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## IPD127N06L G

### OptiMOS® Power-Transistor

#### Features

- For fast switching converters and sync. rectification
- N-channel enhancement - logic level
- 175 °C operating temperature
- Avalanche rated
- Pb-free lead plating, RoHS compliant

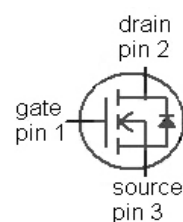
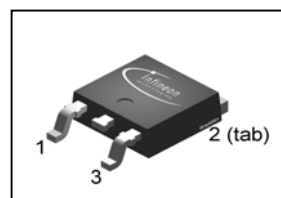


|         |                                                                                     |
|---------|-------------------------------------------------------------------------------------|
| Type    | IPD127N06L G                                                                        |
|         |  |
| Package | PG-TO252-3                                                                          |
| Marking | 127N06L                                                                             |

#### Product Summary

|                  |      |    |
|------------------|------|----|
| $V_{DS}$         | 60   | V  |
| $R_{DS(on),max}$ | 12.7 | mΩ |
| $I_D$            | 50   | A  |

PG-TO252-3



**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     |
|                                     |                   | $T_C=100\text{ °C}$                                                                                  | 48          |       |
| Pulsed drain current                | $I_{D,pulse}$     | $T_C=25\text{ °C}^{2)}$                                                                              | 200         |       |
| Avalanche energy, single pulse      | $E_{AS}$          | $I_D=50\text{ A}$ , $R_{GS}=25\text{ Ω}$                                                             | 240         | mJ    |
| Reverse diode $dv/dt$               | $dv/dt$           | $I_D=50\text{ A}$ , $V_{DS}=48\text{ V}$ ,<br>$di/dt=200\text{ A/μs}$ ,<br>$T_{j,max}=175\text{ °C}$ | 6           | kV/μs |
| Gate source voltage                 | $V_{GS}$          |                                                                                                      | ±20         | V     |
| Power dissipation                   | $P_{tot}$         | $T_C=25\text{ °C}$                                                                                   | 136         | W     |
| Operating and storage temperature   | $T_j$ , $T_{stg}$ |                                                                                                      | -55 ... 175 | °C    |
| IEC climatic category; DIN IEC 68-1 |                   |                                                                                                      | 55/175/56   |       |

<sup>1)</sup> Current is limited by bondwire; with an  $R_{thJC}=1.1\text{ K/W}$  the chip is able to carry 64 A.

<sup>2)</sup> See figure 3



## IPD127N06L G

| Parameter | Symbol | Conditions | Values |      |      | Unit |
|-----------|--------|------------|--------|------|------|------|
|           |        |            | min.   | typ. | max. |      |

### Thermal characteristics

|                                     |            |                                              |   |   |     |     |
|-------------------------------------|------------|----------------------------------------------|---|---|-----|-----|
| Thermal resistance, junction - case | $R_{thJC}$ |                                              | - | - | 1.1 | K/W |
| SMD version, device on PCB          | $R_{thJA}$ | minimal footprint                            | - | - | 75  |     |
|                                     |            | 6 cm <sup>2</sup> cooling area <sup>3)</sup> | - | - | 50  |     |

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

#### Static characteristics

|                                  |               |                                                            |     |      |      |                  |
|----------------------------------|---------------|------------------------------------------------------------|-----|------|------|------------------|
| Drain-source breakdown voltage   | $V_{(BR)DSS}$ | $V_{GS}=0\text{ V}, I_D=1\text{ mA}$                       | 60  | -    | -    | V                |
| Gate threshold voltage           | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=80\text{ }\mu\text{A}$                 | 1.2 | 1.6  | 2    |                  |
| Zero gate voltage drain current  | $I_{DSS}$     | $V_{DS}=60\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$  | -   | 0.01 | 1    | $\mu\text{A}$    |
|                                  |               | $V_{DS}=60\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ °C}$ | -   | 1    | 100  |                  |
| Gate-source leakage current      | $I_{GSS}$     | $V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$                    | -   | 1    | 100  | nA               |
| Drain-source on-state resistance | $R_{DS(on)}$  | $V_{GS}=4.5\text{ V}, I_D=33\text{ A}$                     | -   | 12.5 | 16.7 | $\text{m}\Omega$ |
|                                  |               | $V_{GS}=10\text{ V}, I_D=50\text{ A}$                      | -   | 10.0 | 12.7 |                  |
| Gate resistance                  | $R_G$         |                                                            | -   | 1.5  | -    | $\Omega$         |
| Transconductance                 | $g_{fs}$      | $ V_{DS} >2 I_D R_{DS(on)max}, I_D=50\text{ A}$            | 35  | 69   | -    | S                |

<sup>3)</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.



