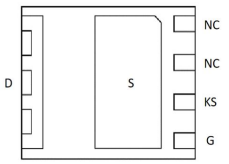
# E-mode 650V,10A,200mΩ GaN HEMT

## Description

TK65x200 is an enhancement mode GaN-on-silicon transistor. GaN is a wide band gap semiconductor with high power density. The gallium nitride transistor is characterized by no body diode, so the reverse recovery charge is zero.

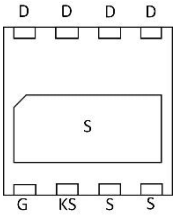
## Features

- 650 V enhancement mode power switch
- $R_{DS(on)}$ =200mΩ
- $I_{DS(max)}$ = 10A
- Easy gate drive requirements (0 V to 6 V)
- Very high switching frequency (> 10 MHz)
- Fast and controllable fall and rise times
- Zero reverse recovery loss

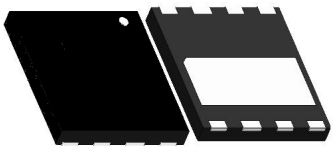




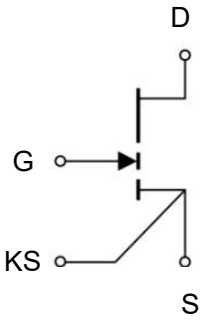

DFN5x6




Bottom View



DFN8x8

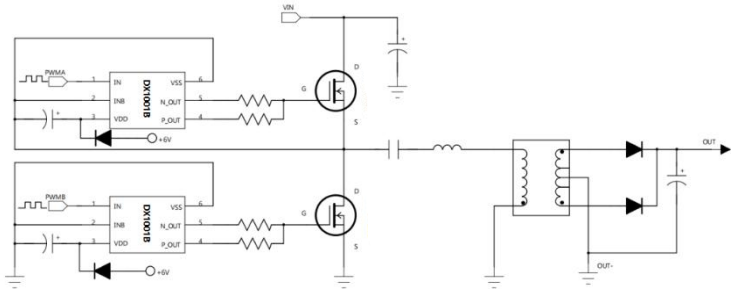



## Applications

- Fast Battery Charging
- LED lighting drivers
- Power Factor Correction
- LLC Converters
- Wireless Power Transfer

## Device Information

| Part Number | Marking Code | Package | Packing |
|---|---|---|---|
| TK65C200 | 6510CE | DFN5x6 | Tape 4000pcs/reel |
| TK65F200 | X6510FE | DFN8x8 | 260pcs/tray |



Typical application circuit of LLC

## Absolute Maximum Ratings (Tc=25℃ unless otherwise specified)

| Parameter | Symbol | Value | Unit | Condition |
|---|---|---|---|---|
| Drain-Source voltage | $V_{DS}$ | 650 | V | |
| Gate-source voltage | $V_{GS}$ | -10 to 6 | V | |
| Continuous drain current* | $I_D$ | 10 | A | Tc=25℃ |
| | | 4.5 | A | Tc=125℃ |
| Operation and storage temperature | $T_j$ | -55 to 150 | ℃ | |
| | $T_{stg}$ | -55 to 150 | ℃ | |

*** An Estimated Value**

## Electrical Characteristics (Tc=25℃ unless otherwise specified)

### Typical Performance – Static

| Parameter | Symbol | Values | | | Unit | Test condition |
|---|---|---|---|---|---|---|
| | | Min. | Type. | Max. | | |
| Drain source breakdown voltage | $BV_{DS}$ | 650 | / | / | V | VGS=0V, ID=200μA |
| Total drain leakage current | $I_{DSS}$ | / | 1 | 10 | μA | VDS=650V, VGS=0V, Tj=25℃ |
| | | / | 8 | 110 | μA | VDS=650V, VGS=0V, Tj=150℃ |
| Gate-to-source current | $I_{GSS}$ | / | 10 | / | μA | VDS=0V, VGS=6V, Tj=25℃ |
| Static drain-source on-resistance | $R_{DS(ON)}$ | / | 150 | 200 | mΩ | VGS=6V, ID=3A, Tj=25℃ |
| | | / | 300 | / | mΩ | VGS=6V, ID=3A, Tj=150℃ |
| Gate threshold voltage | $V_{GS(th)}$ | 1.2 | 1.6 | 2.0 | V | VDS=VGS, ID=3.5mA, |

