

1. General description

Silicon Carbide MOSFET in a TO247-4L plastic package, designed for high frequency, high efficiency systems.



2. Features and benefits

- Kelvin source configuration
- Low specific on-resistance
- Optimized dynamic performance
- 0V turn-off V_{GS} for simple gate driving
- 100% UIS Tested
- Easy to parallel
- RoHS compliant
- Automotive Qualified (AEC-Q101)

3. Applications

- Automotive on board chargers
- Automotive DC-DC converters
- Automotive electric compressor motor drives
- HV battery management systems

4. Quick reference data

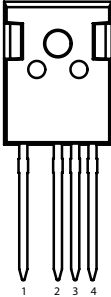
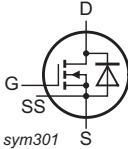
Table 1. Quick reference data

Table 17: Quick reference data

| Symbol | Parameter | Conditions | Notes | Values | | | Unit |
|-------------------------|----------------------------------|---|-------|------------|-----|-----|------|
| Absolute maximum rating | | | | | | | |
| V _{DS} | drain-source voltage | 25 °C ≤ T _j ≤ 175 °C | | 1200 | | | V |
| I _D | drain current | V _{GS} = 18 V; T _{mb} = 25 °C | | 55 | | | A |
| P _{tot} | total power dissipation | T _{mb} = 25 °C, T _j = 175 °C | | 366 | | | W |
| T _j | junction temperature | | | -55 to 175 | | | °C |
| Symbol | Parameter | Conditions | Notes | Min | Typ | Max | Unit |
| Static characteristics | | | | | | | |
| R _{DS(on)} | drain-source on-state resistance | V _{GS} = 15 V; I _D = 20A; T _j = 25 °C | | - | 75 | - | mΩ |
| | | V _{GS} = 18 V; I _D = 20 A; T _j = 25 °C | | - | 65 | 90 | mΩ |
| Dynamic characteristics | | | | | | | |
| Q _{G(tot)} | total gate charge | I _D = 20 A; V _{DS} = 800 V; V _{GS} = -4 V/18 V; T _j = 25 °C | | - | 62 | - | nC |
| Q _{GD} | gate-drain charge | | | - | 10 | - | nC |
| Source-drain diode | | | | | | | |
| Q _r | recovered charge | I _{SD} = 20 A; di/dt = 500 A/μs; V _{DS} = 400 V; T _j = 25 °C | | - | 52 | - | nC |

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-----------------------------------|---|---|
| 1 | D | drain |  |  |
| 2 | S | source | | |
| 3 | SS | source sense | | |
| 4 | G | gate | | |
| mb | D | mounting base; connected to drain | | |

6. Ordering information

Table 3. Ordering information

| Type number | Package Name | Orderable part number | Packing method | Small packing quantity | Package version | Package issue date |
|----------------|--------------|-----------------------|----------------|------------------------|-----------------|--------------------|
| WNSC2M75120R-A | TO247-4L | WNSC2M75120R-A6Q | Tube | 30 | TO247N-4L | 17-Dec-2021 |

7. Marking

Table 4. Marking codes

| Type number | Marking codes |
|----------------|--------------------|
| WNSC2M75120R-A | WNSC2M 75120R-A |

8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | Notes | Values | Unit |
|--------------|--|--|--------|------------|------|
| V_{DS} | drain-source voltage | $25\text{ °C} \leq T_j \leq 175\text{ °C}$ | | 1200 | V |
| $V_{GS,max}$ | gate-source voltage | | | -10 to 22 | V |
| $V_{GS,op}$ | gate-source voltage | | | -4 to 18 | V |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}, T_j = 175\text{ °C}$ | | 366 | W |
| I_D | drain current | $V_{GS} = 18\text{ V}; T_{mb} = 25\text{ °C}$ | | 55 | A |
| | | $V_{GS} = 18\text{ V}; T_{mb} = 100\text{ °C}$ | | 39 | A |
| I_{DM} | peak drain current | pulse width t_p limited by T_{jmax} | Fig.17 | 110 | A |
| I_S | continuous diode current | $V_{GS} = -4\text{ V}; T_{mb} = 25\text{ °C}$ | | 54 | A |
| I_{SM} | pulse diode current | $V_{GS} = -4\text{ V}$; pulse width t_p limited by T_{jmax} | | 110 | A |
| E_{as} | single pulse drain-to-source avalanche | $I_{AS} = 15\text{ A}; L = 1\text{ mH}; V_{DD} = 100\text{ V}; T_j = 25\text{ °C}$ | | 113 | mJ |
| T_{stg} | storage temperature | | | -55 to 175 | °C |
| T_j | junction temperature | | | -55 to 175 | °C |
| $T_{sld(M)}$ | peak soldering temperature | | | 260 | °C |

