

OptiMOS<sup>â</sup> Buck converter series

Feature

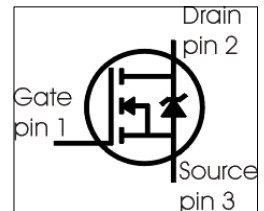
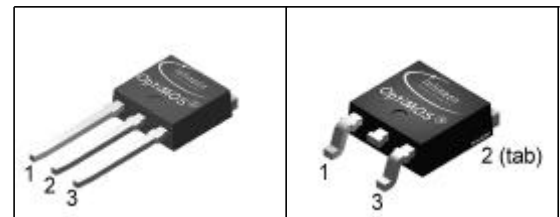
- N-Channel
- Logic Level
- Low On-Resistance  $R_{DS(on)}$
- Excellent Gate Charge x  $R_{DS(on)}$  product (FOM)
- Superior thermal resistance
- 175°C operating temperature
- Avalanche rated
- $dv/dt$  rated
- Ideal for fast switching buck converters

Product Summary

$V_{DS}$	30	V
$R_{DS(on)}$	20	m $\Omega$
$I_D$	30	A

P- TO251 -3-1

P- TO252 -3-11



Type	Package	Ordering Code	Marking
IPD20N03L	P- TO252 -3-11	Q67042-S4050	20N03L
IPU20N03L	P- TO251 -3-1	Q67042-S4106	20N03L

Maximum Ratings, at  $T_j = 25^\circ\text{C}$ , unless otherwise specified

Parameter	Symbol	Value	Unit
Continuous drain current <sup>1)</sup> $T_C=25^\circ\text{C}$	$I_D$	30 30	A
Pulsed drain current $T_C=25^\circ\text{C}$	$I_{D \text{ puls}}$	120	
Avalanche energy, single pulse $I_D=15\text{A}$ , $V_{DD}=25\text{V}$ , $R_{GS}=25\Omega$	$E_{AS}$	15	mJ
Repetitive avalanche energy, limited by $T_{jmax}^{2)}$	$E_{AR}$	6	
Reverse diode $dv/dt$ $I_S=30\text{A}$ , $V_{DS}=24\text{V}$ , $di/dt=200\text{A}/\mu\text{s}$ , $T_{jmax}=175^\circ\text{C}$	$dv/dt$	6	kV/ $\mu\text{s}$
Gate source voltage	$V_{GS}$	$\pm 20$	V
Power dissipation $T_C=25^\circ\text{C}$	$P_{tot}$	60	W
Operating and storage temperature	$T_j, T_{stg}$	-55... +175	$^\circ\text{C}$
IEC climatic category; DIN IEC 68-1		55/175/56	

### Thermal Characteristics

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>Characteristics</b>					
Thermal resistance, junction - case	$R_{thJC}$	-	1.7	2.5	K/W
Thermal resistance, junction - ambient, leaded	$R_{thJA}$	-	-	100	
SMD version, device on PCB: @ min. footprint @ 6 cm <sup>2</sup> cooling area <sup>3)</sup>	$R_{thJA}$	-	-	75 50	

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
<b>Static Characteristics</b>					
Drain-source breakdown voltage $V_{GS}=0V, I_D=1mA$	$V_{(BR)DSS}$	30	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D=25\mu A$	$V_{GS(th)}$	1.2	1.6	2	
Zero gate voltage drain current $V_{DS}=30V, V_{GS}=0V, T_f=25^\circ C$ $V_{DS}=30V, V_{GS}=0V, T_f=125^\circ C$	$I_{DSS}$	-	0.01 10	1 100	$\mu A$
Gate-source leakage current $V_{GS}=20V, V_{DS}=0V$	$I_{GSS}$	-	1	100	
Drain-source on-state resistance $V_{GS}=4.5V, I_D=15A$	$R_{DS(on)}$	-	22.9	31	m $\Omega$
Drain-source on-state resistance $V_{GS}=10V, I_D=15A$	$R_{DS(on)}$	-	15.5	20	

<sup>1</sup>Current limited by bondwire ; with an  $R_{thJC} = 2.5K/W$  the chip is able to carry  $I_D= 42A$  at  $25^\circ C$ , for detailed information see app.-note ANPS071E available at [www.infineon.com/optimos](http://www.infineon.com/optimos)

<sup>2</sup>Defined by design. Not subject to production test.

<sup>3</sup>Device on 40mm\*40mm\*1.5mm epoxy PCB FR4 with 6cm<sup>2</sup> (one layer, 70  $\mu m$  thick) copper area for drain connection. PCB is vertical without blown air.