## Thermal characteristics（DFN5x6）

| Parameter | Symbol | Values | Unit | Note/Test Condition |
|---|---|---|---|---|
| Thermal resistance, junction-ambient | $R_{thJA}$ | 60.8 | °C/W | |
| Thermal resistance, junction-case | $R_{thJC}$ | 1.72 | °C/W | |
| Maximum reflow soldering temperature | $T_{sold}$ | 260 | °C | MSL3 |

## Thermal characteristics（DFN8x8）

| Parameter | Symbol | Values | Unit | Note/Test Condition |
|---|---|---|---|---|
| Thermal resistance, junction-ambient | $R_{thJA}$ | 58.5 | °C/W | |
| Thermal resistance, junction-case | $R_{thJC}$ | 1.72 | °C/W | |
| Maximum reflow soldering temperature | $T_{sold}$ | 260 | °C | MSL3 |

## Typical Performance – Dynamic

| Parameter | Symbol | Values | | | Unit | Test condition |
|---|---|---|---|---|---|---|
| | | Min | Type | Max | | |
| Input capacitance | $C_{ISS}$ | / | 72 | / | pF | $V_{DS}$=400V, $V_{GS}$=0V, f=1MHz |
| Output capacitance | $C_{OSS}$ | / | 20 | / | pF | |
| Reverse transfer capacitance | $C_{RSS}$ | / | 0.2 | / | pF | |
| Output capacitance, energy related | $C_{OSS(er)}$ | / | 31 | / | pF | $V_{DS}$=0V to 400V,$V_{GS}$=0V |
| Output capacitance time related | $C_{OSS(tr)}$ | / | 44 | / | pF | |
| Total gate charge | $Q_G$ | / | 2.4 | / | nC | $V_{DS}$=400V, $V_{GS}$=0V to 6V |
| Gate-drain charge | $Q_{GD}$ | / | 1.1 | / | nC | |
| Gate-source charge | $Q_{GS}$ | / | 0.25 | / | nC | |
| Gate Resistance | $R_G$ | / | 1.95 | / | Ω | *f* = *f*res, Open drain |
| Turn-on delay time | $t_{d(on)}$ | / | 2 | / | nS | $V_{DS}$=400V; $I_D$=6A; L=318uH; $V_{GS}$=6V Ron=10Ω; Roff=2Ω; |
| Turn-off delay time | $t_{d(off)}$ | / | 4 | / | nS | |
| Rise time | $t_r$ | / | 5 | / | nS | |
| Fall time | $t_f$ | / | 6 | / | nS | |

