N-Ch 40V Fast Switching MOSFETs

- ★ Super Low Gate Charge
- ★ 100% EAS Guaranteed
- ★ Green Device Available
- ★ Excellent CdV/dt effect decline
- ★ Advanced high cell density Trench technology

## Product Summary

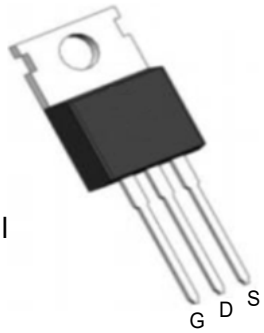
Green

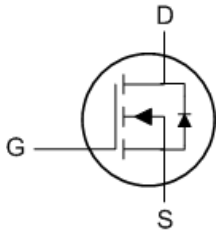
| BVDSS | RDSON | ID |
|---|---|---|
| 40V | 2.7mΩ | 190A |

## Description

The XR190N04T is the high performance N-ch MOSFETs with high cell density which provides excellent RDSON and gate charge for most of the synchronous buck converter applications . The XR190N04T meets the RoHS and Green Product requirements 100% EAS guaranteed with ful function reliability approved.

## TO220AB Pin Configuration




## Absolute Maximum Ratings

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 40 | V |
| $V_{GS}$ | Gate-Source Voltage | ±25 | V |
| $I_D$@$T_C$=25℃ | Continuous Drain Current, $V_{GS}$ @ 10V[1,6] | 190 | A |
| $I_D$@$T_C$=100℃ | Continuous Drain Current, $V_{GS}$ @ 10V[1,6] | 123 | A |
| $I_{DM}$ | Pulsed Drain Current[2] | 760 | A |
| EAS | Single Pulse Avalanche Energy[3] | 196 | mJ |
| $I_{AS}$ | Avalanche Current | 28 | A |
| $P_D$@$T_C$=25℃ | Total Power Dissipation[4] | 61 | W |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | ℃ |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | ℃ |

## Thermal Data

| Symbol | Parameter | Typ. | Max. | Unit |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient [1] | --- | --- | ℃/W |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case[1] | --- | 2 | ℃/W |

## Electrical Characteristics ($T_J$=25 ℃, unless otherwise noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=250uA | 40 | --- | --- | V |
| $\triangle BV_{DSS}/\triangle T_J$ | $BV_{DSS}$ Temperature Coefficient | Reference to 25℃ , $I_D$=1mA | --- | --- | --- | V/℃ |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance[2] | $V_{GS}$=10V , $I_D$=57A | --- | 2.7 | 3.5 | mΩ |
| | | $V_{GS}$=4.5V , $I_D$=20A | --- | --- | --- | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =250uA | 2 | 2.8 | 4 | V |
| $\triangle V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | --- | --- | --- | mV/℃ |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=40V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | 1 | uA |
| | | $V_{DS}$=40V, $V_{GS}$=0V , $T_J$=100℃ | --- | --- | 100 | |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$=±25V , $V_{DS}$=0V | --- | --- | ±100 | nA |
| gfs | Forward Transconductance | $V_{DS}$=5V , $I_D$=20A | --- | --- | --- | S |
| $R_g$ | Gate Resistance | $V_{DS}$=0V , $V_{GS}$=0V , f=1MHz | --- | --- | --- | Ω |
| $Q_g$ | Total Gate Charge | $V_{DS}$=20V , $V_{GS}$=10V , $I_D$=57A | --- | 80 | --- | nC |
| $Q_{gs}$ | Gate-Source Charge | | --- | 17 | --- | |
| $Q_{gd}$ | Gate-Drain Charge | | --- | 21 | --- | |
| $T_{d(on)}$ | Turn-On Delay Time | VGS=10V, VDD=20V, RG=3Ω, RL=1Ω, ID=57A | --- | 21 | --- | ns |
| $T_r$ | Rise Time | | --- | 32 | --- | |
| $T_{d(off)}$ | Turn-Off Delay Time | | --- | 71 | --- | |
| $T_f$ | Fall Time | | --- | 40 | --- | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=20V , $V_{GS}$=0V , f=1MHz | --- | 4900 | --- | pF |
| $C_{oss}$ | Output Capacitance | | --- | 528 | --- | |
| $C_{rss}$ | Reverse Transfer Capacitance | | --- | 317 | --- | |

## Diode Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current[1,5] | $V_G$=$V_D$=0V , Force Current | --- | --- | 190 | A |
| $V_{SD}$ | Diode Forward Voltage[2] | $V_{GS}$=0V , $I_S$=57A , $T_J$=25℃ | --- | --- | 1.2 | V |

