



STE140NF20D

N-channel 200 V, 0.010 Ω , 140 A, ISOTOP
STripFET™ II with fast recovery diode Power MOSFET

Preliminary Data

Features

| Type | V _{DSS} | R _{DS(on)} max | I _D |
|-------------|------------------|-------------------------|----------------|
| STE140NF20D | 200 V | < 0.012 Ω | 140 A |

- Exceptional dv/dt capability
- Low gate charge
- 100% avalanche tested

Application

- Switching applications

Description

This Power MOSFET is produced using STMicroelectronics' unique STripFET™ process, which is specifically designed to minimize input capacitance and gate charge. The STE140NF20D offers extremely fast switching performance thanks to the intrinsic fast body diode, making the device ideal for hard switching topologies.

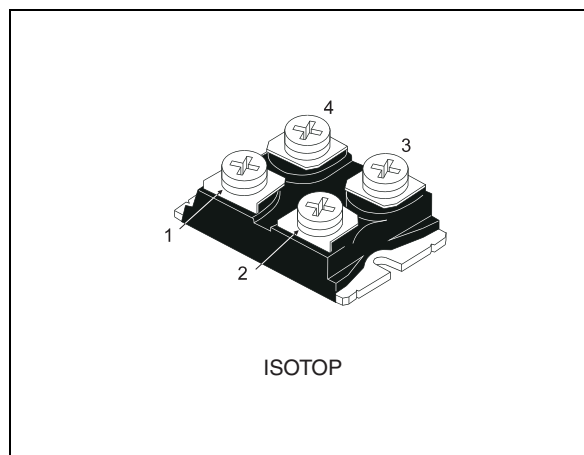


Figure 1. Internal schematic diagram

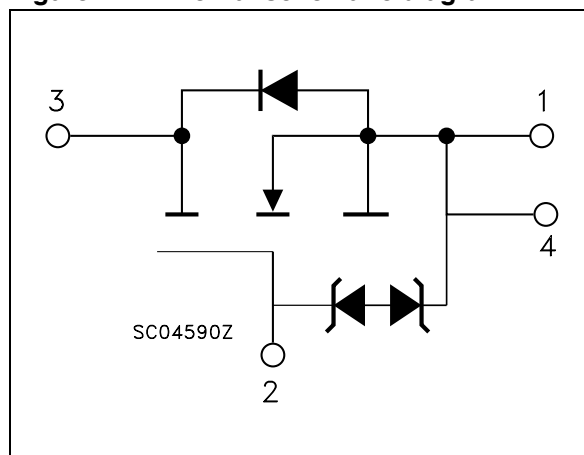


Table 1. Device summary

| Order code | Marking | Package | Packaging |
|-------------|----------|---------|-----------|
| STE140NF20D | 140NF20D | ISOTOP | Tube |

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1 Electrical ratings

Table 2. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|--------------------|---|-------------|---------------------|
| V_{DS} | Drain-source voltage ($V_{GS} = 0$) | 200 | V |
| V_{GS} | Gate-source voltage | ± 20 | V |
| $I_D^{(1)}$ | Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$ | 140 | A |
| $I_D^{(1)}$ | Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$ | 260 | A |
| $I_{DM}^{(2)}$ | Drain current (pulsed) | 560 | A |
| $P_{TOT}^{(2)}$ | Total dissipation at $T_C = 25\text{ }^\circ\text{C}$ | 500 | W |
| | Derating factor | 4 | W/ $^\circ\text{C}$ |
| $dv/dt^{(3)}$ | Peak diode recovery voltage slope | 25 | V/ns |
| T_J T_{stg} | Operating junction temperature Storage temperature | - 55 to 150 | $^\circ\text{C}$ |

1. The value is rated according $R_{thj-pcb}$
2. Pulse width limited by safe operating area
3. $I_{SD} \leq 30\text{ A}$, $di/dt \leq \text{TBD A}/\mu\text{s}$, $V_{DD} \leq 80\% V_{(BR)DSS}$

Table 3. Thermal resistance

| Symbol | Parameter | Value | Unit |
|----------------|-------------------------------------|-------|---------------------------|
| $R_{thj-case}$ | Thermal resistance junction-case | 0.25 | $^\circ\text{C}/\text{W}$ |
| $R_{thj-amb}$ | Thermal resistance junction-ambient | 40 | $^\circ\text{C}/\text{W}$ |

