

1. General description

Silicon Carbide MOSFET in a TSPAK plastic package with top side cooling structure, designed for high frequency, high efficiency systems.



2. Features and benefits

- Automotive Qualified (AEC-Q101)
- Reduced cooling requirements
- Low on-resistance
- Fast switching speed
- 0V turn-off gate voltage for simple gate driver
- 100% UIS Tested
- Easy to parallel
- Controllable dV/dt for optimized EMI
- RoHS compliant



3. Applications

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

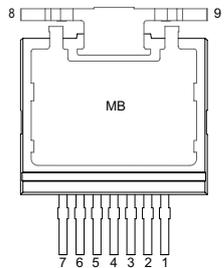
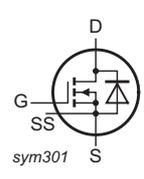
4. Quick reference data

Table 1. Quick reference data

| Symbol | Parameter | Conditions | Notes | Values | | | Unit |
|--------------------------------|----------------------------------|---|-------|------------|-----|-----|------|
| Absolute maximum rating | | | | | | | |
| V_{DS} | drain-source voltage | $25\text{ °C} \leq T_j \leq 175\text{ °C}$ | | 1200 | | | V |
| I_D | drain current | $V_{GS} = 18\text{ V}; T_{mb} = 25\text{ °C}$ | | 96.8 | | | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}, T_j = 175\text{ °C}$ | | 540 | | | 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 | $V_{GS} = 15\text{ V}; I_D = 40\text{ A}; T_j = 25\text{ °C}$ | | - | 30 | - | mΩ |
| | | $V_{GS} = 18\text{ V}; I_D = 40\text{ A}; T_j = 25\text{ °C}$ | | - | 24 | 40 | mΩ |
| Dynamic characteristics | | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D = 40\text{ A}; V_{DS} = 800\text{ V}; V_{GS} = -4\text{ V}/18\text{ V}; T_j = 25\text{ °C}$ | | - | 151 | - | nC |
| Q_{GD} | gate-drain charge | | | - | 21 | - | nC |
| Source-drain diode | | | | | | | |
| Q_r | recovered charge | $I_{SD} = 40\text{ A}; di/dt = 500\text{ A}/\mu\text{s}; V_{DS} = 400\text{ V}; T_j = 25\text{ °C}$ | | - | 129 | - | nC |

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----------|--------|-----------------------------------|--|---|
| 1 | G | gate |  |  |
| 2 | SS | source sense | | |
| 3-7 | S | source | | |
| 8-9 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 |
|-----------------|--------------|-----------------------|----------------|------------------------|-----------------|--------------------|
| WNSC2M30120TB-A | TSPAK | WNSC2M30120TB-A6J | Reel | 600 | TSPAKH | 06-Dec-2024 |

7. Marking

Table 4. Marking codes

| Type number | Marking codes |
|-----------------|---------------------|
| WNSC2M30120TB-A | WNSC2M 30120TB-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 | Absolute maximum values | | -10 to 22 | V |
| $V_{GS,op}$ | gate-source voltage | Recommended operational values | | -4 to 18 | V |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}, T_j = 175\text{ °C}$ | | 540 | W |
| I_D | drain current | $V_{GS} = 18\text{ V}; T_{mb} = 25\text{ °C}$ | | 96.8 | A |
| | | $V_{GS} = 18\text{ V}; T_{mb} = 100\text{ °C}$ | | 68.4 | A |
| I_{DM} | peak drain current | pulse width t_p limited by T_{jmax} | Fig.17 | 190 | A |
| I_S | continuous diode current | $V_{GS} = -4\text{ V}; T_{mb} = 25\text{ °C}$ | | 73.1 | A |
| I_{SM} | pulse diode current | $V_{GS} = -4\text{ V}$; pulse width t_p limited by T_{jmax} | | 190 | A |
| E_{as} | single pulse drain-to-source avalanche | $I_{AS} = 20\text{ A}; L = 1\text{ mH}; V_{DD} = 100\text{ V}; T_j = 25\text{ °C}$ | | 200 | 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 |

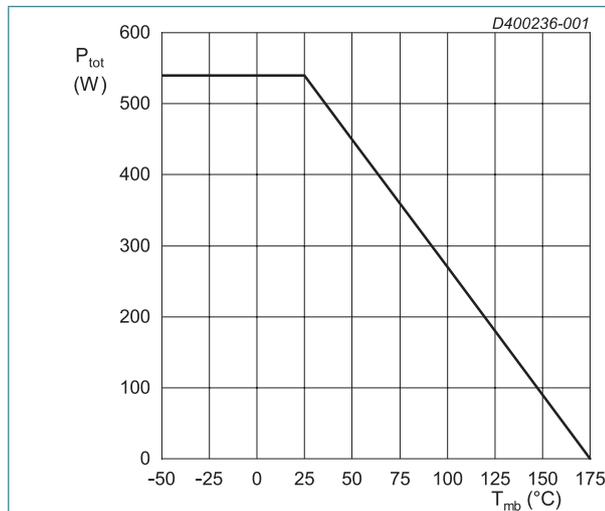


Fig. 1. Total power dissipation as a function of mounting base temperature; maximum values