Figure 1 Typ. output characteristics

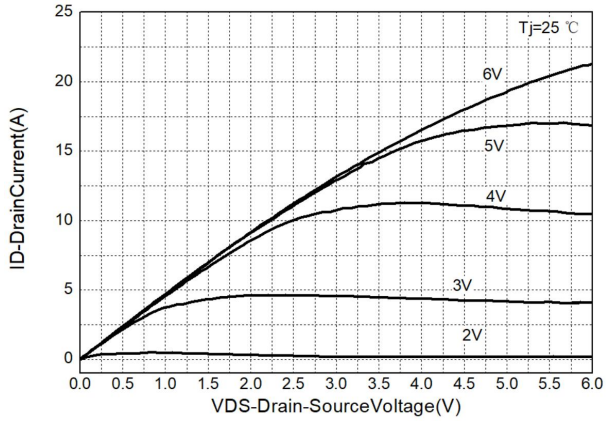



Figure 2 Typ. Drain-source on-state resistance

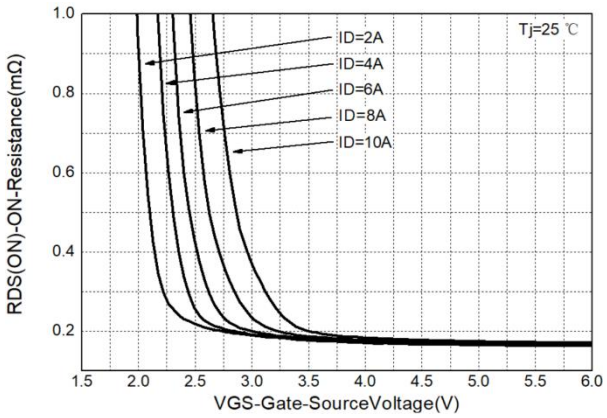



Figure 3 Typ. channel reverse characteristics

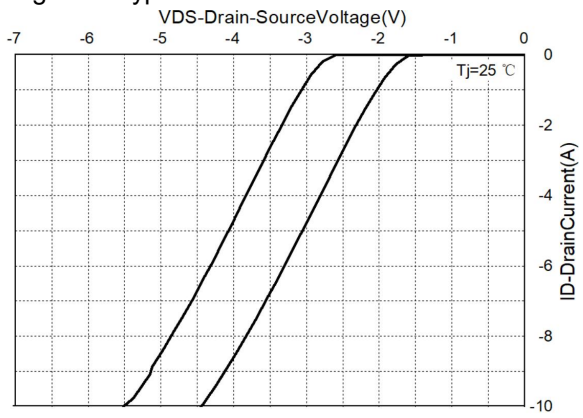



Figure 4 Typ. transfer characteristics

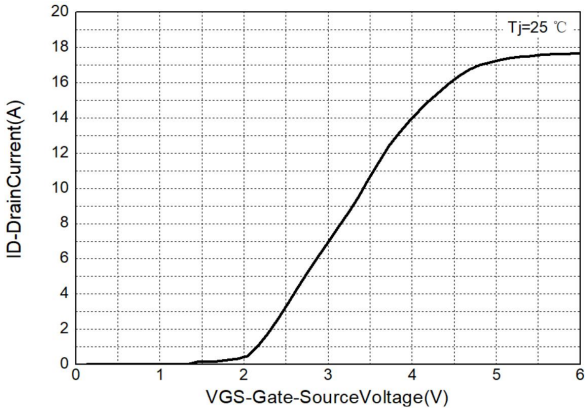



Figure 5 Typ. Gate threshold voltage

