



**THE DATASHEET OF  
IPB120N04S404ATMA1**

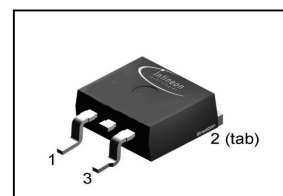


**OptiMOS™ -T2 Power-Transistor**
**Features**

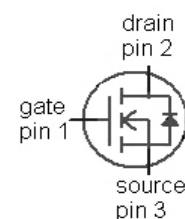
- N-channel - Enhancement mode
- Automotive AEC Q101 qualified
- MSL1 up to 260°C peak reflow
- 175°C operating temperature
- **Green package (lead free)**
- 100% Avalanche tested

**Product Summary**

$V_{DS}$	40	V
$R_{DS(on),max}$	3.6	mΩ
$I_D$	120	A

**PG-TO263-3-2**


Type	Package	Ordering Code	Marking
IPB120N04S4-04	PG-TO263-3-2	-	4N0404


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

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	$I_D$	$T_C=25\text{ °C}, V_{GS}=10\text{V}$	120	A
		$T_C=100\text{ °C}, V_{GS}=10\text{V}^{1)}$	91	
Pulsed drain current <sup>1)</sup>	$I_{D,pulse}$	$T_C=25\text{ °C}$	480	
Avalanche energy, single pulse	$E_{AS}$	$I_D=60\text{A}$	75	mJ
Avalanche current, single pulse	$I_{AS}$	-	120	A
Gate source voltage	$V_{GS}$	-	±20	V
Power dissipation	$P_{tot}$	$T_C=25\text{ °C}$	79	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.	
<b>Thermal characteristics<sup>1)</sup></b>						
Thermal resistance, junction - case	$R_{thJC}$		-	-	1.9	K/W
Thermal resistance, junction - ambient, leaded	$R_{thJA}$		-	-	62	
SMD version, device on PCB	$R_{thJA}$	minimal footprint	-	-	62	
		6 cm <sup>2</sup> cooling area <sup>2)</sup>	-	-	40	

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

#### Static characteristics

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0V, I_D=1mA$	40	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=40\mu A$	2.0	3.0	4.0	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS}=40V, V_{GS}=0V, T_j=25^\circ\text{C}$	-	0.01	1	$\mu A$
		$V_{DS}=18V, V_{GS}=0V, T_j=85^\circ\text{C}^{2)}$	-	3	36	
Gate-source leakage current	$I_{GSS}$	$V_{GS}=20V, V_{DS}=0V$	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=100A$	-	3.2	3.6	m $\Omega$

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

**Dynamic characteristics<sup>1)</sup>**

Input capacitance	$C_{iss}$	$V_{GS}=0V, V_{DS}=25V,$ $f=1MHz$	-	3150	4100	pF
Output capacitance	$C_{oss}$		-	770	1000	
Reverse transfer capacitance	$C_{rss}$		-	30	70	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=20V, V_{GS}=10V,$ $I_D=120A, R_G=3.5\Omega$	-	11	-	ns
Rise time	$t_r$		-	18	-	
Turn-off delay time	$t_{d(off)}$		-	9	-	
Fall time	$t_f$		-	15	-	

**Gate Charge Characteristics<sup>1)</sup>**

Gate to source charge	$Q_{gs}$	$V_{DD}=32V, I_D=120A,$ $V_{GS}=0 \text{ to } 10V$	-	20	26	nC
Gate to drain charge	$Q_{gd}$		-	7	16	
Gate charge total	$Q_g$		-	42	55	
Gate plateau voltage	$V_{plateau}$		-	6.0	-	V