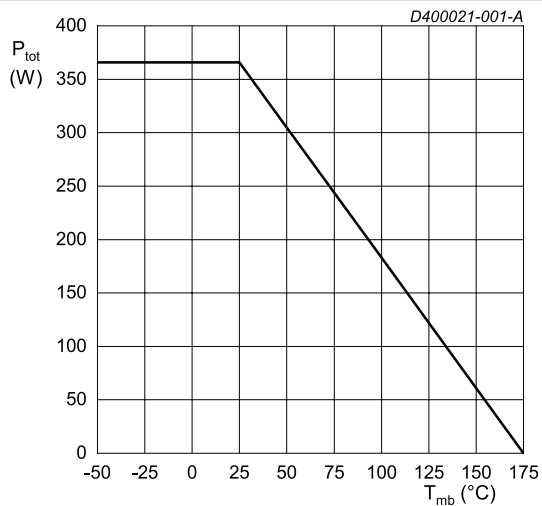


Fig. 1. Total power dissipation as a function of mounting base temperature; maximum values

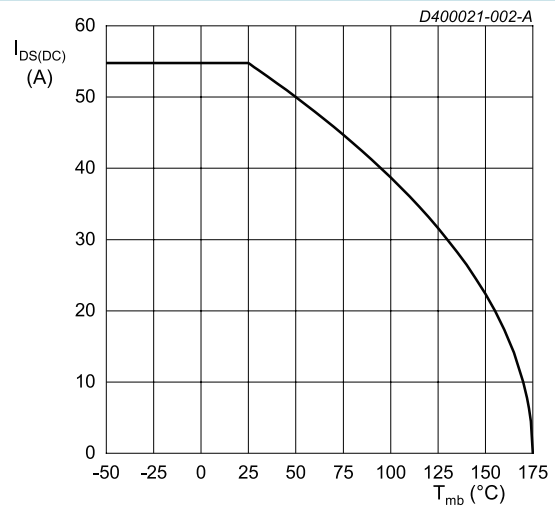


Fig. 2. Continuous Drain Current as a function of mounting base temperature

9. Thermal & Mechanical characteristics

Table 6. Thermal & Mechanical characteristics

| Symbol | Parameter | Conditions | Notes | Min | Typ | Max | Unit |
|----------------|---|--------------------|-------|-----|------|-----|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | | | - | 0.41 | - | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | | - | 40 | - | K/W |
| M_d | Mounting torque | M3 or 6 - 32 screw | | - | - | 0.6 | Nm |

Note: It is recommended that a metal washer is inserted between screw head and mounting tab.
Do not use self-tapping screws.
Device is ESD sensitive. Handling precautions are recommended.