**IPD127N06L G**

| Parameter | Symbol | Conditions | Values |      |      | Unit |
|-----------|--------|------------|--------|------|------|------|
|           |        |            | min.   | typ. | max. |      |

**Dynamic characteristics**

|                              |              |                                                                                 |   |      |      |    |
|------------------------------|--------------|---------------------------------------------------------------------------------|---|------|------|----|
| Input capacitance            | $C_{iss}$    | $V_{GS}=0\text{ V}, V_{DS}=30\text{ V},$<br>$f=1\text{ MHz}$                    | - | 1700 | 2300 | pF |
| Output capacitance           | $C_{oss}$    |                                                                                 | - | 410  | 550  |    |
| Reverse transfer capacitance | $C_{rss}$    |                                                                                 | - | 110  | 165  |    |
| Turn-on delay time           | $t_{d(on)}$  | $V_{DD}=30\text{ V}, V_{GS}=10\text{ V},$<br>$I_D=50\text{ A}, R_G=3.6\ \Omega$ | - | 9    | 13   | ns |
| Rise time                    | $t_r$        |                                                                                 | - | 14   | 21   |    |
| Turn-off delay time          | $t_{d(off)}$ |                                                                                 | - | 39   | 58   |    |
| Fall time                    | $t_f$        |                                                                                 | - | 13   | 21   |    |

**Gate Charge Characteristics<sup>4)</sup>**

|                          |               |                                                                            |   |     |    |    |
|--------------------------|---------------|----------------------------------------------------------------------------|---|-----|----|----|
| Gate to source charge    | $Q_{gs}$      | $V_{DD}=30\text{ V}, I_D=50\text{ A},$<br>$V_{GS}=0\text{ to }10\text{ V}$ | - | 6   | 9  | nC |
| Gate charge at threshold | $Q_{g(th)}$   |                                                                            | - | 3   | 4  |    |
| Gate to drain charge     | $Q_{gd}$      |                                                                            | - | 17  | 26 |    |
| Switching charge         | $Q_{sw}$      |                                                                            | - | 21  | 31 |    |
| Gate charge total        | $Q_g$         |                                                                            | - | 52  | 69 |    |
| Gate plateau voltage     | $V_{plateau}$ |                                                                            | - | 3.7 | -  | V  |
| Output charge            | $Q_{oss}$     | $V_{DD}=30\text{ V}, V_{GS}=0\text{ V}$                                    | - | 16  | 21 |    |

**Reverse Diode**

|                                  |               |                                                                   |   |      |     |    |
|----------------------------------|---------------|-------------------------------------------------------------------|---|------|-----|----|
| Diode continuous forward current | $I_S$         | $T_C=25\text{ °C}$                                                | - | -    | 50  | A  |
| Diode pulse current              | $I_{S,pulse}$ |                                                                   | - | -    | 200 |    |
| Diode forward voltage            | $V_{SD}$      | $V_{GS}=0\text{ V}, I_F=50\text{ A},$<br>$T_J=25\text{ °C}$       | - | 0.93 | 1.3 | V  |
| Reverse recovery time            | $t_{rr}$      | $V_R=30\text{ V}, I_F=I_S,$<br>$di_F/dt=100\text{ A}/\mu\text{s}$ | - | 52   | 65  | ns |
| Reverse recovery charge          | $Q_{rr}$      |                                                                   | - | 99   | 125 | nC |

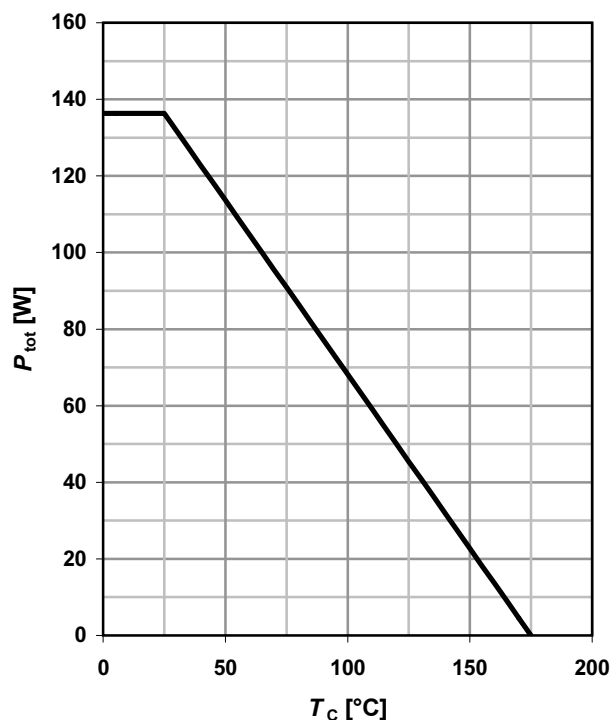
<sup>4)</sup> See figure 16 for gate charge parameter definition