**Reverse Diode**

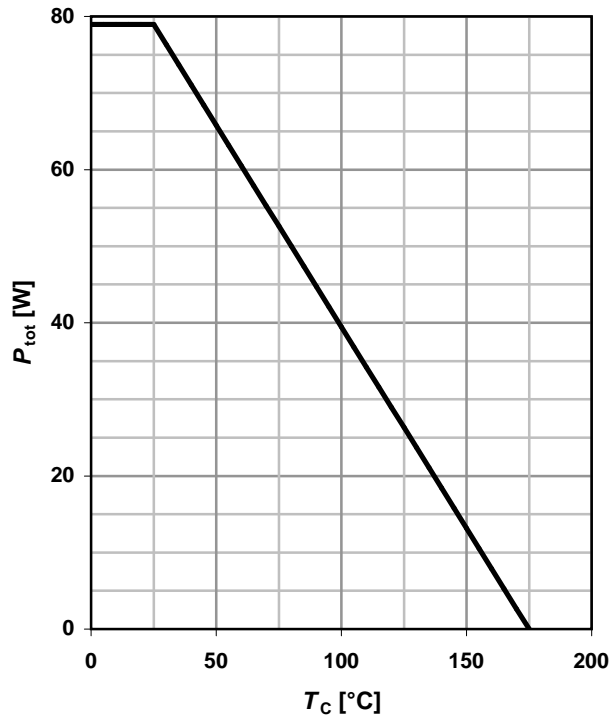
Diode continuous forward current <sup>1)</sup>	$I_S$	$T_C=25^\circ C$	-	-	120	A
Diode pulse current <sup>1)</sup>	$I_{S,pulse}$		-	-	480	
Diode forward voltage	$V_{SD}$	$V_{GS}=0V, I_F=100A,$ $T_J=25^\circ C$	-	0.9	1.3	V
Reverse recovery time <sup>1)</sup>	$t_{rr}$	$V_R=20V, I_F=I_S,$ $di_F/dt=100A/\mu s$	-	45	-	ns
Reverse recovery charge <sup>1)</sup>	$Q_{rr}$		-	50	-	nC

<sup>1)</sup> Defined by design. Not subject to production test.

<sup>2)</sup> Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70 μm thick) copper area for drain connection. PCB is vertical in still air.

