

# ASC75N1200MT4X

1200V, 75A, 30mΩ, N-Channel, Silicon Carbide MOSFET

Product Data Sheet

ASTC-3T04-79A A/1



爱仕特科技  
AST TECHNOLOGY

## General Description

The AST-MT4 series SiC MOSFET in TO-247-4 package ensures stable high-temperature operation for power-dense and energy-critical systems, enabling compact designs with reduced EMI.

## Features

- 3<sup>rd</sup> Generation SiC MOSFET Technology
- High-Speed Switching with Low Capacitances
- High Blocking Voltage with Low  $R_{DS(on)}$
- Optimized package with Separate Driver Source Pin
- Easy to parallel and Simple to Drive
- RoHS Compliant, Halogen Free



## Applications

- EV Charging
- High Voltage DC/DC Converters
- Switch Mode Power Supplies
- Power Factor Correction Modules

## Ordering Informations

|                |                |
|----------------|----------------|
| Order Number   | ASC75N1200MT4X |
| Marking        | ASC75N1200MT4  |
| Package Type   | TO-247-4       |
| Packing Method | Tube           |

## Key Parameters

| Symbol                  | Parameter                         | Values      |      |      | Unit | Test Conditions                                                                                        |
|-------------------------|-----------------------------------|-------------|------|------|------|--------------------------------------------------------------------------------------------------------|
| Absolute maximum rating |                                   |             |      |      |      |                                                                                                        |
| V <sub>DS</sub>         | Drain-Source Voltage              | 1200        |      |      | V    | T <sub>C</sub> =25°C                                                                                   |
| I <sub>D</sub>          | Drain Current (continuous)        | 75          |      |      | A    | T <sub>C</sub> =25°C                                                                                   |
| P <sub>D</sub>          | Power Dissipation                 | 375         |      |      | W    | T <sub>C</sub> =25°C                                                                                   |
| T <sub>J</sub>          | Junction Temperature              | -55 to +175 |      |      | °C   |                                                                                                        |
| Symbol                  | Parameter                         | Min.        | Typ. | Max. | Unit | Test Conditions                                                                                        |
| Static characteristics  |                                   |             |      |      |      |                                                                                                        |
| R <sub>DS(on)</sub>     | Static Drain-Source on Resistance | -           | 36   | 43   | mΩ   | V <sub>GS</sub> =15V; I <sub>D</sub> =33A; T <sub>J</sub> =25°C                                        |
|                         |                                   | -           | 30   | 36   | mΩ   | V <sub>GS</sub> =18V; I <sub>D</sub> =33A; T <sub>J</sub> =25°C                                        |
| Dynamic characteristics |                                   |             |      |      |      |                                                                                                        |
| Q <sub>G</sub>          | Total Gate Charge                 | -           | 72   | -    | nC   | V <sub>DS</sub> =800V; V <sub>GS</sub> =-5V/18V; I <sub>D</sub> =33A; T <sub>J</sub> =25°C             |
| Q <sub>GD</sub>         | Gate-Drain Charge                 | -           | 19   | -    |      |                                                                                                        |
| Source-Drain diode      |                                   |             |      |      |      |                                                                                                        |
| Q <sub>rr</sub>         | Reverse Recovery Charge           | -           | 325  | -    | nC   | V <sub>GS</sub> =-5V; I <sub>F</sub> =33A; V <sub>R</sub> =800V; di/dt=2600A/μs; T <sub>J</sub> =175°C |

## Absolute Maximum Ratings (at $T_c=25^\circ\text{C}$ unless otherwise specified)

| Symbol         | Parameter                                            | Values      | Unit             |
|----------------|------------------------------------------------------|-------------|------------------|
| $V_{DS}$       | Drain-Source Voltage                                 | 1200        | V                |
| $I_D$          | Drain Current (continuous; $T_c=25^\circ\text{C}$ )  | 75          | A                |
|                | Drain Current (continuous; $T_c=100^\circ\text{C}$ ) | 52          |                  |
| $I_{DM}$       | Drain Current (pulsed)                               | 200         | A                |
| $V_{GS}$       | Gate-Source Voltage                                  | -10/+22     | V                |
| $P_D$          | Power Dissipation ( $T_c=25^\circ\text{C}$ )         | 375         | W                |
| $T_J, T_{stg}$ | Junction and Storage Temperature Range               | -55 to +175 | $^\circ\text{C}$ |

