# UMW IPP015N04N G

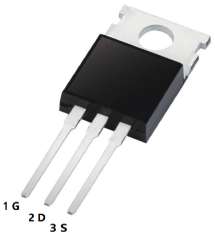
40V N-Channel MOSFET

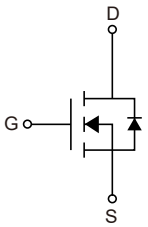
## 1.Features

- $V_{DS\ (V)}$=40V
- $I_D$=120A
- $R_{DS(ON)}$<1.5mΩ($V_{GS}$=10V)
- Optimized technology for DC / DC converters
- Fast switching MOSFET for SMPS
- N-channel normal level
- Very low on-resistance $R_{DS(ON)}$
- Excellent gate charge x $R_{DS(ON)}$ product (FOM)

## 2.Pinning information

| Pin | Symbol | Description |
|---|---|---|
| 1 | G | GATE |
| 2 | D | DRAIN |
| 3 | S | SOURCE |




## 3.Absolute Maximum Ratings $T_C$= 25°C

| Parameter | Symbol | Conditions | Rating | Units |
|---|---|---|---|---|
| Continuous drain current | $I_D$ | $V_{GS}$=10V, $T_C$=25°C | 120 | A |
| | | $V_{GS}$=10V, $T_C$=100°C | 120 | |
| Pulsed drain current [2] | $I_{D,pulse}$ | $T_C$=25°C | 400 | |
| Avalanche current, single pulse [3] | $I_{AS}$ | $T_C$=25°C | 100 | |
| Avalanche energy, single pulse | $E_{AS}$ | $I_D$=100A, $R_{GS}$=25Ω | 865 | mJ |
| Gate source voltage | $V_{GS}$ | | ±20 | V |
| Power dissipation | $P_{tot}$ | $T_C$=25°C | 250 | W |
| storage temperature | $T_J$,$T_{STG}$ | | -55 to 175 | °C |
| IEC climatic cateory; DIN IEC 68-1 | | | 55/175/56 | |

Notes:

1) J-STD20 and JESD22.

2) See figure 3 for more detailed information.

3) See figure 13 for more detailed information.

## 4.Electrical Characteristic ($T_C$=25°C unless otherwise noted)

| Parameter | Symbol | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Thermal resistance, junction -case | $R_{thJC}$ | | | | 0.6 | K/W |
| SMD version, device on PCB | $R_{thJA}$ | minimal footprint | | | 62 | K/W |
| | | 6 cm$^2$ cooling area [4]) | | | 40 | K/W |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}$=0V, $I_D$=1mA | 40 | | | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=200μA | 2 | | 4 | V |
| Zero gate voltage drain current | $I_{DSS}$ | $V_{DS}$=40V, $V_{GS}$=0V, $T_J$=25°C | | 0.1 | 2 | μA |
| | | $V_{DS}$=40V, $V_{GS}$=0V, $T_J$=125°C | | 20 | 200 | μA |
| Gate-source leakage current | $I_{GSS}$ | $V_{GS}$=20V, $V_{DS}$=0V | | 10 | 100 | nA |
| Drain-source on-state resistance [5]) | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=100A | | 1.2 | 1.5 | mΩ |
| Gate resistance | $R_G$ | | | 1.5 | | Ω |
| Transconductance | $g_{FS}$ | $\|V_{DS}\|>2\|I_D\|R_{DS(ON)max}$,$I_D$=100 A | 120 | 230 | | S |
| Input capacitance | $C_{iss}$ | $V_{GS}$=0V, $V_{DS}$=20V, f=1MHz | | 15000 | 20000 | pF |
| Output capacitance | $C_{oss}$ | | | 4000 | 5300 | pF |
| Reverse transfer capacitance | $C_{rss}$ | | | 160 | | pF |
| Turn-on delay time | $t_{D(on)}$ | $V_{DD}$=20V, $V_{GS}$=10V<br>$I_D$=30A, $R_G$=1.6Ω | | 40 | | ns |
| Rise time | $t_r$ | | | 10 | | ns |
| Turn-off delay time | $t_{D(off)}$ | | | 64 | | ns |
| Fall time | $t_f$ | | | 13 | | ns |
| Gate to source charge | $Q_{gs}$ | $V_{DD}$=20V, $I_D$=100A<br>$V_{GS}$=0 to 10V | | 76 | | nC |
| Gate charge at threshold | $Q_{g(th)}$ | | | 46 | | nC |
| Gate to drain charge | $Q_{gd}$ | | | 23 | | nC |
| Switching charge | $Q_{SW}$ | | | 75 | | nC |
| Gate charge total | $Q_g$ | | | 188 | 250 | nC |
| Gate plateau voltage | $V_{plateau}$ | | | 5 | | V |