**IPD127N06L G**

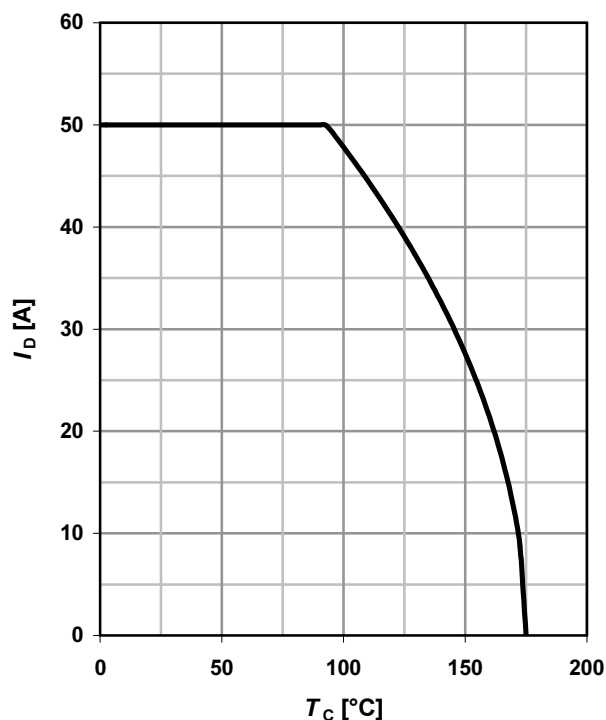
### 1 Power dissipation

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



### 2 Drain current

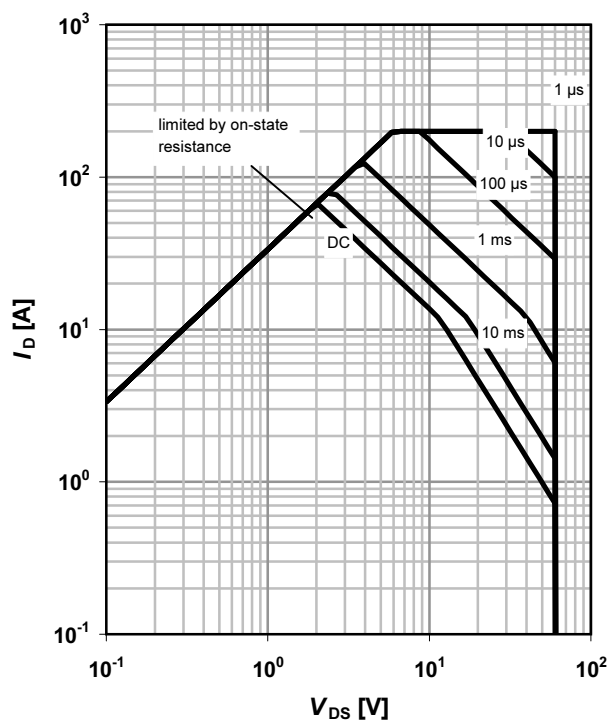
$$I_D = f(T_c); V_{\text{GS}} \geq 10 \text{ V}$$