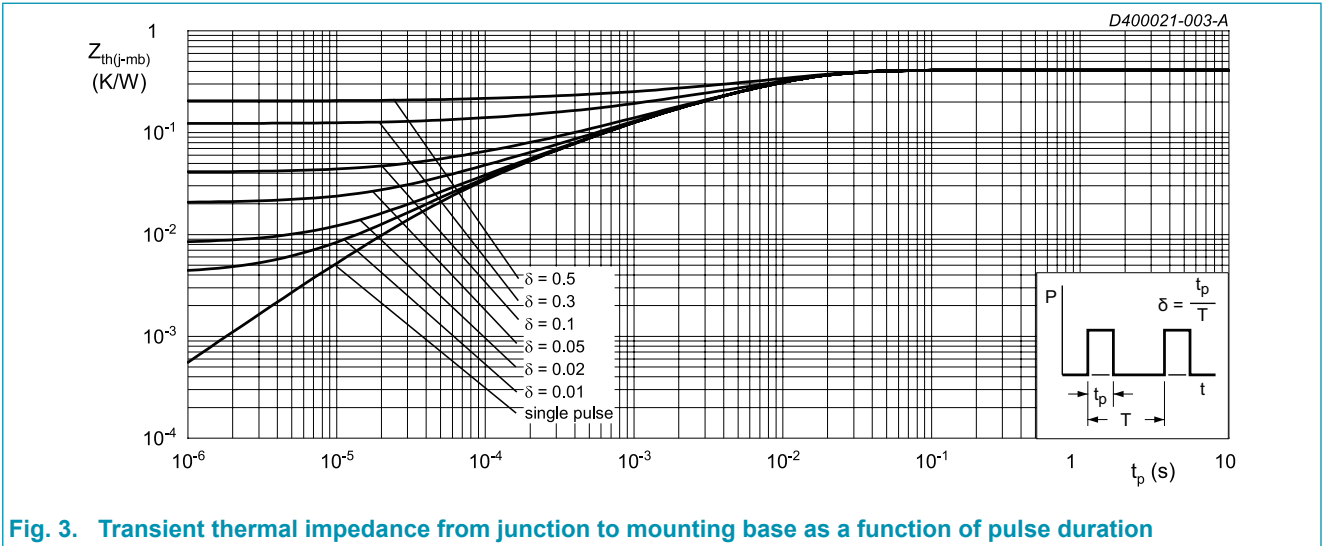


Fig. 3. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Characteristics

Table 7. Characteristics

| Symbol | Parameter | Conditions | Notes | Min | Typ | Max | Unit |
|-------------------------|---|--|--------|------|------|-----|------|
| Static characteristics | | | | | | | |
| V _{(BR)DSS} | drain-source breakdown voltage | I _D = 100 μA; V _{GS} = 0 V; T _J = 25 °C | | 1200 | - | - | V |
| V _{GS(th)} | gate-source threshold voltage | I _D = 5 mA; V _{DS} = 10 V; T _J = 25 °C | | 1.9 | 2.2 | 3.5 | V |
| | | I _D = 5 mA; V _{DS} = 10 V; T _J = 175 °C | | - | 1.5 | - | V |
| I _{DSS} | drain leakage current | V _{DS} = 1200 V; V _{GS} = 0 V; T _J = 25 °C | | - | 0.2 | 100 | μA |
| | | V _{DS} = 1200 V; V _{GS} = 0 V; T _J = 175 °C | | - | 2 | - | μA |
| I _{GSS} | gate leakage current | V _{GS} = 22 V; V _{DS} = 0 V; T _J = 25 °C | | - | 10 | 100 | nA |
| | | V _{GS} = -10 V; V _{DS} = 0 V; T _J = 25 °C | | - | 10 | 100 | nA |
| R _{DS(on)} | drain-source on-state resistance | V _{GS} = 15 V; I _D = 20 A; T _J = 25 °C | | - | 75 | - | mΩ |
| | | V _{GS} = 18 V; I _D = 20 A; T _J = 25 °C | | - | 65 | 90 | mΩ |
| | | V _{GS} = 18 V; I _D = 20 A; T _J = 175 °C | | - | 122 | - | mΩ |
| R _G | gate resistance | f = 1 MHz; T _J = 25 °C | | - | 2.8 | - | Ω |
| g _{fs} | transconductance | V _{DS} = 20 V; I _D = 20 A; T _J = 25 °C | | - | 10 | - | S |
| Dynamic characteristics | | | | | | | |
| Q _{G(tot)} | total gate charge | I _D = 20 A; V _{DS} = 800 V; V _{GS} = -4 V/18 V; T _J = 25 °C | | - | 62 | - | nC |
| Q _{GS} | gate-source charge | | | - | 25 | - | nC |
| Q _{GD} | gate-drain charge | | | - | 10 | - | nC |
| C _{iss} | input capacitance | V _{DS} = 1000 V; V _{GS} = 0 V; f = 1 MHz; T _J = 25 °C | | - | 1317 | - | pF |
| C _{oss} | output capacitance | | | - | 58 | - | pF |
| C _{rss} | reverse transfer capacitance | | | - | 6.7 | - | pF |
| E _{oss} | Coss stored energy | | | - | 29 | - | μJ |
| t _{d(on)} | turn-on delay time | V _{DS} = 800 V; V _{GS} = -4 V/18 V; R _{G(ext)} = 5.1 Ω; I _D = 20 A; L = 330 μH; T _J = 25 °C | | - | 3 | - | ns |
| t _r | rise time | | | - | 19 | - | ns |
| t _{d(off)} | turn-off delay time | | | - | 16 | - | ns |
| t _f | fall time | | | - | 42 | - | ns |
| E _{on} | turn-on energy <small>(SiC Diode FWD)</small> | | Fig.20 | - | 163 | - | μJ |
| E _{off} | turn-off energy <small>(SiC Diode FWD)</small> | | Fig.20 | - | 95 | - | μJ |
| E _{on} | turn-on energy <small>(Body Diode FWD)</small> | | Fig.20 | - | 202 | - | μJ |
| E _{off} | turn-off energy <small>(Body Diode FWD)</small> | | Fig.20 | - | 107 | - | μJ |
| Source-drain diode | | | | | | | |
| V _{SD} | source-drain voltage | V _{GS} = 0 V; I _{SD} = 10 A; T _J = 25 °C | | - | 3.2 | - | V |
| | | V _{GS} = -4 V; I _{SD} = 10 A; T _J = 25 °C | | - | 4.8 | - | V |
| | | V _{GS} = -4 V; I _{SD} = 10 A; T _J = 175 °C | | - | 4.2 | - | V |
| t _{rr} | reverse recovery time | I _{SD} = 20 A; di/dt = 500 A/μs; V _{DS} = 400 V; T _J = 25 °C | | - | 21 | - | ns |
| Q _r | recovered charge | | | - | 52 | - | nC |
| I _{rrm} | reverse recovery current | | | - | 4.3 | - | A |

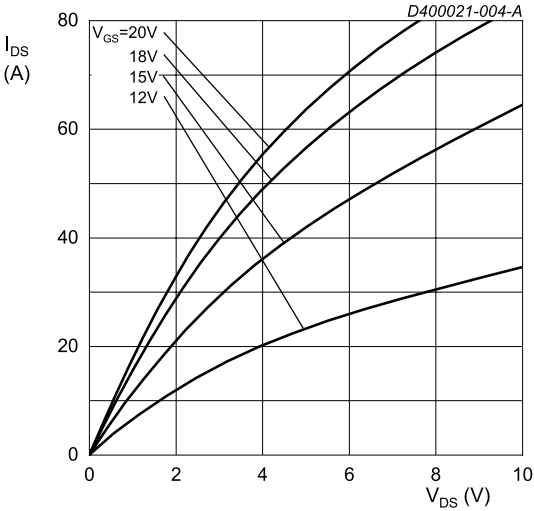


Fig. 4. Output characteristics; drain current as a function of drain-source voltage; typical values