## MOSFET Characteristics

| Symbol                                                                       | Parameter                         | Min. | Typ.  | Max. | Unit | Test Conditions                                                                                                                |
|------------------------------------------------------------------------------|-----------------------------------|------|-------|------|------|--------------------------------------------------------------------------------------------------------------------------------|
| Static characteristics (at T <sub>J</sub> =25°C unless otherwise specified)  |                                   |      |       |      |      |                                                                                                                                |
| BV <sub>DS</sub>                                                             | Drain-Source Breakdown Voltage    | 1200 | -     | -    | V    | I <sub>D</sub> =250μA; V <sub>GS</sub> =0V                                                                                     |
| I <sub>DSS</sub>                                                             | Zero Gate Voltage Drain Current   | -    | 5     | 100  | μA   | V <sub>DS</sub> =1200V; V <sub>GS</sub> =0V                                                                                    |
| I <sub>GSS</sub>                                                             | Gate-Body Leakage Current         | -    | 10    | 250  | nA   | V <sub>GS</sub> =-10/20V; V <sub>DS</sub> =0V                                                                                  |
| V <sub>GS(th)</sub>                                                          | Gate Threshold Voltage            | 2.2  | 2.5   | 3.6  | V    | V <sub>DS</sub> =V <sub>GS</sub> ; I <sub>D</sub> =10mA                                                                        |
| V <sub>GS(on)</sub>                                                          | Recommended Turn-on Voltage       | -    | 15/18 | -    | V    | Static                                                                                                                         |
| V <sub>GS(off)</sub>                                                         | Recommended Turn-off Voltage      | -    | -5    | -    |      |                                                                                                                                |
| R <sub>DS(on)</sub>                                                          | Static Drain-Source on Resistance | -    | 36    | 43   | mΩ   | V <sub>GS</sub> =15V; I <sub>D</sub> =33A; T <sub>J</sub> =25°C                                                                |
|                                                                              |                                   | -    | 54    | -    |      | V <sub>GS</sub> =15V; I <sub>D</sub> =33A; T <sub>J</sub> =175°C                                                               |
|                                                                              |                                   | -    | 30    | 36   |      | V <sub>GS</sub> =18V; I <sub>D</sub> =33A; T <sub>J</sub> =25°C                                                                |
|                                                                              |                                   | -    | 45    | -    |      | V <sub>GS</sub> =18V; I <sub>D</sub> =33A; T <sub>J</sub> =175°C                                                               |
| Dynamic characteristics (at T <sub>J</sub> =25°C unless otherwise specified) |                                   |      |       |      |      |                                                                                                                                |
| C <sub>iss</sub>                                                             | Input Capacitance                 | -    | 2220  | -    | pF   | V <sub>DS</sub> =1000V; f=1MHz; V <sub>AC</sub> =25mV                                                                          |
| C <sub>oss</sub>                                                             | Output Capacitance                | -    | 105   | -    |      |                                                                                                                                |
| C <sub>rss</sub>                                                             | Reverse Transfer Capacitance      | -    | 7     | -    |      |                                                                                                                                |
| g <sub>fs</sub>                                                              | Transconductance                  | -    | 23    | -    | S    | V <sub>DS</sub> =20V; I <sub>D</sub> =33A                                                                                      |
| E <sub>oss</sub>                                                             | Coss Stored Energy                | -    | 48    | -    | μJ   | V <sub>DS</sub> =1000V; f=1MHz                                                                                                 |
| E <sub>on</sub>                                                              | Turn-on Energy (Body Diode)       | -    | 378   | -    | μJ   | V <sub>DS</sub> =800V; V <sub>GS</sub> =-5/18V; I <sub>D</sub> =33A; L=100μH; R <sub>G(ext)</sub> =2.5Ω; T <sub>J</sub> =175°C |
| E <sub>off</sub>                                                             | Turn-off Energy (Body Diode)      | -    | 98    | -    |      |                                                                                                                                |
| Q <sub>G</sub>                                                               | Total Gate Charge                 | -    | 72    | -    | nC   | V <sub>DS</sub> =800V; V <sub>GS</sub> =-5/18V; I <sub>D</sub> =33A                                                            |
| Q <sub>GS</sub>                                                              | Gate-Source Charge                | -    | 26    | -    |      |                                                                                                                                |
| Q <sub>GD</sub>                                                              | Gate-Drain Charge                 | -    | 19    | -    |      |                                                                                                                                |
| R <sub>G(int)</sub>                                                          | Internal Gate Resistance          | -    | 1.2   | -    | Ω    | f=1MHz; V <sub>AC</sub> =25mV                                                                                                  |
| t <sub>d(on)</sub>                                                           | Turn-on Delay Time                | -    | 17    | -    | ns   | V <sub>DS</sub> =800V; V <sub>GS</sub> =-5/+18V; I <sub>D</sub> =33A; R <sub>G(ext)</sub> =2.5Ω; Load=100μH                    |
| t <sub>r</sub>                                                               | Rise Time                         | -    | 20    | -    |      |                                                                                                                                |
| t <sub>d(off)</sub>                                                          | Turn-off Delay Time               | -    | 25    | -    |      |                                                                                                                                |
| t <sub>f</sub>                                                               | Fall Time                         | -    | 9     | -    |      |                                                                                                                                |

## Body Diode Characteristics (at $T_J=25^\circ\text{C}$ unless otherwise specified)

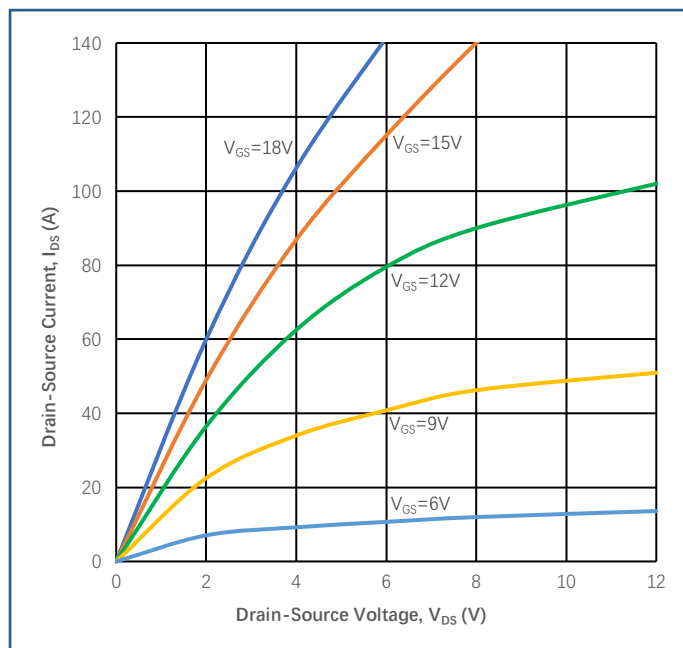
| Symbol    | Parameter                        | Min. | Typ. | Max. | Unit | Test Conditions                                                                                                  |
|-----------|----------------------------------|------|------|------|------|------------------------------------------------------------------------------------------------------------------|
| $V_{SD}$  | Diode Forward Voltage            | -    | 3.6  | 6    | V    | $V_{GS}=0\text{V}; I_F=20\text{A}; T_J=25^\circ\text{C}$                                                         |
|           |                                  | -    | 3.2  | 6    |      | $V_{GS}=0\text{V}; I_F=20\text{A}; T_J=175^\circ\text{C}$                                                        |
| $I_S$     | Continuous Diode Forward Current | -    | 68   | -    | A    | $V_{GS}=0\text{V}; T_C=25^\circ\text{C}$                                                                         |
| $T_{rr}$  | Reverse Recovery Time            | -    | 32   | -    | ns   | $V_{GS}=-5\text{V}; I_F=33\text{A}; V_R=800\text{V};$<br>$di/dt=2600\text{A}/\mu\text{s}; T_J=175^\circ\text{C}$ |
| $Q_{rr}$  | Reverse Recovery Charge          | -    | 325  | -    | nC   |                                                                                                                  |
| $I_{rrm}$ | Peak Reverse Recovery Current    | -    | 22   | -    | A    |                                                                                                                  |