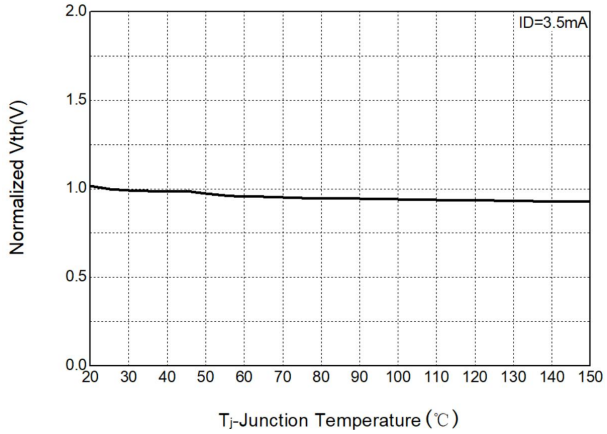



Figure 6 Typ. Drain-source on-state resistance

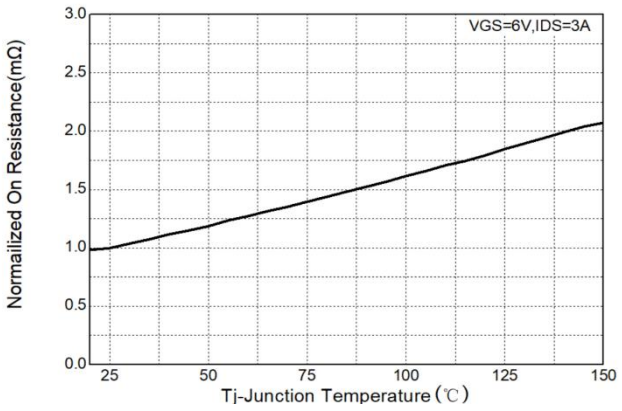



Figure 7 Typ.Drain-source leakage characteristics

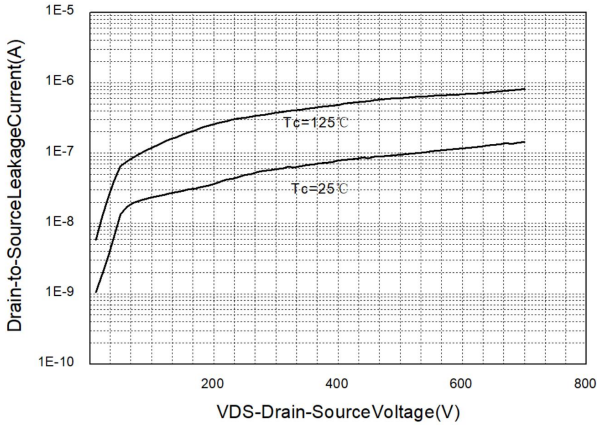



Figure 8 Typ. gate charge

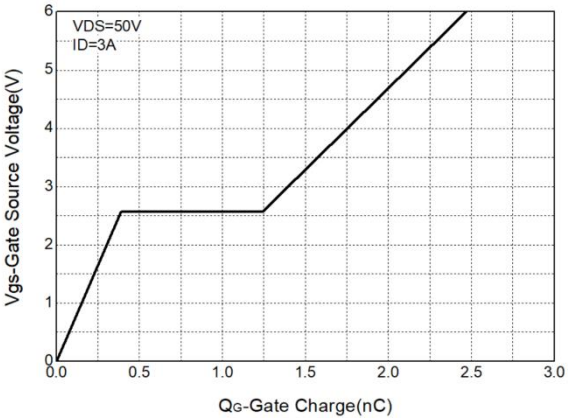


Figure 9.1 Safe operating area（DFN5x6）

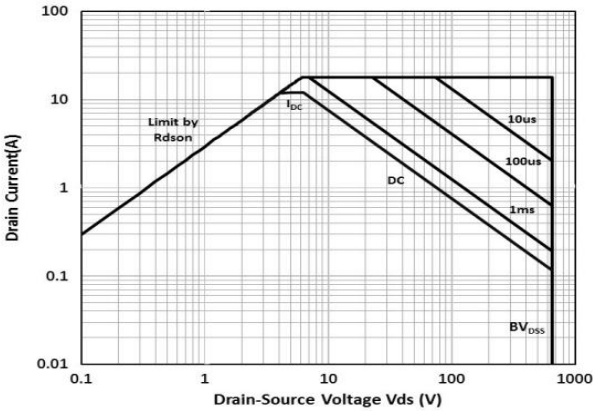