### 3 Safe operating area

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

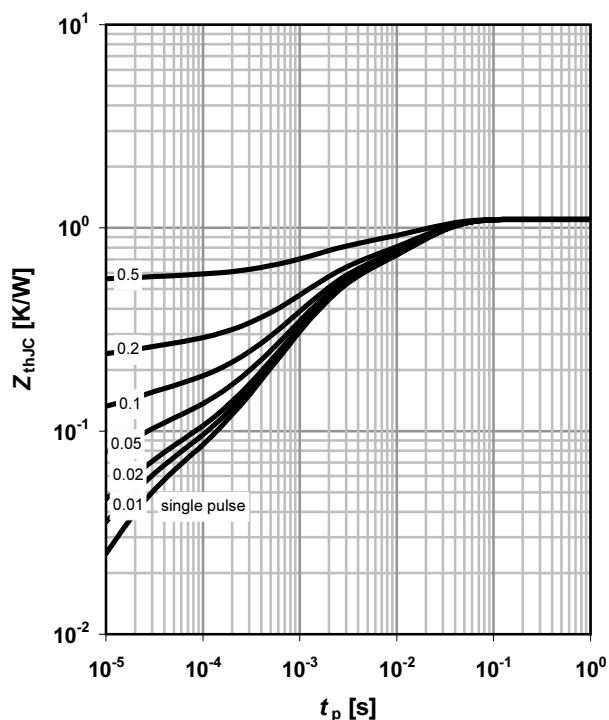
parameter:  $t_p$



### 4 Max. transient thermal impedance

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

parameter:  $D = t_p/T$



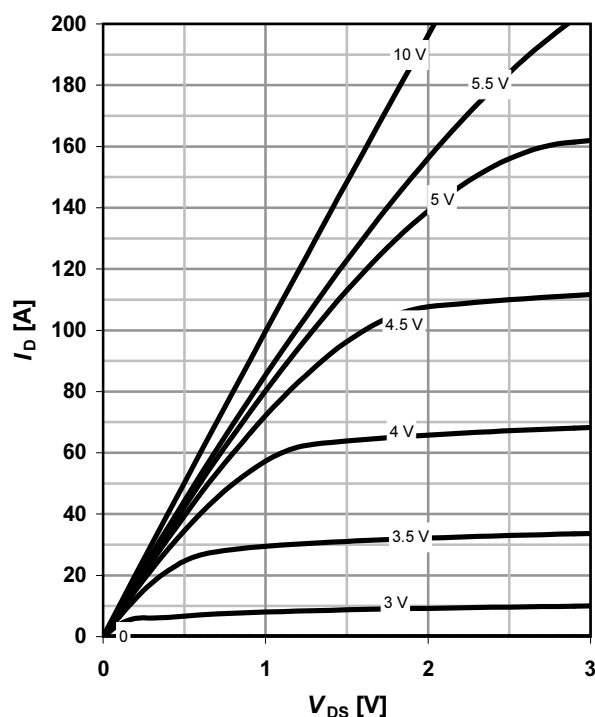


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### 5 Typ. output characteristics