Notes:1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

2. EAS condition: $T_J$=25℃, $V_{DD}$=20V, $V_G$=10V, $R_G$=25Ω, L=0.5mH, $I_{AS}$=28A

3. Pulse Test: Pulse Width≤300μs, Duty Cycle≤0.5%

# Typical Performance Characteristics

**Figure1:** Output Characteristics

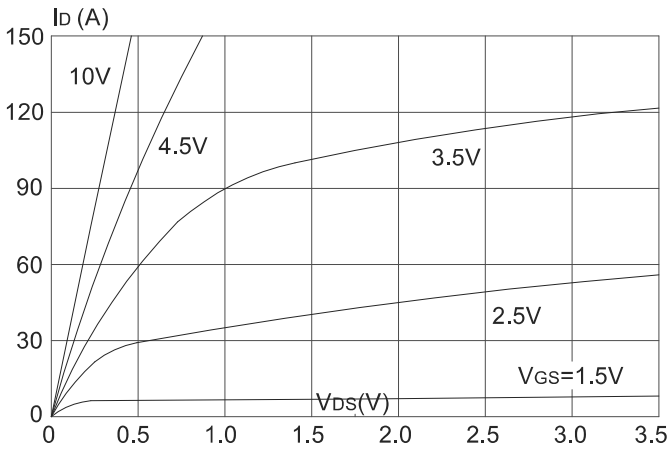



**Figure 2:** Typical Transfer Characteristics

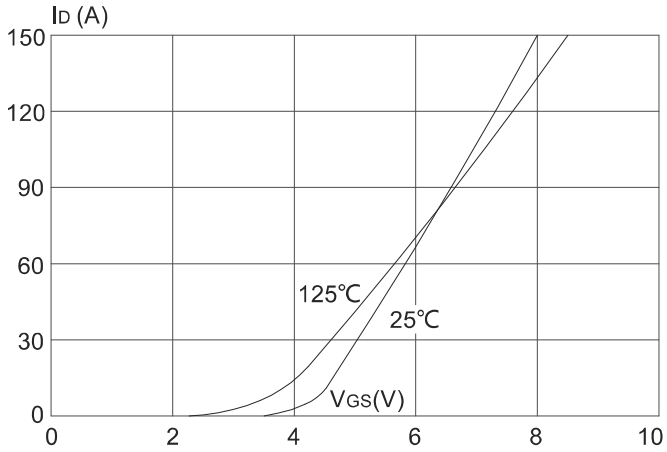



**Figure 3:**On-resistance vs. Drain Current

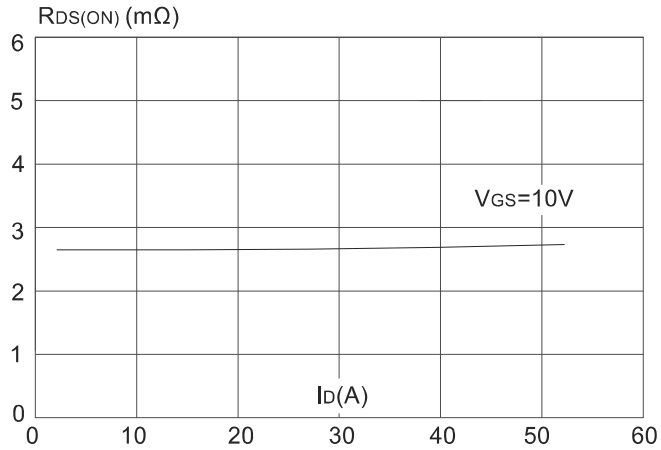



**Figure 4**: Body Diode Characteristics

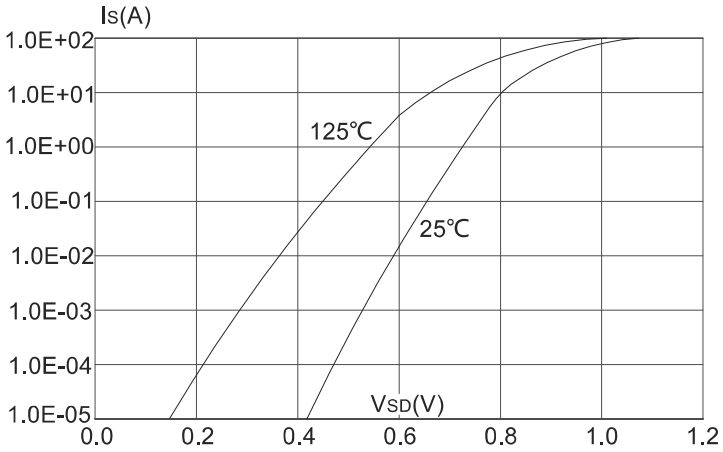