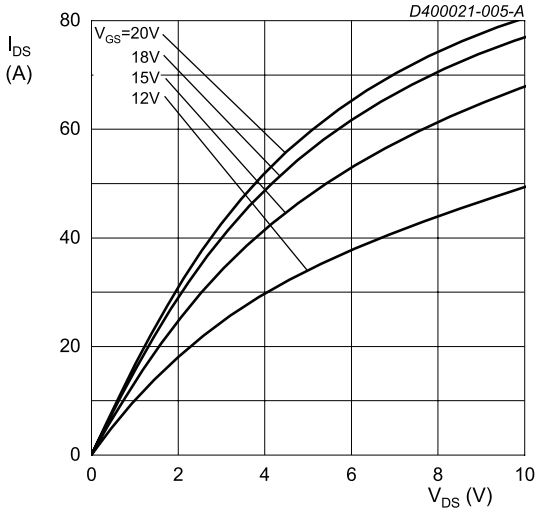


Fig. 5. Output characteristics; drain current as a function of drain-source voltage; typical values

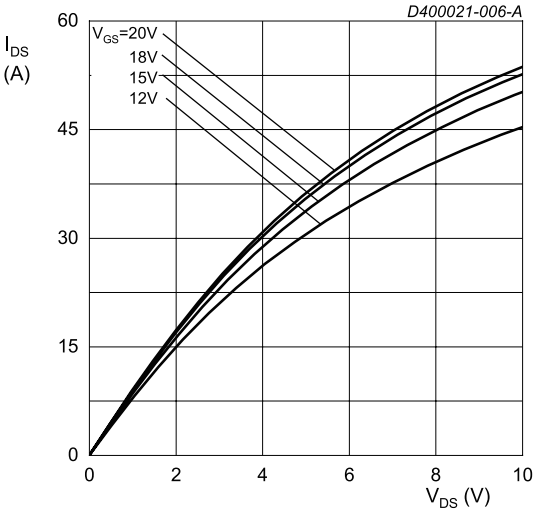


Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values

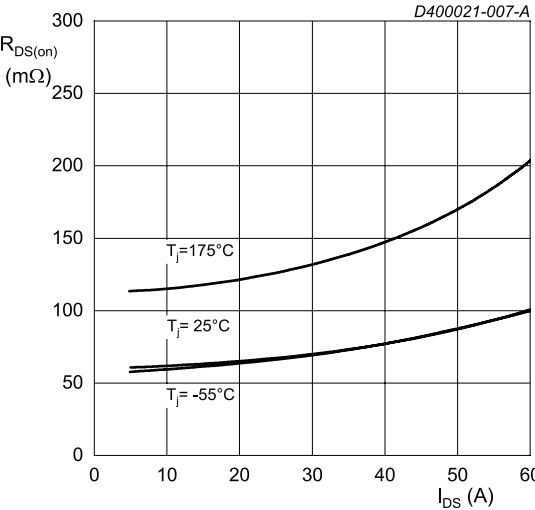


Fig. 7. Drain-source on-state resistance as a function of drain current; typical values