## Thermal Characteristics

| Symbol          | Parameter                               | Value. | Unit                      |
|-----------------|-----------------------------------------|--------|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case    | 0.40   | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | 40     | $^\circ\text{C}/\text{W}$ |

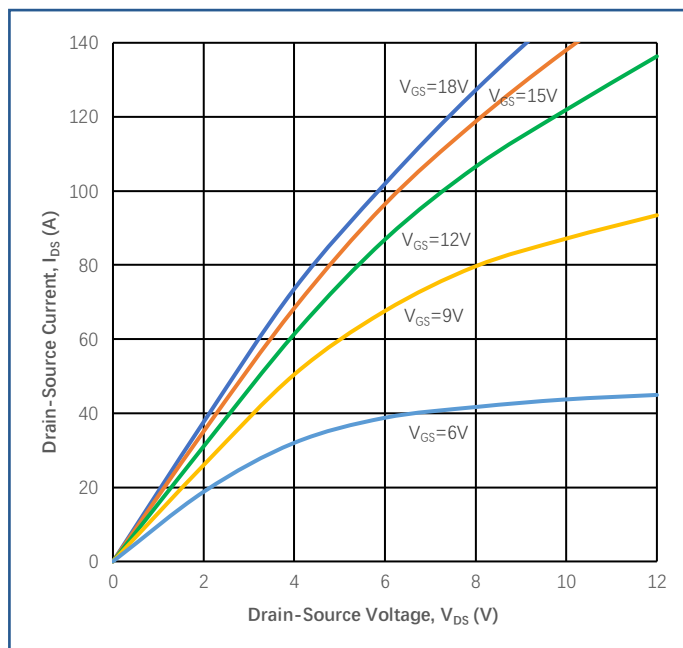
The values are based on Junction-to-Case Thermal Impedance measured with the device mounted to a large heat sink, assuming a maximum junction temperature of  $T_{J(max)}=175^\circ\text{C}$ .

## Typical Performance



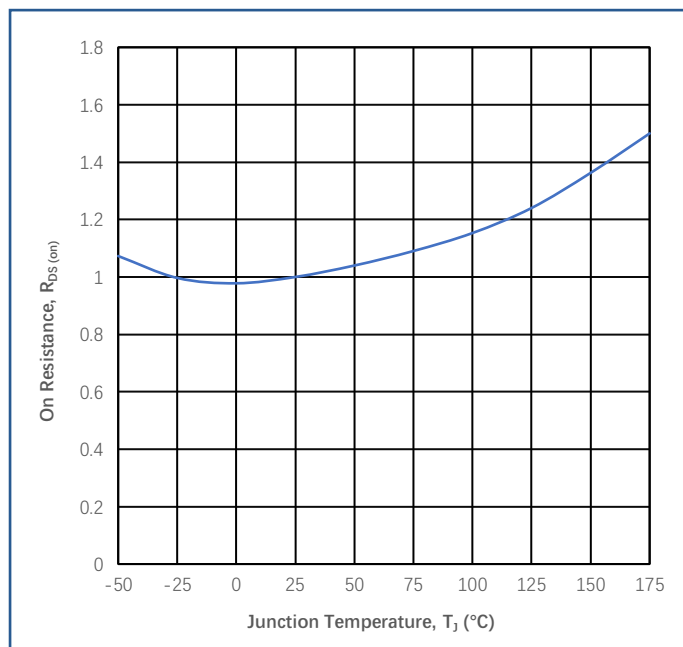
**Figure 1**

Output Characteristics ( $T_J = 25^\circ\text{C}$ )



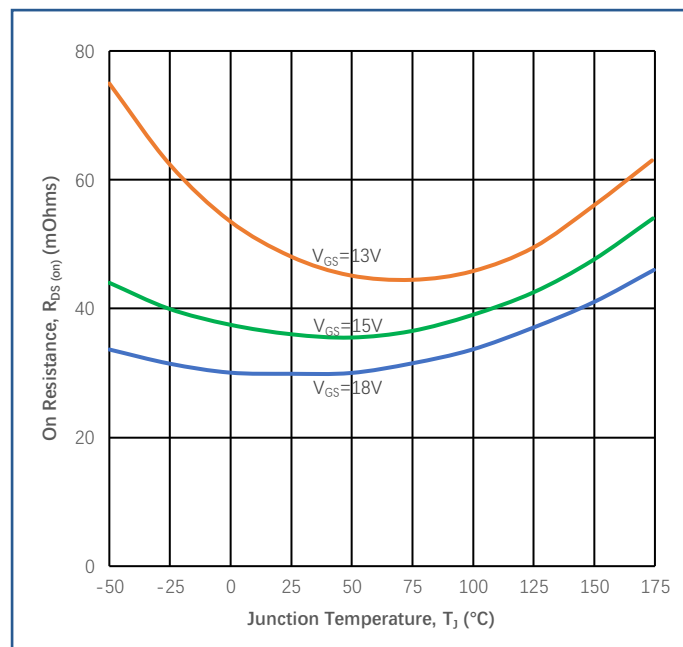
**Figure 2**

Output Characteristics ( $T_J = 175^\circ\text{C}$ )