**Electrical Characteristics**

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

**Dynamic Characteristics**

Transconductance	$g_{fs}$	$V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$ , $I_D = 30A$	14	28	-	S
Input capacitance	$C_{iss}$	$V_{GS} = 0V$ , $V_{DS} = 25V$ , $f = 1MHz$	-	530	700	pF
Output capacitance	$C_{oss}$		-	200	275	
Reverse transfer capacitance	$C_{rss}$		-	60	90	
Gate resistance	$R_G$		-	1.3	-	$\Omega$
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 15V$ , $V_{GS} = 10V$ , $I_D = 15A$ , $R_G = 12.7\Omega$	-	6.2	9.3	ns
Rise time	$t_r$		-	11	17	
Turn-off delay time	$t_{d(off)}$		-	23	34	
Fall time	$t_f$		-	18	27	

**Gate Charge Characteristics**

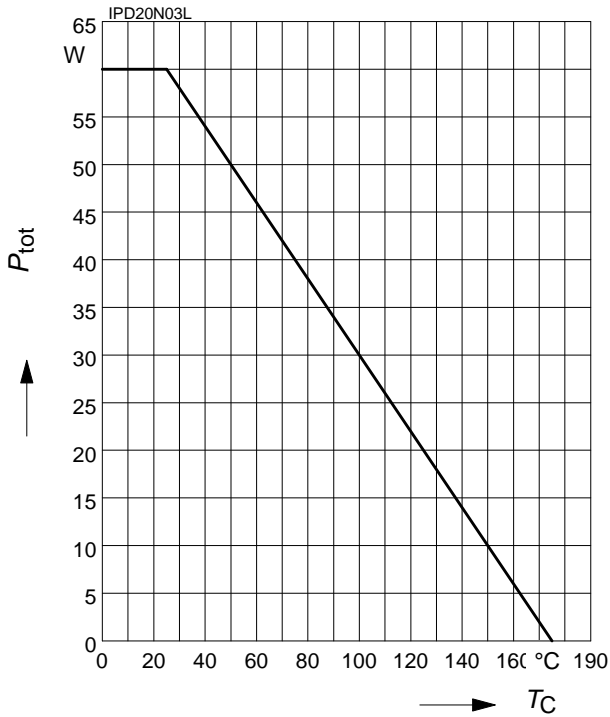
Gate to source charge	$Q_{gs}$	$V_{DD} = 15V$ , $I_D = 15A$	-	2.5	3.1	nC
Gate to drain charge	$Q_{gd}$		-	6.4	9.6	
Gate charge total	$Q_g$	$V_{DD} = 15V$ , $I_D = 15A$ , $V_{GS} = 0$ to $5V$	-	8.4	11	
Output charge	$Q_{oss}$	$V_{DS} = 15V$ , $I_D = 15A$ , $V_{GS} = 0V$	-	8	10	nC
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} = 15V$ , $I_D = 15A$	-	3.6	-	V

**Reverse Diode**

Inverse diode continuous forward current	$I_S$	$T_C = 25^\circ C$	-	-	30	A
Inv. diode direct current, pulsed	$I_{SM}$		-	-	120	
Inverse diode forward voltage	$V_{SD}$	$V_{GS} = 0V$ , $I_F = 30A$	-	1.1	1.4	V
Reverse recovery time	$t_{rr}$	$V_R = 15V$ , $I_F = I_S$ , $dI_F/dt = 100A/\mu s$	-	15	18	ns
Reverse recovery charge	$Q_{rr}$		-	2	3	nC