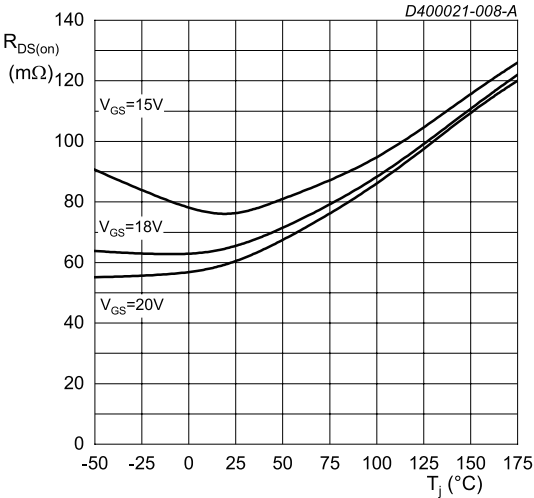


Fig. 8. Drain-source on-state resistance as a function of junction temperature

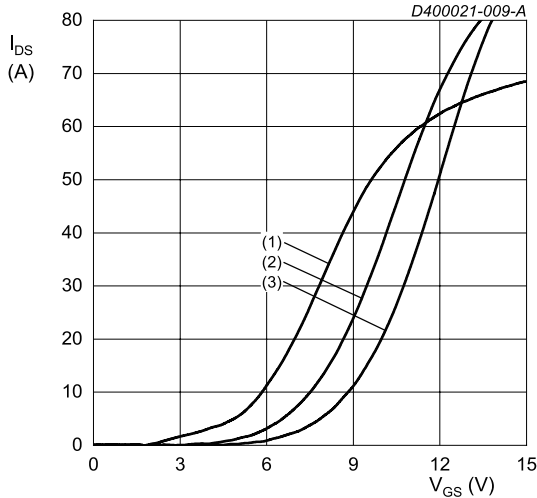


Fig. 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values

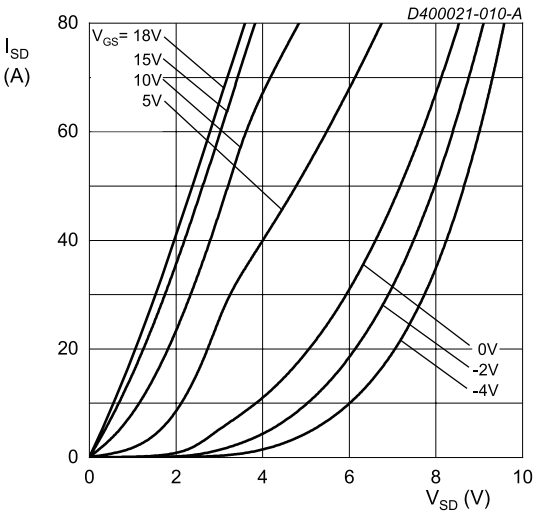


Fig. 10. Body diode forward characteristics; typical values

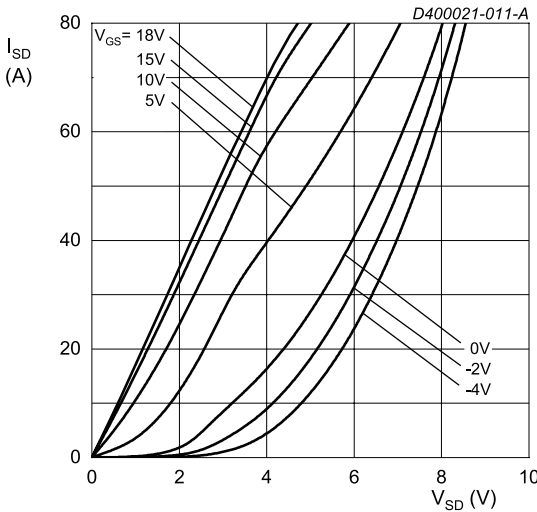
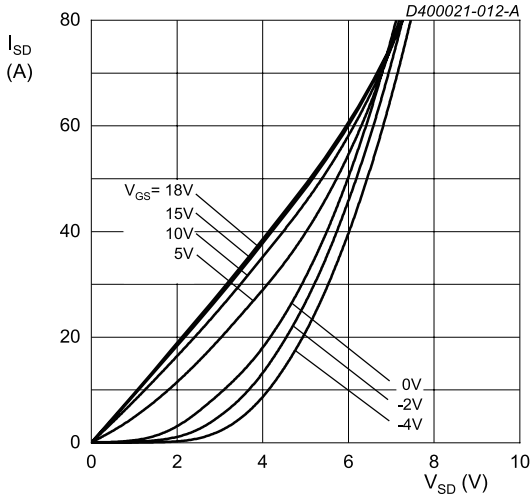
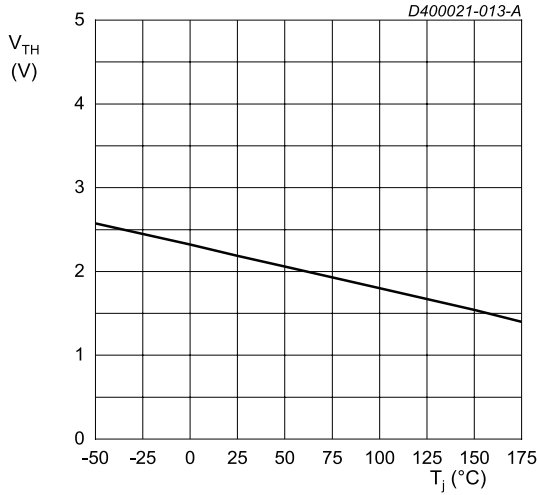


Fig. 11. Body diode forward characteristics; typical values



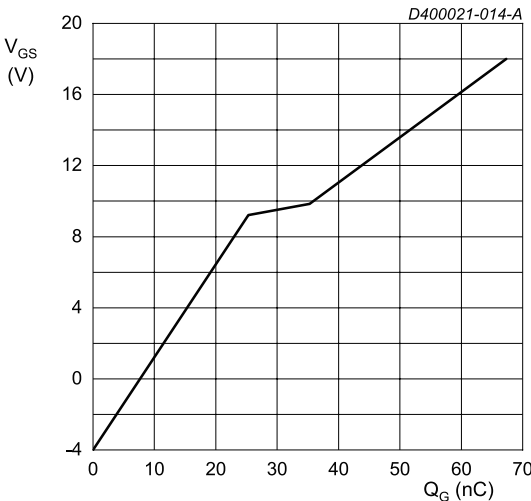
$T_j = 175\text{ }^{\circ}\text{C}; t_p < 200\text{ }\mu\text{s}$