**Figure 3**

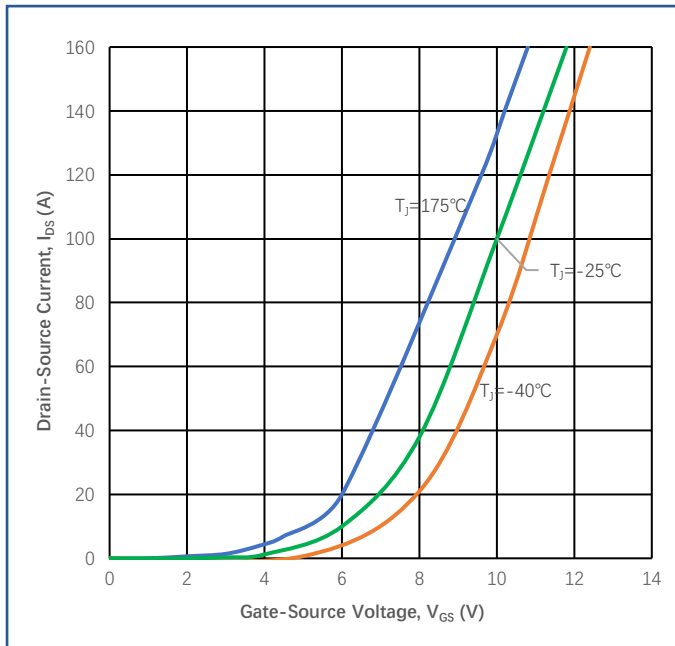
Normalized On-Resistance vs. Temperature