**1 Power dissipation**

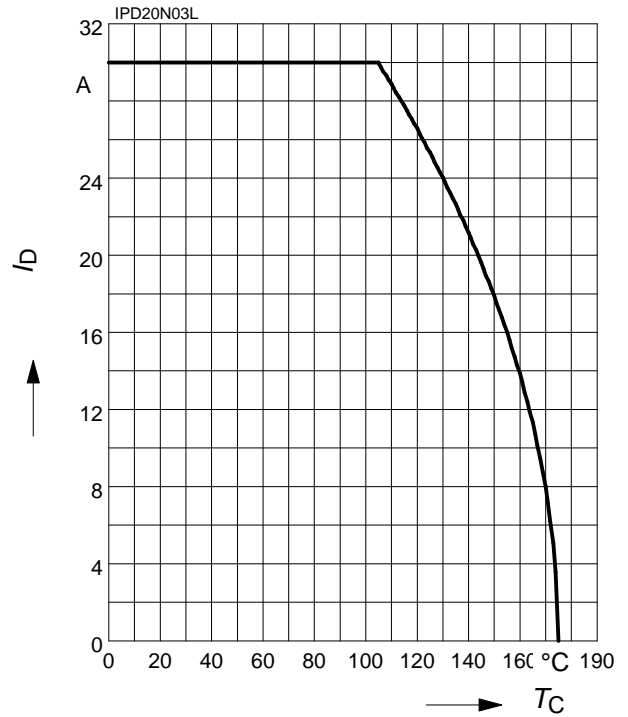
$P_{tot} = f(T_C)$



**2 Drain current**

$I_D = f(T_C)$

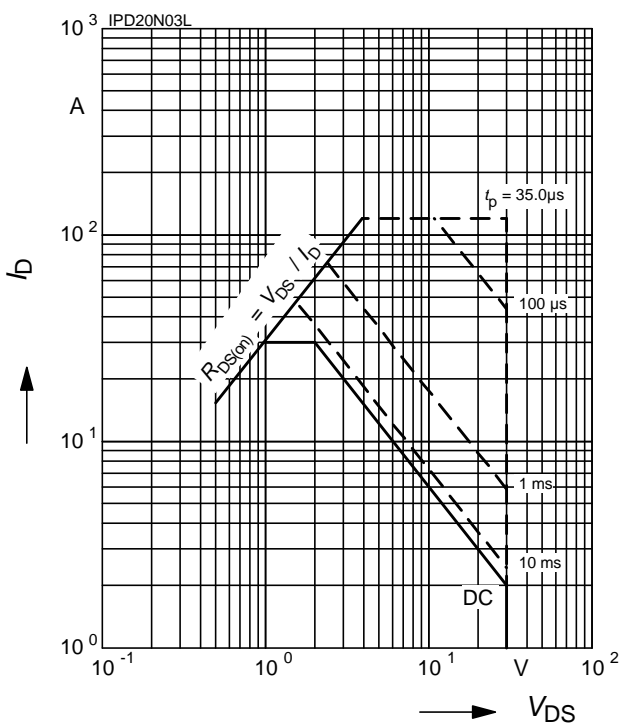
parameter:  $V_{GS} \geq 10\text{ V}$



**3 Safe operating area**

$I_D = f(V_{DS})$

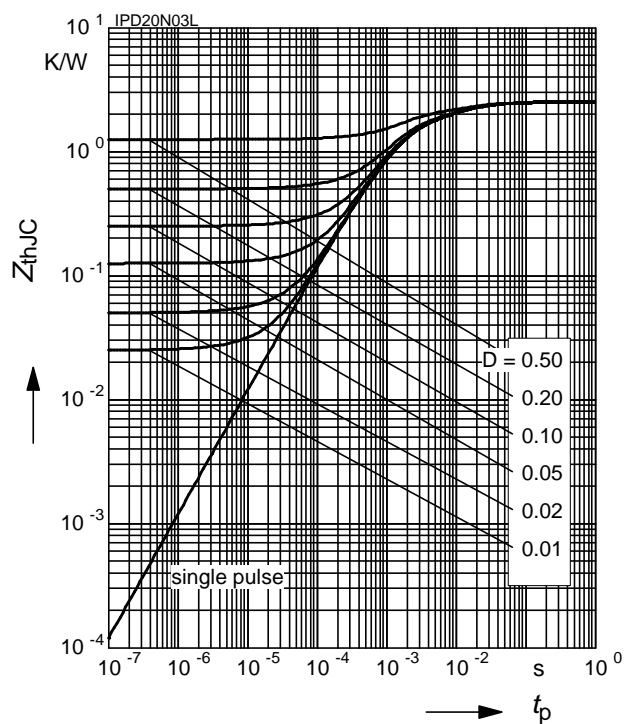
parameter:  $D = 0, T_C = 25\text{ °C}$



**4 Max. transient thermal impedance**

$Z_{thJC} = f(t_p)$