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

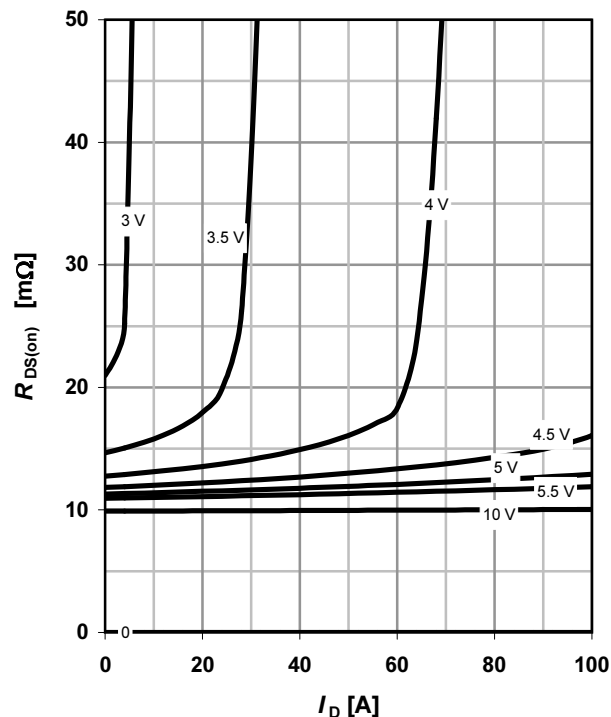
parameter:  $V_{GS}$



### 6 Typ. drain-source on resistance

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

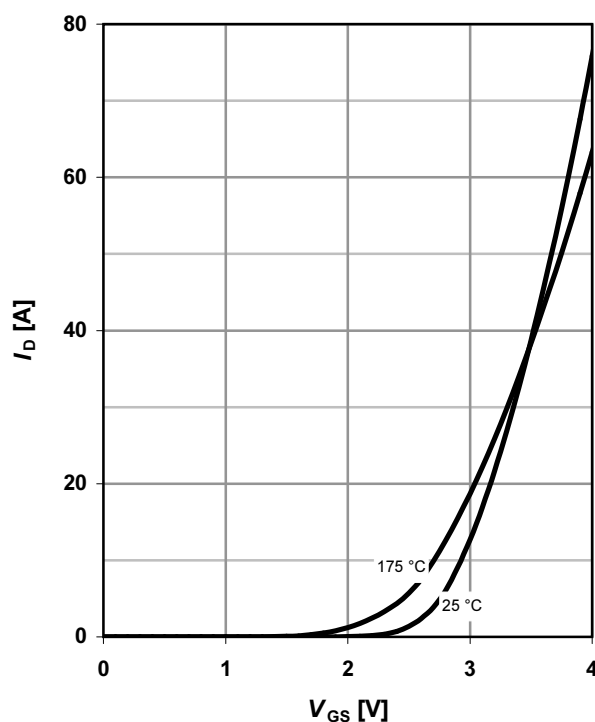
parameter:  $V_{GS}$



### 7 Typ. transfer characteristics

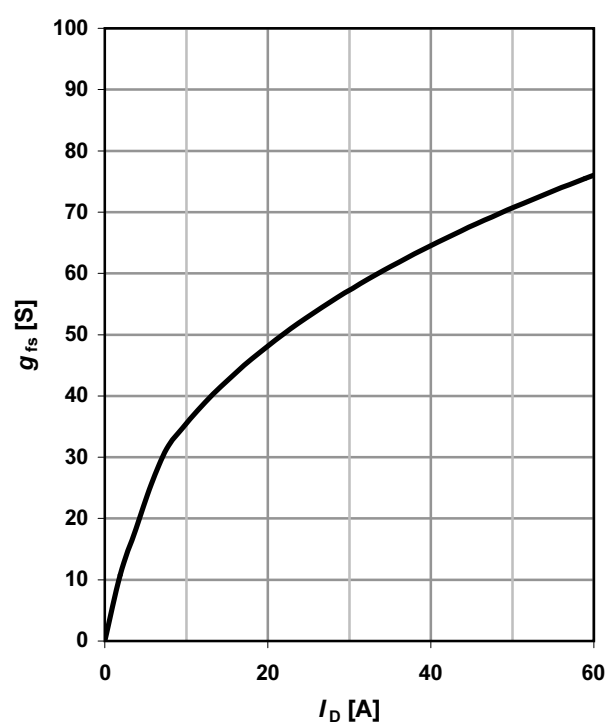
$$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$$

parameter:  $T_j$



### 8 Typ. forward transconductance

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

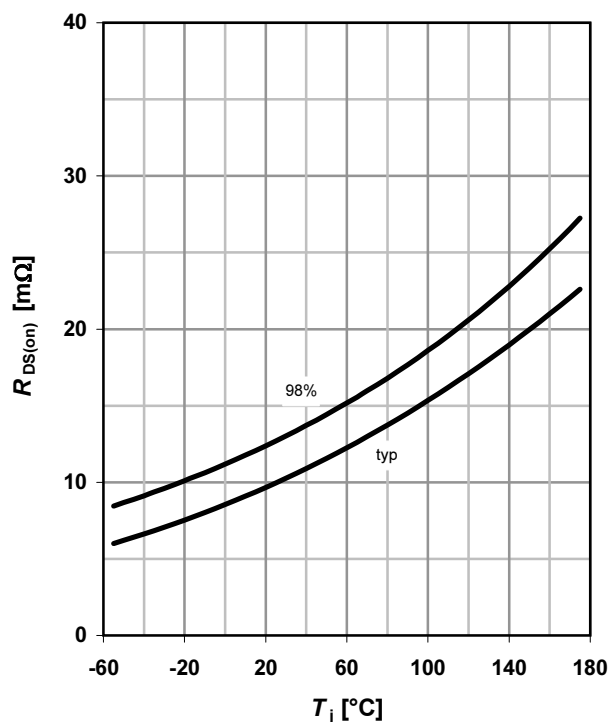




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### 9 Drain-source on-state resistance

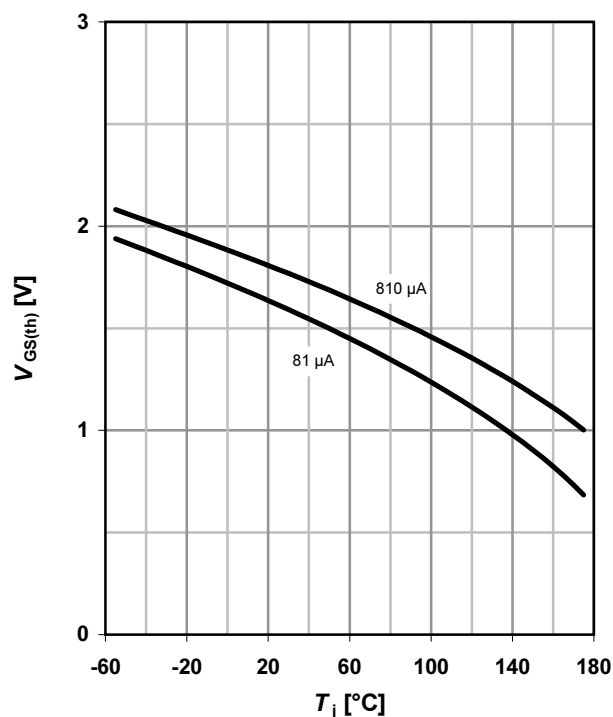
$$R_{DS(on)} = f(T_j); I_D = 50 \text{ A}; V_{GS} = 10 \text{ V}$$