Fig. 12. Body diode forward characteristics; typical values



$V_{DS} = 10\text{ V}; I_{DS} = 5\text{ mA}$

Fig. 13. Threshold voltage as a function of junction temperature



$I_{DS} = 20\text{ A}; I_{GS} = 0.1\text{ mA}; V_{DS} = 800\text{ V}; T_j = 25\text{ }^{\circ}\text{C}$

Fig. 14. Gate-source voltage as a function of gate charge; typical values

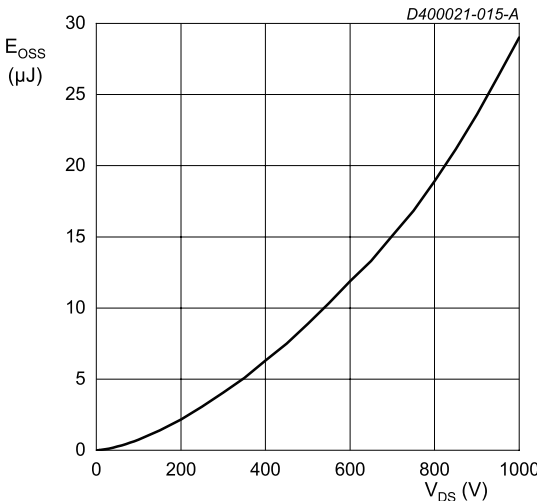
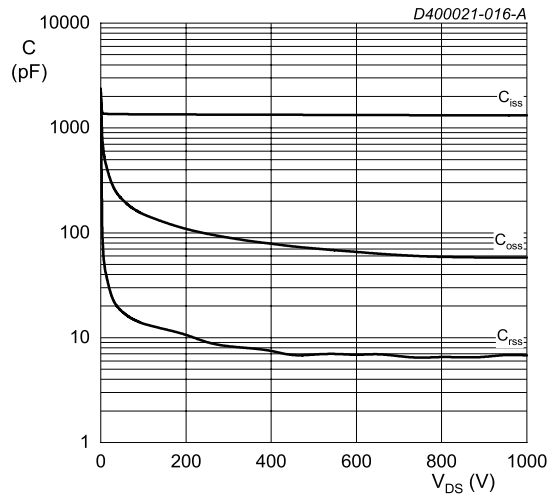
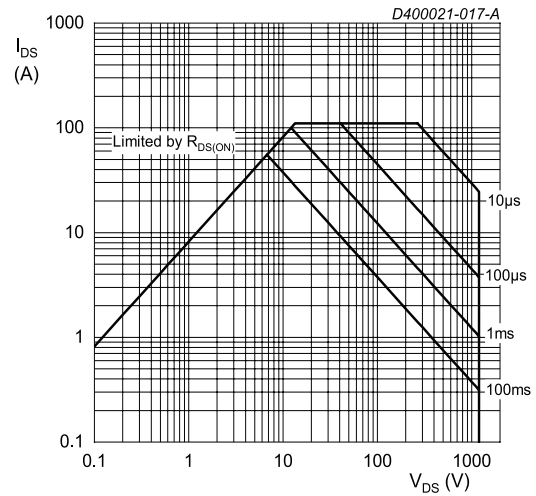


Fig. 15. Output capacitor stored energy as a function of drain-source voltage



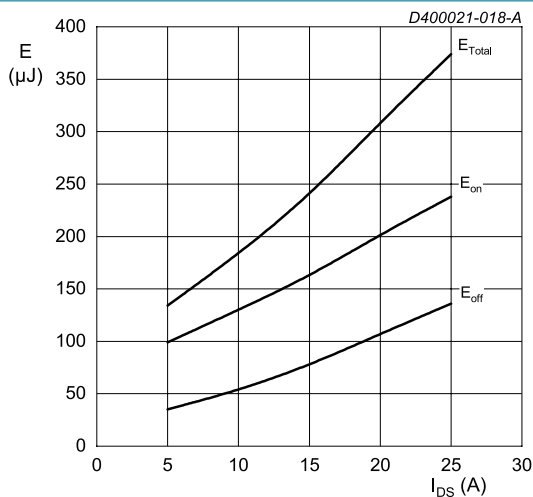
$V_{DS} = 0 - 1000 \text{ V}$
 $T_j = 25 \text{ }^\circ\text{C}$; $V_{AC} = 25 \text{ mV}$; $f = 1 \text{ MHz}$

Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



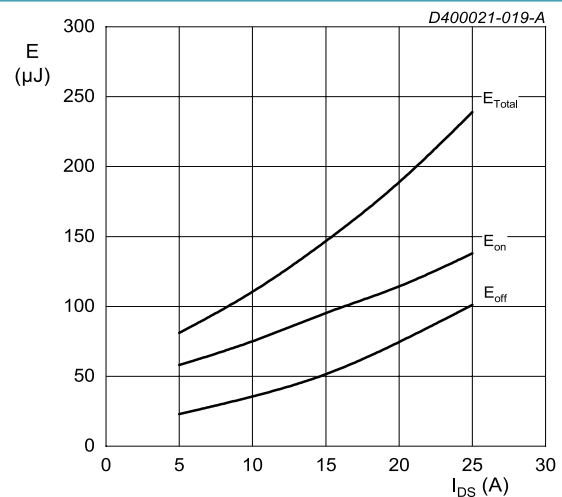
$T_j = 25 \text{ }^\circ\text{C}$; $D = 0$
 Parameter: t_p