Table 4. Avalanche data

| Symbol | Parameter | Value | Unit |
|----------|--|-------|------|
| I_{AR} | Avalanche current, repetitive or not repetitive ⁽¹⁾ | TBD | A |
| E_{AS} | Single pulse avalanche energy ⁽²⁾ | TBD | mJ |

1. Pulse width limited by T_{jmax}
2. Strating $T_j = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$

2 Electrical characteristics

($T_{CASE} = 25\text{ °C}$ unless otherwise specified)

Table 5. On/off states

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|--|---|------|-------|-----------|--------------------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $I_D = 1\text{ mA}$, $V_{GS} = 0$ | 200 | | | V |
| I_{DSS} | Zero gate voltage drain current ($V_{GS} = 0$) | $V_{DS} = \text{max rating}$, $V_{DS} = \text{max rating @ } 125\text{ °C}$ | | | 10 100 | μA μA |
| I_{GSS} | Gate body leakage current ($V_{DS} = 0$) | $V_{GS} = \pm 21\text{ V}$ | | | ± 100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$ | 2 | 3 | 4 | V |
| $R_{DS(on)}$ | Static drain-source on resistance | $V_{GS} = 10\text{ V}$, $I_D = 70\text{ A}$ | | 0.010 | 0.012 | Ω |

Table 6. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|---|------|------|------|------|
| g_{fs} | Forward transconductance | $I_D = 140\text{ A}$, $V_{DS} = 150\text{ V}$ | | TBD | | |
| C_{iss} | Input capacitance | $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$ | | 9900 | | pF |
| C_{oss} | Output capacitance | | | 2000 | | pF |
| C_{rss} | Reverse transfer capacitance | | | 450 | | pF |
| Q_g | Total gate charge | $V_{DD} = 480\text{ V}$, $I_D = 140\text{ A}$ | | 390 | | nC |
| Q_{gs} | Gate-source charge | $V_{GS} = 4.5\text{ V}$ | | TBD | | nC |
| Q_{gd} | Gate-drain charge | (see Figure 3) | | TBD | | nC |

Table 7. Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------------|---------------------|---|------|------|------|------|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD} = 100\text{ V}$, $I_D = 70\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 2) | | TBD | | ns |
| t_r | Rise time | | | TBD | | ns |
| $t_{d(off)}$ | Turn-off delay time | | | TBD | | ns |
| t_f | Fall time | | | TBD | | ns |

Table 8. Source drain diode

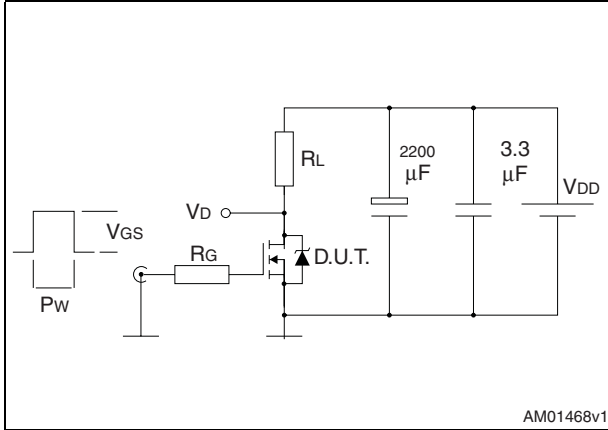
| Symbol | Parameter | Test conditions | Min | Typ. | Max | Unit |
|-----------------|-------------------------------|---|-----|------|-----|------|
| I_{SD} | Source-drain current | | | | 140 | A |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) | | | | 560 | A |
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD} = 70\text{ A}$, $V_{GS} = 0$ | | | 1.6 | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 70\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 100\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ | | TBD | | ns |
| Q_{rr} | Reverse recovery charge | | | TBD | | nC |
| I_{RRM} | Reverse recovery current | | | TBD | | A |

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration=300 μs , duty cycle 1.5%

