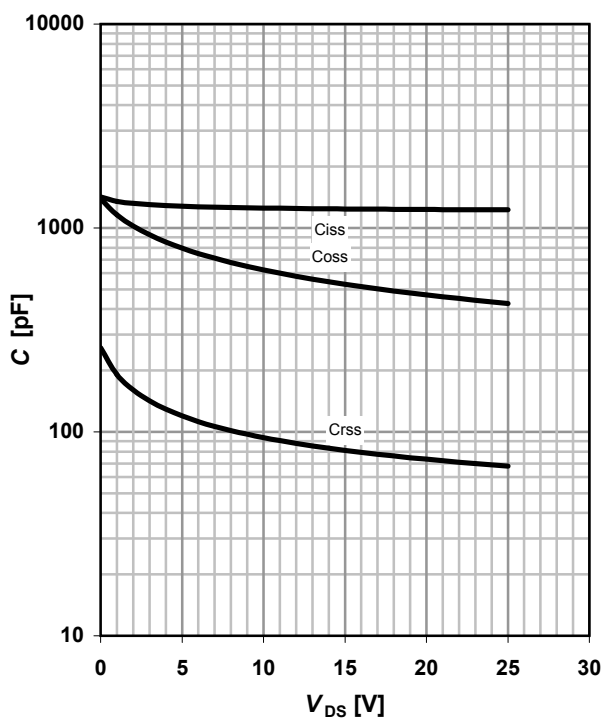
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

parameter: I_D



11 Typ. Capacitances

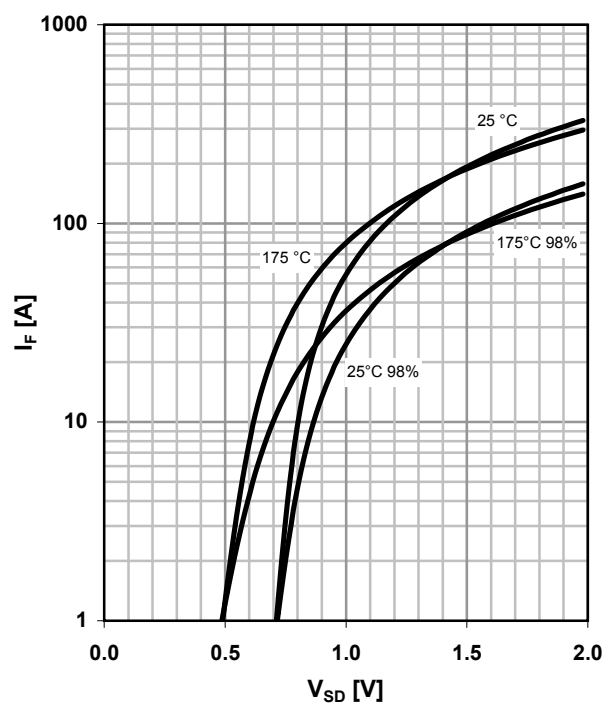
$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$



