

BCF65N190Y1

N-Channel Silicon Carbide Power MOSFET

650 V, 18 A, 190 mΩ



bestirpower

Features

- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitance
- Fast Intrinsic Diode With Low Reverse Recovery
- Low Switching Losses

| BV_{DSS} | $I_D, T_C=25^\circ\text{C}$ | $R_{DS(on),typ}$ | $Q_{g,typ}$ |
|------------|-----------------------------|------------------|-------------|
| 650 V | 18A | 190 mΩ | 15.3 nC |

Applications

- Switch Mode Power Supplies
- High Voltage DC/DC Converters
- Uninterruptable Power Supplies
- EV Battery Chargers
- Solar/Wind Inverters



Absolute Maximum Ratings ($T_J = 25^\circ\text{C}$ unless otherwise noted)

| Symbol | Parameter | Value | Unit |
|----------------|---|---|------------------|
| V_{DSS} | Drain to Source Voltage | 650 | V |
| V_{GS} | Gate to Source Voltage (DC) | -10 / +22 | V |
| V_{GSop} | Recommended Operation Value | 0/15 | V |
| I_D | Drain Current | $V_{GS} = 15\text{ V}, (T_C = 25^\circ\text{C})$ | 18 |
| | | $V_{GS} = 15\text{ V}, (T_C = 100^\circ\text{C})$ | 12.8 |
| I_{DM} | Drain Current | Pulsed | 36 |
| P_D | Power Dissipation | ($T_C = 25^\circ\text{C}$) | 54 |
| E_{AS} | Single Pulse Avalanche Energy | $V_{DD}=50\text{V}, V_{GS}=15\text{V}, L=0.5\text{mH}, I_{AS}=11.5\text{A}$ | 33.4 |
| T_J, T_{STG} | Operating and Storage Temperature Range | -55 to 175 | $^\circ\text{C}$ |

Thermal Characteristics

| Symbol | Parameter | Value | Unit |
|-----------------|---|-------|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max. | 1.98 | $^\circ\text{C/W}$ |
| T_{sold} | Soldering temperature, wave soldering only allowed at leads | 260 | $^\circ\text{C}$ |

Electrical Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise noted)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|--------|-----------|-----------------|-----|-----|-----|------|
|--------|-----------|-----------------|-----|-----|-----|------|

Off Characteristics

| | | | | | | |
|------------|-----------------------------------|---|------|-----|------|---------------|
| BV_{DSS} | Drain to Source Breakdown Voltage | $V_{GS} = 0\text{ V}, I_D = 100\ \mu\text{A}$ | 650 | - | - | V |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$ | - | 0.1 | 20 | μA |
| I_{GSS} | Gate-Source Leakage Current | $V_{DS} = 0\text{ V}, V_{GS} = +22\text{ V}$ | - | - | +250 | nA |
| I_{GSS} | Source-Gate Leakage Current | $V_{DS} = 0\text{ V}, V_{GS} = -10\text{ V}$ | -250 | - | - | nA |

On Characteristics

| | | | | | | |
|--------------|--------------------------------------|---|---|-----|-----|----|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS} = V_{DS}, I_{DS} = 10\text{ mA}, T_J = 25^\circ\text{C}$ | - | 3.9 | - | V |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS} = 15\text{ V}, I_D = 7\text{ A}$ | - | 190 | 215 | mΩ |
| | | $V_{GS} = 15\text{ V}, I_D = 7\text{ A}, T_J = 175^\circ\text{C}$ | - | 163 | - | |

Dynamic Characteristics

| | | | | | | |
|--------------|-------------------------------|--|---|------|---|----|
| C_{iss} | Input Capacitance | $V_{GS} = 0\text{ V}, V_{DS} = 650\text{ V}, f = 1\text{ MHz}$ | - | 431 | - | pF |
| C_{oss} | Output Capacitance | | - | 30 | - | |
| C_{riss} | Reverse Capacitance | | - | 3 | - | |
| $Q_{g(tot)}$ | Total Gate Charge | $V_{DS} = 400\text{ V}, I_D = 7\text{ A}, V_{GS} = 0\text{ V} / 15\text{ V}$ | - | 15.3 | - | nC |
| Q_{gs} | Gate to Source Charge | | - | 5.5 | - | |
| Q_{gd} | Gate to Drain "Miller" Charge | | - | 2.6 | - | |
| R_G | Internal Gate Resistance | $f = 1\text{ MHz}, V_{AC} = 25\text{ mV}$ | - | 36 | - | Ω |