Fig. 17. Forward bias safe operating area



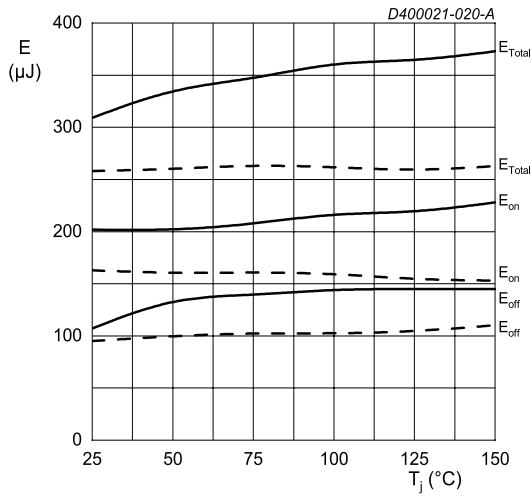
$T_j = 25 \text{ }^\circ\text{C}$; $V_{DD} = 800 \text{ V}$; $R_{G(ext)} = 5.1 \text{ } \Omega$;
 $V_{GS} = -4 \text{ V}/18 \text{ V}$; $L = 330 \text{ } \mu\text{H}$
 FWD = WNSC2M75120R-A

Fig. 18. Clamped Inductive Switching Energy as a function of drain current



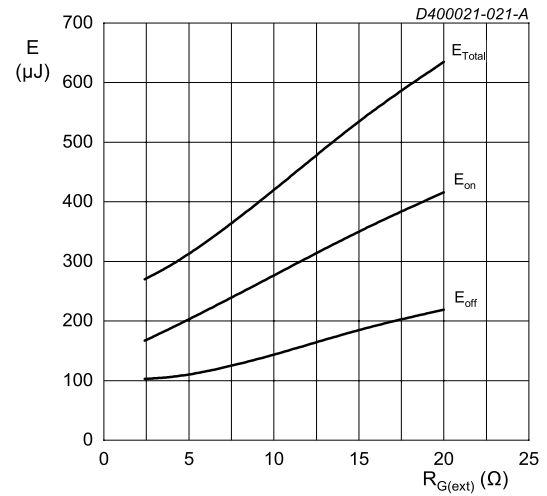
$T_j = 25 \text{ }^\circ\text{C}$; $V_{DD} = 600 \text{ V}$; $R_{G(ext)} = 5.1 \text{ } \Omega$;
 $V_{GS} = -4 \text{ V}/18 \text{ V}$; $L = 330 \text{ } \mu\text{H}$
 FWD = WNSC2M75120R-A

Fig. 19. Clamped Inductive Switching Energy as a function of drain current



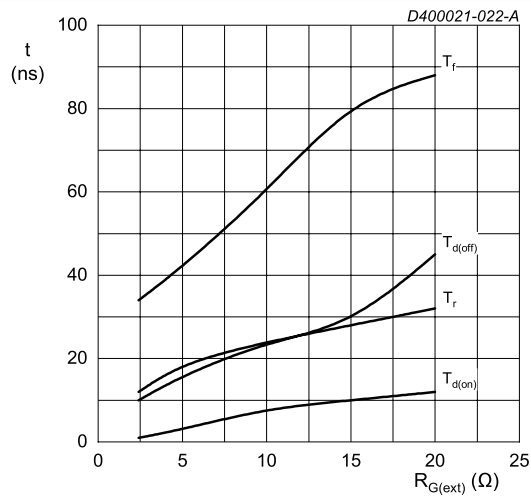
$I_{DS} = 20 \text{ A}$; $V_{DD} = 800 \text{ V}$; $R_{G(ext)} = 5.1 \Omega$;
 $V_{GS} = -4 \text{ V}/18 \text{ V}$; $L = 330 \mu\text{H}$
 FWD = WNSC2M75120R-A
 FWD = WNSC2D201200(---)

Fig. 20. Clamped Inductive Switching Energy as a function of junction temperature



$T_j = 25 \text{ }^\circ\text{C}$; $V_{DD} = 800 \text{ V}$; $I_{DS} = 20 \text{ A}$; $V_{GS} = -4 \text{ V}/18 \text{ V}$
 FWD = WNSC2M75120R-A; $L = 330 \mu\text{H}$

Fig. 21. Clamped Inductive Switching Energy as a function of external gate resistance



$T_j = 25 \text{ }^\circ\text{C}$; $V_{DD} = 800 \text{ V}$; $I_{DS} = 20 \text{ A}$; $V_{GS} = -4 \text{ V}/18 \text{ V}$
 FWD = WNSC2M75120R-A; $L = 330 \mu\text{H}$