| | | | | | | |
|---|---|---|---|---|---|---|
| Gate charge total, sync. FET | $Q_{g(synC)}$ | $V_{DS}$=0.1V, $V_{GS}$=0 to 10V | | 177 | | nC |
| Output charge | $Q_{oss}$ | $V_{DD}$=20V, $V_{GS}$=0V | | 147 | | nC |
| Diode continuous forward current | $I_S$ | $T_C$=25°C | | | 120 | A |
| Diode pulse current | $I_{S,pulse}$ | | | | 400 | A |
| Diode forward voltage | $V_{SD}$ | $V_{GS}$=0V, $I_F$=100A, $T_J$=25°C | | 0.88 | 1.2 | V |
| Reverse recovery charge | $Q_{rr}$ | $V_R$=15V, $I_F$=$I_S$, $di_F/dt$=400A/μs | | 141 | | nC |

Notes:

4) Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm2 (one layer, 70 um thick) copper area for drain connection. PCB is vertical in still air.

5) Measured from drain tab to source pin.

6) See figure 16 for gate charge parameter definition.

## 5.1Typical characteristic

$P_{tot}=f(T_C)$

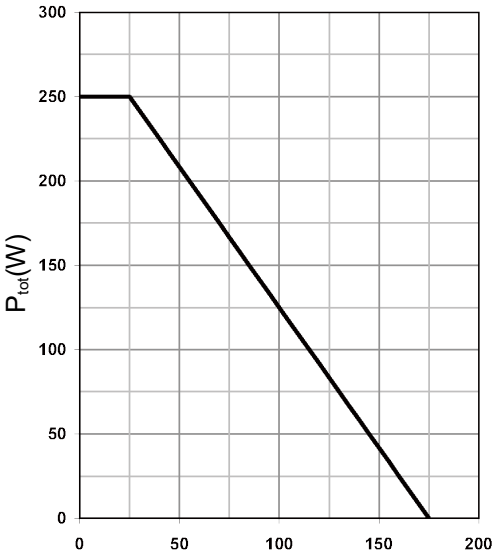



Fig 1. Power dissipation

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

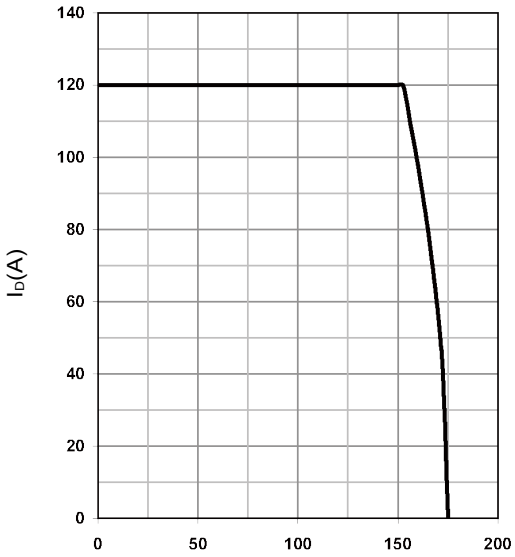



Fig 2. Drain current

ID=f($V_{DS}$); $T_C$=25°C; D=0, parameter: $t_p$

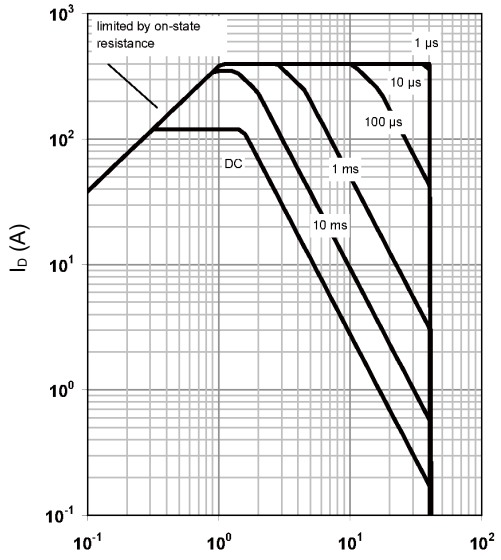



Fig 3. Safe operating area

$Z_{thJC}=f(t_p)$, parameter: $D=t_p/T$