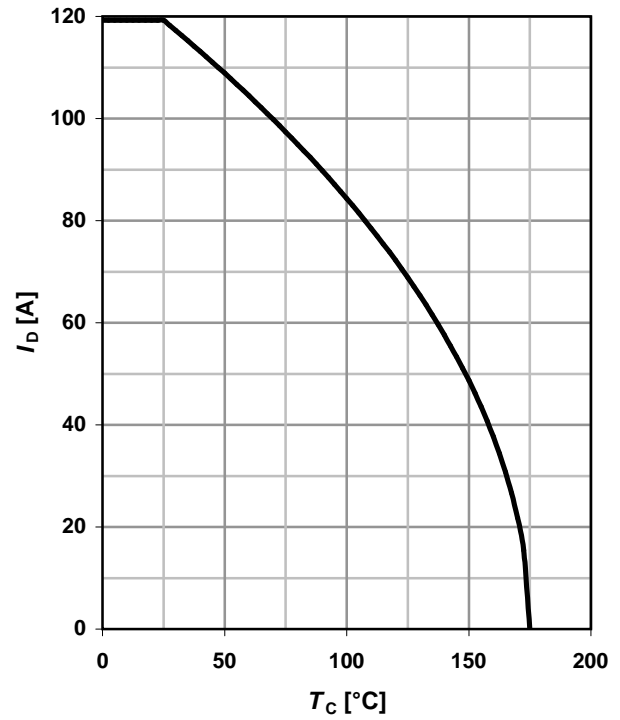
**1 Power dissipation**

$P_{tot} = f(T_C); V_{GS} \geq 6\text{ V}$



**2 Drain current**

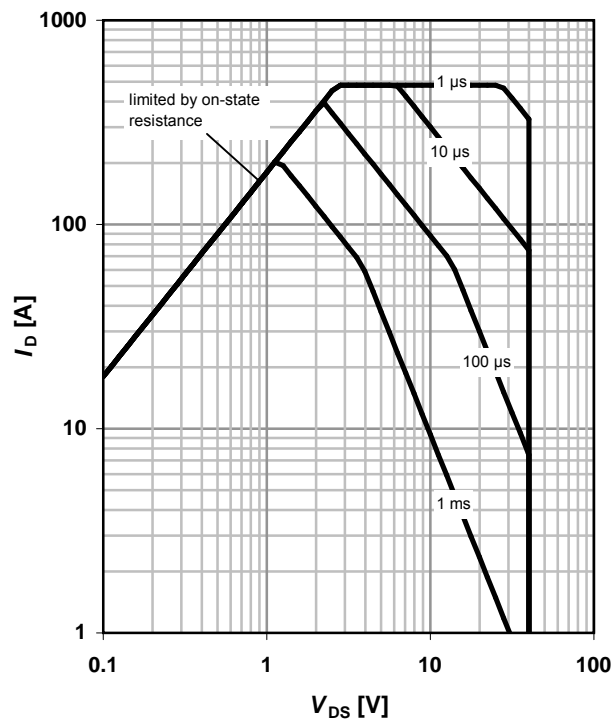
$I_D = f(T_C); V_{GS} \geq 6\text{ V}$



**3 Safe operating area**

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

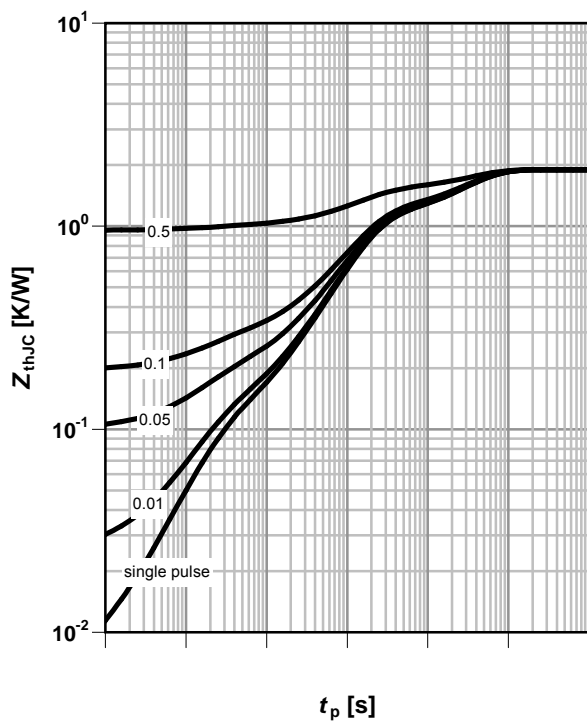
parameter:  $t_p$



**4 Max. transient thermal impedance**

$Z_{thJC} = f(t_p)$