12 Forward characteristics of reverse diode

$I_F = f(V_{SD})$

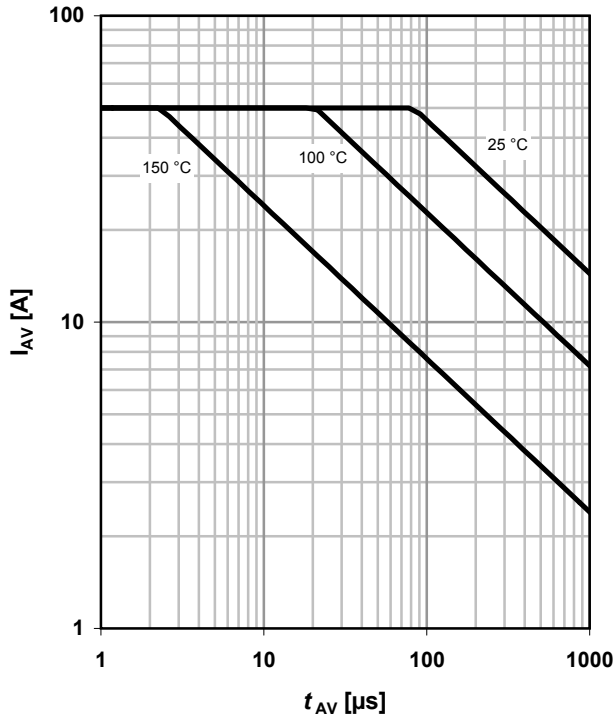
parameter: T_j



13 Avalanche characteristics

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

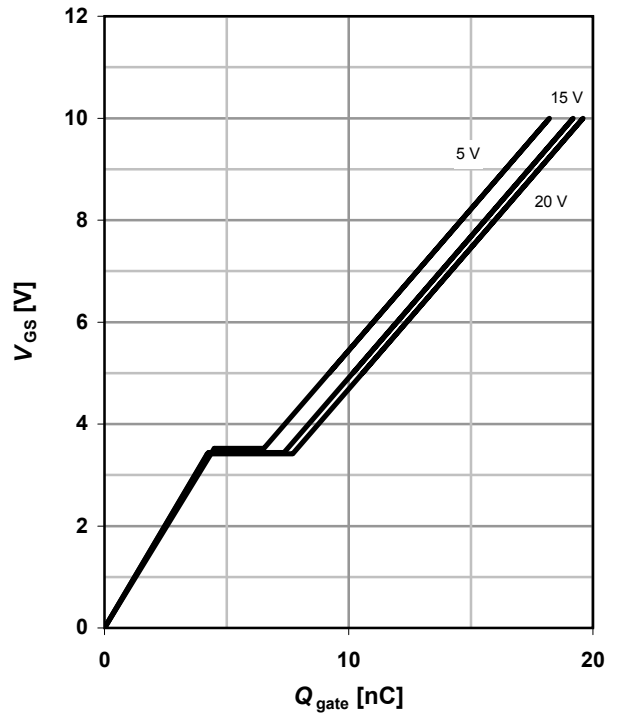
parameter: $T_{j(start)}$



14 Typ. gate charge

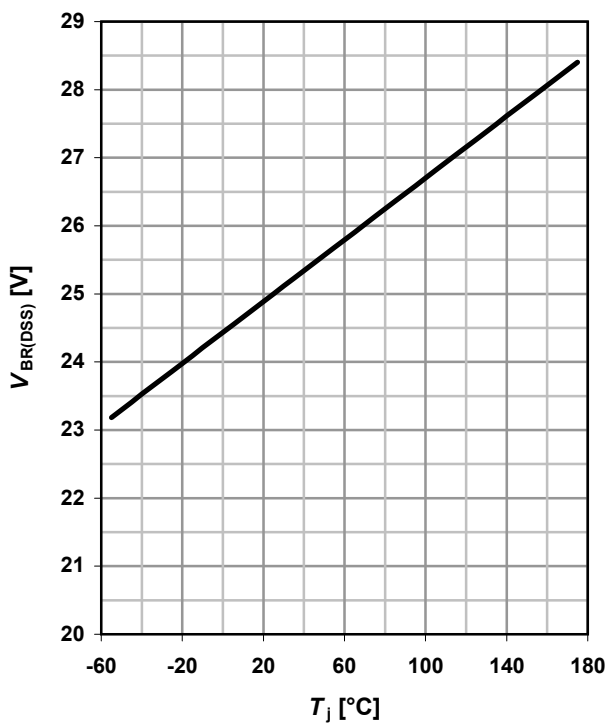
$V_{GS}=f(Q_{gate}); I_D=25\ A\ pulsed$

parameter: V_{DD}