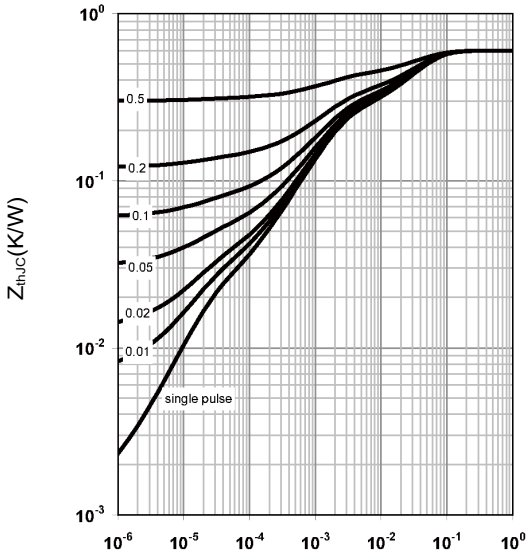



Fig 4. Max transient thermal impedance

## 5.2Typical characteristic

$I_D=f(V_{DS})$; $T_J$=25°C, parameter: $V_{GS}$

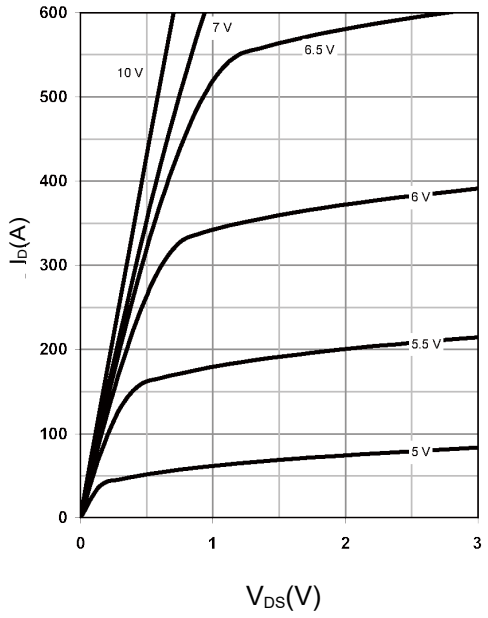



Fig 5. output characteristics

$R_{DS(ON)}=f(I_D)$; $T_J$=25°C, parameter: $V_{GS}$

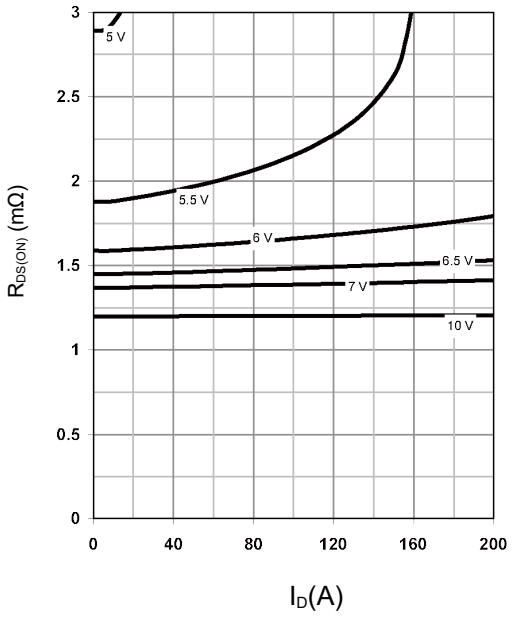



Fig 6. drain-source on resistance

ID=f($V_{GS}$); |$V_{DS}$|>2| $I_D$ |$R_{DS(ON)max}$, parameter: $T_J$

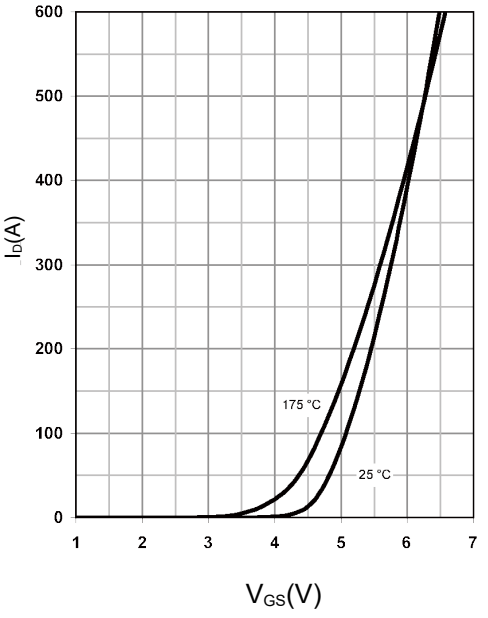



Fig 7. transfer characteristics

$g_{fs}=f(I_D)$; $T_J$=25°C

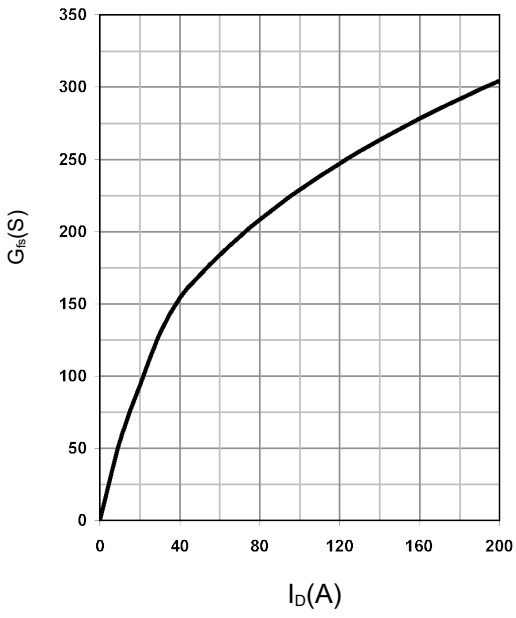



Fig 8. forward transconductance