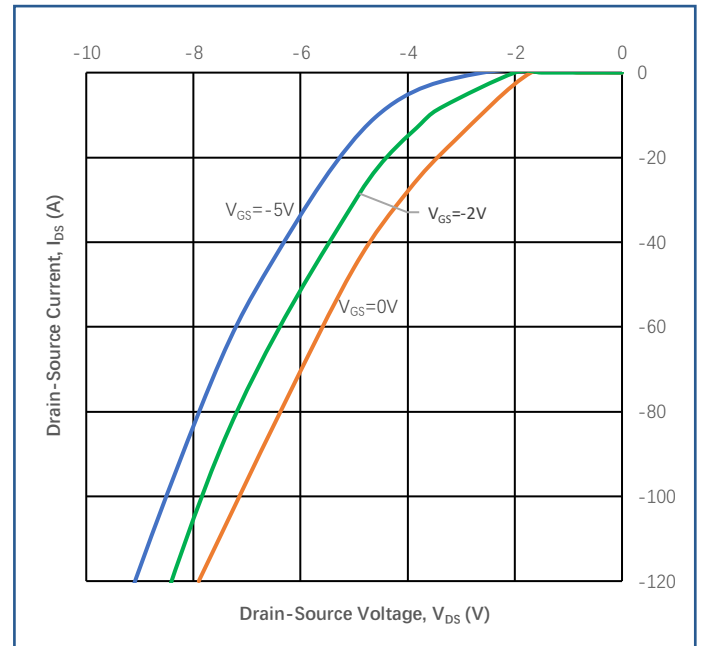
**Figure 4**

On-Resistance vs. Temperature

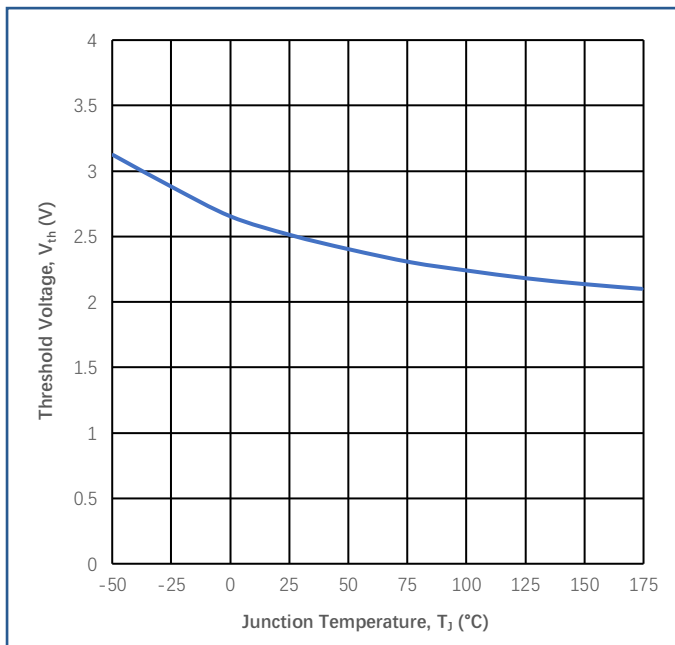
## Typical Performance



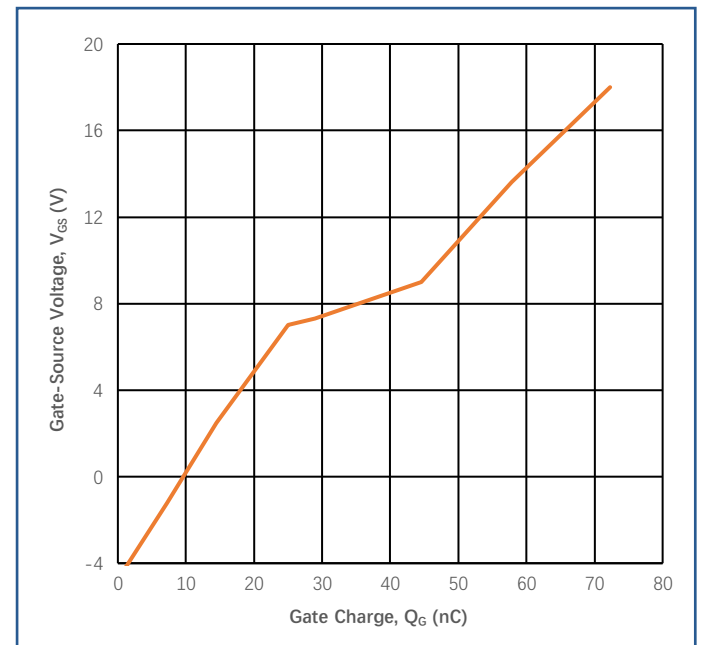
**Figure 5**  
Transfer Characteristic



**Figure 6**  
Body Diode Characteristic at  $25^\circ\text{C}$

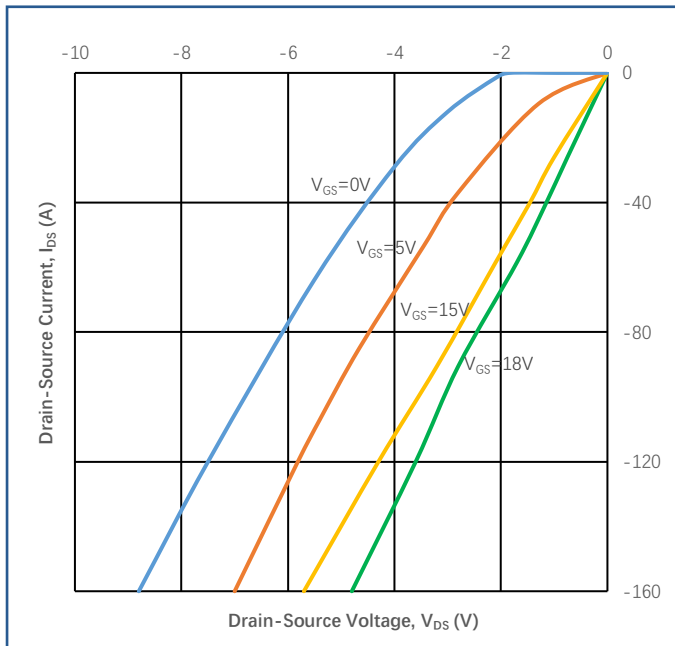


**Figure 7**  
Threshold Voltage vs. Temperature



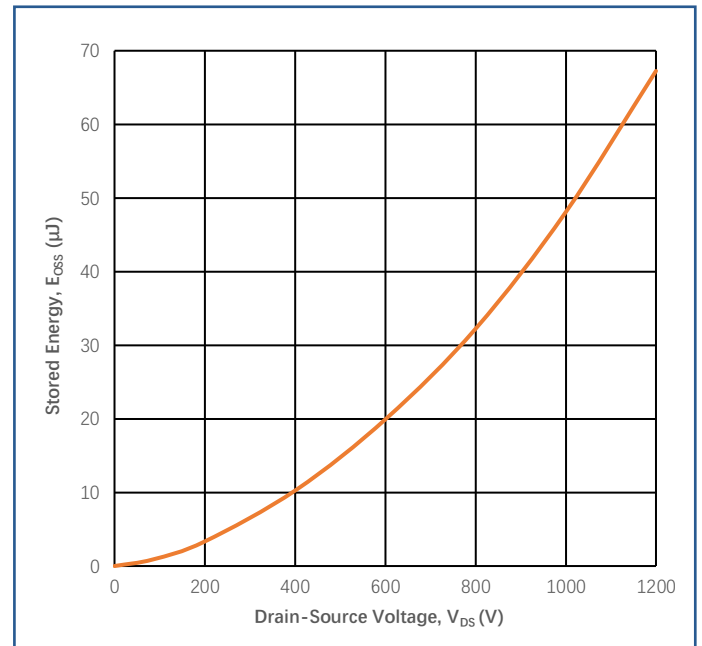
**Figure 8**  
Gate Charge Characteristics