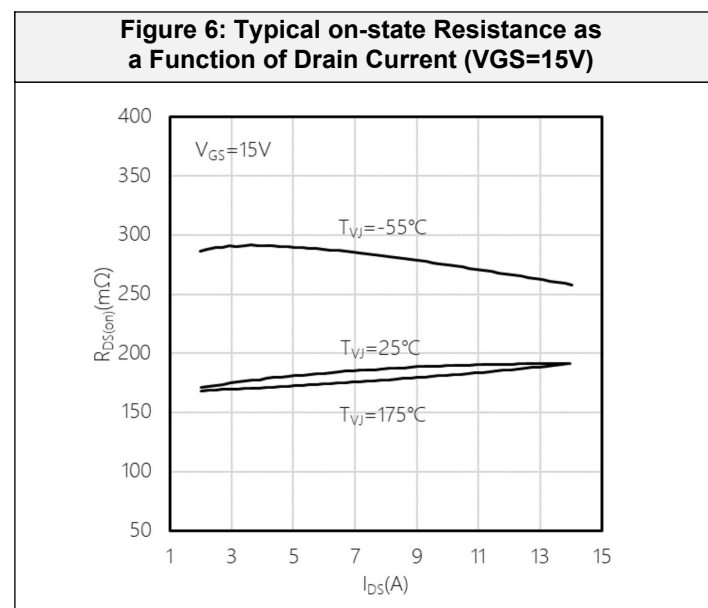
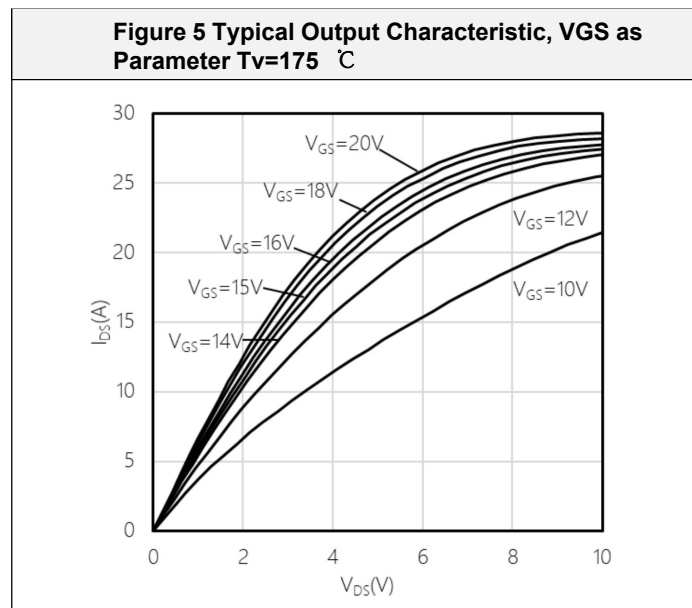
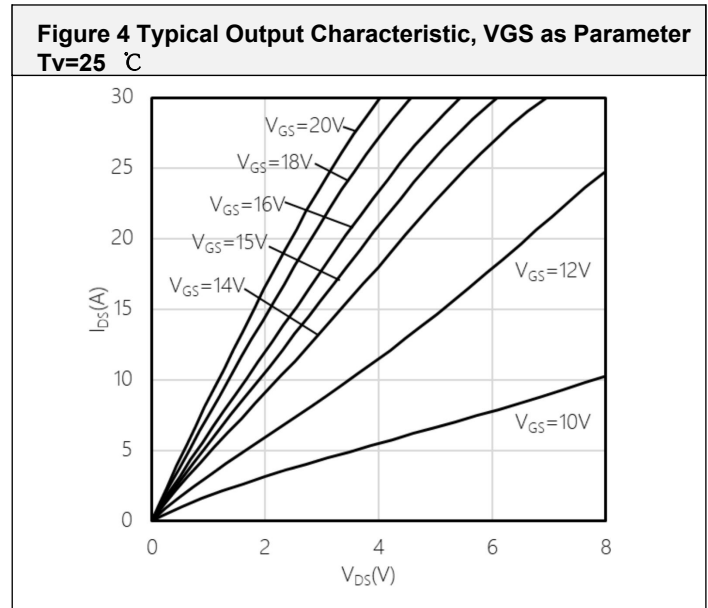
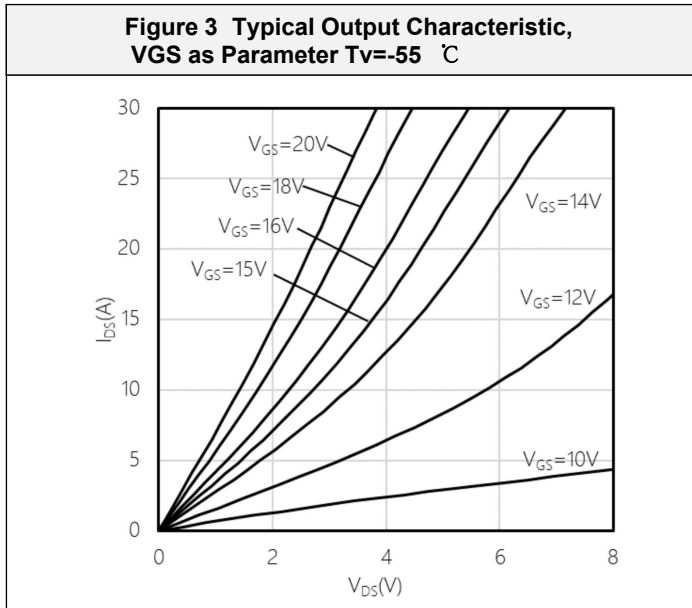
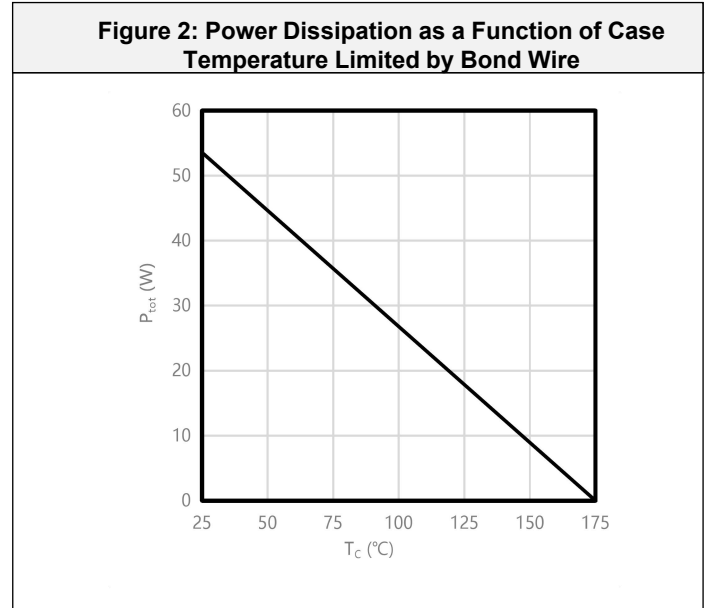
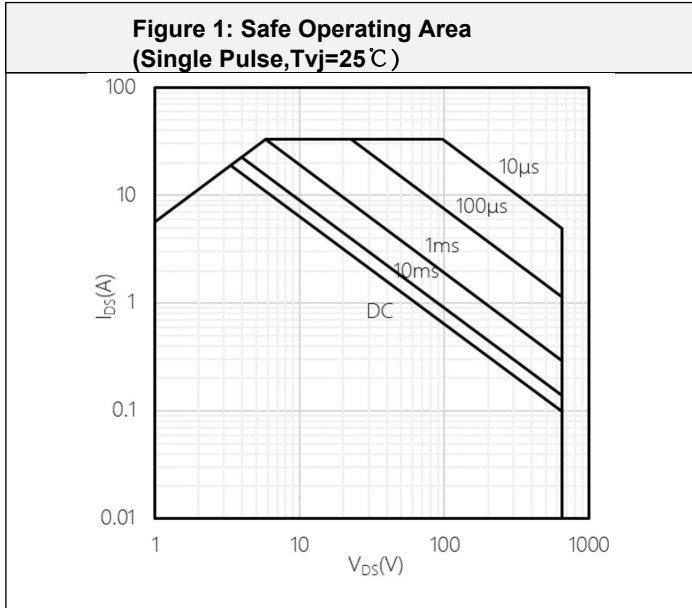
Switching Characteristics