## 5.3Typical characteristic

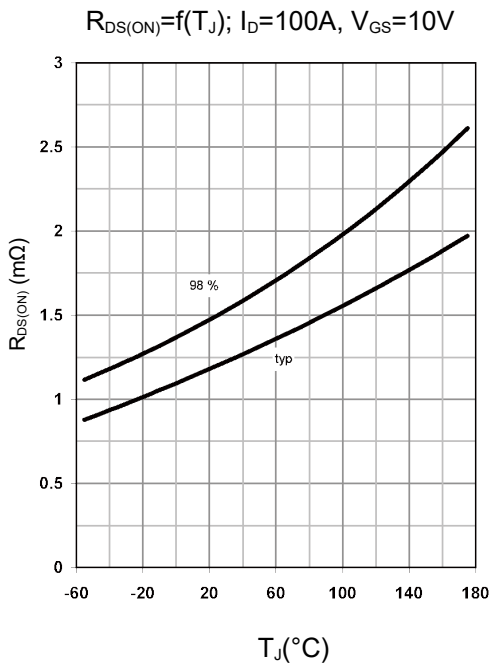



Fig 9. Drain-source on-state resistance

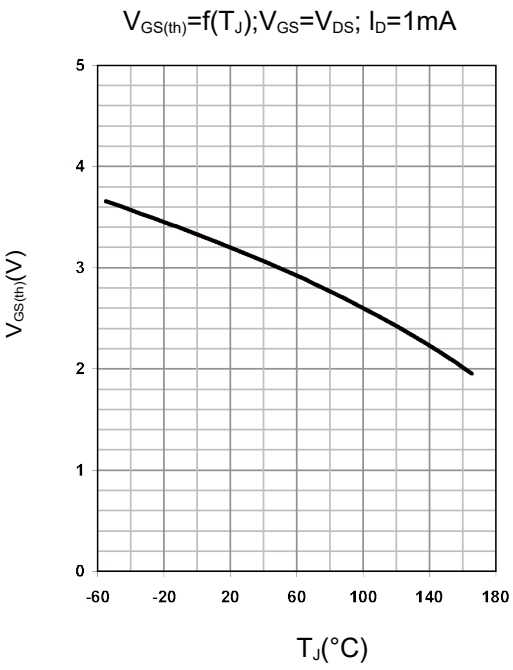



Fig 10. Tgate threshold voltage

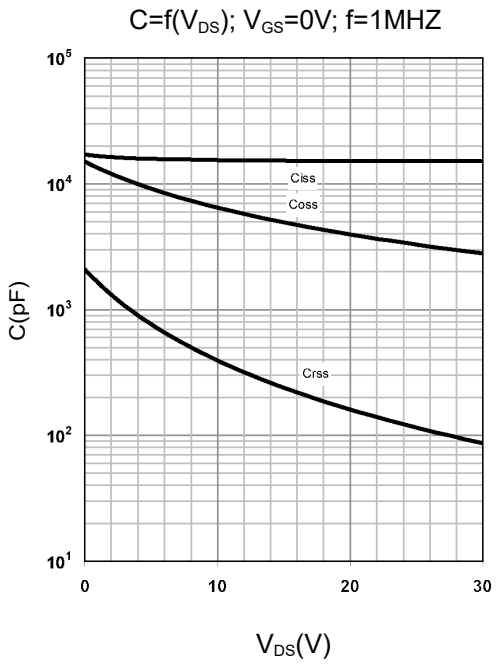



Fig 11. capacitances

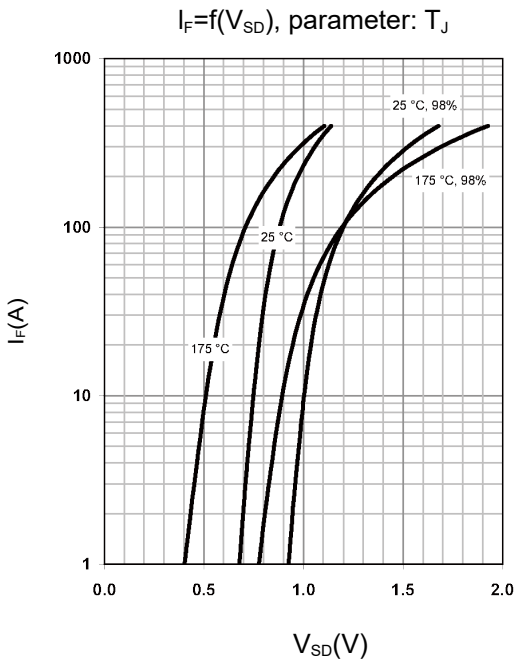



Fig 12. Forward characteristics of reverse diode

## 5.4Typical characteristic

$I_{AS}=f(t_{AV})$; $R_{GS}=25\Omega$, parameter: $T_{j(start)}$

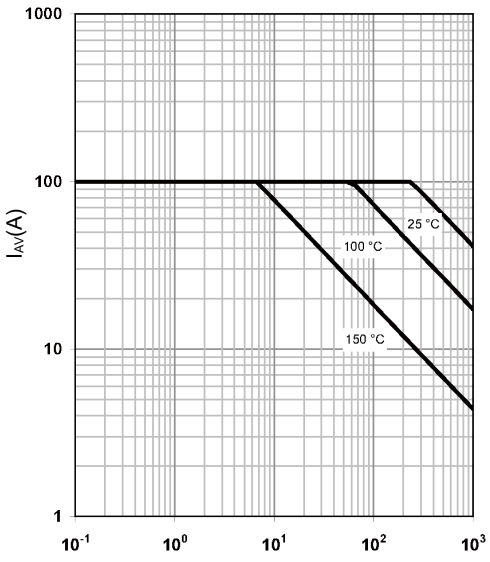



Fig 13. Avalanche characteristics

$V_{GS}=f(Q_{gate})$; $I_D=100A$pulsed, parameter: $V_{DD}$

