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

## Product Summary

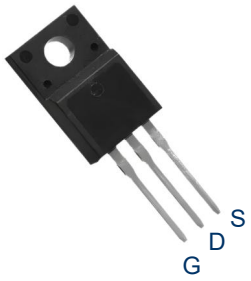
Green

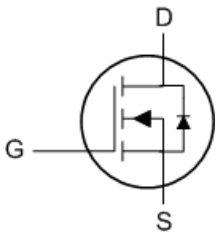
| BVDSS | RDSON | ID |
|---|---|---|
| 40V | 2.8mΩ | 120A |

## Description

The XR120N04FT is the high cell density trenched N-ch MOSFETs, which provides excellent RDSON and gate charge for most of the synchronous buck converter applications. The XR120N04FT meets the RoHS and Green Product requirements, 100% EAS guaranteed with full function reliability approved.

## TO220F Pin Configuration




## Absolute Maximum Ratings

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 40 | V |
| $V_{GS}$ | Gate-Source Voltage | ±20 | V |
| $I_D$@$T_C$=25℃ | Continuous Drain Current, $V_{GS}$ @ 10V[1,6] | 120 | A |
| $I_D$@$T_C$=100℃ | Continuous Drain Current, $V_{GS}$ @ 10V[1,6] | 83 | A |
| $I_{DM}$ | Pulsed Drain Current[2] | 480 | A |
| EAS | Single Pulse Avalanche Energy[3] | 441 | mJ |
| $I_{AS}$ | Avalanche Current | --- | A |
| $P_D$@$T_C$=25℃ | Total Power Dissipation[4] | 115 | 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] | --- | 1.3 | ℃/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 , $I_D$=19A | --- | 2.8 | 3.6 | mΩ |
| | | $V_{GS}$=4.5V , $I_D$=19A | --- | 3.7 | 4.8 | |
| | | $V_{GS}$=2.5V , $I_D$=10A | --- | --- | --- | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =250uA | 1 | --- | 2.5 | 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 , $T_J$=125℃ | --- | --- | 100 | |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$=±20V , $V_{DS}$=0V | --- | --- | ±100 | nA |
| gfs | Forward Transconductance | $V_{DS}$=5V , $I_D$=14A | --- | 39 | --- | S |
| $Q_g$ | Total Gate Charge | $V_{DS}$=20V , $V_{GS}$=10V , $I_D$=19A | --- | 110 | --- | nC |
| $Q_{gs}$ | Gate-Source Charge | | --- | 20 | --- | |
| $Q_{gd}$ | Gate-Drain Charge | | --- | 20 | --- | |
| $T_{d(on)}$ | Turn-On Delay Time | $V_{DS}$=20V , $V_{GS}$=10V , $R_G$=6Ω , $R_L$=1Ω | --- | 14 | --- | ns |
| $T_r$ | Rise Time | | --- | 26 | --- | |
| $T_{d(off)}$ | Turn-Off Delay Time | | --- | 77 | --- | |
| $T_f$ | Fall Time | | --- | 22 | --- | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=20V , $V_{GS}$=0V , f=1MHz | --- | 6130 | --- | pF |
| $C_{oss}$ | Output Capacitance | | --- | 401 | --- | |
| $C_{rss}$ | Reverse Transfer Capacitance | | --- | 348 | --- | |

## Diode Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current[1,4] | $V_G$=$V_D$=0V , Force Current | --- | --- | 120 | A |
| $V_{SD}$ | Diode Forward Voltage[2] | $V_{GS}$=0V , $I_S$=19A , $T_J$=25℃ | --- | --- | 1.2 | V |
| $t_{rr}$ | Reverse Recovery Time | IF=19A , di/dt=100A/μs , $T_J$=25℃ | --- | 25 | --- | nS |
| $Q_{rr}$ | Reverse Recovery Charge | | --- | 16 | --- | nC |

Note :

1.Repetitive Rating: Pulse width limited by maximum junction temperature.
2.$E_{AS}$ condition: $T_J$=25℃,$V_{DD}$=40V,$V_G$=10V, Rg=25Ω, L=0.5mH.
3.Repetitive Rating: Pulse width limited by maximum junction temperature.