## Typical Performance



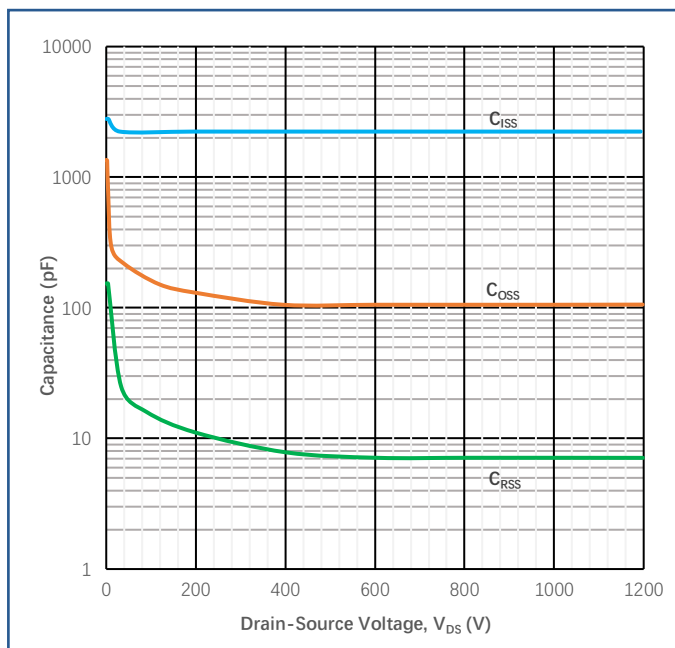
**Figure 9**

3<sup>rd</sup> Quadrant Characteristic at 25°C



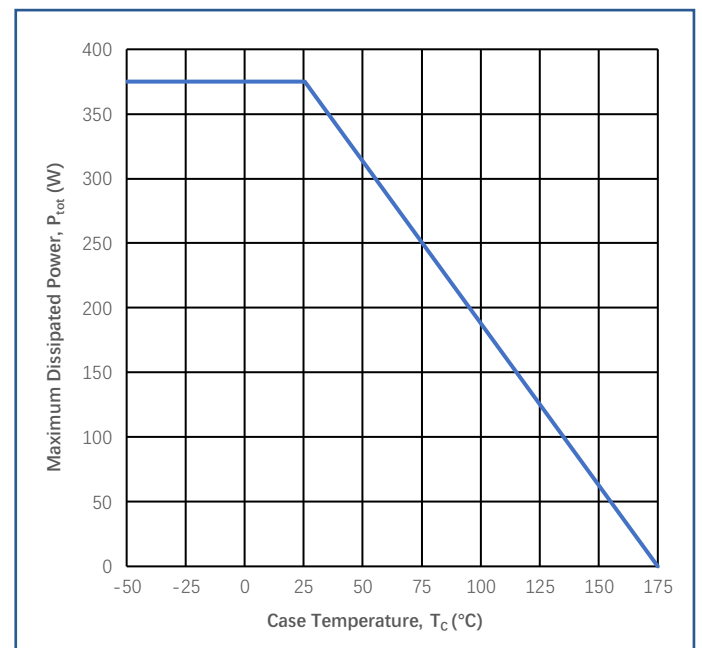
**Figure 10**

Output Capacitor Stored Energy



**Figure 11**

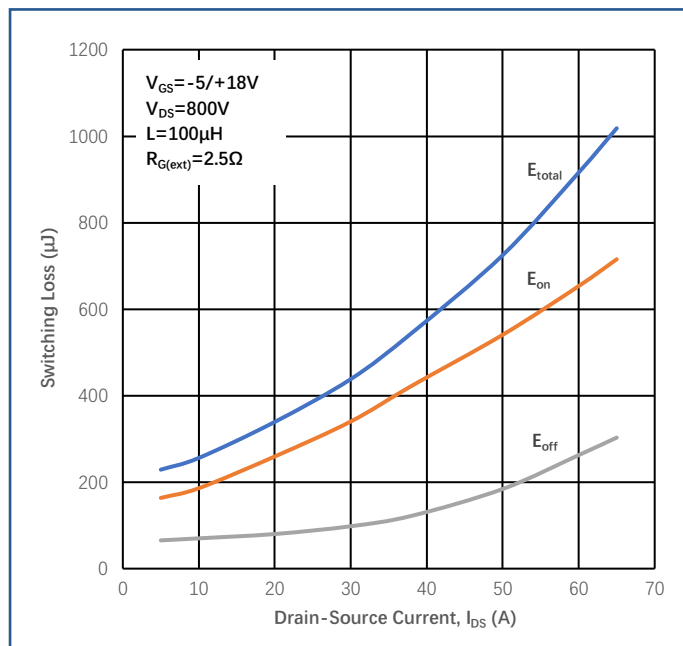
Capacitances vs. Drain-Source



**Figure 12**

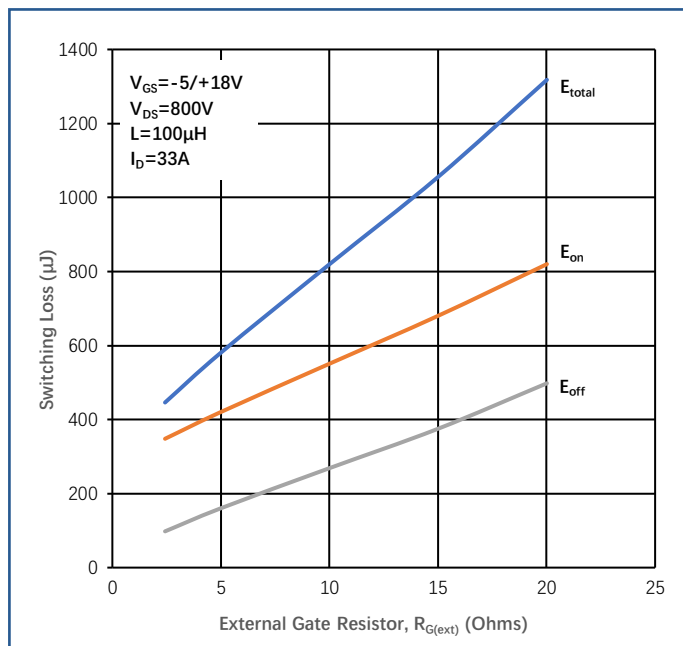
Max Power Dissipation Derating vs  $T_C$