Fig. 22. Switching time as a function of external gate resistance

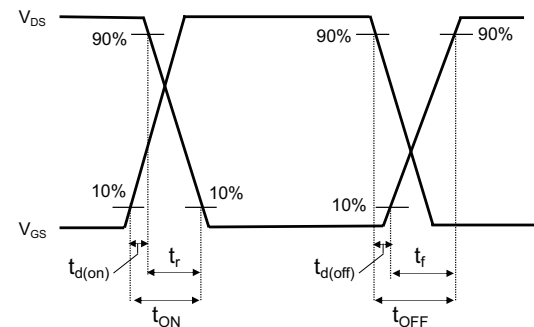
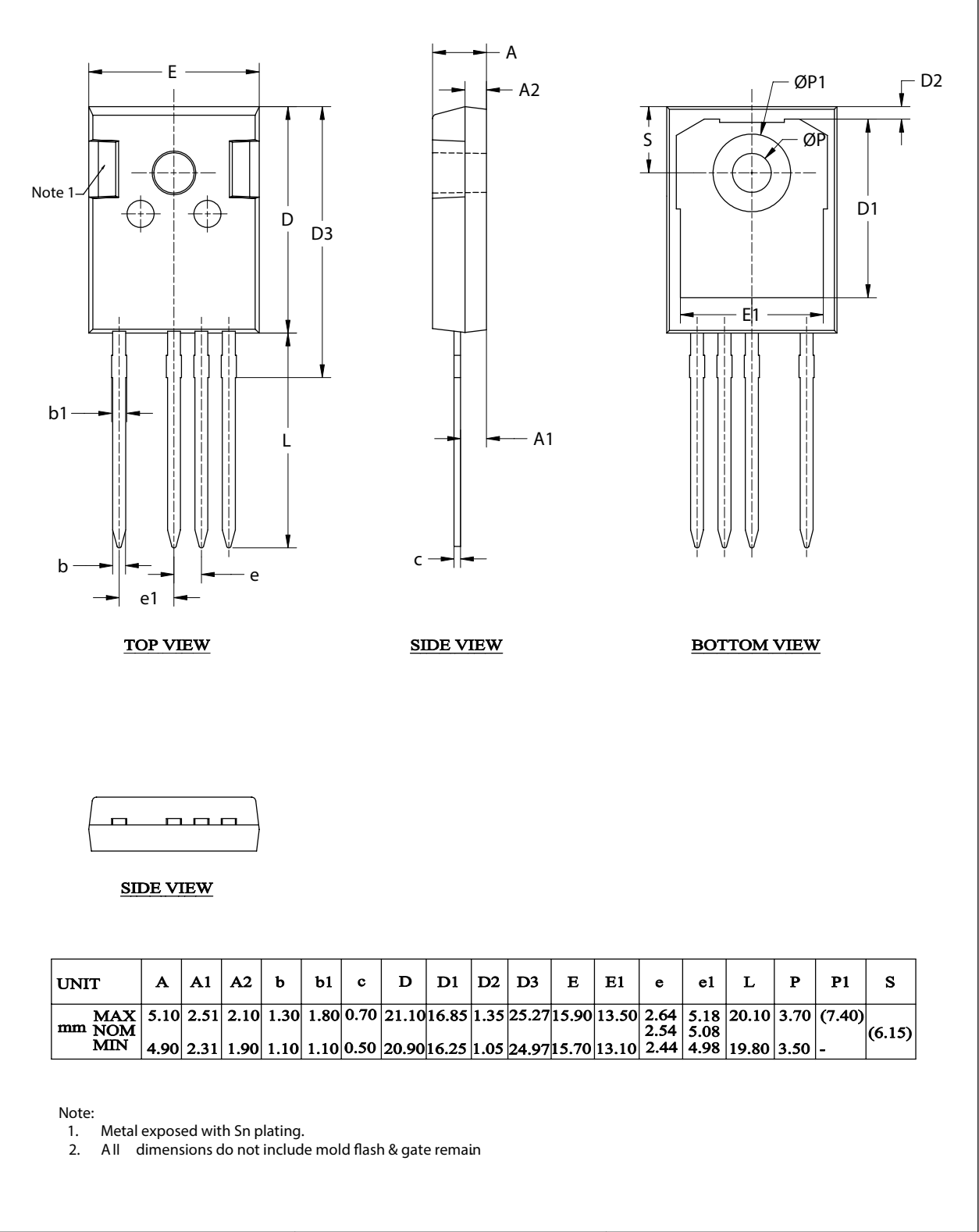


Fig. 23. Switching time definition

11. Package outline

Plastic single-ended through-hole package; heatsink mounted; 1 mounting hole; 4 leads TO-247

TO247-4L



12. Legal information

Data sheet status

| Document status [1][2] | Product status [3] | Definition |
|--------------------------------|--------------------|---|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
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13. Contents

1. General description..... 1

2. Features and benefits 1

3. Applications 1

4. Quick reference data..... 1

5. Pinning information..... 2

6. Ordering information..... 2

7. Marking..... 2

8. Limiting values 3

9. Thermal & Mechanical characteristics 4

10. Characteristics..... 5

11. Package outline 11

12. Legal information 12

13. Contents 14

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For sales office addresses, please send an email to: salesaddresses@ween-semi.com
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