## Typical Electrical And Thermal Characteristics (Curves)

**Figure 1. Output Characteristics**

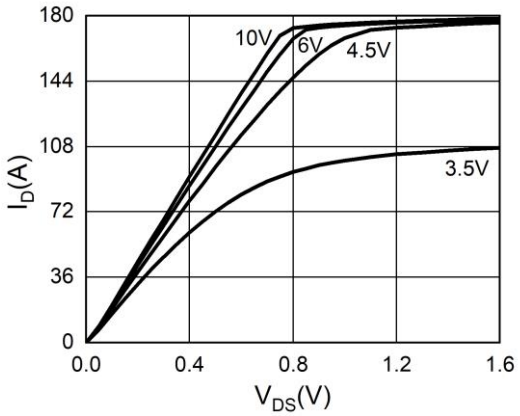



**Figure 2. Transfer Characteristics**

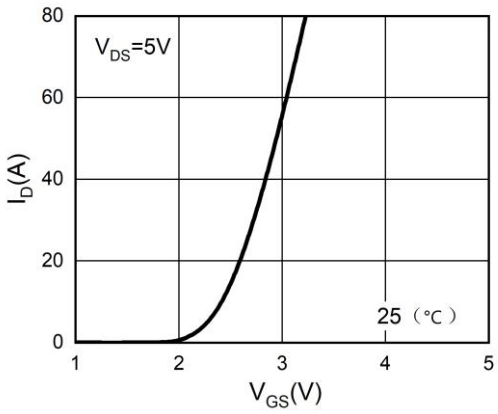



**Figure 3. Power Dissipation**

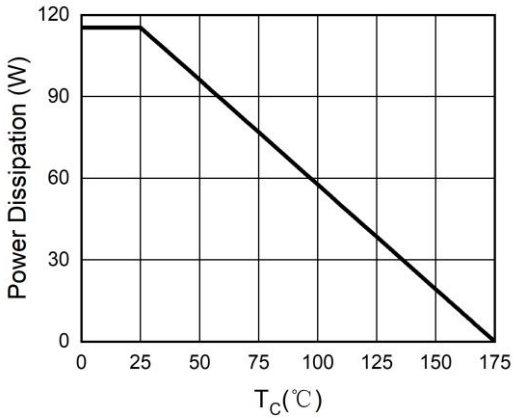



**Figure 4. Drain Current**

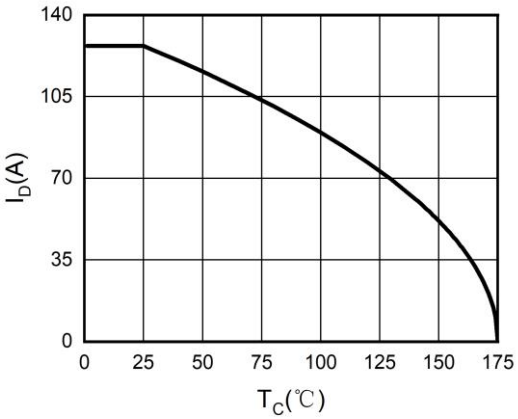



**Figure 5. $BV_{DSS}$ vs Junction Temperature**

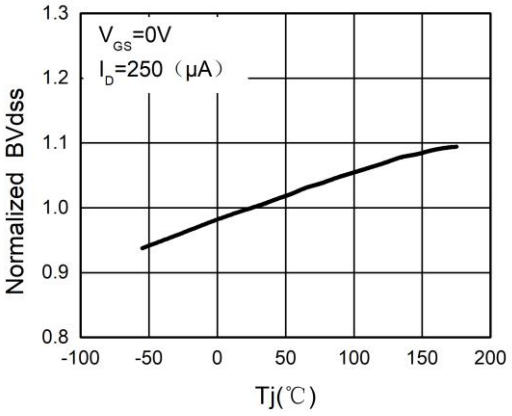
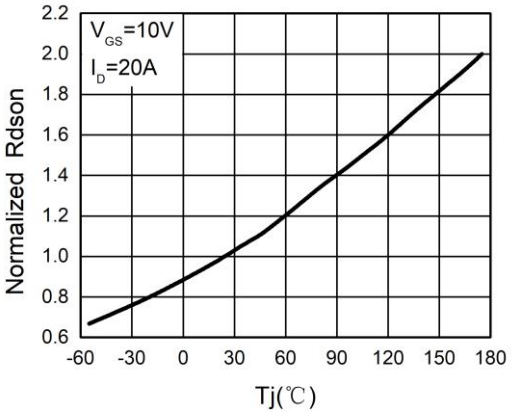