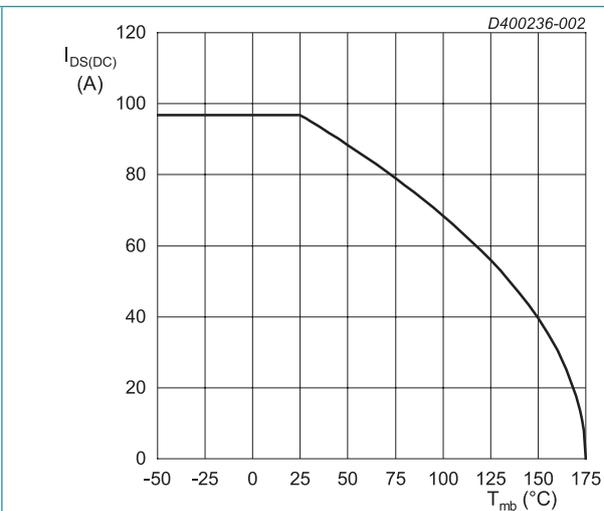


Fig. 2. Continuous Drain Current as a function of mounting base temperature

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 | | | - | 0.28 | - | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | | - | 40 | - | K/W |

Note: Device is ESD sensitive. Handling precautions are recommended.

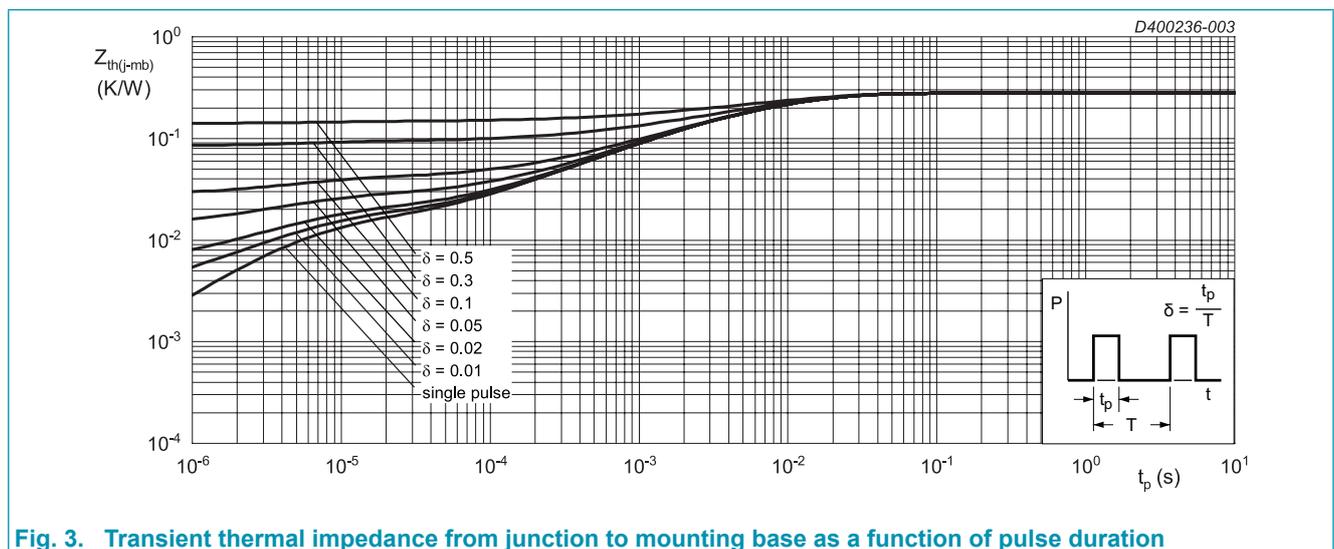
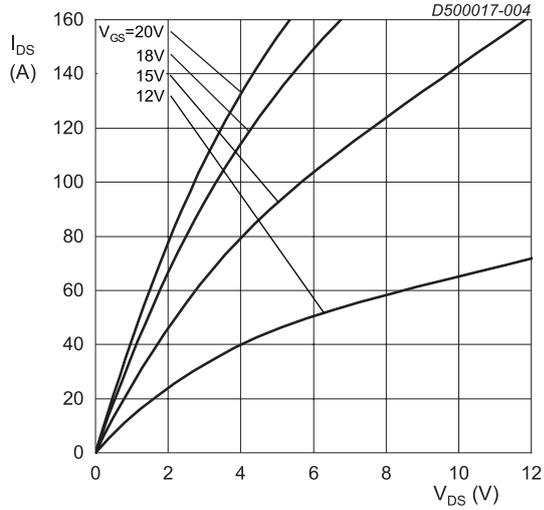


Fig. 3. Transient thermal impedance from junction to mounting base as a function of pulse duration