## Typical Performance



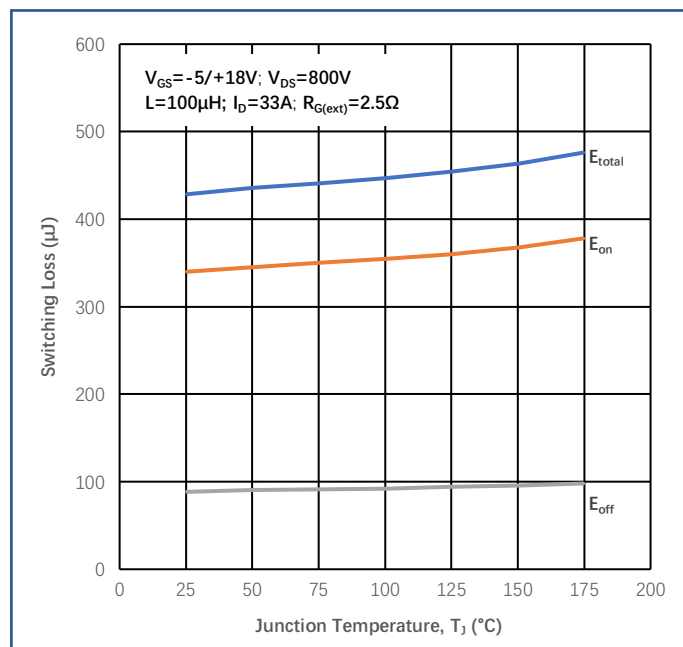
**Figure 13**

Switching Energy vs. Drain Current



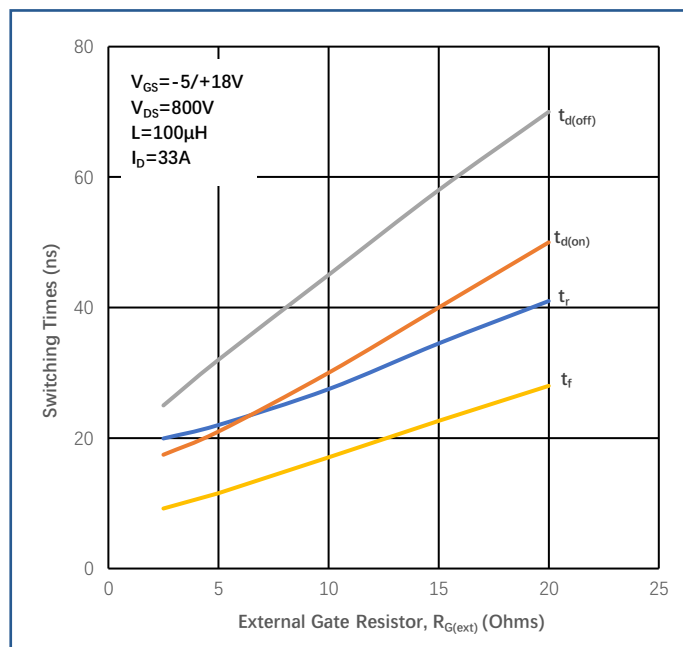
**Figure 14**

Switching Energy vs.  $R_{G(ext)}$



**Figure 15**

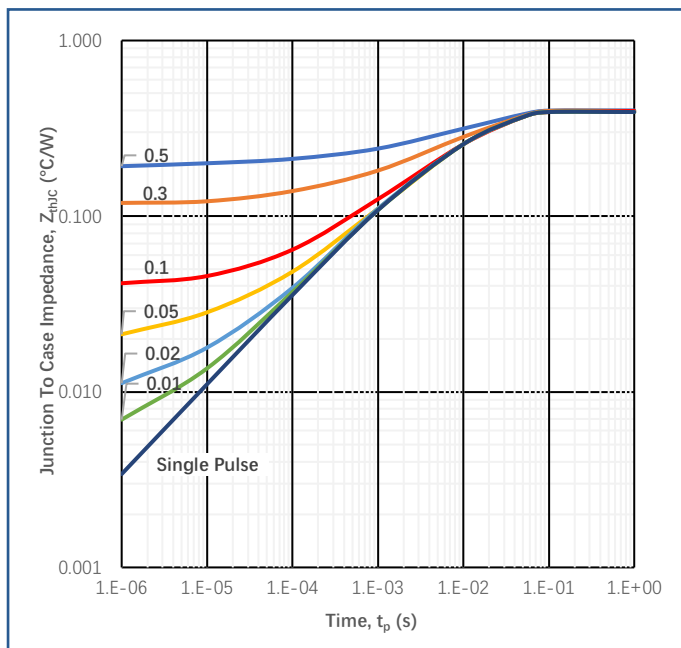
Switching Energy vs. Temperature



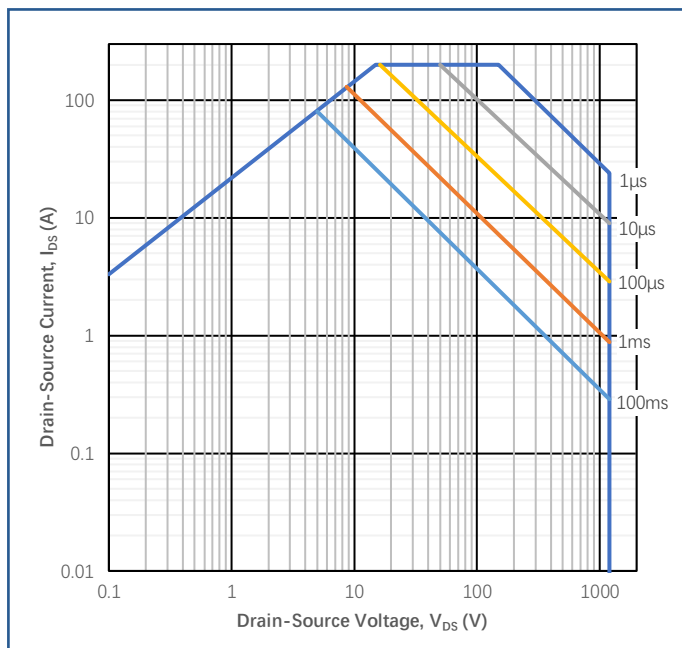
**Figure 16**

Switching Times vs.  $R_{G(ext)}$

## Typical Performance



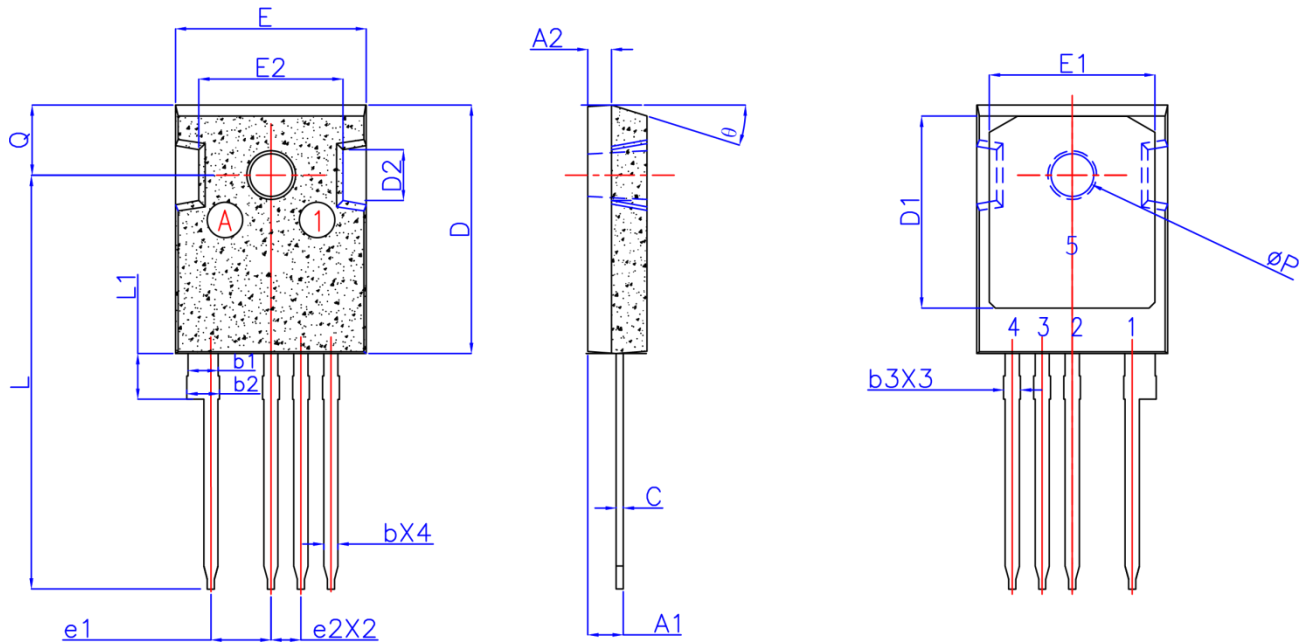
**Figure 17**  
Transient Thermal Impedance



**Figure 18**  
Safe Operating Area

## Package Dimensions (mm)

### Package Type: TO-247-4



| Symbol | Millimeters |       |       | Inches     |       |       |
|--------|-------------|-------|-------|------------|-------|-------|
|        | Min.        | Type. | Max.  | Min.       | Type. | Max.  |
| A      | 4.80        | 5.00  | 5.20  | 0.189      | 0.197 | 0.205 |
| A1     | 2.85        | 3.00  | 3.15  | 0.112      | 0.118 | 0.124 |
| A2     | 1.90        | 2.00  | 2.10  | 0.070      | 0.080 | 0.080 |
| b      | 1.15        | 1.20  | 1.25  | 0.045      | 0.047 | 0.049 |
| b1     | 2.40        | 2.50  | 2.60  | 0.094      | 0.098 | 0.102 |
| b2     | 2.61        | 2.76  | 2.91  | 0.103      | 0.109 | 0.115 |
| b3     | 1.30        | 1.42  | 1.57  | 0.051      | 0.056 | 0.062 |
| C      | 0.55        | 0.60  | 0.65  | 0.022      | 0.024 | 0.026 |
| D      | 20.80       | 21.00 | 21.20 | 0.819      | 0.827 | 0.835 |