| | | | | | | |
|--------------|---------------------------|--|---|------|---|----|
| $t_{d(on)}$ | Turn-On Delay Time | $V_{GS} = 0/15\text{ V}, L = 600\ \mu\text{H}, V_{DS} = 400\text{ V}, I_D = 7\text{ A}, R_{G(on)} = 2.2\ \Omega, R_{G(off)} = 2.2\ \Omega$ | - | 29.2 | - | ns |
| t_r | Turn-On Rise Time | | - | 11.7 | - | |
| $t_{d(off)}$ | Turn-Off Delay Time | | - | 46.1 | - | |
| t_f | Turn-Off Fall Time | | - | 16.5 | - | μJ |
| E_{on} | Turn-On Switching Energy | | - | 67.8 | - | |
| E_{off} | Turn-Off Switching Energy | | - | 15 | - | |

Source-Drain Diode Characteristics

| | | | | | | |
|-----------|----------------------------------|--|---|------|---|----|
| I_S | Continuous Diode Forward Current | $T_C = 25^\circ\text{C}$ | - | 13.5 | - | A |
| | | $T_C = 100^\circ\text{C}$ | - | 7.7 | - | |
| V_{SD} | Diode Forward Voltage | $V_{GS} = 0\text{ V}, I_{SD} = 3.5\text{ A}$ | - | 3.3 | - | V |
| t_{rr} | Reverse Recovery Time | $V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, I_{SD} = 7\text{ A}, di/dt = 2000\text{ A}/\mu\text{s}$ | - | 26 | - | ns |
| Q_{rr} | Reverse Recovery Charge | | - | 68 | - | nC |
| I_{rrm} | Peak Reverse Recovery Current | | - | 6.9 | - | A |