### 10 Typ. gate threshold voltage

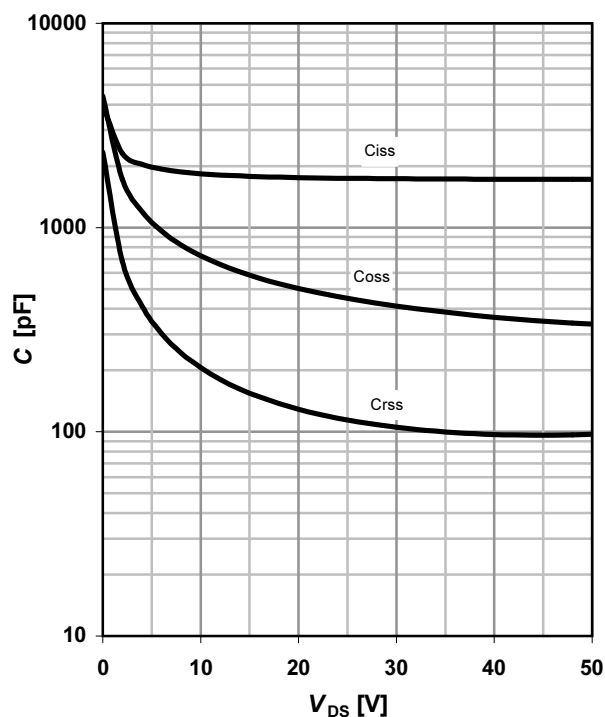
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$$

parameter:  $I_D$



### 11 Typ. capacitances

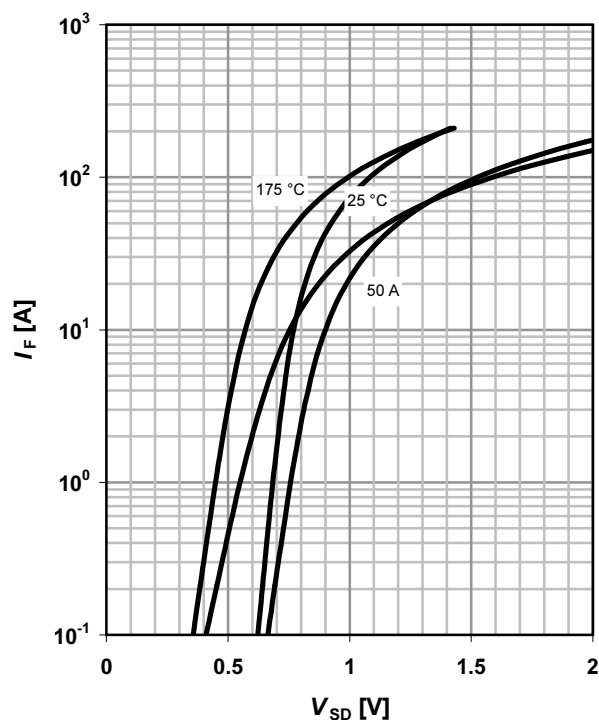
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$