Test circuit

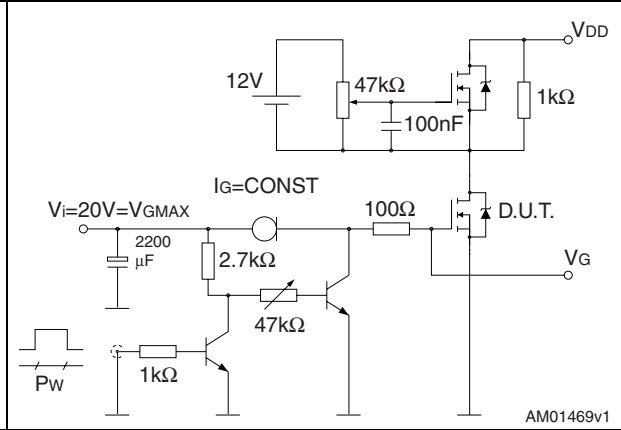
3 Test circuit

Figure 2. Switching times test circuit for resistive load



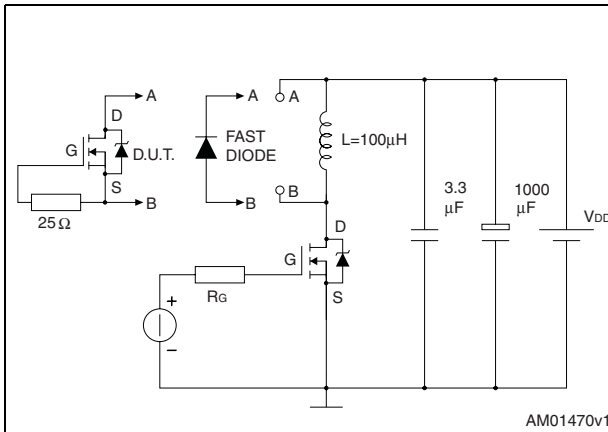
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Figure 3. Gate charge test circuit



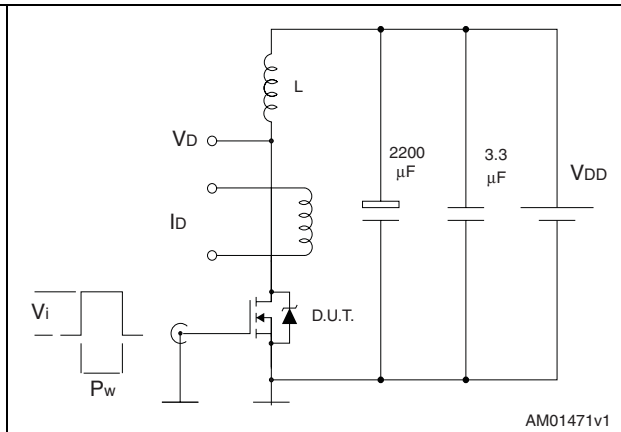
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Figure 4. Test circuit for inductive load switching and diode recovery times



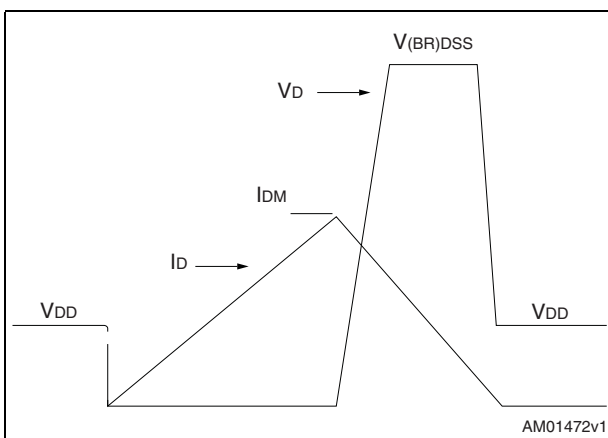
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Figure 5. Unclamped inductive load test circuit