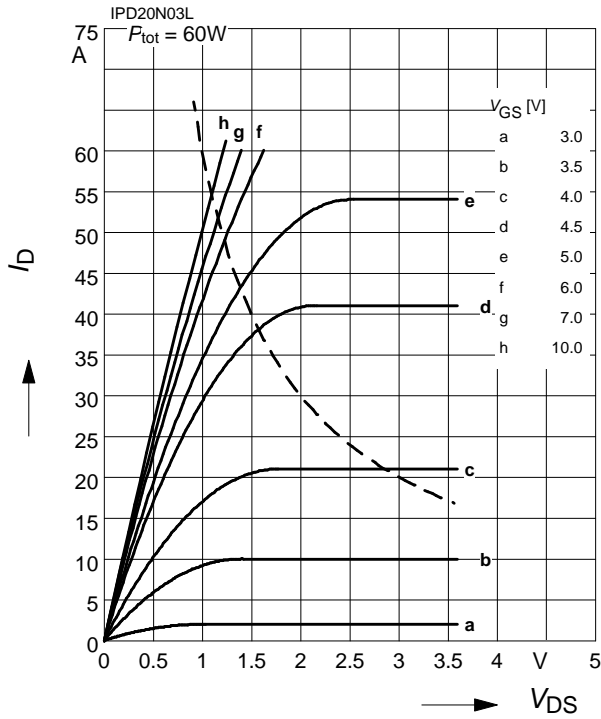
parameter:  $D = t_p/T$



**5 Typ. output characteristic**

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

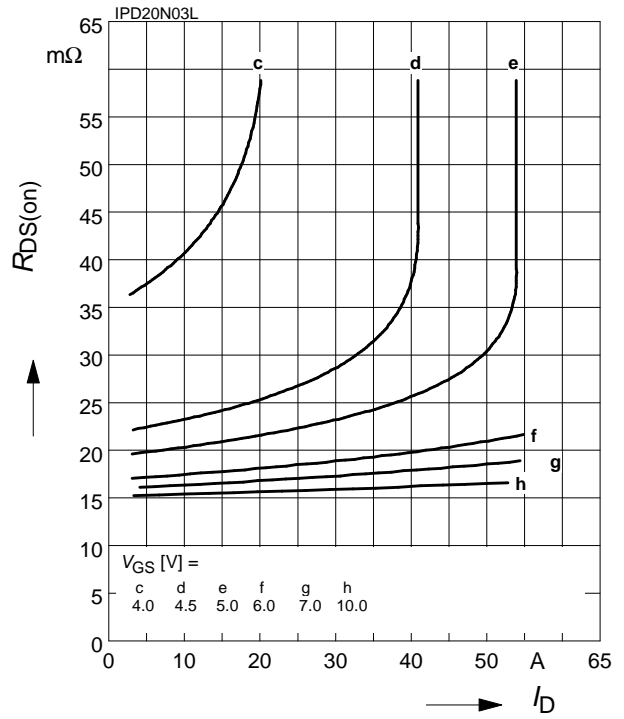
parameter:  $t_p = 80 \mu\text{s}$



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

$R_{DS(on)} = f(I_D)$

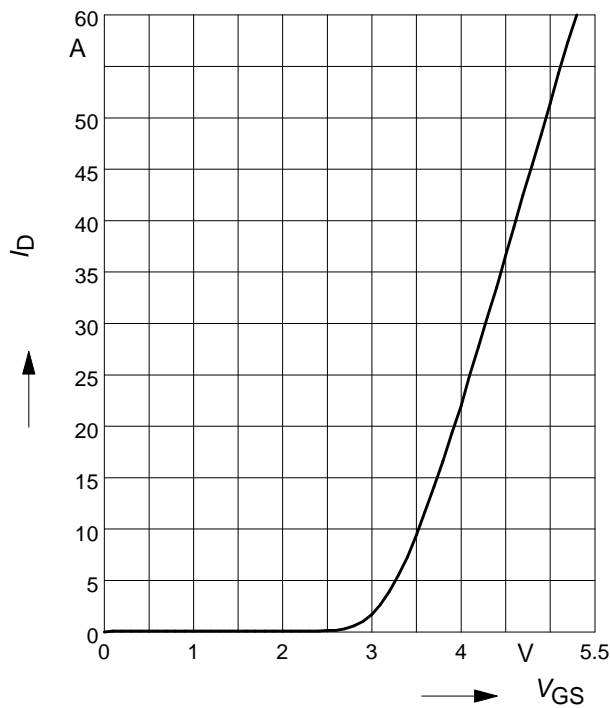
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