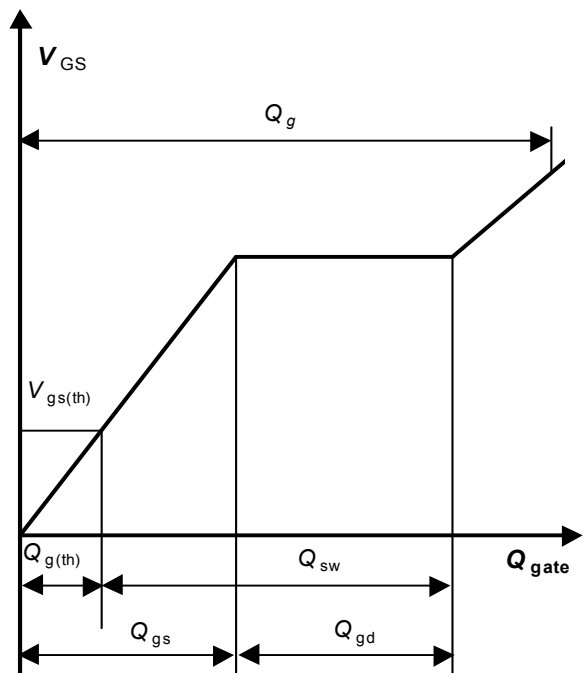


15 Drain-source breakdown voltage

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

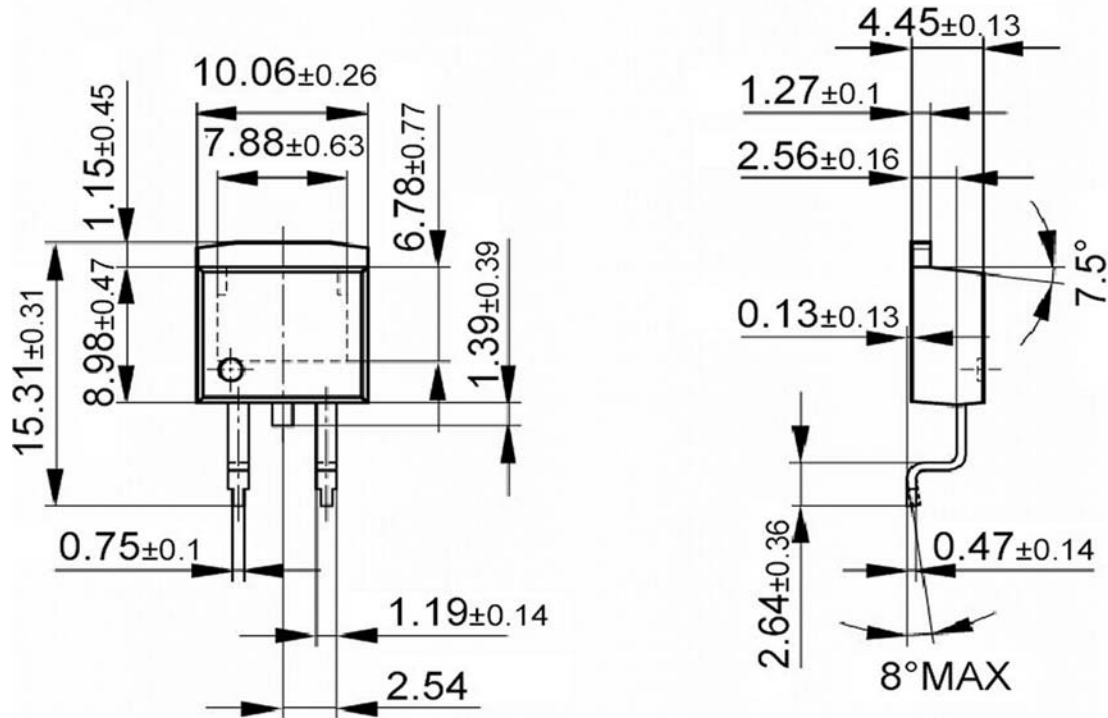


16 Gate charge waveforms

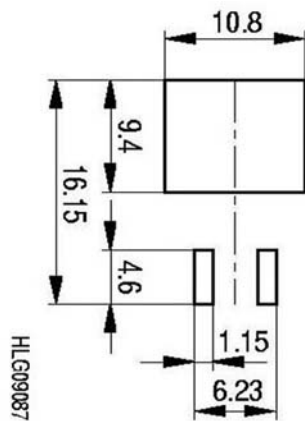


Package Outline

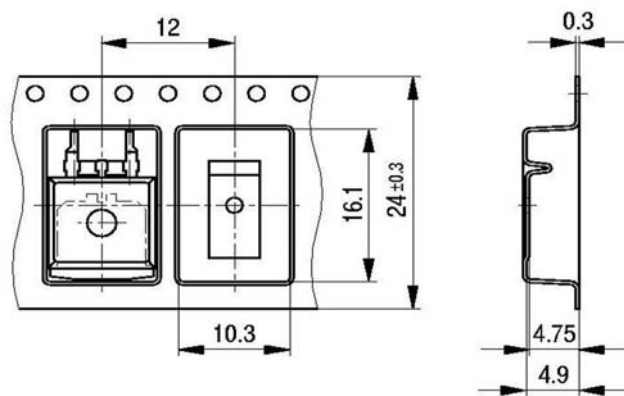
P-TO263-3-2: Outline



Footprint

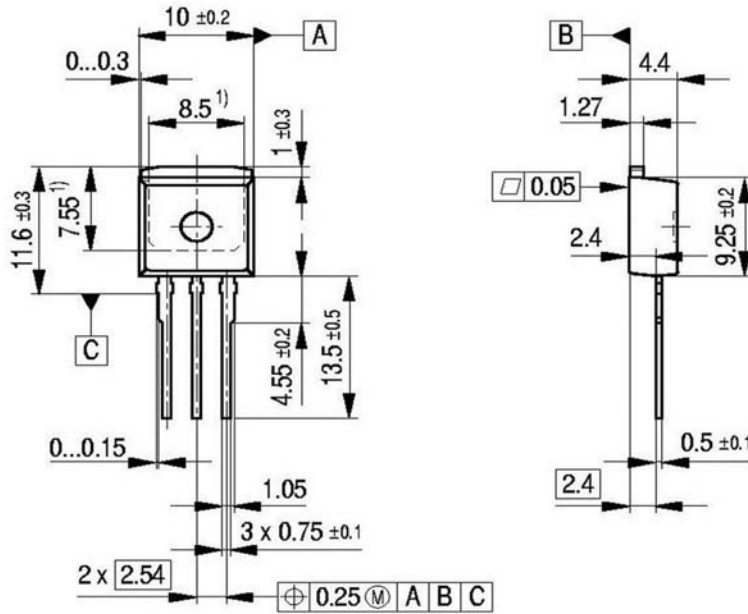


Packaging