| D1     | 15.94       | 16.24 | 16.54 | 0.628      | 0.639 | 0.651 |
| D2     | 4.3Type     |       |       | 0.169 Type |       |       |
| e1     | 4.93        | 5.08  | 5.23  | 0.194      | 0.200 | 0.206 |
| e2     | 2.39        | 2.54  | 2.69  | 0.094      | 0.100 | 0.106 |
| E      | 15.95       | 16.15 | 16.35 | 0.628      | 0.636 | 0.644 |
| E1     | 13.82       | 14.02 | 14.26 | 0.544      | 0.552 | 0.561 |
| E2     | 12.00       | 12.20 | 12.40 | 0.472      | 0.480 | 0.488 |
| L      | 34.65       | 35.05 | 35.45 | 1.364      | 1.380 | 1.396 |
| L1     | 3.72        | 3.87  | 4.02  | 0.150      | 0.150 | 0.160 |
| Q      | 5.85        | 5.95  | 6.05  | 0.230      | 0.234 | 0.238 |
| φP     | 3.45        | 3.60  | 3.75  | 0.136      | 0.142 | 0.148 |
| θ      | 17.5°       |       |       | 17.5°      |       |       |

| Pin | Symbol | Description                          |
|-----|--------|--------------------------------------|
| 1   | D      | Drain                                |
| 2   | S      | Power Source                         |
| 3   | S      | Driver Source                        |
| 4   | G      | Gate                                 |
| mb  | D      | Mounting Base;<br>Connected to Drain |

#### Note:

1. All metal surfaces are Sn plated (matte), except area of cut.
2. Burr or mold flash size (0.5 mm) is not included in the dimensions.

## Notes & Disclaimer

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