$I_D = f(V_{GS}); V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$

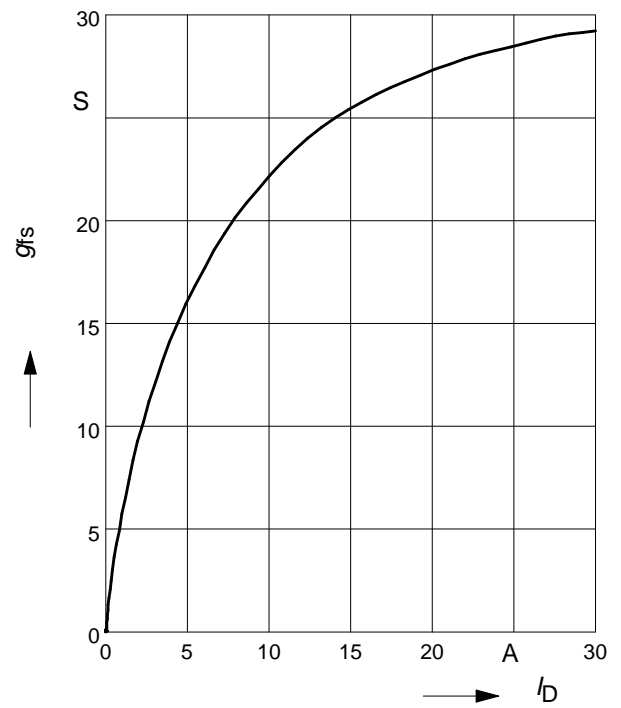
parameter:  $t_p = 80 \mu\text{s}$



**8 Typ. forward transconductance**

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

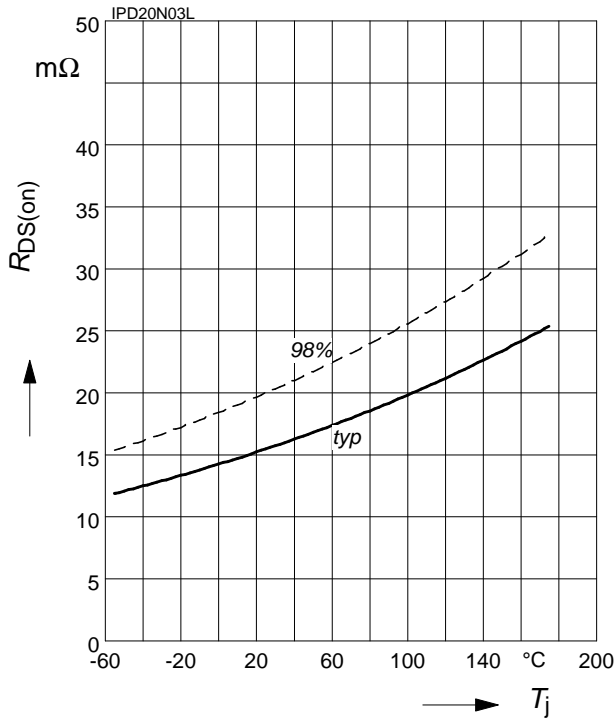
parameter:  $g_{fs}$



**9 Drain-source on-state resistance**

$$R_{DS(on)} = f(T_j)$$

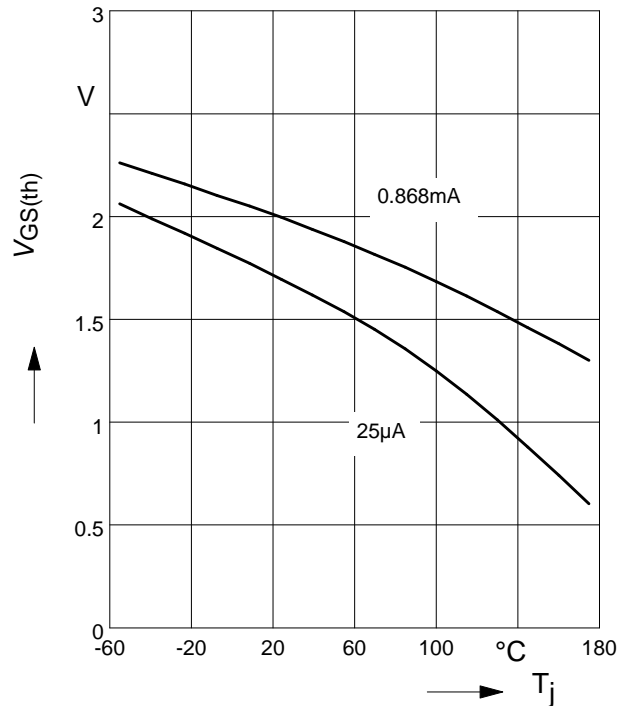
parameter :  $I_D = 15 \text{ A}$ ,  $V_{GS} = 10 \text{ V}$