### 12 Forward characteristics of reverse diode

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

parameter:  $T_j$



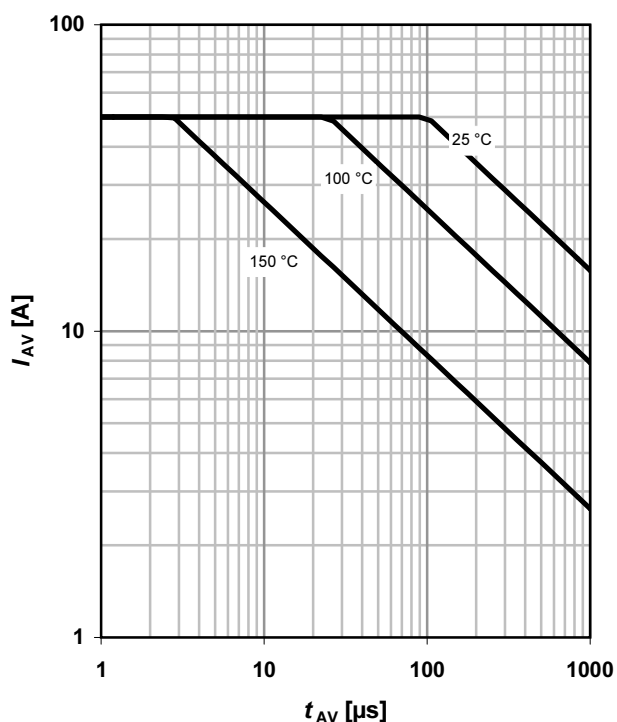


## IPD127N06L G

### 13 Avalanche characteristics

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

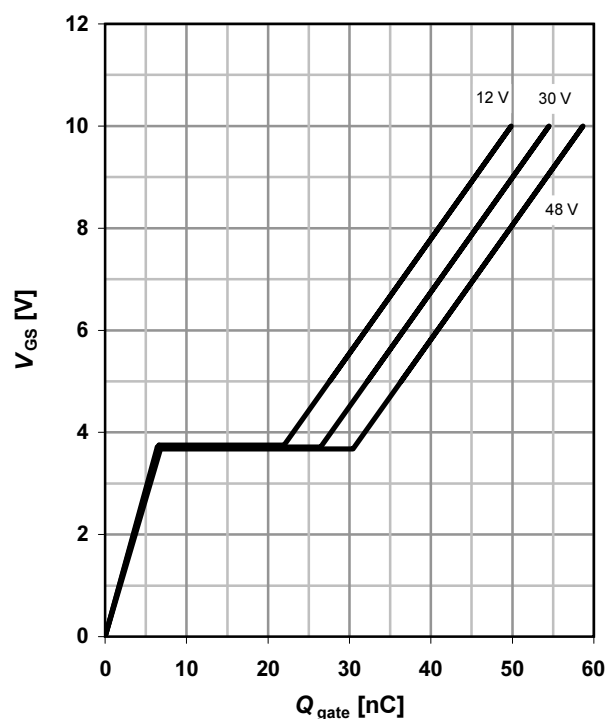
parameter:  $T_{j(\text{start})}$



### 14 Typ. gate charge

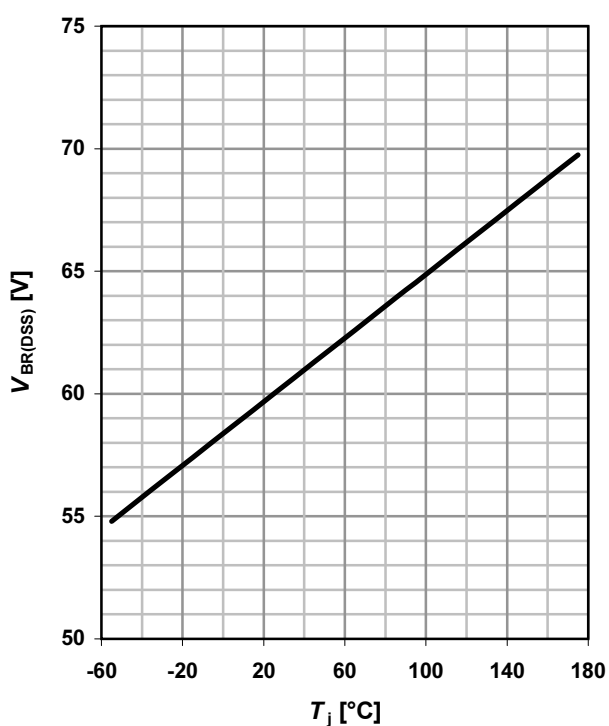
$$V_{GS}=f(Q_{\text{gate}}); I_D=50\ \text{A pulsed}$$