**Figure 6. $R_{DS(ON)}$ vs Junction Temperature**



## Typical Electrical And Thermal Characteristics (Curves)

**Figure 7. Gate Charge Waveforms**

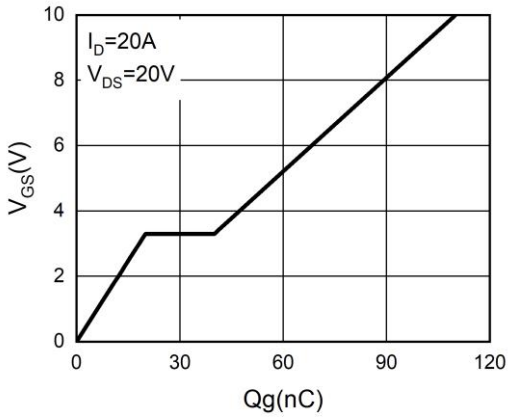



**Figure 8. Capacitance**

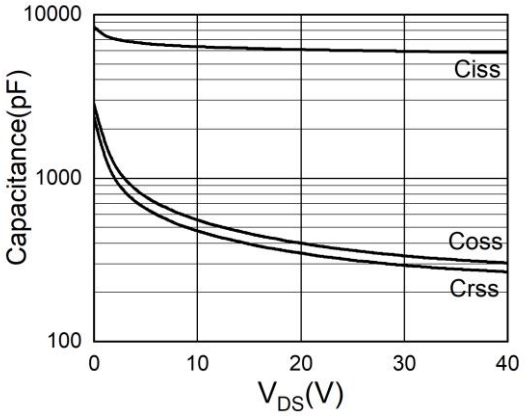



**Figure 9. Body-Diode Characteristics**

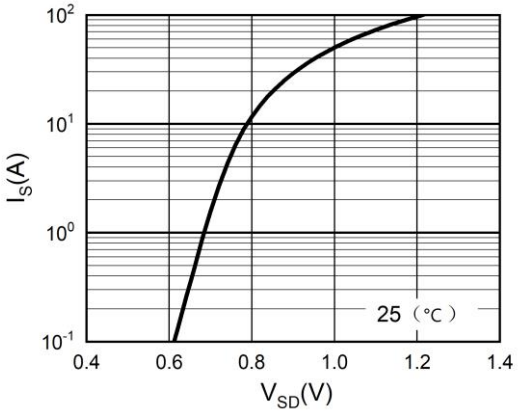
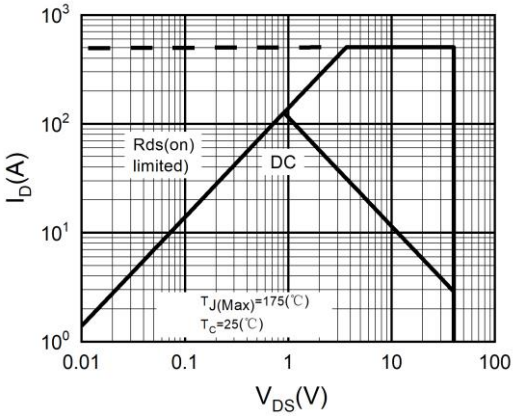