**10 Typ. gate threshold voltage**

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

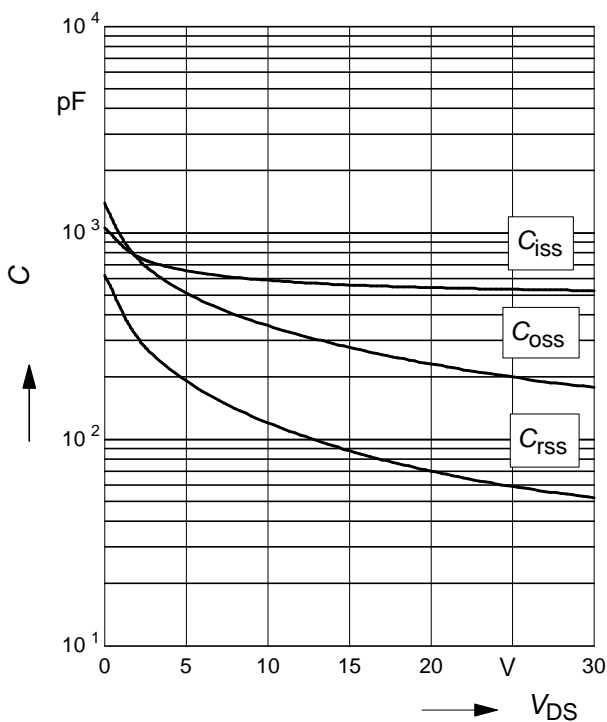
parameter:  $V_{GS} = V_{DS}$



**11 Typ. capacitances**

$$C = f(V_{DS})$$

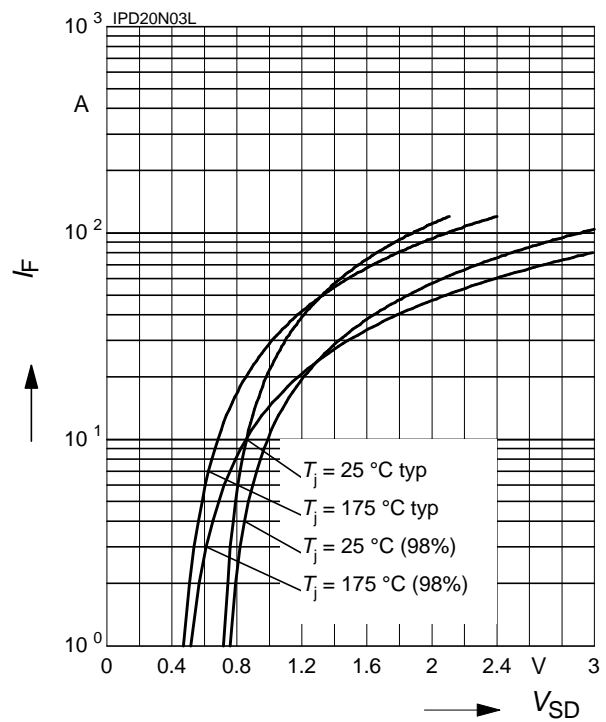
parameter:  $V_{GS} = 0 \text{ V}$ ,  $f = 1 \text{ MHz}$



**12 Forward character. of reverse diode**

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

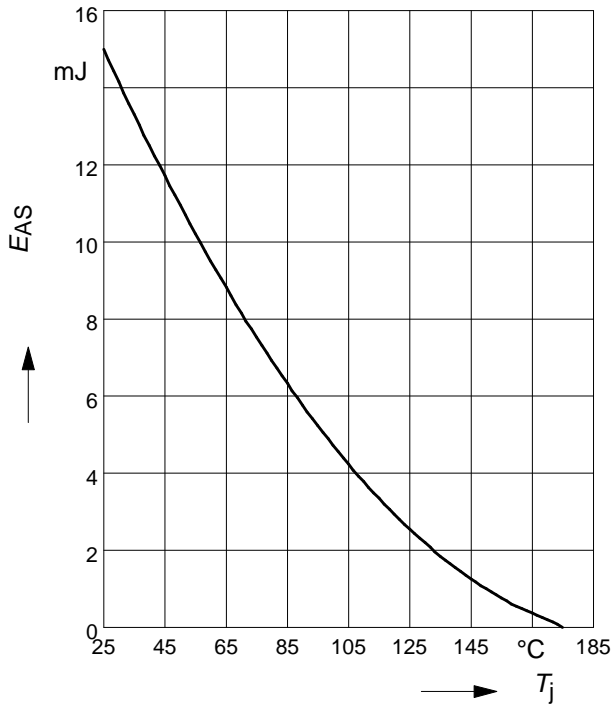
parameter:  $T_j$ ,  $t_p = 80 \mu\text{s}$