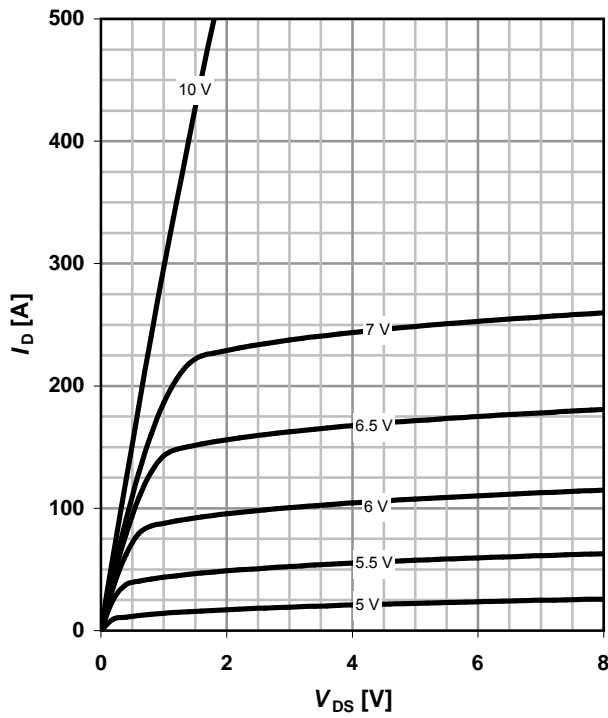
parameter:  $D = t_p/T$



**5 Typ. output characteristics**

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

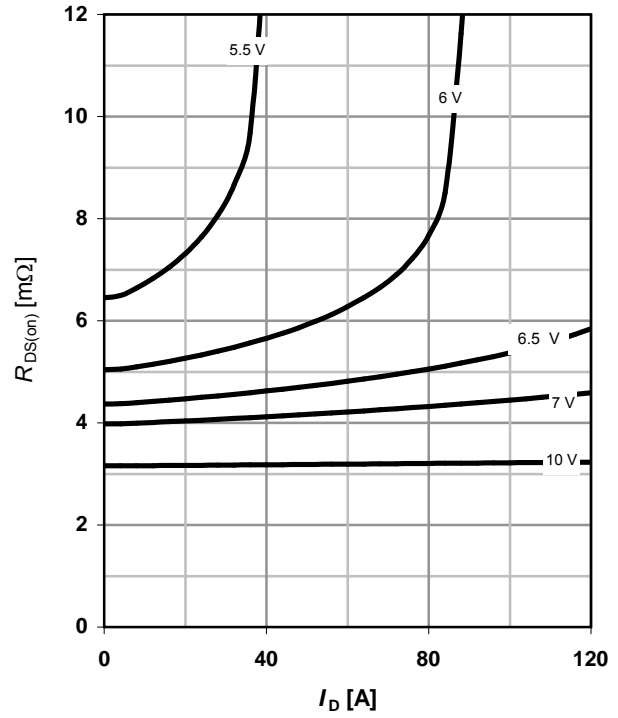
parameter:  $V_{GS}$



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

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

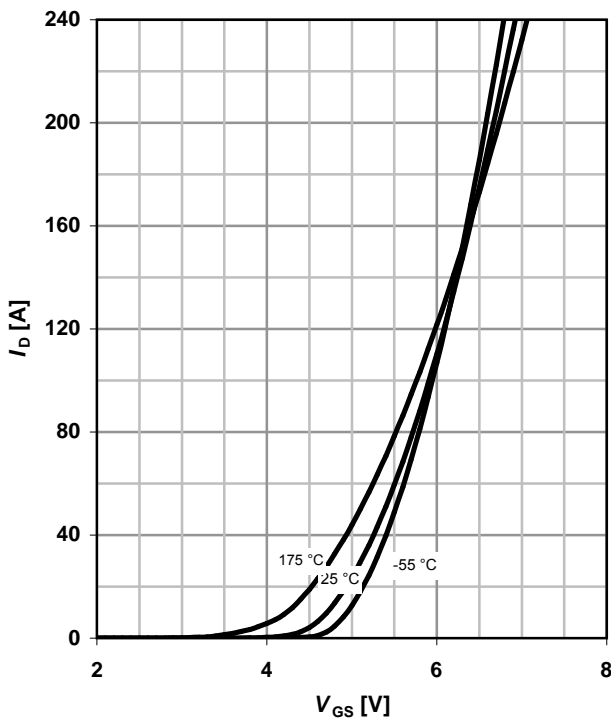
parameter:  $V_{GS}$