parameter:  $V_{DD}$

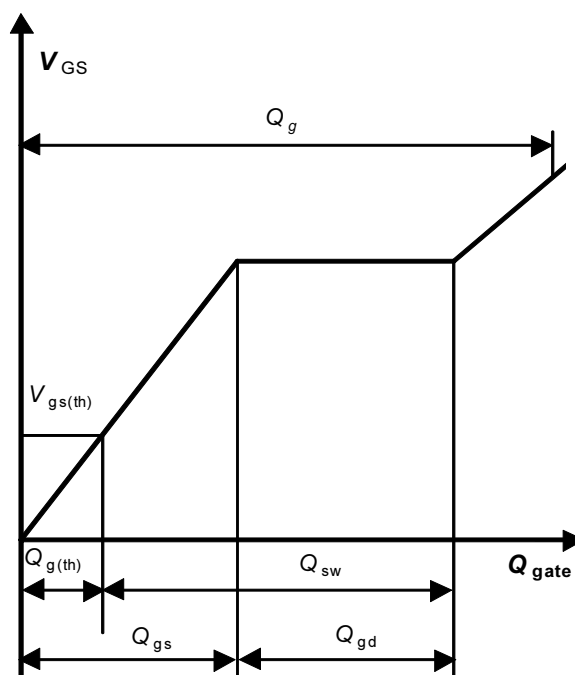


### 15 Drain-source breakdown voltage

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



### 16 Gate charge waveforms

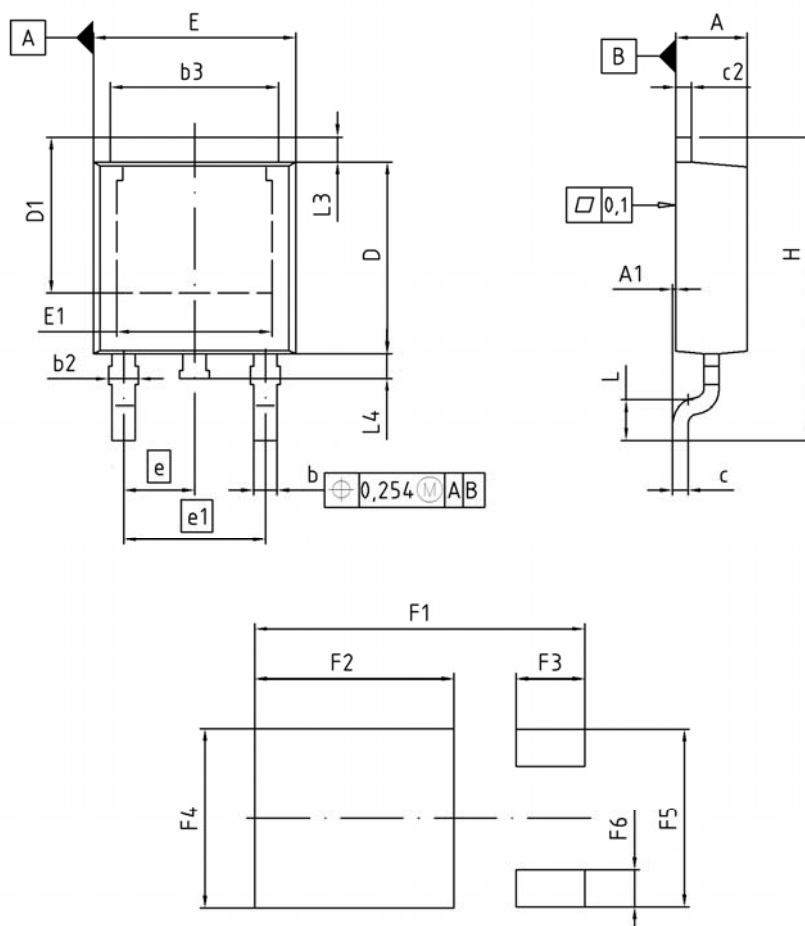






**IPD127N06L G**

**PG-TO252-3: Outline**



| DIM | MILLIMETERS |       | INCHES |       |
|-----|-------------|-------|--------|-------|
|     | MIN         | MAX   | MIN    | MAX   |
| A   | 2.16        | 2.41  | 0.085  | 0.095 |
| A1  | 0.00        | 0.15  | 0.000  | 0.006 |
| b   | 0.64        | 0.89  | 0.025  | 0.035 |
| b2  | 0.65        | 1.15  | 0.026  | 0.045 |
| b3  | 5.00        | 5.50  | 0.197  | 0.217 |
| c   | 0.46        | 0.60  | 0.018  | 0.024 |
| c2  | 0.46        | 0.98  | 0.018  | 0.039 |
| D   | 5.97        | 6.22  | 0.235  | 0.245 |
| D1  | 5.02        | 5.84  | 0.198  | 0.230 |
| E   | 6.40        | 6.73  | 0.252  | 0.265 |
| E1  | 4.70        | 5.21  | 0.185  | 0.205 |
| e   | 2.29        |       | 0.090  |       |
| e1  | 4.57        |       | 0.180  |       |
| N   | 3           |       | 3      |       |
| H   | 9.40        | 10.48 | 0.370  | 0.413 |
| L   | 1.18        | 1.70  | 0.046  | 0.067 |
| L3  | 0.90        | 1.25  | 0.035  | 0.049 |
| L4  | 0.51        | 1.00  | 0.020  | 0.039 |
| F1  | 10.50       | 10.70 | 0.413  | 0.421 |
| F2  | 6.30        | 6.50  | 0.248  | 0.256 |
| F3  | 2.10        | 2.30  | 0.083  | 0.091 |
| F4  | 5.70        | 5.90  | 0.224  | 0.232 |
| F5  | 5.66        | 5.86  | 0.223  | 0.231 |
| F6  | 1.10        | 1.30  | 0.043  | 0.051 |

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