Typical Performance Characteristics



Typical Performance Characteristics

Figure 7: Typical on-state Resistance as a Function of Temperature ($I_{DS}=7A$)

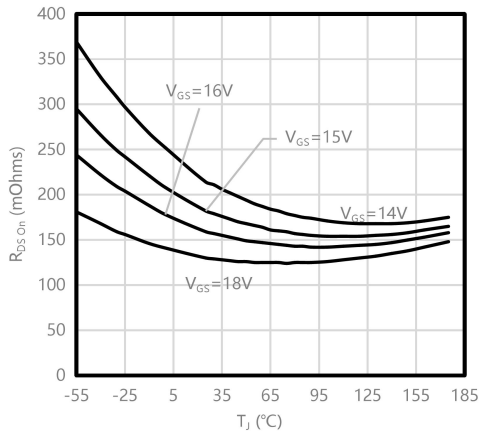


Figure 8: Typical on-state Resistance as a Function of V_{GS} ($I_{DS}=7A$)

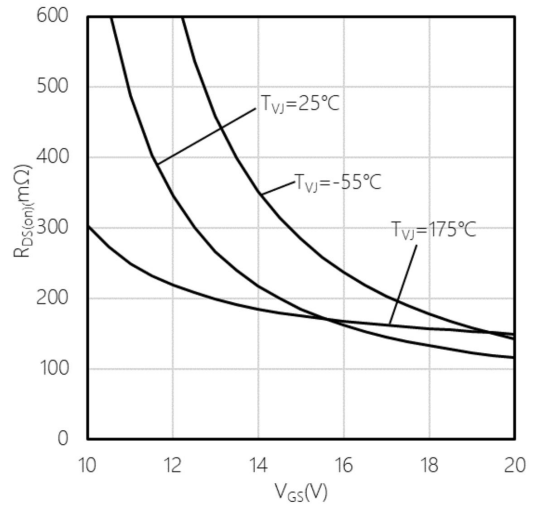


Figure 9: Typical Transfer Characteristic ($V_{DS}=20V$)

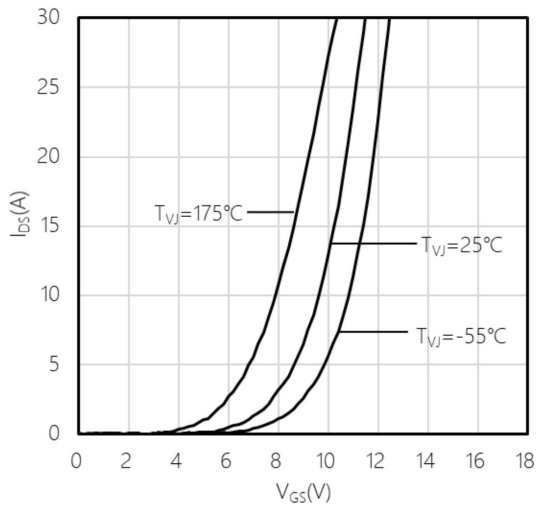


Figure 10: Threshold Voltage vs Temperature ($I_{DS}=10mA$)

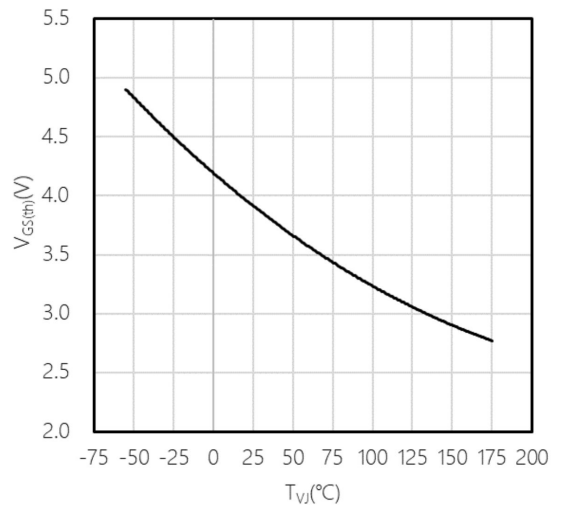


Figure 11 Typical Reverse Drain Current as Function of Reverse Drain Voltage, V_{GS} as Parameter $T_v=-55^{\circ}C$