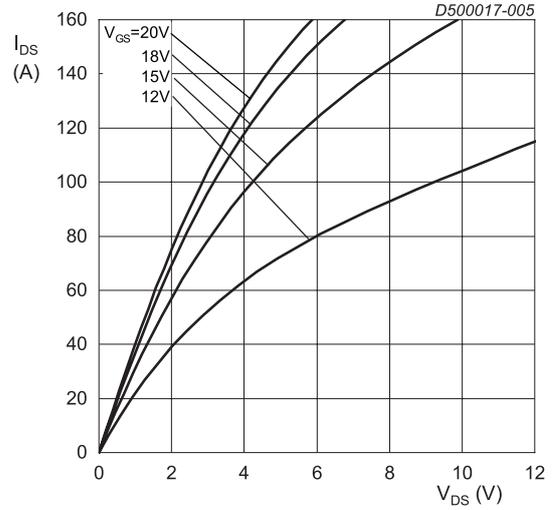
10. Characteristics

Table 7. Characteristics

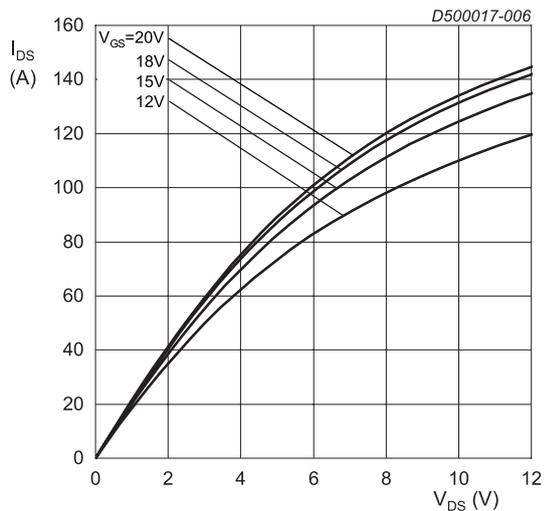
| Symbol | Parameter | Conditions | Notes | Min | Typ | Max | Unit |
|--------------------------------|----------------------------------|---|--------|------|------|---------|------------|
| Static characteristics | | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = 100 \mu A; V_{GS} = 0 V; T_J = 25 \text{ }^\circ C$ | | 1200 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D = 12 \text{ mA}; V_{DS} = 10 \text{ V}; T_J = 25 \text{ }^\circ C$ | | 1.9 | 2.6 | 3.5 | V |
| | | $I_D = 12 \text{ mA}; V_{DS} = 10 \text{ V}; T_J = 175 \text{ }^\circ C$ | | - | 1.9 | - | V |
| I_{DSS} | drain leakage current | $V_{DS} = 1200 \text{ V}; V_{GS} = 0 \text{ V}; T_J = 25 \text{ }^\circ C$ | | - | 0.2 | 100 | μA |
| | | $V_{DS} = 1200 \text{ V}; V_{GS} = 0 \text{ V}; T_J = 175 \text{ }^\circ C$ | | - | 2 | - | μA |
| I_{GSS} | gate leakage current | $V_{GS} = 22 \text{ V}; V_{DS} = 0 \text{ V}; T_J = 25 \text{ }^\circ C$ | | - | 10 | 100 | nA |
| | | $V_{GS} = -10 \text{ V}; V_{DS} = 0 \text{ V}; T_J = 25 \text{ }^\circ C$ | | - | 10 | 100 | nA |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 15 \text{ V}; I_D = 40 \text{ A}; T_J = 25 \text{ }^\circ C$ | | - | 30 | - | m Ω |
| | | $V_{GS} = 18 \text{ V}; I_D = 40 \text{ A}; T_J = 25 \text{ }^\circ C$ | | - | 24 | 40 | m Ω |
| | | $V_{GS} = 18 \text{ V}; I_D = 40 \text{ A}; T_J = 175 \text{ }^\circ C$ | | - | 48 | - | m Ω |
| R_G | gate resistance | $f = 1 \text{ MHz}; T_J = 25 \text{ }^\circ C$ | | - | 0.8 | - | Ω |
| g_{fs} | transconductance | $V_{DS} = 20 \text{ V}; I_D = 40 \text{ A}; T_J = 25 \text{ }^\circ C$ | | - | 27 | - | S |
| Dynamic characteristics | | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D = 40 \text{ A}; V_{DS} = 800 \text{ V}; V_{GS} = -4 \text{ V}/18 \text{ V}; T_J = 25 \text{ }^\circ C$ | | - | 151 | - | nC |
| Q_{GS} | gate-source charge | | | - | 63 | - | nC |
| Q_{GD} | gate-drain charge | | | - | 21 | - | nC |
| C_{iss} | input capacitance | $V_{DS} = 1000 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}; T_J = 25 \text{ }^\circ C$ | | - | 3305 | - | pF |
| C_{oss} | output capacitance | | | - | 139 | - | pF |
| C_{rss} | reverse transfer capacitance | | | - | 12 | - | pF |
| E_{oss} | Coss stored energy | | | - | 69.5 | - | μJ |
| $t_{d(on)}$ | turn-on delay time | $V_{DS} = 800 \text{ V}; V_{GS} = -4 \text{ V}/18 \text{ V}; R_{G(ext)} = 5.1 \Omega; I_D = 40 \text{ A}; L = 100 \mu H; T_J = 25 \text{ }^\circ C$ | | - | 27 | - | ns |
| t_r | rise time | | | - | 34 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | | - | 51 | - | ns |
| t_f | fall time | | | - | 14 | - | ns |
| E_{on} | turn-on energy (SiC Diode FWD) | | Fig.20 | - | 552 | - | μJ |
| E_{off} | turn-off energy (SiC Diode FWD) | | Fig.20 | - | 162 | - | μJ |
| E_{on} | turn-on energy (Body Diode FWD) | | Fig.20 | - | 671 | - | μJ |
| E_{off} | turn-off energy (Body Diode FWD) | Fig.20 | - | 154 | - | μJ | |
| Source-drain diode | | | | | | | |
| V_{SD} | source-drain voltage | $V_{GS} = 0 \text{ V}; I_{SD} = 20 \text{ A}; T_J = 25 \text{ }^\circ C$ | | - | 3.2 | - | V |
| | | $V_{GS} = -4 \text{ V}; I_{SD} = 20 \text{ A}; T_J = 25 \text{ }^\circ C$ | | - | 4.8 | - | V |
| | | $V_{GS} = -4 \text{ V}; I_{SD} = 20 \text{ A}; T_J = 175 \text{ }^\circ C$ | | - | 4.2 | - | V |
| t_{rr} | reverse recovery time | $I_{SD} = 40 \text{ A}; di/dt = 500 \text{ A}/\mu s; V_{DS} = 400 \text{ V}; T_J = 25 \text{ }^\circ C$ | | - | 33.4 | - | ns |
| Q_r | recovered charge | | | - | 129 | - | nC |
| I_{rrm} | reverse recovery current | | | - | 6.9 | - | A |