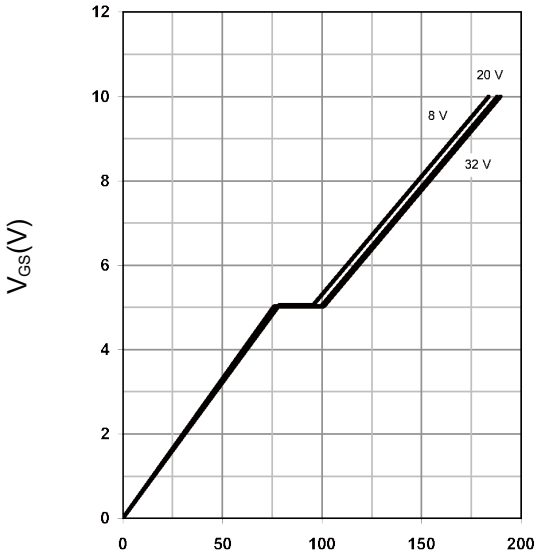



Fig 14. gate charge

$V_{BR(DSS)}=f(T_J)$; $I_D$=1m A

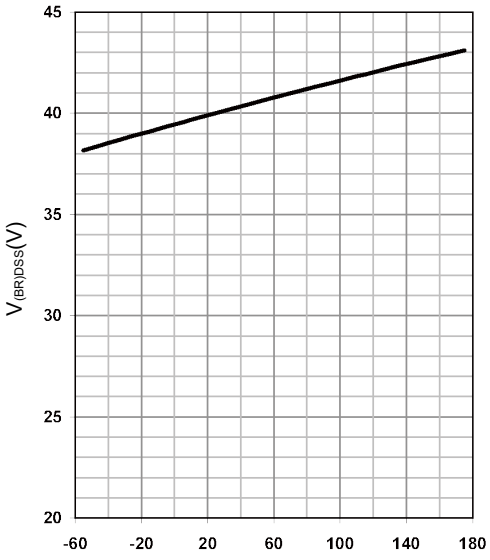



Fig 15. drai source breakdown voltage

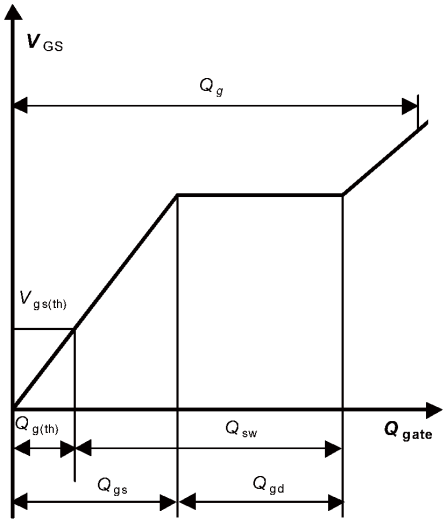
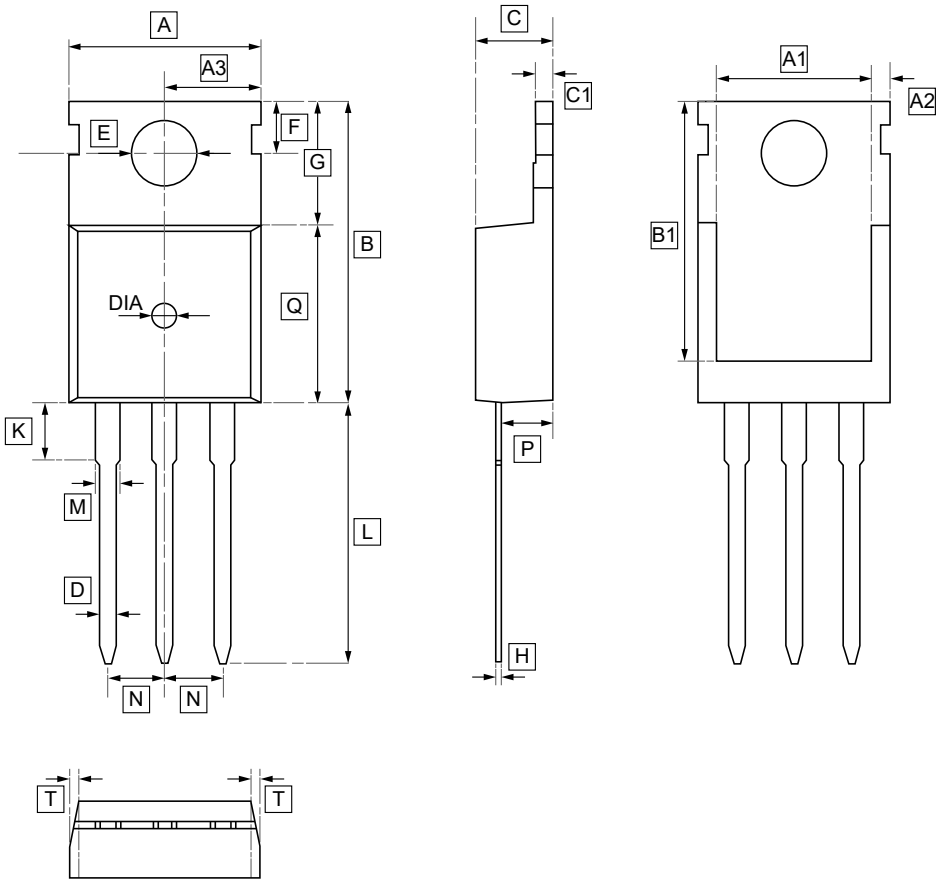



Fig 16. Gate charge waveforms

## 6.TO-220 Package Outline Dimensions

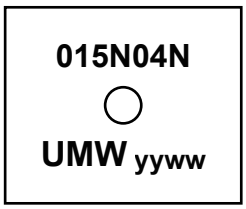



**DIMENSIONS (mm are the original dimensions)**

| Symbol | A | A1 | A2 | A3 | B | B1 | C | C1 | D | E | F | G |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min | 9.7 | 8.44 | 1.05 | 4.8 | 15.4 | 12.9 | 4.28 | 1.1 | 0.6 | 3.4 | 2.65 | 5.2 |
| Max | 10.3 | 8.84 | 1.25 | 5.2 | 16.2 | 13.5 | 4.68 | 1.5 | 1.0 | 3.8 | 3.25 | 5.8 |

| Symbol | H | K | L | L1 | M | N | P | Q | T | DIA |
|---|---|---|---|---|---|---|---|---|---|---|
| Min | 0.4 | 2.9 | 12.8 | 2.7 | 1.15 | 2.49 | 2.1 | 8.7 | W:0.35 | ⊙1.5 |
| Max | 0.6 | 3.3 | 13.6 | 3.3 | 1.35 | 2.59 | 2.7 | 9.3 | | (deep 0.2) |

## 7.Ordering information




yy: Year Code
ww: Week Code

| Order Code | Package | Base QTY | Delivery Mode |
|---|---|---|---|
| UMW IPP015N04N G | TO-220 | 1000 | Tube and box |

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