**Figure 5:** Gate Charge Characteristics

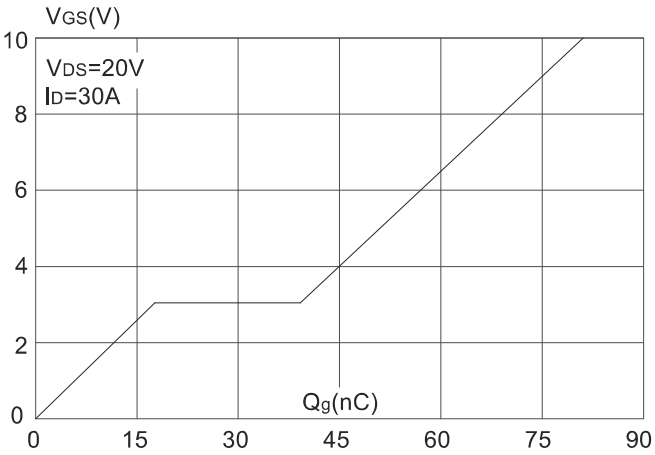



**Figure 6:** Capacitance Characteristics

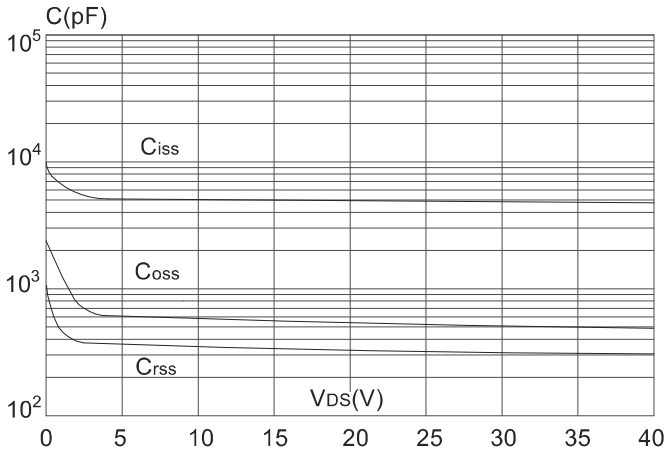


**Figure 7:** Normalized Breakdown Voltage vs. Junction Temperature

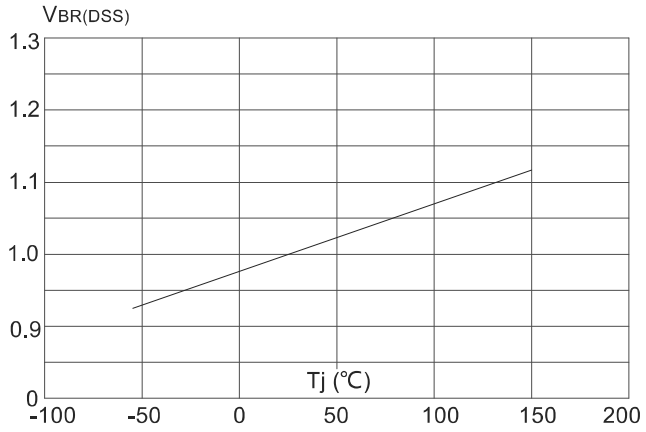



**Figure 8:** Normalized on Resistance vs. Junction Temperature

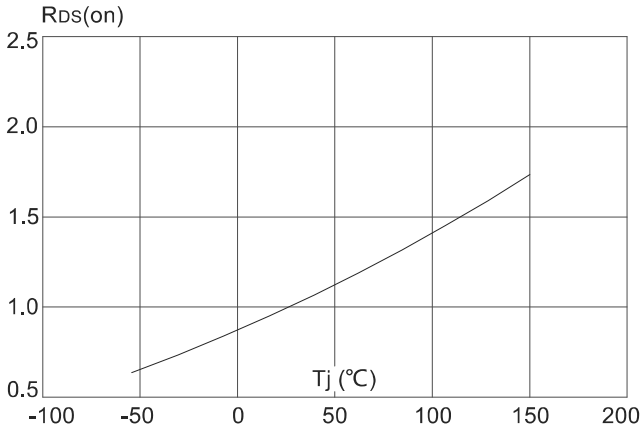



**Figure 9:** Maximum Safe Operating Area

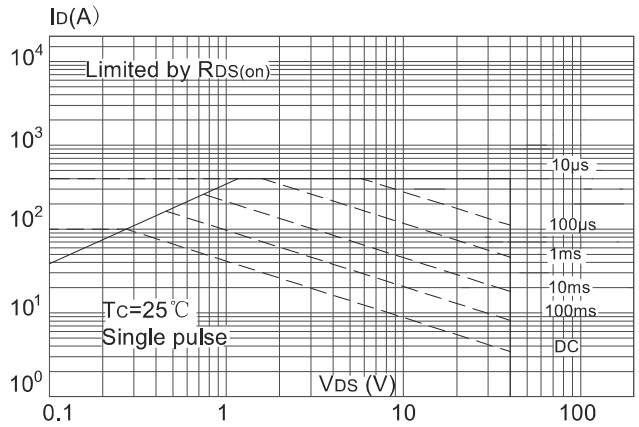



**Figure 10:** Maximum Continuous Drain Current vs. Case Temperature

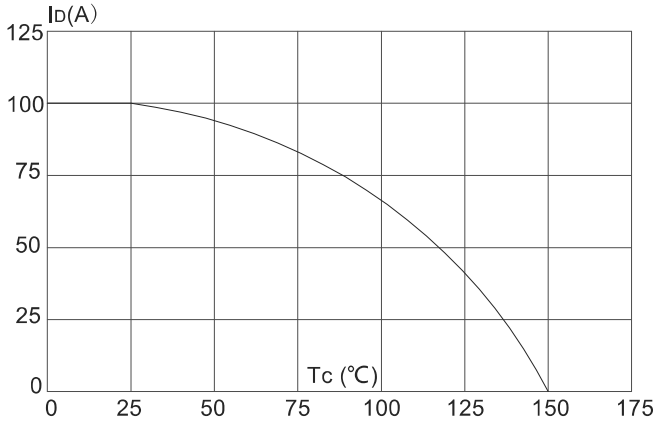