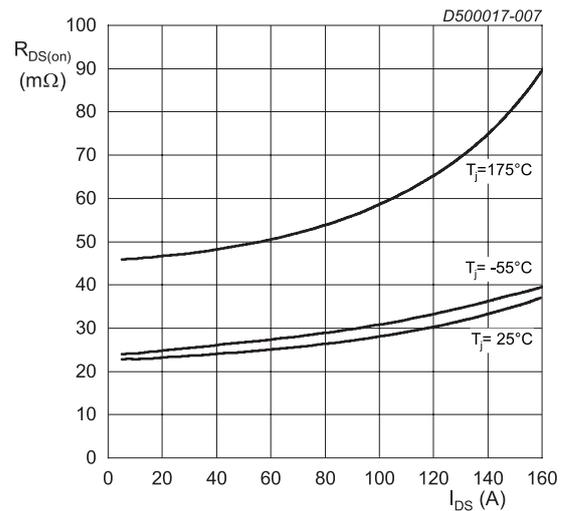
$T_j = -55\text{ °C}; t_p < 200\ \mu\text{s}$
Fig. 4. Output characteristics; drain current as a function of drain-source voltage; typical values



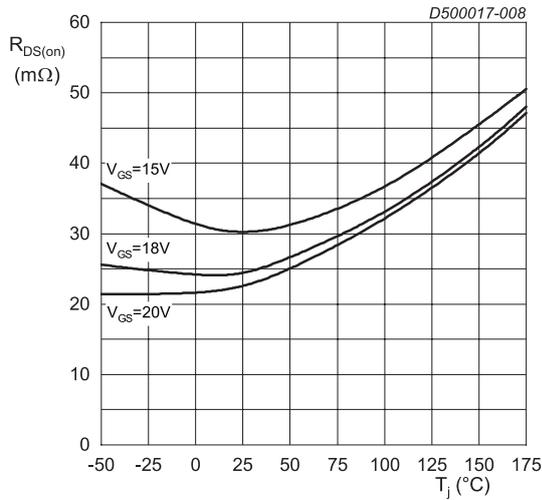
$T_j = 25\text{ °C}; t_p < 200\ \mu\text{s}$
Fig. 5. Output characteristics; drain current as a function of drain-source voltage; typical values



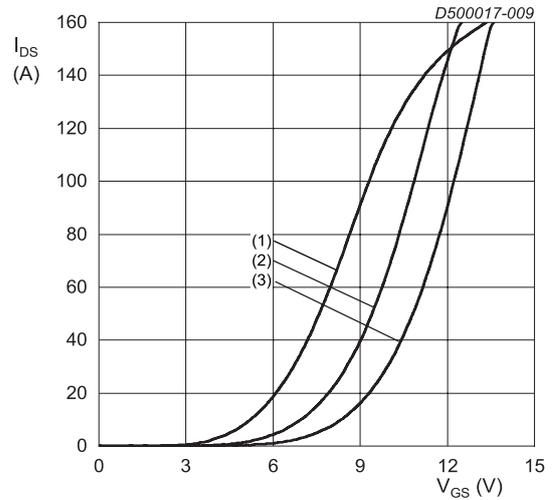
$T_j = 175\text{ °C}; t_p < 200\ \mu\text{s}$
Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values