Figure 10.1 Max.transient thermal impedance（DFN5x6）

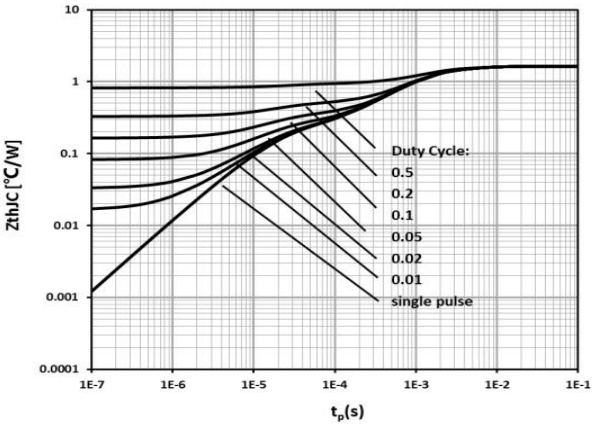



Figure 9.2 Safe operating area（DFN8x8）

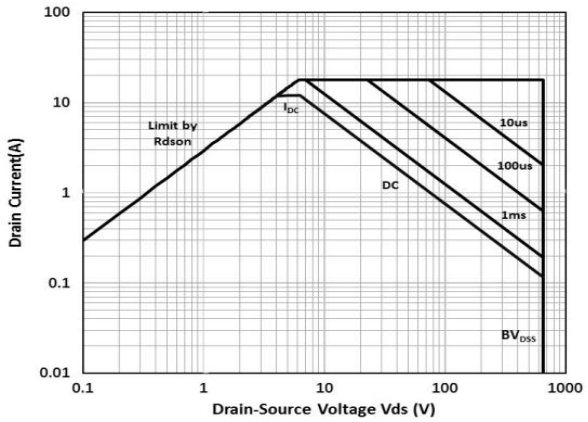



Figure 10.2 Max.transient thermal impedance（DFN8x8）

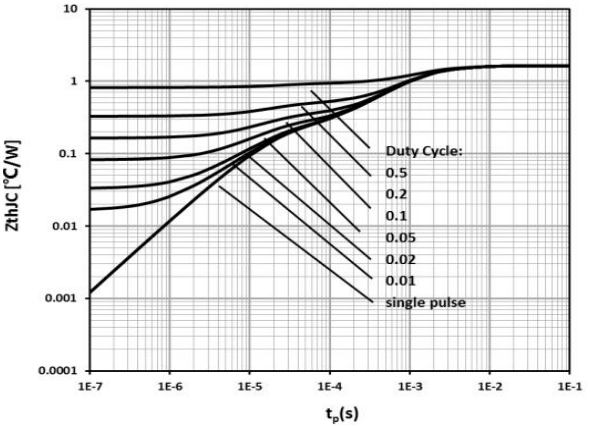



Figure 11 Power dissipation

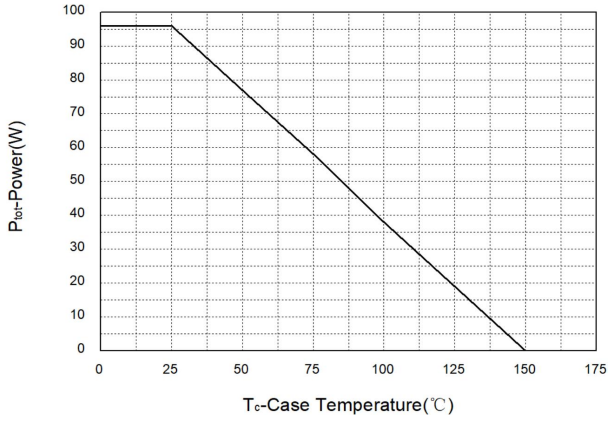
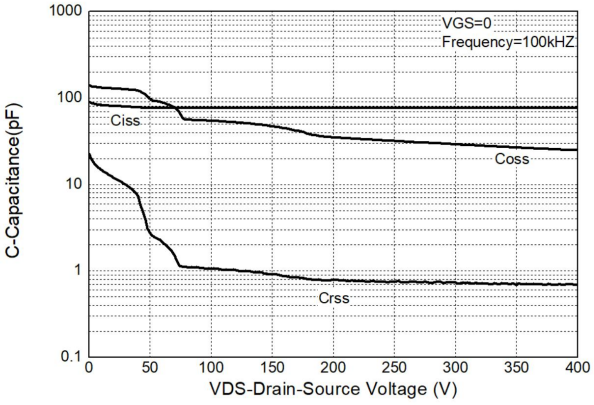