**13 Typ. avalanche energy**

$$E_{AS} = f(T_j)$$

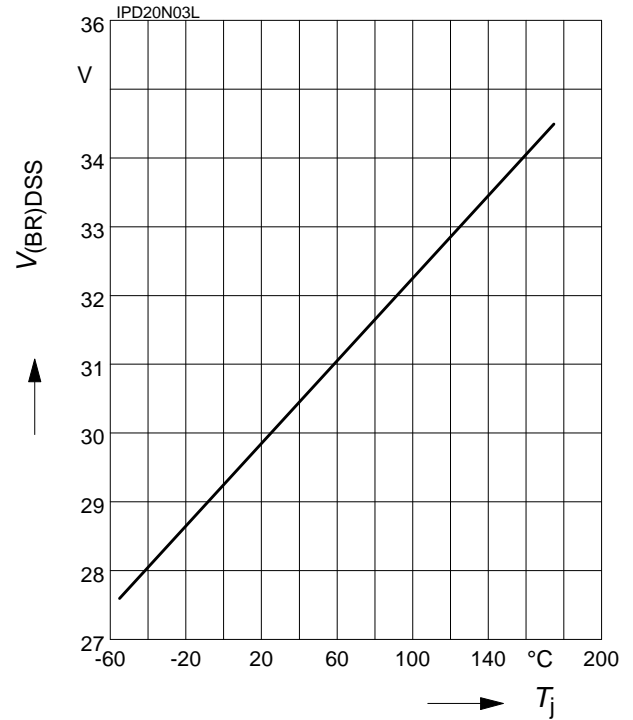
par.:  $I_D = 15\text{ A}$ ,  $V_{DD} = 25\text{ V}$ ,  $R_{GS} = 25\ \Omega$