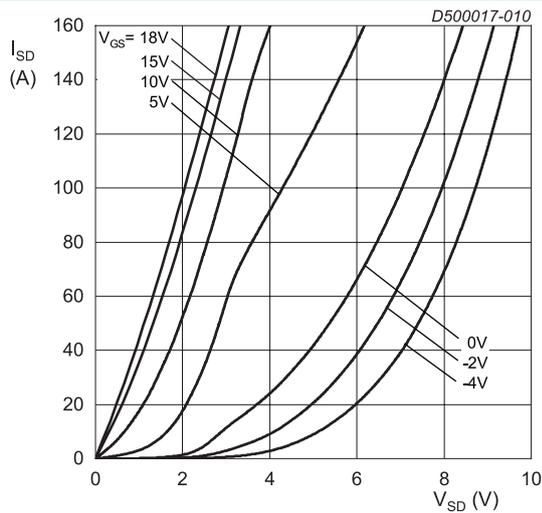
$V_{GS} = 18\text{ V}; t_p < 200\ \mu\text{s}$
Fig. 7. Drain-source on-state resistance as a function of drain current; typical values



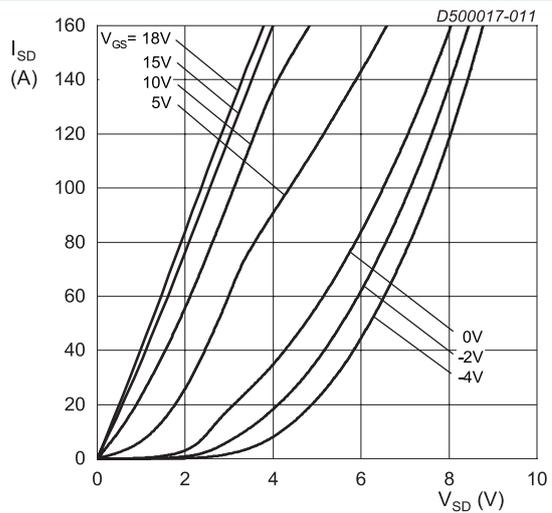
$I_{DS} = 40 A; t_p < 200 \mu s$
Fig. 8. Drain-source on-state resistance as a function of junction temperature



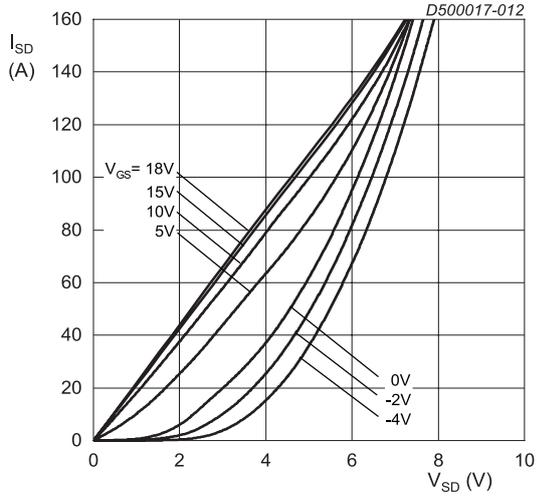
$V_{DS} = 20 V; t_p < 200 \mu s$
Fig. 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values



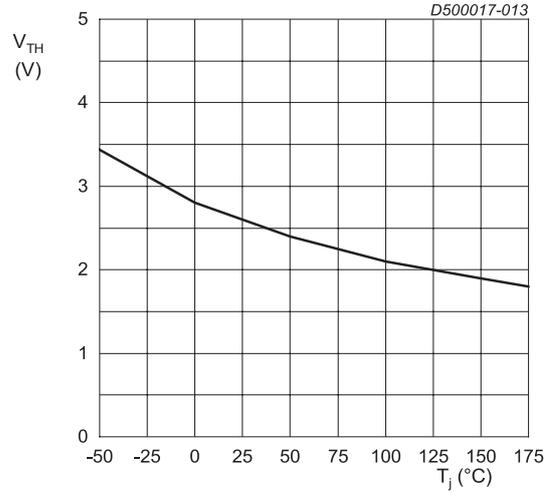
$T_j = -55 ^{\circ}C; t_p < 200 \mu s$
Fig. 10. Body diode forward characteristics; typical values



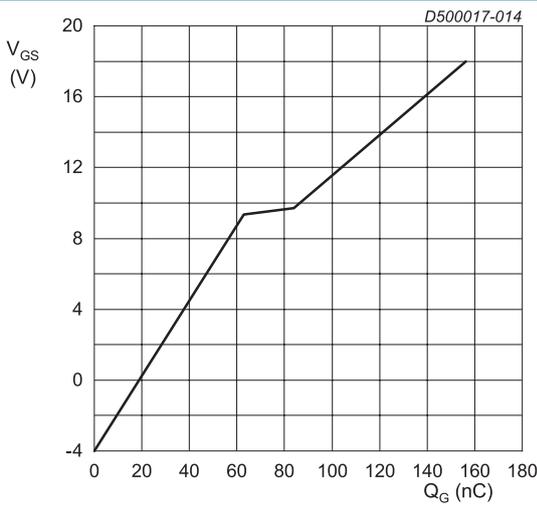
$T_j = 25 ^{\circ}C; t_p < 200 \mu s$
Fig. 11. Body diode forward characteristics; typical values



$T_j = 175\text{ }^\circ\text{C}; t_p < 200\text{ }\mu\text{s}$
Fig. 12. Body diode forward characteristics; typical values



$V_{DS} = 10\text{ V}; I_{DS} = 12\text{ mA}$
Fig. 13. Threshold voltage as a function of junction temperature