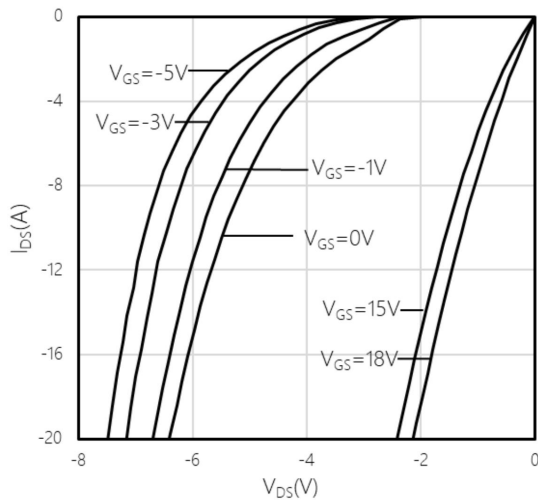
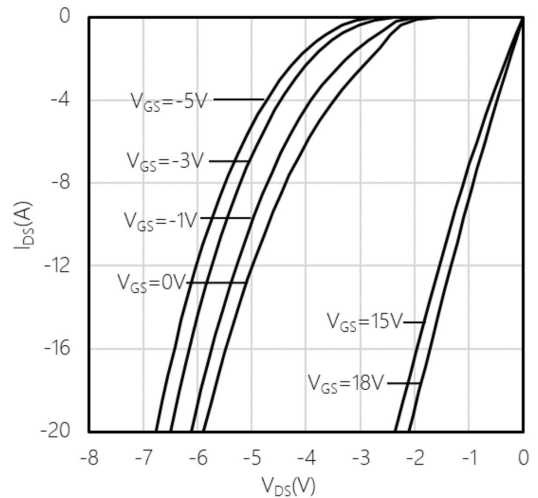


Figure 12 Typical Reverse Drain Current as Function of Reverse Drain Voltage, V_{GS} as Parameter $T_v=25^{\circ}C$



Typical Performance Characteristics

Figure 13: Typical Reverse Drain Current as Function of Reverse Drain Voltage, VGS as Parameter

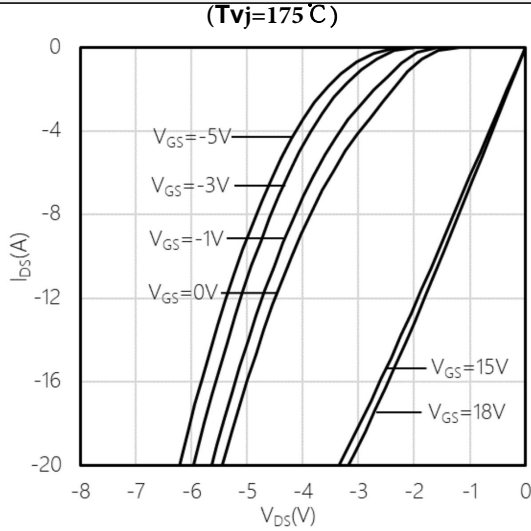


Figure 14: Typical Reverse Drain Voltage as Function of Junction Temperature

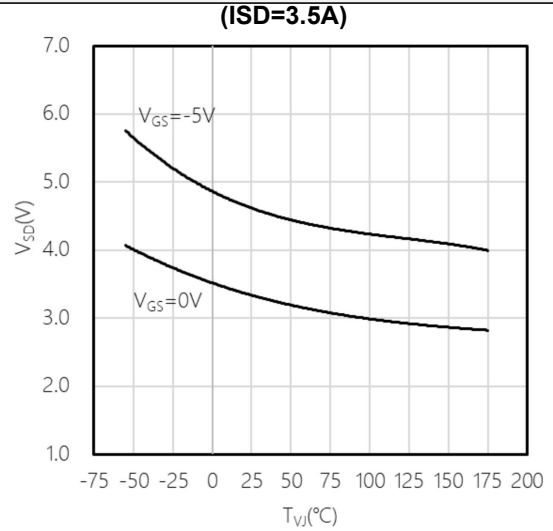


Figure 15: Typical Switching Energy as a Function of Junction Temperature

($V_{GS}=0/15\text{V}, V_{DS}=400\text{V}, R_G(\text{ext})=2.2\Omega, I_{DS}=7\text{A}$)

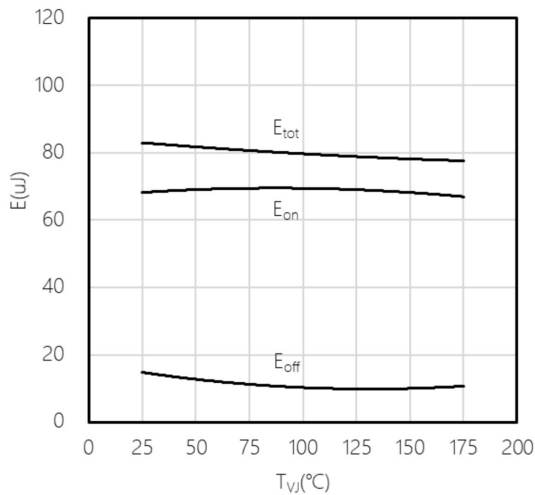


Figure 16: Typical Switching Energy as a Function of Junction Temperature

($V_{GS}=0/15\text{V}, V_{DS}=400\text{V}, T_{vj}=25^{\circ}\text{C}, I_{DS}=7\text{A}$)