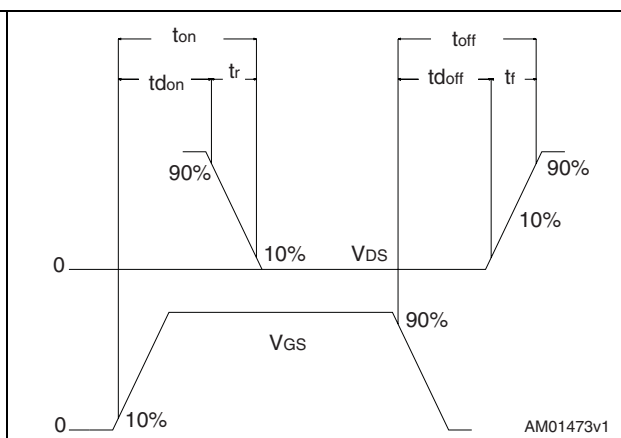
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Figure 6. Unclamped inductive waveform



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Figure 7. Switching time waveform



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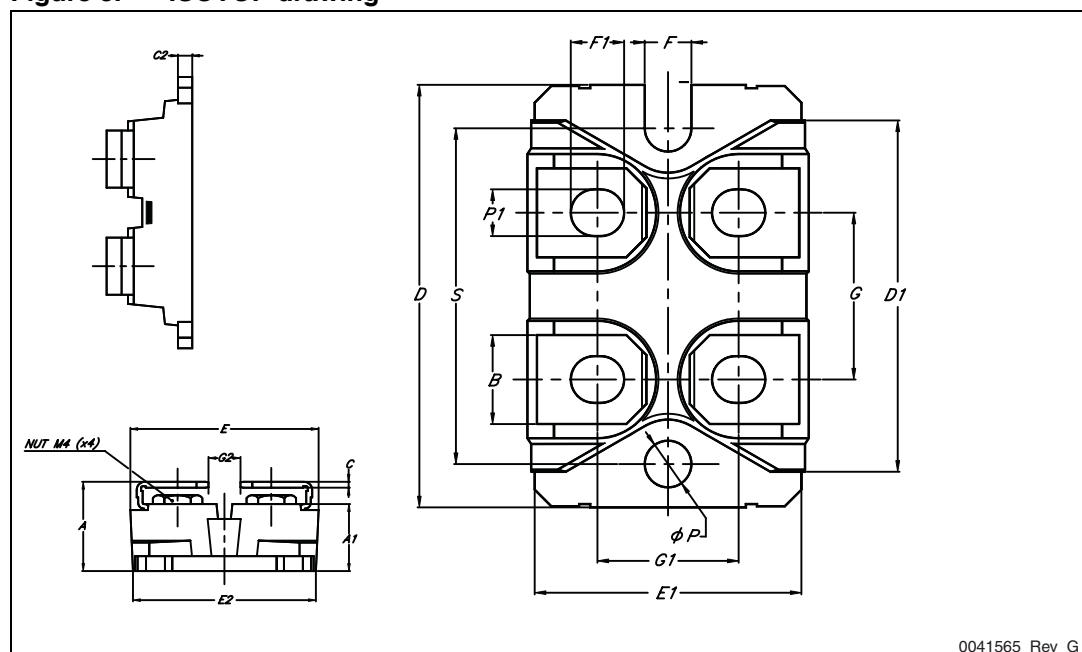
4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

Table 9. ISOTOP mechanical data

| Dim. | mm | | |
|----------|-------|-------|-------|
| | Min. | Typ. | Max. |
| A | 11.80 | | 12.20 |
| A1 | 8.90 | | 9.10 |
| B | 7.80 | | 8.20 |
| C | 0.75 | | 0.85 |
| C2 | 1.95 | | 2.05 |
| D | 37.80 | | 38.20 |
| D1 | 31.50 | | 31.70 |
| E | 25.15 | | 25.50 |
| E1 | 23.85 | | 24.15 |
| E2 | | 24.80 | |
| G | 14.90 | | 15.10 |
| G1 | 12.60 | | 12.80 |
| G2 | 3.50 | | 4.30 |
| F | 4.10 | | 4.30 |
| F1 | 4.60 | | 5 |
| ϕP | 4 | | 4.30 |
| P1 | 4 | | 4.40 |
| S | 30.10 | | 30.30 |

Figure 8. ISOTOP drawing



0041565_Rev_G

5 Revision history

Table 10. Document revision history

| Date | Revision | Changes |
|-------------|----------|---------------|
| 27-Jan-2009 | 1 | First release |

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