$I_{DS} = 40\text{ A}; I_{GS} = 0.1\text{ mA}; V_{DS} = 800\text{ V}; T_j = 25\text{ }^\circ\text{C}$
Fig. 14. Gate-source voltage as a function of gate charge; typical values

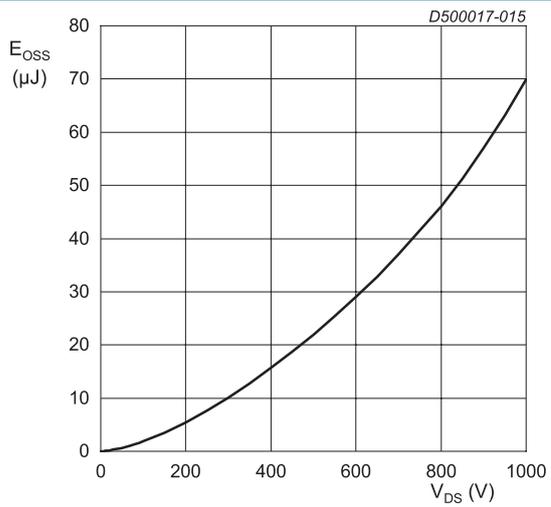
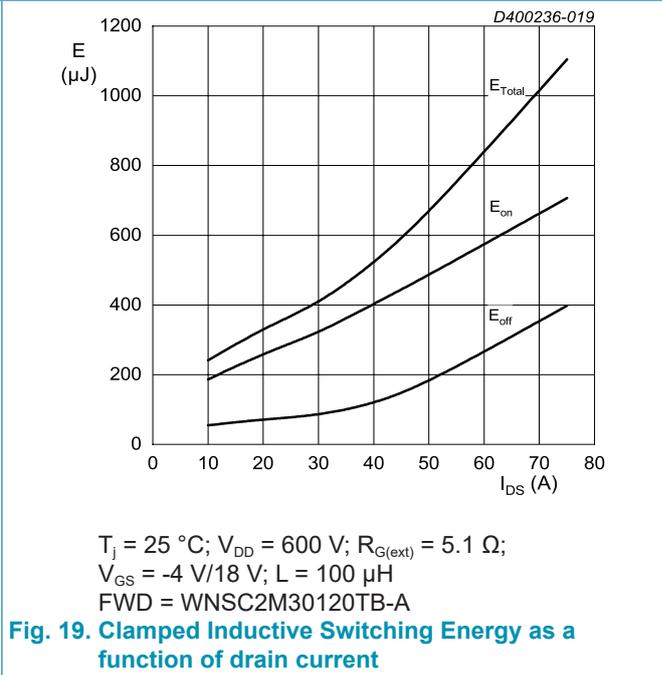
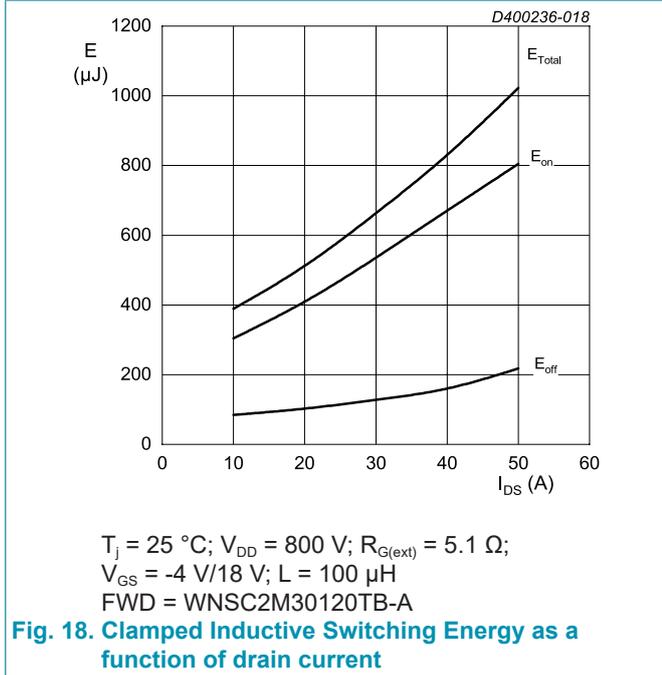
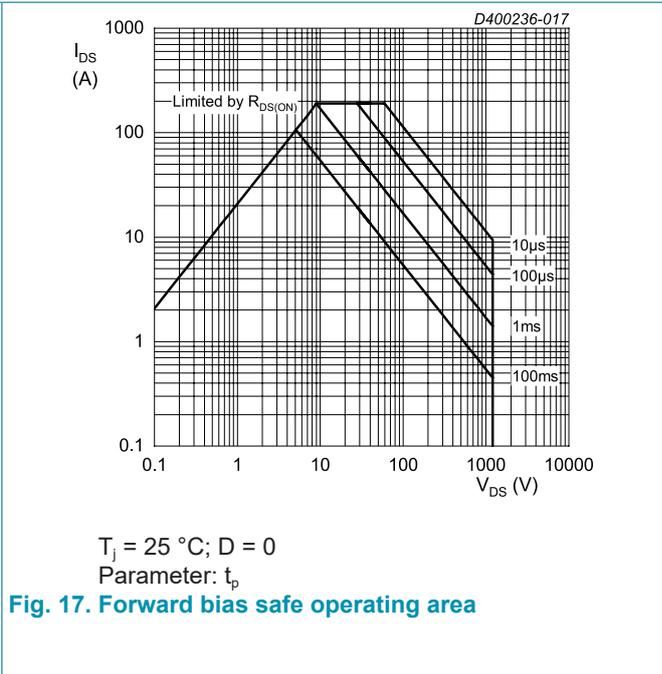
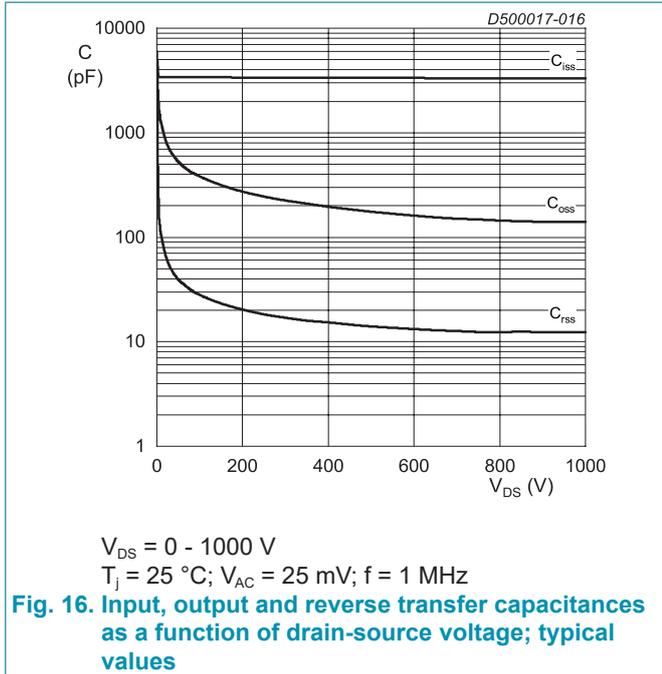
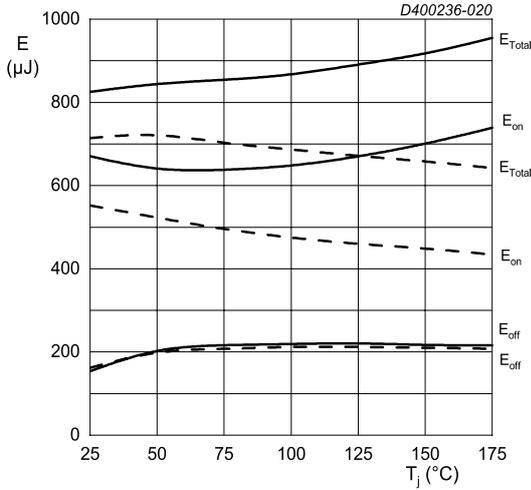