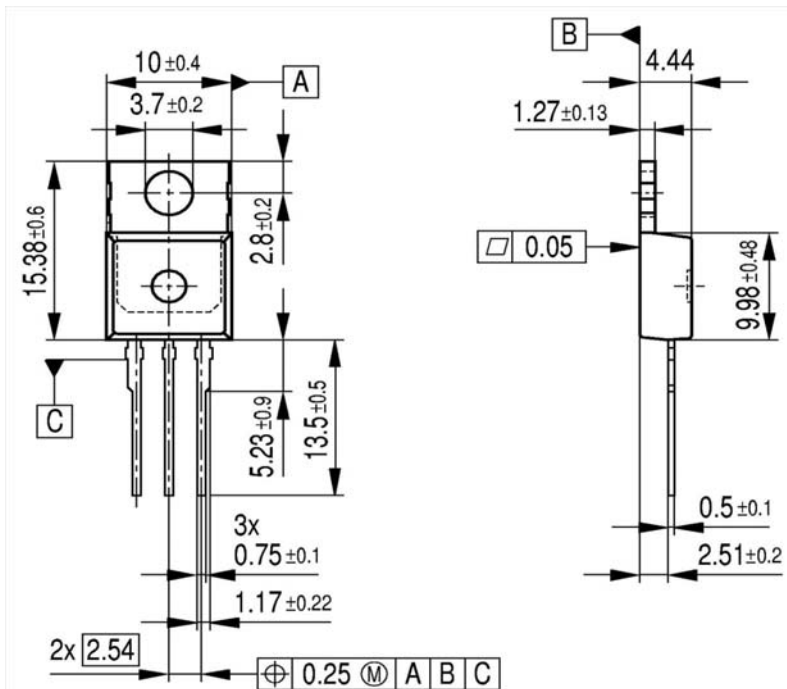
Dimensions in mm

P-TO262-3-1: Outline



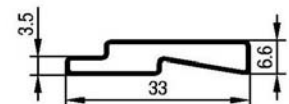
1) Typical
 Metal surface min. X = 7.25, Y = 6.9
 All metal surfaces tin plated, except area of cut.

P-TO220-3-1: Outline



All metal surfaces tin plated, except area of cut.
 Metal surface min. x=7.25, y=12.3

Packaging



Dimensions in mm

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