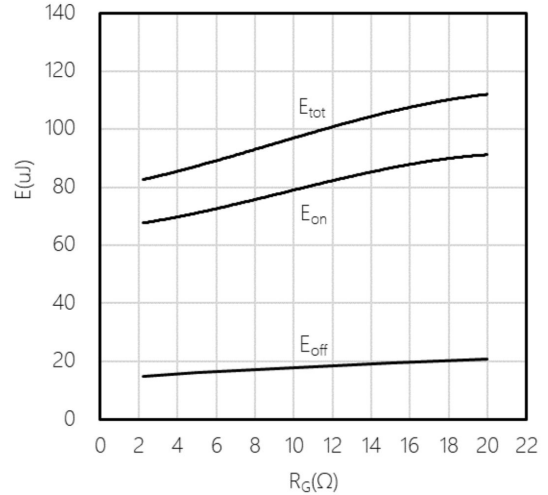


Figure 17: Typical Switching Energy Losses as a Function of Gate Resistance

($V_{GS}=0/15\text{V}, V_{DS}=400\text{V}, T_{vj}=175^{\circ}\text{C}, I_{DS}=7\text{A}$)

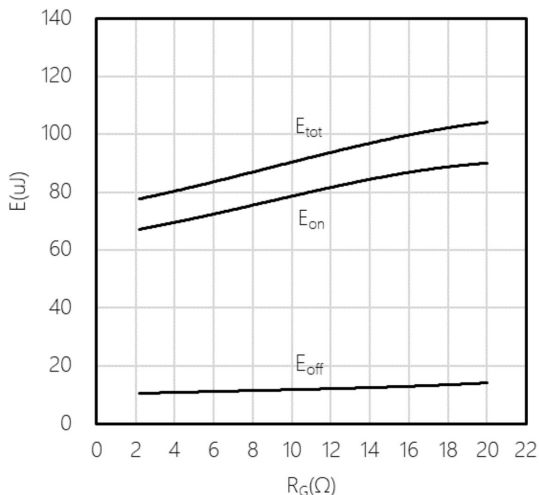