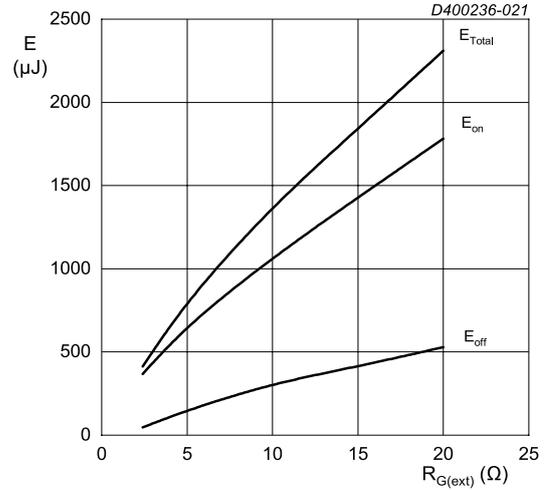
Fig. 15. Output capacitor stored energy as a function of drain-source voltage





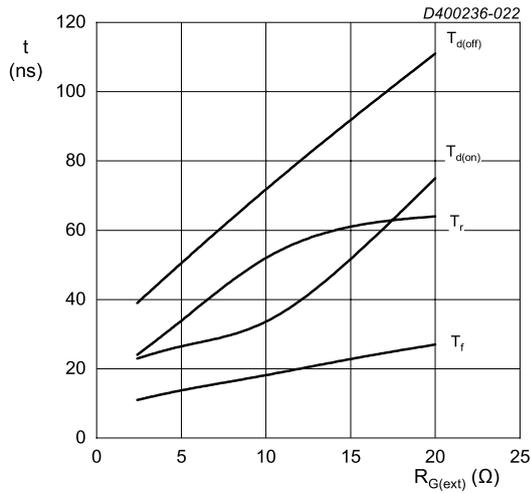
$I_{DS} = 40 \text{ A}; V_{DD} = 800 \text{ V}; R_{G(ext)} = 5.1 \text{ } \Omega;$
 $V_{GS} = -4 \text{ V}/18 \text{ V}; L = 100 \text{ } \mu\text{H}$
 FWD = WNSC2M30120TB-A

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



$T_j = 25 \text{ } ^\circ\text{C}; V_{DD} = 800 \text{ V}; I_{DS} = 40 \text{ A}; V_{GS} = -4 \text{ V}/18 \text{ V}$
 FWD = WNSC2M30120TB-A; $L = 100 \text{ } \mu\text{H}$