**7 Typ. transfer characteristics**

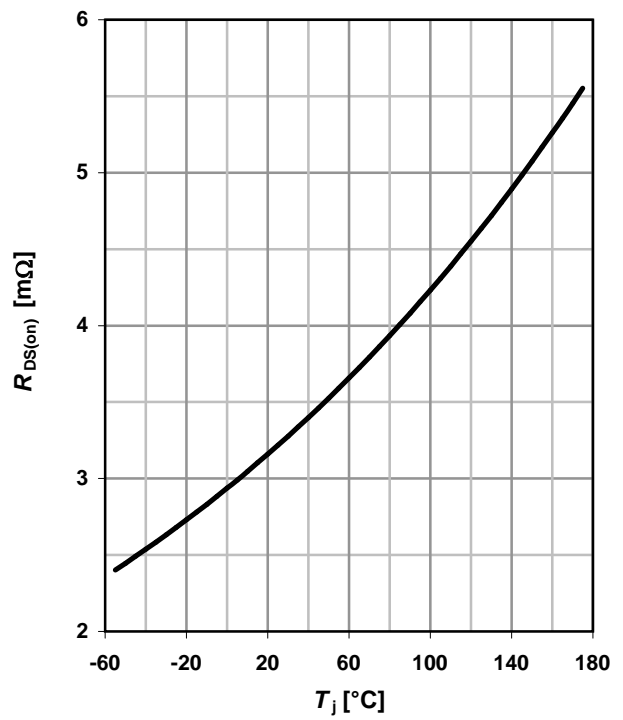
$I_D = f(V_{GS}); V_{DS} = 6\text{ V}$

parameter:  $T_j$



**8 Typ. drain-source on-state resistance**

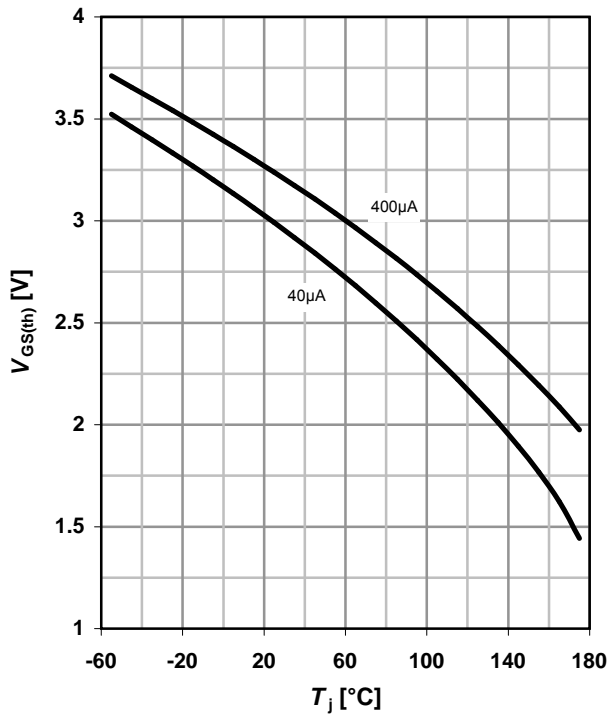
$R_{DS(on)} = f(T_j); I_D = 100\text{ A}; V_{GS} = 10\text{ V}$



**9 Typ. gate threshold voltage**

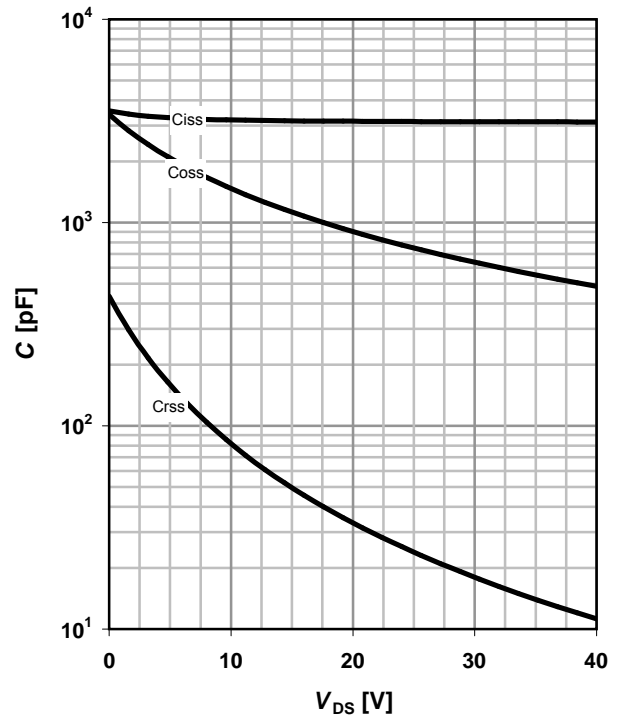
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