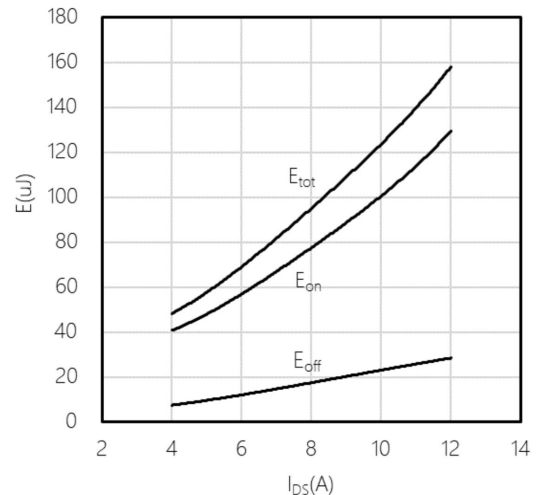
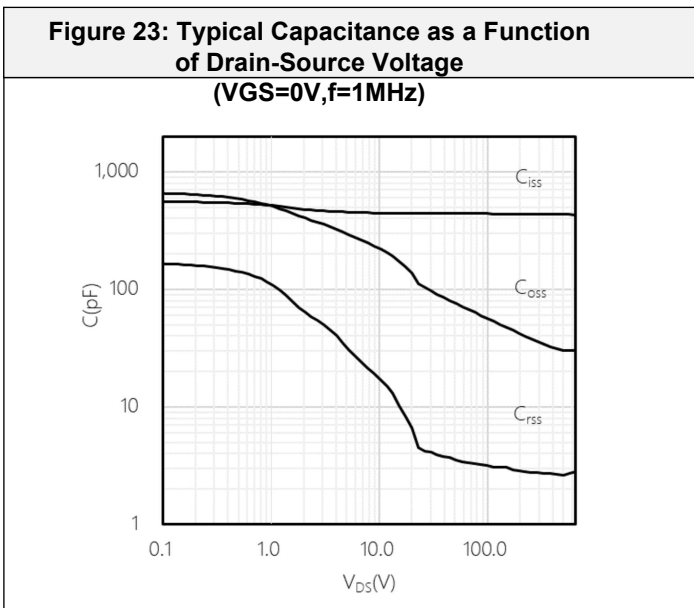
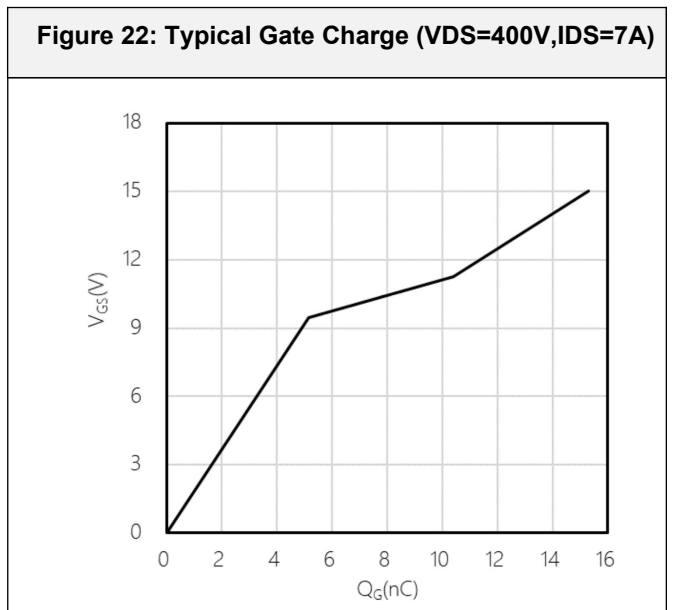
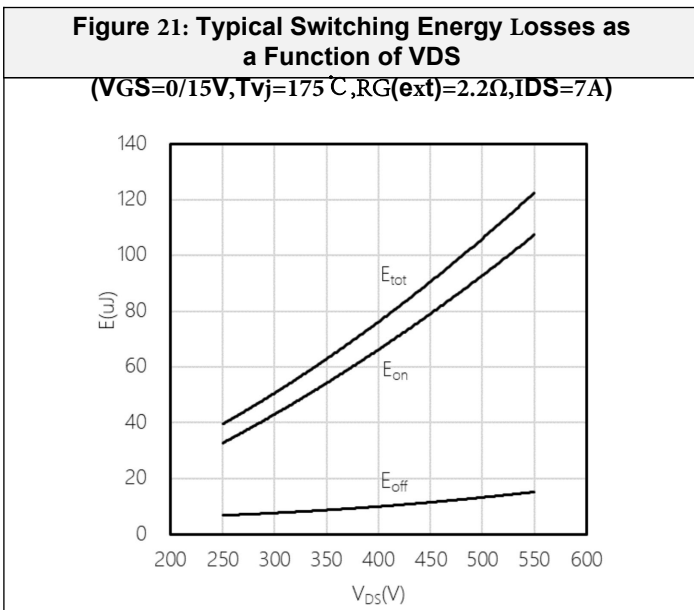
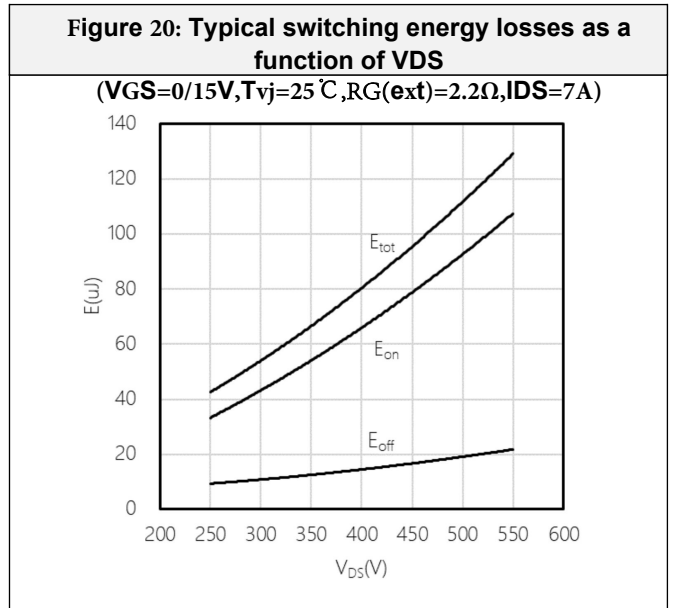
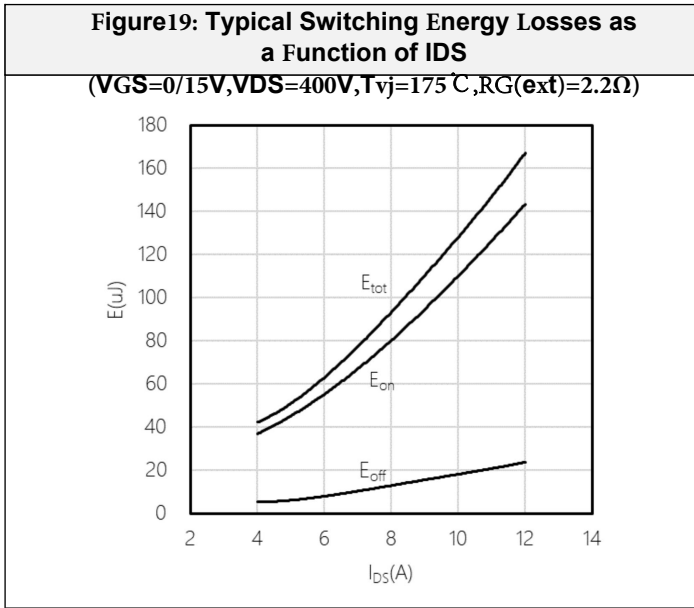