**15 Drain-source breakdown voltage**

$$V_{(BR)DSS} = f(T_j)$$

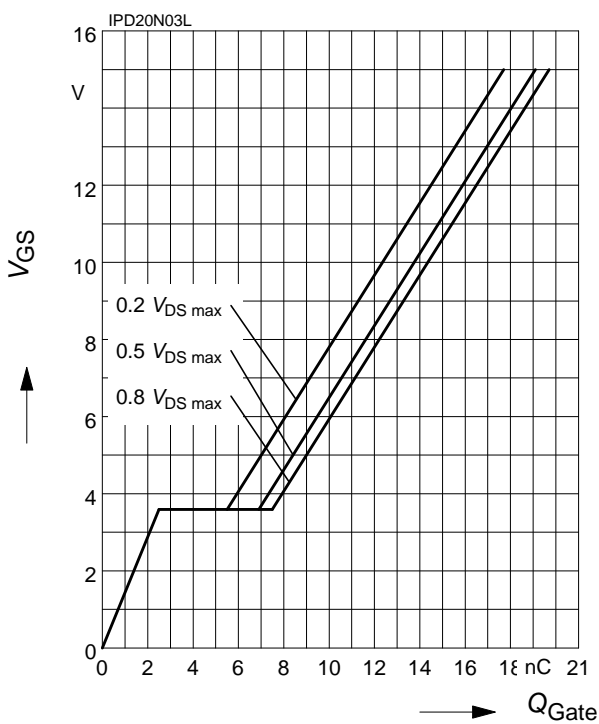
parameter:  $I_D = 10\text{ mA}$



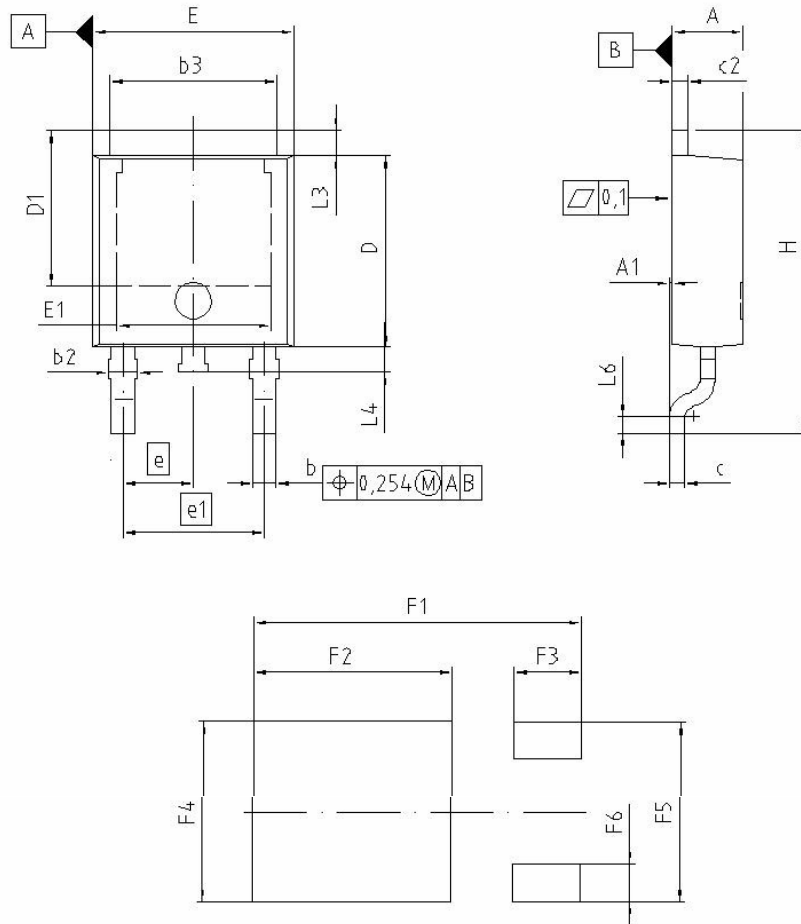
**14 Typ. gate charge**

$$V_{GS} = f(Q_{Gate})$$

parameter:  $I_D = 15\text{ A pulsed}$



TO-252-3-1 Package outline

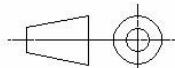


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.184	2.388	0.086	0.094
A1	0.000	0.150	0.000	0.006
b	0.635	0.889	0.025	0.035
b2	0.650	1.150	0.025	0.045
b3	5.004	5.500	0.197	0.217
c	0.460	0.580	0.018	0.023
c2	0.460	0.980	0.018	0.039
D	5.969	6.223	0.235	0.245
D1	5.020	5.320	0.198	0.209
E	6.400	6.731	0.252	0.265
E1	4.900	5.100	0.193	0.201
e	2,286		0.090	
e1	4,572		0.180	
N	3		3	
H	9.400	10.084	0.370	0.397
L3	0.900	1.118	0.035	0.044
L4	0.650	1.016	0.026	0.040
L6	0.510	0.686	0.020	0.027
F1	10.500	10.700	0.413	0.421
F2	6.300	6.500	0.248	0.256
F3	2.100	2.300	0.083	0.091
F4	5.700	5.900	0.224	0.232
F5	5.660	5.660	0.222	0.231
F6	1.100	1.300	0.043	0.051

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0 2.0 4mm

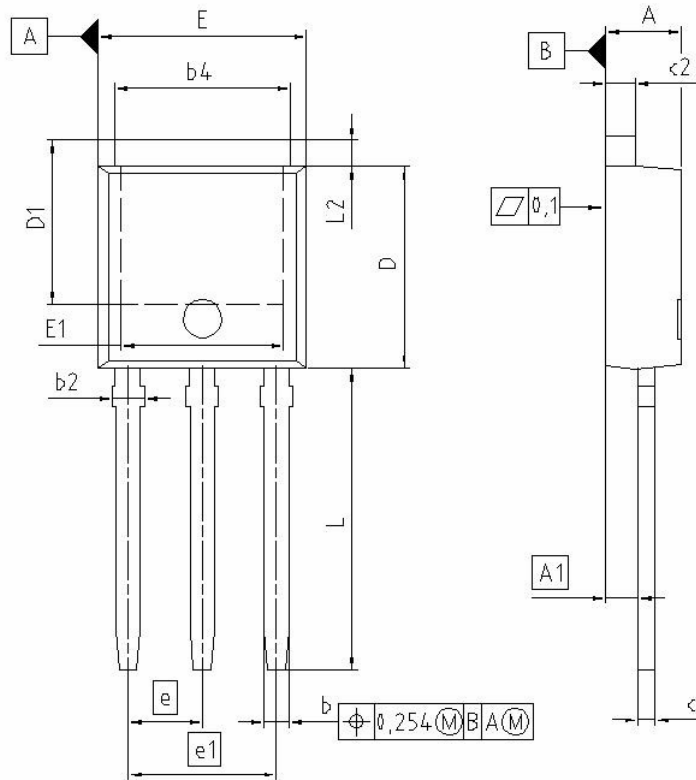
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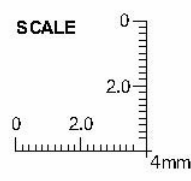




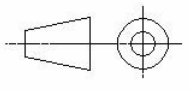
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.159	2.413	0.085	0.095
A1	0.900	1.118	0.035	0.044
b	0.650	0.850	0.026	0.033
b2	0.650	1.150	0.026	0.045
b4	5.004	5.500	0.197	0.217
c	0.457	0.580	0.018	0.023
c2	0.737	0.980	0.029	0.039
D	5.969	6.223	0.235	0.245
D1	5.100	6.121	0.201	0.241
E	6.400	6.731	0.252	0.265
E1	4.850	5.207	0.191	0.205
e	2.280		0.090	
e1	4.570		0.180	
N	3		3	
L	8.900	9.525	0.350	0.375
L1	0.900	1.143	0.035	0.045

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