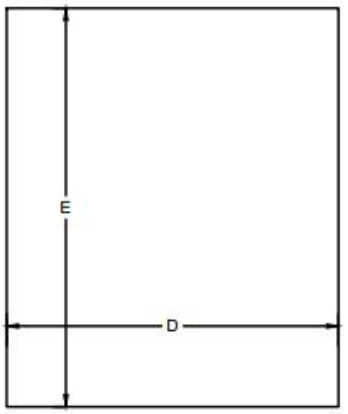

Figure 10　Capacitances



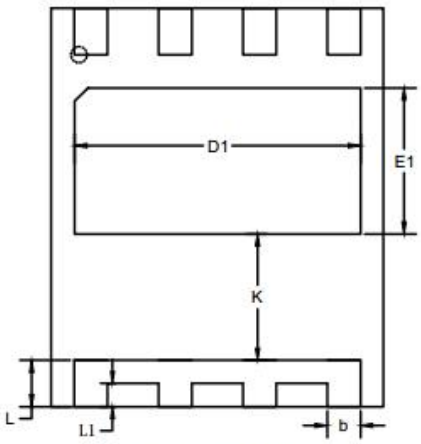
## Package Outline Dimensions

### DFN5x6

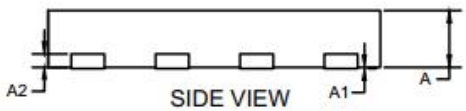
| Dimensions(mm) | | | |
|---|---|---|---|
| **Symbol** | **Min.** | **Nom.** | **Max.** |
| A | 0.8 | 0.85 | 0.9 |
| A1 | - | 0.02 | 0.05 |
| A2 | | 0.2(REF) | |
| b | 0.45 | 0.50 | 0.55 |
| D | 4.90 | 5.00 | 5.10 |
| D1 | 4.20 | 4.30 | 4.40 |
| E | 5.90 | 6.00 | 6.10 |
| E1 | 2.10 | 2.20 | 2.30 |
| e | | 1.27 | |
| k | 1.9 | - | - |
| L | 0.65 | 0.7 | 0.75 |




TOP VIEW



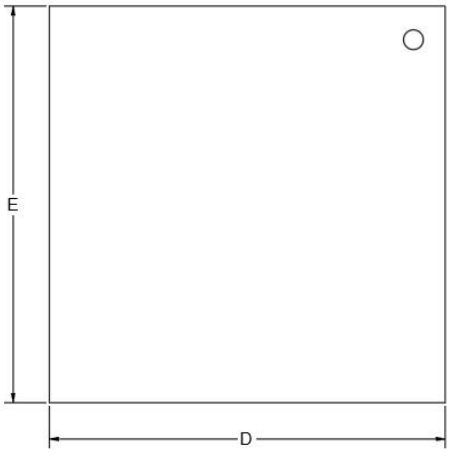

BOTTOM VIEW



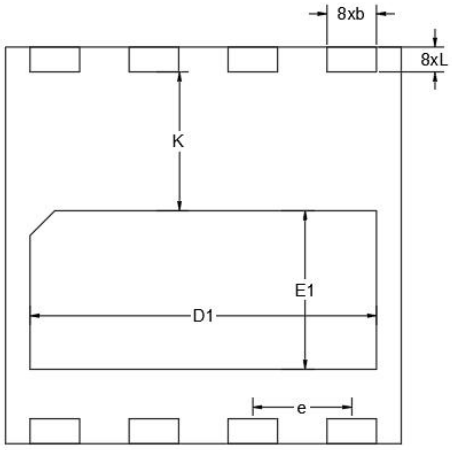

SIDE VIEW

**DFN8x8**

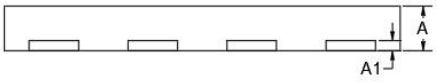
| Dimensions(mm) | | | |
|---|---|---|---|
| **Symbol** | **Min.** | **Nom.** | **Max.** |
| A | 0.80 | 0.90 | 1.00 |
| A1 | | REF 0.203 | |
| b | 0.95 | 1.00 | 1.05 |
| D | 7.90 | 8.00 | 8.10 |
| D1 | 6.90 | 7.00 | 7.10 |
| E | 7.90 | 8.00 | 8.10 |
| E1 | 3.10 | 3.20 | 3.30 |
| e | | REF 2.00 | |
| k | | REF 2.80 | |
| L | 0.45 | 0.50 | 0.55 |




TOP VIEW




BOTTOM VIEW




SIDE VIEW