parameter:  $I_D$



**10 Typ. capacitances**

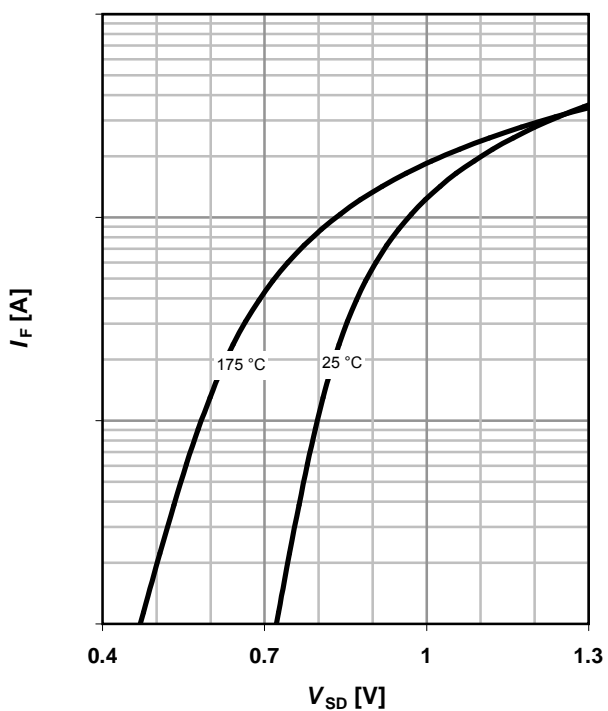
$C = f(V_{DS}); V_{GS} = 0 V; f = 1 MHz$



**11 Typical forward diode characteristics**

$I_F = f(V_{SD})$

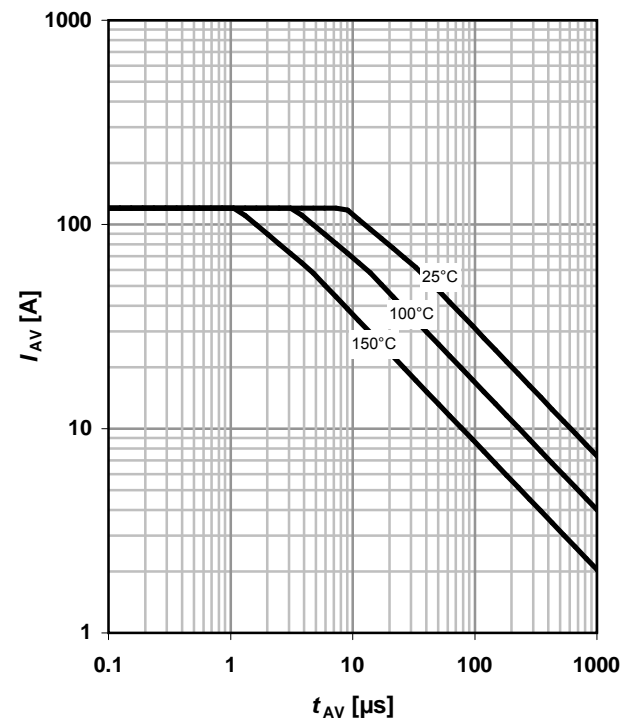
parameter:  $T_j$



**12 Typ. avalanche characteristics**

$I_{AS} = f(t_{AV})$

parameter:  $T_{j(start)}$



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## Revision History

Version	Date	Changes
1.0	22.10.2013	Final Datasheet
1.1	07.04.2014	Added Avalanche Current

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