Figure 18: Typical Switching Energy Losses as a Function of IDS

($V_{GS}=0/15\text{V}, V_{DS}=400\text{V}, R_G(\text{ext})=2.2\Omega, T_{vj}=25^{\circ}\text{C}$)

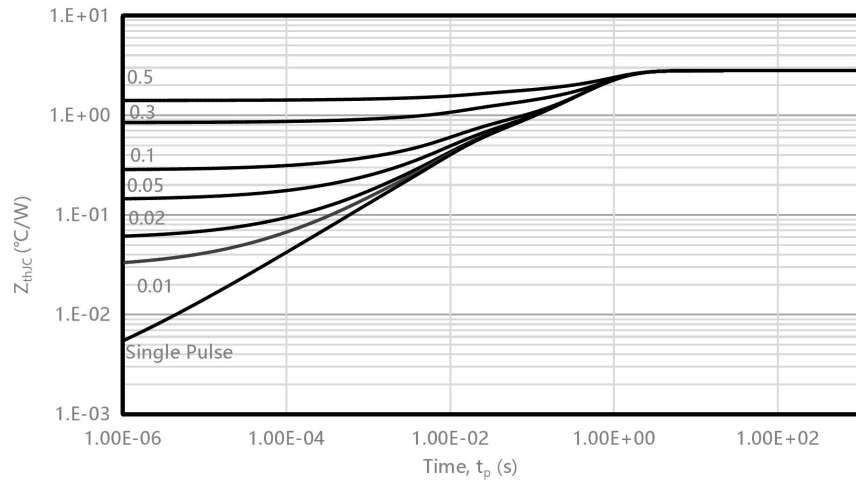


Typical Performance Characteristics



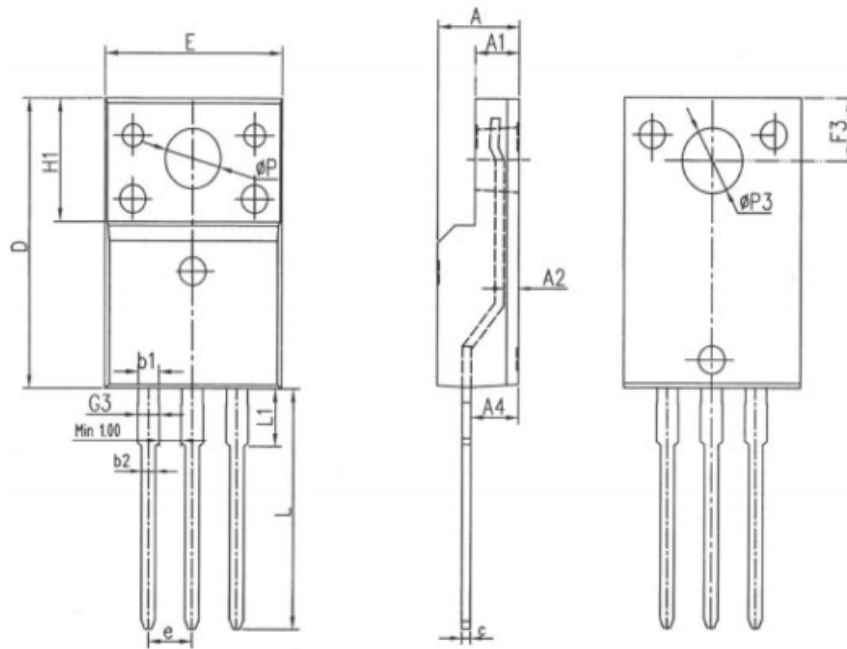
Typical Performance Characteristics

Figure 25: Transient thermal resistance (MOSFET)



Package Outlines

TO-220F



COMMON DIMENSIONS

| SYMBOL | MM | | |
|--------|----------|-------|-------|
| | MTN | NOM | MAX |
| E | 10.00 | 10.20 | 10.40 |
| A | 4.50 | 4.70 | 4.90 |
| A1 | 2.34 | 2.54 | 2.74 |
| A2 | 0.65 | 0.85 | 1.30 |
| A4 | 2.55 | 2.75 | 2.95 |
| c | 0.40 | 0.50 | 0.65 |
| D | 15.57 | 15.87 | 16.17 |
| H1 | 6.70REF | | |
| e | 2.54BSC | | |
| ΦP | 3.183REF | | |
| L | 12.68 | 12.98 | 13.28 |
| L1 | 3.25 | 3.45 | 3.65 |
| ΦP3 | 3.45REF | | |
| F3 | 3.10 | 3.30 | 3.50 |
| G3 | 1.10 | 1.30 | 1.50 |
| b1 | 1.05 | 1.20 | 1.35 |
| b2 | 0.70 | 0.80 | 0.92 |

* Dimensions in millimeters

Package Marking and Ordering Information

| Part Number | Top Marking | Package | Packing Method | Quantity |
|-------------|-------------|---------|----------------|----------|
| BCF65N190Y1 | BCF65N190Y1 | TO-220F | Tube | 50 units |

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