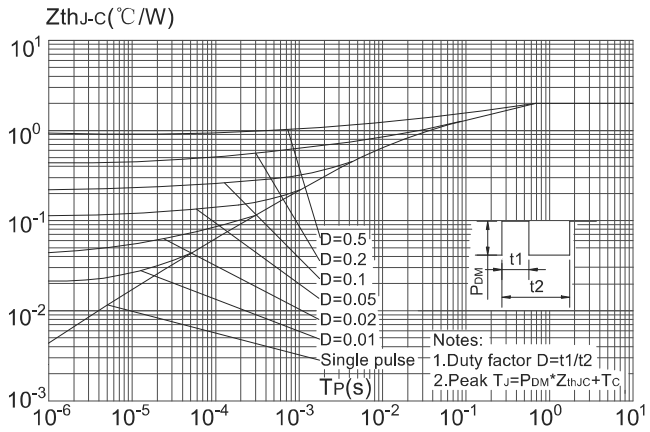
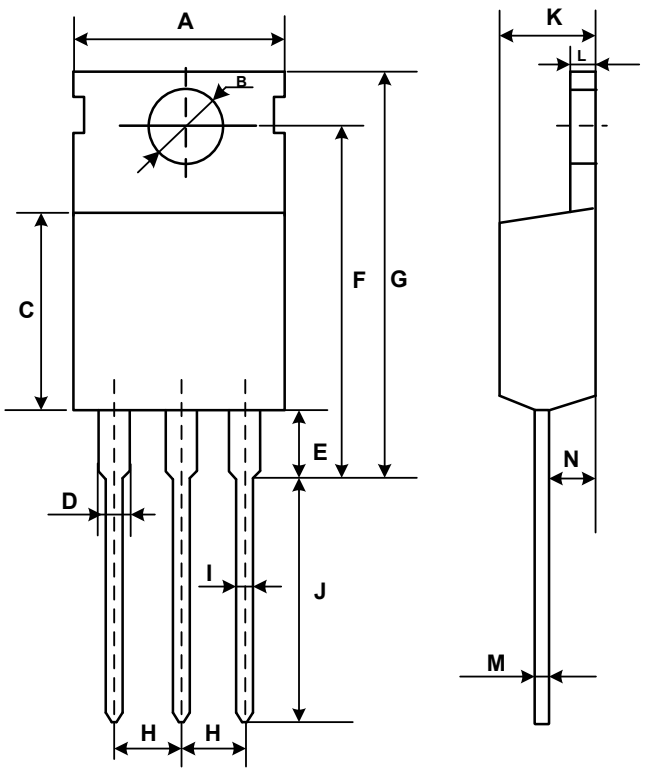



**Figure.11:** Maximum Effective Transient Thermal Impedance, Junction-to-Case



**Mechanical Dimensions for TO-220**




OMMON DIMENSIONS

| SYMBOL | MM | |
|---|---|---|
| | MIN | MAX |
| A | 9.70 | 10.30 |
| B | 3.40 | 3.80 |
| C | 8.80 | 9.40 |
| D | 1.17 | 1.47 |
| E | 2.60 | 3.50 |
| F | 15.10 | 16.70 |
| G | 19.55MAX | |
| H | 2.54REF | |
| I | 0.70 | 0.95 |
| J | 9.35 | 11.00 |
| K | 4.30 | 4.77 |
| L | 1.20 | 1.45 |
| M | 0.40 | 0.65 |
| N | 2.20 | 2.60 |