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



$T_j = 25 \text{ } ^\circ\text{C}; V_{DD} = 800 \text{ V}; I_{DS} = 40 \text{ A}; V_{GS} = -4 \text{ V}/18 \text{ V}$
 FWD = WNSC2M30120TB-A; $L = 100 \text{ } \mu\text{H}$

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

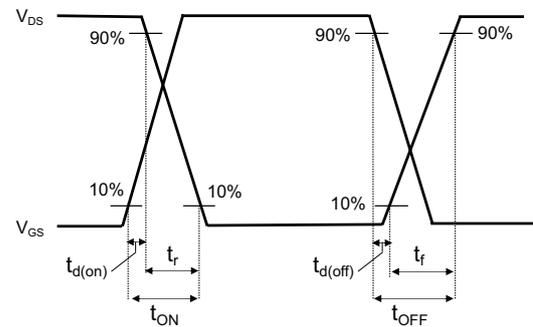
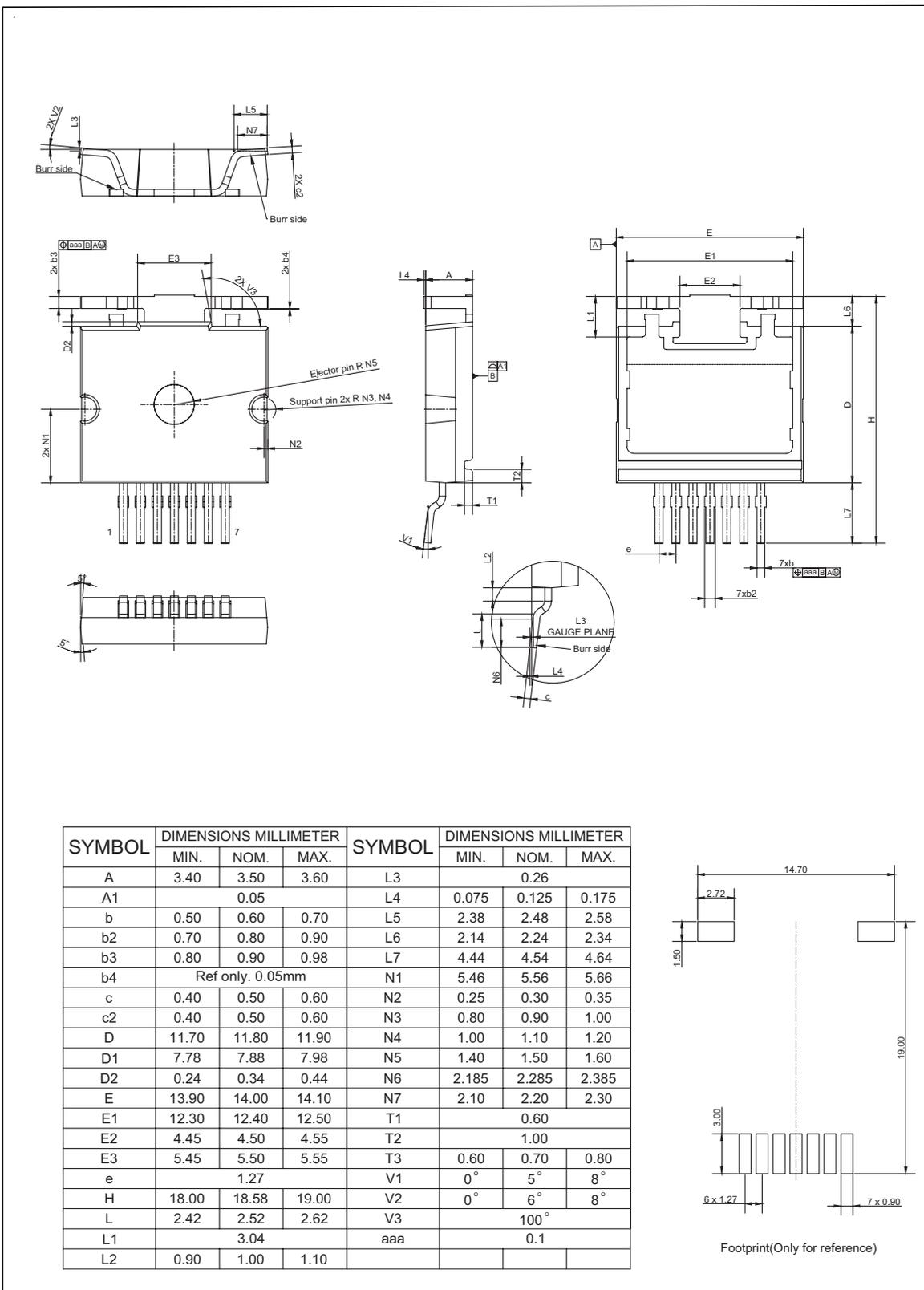


Fig. 23. Switching time definition

11. Package outline



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. |
| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
| Product [short] data sheet | Production | This document contains the product specification. |

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- [2] The term 'short data sheet' is explained in section "Definitions".
- [3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.ween-semi.com>.

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