**Figure 10. Maximum Safe Operating Area**



## Test Circuit

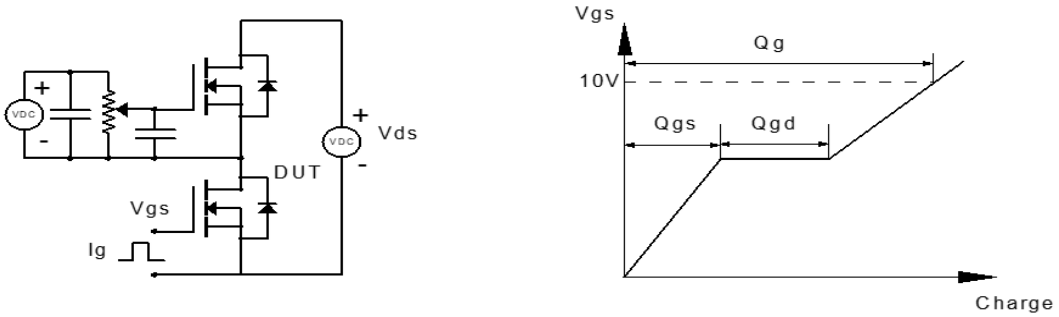



**Figure 1: Gate Charge Test Circuit & Waveform**

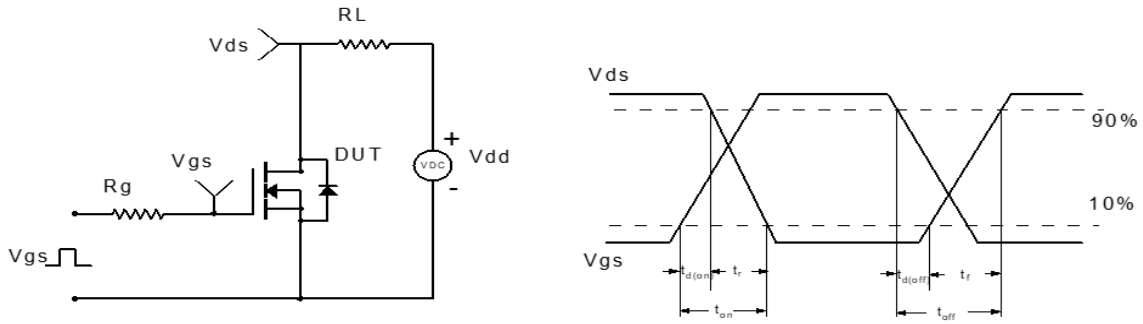



**Figure 2: Resistive Switching Test Circuit & Waveform**

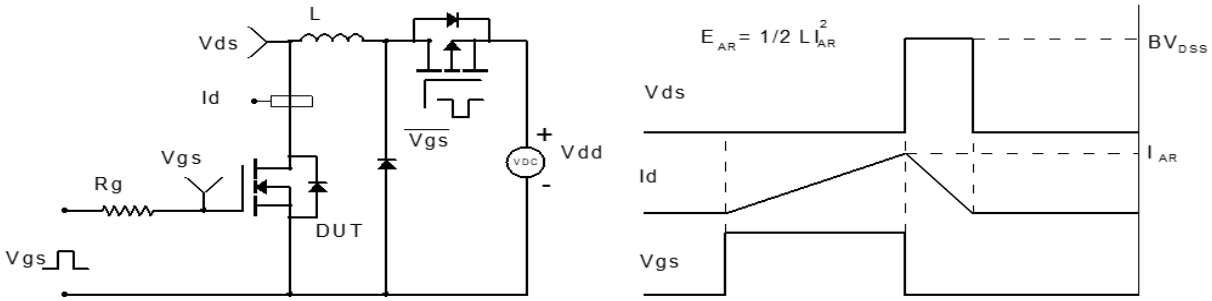



**Figure 3: Unclamped Inductive Switching Test Circuit& Waveform**

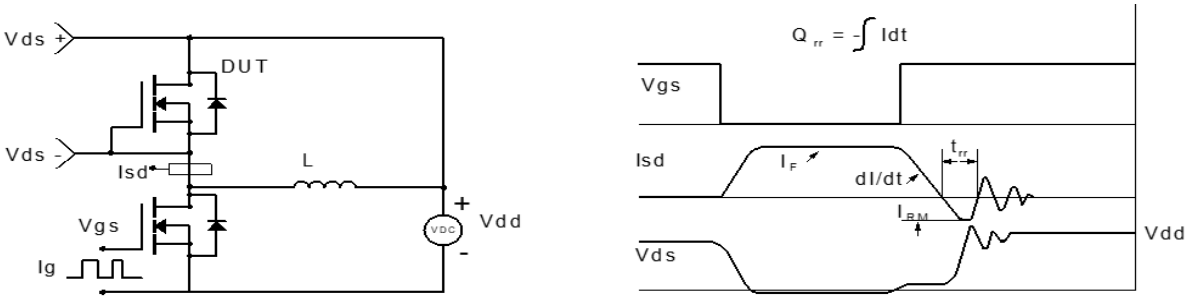
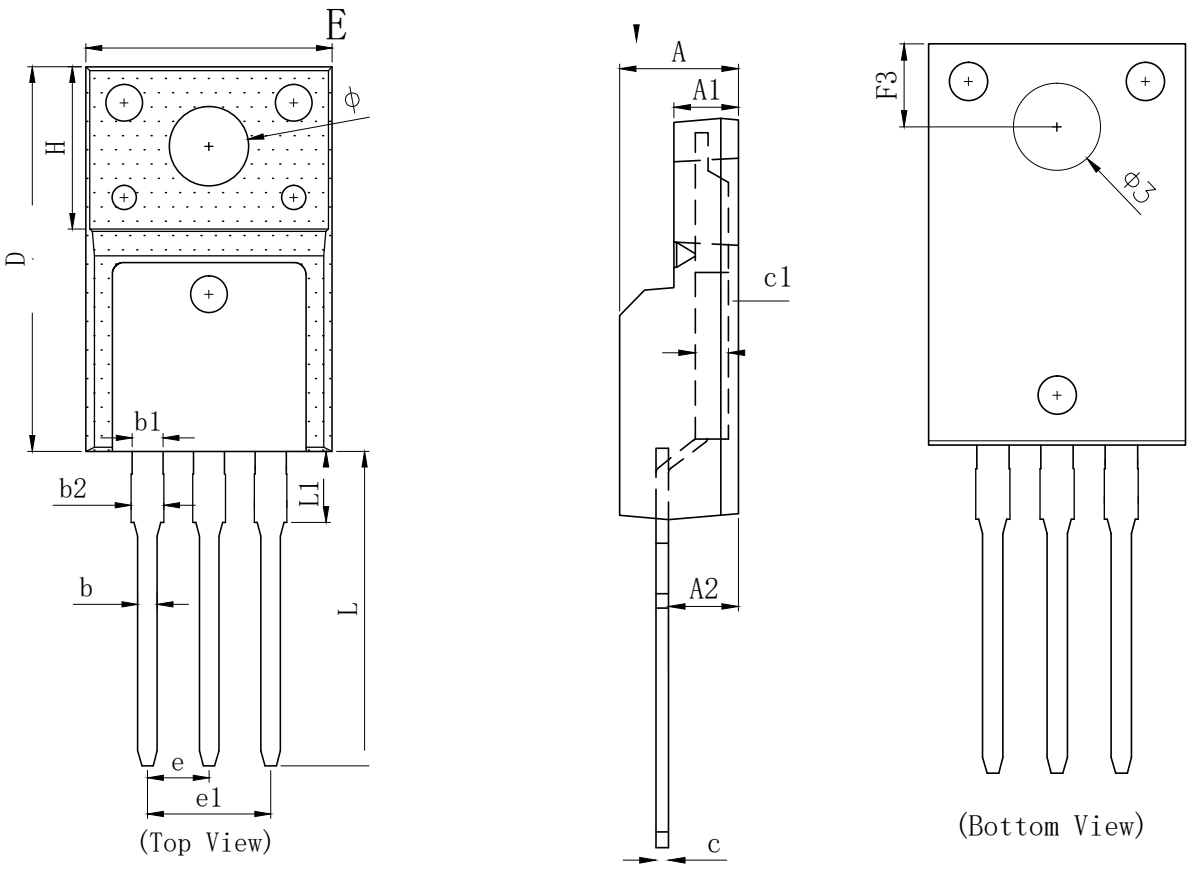



**Figure 4: Diode Recovery Test Circuit & Waveform**

**Mechanical Dimensions for TO-220F**




| SYMBOL | MILLIMETER | | |
|---|---|---|---|
| | MIN | Typ. | MAX |
| A | 4.500 | 4.700 | 4.900 |
| A1 | 2.340 | 2.540 | 2.740 |
| A2 | 2.560 | 2.760 | 2.960 |
| b | 0.700 | 0.800 | 0.950 |
| b1 | 1.180 | 1.280 | 1.430 |
| b2 | 1.250 | 1.350 | 1.550 |
| c | 0.400 | 0.500 | 0.650 |
| c1 | 1.200 | 1.300 | 1.350 |
| D | 15.570 | 15.870 | 16.170 |
| H | 6.700 REF | | |
| E | 9.960 | 10.160 | 10.360 |
| e | 2.540 BSC | | |
| e1 | 5.080 BSC | | |
| L | 12.680 | 12.980 | 13.280 |
| L1 | 2.780 | 2.930 | 3.080 |
| F3 | 3.150 | 3.300 | 3.450 |
| ϕ | 3.030 | 3.180 | 3.450 |
| ϕ3 | 3.150 | 3.450 | 3.650 |